The Correlation of Immersion and User Satisfaction in Video Games

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ABSTRACT

This paper describes the correlation between immersion in video games and player enjoyment. A commonly accepted definition of immersion in the context of video game playing is established and used. Surveys given before and after game-play were used as a primary method of gathering data. Two surveys were given to participants prior to game-play, participants played a game for an hour, and a final survey was given. The data from the surveys was used to show relationships between immersion factors and player enjoyment. Such correlations could provide new and more effective methods of video game development and testing.

Categories and Subject Descriptors

D.2.8 [Metrics]: Performance measures

K.8.m [Personal Computing]: Miscellaneous

General Terms

Measurement, Documentation, Performance, Design, Experimentation, Human Factors

Keywords

Immersion, Absorption, Video, Game, Engagement, Sense, Presence

1. INTRODUCTION

In this project we define immersion simply as a sense of presence, the sense of one being in a fictional world outside of the real one. The definition follows Emily Brown and Paul Cairn's [3] recently published work in determining a grounded structure to immersion from the myriad of different ideas. A common example would be a horror movie patron who becomes immersed in the movie and jumps off of the seat during unexpectedly frightful moments. This is not to say, however, that every person experiences immersion the same way, or even the same amount. Immersion is known as a very subjective experience [2-11].

Video games are a billion dollar industry in which producers like Atari Inc. are making millions of dollars every year by making products with little real-world value other than user satisfaction [1]. Just as for any programmers, video game programmers depend on strong designs and heuristics to produce profitable games. There are dozens of different heuristics and tests currently in use for game evaluation; however, all heuristics that I have seen undervalue the idea of player absorption (immersion) [4, 9]. I believe that this is a critical oversight, as immersion could be major factor in user satisfaction and good game design.

One example of common game evaluation comes from an anonymous game developer in a study by Penelope Sweetser and Peta Wyeth [9]. The evaluation consisted of three main areas: game mechanics including environment physics and realistic reactions, game interface including ease of use and overall transparency of controls, and game play including winnability, art and sound effects, and rewards. Several evaluations like this list elements of immersion (ex. 'user feels a part of the game' or 'user loses sense of time') as small relevant factors, but none are giving the matter enough weight.

I have found a relationship in video game play between satisfaction and immersion in that the more a part of the game the user feels the more positive that user will feel about the entire game experience. This means that a user feeling as though he/she is inside the game 'world' will have a more enjoyable experience than a user who does not. To gather evidence, a user test was conducted involving 17 participants playing a game and filling out surveys to establish game preference, satisfaction, and immersion.

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The data showed some strong relationships between player satisfaction, immersion, and the amount of time a user would wish to play that game at one sitting (without other time constraints). Other relationships were also noted. In the conclusions, I detail the likely use of my findings to increase the play-time, replay value, and likelihood of purchase for video games through better video game design heuristics and testing.

This paper continues with a small discussion of the current status of immersion research. Following this discussion the methods I used are detailed, including specific questions from the surveys, and some of the noted limitations of the study. Once the methodologies are described I conclude by talking about some of the noticed relationships and possible uses of this information.

2. BACKGROUND RESEARCH

Researchers [2, 3, 6-8, 10] in both the science and psychological fields have begun to link the phenomena of game absorption/immersion with a sort of subconscious openness. Psychologists [6] study the emotional responses and effects of violent video games with children. In their research, children showing higher levels of immersion (only one of the factors studied) seemed to have more of a reaction – they were affected more by the games. Ravaja and Salminen, et al. [8] studied emotional response to video gaming. They concluded that immersion might result in a user losing some sense of self, caring less about normal morals/norms, and being generally more open to connect what that user is doing directly with how they are feeling. For example, an absorbed user who is playing a video game with violence may connect the happiness of playing it directly with that game even if that user normally disapproves of violence.

Studies show immersion occurs in increasing levels [3]. A person can experience small, moderate, or high levels of immersion. The first level of immersion is called engagement, and is characterized by a player becoming transfixed by a game. The player begins to put more importance on the game and starts to spend larger amounts of time playing or thinking about playing. From engagement, a player can move on to the next level called engrossment. At this point a player is spending a great deal of time playing the game, and considers the game very important. Finally, a player may reach the highest level called immersion. When a player reaches a state of immersion, the game experience becomes intrinsically rewarding, and the player may lose track of time or may even lose a sense of what's going on around him or her.

Right now there is no established method to measuring immersion. To help score some of the important factors of immersion, I decided to use a survey and scoring tool from the United Kingdom's Independent Television Commission [5]. This survey is called the Sense of Presence Inventory (SOPI), and was developed to help measure immersion and sense of presence through various media (television, radio, video games, etc…). The SOPI uses Likert scale questions with 1 to 5 scales that are scored into four main categories: spatial presence, engagement, ecological validity/naturalness, and negative effects. (More details in the methods section)

To my best knowledge, there has been no study on the direct effect of user immersion or the response from a user who 'gets immersed' in a game. Most studies that have an element of immersion aren't designed to study it alone [2, 6-8, 10]. Therefore, we are lacking evidence to describe the potential of focusing the design of games to promote it. Through the use of my user test and surveys, I'm able to describe the usefulness of immersion as a heuristic.

3. METHODS

As mentioned in the introduction, the primary method of experimentation was a user test with a few surveys. Two surveys were given prior to playing the game, the user test consisted of a single group game-play experience with a first-person shooter game - Half Life: Deathmatch, and one survey was given directly following game-play. The surveys were conducted in a group setting to allow for questions and explanations. A more detailed explanation follows.

3.1 Pre-Game

To gather participants, I collected a list of previous Saint Mary's University LAN party attendants and emailed them. A group of 17 participants was established. I met with them all as a group, and explained the experiment process in more detail. Noteworthy is the fact that a majority of the participants had experience playing the game, and had a moderate to extensive level of video game experience in general. The participants were told that I was conducting an experiment involving video games, and were offered both pizza and the possibility of cash prizes once the experiment was over. The top three places and two other random players would receive cash prizes.

The participants were also told to avoid caffeine, mood altering chemicals, and high physical exertion for at least 24 hours prior to the game date; participants were asked to limit their non-game

interactions with other players as much as possible when playing that day. Then I administered the first survey about game preference and experience (see Figure 1 for sample questions).

Due to the highly individualized nature of immersion, it was important to quantify some personal characteristics about the participants. These characteristics included genre preferences (role-playing games vs. sports or first-person shooters); individual worth of graphics, sound, storyline, etc…; and the participant's level of video gaming experience in general.

These factors are highly relevant to the person's willingness/ability to become immersed in a video game. Of course, some of these factors will inhibit some participants as well: for example, a person who doesn't normally like playing a first-person shooter and doesn't have experience doing so will have more of a barrier to immersion than an experienced player that regularly plays them.

On the experiment date participants were given a survey to determine their current physical condition and overall mood to ensure that results weren't skewed by players who were impaired by sickness, drugs, depression, etc… This second survey included mostly Likert scale questions (see Figure 2 for sample questions).

After all of the participants had completed the survey, I told them again to try to limit their non-game interactions with others, that the first 2 out of 5 rounds of 10 minutes would be practice before scores were kept, pizza would be served after the game was over, and that there were cash prizes for the top three players and two other random players.

Please order your preference of game genre 1 - 5 (5 being highest):

RPG's_____ First-Person Shooters_____ Strategy games_____

Sports games_____ Other (name)_____ _____

Overall, I generally play video games

< 1 hour per week _____ 1 to 4 hours per week _____

5-10 hours per week _____ > 10 hours per week _____

Figure 1. Sample questions from the first pre-game survey to determine gaming preferences and overall gaming experience

	Strongly Agree				**Strongly Disagree**
I am feeling good today	1	2	3	4	5
I want to play this game right now	1	2	3	4	5
Today has been a good day so far	1	2	3	4	5

Figure 2. Sample questions from the second pre-game survey for determining overall player condition

3.2 Conducting Play

For the experiment one computer lab was equipped with 20 Dell PCs that were wired into two switches. These two switches were wired into a final switch that was connected to the game server PC. The server was equipped with a Steam administrative package, and was set to change maps and reset player scores every ten minutes. By resetting the maps so often, I hoped to limit the advantage the experienced players would have in finding the best places on the map. Unfortunately, this setup does force breaks in a player's experience (even if only for 15-30 seconds) that weaken an immersive experience.

Before play started, the participants with no experience with the game were given basic instructions on how to move and use weapons. Once these players asserted that they understood the instructions, I asked everyone if there were any questions. No questions or objections were brought up, and all participants were instructed to begin game-play. Six separate maps were played for a total game time of one hour. Once the seventh map began to load, participants were asked to stop playing and take the final survey.

3.3 Post Game

The final survey consisted of mostly Likert scale questions dealing with the game experience and satisfaction and questions from the SOPI presence assessment tool. Figures 3 and 4 show sample questions from the post-game survey dealing with satisfaction and immersion respectfully.

Questions from the satisfaction survey determined how much fun the player had, and if the player had more fun, less fun, or a normal amount of fun during the experience as compared to usual experiences with similar games he or she has played (if any). The SOPI scored a series of questions related to experiencing some media (television, radio, video games, etc…) into four areas: spatial presence, engagement, ecological validity -naturalness, and negative effects. Each question has a scale from 1 (strongly disagree) to 5 (strongly agree). The mean score of each factor is generated and used to determine the level each factor was experienced.

Spatial presence is defined as the amount a player feels a part of the game or 'in the game' instead of sitting at a computer. Similar to the level of immersion defined in the introduction, engagement is the amount a player feels transfixed by the game and wants to continue playing. Naturalness measures how much a player finds the game environment and characters realistic. It has to do with graphical quality, game physics, and a range of other details that make the game believable. Negative effects are the adverse feelings the player experiences while playing (headache, eye-strain, dizziness, etc…).

Once the users completed the final survey, all of the surveys were collected, the participants were given pizza, and the top 3 and bottom 2 players were given cash prizes of $5, $2, $2, $5 and $5 respectively. Later, with help from Dr. Luttmers of the Saint Mary's University's Psychology department, all survey data was reviewed and input into SPSS software for ease of review and computing relations. SPSS is a powerful statistical program that allows for simple execution and processing of most normal functions (means, correlations, one way ANOVAs, etc…). Dr. Luttmers also assisted in quantifying this scoring information to make correlations between satisfaction and immersion.

	Strongly Agree				**Strongly Disagree**
There's something else I would rather have been doing	1	2	3	4	5
I enjoyed playing this game	1	2	3	4	5
I enjoyed the graphics	1	2	3	4	5
I had trouble using the keyboard	1	2	3	4	5

Figure 3. Sample questions from the post-game survey dealing with player satisfaction.

	Strongly Agree				**Strongly Disagree**
I felt I was a part of the game	1	2	3	4	5
I lost track of time	1	2	3	4	5
The displayed environment seemed real	1	2	3	4	5

Figure 4. Sample questions from the post-game survey copied from the SOPI to rate levels of engagement, presence, naturalness, and negative effects.

3.4 Limitations

There were several limiting factors involved in this study. First and foremost, this was a semester-long research project done for a class. This means that there were strong financial and time constraints. I was thus limited to using a gaming system and game that was already set up for use, and further limited by the number of participants I could accommodate.

The game itself was not the best choice for measuring immersion. Half-Life: Deathmatch is a FPS that puts all players in a free-for-all killing zone. Once killed, a player is immediately brought back to life in a new, random location. This feature leads to frantic, reaction-based play that weakens the ability to become immersed in the game.

4. RESULTS

As I explained before, there is no established method for determining a level of immersion. By using the SOPI I hoped to show a link between satisfaction and the three positive factors measured in the SOPI: presence, engagement, and naturalness. Unfortunately, I was only able to find a strong relationship between satisfaction and one factor-engagement. This does not mean that immersion is unrelated to satisfaction. The results found were

positive, and there is evidence that outside factors (small sample group, lack of resources, player bias, etc…) may have caused interference in the study.

Overall, the strongest relationships found were those dealing with engagement and others dealing with spatial presence. A strong, positive relationship was observed between engagement and player satisfaction whereby as the scores for engagement increased so did those for satisfaction. The SPSS software calculated an $r = 0.725$ where r ranges from 1.0 (directly positive relationship) to -1.0 (directly negative-inverse relationship); calculated significance (percent probability results were generated by chance) p was recorded as $p = 0.001$ where p ranges from 1.0 (100%) to 0.0 (0%).

Further, these two variables also associated with the time a user would wish to play the game at one sitting (given no other timely constraints): the greater the enjoyment or engagement the longer they would play. This was the expected outcome from the definitions. Also, negative effects show a negative relationship with these variables: the more the players enjoy the experience the fewer noticed negative effects.

Two strong relationships were found with spatial presence. In the first, as the amount the user felt challenged by the game increased, that user's spatial presence rating increased. Here the relationship was recorded as $r = 0.636$ and the significance as $p = 0.006$. In the second, the scores for user's spatial presence rating rose when the scores for the user's opinion about the quality of graphics rose. Also important to note is the breakdown of the levels of spatial presence. According to the data, the participants who reported playing video games an average of less than six hours per week (light to moderate players) experienced nearly significantly greater spatial presence than those who play six or more hours per week (heavy players).

Noticed points of importance related to the participant group follow. I found that heavy players reported significantly less negative effects than the moderate to light players. Light player's mean score was 2.576 compared to heavy player's mean of 1.472 on a 1-5 scale. A relationship between these players and realism also approached significance, whereby the moderate to light players found the game experience to be more realistic than the heavy players.

A relation with engagement was also found with the participant's game genre of choice. The participants who said that they favored first-person-shooter (FPS) games over all others reported significantly more engagement than those who favor some other genre over FPS. This outcome was also expected, and may have led to player bias towards the game.

Correlations

		Engagement	Enjoyed playing	Time would play at once	Negotive Effects
Engagement	Pearson Correlation	1	.725**	.710**	-.187
	Sig. (2-tailed)		.001	.001	.472
	N	17	17	17	17
Enjoyed playing	Pearson Correlation	.725**	1	.712**	-.416
	Sig. (2-tailed)	.001		.001	.097
	N	17	17	17	17
Time would play at once	Pearson Correlation	.710**	.712**	1	-.337
	Sig. (2-tailed)	.001	.001		.186
	N	17	17	17	17
Negotive Effects	Pearson Correlation	-.187	-.416	-.337	1
	Sig. (2-tailed)	.472	.097	.186	
	N	17	17	17	17

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 5. SPSS table showing correlation data between each variable: level of engagement from the SOPI, amount player enjoyed experience, the amount a player would like to continuously play, and negative effects. Strong relationships noted between engagement, enjoyment, and time variables.

Correlations

		Spatial Presence	Ecological Validity/ Naturalness	Enjoy graphics	Was challenging
Spatial Presence	Pearson Correlation	1	.879**	.436	.636**
	Sig. (2-tailed)		.000	.081	.006
	N	17	17	17	17
Ecological Validity/Naturalness	Pearson Correlation	.879**	1	.359	.543*
	Sig. (2-tailed)	.000		.157	.024
	N	17	17	17	17
Enjoy graphics	Pearson Correlation	.436	.359	1	.599*
	Sig. (2-tailed)	.081	.157		.011
	N	17	17	17	17
Was challenging	Pearson Correlation	.636**	.543*	.599*	1
	Sig. (2-tailed)	.006	.024	.011	
	N	17	17	17	17

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 6. SPSS table showing correlation data between each variable: presence, naturalness, graphics enjoyment, and challenge. Fairly strong relationships noted between all variables.

5. CONCLUSIONS

While I am not able to say directly that immersion leads to player satisfaction, I have seen evidence that some factors of immersion (especially engagement) were strongly related to satisfaction for this game. This particular FPS generated a large amount of engagement and a related amount of enjoyment. There were some setbacks that negatively affected results, but I believe it can still be hypothesized that immersion will make a strong video game design heuristic for player satisfaction.

Users purchase video games and systems, spend their own time and efforts to learn to use them, and continue to purchase such items in the future with little to no interaction with the people who produce them. In order to fully capitalize on this occurrence, video game producers need to design games that users feel satisfied in purchasing. Satisfaction leads to replay, reputation building, and future purchase; ultimately, satisfaction leads to profit for the video game industry. And when you're talking about games in which users are already willing to pay real money to other users for money or items only usable in a game world, better game design means a lot more revenue for game producers. The results of my study will potentially help the game developers increase the amount of time a user wishes to play, the user's overall enjoyment in the product, and the likelihood that the users will purchase similar products from them in the future.

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