

Accessibility for Motor Disabilities in Immersive Technologies

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ABSTRACT

The rise of immersive technologies such as virtual reality (VR), augmented reality (AR), and extended reality (XR) has revolutionized experiences in industry, entertainment, and academia. However, individuals with motor disabilities face challenges in accessing these technologies due to conventional interaction methods relying on motion-tracked controllers. This panel discussion explores the barriers faced by people with motor disabilities and the potential benefits of overcoming these challenges. It delves into innovative interaction methods, the role of immersive technologies in physical rehabilitation, and designing for diversity and inclusion. Ethical considerations in creating accessible immersive experiences, such as privacy, equity, and responsible data use, are also addressed. Future directions for accessible immersive technologies are discussed, highlighting advancements in adaptive equipment and interfaces. The panel aims to foster collaboration between technology developers, researchers, and disability advocates to ensure immersive technologies are inclusive and beneficial for all.

KEYWORDS

Accessibility, Augmented Reality, Extended Reality, Immersive Technology, Virtual Reality.

INTRODUCTION

Immersive technologies have the ability to allow users to merge the virtual world with the physical world (Laato et al., 2024) and even feel like they are part of a different world (Slater et al., 2022). This kind of technology that can provide an immersive experience has the potential to offer those with motor disabilities to have experiences that would otherwise be impossible for them to have, e.g., climbing a mountain range (Harz, 2024), seeing deep sea creatures in an underwater cave (NorthmanVR, 2020).

To benefit from such technologies, basic motor skills are required to set up and operate the equipment, which can, unfortunately, be challenging for people with motor disabilities and deter them from enjoying the benefits of immersive technologies (Mott et al. 2020). Therefore, becoming aware of these challenges will provide a good foundation for investigating ways to support people with motor disabilities so that they can overcome these challenges.

Immersive technologies can also have the potential to help with physical rehabilitation; specifically with regard to overcoming a common obstacle known as kinesiophobia, an irrational injury-related fear of movement due to anticipated discomfort or pain resulting from the movement (Larsson et al. 2016), which causes patients to give up on regular movement to reinstate a healthy level of movement (Zhu et al., 2024). Since immersive technologies commonly make use of motion-tracked interactions, fun activities can potentially be re-created which may be a more attractive way of dealing with the discomfort and pain that come with physical activities required as part of rehabilitation (Hennessy et al., 2020).

The future of accessible immersive technology holds immense potential for transforming the lives of individuals with motor disabilities. Developments in brain-computer interfaces (BCIs) and haptic feedback systems are at the forefront of this transformation. BCIs, which enable direct communication between the brain and a computer, could allow users to control virtual environments using only their thoughts, bypassing the need for traditional physical controllers. This technology could open up new realms of digital interaction and independence for people with severe motor disabilities (Creed et al., 2024).

Haptic feedback systems, which provide tactile sensations to the user, are another promising area of development. These systems could simulate the feeling of touch in virtual environments, providing a more immersive and intuitive experience. For individuals with motor disabilities, haptic feedback could enable a more natural and engaging way to interact with virtual objects and environments (Van Wegen, et al, 2023). Personalization is key to making these technologies truly accessible. The advancement of adaptive technology, tailored to individual needs and abilities, will be crucial. This could involve customizable interfaces, adjustable sensitivity settings, and other features that accommodate a wide range of physical capabilities. Artificial intelligence (AI) and machine learning are set to play

a significant role in this evolution (Kim, et al., 2020). These technologies can be harnessed to create interfaces that learn from the user's behavior and adapt accordingly, ensuring a more seamless and user-friendly experience. For example, an AI-powered system could detect when a user is struggling with a particular interaction and automatically adjust the interface to make it more accessible.

Developing immersive experiences that are accessible presents several ethical issues that need to be carefully considered. Since these technologies frequently call for the acquisition of sensitive personal and biometric data, privacy and data security are of the utmost importance (Hill, 2029). Retaining user trust and safety requires making sure that this data is used appropriately and kept safe from abuse. The possibility of a digital divide and injustice must also be addressed, since not everyone may have equal access to these technologies because of financial or geographic constraints. Prioritizing user consent, transparency, and control over personal data is essential for ethical design approaches. In addition, developers and researchers need to be aware of the possibility of unforeseen outcomes that could reinforce preconceptions or lead to dependency. In addition, developers and researchers need to be aware of the possibility of unforeseen outcomes that could reinforce preconceptions or lead to dependency (Stendal & Bernabe, 2024). The creation and application of accessible immersive technologies can be directed in a way that respects the autonomy and dignity of people with motor disabilities by abiding by the values of responsibility, reciprocity, and care.

PROPOSED FORMAT AND PANEL ORGANISATION

The envisaged panel will be approximately 90 minutes long. This panel brings together academics who recognize the need to address the challenges brought about by making use of novel technologies that can benefit the general public but create a gap for people who find this technology inaccessible due to motor disabilities. The panel will follow the structure outlined below:

Introduction. The role of Society 5.0 in teaching and learning. Moderator: Theo Bothma (6 minutes)

Theme 1. Introduction to accessibility for immersive technologies. Dave Ka (4 minutes)

Theme 2. Current known challenges for people with motor disabilities. Anika Myer (4 minutes)

Theme 3. Immersive technologies as a way to address kinesiophobia. Dave Ka (4 minutes)

Theme 4. Future Directions for Accessible Immersive Technologies. Daniel Alemneh. (4 minutes)

Theme 5. Ethical Considerations in Accessible Immersive Experiences. Marlene Holmner (4 minutes)

Theme 6. Global Perspective on Accessible Immersive Technologies (4 minutes)

Breakout group for each theme. (25 minutes)

Feedback and discussion. Group leaders. (25 minutes)

Summary and conclusion. Moderator: Theo Bothma (10 minutes).

ENGAGEMENT WITH THE AUDIENCE

After the presentations, the moderator and panelists will divide the audience into six sub-groups (one group per theme), inviting them to share their ideas, and experiences with related research, relevant theories, and methodologies (25 minutes). Each group will nominate a person to give feedback. This feedback from the six groups will take an additional 25 minutes. Audience input will be summarized by the moderator and briefly shared with the audience in a 10 minutes summary discussion, as well as via email.

EXPECTED OUTCOMES

By the end of the discussion, the audience will have increased their awareness of the current limitations in immersive technologies that present challenges for people with motor disabilities and understand how these technologies can benefit these people if the identified challenges can be addressed. The envisioned outcome will be to use the knowledge shared and discussed to suggest potential solutions.

RELEVANCE TO THE 87TH ANNUAL MEETING OF THE ASSOCIATION FOR INFORMATION SCIENCE AND TECHNOLOGY

This panel aligns with the theme of the annual meeting, namely “Putting People First: Responsibility, Reciprocity, and Care in Information Research and Practice” by contributing to discussions for making immersive technologies more accessible. Creating more awareness about the current lack of accessibility and outlining potential solutions to help people who struggle with motor disabilities so that more interest is encouraged to design methods that will enable such people to also enjoy the benefits of immersive technologies.

PANEL MEMBERS AND MODERATORS

Kwan Sui Dave Ka is a Lecturer in the Department of Information Science at the University of Pretoria. He has recently completed his master's study in using proprioception to support menu item selection in virtual reality. Dave's research is primarily focused on interaction design for virtual reality experiences and has a particular interest in improving accessibility in virtual reality experiences for people who struggle with motor disabilities.

Theo J.D. Bothma is Professor Emeritus / contract professor in the Department of Information Science at the University of Pretoria, South Africa. He is the former Head of Department and Chairperson of the School of Information Technology (until his retirement at the end of June 2016). His current research focuses primarily on aspects of information literacy, e-lexicography and digital humanities. He is a member of ASIS&T, a Steering Committee member of African Center of Excellence in Information Ethics, and joint Editor-in-Chief of *Libri*.

Marlene Holmner is an Associate Professor and Head of the Department of Information Science, in the University of Pretoria, South Africa. Marlene serves on the Information Technology for Development Editorial Board, and several other journal editorial boards. She is also active in ASIS&T, serving as officer in 2021-2023 and a Steering Committee member of African Center of Excellence in Information Ethics. Marlene publishes primarily in the areas of information ethics, information communication for development, and ICT in education.

Daniel Alemneh is head of the Digital Curation Unit at the University of North Texas Libraries and teaches at the College of Information. He is also a Research Associate in the Department of Information Science, University of Pretoria. For the past twenty years, Dr. Alemneh has been actively involved in various professional activities, including serving on the ASIS&T and ICKM Boards of Directors.

Anika Meyer is a Lecturer in the Department of Information Science, University of Pretoria where she is also enrolled for her doctoral studies, titled: Stakeholder Information Sharing: A Naturalistic Case Study of Software Development. Her research interests include information behaviour, knowledge management, guided inquiry, third space, creative spaces, participatory design, and agile methodology.

John MacLeod is the executive director of XRLibraries, a leading company integrating XR technology in libraries and schools. Over the last four years, he has worked with state and local libraries to develop and implement strategies for deploying augmented, virtual, and 360 VR technology and programs. He has served as a Commissioner for the Marin County Free Library for the last four years and received the 2018 California State Library Association President Award.

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