Conducting a Remote Virtual Reality Experiment during COVID-19

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Conducting VR experiments remotely, especially with longitudinal experimental designs is challenging. This paper reports on a 9-week ecological VR study, highlighting opportunities and challenges to inform the design of future VR studies.

ACM Reference Format:
Nabil Ch, Alberta A. Ansah, Atefeh Katrahmani, Julia Burmeister, Andrew L. Kun, Caitlin Mills, Orit Shaer, and John Lee. 2021. Conducting a Remote Virtual Reality Experiment during COVID-19. In *CHI '21: CHI Remote XR workshop, May 15–16, 2021, Yokohama, Japan.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/1122445.1122456

1 INTRODUCTION

We conducted a 9-week experiment where participants completed a VR session daily (weekdays) for 6 of the 9 weeks. Here we report on the feasibility of such participant-compliant longitudinal experimental designs, with recommendations for what may result in best practices, with low attrition rates and high fidelity data.

2 EXPERIMENT

Our study explored the effect of mindfulness practices and VR nature experiences on stress, focus and creativity of remote workers. To recruit potential participants we used social media platforms to distribute a screening survey which included questions about experience with VR, living and working arrangement, and a standard anxiety assessment instrument. Based on the responses, we selected 20 participants and invited them to participate in the study. We selected people who (1) did not own a VR headset, (2) lived in urban or suburban areas (and thus might get fewer opportunities to experience nature in their everyday life), and (3) were above average, but fell below the clinical threshold, on a commonly administered self-report scale for anxiety. We sent participants a VR headset, which also served as compensation for their participation. Additionally, participants received a $15 gift card after every 3 weeks if they completed at least 80% of their daily tasks for that period. All of our participants ended up receiving the gift cards every three weeks. On the weekends before the start of each three week period, we met with individual participants via Zoom to discuss

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Manuscript submitted to ACM

the tasks for the coming weeks. Instruction videos were sent to the participants prior to the meeting on the weekend. Participants could also reach us via email if they had any questions or needed help with the tasks during the weeks. The 9-week study consisted of 3 phases:

(1) Week 1–3: No VR + No Mindfulness (NVR-NM)
(2) Week 4–6: VR + No Mindfulness (VR-NM): 10 minutes VR practice daily
(3) Week 7–9: VR + Mindfulness (VR-M): 10 minutes VR + Mindfulness practice daily

During the entire 9-week study we asked participants to check in every weekday via text messages and answer some questions. The participants also needed to complete a survey before starting each of the three phases. During the first 3 weeks, participants were asked to send text messages to check in every day and answer several questions (see next section). During weeks 4 to 6, we instructed participants to view specific nature scenes in VR for 10 minutes every weekday using the Guided Relaxation application, and then respond to question via text messages. During weeks 7 to 9, participants engaged in three mindfulness practices, one each week, for an average of 10 minutes per day. They used an application called Healthy Minds. We asked them to follow the mindfulness exercises with a VR to experience nature and then the text check-in.

We sent reminder text message to participants daily. To ensure that the participants completed the daily task at a time that is convenient for them, the daily check-ins were initiated by the participants via text messages. We used Twilio, a cloud communications platform to send and receive text messages, including for automating the replies to the text messages received from the participants. The contents and timestamps of the text messages received from the participants were stored in a cloud-based spreadsheet on Airtable.

During the daily check-in, participants were asked four questions via text messages on their smartphones. The first two questions were intended to assess the level of focus and stress of the participants. The last two questions assessed their creativity. Additionally, at the beginning of each 3-week phase, participants completed a survey which included questions about demographics, effects of COVID-19, mindfulness, depression, and anxiety.

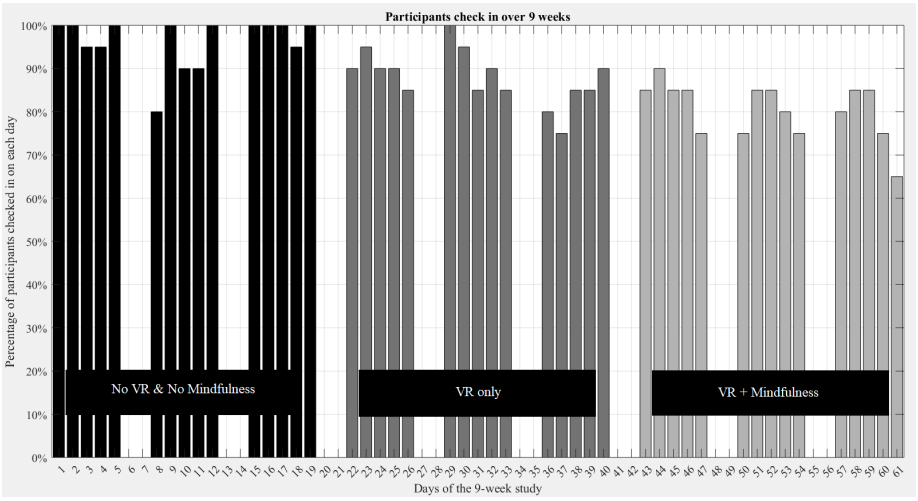

Fig. 1. Number of daily check-ins over 9 weeks. Day 1 is the first day for each participant.

3 REFLECTIONS ON THE EXPERIMENT

Compliance. Participants, on average, were highly compliant. Figure 1 shows that more participants began to miss their daily tasks as the study progressed, yet only dropped below 70% for only one day. The lowest percentage of participants checked in on December 25, that is Christmas day, which for many people is reserved to spend with family.

Hardware cost and availability. We needed a VR headset for each participant, which can be a significant cost for a project. Additionally, the VR headset we selected for the study, the Oculus Go, was discontinued by the manufacturer after our funding was approved. New devices became scarce on the market and even the ones we found through online re-sellers were listed at a higher price than the manufacturer's suggested retail price.

Shipping. We had to carefully time shipping such that VR headsets arrive before the start of week 4 of the experiment, but not too early. If they arrived too early participants could start using VR early, and the data during weeks 1-3 would no longer represent the non-VR case. There were however some unexpected shipping delays. Thus, some participants missed a few days of daily tasks that required VR.

Setup. Even though we provided detailed video instructions for setting up the VR headset and experiencing virtual nature, we found it beneficial to meet all the participants individually and help them set up the hardware and solve any technical issues. Still, some technical issues were difficult to debug since we couldn't recreate them at our end.

Experimental control. We tried to specify all important details like which application, nature scene, and background music to use and for how long the participants should experience the virtual nature scene. But it was impossible to verify that all the participants were following these instructions. In fact, we know that some participants did not follow our instructions. For example, in an interview after the 9-week study, one participant told us that they did the mindfulness practice and the VR nature experience at the same time: "It was probably started by just feeling that time crunch of you know. I have a busy work schedule in December and then the holidays, everything was feeling pretty stressful".

Our experiment was also affected by the predictably, and unpredictably, changing context of our participants. Our study was conducted in the US between October 2020 and January 2021, a time frame that included the US presidential election, US Thanksgiving, Christmas, New Year's Eve, and varying COVID-19 restrictions, all of which were events that could affect the daily lives of our participants.

4 CONCLUSION

We found some practices which may be useful in navigating the challenges of conducting a remote longitudinal VR study: selecting cost effective, readily available hardware for the study; providing clear and detailed instructions to participants, meeting each participant individually, and sending periodic reminders; providing compensation in phases instead of at once to motivate participants to complete their tasks. In addition, researchers might need to take into consideration major events, such as holidays, especially if the participants are responsible for completing some tasks on their own. This method was developed in the context of the COVID-19 pandemic, but it demonstrates opportunities for remote experiments that include: more naturalistic settings, extended participation, and more inclusive participants samples.

5 ACKNOWLEDGEMENTS

This work was in part supported by NSF grants CMMI- (University of New Hampshire: 1840085; Wellesley College: 1840031; University of Wisconsin-Madison: 1839484).