

DEPARTMENT: CONFERENCES

MUM 2020

Jonathan Liebers  and Roman Heger , University of Duisburg-Essen, 45141 Essen, Germany

The 19th International Conference on Mobile and Ubiquitous Multimedia (MUM 2020) took place from November 22, 2020, to November 25, 2020. Originally located in Essen, Germany, the event was changed to a virtual venue that brought together researchers and practitioners from academia and industry. The program included two keynotes, 32 paper presentations, 11 posters, six demos, and in total 96 participants.

To host the online conference, the general chair, Stefan Schneegass, chose “Remo”^{*} as a solution that was very well received by the attendees of the conference. In Remo, the virtual conference area was designed to mimic the originally planned location, the Zollverein UNESCO World Heritage site in Essen (cf., Figure 1). Besides a packed program of audio and video presentations, Remo allowed participants to gather at various locations within the virtual venue for conversations with a handful of their peers. Those locations included the virtual registration desk, the main room with several tables in front of a virtual stage, and also a lounge area for some relaxed socializing. Furthermore, a dedicated virtual location for any single virtual poster and demo exhibition was provided. This enabled the individual work to be presented in front of a smaller group in a personalized way on a versatile and interactive virtual whiteboard. The multitude of small-scale locations, allowing communication between a few attendees each, facilitated the overall online exchange and rich interactivity of the virtual venue.

The first day of the conference on Sunday, November 22, 2020, started with three workshops on the tangible web to support mobile and cross-device interactions, mixed reality applications for in-vehicle experiences in automated driving, and wearable designing for attention and executive control in implicit interaction. It was followed by a doctoral colloquium on Monday, November, 23, 2020 (for more about attending online

doctoral events, see the column in our October-December 2020 issue: 10.1109/MPRV.2020.3021300).

This year, articles accepted to the **9th ACM International Symposium on Pervasive Displays (PerDis)** could be presented at the MUM conference since the PerDis Symposium 2020 was canceled due to the prevalent pandemic. Overall, six articles were presented across a dedicated PerDis session and the session on health and wellbeing.

The main part of the conference was started by Pattie Maes of the MIT Media Lab, presenting a great opening keynote on enhancing human cognition. In her talk, she presented new types of wearable devices that monitor the user but that also can intervene and support people with new skills in live settings. This enables new opportunities for human studies in psychology and neuroscience or the creation of new products. Her work ranges from the topic of attention, to communication, also including memory and learning, as well as creativity and decision-making. One example is “AttentivU,” a system that can notify participants in a classroom setting or car drivers when their attention of the current situation begins to drift, positively enhancing their attention over time. Another system, “Dormio,” can support creativity by leveraging hypnagogic dreams, mimicking the steel-ball technique of Thomas Edison. Overall, her presentation was very inspiring and very well received by the audience.

Afterward, the program continued with a session on **mobile and wearable** computing. Radu-Daniel Vatavu and Jean Vanderdonckt presented a design space and the users’ preferences for graphical menus on smart glasses. Their findings are based on a larger user study ($N = 251$) and their results indicate key variables that influence user’s preference of the visual appearance of graphical menus. Christopher Clarke *et al.* explored an opportunity for private audio channels in public settings by correlating the real-time data of earphones’ inertial sensors against a camera recording. This allows the creation of applications that stream personal audio to each user by spontaneously associating an earable device with a camera view. In addition, Alexander Schiewe *et al.* investigated visualization approaches on a smartwatch for real-time feedback during running activities. To extend the capabilities of mobile devices that employ touchscreens, Huy Viet Le *et al.*

^{*}<https://remo.co>

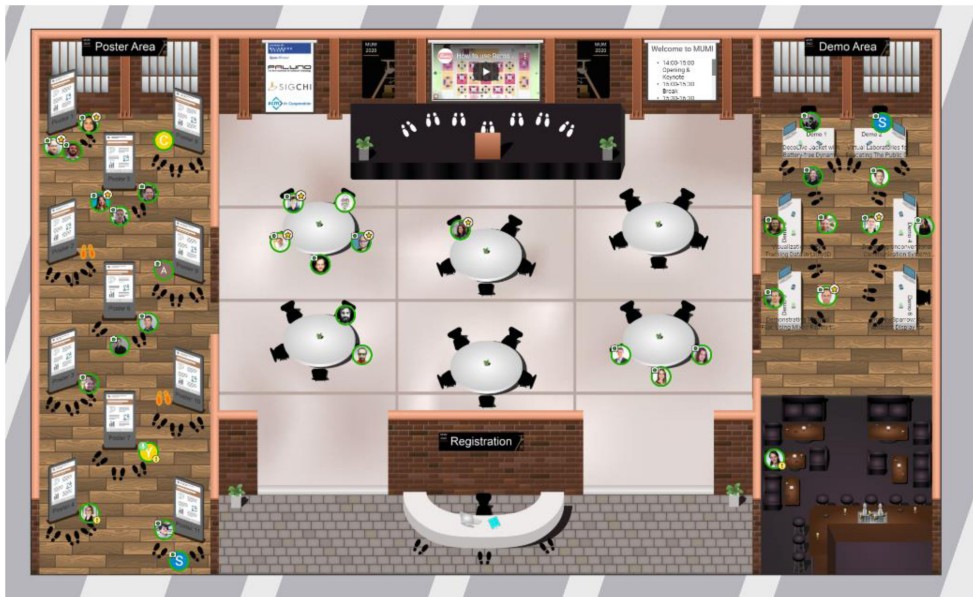


FIGURE 1. Virtual venue's design. Each (middle) table, poster stand (left), and demo table (right) is a small, self-contained virtual conferencing location that only connects participants who are at that specific location. The location could be changed via mouse click.

presented an always-available input technique that utilizes finger flexion on a touchscreen as another input modality. Finally, Vassilios Stefanis *et al.* explore challenges in mobile text entry using virtual keyboards for users with an impaired vision.

The final session for the day presented work related to the **smart home**. First, Alexandra Voit *et al.* explored nonurgent notifications in smart homes with the help of a smart plant system, followed by Eleftherios Papachristos *et al.* who employed multisensory ambient information displays as a notification delivery system for smart homes. Besides, their investigations of notification mechanisms, Alexandra Voit *et al.* also conducted an exploration on user acceptance and attitude toward smart speakers. They deployed such speakers in households and followed up with initial, mid-term, and final interviews over four weeks. Expectations were also explored by Karola Marky *et al.* in their article "You just can't know about everything," which concerned itself with the privacy demands of visitors to a smart home. They found that visitors have similar privacy preferences for existent smart devices as the owner of those devices, yet could not judge the consequences of data collection norexpress their privacy preferences.

The session on **mobility and urban life** was started by Minori Manabe *et al.* on the design of a telepresence system for exploring the city with personal guides., Ada Pozo *et al.* used mobile data to learn about urban nightlife routines of young people in a larger study ($N = 184$). Andreas Riegler *et al.* presented a research agenda for mixed reality in automated vehicles and only Andreas

Riegler presented "StickyWSD," where content positioning on a windshield display for automated driving was investigated. Moreover, Sarah Grace Dellana *et al.* compared voice interactions and a tangible shape-changing controller for collaboration around an interactive tabletop map.

The **health and wellbeing** session began with the presentation of a systematic review and sentiment analysis of online user reviews for fitness and nutrition mobile applications; this work was presented by Francisca Pimenta. Similarly, Lakmal Meegahapola *et al.* focused on understanding eating episodes of college students through mobile sensing to minimize user interaction for the generation of mobile food diaries. The remaining talks explored the user perception of AI-driven apps for mobile health diagnosis (Matthias Baldauf *et al.*), and X-ray visualization techniques in head-mounted optical see-through augmented reality (Uwe Gruenefeld *et al.*).

The day finished by building on previous discussions on **privacy**, with research talks ranging from the design and evaluation of a personal password meter (Ankit Kariryaa and Johannes Schöning) to aspects of protecting mobile food diaries from getting too personal (Lakmal Meegahapola *et al.*) and comparison of nudging mechanisms to raise awareness of mobile applications accessing the front-facing camera of a smartphone (Mariam Hassib *et al.*). Also presented in this session was research from Felix Anand Epp *et al.*, who used a field study to explore collocated sharing in public spaces. For their work, they were awarded an Honorable Mention award.

The final day of the conference discussed topics on **haptics and virtual reality (VR)**, as well as **augmented reality (AR) and learning**. For the former, Arthur Theil *et al.* developed “Tactile Board,” a multimodal augmentative and alternative communication device for individuals with deafblindness. Tactile patterns were the focus of work by Oliver Beren Kaul *et al.* They found that the recognition rate of on-the-head spatial tactile patterns is high and they present a detailed evaluation of the participant’s distinguishment of the patterns. Takuro Nakao *et al.* presented “FingerFlex,” a standalone glove that actuates the metacarpophalangeal joint of each finger via shape memory alloy to simulate the sensation of pressing a button. Hands were also a focus of Mostafa Elbeheri *et al.*, whose work was honored with this year’s Best Paper Award. Elbeheri *et al.* investigated the effect of a rigid-hand representation on presence when interacting with passive haptics controls in virtual reality, where they compared three conditions, “no hands at all,” “hands represented as a rigid 3D model,” and “hands represented as a rigid 3D model with a snapping mechanism.” Results of a between-subject user study ($N = 45$) show that a 3D model accompanied by a snapping mechanism significantly increased the sense of presence and user experience of their participants. Finally, Sarah Faltaous *et al.* presented an important work to increase safety in VR environments by using electrical muscle stimulation to prevent users from hitting physical obstacles. The stimulation actuates muscles that pull the wearer’s arm away before an actual collision happens.

The final session of MUM 2020 centered on **AR and learning**, with papers spanning science and music education, task learning, and game play. Francisco Kiss *et al.* presented their investigation of requirements for a virtual ubiquitous microscope, where users can zoom in on objects up to a microscopic level. This science theme was revisited at the end of the session by Pascal Knierim *et al.*, who compared learning experiences of physical lab setups and their virtual equivalent in augmented reality. In their work, they made users set up laboratory experiments with real lab equipment, nonfunctional tangible props, and virtual representations. Their results indicate that a virtual representation of the objects reduces the time needed to set up the lab experiment without affecting knowledge transfer, leading to the claim that tangibility is overrated. Beyond the sciences, Yara Fanger *et al.* described “PIANX,” a platform for piano players to alleviate music performance anxiety using mixed reality. Their platform includes two types of finger tracking based on a leap motion and see-through VR as well as three different settings where users can practice the instrument. They also implemented a mechanism for feedback in real time. With a more industrial focus, Jannike Illing *et al.* compared three different types of presenting

instructions to support workers in time-critical assembly tasks. By comparing a paper-condition, a camera-based see-through tablet as the second, and a head-mounted device for augmented reality as the third condition in a user study, they found that AR can improve the performance and understanding of time and spatial factors. Finally, Marco Kurzweg *et al.* Honorable Mention award-winning research found that characters in augmented reality can influence the decisions of a player by the way they behave. In the setting of an augmented reality trading card game, they found that posture can encourage or discourage the playing of a certain card, making games more interesting by adding a social component.

The conference finished with an exciting closing keynote on “Augmented Materiality” by Jürgen Steimle of Saarland University, Germany. In his work, he uses material aspects to augment human–computer interaction (HCI) but also uses HCI in turn to augment material aspects. He is creating novel interactive materials such as a wood veneer augmented with a display that also allows input. Other examples are stretchable materials, allowing for continuous input with rich tactile feedback. This type of material is more demanding from the perspective of the material due to its stretchability property than, for example, bending materials. Newly developed methods such as utilizing inexpensive printers and functional inks allow for mitigating challenges. This keynote was very well received and sparked a vivid discussion amongst the attendees.

In addition to the three noted awards (one best paper and two honorable mentions), Trinh-Minh-Tri Do and Daniel Gatica-Perez were awarded a 10-year impact award for their work “By their apps you shall understand them: Mining large-scale patterns of mobile phone usage.” The article was an early pioneer work in the study of app usage patterns and has been cited 85 times since 2010. Congratulations!

MUM 2021 will take place in Leuven, Belgium, from December 5–8, 2021. It will be hosted by Adalberto Simeone. For more information, see <http://mum-conf.org/2021>.

JONATHAN LIEBERS is currently a Ph.D. student at the Human–Computer Interaction Group, University of Duisburg-Essen. His research interest lies mainly within the field of usable security and implicit identification. Contact him at jonathan.liebers@uni-due.de.

ROMAN HEGER is currently a master’s student in computer science and a research assistant in the Human–Computer Interaction Group, University of Duisburg-Essen. He currently explores the field of input devices for virtual reality and IoT applications in health context. Contact him at roman.heger@uni-due.de.