

# How does virtual human companionship impact stress levels in patients in preoperative surgeries?

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## Introduction

Surgical procedures often induce significant anxiety and stress in patients, particularly in the pre-operative phase [1]. Research has demonstrated that the presence of a companion during this critical period can significantly reduce emotional distress, fostering a sense of comfort and security [2]. However, not everyone has companions with them during these critical stages.

This research explores the potential of virtual reality (VR) as an innovative tool for pre-operative stress, focusing on the presence of virtual human companionship. By examining the effects of VR-based social presence, we aim to explore how virtual interactions might alleviate pre-operative stress among patients. While preliminary studies have reported promising results in reducing anxiety among adults undergoing elective and oncological surgeries [3, 4], this research seeks to further understand and validate the efficacy of VR in enhancing emotional well-being prior to surgery.

## Hypothesis

### Null Hypothesis

Virtual human companionship prior to surgery has no significant effect on stress levels in individuals compared to those without such companionship.

### Alternate Hypothesis

Virtual human companionship prior to surgery significantly reduces stress levels in individuals compared to those without such companionship.

## Variables

**Independent Variable:** Virtual human companionship

**Dependent Variable:** Stress and comfort levels

**Comfort Variable:** People who have and haven't done surgeries.

## Methodology

This study involved 20 participants (young adults age 18–23) divided into two groups: 10 with prior surgical experience (treatment group) and 10 without (control group). Each group was further split into two subgroups each to test the independent variable (Figure 1). Participants were placed in the simulation using the Oculus Quest 2 and stress levels were measured throughout the simulation using a pulse sensor integrated with an Arduino system to track heart rate (Figure 2) to which we got an average heart rate per participant for the whole simulation.

The VR simulation placed participants in a hospital lobby where they embodied a patient with a mirror in front of them. They are waiting for a virtual doctor to inform them of their upcoming surgery (Figure 3). After the VR experience, participants completed a questionnaire assessing stress, comfort, and the realism and engagement of the scene, using a 5-point Likert scale. All participants provided informed consent, and anonymity was ensured throughout the study.

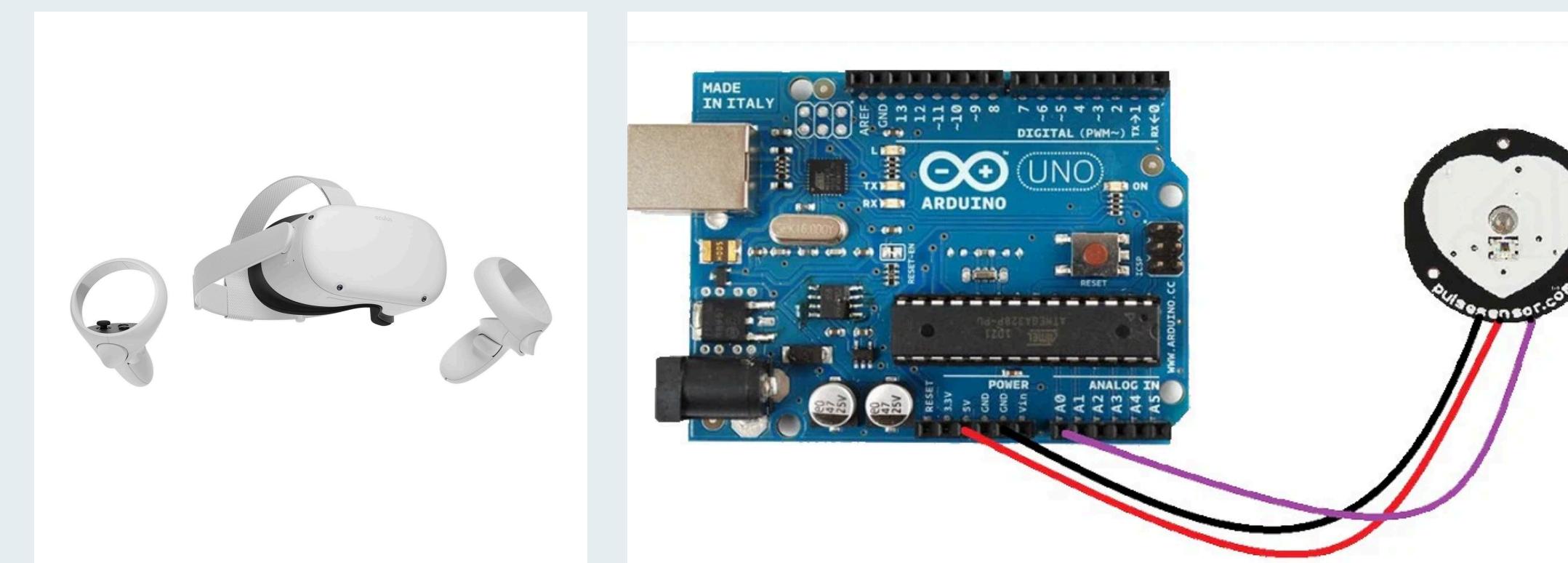


Figure 2. Equipment used during the study. Oculus Quest 2 Headset (left) and Arduino with Pulse Sensor (Right)

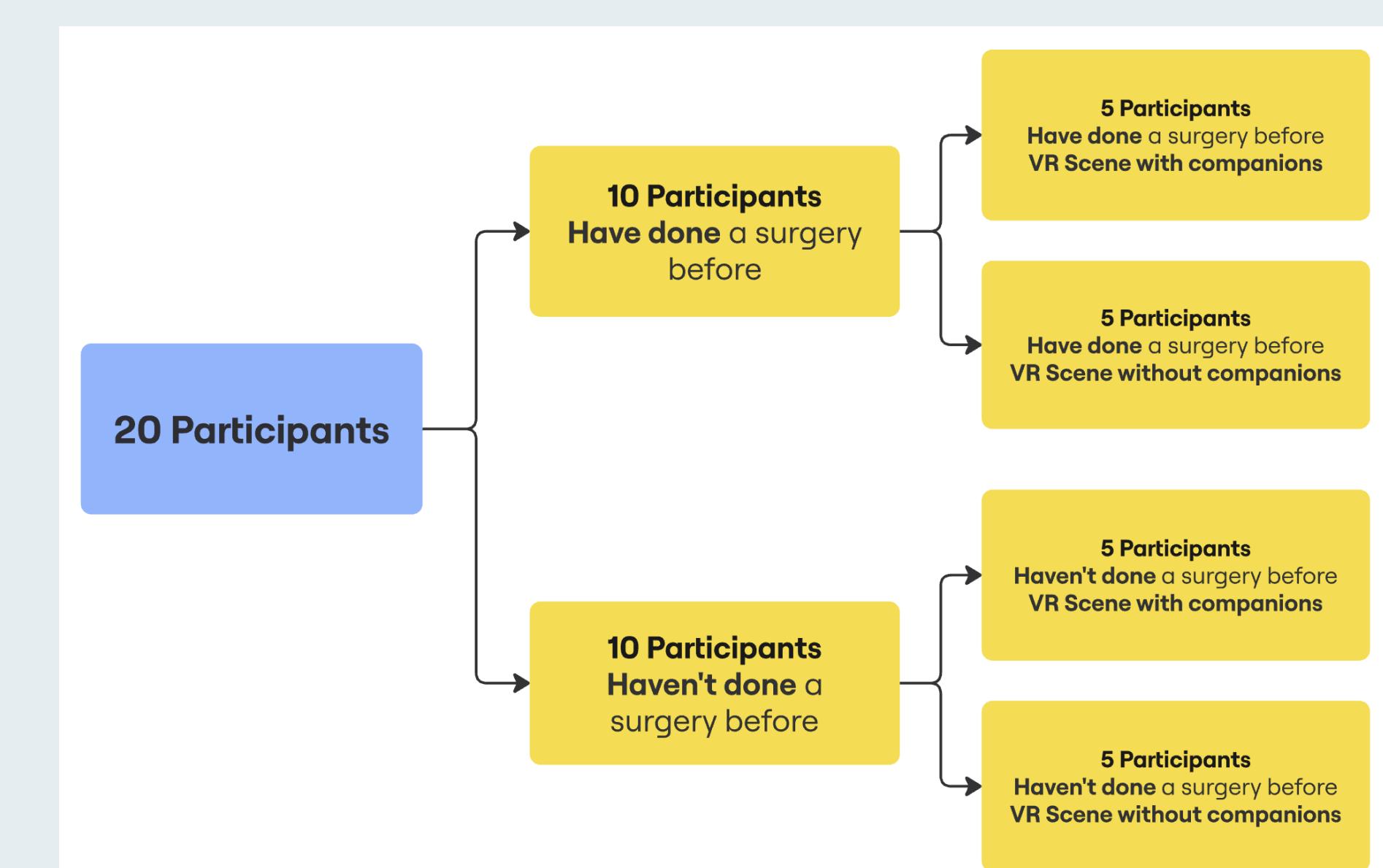


Figure 1. Flowchart of experimental setup



Figure 3. Virtual Environment Scene.  
(Top) Shows patient alone speaking with the doctor  
(Bottom) Shows patient with human companions

## Results

The analysis of average heart rates across all four groups showed a very minimal decrease in heart rates for participants exposed to virtual companions ("with friends") compared to those without companions, regardless of prior surgical experience (Figure 4). However, this difference was too small to be considered significant.

On the other hand, the questionnaire results (Figure 5) demonstrated that participants in the "with friends" condition consistently rated slightly higher on measures of comfort, stress reduction, much better distraction and a higher perceived engagement with the virtual human companionship. However, it should be noted that participants in the "without friends" condition reported that they felt the scene was more realistic than the group "with friends".

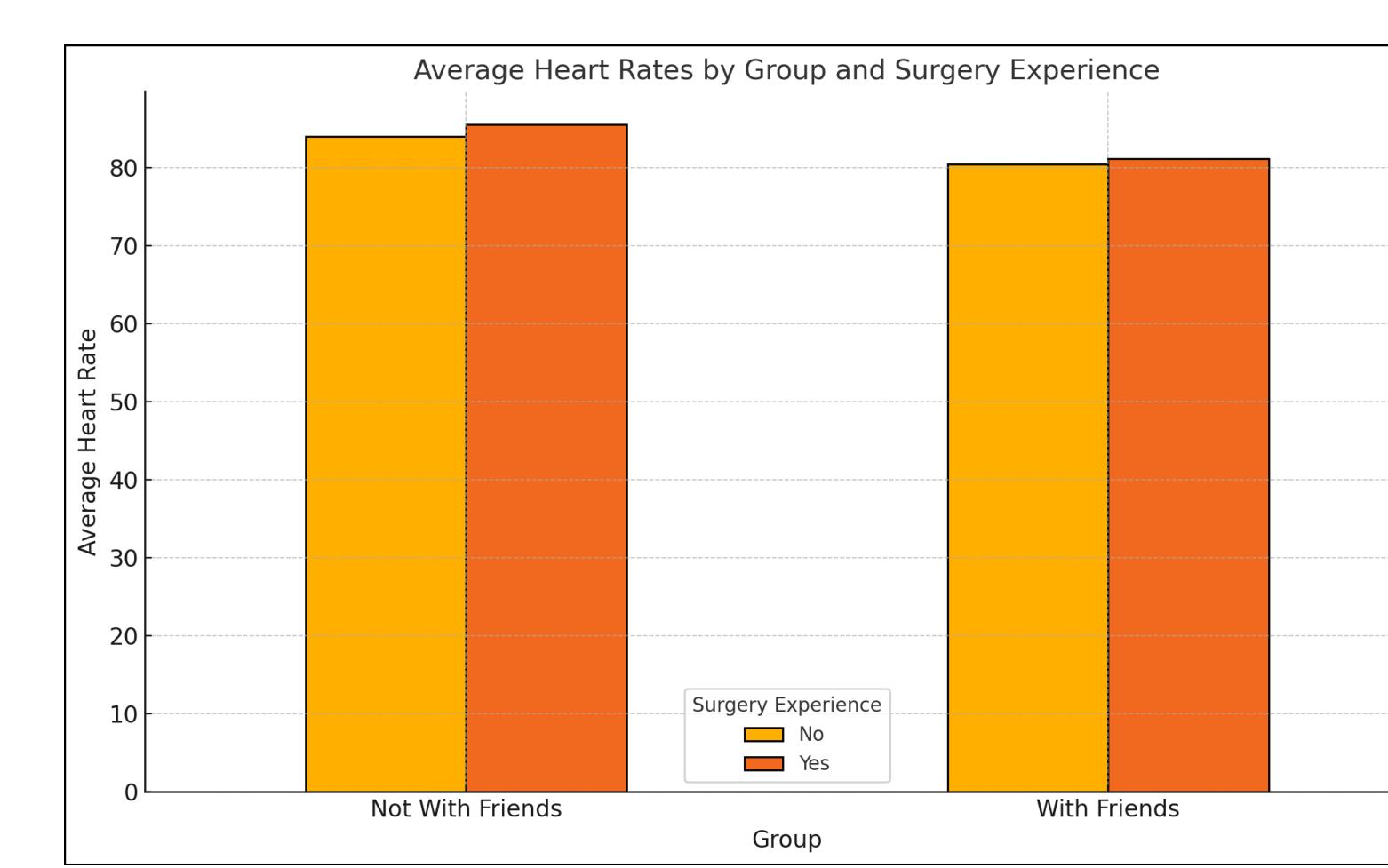


Figure 4. Averaged heartrates for all 4 groups (done and haven't done surgery for both vr scenes)

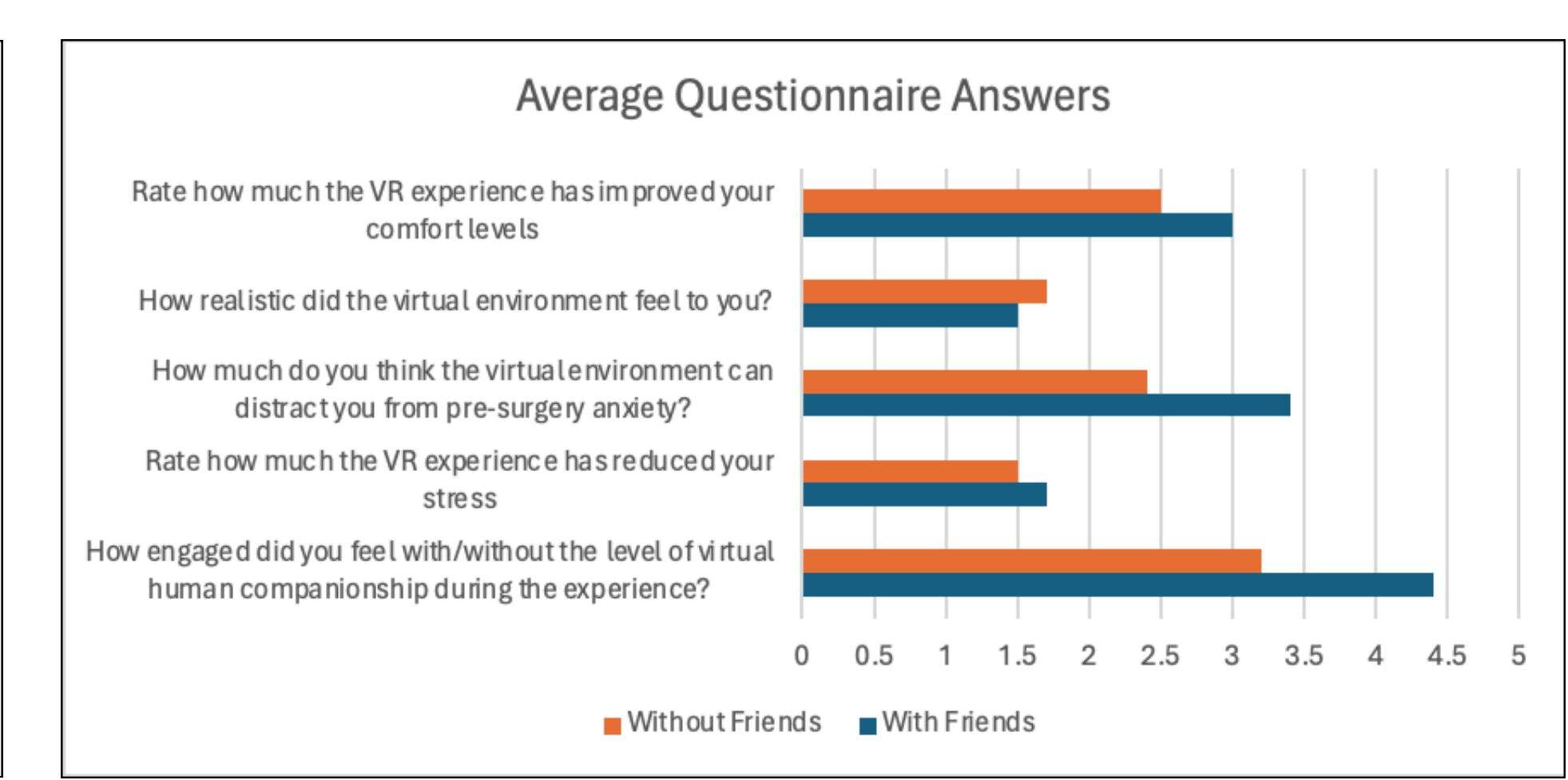


Figure 5. Averaged results from the questionnaires from all participants.  
Note: Participants that were in the scene without companions couldn't answer the last question due to no companion in the VR scene

## Discussion

The results suggest that VR does help in reducing stress, increasing comfort, distraction and engagement. However, it should be noted that the VR environment was not perceived as highly realistic, and it didn't significantly reduce stress levels (averaging around 1 – 1.5) as reflected in participant feedback, suggesting that greater immersion and refinement are needed to enhance its effectiveness.

Additionally, the use of a basic pulse sensor may have limited the accuracy of heart rate measurements. Employing a professional-grade heart rate monitor in future studies would provide more reliable and precise data.

Lastly, it's important to note that gender or culture was not taken into consideration for the models which can have impacted results as people have a preference with who they can feel comfortable with. Hence, next time this aspect must be considered.

## References

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