

# 3rd Workshop on User-Embodied Interaction in Virtual Reality (UIVR)

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Figure 1: User Embodiment in Virtual Environments.

## ABSTRACT

The representation of users to others and themselves is especially important for Virtual/Mixed/Augmented Reality (VR/MR/AR) applications. The development of technological solutions and the understanding of underlying cognitive effects challenges human-computer interaction (HCI) and related disciplines. A number of interesting research questions, such as realism of appearance and behavior as well as their effects on perception and user behavior arise, that are yet to be explored. To support a discussion and the generation of a common agenda, we will organize the 3rd half-day workshop on User-Embodied Interaction in VR (UIVR) gathering researchers and practitioners emphasizing the discussion of different positions on applications and findings to collect guidelines for future developments.

## CCS CONCEPTS

• **Human-centered computing** → *HCI theory, concepts and models; Empirical studies in HCI.*

## KEYWORDS

User embodiment, body ownership, avatars, embodied interaction, social interaction

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## 1 TOPIC ILLUSTRATION

“User embodiment concerns the provision of users with appropriate body images so as to represent them to others (and also to themselves) [...]” [2, p.1]. Through virtual environments, coherent multi-sensory stimulation can lead to the adaptation of virtual bodies [7]. In turn, users may perceive ownership (in particular, accepting the virtual body as a source of bodily sensations [4]), agency (i.e., feeling control over the virtual body’s movements), and even a change in the perception of their own body scheme [11]. These effects are dependent on top-down and bottom-up information processing. In consequence, users may adapt behaviors to what they attribute as characteristics of the virtual body, known as the Proteus Effect [13].

User embodiment has impacts on both, individual interactions (user–environment interactions) as well as collaborative or social interactions (user–user interactions) [9]. Regarding individual interactions, there are multiple questions to be tackled that concern efficiency and usability of embodiment, for example to navigate and manipulate an environment. Regarding collaborative or social interactions, any modification of appearance and behavior representation will impact the perception of users as well as the perception of the social interaction per se. We “cannot not communicate” [12], meaning that every social cue will be interpreted by a user. Understanding embodied interactions is an essential research challenge in the context of virtual environments that are capable of completely decoupling physical appearance and behavior from virtual representations [1], and to augment social interactions [10]. The topic has gained strong interest in recent years as seen by the numbers of publications in relevant conferences (such as IEEE VR, ISMAR, MUC, CHI, SUI, VRST, GI VRAR) and is of high importance for these and related research communities.

## 2 WORKSHOP CONTENT INFORMATION

The UIVR workshop welcomes disciplinary and interdisciplinary **research paper** submissions with technical, evaluative, or theoretical contributions in the areas of user-embodied interaction, collaborative and augmented interactions, tracking, perception and cognition, medicine and therapy, security, and discussions on ethical issues that share the theme of user embodiment. In addition, we welcome **position papers** that may derive their positions from previously published work and present a clear and strong standpoint as a basis for discussion. We further welcome **flashlight papers** in the form of extended abstracts by students or junior researchers that may describe work in progress. We allow resubmissions of previously published papers that will be accepted for an oral presentation at the workshop but not included in the proceedings. Previous contributions at UIVR ranged from the proposal of design frameworks [3] to time exposure investigations [8], virtual audience behaviors [6], as well as technology comparisons [5] and created a fruitful discussion. The goal of UIVR is to gather the VR and HCI communities to foster collaborations, and provide a basis for a discussion that results in a common agenda and research framework for future projects.

**Structure.** The UIVR is planned as an afternoon workshop and structured along an introductory welcome session, a keynote, paper talks, a flashlight session, as well as a final moderated discussion to summarize and reflect on the findings as well as to exchange positions and ideas.

**Target Group.** We target researchers and practitioners to connect the HCI, AR/VR, and cognitive science communities. We specifically encourage to submit preliminary work in forms of flashlights that will be presented in a 5-10 minutes format. The workshop aims at interconnecting different fields of research and interest groups.

## 3 SUMMARY

The workshop topic is both timely and important for the HCI community. Especially with the rise of applications for health, learning, and training, it is crucial to connect interrelated research areas to progress to a common framework and to discuss societal impacts and ethical considerations.

## 4 ABOUT THE ORGANIZERS

**Daniel Roth** is a currently a senior research scientist at the Technical University of Munich (TUM), at the Chair for Computer Aided Medical Procedures and Augmented Reality. Before, he was postdoctoral researcher at the University of Würzburg, HCI Group. He published in key VR, AR, MR, and HCI outlets on the topic of avatars, embodiment and social interaction, serves as reviewer for related journals and conferences and actively supports their goals as organizer and committee member.

**Iana Podkosova** is a post-doctoral researcher at TU Wien, Institute of Visual Computing and Human-Centered Technology. She published in key VR conferences contributing with the state of the art development of multi-user tracking and simulation systems.

**Niels Christian Nilsson** is an associate professor at Aalborg University Copenhagen. Niels served as program committee member for IEEE VR since 2016 and as editor or reviewer for multiple VR

outlets, such as Springer Encyclopedia of Computer Graphics and Games, Frontiers in ICT/Robotics and AI. His research is focused on perception, cognition, and locomotion in VR.

**Alexander Kulik** is scientist, designer and developer at Consensive. Before, he was postdoctoral researcher at at the Bauhaus-University Weimar, Virtual Reality Systems Group. His research focuses on 3D user interfaces and multi-user systems. He published and served as reviewer/committee member for key VR conferences.

**Gerd Bruder** is Research Assistant Professor at the Institute for Simulation and Training, University of Central Florida. He has published and organized multiple key VR and HCI related conferences.

## REFERENCES

- [1] Jeremy N Bailenson, Andrew C Beall, Jack Loomis, Jim Blascovich, and Matthew Turk. 2004. Transformed social interaction: Decoupling representation from behavior and form in collaborative virtual environments. *Presence: Teleoperators & Virtual Environments* 13, 4 (2004), 428–441. <https://doi.org/10.1162/1054746041944803>
- [2] Steve Benford, John Bowers, Lennart E. Fahlén, Chris Greenhalgh, and Dave Snowden. 1995. User Embodiment in Collaborative Virtual Environments. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (Denver, Colorado, USA) (CHI '95)*. ACM Press/Addison-Wesley Publishing Co., New York, NY, USA, 242–249. <https://doi.org/10.1145/223904.223935>
- [3] Anna Eliza Bleakley. 2020. Towards an Interaction Design Framework for Conversation Roles in VR. *Mensch und Computer 2020-Workshopband* (2020).
- [4] Shaun Gallagher. 2000. Philosophical Conceptions of the Self: Implications for Cognitive Science. 4, 1 (2000), 14–21.
- [5] Elisabeth Ganal, Andrea Bartl, Franziska Westermeier, Daniel Roth, and Marc Erich Latoschik. 2020. The effects of reconstruction accuracy and invasiveness of tracking systems for User Embodiment in Virtual Reality. *Mensch und Computer 2020-Workshopband* (2020).
- [6] Yann Glémarec, Jean-Luc Lugin, Anne-Gwenn Bossier, Paul Cagniat, Cédric Buche, and Marc Erich Latoschik. 2020. Pushing Out the Classroom Walls: A Scalability Benchmark for a Virtual Audience Behaviour Model in Virtual Reality. *Mensch und Computer 2020-Workshopband* (2020).
- [7] Konstantina Kilteni, Antonella Maselli, Konrad P Kording, and Mel Slater. 2015. Over my fake body: body ownership illusions for studying the multisensory basis of own-body perception. *Frontiers in human neuroscience* 9 (2015), 141. <https://doi.org/10.3389/fnhum.2015.00141>
- [8] Martin Kocur, Daniel Roth, and Valentin Schwind. 2020. Towards an Investigation of Embodiment Time in Virtual Reality. *Mensch und Computer 2020-Workshopband* (2020).
- [9] Alexander Kulik, André Kunert, Stephan Beck, Roman Reichel, Roland Blach, Armin Zink, and Bernd Froehlich. 2011. C1x6: a stereoscopic six-user display for co-located collaboration in shared virtual environments. In *ACM Transactions on Graphics (TOG)*, Vol. 30. ACM, 188. <https://doi.org/10.1145/2024156.2024222>
- [10] Daniel Roth, Gary Bente, Peter Kullmann, David Mal, Chris Felix Purps, Kai Vogeley, and Marc Erich Latoschik. 2019. Technologies for Social Augmentations in User-Embodied Virtual Reality. In *25th ACM Symposium on Virtual Reality Software and Technology*. 1–12.
- [11] D. Roth and M. E. Latoschik. 2020. Construction of the Virtual Embodiment Questionnaire (VEQ). *IEEE Transactions on Visualization and Computer Graphics* 26, 12 (2020), 3546–3556. <https://doi.org/10.1109/TVCG.2020.3023603>
- [12] Paul Watzlawick, Janet Beavin, and Don Jackson. 2017. Some tentative axioms of communication. In *Communication theory*. Routledge, 74–80.
- [13] Nick Yee and Jeremy Bailenson. 2007. The Proteus effect: The effect of transformed self-representation on behavior. *Human communication research* 33, 3 (2007), 271–290.