Investigating Flow, Presence, and Engagement in Independent Video Game Mechanics

2014

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INVESTIGATING FLOW, PRESENCE, AND ENGAGEMENT IN INDEPENDENT VIDEO GAME MECHANICS

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Digital Media
in the College of Arts and Humanities
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Spring Term, 2014

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ABSTRACT

Video games are being studied today more than ever before. The engagement that they generate with the user, if harnessed, is thought to have applications across numerous other fields. Educators especially wish to implement elements of gaming into supplemental activities to help further interest students in the learning process. Many claim that this is because classroom's today are in direct contradiction with the real home life of students. Student's today were born into the fast paced world of the digital realm, frequently multi-tasking between watching television, playing games, doing homework, and socializing. As educators begin to create game like experiences to drive student engagement they will seek to create interactions that foster the psychological phenomena of flow, presence, and engagement. Each of these three processes helps play a key role in what makes video games the attention-grabbing medium that they are. When creating games it would be beneficial to know which type of game mechanics reinforce these phenomena the most. The goal of this study is to investigate, *Super Meat Boy* and *Limbo*, two very similar games with very different mechanical representations and see which game is more engaging in these three areas. Twenty-nine participants played one of the two games for forty-five minutes, completed three separate measurements, and were observed throughout the process. The results were analyzed and found one game to indeed be more engaging than the other.

ACKNOWLEDGEMENTS

I would like to thank all the people who helped me reach this point. First and foremost Dr. McDaniel for offering his time and guidance to a Digital Media student who had no idea what he was getting into. His guidance and encouragement opened many doors for me all starting with this paper. I would then like to thank the Dr. Kim and Dr. Bowers for serving on my committee and helping this process come full circle. I would also like to thank Michael Carney, Nicholas Ware, and Nathan Snow for helping me facilitate the experimental phase of my project.

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INTRODUCTION

The video game industry continues to grow at an astonishing pace. According to recent projections, revenue driven by interactive entertainment will grow to $70.4 billion worldwide and the number of gamers is predicted to be greater than 1.2 billion by year's end (Gamasutra, 2013, para 1). There once was a time where playing video games was considered a niche hobby; however, today it seems more difficult to find someone who does not interact with games than it is to find a person who does.

With this continual growth in popularity people are now flocking to the game industry in greater numbers than ever before. Large corporations are being founded with the hopes of creating the next big AAA blockbuster title, while small indie development teams are constantly creating content in the hopes of making the next breakout independent game (e.g., *Angry Birds*). Others are attempting to push the boundaries of what we consider to be games while elevating interactive design to an art form. Academics are more frequently approaching the study of video games, whether that is to research the best ways to implement game design practices into instructional design or to study the potential positive or negative effects of video games on the mind. Students are enrolling in higher education programs across the country in order to better prepare themselves to be productive members of the game design and development communities.

What is drawing so many to interactive media platforms such as games? What makes video games so interesting that the industry has sustained such large growth

over such a long period of time? Unlike other forms of media, video games are not a passive experience and rely on interactivity that drives user engagement. Being that the engagement between the user and application is what makes video games so popular, it is then worthwhile to pose the question: What game design mechanics most facilitate the psychological phenomenon that create this engagement, and, in turn, the desire to play games?

If one were to discover that certain types of game mechanics were more engaging than others, this information would have a wide range of applications. For example, if an individual were creating a game for profit, it would be helpful to create a game featuring the more engaging mechanics that would lead to the desire to purchase additional content. If one's wish were to design a game to facilitate learning, he or she would want to incorporate the mechanics that most encourage students to enter a flow state and transform the experience of learning from monotonous to pleasurable. If someone wanted to create a game to be viewed as art, that person would seek to benefit from the mechanics that most engross the player, engage with his or her emotions, and close off his or her mind to the surroundings of the real world.

The current study will seek to explore this question of engagement by investigating phenomena such as flow and immersion within the context of different game mechanics. The study hopes to return results that indicate certain mechanics are more engaging than others within the context of two similar games. If so, it could then lead to research comparing vastly different mechanics across a more diverse range of titles.

BACKGROUND

Overview of Current Research

Most of the research involving engagement in interactive experiences focuses on applications to education. Young people today are being born into a world of fast paced information, all being transmitted at lightning fast speeds. Children are enthralled with digital experiences such as *MineCraft* and *Pokemon*. While these technologies are capable of keeping the attention of children for hours upon hours, classrooms are running into issues of engagement in the school environment. The traditional classroom-learning environment of singular attention needing to be allocated to textbooks is in direct conflict with the rest of student's modern day lives (deCastle, 2004, 81). Today's students are capable of incredible amounts of multitasking, often doing homework while listening to music, watching television, and chatting with their friends. With this being the case educators are looking for ways to harness the power of digital interactivity and bring it into the classroom and in turn engage children in the learning process in a way never seen before.

Engagement

Engagement is a term used broadly across many different papers to describe the subjective experience of game involvement. However, there are more well-defined phenomena that are used to describe what is happening when one is engaged with a game. Of these, the most relevant to this study are immersion, presence and flow.

Immersion

Immersion is defined as the “subjective impression that one is participating in a comprehensive, realistic experience.” (Dede, 2009, 66). Immersion in a digital experience depends on the user entering a state of willful suspension of disbelief. Dede claims that in order to accomplish this suspension of disbelief among users, the digital experience needs to draw on sensory, actional, and symbolic factors. Sensory immersion is defined as the digital replication of a sense of location inside the digital space. While such an experience is still possible within the traditional setting of a computer monitor, sensory immersion can be greater achieved through the use of haptic interfaces and virtual reality technology. Where before these types of devices were limited to novelty experiences in museums and science centers, new technologies like the Oculus Rift and Omni are paving the way for this type of immersion to be brought home to the mass market. Actional immersion involves the empowerment of the user to be able to take actions that would be otherwise impossible in the real world and requires that these actions have novel and intriguing consequences. For example when a video game allows for a player to become invisible and spy on other users this creates a more intense form of engagement. Symbolic immersion requires the triggering of powerful psychological associations within the experience. By presenting digital recreations of things we associate certain emotions with in the real world a greater sense of immersion is created. An example of something that would create strong

symbolic immersion would be a horror game that draws inspiration from a commonly known religious icon, such as a cross, demon, or an angel.

The more a video game's design caters to these forms of immersion, the greater the suspension of disbelief, and in turn the greater the potential for engagement.

Presence

While presence is similar to immersion in many ways, it has been commonly defined "as being in a normal state of consciousness and having the experience of being inside a virtual environment" (Brocknyer, 2009, 624). It has also been described as "being cut off from reality to such an extent that the game was all that mattered" (Jennet, 2008, 641). Slater assessed some participants and found that they described the phenomena as "a sense of "being there", the extent to which they experienced the virtual environments as more presenting reality than the real world in which the experiment was taking place, and the extent to which the subject experienced the virtual environments as places visited rather than images seen"(1994, 130). However, presence is not necessarily exclusive to interactive media, but is also achievable with traditional media such as film and books. For example, most have had the experience of being so engrossed in a novel that they lose their awareness of reality and are mentally "transported" into the fictional world.

Flow

Flow is a term used to describe a state of mind that is achieved when a person is participating in an activity where the difficulty required to complete the task is in harmony with their skill at said task (Csikszentmihalyi, 1990). For example, a tennis player who is playing a match against someone of vastly superior skill will become frustrated and distraught while the more talented opponent is quickly losing interest in the activity. However, when you match two players together with similar skill levels, the players will be able to lose themselves in the experience and enjoy it to their maximum potential. While the discussion of flow began before video games reached their now monolithic popularity, it is easy to see how this relationship between skill and challenge lends itself to the medium. Entering a flow state is a highly desirable experience; it is described as causing a feeling of being in total control, losing oneself completely to the activity and losing track of time. Flow is a psychological phenomenon that all designers strive to facilitate. Flow is the process that allows *World of Warcraft* players to log hundreds of days of playtime and still come back for more.

Motivation

Video games are an incredibly engaging medium. Through the processes of engagement, flow, and presence players are spending over three billion hours a week globally playing video games (McGonigal, 2010). What is motivating people to spend this amount of time on an activity that, in most cases, has no tangible reward? Pryzbylski posits that video games motivate an incredible amount of goal directed

behavior and foster a feeling of intrinsic motivation. Intrinsic motivation refers to behavior being driven by internal rewards; video games are often played because the activity of playing them is a reward in of itself. This is in contrast to extrinsic motivation where people execute behaviors in order to gain an external reward or avoid a negative consequence. Video games allow for intrinsic motivation by satisfying three human needs: the need for competence, autonomy, and relatedness (2010).

Video game designers have been adept at allowing users to attain a sense of competency since the golden age of arcades. Developers have structured their challenges to make sure they are proportionally increasing in difficulty relative to the users skill. Players continually master new skills and become better performers at old ones. This creates a sense of accomplishment and skill within the player that brings about the desire to continually chase these feelings. These designs are not limited only to single player experiences either, in games like *StarCraft* 2 game makers are beginning to evaluate the competency of each individual player and match them against players of similar skill level.

The second need that modern day games are getting especially good at satisfying is the need for autonomy. Due to the technical limitations endured during the early days of game design, many games were not capable of giving the player a sense of choice as to what they could do in the virtual world. Players of *Pac-Man* could choose which direction they wanted to eat the dots, but they could still only eat the dots. As technology has become more and more powerful, games like *Fallout 3* allow players to select one of numerous goals that they wish to accomplish and then pursue said goal in

any manner they wish. When games allow for this sort of choice on behalf of the player, the user may feel a sense of control that they may even lack in the real world, once again increasing the motivation to continue playing the game.

The final need that many of today's games satisfy in an exceptional manner is that of relatedness. One of the most popular genres in gaming today is that of the Massively Multiplayer Online Role Playing Game (MMORPG). Games like *Ever Quest* allow for players to enter a social setting where goals are clearly defined and players must work together in order to achieve them. Unique to games, players are allowed to socialize behind the guise of an avatar, allowing many social judgments that would exist in real life to not take place in the virtual setting. This allows for players to socialize in organic and natural ways, where you are judged only on your character and skill, both of which are factors that are readily in the player's control.

APPLICATION

Video games are extremely adept at creating a sense of engagement with the user. Perhaps more so than any other medium, video games demand continued cognitive involvement from individuals. If you observe someone playing video games on their couch, it is more than likely you will see the participant leaning forward in their chair, actively engaging with the game, whereas if you see someone watching a movie or reading a book in the same space, they are most likely to be relax and laid back into the chair. This is because unlike film and literature, the user is interacting with the game and the gamer is an active participant in the experience; without the interactions with the player the game cannot progress. The player is continually required to contribute to the piece by authoring his own part of the experience. With the fact that video games are not a “passive” form of media, many are attempting to look for ways to carry over the benefits of entertainment games into other realms; of these, the most prominent would be education. For some young students, academic work is looked at as tedious and dull. Educators are looking for ways to implement engaging and pleasurable interactive learning into their curriculum.

In his writings, Myers believes that with the advances in computer technologies and networked learning, we have an exciting opportunity to design virtual learning environments that are realistic, authentic, engaging, and extremely fun (2005). Video games are already effective teachers; games like *Eve Online* teach complex economies, social hierarchies, and interfaces that are tremendously difficult to comprehend in a manner that is fun to the user. Even when playing a game as simple

as *Super Mario World*, the player is learning a series of patterns that they begin to recognize more easily with time, moving on the path from novice to master with each level. Koster even describes fun as the feedback the brain gives us when we are absorbing patterns for learning purposes (2004). If this learning is so expertly transmitted by developers to players in an entertainment setting, we should also be harnessing these same techniques for educational purposes.

Dede claims that immersion in a digital environment can enhance education in at least three ways: by enabling multiple perspectives, situated learning, and transfer. Digital environments allow students to change their perspective or frame of reference. The use of multiple perspectives has been shown to help students in the understanding of complex scientific concepts such as observing atomic reactions and other chemical phenomena. Situated learning is achieved in virtual worlds by allowing digital simulations of authentic problem-solving communities in which learners interact with other virtual entities who have varied skill levels. This allows for students to learn alongside entities with a higher expertise in a certain subject and work with variable expectations of what is required of them. Transfer is defined as the application of knowledge learned in one situation to another situation and is demonstrated if instruction on a learning task leads to improved performance on a transfer task, ideally a skilled performance in real world setting (2009).

Michele Dickey (2005) makes the claim that “the purpose of game design is entertainment, whereas the purpose of instructional design is education. Yet it may not be productive to view these two undertakings as polar opposites or mutually exclusive”

(p.78). Strong game design techniques require players to invest time in them, learn their complex systems, and attach emotionally to what is going on. If instructional designers began taking cues from interactive designers, these engaging habits displayed by the users could be brought over into the classroom where educators are struggling to keep the attention of students with traditional teaching methods.

When interactive design has been implemented into the area of education many of the proposed benefits have in fact been observed to be true. Cordova and Lepper conducted an experiment on the subject of the beneficial effects of contextualization, personalization, and choice on the learning process. They sought to see if the learning process in children in grades four and five would yield higher results if the exercises that are normally taught in an extremely abstract and uniform way were presented in a more meaningful context of inherent appeal to children.

The experiment presented a simple math game that involved using the basic orders of operation to combine three numbers into the highest possible value. The goal was to reach the value of fifty before the competing computer. Depending on the group, students were presented with one of several different versions of the game. Some students were presented with a very traditional and bland looking “board game” style experience while others games were contextualized to include a pirate or space theme. Children who were given the contextualized version of the game consistently scored better on the posttest, showing greater mastery of the material. These results continued to increase when students were given choice over non-integral elements of the program

and allowed to personalize the game so that it made references to things that they enjoyed (1996).

Huizenga also conducted a study to examine the motivational and learning effects of a mobile city game called *Frequency 1550. Frequency 1550* is a mobile game focused on medieval Amsterdam that is intended to be completed during a single school day. Students break into groups of four or five and then each group splits into two halves. One group of players walks around the city following instructions taking them from landmark to landmark; all the while the other group sits at "base" on their computer to feed them information. After half a day of doing one task the students switch teams and get to experience things from the other side. In the conducted study half the participants played the mobile game and the other half were given a regular project based lesson series. Both groups were given a pre exercise assessment by their teachers that estimated their initial history ability and then followed their instruction with a posttest to assess their mastery of the subject and were also given a questionnaire to assess their motivation towards the subject of history. The posttest results showed a significant difference between the mastery of the subject matter between the two groups; students given the Frequency 1550 game had a mean score of 60% on the posttest while students provided with the regular project-based lesson series had a mean score of 36% (2009).

Games are not only being considered for positive use in education-based games, recreational games are being studied for their inherent benefit in facilitating cognitive processes such as forming complex mental representations and making inferences.

Pillay posits that “recreational computer game players would need highly organized knowledge structures in their internal representations because these would help them efficiently deploy knowledge and make meaningful inferences when confronted with game situations” (2000). However, there is a debate on whether students are actually capable of transferring these skills from recreational activities to the domain of education. Crisafulli states that in the case of recreational computer games, information technology systems, and educational software, it is apparent that there is a significant overlap in design information that appears to be sufficient to facilitate transfer of knowledge and skills (1993).

Gee makes the claim that quality video games of today incorporate many learning principals vital to success in the classroom. One of the most impressive is that of Cross-Function Teams, games like *World of Warcraft* demand that players learn their character class that they choose to play as. Each class has numerous abilities, skills, and complicated roles to master and only with an understanding of these very difficult systems will players be able to contribute to the success of the in game missions. However, simply learning their own function is not enough, though they specialize in their own class they must have a thorough understanding of the capabilities of the other classes and what they bring to the table. Only with this absolute knowledge of all participants’ capabilities will the group, as a whole, be able to succeed. Gee also states some learning benefits that games have over traditional education settings. He poses that video games allow for users to perform a task before they are competent. In classrooms students are expected to familiarize themselves with a subject through the

text before they are allowed to “perform” in solitary or group settings. However, video games allow for players to perform as they are attaining competency. While their performance will not be as high as more experienced players, they can gain help mid performance by seeking knowledge from those more experienced and using helpful tools the game provides them with (2005).

While the benefits of video game engagement in education are now being studied more than ever before, it is not the only area where people are looking to make the mundane exciting. Gamification is now a rising area of interest for the corporate world. By incorporating game design structures like experience, achievements, and rewards to trivial tasks taken by employees, the performer becomes more engaged in the exercise. Online websites are also starting to grant people virtual experience points for performing either everyday tasks or website specific ones. Fitocracy is a website that allows users to sign up for a social network where people input their daily workouts and gain experience for doing so. Users level up and are presented with challenges to complete for extra rewards. This allows the site to foster a community of people competing against one another using game design rewards for real world activities.

With such large interest being expressed at the idea of game design practices being imported into fields other than entertainment, it is once again prudent to ask what game design practices are the best at fostering this highly sought after engagement.

Different Game Mechanic Representations

What game design mechanics most facilitate the psychological experiences that create the desire to play games? To investigate this *Limbo* and *Super Meat Boy* were selected for comparison.

These games were chosen for several reasons. For one they are both considered to be quality interactive experiences, *Limbo* sold 300,000 copies in its first month available and *Super Meat Boy* has sold over a million copies to date. For the sake of play duration, both of the selected games require minimal time to understand the systems, thus allowing for engagement to be facilitated much quicker than with other games.

While both titles share the same genre, the games also feature several key differences. *Limbo* features a highly abstract, unguided experience; the gameplay lacks many staples of modern game design. *Limbo* presents a distinct lack of UI elements both outside and inside the levels. The game features no level selection and no tutorials. The game presents itself with no concrete story and chooses to keep the player inside the gameplay at all times with no cut scenes or loss of character control. The art direction is discernibly bleak and the tone is depressing. The design draws on very slow gameplay with challenges based on discerning the environment while avoiding “twitch” or reaction based challenges. The game lacks any sense of customization, personalization, or choice. The game also lacks a high amount of performance feedback that many writers consider a key piece of creating an engaging experience.

Super Meat Boy, on the other hand, is a more traditional platforming experience. Traditional platform mechanics include physical hand eye coordination challenges, a fast paced environment, and a steady increase in game difficulty. *Super Meat Boy* features a very common and easily understood narrative. The game provides in-level tutorial text and level selection is done from a menu outside of the gameplay experience. The art direction is colorful and the tone is joyous and irreverent. The game chooses to reward players with cut scenes and leaves little room for personal interpretation. Challenges in *Super Meat Boy* feature more traditional gaming tropes where players are rewarded for quick reaction time and physical skill. The game presents players with choices for customization and large amount of choice in how you go about solving each challenge. The game features a high amount of performance feedback including a duration timer, alphabetical performance grade, and most notably a fast paced replay of every move taken by the player upon completion.

Table 1: *Game Differences*

Super Meat Boy Characteristics	**Limbo Characteristics**
Traditional Platforming Experience	Highly Abstract and Unguided Experience
Common and Easily Understood Narrative	No Concrete Narrative
In Game Tutorial Text	No UI Elements
Level Selection From Over World	Continuous Experience of Levels
Joyous and Irreverent Tone	Bleak and Depressing Tone
Cutscenes as Rewards	No Cutscenes or loss of character control
Customization and choice	No customization or choice

With the games being defined as they are, two hypotheses were formed. The first hypotheses being that the mechanics of *Super Meat Boy* will be more engaging than *Limbo*'s to participants with a lower than average video game self-efficacy score. The second being that those with a higher than average self-efficacy score will find *Limbo* to be more engaging than their lower than average score counterparts, however they will still not find it as engaging as *Super Meat Boy*.

Methods

Participants

Twenty-nine undergraduate students were recruited to participate in the study. Of those participants, 65% were male and 35% were female. Participants were an average age of 23.35 years old. The participants rated themselves on the video game self-efficacy at an average of 40.32 out of a total of 54 points.

Measures

Demographic Information

Basic background information was taken from participants by completing a short general demographic survey. The survey contained questions regarding information such as age, gender, race, educational level, and general comfort with games.

Videogame Self-Efficacy

To measure experience with video games, participants filled out the Video Game Self-Efficacy (VGSE) (Pavlas, 2010). The measure is a ten-item scale where responses to each item range from one (strongly disagree) to six (strongly agree). However, only nine questions were utilized for this study. Higher scores equate to more video game self-efficacy.

Game Engagement Questionnaire (GEQ)

In order to measure engagement, participants completed the Game Engagement Questionnaire (GEQ; Brockmyer et al., 2009). The questionnaire is a nineteen-item

scale that assesses several aspects related to gameplay engagement. These include presence, flow, immersion, and absorption. Participants filled out each element using a 5-point Likert scale ranging from one (strongly disagree) to five (strongly agree).

Presence Questionnaire (PQ)

To assess flow state, the study will make use of a modified version of the Presence Questionnaire (PQ) (Witmer, 1998). The questionnaire contains twenty-six items and is answered by marking an "X" in the appropriate box of the seven-point scale in accordance with the question content and the descriptive labels.

Audio File Reaction

Reactions to an audio file were recorded during the experiment by an observer. A numerical representation of the subject's reaction was recorded. A zero was recorded if there is no observable reaction, a one if the participants head turned toward the sound, a two if the player searched for their keys while remaining seated, and a three if the subject got up and talked to the experimenter in the adjoining room.

Procedure

The participants were asked to arrive at the facility at an agreed upon time. They then filled out both the Video Game Self Efficacy measure and a short demographic survey. The participants were then directed to play either the game *Limbo* or *Super Meat Boy*. The play sessions lasted the duration of forty-five minutes.

Figure 1: Testing Area

After thirty-five minutes of play, a sound file was activated consisting of three statements played at increasing volume. The audio files posed the question, “Did you drop your keys?” The reaction was observed and recorded. After forty-five minutes the play session was concluded and the player was asked to fill out the Game Engagement Questionnaire, Presence Questionnaire, and a post play survey. The participants were debriefed and allowed to leave.

RESULTS

The video game self-efficacy is totaled out of 54 points. The mean for the Limbo group was 42.71 with a standard deviation of 9.89. While the Super Meat Boy group had a mean of 37.93 and a standard deviation of 13.05. The total mean across both groups was 40.32 and the total standard deviation was 11.90.

This was a higher average VGSE score in Kreutzer's study, which had an average of 39.86 and a standard deviation of 10.02 (2013). The original scale as well as Kreutzer's study utilized a total of 10 questions. Kreutzer's average score was 65% of the possible 60-point total, while this study's average was 75% of the lowered possible total of 54.

The game engagement questionnaire is totaled out of 95 points. The mean for the Limbo group was 58.29 with a standard deviation of 10.05. While the Super Meat Boy group had a mean of 53.20 and a standard deviation of 10.63.

Both of the present studies average GEQ scores were higher than that found in Brockmyer's study. When creating the GEQ it was found that students scored an average of 32.45 between males and females (2009). This is much lower than the combined average of both the present studies group, which had an average of 55.76.

The presence questionnaire is totaled out of 182 points. The mean for the Limbo group was 131.21 with a standard deviation of 12.75. While the Super Meat Boy group had a mean of 114.67 and a standard deviation of 22.76 (See Table 1, Table2).

These scores were higher than Witmer's study average score that was 98.11 with a standard deviation of 15.78 (1998). The modified version of the scale for the

study utilized only 19 items with a maximum score of 133, making the average percent score 73%. The present study's PQ had maximum potential score of 182 had the combined average of both groups came out as one point lower, with a average score of 67%.

The audio filed playing half way through the play session served as an interesting experiment but the results showed no significant connection to any other variables. In some cases players with a higher than average VGSE recorded no reaction to the audio file, yet still most if not all ignored it. Players were more likely to look up at the audio file during the *Limbo* game but this could also be due to the fact that the game features significantly less distracting audio than *Super Meat Boy*.

The final survey contained some open-ended questions to ask their opinion on what they experienced. One question posed to the *Limbo* group was "Did you find the game's minimalist approach to explanation more or less engaging?". Surprisingly many users found the unguided approach to be more engaging. One participant stated in response "More engaging, I had to immerse myself into the environment in order to understand what my goals were and how to reach them." And another stated "I felt it gives the user the ability to think critically and gives it a sense of mystery, enabling the user to figure things out for themselves." Yet another said "I found it more engaging because, instead of telling me what to do, it allowed me to figure it out on my own. Figuring out the solution to a puzzle with out any hints is much more rewarding." Of all 14 participants playing *Limbo* only a single user found the unguided approach to be less engaging.

This same sentiment was echoed in the question “Did you find the game style of minimal player feedback helpful?”. Several examples of user responses include: “Yes, this made solving puzzles give me a higher sense of accomplishment that made me want to continue.”, “Yes, I was just trying to overcome the next obstacle rather than look at the game as a whole.”, and “ Yes, because it did not distract me from the game experience and allowed me to focus on the gameplay itself.” Of all 14 participants not a single user found the minimal player feedback to be detrimental or unhelpful.

The group with the more traditional game, *Super Meat Boy,* had a much larger difference of opinion. The question was posed to them “Did you find the games style of large amounts of player feedback helpful?” One user stated “I didn’t watch the replays, but I could see how players can find them helpful.” Several other participants simply stated “no”. 7 of the 15 users believed the feedback to be detrimental. Some of those who did find it to be helpful said “Yes, I found it to help with my overall motivation”, “Yes, the marks left behind helped identify jump locations to a point, but the longer time spent on a level, the less helpful it was” and “Yes it was helpful, I wish there was more time to play and use the feedback it definitely was helpful.”

When this group was posed with the question “Did you find the game’s in depth approach to explanation more or less engaging?” they had another mixed bag of responses. 8 of the 15 participants found the explanation to be either detrimental or they were not aware of it past the first level. Examples of negative responses include “Neutral, I didn’t notice it. I did like that you could see the trail of where you had previously been, it was like you could scale your best effort”, “There were explanations

in the game? Still, it was more or less easy to pick out what killed me and what the various objects did", and "At first I was more compelled on the time I was receiving after fixating forever on the boss of level 1, I began to disregard it." In most cases players with a below average VGSE score found the explanation detrimental and players with an above average score found them to be helpful or neutral.

Of the *Limbo* participants 8 users had a below average VGSE score when compared to the entire participant pool. When comparing only the 14 who played *Limbo* 50% had higher than average scores on both the GEQ and PQ. 25% had an above average PQ score with a below average GEQ. The final 25% had a below average GEQ and PQ score.

The remaining 7 participants scored an above average VGSE score when compared to the entire participant pool. Comparing only those who played *Limbo* 29% scored above average on both the GEQ and PQ. 29% scored only above average on the GEQ and 29% scored below average GEQ and PQ. The remaining 13% scored only an above average PQ.

Of the *Super Meat Boy* participants 7 participants scored an above average VGSE score when compared to the entire participant pool. Comparing only those who played *Super Meat Boy* 29% scored above average on both the GEQ and PQ. 29% scored only above average on the GEQ and 29% scored below average GEQ and PQ. The remaining 13% scored only an above average PQ.

The remaining 8 participants scored a below average VGSE score when compared to the entire participant pool. Comparing only those who played *Super Meat*

Boy 50% scored an above average on both the GEQ and PQ. 25% scored below average on the GEQ and PQ. The remaining 25% scored above average only on the PQ.

Table 2: Limbo Means and Standard Deviations

	M	SD
VGSE	42.71	9.89
GEQ	58.29	10.05
PQ	131.21	12.75

Table 3: *Super Meat Boy* Means and Standard Deviations

	M	SD
VGSE	37.93	13.05
GEQ	53.20	10.63
PQ	114.67	22.76

DISCUSSION

Implications

The study's results found neither hypothesis to be correct. The presence questionnaire and game engagement questionnaire both saw higher averages in the case of *Limbo* over *Super Meat Boy*. This information would seem contrary to what many would assume when thinking of traditional game engagement.

The first hypothesis stated that the mechanics of *Super Meat Boy* would be more engaging than *Limbo*'s to participants with a lower than average video game self-efficacy score. This turned out to be false. It was found in the *Limbo* group that 50% of players with below average VGSE scores scored above average on both the PQ and GEQ with 25% scoring above average on only the PQ. This information was mirrored exactly with the *Super Meat Boy* below average VGSE participants.

The second hypothesis stated that those with a higher than average self-efficacy score will find *Limbo* to be more engaging than their lower than average score counterparts, however they will still not find it as engaging as *Super Meat Boy*. This turned out not to be true, *Limbo* players with an above average VGSE score had an average GEQ score of 58.1. Those with lower than average VGSE scores had an average GEQ score of 60.25. This was reflected with the PQ scores being higher for below average VGSE scores at 131.5 to 131.1.

When both sets of data are looked at across the population it would seem that

the games were a wash with no relevance between VGSE scores and engagement. However it is still worth noting that when looking at absolute averages *Limbo* users had an average GEQ score of 58.28 and a PQ average score of 131.21. These values are higher in both cases when compared to the *Super Meat Boy* group who had an average GEQ score of 53.20 and an average PQ score of 114.66.

In the case of flow *Limbo* does not fit well with the idea of an equitable skill level relative to the opponent in the way *that Super Meat Boy* does. *Limbo* starts off from the very beginning as an exercise in patience. Players learn what can be done through simple trial and error, one death after another until each game play segment has been mastered. *Super Meat Boy* does a similar act with regards to multiple deaths but the challenge is always scaled to be of a proper challenge in relation to player skill and experience.

With these results it would seem that the highly abstract unguided experience was more engaging than the traditional level-by-level game design. Translating this into the realm of education would be the opposite of what many others are doing. Cordova and Lepper's math game was very much in line with a traditional *Super Meat Boy* game design experience. If they were to emulate *Limbo's* design they would have to remove almost all of their contextual and relational queues while retaining the basic visual presentation of a game being played. This is certainly a less attractive option for the realm of education and not the idea that many are looking to implement. The results of this study may also not be indicative of what type of game a younger audience, such as Cordova and Lepper's participants, would be engaged with, being that the mean age of

this study was 23.35 years old.

In the realm of game design these results make a much more interesting argument. If the ambient unguided experience was more engaging than the traditional gaming experience, what does this say about modern audiences? Game design studios like Infinity Ward are always trying to make each new title in the popular *Call of Duty* series more accessible and welcoming to a new player. While this approach has served them well with consistent record-breaking sales, the idea that players desire a more non-traditional unguided experience has been thoroughly showcased in just the past few years. Games like *Day Z* and *Rust* have seen sales of over a million units before the game has even left its alpha stage of development. Both of these games place players into a world with no objective other than that of survival. The games lack any sense of traditional game narrative, level structure, or customization yet these games are experiencing some of the greatest success the video game industry is seeing today. The results of this study certainly support the notion that people are able to find these experiences more engaging than those of traditional games.

However, games are not an absolute science. As with any art form, tastes and preferences are all in the eyes of the beholder. Yes, the phenomena of flow, presence, and engagement are well researched enough that they can be tracked and measured to a degree, but if one form of game mechanic is found to be more engaging than another there will still always be an audience for that other mechanic.

As educators continue to attempt to bring the engaging medium of video games into a more instructional setting it is a worthy pursuit to investigate designing all types of

games and not only assignments hidden under the guise of “levels”. Video games have proven their merit time and time again with helping users be engaged, easing the burden of understanding complex systems, and increasing intrinsic motivation. Hopefully within the coming years educational games will be seen as a core supplemental activity to traditional learning.

Study Limitations

The largest limitation of this study was its small sample size. Only questioning 29 participants is not indicative of the gaming population as a whole but this amount served its purpose for this exploratory study. Another limitation is that of the audience age. The gaming population is a large group with enthusiasts being as young or as old as you can imagine. If the study was to be repeated both a larger sample size and wider range of ages should be utilized. After seeing the insight from the discussion questions, the study could also utilize more probing questions in the open response section. Interviews with the participants following the play session could lead to greater insight into their perceived engagement with the different specific mechanics.

Another limitation on the study was my experience with advanced statistics. More information could be obtained through the study results by using regression analysis and other statistical measures. Familiarity with the program SPSS would have been of great benefit as well.

Finally, it may be misguided to directly assume that immersion and fun are interchangeable. It has been argued that one can be immersed in an experience while not necessarily enjoying the activity. While the present study did not set out to

specifically find the most enjoyable experience, it was an underlying assumption.

Future Research

This study was only able to explore two games that were very similar in many regards. Noting that a disparity in engagement was present, this type of study could be used to explore games of vastly different mechanics and genres. If this study was repeated with a focus on educational games and compared games with extremely different mechanics, a better idea of which types of experiences facilitate flow, presence, and engagement would be formed. That knowledge would lead to a better understanding of what kinds of education based games to make and in turn a better learning experience for students.

This study could also be repeated with benefits for the private sector. During the early stages of production for a game, designers are often still experimenting with different combinations of mechanics and design representations to find out which would best suite their audience. If this study was to be replicated using two different builds of one game, it would help the design team to choose the build that will have the most desired interactive experience.

Future research could also begin to explore mechanic engagement on a micro level. Using one base art style and contextualization, presenting players with many different video game mechanics and then referencing their engagement levels across them could reveal what types of video games our brains are most likely to encounter a flow state, heavy engagement, or increased presence. This would benefit those trying to make a practical game without concern for its artistic merit, especially for use in

something like the educational realm.

Appendix A: Videogame Self-Efficacy Scale

1	I can always manage to solve difficult problems within a videogame if I try hard enough.
2	In a video game, if someone opposes me, I can find the means and ways to get what I want.
3	It is easy for me to stick to my plans and accomplish my goals in a video game.
4	I am confident that I could deal efficiently with unexpected events in a video game.
5	I can solve most problems in a video game if I invest the necessary effort.
6	I can remain calm when facing difficulties in a video game because I can rely on my coping abilities.
7	When I am confronted with a problem in a video game, I can usually find solutions
8	If I am in trouble in a video game, I can usually think of a solution.
9	I can usually handle whatever comes my way in a video game.

Appendix B: Presence Questionnaire

1	How much were you able to control events?
2	How responsive was the environment to the actions that you initiated?
3	How natural did your interactions with the environment seem?
4	How completely were all of your senses engaged?
5	How much did the auditory aspects of the environment involve you?
6	How natural was the mechanism which controlled movement through the environment?
7	How aware were you of your display and control devices?
8	How aware were you of the events occurring in the real world around you?
9	How compelling was your sense of objects moving through space?
10	How inconsistent or disconnected was the information coming from your various senses?
11	How much did your experiences in the virtual environment seem consistent with your real-world experiences?
12	Were you able to anticipate what would happen next in response to the actions that you performed?
13	How completely were you able to actively survey or search the environment using vision?
14	How well could you identify sounds?
15	How well could you localize sounds?
16	How compelling was your sense of moving around inside the virtual environment?
17	How closely were you able to examine objects?
18	How well could you move or manipulate objects in the virtual environment?
19	How involved were you in the virtual environment experience?

20	How distracting was the control mechanism?
21	How much delay did you experience between your actions and expected out-comes?
22	How proficient in moving and interacting with the virtual environment did you feel at the end of the experience?
23	How much did the control devices interfere with the performance of assigned tasks or with other activities?
24	How well could you concentrate on the assigned task or required activities rather than on the mechanisms used to perform those tasks or activities?
25	Did you learn new techniques that enabled you to improve your performance?
26	Were you involved in the experimental task to the extent that you lost track of time?

Appendix C: Game Engagement Questionnaire

1	I lose track of time
2	Things seem to happen automatically
3	I feel different
4	I feel scared
5	The game feels real
6	If someone talks to me, I don’t hear them
7	I get wound up
8	Time seems to kind of stand still or stop
9	I feel spaced out
10	I don’t answer when someone talks to me
11	I can’t tell that I’m getting tired
12	Playing seems automatic
13	My thoughts go fast
14	I lose track of where I am
15	I play without thinking about how to play
16	Playing makes me feel calm
17	I play longer than I meant to
18	I really get into the game
19	I feel like I just can’t stop playing

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