

Proceedings of the 1st Workshop on Shaping Future Human Connection: Social Augmentation through XR Technologies

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Abstract

This preface introduces the Proceedings of the Workshop on Shaping Future Human Connection: Social Augmentation through XR Technologies (SAXR 2026), co-located with the ACM CHI Conference on Human Factors in Computing Systems (CHI 2026) and held in Barcelona, Spain, on April 13, 2026. SAXR 2026 offered a dedicated satellite event at CHI 2026 for researchers, designers, and practitioners interested in the challenges, opportunities, and methodologies of Social XR. The workshop featured Mini-Thematic Sessions with accepted extended abstracts and collaborative group activities.

The workshop website is accessible at: <https://sites.google.com/view/social-xr-chi2026/home>.

Keywords

Extended Reality, Social Augmentation, Human-Computer Interaction, Emotional Communication, Inclusive Interaction, Artificial Intelligence, Avatar-mediated Interaction

1. Introduction

Human social interactions are undergoing profound transformations, driven by the rapid evolution of communication technologies. In particular, Extended Reality (XR) technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), have reshaped how people connect, collaborate, and communicate across distances [1, 2, 8]. Beyond simply reproducing real-world interactions, XR enriches communication by enabling the exchange of social and emotional cues, clarifying intent, enhancing emotional expression, and supporting collaboration [3, 11, 13]. The recent advancement of artificial intelligence further amplifies this potential by allowing adaptive, context-sensitive augmentation [6, 20].

Research on social augmentation contributes both theoretically, by deepening our understanding of human social and emotional interaction [10, 9], and practically, by informing the design of XR systems that foster meaningful, inclusive, and ethically grounded interactions [4, 15, 16]. In avatar-mediated VR interactions, social augmentation has shown promise in improving social presence [21, 24], with examples such as augmented facial expressions that clarify intent [22] or enhance emotional communication [20], and overlays that make group emotions salient [11, 14]. MR can embed social cues directly into physical environments, making technology an additive rather than merely compensatory tool [17, 15]. However, research often overlooks long-term engagement, inclusivity, ethics, and the subtle dynamics of social-emotional exchange [5, 18]. These gaps motivated the organization of SAXR

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2026, which brought together an interdisciplinary community to explore the design, evaluation, and societal implications of socially augmented XR systems.

2. Objectives

SAXR 2026 promoted both research and practical developments in XR-mediated social augmentation. Although XR technologies have significantly advanced capabilities for remote communication and collaboration [16, 13], challenges remain in making social augmentations feel natural, scalable, accessible, and ethically responsible [3, 6]. Poor design choices risk over-augmentation, which can overwhelm users or distort social signals, potentially undermining trust [5, 27]. This highlights the need for rigorous evaluation methods combining behavioral, self-report, and physiological measures [26, 28].

The workshop aimed to address key gaps in the design and deployment of Social XR systems by investigating integrated strategies across five core themes. Participants were encouraged to actively contribute their perspectives, share empirical findings, and collaboratively develop design concepts and research agendas for socially augmented XR environments that are engaging, inclusive, and informed by multiple perspectives [29, 18]. A key objective was to foster interdisciplinary exchange among communities in HCI, XR design, social computing, cognitive sciences, and AI, and to encourage collaboration between academia and industry across domains such as education, healthcare, professional collaboration, therapy, and creative performance [19, 23].

3. Topics of Interest

As stated in its call for participation, SAXR 2026 focused on contributions addressing the following themes:

- **Social augmentation in XR:** Modification and enhancement of social cues in both physical and virtual contexts, exploring how social interactions can be embedded seamlessly across mixed or virtual environments to enhance communication, collaboration, and expressive opportunities; avatar-mediated interaction and social presence; augmentation of non-verbal cues (gaze, gesture, facial expressions, proxemics).
- **AI-supported adaptive and personalized interactions:** Systems that respond to individual differences and provide context-sensitive feedback; integration of generative and predictive models into XR interfaces; personalized augmentation strategies that scale without distorting social signals; multimodal sensing and affective computing for real-time adaptation.
- **Ethical system design:** Privacy-preserving approaches to social and affective data collection; fairness and bias in socially augmented systems; trust and transparency in AI-driven social augmentation; responsible design frameworks for Social XR.
- **Accessible Social XR:** Strategies, tools, and frameworks for inclusive social interactions; support for users with diverse abilities, linguistic, or cultural backgrounds; cross-cultural design considerations; XR for therapy, rehabilitation, and social skill development.
- **Rigorous evaluation methods:** Behavioral, self-report, and physiological measures for assessing social augmentations; longitudinal studies on engagement and wellbeing; benchmarks and protocols for evaluating Social XR systems; evaluation of ethical and societal implications.

4. Program

SAXR 2026 was held in Barcelona, Spain, on April 13, 2026. The workshop consisted of two 90-minute sessions with the following structure:

First session (90 min):

- Welcome and introduction to the workshop objectives (10 min)

- Mini-Thematic Sessions: authors of accepted extended abstracts presented their work in small thematic clusters, each delivering a 10-minute joint presentation followed by a 2-minute Q&A (80 min)

Second session (90 min):

- Guided group discussions on key aspects of XR-mediated social augmentation, supported by guiding questions to steer reflection across different thematic perspectives (50 min)
- Group presentations and plenary discussion, with each group sharing design concepts and novel augmentation ideas (30 min)
- Wrap-up and closing remarks, including presentation of the Best Extended Abstract, Best Student Extended Abstract, and Best Presentation awards (10 min)

The accepted contributions were organized into five thematic sessions:

1. **Sensing, Visualizing & Modulating Social Signals** (6 papers)
2. **AI Agents, Avatars & Identity Infrastructures** (7 papers)
3. **Social XR for Therapy, Wellbeing & Clinical Training** (6 papers)
4. **Learning, Inclusion & Structured Social Interaction** (7 papers)
5. **Foundations, Infrastructure & Societal Implications of Social XR** (7 papers)

5. Website & Proceedings

All workshop material, including the schedule, accepted papers, and outcomes, is available on the workshop website at <https://sites.google.com/view/social-xr-chi2026/home>.

The proceedings of SAXR 2026 are published as open-access with CEUR-WS.org, ensuring broad visibility within the HCI and XR research communities. In addition, the outputs from the workshop activities will be consolidated into a comprehensive report summarizing key insights, research challenges, methodological considerations, and design recommendations for future Social XR research and systems.

6. Organizers and Program Committee

SAXR 2026 was organized by:

- **Alessandro Visconti**, Politecnico di Torino, Italy
- **Fabrizio Lamberti**, Politecnico di Torino, Italy
- **Theophilus Teo**, University of South Australia, Australia
- **Gun A. Lee**, University of South Australia, Australia
- **Allison K. Jing**, RMIT University, Australia
- **Kiyoshi Kiyokawa**, Nara Institute of Science and Technology, Japan
- **Adalberto L. Simeone**, KU Leuven, Belgium

In addition to the editors, the workshop's Program Committee included: Davide Calandra (Politecnico di Torino), Alberto Cannavò (Politecnico di Torino), Roberta Macaluso (Politecnico di Torino), Tamil Selvan Gunasekaran (University of Auckland), Bowen Yuan (University of Adelaide), Eunghae Lim (Chonnam National University), Hyunwoo Cho (University of Adelaide), Zhidian Lin (RMIT university), Hexu Chen (RMIT university), Yi Wang (RMIT university).

All submitted extended abstracts were peer-reviewed by an international Program Committee composed of experts in the relevant research areas. Each submission was evaluated based on its scientific quality, originality, and relevance to the workshop topics by **two reviewers**, carefully avoiding any conflicts of interest, with reviewers coming from institutions different from those of the authors of the paper under review. The accepted papers received positive evaluations from both reviewers, with

recommendations for acceptance and comments highlighting their suitability for the workshop and their potential to foster productive discussion. Out of 37 submissions, 33 papers were accepted for inclusion in these proceedings.

The submission deadline was **February 12, 2026**, and the acceptance notification was sent on **February 25, 2026**.

References

- [1] J. McVeigh-Schultz and K. Isbister, “The case for ‘weird social’ in VR/XR: A vision of social superpowers beyond meatspace,” in *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (CHI EA ’21)*, ACM, 2021.
- [2] A. Simeone, B. Weyers, S. Bialkova, and R. W. Lindeman, “Introduction to Everyday Virtual and Augmented Reality,” Springer International Publishing, 2023, pp. 1–20.
- [3] B. Roth, G. Bente, M. E. Latoschik et al., “Technologies for social augmentations in user-embodied virtual reality,” in *Proceedings of the 25th ACM Symposium on Virtual Reality Software and Technology (VRST ’19)*, ACM, 2019.
- [4] D. Roth, C. Kleinbeck, T. Feigl, C. Mutschler, and M. E. Latoschik, “Beyond replication: Augmenting social behaviors in multi-user virtual realities,” in *IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, 2018, pp. 215–222.
- [5] S. Y. Oh, J. N. Bailenson, N. C. Krämer, and B. Li, “Let the avatar brighten your smile: Effects of enhancing facial expressions in virtual environments,” *PLOS ONE*, vol. 11, no. 9, p. e0161794, 2016.
- [6] B. Yang, Y. Guo, L. Xu, Z. Yan, H. Chen, G. Xing, and X. Jiang, “SocialMind: LLM-based proactive AR social assistive system with human-like perception for in-situ live interactions,” *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.*, vol. 9, no. 1, 2025.
- [7] D. Roth, D. Mal, C. F. Purps, P. Kullmann, and M. E. Latoschik, “Injecting nonverbal mimicry with hybrid avatar-agent technologies,” in *Proceedings of the ACM Symposium on Spatial User Interaction (SUI ’18)*, ACM, 2018.
- [8] D. Roth, K. Waldow, M. E. Latoschik, A. Fuhrmann, and G. Bente, “Socially immersive avatar-based communication,” in *2017 IEEE Virtual Reality (VR)*, 2017, pp. 259–260.
- [9] A. Vinciarelli, M. Pantic, and H. Bourlard, “Social signal processing: Survey of an emerging domain,” *Image and Vision Computing*, vol. 27, no. 12, pp. 1743–1759, 2009.
- [10] L. Tickle-Degnen and R. Rosenthal, “The nature of rapport and its nonverbal correlates,” *Psychological Inquiry*, vol. 1, no. 4, pp. 285–293, 1990.
- [11] J. D. Hart, T. Piumsomboon, L. Lawrence, G. A. Lee, R. T. Smith, and M. Billinghurst, “Emotion sharing and augmentation in cooperative virtual reality games,” in *CHI PLAY ’18 Extended Abstracts*, ACM, 2018.
- [12] J. D. Hart, T. Piumsomboon, G. Lee, and M. Billinghurst, “Sharing and augmenting emotion in collaborative mixed reality,” in *2018 IEEE ISMAR-Adjunct*, 2018, pp. 212–213.
- [13] A. Jing, K. May, B. Matthews, G. Lee, and M. Billinghurst, “The impact of sharing gaze behaviours in collaborative mixed reality,” *Proc. ACM Hum.-Comput. Interact.*, vol. 6, CSCW2, 2022.
- [14] A. Jing, T. Teo, J. McDade, C. Zhang, Y. Wang, A. Mitrofan, R. Thareja, H. Shin, Y. Lee, Y.-H. Gil, M. Billinghurst, and G. A. Lee, “Superpowering emotion through multimodal cues in collaborative VR,” in *2024 IEEE ISMAR*, 2024, pp. 160–169.
- [15] K. Kiyokawa, M. Billinghurst, S. E. Hayes, A. Gupta, Y. Sannohe, and H. Kato, “Communication behaviors of co-located users in collaborative AR interfaces,” in *Proceedings of the International Symposium on Mixed and Augmented Reality*, 2002, pp. 139–148.
- [16] S. Lukosch, M. Billinghurst, L. Alem, and K. Kiyokawa, “Collaboration in augmented reality,” *Computer Supported Cooperative Work (CSCW)*, vol. 24, 2015.
- [17] F. Mathis, X. Zhang, M. McGill, A. L. Simeone, and M. Khamis, “Assessing social text placement in mixed reality TV,” in *Proceedings of the 2020 ACM International Conference on Interactive Media Experiences (IMX ’20)*, ACM, 2020, pp. 205–211.

- [18] J. Han, A. Vande Moere, and A. L. Simeone, “An authorable metaverse: Personalising spaces into places for social belonging,” in *Workshop Metaverse4All at ACM CHI*, 2024.
- [19] F. G. Praticò, I. Checo, A. Visconti, A. Simeone, and F. Lamberti, “Designing hand-held controller-based handshake interaction in social VR and metaverse,” in *Proceedings of the 16th ACM SIGGRAPH Conference on Motion, Interaction and Games (MIG '23)*, ACM, 2023.
- [20] A. Visconti, D. Calandra, F. Giorgione, and F. Lamberti, “Enhancing social experiences in immersive virtual reality with artificial facial mimicry,” *IEEE Transactions on Visualization and Computer Graphics*, vol. 31, no. 5, pp. 3325–3335, 2025.
- [21] A. Genay, E. Kimura, M. Hachet, A. Lécuyer, Y. Hirao, M. Perusquía-Hernández, H. Uchiyama, and K. Kiyokawa, “Preparing users to embody their avatar in VR,” in *Proceedings of the 36th Australasian Conference on Human-Computer Interaction (OzCHI '24)*, ACM, 2025, pp. 537–550.
- [22] X. Wang, S. Zhao, Y. Wang, H. Z. Han, X. Liu, X. Yi, X. Tong, and H. Li, “Raise your eyebrows higher: Facilitating emotional communication in social VR through region-specific facial expression exaggeration,” in *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*, ACM, 2025.
- [23] T. Teo, A. Jing, C. Zhang, M. Frederick, H. Shin, Y. Lee, Y.-H. Gil, M. Billingham, and G. A. Lee, “Sharing facial cues at different target positions to support virtual collaboration,” ACM, 2025.
- [24] T. Wakabayashi, Y. Okada, and K. Zempo, “Effect of salesperson avatar automatically mimicking customer’s nodding on the enjoyment of conversation in virtual environments,” in *Proceedings of AHs (AHs '23)*, 2023, pp. 334–337.
- [25] D. S. Choi, J. Park, M. Loeser, and K. Seo, “Improving counseling effectiveness with virtual counselors through nonverbal compassion,” *Scientific Reports*, vol. 14, no. 1, pp. 1–12, 2024.
- [26] A. Dey, Y. Cao, and C. Dobbins, “Effects of heart rate feedback on an asymmetric platform using AR and laptop,” in *2022 IEEE VRW*, 2022, pp. 209–216.
- [27] S. M. Boker, J. Xu, J. L. Rotondo et al., “Adaptive modification of head movement and facial expression in dyadic interactions through active appearance models,” *Philosophical Transactions of the Royal Society B*, vol. 364, no. 1535, pp. 3485–3495, 2009.
- [28] A. Zheleva, J. Hardeman, W. Durnez et al., “The impact of eye gaze on social interactions of females in virtual reality,” *Heliyon*, vol. 9, no. 10, 2023.
- [29] C. Parker, S. Yoo, J. Fredericks et al., “The third workshop on building an inclusive and accessible metaverse for all,” in *CHI EA '25*, ACM, 2025.

Declaration on Generative AI

The author(s) have not employed any Generative AI tools.