Preference, Time Perception, and Associated Flow

Variables in Video Games

Caitlin Faughnan

Submitted in partial fulfilment of the requirements of the BA Hons in Psychology at Dublin Business School, School of Arts, Dublin.

Supervisor: Dr. John Hyland
Programme leader: Dr. Rosie Reid

March 2018
Department of Psychology
Dublin Business School
# Table of Contents

Acknowledgments ............................................................................................................ 3
Abstract .............................................................................................................................. 4

Chapter 1: Introduction ..................................................................................................... 5
  1.1 History of Video Games ............................................................................................ 5
  1.2 Video Games Today ................................................................................................. 7
  1.3 Flow ......................................................................................................................... 8
  1.4 Previous Research .................................................................................................. 10
  1.5 Contributing to Research ...................................................................................... 12
  1.6 Hypotheses ............................................................................................................ 13

Chapter 2: Methodologies .................................................................................................. 14
  2.1 Introduction ............................................................................................................ 14
  2.2 Participants ............................................................................................................ 14
  2.3 Design .................................................................................................................... 15
  2.4 Procedure .............................................................................................................. 16
  2.5 Materials ............................................................................................................... 18
  2.6 Data Analysis ........................................................................................................ 20
  2.7 Ethics ...................................................................................................................... 21

Chapter 3: Results ............................................................................................................. 22
  3.1 Introduction ............................................................................................................ 22
  3.2 Descriptive Statistics ............................................................................................ 23
  3.3 Inferential Statistics .............................................................................................. 23

Chapter 4: Discussion ....................................................................................................... 26
  4.1 Revision of Hypotheses ......................................................................................... 26
  4.2 Limitations ............................................................................................................. 29
  4.3 Recommendations ............................................................................................... 30
  4.4 Conclusion ............................................................................................................. 31

References ......................................................................................................................... 32
Appendices .......................................................................................................................... 38
Acknowledgements

I would like to sincerely thank my supervisor Dr. John Hyland for his advice, dedication, enthusiasm, and prompt e-mail replies once the panic of deadlines set in.

I would also like to thank my participants, as without them, I would not have a study. I’d also like to thank my friends and family, but in particular, my grandmother Mary, my mother Thomasina, and my boyfriend Kalen for their constant encouragement. Last, but not least, I would like to give a special thanks to Vicky and Catherine, whom without their support for the last 3 years, I would not have survived college to this point.
Abstract

The aim of this study was to investigate if an individual’s game preference (in this case narrative rich versus narrative un-rich) effected their perception of time and the flow variables “Control”, “Positive Emotional Experience”, and “Absorption through Concentration”. There was a total of 18 participants, 55.6% were male, and 44.4% were female. The design for this study was a quantitative, correlational, within-between subject, field experiment. Participants played two games, Life is Strange (narrative rich), and Hero Siege (narrative un-rich), for an undisclosed period of time. Their perceived time playing the games was collected via a standalone question “How long do you feel you were playing for?” Participants then filled in the Flow State Scale for Occupational Tasks. A series of mixed ANOVA’s were carried out on the data and found significant interaction effects between the variables.
1. Introduction

1.1 History of Video Games

Physicist Doctor Edward Uhler Condon unveiled the first recognized model of a game machine at the New York World’s Fair in 1940. “The game, was based on the ancient mathematical game of NIM, was played by about 50,000 people during the six months it was on display, with the computer reportedly winning more than 90 percent of the games.” (Chikhani Riad, 2015). It wasn’t until almost three decades later, that a game system that could be played at home was introduced. This was when Ralph Baer along with his team, released a prototype, named the “Brown Box”, in 1967. The “Brown Box” was the first multi-player, multi-program video game system. (Video Game History, 2017). The “Brown Box” was capable of running games such as ping-pong, checkers, and four other sporting games through a television set. According to the National Museum of American History, “Ralph Baer recalled “The minute we played ping-pong, we knew we had a product. Before that we weren’t too sure.” The “Brown Box” was officially licensed to Magnavox, which then released the system as the Magnavox Odyssey in 1972. This machine preceded Atari by a couple of months, but the Atari is commonly mistaken as the first games console. The release of the Magnavox Odyssey was the official start to the rise of the console video game era.

Sega and Taito were some of the first companies to catch people’s interest in the world of arcade gaming in 1966 and 1967 when they released electro-mechanical games Periscope and Crown Special Soccer. However, in 1972, Atari started to raise the bar for the industry surrounding the arcade. Towards the end of November 1972

The 1970’s was also a time when the personal computer was becoming more of a reality. Intel’s invention of the world’s first microprocessor allowed for many more advancements in terms of creating games. Gunfight which was released in 1975 was one of the first examples of a multi-player human-vs-human combat shooter game. With advancements in technology it was able to introduce new styles of gameplay including joystick movement to control where a person was moving and a separate joystick for shooting direction. The video game industry did go into decline in the early 1980’s as there were many low-quality games being flooded into the market. (Hadzinsky, 2014) The competition with the home computer also caused a crash for the video game market in 1983. Home computers were also stronger and magazines like “Computer and Video Games” and “Gaming World” provided BASIC source code and utility programs that could be typed into early PC’s. (Chikhani Riad, 2015)

It wasn’t until Nintendo released the Nintendo Entertainment System (NES), (1985 in the States and 1983 in Japan, originally known as Famicom), with its video game Super Mario Brothers that the video game industry was once again rejuvenated. Nintendo managed to dominate the video game industry until Sony released the PlayStation which contained a 32-bit processor. The competition between companies continued to pave the way for video games today.
1.2 Video Games Today

A paper released by the Entertainment and Leisure Software Publishers Association (ELSPA) stated that, over the last 15 years, electronic entertainment has been considered a “dominant leisure pursuit” (ELSPA, 2003). Today it is estimated that the video game industry makes up an estimated $100 billion globally, and this number is continually growing. It is also estimated that “nearly two-thirds of American homes have household members who play video games regularly” (Video Game History, 2017). To be considered a “gamer”, individuals need to play more than three hours a week. (Entertainment Software Association, 2015). The average age of a “gamer” is 35 years old, while the average number of years a gamer has been playing is thirteen years. (Krista Lofgren, 2017). Fifty-Six percent of most frequent gamers, use a PC to play games. This is followed by 53% on a dedicated console, 36% on a smartphone, 31% on a wireless device, and 17% on a dedicated handheld system. (Krista Lofgren, 2017). This shows that the main competition is still between PC games and dedicated console games. Competition is also a huge area in video games today. This is due to the emergence of the rapidly expanding area of E-Sports. E-Sports viewership has erupted over recent years, growing from 204 million to 292 million between the years 2014-2016, resulting in a 43% increase in just two years. In terms of global revenue, it has grown from $194 million in 2014 to $463 million in 2016, a resulting 239% increase in two years. (Krista Lofgren, 2017). Valve’s “Dota 2” and “CS-GO”, and Riot’s “League of Legends” were three of the top eSports titles in 2016. (Krista Lofgren, 2017). All these games have seen changes over the years from their original starting points. Majority of online games now also see weekly updates and improvements through “Patch” updates. These
patch updates generally include, bug fixes and creating a smoother and more immersive environment for the player. “Game developers are looking for ways to expand the reach of their products. By taking existing intellectual properties from books or movies” (Jenova Chen, 2017). People will regularly comment on how much they enjoy a book or movie, particularly if they were immersed in the experience. Video game developers usually try to achieve this same effect. A player may be playing a game for hours, and not realize it. To them it may have felt like a shorter period. The best way to describe this phenomenon is to look at Mihaly Csikszentmihalyi’s definition of Flow.

1.3 Flow

Mihaly Csikszentmihalyi, set out to explain what happiness was/is twenty years ago, and found Flow. In his own words, he defines flow as

“A state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will continue to do it even at great cost, for the sheer sake of doing it.” (Csikszentmihalyi, 1990).

Csikszentmihalyi considers there to be eight elements to flow. These include:

1. Clarity of goals, e.g., knowing exactly what it takes to win a game.

2. High concentration, e.g., being able to focus completely on a task without any distractions or interruptions.

3. Balance, between an individual’s skills, and the challenge presented.

4. Control, e.g. in a game they feel secure they are not overly confused or feeling controlled by the requirements of the game.
5. Ease/Effortlessness, e.g. the activity runs smoothly for the participant, on the outside it may seem strenuous, but the participant when experiencing flow, will respond with ease internally.

6. Altered time perception, e.g. if a person is experiencing a deep level of flow, their sense of time can be skewed, two hours may feel like 10 minutes and vice-versa.

7. Action and consciousness mesh, e.g. an individual doesn’t feel separated from their actions.

8. Immediate Return on Investment (IROI), the goal of the activity that an individual is taking part in is rewarding, as well as the activity itself.

It is worth noting that not all these aspects are required for flow to be experienced. (Csikszentmihalyi, 1990) However, one of the key aspects in Flow is balance. For a person to maintain or reach their state of flow, they need an activity that balances the challenges of the activity and the abilities of the participant. If a challenge is too difficult it can create a state of anxiety within an individual, and if the task is too simple, the individual will become bored and uninterested. However, as humans we do have tolerance, so there is room for something to be a little bit more challenging than an individual’s skill level can handle, and vice versa. (Csikszentmihalyi, 1990). Due to the special relationship between challenge and ability, flow is regularly looked at in fields such as sporting. (Jenova Chen, 2017). It has become apparent that “gamers”, value games based on if they stimulate flow experiences. (Holt, 2000). Once game designers have understood the aspects that contribute to flow, they can revisit them from a game design perspective. Three of the core aspects which would be
needed are; the game is “intrinsically rewarding” and the player wants to play the game, the game offers the right amount of challenge for the skill level it’s aimed at, and the player needs to have a feeling of personal control over the activity. (Jenova Chen, 2017). A game made with these in mind should cause a player to lose track of time and self-consciousness, causing them to be “In the Zone”. The argument can also be made that if the player must want to play the game, that their game preference would be taken into consideration when trying to induce flow. However, it can be quite hard to develop games designed for specific preferences, while still turning a profit. We could also propose that game preference would be linked to time perception, in that if a player likes a genre more than another, they will be more likely to lose track of time and be “In the Zone”, than if they were playing a genre they weren’t fond of, regardless of some of the other flow aspects. While there have been some research papers which focus on flow in video games, flow is more commonly looked at in sport, while topics of cognitive flexibility, education and, aggression are more commonly undertaken when looking at video games.

1.4 Previous Research

“Playing videogames is now a major leisure pursuit, yet research in the area is comparatively sparse.” (Wood R. et al, 2007) A study carried out by Wood R. et al, 2007, examined experiences of “time loss” among a group of gamers, totalling 280 participants, through the use of online surveys measuring quantitative and qualitative data. Within their findings it was shown that time loss occurred regardless of gender, age or frequency of play. However, they did find that there are some structural characteristics which contributed to time loss, such as: complexity/difficulty, missions, high-scores, multiple levels, having multiple-player
interactions, and the plot of a game. Their results concluded that the loss of time experienced by players had an overall positive effect as it allowed for participants to feel relaxed or to escape their individual realities temporarily. However, it did note that some participants felt negatively towards the time loss. Stating that it brought about feelings of guilt for wasting time or that it caused a social conflict.

“Many online game players have problems controlling their time. They can’t stop playing a game they enjoy.” (Rau P et al., 2006) This is from another time-based study for video games, Rau et al., 2006, however compared novice and expert online game players in an internet café over the course of one month to see if either were subject to “time distortion”. The participants for this study had to play Diablo 2, which was released in 2000 by the company Blizzard. This study also included much younger participants, as the age range was from 9 up to 20 years old. For this study, time distortion was defined as “difference between the playtime-interval and the playtime duration estimation” (Rau P et al., 2006). This study found no significant results between novice and expert players in time distortion, but it did find that novice and expert players tended to over-estimate the 30-minute break off point, while expert players underestimated the 60-minute break off point. Novice players continued to overestimate the 60-minute break off point.

“Our paper shows that cognitive flexibility, a cornerstone of human intelligence, is not a static trait but can be trained and improved using fun learning tools like gaming,” (Dr. Brian Glass,2013). He is not alone in this opinion; many researchers have realized the actual benefits of video games. The study Dr. Brian Glass is referring to is based on psychological tests that were run before and after volunteers played the strategy game StarCraft or The Sims for 40 hours over 6 to 8 weeks. In this study however, most participants were female as the recruiters were unable to
recruit enough male players who played for roughly only 2 hours a week. The research showed an increase in performance in psychological tests for those who were assigned to play StarCraft. They showed greater speed and accuracy in cognitive flexibility tests. Glass further said

“We need to understand now what exactly about these games is leading to these changes, and whether these cognitive boosts are permanent or if they dwindle over time. Once we have that understanding, it could become possible to develop clinical interventions for symptoms related to attention deficit hyperactivity disorder or traumatic brain injuries, for example.”

Studies across the board have shown the benefits of playing video games. A study in the University of Texas Medical Branch at Galveston (2012) found that high school students out performed medical researchers at performing virtual reality surgery. Researchers in the University of Padua (2013) found that playing action games seems to improve speed and accuracy in literacy skills in children with dyslexia. This has also been seen in a study conducted by (Boot, W. et al., 2008), where expert video game players have been found to outperform non-players across measures such as basic attention and performance.

1.5 Contributing to research

Upon searching for past papers, there does seem to be a gap in current research looking at time perception, game preference and flow variables all together. The aim of this study is to add to the current pool of research available and apply a new perspective. This research is being conducted to see if there is a connection between an individual’s perception of time, and game preference over a narrative-rich game or a narrative un-rich game. An attempt will also be made to measure the
participant’s flow level after playing both types of game and comparing this to their
game preference also. Another apparent gap in research into flow and video games
was found when trying to find a scale/questionnaire that was measurable against
computer use. Majority of flow scales currently available such as the Flow State
Scale (FSS) are aimed directly at sports and could not be easily applied to the
research being conducted.

1.6 Hypotheses

Hypothesis 1:

Game preference will influence time estimates of participants. Participants who
prefer the narrative rich game will have lower time estimates for the fame.
Participants who prefer the narrative un-rich game will have a lower time estimate
for that game.

Hypothesis 2:

Game preference will have an impact on the flow variable “Control”, for both the
narrative rich game and the narrative un-rich game.

Hypothesis 3:

Game preference will have an impact on the flow variable “Positive Emotional
Experience”, for both the narrative rich game and the narrative un-rich game.

Hypothesis 4:

Game preference will influence the flow variable concentration for both the
narrative rich game and the narrative un-rich game.
2. Methodologies

2.1 Intro:

The following chapter contains the methodology of this experiment. This includes a discussion on gathering participants, the design of the experiment, the procedure followed, the materials used, descriptive statistics, and an ethics section.

2.2 Participants

The intended target audience for this experiment was both male and females aged 18 and over. Participants required basic PC knowledge but did not need to be an avid “gamer”. Skill level ranged from rare PC use to very frequent use. In order to access this sample, volunteers were contacted by social media, such as Facebook messenger, E-mail, WhatsApp, or through word of mouth. They were invited to take part, but there was no pressure put on the participants to volunteer their time. There was no reward or incentive for the participants to volunteer their time. Prior to the collection of data, a research proposal form along with a copy of the intended survey was sent to and given approval by the Dublin Business School Psychology Ethics Committee, and the Code of Professional Ethics were complied with.

In total there was 18 participants in the study which compiled of 10 males, which made up 55.6% of the sample, while there were 8 females which accounted for 44.4% of the sample. Participants ranged in age from 18-50, with a mean age of 24.7 years old.

Inclusion Criteria:

Males and females aged over 18, with basic PC knowledge.
Exclusion Criteria:

Males and females under 18 years of age.

Individuals with no PC experience.

2.3 Design

The study was a quantitative, correlational, within-between subject, field experiment design. The experiment was to look at the relationships and associations between game preference, “Flow” in video games, and time perception. The study included recruiting males and females over the age of 18, with basic PC knowledge. All participants were to play the games, both narrative rich and narrative un-rich, for the same set amount of time, in their own environment. To counter-balance the experiment half the male participants and half the female participants played the games in reverse order, i.e. five males played the narrative rich game first followed by the narrative un-rich game and vice versa. Participants were randomly assigned to play order groups by pulling the names out of a hat. To measure time estimates a standalone question at the start of the survey asked the following, “How long do you feel you were playing the game for?” Participants were then asked to fill in a 14-point questionnaire known as the “Flow State Scale for Occupational Tasks”. A series of mixed ANOVA’s were run to compute the data where the IV was game preference, and the DV’s were time estimate mismatch, flow variable control, flow variable positive emotional experience, and flow variable concentration. It was a field experiment design as the experiment was performed at different times for the participants in their own environment, using their own equipment, not in a lab-restricted setting.
2.4 Procedure

Approval for the experiment was given by the Dublin Business School Psychology Research Ethics Committee and the chosen games and questionnaire were approved by my assigned supervisor before the commencement of the experiment. Potential participants were contacted and invited to take part in the experiment but were not put under any pressure to agree. A time, date, and location were then decided upon for the experiment to all participants who agreed to volunteer themselves. The experiment took place in a familiar location for each participant, no lab settings were used. Unfortunately, a set amount of time could not be given to the participants for the length of the experiment due to its nature. Inconvenience was attempted to be kept at a minimum, by finding out if the participant had anywhere to be or anything to do by a specific time. Participants were informed that they would not be able to receive an accurate total time before the experiment took place, as it would skew results, but they were advised to have at least two hours and forty-five minutes of free time available. Majority of participants worked or had college during the day, so all the experiments took place in the evening. Participants were randomly assigned a play order to counter-balance the experiment. Meaning half the male participants and half the female participants played the narrative rich game first, followed by the break, and then the narrative un-rich game. The other half of the male participants and the female participants played the narrative un-rich game first, followed by the break, and then played the narrative rich game. Participants were not aware of which group they were in and both groups played for the same amount of time and had a break for the same length of time. The names of the ten male participants, and the eight female participants were put into a hat, which the researcher then pulled the names out to randomly assign to the groups. The first five
male names pulled out played the narrative-rich game first and the first four female names pulled out also played the narrative-rich game first. The remaining names of the male and female participants were then to play in the opposite order, narrative un-rich first.

The experiment began with the researcher’s arrival, at the location and time agreed upon with each participant. There was small conversation and participants were asked to read over and sign the consent form (See appendices fig.1) Participants were advised at the start of the experiment both verbally and through written word on the consent forms that if they felt uncomfortable at any time, wanted to stop the experiment for whatever reason, or decided that they wanted their data omitted, that it would be no problem. It was also requested by the researcher that the participants not to look at their phones or any clocks – if possible, for the duration of the experiment, but particularly during the breaks between the two video games, as it could influence the answers.

Life is Strange, was the narrative-rich game they were required to play, and Hero Siege was the narrative un-rich game they were required to play. The participants were not told how long they would be playing for, nor were they told how long the break would be afterwards. The participants played the game for 32 minutes. After 32 minutes they were asked to stop, regardless of where they were in the games and to fill in the questionnaire (See appendices fig.2 and 3). The participants had a break for 7 minutes, during which all participants refrained from phone use and looking at any clocks. The 2nd game was launched on their PC, by the researcher (permission was asked verbally of the participant by the researcher and granted), to prevent the participant from viewing the clock on their computer screen. After the 7-minute break, the participants began playing game 2, also for 32 minutes however, they
were again not made aware of the time. At the end of the 2nd game of 32 minutes, the participant was asked to fill in the same questionnaire. The questionnaires did have one difference between them, which was simply the name of the task at the top, one was assigned to Life Is Strange and the other was assigned to Hero Siege. Upon full completion of both games, participants were asked verbally which game they preferred playing and this was noted by the researcher. The experiment was then complete, and participants were given a debrief sheet (see appendices fig. 4) which thanked them for their time, gave a breakdown of the times they were playing both games, and how long the break was in between, as well as contact details. The contact details provided were the email address of the researcher and the supervisor.

Participants used their own desktop computers or laptops, depending on if they met the criteria required for the games to run smoothly, (in this study, all participants were able to use their own) and they wore headphones – also their own, so they would not be distracted by any exterior noises.

2.5 Materials

The questionnaire used for this experiment was “The Flow State Scale for Occupational Tasks.” This questionnaire was in addition to two demographic questions asked at the start, one of which asked gender, and the other asked for age. A standalone question of “How long do you feel you were playing the game for?” was also asked before the questionnaire was filled in. (See appendices fig.2 for full questionnaire). The demographic questions allowed for a further breakdown in the data if required and allowed for a better overall picture when analysing descriptive statistics.

A consent form was given to every participant to sign and give back to the researcher, this consent form included the outline of the study, right to withdraw, confidentiality
agreement, as well as researcher and supervisor details. (See appendices fig. 1) There were 2 questionnaires in total to be filled in by the participants, both of which included the same questions but varied in the name of activity. One was labelled Life is Strange, while the other was labelled as Hero Siege. Participants were required to fill in both questionnaires fully, including the demographic questions, but were able to withdraw or object at any time. Following the completion of the experiment, a debrief sheet was given to all the participants, advising them of the time they spent playing both games and the break in between. It also included contact details (e-mail) of the researcher and the supervisor. Participants were invited to contact either/or if they wanted a copy of the end results or to even just speak about their experience or seek support. The data that was collected was analysed through SPSS using software version 24.

The Flow State Scale for Occupational Tasks was selected as many of the current available questionnaires relating to “Flow”, are physical sport related, and therefore not relevant to PC gaming. The Flow State Scale for Occupational Tasks was developed by Yoshida K. et al, 2013, to develop a scale which measured a patient’s flow in a situation such as occupational therapy. It consists of 14 questions which are marked on a 7-point Likert scale. With answers ranging from 1 – Strongly Disagree, 4 – Undecided, and 7 – Strongly Agree. Questions were broken down into three categories to measure flow, these were, “Control” (questions 2,4,5,14,10, and 8), “Positive Emotional Experience” (questions 1,3,9,13), and “Absorption through Concentration” (questions 6,7,11,12). Tests of reliability looking at Cronbach’s Alpha were run and found that questions 4 and 9 needed to be removed for reliability purposes.

The participants also used their own computers, being either desktop PC’s or laptops capable of running the game smoothly. The PC or laptop had to have at least Windows Vista OS or later, a dual core processor with 2.0Ghz or similar, at least 4GB of RAM,
an Nvidia or AMD video card with at least 512MB VRAM. They also needed at least 4GB of hard-drive storage.

The participants pre-installed “Steam”, which is a digital distribution platform developed and owned by parent company Valve. Using Steam, participants were able to pre-install the two required games, Life Is Strange and Hero Siege. As this experiment was done in person, the questionnaires, consent forms, and debrief sheets were pre-printed and filled out by hand opposed to using an online survey tool.

Life is Strange is was the first game played by half the participants. Life is Strange was picked as the story-rich game as it is “An award-winning and critically acclaimed episodic adventure game.” (Life is Strange, 2015). The fact that the game was episodic, yet still interactive, is why it was picked for the story-rich game. “Story Rich”, is also one of the popular user-defined tags for this game, so individuals widely view it as narrative-rich. Life is Strange is rated as 16+ by Pan European Game Information (PEGI), which is a video game classification board. Due to this, the age limit was set at 18 for volunteers to partake in the experiment, and it also removed the need for parental consent.

Hero Siege was the other game played by all the participants and was picked to go against Life Is Strange as it is more of a “Hack-and-Slash” rogue type game. There is no real story at all to the game. Hero Siege does have a multi-player option but for this experiment, participants were only allowed to use the single player option to allow for more control over the experiment. (Hero Siege, 2013)

2.6 Data Analysis

Descriptive statistics were ran using SPSS version 24 to highlight the breakdown of participants. The analysis of the descriptive statistics showed that of the participants, 10
were male (55.6%), and 8 were female (44.4%), making up a cumulative total of 18 participants (100%). The age range of participants 18 – 50. The mean age was 24.72 with a standard deviation of 8.95. In terms of game preference, 50% in total preferred Life is Strange, and the other 50% preferred Hero Siege. Males preferred Hero Siege at 70% compared to the 30% of males which preferred Life is Strange. Females preferred Life is Strange at 75% compared to 25% of females which preferred Hero Siege. The total time played for each game was 32 minutes, the mean time guess for Life Is Strange was 2.44 minutes away from the correct time. The lowest time guess was under by 12 minutes, and the highest time guess was over by 28 minutes, with a standard deviation of 9.21 minutes. The mean time guess for Hero Siege was 7.28 minutes away from the correct time. The lowest time guess in Hero Siege was under by 12 minutes, and the highest time guess was over by 58 minutes, with a standard deviation of 18.53 minutes.

2.7 Ethics

Prior to the commencement of this experiment a research proposal was submitted to the Dublin Business School Psychology Research Ethics Committee for approval and to ensure the Code of Professional Ethics was adhered too. Permission was granted for the experiment by the committee and a supervisor was assigned. Preceding the commencement of the experiment, the supervisor approved the chosen video games as well as the use of the questionnaires and standalone questions. This experiment does have an aspect of deception to it, but it was still approved as it was a requirement for the study and a full debrief was provided to each participant, as well as contact details if they wanted to discuss their experience further. When recruiting the participants, they were also informed that a full time debrief would be provided but could not be given prior. The guideline set to the participants was to have at least two hours and forty-five minutes of available time for the experiment to take place.
3. Results

3.1 Intro:

The following chapter will report on both the descriptive statistics and inferential statistics. The inferential statistics discussed will cover the four hypotheses. Hypothesis one: Game preference will influence time estimate mismatches of participants, those who prefer the narrative-rich game will have lower time estimates for that game. Participants who prefer the narrative un-rich game will have lower time estimates for that game. Hypothesis two: Game preference will have an impact on the flow variable “Control”. Hypothesis three: Game preference will influence the flow variable “Positive Emotion”. Hypothesis four: Game preference will influence the flow variable “Concentration”.

3.2 Descriptive Statistics

Descriptive statistics were run using SPSS version 24 to get an overall look at the data. The analysis of the descriptive statistics showed that of the participants, 10 were male (55.6%), and 8 were female (44.4%), making up a cumulative total of 18 participants (100%). The age range of participants 18 – 50. The mean age was 24.72 with a standard deviation of 8.95. In terms of game preference, 50% in total preferred Life is Strange, and the other 50% preferred Hero Siege, there was no “Neither” option. Males preferred Hero Siege at 70% (38.89% overall) compared to the 30% (16.67% overall) of males which preferred Life is Strange. Females preferred Life is Strange at 75% (33.33% overall) compared to 25% (11.11% overall) of females which preferred Hero Siege. The total time played for each game was 32 minutes, the mean time guess for Life Is Strange 2.44 minutes away from the correct time. The lowest time guess was under by 12 minutes, and the highest time
guess was over by 28 minutes, with a standard deviation of 9.21 minutes. The mean
time guess for Hero Siege was 7.28 minutes away from the correct time. The lowest
time guess in Hero Siege was under by 12 minutes, and the highest time guess was
over by 58 minutes, with a standard deviation of 18.53 minutes.

3.3 Inferential Statistics

Test 1

A mixed ANOVA found that there was a significant interaction effect between
game preference and time estimated mismatch (F(1,16)=33.52, p <.001) with an
effect size of 67%. In relation to main effects, there was a significant difference for
time estimate mismatch for Life is Strange (narrative-rich), versus Hero Siege
(narrative un-rich). (F(1,16)=5.29, p=.035) with an effect size of 25%. There was
also a significant difference between game preference (F(1,16)=4.62, p=.047) with
an effect size of 22.4%. Thus, proving hypothesis 1, that for majority of participants,
their game preference did influence their time estimate mismatch. The games were
both played for 32 minutes, and the participants time guesses were computed by
seeing how far above or below they guessed. A subsequent mixed ANOVA was run
to ensure the data was not being effected by game play order, and this yielded non-
significant results via interaction effect, (F(1,16)=1.72, p=.208) with an effect size of
9.7%. There was also no significant mains effect present (F(1,16)=1.89, p=.188)
with an effect size of 10.6%. There was also no significant result found when
looking between subjects at order (F(1,16)=1.92, p=.185) with an effect size of
10.7%. A paired sample T-Test was also run to validate the results further, finding
no significant difference between Life is Strange (M=2.44, SD=9.21) or Hero Siege
(M=7.28, SD=18.53) time estimate mismatch (t(17)= -1.35, p=.195, CI(95%), -12.40 – 2.73). Therefore, the null cannot be rejected.

Test 2

A mixed ANOVA found that there was a significant interaction effect between game preference and the flow variable “Control”, (F(1,16)=6.61, p=.021) with an effect size of 29.2%. In regards to main effects there was a significant difference for the flow variable “Control” between Life is Strange versus Hero Siege (F(1,16)=16.32, p = .001), with an effect size 50.5%. However, there was no significant difference found between game preference for Life is Strange or Hero Siege, (F(1,16)=1.99, p=.178) with an effect size of 11%. Hypothesis 2, has been proven via. Interaction effect, while on their own, only one main effects variable is significant, but when looking at the interaction effect between “Control” and game preference, the result is significant.

Test 3

A mixed ANOVA found that there was a significant interaction effect between game preference and the flow variable “Positive Emotion”, (F(1,16)=35.54, p<.001), with an effect size of 69%. Regarding main effects, there was no significant difference for the flow variable “Positive Emotion” between Life is Strange and Hero Siege. (F(1,16)=1.02, p=.327), with an effect size of 6%. However, there was a significant difference between game preference (F(1,16)=6.12, p=.025), with an effect size of 27.7%. Hypothesis 3 has also been proven via interaction effect, for “Positive Emotion” and game preference.
A mixed ANOVA found that there was a significant interaction effect between game preference and the flow variable “Concentration”, (F(1,16)=32.25, p<.001) with an effect size of 66.8%. Regarding main effects there was no significant result between the flow variable “Concentration” across both Life is Strange and Hero Siege, (F(1,16)=1.00, p=.331), with an effect size of 5.9%. There was also no significant difference between game preference (F(1,16)=.56, p=.467), with an effect size of 3.3%. Hypothesis 4, game preference versus flow variable “Concentration”, has been proven via interaction effect.
4. Discussion

The aim of this study was to investigate whether game-type preference influenced time perception, or flow in video games played on a PC by both male and female participants with basic computer knowledge. The game-types explored in this study were narrative-rich (Life is Strange) and narrative un-rich (Hero Siege). The flow variables tested were “Control”, “Positive Emotional Experience”, and “Absorption through Concentration”. Time perception was measured by calculating the estimates of the participants versus the actual time they spent playing the games.

4.1 Revision of Hypothesis

The results of the first hypothesis showed a significant interaction effect between game preference and time estimate mismatch. This is somewhat in line with previous research such as the studies carried out by Wood et al., 2007 and Rau P. et al, 2006. Both studies found that players experience time loss or have problems controlling their time. However, we cannot say it directly agrees with the previous findings as game preference was an added variable for this study, and it was not directly looked at within their previous research. Those who preferred Life Is Strange, tended to over-estimate the time spent playing both games. The mean time guess for Life is Strange, for the participants who preferred it, was 2.11 minutes. While the mean time guess for a participant who preferred Life is Strange for the game Hero Siege was 19.11 minutes, which is a gross over-estimation. The participants who preferred Hero Siege, tended to overestimate time played for Life is Strange (mean score of 2.78 minutes), but then under-estimated the time they were playing Hero Siege for (mean score of -4.56 minutes). Time estimate mismatch as a main effect within-subjects was also significant (p=.035), as was looking at
game preference when looking between subjects (p=.047). As a subsequent mixed
ANOVA was run against game order (IV) and time estimate mismatch (DV) for
both games, and no significant result was found, so we can conclude that the play
order, did not affect the time estimates of participants. A paired samples T-Test was
also run for the time estimate mismatch between Life is Strange and Hero Siege and
did not yield any significant result. This allows us to conclude that the interaction
effect was key, and that game preference significantly impacts time perception.
During Rau P et al.’s study, they found evidence that a negative stimuli or
experience increases the likely hood of an overestimation of the time spent, and
positive experiences can cause an underestimation of the time spent. This has been
proven in hypothesis 1, particularly by the mean scores of time estimate mismatch
for those who preferred Hero Siege, and their associated time guesses for that game.

The results of hypothesis two were proven via interaction effect. This hypothesis
looked at game preference and the flow variable “Control”. The variables for flow
were broken down into their subcategories and compared against game preference
much like with other scales, e.g. DASS21. The results for game preference versus
control were significant when looking at the interaction effects. Upon looking at the
descriptive statistics for game preference and control, it was found that the mean
scores for the control variable in Life is Strange (LIS), despite game preference,
presented similar scores LIS preference mean score=25.33, Hero Siege (HS)
preference mean score=24.33. However, when looking at HS and the control flow
variable, it was noted that those who preferred LIS, felt much less in control when
playing Hero Siege, mean=16.33, while those who preferred Hero Siege, scored
much higher in control with a mean of 22.33. Upon looking at the main effects, the
control variable was also significant on its own, however when looking between subjects at game preference, there was no significance found.

Hypothesis three set out to prove that game preference would have an effect on the flow variable “Positive Emotional Experience”. There was again, a significant interaction effect between game preference and positive emotional experience. There was no significant mains effect between positive emotional experience for participants across both LIS and HS. However, there was a significant result for game preference when looking at the between-subjects effects. Upon further study of the results, it was shown that those who preferred LIS, experienced slightly higher levels of positive emotional experience during Life is Strange, compared to when they were playing Hero Siege. Those who preferred LIS had significantly lower positive emotional experiences when playing HS, with a mean score of 7.56. This is compared to the mean score of those who preferred HS, with a resulting positive emotional experience mean score of 16.78.

The aim of hypothesis four, was to investigate whether game preference had an influence over the flow variable “Absorption through Concentration”. This test again yielded a significant result via. Interaction effects between game preference and concentration. The main effects when studied, yielded no significance, as did the breakdown between-subjects for game preference. A breakdown in the descriptive statistics of the results showed that preference influenced concentration. Those who preferred LIS, had higher levels of concentration throughout gameplay with a mean score of 20.56 compared to participants who preferred HS, and had a mean score of 14.44 in concentration while playing LIS. Participants who preferred HS, scored higher in concentration throughout the game-play of HS, with a mean score of 18.33, than those who preferred LIS, who had a mean score of 15.
Ornstein (1977), believed that a successful experience is better organized in the memory than a negative event/experience. Ornstein went on to further argue pleasant memories, or memories of a good experience take up “less cortical space” and, thus, the experience is recorded as taken less time than it did. His beliefs are in-line with the findings of this study.

4.2 Limitations

It is important to note that there are limitations to the current research which should be considered when interpreting the results. There were only 18 participants involved in this study, due to the deception of time, not as many people could freely volunteer. While gender was not looked at exclusively in this study, it was still difficult to find females over the age of 18 with basic PC knowledge who were willing to take part. Participants also required a computer capable of running both games smoothly, as to not be interrupted. This meant they needed a PC or laptop with at least Windows Vista OS or later, a dual core processor with 2.0Ghz or similar, at least 4GB of RAM, an Nvidia or AMD video card with at least 512MB VRAM. They also needed at least 4GB of hard-drive storage.

Some participants had also played Life is Strange beforehand, some briefly and others to completion. While this was not criteria for inclusion or exclusion in the study, it could be a factor to look at in the future relating to time perception. The experiment was not performed in lab settings, it was done in the environment of the participants and at different times, this could also skew the results. Rau P et al.’s,(2006), experiment was also not conducted in lab settings; however participants were tested in the same internet café, hence the results yielded from his study may
have more weight to them, he was also able to gather more participants. Some participants who guessed the same time length for both games had stated that they felt for consistency reasons, that the games would have had to be played for the same length of time. Despite their guesses still being inaccurate (no participants guessed the correct time of 32 minutes), it could be argued that they did not answer the question of perceived time.

It should also be noted that to satisfy Cronbach’s Alpha in SPSS, questions 4 and 9 had to be omitted from the totals. Question 4, falling under the flow variable of Control, was “My abilities matched the challenges of what I was doing.,” and question 9, falling under the category of Positive Emotional Experience was, “The task was really boring”. The Flow State Scale for Occupational Tasks also had many limitations, such as its design for use in a clinical situation, e.g., occupational therapy. However, it was one of the only scales currently available which attempted to measure flow without any sporting aspects/questions.

4.3 Recommendations

Moving forward, there are still many areas of video games regarding their advantages and disadvantages which can be looked at. From this study, a link has been shown between an individual’s preference for certain game types, in this case, narrative rich and narrative un-rich, versus their time perception and the measured flow variables. With the implementation of a more accurate scale measuring flow outside of a clinical setting and moving away from sporting, both psychologists and game designers may be better able to utilize the potential benefits of flow in game design. For example, an individual who is struggling to learn a subject in school, may benefit from an immersive video game experience which appeals to their
preferences and induces flow. As video games have been shown to improve recall (Boot R. et al, 2008), this could be another step forward from an educational point of view. With the added benefit of flow being induced, the participant may experience a subject more positively.

4.4 Conclusion

This study has added more significant data to the pool currently available. Significant results have been observed between game preference (narrative rich versus narrative un-rich), time estimated mismatch, and associated flow variables Control, Positive Emotional Experience, and Absorption through Concentration. As all results were significant via interaction effects, it allows us to conclude that game preference for narrative rich versus narrative un-rich games influences a person’s perception of time and their flow experience. This was further proven when a mixed ANOVA found that there was no significant difference between game play order (which was used to counter-balance the experiment), and the time perception scores of the participants. The limitations in this study previously mentioned, such as sample size, and lack of lab settings can be used to build upon and improve the study if re-visited in the future. Notwithstanding the limitations of this study, the data found and presented can add to research as it takes a different approach to the studies previously conducted.
References


Appendices

Appendix Figure 1 - Consent Form

Consent Form

My name is Caitlin Faughnan and I am conducting research on time perception, preference and immersion in video games. This research is being conducted for my undergraduate thesis.

The participation of this study includes an experiment where you will play 2 separate video games for a non-disclosed period of time. At the end of the experiment the exact timings will be made available to you. The researcher (Myself), will monitor in the background and at the end of each game play you will be asked to fill in a short 14 point questionnaire.

If you feel uncomfortable at any point during the experiment, you can let me know and we can pause or completely halt your participation in the study.

Participation is completely voluntary and so you are not obliged to take part. You also have the right to withdraw from the study at any point for whatever reason.

There are no associated risks with participation and inconvenience caused will be minimalized.

The experiment is not anonymous, however all information collected will be solely used for experimental purposes. Information collected will be stores securely and not made public without prior consent.

If you have any further questions, please do not hesitate to contact me.

Please sign here to indicate that you have read and understand this form

X

Researcher: Caitlin Faughnan          E-mail: [redacted]
Supervisor: John Hyland              E-mail: [redacted]
Appendix Figure 2 - Questionnaire 1

Name of activity: (Hero Siege)

Age: 
Gender:

How long do you feel you were playing the game for? ________

Please recall your experience of the task or activity you just completed and answer the following questions. There are no right or wrong answers, so please answer intuitively.

1 – Strongly Disagree   4 – Undecided   7 – Strongly Agree

1. I had a meaningful time.

   1 2 3 4 5 6 7

2. I knew clearly what I wanted to do or what I should do at every moment.

   1 2 3 4 5 6 7

3. I really enjoyed what I was doing.

   1 2 3 4 5 6 7

4. My abilities matched the challenge of what I was doing.

   1 2 3 4 5 6 7

5. I felt that I could deal with whatever might happen next.

   1 2 3 4 5 6 7

6. It felt like time passed quickly.

   1 2 3 4 5 6 7

7. It was easy to concentrate on what I was doing.

   1 2 3 4 5 6 7

8. I was aware of how well the task was going.

   1 2 3 4 5 6 7

9. The task was really boring.

   1 2 3 4 5 6 7

10. I had a sense of great control over everything I was doing.

    1 2 3 4 5 6 7

11. I lost track of time while doing the task.
12. I lost myself in doing the task.

13. I wanted to do it again.

14. I knew how well I was dealing with the task.

Appendix Figure 3 - Questionnaire 2

Name of activity: (Life is Strange)

Age: Gender:

How long do you feel you were playing the game for? ________

Please recall your experience of the task or activity you just completed and answer the following questions. There are no right or wrong answers, so please answer intuitively.

1 – Strongly Disagree 4 – Undecided 7 – Strongly Agree

1. I had a meaningful time.

2. I knew clearly what I wanted to do or what I should do at every moment.

3. I really enjoyed what I was doing.

4. My abilities matched the challenge of what I was doing.

5. I felt that I could deal with whatever might happen next.

6. It felt like time passed quickly.

7. It was easy to concentrate on what I was doing.

8. I was aware of how well the task was going.
9. The task was really boring. 

   1 2 3 4 5 6 7

10. I had a sense of great control over everything I was doing. 

   1 2 3 4 5 6 7

11. I lost track of time while doing the task. 

   1 2 3 4 5 6 7

12. I lost myself in doing the task. 

   1 2 3 4 5 6 7

13. I wanted to do it again. 

   1 2 3 4 5 6 7

14. I knew how well I was dealing with the task. 

   1 2 3 4 5 6 7

Appendix Figure 4 - Debrief Sheet

Debrief Sheet:

Thank you for your participation in this experiment. 

The following is a breakdown for the amount of time you were playing the two video games for. 

Video Game 1: 32 minutes. 

Video Game 2: 32 minutes. 

The break in between the games was 7 minutes.

If you have any further questions, would like to request a copy of the completed research, or would like to talk about your experience, please contact me at xxxxxx@mydbs.ie.

You can also contact my supervisor at xxxxxx@dbs.ie

Appendix Figure 5 – Scoring for questionnaire
Appendix Figure 6 – Original Questionnaire
<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I had a meaningful time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2. I knew clearly what I wanted to do or what I should do at every moment</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3. I really enjoyed what I was doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4. My abilities matched the challenge of what I was doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5. I felt that I could deal with whatever might happen next</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6. It felt like time passed quickly</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7. It was easy to concentrate on what I was doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8. I was aware of how well the task was going</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9. The task was really boring</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10. I had a sense of great control over everything I was doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11. I lost track of time while doing the task</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12. I lost myself in doing the task</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13. I wanted to do it again</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14. I knew how well I was dealing with the task</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>