SIC-XR: workshop on Social Interaction and Collaboration in eXtended Reality

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ABSTRACT

In recent years, the use of immersive technologies is finding wide use in various fields. The workshop *Social Interaction and Collaboration in eXtended Reality* (SIC-XR) is an opportunity to explore the dynamics of social interaction and collaboration in immersive technologies, with a specific focus on eXtended Reality applications. With the growing adoption of these technologies in fields like remote work, education, and healthcare, it becomes crucial to investigate and enhance the ways people engage and collaborate in virtual environments.

Index Terms: eXtended Reality, Social Interaction, Collaboration

1 INTRODUCTION

Extended Reality (XR) technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), are profoundly reshaping how people interact and collaborate in the digital world, breaking down physical barriers and creating new opportunities for social connection [13]. Immersive solutions range from integrating digital elements into the real world to creating fully virtual environments, expanding the boundaries of human interaction. However, the expansion of XR also brings significant challenges in terms of social cohesion, collaboration, inclusivity, and accessibility [12]. Designing XR environments with social interaction and collaboration in mind is crucial for creating spaces that enable meaningful connections and teamwork. Immersive technologies can bring people together at a distance, but they can also introduce new barriers for individuals who may encounter accessibility challenges or feel disconnected from digital spaces that lack consideration for different needs. To foster inclusive social interactions, XR design must prioritize not only accessibility for individuals with physical and cognitive disabilities but also cultural sensitivity and representation [4]. This includes implementing adaptive interfaces, accessible controls, and alternative navigation methods that make XR environments usable for people with varied abilities. Additionally, it requires thoughtful representation of diverse user identities and cultural backgrounds, ensuring everyone can see themselves reflected and valued in these digital spaces.

The workshop *Social Interaction and Collaboration in eXtended Reality* (SIC-XR) is an opportunity to explore the dynamics of social interaction and collaboration in immersive technologies, with a specific focus on eXtended Reality applications.

The goal of the workshop is to bring together researchers, practitioners, developers, and interaction design experts to discuss current challenges and future potential in the area of social interaction and collaboration in XR.

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2 WORKSHOP PROGRAM

The workshop was organized as follows: after an introduction to the workshop, a keynote on *Human Augmentation – Understanding, Playing, Learning* is given by Prof. Stephan Lukosch. Afterwards, accepted papers are presented. At the end, conclusions and a collective discussion are drawn.

The keynote covered human augmentation, an interdisciplinary field that aims to improve sensory, motor and cognitive abilities through technologies such as prosthetics, exoskeletons and brain-computer interfaces. Recent projects to explore the potential of these technologies in play, learning and interaction are presented by the speaker.

Fourteen papers were accepted, including 11 regular papers and 3 position papers. Considering that Social Extended Reality (Social XR) represents an emerging domain within XR, the term *Social XR* is currently characterized by an ambiguous definition and inconsistent usage in both academic and industrial settings. Starting from an analysis of current research, Moslavac et al.[9] addressed this challenge with the aim of promoting a clearer and more shared conceptualization and definition of Social XR.

In general, different fields of application have been explored. Waligórski [16] explored the challenges faced by Polish users during international communication in social virtual reality platforms. Through an ethnographic study, linguistic, technological, cultural and geographic obstacles that contribute to the risk of socio-cultural exclusion were analyzed. In the same field of culture, Casillo et al. [2] proposed a framework to enhance the cultural user experience in the metaverse by combining XR and Recommender Systems that support two types of users: standard users and expert users.

Adjorlu et al. [1] presented a user-oriented development process of a VR application aimed at replicating a facility for work with mentally ill people. The paper showcases three steps in the iterative development, as well as the process of gathering the feedback from the patients of the institution. But this is not the only article in the medical field. In [10] Naylor and Adjorlu explored the development and potential of a VR application designed to facilitate online training for novice teachers in Applied Behavior Analysis techniques and philosophies. The platform aims to enhance the accessibility and convenience of training by enabling collaborative role-playing exercises in immersive VR environments. Rizzo et al. [14] presented the development and preliminary evaluation of an XR-based training environment designed to teach dentistry students how to position orthodontic brackets accurately.

The use of eye-tracking is another widely explored aspect. In [8] Moharana et al. explored the use of eye-tracking metrics as indicators of cognitive workload in Collaborative Virtual Reality environments. Participants took part in a collaborative task across two VR scenarios: a closed workspace and an open workspace. The results demonstrate that eye-based metrics are reliable indicators of cognitive effort and suggest that open workspaces significantly mitigate stress and mental load. Sarri and Mania analyzed the use of gaze-based visualizations as a communication tool in AR collaboration scenarios [15]. They focused on situations in which one user gives instructions, either verbally or through gaze visualization, to

another with different levels of knowledge. Results show that gaze visualizations reduce errors and ambiguity, improve task efficiency and lower cognitive load compared with verbal instructions. Also Khokhar et al. [5] investigated the impact of gaze visualization on instructional communication and effectiveness during a VR task with real-world applications, specifically in geological terrain education. They conducted a within-subjects experimental study to examine how the presence or absence of gaze visualization influences subjective and objective measures of tutors' performance and instructional communication across three distinct spatial interaction tasks.

Merz et al. [7] explored asymmetric collaboration under two distinct tasks: collaborative sorting and conversational talking tasks. They conducted a mixed design study to explore critical constructs such as self-perception, other-perception, and task-perception. Kojic et al. [6] analyzed two apps, Ikea and Virtlo, with different levels of interactivity, to explore the impact of physical movements on usability and social comfort. The paper provides useful insights for designing of AR apps that are engaging and socially acceptable.

In [3] Della Greca et al. examined the relationship between virtual environments, users' empathic abilities, and their ability to mimic emotional expressions, focusing on sadness interacting with an avatar in different virtual contexts. The results indicate that the time required to replicate the sad expression varied according to individual empathic abilities and the characteristics of the virtual environment. Empathic concern and personal distress emerged as significant predictors of participants' response times.

Another interesting aspect was explored by Zaba et al. [17]. They explored the transformation of traditional tabletop games into AR-based role-playing game experiences. The analysis focuses on two distinct navigation systems: the NavMesh system and the Waypoint system, evaluating their impact on intuitiveness, immersion, and interaction dynamics.

Ng and Chung [11] presented a saliency-aware bullet comment framework for 360° videos. Bullet comments are time-anchored comments that float across the screen during video playback, and are popular in East Asian video streaming platforms. The paper addressed the challenge of displaying bullet comments effectively in 360° videos, where the user's field of view is limited.

3   WEBPAGE AND CALL FOR PAPERS

The website (https://sites.google.com/view/sic-xr) is used to share information and the workshop program. All contributions are collected and published in the IEEE Digital Library. The workshop is scheduled for half a day as part of the 32nd IEEE Conference on Virtual Reality and 3D User Interfaces in Saint-Malo, France. It aims to explore aspects of social interaction and collaboration within the eXtended Reality by considering several topics, including but not limited to:

- Social dynamics in XR
- Accessibility in XR
- Inclusivity in Immersive Technologies
- User Safety and Ethical Standards
- Designing for Engagement and Cohesion
- Emotional and Psychological Impacts of XR
- Educational and Collaborative Uses of XR

We invited submissions of two types of papers: regular papers and position papers. Submissions have been thoroughly reviewed by all the organizers for relevance and by two program committee members for each submission, based on their expertise. The evaluation criteria included factors such as relevance, originality, and overall quality.

4   CONCLUSION

The workshop Social Interaction and Collaboration in eXtended Reality explored the dynamics of social interaction and collaboration within XR environments, highlighting challenges and opportunities for promoting inclusive, safe and engaging experiences. Contributions highlighted innovative solutions in areas such as health and cross-cultural communication, as well as advanced techniques such as gaze tracking. This represents a significant step toward designing immersive technologies that are more accessible and geared toward improving social interaction and collaboration.

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