Using Virtual Reality to Train Suicide Negotiation: The Role of Presence, Empathy, and

Rapport

Psychology of Conflict, Risk, and Safety

University of Twente

Lorenz Bünnemann

Date: 26/05/2024

1st Supervisor: dr. S. J. Watson

2nd Supervisor: dr. M. S. D. Oostinga

Abstract

Suicide negotiation concerns talking to a person in dangerous and potentially life-threatening situations. To best help the person out of the situation, the Behavioural Influence Stairway Model (BISM) was developed by the United States crisis negotiation unit of the FBI. Suicide negotiation training is being administered mostly through role-play. This experiment considers the usage of Virtual Reality (VR) as an alternative training method. Participants were tasked to watch training videos to learn about the BISM and then had to carry out a crisis negotiation with a virtual character considering suicide, where they had to select answers corresponding to the different stages of the BISM and the performance as determined by the adherence to the BISM stages was evaluated. Afterwards, a survey was administered regarding their experienced levels of spatial presence, social presence, empathy towards the agent, and rapport with the agent. It was tested whether spatial presence or social presence were positively associated with crisis negotiation performance and whether there is a positive relationship between empathy or rapport and spatial or social presence. Contrary to expectation, empathy and spatial presence had negative effects on the performance of the participants while higher perceived rapport improved performance. Empathy was significantly positively correlated with social presence and rapport. This study is one of the first exploring Virtual Reality as a tool to teach crisis negotiation with the findings highlighting the negative effects spatial presence and empathy can have on performance in VR crisis negotiations.

Introduction

The World Health Organisation (2023) estimates that 703,000 people take their own lives each year, with suicide being the fourth most common type of death in people aged 15-29. There are certain events that can propel a person into a state of crisis causing them to consider suicide (World Health Organisation, 2023; see also Vecchi et al., 2005). Sometimes, in these situations, it is possible for law enforcement to intervene by sending a negotiator tasked with defusing the dangerous situation. It requires the person in crisis still being indecisive about their situation and willing to converse with another person.

Suicide negotiation is thus a situation with very high stakes and therefore negotiators should train negotiation skills to become as capable as possible for these situations. The current method of negotiation developed by the Crisis Negotiation Unit of the FBI focuses on trying to understand and calm down the person at risk of suicide (Vecchi et al., 2005; see also Vecchi et al., 2019; Johnson et al., 2018). With such high stakes and the increase in availability of Virtual Reality (VR) equipment (Turner & Casey, 2014), this research investigates the potential of Virtual Reality in training crisis negotiators and the prerequisites that must be met to create effective VR training scenarios. When entering the virtual environment in VR, having the feeling of being transferred to a real world offers many opportunities of creating realistic scenarios that emulate partly dangerous, real-world situations and conveying the sense of being there without any of the connected dangers.

Suicide Negotiation

The so-called crisis state is a state where the suicidal person, the 'person in crisis' (PiC) experienced some sort of loss, for example loss of a job, a relationship, or the death of a loved one (Vecchi et al., 2005). At the same time, they are feeling like they are unable to

achieve their goals and are unable to cope with the situation using their usual coping styles (James & Gilliland, 2001 in Vecchi et al., 2005). The crisis state is characterised by a tendency to make impulsive decisions based on one's current emotional state (high emotionality) without regard for future threats or benefits (low rationality). Negotiators attempt to reduce this emotionality and to reinstate a rational line of thinking in the PiC which enables them work towards an acceptable solution, using techniques such as the Behavioural Influence Stairway Model (BISM) (Vecchi et al., 2005; see also Vecchi et al., 2019; Ireland & Vecchi, 2009). It is a non-combative approach that aims to build a positive relationship with the people involved that has already been successfully used in many different high stakes situations like hostage situations (Johnson et al., 2018; see also Grubb, 2010, Vecchi et al., 2019) and suicide situations (Vecchi et al., 2019; see also Johnson et al., 2018). According to a 2013 report by the FBI Hostage Barricade System, which includes hostage and suicide situations, 97% of crisis situations were resolved without injury (Thompson, 2014).

Aside from reducing emotionality, another goal of the BISM is to potentially decrease the immediate perceived threat towards the psychological, physical, or emotional well-being of the person in crisis (Vecchi et al., 2019). Reducing emotionality and decreasing the immediate perceived threats are both important to engage in a constructive conversation that can help to reach the ultimate goal, which is having the person contemplating suicide to remove themselves from the dangerous situation into a safer one, for example back behind guard rails or away from the edge of the roof, where they can receive further help from emergency service workers for instance (Vecchi et al., 2005; see also Vecchi et al., 2019).

The model consists of four distinct stages, Active Listening, Empathy, Rapport and Trust, and Influence, where each stage builds upon the previous one, meaning that the next

stage can only be started when the previous stage has been fulfilled before (Vecchi et al., 2019):

Stage 1 - Active Listening

In this stage, the negotiator actively listens to the person in crisis, meaning they try to get a deep understanding of the person in crisis and actively process any information they convey as well as identify the parts of the story still missing. The negotiator utilises active listening strategies to convey the feeling to the person in crisis that they are being listened to and encourage the PiC to give out information. This is classified as the first stage but should still be present during all later stages as well so the information the person in crisis is conveying is processed properly and the person in crisis feels heard at all times.

Stage 2 - Empathy

Empathy is the concept of being able to shift one's own perspective to another one and contains the concepts of sympathy, emotional contagion, or compassion (Cuff et al., 2016). Empathy requires active listening in order for the negotiator knowing enough about the situation to emphasise with the PiC. In the empathy stage of the conversation, the negotiators are trying to perceive the situation from the perspective of the person in crisis to understand them better and convince them that the negotiator genuinely cares. This is attempted through different means such as mirroring, which describes briefly feeling and displaying the same emotions the PiC is expressing, or emotional labelling, which is the act of naming the specific emotions the PiC is feeling currently (e.g. "You seem angry.") (Royce, 2005). This display of empathy is needed to move onto the next stage of building rapport with the PiC.

Stage 3 - Rapport/Trust

In this stage, the negotiator attempts to establish a good relation with the person in crisis (Rapport) and simultaneously build trust. Rapport is the harmonious interaction between individuals characterised by a positive view of the conversational partner which ensures the conversation flows smoothly (Tickle-Degnen & Rosenthal, 1990; see also Richardson & Nash, 2021; van der Klok, 2023). Having rapport during a conversation has been shown to be effective in attaining more, and more accurate information from the conversational partner (Nash et al., 2016, see also Vallano & Compo, 2011). Rapport can be used as a strategy resulting in the conversational partner's trust into the negotiator (David et al., 2018; see also Neequaye, 2023). Trust is the state of thinking that the negotiator is being truthful and sincere in their words and actions. Reaching trust signifies a willingness of the person in crisis to be influenced by the negotiator and increases the chances of compliance (Vecchi et al., 2019, see also Cialdini, 2016, p. 7) which makes it crucial in transitioning into the next stage.

Stage 4 - Influence

Influence in the crisis negotiation context can be defined as being capable of affecting another person behaviourally using persuasive tactics (Cialdini, 2001; see also Kamphuis et al., 2006 as cited in van der Klok, 2023). Influence might include having the person in crisis move to continue the conversation in a safer position or convincing them to converse to another person relevant to the crisis context. Eventually, the negotiator may be able to negotiate acceptable solutions for both sides. To understand when the negotiator has successfully completed a stage to eventually reach this stage, training of the model is required.

Suicide Negotiation Training

Suicide negotiation is a topic that involves high stakes which makes training the necessary skills vital for a successful application of the model. Suicide negotiation has commonly been trained using role-plays (van Hasselt et al., 2008). For instance, a role play test developed by the Crisis Negotiation Unit of the FBI. These specific role-plays consist of audio material presenting scenarios which are then tackled with the help of different prompts (van Hasselt et al., 2008) in which performance of the negotiators was rated on the amount of active listening skills used. The program resulted in higher levels of active listening skills overall (Van Hasselt et al., 2006). Various role-plays using written instructions are also used as explained by Greenstone (2013, p. 192-202). Training through role playing has many advantages such as the opportunity to receive direct feedback and instructions helping to tailor the experience and adapt based on performance (van Hasselt et al., 2008). However, role playing also comes with limitations such as availability of role-playing actors and the time investment related to setting up the scenarios for each individual trainee. Training crisis negotiation in virtual reality might have the option to address this limitation.

Virtual Reality

Virtual reality (VR) has been on the rise in various scientific fields in recent times (Pimentel et al., 2021; see also Turner & Casey, 2014). Through VR, researchers in psychology can create immersive experiences for participants, in which every aspect can be controlled by the researchers (Wilson & Soranzo, 2015), including creating environments around experiences that normally would not be possible to experience in a safe manner, like crisis negotiations. When applied widespread, VR studies may also be more cost effective (Turner & Casey, 2014) and potentially more immersive than role-playing (Wilson &

Soranzo) across different scenarios which makes them an interesting prospect to be investigated for crisis negotiations.

Virtual reality has also shown benefits as a teaching and training tool that is able to train and reinforce, for instance, practical skills (Abich et al., 2021; see also Psotka, 1995; Philippe et al., 2020). Training different skills in VR facilitates the retention of knowledge in some scenarios while being outperformed by other methods of training (Abich et al., 2021). Virtual reality training also offers the advantage of training at one's own pace, including the ability to redo training exercises to reinforce the learned concepts (Sapkaroski et al., 2020). This means that crisis negotiators in training would be able to have the training fitted to their needs and the ability to easily repeat scenarios, situations, or people in crisis they have trouble with interacting.

While the potential of VR is high, the technology is not without its faults within the context of suicide negotiation. Suicide negotiation is a task requiring in depth social interactions with the interaction partner (Vecchi et al., 2005; see also Vecchi et al., 2019). Therefore, the agent created for the purpose of portraying a person in crisis needs detailed social characteristics which may be hard to create. The virtual agent needs to be realistic in both character as well as visually which takes significant effort. Furthermore, this effort needs to be repeated for every additional scenario including character and visuals for the experience to be meaningfully repeatable.

To get the most out of a VR experience, the experience should be immersive to reach a higher chance of success in transferring learned skills from VR into the real world (Grassini et al., 2020). Thus, the feeling of presence felt by participants and trainees within a VR environment is a key factor to consider.

Presence

One prevalent topic in virtual reality is the concept of presence, defined as "the subjective feeling of existence in an experienced environment" as defined by Nicovich et al. (2017, Presence section, para. 3) or simply "the sense of being there" (Skarbez et al., 2017). Having people feeling a sense of presence in the virtual environment that has been created, is important for the trainees as Virtual Reality as a training tool itself does not necessarily suffice to translate the learned skills to the real world (Grassini et al., 2020). It may also be important for the participant to properly recognise the situations in which they are successful in their negotiation or when certain phases need to be built further upon, which might be indicated by their performance in VR. The intention of presence within environments meant to emulate real world scenarios, is that information learned is easier accessible when the negotiator has learned this information in a perceived similar place based on principles of encoding specificity (Parker et al., 2020). Presence in the current study can be constructed from two sub-concepts: Spatial Presence and Social Presence.

Spatial Presence is defined as the "illusion to be located in an environment that is conveyed by some sort of media technology" (Hartman et al., 2015, pp. 116). This feeling of presence can be partially evoked using head-mounted displays like the Meta Quest 2, which replaces the visual perception of the real world with a simulated one (Van Gelder et al., 2014). This replacement helps to transfer oneself into any space important within the current context rather than relying on this space to be freely accessible for trainers and trainees. For a crisis negotiation for example, spatial presence can, for instance, describe how realistic the environment is where the crisis negotiation takes place. Spatial presence thus contributes to setting the stakes of the negotiation when it is capable of correctly emulating a real environment.

Social Presence is defined as whether the other characters found in the VR are perceived as present or not and if they appear human to the participant (Lombard & Jones, 2015). For a VR crisis negotiation, social presence describes how realistic the person in crisis appears to the negotiator which is important for the overall sense of presence felt by participants (Lombard & Jones, 2015). With social presence being present in VR scenarios, it is possible for a virtual character to elicit similar emotions in the participant as a real world conversant would (Mulvaney et al., 2024). This contributes to the virtual scenario more closely resembling a real-life situation not only through perceived surroundings but also through felt emotions, which include the emotions required for advancing through a crisis negotiation using the BISM.

Empathy and Rapport

As social presence is an important factor in representing real human interaction and eliciting the related feelings accurately (Mulvaney et al., 2024), the concepts of empathy and rapport may be logically connected with presence. Within the BISM model, empathy and rapport are crucial phases to reach the final goal. Therefore, a prerequisite for advancing into the next stage in real negotiations is properly feeling and displaying empathy and rapport. This makes it essential to look at the capacity in which these feelings of empathy and rapport can be evoked with a virtual agent in VR.

Previous research that has investigated the relationship between empathy and social presence have come to different conclusions. While the relationship could not be established for some (Felnhofer et al., 2014) in which trait empathy was investigated, others found social presence to be a significant predictor of state empathy felt by the participants (Bouchard et al., 2013) and empathy including both state and trait as a predictor of experienced presence

(Nicovich et al., 2017). A link may exist due to a potential requirement to perceive the digital character as a real being, rather than lines of code (Lombard & Jones, 2015).

The other concept present as a stage in the BISM, rapport, has also been investigated in relation to social presence. Rapport during the negotiation process was described as a connection experienced between the person in crisis and the negotiator (Vecchi et al., 2019). Different studies have shown to some extent that some rapport with a virtual person can be established (Huang et al., 2011, Hale & Hamilton, 2016). However, as social presence also requires a connection with the person in crisis as they need to be perceived as a complex other (Oh et al., 2018), rapport and social presence appear to be linked to some extent. This link has also been indicated during interviews carried out by Sauer (2024).

Due to the social components of rapport and empathy being prerequisites in successfully carrying out a real crisis negotiation, it is aimed to determine whether this can be also achieved in VR. The potential importance of social presence in perceiving the virtual conversant as someone one can feel empathetic to, or build rapport with,

The current study

The current study aims to investigate the potential effectiveness of virtual reality environments in crisis negotiation with an individual considering suicide. Using a virtual reality suicide negotiation, the role of presence felt by the participants will be observed and analysed in relation to their performance in the VR negotiation, and their empathy and rapport towards the person in crisis. To determine the presence experienced by the participants, and self-report questionnaires are used. Using this experiment, the following research questions are explored:

Research Question 1: Is spatial presence positively associated with crisis negotiation performance in this virtual reality crisis negotiation?

Research Question 2: Is social presence positively associated with crisis negotiation performance in this virtual crisis negotiation?

Research Question 3: Is there a positive relationship between empathy towards the person in crisis and the experienced levels of spatial-, and social presence?

Research Question 4: Is there a positive relationship between rapport towards the person in crisis and the experienced levels of spatial-, and social presence?

Methods

Design

All participants received training videos to become suicide negotiators. They were randomly allocated to one of two groups that received slightly different error handling training videos. One group received videos that focused on the need to prevent making errors during the negotiation (error prevention). The other group watched videos portraying making errors during the negotiation as being acceptable and even potentially having positive outcomes based on the negotiator's response afterwards (error management). This difference is implemented and controlled for within other analyses in this research and more in depth as part of another research using the same participant pool. Additionally, the participants indicated their propensity to experience motion sickness and, if applicable, prior experiences with crisis negotiation. Afterwards, they participated in a VR crisis negotiation with a virtual agent of a person in crisis, modelled after the different stages of the BISM. The number of correct choices made by the participant within this experiment is evaluated to create the dependent variable of crisis negotiation performance. Following this, the participants reported their felt spatial and social presence in the VR, and empathy and rapport felt with the digital person in crisis. These four self-report scales form the other variables to determine their influence on performance and the relationship between each other. Finally, the participants fill out a short demographics questionnaire. The participants are wearing a wristband throughout the process that measures their heart rate and electrodermal activity.

Participants

The participants were gathered through the participant gathering tool Sona-Systems, by hanging out flyers around the University of Twente campus, by directly approaching

students on that same campus, snowball sampling, as well as convenience sampling. In total, 42 participants were recruited.

Out of the 42 participants that started the study, one participant had to be excluded due to technical equipment failure that resulted in the pre-emptive cancellation of the experiment in that specific case. This resulted in 41 participants with valid survey responses. Of the 41 participants with valid survey responses, 19 people were from Germany, 12 people from the Netherlands, seven from other European countries and three from eastern Asian countries. The mean age of the sample was 23.51 ($SD = 7.8$) with the youngest being 18 and the oldest being 56 years. Twenty-seven participants (65.85%) identified as female while fourteen (34.15%) identified as male. The highest level of education achieved in the sample was a high school diploma for 32 participants, an apprenticeship for two participants, and a bachelor's degree for seven participants. 25 participants already had some prior experience with Virtual Reality while 16 participants used VR for the first time. Seven participants also already had some prior experience with crisis negotiation. The experiences described included training sessions during studies or internships, working in rehabilitation, and personal experiences with oneself and friends.

Measures

The following tools, hardware, and software options were used to carry out this experiment and will later be explained in more detail at their relevant points during the procedure: The study flow was integrated into the survey tool Qualtrics. This includes the ethical consent form, the instructional videos, the instructional questions, the questionnaires, and the debrief.

The Meta Quest 2 glasses by Meta were used as the VR headset. The design of the environment was completed using Unity editor version 2021.3.8f1. Dialogue responses were recorded as either correct or incorrect replies in an output file.

Physiological data was measured using an Empatica E4 wristband. Heart rate and electrodermal activity was measured to evaluate the stress levels of the participants used for another study stemming from this data pool. Due to this study's different focal point and the inaccurate readings stemming from the wristband, these physiological measurements were discarded.

Scales

Spatial and Social Presence

To measure spatial and social presence, an adapted version of the immersiveness scale of Renes (2023) first implemented by Hartman et al. (2015) was used. The original included items regarding the concept of co-presence, concerning a second human within the VR environment. As the experiment only included one real person in the VR (the other being the virtual character), these items were thus removed. Additionally, the original item: "0" was moved into the empathy scale during the construction of the scales, as the wording suited the definition used for empathy more than social presence. Finally, the wording was adapted to fit the current experiment. For instance, "My partner was responsive towards me in the virtual environment" was turned into "The character on the roof was responsive towards me in the virtual environment." as this more closely suited the current experiment [see Appendix D].

All the items of this scale were measured using a 5-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree". Spatial presence was measured using six items such as "I felt like I was part of the virtual environment". Social presence was measured

using four items such as "The other character's behaviour was often a reaction to my own behaviour in the virtual environment". Generally, a higher level of agreement indicated a higher level of presence, with the exception of item 6 within the spatial presence scale "I was easily distracted during the interaction". This item was reverse coded and thus a lower level of agreement indicated a higher level of presence.

With a sample size of 41, the spatial presence scale had a low reliability ($\alpha = .64$). A higher Cronbach's alpha value can be achieved by removing item 6, "I was easily distracted during the interaction." ($\alpha = .72$) while keeping high correlation to the original variable $r(39) = .98, p < .001$. The subsequent analyses using spatial presence are thus excluding this item. The original scale consisting of five items will still be tested in the analyses to ensure that no significant differences emerge from the removal of this item.

The Cronbach's alpha for the social presence scale was also low indicating a lower reliability ($\alpha = .62$). However, a higher value can also be achieved here by removing item 4, "The other character made me feel like I was in the environment with another person.", of the social presence scale ($\alpha = .67$) which also keeps a high correlation to the original variable $r(39) = .90, p < .001$. This means that all future analyses mentioning social presence refer to the scale with this item removed.

Empathy

Two facets of state empathy were measured with one item each. Cognitive empathy, the ability to comprehend the internal state of another (Reniers et al., 2011), is measured with the item "It was easy to understand how the other character felt in the virtual environment.", which was moved from the social presence scale during scale construction. Affective empathy, the ability to experience the emotional situation of another (Reniers et al., 2011), was measured with the item "I felt an emotional response from interacting with the other character." [see Appendix D]. The responses were given on a five-point Likert-scale ranging

from "Strongly disagree" to "Strongly agree" with higher levels of agreement indicating higher levels of empathy felt by the participant.

As the empathy scale consisted of only two items, a Spearman correlation was carried out to determine the relationship between these two items. This test revealed a weak but significant correlation between the two empathy items $r_s(39) = .36$, $p = .02$. Because the items in the scale consider different facets of empathy, affective and cognitive, removing an item might have negative impacts on content validity. Therefore, the scale was kept as it is for subsequent analyses.

Rapport

Rapport was measured with three items each focusing on a different part of the tripartite model of rapport (Tickle-Degnen & Rosenthal, 1990; see also Gabbert et al., 2021). The model consists of three different concepts that need to be present for rapport, being attentive to one another (mutual attentiveness), the mutual impression that it is a positive interaction including caring for one another (positivity), and the feeling both communication partners are on the same wavelength (coordination) (Tickle-Degnen & Rosenthal, 1990). Mutual attentiveness was measured using the item "The person in crisis and I were paying attention to each other.". Positivity was measured with the item "The conversation felt mutually respectful." and coordination was measured with "The conversation with the person in crisis flowed smoothly." [see Appendix D]. The participants could again respond on a 5-point Likert scale from "Strongly disagree" to "Strongly agree" where higher scores show a higher level of rapport felt with the person in crisis.

Similar to the empathy scale, the rapport scale had shown a very low reliability ($\alpha = .55$) but is also a short scale consisting of only 3 items. Because these three items are

measuring the three different dimensions of the tripartite model of rapport and content validity might suffer from removing one, this lower alpha value was accepted.

Stress

The stress scale measures the experienced level of stress by the participant before the negotiation and was set up by another researcher but has become relevant for exploratory analyses within this paper. Stress was measured using three items based on a 4-item stress scale by Ströfer et al. (2016) which was derived from the Perceived Stress Scale by Cohen et al. (1983). The statements were reformulated into I-statements with the instruction inquiring the participant about their experience before the negotiation. The scale consists of the items "I felt nervous.", "The stress I felt increased to such high levels that I could not let go of it.", and "I felt tension." [see Appendix D]. One item of the scale by Ströfer et al. (2016) was removed as it was reactive to an event rather than in anticipation of the negotiation, namely "To which extent did you feel upset during, or after the interview?". The scale had an acceptable reliability (α = .74).

Other

Alongside stress, the variables of worry, self-efficacy, and cognition are measured with a questionnaire containing 10 items such as "I felt that thanks to my resourcefulness, I knew how to handle unforeseen situations." or "I felt nervous" on a 5-point scale ranging from "Not At All" to "Very Much So". Higher ratings indicated higher levels of experiencing these certain emotions. These variables were created for another project and, apart from the Stress measure, will not be used or discussed further within this paper.

Procedure

In the beginning, the participants received a consent form [see Appendix A] in which they were first thanked and given a brief explanation about the study. They were informed that they will take on the role of a crisis negotiator and learn about crisis negotiation before utilising the acquired knowledge in a VR environment. Then, they were informed about the potential risks of the study, and informed about the sensitive topics that are part of the experiment (Suicide, Fear of heights) where their right to withdraw at any point for any reason was stressed. Afterwards, it is explained how the information collected is used and that it is stored and handled anonymously [see Appendix A]. While reading the informed consent, the participants were given the opportunity to ask questions which were answered by the researcher, which were present during the whole procedure. Having read the information, the participants are required to tick their agreement for all four separate key points within the survey tool Qualtrics to give explicit consent [see Appendix A]. After accepting the informed consent, the participants put on an Empatica E4 wristband which was then turned on with the intention to gather physiological measurements. Simultaneously, the researchers started a timer to synchronise the heart rate to the learning phase, the VR phase, and the post-VR phase of the experiment. With the wristband equipped, the participants started working with the learning materials.

Learning Phase

Firstly, the participants watched five learning videos regarding crisis negotiation with the focus on the behavioural influence stairway model (BISM) [see Appendix B]. These videos were created with consideration for guidelines set out by Brame (2016) to increase learning effectiveness, which includes creating a few shorter videos rather than one longer video to reduce cognitive load on the participants. The first video gave a brief introduction

into the topic of suicide attempts and the learning structure of the videos to explain to the participants what they can expect [see Appendix B1]. The second video then gave an introduction into crisis negotiation and introduced the BISM as a viable strategy [see Appendix B2]. The third video gives an in-depth explanation of the BISM with some examples such as an example dialogue for the individual phases [see Appendix B3]. The fourth video discusses the topic of errors in negotiation with a focus on either preventing errors [see Appendix B4] or error management [see Appendix B5]. The last video was a summary of the previous videos the participants watched [see Appendix B6 and Appendix B7].

After having watched all videos, the participants were asked multiple choice questions related to the content of the instructional videos [see Appendix E]. These questions are related to the training contents and are meant to strengthen the understanding of the previously studied materials by having the participants apply their gained knowledge to new situations posed by the questions. For instance, "An example of a judgement error is when the negotiator asks the PiC about their family even after the PiC stated they did not want to talk about them." with the answer possibilities "True", "False", and "I don't know". After answering each question, they get a display telling them whether they answered right or wrong and what the correct answer to the question is.

After completing all the learning materials, the participants moved away from Qualtrics to familiarise themselves with the Meta Quest 2 glasses. At this stage, they are explained the controls of the quest controller and glasses including how to move in the VR, how to look around, and how to select dialogue options. As soon as the participants understand how they can interact with the VR environment and state that they are ready with no further questions, they put on the glasses and are handed the controllers to start the VR experiment.

Virtual Reality Phase

The environment used in Sauer (2024) was used and slightly adapted for this experiment. The participants spawn in on a road surrounded by various tall buildings facing into the direction of one of these tall buildings. To both sides there is a sidewalk including scenery assets such as trees, lampposts, traffic lights, or a newspaper machine. This start is intended for the participants to familiarise themselves with the controls of this virtual reality experiment. After 15 seconds within the VR, the participants receive an alert message. An audio message is played that emulates a radio call to the negotiator, using distortions and chatter. This radio informs the participants that there is a man standing on a rooftop close to their current location and that they should move towards that location quickly. If the participant chooses to turn around on the street, they see a large part of the rest of the city and its tall buildings that indicate a danger connected to their rooftops. To create an environment more closely resembling a real city, the scenery includes parked cars, signs, fire hydrants, power lines, and more. As shown in Figure 1, the person in crisis standing at the edge of the roof is already visible from the position of the participants.
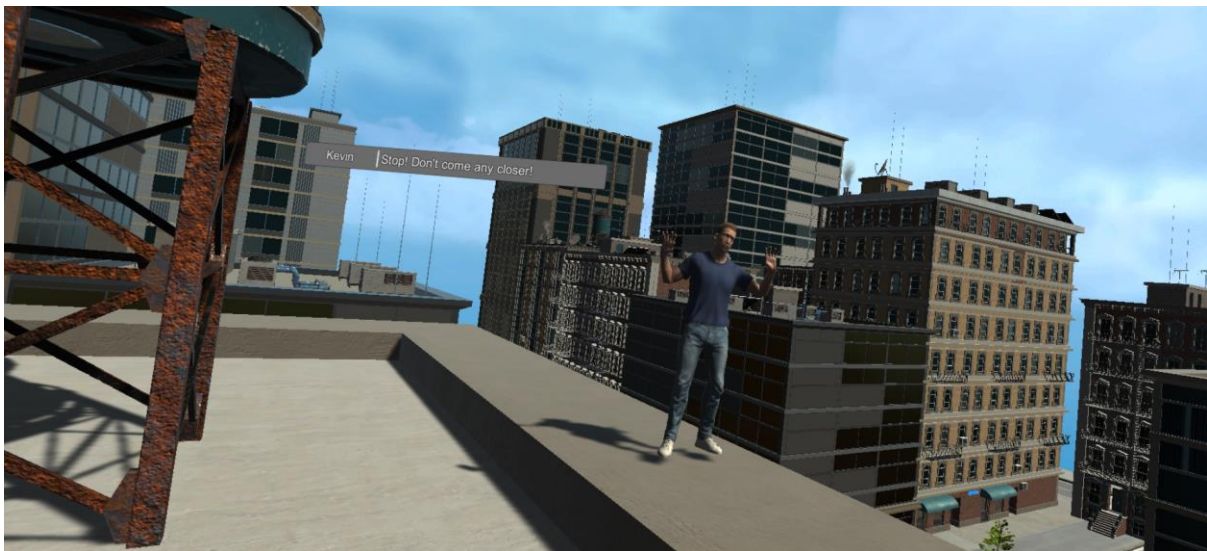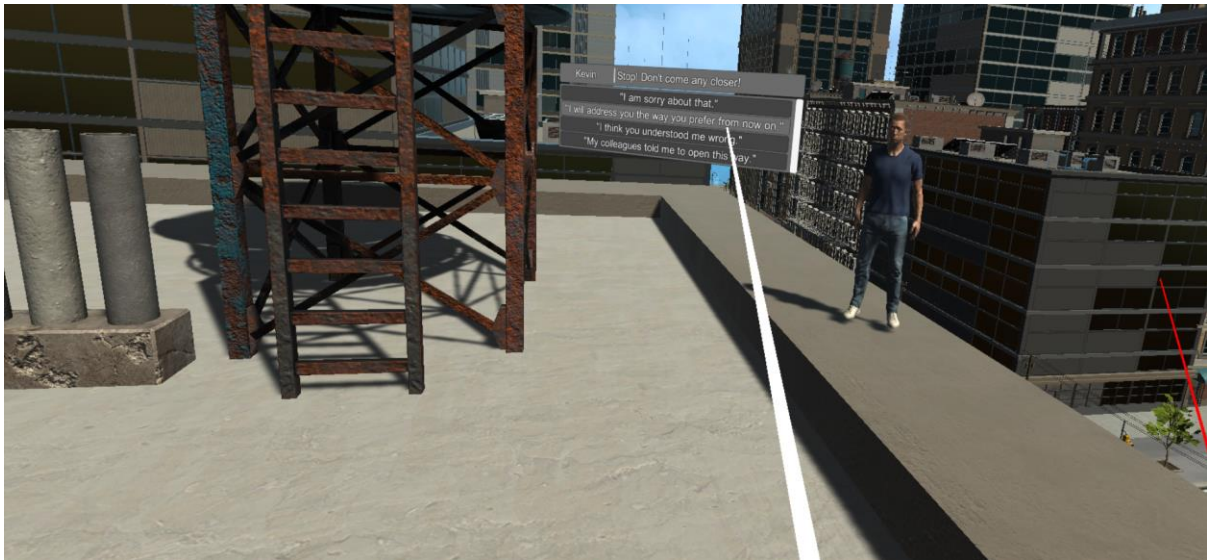
Figure 1

The VR Environment

As soon as the participants move onto this intersection, they are teleported onto the roof. Here they get a message displayed on the glasses telling them to "Look around" as they are initially facing towards the opposite direction of the person in crisis after the teleport. While looking around the participant can see they are positioned on the roof and that the person in crisis is standing idly at the edge behind them. The participants are required to move towards the person in crisis to activate their dialogue. While on the roof, their movement is restricted to a certain area that keeps the person in crisis in sight and relatively close. As soon as the participant enters a specific area close enough to the person in crisis, the dialogue starts with the person in crisis looking towards the participant and audibly addressing them, urging them to not come closer. In Figure 2 it is shown how this is portrayed to the participant.

Figure 2

Beginning of Negotiation and Opening of Dialogue Window

During the dialogue, the participants are shown multiple options of dialogue previews they can select. Figure 3 shows an example of this selection window. Selecting a preview reveals the complete dialogue text that will be said to the character that embodies the person in crisis.

Figure 3

Multiple Choice Dialogue Window Example

Every selected part of dialogue will prompt a reply from the person in crisis which is presented in the form of an audio file that automatically plays. Additionally, during every reply of the PiC, an animation fitting to that piece of dialogue and the emotions connected to that reply is played. An example can be observed in figure 4. These animations were modelled after behavioural tendencies of people in crisis as researched in Oostinga et al. (submitted). After each animation, the PiC reverts to their default idle animation until their next line of dialogue.

Figure 4

Animation Example

The participants work their way through the negotiation picking their preferred

dialogue options. Each dialogue option is referring to a specific stage within the BISM,

classifying them as correct or incorrect is dependent on their accordance with the BISM

stages. Dialogue options to which there was no correct answer, are also coded to determine

which answers are picked but are not differentiated as "correct" or "incorrect". The first

dialogue option presents a choice between addressing the PiC with their first name or their

last name. Selecting either option is presented as an error and elicits a negative response from

the PiC. This specific dialogue option was implemented to test how the participant handles

making errors, which was a focal point within the other research. Reacting to that negative

response of the PiC, the participant can choose between four options; Either they can

apologise, assure the error will not happen again, deny the error happened, or deflect blame

(see Figure 2). The former two will elicit a positive response of the person in crisis, the latter

two elicit a negative response. Afterwards, the participants have to always choose between

two dialogue options which relate back to the different stages of the BISM. One of the two answer options of each decision is always incorrect according to the BISM training and will trigger a negative response of the person in crisis. For instance, if the participant tries to influence the person in crisis in decision 3 already by telling them to come down, the agent will angrily refuse [see Appendix C]. The other option is always correct and usually triggers a positive response. For instance, in decision 3, when the participant chooses to listen, as recommended by the BISM, instead of trying to influence the PiC, which would be too early according to the BISM, the PiC will be more forthcoming and open (van der Klok, 2023) [see Appendix C]. The choices determine the final dependent variable of performance by adding the number of correct choices together. The exception is choice 4, where both options result in a negative response to, again, force the participant to react to a supposed error of theirs [see Appendix C]. In the end, the character of the person in crisis will end their dialogue by either claiming they will come down and beginning a forward walking animation, or by stating that they want to speak to a different negotiator. The outcome is dependent on the previously selected option by the participants and how well it was aligned with the BISM. Both of these answers signal the ending of the negotiation, and the participant exits the scenario and puts down the VR glasses.

Post-VR Phase

Having completed the VR scenario, the participants were asked to return to their seat in front of the PC and continued with the questionnaires. They first started with their experience regarding spatial and social presence, experienced rapport, and their felt empathy. Afterwards, the questionnaires regarding worry, self-efficacy, cognition, and stress were presented.

Finishing that scale, the participants filled out demographic information about themselves before they were presented with the debrief. In the debrief they were made aware of the research aim and their group allocation and any outstanding questions were discussed. In the debrief they had the opportunity to either consent to the usage of their collected data or withdraw their cooperation, which none of the participants did. Regardless of the option they chose, after this section the study is concluded, and the participant returns all equipment.

Results

Descriptive Statistics

The descriptive statistics of spatial presence, social presence, empathy, rapport, and performance can be observed in Table 1. Additionally, the original scales of spatial and social presence which contained all original items can be identified by the [OS] addition following the name (see Table 1). The performance scale was heavily skewed towards the left with over 70% (73.17%) of the participants scoring the full number of points and none scoring below 3.

Table 1

Descriptive Statistics for Spatial Presence, Social Presence, Empathy, Rapport, and Performance

Measure	N	Min.	Max.	M	SD
Spatial Presence	41	1.80	4.60	3.45	0.72
Social Presence	41	2.67	5.00	4.27	0.56
Empathy	41	1.00	5.00	3.85	0.86
Rapport	41	2.33	5.00	3.96	0.60
Performance	41	3.00	5.00	4.51	0.84
Spatial Presence [OS]	41	2.17	4.67	3.60	0.63
Social Presence [OS]	41	2.75	5.00	4.13	0.55

Note. The [OS] ending of the Spatial Presence and Social Presence entry signifies the original scale of these two variables, in which no items were removed to enhance the internal reliability.

To answer the research questions of whether there is a significant, positive correlation between spatial and social presence and empathy or rapport a correlation analysis was carried out. The positive correlation between Spatial Presence and Empathy (see Table 2) was barely

non-significant[1]. For Social Presence and Empathy, a significant positive correlation can be seen. For rapport, the correlations were non-significant both with spatial presence as well as with social presence (see Table 2). Therefore, strong indications are found that the empathy felt with the virtual person in crisis is positively correlated with the social presence experienced in the virtual reality scenario. Additionally, there are indications that spatial presence in the VR is also positively correlated to the empathy felt with the PiC. On the other hand, rapport was not significantly correlated with the sense of social and spatial presence felt in the virtual environment.

Apart from these findings, a positive correlation between Empathy and Rapport within the experiment was found $r(39) = .46$, $p = .003$.

Table 2

Correlation table between Spatial Presence (1), Social Presence (2), Empathy (3), Rapport (4), and Performance (5)

Variable	*M*	*SD*	1	2	3	4	5
1. Spatial Presence	3.45	0.72	1				
2. Social Presence	4.27	0.56	.19	1			
3. Empathy	3.85	0.86	.30	**.46***	1		
4. Rapport	3.96	0.60	.06	.26	**.46***	1	
5. Performance	4.51	0.84	**-.44***	-.16	-.24	.26	1

Note. * = Correlation is significant at the 0.05 level, *n* = 41

---

[1] The original spatial presence variable shows a correlation that is significant $r(39) = .37$, $p = .017$.

Inferential Statistics

To test whether spatial presence or social presence are capable of predicting participant performance, a linear regression analysis was performed including Performance as a dependent variable and spatial presence and social presence[2] as predictor variables while also controlling for the covariance created by the type of training videos the participant watched before the negotiation (training type)[3], propensity for cybersickness, empathy, and rapport. The model was able to predict performance $R^2 = .44$, $F(6, 34) = 4.41$, $p = .002$.

The outcome of this regression analysis as depicted in Table 3 shows that spatial presence does appear to predict performance. The effect however, is, contrary to expectations, a negative one. Social presence on the other hand, did not significantly predict performance. Rapport had a significant positive effect on performance in the dataset.

The significance and non-significance found in the analyses remains the same when substituting the Social-, and Spatial Presence variables with their initial variable, meaning that the removal of the problematic items in favour of a higher Cronbach's alpha has no significant effect on the other results.

---

[2] This analysis was also carried out using the full spatial presence and social presence scales where it was confirmed that no significantly different results arose from this change.

[3] There were two groups of participants that watched training videos related to either error prevention or error management in crisis negotiation. Both groups received the same training regarding the Behavioural Influence Stairway Model and the difference between these two groups is not investigated within this study. Nevertheless, the potential influence is investigated.

Table 3

Multiple regression analysis on Performance

Variable	B	SE	t	p
Constant	**4.73**	**1.15**	**4.11**	**<.001**
Spatial Presence	**-0.38***	**0.16**	**-2.34**	**.025**
Social Presence	-0.84	0.22	-0.38	.719
Empathy	**-0.37***	**0.17**	**-2.14**	**.039**
Rapport	**0.78***	**0.25**	**3.16**	**.003**
Training Type	-0.38	0.26	-1.46	.153
Cybersickness	-0.25	0.30	-0.85	.399

Note. * = Correlation is significant at the 0.05 level, $n = 41$

Includes Performance score as a dependent variable with Spatial Presence, Social Presence, Learning Material Group, Tendency to get motion sick (Cybersickness), Empathy, and Rapport as independent variables.

Exploratory Analysis

One theory why the effect of spatial presence on performance and the correlation between empathy and performance was negative instead of, as theorised, positive, is that stress may factor into the ability to handle the negotiation. Due to an increased feeling of being in the situation and on a rooftop (spatial presence) and genuinely caring for the character (empathy), stress levels might rise. This may then lead to poorer performance due to the increased stress experienced while carrying out the task. As this study did not include a functional stress measure, this specific hypothesis cannot be tested. The experiment did however include a pre-stress measure which will be analysed for the general impact of stress before the experiment on performance within the virtual crisis negotiation.

Inserting this variable into the previous multiple linear regression model reveals that experienced stress before the VR part does not have a significant effect on performance within this experiment (see Table 4). Stress did also not have a significant correlation with spatial presence $r(39) = .26$, $p = .096$, social presence $r(39) = .19$, $p = .245$, empathy $r(39) = .25$, $p = .123$, or rapport $r(39) = -.14$, $p = .393$.

Table 4

Multiple regression analysis on Performance with Stress included.

Variable	Unstandardised B	SE	t	p
Constant	**4.73**	**1.17**	**4.05**	**<0.001**
Spatial Presence	**-0.38***	**0.17**	**-2.26**	**.031**
Social Presence	-0.86	0.23	-0.37	.711
Empathy	**-0.37***	**0.18**	**-2.10**	**.044**
Rapport	**0.78***	**0.25**	**3.10**	**.004**
Stress	0.01	0.18	0.06	.954
Training Type	-0.38	0.23	-1.31	.198
Cybersickness	-0.26	0.34	-0.77	.449

Note. Includes Performance score as a dependent variable with Spatial Presence, Social Presence, Learning Material Group, Tendency to get motion sick (Cybersickness), Stress Empathy, and Rapport as independent variables.

* = Correlation is significant at the 0.05 level, *n* = 41

Discussion

The aim of this study was to investigate Virtual Reality as a tool to train people in the field of crisis negotiation. With the help of an experiment, the relationships of spatial presence, social presence, empathy, and rapport were looked at and evaluated for their interactions between each other and between the performance of the trainees of this experiment. Both empathy and spatial presence had a significant negative effect on performance. Rapport was found to have a significant positive effect on the negotiation performance. The effect of social presence on performance was non-significant. Among these four predictor variables, significant, positive correlations have been found between empathy and rapport, and empathy and social presence. The other relationships among the predictor variables were non-significant.

Spatial and Social Presence

Generally, the level of spatial presence and social presence felt by the participants was above the midpoint and relatively high, particularly for social presence. However, the results differed from the expected effects. While it was expected that the sense of presence would increase the performance of the participants in the negotiation, this effect was not found for social presence and an opposite effect was found for spatial presence. In the experiment, the higher the participant felt immersed in the experience, the lower their performance in the negotiation was according to the BISM training material.

An idea for this unexpected effect is that a higher level of spatial presence may lead to a higher level of stress which in turn negatively impacts the performance of the participants. A negative effect of empathy on performance supported this idea. An exploratory analysis of an attached stress variable did not support this idea; however, this stress variable was regarding stress before the negotiation and not during the negotiation. While stress before the

VR did not influence the level of presence, stress during the VR cannot be ruled out as a possibility. However, an exploratory analysis of an attached stress variable in the questionnaire did not support this hypothesis. Therefore, this effect of a reduced performance coming with a higher level of spatial presence remains unexplained within this research.

Another potential reason for this unexpected effect could be distractions within the VR environment. An increasing level of presence could be related to a tendency of being distracted, details, or moving objects within the VR environment, reducing the participant's capacity to focus or recall the necessary information about the BISM and thus increasing the likelihood of making errors. A study by Howard and Gutworth (2020) demonstrated that approaches utilising higher levels of presence can lead to a decrease in performance when training social skills. This not only offers a potential explanation for these unexpected findings, but also casts doubt on the viability of VR in training suicide negotiations.

Social presence was shown to be significantly positively correlated with empathy within this study. Perceiving the other being as a meaningful entity instead of a virtual agent has been expected to contribute to feeling empathetic towards the character. These findings are consistent with a prior experiment by Shin (2018; see also Shin, 2013) in which participants witnessed characters being victim to social issues either on a head mounted display, or a flat screen TV. The level of social presence experienced by the participants was highly correlated to the empathy the participants experienced with the character in VR. Therefore, it is argued that social presence is required for a VR crisis negotiation training.

Counterintuitively, social presence was not significantly correlated with rapport despite rapport entailing social components as a prerequisite. This is an odd finding considering the baseline assumption is the same as with empathy. Namely, when the user experiences social presence, it is expected that their rapport and empathy levels are higher. Nonetheless, these results are consistent with the findings of Sauer (2024) who attributed this

missing correlation to the scale being only one item. Similarly, this reasoning may be applied to the current study in which the rapport scale was comprised of three items who all measured different facets of the tripartite model of rapport.

Empathy and Rapport

Empathy and Rapport were positively correlated within this experiment. A higher level of empathy with the PiC usually meant a higher perceived level of rapport as well. This finding may arise due to the nature of the BISM being a step-based model (Vecchi et al., 2005). As the empathy stage comes immediately before the rapport stage, participants that were under the impression that they have not achieved the necessary level of empathy may have felt similarly about rapport. Despite this theory, this finding of a significant, positive relationship between empathy and rapport stands in direct contrast to the findings of Sauer (2024) who found a non-significant negative correlation.

Empathy and rapport showed to have significant effects on performance. Empathy did have a negative effect on performance indicating that a higher level of empathy felt with the PiC tends to lower negotiation performances. This may be due to a higher cognitive cost associated with consciously building empathy (Hodges & Klein, 2001). Having to focus on building empathy with the person in crisis alongside the other aspects and stages to consider, may thus have a significant cognitive impact that reduces the ability of the participant to select the correct choices. Cameron et al., (2019) provides an argument based on their experiment, that empathy sometimes is disregarded due to its cognitive costs. As disregarding empathy is not viable during crisis negotiation, the participant must accept this higher cognitive load.

Rapport, on the other hand, had a positive impact on performance, meaning that the participants tended to perform better when they felt a higher level of rapport with the person in crisis. For the supposed effect of rapport, the time order could not be established, and the

effect could also stem from the fact that a person that performs better also has a more positive interaction with the person in crisis. This more positive interaction with the person in crisis then results in the negotiator feeling like they have a higher level of rapport with the person in crisis. It is important though to stress that this higher level of rapport is only felt by the participants and might not necessarily be mutual. Prior research in investigative interviewing even indicates that professionals that aim to build rapport frequently overestimate the rapport built with their conversational partner (Walsh et al., 2017) or are unable to keep the built rapport (Walsh & Bull, 2012). Miscalculations of built rapport may occur in these situations due to the lack of instantaneous feedback for the negotiator (Walsh et al., 2017) or missing relevant social cues due to the already cognitively demanding nature of the negotiation (Richardson & Nash, 2021). According to Walsh and Milne (2017), miscalculations of built rapport may occur in situations where there are not enough conclusive or negative reactions.

Limitations and Further Research

The sample was fairly homogenous likely due to the sampling method of convenience sampling which was applied given the time and cost constraints of this project. This resulted in the sample being mostly Dutch and German psychology students which likely differ in various regards to crisis negotiators or police officers in training to become negotiators. For instance, the sense of presence was relatively high within this study though most participants did not have any prior experience with crisis negotiation. A trained negotiator's real-world experience with suicide negotiation might significantly diverge from the expectations of suicide negotiations that an unexperienced layperson possesses, which the sample consisted off. Thus, police negotiators in training may have a different perspective on the methodology and consider the VR negotiation as less realistic, experience a lower level of social presence, and due to this, also struggle to build empathy or rapport with the person in crisis.

Additionally, the dialogue tree was kept simple. Most of the decisions made the participant decide between only two options without the possibility of inserting any own input. This has its advantages but also a few shortcomings. As can be deduced from the high scores measured in the performance, this format appeared to be not particularly challenging to the participants, which was deemed appropriate due to the participants being novices. Another disadvantage from this method is the lack of benefit from redoing the training exercise. As there is always a maximum of one positive reaction or one negative reaction, the trainee would be capable of seeing everything this specific scenario has to offer by completing the scenario merely two times, which negates the argument of the accessibility of VR providing the chance to train in one's own time and at one's own pace. Using this approach, the technical challenges were kept to a necessary minimum considering the researchers lack of (VR) development experience.

More technically challenging but also new potential is offered by using an actor as a second person within VR that embodies the person in crisis. The option of having a second person in VR that speaks as if they are the PiC offers the opportunity to have an open conversation in which you receive instant feedback, and emotions can be accurately portrayed by the actor. As VR can achieve a higher level of presence than when merely imagining oneself in a specific situation (Ahn et al., 2013). This way, it may be possible to achieve a higher level of presence while also keeping a high level of openness of the conversation and have an interaction that appears accurate to a real-world situation due to the experiences of the trained actor. This method also comes with its flaws and limitations. The actor first needs to be trained sufficiently to portray the person in crisis accurately which may be cost and time intensive and the training can still only be provided during specific times in specific locations instead of being always available.

Another option of setting up the environment with open conversations could be having the person in crisis be portrayed through an AI language models a character that can freely hold a conversation and be ready for open speech input by the trainee. The potentials, advantages, and risks of AI and individual speech input have recently been researched by Zargham et al. (2024) including potential for increased sense of presence and a more natural feel. On the other hand, the use of language models also offers risks as the freeness of interaction from both sides may lead to the conversation becoming inappropriate (Zargham et al., 2024) or inaccurate as AI language models sometimes tend to provide false information (Perković et al., 2024). Therefore, extensive training of the AI without a guarantee of success would be required. Therefore, the application of AI models in crisis negotiation is also associated with risks and challenges.

Both an actor and AI as a person in crisis would likely increase the variability of performance scores due to the openness of the conversation while the chosen approach resulted in perfect performance scores for most participants. These three different modes of setting up a virtual reality conversation all come with their individual strengths and weaknesses. The deciding factor, which of these methods is the most effective in training crisis negotiation skills, may be a compelling basis for future research in the field.

Furthermore, as this research still attempts to establish a baseline into the effects and viability of VR in suicide negotiation, the measurements used in this study are limited and leave questions raised by the results unanswered. Employing more measures may be advantageous to finding out the underlying reasons for the unexpectedly negative effect of spatial presence and empathy on performance. The police negotiation cadre of Hong Kong tests their negotiation candidates for their ability to withstand stress and fatigue due to the stressful nature of such high-stake negotiations (Vecchi et al., 2019). Therefore, a stress related measure seems likely to yield additional findings and potentially offer explanations

for the current findings. This measure may be helpful in providing clarity into whether stress does, for instance, have a mediating effect between presence and performance.

Conclusion

This research is one of the first to experiment with applying virtual reality as a tool to train suicide negotiation. It provides a glimpse into the capabilities of Virtual reality to reinforce learned skills within a secure and controlled environment. The findings regarding presence especially stress the importance of spatial presence in the VR negotiation process. The study adds to establishing a baseline of VR in crisis negotiation with the methodology may be used as inspiration for training future crisis negotiators.

This study aimed to investigate virtual reality and its spatial and social presence attributes as a tool to facilitate crisis negotiation training. While a good level of spatial and social presence was achieved in many participants, spatial presence was detrimental to the performance instead of the expected improvement while crisis negotiation conversing. This study offers a new, unexpected perspective. A heightened sense of presence can not only lead to higher performance but instead lead to the exact opposite. This is a new, important aspect to consider in the future design of training programs that aim to utilise virtual reality as a platform for teaching and training.

Reference List

Abich, J., Parker, J., Murphy, J. S., & Eudy, M. (2021). A review of the evidence for training effectiveness with virtual reality technology. *Virtual Reality, 25*(4), 919-933. Doi: 10.1007/s10055-020-00498-8

Ahn, S. J., Le, A. M. T., & Bailenson, J. (2013). The effect of embodied experiences on self-other merging, attitude, and helping behavior. *Media Psychology, 16*(1), 7-38. Doi: 10.1080/15213269.2012.755877

Bouchard, S., Bernier, F., Boivin, E., Dumoulin, S., Laforest, M., Guitard, T., Robillard, G., Monthuy-Blanc, J., & Renaud, P. (2013). Empathy Toward Virtual Humans Depicting a Known or Unknown Person Expressing Pain. *Cyberpsychology, Behavior, and Social Networking*, *16*(1), 61-71. Doi: 10.1089/cyber.2012.1571

Cameron, C. D., Hutcherson, C. A., Ferguson, A. M., Scheffer, J. A., Hadjiandreou, E., & Inzlicht, M. (2019). Empathy is hard work: People choose to avoid empathy because of its cognitive costs. *Journal of Experimental Psychology: General, 148*(6), 962. Doi: 10.1037/xge0000595

Cialdini, R. B. (2001). The science of persuasion. *Scientific American, 284*(2), 76-81.

Cialdini, R. (2016). *Pre-suasion: A revolutionary way to influence and persuade*. Simon and Schuster.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*, 385-396. Doi: 10.2307/2136404

Cuff, B. M., Brown, S. J., Taylor, L., & Howat, D. J. (2016). Empathy: A review of the concept. *Emotion review, 8*(2), 144-153. Doi: 10.1177/1754073914558466

David, G. C., Rawls, A. W., & Trainum, J. (2018). Playing the interrogation game: Rapport, coercion, and confessions in police interrogations. *Symbolic Interaction*, *41*(1), 3-24. Doi: 10.1002/symb.317

Felnhofer, A., Kothgassner, O. D., Hauk, N., Beutl, L., Hlavacs, H., & Kryspin-Exner, I. (2014). Physical and social presence in collaborative virtual environments: Exploring age and gender differences with respect to empathy. *Computers in Human Behavior*, *31*, 272-279. Doi: 10.1016/j.chb.2013.10.045

Gabbert, F., Hope, L., Luther, K., Wright, G., Ng, M., & Oxburgh, G. (2021). Exploring the use of rapport in professional information-gathering contexts by systematically mapping the evidence base. *Applied Cognitive Psychology, 35*(2), 329-341. Doi: 10.1002/acp.3762

Grassine, S., Laumann, K., & Rasmussen Skogstad, M. (2020). The Use of Virtual Reality Alone Does Not Promote Training Performance (but Sense of Presence Does) [Original Research]. *Frontiers in Psychology, 11*. Doi: 10.3389/fpsyg.2020.01743

Greenstone, J. L. (2013). *The elements of police hostage and crisis negotiations: Critical incidents and how to respond to them.* Routledge. Doi: 10.4324/9780203463277

Grubb, A. (2010). Modern day hostage (crisis) negotiation: The evolution of an art form within the policing arena. *Aggression and Violent Behavior, 15*(5), 341-348. Doi: 10.1016/j.avb.2010.06.002

Hartmann, T., Wirth, W., Vorderer, P., Klimmt, C., Schramm, H., & Böcking, S. (2015). Spatial Presence Theory: State of the Art and Challenges Ahead. In M. Lombard, F. Biocca, J. Freeman, W. Ijsselsteijn, & R. J. Schaevitz (Eds.), *Immersed in Media: Telepresence Theory, Measurement & Technology* (pp. 115-135). Springer International Publishing. Doi: 10.1007/978-3-319-10190-3_7

Hale, J., & Hamilton, A. F. D. C. (2016). Testing the relationship between mimicry, trust and rapport in virtual reality conversations. *Scientific Reports, 6*(1), 35295. Doi: 10.3389/frobt.2018.00114

Hodges, S. D., & Klein, K. J. (2001). Regulating the costs of empathy: the price of being human. *The Journal of socio-economics, 30*(5), 437-452. Doi: 10.1016/S1053-5357(01)00112-3

Howard, M. C., & Gutworth, M. B. (2020). A meta-analysis of virtual reality training programs for social skill development. *Computers & Education*, *144*, 103707. Doi: 10.1016/j.compedu.2019.103707

Huang, L., Morency, L. P., & Gratch, J. (2011). Virtual Rapport 2.0. In *Intelligent Virtual Agents: 10th International Conference, IVA 2011, Reykjavik, Iceland, September 15-17, 2011. Proceedings 11* (pp. 68-79). Springer Berlin Heidelberg.

Ireland, C. A., & Vecchi, G. M. (2009). The Behavioral Influence Stairway Model (BISM): a framework for managing terrorist crisis situations? *Behavioral Sciences of Terrorism and Political Aggression, 1*(3), 203-218. Doi: 10.1080/19434470903017722

Johnson, K. E., Thompson, J., Hall, J. A., & Meyer, C. (2018). Crisis (hostage) negotiators weigh in: the skills, behaviors, and qualities that characterize an expert crisis negotiator. *Police Practice and research*, *19*(5), 472-489.

Lombard, M., & Jones, M. T. (2015). Defining Presence. In (pp. 13-34). Springer International Publishing. Doi: 10.1007/978-3-319-10190-3_2

Mulvaney, P., Rooney, B., Friehs, M. A., & Leader, J. F. (2024). Social VR design features

and experiential outcomes: narrative review and relationship map for dyadic agent conversations. *Virtual Reality, 28*(1), 45. Doi: 10.1007/s10055-024-00941-0

Nash, R. A., Nash, A., Morris, A., & Smith, S. L. (2016). Does rapport-building boost the eyewitness eyeclosure effect in closed questioning?. *Legal and Criminological Psychology, 21*(2), 305-318. Doi: 10.1111/lcrp.12073

Neequaye, D. A. (2023). Why rapport seems challenging to define and what to do about the challenge. *Collabra: Psychology*, *9*(1). Doi: 10.1525/collabra.90789

Nicovich, S. G., Boller, G. W., & Cornwell, T. B. (2017). Experienced Presence within Computer-Mediated Communications: Initial Explorations on the Effects of Gender with Respect to Empathy and Immersion. *Journal of Computer-Mediated Communication*, *10*(2). Doi: 10.1111/j.1083-6101.2005.tb00243.x

Oh, C. S., Bailenson, J. N., & Welch, G. F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers in Robotics and AI, 5*, 409295. Doi: 10.3389/frobt.2018.00114

Oostinga, M. S., Pallante, V., Van der Houwen, F., Van der Klok, N., Otten, T., & Van Lith, L. (submitted). *Risk, threat, or vulnerability? An ethogram to qualify concerning behaviour of citizens in police-civilian interactions via bodycam footage.*

Parker, J. A., Kaplan, A. D., Volante, W. G., Abich IV, J., & Sims, V. K. (2020, December). Exploring the encoding specificity principle and context-dependent recognition in virtual reality. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 64, No. 1, pp. 1481-1485). Sage CA: Los Angeles, CA: SAGE Publications. Doi: 10.1177/1071181320641353

Perković, G., Drobnjak, A., & Botički, I. (2024). Hallucinations in LLMs: Understanding and Addressing Challenges. In *2024 47th MIPRO ICT and Electronics Convention (MIPRO)* (pp. 2084-2088). IEEE. Doi: 10.1109/MIPRO60963.2024.10569238

Philippe, S., Souchet, A. D., Lameras, P., Petridis, P., Caporal, J., Coldeboeuf, G., & Duzan, H. (2020). Multimodal teaching, learning and training in virtual reality: a review and case study. *Virtual Reality & Intelligent Hardware, 2*(5), 421-442. Doi: 10.1016/j.vrih.2020.07.008

Pimentel, D., Kalyanaraman, S., Lee, Y.-H., & Halan, S. (2021). Voices of the unsung: The role of social presence and interactivity in building empathy in 360 video. *New Media & Society*, *23*(8), 2230-2254. Doi: 10.1177/1461444821993124

Psotka, J. (1995). Immersive training systems: Virtual reality and education and training. *Instructional Science, 23*(5-6), 405-431. Doi: 10.1007/bf00896880

Renes, D. L. (2023). *Exploring Co-offending in Residential Burglary through Virtual Reality: A Novel Approach.* University of Twente.

Richardson, B. H., & Nash, R. A. (2021). 'Rapport myopia'in investigative interviews: Evidence from linguistic and subjective indicators of rapport. *Legal and Criminological Psychology*, *27*(1), 32-47. Doi: 10.1111/lcrp.12193

Royce, T. (2005). The negotiator and the bomber: Analyzing the critical role of active listening in crisis negotiations. *Negotiation Journal, 21*(1), 5-27. Doi: 10.1111/j.1571-9979.2005.00045.x

Sapkaroski, D., Mundy, M., & Dimmock, M. R. (2020). Virtual reality versus conventional clinical role-play for radiographic positioning training: a students' perception study. *Radiography, 26*(1), 57-62. Doi: 10.1016/j.radi.2019.08.001

Sauer, J. (2024). *Evaluating a New Virtual Reality Environments' Effectiveness for Suicide Negotiation Training Performance Evaluation*. University of Twente.

Shin, D. H. (2013). Defining sociability and social presence in Social TV. *Computers in human behavior, 29*(3), 939-947. Doi: 10.1016/j.chb.2012.07.006

Shin, D. (2018). Empathy and embodied experience in virtual environment: To what extent can virtual reality stimulate empathy and embodied experience?. *Computers in human behavior, 78*, 64-73. Doi: 10.1016/j.chb.2017.09.012

Skarbez, R., Frederick P. Brooks, J., & Whitton, M. C. (2017). A Survey of Presence and Related Concepts. *ACM Comput. Surv.*, *50*(6), Article 96. Doi: 10.1145/3134301

Ströfer, S., Ufkes, E. G., Noordzij, M. L., & Giebels, E. (2016). Catching a deceiver in the act: Processes underlying deception in an interactive interview setting. *Applied psychophysiology and biofeedback, 41*, 349-362. Doi: 10.1007/s10484-016-9339-8

Thompson, J. (2014). *Crisis or hostage negotiation? The distinction between two important terms*. FBI Law Enforcement Bulletin. https://leb.fbi.gov/articles/featured-articles/crisis-or-hostage-negotiation-the-distinction-between-two-important-terms

Tickle-Degnen, L., & Rosenthal, R. (1990). The Nature of Rapport and Its Nonverbal Correlates. *Psychological Inquiry, 1*(4), 285-293. Doi: 10.1207/s15327965pli0104_1

Turner, W. A., & Casey, L. M. (2014). Outcomes associated with virtual reality in psychological interventions: where are we now? *Clinical Psychology Review*, *34*(8), 634-644. Doi: 10.1016/j.cpr.2014.10.003

Vallano, J. P., & Compo, N. S. (2011). A comfortable witness is a good witness: Rapport-building and susceptibility to misinformation in an investigative mock-crime interview. *Applied cognitive psychology, 25*(6), 960-970. Doi: 10.1002/acp.1789

van der Klok, N. (2023). *Temporal Dynamics of Behavioural Change in Crisis Negotiation: An Empirical Exploration of the Revised Behavioural Influence Stairway Model* (Master's thesis, University of Twente).

Van Gelder, J.-L., Otte, M., & Luciano, E. C. (2014). Using virtual reality in criminological research. *Crime Science*, *3*(1). Doi: 10.1186/s40163-014-0010-5

Van Hasselt, V. B., Baker, M. T., Romano, S. J., Sellers, A. H., Noesner, G. W., & Smith, S. (2005). Development and validation of a role-play test for assessing crisis (hostage) negotiation skills. *Criminal Justice and Behavior, 32*(3), 345-361. Doi: 10.1177/0093854804274374

Van Hasselt, V. B., Baker, M. T., Romano, S. J., Schlessinger, K. M., Zucker, M., Dragone, R., & Perera, A. L. (2006). Crisis (hostage) negotiation training: A preliminary evaluation of program efficacy. *Criminal Justice and Behavior, 33*(1), 56-69. Doi: 10.1177/0093854805282328

Van Hasselt, V. B., Romano, S. J., & Vecchi, G. M. (2008). Role Playing: Applications in Hostage and Crisis Negotiation Skills Training. *Behaviour Modification, 32*(2), 248-263. Doi: 10.1177/0145445507308281

Vecchi, G. M., Van Hasselt, V. B., & Romano, S. J. (2005). Crisis (hostage) negotiation: current strategies and issues in high-risk conflict resolution. *Aggression and Violent Behavior*, *10*(5), 533-551. Doi: 10.1016/j.avb.2004.10.001

Vecchi, G. M., Wong, G. K. H., Wong, P. W. C., & Markey, M. A. (2019). Negotiating in the skies of Hong Kong: The efficacy of the Behavioral Influence Stairway Model (BISM) in suicidal crisis situations. *Aggression and Violent Behavior*, *48*, 230-239. Doi: 10.1016/j.avb.2019.08.002

Walsh, D., & Bull, R. (2012). Examining rapport in investigative interviews with suspects: Does its building and maintenance work?. *Journal of police and criminal psychology*, *27*, 73-84. Doi: 10.1007/s11896-011-9087-x

Walsh, D., King, M., & Griffiths, A. (2017). Evaluating interviews which search for the truth with suspects: but are investigators' self-assessments of their own skills truthful ones?. *Psychology, Crime & Law, 23*(7), 647-665. Doi: 10.1080/1068316X.2017.1296149

World Health Organisation (2023, August 28). *Suicide*. Retrieved from:

    https://www.who.int/news-room/fact-

    sheets/detail/suicide#:~:text=Every%20year%20703%20000%20people,on%20the%2

    0people%20left%20behind.

Wilson, C. J., & Soranzo, A. (2015). The Use of Virtual Reality in Psychology: A Case Study

    in Visual Perception. *Computational and Mathematical Methods in Medicine*, *2015*,

    151702. Doi: 10.1155/2015/151702

Zargham, N., Friehs, M. A., Tonini, L., Alexandrovsky, D., Ruthven, E. G., Nacke, L. E., &

    Malaka, R. (2024). Let's Talk Games: An Expert Exploration of Speech Interaction

    with NPCs. International Journal of Human–Computer Interaction, 1-21. Doi:

    10.1080/10447318.2024.2338666

Appendix A

Informed Consent Form

Informed Consent as presented to the participants. Each of the four boxes at the bottom need to be ticked to continue the experiment.

UNIVERSITY OF TWENTE.

General Study Information
Thank you for taking the time to participate in this study about crisis negotiation.

Often times, police are called to situations involving people showing concerning behaviour. In this study, you will be asked to take on the role of a crisis negotiator by first learning about crisis negotiation and then utilising this knowledge in a Virtual Reality environment.

Risks associated with participating in the study
I understand that taking part in the study involves the potential risk of motion sickness. This study contains the following sensitive topics: Suicide, Fear of heights.

If I feel uncomfortable to continue I can withdraw from participating in the study without penalty or having to state a reason.

Use of Information
I understand that information I provide will be used for a study as part of a master's thesis, and potentially other projects that build on this thesis. I understand that the recordings and all data made during the VR training will be anonymised and only anonymised data will be stored or shared beyond the study team.

Future use and reuse of the information by others
I give permission for the physiological data (e.g. heart rate) and survey data and the recordings of the VR training that I provide, to be archived within the cloud service Sharepoint by Microsoft Teams and within the survey platform Qualtrics. These storage options are not accessible for anyone other than the researchers involved with the project and no identifiable information will be collected or stored.

Taking Part in the Study

I have read the study information or they have been read to me and I confirm I understood the information given.	O
I have been able to ask questions about the study and my questions have been answered to my satisfaction.	O
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	O
I understand that taking part in the study involves tracking of physiological data using a wristband.	O

→

Appendix B

Crisis Negotiation Videos

Appendix B1

Video 1: Introduction to the topic of suicide and learning and video structure.

https://youtu.be/BMDeboQZC_0

Appendix B2

Video 2: Explanation of the crisis State and introduction to crisis negotiation.

https://youtu.be/ebXktOzP-N8

Appendix B3

Video 3: Explanation of the Behavioural Influence Stairway Model.

https://youtu.be/1RarJhN82SU

Appendix B4

Video 4A: Video about the view errors during negotiation according to the "Error Management" approach. This video is only shown to participants that were randomly assigned to the error management group.

https://youtu.be/3PA6Dab5MnE

Appendix B5

Video 4B: Video about the view errors during negotiation according to the "Error Prevention" approach. This video is only shown to participants that were randomly assigned to the error prevention group.

https://youtu.be/sLfcSbWYglg

Appendix B6

Video 5A: Summary of the previous videos when allocated to the error management group (1, 2, 3, 4A). This video is only shown to participants allocated to the error management group.

https://youtu.be/DPh0kN1JF3k

Appendix B7

Video 5B: Summary of the previous videos when allocated to the error prevention group (1, 2, 3, 4B). This video is only shown to participants allocated to the error prevention group.

https://youtu.be/1HsBLtAI9-Q

Appendix C

Dialogue Decision Tree

Graphical depiction of the dialogue tree implemented in the Virtual Reality experiment. Red text boxes show what the person in crisis says to the participants. Grey text boxes show the options presented to the participants with the blue boxes showing what is being said towards the person in crisis. Red arrows show what options prompt a negative response of the person in crisis while green arrows show which options evoke a positive response.

"My colleagues told me to open this way"

I" think you understood me wrong"

"I am sorry about that."

"I will address you the way you prefer from now on"

"Whatever."

"Thanks."

Ask the person to step away from the ledge.

Ask why they are standing on the ledge.

"Please step away from the ledge. You're at risk of hurting yourself. I'll listen to what you have to say."

"I'm interested in getting to know you and why you are up here."

reach out to a debt
consultant?"

"You just don't
understand my
situation! Why would
you be able to help me? I
feel like you're just trying
to get this done as fast
as possible. If I step
down, I'll be left alone
with my problems again
anyway."

Explain impact of suicide
on close ones.

Explain your role as the
negotiator.

"You might be right in that you are alone with your problems again later. But I also know that you'll cause your family a lot of distress if you hurt yourself. Did you think about how they might feel if you decide to leave them."

"It's understandable and normal that you're eeling angry and misunderstood. I'm not here to tell you what to do. I want to understand how you feel, and then work with you to find a solution. For that we need to trust each other. Is that ok?"

"You think I haven't thought about that? I'm of no use... I still don't know how to escape all of this. How do I tell them we might lose... everything?"

"I'm sorry. I just don't know what to do anymore. I feel like everything I do makes my situation worse. I've already tried everything. Also, my family doesn't even know about our debt. How should I tell them that we might lose... everything?"

Suggest talking to their families

Suggest stepping away from the edge

Suggest talking to their families

Suggest stepping away from the edge

"We won't know how your family will react unless we talk to them. Why don't you step down from the edge and we can discuss how you might explain things to them. I won't come any closer, so you are still in total control of what you do."

"We can definitely talk through how you can talk to your family, but I am worried about how close you are to the edge. Why don't you step a little closer to me while we can talk about this more. I won't come any closer so you can still be in total control of what you do

"We won't know how your family will react unless we talk to them. Why don't you step down from the edge and we can discuss how you might explain things to them. I won't come any closer, so you are still in total control of what you do."

"We can definitely talk through how you can talk to your family, but I am worried about how close you are to the edge. Why don't you step a little closer to me while we can talk about this more. I won't come any closer so you can still be in total control of what you do

"You don't seem to want to listen to me, so I don't want to talk to you anymore. Leave me alone! I want to talk to someone else."
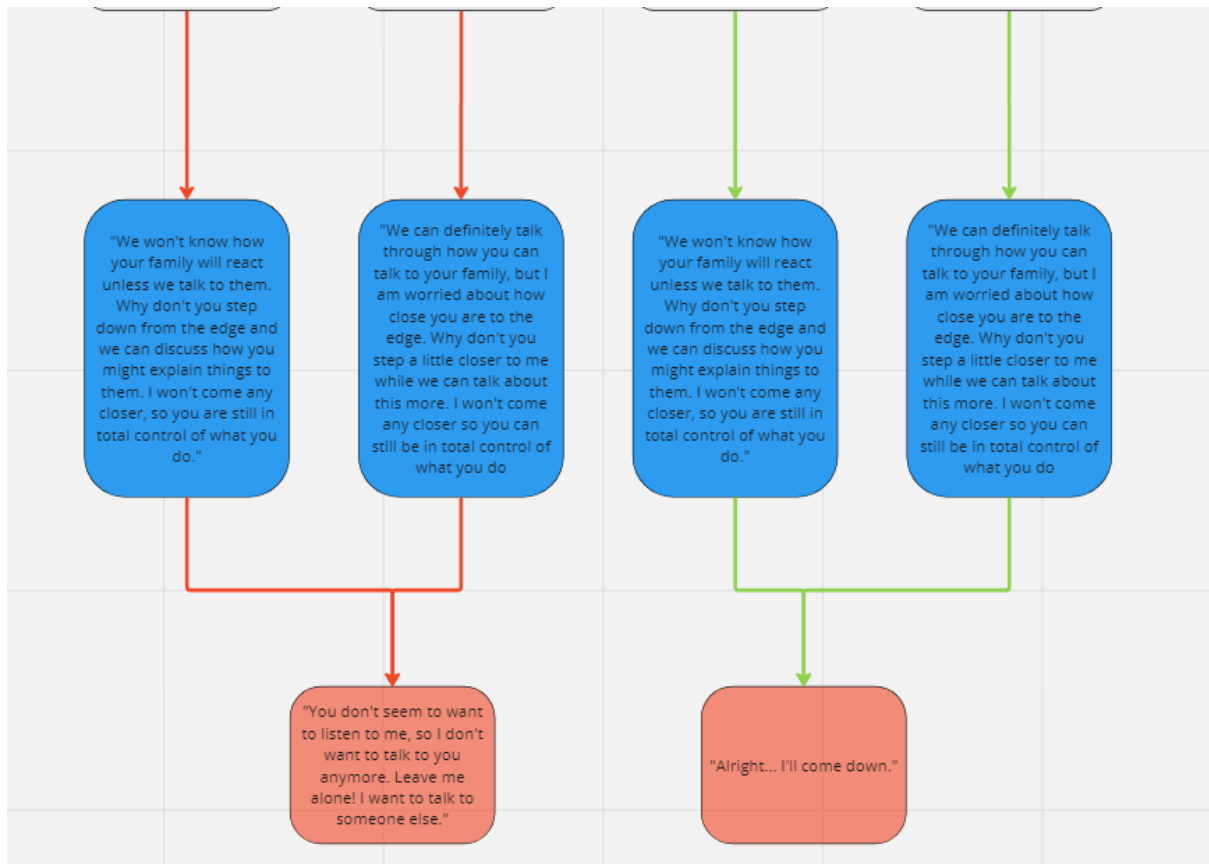
"Alright... I'll come down."

Appendix D

Scales

All variables were measured on a five-point Likert-scale ranging from strongly disagree to strongly agree apart from the stress variable which was measured on a five-point scale from not at all to very much so.

Spatial Presence

1. I felt like I was actually in the virtual environment.
2. I felt like I was part of the virtual environment.
3. It felt like I was physically present in the virtual environment.
4. I felt like I could be active in the virtual environment.
5. I felt like I could do anything I wanted in the virtual environment.
6. I was easily distracted during the interaction.

Social Presence

1. The other character seemed to have emotions of their own.
2. The character on the roof was responsive towards me in the virtual environment.
3. The other character's behaviour was often a reaction to my own behaviour in the virtual environment.
4. The other character made me feel like I was in the environment with another person.

Empathy

1. It was easy to tell how the other character felt in the virtual environment.
2. I felt an emotional response from interacting with the other character.
3. The person in crisis and I were paying attention to each other.

Rapport

1. The person in crisis and I were paying attention to each other.
2. The conversation felt mutually respectful.
3. The conversation with the person in crisis flowed smoothly.

Stress

1. I felt nervous.
2. The stress I felt increased to such high levels that I could not let go of it.
3. I felt tension.

Appendix E

Training Questions and Answers

The following questions were asked after the learning videos were shown. After each answer, the correct answer would be displayed.

Q1: What is the overall aim of crisis negotiation
   A. To solve the problems of the person in crisis
   B. To guide them to safety
   C. I don't know
A1: The purpose of the crisis negotiator is to ensure the safety of the person in crisis. Afterwards, the person in crisis can be helped more specifically by other professionals.

Q2: During crisis negotiation, you always need to get the person to safety before you can talk to them
   A. True
   B. False
   C. I don't know
A2: In some situations, you may have to focus on the safety of the person in crisis first. But often, you should talk to the person first, as they will then be more likely to listen to you and can effectively be guided to safety.

Q3: The stages of the BISM are: Active listening, Sympathy, Rapport/Trust, Influence
   A. True
   B. False
   C. I don't know
A3: The correct BISM stages are: Active listening, Empathy, Rapport/Trust, Influence.

Q4: If you "fall down" a stage, you cannot continue the negotiation.
   A. True
   B. False
   C. I don't know
A4: It is entirely possible to work on moving back up the BISM stages after falling down one or more stages.

Q5: Active listening is necessary during the whole negotiation.

    A. True

    B. False

    C. I don't know

A: Active listening is required during every stage of a crisis negotiation.

Q6: An example of a judgment error is when the negotiator asks the PiC about their family even after the PiC stated they did not want to talk about them.

    A. True

    B. False

    C. I don't know

A6: A judgement error is an error in which the negotiator misjudges the current relationship with the person in crisis and says something inappropriate for the situation. For example when the negotiator repeatedly asks about a certain topic despite the person in crisis stating they don't want to discuss said topic.

Q7: What is an example of a 'factual error'?

    A. When the time and day of an event are mixed up

    B. When the negotiator asks to openly what can be done to help

    C. I don't know

A7: A factual error is an error of fact, i.e. When the negotiator is objectively wrong. Mixing up the time and day is an example of a factual error.