Exploring Immersive Technologies to Simulate Fear of Crime

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ABSTRACT

The implementation of Virtual Reality (VR) tools in criminological research is very scarce, and almost non-existent in the fear of crime (FoC) field. Our objective is to assess the feasibility of Immersive Technologies for research on FoC. To do so, a simulation (360° video) grounded on the manipulation of environmental variables (street lighting) was conducted. Our preliminary results suggest that: (a) virtual simulation of absence of urban lighting elicits experiences of FoC, and (b) that simulation of experiences of FoC in virtual reality is an adequate strategy for analysis of this phenomenon.

CCS CONCEPTS

• **CCS**; • **Human-centered computing**; • **Visualization**; • **Empirical Studies in visualization**;

KEYWORDS

Criminology, fear of crime, virtual reality, 360° video, immersive technologies, environmental variables.

ACM Reference Format:
Francisco J. Castro-Toledo, Konstantinos Koumaditis, Panagiotis Mitkidis, and Juan O. Perea-Garcia. 2019. Exploring Immersive Technologies to Simulate Fear of Crime. In *25th ACM Symposium on Virtual Reality Software and Technology (VRST '19), November 12–15, 2019, Parramatta, NSW, Australia.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3359996.3364713

1 INTRODUCTION

Despite its use in social sciences, the implementation of VR tools in criminology is still very scarce [Van Gelder et al. 2014]. Recently, as Immersive Technologies (Virtual/Augmented/Mixed Reality) advanced providing higher levels of immersion, visual stimuli, user interactivity in an approachable cost, they depict a promising tool for the crime sciences, as literature highlights [Koumaditis et al. 2018; Toet and van Schaik 2012]. Moreover, the use of VR is becoming increasingly interesting in social studies, with several VR applications presenting advances over systematic observation in analogue real-life spaces in terms of cost, flexibility, replication, reuse, control of the experimenter etc., [Ticknor 2018]. Taking as a point of departure the need to extend the research arsenal with new innovative methods, we focus on Immersive technologies and closely to VR (e.g. 360° videos viewed with the use of a VR headset). Herein, the preliminary results of a study that was designed to immerse subjects in a standardized VR experience of FoC, are depicted. The study is an adaptation to VR of a previous in-the-field experiment by Castro-Toledo et al. [Castro-Toledo et al. 2017], in which they tested the influence of a traditional environmental variable on FoC (i.e. luminosity of urban settings). Similarly, in this case, we expected participants to score higher in negative affects, especially those related to fear, after exposure to the experimental, but not the control condition. We also designed a short interview protocol to restrain the possible sources of said emotions only to those variables of interest for the study (i.e. lack of luminosity, and FoC).

Figure 1: Study location during the day (left) and study location during the VR experience (right)

2 MATERIALS AND METHODS

2.1 Sample

The sample (N = 50) was composed of 25 men and 25 women with a mean age of 23.98 (SD = 3.44, Min = 19, Max = 35) who participated in exchange for financial compensation of 100 DKK and gave written informed consent. The study was approved by local ethics committee.

2.2 Stimulus and task

We recreated two different scenarios for our two conditions – in the control condition, participants were immersed in a video in which

VRST '19, November 12–15, 2019, Parramatta, NSW, Australia

ACM ISBN 978-1-4503-7001-1/19/11.
https://doi.org/10.1145/3359996.3364713

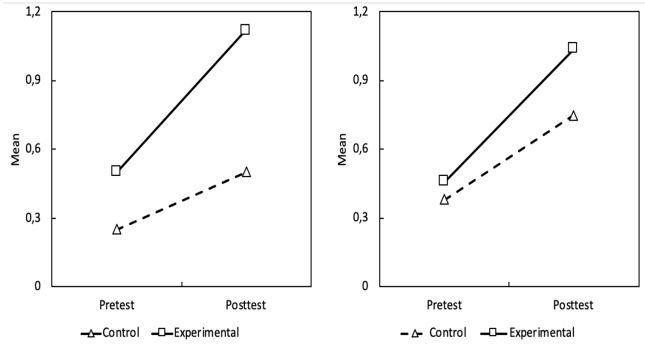

Figure 2: Affects mean (scared and afraid) across condition

the camera moved along an open public space at night in Aarhus (Denmark). The experimental condition immersed participants in a similar experience, but at the end of the path the street lights were turned off. The video (7 minutes and 32 seconds) distributed in three sections: 1) intro (instructions), 2) first section of road and 3) second section (experimental condition variation).

2.3 Procedure

Once the participants were received in the lab and completed a pretest designed to assess their perception of risk of victimization in different areas of the city of Aarhus (Denmark) and to check that the area used for recording the simulation was perceived as the most insecure (see Fig. 1). Additionally, as emotional measure, they were also asked to fill a PANAS questionnaire before and after the virtual reality simulation (Positive and Negative Affects Schedule) [Watson et al. 1988]. Instructions were given both by the researcher prior to the VR experience and by a voice embedded in the video.

3 RESULTS

Regarding the efficacy of our experimental stimulus to elicit the emotion of fear, we focused on the block of negative affects of the PANAS. We performed repeated measures analysis using the Wilcoxon sign rank test instead of an independent groups' analysis because the rates of the affects of our interest (ie, afraid and scared) showed a different distribution in the pretest across groups (control group: Mscared= 0,25, SDscared = 0,676, Mafraid = 0,38, SDafraid = 0,647; experimental group: Mscared = 0,50, SDscared= 0,762, Mafraid = 0,46, SDafraid = 0,811). Fig. 2 includes a summary of mean in affects, and Table 1 shows all Wilcoxon sign rank test applied in both groups.

4 CONCLUSIONS

In short, when it becomes desirable to present participants with a sufficiently realistic experience of victimization, our initial results depict that Immersive Technologies (VR and 360° videos) could be used as a substitute for analogous physical environments and, consequently, provide new opportunities for criminological research.

Table 1: Summary of the Wilcoxon sign rank.

	Affect		n	Average ranges	Sum of ranges	z	p
Experimental	Scared	Negative[a]	2	3.5	7	-2.556[d]	0.011
		Positive[b]	10	7.1	71		
		Ties[c]	14				
		Total	26				
	Afraid	Negative[a]	2	5.5	11	-2.232[d]	0.026
		Positive[b]	10	6.7	67		
		Ties[c]	14				
		Total	26				
Control	Scared	Negative[a]	3	6.5	19.5	-1.732[d]	0.083
		Positive[b]	9	6.5	58.5		
		Ties[c]	12				
		Total	24				
	Afraid	Negative[a]	4	6	24	-1.897[d]	0.058
		Positive[b]	10	8.1	81		
		Ties[c]	10				
		Total	24				

ACKNOWLEDGMENTS

This study has been supported by seed funding from the Interacting Minds Centre at Aarhus University.

REFERENCES

Francisco J Castro-Toledo, Juan O Perea-García, Rebeca Bautista-Ortuño, and Panagiotis Mitkidis. 2017. Influence of environmental variables on fear of crime: Comparing self-report data with physiological measures in an experimental design. *Journal of Experimental Criminology* 13, 4 (2017), 537–545.

Konstantinos Koumaditis, Francesco Chinello, and Sarune Venckute. 2018. Design of a Virtual Reality and Haptic Setup Linking Arousals to Training Scenarios: A Preliminary Stage. In *2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*. IEEE, 1–2.

Bobbie Ticknor. 2018. *Virtual Reality and the Criminal Justice System: Exploring the Possibilities for Correctional Rehabilitation.* Lexington Books.

Alexander Toet and Martin G van Schaik. 2012. Effects of signals of disorder on fear of crime in real and virtual environments. *Journal of Environmental Psychology* 32, 3 (2012), 260–276.

Jean-Louis Van Gelder, Marco Otte, and Eva C Luciano. 2014. Using virtual reality in criminological research. *Crime Science* 3, 1 (2014), 10.

David Watson, Lee Anna Clark, and Auke Tellegen. 1988. Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology* 54, 6 (1988), 1063.