Effects of Game Explanation on Continued Gameplay Probability of a VR Game

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In this study we would be enquiring whether the probability of new VR user coming back to play the same VR game increases or not when a game explanation or guidance is provided. To measure this, we would be having two groups of new VR users. One group will be provided an explanation and another group will not be provided with any game explanation. Group with no game explanation would be our baseline. After the end of each game play, for both the groups, participants will be given an experience- based questionnaire. The data collected from this questionnaire will be used to analyze the outcome and to infer a possible successful answer to our research question. Any other outcome, apart from those relevant to our research question, might also be possible.

CCS Concepts: • **Human-centered computing** → **Virtual reality**; **User studies**; *Laboratory experiments*; • **Hardware** → **Haptic devices**.

Additional Key Words and Phrases: virtual reality, VR, game, game explanation, HCC, player experience, replay probability

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1 INTRODUCTION

Our research question is "Will the probability of a new Virtual Reality (VR) user coming back to play the same VR game increase if the user is provided an explanation about the game, when compared to those who are not?". We want to study the effect of VR game explanation on players' experience, and we would try to measure it by looking at the possibility of the player returning or willing to return to play the VR game again. There is also a possibility of contradiction that leaving the player to explore the game, without a prior explanation, may also enhance the experience and urge them to replay the game, as seen in the outcome of [7, 8, 17–19]. We believe that users provided with gameplay guidance (the explanation) for the VR game prior to playing will show more interest in coming back to play the game or another similar game. An explanation is a comprehensive description about something, in our case the VR game. It reduces the cognitive load and assists in decision-making, enhancing the overall experience of that something. The intention behind providing an explanation could be goal oriented, like, trying to make the game transparent, enable the player to make faster game decisions or to persuade the players that the VR game is interesting, and they might come back to experience it again [1]. For this study we want new VR user as participants because the results of [4, 11] shows that participants who have no experience of VR or VR games would be more interested and would exhibit insightful behavior to boost sale [13]. We intend to have 2 groups of fresh VR users. One group will be provided a game explanation and the other group will not be provided any explanation. At the end of each session of gameplay, participants will be asked

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to fill an experience-based questionnaire which will be used to analyze the effect of the presence of (or absence of) an explanation in both the cases. Theories associated with explanation have mostly been established for real world scenarios. This study will attempt to build a study similar theory for the VR world. As Balog and Radlinski [1] points out, explanation in VR or VR games is gaining more and more attention, and is being used in multiple formats, like in strategy games [17], "knowledge power" [22], behavioral studies [15], tutorials [11], [8], and many more. Hence, it becomes important to understand the differences and implications of providing or not providing an explanation, especially in the case of VR games, so that; this knowledge can be strategically used for the benefit of an individual or an organization, may that be a game developer, a game company, or the game player themselves.

2 RELATED WORK

There are numerous works related to our research question and can be majorly viewed as having similar research goals, having similar behavioral aspects, and having similar game play enhancement. Many of the explanation-related studies were conducted on non-VR aspects or environments. This study will help in proving whether those theories are applicable in a VR environment as well.

2.1 Similar Research Goals

Balog and Radlinski [1] measured whether an explanation with a goal, provided with recommendations by the researcher, creates the intended effect on the recipient; this is in coherence with the research question (RQ) of this study - whether an explanation will increase the chances of replay/reuse. Robertson et al. [17] have measured the 2D game performance based on explanation versus no explanation. This is like our RQ for VR game replay/reuse probability based on explanation versus no explanation. Bertelsmeyer et al. [2] focused on directed gameplay, which is in-line with providing explanation prior to gameplay, however, directed gameplay provides helpful instructions throughout the game session. Similarly, Frommel et al. [8], created in-game tutorials for game explanation. In this, the research goal is similar, however, we will be explaining the game verbally and will be comparing the effects with a different baseline, that is, against gameplay with no explanation. The goal of Lindley et al. [14] is obtaining an adaptive game mechanics, which is in-line with one of our expected outcomes where game explanation makes the game more adaptive for reuse/replay. Our RQ aims to verify whether game explanation increases acceptance of the VR game. This is congruent with acceptance evaluation through sentiment analysis [20]. Acceptance and experience of cultural heritage [5] is being evaluated based on VR environment, which is relevant to our study, as we are trying to see whether explanation has any impact on acceptance of a VR game.

2.2 Similar Behavioral Aspects

We are trying to find the effect of explanation on the replay of the VR Game, similarly, Grech et al. [11] had studied the effect of VR on learning the shooting sport. There are similarities on the behavioral front with respect to explanation and VR. A thought: if a VR game is used to learn a sport then an explanation about a VR game should help a player understand or get acquainted with the VR game. Based on the players' feedback in [22], VR can bring about behavioral changes or improvement. This aspect can be leveraged with the addition of explanation to increase interest in the VR game and hence, increase possibility of replay/reuse. Jim Whitehead [23] taught (provided) the game design (an explanation) and he observed the effects. Our RQ is similar, except, we have a baseline against which we will be comparing; additionally, the medium is VR. The determinants identified in [21] can be secondary variables for measuring game acceptance for our VR game. Studies related to the acceptance model in education games [16], are also related, as the acceptance model

brings positive behavioral change towards education, like how explanation may have the positive effect of increasing the VR game popularity.

2.3 Similar Gameplay Enhancement

Georgiadis and Yousefi [10] enhanced the user experience (UX) by the introduction of a bare hand controller and the addition of another player; similarly, we are trying to see whether providing an explanation enhances game experience. Christensen et al. [4] shared game information with players and is congruous to our RQ; however, objectives of both works differ. Multiple constituents of enjoyable experiences are studied in [18, 19], while we are trying to check if game explanation can be one factor. Li et al. [13] studied the effect of latency (a technical statistic) on players' UX; our RQ studies the behavioral side of the experience. Bian et al. [3] studied the effects of customization on player experiences and motivation in a VR game; providing (or not) an explanation is a type of customization and can be implemented on the basis of the outcome. Frommel et al. [9] studied the effects of controller-based locomotion on player experience in a VR game; similarly, the effect of explanation on VR game experience would be studied by us.

3 METHODS PROPOSED

As mentioned in the introduction, our research method would be between-groups. We are hoping to have two groups of participants. One group will be given the game explanation and the other group will not be given any game explanation. At the end of each gameplay, each player would be asked to complete behavioral questionnaire, which will be used for result analysis.

3.1 Population

Our target population will consist of users completely new to VR. Grech et al. [11] and Cristensen et al. [4] suggest that participants with no experience of VR or VR games would be more interested in participating in a VR study and would exhibit insightful behavior. Age of participants will be limited to 14 to 36 years of age, per the average distribution of video game players [6].

3.2 Recruitment

Participants will be recruited via email, poster, and social media advertisement. These ads will ask for new VR users and explain the task of playing a VR game and answering questions before and afterwards. The total number of participants will range from 28 to 50 people, in line with the population size in studies from Frommel et al. [8] and Georgiadis et al. [10]. The total pool of participants will be randomly split into two equally sized groups. Power analysis shows power is 0.72 when the total number of participants is 28 and 0.91 when the total number of participants is 50.

3.3 Study Location

The study will be conducted in a virtual environment created in a research lab. This will grant more control over the technology used and environment while providing easier access to resources like computers and VR devices. Additionally, it will be easier to provide the VR game explanation in the controlled environment.

3.4 Method Type

Suggested by Robertson et al. [17], this study will be conducted in the one-way between-subjects ANOVA test. The two groups will be designated experiment and control. A pre-gameplay questionnaire will be conducted to collect basic

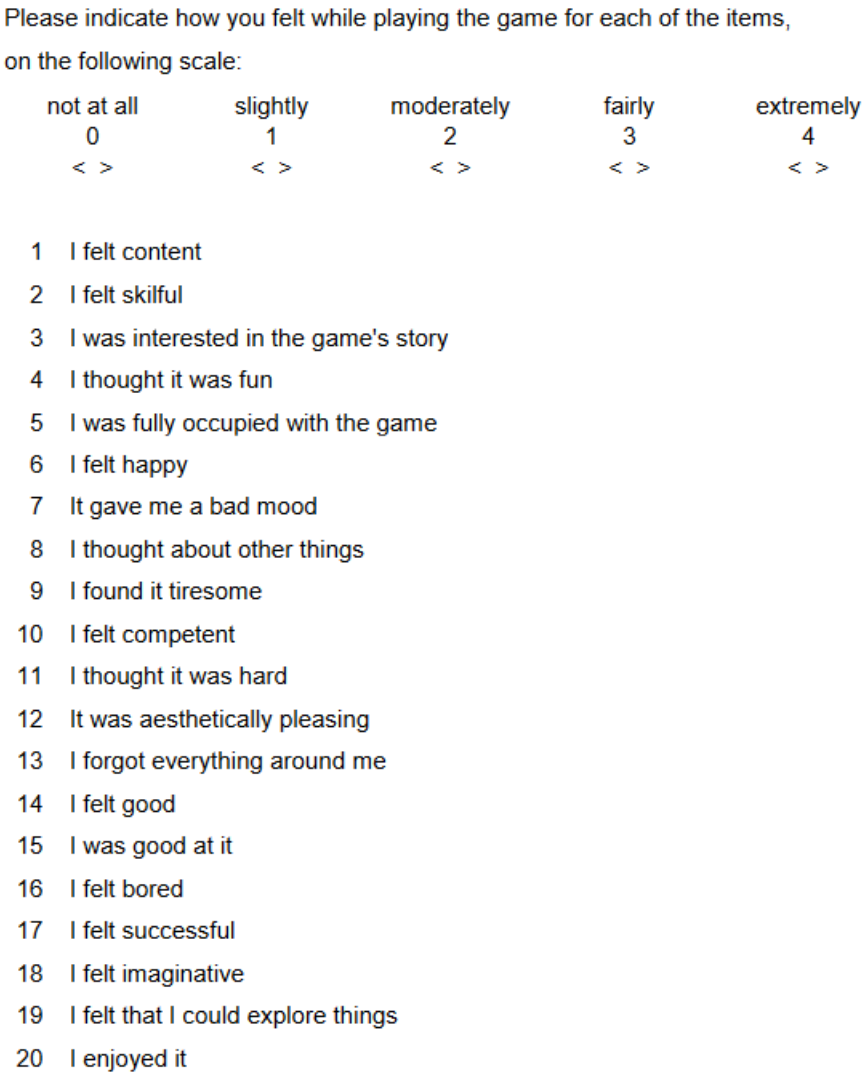

Fig. 1. Example Questionnaire [12]

demographic and background data. This will help identify any covariates that may show up during the study. The guided experiment group will receive an explanation while the unguided control group will not. The two groups will then play the game. Gameplay duration will be recorded for each session for both, guided and unguided groups and after every session participants would be required to complete a Game Experience Questionnaire (GEQ), which would be shared with the participants in a digital format just after the gameplay. Figure 1 shows an example GEQ from [12]. Additionally, the participants' behaviors would be noted during their play session; for example, any unexpected verbal exclamations or questions, bouts of confusion, or inability to complete objectives would be recorded by the researcher.

3.5 Data Analysis

Data analysis will be include a description (a quantitative distribution) and a model (a qualitative summary) of the gameplay time data for both groups using their mean times. Responses for the GEQ will be used to create a distribution plot of the mean values; corresponding plots will be compared.

3.6 Other Studies

Similar methods have been used in [1, 8], where, instead of game explanation, goal explanation and tutorials, respectively, has been used as variables. Grech and Sacco [11] have used a similar method, but, in this case performance is compared between experienced VR game players and in-experienced VR game players. Georgiadis and Yousefi [10] used NASA Task Load Index (TLX) and interaction methods questionnaire to gather quantitative feedback and qualitative feedback was collected through interviews. Also, the GEQ designed by IJsselsteijn et al. was used in [4] which is a subjective approach for measuring the player experience. GameFlow, derived from heuristics experience of game users, has been used in [18, 19] for evaluation of games. These options can further be explored and could be applied to obtain qualitative and quantitative data as per our requirements.

4 RESULTS EXPECTED

Possible outcomes would be: (a) more participants, who were provided guidance, would feel more likely to come back to play the same game, or (b) more participants, who were left to explore the VR game without guidance, would feel more likely to come back to play the same game. The outcome variable mostly relates to people's behaviors because the outcome would indicate that (a) having some guidance increases the probability of reuse/replay or (b) having a chance to explore something new might increase interest and might correspondingly increase the probability of reuse/replay. Beyond recording factors for game replay/reuse, we would be obtaining some subjective measurements through the questionnaire that we might use for qualitative data collection [3, 18, 19]. We are also hoping to use distribution charts for analysis and result display, in similar manner to [3, 4, 8].

An example set of results is as follows. Group 1 is the experimental group provided an explanation, while Group 2 is not provided an explanation. Both groups have four participants. Their gameplay time can be modeled in the below chart and a comparative bar plot can be modeled in Figure 2.

Group 1	Gameplay Duration	Group 2	Gameplay Duration
Participant 1	20 min	Participant A	10 min
Participant 2	18 min	Participant B	15 min
Participant 3	15 min	Participant C	18 min
Participant 4	30 min	Participant D	8 min
Mean	20.75 min	Mean	12.5 min

Similarly, for the GEQ consider the below sample for the same two groups.

GEQ - Group 1	Participant 1	Participant 2	Participant 3	Participant 4	Mean
Felt content	3	4	3	4	3.5
Felt skillful	4	4	3	3	3.75
Interested in Story	4	4	3	4	3.5
Felt happy	4	4	4	4	4

GEQ - Group 2	Participant 1	Participant 2	Participant 3	Participant 4	Mean
Felt content	2	1	2	1	1.5
Felt skillful	2	0	2	1	1.25
Interested in Story	2	2	3	2	2.25
Felt happy	2	2	1	0	1.25

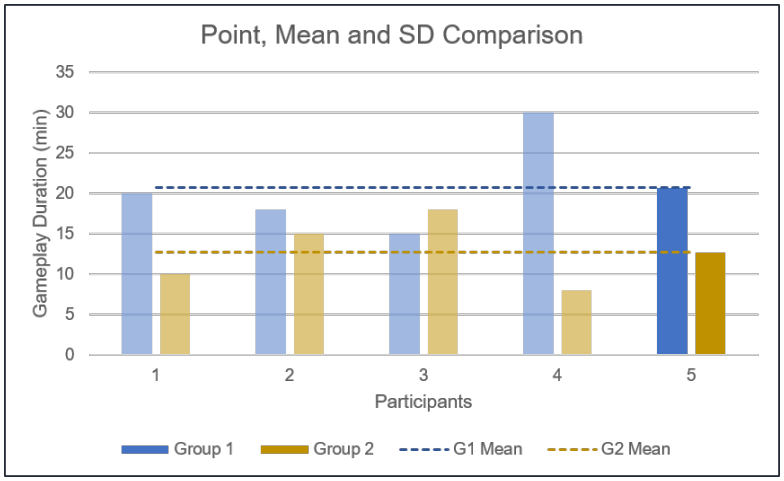

Fig. 2. Bar plot of expected results

Plotting our mean GEQ values, we would create a plot similar to Figure 3.

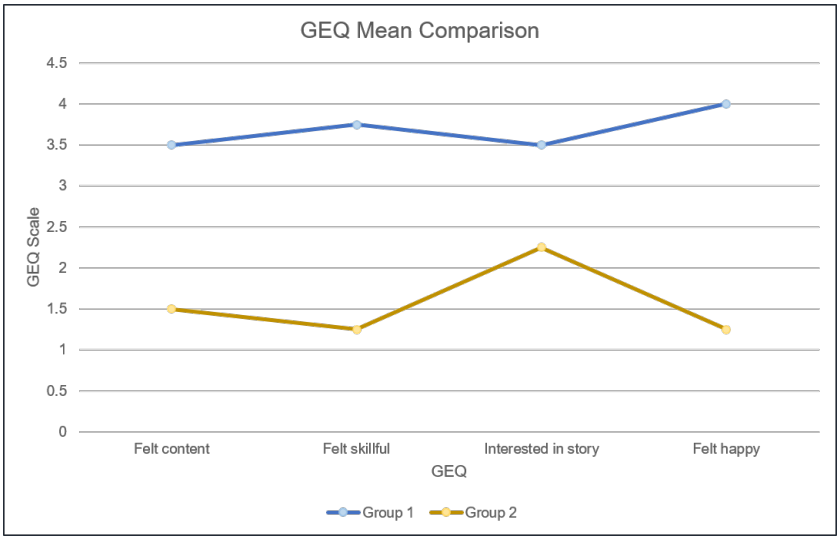

Fig. 3. Line graph of GEQ means

To support our hypothesis, we are expecting the following.

(1) The mean of positive GEQs of Group 1 is greater than the mean of positive GEQs of Group 2.
(2) The mean of negative GEQs of Group 1 is fewer than the mean of negative GEQs of Group 2.
(3) The number of GEQs supporting (1) to be more for Group 1.
(4) The number of GEQs supporting (2) to be less for Group 2.

5 DISCUSSION

Our results may imply either

(1) (In support of our hypothesis) Providing an explanation can enhance the gameplay experience,
(2) Or without explanation, gameplay experience can be satisfactory.

Additionally, if the mean of the gameplay time for the experiment group is more than that of the control group, we would expect the mean GEQ response values for the former would be more positive than that for the latter.

The outcome in [4] is somewhat similar to our study. Here, the authors developed three different versions of a multiplayer game: Non-VR, Simple VR and Full VR and compared the aspect scores for every game; they found that aspect scores were higher for the VR versions when compared with non-VR versions, provided that, VR versions are constructed with care. Thus, inferring that VR experiences are better than non-VR experiences. Also, the game flow model used by Sweetser et al. [19] and Sweetser et al. [18] can be used in our study to measure or study the subjective aspects of enjoyment, engagement, and enhanced game experience. Frommel et al. [**?**] also provides a similar argument, in which a context-specific tutorial heightens the positive emotions and intrinsic motivation, which can be leveraged for our study.

Limitations to our study may include the participants' prior video game experience, which may have an effect on their ease of understanding the VR game despite not having VR experience. Explanation quality may influence the game experience for participants in the experiment group, as each individual would understand the explanation differently.

6 CONCLUSION

Referring to Grech and Sacco [11], we can assume that the interest in VR games would continue to grow as there is a general curiosity about VR among the general population. We are hoping that through this study some additional insights will be obtained, as happened with Christensen et al. [4]. Inspired by Sweetser et al. [19] and Sweetser et al. [18], the results of this study could further be extended to understand the other behavioral aspects of enjoyment.

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