An Academic Conference in Virtual Reality? – Evaluation of a SocialVR Conference

Miriam Mulders
Learning Lab
University of Duisburg-Essen
Essen, Germany
miriam.mulders@uni-due.de

Raphael Zender
Institute of Computer Science
University of Potsdam
Potsdam, Germany
raphael.zender@uni-potsdam.de

Abstract—One of the first academic conferences in head-mounted display (HMD)-based Social Virtual Reality (SocialVR) was realized. The conference aims to support knowledge acquisition and informal exchange regarding the technology SocialVR itself and the use of Virtual and Augmented Reality technologies (VR/AR) in vocational education. The paper presents results of an explorative study of 75 conference participants. Results indicate that SocialVR is generally suited to host an academic conference. In some areas, it seems inferior or equivalent to other digital formats or face-to-face events. In other areas, it offers added value. Further research is needed to take advantage of these positive effects.

Index terms—virtual reality, SocialVR, academic conference, AltspaceVR, evaluation, social presence

I. Motivation

Virtual Reality (VR) technologies are increasingly promoted as a promising tool in training settings [1], [2], product development [3] and entertainment sector [4]. Furthermore, VR becomes more and more interesting as an instrument for research studies [5]. In other areas (e.g., academic conferences) the technology is still rarely used.

Researchers' activities within academic conferences are generally considered to be highly relevant for knowledge production. So far, this relevance has been contrasted by a considerable research deficit. Few empirical works focus on the role of conferences in science [6]. The exploration of conferencing in virtual space is yet to come. Several benefits of attending an academic conference virtually are noteworthy, e.g., reducing associated travel and time costs, carbon footprint. Therefore, the purpose of our study is (1) to present results of one of the first - to the best of authors knowledge - academic conferences, that took place entirely in virtual space and (2) to derive media-didactic design recommendations for the organization of virtual conferences. We conducted an investigative study that provided initial insights into academic conferences in Social Virtual Reality (SocialVR). Follow-up studies need to verify these.

In SocialVR, people do not meet at a physical location but use a VR multi-user environment. The term *SocialVR* covers a growing number of multi-user VR applications in which users interact in a virtual world via VR head-mounted displays (HMDs) [7]. Interactions range from simple voice or text chat communications to collaborative 3D content creation. Users may be physically distributed globally but feel the phenomenon of *social presence*. The term describes the level of awareness of the co-presence of another human, being or intelligence as well as the feeling that one has some level of access or insight into the other's intentional, cognitive, or affective states [8]. Through social presence the users experience an immediate proximity to each other [9], gain insights into multiple perspectives and are highly motivated to participate in an exchange - like in classic meetings in physical reality.

It is worth mentioning that the Covid 19 pandemic was at the same time as the conference. The pandemic requires a substantial change to the traditional approach how to design conferences in science. It has been recommended to reduce exposure by avoiding large gatherings. This has led to the cancellation of numerous conferences worldwide. Similar recommendations may be necessary for future pandemics as well. Due to the current situation, it is important to develop design recommendations for academic conferences in SocialVR (1) to reduce exposure while maintaining high-quality academic conferences during pandemics such as Covid 19 and (2) to exploit the added value of this technology for conferences in general.

This paper has two primary objectives. On the one hand, opportunities and challenges of using SocialVR as a medium for academic conferences will be presented based on a specific case study. On the other hand, the general applicability of the medium for this application area will be evaluated and discussed. Therefore, the following structure is used. First, a brief overview of the conference itself and its organization will be given. Afterwards, the evaluation is described and discussed. The paper concludes with a summary.

II. SocialVR Conference

The conference topic was about VR and Augmented Reality (AR) technologies in vocational education (VRARBB@SocialVR). The SocialVR conference [10] was funded by the German Federal Ministry of Education and Research. It took place in November and December 2020 and was developed in collaboration between two German universities from different disciplines, namely computational

and educational sciences. The online platform *AltSpaceVR* [11] by *Microsoft Corporation* was used to host the conference.

Participants have been represented by an avatar that could be personalized. Fig. 1 shows some of the conference participants with their avatars. They have a comic-like appearance for performance reasons. Interactions with each other are primarily via voice chat, using spatial audio, so that the direction and distance of the speakers is represented by the volume and direction of the sound.

Fig. 1.   Conference participants as comic-styled avatars

In addition, some gestures (depending on the VR headset being used) are supported – e.g., head and hand movements as well as certain finger gestures. Emoticons can also be used, which ascend above the avatars (e.g., hearts in Fig. 1).

The basic conference structure was based on a discussion-oriented conference format instead of a submission-driven style. It is oriented towards typical academic conferences and workshops in German-speaking countries in order to ensure comparability in the context of the evaluation. The use of a medium such SocialVR required some fundamental conceptual adjustments compared with real-world academic conferences.

First, the use of screens and even more so of VR headsets over a period of several hours is exceedingly fatiguing. Therefore, the SocialVR conference was designed for a maximum of two hours per day and a maximum of six hours per week. In order to still be able to comprehensively discuss the conference topic, the conference period was set to six weeks.

Second, to meet the challenge of keeping participants in contact over six weeks and motivating them to attend the conference, an accompanying online tool (*Discord* [12]) was used. Here, the participants were able to discuss between the sessions, establish and maintain contacts, and also take advantage of technical support.

Third, participation with a commercially available VR headset was strongly recommended. It was also important to be able to participate via a desktop application for *Windows* and *Mac*. In addition, the participants should not encounter any additional financial costs as a result of attending the conference.

These factors influenced the choice of the SocialVR platform, which fell on *AltspaceVR*.

A. Rooms

The conference program consisted of session formats that differed in both, form (e.g., keynotes, workshops, demonstrations) and content (e.g., infrastructure, preparation of teachers and learners). The rooms varied between sessions.

Traditional conference session formats, such as presentations and keynotes, were implemented. The lecture hall was the most used room during the conference (see Fig. 2). This room is a classic hall designed for frontal presentations. There is a clear area separation between presenters (stage) and audience.

The possible presentation methods and tools have been individually arranged with the presenters. However, it became apparent that the unfamiliar medium with its technical possibilities and limitations did not yet offer much inspiration regarding new forms of presentation. Except for the sporadic display of 3D models, most of the lecturers used classic slides and their presentations are followed by a discussion.
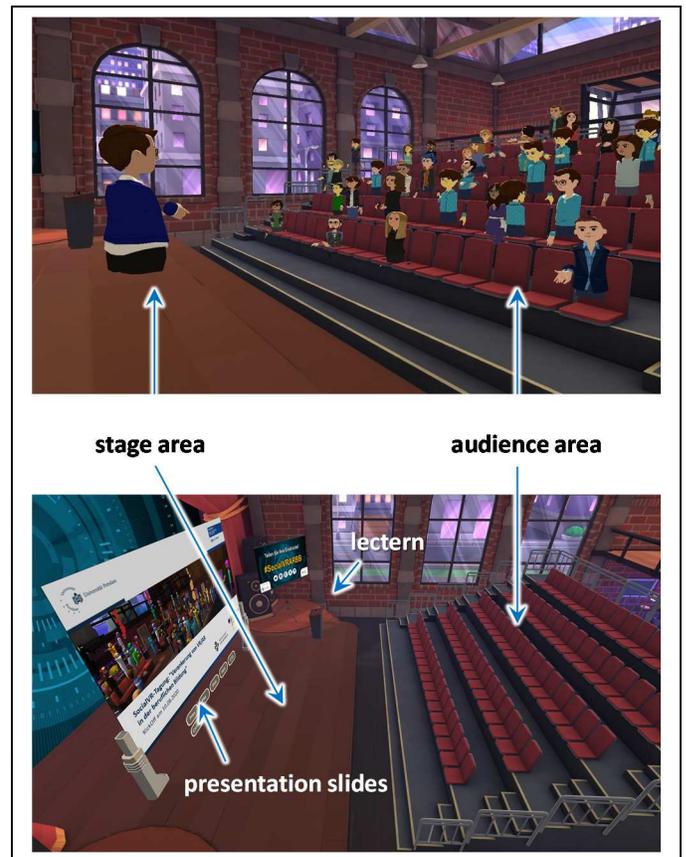

Fig. 2.   Lecture Hall

Formal input, however, is only one part of academic conferences. According to research findings, the informal activities of researchers (e.g., networking) at academic conferences are particularly relevant for knowledge sharing [13]. Therefore, when designing the rooms, care was taken to create scenarios that enable social exchange between participants. The common room was used especially for

discussions after the sessions but also for meetings between events (see Fig. 3). The most important feature is that there are no limited areas and attendees can move freely.

As a result, discussion groups formed at different corners of the room. Furthermore, a few entertaining offers (e.g., basketball hoop and balls, box with snowballs, selfie wall) were added. These offerings were often used. A gallery and a board with current information (e.g., next events) established the connection to the conference.
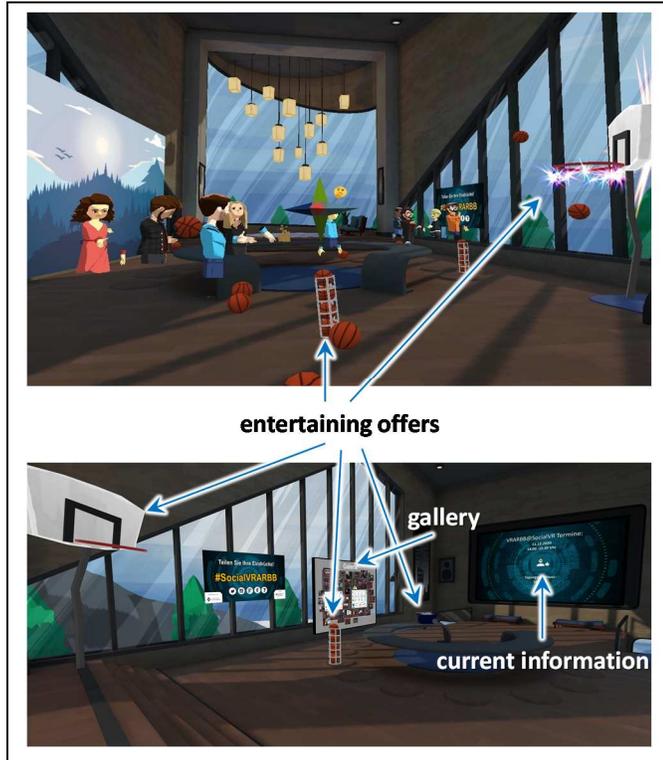

Fig. 3.   Common Room

Another room for a project and provider presentation is shown in Fig. 4. It represents a valley framed in mountains, in which projects could be presented at different locations with posters, videos and/or 3D models. A central signpost guided the arriving participants to the individual project presentations. In total, there were three identical project rooms that could be navigated between with a teleporter.

In addition to these rooms dedicated to specific session formats, there were special sessions for which variations of the rooms were used. For example, a variation of the lecture hall room without rows of seats was chosen for the presentation and discussion of a community project. This created a more relaxed atmosphere compared to a classic, frontal session. Another session was an evening social event, for which a nighttime version of the common room was used. All participants were from the European time zone.

B. General Impressions

The following data are impressions made in advance or during the conference and are not part of the evaluation. 114 interested persons, mainly from research and higher education

sectors, registered for the conference. Unfortunately, actual participation numbers decreased as the conference progressed.

Furthermore, a majority of the participants experienced technical problems. Two of the most encountered problems were audio interferences due to limited network bandwidth and the low-quality personal equipment of participants as well as login problems (cause unknown).
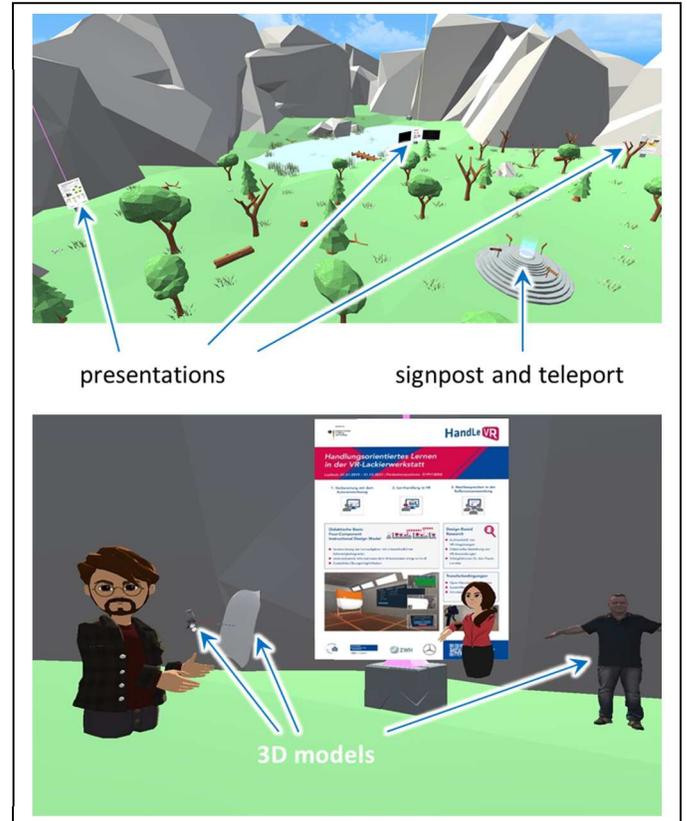

Fig. 4.   Room for project and provider presentations

Positively remarkable was that the participants repeatedly appreciated the very personal and stimulating atmosphere. In individual conversations, this was ascribed both to the playful visualization within *AltspaceVR* and to the feeling of having a particularly social presence. However, it probably also played a role that most of the participants had not had any on-site contact with larger groups of colleagues for a long time due to Covid 19 lockdowns and now very much valued this experience.

It was also noticeable that even people who had not had much experience with VR very quickly showed VR-appropriate body language. With most of the headsets used, only head movements (via the headset) and hand gestures (via the VR controllers) were sensed and applied to the avatar. This resulted in these gestures becoming very important to guide verbal explanations. This possibility was intuitively used in a comprehensive way even by VR novices after a few minutes.

III.   EVALUATION

This section will discuss challenges and strategies to address them for planning academic conferences in SocialVR. In this regard, the aim of the explorative study was to sufficiently

evaluate the elaborated conference format and to identify opportunities for improvement to be able to consider them in the conception and realization of future SocialVR conferences. Therefore, the study tries to answer the following guiding research questions (RQs):

- RQ1: Is SocialVR generally suitable for academic conferences?

- RQ2: What are the advantages and disadvantages of an academic conference in SocialVR?

- RQ3: How can academic conferences be prepared to support learning and networking?

- RQ4: What kinds of hardware do the participants use for participation?

- RQ5: Why did many of the registered participants not attend the conference?

In the following, the methods for the study are presented before the results of the evaluation are described. Afterwards, the results are discussed - in relation to the guiding questions.

A. Methods

Within the study, the conception of an academic conference in SocialVR is evaluated. The survey was realized via *Limesurvey* and took about 10 to 15 minutes. Participation was voluntary. The survey consisted of demographic information as well as closed and open questions to evaluate the selected formats and contents. The results of the survey include various descriptive statistics. In addition, free-text responses were analyzed using qualitative content analysis methods. Categories were developed inductively [14], [15]. In some places, reference is made to quotes from participants. Due to missing values, the sample size varies between the variables.

B. Results

A total of 75 of the 114 registered persons took part in the survey. The average age is 38 years (range: 25 to 58 years). 36% of the participants are female, 55% male. For 61% it was the first SocialVR conference. 24% stated that they had already gained experience with SocialVR. While at the beginning often more than 50% of the respondents were present at the sessions, this drops to 25% in some cases at the end. Fig. 5 illustrates participants' motivations for attending the conference. The authors pre-defined various reasons for participation, from which participants could select one or more.
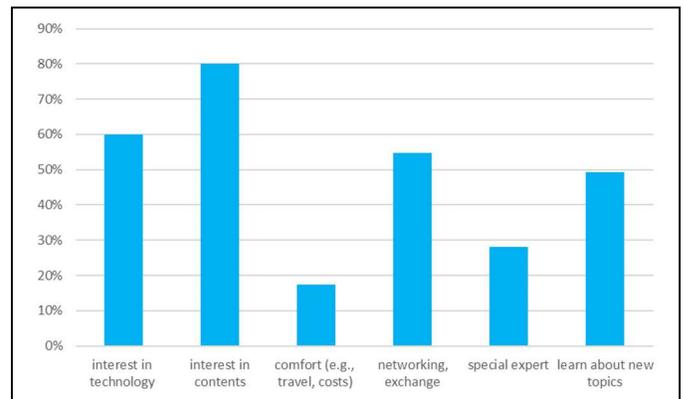

Fig. 5. Participants' motivations for attending the conference.

When asked about the benefits of attending an academic conference in SocialVR, 55% saw added value in social interaction with others, 43% in content-related input from the presentations, 56% in interacting with a scientific community, 68% in trying out new possibilities, and 67% in gaining new experiences. In the free text responses on benefits (*N*=60), various positive expressions were found, which could be assigned to the categories of interpersonal interaction (24 mentions), social presence (14 mentions), immersion (12 mentions) and working with 3D models (10 mentions). One participant wrote *"[...] it integrates social interaction opportunities, increases participant focus through immersion, and will technically evolve over the next few years."*

According to these results, social interaction seems to be experienced differently and possibly superior to other virtual conferencing tools. In this context, the design of the common room (see Fig. 3) was perceived by 59% to be the most suitable for interpersonal exchange. The lecture hall was rated as suitable for communication by only 9%.

The participants were also asked in a free-text task about disadvantages of an academic conference in VR (*N*=60). The uncomfortable feeling of wearing a headset (17 mentions), cost and effort associated with the technology (14 mentions), limited facial expressions (20 mentions) and the lack of the possibility to take notes (10 mentions) were named. However, the need for a stable internet connection (8 mentions) was also criticized. In this context, some participants reported technical hurdles (13% yes, 36% partly).

In the run-up to the conference, participants were already asked, which kind of hardware they will use for participation. Two thirds announced they would attend the conference with a headset. This could be confirmed within the evaluation (see Fig. 6). Multiple responses were possible. Added up, 76% stated that they had participated in the conference via a headset. We assume that a decent portion of the participants have opted for a mixed approach by following some sessions via headset and others via desktop application.
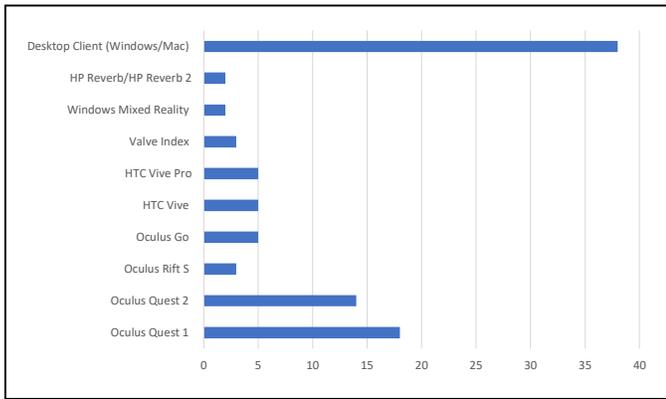
Fig. 6. Participation depending on kind of technology.

As said, participation numbers decreased as the conference progressed. That is why the participants were asked in a free-text task why they chose not to attend certain sessions (*N*=76). Two thirds (51 mentions) named time constraints and overlap with other commitments as reasons. In advance of the conference, the organizing team decided to spread the sessions over several weeks. There were no more than two to three sessions per week to keep screen time and the associated workload low. Nevertheless, mainly time-related reasons seem to have hampered participation.

Furthermore, the participants were asked about their subjective assessment of the suitability of SocialVR for academic conferences using a 5-point Likert scale (1 = "*not suitable at all*", 5 = "*highly suitable*"). The average assessment was 3.98 (*SD* = .67). Frequency distribution is illustrated in Figure 6. No one chose the answer option "*not suitable at all*".
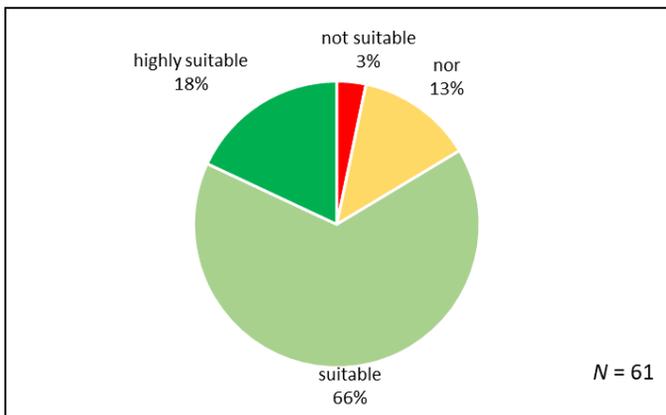

Fig. 7. Suitability of SocialVR for academic conferences.

Regarding the suitability of SocialVR for academic conferences, one participant wrote "*I found the idea of doing a conference in VR fascinating from the beginning. I am excited by the technology and it was a new experience every time [...].*" Another participant emphasized the advantages for "*[...] Social togetherness. Personal networking [...]*". Other strengths of the format are seen in the "*exchange, which felt [...] very authentic,*" in an "*informal atmosphere [...],*" in "*low contact barrier[s],*" and in a "*strengthening of concentration and attention.*"

Participants were asked which room they favored during the conference. 41% liked the lecture hall best 25% preferred the common room and other 23% favored the room of project and provider presentations. Furthermore, they were asked which room they thought was most suitable for social exchange. Only 9% think the lecture hall is appropriate, while 59% consider the common room conducive to interaction. Another 21% think the room of project and provider presentations is suitable for social exchange.

For follow-up conferences in SocialVR, the participants would like to "*make better use of the advantages and peculiarities of the medium and use them more*" to stand out from other video conferencing tools (e.g., Zoom). They request "*more interaction, 3D elements, a different world than the lecture hall environment [...].*" Overall, 65% of participants disclose wanting to participate in more SocialVR events. 1% have no interest and 9% have partial interest.

IV. DISCUSSION

Results point to opportunities and challenges that an academic conference in SocialVR brings with it. Regarding the central questions, the following statements can be made.

A. RQ1: Suitability of SocialVR for Academic Conferences

It can be stated that this conference format offers certain advantages, especially in times of the Covid 19 pandemic, when people cannot meet face to face as usual. There is a consensus among the participants that SocialVR seems to be suitable for academic conferences. More than half of the participants are interested in participating in future conferences.

B. RQ2 & 3: Advantages and Disadvantages of SocialVR Conferences

Advantages are seen in the increased facial expressions and gestures compared to other digital tools. Nevertheless, it was demanded that facial expressions as well as gestures in SocialVR should still be expanded. Moreover, using 3D models offers completely new possibilities for academic conferences. Artifacts that are otherwise unavailable can be viewed from different perspectives and distances (e.g., an animated 3D model of the solar system hovering in the lecture hall). Scientists anywhere in the world can view and discuss it simultaneously. Entertaining offers (e.g., playing basketball) allows to make academic conferences more exciting and offers new possibilities for social events besides the actual conference.

Though, disadvantages arise due to poorer resolution and the uncomfortable feel of the headsets. In addition, for more than half of the participants it was the first conference in SocialVR. As this was already suspected in the run-up to the conference, tutorials for the use of *AltspaceVR* were made available as PDFs and videos before the start of the conference. It is likely that technical hurdles (e.g., error-prone setup, need for a stable internet connection) will decrease over time, that wearing a headset becomes more comfortable, and that the expertise of participants will increase. Regarding this, one participant wrote "*In 20 years we will laugh about this. For today, it was great.*"

C. Preparation to support learning and networking

The design of the rooms seems to be important for learning and communication. Rooms, such as lecture halls, face forward

towards the stage and the presenters. The focus is on the content However, these rooms are spatially restricted. Other rooms with greater freedom of movement are more likely to allow interactions between participants and are therefore rated higher. As in the real world, rules of behavior and conversation seem to apply in SocialVR. Few would dare to speak aloud during a lecture, while for example an entrance hall encourages interpersonal exchange. To maximize engagement, interactive scenarios are recommended.

Moreover, during the planning of an academic conference in SocialVR, prior knowledge of the participants must be considered to enable adaptive learning. Knowledge regarding the VR technology itself must also be captured to initiate support activities (e.g., exploratory session) and adjust screen times. Overtaxing participants, whether by the content or by the technology, inhibits learning processes and interpersonal exchange.

D. RQ4: User Behaviour regarding Technology

Surprisingly, a significant majority participated in the conference via a headset. Such a technically equipped audience had not been expected in advance of the conference. The authors conclude that the VR-related scientific community is well prepared for SocialVR conferences and is motivated to participate in such events in the future.

E. RQ5: Low Attendance Quote

Two reasons for declining attendance in particular can be assumed here. One is the additional workload in the academic area due to the switch to purely online teaching. The other was the year-end workload in the business sector. Follow-up conferences should respect typical academic conference periods. This was not possible due to the strictly time-limited project funding in 2020.

Overall, the evaluation indicates that an academic conference in SocialVR offers various advantages. In some areas, it seems inferior or equivalent to other digital formats or face-to-face events. A 1:1 transfer of a speech planned for a face-to-face event, which includes integrating the presentation slides to a screen in the 3D room, cannot open any added value. In other areas, using SocialVR is profitable.

Travel costs and associated expenses are eliminated. This opens a chance for participants with extended travel distances and legal, health or other travel restrictions to easily participate in the academic exchange. Thus, participation is also possible for financially weak interested persons.

Furthermore, spatial boundaries can be removed. Rooms can be designed according to the content. Content can be illustrated via 3D artifacts. Spaces can be adapted to enable and support different forms of collaboration. Whether and to what extent SocialVR is suitable for future academic conferences seems to depend on many factors (e.g., topic, conference formats, target group).

A conference, as in the present case, that also deals thematically with VR/AR seems predestined, since it can be assumed that the participants are intrinsically motivated to deal with the technology. In addition, 60% participated out of interest in the technology. This cannot be assumed for other conferences with different participants. Incentives must be created, and the technology must be well explained to avoid effects such as reactance and to increase acceptance of the technology.

To conclude, the added value compared to other formats, whether in presence or digital, can only be determined in individual cases.

V. CONCLUSION

SocialVR offers a previously rarely used potential for the hosting of academic conferences. This paper describes the realization of one of the first academic conferences in SocialVR. In particular, the impressions of the conference participants were collected and evaluated with regard to the applicability of the SocialVR medium for a conference context.

Following up on this research, this pilot study has two major contributions: First, academic conferences in SocialVR are possible and ratings are promising. Second, there is a need to conduct further research on academic conferences in SocialVR. Based on the results of our study, follow-up studies need to use SocialVR at other conferences. Different providers (e.g., *Mozilla Hubs*, *Tricat Spaces*), different disciplines (e.g., computer science, education), and different target groups (e.g., technically inexperienced vs. experienced) should be investigated. Some research is still required to determine under which conditions the use of SocialVR offers added value for conferences in science.

The artifacts arising from the conference (e.g., *AltspaceVR* tutorials, slides, a keynote recording, posters of the project presentations) are available on the conference website [10] in German language.

REFERENCES

[1] D. Allcoat & A. Mühlenen, "Learning in virtual reality: Effects on performance, emotion and engagement," Research in Learning Technology, vol. 26, 2018, doi: 10.25304/rlt.v26.2140.

[2] T. A. Mikropoulos and A. Natsis, "Educational virtual environments: A ten-year review of empirical research (1999–2009)," *Computers & Education,* vol. 56, no. 3, 2011, pp. 769–780.

[3] S. Choi, K. Jung, and S. D. Noh, "Virtual reality applications in manufacturing industries: Past research, present findings, and future directions," *Concurrent Engineering*, vol. 23, no. 1, 2015, pp. 40–63.

[4] W. Powell, T. Garner, S. Shapiro, and B. Paul, "Virtual Reality In Entertainment: The State Of The Industry," *British Academy of Film and Television Arts,* 2017.

[5] R. Zender, A. H. Knoth, M. H. Fischer, and U. Lucke, "Potentials of Virtual Reality as an Instrument for Research and Education," *i-com,* vol. 18, no. 1, 2019, pp. 3–15.

[6] K. Hauss, *Der Nutzen wissenschaftlicher Konferenzen in der Nachwuchsausbildung: Theorie und Empirie eines globalen Phänomens.* Springer, 2017.

[7] J. McVeigh-Schultz, A. Kolesnichenko, and K. Isbister: "Shaping Pro-Social Interaction in VR," *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, 2019, pp. 1-12.

[8] F. Biocca and K. Nowak, "Plugging your body into the telecommunication system: Mediated embodiment, media interfaces, and social virtual environments," *Communication technology and society*, 2001, pp. 407-447.

[9] F. Biocca and C. Harms, "Defining and measuring social presence: Contribution to the networked minds theory and measure," *Proceedings of PRESENCE,* 2002, pp. 1-36.

[10] R. Zender. "VRARBB@SocialVR: Verankerung von VR/AR-Technologien in der beruflichen Bildung" https://www.cs.uni-potsdam.de/socialvr (accessed Apr. 7, 2021).

[11] AltSpaceVR by Microsoft. https://altvr.com (accessed Apr. 7, 2021).

[12] Discord. https://discord.com (accessed Apr. 7, 2021).

[13] I. Reychav and D. Te'eni, "Knowledge exchange in the shrines of knowledge: The "how's" and "where's" of knowledge sharing processes," *Computers & Education*, vol. 53, no. 4, 2009, pp. 1266–1277.

[14] U. Kuckartz, *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung.* Weinheim, Juventa, 2002.

[15] P. Mayring, *Qualitative content analysis: Theoretical foundation, basic procedures and software solution.* Klagenfurt, Monograp, 2014.