The influence of Conscientiousness in cooperative video games

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Abstract

Video game adaptive content is a commonly discussed topic in the current days, in particular game adaptation to the player's personality and preferences. To address the problem of having to identify what are these interests and preferences, several psychological models were developed and due to the current models only focusing on individual players, in this study we decided to explore what happens when players with the same and different personality traits are playing a cooperative video game, since they stop being individual players and have to adapt to their companions.

We hypothesize that specifically in the presence of achievement challenges in a video game, the experience is guided not only by the Agreeableness trait, but more importantly by the Conscientiousness trait. More than that we argue that when players are aligned in the Conscientiousness trait, both players will have a better game experience.

A test was conducted using the video game Dark Things About which is a strictly cooperative video game. Players (N=30) played a level of this game having optional achievement objectives to complete and answering to questions of personalized questionnaire using sections of the Game Experience Questionnaire and Big Five Inventory. The most interesting result was the correlation between high Conscientiousness players playing together with the Positive Affect ($U = 15.500$, $p = .026$). This result substantiated our hypothesis in the conditions of our study, indicating that pairs of aligned high Conscientiousness players had a better game experienced when compared to pairs of aligned low Conscientiousness players.

Keywords

Conscientiousness; Agreeableness; Achievements; Game Experience Questionnaire; Five Factor Model; Cooperative Game; Game Development;

Resumo

Nos dias de hoje adaptação de conteúdo em jogos é um conceito alvo de grande discussão, em particular a adaptação às preferências e interesses relacionados com a personalidade de um jogador. Para ajudar na área de estudo de identificação destas preferências e interesses, vários modelos psicológicos foram desenvolvidos. Mas os modelos atuais focam-se num jogador individualmente, neste estudo vamos explorar o que acontece quando jogadores com personalidades semelhantes e ou personalidades diferentes são postos num jogo cooperativo.

Neste estudo lançamos a hipótese de que na presença de Conquistas para serem completadas num jogo, a experiência de jogo é guiada não só pelo traço de Agradabilidade, mas também pelo traço de Consciencioso. Para além disto, lançamos a hipótese de que quando dois jogadores com fortes traços de Consciencioso jogam juntos, a experiência de jogo será melhor para ambos os jogadores.

Um teste foi conduzido, usando o jogo Dark Things About, que é um jogo estritamente cooperativo. Jogadores (N=30) foram colocados a jogar um nível deste jogo, onde existiam Conquistas opcionais para serem completadas e em seguida responderam a um questionário personalizado, que usa secções do Game Experience Questionnaire e Big Five Inventory. O resultado mais importante obtido, foi o da correlação entre jogadores com traços altos de Consciencioso, quando a jogar com jogadores alinhados neste traço, e a presença de Sentimentos positivos ($U = 15.500$, $p = .026$). Este resultado foi de grande importância pois corrobora a nossa hipótese inicial, quando comparado com jogadores alinhados por baixo traço Consciencioso.

Palavras Chave

Conscienciosidade; Agradabilidade; Conquistas; Game Experience Questionnaire; Five Factor Model; Jogo Cooperativo; Desenvolvimento de jogos;

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Acronyms

IST	Instituto Superior Tecnico
UE4	Unreal Engine 4
DTA	Dark Things About
HUD	Head Up Display
BFI	Big Five Inventory
GEQ	Game Experience Questionnaire
MUDs	Multi-User Dungeons

1

Introduction

Contents

1.1 Motivation

According to Bakkes et al. [1] with the increasing complexity of state-of-the-art video games, player models are sorely needed for determining accurately and adapting, the player experience. In recent years there have been some games that take into account the players behaviour. Like Left 4 Dead [2], which adapts the difficulty to players' performance, and Hello Neighbour [3], which learns from the players' actions to change the villain's strategies. But they only focus on difficulty adaptation rather than players' preferences and motivations. This happens because in the present video game industry, many game designers are forced into the proven genres in order for their games to sell well. But these proved genres are not varied enough to satisfy all the players' needs and interests, instead their are made for the masses, for the average type of player or a set of proven types of players, but not all. With this approach there may be a wide space of the possible audience that is left with no product to fill their preferences in video games. According to Thue et al. [4] in video games, one size does not fit all. So, without any knowledge of the current player's preferences, it is difficult for game designers to ensure an enjoyable player experience.

In the present days there are already some proven preference and motivational player models, like the BrainHex [5] and Gamer Motivational Model [6], but they are only applied to players individually. As so they can be used to adapt the game to one single player, but they can't describe what are the preferences and motivations of a pair of players while playing together in a cooperative game.

According to Nash [7] the word cooperative is used because the two individuals are supposed to be able to discuss the situation and agree on a rational joint plan of action, an agreement that should be assumed to be enforceable. In video games and according to Greitmeyer et al. [8] cooperative video game play is characterized by goals that are positively linked in that one player only attains his/her goals when other players also attain their goals. As so, their preferences and motivations can't be measured individually, because, as the definition explains, they need to reach a compromise of their needs which can have preferences and interests from both players.

Therefore our study comes into place. There must be a way to assess which preferences and motivations from each player are still valid while playing a cooperative game. With those it is possible to adapt the cooperative game and create a better experience for the group, filling the gap of player adapted cooperative games.

1.2 Problem

Nowadays there are multiple conceptual models that describe players' profiles, but there is few information on what guides players while in a multiplayer environment. With this few information there is no easy way to design multiplayer video games where the experience is tailored to the players' traits.

With this study we will focus on the case of two player cooperative games and as so the following questions arose:

- What are the personality traits that influence the player experience in a cooperative video game?
- More specifically what are the personality traits that affect the play experience in a achievement context in a cooperative video game?

1.3 Hypothesis

In this study we hypothesize that beside the Agreeableness trait of an individual's personality also the Conscientiousness trait influences the players' experience when in a achievement context in a cooperative video game environment. Providing a better player experience for both players when they are aligned in this personality trait.

We plan to test this hypothesis by creating achievement scenarios in the video game Dark Things About (DTA), where we will put pairs of players to the test and report their behaviour, correlating it to their personality traits. We will not only be looking to pairs of players that are aligned in their traits, but also random combinations, in order to perceive how players that have different Agreeableness and Conscientiousness traits behave in these scenarios and possibly indicate what guides their change in behavior.

1.4 Contributions

With this study we are making the first steps into understanding how individuals with different ratings in the scales of Agreeableness and Conscientiousness are expected to behave in a two player cooperative environment where the game presents activities that appeal to players with higher values of the Conscientiousness trait.

More than that we are making some advancements that will help the game, DTA, to offer a better cooperative experience and that can appeal to a broader audience, by focusing the game to individual characteristics of different types of players.

1.5 Document Outline

In this first part of the document we gave an overview of our motivation and the problem we found, as well as our hypothesis to solve it and what the contributions of this study are.

In chapter 2, Related Work, we will present and discuss the state of the art in the various fields of our study. Starting with personality models we will review the existing models. In the player models section we will review the existing models, explaining in greater depth how can we use them to assess preferences and motivations in players and what are the outputs of each model. In terms of player experience we will be looking on how to explain it and what are the different ways we can assess it.

In chapter 3, we will present the cooperative game DTA, describing development of the game, what are the design goals and what are its strong points that make it a good game for us to test our hypothesis. In the end of this chapter we will go through our solution, what we had to implement and what we could take advantage of in DTA.

In chapter 4, we will explain how we tested our proposed solution and describe the evaluation process of the gathered data from the tests.

Finally in chapter 5 we will go through the conclusions of this study and describe some of the possible future work both in the understanding of how individuals with different personalities interact in cooperative environments and also how DTA could be improved to appeal to other personality traits besides the Conscientiousness trait.

2

Related Work

Contents

In this chapter we will present all the related work for personality models, player models and player experience. In each of the these fields we will review the existing models and what tools we can use to measure them, focusing on the ones that can be applied in the context of our study.

2.1 Personality Models

The first studies on human personalities can be traced back as long as 400 BC to Hippocrates and his four types of temperament model. Since then, many studies were conducted and many models were proposed. In this section we will go through the most important and widely accepted personality models and how to apply them.

2.1.1 Five Factor Model

According to McCrae et al. [9], the Five Factor Model was created based on natural language adjectives and theoretically based personality questionnaires which supports the comprehensiveness of the model and its applicability across observers and cultures. This personality model is organized in a hierarchy of personality traits related with the five basic dimensions: **Extraversion**, **Agreeableness**, **Conscientiousness**, **Neuroticism**, and **Openness to Experience**. Each of these dimensions includes six facets that describe in more depth persons associated with them and which will be described in greater detail below (based on the descriptions of Costa and McCrae [10]).

2.1.1.A Extraversion

Extraversion describes how a person relates to the world and it includes the following six facets:

- **Friendliness** which describe individuals who make friends easily, feel comfortable around people, act comfortably with others and Cheer people up, when they have high values in this facet. While individuals with lower values can be related to be hard to get to know, often feel uncomfortable around others and keep others at a distance.
- **Gregariousness** which describe individuals who love large parties, talk to a lot of different people, enjoy being part of a group and involve others in what they are doing, when they have higher values in this facet. While individuals with lower values can be related to preferring to be alone, do not liking crowded events.
- **Assertiveness** which describe individuals who take charge, can talk others into doing things and take control of things, when they present high values in this facet. While individuals with lower values can be related to waiting for others to lead the way, don't liking to draw attention to themselves and holding back opinions.

- **Activity** which describe individuals who are always busy do a lot in their spare time and react quickly, when they present high values in this facet. While individuals with lower values can be related to liking to take their time, letting things proceed at their own pace and react slowly.
- **Excitement-seeking** which describe individuals who seek adventure, enjoy being part of a loud crowd and seek danger, when they present high values in this facet.
- **Cheerfulness** which describe individuals who have a lot of fun, laugh their way through life, look at the bright side of life and amuse friends, when they present high values in this facet. While individuals with lower values can be related to not being easily amused and seldom joke around.

2.1.1.B Agreeableness

Agreeableness manifests in people that are normally kind, sympathetic and cooperative and it includes the following facets:

- **Trust** which describe individuals who trust others, believe that people are basically moral and think that all will be well, when they present high values in this facet. While individuals with lower values can be related to distrusting people and believing that people are essentially evil.
- **Compliance** which describe individuals who would never cheat and stick to the rules, when they present high values in this facet. While individuals with lower values can be related to using others for their own ends, know how to get around the rules, putting people under pressure and pretending to be concerned for others.
- **Altruism** which describe individuals who make people feel welcome, are concerned about others and have a good word for everyone, when they present high values in this facet. While individuals with lower values can be related to being indifferent to the feelings of others and making people feel uncomfortable.
- **Cooperation** which describe individuals who are easy to satisfy and can't stand confrontations, when they present high values in this facet. While individuals with lower values can be related to contradicting others, insulting people and holdinh a grudge.
- **Modesty** which describe individuals who dislike being the center of attention and consider themselves an average person, when they present high values in this facet. While individuals with lower values can be related to thinking highly of themselves, boasting about their virtues and making myself the center of attention.
- **Sympathy** which describe individuals who feel sympathy for those who are worse off than themselves, value cooperation over competition and suffer from others' sorrows, when they present

high values in this facet. While individuals with lower values can be related to not being interested in other people's problems, tending to dislike soft-hearted people and believe people should fend for themselves.

2.1.1.C Conscientiousness

Conscientiousness describes how serious a person is when performing a task and it includes the following six facets:

- **Self-efficacy** which describe individuals who excel in what they do, come up with good solutions and know now how to get things done, when they present high values in this facet. While individuals with lower values can be related to misjudging situations and not understanding things.
- **Orderliness** which describe individuals who like order and doing things according to a plan, when they present high values in this facet. While individuals with lower values can be related to not being bothered by messy people and not being bothered by disorder.
- **Dutifulness** which describe individuals who try to follow the rules and keep promises, when they present high values in this facet. While individuals with lower values can be related to breaking rules and misrepresenting the facts.
- **Achievement-striving** which describe individuals who work hard, turn plans into actions and demand quality, when they present high values in this facet. While individuals with lower values can be related to doing just enough work to get by and putting little time and effort into their work.
- **Self-discipline** which describe individuals who are always prepared and carry out their plans, when they present high values in this facet. While individuals with lower values can be related to wasting their time, needing a push to get started and postpone decisions.
- **Cautiousness** which describe individuals who avoid mistakes and choose their words with care, when they present high values in this facet. While individuals with lower values can be related to making rash decisions and acting without thinking.

2.1.1.D Neuroticism

Neuroticism describes if a person tends to develop undesirable emotions and it includes the following facets:

- **Anxiety** which describe individuals who fear for the worst and get stressed out easily, when they present high values in this facet. While individuals with lower values can be related to not being

easily disturbed by events, not worrying about things that have already happened and adapt easily to new situations.

- **Anger** which describe individuals who get angry easily, are often in a bad mood and lose their temper, when they present high values in this facet. While individuals with lower values can be related to rarely getting irritated, not being easily annoyed and rarely complain.
- **Depression** which describe individuals who dislike themselves and have frequent mood swings, when they present high values in this facet. While individuals with lower values can be related to feeling comfortable with themselves.
- **Self-consciousness** which describe individuals who are easily intimidated, are afraid that they will do the wrong thing and find it difficult to approach others, when they present high values in this facet. While individuals with lower values can be related to not being embarrassed easily, being comfortable in unfamiliar situations and being able to stand up for themselves.
- **Immoderation** which describe individuals who do not know why they do some of the things they do and do things they later regret, when they present high values in this facet. While individuals with lower values can be related to easily resisting temptations.
- **Vulnerability** which describe individuals who panic easily, become overwhelmed by events and by emotions, when they present high values in this facet. While individuals with lower values can be related to remain calm under pressure and can handle complex problems.

Studies related with this trait show that people with high neuroticism indexes have higher risk of developing mental disorders.

2.1.1.E Openness to Experience

Openness to Experience describes if a person tends to be curious and in touch with art and imagination and its six facets are the following:

- **Imagination** which describe individuals who have a vivid imagination, like to get lost in thought and spend time reflecting on things, when they present high values in this facet. While individuals with lower values can be related to seldom get lost in thought and have difficulty imagining things.
- **Artistic Interest** which describe individuals who believe in the importance of art and see beauty in things that others might not notice, when they present high values in this facet. While individuals with lower values can be related to not liking art or some of it's forms
- **Emotionality** which describe individuals who experience my emotions intensely, are passionate about causes and try to understand themselves and their lives, when they present high values in

this facet. While individuals with lower values can be related to not being easily affected by their emotions.

- **Adventurousness** which describe individuals who prefer variety to routine and are interested in many things, when they present high values in this facet. While individuals with lower values can be related to disliking changes and like being attached to conventional ways.

- **Intellect** which describe individuals who like to solve complex problems, can handle a lot of information and enjoy thinking about things, when they present high values in this facet. While individuals with lower values can be related to not being interested in abstract ideas and not being interested in theoretical discussions.

- **Liberalism** which describe individuals who believe that there is no absolute right and wrong, when they present high values in this facet. While individuals with lower values can be related to believing in one true religion and that laws should be strictly enforced.

The standard way of measuring the Five Factors is through questionnaire which according to Spronk et al. [11] is not the most reliable method, but is less time consuming, expensive and the trade-offs in reliability are reasonable, when compared to the methods of measuring through interviewing or direct observations.

One of the questionnaires that measure the Five Factors is the Big Five Inventory (BFI) [12] which is a questionnaire composed of 44 items where the the user needs to rate each one into a scale between 1 and 5, where 1 corresponds to ”Disagree Strongly” and 5 corresponds to ”Agree Strongly”. Each trait is measured by the sum of answered values of a subset of these 44 items. The items could be either in the normal form or the reversed form, this means that when the values are summed the values of the reverse items need to be reversed (for example 1 becomes 5 and 5 becomes 1).

2.1.2 Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator [13] (MBTI) is a self-report questionnaire that indicates a person’s psychological preferences. Created by Katharine C. Briggs and her daughter Isabel B. Myers, it is based on a conceptual theory proposed by Carl Jung [14] which consists of four psychological functions: sensation, intuition, feeling and thinking. Based on these four functions Myers and Briggs defined four dichotomies, Extraversion-Introversion, Sensing-Intuition, Thinking-Feeling and Judging-Perceiving, in which each person is defined by a value in the scale of each dichotomy.

Extraversion-Introversion is related to how an individual ”gains energy”. Extravert individuals like to be with others and gain energy from people and the environment. Introvert individuals gain energy from alone-time and need periods of quiet reflection throughout the day.

Sensing-Intuition is related to how an individual collects information. Sensing individuals gather facts from their immediate environment and rely on the things they can see, feel and hear. Intuitive individuals look more at the overall context and think about patterns, meaning, and connections.

Thinking-Feeling is related to how an individual makes decisions. Thinking individuals look for the logically correct solution, whereas Feeling individuals make decisions based on their emotions, values, and the needs of others.

Judging-Perceiving is related to how an individual organizes her/his environment. Judging individuals prefer structure and like things to be clearly regulated, whereas Perceiving individuals like things to be open and flexible and are reluctant to commit themselves.

Even though this model is one of the most used at the industrial and enterprise levels, it has also received a lot of criticism in the research field claiming that it lacks reliability, validation and empirical evidence [15].

2.1.3 Cloninger's Psychobiological Model of Temperament and Character

The Cloninger's Temperament and Character Inventory [16] (TCI) model uses a questionnaire to identify the intensity and relationship between seven personality dimensions, four of temperament and three of character. Temperament's dimensions are Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence. Novelty Seeking is observed as exploratory activity in response to novelty. Harm Avoidance is seen as pessimistic worry in anticipation of problems. Reward Dependence relates to sentimentality and dependence on other individuals' approval. Persistence dimension is related to industriousness, determination, and perfectionism.

Character's dimensions are Self-Directedness, Cooperativeness and Self-Transcendence. Self-Directedness indicates how responsible an individual is. Cooperativeness relates to the degree to which individuals feel themselves as integral parts of human society. Self-Transcendence, relates to the degree to which individuals feel themselves as integral part of the universe.

2.2 Player Models

As discussed in the previous section, each person has different traits that describe his/her personality, similarly every player has his/her own preferences when playing games. As so there is a need to create psychological models that describe what the player needs and wants, in some cases the models presented below can be related to some of the previous personality models.

In this section we are going to review the existing player models, their connection with personality traits and how they can be used.

2.2.1 Bartle Player Types

Bartle [17] developed a model based on direct observation of players using Multi-User Dungeons (MUDs) which are multi-user virtual environments and obtained four different sub-groups: Achievers, Explorers, Killers and Socialisers. These four groups can be placed in a two dimensional graph where the x axis represent world-oriented versus player-oriented and the y axis represent action versus interaction, as shown in Figure 2.1.

Figure 2.1: Bartle Graph [18] visual representation

Bartle concluded that each of these four sub-groups views the playing of MUDs differently. Achievers are players that act upon the world and they like competition. To these players MUDs could be compared to games like chess and tennis. Explorers enjoy exploring the game in all its extent, being it either by exploring the virtual world or by exploring the game mechanics. To these players MUDs could be compared to pastimes like reading and gardening. Socializers are players that enjoy interacting with other players. To these players MUDs were entertainment like television and going to nightclubs. Killers take enjoyments in competing with other players, where they can demonstrate their superiority. To these players MUDs were sports like hunting, shooting, and fishing.

2.2.2 Demographic Game Design

Opposing from Bartle's model, the Demographic Game Design [19] (DGD) is based on personality models instead of observation. The Demographic Game Design 1 (DGD1) was created with objective to adapt the Myers-Briggs Type Indicator to gaming, however they never managed to create an accurate survey for this model[1]. Demographic Game Design 2 (DGD2) was an attempt to improve on the flaws of DGD1, but it too had his flaws and was later used as basis for BrainHex trait model, which we will explain in the next section.

[1] http://onlyagame.typepad.com/only_a_game/2005/08/towards_dgd2.html

2.2.3 BrainHex

Created by International Hobo, a successor, to the above mentioned, DGD1 and DGD2, BrainHex [5] is described as a satisfaction model (Figure 2.2), due to being related to the areas of the brain that are stimulated while a person plays a game. The model is divided into the following seven classes: Seeker, which is described by the curiosity about the unknown; Survivor, which is described by the enjoyment of fear and escape tense situations; Daredevil, which is described by the excitement of living on the edge and rushing around at all speed; Mastermind, which is described by the enjoyment in devising strategies and be as efficient as possible; Conqueror, which is described by the pleasure of beating impossible odds and be the best against others; Socialiser, which is described by the enjoyment in hanging with others and socialise; Achiever, which is described by wanting to get every collectible and achieving long term goals.

Figure 2.2: BrainHex classes [20] visual representation

Each of these seven classes are related with seven key elements of the nervous system, being them, the hippocampus and sensory cortices, the amygdala, epinephrine, norepinephrine, the orbito-frontal cortex, the hypothalamus, and the nucleus accumbens.

The BrainHex traits of a player are usually measured using a questionnaire, composed of a number of items that players rate in a 5-point Likert scale. These players are characterized by a major and a minor class, being them related with the most satisfactory types of activities the player enjoys to perform whilst playing video games.

2.2.4 Gamer Motivation Model

Created by Nick Yee and Nicolas Ducheneaut, the Gamer Motivational Model [6] (Figure 2.3) was developed using factor analysis, a psychology method to identify how variables cluster together.

Figure 2.3: Gamer Motivation Model [21] visual representation

The model has twelve categories, called motivations, which were extracted based on a questionnaire, where each question described a situation in-game and the players would rate them on a 5-point Likert scale. The twelve different motivations obtained can be clustered into six pairs, which are the following: Action, Social, Mastery, Achievement, Immersion and Creativity.

Each player is characterized by a percentile value in each of the twelve motivations that represents how strong that person's motivations compared to the rest of the population.

Action values dictates if the player is more into fast paced action or more of a slow paced video games with calmer settings, depending if they have higher or lower values respectively. In this category fit the Destruction and Excitement motivations. Players with higher values of destruction tend to take enjoyment from causing mayhem and destroy the environment. Players with higher values of excitement tend to enjoy games that incite high adrenaline.

Social values dictates if the player is more into playing with other people, regardless of whether they are collaborating or competing, or more of a solo player. In this category fit the Competition and Community motivations. Players with higher values of competition tend to like to oppose other players and to like being acknowledged as the best. Players with higher values of community enjoy chatting with others and working as a team to achieve a common goal

Mastery values dictates if the player is more into complex game with a great strategic component or more into accessible and forgiving games. In this category fit the challenge and Strategy motivations. Players with higher values of challenge tend to enjoy games that rely a lot on player skill and are often

persistent and take time to improve themselves. Players with higher values of strategy prefer games that require careful decision making and planning.

Achievement values dictates if the player is more into collecting objects and power or if the player doesn't care much about progress and scores in the game. In this category fit the Completion and Power motivations. Players with higher values of completion want to do everything the game has to offer. Players with higher values of power want to become as powerful as possible in the game world.

Immersion values dictates if the player is more into being engaged in the game world, narrative, characters and setting , or more into the game mechanics, without minding themselves with the narrative experiences the games has to offer. In this category fit the Fantasy and Story motivations. Players with higher values of fantasy tend to enjoy being someone else somewhere else. Players with higher values of story want games with elaborate stories and with well developed characters.

Creativity values dictates if the player has the need to make the game is own, by customizing it as much as possible, or if the player just want the game as it is. In this category fit the Design and Discovery motivations. Players with higher scores of design are the ones that seek to express themselves in the game putting a lot of effort into customization. Players with higher discovery values tend to experiment as much as possible with the gaming and finding what are the limits of it.

Each pair of motivations is highly correlated with one another, while motivations in different pairs are less correlated. It was also concluded, due to the correlation between motivations that those can also be grouped in three clusters, Action-Social, Mastery-Achievement and Immersion-Creativity. These clusters can be mapped on to well known personality traits of the Five Factor Model. The Action-Social cluster can be mapped to Extraversion, the Mastery-Achievement can be mapped to Conscientiousness and the Immersion-Creativity can be mapped to Openness to Experience.

2.3 Player Experience

To better understand how we are going to measure the player experience (or game experience) we first need to understand what is player experience. In general terms, experience does not only mean the mere stimulation of senses, it includes complex cognitive, emotional and behavioural processes. In video games, the player experience can be subdivided into different parts of a whole, such as immersion, fun, engagement, flow and playability are parts of the whole that is player experience.

Each of these characteristics of player experience can be measured separately and have different ways to do so. But in order to measure player experience in our experiment we will need a unique and concise way to do so, which does not imply the usage of measuring equipments, such as cameras or brain wave detection for each of the game experience dimensions. So, for measuring our player experience as a whole there are two more widely used methods. The Game Experience Questionnaire

(Game Experience Questionnaire (GEQ)) and the Game Engagement Questionnaire, which we will describe in greater detail below.

2.3.1 Game Engagement Questionnaire

The Game Engagement Questionnaire was developed by Brockmyer et al. [22] with the objective to determine the impact of violent video games on individuals. The initial questionnaire was created by literature revision on the topics of immersion, presence, flow, psychological absorption and dissociation, later it was improved based on participants reports on associations made with engagement in games. The final questionnaire is composed of 19 items which need to be rated in the scale of ”No”, ”Sort of” or ”Yes” as to what the participant feel it describes them best in each situation. The questionnaire can be used for different video games describing the participant with an engagement value, which indicate if the player can get more or less engaged in the game.

Even though the Game Engagement Questionnaire can be a good tool to measure the engagement of players in a game, it has some limitations in terms of characterizing the participants in the different dimensions that are part of game experience. Besides that, due to being tied with how violent video games can have a bad impact on players, it has received some criticism for not being impartial in that field and assuming from the start that violent video games have a bad valence [23].

2.3.2 Game Experience Questionnaire

The GEQ is a questionnaire created by IJsselsteijn et al, [24] to measure player experience. It's structure is divided into three modules which are, the core module, the social presence module and the post-game module. These modules are composed by a set of questions (items) which describe feelings, that were possibly felt during the play experience, The participants' need to answer each of these items rating them on a scale between 1 and 4, where 1 means not at all and 4 means extremely.

The core module assesses game experience as scores on seven components: Immersion, Flow, Competence, Positive and Negative Affect, Tension and Challenge. This module is composed by 33 items and additionally also has a 14 in-game item version, which allows for assessments of game experience at multiple intervals during a game session.

The social presence module is composed by 17 items and reports psychological and behavioural involvement of the player with other social entities, be they virtual, mediated or co-located and is divided into three components: Empathy, Negative Feelings and Behavioural Involvement.

The post-game module is composed by 17 item and assesses how players felt after they had stopped playing. This is a relevant module for assessing naturalistic gaming, but may also be relevant in experimental research. This module is divided into: Positive Experience, Negative Experience, Tiredness and

Returning to Reality.

The well defined boundaries between each of the modules allow for them to be administered separately depending on the needs of the research. In order to get the scale scores on each dimension, it is needed to make the average of the the values on each question that is associated with a dimension.

2.4 Discussion

In this chapter, we reviewed existing personality and player models as a way to identify what dimensions of each model could fit our purpose and what correlations they could have between one another. Due to player models being correlated to an individual's personality, we decided to not use a player model to describe our participants and instead focus on personality traits that could guide our hypothesis. We decided to use personality traits described in the Five Factor model, due to this model being one of the most used and widely accepted. The traits we will be focusing on, are the agreeableness which as described before can describe if an individual tends to be more or less cooperative and conscientiousness which can be tied to individuals who tend to complete the tasks with perfection, and as Nick Yee found out in the Gamer Motivational Model, can be correlated to the Mastery-Achievement cluster. This evidence, backs up our hypothesis that players with higher Conscientiousness traits tend to enjoy to complete achievements in video games.

As a way to evaluate the game experience during our experiment we decided to use the Game Experience Questionnaire as it is more widely accepted and provides more insightful data on the different dimensions of player experience, when compared with the Game Engagement Questionnaire.

3

Implementation

Contents

In this chapter we will go through the technologies we used, how we used them and the solutions we followed to the problem and hypothesis presented in chapter 1.

3.1 Dark Things About

DTA is a story-driven Cooperative Survival video game, currently being developed by the author of this study with a team of Instituto Superior Tecnico (IST) colleagues. The game started being developed as a university project and is now being developed as a side project. In the following subsections we will describe what the game is and what makes it a good option to validate our hypothesis. It is worth to mention that all the solution that will be presented in the the next chapters was implemented for this study and was later accepted by all the DTA team to make it an integral part of the game.

3.1.1 Design Overview

DTAs is a local cooperative game for two players, without split screen. The aforementioned Cooperative Survival genre, is a denomination the team developing the game started using with the objective to demonstrate the innovative dynamic between the two players, which makes the game progression impossible if there is no communication nor cooperation between the two players. This dynamic is achieved by dividing the responsibilities by both players, one of them has the control over the game camera, which enables to see the world whilst the other has control over a lantern, which enables the players to see in the dark environment, as illustrated in Fig. 3.1. Both of these mechanics are tools for the players to solve puzzles and overcome enemies, that together with the tense environment creates a challenging and differentiating experience.

Figure 3.1: In game screenshot of the pair of characters in DTA where the back character is controlling the perspective of the game camera and the front character is controlling the lantern to see in the dark environment

The game is structured around levels in which the players will have the opportunity to play with two different pairs of characters each with their own play-styles and knowledge of the world around them. Having different knowledge about the world means that when the players use a certain character to control the camera, the way they view the world around them may change, highlighting and revealing certain objects and information that allows them to progress in the game.

3.1.2 Engine and Tools

The engine upon which the game was build is the Unreal Engine 4 (UE4)[1], a modern game engine developed by Epic Games[2]. UE4 was built using the C++ programming language which in turn is the programming language available to develop games in the engine. UE4 also provides a visual scripting language called Blueprints, illustrated in Fig.3.2 which allows for faster prototyping and development with the drawback of a performance overhead.

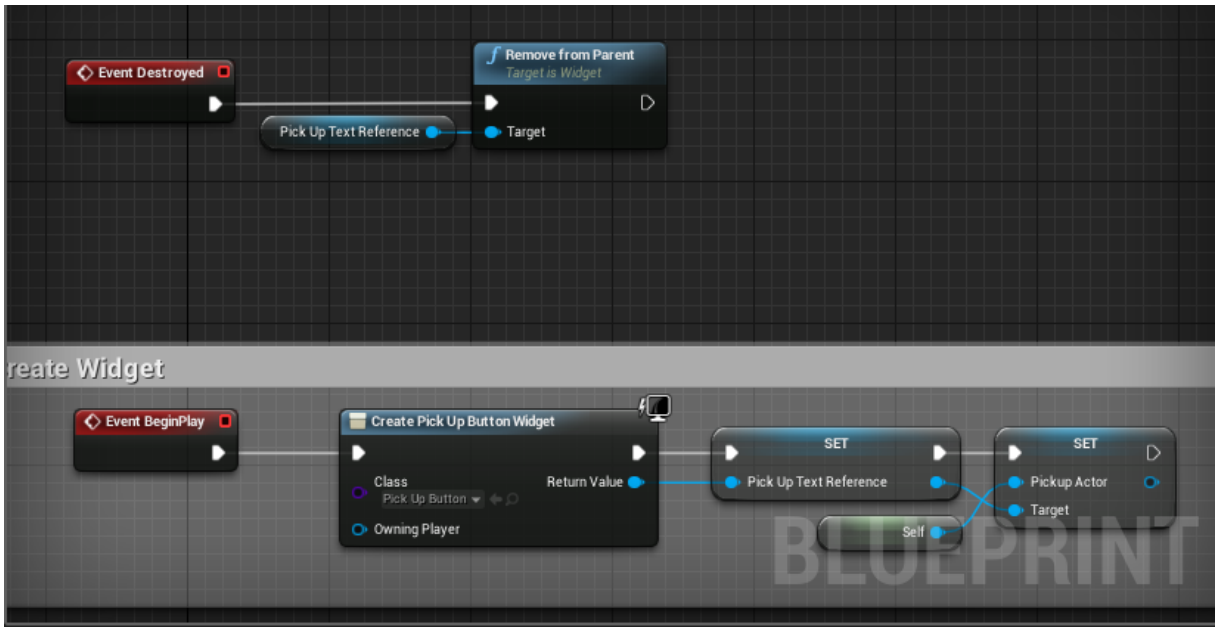

Figure 3.2: Screenshot of a Blueprint

DTA is being built using both of these languages, making a trade-of between the two and using the one that better suits for each situation.

Additionally we run the Wwise[3] plugin, from audiokinetic, which is a program for interactive audio. This plugin allows us to have greater control over the sounds and musics in the engine.

[1] https://www.unrealengine.com/
[2] https://www.epicgames.com/
[3] https://www.audiokinetic.com

3.2 Solution Overview

In order to create an environment where we could test our hypothesis we designed three scenarios that could potentially be more appealing to players that present higher values of the Conscientiousness trait. As previously explained the Conscientiousness trait can be related to a player's motivation to complete achievements in games (correlation made by Nick Yee, et al. in [25], so the scenarios designed are achievements in the game DTA. These achievements needed to be different and optional situations, that could be done independently from one another and that could give a certain measure of how much Conscientiousness a player is. Additionally and contrary to what many video games do, our achievements have no reward whatsoever, which helps us to appeal only to players who are doing the achievements just for the sake of completion, instead of players who are doing them for the in-game rewards. With that in mind we designed the following three achievements with each needing more effort than the previous one, from the point of view of how Conscientiousness an individual needs to be to complete it.

- **Statues Achievement** - In this achievement players have to collect 12 statues scattered around an open garden. When designing this challenge we had the need to make the statues shine in the dark, as demonstrated in Figure 3.3, this way, the challenge is not to find them, but to collect them. We decided to avoid the finding component of the achievement so it wouldn't go against some players that present high Conscientiousness trait but don't enjoy to seek for hidden objects.

Figure 3.3: In game screenshot of the statues glowing in the dark of the **Statues Achievement**

- **Laps Achievement** - In this achievement players have to complete 3 laps around the mansion in the top of the hill in the garden, seen in the back of Figure 3.4. The laps can be done either

clockwise or counter clockwise this way players wont get confused or frustrated if they went in the wrong direction. This is accomplished by inserting four invisible checkpoints around the house, that when all activated count as lap completed. In order to make it a cooperative effort and to avoid the possibility of shortcuts, the laps are counted for the pair of players, so if one player completes the lap all the checkpoints are reset and the players have to go through them again to complete another lap.

Figure 3.4: In game screenshot of the mansion (stone building in the back) where the players can complete the **Laps Achievement**

- **Wait Achievement** - In this achievement players have to go to the small garden door in the back of the garden area, seen in Figure 3.5 and wait near the gate for 2 minutes in order to complete the achievement (later changed to 1 minute as will be explained in chapter 4). If the players leave the area the achievement will reset. This challenge was designed to be the most boring and tiresome to do, as players would have to stop playing willingly for a certain amount of time without any information on their progress. This allows us to point out players that are willing to do whatever the games has available just for the sake of completing it, which is what players with higher Conscientiousness trait are expected to do.

In order to have good introduction to DTAs controls and gameplay, that we could use in a experiment context, we took advantage of the first level of DTA, which is a tutorial level and that also had potential for the implementation of the achievements. For the achievement implementation we set as prerequisites that they should happen in a well defined section of the level and that the duration to complete all of them should be similar to playing the rest of the level. These constraints would help us verify if players are really committed to spend their time completing the achievements as it would be a side track to the main objective and would increase their play time. In order to satisfy our needs we adjusted the garden section of the level, seen in Figure 3.6, which is a section near the end of the level and that contains an open area to explore in the middle of trees and near a mansion. With the positioning of this area, players

Figure 3.5: In game screenshot of the garden back gate where the players can complete the **Wait Achievement**

would already have played the great majority of the level which would get them acquainted with the controls and gameplay mechanics of DTA and the area dimensions allowed us to create achievements that could take considerable amount of time to complete. Additionally and due to this garden not being the end of the level allowed us to make a distinction between the real objective of the game and the optional achievements. This way players with no interest in completing the achievements would easily perceive them as optional and proceed with the level main objective.

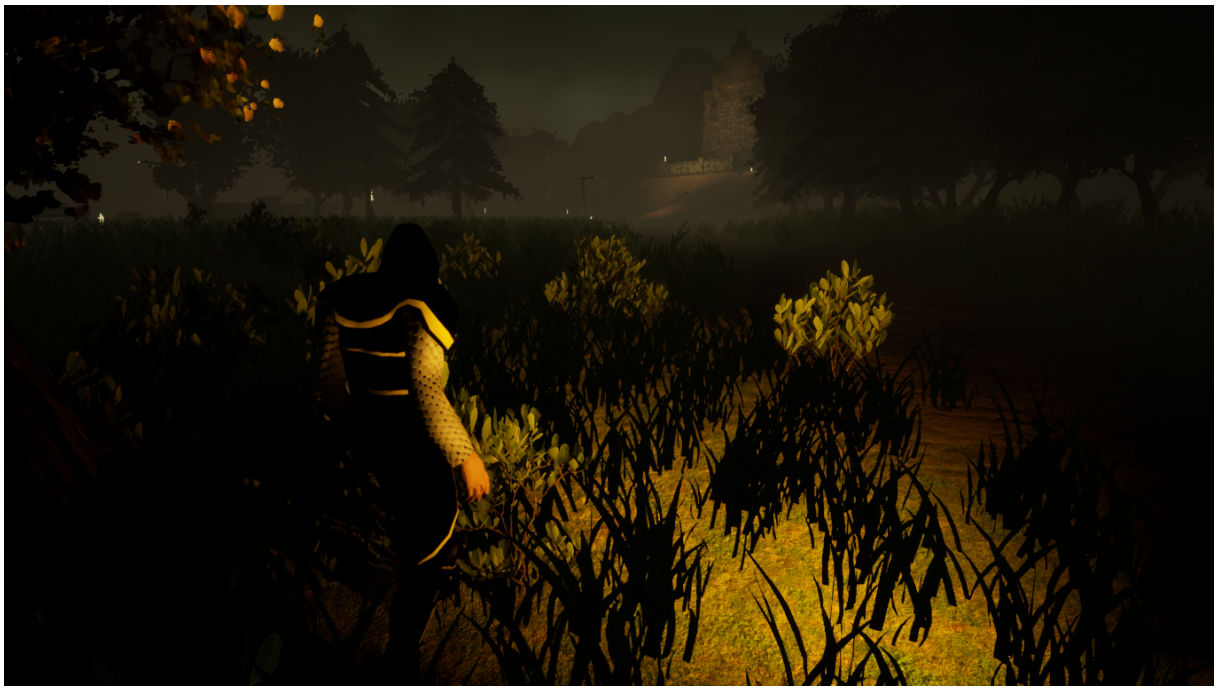

Figure 3.6: In game screenshot of the garden area where the players can complete the Achievement

Due to the challenges alone not being obvious enough for players to find them, we implemented

a achievement menu and a achievement tracker. The achievement menu is a screen in the pause menu, as presented in Figure 3.7, that allows players to see which challenges are available and the progress made in each one. This functionality is introduced to players when they step into the garden, so that players are aware of the existence of the achievements, this way we avoid the need for external intervention for explanation.

Figure 3.7: In game screenshot of the Achievement Menu

The achievement tracker, demonstrated in Figure 3.8 is a Head Up Display (HUD) that is displayed to players whenever they make progress in one of the achievements, this way players would be reminded of the achievements existence if they made progress in one of them and for players really focused on completing the achievements it makes for a better experience as players wouldn't need to stop every so often to check their achievement progress on the achievement menu.

Figure 3.8: In game screenshot of the Achievement Tracker

The progress in either the achievement tracker and menu show how many statues or laps have been collected/completed of the existing total, for the **Wait Achievement** instead of showing how much time the players were missing to complete it we decided to only display challenge completed when players have completed it. This decision was made based on the previously described intent to make

every achievement more difficult to complete than the last in a Conscientiousness trait point of view. As players with lower Conscientiousness would not be predisposed to wait for a certain amount of time without any feedback on their progress whilst players with higher Conscientiousness trait would want to complete that achievement even if it would require to get no feedback on their progress.

Additionally and as a way of monitoring the players with better precision we implemented a log system that would convert the selected in game variables into a text file for each play through of the level (Appendix B). The following variables were the ones we selected to output in order to analyse in our experiment:

- Play time, which is counted since the players started the level until the end of the level;
- Play time after the garden area, which is counted since the players started the level until the players enter the basement of the mansion;
- Number of statues collected;
- Time to collect all statues since the first one was picked;
- Number of laps completed;
- Time to complete all laps since the first one was finished;
- Waited in the back garden gate, which is a 1 or a 0 depending if the player completed the **Wait Achievement** or not respectively;
- Number of times the players left the waiting area.

With the achievements well defined and the achievement menu, tracker and log system in place we were able to use the first level of DTA as the base of our experiment and proceed to the experiments with players, as we will describe the next chapter.

4

Experiment and Results

Contents

In this chapter we will go through the different phases of our experiment and the methods used to evaluate it. As we found the need to validate our solution before the main test, we decided to divide our experiment in three phases, a pilot test, to validate the level created and our experimental procedure, an online questionnaire, to validate if the created challenges were well designed to appeal to individuals with high values of Conscientiousness trait and the main experiment, where the participants would play the game and answer a questionnaire, to validate our hypothesis. Each of these phases will be described in detail in the following sections.

4.1 Pilot

In this section we will describe the pilot test, which was a preliminary test with the objective to validate if the adapted level of DTA, which was described in chapter 3, had any problem that would be detrimental for the players experience and our experiment.

4.1.1 Preparation

For the pilot test we used the DTA adapted game level and a questionnaire that was created in order to gather Demographic, Game Experience and Five Factor traits data from the participants (The questionnaire presented in Appendix A.2 uses BFI and GEQ validated questionnaires which is described in section 4.1.3 below). This questionnaire was divided into two parts, the first being related to the participants characterization section, that would be answered before playing the game. In this section we asked age, sex, professional relationship with video games, frequency with which the participants played games, if they played multiplayer games, dexterity with gamepad controllers and if they had already played DTAs. The second part was related to the Game Experience and Five Factor sections and was answered after the participants played the game. The Game Experience section, was an adaptation of the original GEQ where we used the Core and Social Presence modules and removed the Post-Game module. We made this decision due to the Post-Game module being all about the transition from game to the real world, which in the case of our experiment brings no meaningful addition to our pool of data and instead would make our questionnaire extensive and detrimental to our participants focus. The Five Factor section, was an adaptation of the BFI questionnaire where we only included the questions related to measuring the Conscientiousness and Agreeableness traits. As pointed out in chapter 2 the Conscientiousness trait relates to a person's interest in completing the challenges available (Achiever), this makes it the main trait we wanted to observe on our participants. The Agreeableness trait was chosen as a control variable, due to individuals with higher agreeableness trait being more inclined to do what others want to, without minding it. To avoid any bias from the order of the questions both in the GEQ and Five Factor sections we presented items in each section in random orders. Also with the objective to not

create a bias we choose to bundle the Five Factor section with the GEQ section after the participants played the game. The idea was not to let any participant understand that we were interested in their behaviour during the play session.

4.1.2 The Experiment

The pilot tests occurred over a period of one month and took place in a software company where all the participants worked. The participants were paired randomly and the experiments were preformed in one of the company's meeting rooms after working hours. In all the tests there was always the presence of a supervisor who would make sure the experiment progressed smoothly and that would observe and take notes on possible issues with the game experience and the experiment.

Each test can be subdivided in the following steps:

1. Introduction to the game and the experiment.
2. Demographic section of the questionnaire.
3. Playing the game level (tutorial, Achievement Challenges and level conclusion)
4. GEQ and BFI sections of the questionnaire.
5. Unstructured interview.

Each of these pilot tests took from 30 to 40 minutes to be completed, varying with the players' communication and cooperation with one another, coordination with controllers and puzzle solving logic.

4.1.3 Results & Discussion

As the pilot phase of the experiment had only the objective to test our experimental procedure, in this section we will only make a brief description of the sample of participants, but we will not analyse the questionnaire or game log data, as the experiment conditions changed between each test, as we solved newly found problems in order to test them with the next pair of participants.

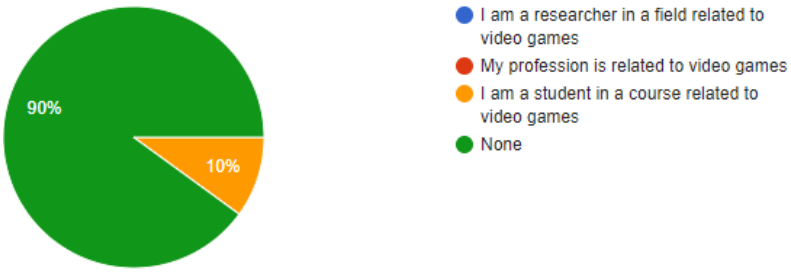

Figure 4.1: Professional relation with video games

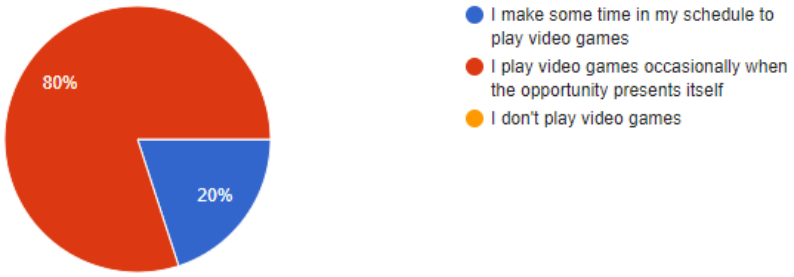

Figure 4.2: Gaming frenquency

In this phase we gathered 10 participants, making a total of 5 pairs to play the game. The participants' age ranged from 20 to 37 and the sex distributions was 2 females, 8 males. As can be seen in the four chart presented in Figure 4.1, since all the participants are professionals in Software Engineering, 9 (90%) reported to have no relationship with video games in their professional lives, while 1 (10%) reported being a student in a course related with video games. The play schedule and the preference for multiplayer games can be observed in Figures 4.2 and 4.3, finally in the proficiency with gamepads, all the 10 participants rated their proficiency as 4 or 5, relating to have high proficiency 4.2.

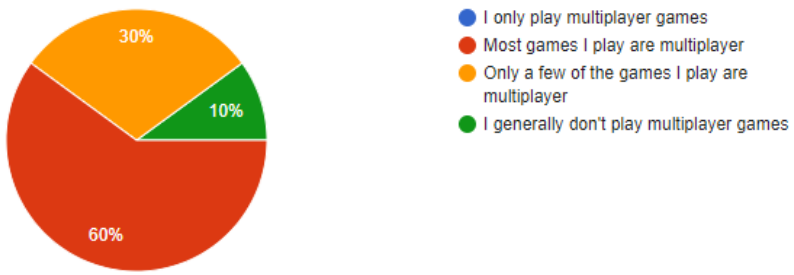

Figure 4.3: Multiplayer game habits

With the feedback gathered from our participants and from what we observed during the pilot tests we pointed out some major problems with the experiment and decided to make some adjustments to both the level and the questionnaire. In the level part we identified that the wait challenge required players to wait for a long amount of time without any feedback, so we decided to reduce the wait time from 2 minutes to 1 minute. We also identified that before the garden area players tend to die multiple times due to the unnoticeable drops of the closed bridge and the river area. This made the game experience more frustrating and could possibly interfere with the results we would get from the experiment. To address these issues we decided to lower the half of the bridge were players come from and leave the other side of the bridge raised, in order to be more perceptible that wouldn't be possible for players to traverse, and to add invisible blocking boxes surrounding all the river side and the drop of the bridge.

Regarding the questionnaire, most of the players reported in the unstructured interview that the questionnaire was extensive and tedious to answer, this issue was mainly observed on the second part of the questionnaire, since participants would have to answer both GEQ and BFI sections which

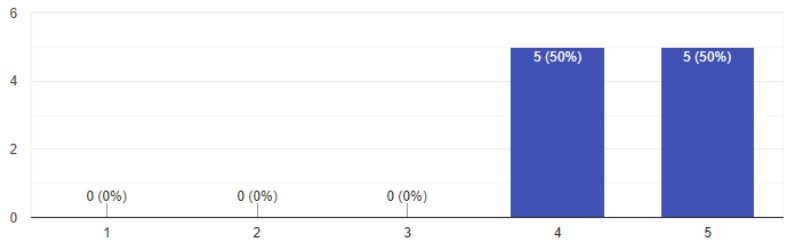

Figure 4.4: Proficiency with gamepad

are composed by a great number of items. Besides this problem we also observed that by answering the GEQ section after playing the whole level, was providing game experience data for the entire level instead of the achievements section, which was our focus. To solve this last issue we decided that the GEQ section would need to be answered after the garden area, referencing in the question that this section was related with the area the participants just finished playing. In turn this solution also allowed for a mitigation in the participants' feeling of the questionnaire being to long, as players would answer the GEQ section, then play until completing the level and at the end answer the BFI section of the questionnaire (the improved version of the questionnaire can be seen in Appendix A.2).

4.2 Online Questionnaire

In this section we will explain the Online Questionnaire phase of the experiment, which was another preliminary test with objective to validate if the achievements created were in fact appropriate to appeal to players that present higher values on the Conscientiousness trait.

4.2.1 Preparation

For this part of the experiment our main focus was to validate if the achievement challenges were well designed to appeal to individuals with higher Conscientiousness trait. In order to do so, we would need to either create a single player version of DTA which would imply a loss of the core experience which is part of this game, or we could record videos of the achievements being completed by two players and ask the participants to rate them according to their liking. We choose to proceed with the second option, as it was the best of the two in terms of keeping the DTA achievements experience as is, even though it could imply some deviation between what the real experience of playing is and the report of each participants liking of achievement being completed in a video.

For each achievement we recorded a separate video, were we showed the process to complete each the challenges, speeding up some parts in order to make the videos more appealing and less time consuming for the participants. These videos were used to create a new questionnaire (Appendix A.1)

where we would ask the participants to rate, on a likert scale, each video in two ways, one according to her/his own liking of the challenge presented and another according to her/his idea of what other persons' liking would be. Even though we only wanted to know the personal rating to each challenge, we followed the work of [26] where the author divided the rating of videos into two questions so that the participants would clearly know that one of the questions is referring to the participant liking specifically and other to what the participant thinks other people liking would be. This can avoid situations were even though the participant doesn't like what is presented in the video, they would still rate it highly in the scale due to thinking that the majority of the people would like what is presented.

Table 4.1: Video rotation by questionnaire version

Version	First Video	Second Video	Third Video
1	Statues Challenge	Laps Challenge	Wait Challenge
2	Wait Challenge	Statues Challenge	Laps Challenge
3	Laps Challenge	Wait Challenge	Statues Challenge

Along with these questions we added a section for participant characterization and a section for the BFI personality traits. Similarly to what we described in section 4.1.1, this Five Factor section was an adaptation of the BFI questionnaire but in this case we only included the Conscientiousness trait items of the original questionnaire, as our focus would be on correlating the Conscientiousness trait with the ratings of the video.

As a way of not biasing the results by the videos order, we decided to create three versions of the questionnaire where the order would rotate as presented in table 4.1.

The results expected for this preliminary experiment would be that players with higher Conscientiousness trait would rate the achievements higher than lower Conscientiousness trait participants, allowing us to validate the achievements designed.

4.2.2 The Experiment

For this test we decided it was better applied as an online questionnaire, which would allow for a faster recruitment and response process. The tests occurred over a period of three days and the participants reached were all university colleagues whom never had never played DTA, in order to not bias the results. The questionnaire was send to each of the participants individually, rotating between each of the versions presented in table 4.1, and it wouldn't take longer than 7 minutes to complete.

4.2.3 Results & Discussion

The online questionnaire got 12 answers, that were evenly distributed between each of the questionnaire versions described in table 4.1.

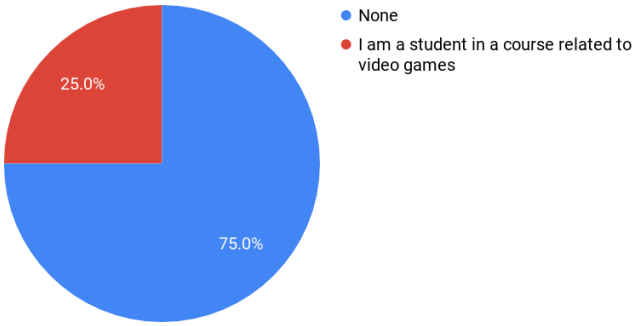

Figure 4.5: Professional relation with video games

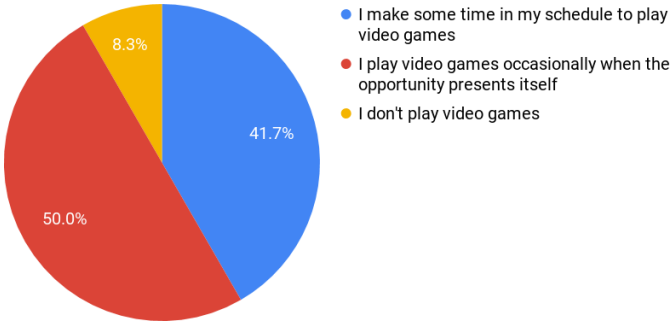

Figure 4.6: Gaming frenquency

Our participant sample was composed by 2 females and 10 males, with ages ranging from 22 to 24, where 3 (25%) reported to being students in video games courses and the other 9 (75%) having no relation with video games in their professional lives (Figure 4.5).

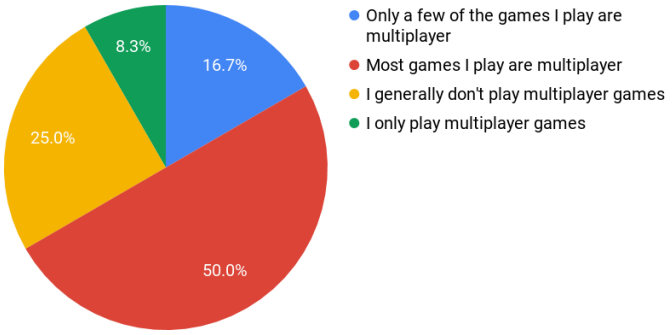

Figure 4.7: Multiplayer game habits

Half of the participants report to play video games when the opportunity presents itself, while 5 (41.7%) report to make time in their schedules to play, whilst 1 (8.3%) reports to not play video games (Figure 4.6). The multiplayer video games appeals to 9 participants (75%) of our sample, whilst 3 (25%) do not normally play multiplayer games (Figure 4.7).

With the like ratings for each achievement video and the Conscientiousness trait scale score of each participant we plotted the dispersion graphics 4.8, 4.9 and 4.10. Regarding each of the challenges game

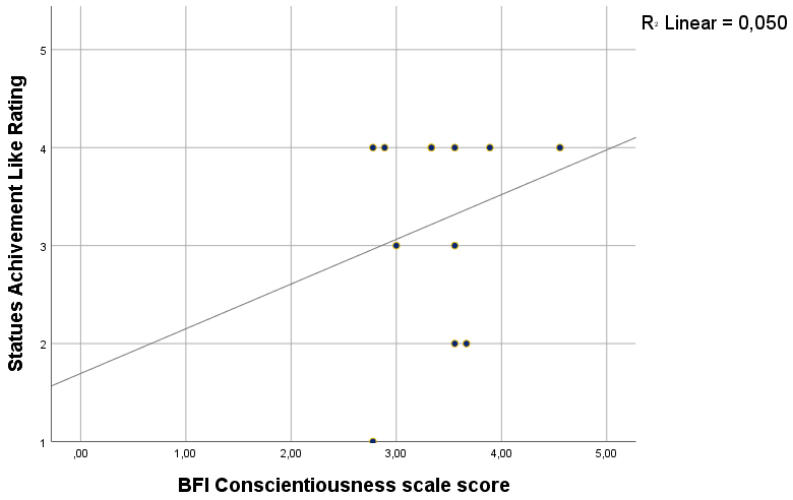

Figure 4.8: Scatter plot of the **Statues Achievement** liking by Conscientiousness trait scale score

play videos the following dispersion graphics show the relation between the participants liking of each achievement and the result of their Conscientiousness trait according to the items of the BFI.

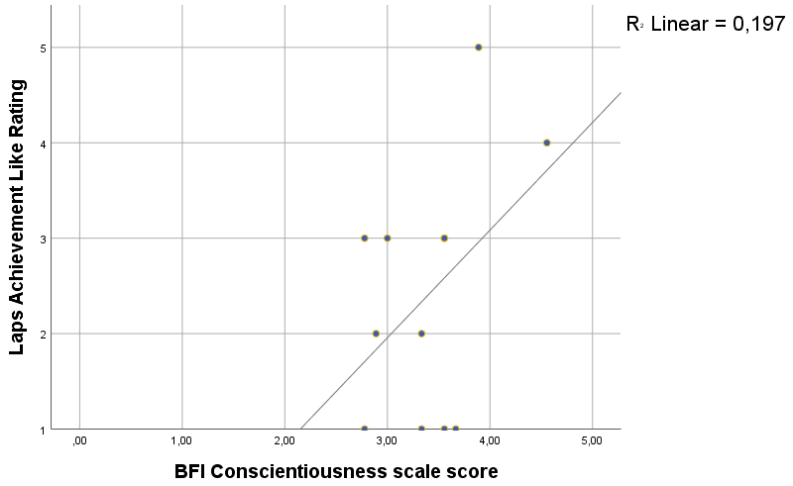

Figure 4.9: Scatter plot of the **Laps Achievement** liking by Conscientiousness trait scale score

As we can observe from each of the plots, there is a clear tendency for participants with higher conscientiousness trait to rate highly each of the challenges. In particular we can observe that the tendency relation gets more accentuated with each challenge with the status achievement 4.8 being the less accentuated while the **Wait Achievement** 4.10 is the most accentuated, this can be explained by what we presented in chapter 3, where each achievement was designed to require a greater effort to be achieved than the previous one. These results allowed us to backup our designed achievements and proceed to the main tests of our experiment without needing to make any changes to any of the challenges.

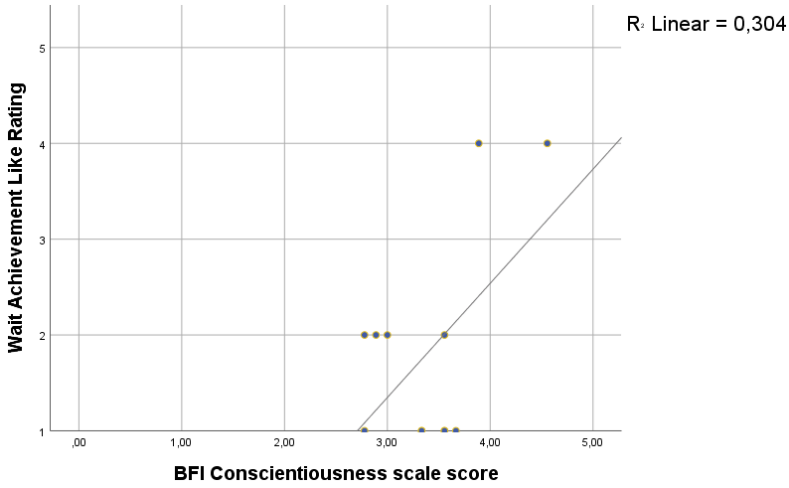

Figure 4.10: Scatter plot of the **Wait Achievement** liking by Conscientiousness trait scale score

4.3 Main Test

In this section we will describe the process and evaluation of the main test of our experiment, ending with a brief discussion of our results and how they support our initial hypothesis. Contrary to the previous sections, in this one we will not describe the preparation of the test, as the previous sections were the preparation for the main part of the experiment.

4.3.1 The Experiment

The participants gathered for this part of the experiment were a mix of students from IST and workers from an outsourcing company.

This phase occurred over a period of two months and the tests were made both in a students room at IST and in a meeting room of the outsourcing company (Figure 4.11). Both rooms were arranged to have similar dispositions in order to not create bias in the experiments. Similarly to the pilot tests, there was always present a supervisor who would have the functions of introducing, monitoring and guiding the experiment.

The tests had no time limit and in all tests the level had to be finished. Each test can be subdivided in the following steps:

1. Introduction to the game's theme and the experiment.

2. Demographic section of the questionnaire.

3. Playing the tutorial (where players would learn the controls) and Achievement area of the game level.

4. Interruption for GEQ section of the questionnaire.

5. Return to the game to play the level conclusion.

6. BFI section of the questionnaire.

7. Unstructured interview.

Figure 4.11: Play Session at the outsourcing company

The tests took from 35 to 45 minutes to be completed, varying similarly to the pilot tests. It is worth mentioning that the loose boundary between the Achievements area and the level conclusion, led us to place upon the experiment supervisor the decision when to interrupt the participants and to tell them to answer the GEQ section of the questionnaire. The supervisor always had to take into consideration that when the players left the achievements zone they had the possibility to go back, and because of that the players should only be interrupted when they demonstrated commitment to proceed with the main objective of the level.

4.3.2 Results & Discussion

In this last test we were able to get 30 participants, forming a total of 15 pairs, with ages ranging from 19 to 38 and where 9 were females and 21 were males. 18 participants (60%) reported to have no relationship with video games in their professional lives, while 10 (33.3%) reported to be students in the field and 2 (6.7%) reported to being researchers in a field related to video games. 9 participants (30%) reported to make time in their schedule to play video games (4.12), 12 (40%) reported playing video games when the opportunity presents itself, while 9 (30%) reported to not play video games (4.13).

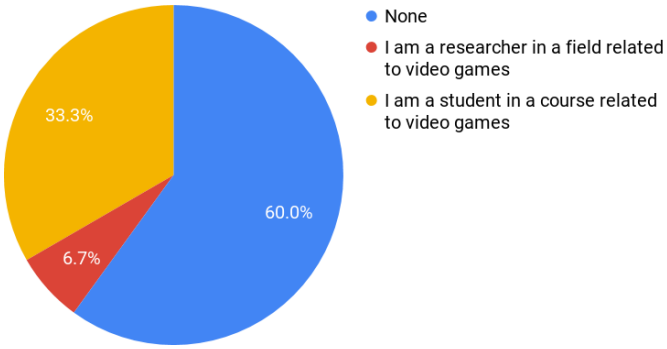

Figure 4.12: Professional relation with video games

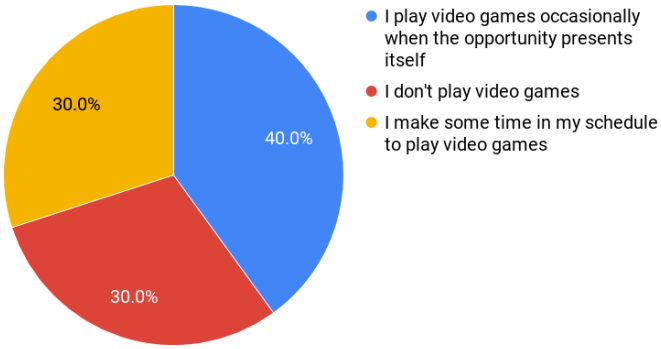

Figure 4.13: Gaming frenquency

On the multiplayer side, 12 participants (40%) reported play mostly multiplayer games, other group of 12 (40%) reported to not play multiplayer video games(being part of this group the 9 participants who reported to not play video games), the remaining 6 players (20%) are divided between only playing multiplayer games and only a few of the games played being multiplayer (4.14). As for the gamepad proficiency, 21 participants (70%) rated themselves as having higher dexterity with gamepads, while 5 (17%) reporting to be average, leaving a small group of participants reporting to have low proficiency with a gamepad (4.15).

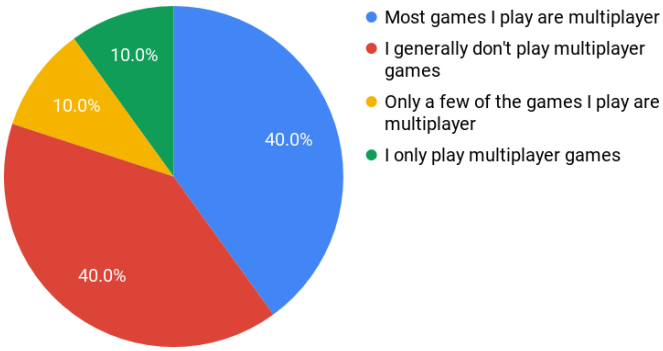

Figure 4.14: Multiplayer game habits

To analyse the data gathered we started by performing normality tests on the BFI and GEQ variables

of each participant, using the Shapiro-Wilk test, due to our sample being rather small (N=30).

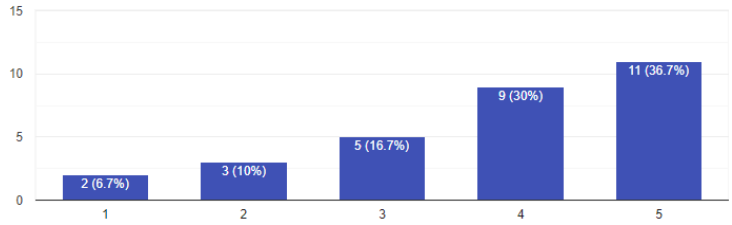

Figure 4.15: Proficiency with gamepad

This test revealed that the BFI Agreeableness and Conscientiousness were normal with a significance p=0.082 and p=0.497 respectively, the GEQ variables Competence , Sensory and Imaginative Immersion, Flow, Positive Affect, Psychological Involvement - Empathy and Psychological Involvement - Negative Feelings were also reported normal. The remaining GEQ variables Tension, Challenge, Negative Feelings and Behavioural Involvement, returned as deviating from the normal (see Figure 4.16).

Tests of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
BFI Conscientiousness scale score	,968	30	,497
BFI Agreeableness scale score	,938	30	,082
GEQ Competence scale score	,957	30	,258
GEQ Sensory and Imaginative Immersion scale score	,939	30	,088
GEQ Flow scale score	,949	30	,163
GEQ Tension scale score	,806	30	,000
GEQ Challenge scale score	,916	30	,021
GEQ Negative affect scale score	,847	30	,001
GEQ Positive affect scale score	,942	30	,100
GEQ Psychological Involvement - Empathy scale score	,945	30	,123
GEQ Psychological Involvement - Negative Feelings scale score	,950	30	,174
GEQ Behavioural Involvement scale score	,917	30	,023

Figure 4.16: Normality test using the Shapiro-Wilk method, over the BFI and GEQ variables.

With our variables divided into normal and non-normal we applied correlation methods between the BFI variables and the GEQ variables. For the normal variables a Pearson product-moment correlation was run to determine the relationship between the two BFI variables and between the BFI variables and the GEQ variables. The test revealed a strong, positive correlation between the Agreeableness trait variable and the Conscientiousness trait variable, which was statistically significant (r = .519, n = 30, p = .003). Which means that in our sample participants with higher values in the Agreeableness trait also

tend to have higher values in the Conscientiousness trait.

As for applying the Pearson product-moment correlation between the BFI and the GEQ variables, the test revealed a strong, negative relation between Agreeableness and Psychological Involvement - Negative Feelings, which was statistically significant (r = -.476, n = 30, p = .008) and positive correlations between Agreeableness and Sensory and Imaginative Immersion (r = .424, n = 30, p = .020), Agreeableness and Psychological Involvement - Empathy (r = .388, n = 30, p = .034) and Conscientiousness and Positive Affect (r = .366, n = 30, p = .046) (consult Figure 4.17 for full results).

Correlations

		BFI Agreeableness scale score	BFI Conscientiousness scale score	GEQ Competence scale score	GEQ Sensory and Imaginative Immersion scale score	GEQ Flow scale score	GEQ Positive affect scale score	GEQ Psychological Involvement - Empathy scale score	GEQ Psychological Involvement - Negative Feelings scale score
BFI Agreeableness scale score	Pearson Correlation	1	,519**	,288	,424*	,348	,359	,388*	-,476**
	Sig. (2-tailed)		,003	,123	,020	,060	,051	,034	,008
BFI Conscientiousness scale score	Pearson Correlation	,519**	1	,077	,348	,328	,366*	,270	-,215
	Sig. (2-tailed)	,003		,686	,060	,077	,046	,149	,253

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

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

Figure 4.17: Pearson product-moment correlation test between both variables of the BFI and between BFI and GEQ variables.

For the non-normal variables a Spearman's rank-order correlation was run to determine the relationship between the normal BFI variables and the non-normal GEQ variables. The test reported there was a negative correlation between Agreeableness and Tension and Agreeableness and Negative affect, which were statically significant (rs(30) = -.423, p = .020) and (rs(10) = -.365, p = .047) respectively (for full results see Figure 4.18).

Correlations

		GEQ Tension scale score	GEQ Challenge scale score	GEQ Negative affect scale score	GEQ Behavioural Involvement scale score
Spearman's rho	BFI Agreeableness scale score	-,423*	,208	-,365*	,250
		,020	,271	,047	,183
	BFI Conscientiousness scale score	-,187	,299	-,222	,041
		,323	,108	,239	,828

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

Figure 4.18: Spearman rank-order correlation, between BFI and GEQ non-normal variables.

These obtained results for each individual player reveal that since the Agreeableness and Conscientiousness variables are strong positive correlated (r = .519, n = 30, p = .003), our results can only be considered for samples where high Conscientiousness are also highly . This result can be somewhat explained by what being low means, which can be tied to non-cooperative, and a non-cooperative individual wouldn't likely participate in a experiment as our study willingly. As for the other obtained cor-

relations, the negatively strong Agreeableness - Negative Feelings (r = -.476, n = 30, p = .008) and the positive Agreeableness - Psychological Involvement - Empathy (r = .388, n = 30, p = .034), can also be somewhat explained by the literature on the agreeableness trait, since an individual would generate less negative feelings when in a cooperative environment and since these individuals tend to be good in co-operation it is expected that these individuals would feel empathy towards their partners. An unexpected result was the positive correlation between Agreeableness and Sensory and Imaginative Immersion (r = .424, n = 30, p = .020), since there is no apparent reason for why the most participants would feel more immersed, a somewhat far fetched point of view, that could explain this correlation, would be that because an individual is playing cooperatively and since that would appeal to her/him, then the cooperative factor counts as a factor on immersion. The last obtained correlation between Conscientiousness and Positive Affect (r = .366, n = 30, p = .046), which can't be disregarded and comes to corroborate our hypothesis, since what we are looking for is a better experience for Conscientiousness individuals and the Positive Affect, tells us that the experience generated positive emotions on these participants.

Since the previous analysis can only reveal correlations for individuals and as our main goal is to correlate the players in a pair with their experience. we decided to divide the players in two groups, High Conscientiousness (High_C) and Low Conscientiousness (Low_C), which was given by if the individuals BFI Conscientiousness score was higher or lower than the mean of Conscientiousness scores. Then we attributed to each player a number from 0 to 3, where:

- **0** - means that the player is Low Conscientiousness and played with another Low Conscientiousness player (Low_C/Low_C).
- **1** - means that the player is Low Conscientiousness but played with a High Conscientiousness player (Low_C/High_C).
- **2** - means that the player is High Conscientiousness but played with a Low Conscientiousness player (High_C/Low_C).
- **3** - means that the player is High Conscientiousness and played with another High Conscientiousness player (High_C/High_C).

With this classification we decided to verify if there is a difference between the two extremes groups, the High_C/High_C players (N = 8) and Low_C/Low_C (N = 10) players, in all the GEQ variables using a Mann-Whitney method. We were only able to apply this grouping to the Conscientiousness trait since it had more evenly distributed sample sizes in both groups, as for the Agreeableness trait the sample sizes had a great gap High_Agreeable/High_Agreeable (N = 4), Low_Agreeable/Low_Agreeable (N = 8).

The test results reported that Tension has a marginal significance (U = 18.500, p = .05), which is not statistically significant, but worth to notice. Challenge is statistically significant, meaning that

	Mean Rank Low_C, Low_C	Mean Rank High_C, High_C	Mann-Whitney U	Asymp. Sig. (2-tailed)
GEQ Competence scale score	9,10	10,00	36,000	,720
GEQ Sensory and Imaginative Immersion scale score	7,60	11,88	21,000	,089
GEQ Flow scale score	8,45	10,81	29,500	,347
GEQ Tension scale score	11,65	6,81	18,500	,050
GEQ Challenge scale score	6,70	13,00	12,000	,012
GEQ Negative affect scale score	10,80	7,88	27,000	,239
GEQ Positive affect scale score	7,05	12,56	15,500	,026
GEQ Psychological Involvement - Empathy scale score	6,80	12,88	13,000	,016
GEQ Psychological Involvement - Negative Feelings scale score	9,85	9,06	36,500	,754
GEQ Behavioural Involvement scale score	9,30	9,75	38,000	,857

Figure 4.19: Mann-Whitney test applied to the GEQ variables using the High Conscientiousness and Low Conscientiousness as the two groups to be separated.

Low_C/Low_C (Mean Rank = 6.70) players felt less challenged when compared with High_C/High_C (Mean Rank = 13.0) players, (U = 12.0, p = .012). Positive Affect is also statistically significant, meaning Low_C/Low_C (Mean Rank = 7.05) players felt less Positive Affect when compared with High_C/High_C (Mean Rank = 12.56) players, (U = 15.500, p = .026). Finally Psychological Involvement - Empathy revealed to be statistically significant, meaning that Low_C/Low_C (Mean Rank = 6.80) players felt less empathetic with their partners when compared with High_C/High_C (Mean Rank = 12.88) players,(U = 13.000, p = .016) (For the full results see Figure 4.19).

The results obtained from this method, reinforced on the individual correlations made previously, since in the Positive Affect, the significance of the result doubled (U = 15.500, p = .026) when a player with high Conscientiousness trait plays together with another High Conscientiousness player. By applying this method we also obtained correlations with Psychological Involvement - Empathy, were the players felt more empathy by one another when aligned positively in the Conscientiousness trait. This can be explained by a common objective both players share, while when aligned negatively there is not a common objective both players share, they just aren't interested in completing the achievements. As

for the Challenge correlation, it came as an unexpected result.

	BFI Agreeablenes s scale score	BFI Conscientiousness scale score
Mann-Whitney U	89,000	85,500
Asymp. Sig. (2-tailed)	,419	,339

Figure 4.20: Mann-Whitney test applied to the Conscientiousness and Agreeableness variables using any done achievement and no achievement done as the two grouping variables

Even though we could get some interesting results related with the Conscientiousness trait, when we tried to correlate both of the BFI traits with having completed any achievement or not (based on the information gathered from the logs presented in Appendix B), there was no statistically significant result (Figure 4.20), having the Conscientiousness trait as statistically significant would mean that players with higher Conscientiousness trait, effectively completed achievements.

5

Conclusion

Contents

5.1 Conclusions

In the beginning of this study we hypothesize (Section 1.3) that in a context achievement in a cooperative environment players that present high values in the Conscientiousness personality trait were going to have a better player experience when paired with a player with also high values on this personality trait. According to our data analysis, our hypothesis can be somewhat corroborated by the values obtained for the Mann-Whitney test using the groups of High_C/High_C and Low_C/Low_C players over the GEQ Positive Affect dimension (U = 15.500, p = .026). These values are even more meaningful when compared with the correlation between the same GEQ dimension but with the singular value of Conscientiousness, telling us that players with high Conscientiousness trait when pared together with other players aligned with them, will feel more positive affect during the play session. On the other hand, since we were not able to correlate the achievements actually completed with the Conscientiousness individuals, there is no evidence, besides the tendency observed in the Online Questionnaires, that the appeal to Conscientiousness players was in the achievements and not on the game DTA itself.

5.2 System Limitations and Future Work

Even with some positive results, we still find some limitations and problems with this study which can be improved upon in future studies and research. The following items were some of the identified problems and what we propose to improve on them:

- The rather small sample and most of the participants having their Agreeableness and Conscientiousness traits on high values, led to conclusions that are not meaningful to extrapolate to bigger and more diverse populations. In order to solve this a bigger study would need to be employed, with a greater sample size, which would allow for more data to analyse.

- A problem that is similar to the previous item is related with the field of work of almost all of our participants being in the software development area. For this issue it also should be applied a similar approach to one described in the previous point.

- The conclusions we reached can only be applied in the context of achievement scenarios in video games, but video games provide a wider range of challenges that could appeal to other different personality traits, which can in turn reveal different behaviours when in a cooperative environment. To approach this issue, it should be done a research involving other personality traits and how they can correlate to other interests in video games. One good starting point would be to take the correlations found by Nick Yee et al. in the Gamer Motivational model, as there were three clusters of dimensions that could be related with existing Five Factor traits.

- Lastly, due to the study being focused on DTA the conclusions made at the moment can only be meaningful in the context of this game. As a way of finding out if our conclusions hold true in other cooperative games a new study using multiple cooperative video games would be needed.

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A

Questionnaires

A.1 Online Questionnaire

Playing "Dark Things About"

By answering this questionnaire, you are helping me improve the player experience of the game "Dark Things About" on which I am working in the context of my Masters thesis.

The questionnaire is composed of some questions to identify you as a player and 3 videos with durations between 30 seconds and 1 minute and 30 seconds along with related questions. In total it will take no longer than 7 minutes to answer and all gathered data will only be used in the context of this work and will not be shared with any other entities.

I thank you in advance for the time spent, every participant is important to make this study a success!

*Required

About You

1. **Age** *

_____

2. **Sex** *
Mark only one oval.

- Female
- Male
- Prefer not to say

3. **What is your professional relation with video games?** *
Mark only one oval.

- I am a researcher in a field related to video games
- My profession is related to video games
- I am a student in a course related to video games
- None

4. **How often do you play video games?** *
Mark only one oval.

- I make some time in my schedule to play video games
- I play video games occasionally when the opportunity presents itself
- I don't play video games

5. **How often do you play multiplayer games?** *
Mark only one oval.

- I only play multiplayer games
- Most games I play are multiplayer
- Only a few of the games I play are multiplayer
- I generally don't play multiplayer games

6. **Have you played or seen a "Dark Things About" demo before?** *
Mark only one oval.

- Yes
- No

Gameplay Video

Please watch the following 3 videos and state your agreement with the sentence written underneath.

In order to make your time worthwhile some sections of the videos have been sped up. Feel free to pause at any time or to rewatch them in order to better understand them and answer the following questions.

Video A

http://youtube.com/watch?v=ENjhegYxKRU

7. **"I personally like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

8. **"I think other people will like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

Video B

http://youtube.com/watch?v=cgSEZEiEnes

9. **"I personally like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

10. **"I think other people will like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

Video C

http://youtube.com/watch?v=oeANHRuPkVk

11. **"I personally like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

12. **"I think other people will like what this challenge encourages the player to do."** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly Agree

More about You

13. **Please indicate the extent to which you agree or disagree with the next statements about yourself** *

Mark only one oval per row.

	strongly disagree	disagree a little	neither agree nor disagree	agree a little	strongly agree
Is a reliable worker					
Perseveres until the task is finished					
Is easily distracted					
Tends to be lazy					
Tends to be disorganized					
Can be somewhat careless					
Makes plans and follows through with them					
Does a thorough job					
Does things efficiently					

A.2 Main Questionnaire

Playing "Dark Things About"

By answering this questionnaire, you are helping me to improve the player experience of the game "Dark Things About" on which I am working in the context of my Masters thesis.

The questionnaire is divided in three parts, the first takes less than 5 minutes and is to be answered before playing the game. The second will not take more than 7 minutes and is to be answered when the supervisor of the test pauses you. The questions in this phase will be related to what you have just experienced in the game.
The last part of the questionnaire will not take more than 7 minutes and is to be answered after the game finishes.

All the gathered data will only be used in the context of this work and will not be shared with any other entities.

I thank you in advance for the time spent, every participant is important to make this study a success!

*Required

About You

1. **Age** *

_____

2. **Sex** *
Mark only one oval.

- ( ) Female
- ( ) Male
- ( ) Prefer not to say

3. **What is your professional relation with video games?** *
Mark only one oval.

- ( ) I am a researcher in a field related to video games
- ( ) My profession is related to video games
- ( ) I am a student in a course related to video games
- ( ) None

4. **How often do you play video games?** *
Mark only one oval.

- ( ) I make some time in my schedule to play video games
- ( ) I play video games occasionally when the opportunity presents itself
- ( ) I don't play video games

5. **How often do you play multiplayer games?** *
Mark only one oval.

- ( ) I only play multiplayer games
- ( ) Most games I play are multiplayer
- ( ) Only a few of the games I play are multiplayer
- ( ) I generally don't play multiplayer games

6. **Please rate your agreement with the statement: "I am comfortable with using a gamepad controller"** *
Mark only one oval.

	1	2	3	4	5	
Totally disagree	( )	( )	( )	( )	( )	Totally agree

7. **Have you played a "Dark Things About" demo before?** *
Mark only one oval.

- ( ) Yes
- ( ) No

Time To Play

Now is time to play the game. But don't get off of this page, leave it open to continue when the supervisor of the test makes you pause.

About your Playing Experience in the Garden

The questions in this section are related to your experience in the garden near the mansion.

Please answer with just that area of the game in mind.

8. **Please indicate how you felt while playing the game for each of the items, on the following scale:** *

Mark only one oval per row.

	Not at all	Slightly	Moderately	Fairly	Extremely
I lost connection with the outside world					
I felt time pressure					
I felt irritable					
I was fast at reaching the game's targets					
I lost track of time					
I enjoyed it					
I was good at it					
I felt successful					
It was aesthetically pleasing					
I felt that I could explore things					
It felt like a rich experience					
I had to put a lot of effort into it					
I felt pressured					
I forgot everything around me					
It gave me a bad mood					
I thought it was fun					
I felt content					
I felt challenged					
I thought it was hard					
I felt bored					
I felt annoyed					
I found it impressive					
I thought about other things					
I was interested in the game's story					
I felt frustrated					
I felt imaginative					
I felt good					
I felt happy					
I felt skilful					
I felt competent					
I was deeply concentrated in the game					
I was fully occupied with the game					
I found it tiresome					

About your Playing Experience with your Companion in the Garden

The questions in this section are related to your experience with your companion in the garden near the mansion.

Please answer with just that area of the game in mind.

9. **Please indicate how you felt while playing the game for each of the items, on the following scale:** *

Mark only one oval per row.

	Not at all	Slightly	Moderately	Fairly	Extremely
I felt revengeful					
When the other was happy, I was happy					
I felt schadenfreude (malicious delight)					
I found it enjoyable to be with the other					
I paid close attention to the other					
When I was happy, the other was happy					
I influenced the mood of the other					
I was influenced by the other's moods					
What the other did affected what I did					
I felt connected to the other					
The other paid close attention to me					
I admired the other					
I felt jealous about the other					
What I did affected what the other did					
My actions depended on the other's actions					
The other's actions were dependent on my actions					
I empathized with the other					

Back to the Game

Now you can return to the game.But don't get off of this page, leave it open to continue after you've finished playing the game.

More about You

10. **Please indicate the extent to which you agree or disagree with the next statements about yourself** *

Mark only one oval per row.

	strongly disagree	disagree a little	neither agree nor disagree	agree a little	strongly agree
Tends to be lazy					
Is helpful and unselfish with others					
Has a forgiving nature					
Does things efficiently					
Can be cold and aloof					
Tends to be disorganized					
Is considerate and kind to almost everyone					
Perseveres until the task is finished					
Does a thorough job					
Is sometimes rude to others					
Is a reliable worker					
Is easily distracted					
Is generally trusting					
Tends to find fault with others					
Starts quarrels with others					
Can be somewhat careless					
Likes to cooperate with others					
Makes plans and follows through with them					

B

Game Logs

Summarized log file, containing a variable in each column and where each row represents a participant.

0		0	0		0	0	0	0:20:06	0:39:10
0		0	0		0	0	0	0:20:06	0:39:10
12	0:03:19	1	3	0:00:56	1	0	3	0:19:09	0:41:24
12	0:03:19	1	3	0:00:56	1	0	3	0:19:09	0:41:24
12	0:02:26	1	3	0:00:55	1	1	7	0:14:27	0:25:42
12	0:02:26	1	3	0:00:55	1	1	7	0:14:27	0:25:42
7	0:03:58	0	1		0	0	3	0:17:53	0:36:05
7	0:03:58	0	1		0	0	3	0:17:53	0:36:05
12	0:05:35	1	3	0:00:56	1	0	7	0:30:27	0:45:02
12	0:05:35	1	3	0:00:56	1	0	7	0:30:27	0:45:02
9	0:05:07	0	1		0	0	0	0:17:39	0:33:42
9	0:05:07	0	1		0	0	0	0:17:39	0:33:42
8	0:02:57	0	0		0	0	2	0:10:33	0:34:57
8	0:02:57	0	0		0	0	2	0:10:33	0:34:57
12	0:05:02	1	3	0:02:21	1	0	3	0:22:02	0:44:02
12	0:05:02	1	3	0:02:21	1	0	3	0:22:02	0:44:02
12	0:02:53	1	3	0:01:16	1	1	4	0:07:20	0:17:55
12	0:02:53	1	3	0:01:16	1	1	4	0:07:20	0:17:55
12	0:03:14	1	3	0:01:02	1	1	7	0:16:06	0:30:47
12	0:03:14	1	3	0:01:02	1	1	7	0:16:06	0:30:47
12	0:05:14	1	3	0:00:52	1	1	7	0:15:03	0:28:43
12	0:05:14	1	3	0:00:52	1	1	7	0:15:03	0:28:43
12	0:02:20	1	3	0:02:46	1	0	20	0:15:09	0:26:49
12	0:02:20	1	3	0:02:46	1	0	20	0:15:09	0:26:49
0		0	0		0	0	0	0:05:35	0:17:49
0		0	0		0	0	0	0:05:35	0:17:49
11	0:04:24	0	2	0:01:17	0	0	0	0:16:03	0:36:22
11	0:04:24	0	2	0:01:17	0	0	0	0:16:03	0:36:22
12	0:03:24	1	3	0:01:04	1	0	0	0:13:11	0:26:54
12	0:03:24	1	3	0:01:04	1	0	0	0:13:11	0:26:54