

A First Pilot Study to Compare Virtual Group Meetings using Video Conferences and (Immersive) Virtual Reality

Frank Steinicke
Human-Computer Interaction
Universität Hamburg, Germany

Annika Meinecke, Nale Lehmann-Willenbrock
Organizational Psychology
Universität Hamburg, Germany

ABSTRACT

Face-to-face communication has evolved as most natural means for communication. However, virtual group meetings have received considerable attention as an alternative for allowing multiple persons to communicate over distance, e. g., via video conferences or immersive virtual reality (VR) systems, but they incur numerous limitations and challenges. In particular, they often hinder spatial perception of full-body language, deictic relations, or eye-to-eye contact. The differences between video conferences and immersive VR meetings still remain poorly understood. We report about a pilot study in which we compared virtual group meetings using video conferences and VR meetings with and without head-mounted displays (HMDs). The results suggest that participants feel higher sense of presence when using an immersive VR meeting, but only if an HMD is used. Usability of video conferences as well as immersive VR is acceptable, whereas non-immersive VR without HMD was not acceptable.

KEYWORDS

Virtual reality, virtual group meetings, video conferences, (social) presence

ACM Reference Format:

Frank Steinicke and Annika Meinecke, Nale Lehmann-Willenbrock. 2020. A First Pilot Study to Compare Virtual Group Meetings using Video Conferences and (Immersive) Virtual Reality. In *SUI '20: ACM Symposium on Spatial User Interaction, Oct 31–Nov 1, 2020, Ottawa, Canada*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3385959.3422699>

1 BACKGROUND

Virtual group meetings are often the only feasible solution for synchronous group communication over large distances [4]. Furthermore, they have become the only option for meeting in times of global crises such as the COVID-19 pandemic. Nowadays, numerous group meetings have transitioned from traditional face-to-face (F2F) meetings to conference calls, video conferences, or immersive VR environments. Such virtual group meetings typically contain representations (e. g., videos or 3D models) of meeting participants as well as some virtual space in which the group meets. Such immersion allows users to perceive a sense of spatial and social presence.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).
SUI '20, Oct 31–Nov 1, 2020, Ottawa, Canada
© 2020 Copyright held by the owner/author(s).
ACM ISBN 978-1-4503-XXXX-X/18/06.
<https://doi.org/10.1145/3385959.3422699>

A vast body of literature suggest that different forms of group meeting technology affect how we communicate, learn, work and make decisions. However, the opportunities and challenges for social interaction in virtual group meetings still remain poorly understood. In this poster we report about a pilot study that we conducted to compare virtual group meetings using video conferences and a VR meetings with or without immersive head-mounted displays (HMDs).

2 PILOT STUDY

In our pilot study we analysed the effects of virtual meeting platforms, i.e., (i) immersive VR with HMD, (ii) non-immersive VR with browser both using mozilla:hubs¹, and (iii) video conference using Zoom² on spatial presence, involvement, perceived realism, social presence, cybersickness and usability. The pilot study was conducted with nine participants (3 male, 6 female) with an average age 30 years (SD=5.27), which were all members from the same research group at our university. Five team members (3 female) were assigned into the video conference group, and four members (3 female) into the VR condition Half of the VR group (1 female) wore HMDs (Oculus Rift CV2) whereas the other half used a web browser to connect to the VR meeting. All participants were naive to the study procedure, and regularly use VR technology and video conferences.

Prior the actual virtual group meeting, participants had to fill out a demographic questionnaires as well as Kennedy's simulator sickness questionnaire (SSQ) [1]. Afterwards, participants logged into their virtual group meeting platform. After 5 minutes of introduction to the functionality of the whiteboard in Zoom and the annotation features in mozilla:hubs, participants received instructions about their team task. For both teams, the task was a variation of the Desert Survival Situation [2]. In this task, participants need

¹<https://hubs.mozilla.com>

²<https://zoom.us>

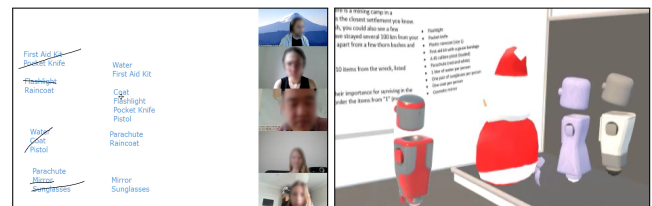


Figure 1: Two different virtual group meetings platforms as used in the pilot study: (left) video conference with Zoom (with blurred faces), and (right) (immersive) VR meeting using mozilla:hubs.

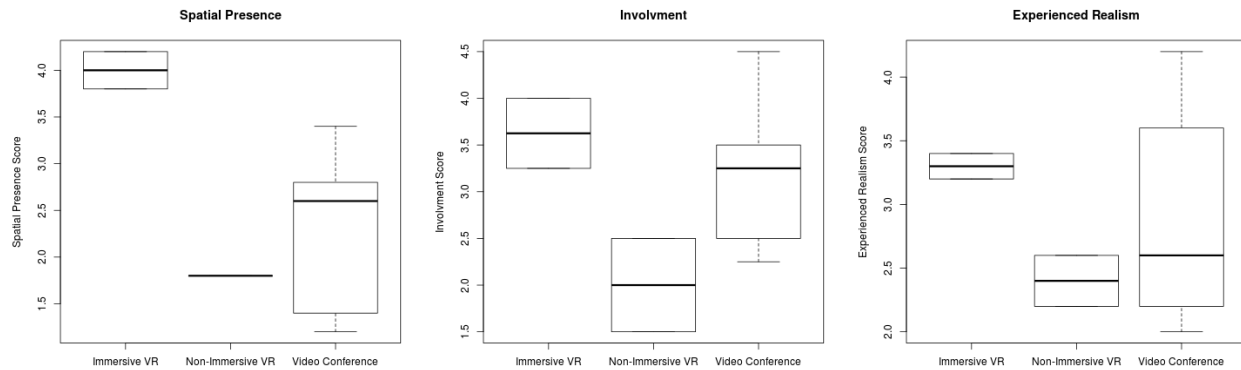


Figure 2: Results for IPQ showing (left) spatial presence, (middle) involvement and (right) experienced realism.

to rank 10 items in their order of importance to assist the groups survival after an imaginary scenario of a plane crash. The task was to provide a ranked list after 20 minutes of group discussion. After the experiment, participants had to fill out the post-SSQ questionnaire, the IPQ presence, social presence [3] and system usability scale.

3 RESULTS

All results were analyzed with a Kruskal-Wallis rank sum test. The only significant result that we could found was on the effect of the virtual group meeting platform on social presence ($\chi^2 = 6.1412$, $df = 2$, $p = 0.046$) (see Fig. 3). A Dunn-Bonferroni post hoc analyses showed that the social presence in immersive VR with HMD is significantly higher than in the video conference condition ($p \leq 0.05$). The results illustrate that participants in the immersive VR condition with HMD perceive highest social presence on average with 5.5 (STD=0.10) on a scale of 1 to 7, while for the non-immersive VR condition without HMD the perceived social presence decrease to an average of 4.07 (STD=1.71), and with video conference it is lowest with 2.08 (STD=0.62) on average.

Fig. 2 shows the measurements of the spatial presence, involvement, and experienced realism. The results on a scale of 0 to 6 suggest that participants in the immersive VR condition with HMD perceive spatial presence on average with 4.0 (STD=1.70), involvement on average with 3.62 (STD=0.53), and experienced realism on average with 3.3 (STD=0.42). For the non-immersive VR condition they perceive spatial presence on average with 2.28 (STD=0.28), involvement on average with 3.2 (STD=1.06), and experienced realism on average with 2.92 (STD=0.14). Finally, participants in the video conference condition perceive spatial presence on average with 1.8 (STD=0.0), involvement on average with 2 (STD=0.71), and experienced realism on average with 2.4 (STD=0.28). The mean IPQ presence score (on a scale of 0 to 6) was 3.64 (SD=3.45) for immersive VR condition with HMD, 2.07 (SD=0.33) for VR conditions without HMD, and 2.8 (SD=0.85) for video conference.

The results for the SUS suggest that the immersive VR condition with HMD provide acceptable usability with 72.5 (STD=10.6), but poor and not acceptable for non-immersive VR conditions without

HMD (on average 38.75 (STD=5.3)). The video conference was evaluated with highest usability and also received acceptable scores (on average 80.5 (STD=16.14)).

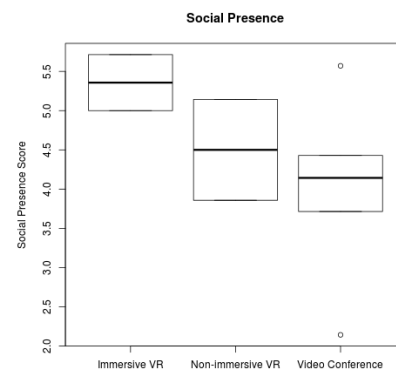


Figure 3: Results for social presence.

4 DISCUSSION

Due to the low number of participants, the presented results are limited and should be considered as a mean to derive hypothesis, which would need to be verified in future studies. However, even with the low sample size, we could find a significant effect of immersion on social presence compared to other virtual group meeting platforms suggesting a strong effect size; again subject to be verified in future work.

REFERENCES

- [1] Kennedy, R. S., Lane, N. E., Berbaum, K. S. & Lilienthal, M. G. (1993). Simulator sickness questionnaire: An enhanced method for quantifying simulator sickness. *The international journal of aviation psychology*, 3(3), 203–220.
- [2] Lafferty, J. C., Eady, P. M. & Elmers, J. (1974). The desert survival problem.
- [3] Lombard, M., Ditton, T. B. & Weinstein, L. (2009). Measuring presence: the temple presence inventory. In *Proceedings of the 12th annual international workshop on presence* (pp. 1–15).
- [4] Steinicke, F. (2016). *Being Really Virtual*. Springer.