

Towards more child safety-oriented decisions through VR

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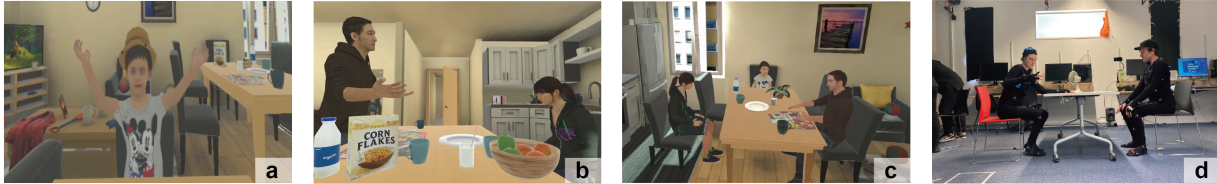


Figure 1: a: child embodiment, b: child's perspective, c: 3rd person perspective, d: motion capture session

ABSTRACT

Witnessing intimate partner violence (IPV) could have long-term negative impacts on children. Such exposure is, however, often overlooked by professionals. We developed a VR scenario which allowed participants to witness IPV from a child's perspective. In this pilot study, we found that they made more child-protective decisions and showed higher levels of empathy towards the child after VR exposure. When comparing the impact between the child's perspective and third-person perspective, no statistically significant differences were found in empathy and decision-making, even though those with the child's perspective had significantly higher levels of presence.

Index Terms: Applied computing—Law, social and behavioral sciences—Psychology

1 INTRODUCTION

It is estimated that 8-25% of children witness intimate partner violence (IPV) during their childhood in high-income countries [2]. Studies have shown that exposure to IPV in childhood may be associated with behavioral, cognitive, and emotional problems lasting into adulthood [13]. Social and healthcare workers working with families have a high chance to be confronted with cases in which children may be exposed to IPV. However, professionals often overlook children's involvement in adult-oriented interventions [5]. Therefore, there is a need to raise awareness of students and professionals about situations in which children witness IPV and to train them in recognizing and assessing such situations. We developed a Virtual Reality (VR) scenario which enables participants to experience IPV from a child's or third-person's perspective. A pilot study with 14 participants was conducted as an initial validation.

2 BACKGROUND

Perspective-taking, the process of one person trying to understand another person's feelings and thoughts, might be an effective way to

help professionals build empathy towards victims [6]. VR promises to enhance perspective-taking as users can enter another person's body to experience the scenario from their perspective. In addition, the illusion of ownership of the virtual body can be induced [11], which could lead to changes in perception, attitude, and behavior. For instance, the embodiment of adults in children's bodies led to a greater overestimation of the size of surrounding objects [1]. Hamilton-Giachritsis et al. found that participants who embodied in a child's body showed a greater ability to recognize emotions [3]. Seinfeld et al. also reported an increase in their emotional recognition ability amongst male offenders after they embodied in virtual female victims [9]. Another study showed that the embodiment of male offenders in a child avatar increased sensitivity to recognize facial emotions; faster heart rates with the increased level of aggression were also observed [10]. These studies have examined the effects of VR exposure on the behavioral or cognitive abilities of perpetrators of violence. However, few studies have focused on professionals. A 2009 study by Raij et al. found that healthcare professionals could recognize the skills they need to improve and inappropriate behaviors when they relived the interview and breast exam as a patient in VR [8]. In this work, we were interested in whether VR exposure would impact participants responding to IPV involving children.

3 EXPERIMENTAL DESIGN

A 2 × 2 mixed-design was used, with format (text or VR) being the within factor and perspective (child or 3rd) the between. We did not manipulate the order of the text and VR: all participants were first given a text vignette of a situation (commonly used in social science [4]) before experiencing a similar but more concrete situation *in vivo* in VR. Half of the participants experienced the VR scenario in the child's perspective, the other half from a 3rd person's.

3.1 Virtual Reality Scene Implementation

A VR scenario was created to allow participants to observe IPV from a child's or third-person perspective (Figure 1), which was on a standalone experience (Quest 2) programmed in Unity. The scene is set on a weekday morning with a mother and a father having a conversation at the breakfast table with their child present. The virtual scene begins with a conversation between the parents where the father gradually commits verbal violence against the mother (humiliating, threatening, intimidating, economic abuse), with no physical violence. The scene ends with the father slamming the door and the mother comforting the child.

All character animations were developed using motion capture data from two professional actors (Figure 1). We used the Optitrack

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system, Unity Face Capture tool for mocap, and Maya for data cleaning. Animation Rigging was used to correct animation clipping. We built our virtual scene based on 3D scanning data of a real room using Polycam. High Definition Render Pipeline (HDRP) and light baking were used for realism and performance optimization. Unity's Timeline system was used for animation, sound, audio, and lighting integration. Final IK was used for virtual embodiment.

3.2 Measurements

Three questionnaires were used to measure participants' responses: Decision Making (DM) measures the extent to which the decision is more child safety-oriented (higher values mean stronger orientation to child safety) [12]; Specific Empathy (SE), developed by ourselves, measures situational empathy towards the child; and the VR Presence (VP) [7] measures the level of presence.

3.3 Hypotheses

Our first goal is to validate the effectiveness of VR in comparison to text vignette:

H1. The decision-making is more child safety-oriented after VR exposure

H2. The level of empathy towards the child is higher after VR exposure

H3. The higher someone's level of presence in virtual reality, the more child safety-oriented their decision is.

The second goal of this study is to investigate the impact of different perspectives; we hypothesized that, compared to the 3rd person's perspective, those who experienced the VR scenario from the child's perspective would:

H4. Make more child safety-oriented decisions

H5. Report a higher level of empathy

H6. Show a higher level of presence

3.4 Participants and Procedure

Fourteen participants from the general public without IPV history (8 female, Age $Mean \pm Std$: 23 ± 1.97) participated in our pilot. They were randomly assigned to one of the conditions (child's perspective or 3rd). On arrival, all participants were asked to read the text vignette and complete the preDM and preSE questionnaire. They then went through the two VR conditions accordingly. Once inside VR, all participants first had to complete simple tasks to familiarize themselves with the virtual body and the environment. Next, they viewed the identical scenario of IPV between parents from either the child's perspective or the third perspective. After the VR scenario, all participants finished the postDM, postSE and VP questionnaires.

4 RESULTS

As expected, participants made more child safety-oriented decisions after the VR experience compared to the text vignette (preDM: 3.07 ± 0.73 ; postDM: 3.71 ± 0.47 ; $d = -0.86$; $t(13) = -3.23$, $p = .007$), validating **H1**. Similarly, VR experience led to a significantly higher level of specific empathy towards the child (preSE: 6.64 ± 1.60 ; postSE: 8.00 ± 1.04 ; $d = -0.974$; $t(13) = -3.65$, $p = .003$), supporting **H2**. However, contrary to **H3**, no statistically significant correlation was found between the increment in the children safety-oriented decision-making ($dif fDM = postDM - preDM$) and VP ($r = -.26$; $t(12) = -0.93$, $p = .370$).

When it comes to between different perspectives, no statistically significant differences were found between the two conditions (child vs 3rd perspective), for Decision Making (1stDM: 3.71 ± 0.49 ; 3rdDM: 3.71 ± 0.49 ; $d = 0.00$; $t(12) = 0.00$, $p = 1.00$) or Empathy (1stSE: 7.86 ± 0.69 ; 3rdSE: 8.14 ± 1.35 ; $d = -0.27$; $t(12) = -0.50$, $p = .626$). Therefore, **H4** and **H5** were not supported. However, we find a higher level of presence in the child's perspective condition (1stVP: 44.1 ± 5.30 ; 3rdVP: 33.6 ± 5.16 ; $d = 2.02$; $t(12) = 3.78$, $p = .003$), supporting **H6**.

5 CONCLUSION

We investigated the potential of using VR to study the impact of IPV exposure from a child's perspective. We found that VR could be effective in enhancing participants' situational empathy for children and lead to more child safety-oriented decisions. However, no statistically significant correlation was found between the increment on the children-oriented decision and the level of presence. Moreover, no statistically significant difference was observed between child and 3rd perspective conditions in terms of decisions (DM) or level of empathy (SE), although participants who had the child's perspective did report a higher level of presence. It is important to note that participants recruited from the general public, the highly abstract vignette, and the small sample size may have precluded the detection of other effects. Due to these limitations, although our results validated our implementation, the implications of how it works with social workers are limited. We are currently conducting a larger scale study with social workers, including an expanded vignette that mirrors case information presented in the VR scenarios.

REFERENCES

- [1] D. Banakou, R. Groten, and M. Slater. Illusory ownership of a virtual child body causes overestimation of object sizes and implicit attitude changes. *Proceedings of the National Academy of Sciences*, 110(31):12846–12851, 2013.
- [2] R. Gilbert, C. S. Widom, K. Browne, D. Fergusson, E. Webb, and S. Janson. Burden and consequences of child maltreatment in high-income countries. *The lancet*, 373(9657):68–81, 2009.
- [3] C. Hamilton-Giachritsis, D. Banakou, M. Garcia Quiroga, C. Giachritsis, and M. Slater. Reducing risk and improving maternal perspective-taking and empathy using virtual embodiment. *Scientific reports*, 8(1):1–10, 2018.
- [4] R. Hughes and M. Huby. The application of vignettes in social and nursing research. *Journal of advanced nursing*, 37(4):382–386, 2002.
- [5] C. Lauritzen, C. Reedt, K. Van Doesum, and M. Martinussen. Implementing new routines in adult mental health care to identify and support children of mentally ill parents. *BMC health services research*, 14(1):1–10, 2014.
- [6] M. R. Mulder and F. W. Winel. Social workers' and police officers' perception of victim credibility: Perspective-taking and the impact of extra-evidential factors. *Psychology, Crime and Law*, 2(4):307–319, 1996.
- [7] X. Pan, M. Slater, A. Beacco, X. Navarro, A. I. Bellido Rivas, D. Swapp, J. Hale, P. A. G. Forbes, C. Denvir, A. F. de C. Hamilton, et al. The responses of medical general practitioners to unreasonable patient demand for antibiotics—a study of medical ethics using immersive virtual reality. *PLoS one*, 11(2):e0146837, 2016.
- [8] A. Raij, A. Kotranza, D. S. Lind, and B. Lok. Virtual experiences for social perspective-taking. In *2009 IEEE Virtual Reality Conference*, pp. 99–102. IEEE, 2009.
- [9] S. Seinfeld, J. Arroyo-Palacios, G. Iruretagoyena, R. Hortensius, L. E. Zapata, D. Borland, B. de Gelder, M. Slater, and M. V. Sanchez-Vives. Offenders become the victim in virtual reality: impact of changing perspective in domestic violence. *Scientific reports*, 8(1):1–11, 2018.
- [10] S. Seinfeld, R. Hortensius, J. Arroyo-Palacios, G. Iruretagoyena, L. E. Zapata, B. de Gelder, M. Slater, and M. V. Sanchez-Vives. Domestic violence from a child perspective: impact of an immersive virtual reality experience on men with a history of intimate partner violent behavior. *Journal of interpersonal violence*, p. 08862605221106130, 2022.
- [11] M. Slater, D. Pérez Marcos, H. Ehrsson, and M. V. Sanchez-Vives. Inducing illusory ownership of a virtual body. *Frontiers in neuroscience*, p. 29, 2009.
- [12] J. Stokes and G. Schmidt. Race, poverty and child protection decision making. *British Journal of Social Work*, 41(6):1105–1121, 2011.
- [13] S. L. Wood and M. S. Sommers. Consequences of intimate partner violence on child witnesses: a systematic review of the literature. *Journal of child and adolescent psychiatric nursing*, 24(4):223–236, 2011.