Virtual and Augmented Reality in Everyday Context (VARECo)

Benjamin Weyers[1], Daniel Zielasko[1], Thiess Pfeiffer[2], Markus Funk[3]

Virtual Reality and Immersive Visualization Group, RWTH Aachen University[1]
Cluster of Excellence Cognitive Interaction Technology, University of Bielefeld[2]
Telecooperation Group, TU Darmstadt[3]

weyers@vr.rwth-aachen.de, zielasko@vr.rwth-aachen.de,
thies.pfeiffer@uni-bielefeld.de, funk@tk.tu-darmstadt.de

1 Introduction

In the last decade, Virtual and Augmented Reality (VR/AR) hardware has entered the consumer market, which expands the potential use of VR and AR in and everyday context, i.e., situations, environments or workflows that are part of everyday life. Examples may be the use of VR for data analysis as part of a data analyst's workflow or the use of AR for supporting spatially dispersed workers in, e.g., maintaining of technical systems. The introduction of VR and AR into the consumer market led to the situation in which not only companies and research institutions with large budgets are able to VR and AR but also smaller companies, educational institutions and everyone who is interested in VR and AR. While this expands the graphical applicability of VR and AR in everyday context, it simultaneously raises new challenges that need to be addressed in current and future research. These challenges are, for instance, the need for long-term use, the integration of hard- and software into existing work spaces, or the need for flexible and cheap creation of content (as in education). To support research and development in this area of interest, we proposed a workshop on VR and AR in Everyday Context (VARECo) bringing together interested researchers and practitioners to discuss current and future work in this research domain. The workshop is planned for MuC 2018 in Dresden.

2 Program, Target Audience, and Organization

The workshop is planned as a *one-day workshop* split into two parts. During the morning session, participants are asked to orally present their research work and systems, based on peer-reviewed papers that are submitted to the workshop. During the talks and the accompanying

Veröffentlicht durch die Gesellschaft für Informatik e. V. 2018 in
R. Dachselt, G. Weber (Hrsg.):
Mensch und Computer 2018 – Workshopband, 02.–05. September 2018, Dresden.
 https://doi.org/10.18420/muc2018-ws07-0185

discussions, the organizers will take notes and classify these for the discussion and working groups planned for the afternoon session. As further preparation, all notes will first be discussed in the audience, such that they can be adapted and extended as well as topics and problem domains can be identified. These smaller topics will be discussed in smaller breakout groups with the overall goal to characterize the research domain of VR and AR in an everyday context and to develop a design space for such systems, which also includes a set of overarching requirements characterizing the research and application domain. The latter is planned to be published in a common publication with all interested participants.

For the papers, we will invite potential participants to submit ongoing research and development work (explicitly including submissions from industry) as *4-6 pages papers*, which address the overall topic of the workshop. Thus, the *target audience* comprises researchers as well as developers and practitioners from industry who are invited to submit and present their (accepted) papers, participate in the workshop and contribute to the working groups in the afternoon session. We will advertise the workshop through its own web page (http://sites.google.com/view/vareco), which will include all details on the topics of the workshop, the submission process (including deadlines), the program, the program committee, as well as information on the workshop organizers. Additionally, we plan to use the supported ConfTool track to organize the submission and reviewing process of the papers.

3 Submission and Reviewing Process

In addition to the website, the workshop was advertised via various channels, such as mailing lists as well as via the website of Mensch und Computer 2018. For the submission process, the organizers followed the published timeline, which included a paper submission, notification, and camera ready deadline. The paper submission deadline was set to June 6, 2018 and extended for one week to June 13, 2018. Until June 13, we received 16 submissions in total, which all entered the reviewing process executed by the program committee of the workshop. Beside the organizers, the program committee consisted of the following persons:

- Jan Gugenheimer, University of Ulm
- Felix Hülsmann , University of Bielefeld
- Pascal Knierim, Ludwig-Maximilians-University Munich
- Eike Langbehn, University of Hamburg
- Florian Müller, Technical University of Darmstadt
- Patric Schmitz, RWTH Aachen University
- Carsten Schwede , University of Bielefeld
- Alexandra Voit, University of Stuttgart
- Stefan Werrlich, BMW München

We managed the reviewing process using ConfTool supported by MuC conference. For each paper, the reviewers submitted two reviews, which we distributed to the authors on time (with the notification deadline on June 27, 2018). Reviewers had to review 2-3 papers each.

From the original 16 submissions, we were able to accept 14 with minor revisions, while requesting major revisions for the remaining 2 papers. The authors of the 2 papers with major revision were invited to submit their revised paper to the organizers until July 9, 2018. Based on the revised paper, we were able to accept one additional paper for presentation. All finally accepted papers had to be resubmitted as camera-ready version through ConfTool until July 11, 2018. For the camera-ready version, we extended the possible size of the papers from 6 to *8 pages* as it turned out during the reviewing process that various submissions would benefit from 2 additional pages, which enabled authors to address the reviewer comments appropriately.

4 Submissions Overview

In this section, we give an overview of all submitted and finally accepted papers for presentation during the workshop in Dresden. For this purpose, we group the submissions into topics (focusing on the everyday life context) and additionally highlight whether they use VR, AR, or MR technology (indicated in square brackets as addition to the title). In general, the topics are everyday work, education & training, collaboration, cultural applications, recommender systems, and basic research & development. 10 out of the accepted 15 submissions use AR technology, 3 focus on VR and 2 submissions consider MR technologies. For the full citations and papers, please refer to the Mensch und Computer Workshop Proceedings accessible through the GI digital library.

4.1 Everyday Work

Augmented Reality to Support Temporal Coordination of Spatial Dispersed Production Teams [AR]
Annette Kluge (Ruhr University Bochum), Arnulf Schüffler (Ruhr University Bochum), Nikolaj Borisov (Ruhr University Bochum), & Benjamin Weyers (RWTH Aachen University)

This paper authored by Kluge, Schüffler, Borisov and Weyers presents preliminary work on the use of AR technology to support spatially dispersed team members in the control of technical systems. The major focus of the paper is the presentation of a user study design and the accompanied technical implementation of the proposed AR system. This implementation prototype uses AR-based augmentation of task and system related information based on predefined standard operating procedures (SOPs), which is called “gaze guiding” by the authors.

Mobile Projection-based Augmented Reality in Work Environments – an Exploratory Approach [AR]
Sebastian Büttner (Ostwestfalen-Lippe University of Applied Sciences & TU Clausthal), Andreas Besginow (Ostwestfalen-Lippe University of Applied Sciences), Michael Prilla (TU Clausthal), Carsten Röcker (Ostwestfalen-Lippe University of Applied Sciences & Fraunhofer IOSB-INA)

This paper authored by Besgino, Büttner, Prilla and Röckers presents a portable but not yet mobile version of a projection-based AR system to augment everyday working environments. The presented solution uses vision-based deep learning algorithms to identify objects and to track their spatial position in the physical environment. This enables the system to create correctly positioned in situ projection in changing working environments in large spaces.

AR in order-picking–experimental evidence with Microsoft HoloLens [AR]
Paula Bräuer (CAU Kiel), Athanasios Mazarakis (CAU Kiel)

This paper authored by Bräuer and Mazarakis presents a user study with 66 participants using the Microsoft HoloLens for an order-picking task in logistics. Besides describing the used AR method and the study design, they present quantitative as well as qualitative results gathered in the study. They highlight that the HoloLens in its currently available version shows certain ergonomic limitations, such as weight and how it has to be put onto the user's head. They argue that these limitations makes the HoloLens unusable. However, the qualitative results argue for the high potential of using augmentation in order-picking tasks.

A Virtual Reality Framework to Validate Persuasive Interactive Systems to Change Work Habits [VR]
Florian Langel (RWTH Aachen University), Yuen C. Law (RWTH Aachen University), Wilken Wehrt (RWTH Aachen University), Benjamin Weyers (RWTH Aachen University)

This paper authored by Langel, Law, Wehrt, and Weyers presents an approach for changing working habits by using a persuasive interactive system in an everyday working environment, such as an office. The authors highlight the challenge to evaluate such systems in realistic situations as these are embedded into working environments that may generate large biases due to uncontrolled changes and thus make effects hard to discover. Thus, they propose to use a virtual reality system to simulate realistic office working environments in a controlled manner. The paper presents a first prototype and a possible working habit to be investigated in a potential future study.

Integration of Augmented Reality into Professional Care Processes [AR]
Marc Janßen (TU Clausthal), Michael Prilla (TU Clausthal)

This paper authored by Janßen and Prilla presents the development process and implementation of AR technology into intensive home care. They follow a co-development approach to include observations the developers make during investigating the care process. The authors discuss the challenges that arose during the process and describe solutions. One is that there are no standard home care situations or procedures caused by the high individuality of patients caused for instance by their medical history. Another observations is the difference in expertise and the need of assistance care givers have. Nevertheless, that AR has high potential in supporting care givers in their everyday work.

4.2 Education and Training

ARBT: Augmented reality-based trainings for vocational trainers in the field of chemistry [AR]
Jens Hofmann (SBG Dresden)

This paper authored by Hofmann describes an approach to train VET trainers to use augmented reality to teach their students in operating a chemical plant. After a discussion of the requirements for the field of application, information on the current usage of technologies in VET classes is provided. In addition, the paper presents the conception of the teaching scenario together with a pilot study to evaluate its success followed by a discussion on the results of a pilot experiment.

Challenges and Opportunities of Mixed Reality Systems in Education [MR]
Pascal Knierim (LMU Munich), Thomas Kosch (LMU Munich), Matthias Hoppe (LMU Munich), Albrecht Schmidt (LMU Munich)

This paper authored by Knierim, Kosch, Hoppe, and Schmidt presents a discussion of the potential use of MR technologies in everyday education. They discuss and present the general problem domain, the potential use and gaps of nowadays MR technologies to be used in everyday education right away. This is followed by the discussion of some challenges from two perspectives considering a) the needs defined by learning and the pedagogical context and b) the technical challenges to be addressed if MR technologies should be used. From this, the authors deduce future opportunities and work that need to be conducted to make MR a successful technology for learning, which also includes an ubiquitous embedding into everyday learning context.

4.3 Collaboration

BeamLite – Mixed Reality zur Unterstützung von Remote-Meetings [MR]
Florian Jasche (University Siegen), Jasmin Kirchhübel (University Siegen), Thomas Ludwig (University Siegen), Corinna Ogonowski (University Siegen)

This paper authored by Jasche, Kirchhübel, Ludwig, and Ogonowski presents a concept for the use of mixed reality technology to support the collaboration (in the sence of a CSCW system) of remotely located persons. The concept comprises the immersion of users on varying levels, thus from VR to AR and between. The authors mainly argue that the concept suits specifically scenarios in which distributed groups of persons want to collaborate, which themselves are located in the same room. The discussion is supported by an empirical pre-study, which offers insights that were used to gather the described concept.

4.4 Cultural Applications

InfoGrid: Acceptance and Usability of Augmented Reality for Mobiles in Real Museum Context [AR]
Alexander Ohlei (University of Lübeck), David Bouck-Standen (University of Lübeck), Thomas Winkler (University of Lübeck), Michael Herczeg (University of Lübeck)

This paper authored by Ohlei, Bouck-Standen, Winkler, and Herczeg presents an AR mobile app for museum visitors. The authors highlight the added benefit of augmented exhibits compared to traditional physical-only artifacts. For the discussion, they use a scenario description that enables to comprehend the exhibit from a visitor's perspective. Additionally, they present

a usability study that was carried out during an event in a museum, which shows an overall positive feedback for the developed app.

InfoGrid: An Approach for Curators to Digitally Enrich their Exhibitions
Alexander Ohlei (University of Lübeck), David Bouck-Standen (University of Lübeck), Thomas Winkler (University of Lübeck), Michael Herczeg (University of Lübeck)

This paper authored by Ohlei, Bouck-Standen, Winkler, and Herczeg presents InfoGrid, a system that enables museum professionals to enrich their exhibitions through overlaying the exhibits with additional media. They present two different tools, which together build the system: the web-based content management platform, the ALS-portal, and the NEMO framework handling the created data through the ALS-portal and provide this data to a mobile AR system used in the exhibition. The authors give design rationals and even present an "envisioned scenario" how to interact with the system. Additionally, they present an actual deployment of the system at the "Bremische Bürgschaft".

4.5 Recommender Systems

Augmented Reality Based Recommending in the Physical World [AR]
Jesús Omar Álvarez Márquez (University of Duisburg-Essen), Jürgen Ziegler (University of Duisburg-Essen)

This paper authored by Marquez and Ziegler presents first results as well as the ongoing work investigating the potential use of AR technology for recommending in the physical environment. The paper discusses the potential use and highlights the major research question that needs to be addressed to turn the technology's benefit into reality. The authors present a small user study conducted to investigate the potential impact of AR for recommending. The study with 15 participants showed that the design of the augmented information has to be developed with care and focus on the task and use case under consideration. The authors additionally argue that the current restriction of AR technology still hinders the development of successful real-life-use scenarios for recommending in the physical world. From this observation, they present future research directions and a set of major research questions they are currently investigating.

4.6 Basic Research and Development

Seamless Hand-Based Remote and Close Range Interaction [VR]
Daniel Zielasko (RWTH Aachen University), Uta Skorzinski (RWTH Aachen University), Torsten W. Kuhlen (RWTH Aachen University), Benjamin Weyers (RWTH Aachen University)

This paper authored by Zielasko, Skorzinski, Kuhlen and Weyers describes an interaction method for remote and close range virtual targets that can be used in augmented and virtual reality. The paper describes and discusses this method and compares it to methods from the literature by giving an overview of the most common practices in this regard (virtual hand,

HOMER, go-go technique) and focuses on the transition between the close and distant range. Additionally, they discuss potential limitations the technique might have.

HoloR: Spatial AR as a prototyping environment for wide FOV AR applications
Carsten Schwede (University of Bielefeld), Thomas Hermann (University of Bielefeld)

This paper authored by Schwede and Hermann presents a room-size projection system for the simulation of wide FOV AR for various types of applications. The authors highlight the problem of current AR systems regarding strong restrictions due to the supported field of view. The proposed solution, which enables research for wide FOV AR applications, is the simulation with a room-sized projection system. In addition to the description of the system, the authors present a comprehensive overview of potential future applications they plan to investigate using the system.

A Prototypical System for Environmental Influences in Virtual Reality [VR]
Mario Heinz (Ostwestfalen-Lippe University of Applied Sciences), Henrik Mucha (Ostwestfalen-Lippe University of Applied Sciences)

This paper authored by Heinz and Mucha explores opportunities to experience environmental conditions such as wind in VR. The authors developed a prototypical system to experience wind and heat changes in VR using a regular fan and a heat lamp connected to their system. Finally, the authors tested their prototype during a one-week workshop where students where developed interactive virtual environments to solve a criminal case or to escape a room by following different hints. Their results show that integrating environmental conditions such as wind has the potential to enhance the realism of virtual scenes.

We should start thinking about Privacy Implications of Sonic Input in Everyday Augmented Reality! [AR]
Katrin Wolf (HAW Hamburg), Karola Marky (TU Darmstadt), Markus Funk (TU Darmstadt)

This paper authored by Wolf, Marky, and Funk addresses privacy implications of sonic input devices in the contest of everyday use of AR technology. They argue that privacy issues of sonic devices are not frequently discussed, even though many devices are already used in everyday situations. To support this points, the author present various situations in which sonic input devices are used and they discuss ideas on how to obtain better privacy conditions. From this, they discuss possible solutions to be investigated in future work, such as the control of permission, add signal-based switch or noise, use mode transparency, and finally to use explicit command to active sonic input.

5 Conclusion

In conclusion, we were able to attract various HCI researchers interested in VR, MR, and AR technology used in everyday context to submit a paper and to present their individual perspective on work in this regard. The workshop comprises the presentation of various tools, methods and approaches in the context of the research area of everyday VR/AR/MR, which will support

a broad discussion of the topic in Dresden and the possibility to shape the area in more detail by collaboratively developing a design space for VR/AR/MR in everyday context.

The Organizers

Benjamin Weyers is a post-doctoral researcher at the Virtual Reality and Immersive Visualization group at RWTH Aachen University. He received his PhD in 2011 from the University of Duisburg-Essen and joined RWTH in 2013. He is interested in the development and research on interactive analysis methods for abstract and scientific data using immersive systems as well as the integration of VR and AR into the control of technical systems for the support of human users in semi-automated control scenarios.
https://sites.google.com/site/benniweyers

Daniel Zielasko is a PhD candidate at the Virtual Reality and Immersive Visualization group at RWTH Aachen University. He received his Master degree in 2013 at RWTH and is now working on the integration of VR technologies and methods into existing analysis workflows. Furthermore, he has a special interest in the prevention of cybersickness and the design of convincing 3D user interfaces and feedback.

Thies Pfeiffer is working at CITEC, Bielefeld University, as technical director of the Virtual Reality Laboratory and the Immersive Media Lab. He received his PhD in 2010 from Bielefeld University and joined CITEC in 2013. His research is focused on human-machine-interaction with immersive media, in particular using natural interaction techniques, such as gestures or eye gaze. Primary domains of application are virtual training, virtual prototyping and assistance systems. https://cit-ec.de/de/zentrallabor/staff/dr-rer-nat-thies-pfeiffer

Markus Funk is a post-doctoral Human-Computer Interaction researcher and area head at the Technical University of Darmstadt. He is an expert in Augmented Reality, Virtual Reality, and Human-Drone Interaction. Markus is interested in using Virtual Reality for education and is further researching how Virtual Reality can be made more immersive by using haptic feedback. http://www.makufunk.de