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Letter to the Editor

Rethinking realities: A call for accurate terminology in eXtended Reality studies

To The Editor,

We read with great interest the article with the title: "Augmented reality training in basic life support with the help of smart glasses. Pilot study." by Aranda-García et al.,[1] published in Resuscitation Plus in June 2023; we wish to highlight and discuss the use of the term "Augmented Reality" (AR) as it was employed within the context of their research.

AR, a key component of eXtended Reality (XR), falls under an emerging umbrella term encompassing various immersive technologies. These include Mixed Reality (MR), Virtual Reality (VR), and Augmented Virtuality (AV). All are designed to merge the physical and digital worlds.[2] Azuma's widely recognized definition of AR in "A Survey of Augmented Reality" (1997) outlines three critical requirements for an AR system: 1) it must blend real and virtual elements, 2) offer real-time interactivity, and 3) align real and virtual components in a three-dimensional (3D) space.[3] Based on this definition, displaying a video call through Vuzix Blade smart glasses (Vuzix, New York, USA) to an external device in the mentioned study,[1] does not meet the criteria for AR, as real environmental interaction and contextually relevant augmentation as virtual elements are not integrated into the user's real-world 3D view.

That might come from the not-so-correct terminology used by Vuzix marketing, which advertises their smart glasses as AR.[4] Within its scope of application, this device has proven effective both as a feedback tool, as demonstrated in Aranda-García et al.'s research,[1] and as a projector displaying high-definition two-dimensional medical images, such as chest radiographs and prostate biopsies.[5,6] Conversely, independent of the specific immersive technology utilized in these studies, they collectively emphasize the potential of this technology to enhance healthcare, as indicated in the references.[1,5,6] This directly addresses the question Aranda-García et al. raised in their publication regarding whether AR smart glasses are an innovative new training tool or a superfluous gadget in resuscitation science.[7,8]

Future research must pay close attention to the specific immersive technologies employed, particularly considering the swift advancements and the emergence of new terminologies within the XR field. For example, unlike AR, Diminished Reality (DR) actively modifies real-world environments by detecting and either removing or altering specific objects.[9] A case in point is the representation of an enlarged automated external defibrillator, as illustrated in Fig. 1.[2]

The most recent Consensus of Science and Treatment Recommendation from the International Liaison Committee on Resuscitation reviewed the use of immersive technologies for basic and advanced life support training for laypeople and healthcare providers, issuing a weak recommendation based on very low-quality evidence.[10] This perspective could shift the next European Resuscitation Council Guidelines for immersive technologies to educate resuscitation, provided that authors use XR terminology accurately and incorporate appropriate methodologies into high-stake randomized controlled trials with uniform XR software. These studies are vital for an accurate comparison of XR's impact on resuscitation education.

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Nino Fijačko: Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Gregor Štiglic:** Funding acquisition, Writing – review & editing. **Christina Gsaxner:** Methodology, Writing – review & editing. **Todd P. Chang:** Methodology, Writing – review & editing. **Robert Greif:** Methodology, Visualization, Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: [Nino Fijačko is a member of the ERC BLS Science and Education Committee. Robert Greif is ERC Director of Guidelines and ILCOR, and ILCOR Task Force chair for Education Implementation

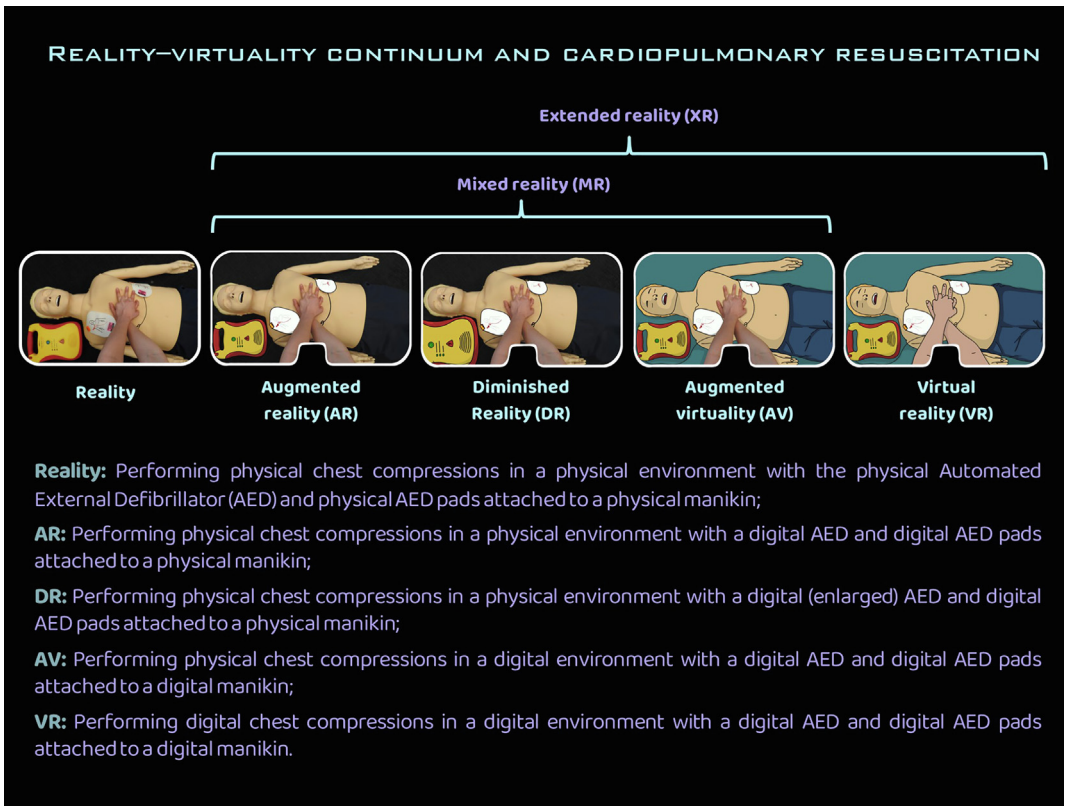

Fig. 1 – Reality-virtuality continuum and cardiopulmonary resuscitation.

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REFERENCES

1. Aranda-García S, Otero-Agra M, Fernández-Méndez F, et al. Augmented reality training in basic life support with the help of smart glasses. A pilot study. Resuscitation Plus 2023;14 100391.
2. Fijačko N, Metličar Š, Kleesiek J, Egger J, Chang TP. Virtual Reality, Augmented Reality, Augmented Virtuality, or Mixed Reality in cardiopulmonary resuscitation: which Extended Reality am I using for teaching adult basic life support? Resuscitation 2023;192 109973.
3. Azuma RT. A survey of augmented reality. Presence: Teleoperators & Virtual Environments 1997;6:355–85.
4. Vuzix [Internet]. Available from: https://www.vuzix.com/products/vuzix-blade-smart-glasses-upgraded.
5. Krause Q, McCrory B. Using Cost Efficient Augmented Reality Glasses in Anatomical Identification. In: Proceedings of the Human Factors and Ergonomics Society Annual Meeting, vol. 65, No. 1. Sage CA: Los Angeles, CA: SAGE Publications; 2021. p. 1004–8.
6. Sparwasser P, Haack M, Epple S, et al. Smartglass augmented reality-assisted targeted prostate biopsy using cognitive point-of-care fusion technology. Int J Medical Robotics Computer Assisted Surg 2022;18:e2366.
7. Aranda-García S, Martínez-Isasi S, Barcala-Furelos R, Darné M, Rodríguez-Núñez A. Augmented reality smart glasses: a new resuscitation training tool or a worthless gadget? Internal Emergency Med 2023:1–2.
8. Aranda-García S, Santos-Folgar M, Fernández-Méndez F, et al. "Dispatcher, can you help me? A woman is giving birth". A pilot study of remote video assistance with smart glasses. Sensors 2022;23:409.
9. Mori S, Ikeda S, Saito H. A survey of diminished reality: techniques for visually concealing, eliminating, and seeing through real objects. IPSJ Trans Computer Vis Appl 2017;9:1–14.
10. Consensus on Science with Treatment Recommendations [Internet]. Available from: https://costr.ilcor.org/document/immersive-technologies-for-resuscitation-education-eit-6405-tf-sr.

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