Does the Perceived Identity of Non-Player Characters Change how We Interact with Them?

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***Abstract*—Although there have been studies demonstrating that users will respond favorably to synthetic companions and team-mates in computer games, there has been little research into how a player's behavior may change when a known non-player character (NPC) assumes a human identity or persona. This is a common scenario in modern computer games, where players interact with NPCs assuming the guise of human characters. To explore this question, an online game was developed in which a human player had a primary objective of surviving against increasingly difficult waves of enemies. As a secondary objective, the player was tasked with protecting an unarmed NPC companion which assumed either a human, or non-human identity, but with identical underlying Artificial Intelligence. The intention was to explore whether the human player would be more or less protective of a synthetic companion simply due to the identity assumed. The results of the study demonstrate that player's behavior does change based on identity, and clearly indicates that the player was more protective of the companion assuming a human identity. Furthermore, the results show that this phenomenon extends beyond simple human and non-human identities, and that the specific persona, or gender of the NPC may influence the player's empathy towards it.**

I. Introduction and Motivation

Many virtual world applications require humans to interact with artificial entities. This is particularly evident in computer games, where agents often form a central component of the gameplay. These non-player characters (NPCs) add depth to the virtual world and serve a variety of roles, from opponents to companions. There is a growing interest in team-mate and companion AI in games [1], and some modern examples such as Ellie from *The Last of Us* have become some of the most celebrated examples of modern computer games AI. Companion AI has also been applied to other areas such as generating artificial team members for team training [2].

Normally the fact that the NPC is an artificial entity is not hidden from the player, but neither is it highlighted, the assumption being that the character that the AI portrays is central to the player's suspension of disbelief. As such, it is typical for the AI in games to assume the role of a believable organic character, often with their own back stories and motivations.

Research has demonstrated that the perception of an NPC's identity, and the associated social interaction [3] affects the user's enjoyment of a game. However, our research has focused on whether we perceive the NPC to be an artificial character or the avatar for another human player. There does not seem to be any research that explores how a player will interact with a *known NPC* with different perceived identities.

For a games developer, this is a pertinent question. Games which include several different characters may use the same underlying artificial intelligence. Through the use of various narrative techniques (such as cut-scenes or dialogue), these NPCs are given personalities but their actual in-game behavior remains the same. The question remains as to whether this is an effective technique or not. Are players fooled or are they willing to suspend their disbelief during the game? Does the perceived identity of the NPC make a difference to how the player interacts with it, or can the player see past this façade?

In this study, we will explore whether the perceived identity of a companion NPC changes how a player behaves. Specifically, we will look at whether a human player would be more, or less, protective of a companion NPC if it was given a human or a non-human identity.

We will begin by discussing some of the related work which inspired this study. We will then describe the concept game developed for this research and the experimental method. We will conclude by presenting and discussing the results.

II. Background

In this section, we will overview the background to this work focusing in the area of human agent interaction (HAI); specifically how human players interact with NPC companions in computer games.

Research has suggested that humans will behave socially towards computers [4]. However, opinions differ as to what factors effect this phenomenon. The field of computer games research has produced evidence that a player will view behavior from a companion they believe to be human more favorably, and notice positive behavior (such as sacrifice, or protection) more often [5], [6]. Conversely, players assign blame to character they believe to be AI controlled (NPCs) [7]. It has been shown that this attribution of responsibility, both credit and blame, extends to other areas of human computer interaction (HCI) research [8]. There is also evidence to suggest that behavior and movement are key factors in positive interaction. For example, people have been shown to be more comfortable communicating with real-time avatars that move like humans [9].

By contrast, the Computers Are Social Actors (CASA) paradigm [10] has shown that in some cases interactions with computers are inherently social, regardless of whether the computer is perceived to be human-like.

There are also data collection issues which must be considered, as traditional self reporting methods (such as surveys) have been shown to lack accuracy as a human's perceptions of their behavior may not match reality. For example, one study gave human players in a game the ability to draw fire from one of two companion NPCs. The players were led to believe that one of the NPC types was controlled by a human, and the other was controlled by an AI, when in fact the NPCs were identical instances of the same AI character. While the players reported that they drew fire more for the *perceived human* character, the data actually indicated the opposite[11]. It has also been suggested that human players have a desire for social companionship within games [12].

It is also clear that the identity of an agent plays an important role in this social interaction. Studies have shown that in computer games a human player will show a preference towards team-mates which they perceive to be human controlled. When presented with two identical NPCs, the player will show a higher preference to the one that they are told is human [13]. This suggests that perceived identity of in-game characters factors into player enjoyment.

For example, research has shown that the appearance of in-game avatars directly affects social interaction [14]. Avatars wearing clothing with negative social connotations (such as black cloaks, or outfits reminiscent of the Ku Klux Klan) [15] elicit more aggressive intentions and attitudes in group exercises than control groups. Also, individuals in virtual worlds with taller avatars have been shown to negotiate more aggressively in face-to-face interactions than participants with shorter avatars[16].

This is related to a phenomenon called the *Proteus Effect*[17]. The Proteus Effect is when the behavior of an individual within a virtual world is affected by the visual appearance of their avatar. Players are known to craft and enact in-game identities, often assuming different behaviors, or genders in their in-game personas [18]. This has been shown to impact racial bias [19], brand attitude [20] and financial saving behavior [21]. In many cases, individuals may create a virtual persona entirely separate from their reality, for example portraying someone who is more confident or competent.

The is also evidence to suggest that dissimilar avatars can have a positive emotional effect on the individual. For example viewing dissimilar avatars reduced public speaking anxiety to a greater extent when compared to a similar avatar [22]. It is possible that this may be because a dissimilar avatar allows the user to alter their body schema (ie. core beliefs about their body) and social role [23], [24]. This appears this has a direct link to appearance, and users with avatars that have more attractive features will generally be more confident in the virtual world [25]. However, there are researchers who contest this hypothesis and suggest that users will generally create avatars which bear similarity to their real selves (with only moderate enhancement)[26].

However, the Proteus Effect generally is not described as extending past the player's perception of their own avatar. But there is research to suggest that the perception of other agents' appearances in the environment will also effect an individual's behavior. Previous studies that have used VR to address social anxiety have found that manipulating features of the audience can reduce trait anxiety, thereby resulting in more confident behavior [27], [28], [29], [30], [31]. Avatars with gender identities have been shown to elicit specific behaviors from the human agents they interact with. Avatars with a female appearance (and gender stereotype) prompted masculine behaviors, conversely male avatars invoked more feminine behavior[32]. However, despite their changes in behavior, the human participants are not consciously aware of the stereotypical behaviors the avatar is eliciting.

We are interested to see if a player's in-game behavior will change if they interact with a known NPC[1] portraying either a Human or Non-Human identity. While we have discussed here a body of research with has assessed similar research areas, there does not appear to have been any research evaluating this particular question. As a secondary objective, we are interested to see if a player's behavior can be altered simply by changing the visual representation of a character from male to female.

III. Concept Game : WebWar

To facilitate our study, a 2D, top-down game was developed in which the player is tasked with protecting an unarmed companion NPC. During the game, the player and companion are attacked by opponent tanks in waves of increasing difficulty. The player can survive 20 shots from the opponent and the companion can survive 100; the opponents can survive a single hit from the player.

The game is online and browser-based using the JavaScript game engine Phaser.js[2]. The view port to the world is 800 pixels wide by 600 pixels high, while the game world is a 2000 pixel square. Below the game view, a small console contains an avatar for the companion along with a console for the companion's communications. The console is written in HTML, styled with CSS and powered by JavaScript.

The player character is controlled using keyboard arrow keys for movement (forward, left and right) and space bar to fire. There is no backward movement or strafing.

At the beginning of the game, the following narrative is supplied that explains the game's premise and objective:

> ***COMPANION NAME*** has been sent to a remote server on the digital WarWeb to investigate the bots that have been taking over cyberspace. You have been sent to protect her during the mission.... It was going to be easy, a babysitting exercise, bots arrived... Now you just need to survive.
>
> You companion's profile image and indicator will flash when they are being attacked.
>
> If ***COMPANION NAME*** dies, you lose 25 points. Survive for as long as you can.

[1]By a 'known NPC, we mean a character which is clearly synthetic in nature and is clearly not controlled by another human player.'

[2]The Phaser.js engine and associated documentation can be downloaded from https://phaser.io/

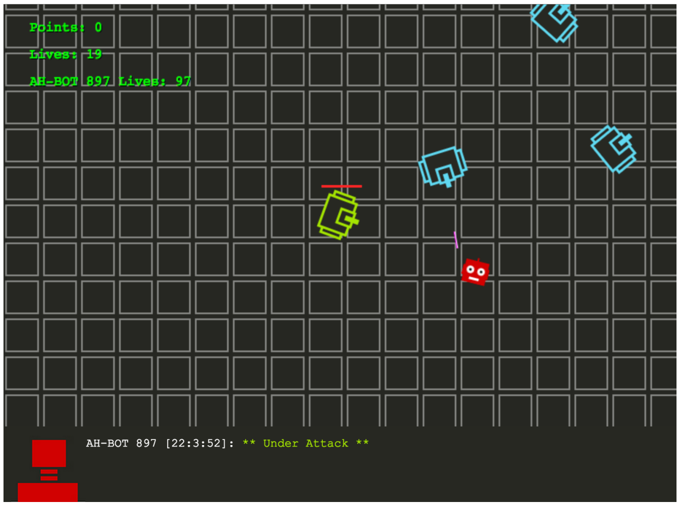

Fig. 1: A screenshot of the Game being played. The players tank can be seen in lime green in the center of the image. Above the player's tank, a small red bar provides a visual representation of the players health. This is further highlighted in the top right where a HUD style display shows the player's and companion's health, as well as the player's score (a kill count). In the top right hand corner, three opponent tanks (light blue) can be seen, and one is currently firing towards the companion. The companion (robot identity) is currently red, indicating that it is under attack. At the bottom of the view, a chat console shows the companion calling to the player for help.

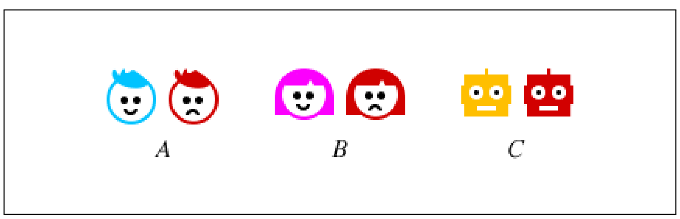

Fig. 2: Sprites used for the companion. The icons on the left are under normal (not under attack) conditions. The icons on the right are under attack (notice the change of color to red). A: Male, B: Female, C: Robot

A. Companion

The intention of our study is to see if a human player would be more protective of an NPC with a human identity. To assess this, three characters were created – one with a robot identity(AH-BOT 897) and two with human identities. Of the two human identities, one was male (Timmy), the other was female (Daisy). Both genders were included as separate characters to help demonstrate the player's preferences towards a human identity character, rather than a character of an arbitrarily selected gender. The companion is selected at random from a choice of the three options.

The companion is visualized in-game using a 'profile' silhouette which depicts their character identity. This profile image is also shown in the chat console to further identify the identity of the companion.

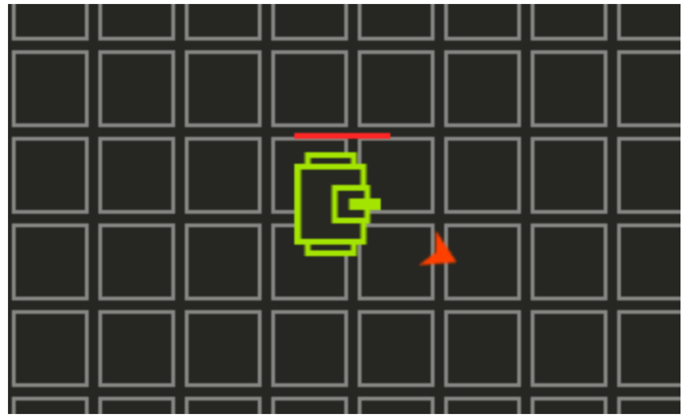

Fig. 3: Companion under attack and out of view of the player. The marker arrow gives the player an indication of the direction of the companion NPC. It is currently flashing red to indicate that the companion is under attack.

The qualities that determine the characters identity are their name, their profile image and their color. The behavior of all three companions is identical; they simply move around the environment using a standard wandering steering behavior [33] at a speed of 60 pixels per second. The companions do not interact or react to either the player or the opponents.

When the companion comes under attack, it prompts the user for help by using a text-based chat console. There is a 1 in 20 chance that the companion will broadcast a message each game loop that it is under attack.

The robot identity companion asks for help with a simple response ** *Under Attack* **. This single, factual response was intended to be fitting for the robot persona of the character. Conversely, to make the human identity companions appear less 'robotic', they ask for help by randomly selecting one of 5 emotive resonances.

- Help I'm under attack!!
- Please help, I'm taking heavy fire
- I'm not sure I'm going to survive this on my own
- They've spotted me and have me in their sights, help quick!!
- Oh no, I've been spotted, quick, help!!

Both human identity companions use the same set of responses selecting one of the 5 messages at random. In addition when the the companion comes under attack, it flashes red. If it is outside the player's view, an arrow flashes red to indicate the companion's direction to allow the player to move to provide assistance. In addition, when the player avatar comes under attack, it sends "help me" messages to the player through the console.

B. Opponent Non Player Characters

The enemy NPCs take the form of tanks and have three states for interacting with the player and companion.

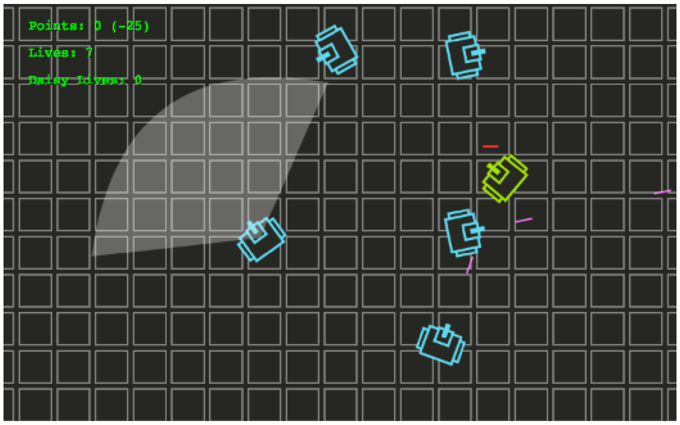

Fig. 4: The opponent's vision cone has been highlighted for the far left opponent. If the player or companion falls within this, the opponent will react to it.

- Docile: While in the docile state, the NPCs wander around the map using a simple random goal wander movement initially at 60 pixels per second. A target is picked 200 pixels in-front within a 90° vision cone. This is decided on a probability of 1:20 every frame. The wander is limited to within the world boundary.
- Alert: Once a player or companion has entered the enemy's vision cone (60°) at a distance less than or equal to 200 pixels (see figure 4), the NPC enters the alert state. In this state, it will stop moving forward and fire at the player adjusting its rotation to keep the player in view.
- Seek: When the player exists in an enemy's vision cone, the enemy enters a seek state. The seek state prompts the NPC to increase its speed and sprint towards the last point at which it saw its target. The vision cone is also doubled in length.

IV. Data Collection

The game was released online and promoted via social media outlets including Facebook and Twitter. To promote game-play (and in keeping with popular online games), the users simply had to access the web page to play. The game was designed to be compatible with all modern browsers with JavaScript and HTML5 support.

During each game, statistics were logged to allow us to analyze gameplay behavior. The player was informed that their gameplay data would be logged, but that no personal information would be recorded.

The following data was recorded on a Firebase database:

1) **Game Scores** The raw score was recorded at the end of each game. This was recorded as the raw score minus any penalties; penalties were incurred if the player had been unable to protect the companion. The player gained 1 point for each opponent tank it destroyed, meaning that the raw score is the player's precise kill count.
2) **Game Duration** Recorded the length of the game in milliseconds.
3) **Survival** Recorded true if the companion survived the game, false if they died.
4) **Distance** The average distance maintained between the player the companion throughout the game.
5) **Rescue Response** Recorded the amount of time it took the player to respond to a distress call from the companion.
6) **Intended Targets** Whenever an opponent fired its weapon, it was aiming at either the companion or the player. The intended target of each round fired was recorded as an ongoing tally in each game.

The data collected represents games played between 2015-04-02 and 2015-04-26.

V. Results

The game was played a total of 173 times. In each game, the companion was selected at random, resulting in the Robot featuring in 57 games, the female character in 47 and the male character in 69.

In the following subsections, we will provide a detailed analysis of the data captured. The full data-set, and game code is available on request for future studies.

A. Game Scores and Duration

At the end of each game, the player was assigned a score based on how many opponent tanks they destroyed. Figure 5 visualizes the distribution of scores against each player type.

As can be observed in the Figure, the player's scores fall into a similar distribution for each of the companion types. This demonstrates that if the player's behavior did vary for the

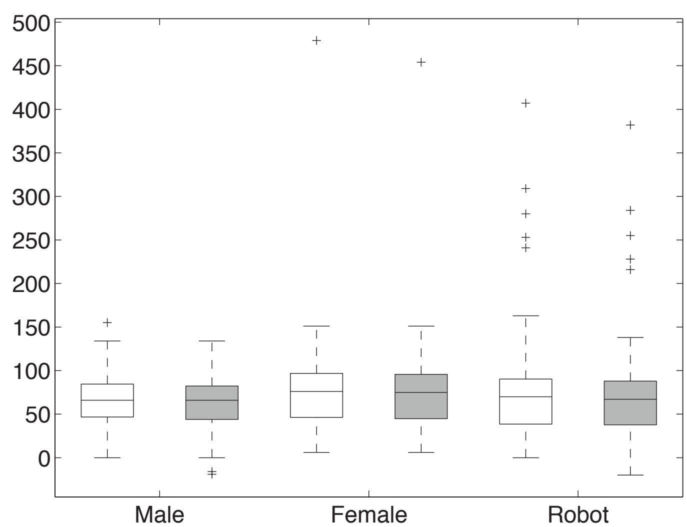

Fig. 5: A box plot of the distribution of scores from each game for each companion type. This includes the raw score (white box) and adjusted score based on companion survival (gray box).

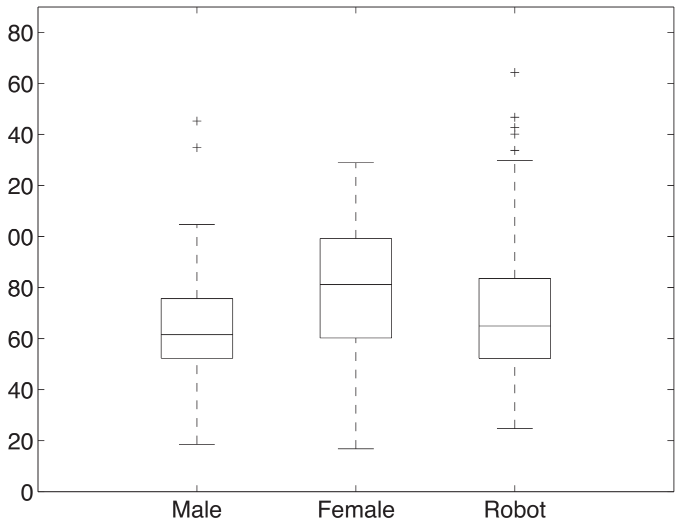

Fig. 6: A box plot of the distribution of game times across the varying companion types. One outlying data point has been omitted as it heavily distorts the graph. We believe that this point was a result of browser error.

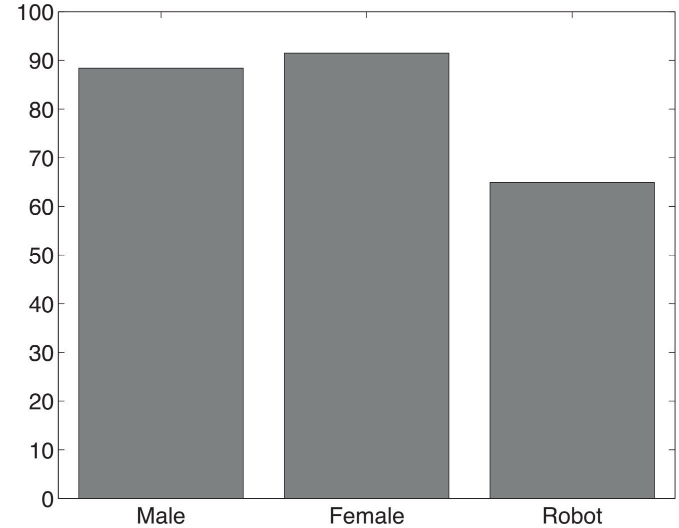

Fig. 7: Survival rates (out of 100%) for the 3 character types. Note that both the male and female identity companions survived arround 90% of games. The robot companion by comparison only survived 64% of games

three companion types, it had no real effect on their resulting game score.

Our first insight into differing player behavior pertains to game duration. The games featuring a human identity companion were typically longer, despite the game scores for each companion type falling into a similar distribution. This means that the player took longer to achieve an equivalent kill count with the human identity companions than they did with the robot identity companions.

We can infer from this data that the players engaged in more cautious playing behavior when paired with a human identity companion. The differing game duration compared with the similar scores indicates that the players would wait for encounters with the opponent rather than actively seeking them out.

B. Survival Rate

Figure 7 shows the percentage of games where the companion survived (outliving the player). This data provides insight into how active the player was in protecting each of the three NPC identities.

The data shows that the human identity companions survived in a higher percentage of games than the robot. The female companion survived the largest number of games (91%), closely followed by the Male (88%). The robot survived significantly less games (64%), indicating that the player may have protected them less.

C. Distance

The average distance between the player and the companion during a game provides further indication of how protective the human was of the NPC. By looking at this data, we can ascertain whether the player remained close to the companion (guarding it) or if the player roamed away.

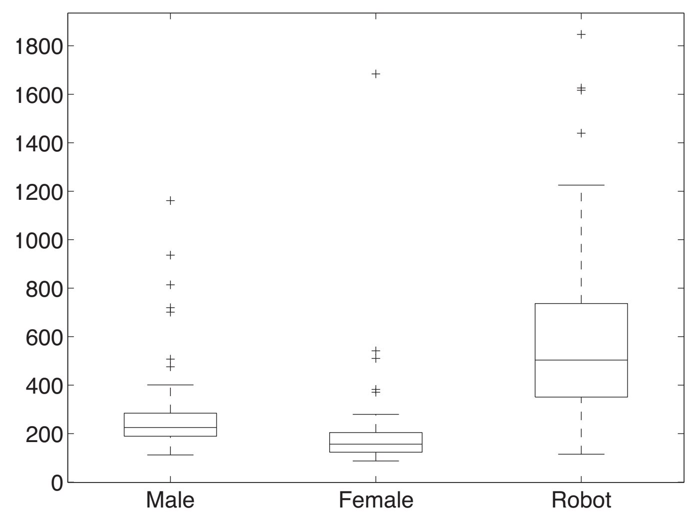

Fig. 8: The average distance between player and companion in each game, for each companion type. Note how the male and female both have a median distance of under 300. By comparison, the median distance for the robot companion is 503, which means that on average the companion was outside the player's visible area.

The average distance data for each individual game is visualized in Figure 8. This chart details the average distance maintained in each game for each companion type. As a point of reference, a distance of 300 or less means that the player and companion were on the screen at the same time. Any distance greater than 300 meant that the companion was likely to be off-screen.

We can observe that the player maintained a significantly closer distance to the companions with a human identity (the male and female), with the median distance under 300 (225 for the Male, and 156 for the Female). However, the median distance for the robot identity is 503, which would be off-screen from the player's perspective.

The data also shows that the player's behavior was relatively consistent with the human identity companions (indicated by the tight interquartile range). However, We can see that the behavior was significantly less consistent with the robot identity NPC.

This data shows that the human player generally kept the companions with human identities within the visible game area. However, they were less concerned about being able to see the robot. On closer inspection, we can also see that the players tended to keep the female identity closer (on average) than the male.

D. Rescue Response

When the companion was attacked, it would call for help from the player. If the player was further than a distance of 200 away, then this created a *rescue request* event. This indicated that the player was too far away to provide immediate protection to the companion.

When a rescue request event was triggered, two timers were instantiated. The first timer recorded how long it took the player to turn towards the direction of the companion (the *turn towards* time), indicating how quickly they responded to the distress call. The second timer recorded how long it took the player to move within 200 of the companion (the *time to engage*) indicating how long it took for them to provide assistance. Both can be seen on figure 9.

Figure 10 shows the *turn towards* and *time to engage* times for the each companion type. We can see that the human player responded in the shortest amount of time to the female and male identity companions, and least quickly to the robot identity companion.

We would expect this trend with the *time to engage* data as the player was typically further away from the companion (as indicated by the average distance data in subsection V-C) and would have taken longer to provide assistance. However, if this was simply a case of the greater distance increasing the time to respond, we would expect the *turn towards* timings to be similar between all three companion types, as the turning time is independent of the distance (as the player can only ever be a maximum of 180 degrees away from heading towards the companion). But as can be seen, the *turn towards* time is significantly greater for the robot identity companion (longer than the time to engage time for the female companion).

E. Shots Fired

Each time an opponent shot a round, it had an intended target which was recorded. The average number of times each companion type was the intended target is visualized in Figure 11.

The data shows that less shots were fired at the player than the companion for each of the three companion types.

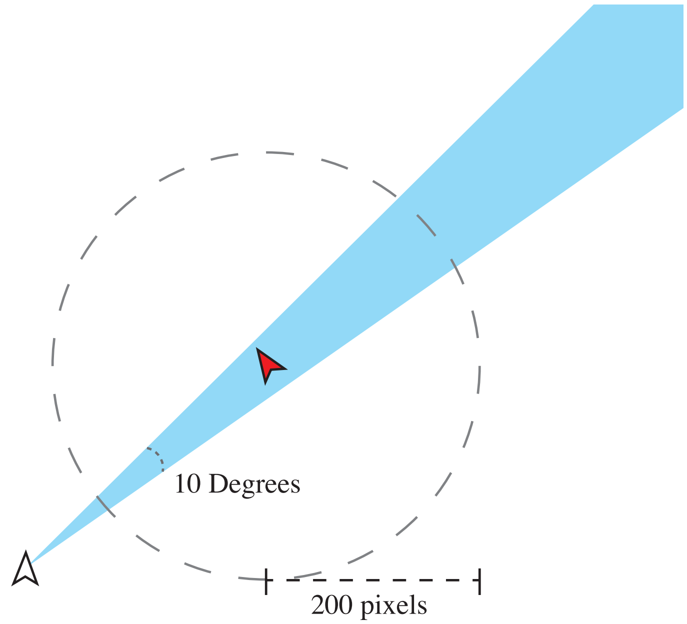

Fig. 9: How reaction to a rescue response event was calculated. The *turn towards* time is how long it took for the player (bottom left chevron) to assume a heading within a 10 degree window of the companion (center chevron). The *time to engage* is how long it took the player to move within a radius of 200 from the companion.

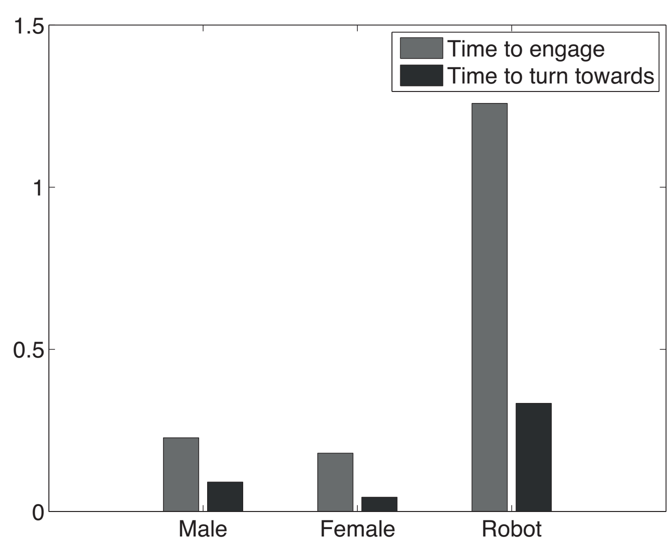

Fig. 10: Reaction time data visualised. We would expect the average distance to have an effect on the time to engage. However, if the player was responding to every distress call the same, we would expect the turn towards time to be equal (as it is independent from distance). Note that the time for the robot identity companion is significantly different from the male and female identity companions.

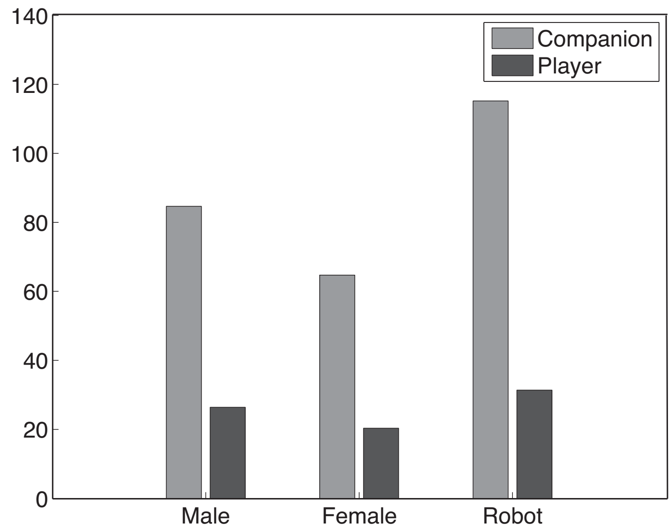

Fig. 11: Average number of shots fired by the opponent tanks with either the companion or player as the intended target.

We would expect this trend, as while the player was able to actively avoid detection by the enemy tanks, the companion simply wandered (making it an easier target). However there are three observations we have made from this data.

Firstly, the robot identity companion was (on average) the intended target of more shots than either the male or female companion. This adds further evidence that the player was more diligent in their protection of the human identity companions, destroying opponents before they were able to target the companion.

Secondly, as with some of the other plots (including *reaction time* and average distance) we observe a difference between the male and female identity companions. On average, the female companion was the intended target of less shots than the male. We also note that with the female companion, the player had 20 shots intended for them (averaged across all games). This is the exact amount required to destroy the player. Due to this data, we can infer that the player likely placed a higher priority on protecting the companion than themselves when paired with the female identity companion. This observation is particularly interesting when we consider that the only difference between the male and female companions is their name, the color, and design of their avatar.

VI. Conclusion

In our motivation, we asked the question of whether a human player would be more, or less, protective of a companion NPC if it was given a human or non-human identity. This study which involved designing a simple web-based survival game has provided evidence that the perceived identity of a known NPC does affect a player's behavior. We have shown that the players treat the NPC with a robot identity very differently from the NPCs with human identities (in this game setting). The results also show that there were some differences in how the player responded to the male and female identity NPCs, highlighting that this phenomena extends beyond simple distinctions between human, and non-human avatars, despite the underlying AI being identical. Despite the three characters being known NPCs, the player changed their behavior significantly based on the characters perceived identity.

This is reminiscent of the Proteus effect (described in Section II). But while the Proteus effect refers solely to the visual appearance of the participant's own avatar, we have described a phenomenon based on how a player relates to the perceived identities of the synthetic characters they interact with. We have chosen to call this the Loki effect, based on the Norse god who was able to change his appearance and identity to trick those who perceived him.

A. Limitations

The task in the game was very specific, notably the player had the objective of surviving, and the secondary objective of protecting the NPC. The NPC had no defensive capabilities itself. We may find that the results of similar studies would be different should the objectives of the game change. It is also worth considering that the payoff for protecting the NPC was relatively small. Had the payoff been much higher, we may expect to see different, utility driven results.

Another limitation is in the nature of the data we collected. A decision was made early in the development process to not collect specific data about the players (such as age and gender). Due to this, it is hard to establish whether the Loki effect is common across a large distribution of individuals, or whether it is only present in a specific community.

B. Future Work

One area which warrants further investigation is how the identity of the player affects their interactions with the NPC. For example, would a male participant be more likely to protect a male, or a female NPC? As we designed the online game to be non-invasive, we made the decision not to capture specific information about the players, so we are currently unable to answer these questions. Future studies would seek to address this limitation. We are also interested to ascertain what difference, if any, the players representation in the virtual world (the Proteus Effect) would have on their relationship with known NPCs.

Another area we wish to further investigate is how the visual representation of the NPCs affect player behavior. For example, in this study, we chose to use color stereotypes for the human identity companions, blue to represent the male character (Timmy), and pink to represent the female character (Daisy). We are interested to see how gameplay would be effected if these colors were switched. We would also seek to explore how the player would respond to a NPC with a gender neutral name and representation and without a stereotypical color assignment.

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