MAX PLANCK INSTITUTE
FOR THE STUDY OF
CRIME, SECURITY AND LAW

VIRTUAL REALITY IN CRIMINOLOGY AND CRIMINAL JUSTICE

CURRENT AND FUTURE DEVELOPMENTS

WORKSHOP

20 March 2025
Günterstalstr. 73, Room 125
79100 Freiburg
(and online)

The Workshop

Virtual Reality (VR) technology has begun to make waves within the field of criminology, with researchers and practitioners exploring its potential to deepen our understanding of criminal decision-making processes, to enhance behavioral interventions, and to offer novel opportunities for offender rehabilitation. This workshop brings together researchers working with VR in criminology and related domains in different countries in Europe. The goal of the workshop is to share research findings, exchange ideas, and discuss future opportunities for the application of VR to study crime and related behavioral phenomena.

Program

9:30–9:45	WALK-IN
9:45–10:00	**Welcome & Introduction** Jean-Louis van Gelder
10:00–10:45	**From Questionnaires to Eye-Tracking in Studying Fear of Crime in Urban Environments: A Discussion on VR for a Next Step** Ines Guedes, Carla Cardoso, Mariana Machado
10:45–11:45	**Situational Fear of Crime and VR Methods** Jelle Brands and Nathan Saucier
11:45–12:15	*Coffee break*
12:15–13:00	**Icrimes: Crime Scene Visualisation Platform for Crime Scene Investigation** Mikaël de Miras
13:00–14:00	*Lunch break*
14:00–14:45	**The Offender's Perception of Race and Disorder in Criminal Opportunities: A Virtual Enactment Approach** Patrick McClanahan (Zoom)

14:45–15:30	**Leveraging Virtual Reality to Inform Sensitive Public Policing Decisions** Edoardo Cocco
15.30–16:00	*Coffee break*
16:00–16:45	**Neural and Behavioral Impact of Becoming a Victim in VR** Sofia Seinfeld
16.45–17:30	**Meeting Your Future Self: A Virtual Reality Behavioral Intervention Program to Stimulate Future Orientation** Esther Mertens
17:30–17.45	**Final reflections and Wrap-up** Jean-Louis van Gelder & Stefano Caneppele
18:30–22:00	Working dinner

Abstracts

From Questionnaires to Eye-Tracking in Studying Fear of Crime in Urban Environments: A Discussion on VR for a Next Step

Ines Guedes, Carla Cardoso, Mariana Machado (University of Porto)

Fear of crime is a classic theme in criminology, with researchers using victimization surveys to measure the level and extent of it since the 1960s. However, multiple problems regarding this type of measurement have been pointed out: epistemological, conceptual, operational, and technical limitations. Over time, our team and previous researchers have undertaken meaningful efforts to address these challenges and improve the measurement validity of this subject matter, including the use of photographs in surveys, assessing the subjects' physiological responses in laboratory settings, and progressing to more immersive and objective methods, such as eye-tracking. Given the lower ecological validity of a picture compared to other stimuli, researchers have recently turned to virtual reality as a next step. This presentation aims to present the results obtained in studies conducted in Portugal on this topic, tracing a methodological evolution from conventional self-reported questionnaires to approaches that included (manipulated) photographs and, more recently, moved the measurement methods towards eye-tracking. Furthermore, it will outline the fragilities of each method and how this sequential path has

advanced the study of fear of crime. Finally, it will discuss the importance of incorporating VR into our studies and how this tool can enhance the measurement of fear of crime in urban settings.

Situational Fear of Crime and VR Methods

Jelle Brands (Leiden University, Institute of Criminal Law & Criminology)
Nathan Saucier (Leiden University, Leiden Learning & Innovation Centre)

In this presentation, we will discuss two studies that comprise a larger research project on *situational fear of crime*. Each study uses VR research methods. The first study combines an experimental research design with computer-generated VR and multimodal (survey and physiological) measurements to explain situational fear of crime. 159 participants completed our VR experiment, in which we focused on how physical and social disorder can engender situational fear of crime. Drawing on our survey results, we found significant effects of disorder on a variety of outcome variables: situationally experienced safety, fear of theft, fear of verbal aggression, fear of physical aggression, and fear of sexually transgressive behavior. Most of our physiological measurements rendered null findings. Hence, we also concluded that the results from our two data sources (survey results vs. physiological measurements) diverge in important ways.
The second study utilizes a relatively new technique – 3D Gaussian Splatting – to improve on the *'objective amount and quality of perceptual input provided to participants'* (Cornet and van Gelder 2021: 894). We are employing Gaussian Splatting to achieve heightened photorealism and in this way, hopefully, further immerse research participants in our VR experience. During the second part of our presentation, we will compare this technique with our earlier computer-generated VR study, showcase our Gaussian Splatted VR environments (and manipulations thereof), and discuss the advantages and disadvantages of this novel technique. We will also look ahead to our planned data collection phase, which will follow a similar design to our previous study.

Icrimes: Crime Scene Visualisation Platform for Crime Scene Investigation

Mikaël de Miras (French National Gendarmerie)

The presentation will give an overview of a recent project involving a crime scene virtualization platform, developed at the Forsensic Laboratory of the French Gendarmerie Nationale. This presentation will introduce the motivation for the project and its main objective, namely to integrate and visualise a multitude of information (physical traces, digital information, etc.) from complex crime scenes. Its key features will then be outlined. This method enables crime scene investigators to perform a variety of useful operations: immersive visualisation into digital twins of

crime scenes; simulation and visualisation of forensic hypotheses, particularly for bloodstain pattern analysis; multi-participant collaboration within the virtual scene, so as to compare hypotheses and experiment with different scenarios; training of crime scene investigators and experts in specific techniques. Lastly, the benefits of this innovative platform will be discussed in terms of improving the efficiency of criminal investigations as well as the quality of service provided to the justice system.

The Offender's Perception of Race and Disorder in Criminal Opportunities: A Virtual Enactment Approach

Patrick McClanahan (University of Alabama, MPI-CSL)

The Broken Windows Theory (BWT) suggests that physical and social disorder, such as graffiti, loitering, and public drinking, fosters more serious crime by signaling neglect and weakening informal social control. Despite its significant influence on crime policy and research, empirical support for the disorder-crime link remains inconsistent. Two key limitations may explain these mixed findings. First, BWT assumes disorder carries a universal meaning—signifying rampant crime without considering contextual factors. Second, most studies rely on large-scale correlational analyses or public perceptions, overlooking how offenders themselves interpret disorder. To address this gap, this study examines how neighborhood-level factors—specifically, perceived racial composition and disorder—shape offender perceptions. Using a 2x2 factorial design, we created virtual neighborhoods that varied by racial composition (all-white vs. all-Black) and levels of disorder (orderly vs. disorderly). A total of 150 incarcerated men in Pennsylvania were randomly assigned to one of the study conditions (neighborhoods), instructed to explore burglary opportunities, and verbalize their thoughts. Participants then completed an "In-VR" survey assessing perceived risk and rewards of breaking into homes. After the VR experience, semi-structured interviews were conducted, guided by participants' verbalized thoughts. This mixed-method approach offers novel insights into how offenders interpret environmental cues related to disorder and race, advancing criminological theories on offender decision-making. Findings contribute to a deeper understanding of the intersection between race, disorder, and crime, informing both theory and policy.

Leveraging Virtual Reality to Inform Sensitive Public Policing Decisions

Edoardo Cocco (University of Lausanne)

This contribution presents a study that explored the potential of virtual reality as a tool for analyzing and informing sensitive public policing decisions. Focusing on the Lausanne city center, the E-MERVEIL project developed an immersive 3D simulation to investigate public perceptions of insecurity and evaluate the

impact of varying levels of police presence. Participants navigated through VR scenarios depicting social and physical disorders, with their physiological and behavioral data being monitored. Results reveal that while VR effectively identifies factors contributing to perceived insecurity, such as active social interactions or disorderly behaviors, increased police visibility did not consistently alleviate these feelings. In some cases, high police presence even heightened fears, being interpreted as a sign of latent danger. The study highlights the complexity of public emotions regarding urban safety and suggests broadening research to encompass diverse emotional responses beyond fear, such as frustration or disillusionment. VR emerges as a promising tool for designing targeted interventions in controlled yet plausible settings, offering new insights into urban policing strategies and citizen reassurance measures.

Neural and Behavioral Impact of Becoming a Victim in VR

Sofia Seinfeld (Universitat Oberta de Catalunya)

Embodiment in an artificial virtual body can be evoked when certain multisensory principles are fulfilled. When participants see a life-size virtual body from a first-person perspective, they can experience the temporal illusion that the artificial body is their own real body. It has been shown that the type of artificial body in which 'embodiment' occurs can differently impact participants' perceptions and cognition. In this talk, I will discuss a series of studies that evaluate the behavioral and neural impact of embodying intimate partner violence perpetrators into the first-person perspective (1PP) of a victim in virtual reality. Specifically, in the talk I will analyze studies that show how embodiment of male offenders into the bodies of a virtual female victim and a virtual child victim leads to changes in emotion recognition. Moreover, I will also discuss evidence from a functional magnetic resonance imaging (fMRI) study, where we have found that the 1PP of a virtual violent situation seems to influence emotion recognition through modifications in Default Mode Network (DMN) brain activity. Altogether, these results provide further evidence that embodiment in VR might influence socio-cognitive processing and also highlight the potential use of VR to improve current rehabilitation programs for perpetrators of domestic violence.

Meeting Your Future Self: A Virtual Reality Behavioral Intervention Program to Stimulate Future Orientation

Esther Mertens (MPI-CSL, Netherlands Institute for the Study of Crime and Law Enforcement)

Shortsighted behavior, such as substance use and delinquency, generally provoke adverse consequences across multiple domains, while future-oriented behavior tends to cultivate positive outcomes, such as goal achievement and money saving.

Therefore, we developed a behavioral intervention program, FutureU, that aims to stimulate future-oriented thinking and behavior by strengthening people's identification with who they will be in 10 years. To this end, FutureU employs immersive Virtual Reality (VR). Through VR, users meet and interact with their future self as well as step into the virtual shoes of this self. During my presentation, I will explain the theoretical framework of FutureU, show how the VR intervention works, present preliminary results on intervention effects and working mechanisms, and discuss the next steps in the FutureU project.

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