CS449 Assignment 5

End User Based Usability Testing of Virtual Reality Environments

Group 11

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26.12.2023

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1- Methodology

The major goal of this extensive usability testing research was to perform a thorough review of two different Virtual Reality (VR) roller coaster applications: 'Pirate Roller Coaster' from CoSpaces and 'Jurassic Dinosaur Coaster' from YouTube. The primary purpose was to compare user preferences, evaluate immersion variables, and identify strengths and limitations in producing an engaging VR experience. We thoroughly planned and carried out the following approach to assure the replicability of our study.

*Users***:** We started by developing a well-defined persona that represented our target user demographic. As a result, we selected four individuals, two males and two females, who had no prior VR experience. Each participant's demographic information, such as age, gender, and background, was gathered. These volunteers were recruited to achieve an equal distribution of gender and background. Here are the more detailed demographic information of the users:

Names of the participants: Ege Demir (male), Alp Eren Yiğit (male), İnci Kögmen (female), Selin Özkan (female)

Occupation: All students

Age: One of them is 20 and three of them are 22

Current education level: All college students

On a scale from 1 (Not Comfortable) to 5 (Very Comfortable), how would you rate your comfort level with using new technology?: All said 5

Have you ever used a Virtual Reality (VR) system before? (Yes/No): All said no

How frequently do you play video games?: 25% occasionally, 25% frequently, 50% rarely

Do you experience motion sickness while using VR or 3D environments?: 75% no, 25% not sure

Task Procedure: The task procedure was created to immerse users in the VR applications and elicit feedback on their overall experiences. Each participant was shown both VR programs, with two starting with 'Pirate Roller Coaster' and the other two starting with 'Jurassic Dinosaur Coaster.' This counterbalanced presenting sequence attempted to reduce any order effects. Users were directed to watch the VR movies and offer feedback based on particular criteria, such as their observations, impressions, and any remarkable features of their experience, during the task. While users were not compelled to make any precise selections, they were invited to offer their opinions on what they found interesting or fascinating. Participants were also polled on their degree of enjoyment throughout the VR experience, their thoughts on the realism and quality of the images, and any recommendations for improvement.

Context: The study was done in controlled surroundings to reduce outside effects and distractions. Each user was placed in a peaceful environment, creating an ideal environment for VR immersion. We also addressed the socio-technical setting, taking into account the study's physical location (e.g., dorms, silent halls) and the interaction between users. We were able to account for the larger ambient aspects influencing the user experience thanks to our contextual analysis. Understanding the actual location assisted us in assessing potential environmental elements that may affect the user experience, such as lighting conditions, background noise, and evaluating space comfort. This perspective enabled us to better comprehend the input and reactions offered by research participants.

Tool: We used the same mobile phone and cardboard VR glasses for each participant to ensure uniformity throughout all user testing sessions. An iPhone 2020 SE was used for the study. Because of this consistency, any variations in user experiences might be traced to the VR programs themselves rather than variances in technology.

Participant 1 - Selin Özkan

Participant 2- İnci Kögmen
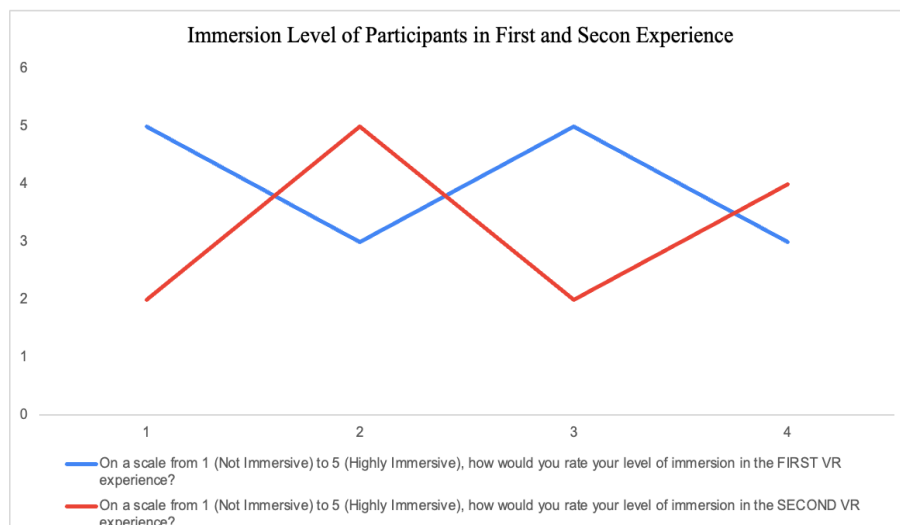

Participant 3 - Alp Eren Yiğit

Participant 4 - Ege Demir

2- Results

The four users participating in this study were asked to start the test in different orders. Accordingly, while participants Selin Özkan and Ege Demir first started their VR experience through the CoSpaces application, İnci Kögmen and Alp Eren Yiğit started their VR experience through the Youtube video. The diversity of the results obtained and whether they are affected by this ranking will also be discussed in the report.

During the testing process, users evaluated the immersion of two different VR experiences on a scale of 1 (Not Immersive) - 5 (Highly Immersive) and expressed their general opinions with open-ended questions. Looking at the trends in the graph (Figure 2.1), the votes given by the users for both experiences have drawn a line that complements each other.A graph like this shows that users who experience videos in different orders are less affected by one and more affected by the other. For example, Selin Özkan who is the first participant, experience CoSpace before Youtube and she found CoSpaces VR experience more immersive than Youtube VR experience.

Immersion Level of Participants in First and Secon Experience

—On a scale from 1 (Not Immersive) to 5 (Highly Immersive), how would you rate your level of immersion in the FIRST VR experience?

—On a scale from 1 (Not Immersive) to 5 (Highly Immersive), how would you rate your level of immersion in the SECOND VR experience?

Figure 2.1- Immersion Evaluation in both Experience

On a scale from 1 (Not Immersive) to 5 (Highly Immersive), how would you rate your level of immersion in the FIRST VR experience?
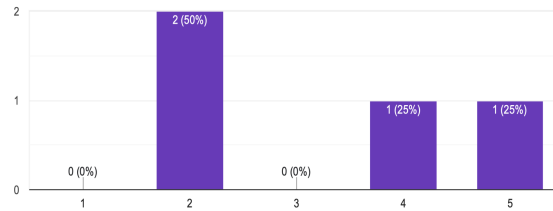
4 responses
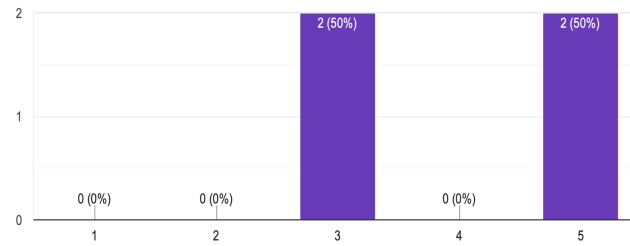
Figure 2.2 - Immersion Evaluation of First Experience

On a scale from 1 (Not Immersive) to 5 (Highly Immersive), how would you rate your level of immersion in the SECOND VR experience?

4 responses

Figure 2.3 - Immersion Evaluation of Second Experience

Users rated the ease of navigation for both experiences on a scale of 1 (Very Easy) to 5 (Very Difficult). The rating distributions of the first and second experiences are the same. Looking at both graphs (Figure 2.1 and Figure 2.4), the third participant (Ege Demir) found the Youtube VR experience immersive at a level of 2 and stated that this system was hard to use. The 4th participant (Alpe Eren) found CoSpaces VR experience quite (4) immersive and stated that the system was easy to use. These two comparisons show that the YouTube VR is found to be less immersive as well as hard to navigate by the users, while the CoSpaces is evaluated with a higher score in terms of immersion, also the ease of guidance is higher. In addition, the results of

users who were asked to evaluate the sound factor in enhancing, distracting and neutral options were similar for both experiences. In general, users found the sound factor entertaining.

## Ease of Use in First and Second Experience
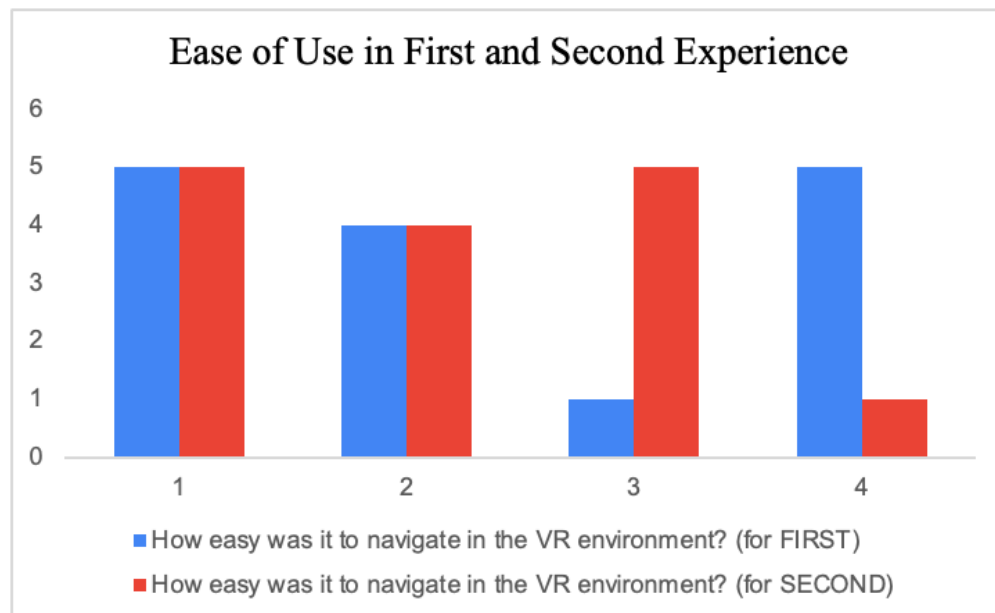
Figure 2.4 - Navigation Evaluation of Both Experience

The most common answers to open-ended questions where users explain their experiences in emotional and physical contexts are; It was ¨normal¨and ¨exciting¨. Both descriptive expressions were used almost equally. During the testing process, users were asked to evaluate the image quality and graphics in an open-ended manner, and the expressions they used to describe them were "realistic" (50%) and "unrealistic" (50%). These responses were received in equal numbers for both experiences. In addition, some users stated that the environment they experienced was simple and needed improvement.

After users completed their experience with both applications, they took part in a survey in which they evaluated system usability. The survey asks users to evaluate the given parameters on a scale of 1-5. The survey was completed by each user for both experiences and the results

were averaged and compared as shown in Figure 2.6 below. Although as it can be seen in the bar graph, the average for some criteria such as 'need of technical support', 'complexity of system' and 'requirement of pre-knowledge' are quite similar; there are noticeable differences in some usability parts. In terms of integration of functions, participants found that this condition is better for the CoSpaces application. The success of the integration of functions in the eyes of the users was evaluated as an average of 4.5 for the CoSpaces application and 2.75 for the Youtube VR. This is one of the biggest differences in evaluation. Also, they found that Youtube VR is 20% more inconsistent than application, as well as VR experience with Youtube is 25% more cumbersome.
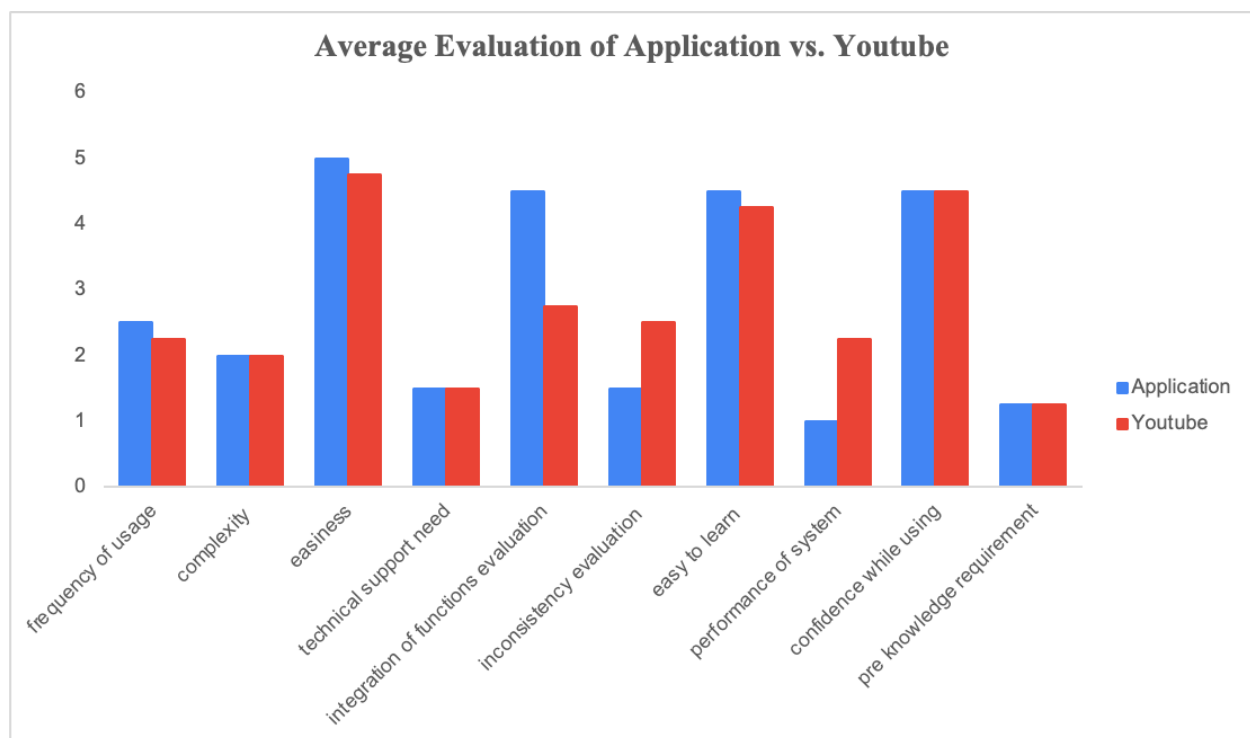
Figure 2.6 - Average Evaluation Points after the Test

3- Discussion and Conclusion

The usability evaluation of 'Pirate Roller Coaster' via CoSpaces application and 'Jurassic Dinosaur Coaster' on YouTube has provided meaningful insights into preferences and the effectiveness of VR applications. Based on the data, we examined the analyzes in 4 categories: Immersiveness and Realism, Audio and Visual Quality, Ease of Navigation and User Experience, and Emotional and Physical Sensations.

Immersiveness and Realism:

Selin Özkan and Ege Demir (CoSpaces First): Both exhibited a strong preference for the immersive qualities of CoSpaces. Selin's high rating (5) for the CoSpaces app's immersiveness contrasted with her lower rating (2) for YouTube, indicating a clear preference for the more interactive and engaging experience offered by CoSpaces. Ege's similar ratings align with this, emphasizing the value of an interactive VR environment in enhancing the sense of immersion.

İnci Kögmen and Alp Eren Yiğit (YouTube VR First): İnci's experience with YouTube, which she described as more akin to watching a video, received a moderate immersion rating (3), but her immersion rating for CoSpaces (5) reflected a significant improvement in her experience. Eren's responses also showed a similar pattern, with a moderate immersion rating for YouTube (3) and a higher rating for CoSpaces (4), underscoring the enhanced immersive quality of the latter.

Audio and Visual Quality:

All participants appreciated the audio component in both applications, highlighting its role in enhancing the VR experience. The consistent positive feedback about audio across both platforms suggests that sound is a critical factor in creating an immersive VR environment.

Visual responses were more varied. Selin and Ege found CoSpaces' visuals more impressive and engaging, while İnci and Eren had a more mixed response. İnci noted the simplicity of YouTube's visuals and found CoSpaces' environment more interactive, whereas Eren appreciated the realistic graphics in YouTube but found the cartoonish graphics in CoSpaces engaging due to their interactivity.

Ease of Navigation and User Experience:

CoSpaces was consistently rated higher for ease of navigation, indicating that its interface was more user-friendly. This aspect of the application likely contributed to the higher immersion ratings, as users could navigate the VR environment more intuitively.

The overall user experience was more positive with CoSpaces. Participants like Selin and Ege found the CoSpaces app to be not only immersive but also fun and engaging. In contrast, the YouTube experience was often seen as less dynamic and engaging.

Emotional and Physical Sensations:

CoSpaces application elicited stronger emotional responses and physical sensations, indicative of a more engaging and immersive experience. For instance, Ege described feeling

excited and amused during the CoSpaces experience, highlighting the app's ability to evoke a wider range of emotions.

The emotional and physical responses to the YouTube VR experience were generally less intense. Participants like İnci and Eren noted a lack of action and excitement in the YouTube VR, suggesting that its static nature might have limited its ability to fully engage users.

Limitations of the study:

Device Limitation - IOS Phone: The use of an iOS phone for testing introduced a significant limitation, especially for the YouTube VR experience. Unlike Android devices, the iOS phone did not support head movement in YouTube VR, potentially impacting the participants' experience and their perception of immersion and interactivity. This hardware limitation may have inadvertently skewed the results in favor of the CoSpaces app, which did not have such restrictions on the iOS platform.

Small Sample Size: The study involved only four participants, this might limit the generalizability of the findings.

Future Study Suggestions:

Ensuring Comparable Capabilities Across Android and IOS Phones: Future studies should
ensure that the VR applications being tested offer comparable experiences on both Android and
IOS platforms. This parity is crucial to avoid any bias that might arise from differences in device
capabilities, ensuring a fair and balanced assessment of the VR experience across different
smartphone platforms.

Increased Sample Size: To enhance the validity of the study, increasing the number of
participants is essential. A larger sample size would allow for more substantial data analysis,
leading to more generalizable conclusions.