The role of error-handling strategies and presence in a VR suicide negotiation

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Abstract

High-stakes scenarios, such as suicide negotiations, require extensive training for negotiators, yet making mistakes is inevitable. Virtual Reality (VR) offers a promising training method, but the effectiveness of different error-handling strategies in this context remains unclear. This study addresses this gap by examining the impact of error management and error prevention strategies, the influence of making an error, and the effect of spatial and social presence on participants in a VR suicide negotiation. Using a qualitative approach, 30 participants were randomly assigned to either the error management strategy group or the error prevention strategy group. After receiving online training on suicide negotiations, the Behavioural Influence Stairway Model and the error-handling strategies, participants participated in a VR suicide negotiation with a fixed error to assess their responses. Thematic analysis of semi-structured interviews revealed that adhering to an error management strategy improves emotional resilience compared to the error prevention strategy, whereas the error prevention strategy emphasized the perceived responsibility of participants. After making an error, participants primarily used a refocus strategy, aiming to re-establish rapport with the Person in Crisis (PiC). Social presence was prioritized in fostering rapport. Task performance remained unaffected despite certain environmental limitations. These findings inform VR-based suicide negotiation training by highlighting the potential of combining error-handling strategies with an emphasis on social presence and how this dynamic may shape prolonged interactions.

Introduction

Each year, approximately 703,000 individuals die due to suicide, making suicide the fourth leading cause of death among individuals aged 15 to 29 years old. In 2019, suicide accounted for 1 in 100 global deaths (WHO, 2024). Common causes of suicide include depression, anxiety, substance abuse, and medical problems (Strentz, 2013). A person in crisis (PiC) can experience extreme emotions and may not consider future risks and therefore might behave irrationally in a situation they are unable to cope with. Such emotional states are most common during the last 24 to 48 hours of someone's life and are a major threat to the individual's well-being (Vecchi et al., 2005). While there is no turning back after performing suicide, it appears that many suicide-related incidents concern people who are seeking help rather than ending their lives (NIMH, 2021). Suicide by jumping is common as it is a highly fatal method, so it is sensible to prioritise safe resolutions (Rock et al., 2005). Ambivalence, in the context of suicide, refers to being torn between the desire to live and the desire to die (Teismann et al., 2024). In 1977, half of individuals who attempted suicide reported experiencing ambivalence during their attempt, a figure that rose to 94% in a more recent study (Harris et al., 2010; Kovacs & Beck, 1977). This state of ambivalence can be crucial for intervention, as these individuals are still contemplating suicide, presenting a critical moment in the decision-making process where timely intervention could potentially influence the outcome. Research shows that many who attempt suicide can recover and find purpose, often without repeating the attempt (Chan et al., 2017). This is where suicide negotiators play a crucial role, as they have a window of opportunity to guide them towards safety.

Crisis negotiation is the strategic use of communication to resolve high-stakes situations peacefully and to prevent harm (Johnson et al., 2017). High-stakes scenarios, such as suicide negotiations, are incredibly demanding for crisis negotiators, and due to the length and intensity of these negotiations, making mistakes is inevitable (Vecchi et al., 2005). There

are two primary error-handling strategies supported in the literature. On one hand there is the error management strategy, which focuses on adaptability and learning after an error, whereas the error prevention strategy focuses on always avoiding errors (Dimitrova et al., 2017). However, it is not known which strategy is most appropriate in suicide negotiations due to limited research on this topic (Oostinga et al., 2018a, 2018b, 2020). Therefore, this study aims to address this research gap by examining how error-handling strategies influences participants' reactions to errors and their impact on interactions in high-stakes scenarios. To explore this, Virtual Reality (VR) was used to simulate a suicide negotiation, enabling an assessment of error-handling strategies and their impact on participants' perceptions. Insights aim to refine crisis negotiation training, enhancing the ability to manage errors and improve outcomes in high-stakes scenarios.

It is not feasible to train negotiators for every possible scenario, nor are suicide negotiations the same as other crisis interventions. VR can safely simulate high-stakes scenarios, and therefore can play an essential role in negotiator training in a controlled immersive environment. To evaluate whether the virtual environment is sufficiently immersive, participants' sense of presence will be explored. Spatial presence refers to the sensation of physically being within the virtual environment, whereas social presence refers to being emotionally and socially connected towards others in the virtual environment (Wang & Zhang, 2018). Participants' sense of presence could influence the perceived seriousness of the high-stakes scenario and the likelihood of making errors. We start the following section with the Behavioural Influence Stairway Model, a theory developed by Vecchi et al. (2019), which supports suicide negotiations. We follow this up with the different error-handling strategies and information on spatial and social presence. We then describe our methodology and thematic analysis, we provide the results on the interviews, and a conclusion and discussion which interprets the findings and addresses limitations within our study.

The Behavioural Influence Stairway Model

Suicide negotiators are trained in the Behavioural Influence Stairway Model (BISM), this model supports suicide negotiations by reducing extreme emotions of the PiC and encourages the person to consider solutions to their problems (Vecchi et al., 2019). By building trust and maintaining credibility with the PiC, the negotiator helps shift overly emotional thoughts toward more rational ones, ultimately guiding the PiC to safety. The applicability of the BISM has been demonstrated in various high-stakes context such as hostage negotiations, conflict resolution, and suicidal interventions (Romano & Vecchi, 2005; Van Hasselt et al., 2008; Vecchi et al., 2005; Vecchi et al., 2019).

The BISM consists of four sequential stages: active listening, empathy, rapport/trust, and influence (Vecchi et al., 2019). Active listening is the first stage, where the negotiator develops credibility and encourages interaction by using open-ended questions. The negotiator tries to obtain information to get a deeper understanding of the PiC. The PiC is encouraged to express their emotions and be heard. Empathy is the following stage and defined by Vecchi et al. (2019) as identifying and understanding the situation of the PiC as well as their feelings and motives. At this stage, the negotiator has sufficient information and sincerely expresses care for the PiC. The negotiator empathises with the PiC and tries to perceive the situation from their perspective. One way to achieve this is mirroring, which is the process of displaying similar emotions as the PiC to validate their emotions. Rapport naturally develops because of active listening and empathy. Rapport means that there is a harmonious relationship and mutual understanding between the PiC and the negotiator. The PiC feels comfortable with the negotiator and is willing to share their concerns. Trust comes with high rapport and when this is established, the PiC will be open to listen to suggestions the negotiator makes. The PiC perceives the negotiator as a trusted entity to rely on, which is necessary to move on to the last stage of the BISM model. The final goal is behavioural

change, which is achieved through influence. The negotiator takes a leading role and makes suggestions to the PiC that seem acceptable for both parties. Successful implementation of the BISM should help to bring about a safe resolution to the suicide negotiation (Vecchi et al., 2019).

These high-stakes negotiations may take hours and are cognitively demanding for negotiators, therefore making errors is inevitable. The BISM teaches negotiators that errors are natural occurrence of the negotiation process and emphasizes that when you "fall back" to an earlier stage, the previous stages must be rebuilt. Therefore, errors can prolong suicide negotiations as they impair the development of empathy, rapport and trust (Vecchi et al., 2019). It is not yet known whether this approach to error, as taught by the BISM, is the most effective message, given that errors could be harmful as they may evoke stress in the negotiators. Therefore, there is a need to understand the impact of error-handling messages on suicide negotiators.

Error-handling strategies

Oostinga et al. (2018b) identified three types of communication errors during crisis negotiation: factual, contextual, and judgmental. Factual errors refer to messages that convey wrong information, such as using the wrong date. Contextual errors occur when negotiators fail to communicate in a way the PiC can understand, such as using technical jargon. Judgement errors occur when the negotiator fails to recognize the other person´s feelings adequately and behaves in a way that evokes discomfort in them, such as making an inappropriate joke. These errors can cause stress and negative emotions in negotiators, disrupting the negotiation process (Oostinga et al., 2020). Proper error-handling strategies, including error prevention and error management, are crucial for negotiators to mitigate these risks (Dimitrova et al., 2017). The error prevention strategy emphasizes that errors can have detrimental consequences and focuses on working faultlessly. By reducing the occurrence of

errors, the negative consequences are avoided. The error management strategy views errors as a natural occurrence and believes that errors can be learned from. Consequently, reducing anxiety and stress of negotiators, which could be useful for high-stakes scenarios (Frese & Keith, 2015; Hofmann & Frese, 2011; Keith & Frese, 2008; Van der Byl & Vredenburg, 2023).

Empirical research suggest that the error management strategy may be more beneficial than the error prevention strategy in terms of motivational and affective factors. Research indicates that the error management strategy reduced negative impact on negotiators compared to the avoidance approach of the error prevention strategy (Chillarege et al., 2003; Dimitrova et al., 2017). For instance, Frese and Keith (2015) examined that the error management strategy fosters learning and resilience, which might mitigate stress and can improve performance under pressure. Even though the literature is favourable of the error management strategy, it cannot be assumed that this will be the same for a suicide negotiation. Oostinga et al. (2018a) examined that viewing errors as a learning process reduced psychological demands during the suicide negotiation. However, this could potentially make negotiators become less sensitive to errors with the risks of not recognizing errors. Therefore, an over-reliance of an error management strategy can be detrimental as this may undermine negotiator's ability to recognize and respond to critical errors, which could have serious consequences in suicide negotiations. In contrast, while the error prevention strategy can negatively impact cognition and adaptability in complex tasks, it is advantageous for predictable simple tasks (Dimitrotva et al., 2017). High-risk organizations emphasize error prevention. Recognizing that strict routines, standards, and controls are essential to reduce the likelihood of significant and potentially harmful errors (Cowley et al., 2021). While adhering too closely to the error prevention strategy may cause excessive stress for negotiators, the fear of making mistakes may hinder performance and reduce overall efficacy (Dimitrova et al.,

2017). The applicability of both strategies to suicide negotiations remains unclear and needs further exploration. Therefore, this study aims to explore the impact of error prevention and management strategies on negotiators in high-stakes scenarios.

Response strategies

As there are different interpretations of the error-handling strategies, there are also varied ways of responding to errors once they occur. Response strategies refer to the actions taken by negotiators to reconcile the communication error. Oostinga et al. (2018b) identified four different response strategies; contradict, attribute, accept and apologize. Contradict involves denying blame, whereas attribute shifts the responsibility to a third party. In both response strategies the negotiator does not take responsibility for the error. Acceptance and apologize are response strategies where the negotiator takes responsibility of the error. Acceptance entails acknowledging the error and changing the approach accordingly, while an apology includes explaining the occurrence of the error and expressing regret (Oostinga et al., 2018b). They found that taking responsibility for errors is critical for error reconciliation and influences the relationship in crisis negotiation. This study will explore whether the response strategies differ depending on the different error-handling strategies. Previous research found that the error prevention strategy increases worry and impairs task focus, affecting the negotiator negatively (Chillarge et al., 2003; Dimitrova et al., 2017). This could lead to them taking more blame and feeling compelled to apologize. In contrast, the error management strategy emphasizes adaptation and learning (Van der Byl & Vredenburg, 2023), which participants in this study may associate with reduced self-blame and greater confidence in correcting the error through acceptance. Assessing how participants perceive and navigate errors requires a safe and controlled VR environment that allows them to engage with immersive elements and experience the consequences of their responses.

Spatial and social presence in VR

Using VR as a controlled environment allows researchers to test different error-handling strategies. VR's immersive nature makes it a valuable tool to supplement current role-playing-based crisis negotiation training. This has proven to be effective in skills building in crisis negotiations (van Hasselt et al., 2008; Vecchi, 2005). For this training to be effective, the VR suicide negotiation must create a sufficiently immersive scene and enable an engaging interaction with a virtual agent. A key factor to enhance this immersion is the experience of spatial and social presence in the VR environment. Spatial presence refers to the feeling of being physically in the virtual environment, whereas social presence refers to experiencing the emotions of the virtual agent in VR as 'real' (Wang & Zhang, 2018). Research suggest that stronger social presence enhances performance as emotionally engaged virtual agents can positively affect social outcomes. However, they could also increase mental distress for some who are uncomfortable with this social interaction (Allmendinger, 2010; Oh et al., 2018). For instance, research on child sexual abuse found that participants who perceived the avatar as highly real experienced stronger emotional reactions (Segal et al., 2022). This prior research indicates how crucial social presence is for effect testing and how social presence could affect negotiators and their response to their error training. Moreover, these findings also suggest that experiencing the virtual agent as a meaningful social entity evokes emotional reactions, which could increase apprehensiveness about making errors. Exploring participants' perceptions of their experience in a VR suicide negotiation is essential, as VR closely simulates a real-life suicide negotiation.

The Current Study

Previous quantitative studies by Tomlin (2024) and Bünnemann (2024) examined the influence of presence and error-handling strategies on participants in a VR suicide negotiation simulation. By incorporating their design, this study builds on their findings by adopting a

qualitative approach, allowing for a deeper exploration by capturing subjective experiences beyond questionnaire responses. Tomlin (2024) found that negotiators adhering to an error management strategy experience higher levels of worry and stress compared to the error prevention strategy. However, these findings were based on a limited set of question items and did not explore underlying psychological processes. Therefore, this study aims to fill that gap by examining how different error-handling strategies impacts participants. Similarly, Bünnemann (2024) highlighted that spatial presence can enhance engagement but could also be detrimental to their performance. His findings also revealed a positive relationship between empathy or rapport and spatial or social presence. Yet his findings also relied solely on self-reported scales. To expand on this, the current study examines participants perceived spatial and social immersion in a VR suicide negotiation and how this impacts their performance and tasks. Furthermore, to assess the effect of an error on participants' behaviour and decision-making, this study implemented a fixed error in the interaction with the PiC during the VR simulation. This design allows to explore how making an error affected their approach to decision-making. By incorporating this qualitative exploration, this study aims to complement quantitative findings by providing a more comprehensive narratives of participants' experiences in a VR suicide negotiation.

Methods

Design and manipulation

This exploratory mixed-method experimental study is a between-subject study building on the work of Tomlin (2024) and Bünnemann (2024). To triangulate findings, additional quantitative data were obtained through replication, which is not included in this report. The qualitative data expands prior studies by exploring participants' subjective experiences with error-handling strategies, presence in the VR simulation and the impact of making an error. Participants completed an online training designed to prepare them as suicide

negotiators in a VR simulation. They were randomly assigned to either the error prevention group, which emphasized avoiding errors, or the error management group, which framed errors as learning opportunities. Following the online training, participants participated in the VR suicide negotiation with a virtual agent portraying a PiC. Afterwards, they completed self-report questionnaires used in previous studies by Tomlin (2024) and Bünnemann (2024). To complement these quantitative findings, semi-structured interviews were conducted to explore participants' experiences of the error-handling strategies training, their sense of presence in the VR simulation and the impact of an error. These interviews allowed a structured and flexible exploration to provide deeper insights into the individual experiences.

Participants

Participants were recruited via convenience and snowball sampling and through the SONA system at the University of Twente. SONA participants earned study credits required for their first and second year. Participants who lacked sufficient knowledge of English or had impairments that hindered their ability to listen to audio materials, view visual materials, or use a VR headset, were excluded from the study. A total of 33 participants started the study, one participant had to be excluded due to technical issues occurring with the VR headset. Additionally, two participants had to be excluded due to technical issues with the survey platform Qualtrics. The total included 30 participants were randomly assigned to the two experimental conditions by Qualtrics: error management *(n* = 16) or error prevention *(n* = 14).

Of the 30 participants, 18 (60%) identified as male, 11 (36.7%) as female and one (3.3%) participant identified as non-binary. The age of participants ranged from 18 to 27 (*M* = 21.87, *SD* = 2.59). In this sample, 24 (80%) participants originated from the Netherlands, four (13.33%) participants from Germany, one (3.33%) participant from Lithuania and one (3.33%) from Peru. Regarding the level of education completed, 18 (60%) participants

achieved high school, followed by 10 (33.33%) participants who achieved their bachelor's degree, and two (6.67%) participants achieved their master's degree. Of the participants, 22 (73.3%) indicated they do not tend to experience motion sickness, whereas the other eight (26.7%) reported being prone to it. However, motion sickness did not occur during the VR simulation. For 13 (43.3%) participants this study was their first time using VR. In this sample five (16.7%) participants indicated to have prior experience with crisis negotiations. These experiences were derived from personal experiences with suicidal friends (40%), working on a suicide hotline (20%), academic courses (20%), and an incident during the Kick-In, where a suicidal first-year student required guidance to connect with the appropriate support (20%).

Procedure and Materials

Pre-simulation training

Before recruiting participants the Ethics Committee BMS (Behavioural, Management and Social sciences) of the University of Twente had given approval to perform the study (ethics number, 241092). Participants were welcomed at the study and after a short debrief were instructed to face the computer screen. The computer has the platform Qualtrics open for the informed consent form, online training and questions, two questionnaires and the debriefing. The informed consent can be found in Appendix A. After participants gave their written consent, the researcher fastened the Embrace Plus. The Embrace Plus was used to measure physiological data such as pulse rate and electrodermal activity. Due to the scope of this study this data will be collected and stored but not analysed. Participants continued in Qualtrics asking questions regarding motion sickness and frequent use of VR. Then participants watched five videos and answered multiple training questions. The purpose was to assess their knowledge and provide sufficient background on suicide negotiation. This prepared them for the VR suicide negotiation simulation and helped evaluate the impact the

different error-handling strategies. The online training took twenty minutes of their time.

The content of the videos and training questions can be found in Appendix B. The first video consisted of suicidal statistics and provided an overview of the contents of the upcoming videos. The second video explained the crisis state and the goal of crisis negotiation. The third video introduced the Behavioural Influence Stairway Model and provided an example for each stage. In the fourth video participants learned about error-handling strategies. The content of the administered video was based on the findings of Dimitrova et al. (2017) and adjusted by Tomlin (2024) and Bünnemann (2024) to highlight the impact of errors during suicide negotiations.

Participants in the error management group learned the following: “Errors can happen and making these is a natural part of the learning process. You can reduce the negative consequence and there are positive things to be gained such as learning more information about the person in crisis. When you make an error. it is important to think about how it can be corrected, what can be learned from it and how that can help you in similar situations in the future. By successfully handling errors you will learn how to negotiate more effectively. If you try to find the useful information errors provide, you could do better during the negotiation.”

Participants in the error prevention group learned the following: “Errors should not be allowed to occur during the learning process. Errors can be harmful to the negotiation process and can lead to negative consequences. It is important to think about how you could prevent errors from occurring, what you could do to successfully detect situations possibly leading to errors, and how that could help you with similar situations in the future. By successfully preventing errors you will learn how to negotiate more effectively. If you try to prevent errors from occurring, you will do better during the negotiation.”

After the manipulation, the three types of communication errors were explained with

corresponding examples. The fifth video was a summary of the contents of the previous videos. Additionally, participants answered seven true-false questions regarding the content of the videos. After completing the true-false questions, a screen was shown instructing the use of the VR controllers.

Simulation with equipment

The researcher demonstrated the use of the VR controllers and assisted participants in adjusting the VR headset. The Meta Oculus Quest 2 was used as the VR headset. The design of the VR game was created by Sauer (2024) using Unity editor version 2021.3.8f1. Before starting the researcher briefly explained the VR environment. The entire VR simulation lasted around five minutes.

Upon entering the VR simulation participants faced the streets and buildings, allowing them to become familiar with the setting of the study. After 15 seconds participants received a phone call saying: “We have an emergency. There is a man standing on the roof of the sunset bar close to you. He goes by the name of Paul Jansen and he appears to want to jump. Please go there quickly.” Participants had to turn around to view the intersection and by looking up they could see the PiC as presented in Figure 1.

Figure 1

VR environment with roof top view

When participants reached the intersection, they were teleported to the roof. Once on the roof, participants were shown a sign instructing them to look around. They had to go near the PiC to start the interaction. As participants approach the PiC he immediately told them to stop and not come any closer. This was the moment where the interaction started. The PiC spoke using audio, whereas participants chose between written dialogue options by pointing with their controller at one of the dialogue options as shown in Figure 2.

Figure 2

Choosing the dialogue options

One of these dialogue options corresponds with the previous training and the others do not. If participants choose an option that is contrary to the BISM the PiC responds negatively. He responds positively if they select the option that aligns with their training.

It was necessary to assess the impact of the different error-handling strategies and how an error affects participants. Therefore, at the start of the interaction there was one fixed error implemented. Participants had two dialogue options. Either to approach the PiC by his first name or by his last name. Both options prompt a negative response from the PiC: “Don’t call me that, I don’t like it when people address me this (in)formally.” At the second dialogue

option, participants had the opportunity to repair the error. Participants had four response options to choose from as identified by Oostinga et al. (2018a) and were instructed by their training on how to repair errors. It can therefore be assessed which response strategy participants are most comfortable with. The further interaction progressed with the stages of the BISM, as in detail described by Bünnemann (2024) and its corresponding decision tree. If participants successfully chose the options aligning with the BISM the PiC would agree to come down. If participants chose the incorrect response the PiC would ask for another negotiator. The dialogue responses were recorded as correct or incorrect in an Excel and .csv file.

Post simulation, measures, and interview topic guide

After completing, the VR simulation participants returned to the computer screen, where they completed two self-report questionnaires in Qualtrics that measured affective responses and presence. However, these are beyond the scope of the current thesis and are not further described or analysed. Further details can be found in the thesis of Tomlin (2024) and Bünnemann (2024) and their self-report questionnaires can be found in Appendix C. Upon finishing the questionnaires, participants were asked for their demographics and were then instructed to face their researcher for the interview.

The interview was recorded using the Zoom H4N Pro Voice/Sound recorder. The topic guide lists topics rather than specific questions, and can be found in Appendix D. The semi-structured interview was employed with basic questions used for guidance and could be adjusted to receive the narrative (Doody & Noonan, 2013). The topic guide consists of three main topics. The first topic explores the general experience of the training and participants' decision-making process. The second topic focuses on the VR simulation and participants' sense of presence. Finally, the third topic examines the occurrence of errors and the different error-handling strategies. To assess the experience of the manipulation and the fixed error at

the start of the simulation, the truth about the error-handling strategies was debriefed at the end of the interview after the participants' perspectives on making errors were explored. The conversation was led by the researcher who aimed to get the detailed experience of the participant. The interviews lasted approximately ten minutes. Afterwards participants returned to the computer screen to give their final consent after the debriefing about the manipulation of the two groups. Participants were thanked for their participation. The debriefing can be found in Appendix E.

To assess whether the manipulation had the intended effect on participants, a manipulation check was performed after the VR simulation. This manipulation check was included in the online questionnaire via Qualtrics. Participants rated their approach during the VR simulation on a 4-point scale, with the following statement: "Because of the training, my approach during the negotiation was to think that making errors was..." (1 = "Problematic, and I tried to prevent them as much as possible" to 4 = "Something I could learn from"). If the manipulation was successful, the participants in the error prevention group were expected to select options 1 or 2, and the error management participants were expected to select option 3 or 4. A Mann-Whitney U-Test was conducted to analyse the manipulation check. A significant result would indicate that the manipulation successfully influenced participants' perceptions of errors.

Data analysis

The goals of the study were to assess the impact of the different error-handling strategies and to analyse the sense of presence of the VR suicide negotiation simulation. Quantitative data were analysed using SPSS and RStudio for the manipulation check and exploratory measures. For the qualitative component, thematic analysis was employed to interprets patterns and provides narratives within the data, which aligns with the study's goals (Braun & Clarke, 2006). This analysis followed a deductive semantic codebook analysis.

Which was driven by theoretical interests in specific parts of the data which align with the exploratory aim of the study, as the desire to triangulate with prior quantitative findings. At the same time, it leaves room for inductive coding to update the coding framework by making overarching connections (Braun & Clark, 2006; Paton, 1990). Initial themes were predefined in the topic guide questions which were associated with the research questions (Maguire & Delahunto, 2017). The structured approach and coding framework were documented and justified all stages of the research process, ensuring transparency (Braun & Clark, 2022' Meyrick, 2006). Amberscript was used to create transcripts of the voice recordings, whereas Atlas. Ti version 22 was used for generating and constructing codes.

Coding procedure

The coding analysis was carried out according to the six stages of thematic analysis identified by Braun and Clarke (2006). Reflexivity and positionality informed the analysis, addressing how the professional background shaped coding and interpretation while mitigating potential bias (Foot & Bartell, 2011). This mitigation was applied by documenting participants' experiences of error strategies and presence without preconceptions and by remaining open to insights that contradicted initial assumptions.

The first stage of Braun and Clarke (2006) is familiarization with the data. While becoming familiar, automatic transcripts were compared to the voice recordings for correcting mistakes. After each transcript, primarily descriptive notes were taken of the spoken text that helped understanding the potentially relevant data. These notes were categorized by the themes of the topic guide. During this familiarization stage, the researcher recognized preference for the error management strategy. This preference stemmed from the researchers' professional background, which suggested the strategy effectiveness. This initial bias led to the assumption that participants will share a similar perspective. To mitigate potential bias, participants initial responses were documented and an open attitude was maintained to

account for insight that challenged prior assumptions. According to Finlay (2002), these early assumptions with the data are part of becoming engaged with the data. During the interviews, questions were frequently rephrased and confirmed by participants to be in line with Braun and Clarke's (2022) guidance. Once familiar with the data, the second phase involved generating initial codes. Main themes were aligned with the research questions and subthemes derived from the topic guides questions. Within these subthemes, inductive codes emerged from the notes of the transcripts, such as *Heightened stress*. During this stage the initial coding frame remained static while the inductive coding was iteratively refined as the progress continued. Initially, emotional responses were prioritized due to expectations of stress under the error prevention condition. To mitigate this influence the data was revisited systematically and the coding procure was repeated multiple times (Guillemin & Gillam, 2004). The third phase involved searching for themes. Subthemes were analysed and combined to create an overarching theme. A hierarchical mind map was used to organise subthemes with the research question at the top, followed by aligned subthemes and their inductive codes. For example, a code related to immersion such as *Lack of facial expressions* appeared in multiple subthemes. Since it negatively impacted immersion, it was grouped under the broader subtheme *Lack of immersion.* Phase four focused on refining themes, where some themes collapsed, and separate themes merged. For example, the separate themes for the manipulation were merged under the main theme *Impact of training strategies*. This was done to create a more coherent narrative and provide a richer description of the data. By constantly reviewing and comparing the codes within the themes, which was supported by feedback sessions, the data was reviewed to ensure coherence and meaningfulness. Feedback sessions allowed neutrality and transparency and stimulated a credible outcome of the theme development and coding process (Braun & Clarke, 2022; Pugh & Veitch, 2019; Wei & Liu, 2024). To illustrate this process, inductive codes such as *Anxiety*, *Reflection on the strategy*

and *Error recovery*, were reclassified under broader subthemes: *Affective responses*, *Cognitive responses* and *Behavioural responses*. Stage five analysed whether the themes reflect the entire meaning of the data set. This was done by rereading the data and feedback sessions to ensure the themes answers the research questions. These systematic steps ensure the findings are grounded in participants' experiences, reflecting both the research questions and the exploratory aim of the study. The final stage, writing up the report, is described in the Results section.

Results

Two main themes explained participants experiences of different error-handling strategies and their sense of presence in a VR suicide negotiation. Table 1 summarizes these main themes and subthemes alongside representative quotes that demonstrates participants perspectives. The first main theme, *Impact of training strategies,* is divided into cognitive, affective and behavioural responses. It explains how the error-handling strategies influenced recognition, emotional responses and the behavioural responses after the occurrence of an error. Additionally, it was analysed whether this stemmed from the manipulation or personal characteristics. The second main theme, *Impact of the VR environment,* examines two aspects of immersiveness. The immersiveness of the social interaction refers to participants engagement with the PiC, while the immersiveness of the VR environment focuses on how the realism of the virtual setting influenced participants' experiences.

Table 1

Coding scheme

Main theme	Subtheme	Example quote
Impact of training strategies	Cognitive responses	"At the beginning, I was kind of like, oh, that's an accident. But I forgot about it after two minutes" (Participant 28, Management).
	Affective responses	"It was a bit stressful. It's like, oh, man, I messed up" (Participant 16, Prevention).
	Behavioural responses	"I try to be a little more personal because he said he didn't like to be called that formal" (Participant 24, Management).
Impact of the VR environment	Immersiveness of the social interaction	"I think I started to really care for him and that I wanted him to come down" (Participant 21, Prevention).
	Immersiveness of the VR environment	"I pressed the wrong button, therefore I wasn't on the roof anymore, but teleported to a different location for short term. And this would never happen in real life situation" (Participant 14, Management).

Impact of training strategies

The theme *Impact of training strategies* reflects the impact of the error prevention and management strategies on participants, as well as how they navigated errors.

Cognitive responses

This subtheme captures participants cognitive process and strategic reflection in response to the error training. Due to the error training, participants in the management group tended to minimize the impact the error had on them, as the error was not considered problematic: "And it didn't feel like such a big error that would mess up the whole conversation or something" (Participant 3, Management). Participants believed that errors can

be fixed, and the severity of the error was not considered. As reflected in one participant's comment, "But I felt it was probably not too big of a mistake, and I could probably still fix it. And it was nice to know that that's all right. The training did help there" (Participant 1, Management). Participants in the management group fostered a flexible mindset, linking errors to learning opportunities. However, the training did not result in any clear positive or negative impact on participants' performance. Whereas participants in the prevention group emphasized their efforts to avoid errors as much as possible:

> I feel like maybe I was a bit too focused on not making errors rather than actually coming up with what the correct answers would be or like the correct responses. So in a real situation where there would be no answer options, I might be struggling a bit more. Because I'm playing it a bit too safe, maybe a bit too scared of making errors. (Participant 26, Prevention)

This quote illustrates how the avoidance of errors impacted participants' decision-making. It highlights their awareness of the error and leads them to strategically rethink every response to avoid further mistakes. This, in turn, hindered their flexibility in generating responses. While there were differences based on the groups, participants in both groups were able to reflect on the magnitude of the error being made. This demonstrates that participants in the error prevention group did not always perceive stress, as some errors were experienced as minor ones. As one participant commented:

> I did make an error at the start, but I could correct it quite easily. But if I had the feeling that it was like a really bad error, then if he showed a bit more emotion then I will be like, oh shit, sorry. But now I did not had that at all. (Participant 15, Prevention)

Participants were attempting to follow the BISM steps and establish empathy, but the initial error may have occurred too early for these steps to be fully achieved. Which results in the error not being experienced as severe. The distinction between the groups and their perceptions of the error influenced how participants felt after making the error.

Affective responses

This subtheme captures the personal impact of errors on participants, with a focus on emotional responses. The error management message was associated with a more minimized perception on severity of the error, whereas the error prevention message elicited stronger emotional responses. Those in the error management group did not experience severe tension, nor were they severely impacted, and they felt rather comfortable. “I was not quite thinking about the errors” (Participant 30, Management). Other participants viewed making errors as manageable and constructive:

> That errors can also have a good outcome. Well, not good outcome, but it can help you to get a good outcome. I think that is what stood out to most to me, as it also said that you can fall back on ladder. So, I think that's the way it can help with a good outcome. (Participant 10, Management)

This optimistic mindset reflects the level of confidence participants maintained after making the initial error. This suggests that the error management message minimized stress and fostered reliance, but it may have been too lenient because the error was not perceived as impactful. In contrast, those in the error prevention group experienced amplified stress after making the initial error and frequently internalized blame for the error. The anxiety intensified as participants felt an increasing sense of responsibility, fearing that the PiC might jump:

> I was really stressed. I was like, oh no, no. I thought that it would influence the rest of the conversation and that he would be instantaneously anxious and more mad and more prone

> to jumping because I made a mistake the first thing I said.
>
> (Participant 18, Prevention)

The prevention message shifted participants' mindset and emphasized the need to prevent errors at all costs, which some found too restrictive:

> I think I felt very stressed about that. Because also in the training it said like you can't make errors because it will negatively influence the situation. So, I was really aware of myself and I did not want to make any errors.
>
> (Participant 21, Prevention)

While participants recognized the importance of the error prevention strategy in a high-stake scenario, it hindered their flexibility during the negotiation, as they were too worried and therefore too focused on not making mistakes. Despite these challenges, participants justified the strictness of the error prevention for its relevance to real-life crisis situations.

After participants were debriefed about both error-handling strategies some participants reflected on the effectiveness on both trainings. They believed that the error prevention message amplified the pressure whereas the error management message diminished this pressure. Despite this reflection, the training encouraged participants to adhere to the provided strategy rather than relying on their prior beliefs. This demonstrates the training's strength. For others the training led to confusion regarding the relationship between the error prevention message, which contradicted "climbing back up" the BISM ladder. This task ambiguity led to participants feeling frustrated and choosing random responses. Furthermore, the training led other participants to associate it with a sense of failure, as they were not successful in bringing the PiC toward safety. This sentiment appeared to be slightly more pronounced among participants in the error prevention group. The different error-handling strategies influenced participants' emotional responses in various ways, but did not affect the recovery strategies they employed.

Behavioural responses

This subtheme describes the steps participants undertook after the occurrence of the error. Three types of responses were identified in the error recovery process: minimizing their blame, apologizing and adapting their behaviour or refocusing on the interaction. These different responses appear to be influenced by personal differences rather than by the experimental conditions. First participants who minimized their blame were effortless in repairing the error, as it was not considered drastic enough to require attention. One participant explained, “Let's just focus on the new option and forget about the previous one. I already forgot that I addressed him wrong” (Participant 29, Prevention). By minimizing the significance of the error, these participants quickly forgot the initial error as they progressed through the interaction. Suggesting that the error was not significant enough to be memorized.

In contrast, some participants prioritised restoring the relationship with the PiC by apologizing or adapting their behaviour. One participant explained, “Okay. Other approach. We should just fix it and apologize. And both of the options had apologizing and just letting him know that for now I would use what he wanted me to use” (Participant 4, Prevention). Apologizing was aimed at restoring the relationship with the PiC, with participants taking the blame for the error more personally. Adapting behavior allowed participants to take a neutral stance. As reflected in one comment: “Well, okay, if you do not want that, that's fine. Then I will address you with your surname” (Participant 6, Prevention). Apologizing appeared to be more prevalent in the error prevention group, but a clear distinction between the experimental condition could not be established. Refocusing on the interaction through analysis and strategic thinking was the most profound strategy applied. Participants reflected on how to remedy the error and improve future responses. One participant explained:

> I also realized and started thinking very much about how I could remedy the mistake and how it could fix the situation, how I could better answer the prompts after that. So, yeah, I

definitely felt like that was a learning moment.

(Participant 7, Management)

This quote highlights not only their analytical mindset but also their engagement with the interaction. As another participant described, “I should really focus in on now. And that was just trying to fix the problem. And I think that made me more attentive and more immersed into the VR experience” (Participant 4, Prevention). This quote suggests that for some participants the occurrence of errors enhanced their engagement, resulting in a heightened focus on the interaction. Error-handling strategies provided valuable insights into participants' cognitive, affective and behavioural responses and contributed to the perceived realism of the interaction with the PiC. Which is closely tied to social presence and the immersive experience. The following section examines the impact of the VR environment and how this shaped individual experiences.

Impact of the VR environment

The theme *Impact of the VR environment* reflects participants’ experiences of the VR simulation focuses on the visual elements and the interaction with the virtual agent.

Immersiveness of the social interaction

This subtheme captures the social presence, plausibility of the scenario and the situational immersion. The extent of emotional engagement during the interaction with the PiC varied among participants, which was driven primarily by personal differences rather than the different training strategies. The scenario, a man standing on a roof contemplating suicide due to losing his home and the inability to speak to his family, was deemed plausible and relatable to a real-life situation. The voice of the PiC was a key factor of the PiC realism, as it was perceived as authentic and genuine, which enhanced the ability to perceive emotions. The emotional tone of the voice increased empathy. This helped participants to feel that their

decisions carried real impact. For some participants, the unexpectedness of the interaction enhanced their immersion:

> Especially the reactions of the person I was talking to. They were very aggressive, very angry, and that made it feel like real life because as the training said, you cannot expect how they react. And they really reacted in a way that I would personally not expect. So, their irrational reaction really made it feel like a real crisis negotiation.
> (Participant 10, Management)

This unexpectedness and expressive emotions were perceived as mirroring the authenticity of a real crisis negotiation. Some participants experienced a lack of emotion in the facial expressions of the PiC, which diminished the emotional connection. Even though participants suggested that human features are crucial for forming a connection, it did not deter participants' motivation and focus on their task of helping the PiC.

Furthermore, participants noted that it was unrealistic for the PiC to agree to come down so easily, which abruptly ended the negotiation. “It was a bit too quick to actually step down. I feel like if he has some pent-up emotions, it will not be that easy to convince him” (Participant 26, Prevention). This quote highlights that while the set up was plausible, the PiC was too easily convinced to match the reality of a real high-stake scenario. Despite these challenges, participants clearly adhered to the stepwise approach taught during the training. “It was quite simple to know what at least was kind of expected for you to choose according to the training, but that's just following the training” (Participant 2, Prevention). However, many participants noted that the answer options were straightforward. This raises the question whether the task might have been too easy and therefore might have made it difficult to perceive the occurrence of errors as impactful.

Immersiveness of the VR environment

This subtheme captures participants experiences of the visual representation of the VR

environment. The 3D depth and surrounding visual environment enhanced participants' sense of presence, as described by one participant: "If you look around you, it's in 3D and you see certain things moving faster than others. It seems like a 3D environment that you're in the real world" (Participant 5, Management). This heightened presence together with the shocking visual of someone on the roof, intensified participants' stress and fear that their words could have fatal consequences. Which influences the PiC's decision to jump:

> Most of the time when this occurs, you see it in movies and you're not kind of part of it. So, people get talked out of it and it's all very clear. And now you're a part of it. So, it's kind of your problem. And that's kind of stressful I think, because if it were a real situation and I would be there, I would be really stressed.
> (Participant 18, Prevention)

The realism of the simulation resulted in a perceived task responsibility and heightened awareness. Even though participants did not experience "really being there," the VR simulation helped participants imagine what the scenario in real life would be like, as it succeeded in being immersive.

However, these effects were not always stark for everyone, as some identified unrealistic features that hindered their immersion, potentially affecting their perception of errors. These features included teleportation to the roof, having sticks for arms and the static movement of the character. All of which impaired the immersion and made the experience feel less authentic. For some participants, these gamified elements created a sense that there were no real consequences. Thereby undermining the severity of errors. As one explained, "It didn't feel real enough that it was like, oh, if I make an error there is a problem" (Participant 3, Management). Additionally, the passing or failing structure and predefined answer options diminished the seriousness of the high-stake scenario as it resembled characteristics of a video game. Even though participants noted the lack of realism in the visual environment, it did not

prevent them from experiencing any immersion. While the environment resembled a video game, participants still found it an improvement over using a simple screen. This resulted in a sense of partial immersion allowing them to effectively perform their task. “I felt like I was following the step stepwise approach and I was doing a good thing. So, I wasn't really backing down or rethinking my approach in that sense” (Participant 9, Prevention). In summary, even though the virtual environment had some limitations, participants were still engaged with the task and performed in accordance with the learning material.

Manipulation Check

The Mann-Whitney U-test showed that there was a statistically significant difference between the error prevention and error management groups ($U = 47.00$, $z = -2.79$, $p = .006$). This means that the distributions between both groups differed and therefore the manipulation successfully influenced participants’ perceptions of errors.

Exploratory Analysis

During the interaction with the PiC, the initial dialogue option elicited a negative response from the PiC due to the fixed nature of the error. The four response strategies, as proposed by Oostinga et al. (2018a), were implemented to assess how participants responded to an error. As the error prevention strategy affects negotiators more negatively, participants in these groups might internalize the blame for the error and apologize. Whereas the error management strategy encourages learning from errors which may result in participants feeling less blame and therefore might accept the error (Chillarge et al., 2003; Dimitrova et al., 2017). While there were apparent differences in the rates of apology and acceptance between the error prevention (apology: 5, accept: 9) and error management groups (apology: 2, accept: 14), the Fisher’s Exact Test indicated that these differences were not statistically significant ($p = .204$).

Discussion

The main objective of this study was to analyse the impact of the different error-handling strategies: error management, error prevention and how these different training strategies impacted participants on a cognitive, emotional and behavioural level. Additionally, this study examined how these strategies affected participants while making an error and their approach to decision-making. Furthermore, this study aimed to analyse how participants experienced spatial and social presence in a VR suicide negotiation and how this impacted their performance and tasks.

Error-handling strategies

Completing the VR suicide negotiation, participants in the error management group felt more confident and less stressed. Conversely, participants in the error prevention group experienced more anxiety, which hindered focus but did not prevent them from adhering to the stepwise approach. While the error management strategy fostered adaptability, its leniency may reduce sensitivity to the severity of errors. In comparison, the strictness of the error prevention message led to a heightened sense of responsibility but also to negative on-task thoughts. These findings align with those of Dimitrova et al. (2017), who suggested that following an error management strategy fostered emotional resilience and confidence towards handling errors. Whereas adhering to the error prevention strategy had detrimental effects on adaptability. The error prevention strategy highlights implementing measures for the avoidance of errors. By solely relying on this strategy a culture of blame and punishment might be enhanced (Torres-González & Sánchez-Aguirre, 2022). While a dominant error management culture without adequate measures of the error prevention strategy can be harmful when implementing safety controls (Van der Byl & Vredenberg, 2023).

Integrating error management and error prevention strategies could provide a balanced approach, reducing stress while fostering adaptability to enhance performance, as supported

by Van der Byl and Vredenberg (2023). Within a suicide negotiation, combining both strategies could reduce the negative consequences of errors due to the avoidance approach and perceived responsibility of the error prevention strategy, as well as the resilience of the error management strategy. The qualitative findings did not support the counterintuitive quantitative findings by Tomlin (2024). She observed that participants in the error management group experienced higher levels of stress prior to the VR simulation compared to participants in the error prevention group, which is surprising based on previous literature. In Tomlin's study (2024), the stress measure consisted of only three questions, which may not have fully captured the construct. Moreover, these items intended to assess stress prior to the VR simulation, but since the questionnaire was administered afterwards, participants may have struggled to recall their feelings at that earlier time. In addition, qualitative data gives a more detailed and rich account of participants than only quantitative data can obtain, as interviews offer more flexibility to rephrase questions and therefore yield richer data (Doody & Noonan, 2013). This could suggest that the qualitative data captured the subjective experiences better than the quantitative data.

Errors

Errors can be harmful to the negotiation process, as they may negatively impact the relationship between the negotiator and the PiC (Vecchi et al., 2005). After making the initial error, participants experienced an impact on the cognitive, emotional and behavioural level. While all participants immediately recognized the error, their perception of its severity was based on personal characteristics and the different training strategies. Participants in the error management group took a more distant approach, not blaming themselves for the error, as the error was perceived as only a minor setback. In contrast, participants in the error prevention group more frequently blamed themselves for the error. However, self-blame was not fully caused by the different training strategies but also due to personal characteristics. Regardless

of the group, participants differentiated between perception of the severity of errors. Noting that the initial error lacked severity and therefore did not cause stress.

However, participants' responses towards the errors varied strongly. Most participants took a refocus approach, as the error heightened participants' focus and engagement with the interaction. Participants actively worked on repairing their rapport with the PiC. The error seemed to enhance participants' perception of the PiC as real and fostered a sense of connection. Participants who apologized wanted to restore the relationship with the PiC. This relational repair strategy aligns with findings by Oostinga et al. (2018a), who found that apologizing re-establishes rapport and results for the person in crisis in a meaningful existence. Notably, participants in the error prevention group apologized more frequently to the PiC, which could indicate that they internalized the blame more compared to the participants in the error management group. How participants felt after the error was not fully caused by the different training groups, but also by the level of immersion and realism participants experienced in the VR simulation. This suggests that participants responses towards errors are shaped by the combination of the training strategy and the intensity of the VR suicide negotiation simulation.

Social and spatial presence

The error-handling strategies did not directly influence participants' sense of immersion, but perceived realism affected their response to errors. The level of emotional connection to the PiC varied between participants. The realism of the scenario, specifically the reasoning of contemplating suicide and the responses of the PiC, fostered an emotional connection as it resembled a real-life suicide negotiation. Spatial presence appeared to be less important to participants. This suggests that social presence is more critical in fostering emotional connections. Even though participants emphasized the importance of forming a connection, those who did not feel emotionally engaged were still motivated to follow their

training to succeed in the negotiation. These findings align with Oh et al. (2018), who demonstrated that social interaction plays a more vital role in fostering presence in virtual environments. While their research does not examine crisis negotiations, their findings indicate that meaningful social interaction can enhance engagement. This indicates that in a suicide negotiation, lower spatial presence does not hinder rapport-building with the PiC, but rather that spatial presence might not be as crucial as social presence. These findings are further supported by Bünnemann (2024), who found that social presence is crucial in maintaining task engagement.

Previous research highlights that recognizing emotions is essential for experiencing presence, whereas a perceived lack of facial expressions diminishes presence (Riches et al., 2019). McMahan et al. (2012) found that visual realism is crucial for the engagement in VR simulations and contributes to the immersive experience. Mulvaney et al. (2024) examined how the visual quality and realism of the environment influences users' experiences, especially in learning context such as surgical training. The role of visual fidelity improves skill acquisition and high visual fidelity enhances surgical skills and improves learning (Mao et al., 2021). Similarly, realistic social interaction plays a crucial role in social skills training. VR mimics real-life scenarios and has proven valuable in training social skills among individuals with autism by reducing social anxiety (Kourtesis et al., 2023). These findings suggest that lower spatial presence does not necessarily have a negative impact on fostering a meaningful connection. Instead, they show the critical role of social presence, reinforcing interpersonal engagement over environmental realism.

Limitations

The first limitation of the study concerns the sampling method, which introduces the risk of familiarity bias. Familiarity bias occurs when participants have prior knowledge of the researcher or the research context. In this study the researcher knew fourteen out of the thirty

participants. Familiarity with the researcher presents potential risks as participants desire to respond socially due to perceived expectations (King & Brooks, 2019). To account for this, participants were anonymously participating. Meaning that the quantitative data cannot be traced back to them. However, due to the researcher also being the interviewer, the researcher had knowledge of familiar participants in the qualitative data of this study. This could hinder obtaining richer data, as the researcher might make earlier interpretations and not require more clarification (Olmos-Vega et al., 2022). To encourage open and honest communication, the researcher emphasized the exploratory nature of the study both before and during the interview, reassuring participants that all responses were welcome. On a positive note, familiarity of participants also ensured existing rapport, making it easier to elicit information from them.

A second limitation concerns participants' demographics. This study entailed novice negotiators instead of experienced negotiators, which may have influenced how training strategies were perceived. As Oostinga et al. (2018a), found that more experienced negotiators favour the error management strategy as they have previous experience with this strategy. This raises the question of whether the findings might differ if the study involved more experienced negotiators.

Finally, task complexity presents another limitation. Participants indicated multiple times that the tasks were straightforward and easy to perform. This does not reflect a true crisis negotiation which is cognitively demanding for negotiators. Furthermore, the straightforwardness of the tasks could undermine the effect of the training strategies as complexity of the tasks could impact error-handling approaches (Keith & Frese, 2008). The premade dialogue also diminished the complexity of the tasks and participants claimed to easily recognize the correct answer. Tasks with limited answer options can decrease cognitive demands, as participants could identify the correct answer without much cognitive effort

(Jónsdóttir et al., 2021). To effectively enhance the cognitive demands of a true suicide negotiation and assessing the true impact of errors, the task could be made more complex by adding multiple answer options rather than just two. The benefit of adding multiple answer options would still give the opportunity to compare participants' response choices. While the complexity of the task could be accounted for, it could also be truly assessed whether the error and training strategies impacts task focus and performance.

Conclusion

This study is among the first primarily qualitative studies to assess how different error-handling strategies impacted participants cognitively, emotionally and behaviourally. It also explored how these strategies affected the experience of making an error and the feeling of presence in a VR suicide negotiation. The error management strategy increased participants' confidence, whereas the error prevention strategy heightened stress and made participants more focused. The downside of the confidence in the management strategy resulted in a nonchalant attitude whereas the benefit of the more focused attitude of the prevention strategy contributed to a more self-aware negotiator. Additionally, the results indicate that the importance of social presence outweighs the limitations of spatial presence. Social presence is critical for fostering an emotional connection. However, the lack of facial expressions undermines recognizing emotions and establishing a deeper connection. Furthermore, it was found that making an error contributed to the realism of the VR simulation. This study underscores the importance of an effective and realistic VR simulation. Further refinement of spatial presence to enhance social realism could make the VR simulation a more effective tool, as it better represents a real-life scenario. By building on these findings, future research could explore how to optimize the straightforwardness of the VR scenario, assessing impact of different errors to improve training outcomes for crisis negotiators.

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Appendix A

Informed consent form

Informed Consent as was shown to the participants. Each box needed to be clicked to continue with the study.

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 qualitative data (e.g., interviews) to be recorded using a dictaphone, transcribed anonymously using Amberscript, and then destroyed after transcription. The data

will be kept confidential, with Amberscript ensuring secure handling as per agreements in place.

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.

Informed Consent Box

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.	○
I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○
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.	○
I understand that taking part in the study involves tracking of physiological data using a wristband.	○

Appendix B1

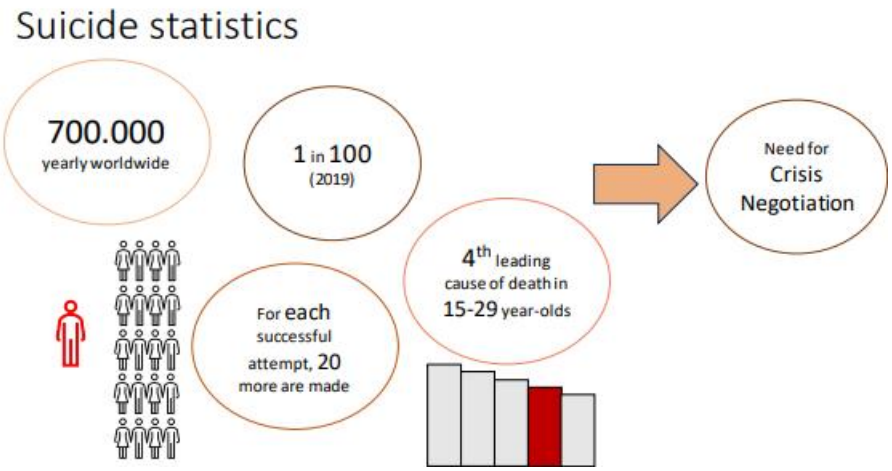
Online training

This Appendix shows the content of the videos as it was presented to participants. First the slides of the video will be displayed and underneath the spoken text.

Video 1: Introduction and suicide statistics

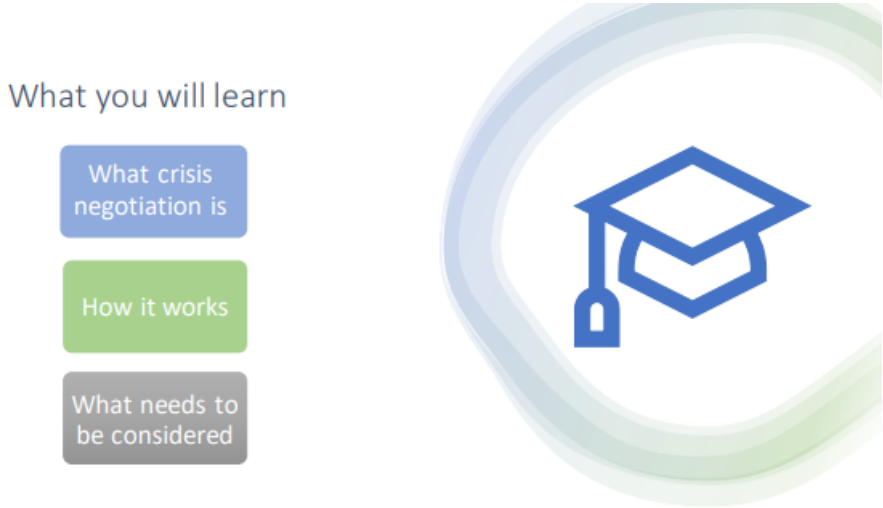
Slide 1:

Slide 2:



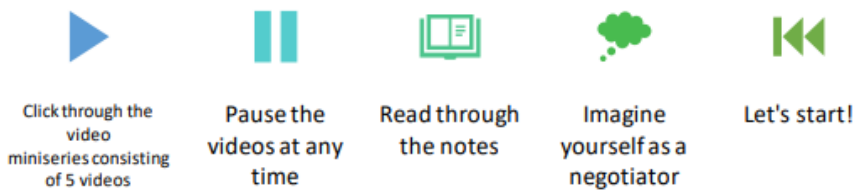
“It is estimated that more than 700.000 suicides occur worldwide every year. It is also estimated that for each successful suicide attempt, 20 other attempts are being made. Suicide is one of the most prevalent causes of death. More than one in every 100 deaths in 2019 were the result of suicide. It is the 4th leading cause of death in 15–29-year-olds. People who are considering or attempting suicide are often in a state of crisis. When a person puts themself in a dangerous situation, crisis negotiators are called to help them back to safety. And this leads us to today's topic of crisis negotiation.”

Slide 3:



“After this training you will know what crisis negotiation is and how it works. With that you will also learn what issues may occur and what to consider when they do. In the end you will be asked a few questions about the content of this training, so pay close attention.”

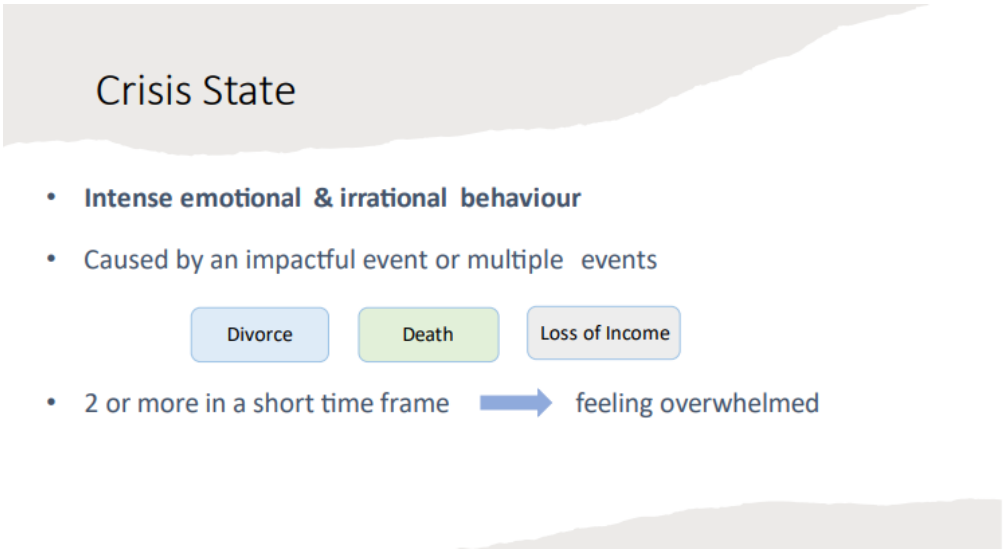
Slide 4:



“You will click your way through this video miniseries consisting of 5 short videos. You are welcome to pause the videos at any time and can read through the notes presented on the screen. During this training imagine yourself as a negotiator. Now, let's move on to the first video!”

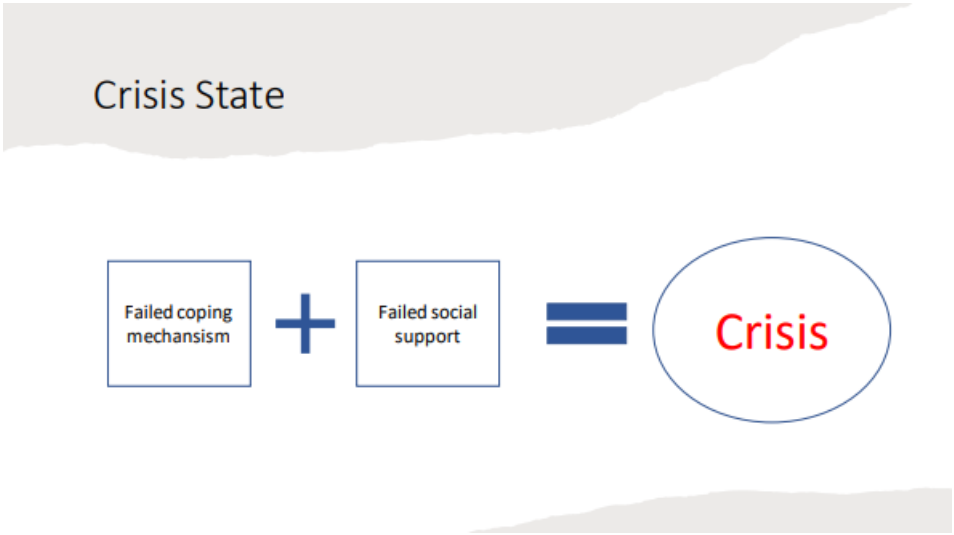
Video 2: Crisis state and crisis negotiation

Slide 1:



“As mentioned before suicidal people are in a state of crisis, which is characterised by a state of intense emotional and irrational behaviour. It can be caused by an impactful event or multiple events such as a divorce, death of a loved one, or the loss of income. Often two or more events that happen within a short time can lead to the person feeling overwhelmed.”

Slide 2:

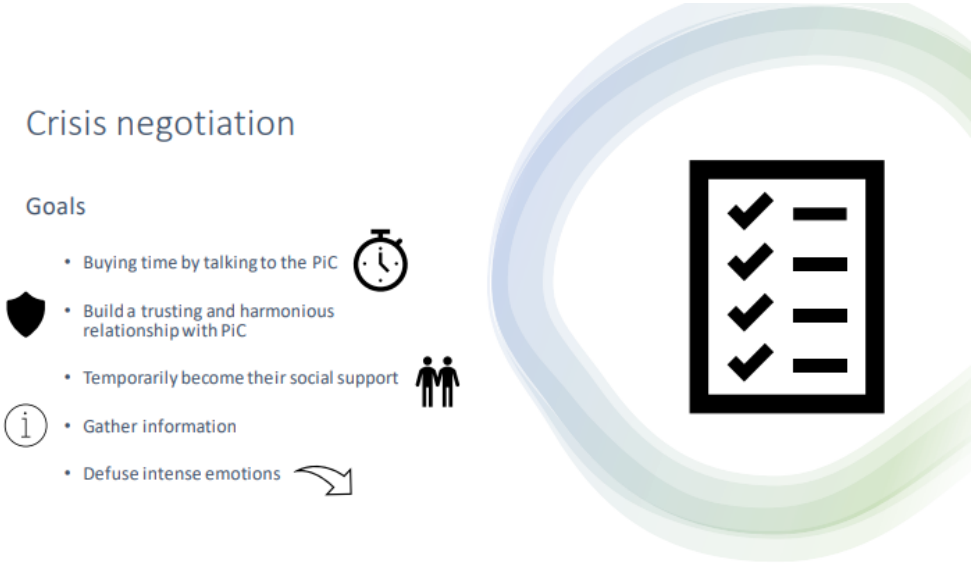


“If the person feels incapable of coping with their problems by themself and perceives a lack of social support, they can fall into this crisis state.”

Slide 3:

“Crisis negotiation aims to help these people, who are in a dangerous situation, back to safety. To achieve this, you as the negotiator should strive to achieve several goals.”

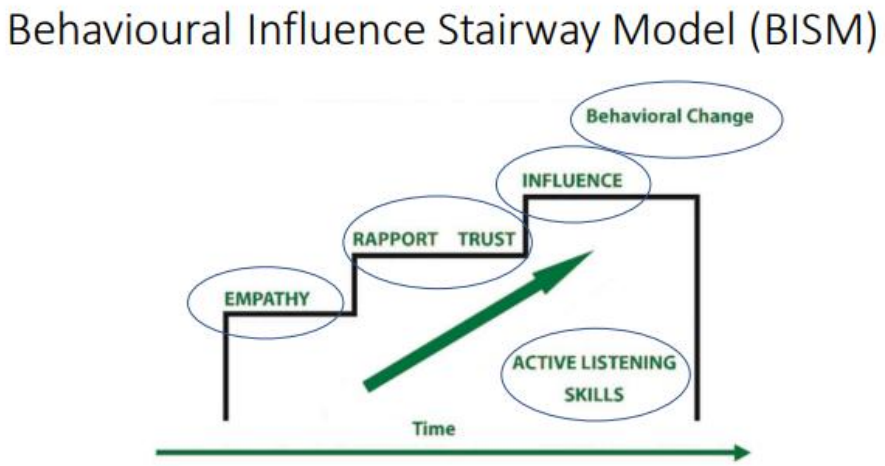
Slide 4:



"An important part of negotiation is buying time, by talking to the person in crisis, while also building trust and a harmonious relation with the person in crisis. The negotiator aims to become their social support during the negotiation, which is vital to be able to influence the person in crisis and guide them to safety. Additionally, the negotiator gathers information to build and carry out the optimal negotiation strategies to resolve the current problems. Lastly, as a person in crisis is filled with intense emotions another crucial factor is to defuse these intense emotions. To achieve these goals, the Behaviour Influence stairway model is used, which you will learn more about in the next video."

Video 3: The Behavioural Influence Stairway Model

Slide 1:



"The Behavioural Influence Stairway Model. The Behavioural Influence Stairway Model or the BISM for short is used to achieve crisis negotiation goals so that the behaviour of the person in crisis can be influenced and they can be guided to safety. The BISM consists of four stages, active listening, empathy, rapport and trust, and influence, each building up on the other to ultimately be able to help the person in crisis out of a dangerous situation by moving them to change their behaviour. As a negotiator you need to move up through the staircase fulfilling every stage before tackling the next. It might happen that you "fall down" a stage, at which point you need to repeat that stage to move back up again."

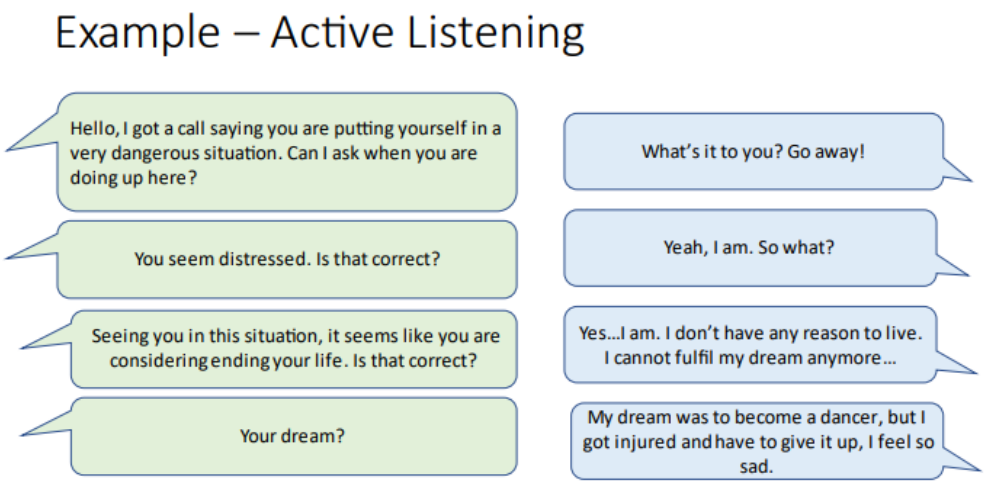
Slide 2:

"Active listening is the backbone of the stairway model and is needed throughout all the other stages. It is also the first step in defusing intense negative emotions and developing credibility as a negotiator. During this stage you should try to not bring in your own experiences and opinions actively listen with a focus on getting the person in crisis to express emotions. Counter to widely held belief that it is harmful to ask suicidal people about their intentions to commit suicide, most are willing to discuss their thoughts."

Slide 3:

“There are a range of different skills that can be helpful during the stage of active listening. These skills can help the negotiator gain more information, clarity of what is being said, and may help the negotiator to be perceived as a better listener.” One of these “Core Listening Skills” repeating back, for example, “Thats why I got fired” - “You were fired.”. Another is Emotional labelling such as “You seem angry”. Others are paraphrasing and summarising of what the person in crisis has said.”

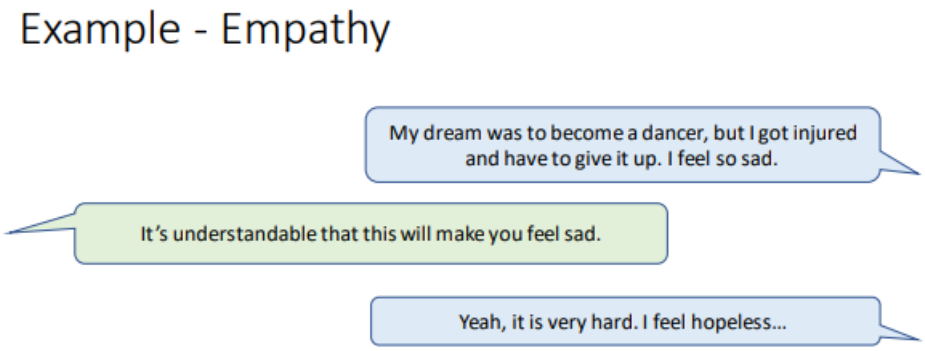
Slide 4:



Slide 5:

"Empathy. Empathy is the second stage of the model and is a by product of active listening. Showing empathy means that you identify with the person in crisis and makes them feel like you care about the situation of the person in crisis. It is crucial that the person in crisis believes you genuinely care about them so that they will listen to what the negotiator has to say. However, you still avoid giving your own opinions or experiences during this stage. An example of showing empathy would be 'It is understandable how you would be angry about that."

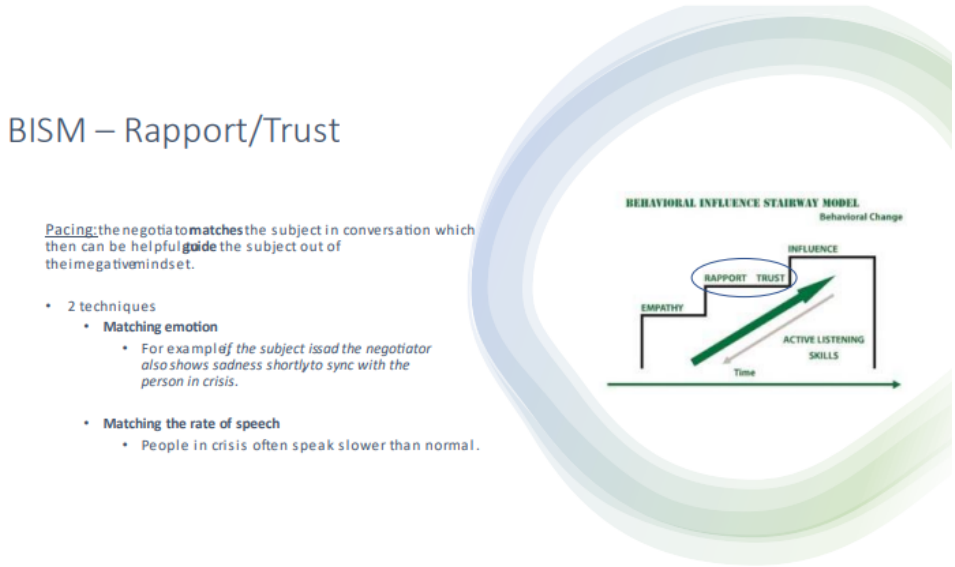
Slide 6:



Slide 7:

"Rapport and Trust. Rapport and Trust are the third stage of the model. Rapport is a friendly, harmonious relationship, characterized by a mutual understanding and respect for each other. Rapport is the last stage in which you should remain in the person in crisis's frame of reference. This is the stage where, after showing a genuine desire to better understand the person in crisis, the emphasis shifts to establishing a working relationship where the person in crisis starts to see the negotiator as a collaborative partner. Good rapport means that you can make the person in crisis feel comfortable to share their concerns."

Slide 8:

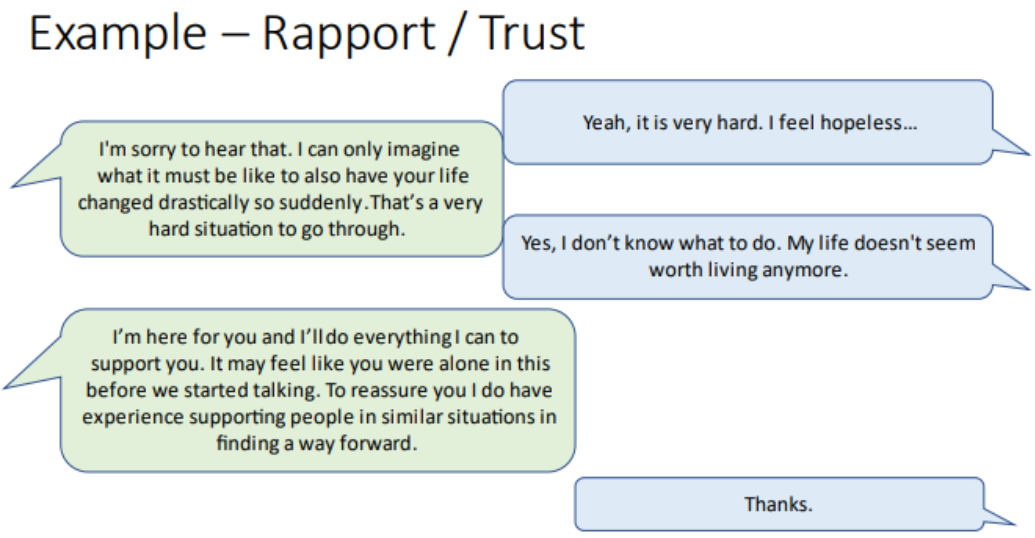


“Pacing is a technique that allows the negotiator to build a connection with the person in crisis. This technique involves matching the person in crisis in conversation. For example, if the person in crisis is sad the negotiator also shows sadness very briefly, to sync with the person in crisis. This way the negotiator can guide the person in crisis out of their negative mindset. Another part of pacing is matching the rate of speech. People in crisis often speak slower than normal.”

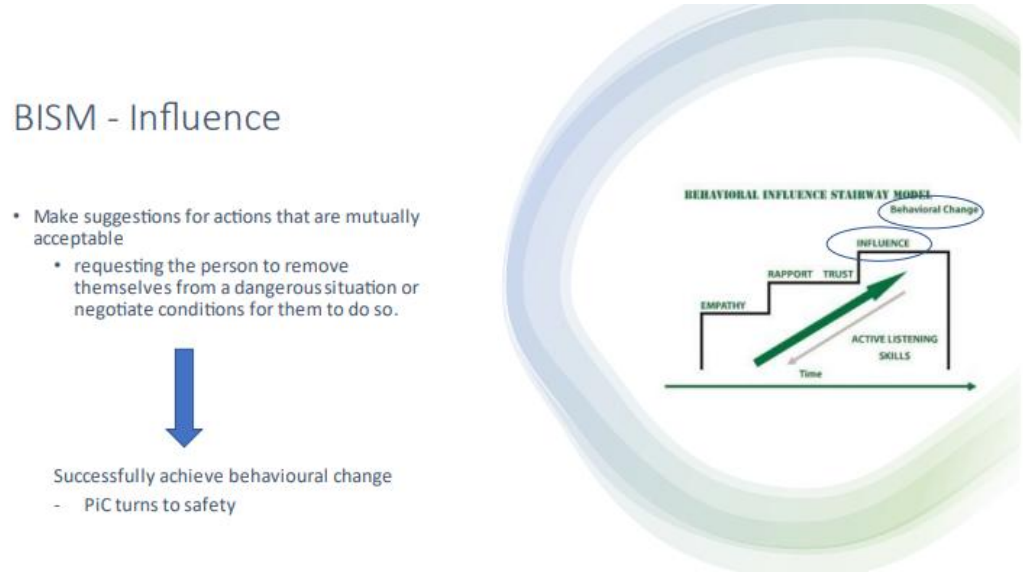
Slide 9:

“Trust naturally occurs with high rapport and makes the person in crisis open to listen to what the negotiator has to say. However, trust can only form if you are honest and keep your word. For example, if you offer to give them something you should give it to them. From this point onwards, you can point out to the PiC what you as a negotiator can do to help them and build an alliance with the PiC.”

Slide 10:

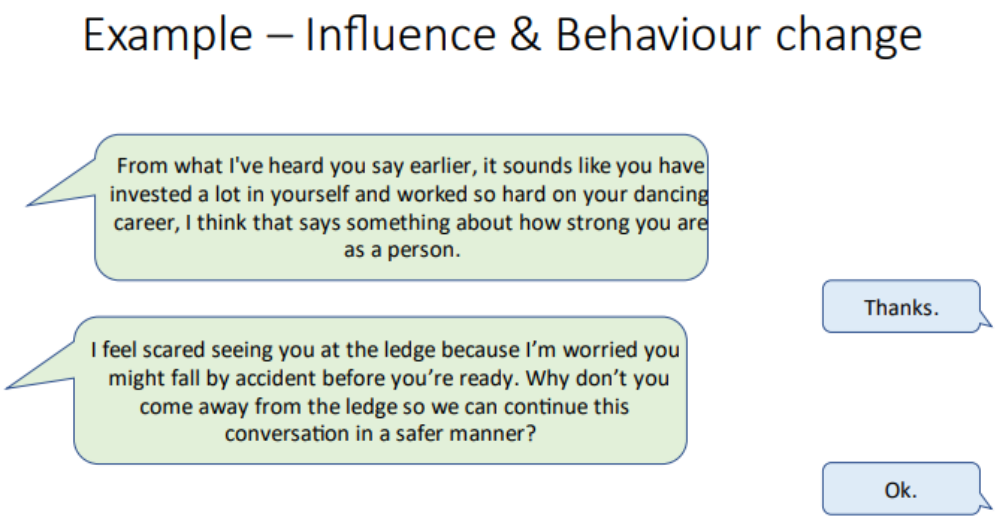


Slide 11:



"Now that you as the negotiator have connected with the person in crisis and built a good bond it is possible to make suggestions to the person in crisis. You can then negotiate actions and resolutions that are mutually acceptable. This may include requesting the person to remove themselves from a dangerous situation or negotiate conditions for them to do so. If everything goes well then you have reached the final step which is the goal of this model. Namely, changing the PiC's behaviour and have them return back to safety."

Slide 12:



Video 4A: Error management condition

Slide 1:

"During negotiations with a person in crisis, it may happen that you say something that is inaccurate or not productive for the current situation. These statements are classified as 'errors' but they can be remedied if managed appropriately."

“Errors can happen and making these is a natural part of the learning process. You can reduce the negative consequence and there are positive things to be gained such as learning more information about the person in crisis. When you make an error, it is important to think of how it can be corrected, what can be learned from it, and how what you learn can help you in similar situations in the future. By successfully handling errors you will learn how to negotiate more effectively. If you try to find the useful information errors provide, you will do better during the negotiation.”

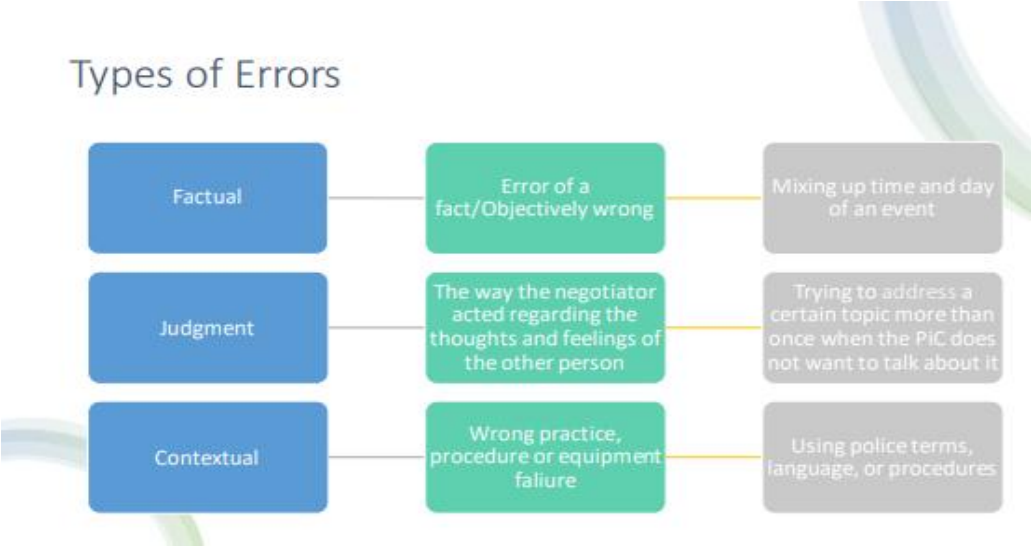
Video 4B: Error prevention condition

Slide 1:

“Errors should not be allowed to occur during the learning process. Errors can be harmful to the negotiation process and can lead to negative consequences. It is important to think of how you can prevent errors from occurring, what you can do to successfully detect situations possibly leading to errors, and how what you know can help you with similar situations in the future. By successfully preventing errors you will learn how to negotiate more effectively. If you try to prevent errors from occurring, you will do better during the negotiation.”

Video 4: Communication errors

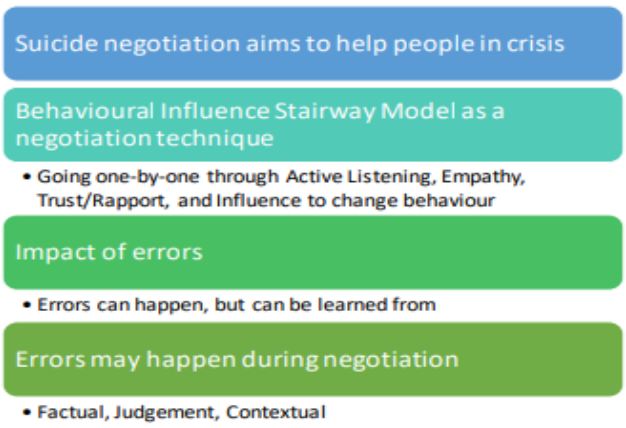
Slide 1:



"There are three types of errors: Factual, Judgement & Contextual A Factual error is an error of a fact. The negotiator says something that is objectively wrong. For example, mixing up the time and date of an event. A Judgement error is an error in the way a negotiator acted regarding the thoughts and feelings of the other person. For instance, trying to address a certain topic more than once when the PiC does not want to talk about it. A Contextual error results from not acting in line with correct police practices or procedures or the failure of equipment. For instance, using police terms, language, or procedures."

Video 5A: Summary management condition

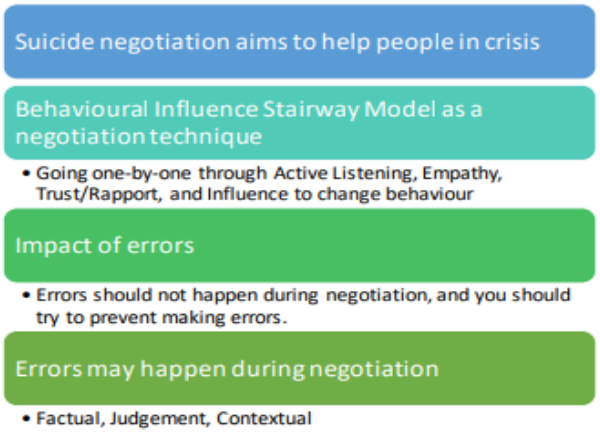
Slide 1:



“This is a brief summary of what has been mentioned during this video miniseries. Suicide negotiation is an important practice used to help people in a state of crisis. The behavioural influence stairway model is a tool that is used to reduce emotions and agree upon mutually acceptable solutions. It consists of multiple stages which have to be fulfilled one by one: Active listening, which is active through all other stages as well, empathy, rapport and trust, and lastly influence. In the end, if successful behavioural change of the PiC is achieved. Throughout the negotiation process, errors can happen, but they can be learnt from. There are 3 types of errors: Factual, Judgement and Contextual.”

Video 5B: Summary prevention condition

Slide 1:



“This is a brief summary of what has been mentioned during this video miniseries. Suicide negotiation is an important practice used to help people in a state of crisis. The behavioural influence stairway model is a tool that is used to reduce emotions and agree upon mutually acceptable solutions. It consists of multiple stages which have to be fulfilled one by one: Active listening, which is active through all other stages as well, empathy, rapport and trust, and lastly influence. In the end, if successful behavioural change of the PiC is achieved. Errors should not

happen during negotiation, and you should try to prevent these from occurring. There are 3 types of errors: Factual, Judgement and Contextual."

Appendix B2: Post-training questions

1. 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.

2. 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.

3. The stages of the BISM are: Active listening, Sympathy, Rapport / Trust, Influence

a. True

b. False

c. I don't know.

4. If you "fall down" a stage, you cannot continue the negotiation.

a. True

b. False

c. I don't know.

5. Active listening is necessary during the whole negotiation.

a. True

b. False

c. I don't know.

6. 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.

7. 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 too openly what can be done to help.

c. I don't know.

Appendix C

Self-reported scale: Questionnaire 1

The first questionnaire measures the variables worry, self-efficacy, stress, on-task thoughts and off-task thoughts. The variables were measured on a five-point Likert scale ranging from Not at all to Very much so.

Worry

I felt worried.

I felt anxious.

Self-efficacy

I felt that thanks to my resourcefulness, I knew how to handle unforeseen situations.

I felt I could solve most problems if I invested the necessary effort.

I was confident that I could efficiently deal with unexpected events.

I felt like I could usually handle whatever came my way.

I felt that if I was confronted with a problem, I could usually find several solutions.

Stress

I felt nervous.

I felt tension.

The stress I felt increased to such high levels I could not let go of it.

On-task thoughts

I found it easy to concentrate on the negotiation.

It was easy to concentrate on what I was doing.

I found it easy to keep thinking about how I was supposed to respond.

Off-task thoughts

I thought about how poorly I was doing.

I thought that I didn't have the necessary skills to do well in the negotiation.

I thought about how dissatisfied I was with how I was doing during the negotiation.

Self-reported scale: Questionnaire 2

The second questionnaire measures the variables stress, rapport, empathy, spatial and social presence. The variables were measured on a five-point Likert scale ranging from Strongly disagree to Strongly agree.

Stress

I felt nervous.

I felt tension.

The stress I felt increased to such high levels I could not let go of it.

Rapport

The person in crisis and I were paying attention to each other.

The conversation with the person in crisis flowed smoothly.

The conversation felt mutually respectful.

Empathy

It was easy to tell how the other character felt in the virtual environment.

The person in crisis and I were paying attention to each other

I felt an emotional response from interacting with the other character.

Spatial Presence

I felt like I was actually in the virtual environment.

I felt like I could be active in the virtual environment.

I felt like I could do anything I wanted in the virtual environment.

I felt like I was part of the virtual environment.

It felt like I was physically present in the virtual environment.

I was easily distracted during the interaction.

Social Presence

The other character seemed to have emotions of their own.

The other character's behaviour was often a reaction to my own behaviour in the virtual environment.

The other character made me feel like I was in the environment with another person.

The character on the roof was responsive towards me in the virtual environment.

Appendix D

Topic Guide

This appendix presents the full topic guide used during interviews for assessing participants' experiences with online training and the VR crisis negotiation.

Training, decision-making and affective responses

-How did you experience the training?

Probe: Were there any moments during the training that stood out to you – this can be either both positive or negative.

-Did the training make you think about the upcoming tasks?

Probe: What did you experience after the training but before the VR crisis negotiation began?

-Did your approach change after the start of the interaction with the PiC?

Probe: Were there other moments that made you change or rethink your approach?

VR experiences, realism and PiC

-How did you feel about the VR crisis negotiation?

Probe: How real did the VR crisis negotiation feel to you?

-What were the most important aspects of the VR crisis negotiation for you to make it real?

-What is your perception about the PiC?

Probe: Did the PiC seem realistic to you?

Probe: Were there any points during the crisis negotiation where you had any emotional response or connection to the PiC?

-Can you describe a specific moment during the VR crisis negotiation that triggered an emotional reaction? What was it about that moment that stood out to you?

Probe: Did it influence your approach?

Effect of errors

-How did you feel about the fact that you might make an error?

To be honest with you, we let everyone make an error right in the start of the VR negotiation. That is, either you approached the PiC too formal or too informal. Do you remember which one you chose?

-Can you recall what you thought and felt at that moment after you had approached the PiC wrongly?

Probe: Any specific thoughts/feelings?

To make it more complicated, we also influenced how you experienced errors upfront. You were in the error management/error prevention group in where we shared that you can learn from errors/errors are very detrimental and should be prevented at all cost.

-Did this error management / error prevention message influence you?

- If yes, in what way?
- If not, why not? Could we have done something to make it more visible?

To wrap up, thanks for your participation.

Appendix E

Debriefing

The debriefing as how it was presented to the participants included a final consent option. Participants could either click the box to give their consent or withdraw by closing the questionnaire.

Thank you for taking part in this experiment.

The aim of this experiment is to see what effects different error strategy trainings can have on negotiators. There were 2 groups, one that learnt about error management and one about error prevention. You were randomly assigned to one of these groups.

1) Error management teaches that making errors is natural and learning how to handle these errors makes you better at your job.
2) Error prevention teaches that making errors needs to be avoided to avoid negative consequences and preventing these errors can make you better at you job.

If you would like to know more about this study or have any questions you can contact:

Robin L.M. Harms

r.l.m.harms@student.utwente.nl

The previous study was about suicide. We realise that this may trigger something in you. If you or someone you know is suicidal you can call one of the following hotline numbers:

Netherlands: +31 800 0113 or +31 900 0113

Germany: +49 800 111 0 111 or +49 800 111 0 222

United Kingdom: +44 800 689 5652

Having learned the intention of this study, you are still allowed to withdraw your consent and all your data will be removed. To do that, simply close this page and your data from this study will be deleted. If you still consent to having your data used within the research, you can indicate that preference below.

○ I consent that my data will be used

Appendix F

Acknowledgement of AI usage

During the preparation of this work, I used Grammarly, EndNote and ChatGPT for assisting with scientific writing and generating a reference list. After using these tools, I thoroughly reviewed and edited the content as needed, taking full responsibility for the final outcome.