David Unbehaun, Christoph Mall, Jan Ellinger, Aydin Coskun, Jule Jensen, Konstantin Aal, Sarah Rüller, Eckehard Moritz, Charlotte Meixner, Urban Plangger and Volker Wulf (2022): Augmented-Reality Approaches in Computer Supported Collaborative Sports: Early Empirical Insights explored from and designed with with Sport Associations. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Posters and Demos, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_p07

Augmented-Reality Approaches in Computer Supported Collaborative Sports: Early Empirical Insights explored from and designed with with Sport Associations

David Unbehaun[1], Christoph Mall[2], Jan Ellinger[2], Aydin Coskun[1], Jule Jensen[1], Konstantin Aal[1], Sarah Rüller[1], Eckehard Moritz[3], Charlotte Meixner[3], Urban Plangger[4], Volker Wulf[1]
University of Siegen[1]; Technical University Munich[2]; Innovationsmanufaktur GmbH[3]; UVEX SPORTS GROUP GmbH & Co. KG[4], Germany

Abstract. This work presents a practice-based design and research approach that was used to explore individual, contextual, and institutional requirements, conceptualize and design AR-based Outdoor-scenarios for individual and joint activities in outdoor sports. Based on the need for social interaction and computer-supported collaborative sports and the decreasing physical activity across all ages, game scenarios for the context of outdoor sports were formulated and implemented with a head-worn multimodal AR interface. Members from seven different sports associations were interviewed and design workshops conducted to understand how to design AR-applications to promote an active lifestyle. The prototype and approach presented here will serve to discuss and reflect our future research activities, methodological concepts, and experiences in the field of HCI, CSCS, CSCW, and Design Communities.

Introduction

A sedentary lifestyle, stress at work and omnipresent availability of industrialized food – collateral consequences of today's civilization and economic growth – create enormous new challenges to the state of health of many people [12, 21]. Physical Activity (PA) decreases, whereas obesity, diabetes, heart diseases and other related health problems increase almost worldwide [20]. PA refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work [21]. Furthermore, the reported prevalence of physical inactivity, as well as the high prevalence of mental health problems, can be linked to factors of increasing urbanization: An increase in land sealing as well as more difficult access to urban green spaces, especially for socio-economically disadvantaged populations. In contrast, a wide range of positive effects on health, cognition, and learning levels have been shown for the passive stay in as well as the active use of urban and rural open green spaces. The presence of green spaces in urban areas and the active usage is associated with enhanced PA, social interaction and mental restoration, stress reduction and enhanced vitality [4,5,22]. Already the exposure to nature alone can be seen as a preventive factor for psychological diseases [8]. Exercising in nature can then improve mood, self-esteem, and stress [9]. Tying in with new hybrid forms of exercise, as seen in the genre of Exergames and the example of Pokémon Go [1], the field of Computer-supported collaborative sports tries to make use of new technologies by expanding sports experiences through Visual Augmentations [16].

Users of sports games, for example, can receive additional information in real-time and in real-life environments during gameplay and experience a range of innovative forms of activity through augmented reality and mixed reality technologies (MR). AR glasses are already available in cycling, in areas such as movement training and rehabilitation [3] in billiard and table tennis [19], or sport climbing [7].

Prospective research directions refer to the opportunity to use AR more commonly on a recreational level, such as making sports more challenging by designing visual obstacles [19] or enabling the users to manually set their training, as is already the case in Augmented Climbing [7]. The related research stresses the importance of motivational, social, and acceptance factors to support individual and social sports activity [16].

Designing ICT-based systems to foster access and promote participation in PA, sports and social participation across all ages and abilities requires researchers and developers to explore individual and social daily life practices and motivational backgrounds of people involved in all forms of sports [1,2,11,12,16,17]. Additionally, of importance is the role that technology nowadays has and how it can impact the motivation and continuation of daily practices in sports and PA [10,13–15].

Our study aims to design and develop an AR-based system to foster physical activity, facilitate social interaction as well as create new innovative ways to access and promote sports and active participation across all ages and abilities. In this paper, we present insights from a project that identified individual and organizational requirements, designed, and developed an ICT-based System aiming to adapt sports activities, such as trim-trails or marathons, and combine them with AR approaches and multi-user applications to create new multimodal scenarios in collaborative and competitive individual and social outdoor interactions. The system was contextualized, designed, and developed with actors (athletes and clubs) and additional stakeholders (associations and multipliers). By exploring heterogeneous requirements and implementing the system in sport-communities, the goal is to enable an innovative and active social lifestyle for various social groups and establish a socio-technical "innovation space" [6], which promotes transfer innovations from academia and various industries into individual and institutional practices.

Methods, Data and Research Questions

Research Approach and Data Collection

As part of an interdisciplinary research project involving different research domains, including sports sciences, soft- and hardware engineering, and HCI, as well as sport associations institutions, we aim to develop the system and the practical scenarios together with the target group (athletes, clubs, associations, and municipalities) to identify factors in the early stages of development that are relevant for the continuous use of the solution. The paper work seeks to address the following research questions: 1) Which specific practice-based factors are concerned in designing an AR-based system to foster physical activity, enable social collaboration and encourage their long-term use, and 2) to what extent can individual and social activities in the context of sports be supported by AR-based activities? Regarding data collection, we followed the Design Case Study Approach by Wulf [18] by applying different methods and instruments from the fields of human-computer interaction (e.g., different levels of prototyping) and qualitative

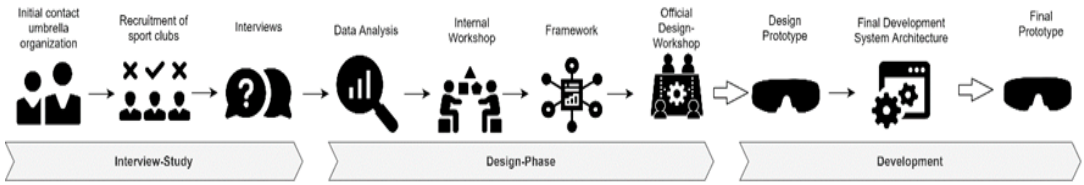

Figure 1: Project design and research stages

research (e.g. interviews, design workshops, participant observations). Our stakeholder network consists of practice partners from various political actors, sports clubs, and associations (see table 1) from different cities and rural areas. To gain meaningful insights into the structure, daily routines, and organization of sports associations, we began with an empirical study regarding existing practices, organizational and social perspectives, individual and social needs, and the challenges confronting our target group in their everyday surroundings. This involved semi-structured interviews with different sports associations.

Right from the outset, the approach enabled an open collaboration amongst a variety of actors, reflecting their different perspectives, knowledge, interests, and expectations. In a second, iterative step, we conducted a design workshop together with managers, training group leaders and sport club members to discuss possible scenarios, use cases, technical restrictions, and barriers. Following the pre-study, we applied a two-step approach in terms of data collection: In the first step, we conducted several semi-structured interviews. We emerged themes from the transcript that then served as anchor points for design workshops with the interview partners (Figure 1). After analyzing the data gathered during these interviews and workshops, we condensed a set of design challenges. Based on the initial interviews and internal workshops, the idea of a cooperative and competitive AR-Setup with various features evolved, which was then introduced to the sports associations and their members in the joint design workshop. All researchers participated in three sets of internal design workshops with different foci in which we developed the technical, organizational and social framework.

Participants and Data Analysis

The study included overall 11 participants from sport associations with different backgrounds (see table 1 for an overview) and 9 members of the research and development team. We conducted the interviews and the design-workshop by using Zoom, since the pandemic situation would not allow personal contacts during this time.

Table 1: Participant Overview

ID	Participant	Role	Institution
1	Mr. S	Project Manager	Local Umbrella Organisation <Name>
2	Mr. R	Regional Coordinator	Local Umbrella Organisation <Name>
3	Mr. B	Manager	Sports Association <Name> with > 50 members
4	Ms. S	Manager & Training Group Leader	Sports Association <Name> with > 500 members
6	Mr. G	Manager & Training Group Leader	Sports Association with > 450 members
7	Ms. K	Sports club member	Sports Association with > 450 members
8	Mr. D	Manager	Sports Association with > 200 members
9	Mr. R	Sports club member	Sports Assocation with > 200 members
10	Mr. F	Manager	Sports Assocation with > 80 members
11	Mr. B	Sports club member	Sports Assocation with > 80 members
12	Mr. U	Researcher in HCI	University of <Name>
13	Ms. J	Researcher in HCI	University of <Name>
14	Mr. C	Researcher in HCI	University of <Name>
15	Mr. F	Researcher in HCI	University of <Name>
16	Mr. A	Researcher in HCI	University of <Name>
17	Mr. P	Co-Founder	Sports Equipment Company <Name>
18	Mr. T	Co-Founder	Creative Management Solutions Company <Name>
19	Ms. M	Researcher and Project Manager	Creative Management Solutions Company <Name>
20	Mr. M	Researcher in Sport Science	Technical University of <Name>

The qualitative data consisted of audio recordings and field notes collected during the interviews and workshops. Our data analysis was performed using a Thematic Analysis (TA) approach [5]. This involves a series of established steps, including open coding of the data material, systematic revision of the coded segments, and identification of code families and their relationships in the search for themes [10]. After the transcription of the interviews, the transcripts were reviewed and coded in an iterative process leading to the compilation of the data categories present in the collected data and to the elaboration of relationships between these categories. In this analysis, we used a combination of bottom-up and top-down approaches to coding, which is very characteristic of TA. We started with the top-down approach by looking for excerpts that would fit the a priori codes we had developed. These were based on the interview guides used for the semi-structured interviews. We identified the following principal themes during the coding sessions: individual adaptability; social aspects; and technical requirements. These overarching themes were derived from our original codes, which included terms such as motivation, interaction, participation, engagement, movement, etc. Coding differences were discussed and eliminated by adding, editing, or deleting codes according to the outcome of the discussion.

Preliminary Findings

Individual and Institutional Customizability

The conducted interviews showed that there is a rising importance of digitalization within sports associations. Mr. D, the manager of the senior hiking sports association, explained: "*The tendency of digitalization has to happen within the next years. It is essential for sports clubs to keep their members and offer something attractive*". Similarly, Mr. B, the manager of a sports association founded in 2017, stated that additionally to the regular training practices, they "*want to achieve a digital regularity*". The most common reason for digitalization amongst the interviewees was the facilitation of data collection and thus training optimization and analysis. Most of the "*athletes that are to some extent ambitious already use sports watches*" described Ms. S, the manager and training group leader of a sports association with 500 members. Mr. G, a manager and training group leader of a sports association with 450 members, described how the athletes are mostly more digitally involved than he is when it comes to collecting data: "*Almost all of them have sports watches now. When they are done with their training, their watches show their timing. They tell me what the watch says, and I note them into my chart by hand*". Furthermore, Mr. G wished for a possibility to immediately transfer the athletes' data to his technical device and continued to express: "*It would be sensational if I could immediately analyze their data and my feedback in return would be instantaneous and always accessible*". The use of technology was not only perceived as convenient for the sports group trainers but also for the athletes themselves. As Mr. G ideated:

"*If the performance-driven athletes could see their development within the last weeks. What kind of training was beneficial or what do I still need to improve? Where are my weaknesses? Where are my strengths? And to be able to analyze that and compare it to another athlete that might have similar abilities*".

Besides the facilitation of training analysis, Mr. B emphasized the possibility of using that data to create individualized training offers through "*an app, based on the scope of previous training*". During the workshop, one participant suggested using your own data for a "*virtual race against the own personal best*". Ms. K, who is a sports club member herself, pointed out the recent importance of collecting data for the sake of sharing it online: "*If you did not record and upload an activity, it does not count*".

During the interviews and the workshop, the participants were asked to name what they consider to be the most essential functions and technical requirements of sports wearables. Mr. G emphasized the importance of "*a stopwatch to measure lap times*". Ms. S mentioned the importance of a "*route map*" and further explained, "*it is essential to explore new routes or retrace them*". During the workshop, one

participant stated: "*The wearable should convey some kind of diagnosis or motivation without the necessity to look on my watch*".

Social Connectedness and Motivational Aspects

The manager of a triathlon sports club, Mr. B, stated during the interview that "*feedback received through technology might be motivating but it is not essential*". Referring to digital sports watches used by members, he concluded: "*If you improved, you'll immediately get feedback on your watch. That can definitely motivate but to be honest, when looking at the whole season, the most motivating part is the competitions*".

The competitions turned out to be the most prominent factor in all the interviews we conducted. Mr. B mentioned in the initial interview, "*I know that the athletes miss one thing most during the pandemic: The competitions*". Due to the COVID-19 pandemic, training and competitions no longer took place, leading to interviewees pointing out how the athletes miss training and competing with all its long-term individual and social preparations and implications). During our Co-Design Workshop, one training group leader stated: "*In times where the direct comparison is not possible, the digital one is even more important*". Similarly, it was mentioned by Mr. G that the "*community that wants to compare themselves is very big*". Competitions were described as not only being motivating because of wanting to win but also the social component, "*to be together and talk about the great competition afterwards"* as argued by Mr. B. Other factors mentioned were the involved playfulness and related motivational aspects. For example, Ms. S mentioned, "*I always say: Adults turn into children when involved in activities that include competition*", and that in terms of group dynamics and competitions, "*everyone automatically wants to be a part of it*".

As seen in the foregoing statements, competitions were identified as an essential motivator for most athletes. Yet, not only for the reason of competing. It turns out to be of similar importance to cooperate as a team as well as to experience the competition together. As Ms. S, the manager of a sports club with approx. 500 members stated: "*Most members are in the sports club because they want social connection*". The social connection includes both the connection to other members as well as their connection to the trainers. As one manager pointed out: "*We realized that we have to keep in contact or else our members will leave*". The interviewees emphasized the importance of integrating a social component into sports technology. During our workshop, we explored several other scenarios that technology could achieve with the participants. One workshop attendant ideated: "*It would be great to compete in a race as a team, so that everyone is wearing augmented glasses and can see where everyone else is*". Another interviewee

suggested the following scenario: "*If you could meet together virtually, 2 pm Saturday, us three will meet for running, maybe two will take the bicycle, five are hiking with their parents, but all together. Having digital groups that can meet*". Another suggestion was to create a social sports platform that allows people to "*create small challenges, for example jumping across three rocks, and if you complete other people's challenges, you'll get an achievement*".

Design Concept and Outlook

Based on the empirical findings from the conducted interviews and the design workshop, several design challenges and scenarios were identified, which are the basis for the concept of the overall system. This illustrates how the overarching framework, scenario and technical infrastructure evolved and was developed. As stated, the participants considered it important that the data during the sporting activities are tracked and that feedback can also be derived from this in various dimensions (sports-related, but also health-related). Here it is important to provide different views on the same data as athletes and sports group trainers have different use cases; while the athlete wants to improve their time or keep track of the oxygen saturation and heart rate, the trainer can use the data to create individual training recommendations and keep track of the progress.

Another important element for the interview partners was the social component. Especially during the pandemic, training in groups was limited and smaller and larger competitions were completely canceled. Therefore, it was emphasized repeatedly that training together but also competing against each other must become an important part of the system. ICT can support this by providing different modes of cooperation or competition: by using a combination of different technologies the users can work out alone or use different features to do sports together or against each other. Based on this feedback, we have tried to develop scenarios on how the system can support multi-user activities. In the following we will focus on a scenario, where two groups consisting of two users are competing with each other.

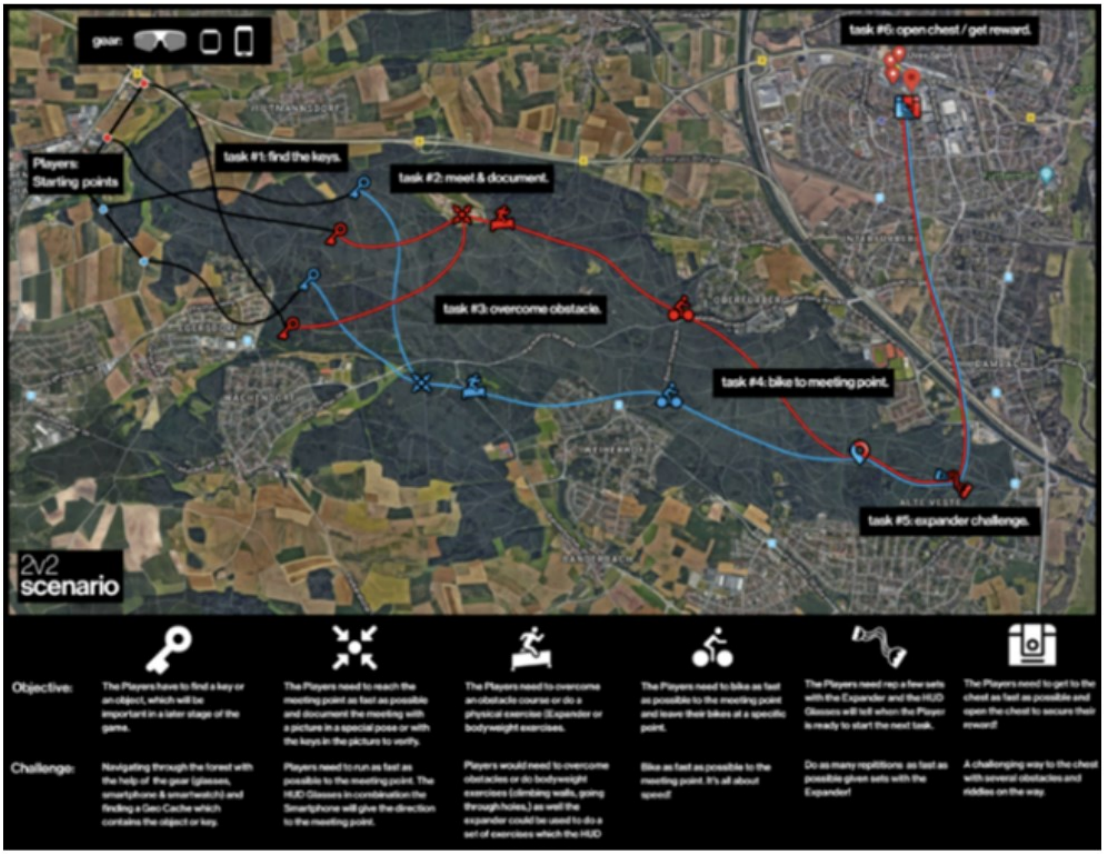

Figure 2: 2 vs. 2 Game mode

There are a lot of possibilities on how to organize a collaborative or competitive scenario in outdoor group interactions with Augmented-Reality solutions. We decided to combine both the collaborative and competitive elements which can be used in many different variations in a 2 vs. 2 example (see Figure 2). The displayed movements of the one team are colored in red and these of the others in blue. This specific scenario is divided into 6 tasks. Each task is important for the final task which will be to find and unlock the chest with a key or a digital code to get the reward. 1).

The players will start by foot at the same time and their first task will be to find the “keys” as fast as possible to then further proceed in the process of finding the chest. With the help of the technical equipment (AR glasses, smartphone & smartwatch) the players need to navigate through the forest and find a geocache that contains the object or key. 2)

The next task will be to get to the meeting point, where the team members of each team will meet, and must “verify” by documenting themselves with a picture in a special pose or scanning each other’s devices.

3) This task will be a physical task where both team members with the help of each other need to special tasks that can be defined by themselves or their trainer.

After reaching the final point of task three, the teams will get the next information for the upcoming task. After the physical exercise, the players need to reach a point where they can grab a bike and need to reach the next point as fast as possible.

4) Reaching the Expander Challenge, the players leave their bikes and are required to do a few sets with an Expander which is connected to the AR glasses. After finishing a specific amount of sets the system will inform the teams that they can proceed to the next and final task.

5) On the final task the teams will need to cross a course of obstacles filled with physical or cognitive exercises and games which need to be solved to get to the reward.

6) Finally, the chest can be opened with the key or key fragments which the teams obtained by finishing the different tasks on their way.

Discussion and Conclusion

To conclude, our work combines an early user integration by the different conducted participatory approaches and a simultaneously developed multi-user and multi-device AR-technology with the aim to promote PA and health from a long-term perspective. Our qualitative inquiry revealed that digital technologies are becoming more and more important in traditional sports clubs, from an athlete-, trainer- as well as management staff perspective. However, many study participants are not well informed on how to best implement such technologies into the regular training process and asked for further advice and guidance. Communication, social collaboration, as well as competition have been identified as the most important features of successful sport club activities. Future research and development in digital technologies should encompass these aspects to be able to create a successful appropriation and to fulfill user needs and expectations. With our qualitative approach, we do not aim to generalize our findings to a broader population but to elaborate deep insights into users' needs and specific circumstances.

Furthermore, due to the COVID-19 pandemic, we were not yet able to perform user tests in real-world environments so far. Therefore, in the upcoming work of our research project, we aim to implement a practice-based research and development approach to further evaluate the potential of the new multimodal, inclusive interaction techniques and collaborative AR environments in sport- and exercise-related contexts. For this purpose, the innovative AR-supported exercise concept based on a "Trim-Trail" will be further developed, implemented, and evaluated to offer natural, effective and uncomplicated green exercise opportunities, training exercises and methods for all genders, ages and fitness levels.

The project is intended to be used as a variety of assessments and method of measures to promote an active lifestyle and at the same time build a bridge to social life (club, association, city, and community) in a local but also supra-regional context. Based on an immersive and multi-user capable AR-technology, an innovative, individualizable opportunity of movement and cognitive training for the purpose of health promotion will hence be created. These multi-user sports- and exercise-related applications to be developed will be researched with regard to their suitability for everyday use and user acceptance of AR-systems as well as their individual physiological and social-emotional effects and evaluated in a proof-of-concept.

References

1. Konstantin Aal and Helmut Hauptmeier. 2019. Pokémon GO: Collaboration and Information on the GO. https://doi.org/10.18420/ECSCW2019_EP04
2. Michael Ahmadi, Anne Weibert, Corinna Ogonowski, Konstantin Aal, Kristian Gäckle, Nicola Marsden, and Volker Wulf. 2018. Challenges and lessons learned by applying living labs in gender and IT contexts. In *Proceedings of the 4th Conference on Gender & IT - GenderIT '18*, 239–249. https://doi.org/10.1145/3196839.3196878
3. Fraser Anderson, Tovi Grossman, Justin Matejka, and George Fitzmaurice. 2013. YouMove: enhancing movement training with an augmented reality mirror. In *Proceedings of the 26th annual ACM symposium on User interface software and technology*, 311–320. https://doi.org/10.1145/2501988.2502045
4. Agnes E. van den Berg, Jolanda Maas, Robert A. Verheij, and Peter P. Groenewegen. 2010. Green space as a buffer between stressful life events and health. *Social Science & Medicine* 70, 8: 1203–1210. https://doi.org/10.1016/j.socscimed.2010.01.002
5. Payam Dadvand, Mark J. Nieuwenhuijsen, Mikel Esnaola, Joan Forns, Xavier Basagaña, Mar Alvarez-Pedrerol, Ioar Rivas, Mónica López-Vicente, Montserrat De Castro Pascual, Jason Su, Michael Jerrett, Xavier Querol, and Jordi Sunyer. 2015. Green spaces and cognitive development in primary schoolchildren. *Proceedings of the National Academy of Sciences* 112, 26: 7937. https://doi.org/10.1073/pnas.1503402112
6. Mónica E. Edwards-Schachter, Cristian E. Matti, and Enrique Alcántara. 2012. Fostering Quality of Life through Social Innovation: A Living Lab Methodology Study Case: Social Innovation and Living Labs. *Review of Policy Research* 29, 6: 672–692. https://doi.org/10.1111/j.1541-1338.2012.00588.x
7. Raine Kajastila, Leo Holsti, and Perttu Hämäläinen. 2016. The Augmented Climbing Wall: High-Exertion Proximity Interaction on a Wall-Sized Interactive Surface. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 758–769. https://doi.org/10.1145/2858036.2858450
8. Florian Lederbogen, Peter Kirsch, Leila Haddad, Fabian Streit, Heike Tost, Philipp Schuch, Stefan Wüst, Jens C. Pruessner, Marcella Rietschel, Michael Deuschle, and Andreas Meyer-Lindenberg. 2011. City living and urban upbringing affect neural social stress processing in humans. *Nature* 474, 7352: 498–501. https://doi.org/10.1038/nature10190
9. Mike Rogerson, Valerie Gladwell, Daniel Gallagher, and Jo Barton. 2016. Influences of Green Outdoors versus Indoors Environmental Settings on Psychological and Social Outcomes of Controlled Exercise. *International Journal of Environmental Research and Public Health* 13, 4: 363. https://doi.org/10.3390/ijerph13040363
10. David Unbehaun, Konstantin Aal, Felix Carros, Rainer Wieching, and Volker Wulf. 2019. Creative and Cognitive Activities in Social Assistive Robots and Older Adults: Results from an Exploratory Field Study with Pepper. https://doi.org/10.18420/ECSCW2019_P07

11. David Unbehaun, Konstantin Aal, Daryoush Daniel Vaziri, Peter David Tolmie, Rainer Wieching, David Randall, and Volker Wulf. 2020. Social Technology Appropriation in Dementia: Investigating the Role of Caregivers in Engaging People with Dementia with a Videogame-based Training System. 1–15. https://doi.org/10.1145/3313831.3376648
12. David Unbehaun, Sebastian Taugerbeck, Konstantin Aal, Daryoush Daniel Vaziri, Jasmin Lehmann, Peter Tolmie, Rainer Wieching, and Volker Wulf. 2020. Notes of memories: Fostering social interaction, activity and reminiscence through an interactive music exergame developed for people with dementia and their caregivers. *Human–Computer Interaction*: 1–34. https://doi.org/10.1080/07370024.2020.1746910
13. David Unbehaun, Daryoush Daniel Vaziri, Konstantin Aal, Rainer Wieching, Peter Tolmie, and Volker Wulf. 2018. Exploring the Potential of Exergames to affect the Social and Daily Life of People with Dementia and their Caregivers. 1–15. https://doi.org/10.1145/3173574.3173636
14. Daryoush D. Vaziri, Konstantin Aal, Corinna Ogonowski, Thomas Von Rekowski, Michael Kroll, Hannah R. Marston, Rakel Poveda, Yves J. Gschwind, Kim Delbaere, Rainer Wieching, and Volker Wulf. 2016. Exploring user experience and technology acceptance for a fall prevention system: results from a randomized clinical trial and a living lab. *European Review of Aging and Physical Activity* 13, 1. https://doi.org/10.1186/s11556-016-0165-z
15. Daryoush Daniel Vaziri. 2018. *Facilitating Daily Life Integration of Technologies for Active and Healthy Aging*. Springer Fachmedien Wiesbaden, Wiesbaden. Retrieved January 10, 2021 from http://link.springer.com/10.1007/978-3-658-22875-0
16. Volker Wulf, Eckehard F. Moritz, Christian Henneke, Kanan Al-Zubaidi, and Gunnar Stevens. 2004. Computer Supported Collaborative Sports: Creating Social Spaces Filled with Sports Activities. In *Entertainment Computing – ICEC 2004*, Matthias Rauterberg (ed.). Springer Berlin Heidelberg, Berlin, Heidelberg, 80–89. https://doi.org/10.1007/978-3-540-28643-1_11
17. Volker Wulf, Claudia Müller, Volkmar Pipek, David Randall, Markus Rohde, and Gunnar Stevens. 2015. Practice-based computing: Empirically grounded conceptualizations derived from design case studies. In *Designing Socially Embedded Technologies in the Real-World*. Springer, 111–150.
18. Volker Wulf, Markus Rohde, Volkmar Pipek, and Gunnar Stevens. 2011. Engaging with practices: design case studies as a research framework in CSCW. 505. https://doi.org/10.1145/1958824.1958902
19. Hui-Shyong Yeo, Hideki Koike, and Aaron Quigley. 2019. Augmented Learning for Sports Using Wearable Head-worn and Wrist-worn Devices. In *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, 1578–1580. https://doi.org/10.1109/VR.2019.8798054
20. Obesity and overweight. Retrieved September 9, 2021 from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
21. Physical activity. Retrieved September 9, 2021 from https://www.who.int/news-room/fact-sheets/detail/physical-activity
22. Urban green space interventions and health: A review of impacts and effectiveness. Full report (2017). Retrieved September 9, 2021 from https://www.euro.who.int/en/health-topics/environment-and-health/urban-health/publications/2017/urban-green-space-interventions-and-health-a-review-of-impacts-and-effectiveness.-full-report-2017