Editorial: The light and dark sides of virtual reality

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Editorial on the Research Topic
The light and dark sides of virtual reality

The application of Virtual Reality (VR) is varied, ranging from entertainment, education, and training to therapy, workflow optimization, and scientific research. Over the past decade, there has been extensive work demonstrating how VR can enhance our lives and improve our wellbeing. VR has positively impacted various fields, for example, by facilitating distant communication, alleviating loneliness, providing relaxation support, and improving remote learning. However, as with any innovative technology, there may be unforeseen downsides to VR that may arise from overuse, poorly developed experiences, or unethical purposes. As a result, some positive use cases may have long-lasting negative effects, while use cases originally intended as negative may help users overcome anxiety or treat disorders. For example, VR can allow users to isolate themselves in horror games, which may be engaging but could negatively impact children, or habituate users to gambling with real money in environments where all external stimuli are heavily altered or reduced. With VR increasingly integrated into our daily lives through virtual workplaces, virtual social gatherings, and the Metaverse, it is critical to identify potential risks and establish design guidelines to ensure user safety. This Research Topic serves as a first step in identifying opportunities, potential risks, and new research directions.

The research article *"Joyful Adventures and Frightening Places–Designing Emotion-Inducing Virtual Environments"* (Steinhaeusser et al.) demonstrates how VR can be used to induce negative and positive emotions in users through the presentation of twelve design guidelines. The effectiveness of the guidelines was evaluated across two user studies. This paper can serve as a valuable resource for researchers and developers seeking to design environments that evoke specific moods. While applications of therapy and mental recovery might benefit from the positive guidelines, other projects targeting either thrill-seeking or certain behavioral changes may benefit from the negative guidelines. In summary, this article demonstrates the potential of both the light and dark sides of using VR.

The research article *"Dialing up the danger: Virtual reality for the simulation of risk"* (McIntosh) investigates the perception and impact of simulating and experiencing risky content in VR. Using thematic analysis and close reading language analysis, this article examines how journalists and media professionals reacted to a VR component during a "Stress Management and Civil Unrest" training session. The participants were found to experience the escalated VR scenario in a direct and active form. While the participants acknowledged that VR-based training can be highly beneficial in preparing for risky situations, they also reported that the simulation could trigger upsetting memories of

past encounters with risky situations in the real world. As a result, this article not only highlights the benefits of using VR for training but also raises ethical concerns regarding the use of VR in such procedures.

The research article *"Increasing awareness of climate change with immersive virtual reality"* (Hartmann et al.) addresses the effectiveness of using VR to promote climate change awareness and environmental attitudes. The authors compare the impact of a VR simulation of the Aletsch glacier melting over a period of 220 years with non-immersive control conditions. They found that participants in the three immersive VR conditions had a significantly stronger positive attitude change toward environmental awareness compared to those in the three non-VR conditions. These findings suggest that VR can be an effective tool for promoting behavioral change regarding environmental attitudes.

The research article *"Embodied Gambling–Investigating the Influence of Level of Embodiment, Avatar Appearance, and Virtual Environment Design on an Online VR Slot Machine"* (Oberdörfer et al.) builds upon previous research investigating the potential risk associated with playing online slots in VR instead of on a desktop computer. In a between-groups user study, participants played one of four versions of a VR online slot machine, using avatars that differed in appearance: 1) full embodiment with high socio-economic status, 2) full embodiment with low socio-economic status, 3) minimal embodiment playground VE, and 4) minimal embodiment laboratory VE. While the study did not reveal a significant influence of the factors examined, the work discusses the potential negative consequences of combining online gambling in VR with embodied virtual environments.

The research article *"Lingering effects associated with the consumer use of virtual reality"* (Porter III and Robb) examines the reported side effects of experiencing VR beyond the commonly known cybersickness. The analysis focused on the HTC Vive and user data collected from the Vive subreddit on Reddit. The authors identified three major categories of effects: perceptual effects, behavioral effects, and changes in dreams. These effects emerged after spending at least 1 hour in VR and disappeared completely after several weeks. The authors substantiated their findings from online discussions by further lending VR devices to novice users and conducting interviews after 4 weeks of use. The results reported in this paper are highly pertinent to the investigation of long-term usage of VR devices and immersive experiences.

The research article *"Social Virtual Reality (VR) Involvement Affects Depression When Social Connectedness and Self-Esteem Are Low: A Moderated Mediation on Wellbeing"* (Lee et al.) examines the impact of participating in social VR games on wellbeing, with a focus on the relationship between involvement, wellbeing, depression, self-esteem, and social connectedness. The results show that involvement in social VR games can positively affect wellbeing. However, when users with low self-esteem join social VR games, it can negatively affect their wellbeing. These results reinforce the overarching theme of this Research Topic by demonstrating that even positive design aspects of VR can result in negative effects depending on the user's mental state.

This Research Topic reveals novel insights into the design, perception, and subsequent impact of VR applications. It highlights that even with positive intentions, negative emotions can arise, but that negative effects of virtual environment design can be useful in therapeutic contexts. This highlights future research directions. Besides further investigating the influences of virtual environment design in specific application areas, such as therapy and education, it is crucial to consider potential ethical challenges when employing VR for training and exposure to specific situations. It is also essential to advance research on the long-term side effects of VR use. Ultimately, investigating the dark sides of VR may lead to positive outcomes that can benefit everyone.

Author contributions

This editorial is written by SO, DB, and AB.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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