The influence of Conscientiousness in cooperative video games

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Abstract—Video game adaptive content is a very talked term in the current days, in particular the game adaptation to the players personality preferences and interests. 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 the game, the experience is guided not only by the Agreeableness trait, but more importantly by the Conscientious trait. More than that we argue that when players are aligned in the conscientious 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 Conscientious 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 conscientious players had a better game experienced when compared to pairs of aligned low conscientious players.

I. INTRODUCTION

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 player’s 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 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 of both of 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.

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?

We hypothesize that besides the Agreeableness trait of an individuals personality also the Conscientious 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 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 Conscientious traits behave in these scenarios and possibly indicate what guides their change in behavior.
II. RELATED WORK

A. 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.

Extraversion describes how a person relates to the world and it includes the following six facets, Friendliness, Gregariousness, Assertiveness, Activity, Excitement-seeking and Cheerfulness.

Agreeableness manifests in people that are normally kind, sympathetic and cooperative and it includes the following facets, Trust, Compliance, Altruism, Cooperation, Modesty and Sympathy.

Conscientiousness describes how serious a person is when performing a task and it includes the following six facets, Self-efficacy, Orderliness, Dutifulness, Achievement-striving, Self-discipline and Cautiousness.

Neuroticism describes if a person tends to develop undesirable emotions and it includes the following facets, Anxiety, Anger, Depression, Self-consciousness, Immoderation and Vulnerability. Studies related with this trait show that people with high neuroticism indexes have higher risk of developing mental disorders.

Openness to Experience describes if a person tends to be curious and in touch with art and imagination and its six facets are Imagination, Artistic Interest, Emotionality, Adventurousness, Intellect and Liberalism.

The standard way of measuring the Big Five traits is through questionnaire which according to Spronk et al.[10] is not the most reliable method, but is less time consuming and expensive and the trade-offs in reliability are reasonable.

One of the questionnaires that measure the Big Five traits is the Big Five Inventory (BFI) which is a questionnaire composed of 44 items where 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).

B. Gamer Motivation Model

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

C. Player Experience

To better understand how we are going to measure the player 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 equipment’s, such as cameras or brain wave detection for each of the game experience dimensions. For measuring game experience as a whole we will be looking into the GEQ

D. Game Experience Questionnaire

The Game Experience Questionnaire is a questionnaire created by IJsselsteijn et al.[11] to measure player experience. Its 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.

E. Discussion

Due to player models being correlated to an individuals personality, we decided to not use a player model like the Gamer Motivational 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 Big Five 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 conscientious traits tend to enjoy to complete achievements in video games.

III. CASE STUDY

A. Dark Things About

Dark Thing About is a story-driven Cooperative Survival video game, currently being developed by the author of this study. The game started being developed as a university project and is now being developed as a side project.

DTA 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. 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.

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.

The engine upon which the game was build is the Unreal Engine 4 (UE4)\(^1\), a modern game engine developed by

\(^1\)https://www.unrealengine.com/
Epic Games\textsuperscript{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, which allows for faster prototyping and development with the drawback of a performance overhead. DTA is being built using both of these languages, making a trade-off between the two and using the one that better suits for each situation.

Additionally we run the Wwise\textsuperscript{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.

B. Game Scenario

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 conscientious trait. As previously explained the Conscientious trait can be related to a player’s need to complete achievements in games, 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 conscientious 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 conscientious 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 2, 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 conscientious trait but don’t enjoy to seek for hidden objects.

- **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. 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.

- **Wait Achievement** - In this achievement players have to go to the small garden door in the back of the garden area, seen in Figure 4 and wait near the gate for 2 minutes in order to complete the achievement. 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

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image1.png}
\caption{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}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image2.png}
\caption{In game screenshot of the statues glowing in the dark of the Statues Achievement}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image3.png}
\caption{In game screenshot of the mansion (stone building in the back) where the players can complete the Laps Achievement}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image4.png}
\caption{In game screenshot of the small garden door in the back of the garden area where the players can complete the Wait Achievement}
\end{figure}

\textsuperscript{2}https://www.epicgames.com/
\textsuperscript{3}https://www.audiokinetic.com
games has available just for the sake of completing it, which is what players with higher conscientious trait are expected to do.

In order to have good introduction to DTA controls and gameplay, that we could use in an 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 5, 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 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.

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 6, 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.

The achievement tracker, demonstrated in Figure 7 is a Heads 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.

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 Conscientious trait point of view. As players with lower conscientious would not be predisposed to wait for a certain amount of time without any feedback on their progress whilst players with higher conscientious 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. 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.

C. Data Gathering

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 conscientious trait and the main experiment, where the participants would play the game and answer a questionnaire, to validate our hypothesis.

D. Pilot

In this pilot test we used the DTA adapted game level and a questionnaire that was created in order to gather Demographic, Game Experience and Big Five traits data from the participants. 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 DTA. The second part was related to the Game Experience and Big Five 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 Big Five 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 previously the Conscientiousness trait relates to a persons 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 agreeable individuals being more inclined to do what others want to, without minding it.

1) Results & Discussion: In this phase we gathered 10 participants, making a total of 5 pairs to play the game. The participant’s age ranged from 20 to 37 and the sex distributions was 2 females, 8 males. Since all the participants are professionals in Software Engineering, 9 reported to have no relationship with video games in their professional lives, while 1 reported being a student in a course related with video games. The playing schedule, 8 participants reported playing games when the opportunity presents itself, while 2 reported making time in their schedule to play. On the preference for multiplayer games, 6 players play mostly multiplayer games, 3 only play a few multiplayer games and 1 reported not to play multiplayer video games. Finally in the proficiency with gamepads, all the 10 participants rated their proficiency as 4 or 5, relating to have high proficiency.

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 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.

E. Online Questionnaire

For this phase of the experiment our main focus was to validate if the achievement challenges were well designed to appeal to individuals with higher conscientious 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 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 peoples liking would be. Even though we only wanted to know the personal rating to each challenge, we followed the work of [12] 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.

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 III-D, this Big Five 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 conscientious trait with the ratings of the video.

1) Results & Discussion: The online questionnaire got 12 answers, that were evenly distributed between each of the questionnaire versions.

Our participant sample was composed by 2 females and 10 males, with ages ranging from 22 to 24, where 3 reported to being students in video games courses and the other 9 having no relation with video games in their professional lives. Half of the participants report to play video games when the opportunity presents itself, while 5 report to make time in their schedules to play, whilst 1 reports to not play video games. The multiplayer video games appeals to 75% of our sample, while 25% does not normally play multiplayer games.

With the like ratings for each achievement video and the conscientious trait scale score of each participant we plotted the dispersion graphics 8, 9 and 10. Regarding each of the challenges game play videos the following dispersion graphics show the relation between the participants liking of each achievement and the result of their conscientious trait according to the items of the BFI.

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 8 being the less accentuated while the Wait Achievement 10 is the most accentuated, this can be explained by what we presented previously, 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.

F. Main Test

Contrary to the previous phases, in this one we will not describe the preparation of the test, as the the previous phases were the preparation for the main part of the experiment.

The participants gathered for this part of the experiment were a mix of students from Instituto Superior Técnico (IST) and workers from an outsourcing company. This phase occurred over a period of two months and the tests were made both in a student’s room at IST and in a meeting room of 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
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 reported to have no relationship with video games in their professional lives, while 10 reported to be students in the field and 2 reported to being researchers in a field related to video games. 30% of the participants reported to make time in their schedule to play video games, 40% reported playing video games when the opportunity presents itself, while 30% reported to not play video games. On the multiplayer side, 12 participants reported play mostly multiplayer games, other group of 12 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 are divided between only playing multiplayer games and only a few of the games played being multiplayer. As for the gamepad proficiency around 70% of the participants rated themselves as having higher dexterity with gamepads, while around 17% reporting to be average, leaving a small group of participants reporting to have low proficiency with a gamepad.

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 normality tests on the BFI and GEQ variables of each participant would feel more immersed, a somewhat far fetched 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.

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 Conscientious 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 Conscientious 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 ($r = .366$, $n = 30$, $p = .046$).

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.

These obtained results for each individual player reveal that since the Agreeableness and Conscientious variables are strong positive correlated ($r = .519$, $n = 30$, $p = .003$), our results can only be considered for samples where high Conscientious are also highly Agreeable. This result can be somewhat explained by what being low agreeable 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 correlations, 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 agreeable individual would generate less negative feelings when in a cooperative environment and since these individuals tend to be good in cooperation 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 agreeable participants would feel more immersed, a somewhat far fetched point of view, that could explain this correlation, would be that because an agreeable 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 Conscientious 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 conscientious 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 Conscientious (High_C) and Low Conscientious (Low_C), which was given by if the individuals BFI Conscientious score was higher or lower than the mean of conscientious scores. Then we attributed to each player a number from 0 to 3, where:

- 0 - means that the player is Low Conscientious and played with another Low Conscientious player.
- 1 - means that the player is Low Conscientious but played with a High Conscientious player.
- 2 - means that the player is High Conscientious but played with a Low Conscientious player.
- 3 - means that the player is High Conscientious and played with another High Conscientious player.

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 Conscientious 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 Low_C/Low_C (Mean Rank = 13.0) players felt less challenged when compared with High_C/High_C (Mean Rank = 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 12).

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 conscientious trait plays together with another High Conscientious 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 conscientious 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.

### Table 1: Mann-Whitney test applied to the GEQ variables using the High Conscientious and Low Conscientious as the two groups to be separated.

<table>
<thead>
<tr>
<th>GEQ Competence scale score</th>
<th>Mean Rank Low_C</th>
<th>Mean Rank High_C</th>
<th>Mann-Whitney U</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9.10</td>
<td>10.00</td>
<td>36,000</td>
<td>.720</td>
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<tr>
<td>GEQ Sensory and Imaginative Immersion scale score</td>
<td>7.60</td>
<td>11.88</td>
<td>21,500</td>
<td>.099</td>
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<tr>
<td>GEQ Flow scale score</td>
<td>8.45</td>
<td>10.81</td>
<td>28,500</td>
<td>.347</td>
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<tr>
<td>GEQ Tension scale score</td>
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<td>6.81</td>
<td>18,500</td>
<td>.050</td>
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<tr>
<td>GEQ Challenge scale score</td>
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<td>13.00</td>
<td>12,000</td>
<td>.012</td>
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<tr>
<td>GEQ Positive affect scale score</td>
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<td>7.98</td>
<td>27,000</td>
<td>.239</td>
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<tr>
<td>GEQ Agreeable scale score</td>
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<td>12.56</td>
<td>15,500</td>
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<tr>
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<td>12.68</td>
<td>13,000</td>
<td>.016</td>
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<tr>
<td>GEQ Psychological Involvement - Empathy scale score</td>
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<td>9.00</td>
<td>36,500</td>
<td>.754</td>
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<tr>
<td>GEQ Psychological Involvement - Negative Feelings scale score</td>
<td>9.30</td>
<td>9.75</td>
<td>38,000</td>
<td>.857</td>
</tr>
</tbody>
</table>

Even though we could get some interesting results related with the conscientious trait, when we tried to correlate both of the BFI traits with having completed any achievement or not, there was no statistically significant result (Figure 13), having the Conscientious trait as statistically significant would mean that players with higher conscientious trait, effectively completed achievements.

### IV. CONCLUSIONS

In the beginning of this study we hypothesize that in a context achievement in a cooperative environment players that present high values in the conscientious 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 conscientious, telling us that players with high Conscientious 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 conscientious individuals, there is no evidence, besides the tendency observed in the Online Questionnaires, that the appeal to Conscientious players was in the achievements and not on the game DTA itself.
A. 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 Conscientious 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 Big Five 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.

ACKNOWLEDGMENT

I would like to start by thanking my family and specially my girlfriend which were always supportive, interested and helpful during the development of all this study. I would also like to acknowledge my supervisor Professor Carlos Martinho which was always very flexible with schedule, even after working hours, to support and discuss the progress and doubts about the study. Last but not least I would like to thank my colleagues of the Dark Things About team, which were always around to help when something was needed for the game and for the good progress of this study.

REFERENCES