Poster Abstract: Human Wellbeing Responses to Real and Simulated Workplaces

A comparison of in-person, online, and virtual environments

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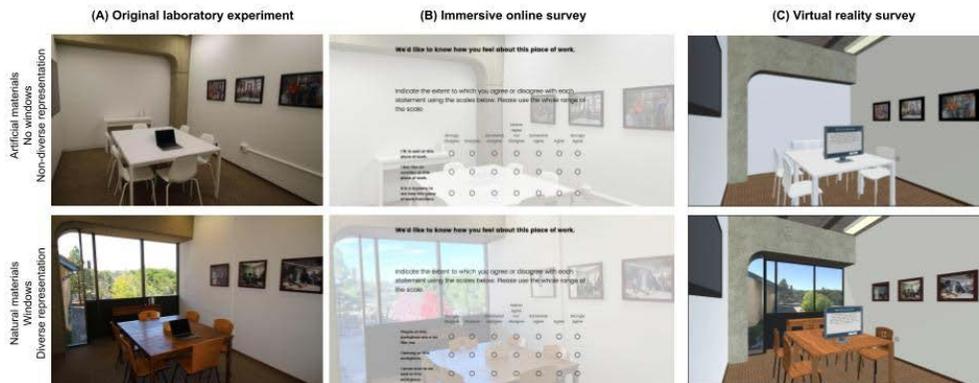{ebianchi,baltaf, arasht,douglasi,landay,billingt}@stanford.edu

Figure 1: Views from (A) Lab experiment, (B) Immersive online survey, and (C) Virtual reality survey

ABSTRACT

Recent studies have emphasized the role of building design on occupant wellbeing. However, studying the impact of built features on wellbeing is time-consuming and expensive. Our work explores the value of different methods to simulate workplace environments and their impact on wellbeing outcomes. Following a laboratory experiment that highlighted the potential of windows and natural materials to reduce stress, we conducted an immersive online replication to assess the continuity of results on a different platform. Online participants reported lower negative affect with natural materials compared to artificial materials, and higher positive affect in the presence of windows vs no window condition, making the stress results similar to those in the lab. Additionally, windows and diverse representations promoted belonging and creativity, respectively. A virtual reality (VR) replication is currently underway with identical variables to investigate the role of VR in facilitating research in this field. Our work contributes to a better understanding of the value of different workplaces (e.g., office, hybrid, or remote) based on their design characteristics.

CCS CONCEPTS

• Human-contered computing → Human computer interaction (HCI) → HCI design and evaluation methods → User studies

KEYWORDS

Workplace design, human wellbeing, virtual reality, crowdsourcing platforms

1 INTRODUCTION

Americans spend almost 90% of their time indoors [1]. Recent studies have shown that building design plays an important role in occupants' wellbeing. For example, biophilic elements can reduce stress [2], and the presence of windows with a view to nature can increase creativity [3]. However, most studies have been conducted on limited populations and exploring the impact of the wide variety of design features possible is costly and time-consuming. Recent developments in research tools such as crowdsourcing platforms and immersive virtual reality (VR) environments are making it viable to replicate the experience of physical environments to conduct larger-scale experiments with numerous design options. This replication can help us understand and analyze the effect of

different designs on occupant wellbeing in a cost- and time-effective manner [4]. However, the external validity of current crowdsourcing and VR systems is not well understood.

We are investigating the effect of workplace features on occupant wellbeing across simulation-based study methods. We focus on the impact of materials (artificial vs. natural), windows (absence vs. presence), and representation (iconography of diverse vs. non-diverse identities) on four wellbeing metrics: stress, sense of belonging, creativity, and pro-environmental behavior. We hypothesize that natural materials, windows, and diverse representations will promote all wellbeing dimensions compared to their counterparts. Through the comparison across different simulation methods, and by considering their level of immersion, we will be able to grasp the effectiveness and validity of each of these study methods. This abstract provides an overview of the preliminary online study results (n = 411) with a comparison with the in-lab experiment (n = 409) our team recently published [5] as well as a discussion of the third approach, using VR.

2 METHODS

Our immersive online study was developed in Qualtrics and distributed on Prolific. The study was a between-subjects factorial design with eight conditions. Each condition had one type of material, window presence, and representation, similar to our lab study [4]. The visual stimuli consisted of a video of the condition the participant had been assigned to and pictures used as the survey background (Fig. 1-B). The videos were recorded in the room used in the in-lab experiment. Participants were asked to imagine themselves in the workplace shown while completing a series of tasks. The tasks and the instruments used to measure our dependent variables are described in [5]. The stressor task from the in-person study (an elevator pitch) was replaced by arithmetic problems and anagrams. Additionally, the belonging questions were re-phrased to reflect changes in our study population.

Our virtual reality study was developed using Revit, SimLab Composer, and Unity software (Fig. 1-C). Performing an in-person VR study allows us to replicate the original stressor and to record physiological data using biosensors as was the case in the lab study. We are using a VR questionnaire that allows the participants to answer the survey questions while in the VR environment. To ensure participants are not spending more than 25 mins wearing the VR headset at a particular time, we shortened some of belonging questions by performing a factor analysis and including a reduced set of items. We are also collecting consent and demographic data outside of the virtual environment.

3 RESULTS

Results from the immersive online survey showed that participants reported a higher sense of belonging and higher positive affect scores (F (403) = 7.44, p = 0.007**, partial η^2 = 0.02) in the window condition (F (403) = 15.62, p < 0.001***, partial η_p^2 = 0.04) relative to no window. They reported lower negative affect scores in the natural materials condition (F (403) = 6.37, p = 0.012*, partial η^2 = 0.02) relative to artificial materials. We found that diverse

representation significantly increased participants' self-reported scores in a list of creative adjectives (F (403) = 8.05, p = 0.005**, partial η^2 = 0.023). These results support our hypotheses. However, we also found that, contrary to our hypotheses, artificial light led to higher convergent creativity scores compared to natural light (F (403) = 4.17, p = 0.042*, partial η^2 = 0.01). Comparatively, the in-lab experiment showed significant main effects of natural materials on self-reported stress and negative arousal, while windows were associated with an increase in positive arousal and a decrease in negative arousal [5]. Finally, diverse representation also led to lower self-reported stress scores in the lab study. However, there were no significant results for belonging in the lab study.

Our immersive survey therefore allowed us to obtain similar results for windows and materials for our stress measures compared to the lab. We also obtained null results in both studies for environmental efficacy. However, significant impact of window on belonging appeared in the online study, but was not found in the lab study.

4 DISCUSSION AND ONGOING WORK

In the lab experiment, one key finding was the role of natural materials in reducing stress [5]. While our online participants were exposed to visuals of natural materials (see Fig.1-B), online surveys do not allow researchers to replicate the tactile stimuli experienced by participants sitting at a wooden table in the original experiment (Fig. 1-A). This aspect of the online experience could have reduced our participants' connection to nature and decreased the stress-reducing role of natural materials. The effect of materials might require a higher level of immersion to achieve external validity and elicit realistic experiences.

The belonging questions were rephrased between the laboratory [4] and online experiment to direct participants' attention to the workplace they were being shown. This attention redirection could have drawn more attention to the variable manipulations compared to the laboratory experiment and thus led to different results for belonging. The online experiment included close-up photos of the picture frames displayed in the room. Therefore, participants experienced a greater exposure to the type of representation in their assigned condition, which could have led to significant relationships between representation and wellbeing not observed in the lab experiment.

We are currently piloting the VR study. Side by side videos of the lab room and VR can be seen at this link.

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