Alignment of Player and Non-Player Character Assertiveness Levels

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ABSTRACT

In video game development, appealing to a large audience is one of the key factors to a successful game. Adapting games to the player's profile has the potential to broaden the games' target audience. Companion Non-Player Characters(NPCs) have a large potential influence on the player's experience.

Based on the *law of similarity-attraction*, we propose adapting companion NPC to the player's profile, more specifically, aligning the NPC's assertiveness level to the player's own assertiveness level. We developed a testbed game, a 2D puzzle platformer with a companion NPC, with two versions of the NPC's behavior, one for each end of the assertiveness scale.

We conducted a 2x2, between-subjects experiment (n=48), in which Assertive and Non-Assertive subjects were randomly matched with one of the NPCs. Subjects recognized the NPC's personality type, giving a significantly higher assertiveness score to the NPC endowed with assertive characteristics. Non-Assertive players reported significantly higher Tension scores when interacting with the Assertive NPC than when interacting with the Non-Assertive NPC. However, based on assertiveness level alignment, there was neither a significant difference in the enjoyment of the experience nor in the player's affinity for the NPC.

KEYWORDS

Video Games, Game Adaptation, Non-Player Character, Media Equation, Assertiveness

1 INTRODUCTION

The desire for games to adapt to the player's interests has been evident since the decade of 1980, with fan-made enhancement kits such as *Crazy Otto*, an expansion to Namco's iconic *Pac Man*(1980). Nowadays we can see even larger success cases for fan-made modifications, such as *Defense of the Ancients*(2003) and *DayZ:Battle Royale*(2013). Game developers have also tried to integrate adaptation into their games. In *Resident Evil 4*(2005), the AI's behavior is adapted to the player's performance [11]. Other games have recently started adapting their monetization tactics to each player, to maximize profits. Mostly used in free-to-play games, it has been used in *Clash of Clans*(2012) and *League of Legends*(2009).

Game adaptation has been shown to increase player enjoyment [1]. Effective approaches to the adaptation process include taking into account the player's performance, tactics, strategies and profile [2, 16].

In this work we propose adapting NPC companions to the player's profile. Taking Media Equation's finding that the *law of similarity-attraction* applies to relationships between people and computers [25], we propose adapting the NPC's behavior to exhibit assertiveness levels that align with the player's own.

For the purposes of evaluation, we predict that the player will perceive the NPC endowed with assertive characteristics as assertive and the NPC endowed with non-assertive characteristics as non-assertive (Hypothesis **H1**). We also predict an increase of the player's enjoyment of the experience when their assertiveness level matches the NPC's (Hypothesis **H2**). Lastly, we predict that the player will have a higher affinity for the NPC when their assertiveness levels match (Hypothesis **H3**).

The rest of the document will be structured as follows: (1) we will start by providing a theoretical review for the subjects our work relates to; (2) describe the implementation and quality assurance process of the testbed game; (3) present the two studies that were conducted to validate our solution and evaluate our hypotheses, and discuss the results obtained; (4) finally, we will summarize our contributions and present ideas for further research on the subject.

2 PLAYER MODELLING

Video game adaptation always relies on having some sort of player model to adapt the game to. This model could simply be gathered from the player's conscious choice of difficulty in the game's menu and stay static throughout the game's length, or it could be gathered through imperceptible data collection about the player's physiology or actions inside the game, and be refined over the course of the gameplay [2].

A very promising method of player modeling is player profiling, which uses psychologically and sociologically verified player profiles to provide a player model that models internal traits of the player, such as their personality and motivations.

For example, Bartle[3] divides online role-playing game players in “achievers", “explorers", “socialisers" and “killers", are based on the player’s preferences. Using player’s motivations, Quantic Foundry’s Gamer Motivational Profile (GMP) which provides a relative percentile score for each motivation, comparing the player’s motivations to those of everyone else that took the survey.

There has also been successful research in using personality models directly taken from the psychological field, and applying them to game adaptation. Van Lankveld [30] found a statistically significant correlation between in-game behavior data and the Five Factor Model. Yee et al.[32] found a statistically significant correlation between player’s chat logs in *Second Life*(2003) and the Five Factor Model(FFM).

The Five Factor Model

The Five Factor Model, or more commonly referred to as “Big Five" is a theory that divides a person’s personality in five main components. These components were discovered and refined by multiple independent empirical studies over a period of 50 years.

The model’s components are, *Extraversion*, how outgoing the person is and how likely they are to seek someone else’s company; *Agreeableness*, how empathic and compassionate the person is towards other people; *Conscientiousness*, how focused, determined and self-disciplined the person is; *Neuroticism*, how emotionally stable a person is, or how likely they are to feel emotions such as fear and anxiety; and *Openness to Experience*, the person’s tendency to think outside of the box and experience new things.

Its use in interpersonal relationships has been the focus of studies such as McCrae and Costa’s [21], in which, using joint-factor examination with Interpersonal Circumplex theories, the two dimensions of the FFM that were found to be of greater influence were *Extraversion* and *Agreeableness*.

Quantic Foundry’s Gamer Motivation Profile

The GMP is an attempt to create a game-specific motivational structure. It is based on 12 major motivations, which are then grouped in pairs based on factor analysis of how they cluster together. These motivation groups are *Immersion*, *Creativity*, *Action*, *Social*, *Mastery* and *Achievement* [31].

The main problem of this model is its black box approach. Since it was developed by a private company, Quantic Foundry, the access to its item’s distribution is protected. Moreover, the results given to the questionnaire are in percentiles that rank the person compared to the rest of the population. From their official website[1] : “A percentile of 80% means you scored higher than 80% of gamers.”. This means that the score any person gets when entering the same answers can vary over time. It also means that, since the questionnaire is of voluntary participation, driven mostly out of curiosity, the population sample might be heavily biased towards the type of gamer that would take that sort of survey, hence not representative of the whole population.

[1]https://apps.quanticfoundry.com/profiles/gamerprofile/rrcfXBpubyYDyT2Gs8SZQ6/ - last accessed on 21/09/2018.

3 GAME ADAPTATION

Video game adaptation takes the player models gathered through the means discussed earlier in the document, and uses them to balance the difficulty, more efficiently monetize, help with analyzing playtesting sessions or generate personalized content.

Difficulty Balancing. - It is clear to see from works which explore M. Csikszentmihalyi’s theory of *flow* [6] in games, that the challenge and difficulty has to be in the right spot throughout the game to maximize player engagement in the task. Games actively track how the player is doing and balance the difficulty of the tasks accordingly. One way of easily achieving this is to increase the health and damage output of enemies, which games in the *The Elder Scrolls* series do. However, games like *Resident Evil 4* go a step further and increase how aggressive enemies are towards the player if they are progressing through the levels too easily and ammunition for the weapons they use the most is made scarcer [11].

Playtesting Analysis. - When testing if the experience that is being provided is the intended one, it is often difficult to pinpoint which aspects of the game or which game mechanics are the problem. Considering the player’s model may help analyzing playtesting sessions and identifying what pleases a particular player or player type.

Monetization. - In free-to-play games, playing the game is free, so in order to be profitable, they often sell additional content and other in-game services to the player through microtransactions. To maximize the potential for the players to spend money on the game, player modeling can be used to help improve the understanding of why players pay, and help identify the players that are more likely to pay. This information might then be used to adapt the market’s content, prices or promotions to increase profits.

Personalized Content Generation. - Personalized Content Generation is a fairly recent research topic, with works like Shaker et al.[28] and Jennings-Teats et al.[14], which demonstrate that platformer levels can be generated online based on a player model, and works like Riedl et al.[26] in which a narrative is adapted using a player model to maximize satisfaction. In Hastings et al.[12], adapting guns in a space shooter to a player model is demonstrated to let players find new and appealing content based on their past

preferences. Dias[7] uses the player's profile to inform the game and adapt its Heads-Up Display, difficulty and control scheme. Player models can also serve as a basis for adapting NPC behavior. Even though agent believability and player modeling are obviously linked, research on this implementation in games is not vast. However, the few efforts that have been made have shown positive results. By imitating the player's behavior, NPCs believability has been shown to increase in Hastings et al.[12] and Muñoz et al.[23]. Bots for *Unreal Tournament*(1999) using a similar approach have even managed to pass the Turing test [17].

4 THE MEDIA EQUATION

The Media Equation is a theory that states that people tend to treat computers and media as people or real places. The studies that were conducted towards the Media Equation book, used the following method: take previous findings from the psychology and sociology fields on interpersonal relationships; change one of the "humans" in the experiment's statement to "computer", e.g. "people like people that flatter them" becomes "people like computers that flatter them"; replicate the same methodology and replace one of the members of the relationship with a computer.

"Can computer personalities be human personalities?"

One study of the Media Equation in particular [25], tests the *law of similarity-attraction* between computers and people. As mentioned previously in the document, this law states that individuals prefer to interact with others who are similar in personality to themselves. As mentioned previously, the two most relevant personality traits from the FFM in interpersonal relationships are *Extraversion* and *Agreeableness*. Nass and his team chose to focus on *Extraversion* in their study, which ranges from *dominance* in the positive end, to *submissiveness* in the opposite end.

The study was a 2x2 between-subjects experiment (n=48). The Bem-Sex Role Inventory was used to choose subjects that fit into a dominant category and a submissive category. The dominant and submissive subjects were randomly assigned a computer that exhibited submissive or dominant behavior. The experiment consisted of the "Desert Survival Problem", in which the player was assisted by the computer to order a list of objects, in order of usefulness, in the hypothetical case of being stranded in a desert. In order to express the computer's dominant/submissive behavior, the experimenters manipulated the following:

The phrasing of the text displayed by the computer. - the dominant computer used strong language, assertions and commands, whereas the submissive computer used weaker language, suggestions and questions.

The confidence level expressed by the computer. - the computer's opinion was accompanied with a 10-point scale of confidence. The dominant computer presented an average confidence level of 8.0 with a standard-deviation of 0.8, conversely, the submissive computer displayed an average confidence score of 3.0 with a standard-deviation score of 0.8.

The order of interaction. - the dominant computer would always interact and give their opinion first, in contrast, the submissive computer always presented their opinion after the subject had already presented theirs.

The name given to the computer. - the dominant computer was given the name of *Max*, and the submissive computer was named *Linus*, which were both confirmed by a pretest to suggest dominance and submissiveness, respectively.

This study found that to convey personality we do not need very complex agents, realistic visuals, or deep logic and artificial intelligence. Posing that "(...) even the most superficial manipulations are sufficient to exhibit personality with powerful effects.". Moreover, subjects preferred the computer that was similar to them in assertiveness, and were more satisfied with the whole experience.

There are a few things to consider when taking this study into account, namely the change in the perception of computers from the year the study was conducted in, 1995, to nowadays. As computing devices become increasingly present in today's society, and the general public become increasingly computer-savvy. The first instinct towards this fact is to assume that people nowadays are more skeptic towards accepting computers as their own, however, according to Johnson and Gardner[15], this change might have the opposite effect. We will discuss this research in further detail in the next section.

Contemporary Research

Nowadays, Media Equation research includes efforts in robotics, such as the one conducted by Konok et al.[18], which studies which qualities dogs have, that make people be fond of them and how to implement the same behavior in social robots. In artificial agents, for example, Bosse et al.[4] present the idea of bad "consequential" agent, this is, an agent that is able to physically threaten human beings, which found a non-conclusive relation between consequential agent and believability. Other research efforts focus even on the influence of social media reviews on online purchase intention of movie tickets, Fu et al.[10] found a highly significant positive effect of the *law of similarity attraction*, previously discussed in this section.

In game design, some research has been conducted. Johnson and Gardner[15], researching "team formation between

humans and computers", found a bias against computer teammates. However they also found that highly-experienced users tend to accept a computer more easily as a teammate and treat them more negatively than less-experienced users do, due to what the researchers call “The Black Sheep Effect". In the same work, further applications of the Media Equation findings on game design are proposed. Among these, the application of the findings of the study presented above, “Can computer personalities be human personalities?", to games.

5 NON-PLAYER CHARACTERS

NPCs have been present in games since the early days of tabletop games, in games such as *Dungeons & Dragons*(1974). It is defined in Oxford Dictionary as “A character in a role-playing or video game that is not controlled by a player of the game" and it is a common tool used by game developers. They can be used as coaches, opponents or companions to the player [2].

As an **opponent**, the NPC’s role is to try to match the player’s skill and provide a suitable challenge, since it has been shown by Scott [27], that if the player finds the opponents too weak, they lose interest in the game, and if they find it too difficult, it also has been shown by Livingston and Charles [19] and Van Lankveld [29], that the player is prone to getting frustrated and quit playing the game. This is where player modeling comes in, helping the developers predict and monitor the player’s skill level and adapt to it dynamically. This has traditionally been a complex AI problem and has been applied to a wide range of game types, from Role-Playing Games to Real-Time Strategy games.

As a **coach**, the NPC is used to redirect the player’s attention and focus, or encourage a certain type of behavior. When coupled with player profiling, this type of NPC can be very effective in games which have a training purpose and personalized coaching is often a requirement.

When NPCs act as **companions** to the player, they are used to help, motivate or even guide the player. It is often the case though, that the player becomes frustrated with the NPC’s behavior for an action that goes against the player’s intentions. For example, if the player is trying to act stealthily and the NPC rushes in to try to eliminate some threat and cause mayhem, the player’s experience might be negatively affected. That is where player modeling can help. With player modeling in mind, the companions have the role of behaving according to the player’s expectations made easier. By understanding the player’s motivations or preferred behavior, the task of deciding how to act becomes quite simple.

Research on companion NPC demonstrated personality and adaptation to the player has been growing over the past few years, with works by Martins [20], Chowanda et al. [5] and Filipe [9] showing some success in demonstrating personality traits through NPC behavior, and works as the one done by Doirado and Martinho [8], which successfully adapts *Fallout 3*’s(2008) companion dog, Dogmeat, to better predict player intentions and behave accordingly.

6 IMPLEMENTATION

The game created to test our hypotheses is called *Cave Escape*[2]. We wanted to create a setting for the game that made the player feel like they were in the same situation, or at least similar, to the NPC. However, one characteristic we wanted to avoid was creating the notion of the characters being part of a team, therefore avoiding a main effect, as the one suggested by Johnson and Gardner[15]. To do this, the setting had to be somewhat neutral in team formation queues, conversely we wanted to avoid settings such as sports based settings and military based settings. The “trapped in a cave together” seemed like a good compromise between having the player and NPC cooperate naturally and not invoking team based reactions. The name given to the game, *Cave Escape*, is meant to reinforce the premise that the player and NPC are stuck in the cave together.

Another requirement for the concept was creating a context in which the player and NPC could interact repeatedly. The two doors were our answer to that requirement. Standing side by side, and only letting one person through before closing, the doors prompted a brief discussion between the two characters, on which door each of them would go through.

Game Mechanics

The purpose of the game mechanics in this experiment is to give a backdrop for the interactions between the NPC and the player. With this in mind, we wanted the puzzles to remain simple enough not to overshadow the interactions, but still engaging enough for the player experience to be positive. The game is based on a couple of mechanics from classic puzzle platformers such as *Portal*(2007), however, the player’s movement is similar to that of *Braid*(2008). They are able to move to either side, and jump. They can also pick up and drop boxes, and enter doors.

The main goal of each level is to open the locked doors, seen in Figure 1(3), to progress to the next level. To unlock the doors, the player has to activate the triggers, seen in Figure 1(2), spread around the level by placing the boxes, seen in Figure 1(1), on them. Above each door, there are indicators representing the amount of triggers associated with it, and their state (Figure 1(4)). This was done to help the player keep track of what they have left to do. Once all the triggers in the room are activated, the door opens to let the player through. There are three other mechanics that are introduced in the game, trampolines (Figure 1(6)), checkpoints (Figure 1(5)) and spikes (Figure 1(7)).

[2]https://youtu.be/lEkBwDwNa2g - Video of the game with assertive NPC.

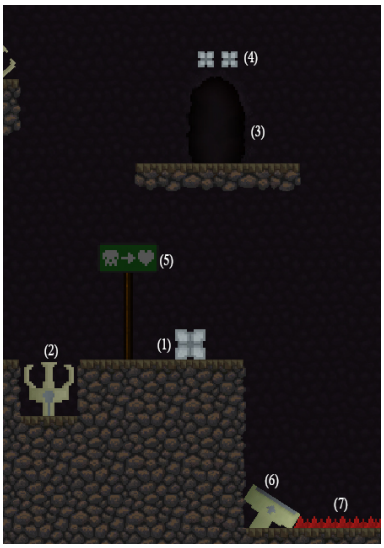

Figure 1: Game's mechanical components.

NPC Behavior and Interactions

We developed a simple dialogue system through which the NPC and the player could interact. In the dialogue interactions, when the player is prompted to give an answer, they have four options to choose from. The four options were the combination of agreeing or disagreeing and non-assertive or assertive phrasing, to provide the player a way to express their own assertiveness level.

In the full game, the player and the NPC interact in five different rooms throughout the game. In three of them, the player and NPC have to choose between themselves who goes through which door. These rooms have the same dialogue structure:

(1) Introduction and small comment by the NPC;
(2) Simple reply by the player;
(3) NPC's comment on the door choosing process;
(4) Statement of intention by the NPC;
(5) Player's decision.

In the third room in which interaction occurs however, although it starts the same way as the other three, when it's time to discuss the doors, the NPC suggests a game of *Rock, Paper, Scissors*. This was done to add some variety to the door choosing process, and avoid repetitiveness. This interaction is, as all dialogue in the game, adapted to the NPC's assertiveness level. The assertive NPC gives the idea of *Rock, Paper, Scissors* as a command rather than a suggestion or offer, as the non-assertive NPC does.

The final interaction adds a twist to the formula. Instead of choosing between two doors, the player and NPC are given only one door for both of them. Making the situation one of competition instead of cooperation. In this scenario, the structure varies in the second half of the interaction. It follows the following structure:

(1) Small comment by the NPC on the previous level;
(2) Simple reply by the player;
(3) NPC notices the singular door;
(4) NPC comments that only one person can escape;
(5) Statement of intention to leave by the NPC;
(6) Player's decision to try to run for the door or stay behind (see Figure 2).

Figure 2: End scene player options.

The player is free to stay behind or run for the door, regardless of what they choose. This is, even if they choose the "Go ahead, I would rather stay." option, the game still allows them to run for the door, and in the case of choosing the "I'm not going to stay here either!" option, they are still allowed to stay behind and sacrifice themselves.

Following the player's decision, the NPC walks towards the door, regardless of the player's choice. The NPC walks slowly if the player decides not to run for the door and stay behind, and, before entering the door, turns back and thanks the player for their "sacrifice". As the NPC enters the door, the game fades to black and ends. If, instead the player decides to run for it, the NPC is programmed to follow the player as closely as possible - walking slowly if the player is trailing them, and faster if the player is ahead, and as both of them get close to the door, the game starts slowing down incrementally, and fades to black just before they get to the door, giving the game an ambiguous ending. This was done to avoid having the idea of defeat or victory influence the player's experience.

In order to express assertiveness, we manipulated the NPC's text according to the following parameters:

(1) *The phrasing of the text used by the NPC* - The assertive NPC uses assertions and statements. In contrast, the non-assertive NPC uses questions, suggestions and seems uncertain of they are saying;

(2) *The name of the NPC* - The name given to the assertive NPC was the same as given to the corresponding assertive computer by Nass et al.[25], "Max". In the same vein, the non-assertive NPC was given "Linus" as their name;
(3) *The NPC's response to the player's answer* - In the first two interactions, the NPC responds to the player's decision, these replies depend on the NPC's assertiveness level, and the player's decision, this is, whether the player goes with or against the NPC's intents. The assertive NPC expresses their dissatisfaction if the player chooses the door the NPC declared as their intended door. If the player goes against the NPC's choice in the first two interactions, the assertive NPC revolts and imposes their choice on the player. Conversely, the non-assertive NPC makes an effort to not seem bothered by the player's choice when it opposes theirs, and accepts whatever the player decides;
(4) *The order of declaration of intent* - The assertive NPC states its preference for a door right away, before the player has any chance to express themselves. On the other hand, the non-assertive NPC is ambiguous when presenting their intentions, and instead asks the player for their choice, and if they would like to choose.

7 PRELIMINARY STUDY

One of the concerns we had when developing the dialogue system, was the relationship between *assertiveness* expression and other personality traits, mainly the *friendliness* trait. To test if there was a correlation between these personality traits, we held an open test during the 2018 Montra de Jogos (MOJO), a yearly game demonstration fair held at Instituto Superior Técnico's (IST) Taguspark campus. We also used this experiment to test the player controls' quality, the first two levels, and the overall quality of the game with a larger sample than the previous informal tests. In this study, we had 20 participants, out of which 6 were female, 14 were male, and the ages varied between 15 and 25 (*mean*=21.65, *s*=2.92). Each person only played the game once with a specific NPC personality. Given the purpose of this study, we wrote four different dialogue scripts:

- Assertive-Friendly;
- Non-Assertive-Friendly;
- Assertive-Unfriendly;
- Non-Assertive-Unfriendly;

Questionnaire

The text was manipulated to express assertiveness according to the theory presented previously, and friendliness through "reverse-engineering" of the friendliness items in the questionnaire used to measure this personality trait.

To measure the NPC's assertiveness and friendliness levels in this experiment we used the Abridged Big Five-Dimensional Circumplex's (AB5C) assertiveness and friendliness scales. The AB5C was chosen because it relates assertiveness and friendliness in the context of interpersonal relationships [13]. These scale were composed of 10 items and the assertiveness scale has a .75 cronbach alpha, while the friendliness scale has a .85 one. A 5-point Likert-scale was used to rate each of the items of these scales, ranging from *"Very inaccurate"* to *"Very accurate"*.

Since the items are written for self-assessment purposes, and we intend to measure the NPC's personality traits, we converted the 20 items into the third-person using the International Personality Item Pool (IPIP) guide found on their official website[3].

The questionnaire was administered in accordance to the methods described in the official IPIP website. Each of the 5 levels of the Likert-scale were assigned a score from 1 to 5, based on whether they were *+keyed*, or *-keyed*. The *+keyed* items are scored in ascending order, while the *-keyed* items are, in contrast, scored in descending order. For example, the fourth level of the Likert-scale, "Moderately accurate", when scoring a *+keyed* item, is assigned a score of 4, and scoring a *-keyed* item, it is assigned a score of 2.

Results

The two scales used gave us an assertiveness score and a friendliness score, which was the mean of the corresponding items. Given our small treatment groups (n=5), we used a Kruskal-Wallis test, and found that there was a statistically significant difference in the assertiveness scores between the different groups, $X^2(3)$=8.215, p=0.042, with a mean rank assertiveness score of 17.00 for Assertive-Friendly, 8.30 for the Assertive-Unfriendly, 7.80 for the Non-Assertive-Friendly and 8.90 for the Non-Assertive-Unfriendly.

Given this result, we used Mann-Whitney U tests on pairs of gathered scores. Comparing the assertiveness scores between the Assertive-Friendly and Non-Assertive-Friendly NPCs, with means of 4.08 and 3.34, respectively, the Assertive-Friendly NPC was ranked significantly higher than the Non-Assertive-Friendly (Mann-Whitney U=1.5, p=.02 two-tailed). However, when comparing assertiveness scores of the Assertive-Unfriendly and Non-Assertive-Unfriendly NPCs, there was no significant difference (Mann-Whitney U=12.5, p>.05).

Another Mann-Whitney test indicated that the assertiveness score of the Assertive-Friendly NPC is significantly higher than that of the Assertive-Unfriendly NPC(Mann-Whitney U=1.5, p=.02 two-tailed)

[3]https://ipip.ori.org/Third-Person-Items.htm - last accessed 25/09/2018

Analysis

The version of the game used in this fair only had two levels and two rooms. This meant that the interaction period with the NPC was merely four dialogue sequences.

The friendly NPCs had assertiveness scores more closely aligned with the ones that they were intended to convey. This is, the Assertive-Friendly NPC had a higher assertiveness score than the Assertive-Unfriendly NPC, and the Non-Assertive-Friendly one had a lower assertiveness score than the Non-Assertive-Unfriendly NPC. From which we concluded that higher levels of friendliness convey different levels of assertiveness better. We believe this correlation happens because higher levels of friendliness translate into more opportunities for interaction. Given the low amount of interactions in this version of the game, this might have had a bigger effect than usual on the perception of the NPC's personality. Given these results, we decided to set the level of friendliness for our main study on the positive end of the scale, and maintain a similar level for both the assertive and non-assertive personalities.

8 MAIN STUDY

In this study we wanted to test if the player's assertiveness level being aligned with the NPC's increases the player's enjoyment of the game and affinity for the NPC.

Questionnaire

The questionnaire used was composed of three sections, player identification and assertiveness self-assessment, game experience and NPC social presence evaluation, and NPC assertiveness assessment.

In the first section, for the assertiveness self-assessment, we used the NEO PI-R's 10-item assertiveness scale, which has a cronbach alpha of .84 (reported by its authors), and evaluated by a 5-point Likert scale.

The second section of the questionnaire is composed by the Game Experience Questionnaire's In-game Module and Social Presence Module. The Social Presence Module was adapted to include the NPC's name, instead of the word "other" in the phrasing of the items. The items in this section are scored with a 5-point Likert scale from "not at all" to "extremely".

In the last section, we measure the NPC's assertiveness with the same 10-item assertiveness scale that was used in the first section of the questionnaire, however, to the same effect of the personality items used in the preliminary study, the items were converted to third-person phrasing.

Procedure

The participant was allowed to be a part of the experiment either remotely or in person. The procedure taken with each participant was the following:

(1) *Introduction* - The participant, upon opening the online questionnaire, was explained that they would be part of an experiment to test a game, that the experience was of voluntary participation and took around 25 to 30 minutes;
(2) *Initial Questionnaire* - The participant was prompted to fill the first section of the questionnaire, the identification and assertiveness self-assessment;
(3) *Starting the game and getting to know the controls* - The participant was told of the various options of playing with a game controller or keyboard and mouse. Then, upon opening the game and pressing "Play", was explained the controls of the game;
(4) *Escaping the Cave* - The participant played the game from start to finish;
(5) *Final Questionnaire* - When the participant was finished playing the game, they filled the two last sections of the questionnaire, described previously.
(6) *Saying goodbye* - Finally, the participant was thanked for participating.

Sample

The participation in this experiment was voluntary. The participants were randomly approached, in person and via social media, and asked to participate in our experiment.

We had a sample of 48 people, aged between 21 and 29 (Mdn=23.75), distribution of gender was 7 females and 41 males. Regarding game experience, 56.3% of the sample is an avid gamer, choosing the "I reserve time in my schedule to play video games.". 79.2% of the sample had already played at least one puzzle-platformer, with 10.2% reporting the genre being one of their favorites. The discrepancy in game and genre experience was not caused by the methods used to disclose the experiment, given its publication through generally game neutral means. We believe this difference comes from the increased likeliness of more game-savvy people to participate in such an experiment voluntarily.

In our sample, the median for assertiveness score, was 3.35, with a standard deviation of 0.60. This median is the cutoff point used to divide our sample into assertive and non-assertive players.

Given our sample size of 48 participants we can observe the four treatment groups and how many observations per treatment group we had in table 1.

	Assertive NPC	Non-Assertive NPC
Assertive Player	8 (Group A)	16 (Group B)
Non-Assertive Player	16 (Group C)	8 (Group D)

Table 1: Participant distribution in experiment and group labelling.

Manipulation Check

Normalization analysis of the NPC's assertiveness scores, using a Shapiro-Wilk test revealed them to be approximately normal. To analyze the player's perception of the NPC's assertiveness, we used a two-way ANOVA model, considering the player's assertiveness level (non-assertive, assertive) and the NPC's demonstrated assertiveness level (non-assertive, assertive) as independent variables.

Consistent with Hypothesis **H1**, the assertive NPC was perceived as significantly more assertive than the non-assertive NPC, $F(1,44)=33.467$, $p<0.001$ (see Figure 3). There was no main effect for the player's assertiveness level, $F(1,44)=1.987$, $p=0.166$, and no significant interaction effect was found, $F(1,44)=0.482$, $p=0.491$.

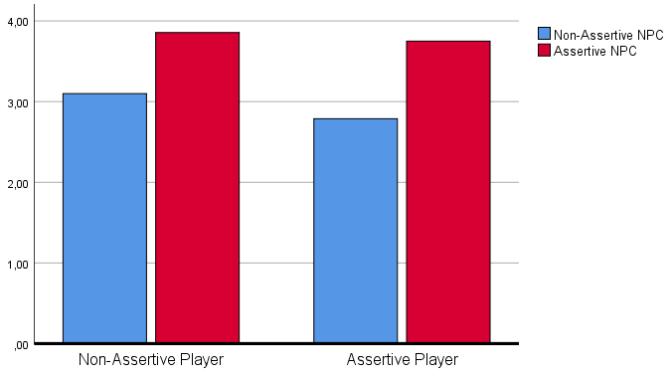

Figure 3: Mean perception of NPC assertiveness score as a function of player and NPC assertiveness level.

Results

We will now describe the analytical process of the results from GEQ's in-game module and social presence module. We started by trying to apply ANOVA on Ranks to the data, however, a normal distribution could not be achieved. Therefore, we used a Kruskal-Wallis H test, separating the data by each treatment group seen in Table 1.

This analysis revealed that there was a statistically significant difference in Tension scores between the different groups, $X^2(3)=13.513$, $p=0.004$, with a mean rank Tension score of 30.44 for group A, 19.91 for group B, 31.63 for group C and 13.50 for group D.

	Mean rank Aligned	Mean rank Not-Aligned	U	p
Competence	28.47	22.52	192.5	.152
Sensory And Imaginative Immersion	24.06	24.72	249.0	.877
Flow	26.19	23.66	229.0	.551
Tension	21.97	25.77	215.5	.352
Challenge	26.09	23.70	230.5	.572
Negative Affect	19,88	26.81	182.0	.086
Positive Affect	29.03	22.23	183.5	.104
Empathy	27.03	23.23	215.5	.374
Negative Feelings	21.34	26.08	205.5	.266
Behavioral Involvement	26.94	23.28	217.0	.393

Table 2: Mann-Whitney U test results for each GEQ component, separated by "aligned" observations.

Applying a Mann-Whitney U test with Bonferroni correction for each pair of groups, revealed that Non-Assertive players report significantly ($p<0.0125$) higher Tension scores when interacting with the Assertive NPC (Mean rank=15.56) than with the Non-Assertive NPC (Mean rank=6.38), $U=15.00$, $p=0.002$.

Hypothesis **H2** predicted that the players would perceive their game experience more positively when their assertiveness levels were aligned with the NPC's own assertiveness level. For this Hypothesis, we have to take into account the seven components in the GEQ's In-game module. Hypothesis **H3** predicted that the players would prefer to interact with the NPC, when their assertiveness levels were aligned with the NPC's own assertiveness level. For this Hypothesis, we are going to analyze each of the three components of the social presence module of GEQ. For both Hypothesis **H2** and **H3**, and since the normality assumption for ANOVA wasn't met, we used a Mann-Whitney U test, separating the observations into "aligned" (groups A and D) and "not-aligned" (groups B and C) to test the effect of assertiveness alignment. There was no significant difference between the aligned and not-aligned groups, as seen in Table 2.

Analysis

A potential reason for the significantly higher Tension score registered when Non-Assertive players interacted with the Assertive NPC, is the NPC's imposition of their choice on the player. The player, being Non-Assertive, would feel frustrated if they wanted the same door, but would not express that feeling to avoid conflict. For context, the items that score this component are "I felt frustrated" and "I felt irritable".

An aspect that is worth considering when reasoning about the results for Hypotheses **H2** and **H3** is the difference in contexts of interaction between the Media Equation study [25], and our scenario. The scenarios of interaction implemented

in this work introduces certain elements that might have an effect on the player's relationship with the NPC. Namely, a potential conflict, when both parties want the same door, which introduces a competitive component to the interaction, in contrast to the interaction by Nass et al.[25] which is merely cooperative. Another aspect that was not present in the Media Equation study's interaction was the potential consequences of the conversation. From the player's point of view, the choice of door could lead to different levels, which meant that this decision could lead to an easier level, and that the NPC wanting one of the doors might mean they know which level is easier.

9 CONCLUSION

We began this work with the intent of testing if the *law of similarity attraction* would apply to player-NPC relationships. With that goal in mind, we started by reviewing the state of the art in player modeling and game adaptation, while also studying research on the relationships between people and media and reviewing recent work done in the field of NPCs.

We developed a testbed game called *Cave Escape*. This game is a 2D puzzle-platformer with a companion NPC, which provides a context for repeating interpersonal interactions, in the form of the discussion and subsequent decision of which door each character will go through. The companion NPC expresses their personality merely through the manipulation text interactions. Given the encapsulation of the dialogue tree in a .txt file, writing and implementing new behaviors is easily accessible. Accompanying the development of the testbed game, informal playtesting sessions were conducted to ensure its player controls and level design quality.

Then, we conducted a user experiment (n=20) and confirmed that a higher level of friendliness allowed the NPC's assertiveness to be perceived more accurately. With this in mind, we implemented two friendly behaviors for the companion NPC, an Assertive behavior and a Non-Assertive one.

We conducted a 2x2, between-subjects experiment (n=48) to test our hypotheses. We found that the players perceived the NPC endowed with assertive characteristics as significantly more assertive than the NPC that exhibited non-assertive characteristics. We also found no difference in the levels of enjoyment of the experience and social presence, when the player's and NPC's assertiveness levels were aligned. However, we found significantly higher Tension scores when Non-Assertive players were matched with the Assertive NPC.

10 FUTURE WORK

From the research methodology described in the previous section, and Johnson and Gardner's[15] work, we believe that taking other Media Equation implications and applying them to video games might lead to worthy research endeavors. A possible experiment design could be extrapolated from the Media Equation's experiment design itself. Taking findings from the Media Equation replacing the computer with an NPC, and inserting the interaction into a video game context.

One of the findings is that gain/loss theory applies to people's interactions with media, this is, people will be more attracted to computers that initially dislike them and end up liking them, than ones that consistently like them from the start [22]. This could easily be applied to video games, for example, in a Role Playing Game (RPG), developing the two behaviors described previously for an NPC, and the same effect of gain/loss theory is observed.

Another interesting finding is that people feel like they owe a favor to a computer, after said computer has done them a favor [24]. This effect can be replicated in a video game context. For example, have, for half of the sample, an NPC help the player with a problem, such as a fight or puzzle and afterward, have the same NPC ask the player for another favor, such as a search for as many materials as possible(it should be a favor in which the player could choose to which degree they want to help). For the other half of the sample, reverse the order of the favor exchange, and observe if there is a significant difference in the amount of work performed by the player.

Another route to follow is focusing on other facets of *Extraversion* and *Agreeableness*, given that in interpersonal relationships, they seem to be the most important personality traits.

In this work, we left out of the scope some of the elements NPCs possess, which are at game designers' disposal, and instead manipulated only the NPC's dialogue. Some other characteristics that could be manipulated to express personality traits are:

- The visuals of the NPC, including physical appearance, expressive animations, both facial and bodily;
- Voice-overs, intonation, higher and lower pitched voices;
- Gameplay behavior, for example, acting more sure of a guess in a puzzle, asking the player which role they would like to take in a cooperative puzzle, running into a mob of enemies, etc.;

As mentioned previously, the interaction context in this work might have had an effect on the player's experience, therefore, different types of interactions should be tested. For example, fully cooperative efforts, or direct competition environment, or love interest, or even a nemesis relationship, in which the NPC plays the player character's archenemy.

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