Ethical Dilemmas of Mixed and Extended Reality

Mohsen Masoumian Hosseini [1], Manijeh Hooshmandja [2, *] and Toktam Masoumain Hosseini [ID] [3]

[1]Department of E-learning in Medical Sciences, Smart University of Medical Sciences, Tehran, Iran
[2]Department of Educational Technology in Medical Sciences, Smart University of Medical Sciences, Tehran, Iran
[3]Department of Nursing, School of Nursing and Midwifery, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran

[*]*Corresponding author*: Department of Educational Technology in Medical Sciences, Smart University of Medical Sciences, Tehran, Iran. Email: hoshmand.66@gmail.com, hooshmandja.m@smums.ac.ir

---

Dear Editor,

Virtual reality enables various experiences, including medical education, from a first-person perspective. In augmented reality (AR), virtual elements are integrated into the real world via a device (e.g., a smartphone or glasses). Mixed reality (MR) refers to the coexistence of digital and real objects that can interact in real-time (1, 2).

Although people in the virtual world can have a variety of occupations, we know that there are some thoughts and ideas that should not be thought about or considered. As far as imagination is concerned, consistency does not stand in its way. Through the images we create, we are all influenced by them. The MR technology raises ethical questions about how virtual characters should be treated and whether the golden rule of reciprocity should be followed. In Brey's view, virtual characters should be treated with respect because we may also treat people poorly if we mistreat them. By mistreating virtual characters, we may cause psychological harm to those characters' human counterparts (3). Mixed reality is on the verge of becoming a mainstream product, so any depiction of violence or abuse must be carefully considered. Immersion in virtual reality can lead to changes in emotions, perception, and behavior, and leaving virtual reality can be challenging in some cases. In addition to its persuasive power, MR technology can be used for unintended purposes, e.g., to persuade someone to participate in an illegal or immoral activity or to act without their consent (2, 4). This article explores a range of potential ethical issues related to MR and extended reality (XR), including the vulnerability of certain groups of people, the consequences of using MR, the distinction between the real and the virtual, data issues, and the potential psychological and social consequences of using MR as an interface for inflicting physical harm.

1. Vulnerability: There are no restrictions on the type of participants in a virtual environment. Participants may include adults and non-patient groups, and generally non-vulnerable individuals. However, children may be unable to distinguish reality from virtual reality, and certain patient groups may also be affected (5).

The whole purpose of XR technology is to persuade, which is how it can achieve its benefits (for example, disaster response training in a virtual environment is a form of persuasion). However, persuasion is often used for malicious purposes, e.g., to incite an illegal or immoral act or to force someone to do something they would not otherwise do (2, 4).

The idea that a certain group of people is responsible for a certain event on XR: There might have been an event on XR where a participant had a negative interaction with a representative of this group of people (e.g., a representative of a different race or gender). Although this event only happened on XR, the participant generalizes it and assumes that e.g. real people of the same type have bad intentions. Participants can also experience this when presented with representations of people they know (2).

2. Consequences of Using MR: Virtual experiences can have physical, emotional, and cognitive after-effects that can be both beneficial and harmful. For example, if a person suffers from motion sickness after using MR, it could lead to an accident, or if a virtual character insults them in real life, it could affect their overall well-being (6). Also, MR can manipulate our body image, positively affecting our behavior towards children or helping make white people less hostile towards black people. If XR is used frequently and over a long time, people can prioritize the virtual world over the real world. Leaving a virtual reality can be challenging in some circumstances, especially if the

person has been living in a virtual fantasy world with a virtual body that has been enhanced (4). As people spend more and more time online, they may consider their virtual bodies more attractive than their real bodies, leading to greater demand for cosmetic surgery (7).

3. Real vs. Virtual World: Illusions of place are likely to occur in VR systems that support natural sensorimotor contingencies. Participants may lose track of real-life events and real-life distrust events after a prolonged stay in virtual reality. As a result, false attributions to a particular group of people may occur, dangerous prejudices may arise, and adaptation to the real world may be difficult (8). Embodiment through virtual reality can affect emotional, cognitive, and behavioral functions. By using XR, one can depict situations that can cause psychological harm. For example, one can interact with deceased relatives via virtual reality. However, it is unclear whether this affects the process of accepting loss, for example, or whether it triggers feelings such as grief or anger (4).

The inability to distinguish between current and past events: Participants tend to remember virtual events as if they were real and cannot distinguish between events that actually happened and those that happened over time on XR. This also puts them in danger of distrusting actual events that take place in reality. In some situations, people forget that there is a gap between reality and virtual reality after spending some time in a simulation (2, 4).

When actions are performed by a virtual body or a remote-controlled robot that is controlled via an interface, it should be clear what the legal and ethical responsibilities are. Some participants might argue that their intentions were not properly realized through the interface, leading them to harmful behavior. Under what legal responsibility does the question arise in the case of a physical robot? Is it that of the participant, the robot, or the robot manufacturer? (2)

4. Data Issues: Collecting personal data in the virtual environment can enhance the sense of super-realism, but it also raises several ethical considerations about data privacy, sharing, and misuse. The MR systems may collect personal information about participants, including motor actions, eye movements and reflexes, preferences, habits, and interests. In MR worlds, collected data may be shared with third parties, and the person whose data is shared may be at higher risk due to the realistic environment. In the future, super-realism will make it possible to create virtual copies of real people who look, act, and speak like themselves. Body swapping on VR is usually used for positive purposes, e.g., to solve personal dilemmas, but it is also possible to use this technology to gain insight into another person's thoughts (9).

5. Potential Psychological and Social Conse-

quences: Mixed reality could hurt social norms and mental health, leading to social isolation and a preference for virtual social interaction. Moreover, if MR is overused, people may neglect their bodies and children (10).

Footnotes

References

1. Vaughan N, Dubey VN, Wainwright TW, Middleton RG. A review of virtual reality based training simulators for orthopaedic surgery. *Med Eng Phys*. 2016;**38**(2):59–71. [PubMed ID: 26751581]. https://doi.org/10.1016/j.medengphy.2015.11.021.

2. Wassom BD. Privacy. *Augmented Reality Law, Privacy, and Ethics*. 2015. p. 43–69. https://doi.org/10.1016/b978-0-12-800208-7.00003-x.

3. Brey P. The ethics of representation and action in virtual reality. *Ethics Inf Technol*. 1999;**1**(1):5–14. https://doi.org/10.1023/a:1010069907461.

4. Madary M, Metzinger TK. Recommendations for good scientific practice and the consumers of vr-technology. *Front Robot AI*. 2016;**3**. https://doi.org/10.3389/frobt.2016.00003.

5. Tychsen L, Foeller P. Effects of immersive virtual reality viewing on young children: visuomotor function, postural stability and visually induced motion sickness. *J Am Assoc Pediatr Ophthalmol Strabismus*. 2018;**22**(4). https://doi.org/10.1016/j.jaapos.2018.07.011.

6. Chalmers DJ. The Virtual and the Real. *Int J Philos*. 2017;**9**(46):309–52. https://doi.org/10.1515/disp-2017-0009.

7. Rajanala S, Maymone MBC, Vashi NA. Selfies-living in the era of filtered photographs. *JAMA Facial Plast Surg*. 2018;**20**(6):443–4. [PubMed ID: 30073294]. https://doi.org/10.1001/jamafacial.2018.0486.

8. Slater M. Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philos Trans R Soc Lond B Biol Sci*. 2009;**364**(1535):3549–57. [PubMed ID: 19884149]. [PubMed Central ID: PMC2781884]. https://doi.org/10.1098/rstb.2009.0138.

9. Spiegel JS. The ethics of virtual reality technology: Social hazards and public policy recommendations. *Sci Eng Ethics*. 2018;**24**(5):1537–50. [PubMed ID: 28942536]. https://doi.org/10.1007/s11948-017-9979-y.

10. Osimo SA, Pizarro R, Spanlang B, Slater M. Conversations between self and self as Sigmund Freud–A virtual body ownership paradigm for self counselling. *Sci Rep*. 2015;**5**:13899. [PubMed ID: 26354311]. [PubMed Central ID: PMC4564809]. https://doi.org/10.1038/srep13899.