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The MAXLab Aggression and Bystander Intervention Scenario Set (MAXLab_ABISS): A modular scenario set for studying decision making in situations of interpersonal violence in virtual reality (preprint)

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Published on: Oct 20, 2023

DOI: https://doi.org/10.21428/cb6ab371.6ada0dc6

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ABSTRACT

This Research Note describes the MAXLab Aggression and Bystander Intervention Scenario Set (MAXLab_ABISS). This modular stimulus set contains various immersive 360° videos that can be used to study decision making in situations of interpersonal violence. The goal of MAXLab_ABISS is to provide the research community with a new method for collecting data involving immersive technology that allows for studying peoples' perceptions of, and reactions towards, violent situations. We describe the scenarios and how they can be used, elaborate on the production process, provide technical specifications, and explain how the scenario set can be obtained.

Keywords: virtual reality, sexual harassment, bystanders, interpersonal violence, emotions, 360° video, MAXLab

1 | Introduction

Hypothetical scenarios or 'vignettes' are a common research method in criminology. Generally, they involve short written descriptions of situations. Research participants are tasked to read the description, imagine themselves in the situation, and subsequently respond to questions pertaining to it, such as how they perceive specific aspects of the situation and how they would act if they were to be in it. From a methodological perspective, scenarios have many advantages. They are easy to produce, versatile, carry negligible cost, allow for experimental variation, and can be combined with other data sources (e.g., panel data). Importantly, scenarios allow for adding a certain amount contextual information, which can nest responses within a situation and provide a frame of reference (Pogarsky, 2004; Van Gelder & Nagin, 2023).

Written scenarios, however, also suffer from important limitations that are compounded for the study of crime due to the discrepancy between a crime situation 'on paper' versus how such a situation is experienced in real life. Brief descriptions are, for example, unlikely to elicit the same cognitions and emotions that real life situations do, and ample research has shown that people only have a limited ability to accurately predict their own future behavior or that of others in circumstances that involve strong emotions and affective states (e.g., Van Boven & Loewenstein, 2005; Ariely & Loewenstein, 2006). Additionally, despite the ability to provide a certain level of contextual information, brief narratives may not fully capture the complexity of real-life situations, and realistically incorporate important nuances of social experience—e.g., number of people present; body posture and physique of parties involved; facial expressions; tone and inflection—which may give rise to differential interpretation and measurement error. Finally, written scenarios rely on the ability of people to imagine themselves in a hypothetical situation and are not sensitive to individual differences in this ability (see Van Gelder et al., 2019, 2022 for a more extensive description of limitations).

A way to overcome these limitations is to perceptually immerse participants in a virtual analogue of the situation of interest. Immersive virtual reality (VR) scenarios have the capacity to achieve high levels of realism, and efficiently provide substantial contextual detail. Moreover, the use of standardized virtual scenarios minimizes idiosyncratic imputation. One of the most significant advantages of virtual reality (VR) is its experiential nature. VR has the unique capability to elicit the cognitive, emotional, and visceral states (e.g., thrill, fear, arousal) that are inherent to offending situations (van Gelder, 2023). This enhances ecological validity, and provides a more accurate representation of the emotional dynamics involved

As virtual reality is expensive, time consuming to develop, and requires expertise, we have developed the Aggression and Bystander Intervention Scenario Set (MAXLab_ABISS) to provide the criminological research community with a modular set of relevant virtual scenarios that can be used in empirical studies in different possible configurations. Specifically, the scenarios involve situations of provocation to study (reactive) violence and instances of sexual harassment, providing a platform to explore the dynamics of criminal decision making, guardianship, and bystander intervention.

The material in the scenario set is ready for use and only requires an off-the-shelf VR headset that is widely available. Below, we elaborate on the production process of the scenario set, its properties and technical specifications, describe the scenarios included in it and how they can be used in research designs, provide examples of research questions that can be addressed, and explain how MAXLab_ABISS can be obtained.

2 | MAXLab_ABISS: Production Process and Technical Specification

MAXLab_ABISS was developed to study a broad set of research questions relating to aggression and bystander invention or guardianship, with a specific focus on how emotions, such as anger and fear, and visceral drive states, such as excitement and arousal, influence the interpretation of a situation and subsequent behavior. The VR scenario set, which will be described in more detail in the next section, is structured in modular fashion in the sense that its components can be combined in different ways to allow for different factorial research designs.

Principally, full scenarios consist of three consecutive components. The first component is intended to provide background information about the situation and can be adapted to fit the research question at hand. The second component is intended to evoke feelings of anger, or a sense of arousal. The third component involves the situation of interpersonal violence, either a violent altercation or a situation of sexual harassment.[1] Before describing the contents of each component (see Section 3. Scenario Set Components**)**, we first describe the production process, the setting of the virtual environment, scenario development, technical video and audio specifications, and other relevant details.

2.1 | Immersive 360° video

The scenario set was created using immersive 360° video technology, which involves spherical recordings that allow viewers to observe their surroundings from all angles, replicating the experience of being physically present within the virtual environment. Unlike computer-generated virtual reality, immersive 360° video typically does not allow viewers to influence the course of events in the scenario or to move around in a virtual space. However, it compensates by offering participants a hyper-realistic depiction of the environment. Additionally, the linear nature of 360° video aligns with the structure of written scenarios, which allows for standardization, contributes to internal validity, and enables meaningful comparisons between VR studies and prior research (see Van Gelder et al., 2019).

2.2 | Setting and Production

The scenarios are set in an Irish Pub (see Figure 1). This setting was chosen because Irish Pubs are commonly found all over the world and tend to have similar features irrespective of location. That is, the wide recognition of Irish Pubs enables the use of the scenarios for research purposes in different countries and facilitates their use for replication purposes.

A professional VR production studio produced the 360° videos and the shoot was directed by a film director. Six professional actors were casted to play the different roles in the scenarios. In addition to the primary actors who provide the main content in each scenario, over 50 “extras” were hired to act as bar patrons to suggest the appearance of a full and lively bar.

2.3 | Point-of-View Perspective

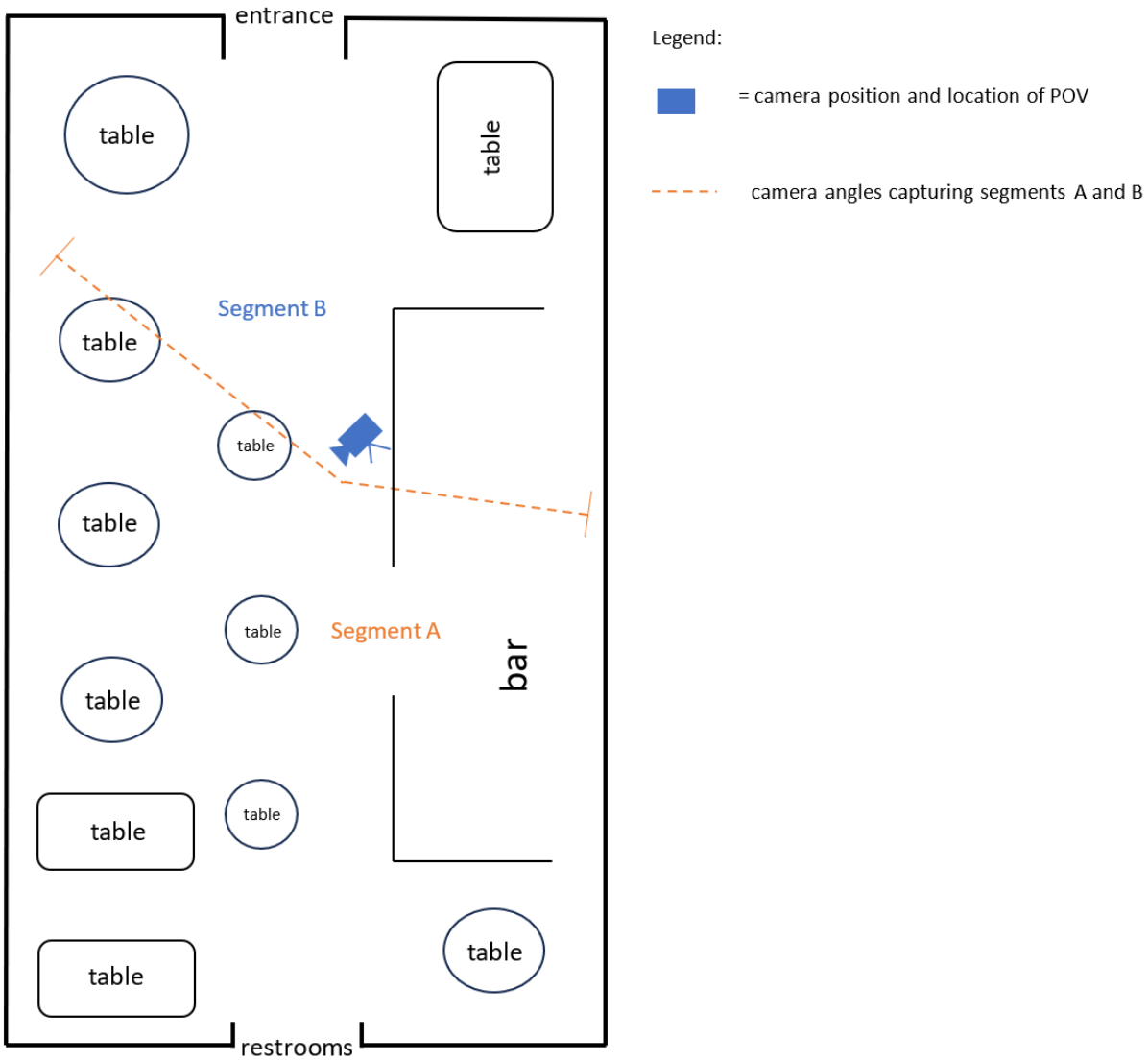
The 360° video recordings were captured from a point-of-view (POV) perspective to allow research participants, as viewers, to experience the scenarios as if they were amid the action. This POV approach was chosen to maximize feelings of presence and engagement, making participants feel immersed and involved in the scenario. To further enhance presence, pub patrons, i.e., the actors in the scenarios, actively involved, spoke to, and directed their attention towards the viewer. The suggested “interaction” between patrons and the viewer was scripted in such a way that any reaction (or lack thereof) on the part of the viewer was inconsequential—i.e., the video runs linearly and uninterrupted, such that the viewer, while feeling part of it, cannot interfere with the flow of events.

Figure 1. Impression of the Irish pub

2.4 | Video Development

The scenarios were filmed with a RED Helium camera with an 8K-sensor in combination with an *Entaniya* M12 280 fisheye lens, which has a circular field of view of 280°. To generate the full 360° panoramic view, two opposing segments were filmed. Segment A covers about 220° of the sphere and Segment B covers about 140° of the sphere (see Figure 2). Specifically, all scenario components were filmed separately in the two sphere segments. Primary scenario content was captured in Segment A of the diagram of Figure 2. After primary content was filmed, the Segment B captured filler footage in sphere 2 consisting of extras engaged in typical barroom room behavior (i.e., chatting, drinking) and unengaged with the content of the scenarios. The two spheres of the environment were imperceptibly stitched together in post-production such that participants viewing the scenario in virtual reality goggles could seamlessly view around the full 360° environment throughout the duration of each scenario.

Figure 2. Floorplan of the barroom with camera position and camera angles



2.5 | Spatial Audio/3rd Order Ambisonics

The 360° videos are all accompanied by a spatial audio track in 3rd order Ambisonics format, which is a method for recording and playing back three-dimensional audio. Mimicking the spatial layout of the barroom, the individual audio recordings were positioned on a virtual audio stage to create the 360° sound field. This enables viewers to hear actions they see in the video from the correct direction and distance and results in a naturalistic auditive experience.

In addition to typical barroom background noises (e.g., chattering, music playing), intentional salient audio cues, i.e., a bartender knocking on the bar, a glass shattering, loud cheering, were embedded in the scenarios to direct the attention of participants to a certain area within the barroom. These cues were selected because they are authentic bar sounds and can grab people's attention without being conspicuous. Importantly, the cues were

timed to (re)orient participants' attention towards the main action occurring within the scenario, which shifts back and forth from the barroom to the bar, to ensure that all viewers are exposed to the same scenario content.

The audio cues also served a second purpose. By directing viewers' attention to a certain area, a 'blind spot' behind the field of view is created. As previously noted, MAXLab_ABISS is composed of multiple components that can be combined in unique ways to address different research questions. Consequently, there are inconsistencies in image areas with people and moving objects during the transitions between video shots. The audio cues serve to divert viewer attention and field of view away from these inconsistencies.[2] Simply put, the audio cues facilitate the transitions between subsequent shots in the scenarios by ensuring they are not noticed by the viewer. For example, audio-directed attention to the bartender standing behind the bar enables changing of the scenario in the barroom behind the field of view where the subsequent action in the scenario will play out. This strategy makes it possible to follow up any of the emotion evocation components by either the component with interpersonal violence or harassment and create the impression that one is experiencing a natural and uninterrupted flow of events.

2.6 | In-VR Survey (Post Scenario)

The VR application used in this stimulus set has the capability of incorporating a customizable in-VR survey immediately following the scenario. The survey component we use is based on the VRQuestionnaireToolkit (Feick et al., 2020). This allows viewers to respond to pertinent survey questions without taking off the VR headset, thus capturing their emotions, cognitions, and intentions in the 'heat of the moment.' Survey questions are answered through gaze-based interactions involving a small cursor point fixed at the center of the field of view. Interactive elements of the user interface of the VR questionnaire, such as buttons and checkboxes, can be activated by the user placing the gaze point over an element and leaving it positioned on it for a short period of time (e.g., 1500 milliseconds). Importantly, this approach does not necessitate the use of controllers. The queried information by the in-VR survey is saved as a CSV formatted text file so that it can be associated with the participant ID and can be easily merged with other data sources (e.g., computer-based survey data). Figure S2 in online Supplemental Materials presents an example of an in-VR survey item.

3 | Scenario Set Components[3,4]

The components of MAXLab_ABISS can be combined in different ways and viewed sequentially or in isolation. As noted earlier, complete scenarios consist of three consecutive components: an introduction, an emotion evocation, and the actual violent situation. The different versions of the components can be combined to create full factorial research designs. In total, there are two versions of the introduction, five versions for the emotion evocation, and two main scenario versions. This results in a total of 20 (=2x5x2) possible complete scenario configurations. Additional experimental manipulation can be implemented in the introduction component by varying the contextual information provided to viewers. Below, we describe the different scenario components in more detail.

3.1 | Introduction component

The introductory opening shot (approx. 40 seconds) is situated outside the bar with the viewer gaze initially directed to the bar's entrance door (See Figure S1 in online Supplemental Materials). Muted sounds—chatter and music—emerge from inside the bar. The purpose of the introduction component is to be able to provide contextual information about the scenario. To this end, written text can be displayed in the scenario (e.g., where the viewer is, why they are there, and that they will enter the bar soon). The text can be adapted according to research purposes and narrative of the study at hand.[5] The introduction fades to black right before leading into one of five possible emotion evocation components.

Two different versions of the introduction scene were filmed. One with an bouncer sitting on a bar stool next to the entrance door, and the other without the bouncer present. In terms of research questions, this allows, for example, an experimental manipulation of a capable guardian or different levels of security or risk for tests of routine activity and deterrence theories.

3.2 | Emotion Evocation

This component (approx. 180 seconds) is situated within the barroom. The POV is placed along the long end of the bar facing out towards the bar room, as depicted in Figure 2. This provides the sensation that one is standing at the bar in the middle of the action. There is loud music and lively barroom chatter.[6] The first 50 seconds of all five versions of this component transpire without any meaningful event happening and serve to familiarize the viewer with their surroundings and take in the environment. The relevant action in this component serves to evoke either anger/irritation or sexual arousal/excitement. Different versions of the emotion evocation component are described below.

3.2.1 | Anger Versions 1 & 2

In Anger Version 1 (V1), a male patron approaches the bar in a loud and obnoxious manner to order drinks. While waiting for his drinks, the patron notices the POV and begins to taunt and provoke the viewer in a non-threatening way (See S3 in online Supplemental Materials for transcript of interaction). The interaction concludes with the patron burping in the face of the POV and returning to his table. Importantly, the patron in this version is the *same male* that involves the POV in the extended 'Bar Fight' scenario described below. Anger Version 2 (V2) is identical to Anger V1 but involves a *different male* patron. This patron does not reappear in the subsequent components. These anger evocation components were intentionally designed and filmed to elicit feelings of anger and irritation, while minimizing feelings of fear. This approach allows for unique research questions about the type of emotions experienced and the sources of these experiences. For example, by manipulating whether participants encounter an antagonistic character in the evocation component, researchers can test the extent to which anger versus fear differentially shapes situational interpretations (e.g., Barnum & Solomon, 2019; Lerner et al., 2015). Moreover, by manipulating the identity of the antagonistic character, and therefore whether they have continued interactions with the character,

researchers can measure both integral (for the same patron) and incidental (different patrons) affect. This allows for unique extensions of both lab-based priming studies and vignette studies.

3.2.2 | Sexual Arousal Versions 1 & 2

In Sexual Arousal V1, an attractive female wearing a stylish black dress, approaches the bar to order drinks. The woman takes notice of the POV, establishes eye contact, and proceeds with flirtatious conversation and alluring mannerisms (See S3 in online Supplemental Materials for transcript of interaction). Eventually she offers the POV a drink. The interaction concludes with the female returning to her table. Importantly, the *same female* appearing in this version also appears in the 'Sexual Harassment' scenario described below. Sexual Arousal V2 is identical to Sexual Arousal V1 but with a *different* attractive female. Importantly, the woman in V2 does not reappear in subsequent components.

3.2.3 | Neutral Version (control)

Finally, in the neutral version no meaningful events transpire and there is no interaction with the POV. This allows researchers to examine whether affective experiences differentially shape situational evaluations between participants who experienced one of the four 'emotion evocation' stimuli and those who did not experience any evocation stimulus. By comparing versions of the scenario in which feelings have been experimentally manipulated to versions where they have not, researchers can discern the impact of subjectively reported feelings and physiological reactions on behavioral intentions. This approach is significant as it not only identifies the strength of the association between feelings and intentions to aggress but also determines the extent to which emotions influence cost-benefit considerations. Moreover, it examines the potential direct and/or conditional effect of emotions on intentions, thus advancing the refinement of decision theory.

3.3 | Main Scenarios: Bar fight and sexual harassment

The third scenario components (approx. 90 seconds) serve as the main scenarios and seamlessly follow one of the five emotion evocation components. The two versions present an opportunity to engage in a bar fight or to intervene upon witnessing a woman being sexually harassed. Importantly, both versions were scripted to gradually intensify, allowing for the scenario to be concluded at different stages (i.e., cut points) to gage participant responses at varying levels of escalation. This approach enables unique comparisons of emotions and decision processes across different levels of provocation. For instance, a shorter version of the bar fight may end with verbal abuse, while a longer cut may depict physical abuse. We detail potential cut points below.

3.3.1 | Bar fight scenario

In this scenario version, the viewer encounters the same male patron from Anger V1, who attempts to provoke a physical altercation (referred to here as the antagonist). This scenario is reminiscent of the traditional bar fight scenario commonly employed in prior criminological research (e.g., Carmichael & Piquero, 2004; Exum, 2002). Specifically, the scene begins with a loud crash of a breaking glass when the antagonist spills his beer,

seemingly after bumping into another patron (cut point 1). After a heated argument with the other patron, the antagonist returns to the bar to order a new beer and is visibly upset. He makes eye contact with the POV and aggressively accuses the viewer of laughing at him. He then takes the participant's beer, takes a large drink, and spits it back into the bottle. Following this, in an aggressive tone, he challenges the POV, asking, "What are you going to do about it?" (cut point 2). The antagonist then returns to his table. Shortly after, the other patron returns, and the two men get into a physical altercation (cut point 3). Each cut-point is intended to assess different situational interpretations each relevant to various potential research questions. Examples include:

- Cut point 1: How do emotional (or lack thereof) experiences arising from the evocation component shape momentary assessments of ambiguous interactions and conflicts?
- Cut point 2: How do emotional experiences shape people's response to provocation?
- Cut point 3: Do feelings of anger make someone more or less willing to intervene on behalf of the antagonist during a third-party physical altercation?

3.3.2 | Sexual harassment scenario

In the sexual harassment scenario, the attractive female from Arousal V1 returns to the bar near the POV to retrieve previously purchased drinks when she is approached by another male bar patron who begins to flirt with her (cut point 1). The male's behavior gradually becomes more inappropriate, culminating in unwanted physical contact, causing the female to yell at him to stop. At this time, the female looks in the direction of the POV as if to signal for help (cut point 2). When the antagonist witnesses this, he redirects his attention to the POV and challenges the POV to "do something about it" (cut point 3). Possible research questions for the harassment scenario might include:

- Cut point 1: How does arousal (or lack thereof) arising from the arousal evocation component shape momentary interpretations of the man's intentions towards the woman?
- Cut point 2: How does an emotional connection (or lack thereof) influence whether and how a person decides to intervene on behalf of the woman?
- Cut point 3: To what extent are feelings of arousal and desire related to the way a person responds to the situation (e.g., through the use of violence)?

4 | Practical Application

Beyond the structure of MAXLab_ABISS and its ability to capture key situational mechanisms, the scenario set has a broader application, enabling it to address a wide range of research questions related to decision-making, interpersonal violence and victimization. Importantly, these materials can be both seamlessly integrated into existing longitudinal studies or used in original data collection efforts. In this context, we present a few practical implementation strategies, though we emphasize that these only represent a fraction of the potential possibilities.

Above we described the use of *in*-VR surveys which allows study participants to provide *immediate* responses to survey items while remaining in the virtual environment. This approach facilitates between-subject analyses in relevant outcomes. However, the strategy can also be easily adapted to capture within-subject changes by implementing in-VR surveys before and after participants experience the virtual scenario. For example, it is possible to measure baseline emotions or perceptions prior to the VR experience and subsequently assess any changes after the experiencing the VR scenario. Furthermore, MAXLab_ABISS is compatible with computer and/or paper-based surveys. In this context, participants first experience the VR content and then complete a follow-up survey in response to the presented scenario or, conversely, respond to a survey (e.g., measuring personality characteristics) at a different time point prior to the VR experiment.

MAXLab_ABISS not only accommodates experimental and survey designs but also proves suitable for mixed methods approaches. For instance, while immersed in the 360° scenarios, participants have the opportunity to spontaneously verbally elaborate on their thoughts and situational interpretation. This enables unbounded expression of emotions, insights and immediate thought processes, transcending the constraints of pre-defined survey items. Furthermore, researchers can supplement the VR experience with structured and semi-structured qualitative interviews. Relatedly, researchers can record participants' experiences in the virtual environment and subsequently conduct formal interviews while participants view the playback and elaborate on decision processes (e.g., Nee et al., 2019).

Finally, MAXLab_ABISS offers a unique opportunity to supplement subjective survey items with behavioral measures and physiological responses. Virtual reality technology has the ability to record various ancillary movements, including eye-tracking, reaction time to questions, and pupil dilation.[7] These objective measures can reveal unique decision-making tendencies not captured by traditional survey items. Moreover, researchers can easily integrate various cardiovascular, salivary, or neurological biomarkers to capture physiological responses to the realistic criminogenic stimuli in real time. Affective physiological responses such as stress resulting in cortisol spikes and increased heart rate have been found to exert strong influences on key decision-making constructs (Porcelli & Delgado, 2017). The integration of biomarkers can lead to nuanced comparisons and corroboration of physiological and subjective affective experiences that underly decision-making processes during violent conflicts (see, e.g., Baldwin et al., 2019; Harris et al., 2017).

5 | Availability of Stimulus Material

Currently, the complete immersive stimulus set is available in the original German language, as well as in the English and Dutch languages. Interested researchers can send an email to: Maxlab@csl.mpg.de or contact the first author.

6 | Concluding Remarks

In this paper we described the purpose and development of a modular scenario set that, through customizable factorial design of 20 immersive 360° video components, can accommodate a broad range of research

questions related to emotions, decision making, victimization, guardianship, aggression, and interpersonal violence. Specifically, MAXLab_ABISS was designed to be a safe and effective research tool for evoking, manipulating, and capturing key cognitive and affective processes *within* the context of real-life criminogenic settings. This is particularly important for the study of aggression and violence, as these situations are characterized by an "emotional field of tension and fear" (Collins, 2008, p. 19; see also Copes et al., 2013; Tedeschi & Felson, 1994). Importantly, the contents of MAXLab_ABISS can easily be integrated into different experimental and non-experimental research designs and because the video content is relevant to a diverse population in terms of sex, race and ethnicity, age, and location, MAXLab_ABISS can lend a platform for cross-national studies and replication efforts. It is our hope the stimulus set can provide a novel, complimentary tool in the methodological toolkit for criminological theory testing and for the refinement of crime prevention policy.

References

Ariely, D., & Loewenstein, G. (2006). The heat of the moment: The effect of sexual arousal on sexual decision making. *Journal of behavioral decision making*, *19*(2), 87-98.

Baldwin, S., Bennell, C., Andersen, J. P., Semple, T., & Jenkins, B. (2019). Stress-activity mapping: physiological responses during general duty police encounters. *Frontiers in psychology*, *10*, 2216.

Barnum, T. C., & Solomon, S. J. (2019). Fight or flight: Integral emotions and violent intentions. *Criminology*, *57*(4), 659-686.

Carmichael, S., & Piquero, A. R. (2004). Sanctions, perceived anger, and criminal offending. *Journal of Quantitative Criminology*, *20*, 371-393.

Collins, R. (2008). *Violence: A micro-sociological theory*. Princeton University Press.

Copes, H., Hochstetler, A., & Forsyth, C. J. (2013). Peaceful warriors: Codes for violence among adult male bar fighters. *Criminology*, 51(3), 761-794.

Exum, M. 2002. "The Application and Robustness of the Rational Choice Perspec- tive in the Study of Intoxicated and Angry Intentions to Aggress." *Criminology* 40:933-66.

Feick, M., Kleer, N., Tang, A., & Krüger, A. (2020). The Virtual Reality Questionnaire Toolkit. https://doi.org/10.1145/3379350.3416188

Harris, M. L., Oldmeadow, C., Hure, A., Luu, J., Loxton, D., & Attia, J. (2017). Stress increases the risk of type 2 diabetes onset in women: A 12-year longitudinal study using causal modelling. *PloS one*, *12*(2), e0172126.

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual review of psychology*, *66*, 799-823.

Nee, C., van Gelder, J. L., Otte, M., Vernham, Z., & Meenaghan, A. (2019). Learning on the job: Studying expertise in residential burglars using virtual environments. *Criminology*, *57*(3), 481-511.

Pogarsky, G. 2004. “Projected Offending and Contemporaneous Rule-violation: Implications for Heterotypic Continuity.” Criminology 42:111-36.

Porcelli, A. J., & Delgado, M. R. (2017). Stress and decision making: effects on valuation, learning, and risk-taking. *Current opinion in behavioral sciences*, *14*, 33-39.

Tedeschi, J. T.,& Felson, R. B. (1994). *Violence, aggression, and coercive actions*. Washington: American Psychological Association.

Van Boven, L., & Loewenstein, G. (2005). Empathy gaps in emotional perspective taking. *Other minds: How humans bridge the divide between self and others*, 284-297.

Van Gelder, J. L. (2023). Virtual Reality for Criminologists: A Road Map. *Crime and Justice*, *52*(1). https://doi.org/10.1086/726691

Van Gelder, J. L., De Vries, R. E., Demetriou, A., Van Sintemaartensdijk, I., & Donker, T. (2019). The virtual reality scenario method: Moving from imagination to immersion in criminal decision-making research. *Journal of research in crime and delinquency*, *56*(3), 451-480.

Van Gelder, J. L., De Vries, R. E., Van Sintemaartensdijk, I., & Donker, T. (2022). Personality pathways to aggression: Testing a trait-state model using immersive technology. *Criminology*, *60*(3), 406-428.

Van Gelder, J. L., & Nagin, D. S. (2023). Crime, Choice, and Context. *Journal of Research in Crime and Delinquency*, *60*(4), 407-415.

Notes

[1] A cropped German-language version of one of the scenario combinations can be watched here: https://doi.org/10.57801/8N5M-QT41 (audio ommitted for copyright reasons).

[2] Participant compliance with the audio cues and their visual focus within the environment can be measured by the VR system using invisible colliders strategically positioned throughout the environment. These colliders detect when and for how long participants' gaze intersects with them. These data provide valuable information on the timing and duration of participants' attention and can be recorded for analysis.

[3] A first version of the scenarios was piloted in the actual bar room setting to test technical feasibility, the flow of dialogue and events, and choreography. These scenarios were played by a cast of local actors and also recorded using 360° video. Iterations to the scenarios were made upon review of the video footage.

[4] The run time for all scenario components can be adjusted.

[5] By way of example, a current data collection uses the text to instruct participants to imagine they are going to a concert with their friends, but the friends are running late. This explains why the viewer appears in the bar alone, effectively controlling for potential peer influence confounds. Adapted versions of the text, for example, could provide additional cues intended to evoke feelings of irritation by adding provoking details such as the friends "forgetting" about the meet-up time and making the viewer late to the concert or provide information about the patrons inside the bar.

[6] The music can be changed and/or used as an additional manipulation.

[7] Note that eye-tracking is only possible with specific VR headsets

Supplemental Files

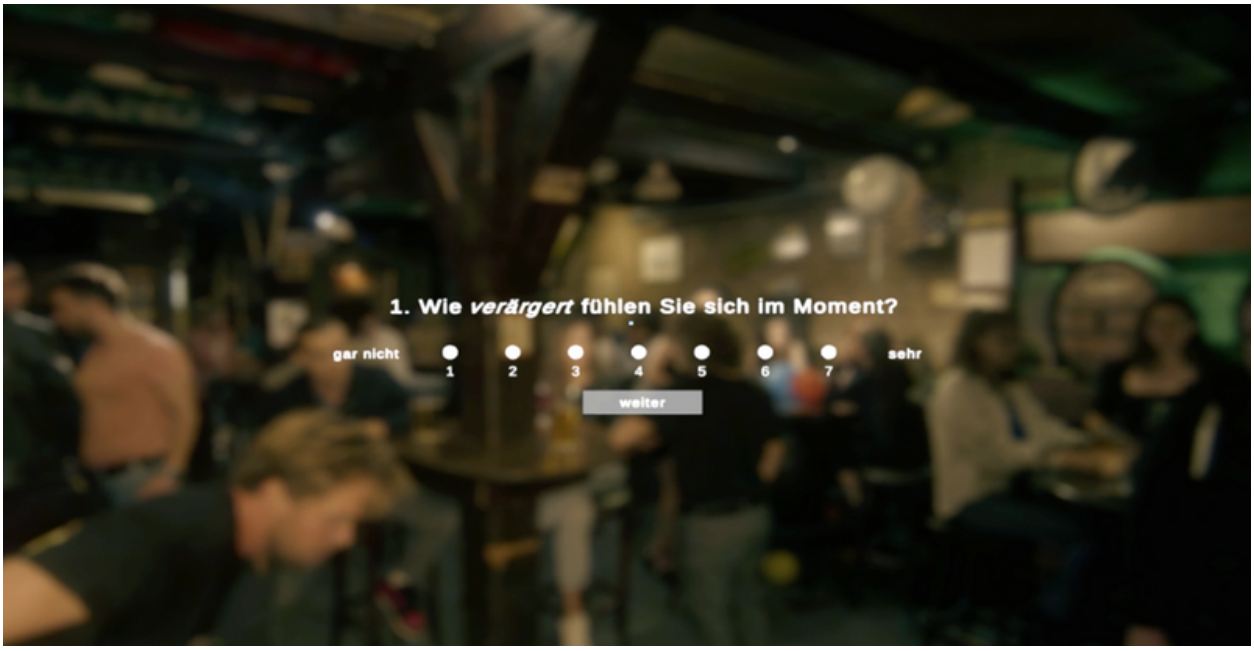
Additional Figures

Figure S1. Screenshot of introduction Scene with Text

Note. The message on the door translates as follows. "Imagine the following: You are going to a concert with a group of your friends to see one of your favorite bands, and you are looking forward to it. You arrive at the

meeting place too early and decide to go to a bar to wait because it's cold outside. You will automatically enter the bar shortly."

Figure S2. Screenshot of In-VR Survey Item



*Note***.** Item translation: "How *angry* do you feel at this moment?" (not at all – very).

S3. English Scenario Transcriptions

T1. Bar Fight Scenario English Transcript

Anger 1 Through Bar Fight Scenario:

[Enter bar—scene begins]

[Intoxicated man approaches POV at the bar]

> **Man**: "What? Am I hitting on you or what?"
>
> **Bartender**: "Does anybody here need anything else?"
>
> **Man**: "Yeah me. Two more beers."
>
> **Bartender**: "Large or small?"
>
> **Man**: "Large of course, dude. Small beers are for guys with small dicks!"

[Man glances at POV; phone rings]

> **Man** (on the phone): "Yes hello? Sven here. What? Yes, I'm in a bar with Dina. What, chicks? No man, there are only pissers here…Ok yes, I'm here. Ok yes, I'll see you then. Bye."

[Man leaves bar]

[Bartender taps on bar]

> **Bartender** (audio cue #1): "Do you need anything else? I see you still have some. Let me know if you want anything."

[Glass breaks behind POV (audio cue #2)]

> **Man** (to bar patron): "Watch out!"
>
> **Bar Patron**: "What do you mean 'watch out'?"
>
> **Man**: "You owe me a beer! It's clear, isn't it?"
>
> **Bar Patron**: "Dude, it's your own fault. I don't owe you anything, dude! So that's clear!"
>
> **Man**: "Dude, you're really going to do this or what? Just admit that it was you!"
>
> **Bar Patron**: "Now listen to me, dude, now watch whom you're accusing now. With me you are there namely wrong!"
>
> **Man**: "Do you think I am afraid of you? I won't even waste my time on an idiot like you. Go away and fuck off, dude!"

[Bar Patron walks away; Man returns to bar near POV]

> **Man**: "Fuck really dude, do I have to get new beer now, or what? Fuck, my pants are fucked too!"

[Man taps on bar]

> **Man** (to Bartender): "Hey! One beer!".
>
> **Man** (to himself): "Fuck, wankers everywhere! Such a pain in my ass!"

[Man notices POV looking in his direction]

> **Man**: "What? What are you looking at? You think this is funny, or what?"

[Man steals POV beer, drinks it and slams it back on the bar]

> **Man**: "That's exactly what I needed. Not so funny, huh? What are you going to do about it now? Huh?!"

[End scene]

T2. Harassment Scenario Transcript

Arousal 1 Through Harassment Scenario:

[Enter bar—scene begins]

[Woman approach bar near POV talking on phone]

> **Woman** (on phone): “But too bad you're not here! ... What? You're crazy, of course you can still come! We just got here…Yes? Ah ha? Yes, please make sure you come, that would be mega! Oh that would be mega cool. Please please! What? Ah, No, let's see, the night is still young! Yeah, okay. Okay yes please set it up, okay? Okay, I'll see you then. Okay, bye.”
>
> **Woman** (to Bartender): “Can I have five beers and three vodkas please?”
>
> **Bartender**: “Yeah.”
>
> **Woman** (to bartender): “On the birthday bill? It's my birthday.”
>
> **Bartender**: “Oh well then happy birthday then! Enjoy your evening!”

[Woman looks in direction of POV]

> **Woman**: “Hey.”
>
> **Bartender**: “So, three beers and the five vodkas, there you go.”
>
> **Woman**: “Thank you.”
>
> **Bartender**: “For the birthday girl! Is there anything else I can do for you?”

[Woman smiles in direction of POV]

> **Woman**: “Um, my friend would like another drink.”
>
> **Bartender**: “Okay!”
>
> **Woman** (to bartender): “Put it on my birthday bill!”
>
> **Bartender**: “Sounds good. Let's do it.”

[Woman picks up beers and points to tray of shots]

> **Woman** (to bartender): I'll get that in a minute.

> **Woman** (to POV): I'll see you around!

[Bartender taps on bar]

> **Bartender** (audio cue #1): “Romeo. Can I get you another beer or... something else?”

[Loud cheers and yelling behind POV (audio cue #2)]

[Woman returns to bar to get shots]

[Man stilling nearby approaches bar near POV and turns towards Woman]

> **Woman**: “Uh, sorry, can I have a minute?”
>
> **Man**: “Yeah, no problem.”

[Woman picks up shots]

> **Man**: “Whoa, whoa, whoa!”
>
> **Woman**: “Sorry! I didn't see you!”
>
> **Man**: “It’s okay, I was just going to say hi anyway.”
>
> **Woman**: “Hi! Uh... sorry, my... that table back there is waiting for me. My birthday!”
>
> **Man**: “Oh! Happy birthday!”
>
> **Woman**: “Thank you!”
>
> **Man**: “Can I buy you a drink, come on. A birthday drink?”
>
> **Woman**: “Uh, I can't leave my girls hanging. Sorry.”
>
> **Man**: “Ah....”
>
> **Woman**: “Maybe later, okay?”
>
> **Man**: “Come on.”
>
> **Woman**: “Come on?”
>
> **Man**: “Please. What'll it be?”
>
> **Woman** (sighing in frustration).

> **Man** (imitating her): “Ohhhh.”
>
> **Woman**: “You're going to spill the drinks!”
>
> **Man**: “Now don't worry about the drinks. I can buy you many drinks as you want!”
>
> **Woman**: “Don't touch me and just let me pass, okay!?”
>
> **Man**: “Now don't act like that. I saw the way you were looking at me the whole time just now.”
>
> **Woman**: “Don't touch me, asshole!”
>
> **Man**: “whoa whoa whoa, why so hot-tempered? Huh? I'm not going to let you pass? One drink, beautiful.”
>
> **Woman**: “Leave me alone, dude!”

[Scene ends]