Shaping Future Human Connection: Social Augmentation through XR Technologies

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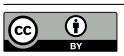
Abstract

Human social interactions are undergoing profound transformations, driven by the rapid evolution of communication technologies. In particular, Extended Reality (XR) technologies have reshaped how people connect, collaborate, and communicate across distances. 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. The recent advancement of artificial intelligence further amplifies this potential by allowing adaptive, context-sensitive augmentation. Research on social augmentation contributes both theoretically, by deepening our understanding of human social and emotional interaction, and practically, by informing the design of XR systems that foster meaningful, inclusive, and ethically grounded interactions. However, research often overlooks long-term engagement, inclusivity, ethics, and the subtle dynamics of social-emotional exchange. This workshop brings together researchers, designers, and practitioners to explore the challenges, opportunities, and methodologies of Social XR, fostering interdisciplinary dialogue and laying the foundation for sustainable, inclusive, and ethically responsible research and practice.



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CCS Concepts

• **Human-centered computing** → **Collaborative and social computing**; **Human computer interaction (HCI)**; **Virtual reality**; **Mixed / augmented reality**; **Collaborative interaction**.

Keywords

Extended reality, Emotional Communication, Inclusive Interaction, Social Augmentation, Artificial Intelligence

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1 Motivation

Human social interactions are evolving due to societal changes and advances in communication technologies [13, 22]. This has increased attention to social augmentation, which refers to the enhancement or transformation of social and emotional cues via virtual mediated elements to improve understanding and communication between individuals or agents [17, 20]. Such augmentations help people better interpret each other's intentions, enhance social presence, bridge gaps in sensory input, and support individuals with communication challenges [14, 17, 24]. In this context, eXtended Reality (XR) technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), have played a central role, transforming how people connect, communicate, and collaborate

across distances while maintaining social presence [13, 21, 25]. Beyond replicating real-world cues, XR enables social augmentation by extending, amplifying, or reconfiguring social and emotional signals [16, 26, 27], thereby defining Social XR.

In VR avatar-mediated interactions, social augmentation has shown promise in improving social presence [4, 27], with examples such as adaptive gaze cues for smoother turn-taking [2, 30], augmented facial expressions that clarify intent [23] or enhance emotional communication [28], and overlays that make group emotions salient [6, 9, 18]. Yet the challenge remains how to integrate these augmentations seamlessly so they feel natural, scalable, and accessible. Poor design choices risk over-augmentation, which can overwhelm users or distort social signals, potentially undermining trust [14, 26]. This highlights the need for rigorous evaluation methods that combine behavioral, self-report, and physiological measures to ensure augmentations are effective, ethical, and contextually appropriate [1, 25].

Another key consideration is whether augmentations are meaningful within the user's context. MR can embed social cues directly into physical environments through overlays and interactive markers, making the technology an additive rather than merely compensatory tool [10, 12, 29]. From this perspective, Social XR has the potential to enhance communication and open new avenues for expression while promoting inclusivity and accessibility [19]. In particular, it can integrate multiple channels of affective information, such as emotional states conveyed through non-verbal behavior and physiological signals, to improve social awareness and support more effective collaboration [3, 7, 8, 11]. However, social cues are highly individual. Different users react differently to emotional stimuli, and adaptive systems that fail to account for this variability risk inconsistencies in interpreting or responding to signals [5, 29]. Moreover, existing approaches often do not systematically address the integration of multiple modalities, the influence of environmental or cultural context, or the scalability of social augmentations across diverse user groups and application domains [9, 12]. These limitations highlight gaps in designing Social XR systems that are both reliable and generalizable, leaving open questions about how to achieve context-sensitive, adaptive, and ethically responsible interactions.

Moreover, *Artificial Intelligence* (AI) offers potential solutions by creating adaptive and context-sensitive Social XR systems. AI can predict affective and cognitive states from multimodal input, generating personalized feedback and expressive strategies in real time [26, 29]. Generative and predictive models could be embedded into XR interfaces or wearables to deliver subtle, adaptive, and socially intelligent cues [29]. Yet this also raises serious ethical and privacy concerns over how personal and affective data are collected, shared, and used. This highlights the need for careful consideration when designing Social XR systems [17].

This workshop seeks to directly address key gaps in the design and deployment of Social XR systems by investigating integrated strategies across several core themes. Participants will be encouraged to actively engage and contribute their perspectives on each topic. The workshop will cover: (1) **social augmentation in XR**, focusing on the 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; (2) **AI-supported adaptive and personalized interactions**, enabling systems to respond to individual differences and provide context-sensitive feedback, while ensuring integration, scalability, and seamless deployment so that augmentations feel natural and avoid overloading or distorting social signals; (3) **ethical system design**, addressing issues of privacy, fairness, and responsible data use to ensure that Social XR technologies foster trust and equitable participation; (4) **accessible Social XR**, promoting strategies, tools, and frameworks that guarantee accessible social interactions for diverse populations, including users with different abilities and linguistic or cultural backgrounds, and (5) **rigorous evaluation methods**, combining behavioral, self-report, and physiological measures to ensure augmentations are effective, contextually appropriate, ethically grounded, and personally adaptive.

These topics address persistent challenges in Social XR, including the highly individualized nature of social cues, the need for multimodal integration, the influence of environmental and cultural context, and the scalability of social augmentations across diverse user groups. By engaging with these themes, participants will help shape actionable insights and best practices for designing socially intelligent, ethically responsible, and scalable Social XR systems applicable across domains such as education, healthcare, professional collaboration, therapy, and creative performance.

By consolidating interdisciplinary insights from Human-Computer Interaction (HCI), XR, Computer Supported Cooperative Work (CSCW), psychology, and AI, the workshop aims to establish shared research agendas, methodologies, and best practices for socially augmented systems. This effort will advance XR technologies that are socially intelligent, ethically grounded, and impactful across diverse domains, aligning closely with CHI's mission to design technologies that shape everyday human experience while providing the community with actionable principles and frameworks to guide the next generation of XR systems.

2 Organizers

This workshop is organized by a team of researchers with complementary expertise in HCI, CSCW, XR interactions, and Empathic Computing. The team represents an interdisciplinary group combining technical expertise, design experience, and empirical research, which is highly relevant to the aims of the workshop.

Alessandro Visconti is a Ph.D. candidate in Computer and Control Engineering at Politecnico di Torino, Italy. His research aims to enhance user experience in Metaverse virtual worlds by enabling immersive, interactive, and socially engaging implementations. It explores strategies that combine consumer technologies and AI-driven processes to design virtual worlds centered on the user and tailored to individual preferences. He has also served as session chair at IEEE GEM 2024 and IEEE ICIR 2024.

Fabrizio Lamberti received the M.Sc. and Ph.D. degrees in Computer Engineering from Politecnico di Torino, Italy, in 2000 and 2005, respectively, where he is now a Full Professor in the Department of Control and Computer Engineering. His research interests include computer graphics, HCI, VR and AR, intelligent systems, and machine learning applied to virtual experiences. He is a Senior Member of the IEEE and the IEEE Consumer Technology

Society, where he currently serves as Vice President for Technical Activities. He serves as Associate Editor for IEEE Transactions on Consumer Electronics, IEEE Transactions on Visualization and Computer Graphics, IEEE Consumer Electronics Magazine, and the International Journal of Human-Computer Studies. He will be serving as Editor in Chief for IEEE Consumer Electronics Magazine for 2026-2027 term.

Theophilus Teo received the Ph.D. degree in Computer Science from the University of South Australia, Australia, in 2021. He is currently a Postdoctoral Research Fellow at the Empathic Computing Laboratory, University of South Australia (UniSA) STEM IVE. His research encompasses HCI, XR interactions, and remote collaboration. He has served as a Poster and Demo co-chair at ICAT-EGVE 2022 and Demo co-chair at ACM MobileHCI 2024.

Gun A. Lee received the Ph.D. degree in Computer Science and Engineering from Pohang University of Science and Technology (POSTECH) in 2009. He is a Senior Lecturer at the Australian Research Centre for Interactive and Virtual Environments (IVE), UniSA. His research investigates interaction and visualization methods for sharing virtual experience in immersive environments for collaboration and training, with recent focus being on sharing richer communication cues and supporting collaboration across space and time with assistance by virtual agents. He has served on various reviewing panels and editorial boards, such as a paper chair at IEEE ISMAR (2023 and 2025) and track chair for Proceedings of ACM Human-Computer Interaction - Interactive Surfaces and Spaces (2024-2025).

Allison K. Jing is a Lecturer (Assistant Professor) at RMIT University and an Adjunct Researcher. She completed her PhD at the Empathic Computing Lab, University of South Australia, where her research focused on gaze, supported multimodal interaction techniques, combining gaze with hand gestures, speech, or physiological cues—and on interface design for Mixed Reality remote collaboration. Her work has been published in leading venues such as IEEE VR, ISMAR, FrontiersVR, CSCW, ACM CHI, SIGGRAPH and SIGGRAPH Asia. She also holds a Master's degree in HCI from the University of St Andrews (UK).

Kiyoshi Kiyokawa received his M.S. and Ph.D. degrees in Information Systems from Nara Institute of Science and Technology (NAIST), Japan, in 1996 and 1998, respectively, where he is now a Professor at the Graduate School of Science and Technology. From 1999 to 2002, he worked at the Communications Research Laboratory (now the National Institute of Information and Communications Technology, NICT) and was a visiting researcher at the Human Interface Technology Laboratory of the University of Washington from 2001 to 2002. From 2002 to 2017, he was Associate Professor at the Cybermedia Center, Osaka University. His research interests include VR, AR, human augmentation, 3D user interfaces, CSCW, and context awareness. He is a Board Member and Fellow of the Virtual Reality Society of Japan, an Associate Editor for IEEE Transactions on Visualization and Computer Graphics and Frontiers in VR, and has served in key roles in the organization of major IEEE and ACM conferences such as ISMAR, IEEE VR, ISWC, 3DUI, and VRST. He is also an inductee of the IEEE VGTC Virtual Reality Academy (Inaugural Class).

Adalberto L. Simeone received his Ph.D. (2011) and M.Sc. (2006) degrees in HCI from the Università degli Studi di Bari Aldo Moro, Italy. He is an Associate Professor in the Department of Computer Science at KU Leuven, Belgium, where he is also a member of the Subdivision of HCI and the KU Leuven Digital Society Institute (DigiSoc). His research focuses on the fundamental challenges of VR and XR from an HCI perspective, including 3D interaction, cross-reality systems, and accessibility of immersive technologies. He has co-organized several international workshops, including WEVR (2015–2020) and NIDIT (2019–2020) at IEEE VR, Manipulating Reality at DIS 2018, and EPO4VR at CHI 2020, and has served on program committees of major conferences in HCI and XR. He is also principal investigator of multiple funded research projects on cross-reality interaction and hybrid collaborative environments.

3 Plans to Publish Workshop Proceedings

The workshop proceedings will be published in CEUR-WS[1] as open access, ensuring broad visibility within the HCI and XR research communities. In addition, the outputs from the workshop will be consolidated into a comprehensive report summarizing key insights, research challenges, methodological considerations, and design recommendations for future Social XR research and systems. This report will serve as a reference point for the community with the aim of providing the foundation for a subsequent journal special issue (e.g., in Empathic Computing Journal). Participants who make substantial contributions during the workshop will be invited to submit extended versions of their extended abstracts or reflections, fostering continued engagement and collaboration beyond the event itself.

4 Workshop Format and Accessibility Considerations

Accessibility is a central principle in the design of our workshop. All presentations and discussions will include captioning, with manual corrections provided as necessary. Zoom's automatic translation feature will also be enabled to support participants who are non-native English speakers. Translation support will further be available for key documents and presentations. Instructions, submission guidelines, and important materials will be provided in multiple accessible formats (PDF, plain text, ACM TAPS) to accommodate diverse needs.

To further enhance engagement and inclusivity, participants will be invited to upload a short introduction about themselves to the workshop website two weeks prior to the event. These materials will be shared with all attendees to foster early engagement and allow participants to familiarize themselves with each other's work and interests. During the workshop, the Miro platform will be used for collaborative exercises, brainstorming, and speculative design activities, enabling both in-person and remote participants to contribute actively [15]. To maintain ongoing interaction, a Discord server will be created for asynchronous discussion. This space will allow participants to ask questions, share ideas, and self-organize into topic-focused groups. The server will remain active after the workshop, supporting sustained collaboration and dissemination of outputs such as datasets, design prototypes, and evaluation frameworks.

[1] https://ceur-ws.org

5 Offline Materials

All materials produced during and after the workshop will be shared with participants through a central Github repository. This folder will act as a highly accessible resource for our target audiences, including those unable to attend. These offline materials will support post-workshop reflection on the discussions as well as ongoing collaboration and knowledge sharing within the XR-mediated social augmentation research community. These materials will include PDF slides from presentations, participants' presentations, content created during or after breakout discussions, summaries of group discussions, and a consolidated workshop report. The collaboratively generated Miro board will also remain live as a persistent resource, allowing participants to revisit, expand, and build upon the workshop activities and outputs.

6 Pre-Workshop Plans

6.1 Target Audience

This workshop aims to bring together researchers, designers, and practitioners from diverse fields, including HCI, XR design, social computing, and cognitive sciences, to explore the challenges and opportunities of Social XR. The focus will be on engaging experts who can actively contribute to the discussion of the five main themes addressed by the workshop. Participants will be selected based on their potential contribution to the workshop, considering their expertise, perspective, and submitted extended abstracts. This composition ensures a diverse and interdisciplinary group spanning research, design, and applied XR development. The workshop will focus on co-creation and collaborative design activities, aiming to generate actionable insights and research directions for socially augmented XR environments that are engaging, inclusive, and informed by multiple perspectives.

6.2 Recruitment

The call for participation will be widely disseminated through CHI announcements, relevant mailing lists in HCI and XR research communities, and social media platforms such as LinkedIn and X (formerly Twitter). Targeted invitations will also be sent to researchers and practitioners in our professional networks and to international collaborators with expertise in social interaction, XR, and accessibility design. The workshop website will host the call for participation, submission instructions, information about the organizers, and updates about workshop activities.

6.3 Extended Abstract Submission and Review Procedure

Submissions to this workshop should be in the form of extended abstract (5 to 9 pages, excluding references, in single-column CEUR-WS format) addressing the main themes of the workshop. Extended abstracts should clearly communicate the significance and scope of the contribution, particularly how they address at least one or more of the five themes above. Shorter, focused submissions are encouraged, as submissions are judged based on contribution per page. Submissions will be collected via EasyChair.

All submitted extended abstracts will be reviewed by the workshop organizers based on relevance, clarity, and potential to contribute to group discussions and collaborative activities. If research involves human participants, authors must indicate whether ethical approval was obtained or was not required by their institution. The organizers aim to select approximately 10-15 extended abstracts for acceptance. Participants will also be asked to indicate any accessibility needs to support full and equitable participation.

The workshop aims to assemble an interdisciplinary group, including early-career researchers, established academics, and practitioners from industry, to enrich discussions and collaborative design exercises.

6.4 Pre-Workshop Cluster Preparation

Prior to the event, authors of accepted extended abstracts will be organized into clusters aligned with the five main themes of the workshop. They will be informed via email about their assigned cluster. One of the organizers will schedule an initial online call for each cluster to introduce the workshop structure and goals, and to provide guidance on preparing their joint presentation for the Mini-Thematic Sessions. After this call, each cluster will work independently to create a single joint presentation, summarizing their combined contributions. Participants will be asked to send their presentations via email a few days before the workshop, and organizers will address any technical or coordination issues in advance. This process ensures participants are well-prepared while allowing clusters the flexibility to manage their collaboration autonomously.

7 Length of the Workshop

The workshop on-site will consist of two 90-minute sessions. The first session will include a 10-minute welcome, a keynote presentation (up to 20 minutes), and a 60-minute block of Mini-Thematic Sessions. In the Mini-Thematic Sessions, authors of accepted extended abstracts will present in small thematic clusters, with each cluster delivering a 10-minute joint presentation followed by 2-minute Q&A. If fewer extended abstracts are accepted than anticipated, the program may be adjusted by extending discussion or keynote/Q&A time to maintain a balanced and engaging workshop. The second session will begin with 50 minutes of interactive group discussions. After the discussions, participants will reconvene for 30 minutes of group presentations and guided discussion, followed by a 10-minute wrap-up and closing remarks. A possible schedule is presented in Table 1.

8 Workshop Activities

The on-site workshop will consist of two 90-minute sessions. The first session will begin with a short welcome to introduce the workshop objectives, followed by a 20-minute keynote presentation providing an overview of current research and challenges in XR-mediated social augmentation. The inclusion and final length of the keynote may be adjusted, ensuring a balanced schedule that prioritizes interaction and participant engagement. This will be followed by a block of **Mini-Thematic Sessions**, during which each cluster will deliver their pre-prepared 10-minute joint presentation, followed by a 2-minute Q&A. These sessions ensure that

Workshop Schedule	Time Allocation
First Session (90 min)	
Welcome	0–10 minutes
Keynote Speaker	10–30 minutes
Mini-Thematic Sessions	30–90 minutes
Break	
Second Session (90 min)	
Group Discussions	0–50 minutes
Group Presentations and Guided Discussion	50–80 minutes
Conclusions	80–90 minutes

Table 1: Proposed Workshop Schedule with Two 90-Minute Sessions

all accepted extended abstracts are represented, highlight thematic connections, and stimulate discussion across related contributions.

In the second session, participants will continue working in small groups, maintaining the thematic clustering from the first session. Each group will engage in guided discussions on key aspects of XR-mediated social augmentation, supported by a set of guiding questions formulated by the organizers to steer reflection and ensure focus across the different thematic perspectives, such as: *Which aspects of real-world communication could XR augment? - How can AI personalization stay transparent and respectful? - When can social augmentations negatively affect interaction?* Building on these discussions, groups will collaborate on a design challenge, developing concrete ideas for novel augmentation concepts. To support collaboration and visualization of ideas, participants can use a shared Miro board, and each group's outcomes will be synthesized into a short presentation delivered during the plenary session. This stage encourages critical thinking, creativity, and the integration of multiple perspectives. Following the presentations, groups will share their proposed ideas with all workshop participants, fostering cross-group feedback and dialogue. A reflective discussion will follow to consolidate insights, identify common challenges, and surface open research questions, providing an opportunity for participants to critically assess and refine emerging concepts.

At the end of the workshop, three awards will be presented: **Best Extended Abstract** and **Best Student Extended Abstract**, selected by the organizers, and **Best Presentation**, determined jointly by organizers (50%) and participant voting (50%). In addition, the design ideas developed during the workshop may serve as seeds for further research or extended contributions for a future special issue (e.g., in Empathic Computing Journal), ensuring that creative concepts are valued as collective outcomes and fostering continuity and deeper exploration beyond the event.

9 Post-Workshop Plans

With the organizers' strong connections to the HCI and XR research communities, we expect this workshop to spark ongoing collaborations and follow-up activities, including future workshop iterations, joint publications, and the development of design frameworks and evaluation methods for XR-mediated social augmentation. Building on ideas generated during group activities, we also plan to explore a dedicated *special issue* (e.g., in Empathic Computing Journal[2]), inviting participants to expand their concepts into extended contributions reflecting the workshop's collective insights. To sustain post-event collaboration, a Discord channel and shared repository (for participants) will remain active for exchanging materials such as Miro outputs, abstracts, and presentations. The workshop website will also be updated with selected outcomes. In this way, we aim to foster a lasting community of researchers and practitioners advancing inclusive and socially meaningful XR augmentation.

10 Call for Participation

Extended Reality (XR), including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), is reshaping how people interact, communicate, and collaborate. Beyond replicating real-world interactions, XR enables *social augmentation*: the deliberate enhancement of social and emotional signals, enriching communication, fostering engagement, and supporting inclusivity, while raising important questions about design, ethics, and evaluation.

This workshop brings together researchers, designers, and practitioners to examine social augmentation in XR-mediated communication. Across two 90-minute sessions, participants will engage in a keynote, collaborative Mini-Thematic Sessions, and group activities to generate new design concepts and frameworks. In the Mini-Thematic Sessions, authors of accepted extended abstracts will present their work in thematic clusters through 10-minute joint presentations followed by Q&A. In subsequent group discussions, participants will collaboratively explore design challenges and novel augmentation ideas.

We invite submissions of extended abstracts (5 to 9 pages, excluding references, in single-column CEUR-WS format[3] via EasyChair[4]), including empirical studies, case analyses, theoretical perspectives, or speculative design proposals. All contributions will be peer-reviewed and selected based on relevance, clarity, and potential to contribute to collaborative discussions. Accepted extended abstracts will be published in the open-access CEUR-WS proceedings, and at least one author must register and attend the workshop.

To recognize outstanding contributions, three awards will be presented: **Best Extended Abstract** and **Best Student Extended Abstract**, both selected by the organizers, and **Best Presentation**, determined jointly by organizers and participant voting. These awards highlight excellence in research, while fostering active collaboration. Further details will be available on the workshop website.

11 Expected Size of Attendance

We aim for approximately 20–30 participants attending the workshop. This includes 18–24 participants associated with accepted extended abstracts, three organizers, 5–10 additional in-person participants attending as part of the conference, and around 5 remote participants or organizers. The participant group is expected to include early-career researchers, established academics, and industry practitioners, fostering a dynamic exchange of perspectives and

[2] https://www.sciexplor.com/ec
[3] https://ceur-ws.org/HOWTOSUBMIT.html#CEURART
[4] https://login.easychair.org/

experiences. Such diversity will support rich discussions, collaborative activities, and the development of research directions in the emerging field of XR-mediated social augmentation.

References

[1] Steven M. Boker, Jing Xu, Joseph L. Rotondo, et al. 2009. Adaptive modification of head movement and facial expression in dyadic interactions through active appearance models. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364, 1535 (2009), 3485–3495. doi:10.1098/rstb.2009.0152

[2] Doo Sung Choi, Jongyoul Park, Martin Loeser, and Kyoungwon Seo. 2024. Improving counseling effectiveness with virtual counselors through nonverbal compassion involving eye contact, facial mimicry, and head-nodding. *Scientific Rep.* 14, 1 (2024), 1–12. doi:10.1038/s41598-023-51115-y

[3] Arindam Dey, Yufei Cao, and Chelsea Dobbins. 2022. Effects of Heart Rate Feedback on an Asymmetric Platform using Augmented Reality and Laptop. In *2022 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*. 209–216. doi:10.1109/VRW55335.2022.00051

[4] Adélaïde Genay, Erika Kimura, Martin Hachet, Anatole Lécuyer, Yutaro Hirao, Monica Perusquía-Hernández, Hideaki Uchiyama, and Kiyoshi Kiyokawa. 2025. Preparing Users to Embody their Avatar in VR: Insights on the Effects of Priming, Mental Imagery, and Acting on Embodiment Experiences. In *Proceedings of the 36th Australasian Conference on Human-Computer Interaction (OzCHI '24)*. Association for Computing Machinery, New York, NY, USA, 537–550. doi:10.1145/3726986.3726988

[5] Jihae Han, Andrew Vande Moere, and Adalberto L Simeone. 2024. An Authorable Metaverse: Personalising Spaces into Places for Social Belonging. In *Workshop in Building a Metaverse for All: Opportunities and Challenges for Future Inclusive and Accessible Virtual Environments (Metaverse4All 2024) at ACM CHI*. 1–6.

[6] Jonathon D. Hart, Thammathip Piumsomboon, Louise Lawrence, Gun A. Lee, Ross T. Smith, and Mark Billinghurst. 2018. Emotion Sharing and Augmentation in Cooperative Virtual Reality Games *(CHI PLAY '18 Extended Abstracts)*. Association for Computing Machinery. doi:10.1145/3270316.3270596

[7] Jonathon D. Hart, Thammathip Piumsomboon, Gun Lee, and Mark Billinghurst. 2018. Sharing and Augmenting Emotion in Collaborative Mixed Reality. In *2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*. 212–213. doi:10.1109/ISMAR-Adjunct.2018.00069

[8] Allison Jing, Kieran May, Brandon Matthews, Gun Lee, and Mark Billinghurst. 2022. The Impact of Sharing Gaze Behaviours in Collaborative Mixed Reality. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2 (2022). doi:10.1145/3555564

[9] Allison Jing, Theophilus Teo, Jeremy McDade, Chenkai Zhang, Yi Wang, Andrei Mitrofan, Rushil Thareja, Heesook Shin, Yongho Lee, Youn-Hee Gil, Mark Billinghurst, and Gun A. Lee. 2024. Superpowering Emotion Through Multimodal Cues in Collaborative VR. In *2024 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*. 160–169. doi:10.1109/ISMAR62088.2024.00030

[10] K. Kiyokawa, M. Billinghurst, S.E. Hayes, A. Gupta, Y. Sannohe, and H. Kato. 2002. Communication behaviors of co-located users in collaborative AR interfaces. In *Proceedings. International Symposium on Mixed and Augmented Reality*. 139–148. doi:10.1109/ISMAR.2002.1115083

[11] Stephan Lukosch, Mark Billinghurst, Leila Alem, and Kiyoshi Kiyokawa. 2015. Collaboration in Augmented Reality. *Computer Supported Cooperative Work (CSCW)* 24 (12 2015). doi:10.1007/s10606-015-9239-0

[12] Florian Mathis, Xuesong Zhang, Mark McGill, Adalberto L. Simeone, and Mohamed Khamis. 2020. Assessing Social Text Placement in Mixed Reality TV. In *Proceedings of the 2020 ACM International Conference on Interactive Media Experiences* (Cornella, Barcelona, Spain) *(IMX '20)*. Association for Computing Machinery, 205–211. doi:10.1145/3391614.3399402

[13] Joshua McVeigh-Schultz and Katherine Isbister. 2021. The Case for "Weird Social" in VR/XR: A Vision of Social Superpowers Beyond Meatspace *(CHI EA '21)*. Association for Computing Machinery. doi:10.1145/3411763.3450377

[14] Soo Youn Oh, Jeremy N. Bailenson, Nicole C. Krämer, and Benjamin Li. 2016. Let the Avatar Brighten Your Smile: Effects of Enhancing Facial Expressions in Virtual Environments. *PLOS ONE* 11, 9 (2016), e0161794. doi:10.1371/journal.pone.0161794

[15] Callum Parker, Soojeong Yoo, Joel Fredericks, Tram Thi Minh Tran, Mark Colley, Youngho Lee, Khanh-Duy Le, Simon Stannus, Woontack Woo, and Mark Billinghurst. 2025. The Third Workshop on Building an Inclusive and Accessible Metaverse for All *(CHI EA '25)*. Association for Computing Machinery, New York, NY, USA. doi:10.1145/3706599.3706730

[16] Filippo Gabriele Prattichò, Irene Checo, Alessandro Visconti, Adalberto Simeone, and Fabrizio Lamberti. 2023. 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* (Rennes, France) *(MIG '23)*. Association for Computing Machinery, Article 18, 6 pages. doi:10.1145/3623264.3624464

[17] Bernhard Roth, Gary Bente, Marek E. Latoschik, et al. 2019. Technologies for Social Augmentations in User-Embodied Virtual Reality. In *Proceedings of the 25th ACM Symposium on Virtual Reality Software and Technology (VRST '19)*. 1–10. doi:10.1145/3359996.3364269

[18] Daniel Roth, Larrissa Brübach, Franziska Westermeier, Christian Schell, Tobias Feigl, and Marc Erich Latoschik. 2019. A Social Interaction Interface Supporting Affective Augmentation Based on Neuronal Data *(SUI '19)*. Association for Computing Machinery. doi:10.1145/3357251.3360018

[19] Daniel Roth, Constantin Klelnbeck, Tobias Feigl, Christopher Mutschler, and Marc Erich Latoschik. 2018. Beyond Replication: Augmenting Social Behaviors in Multi-User Virtual Realities. In *IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*. 215–222. doi:10.1109/VR.2018.8447550

[20] Daniel Roth, David Mal, Christian Felix Purps, Peter Kullmann, and Marc Erich Latoschik. 2018. Injecting Nonverbal Mimicry with Hybrid Avatar-Agent Technologies: A Naïve Approach *(SUI '18)*. Association for Computing Machinery, 5 pages. doi:10.1145/3267782.3267791

[21] Daniel Roth, Kristoffer Waldow, Marc Erich Latoschik, Arnulph Fuhrmann, and Gary Bente. 2017. Socially immersive avatar-based communication. In *2017 IEEE Virtual Reality (VR)*. 259–260. doi:10.1109/VR.2017.7892275

[22] Adalberto Simeone, Benjamin Weyers, Svetlana Bialkova, and Robert W. Lindeman. 2023. *Introduction to Everyday Virtual and Augmented Reality*. Springer International Publishing, 1–20. doi:10.1007/978-3-031-05804-2_1

[23] Theophilus Teo, Allison Jing, Chenkai Zhang, Michael Frederick, Heesook Shin, Yongho Lee, Youn-Hee Gil, Mark Billinghurst, and Gun A. Lee. 2025. Sharing Facial Cues at Different Target Positions to Support Virtual Collaboration. Association for Computing Machinery. doi:10.1145/3706599.3719679

[24] Linda Tickle-Degnen and Robert Rosenthal. 1990. The Nature of Rapport and Its Nonverbal Correlates. *Psychological Inquiry* 1, 4 (1990), 285–293. doi:10.1207/s15327965pli0104_1

[25] Alessandro Vinciarelli, Maja Pantic, and Herve Bourlard. 2009. Social Signal Processing: Survey of an Emerging Domain. *Image and Vision Computing* 27, 12 (2009), 1743–1759. doi:10.1016/j.imavis.2008.11.007

[26] Alessandro Visconti, Davide Calandra, Federica Giorgione, and Fabrizio Lamberti. 2025. Enhancing Social Experiences in Immersive Virtual Reality with Artificial Facial Mimicry. *IEEE Transactions on Visualization and Computer Graphics* 31, 5 (2025), 3325–3335. doi:10.1109/TVCG.2025.3549163

[27] Takumi Wakabayashi, Yukihiko Okada, and Keiichi Zempo. 2023. Effect of Salesperson Avatar Automatically Mimicking Customer's Nodding on the Enjoyment of Conversation in Virtual Environments. In *Proc.\ AHs (AHs '23)*. 334—-337. doi:10.1145/3582700.3583711

[28] Xueyang Wang, Sheng Zhao, Yihe Wang, Howard Ziyu Han, Xinge Liu, Xin Yi, Xin Tong, and Hewu Li. 2025. Raise Your Eyebrows Higher: Facilitating Emotional Communication in Social Virtual Reality Through Region-Specific Facial Expression Exaggeration. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. doi:10.1145/3706598.3713688

[29] Bufang Yang, Yunqi Guo, Lilin Xu, Zhenyu Yan, Hongkai Chen, Guoliang Xing, and Xiaofan Jiang. 2025. SocialMind: LLM-based Proactive AR Social Assistive System with Human-like Perception for In-situ Live Interactions. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 9, 1 (2025). doi:10.1145/3712286

[30] Aleksandra Zheleva, Julie Hardeman, Wouter Durnez, Charlotte Vanroelen, Jonas De Bruyne, Dennis Osei Tutu, Jessica Morton, Jamil Joundi, Jelle Saldien, and Klaas Bombeke. 2023. The impact of eye gaze on social interactions of females in virtual reality: The mediating role of the uncanniness of avatars and the moderating role of task type. *Heliyon* 9, 10 (2023). doi:10.1016/j.heliyon.2023.e20165