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Commentary and Opinions

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Ethan Waisberg,[1,2] Joshua Ong,[3] Mouayad Masalkhi,[4] Nasif Zaman,[5] Prithul Sarker,[5] Andrew G Lee,[6,7] Alireza Tavakkoli[5]

[1]Department of Ophthalmology, University of Cambridge, Cambridge, United Kingdom; [2]Moorfields Eye Hospital, NHS Foundation Trust, London, United Kingdom; [3]Department of Ophthalmology and Visual Sciences, University of Michigan Kellogg Eye Center, Michigan, USA; [4]University College Dublin School of Medicine, Belfield, Dublin, Ireland; [5]Human-Machine Perception Laboratory, Department of Computer Science and Engineering, University of Nevada, Nevada, USA; [6]The Houston Methodist Research Institute, Houston Methodist Hospital, Texas, USA; [7]Center for Space Medicine, Baylor College of Medicine, Texas, USA

Correspondence to: Ethan Waisberg; email: ethan.waisberg@qehkl.nhs.uk

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The Apple Vision Pro (AVP) is a spatial computing device developed by Apple and incorporates both virtual reality (VR) and augmented reality (AR) technologies.[1] The introduction of AVP has the potential to significantly transform the field of medical education. AVP was introduced on June 5, 2023, and is a notable advancement in spatial computing that integrates digital content with the physical environment, resulting in an engaging and interactive educational experience. The novel spatial computing device presents a comprehensive three-dimensional interface that is operated by instinctive and effortless inputs, namely the user's eyes, hands, and voice. The integration of VR and AR technologies by AVP has the potential to yield significant benefits for both medical education and the practice of clinical medicine.

Our group has previously developed a head-mounted device using AR and VR technology to assess astronaut vision during long-duration spaceflight.[2,3] This same technology could be used terrestrially on low-cost VR headsets to help assess vision of aging populations around the world.[4,5] Advances in the VR/AR arena have already been shown to enhance the teaching, learning, and competency in graduate medical education. The highly immersive quality of these technologies enables students to actively participate in lifelike simulations, realistic medical scenarios, and interactive anatomical models.

The implementation of AVP has the potential to improve medical education and training by offering a more practical and immersive learning experience. VR can offer cost-effective, standardized, and repeatable clinical training. VR headsets can help to provide practical, simulation-based training which is otherwise inherently difficult to provide. Simulation based training involves replicated real life scenarios, and then providing feedback on a student's performance, and has been shown to be superior to traditional clinical education and yield lasting results.[6] AR can also provide significant ethical and financial advantages for anatomy education by eliminating the need for cadavers. AR can effectively combine real world objects with a digital overlay to offer a highly realistic anatomical environment to facilitate learning. Further research in this area will be required to determine if this AR teaching is superior to traditional dissections. AR dissections do have limitations such lack of haptic feedback.

Finally, VR and AR technologies can help medical students better understand various ophthalmic diseases and visual phenomena by visually experiencing it in extended reality (ER). As populations age worldwide, the ability of future primary care providers to understand and recognize

various ophthalmic diseases will become even more important. This can be achieved by overlays in AR to decrease contrast, dull colors, and alter sensory input in an ER environment. In the future, understanding how patients with visual symptoms actually experience their visual environment will require moving beyond conventional visual assessment (e.g., visual acuity, visual field) and direct visualization in VR and AR environments will allow novel and unique opportunities for clinicians of the future.[7] For example, ER technology might allow future clinicians to directly experience what patients see and thus be more empathetic to the concerns of those with vision loss.

In summary, we believe that the Apple Vision Pro and other future developments in AR, VR, and ER will find application in future graduate medical education including simulated clinical scenarios, virtual anatomy teaching, and AR/ER simulations to help clinicians to better understand patient perspectives of disease and more.

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