How the Perceived Identity of a NPC Companion Influences Player Behavior

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Abstract. This paper explores how the perceived identity of a Non-Player Character (NPC) effects a players behaviour in computer games. We explore whether the players will change their behaviour towards a synthetic in-game companion if it assumes different identities. Specifically, will the players change their behaviour if they interact with an identical artificial intelligence, assuming a guise of a human or robot companion. To investigate this question we developed a top-down, 2D on-line game where the player is given the objective of surviving successive waves of hostile opponents. As a secondary objective the player is asked to protect a unarmed male, female or robot companion. The intention is to explore whether the player is more protective over a known NPC assuming either a human or non-human identity. The results of our study indicate that superficially changing the identity of an AI companion can have a dramatic influence over the players behaviour. The players in this study are shown to be significantly more protective to human rather than robot companions, despite the underlying AI being identical. Moreover, our results highlight further differences between the male and female companions.

Keywords: Proteus Effect, Non-Player Character, HCI

1 Introduction and Motivation

Many computer games involve human players interacting with AI driven characters known as NPCs (Non-player characters) or bots. These characters imbue a virtual world with life and depth, and commonly fill the role of adversaries for the player. In recent years the use of NPCs as companions has also become increasingly common [21], Companion AI has also been explored in other areas, such as artificial team members for teamwork training [40], and it has been suggested that human players actively desire social companionship within games [22]. However, there is a growing subgenre of games which place the player in a protective role over a relatively defenceless NPC companion. NPC companions of this type (such as Ellie from *The Last of Us*) have become some of the most celebrated examples of AI in games. However, there has been little research undertaken into how a user will protect companion NPCs, despite this being a growing commercial application.

NPCs often contribute to the game's story. As such, NPCs will often be used to portray characters rich in back-stories, motivations and personalities. The fact that these characters are AI controlled is not hidden from the player, and game developers rely on the players willingness to suspend their disbelief to maintain the illusion of a coherent virtual world. However, studies have shown [37] that the perception of NPC identity can impact the players enjoyment of a game. This highlights that an NPC should be given greater consideration beyond their use as a game mechanic or story device, and that their assumed identity also influences the player.

Research has demonstrated that changing the appearance of in-game avatars directly affects social interaction [3]. Furthermore it has been shown that visual representations can influence players. For example, avatars wearing outfits with negative social connotations [32] elicit more aggressive attitudes, and individuals in virtual worlds with taller avatars have been shown to negotiate more aggressively in face-to-face interactions than participants with shorter avatars [43].

As commercial games attempt to achieve greater levels of graphics realism and immersion, an understanding of how an NPCs identity influences player behaviour could potentially become increasingly relevant. This question will only become more important as the industry moves towards fully immersive gaming, with presence inducing virtual reality (VR) likely to have a massive impact on how players perceive AI characters [14].

In a previous article [15] we described a study where we explored whether the perceived identity of a companion NPC changes how a player behaves. Specifically, we examined whether a human player would be more, or less protective of a companion NPC if they were given a human male, human female, or a non-human identity. In this paper we expand on this research further.

We begin by exploring the background to this work, and then introduce our test game 'WebWar' which was published on-line to gain insight into our study. We then discuss the results; and demonstrate that changing the identity of a known NPC has a significant impact on player behaviour. We conclude with a discussion and description of future work.

2 Background

In this section we will provide a review of the background literature. This review will focus on how human behaviour is influenced by the perceived identity of others, particularly in virtual worlds. We will conclude the review with an overview of the Proteus Effect, a related phenomenon.

Allport [12] suggested that a persons psychology and behaviour are influenced by the actual, imagined or implied presence of others. This is related to the role of "social influence" in social psychology which is a change in thoughts, feelings or behaviour resulting from our interactions with other people [7, 33]. Interestingly, Allports definition implies that other people do not need to be physically present in order for social influence to take place. Blascovich et al. [5] note that this is consistent with observed responses to implied or imagined stimulus, such as thinking about an audiences expectations of an upcoming public speech or becoming frightened from imaginary others depicted in horror novels. It is therefore plausible that this perceived social presence can have a significant impact on social influence, which has significant implications for the design of artificial entities. Heider [16] stated that people cognise their social environment through a process of causal analysis, which involves making attributions about other individuals and their behaviour. Similar attributions are also made towards agents and avatars [11], which has led researchers to consider what factors determine the extent to which a user will perceive the representation to be human-controlled.

One possible explanation was put forward by Blascovich in his "model of social influence in virtual environments" [5, 6]. This model suggests that the attributions an individual makes towards a virtual representation depends on the extent to which they believe it is being controlled by another person, as this impacts the level of perceived social presence and associated social influence. These factors can be further affected by a variety of issues such as behavioural realism, the users own response and how personally meaningful the interaction is. In order to test this model, Fox et al. [9] carried out a meta-analysis of 32 studies that examined the effects of perceived agency (ie. a human-controlled avatar versus computer-controlled agent) on social influence. Measures of social influence included self-reported attitudes, social presence, affect ratings and task performance. Their analysis found that social influence was significantly higher for participants who believed the representation was human-controlled. This effect was particularly strong when the avatar was actually controlled by a human as opposed to a computer. Furthermore, additionally supported by additional studies which have demonstrated that people are more comfortable communicating with avatars that move like humans [39].

In on-line worlds, and large scale multi-player games (including MMOs) players will often create and maintain their own in-game avatar. This avatar is a visual depiction of the identity, including appearance, gender, beliefs or behaviour of the character they wish to portray [20]. Often a player will assume an identity very different from their own, for example, portraying someone who is more confident. In the field of avatar therapy dissimilar avatars have also been shown to reduce public speaking anxiety in participants to a greater extent than those using similar avatars [2]. It has been hypothesised that this may be because the user is able to change their body scheme, or reflect different core views [4, 18]. However, several research contest this theory and argue that users will usually create avatars that are similar to themselves (with moderate enhancement) [28].

Avatar depiction has also been shown to influence the behaviour of the player. This phenomenon, known as the *Proteus Effect* [42] has been shown to influence various social factors, including racial bias [13], brand attitude [1] and financial saving behaviour [17]. In one study exploring this effect, after being shown a reflection of their virtual selves participants were asked to walk over and talk to another participants avatar. It was discovered that participants that had been assigned more attractive avatars were more willing to approach strangers of the opposite gender.

We are also aware that participants may alter their behaviour based on the avatars they interact with. Studies using virtual worlds to treat social anxiety have found that changing specific features of the audience can reduce trait anxiety, resulting in more confident behaviour [10, 38, 41, 8, 31]. Furthermore, interacting with avatars with gender identities has been shown to elicit specific behaviours. For example stereotypical feminine behaviour when interacting with male avatars [36]. Interestingly, the participant was often unaware of their change in behaviour.

Games research has suggested that a player will view the behaviour from an agent they believe to be human more positively. This included noticing favourable behaviour such as sacrifice or protectiveness more often with characters they believed to be human [25, 27], and assigning blame more readily to characters they believe to be NPCs [26, 29]. Furthermore, a human player may show preference towards team-mates which they perceive to be human controlled and when given a choice between two team-mates, the player will show a higher preference to the one that they are told is human [24], despite them both being controlled by identical AI.

A similar study gave human players the ability to draw fire from team-mates during a game [23]. The players were told that one team-mate was controlled by another human, the other by an AI. Interestingly, while the players reported that they drew fire more for the perceived human character, the data suggested the opposite. This indicates how a player believes they act in a game may not match the reality of their in-game behaviour.

Some researchers argue that our interactions with computers are inherently social, and that a user may even treat a computer like a human [34]. Of the most prominent theories in this area is the Computers Are Social Actors (CASA) paradigm [30]. Research in this area has shown that computers are interacted with socially regardless of whether the computer is perceived to be human-like.

The focus of our research is on whether a player will change their in-game behaviour if they interact with a known NPC which is clearly AI controlled, with different assigned identities. Furthermore we are interested to see if superficially altering the appearance and name of a character is sufficient to assign it a different identity.

3 Concept Game

A 2D, top-down game called Web-War was developed to allow us to investigate our question. The game was played on-line through the browser, built using HTML5, JavaScript and the Phaser.js game engine[3]. The game had 3 character types, the player (a blue tank), the companion (an icon which varied with the

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

identity the companion was presenting), and the opponents (blue tanks). The game was a *horde mode* style game, meaning that the longer the player played, the more opponents would be spawned in the game environment. The basic premise is that difficulty increases the longer the game is played, achieved by slowly increasing opponents until the player is overwhelmed.

In the game the player is tasked with protecting an unarmed NPC companion (character icon) which randomly wanders around the environment. The player character is controlled using keyboard arrow keys for movement (forward, left and right) and space bar to fire. The player can survive 20 shots from opponents, the companion 100 shots, and the opponents are destroyed with a single shot. The companion has no ability to defend itself and the player is only able to shoot opponents.

The view-port to the world is an 800 pixels wide by 600 pixels high canvas. The games world itself is a 2000 pixel square with no obstacles. Below the view-port, a small console displays an avatar for the companion and another console displays distress calls from the companion when under attack.

At the beginning of the game, the player is presented with the following narrative which explains the basic premise of the game:

> ***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.

Importantly, it informs the player of core objective (survive) and the secondary objective (save the companion). Furthermore, it indicates that saving the companion is an optional objective with a small penalty should the player not succeed.

3.1 Companion

The focus of this study is whether a human player is more protective of an NPC that has been assigned a human identity. To evaluate this we created three separate identities:

- AH-BOT 897 - A Non-human robot. (Yellow)
- Timmy - A Human male. (Blue)
- Daisy - A human Female (Pink)

Each of these identities were an implementation of an identical AI. What defined the 'identity' was a superficial change of colour, name, and the alert

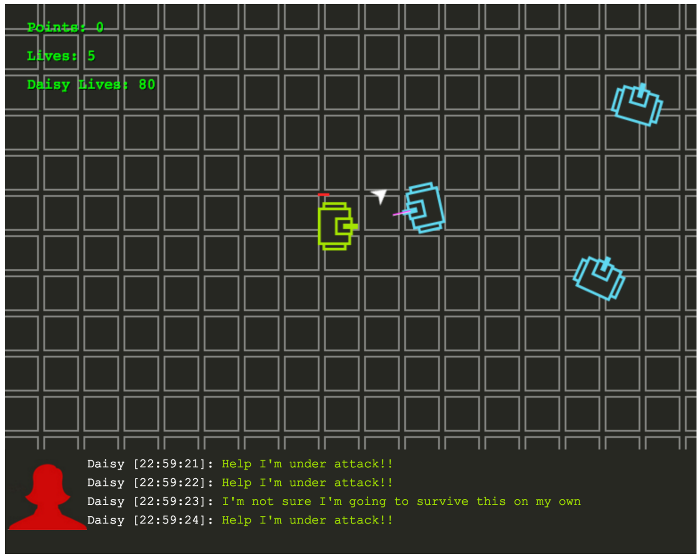

Fig. 1: A screen-shot of the game being played. The player is depicted as a green tank in the centre of the screen. The opponents are the blue tanks on the right. The companion is currently off-screen being attacked, as indicated by its profile image (bottom left) being red. The player is provided with a small arrow (right of player) which indicates the direction of the companion. In the top right of the game window, green text keeps track of game score, the players health, and the health of the companion.

message presented to the player (see Fig. 2). But the characters behaviour in-game was identical.

Each character is powered by an identical wandering steering behaviour [35], which aims to move them around the environment at 60 pixels per second. The companion NPC is a 'dumb agent' and does not react or interact with either player or opponents.

When the companion comes under attack, the user is prompted to help it in two ways. Firstly, the in-game silhouette and the chat silhouette flash red, and a small red arrow appears to direct the player to the location of the companion. Secondly, the chat console displays messages asking for help. While the companion is being attacked there is a 1 in 20 chance that a message will be broadcast to the player.

In games with the robot identity companion a single *** Under Attack *** message is used. This message is designed to be identity appropriate for the robot persona of the character, in contrast to the two human characters which have a selection of emotive of phrases that are selected at random:

- Help, I'm under attack!!
- Please help, I'm taking heavy fire

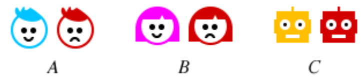

Fig. 2: In-game sprites for the three companions A: Male, B: Female, C: Robot. The icons on the left are under normal conditions. The red icons on the right are under attack.

- 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!!

3.2 Opponent Non Player Characters

The NPCs are depicted within the game as blue tanks, and follow a basic state machine:

Docile While in the docile state, the NPCs wander the map using a simple wander steering behaviour at 60 pixels per second. The wander behaviour is limited to the boundaries of the world.

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 Fig. 3), the NPC enters the alert state. In this state, it will stop moving forward, rotate and fire towards the player.

Seek When the player or companion exits an enemy's vision cone, the enemy enters a seek state. The seek state prompts the NPC to increase its speed and move towards the last position it saw its target. The vision cone is also doubled in length in this state.

4 Data Collection

The game was released on-line and promoted through social media, including Facebook and Twitter. To promote gameplay (and in keeping with popular on-line 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 analyse gameplay behaviour. 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. The player gained 1 point for each opponent tank it destroyed.
2. **Game Duration** Recorded the length of the game in milliseconds.

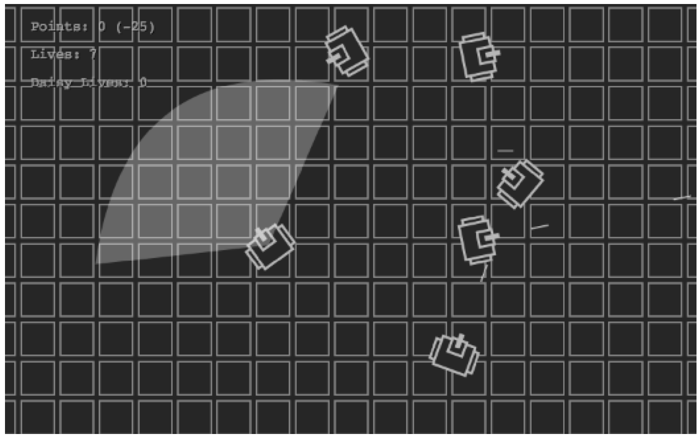

Fig. 3: The opponent will react to the companion or player if it enters its vision cone (highlighted on the far left opponent).

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.

Furthermore, web analytic tools were used to track general data such as unique visits to the game, and the locations of users.

5 Results

The game was played 173 times by 78 unique visits, resulting in an average 2.2 plays per user. Of the unique visits, 59 were from the UK, 11 were from the USA, 8 were from other countries. The companion was selected at random in each game, the Robot identity featured in 57 games, the female character in 47 and the male character in 69. The data collected represents games played between 2015-04-02 and 2015-04-26.

The H test, or One-way ANOVA developed by Kruskall and Wallis [19] was used to establish statistically significant differences between data items. When comparing variance between the companion type along with distance, time to engage, and companion survival. These values are:

- Distance: $4.7349 * 10^{-18}$

- Time To Engage: $8.3638 * 10^{-13}$
- Companion Survival: $6.6641 * 10^{-4}$

In all cases we can reject the null hypothesis when using a p-value of 0.05/3 and can see that there is statistically significant variance in the data.

In the following subsections, we will discuss the analysis of the data captured in relation to our research question. For reference, the mean values for the metrics provided in the previous section are shown in Table 1. These values are averaged across all games for each companion type.

Table 1: Mean values for all games of each companion type.

	Distance	**Turn Time**	**Engage Time**	**Score**	**Duration**	**Survival Rate**
Male	285	90	227	66	66	88
Female	215	50	206	55	80	91
Robot	604	333	1258	70	74	64

5.1 Player Behaviour

To gain insight into player behaviour the score, distance and survival data can be seen in Fig. 4.

The first insight we gain from this plot is that there is a correlation between companions dying and players maintaining a greater distance from them. The mean distance where the companion died is 769.6, in comparison, the mean score where the companion survived is 281.5. This can be expected, as the greater distance exposes the unarmed companion to greater risk of being shot.

The next clear correlation is that all high scoring outliers selected the tactic to neglect the companion (as noted by the average distance data). This resulted in the death of all companions in games scoring over 150 and this is consistent across the majority of games. The mean score for games where the companion died is 118.2 while the mean score for games where the companion survived is 66.3. Meaning that in games where the companion died, the player scored higher.

Fig. 5 shows the relation between average distance and the reaction (or turn towards time) of the player. As it can be seen, there are a number of plays in which the turn towards time is 0, these cases can be categorized in 2 ways.

- Companion consistently within the player's safe zone. As outlined above the companion will only call for help when it is not within a 200 radius of the player. In these cases the companion will have not been outside of this radius and therefore never called for help
- Player did not react at all to the companion's calls for help. In cases where the companion does leave the 200 radius an average turn towards time indicates that the player never responded to the companion's calls for help.

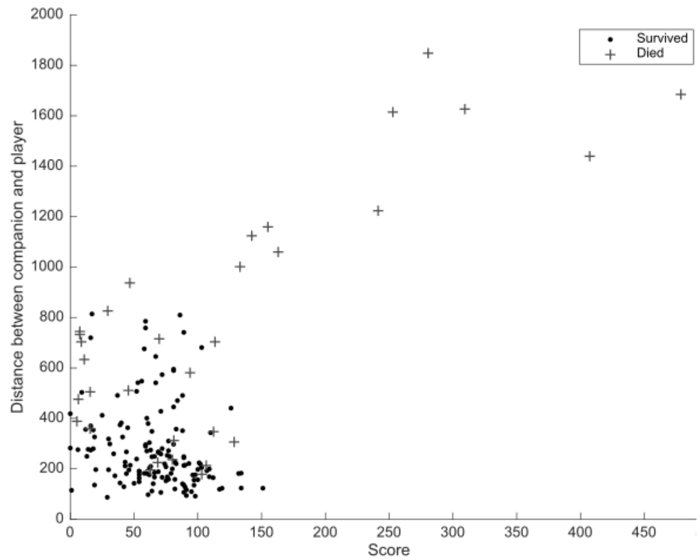

Fig. 4: A plot detailing the score and distance between the player and companion in each game. A cross icon indicates that the companion died and a spot indicates that companion survived. The companion died in 32 games and survived 141.

There are edge cases where the average distance is below 200 but there were times in which the companion was out of the safe radius. These cases do include a turn around time on the plot. Although a small distance was maintained throughout the game there were moments in which the companion ventures far enough away to call for help.

In the following subsections, we will look at the data split across the three companion types.

5.2 Game Scores and Duration

The game score was based on a count of how many opponent tanks the player destroyed, this data is visualized in Fig. 6. The game duration is based on a timer that starts when the game begins, and ends when the player is destroyed, visualized in Fig. 7.

The game scores for all three companion types fall into a similar distribution. This indicates that if there were changes in the players behaviour, it did not have significant impact on the game score. However, it is worth noting that the robot companion had a number of higher scoring outliers.

The first indication of differing player behaviour comes from the game duration data. The games featuring a human identity companion were generally longer. However, considering the overall scores were similar, we can identify that

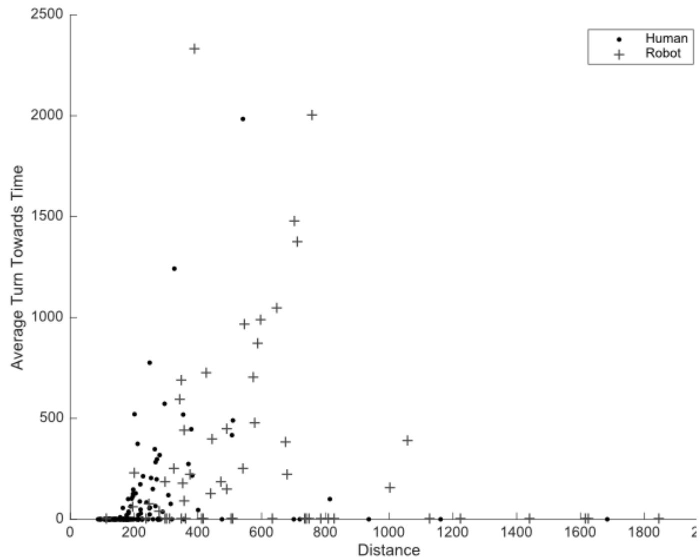

Fig. 5: In this plot we show the average distance between the player and the companion compared against the average time in which a player reacted to the companion's calls for help.

it took the player longer to achieve a comparable kill count when paired with a human identity companion. This suggests that the player engaged in a more cautious playing behaviour when paired with the human identity companions.

5.3 Survival Rate

The survival rate data indicates the percentage of games where the companion survived the game, outliving the player. The provides insight into how actively the player protected each of the three companion types.

Fig. 8 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.

Fig. 8 indicates 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 the least number of games (64%), indicating that the player protected this companion type the least.

5.4 Distance

The distance data gives an indication of whether the player remained close to the NPC or whether they roamed away, and therefore an indication of how

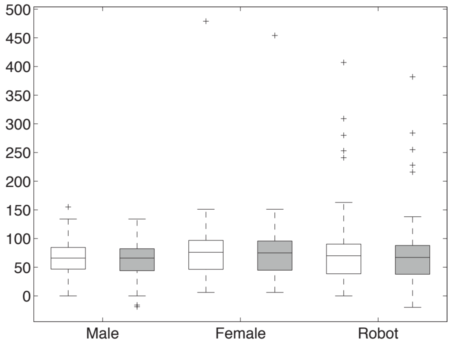

Fig. 6: Distribution of scores from each game for each companion type. This includes the raw score (white) and adjusted score based on companion survival (gray box).

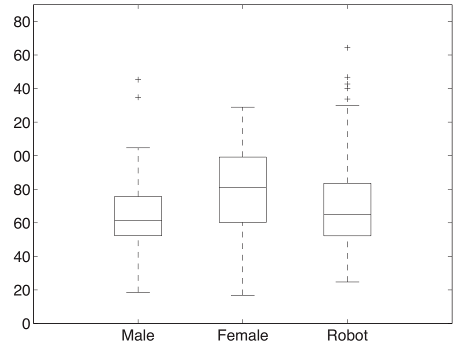

Fig. 7: Distribution of game duration across for each companion types. One outlier (likely a result of browser error) has been omitted as it heavily distorts the graph.

protective the player was of each companion type. An overview of this data for each companion type is provided in Fig. 9.

If the distance was 300 or less the player and companion would have been on screen at the same time. An average distance greater than 300 meant that the companion was usually off-screen.

The player stayed significantly closer to the companions with a human (male or female) identity. The median distances for all games were 225 for the Male, and 156 for the Female. Furthermore, there were a number of high distance outliers for the male companion which can be observed in Fig. 9. By contrast the median distance for the robot identity was 503, which would be over 200 pixels off-screen from the player's perspective.

The data also shows that the player's behaviour was reasonably consistent with the human identity companions, as indicated by the close standard deviation. However, the behaviour was far less consistent with the robot companion.

This data shows that the player typically kept the human identity companions within the visible game area. For the purpose of this study we can interpret this as protective, guarding behaviour. However, they showed less concern for the robot identity NPC. On further investigation, we can also see that the players tended to keep the female identity closer (on average) than the male.

5.5 Rescue Response

During the game if the companion was attacked while outside a 200 radius 'safe zone' it called for help from the player. This created a *rescue event* which indicated that the companion was under attack and that the player was too far away to provide immediate protection from the attack.

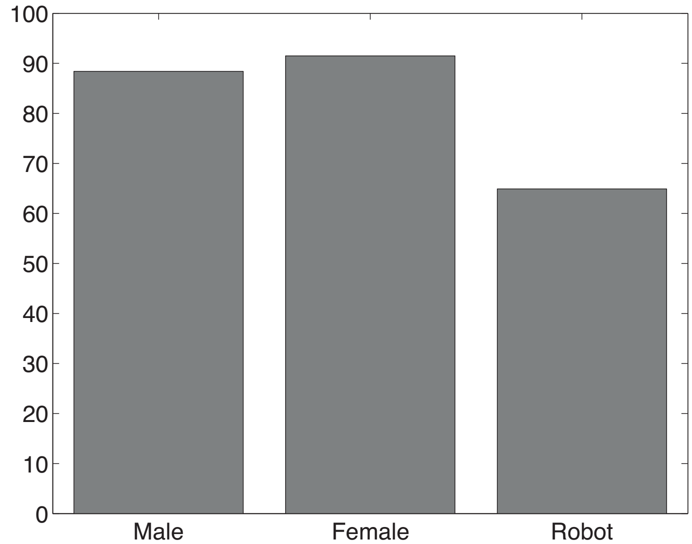

Fig. 8: Survival rates (out of 100%) for the 3 companion types. Both the Male and Female companions survived around 90% of games. The robot companion survived significantly less at 64% of games

The rescue event triggered two timers to start, these timers measured two further events which help to analyse the player's response to the companion. One timer recorded the length of time it took for the player to turn towards the companion (*Turn towards* time). The player was considered to be 'looking' at the companion when it was within a 10 degree vision cone from the playing character. The second timer measured the time that it took for the player to engage with the enemies that were attacking the companion. The *time to engage* was measured as the time it took for the player to move within 200 of the companion. Thus allowing the player to attack enemies and protect the companion. Fig. 11 provides a visualisation of the parameters involved.

In Fig. 10 we show the metrics used to establish the *turn towards* and *time to engage* times for the rescue event. As we can see the responses to the male and female identities are considerably shorter than that of the robot.

As we have established in subsection 5.4 the player is typically further away from a robot companion than a human one. So this increase in *time to engage* is likely a consequence of the player being further away and therefore having to travel further to get to the companion.

Turn towards time is independent of *time to engage* as it is not dependent on the distance between the player and companion and requires a change in heading to respond. We would expect, therefore, for the three *turn towards* times to be similar to each other. As we can see this is not the case, the time for the player to turn towards a robot companion is significantly greater. This indicates that the

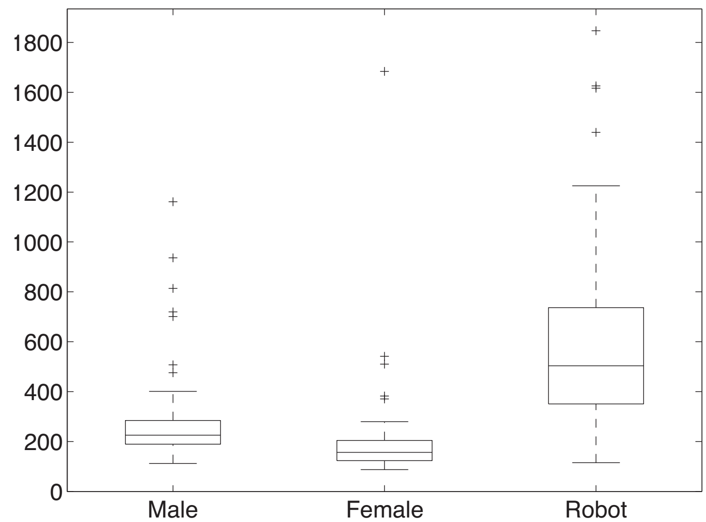

Fig. 9: The average distance between player and companion, for each companion type. Note how both male and female have a median distance of under 300. By comparison, the median distance for the robot companion is 503, which means that on average the robot identity companion was outside the player's visible area.

player is not responding with the same urgency to the robot request as it is to the human ones. It can also be observed that there is also an increased reaction time between male and female companions, which indicates a more protective attitude with the latter.

5.6 Shots Fired

Each time an opponent fired a shot it's target was recorded (the player or companion). The average number of times each companion type was targeted in a game is visualized in Fig. 12.

This indicates that the player was always targeted less often than the companion. We would expect this trend, as while the player is able to actively avoid the opponents, the companion simply wanders the environment and doesn't react to attacks, making it an easier target.

There are two further observations we can make from this data. Firstly, the robot companion was the intended target of more shots than either of the human identity companions. This provides further evidence that the player was more protective of the human identity companions, destroying nearby opponents before they were able to actively target the companion. Put simply, the human identity companions appear to have been valued higher by the player than the robot identity companions.

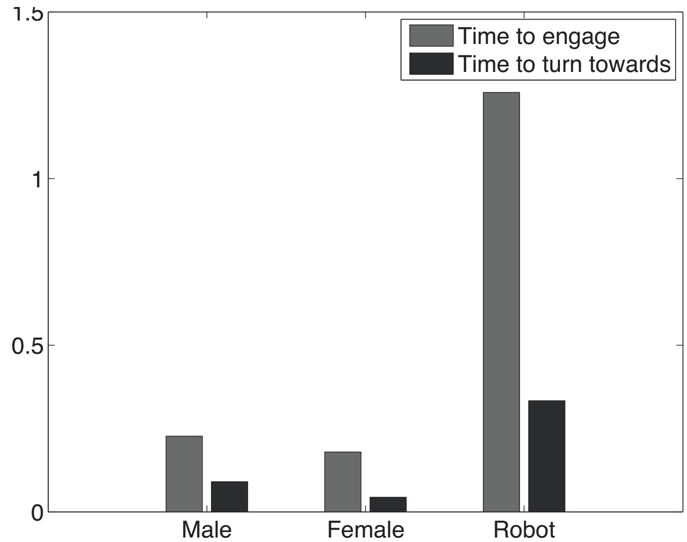

Fig. 10: Visualisation of reaction times. We would expect and can observe the distance between player and companion influencing the *time to engage* times. If the player was responding to calls for help with the same urgency we would expect *turn towards* times to be similar. As can be seen, this is not the case for the *turn towards* times to the robot companion identity.

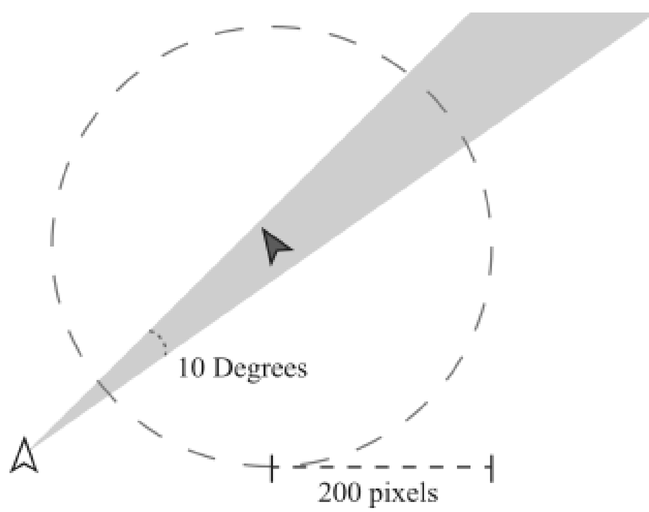

Fig. 11: The rescue response data represents two time spans. The first is the time it took for the player (white chevron) to turn towards the companion (grey chevron). The player is considered to be 'looking' at the companion when it has assumed a heading within 10 degrees of it. The second is how long it takes for the player to enter the 200 'safe zone' radius

Secondly, constant with other data items (such as rescue response, and distance) we note a slight distance between the male and female companions. The female companion was the intended target of less shots overall than the male. Furthermore, the average number of shots targeting the player when paired with the female companion was 20, the exact amount required to kill the player. This provides some evidence that the player placed a higher priority on protecting the companion than their own survival.

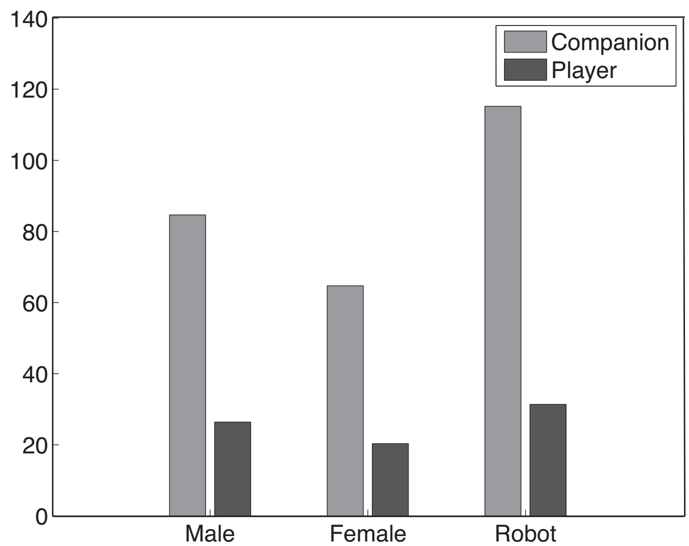

Fig. 12: Average number of shots fired by the opponent tanks with either the companion or player as the intended target.

5.7 Limitations

A limitation of the study is the way the data was collected. A decision was made in the design of the game not to collect specific data about the player (such as gender), as to be non invasive and consistent with other on-line games. Due to this it is hard to establish items such as gender effect in this study. However, further investigations have indicated that there is no gender effect. Table 2 outlines the results of the Kruskall and Wallace's H-Test across our game metrics. This data concerned male, female and androgynous identities and there fore warranted a corrected p-value 0f 0.05/3 according to Bonferroni correction, this further study .

This is based on 218 plays of a second experiment, with the following breakdown, 138 Males, 59 Females, 6 who identified as 'other' and 15 who preferred not to supply their gender.

Table 2: Gender Effect P-Values

Distance	**Survival**	**Reaction**	**Score**	**Game Time**
0.1550	0.7283	0.0508	0.5771	0.1360

Furthermore, the majority of the plays came from the UK, which makes it hard to establish whether the Loki effect is cross-cultural. Another 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?

Secondly, the games objective was very specific, where the player had to survive as long as possible, and could choose whether to protect the NPC or not. The AI controlling the NPC was also very simple, and it had no ability to defend itself. Future studies will need to investigate a larger number of game types with a variety of active and passive NPCs.

6 Conclusion

In the introduction to this work we asked whether superficially changing the identity of an NPC has an impact on player behaviour. To investigate this question we developed a web based horde-mode survival game. In this game (called Web-War) the player is given the main objective of surviving repeated attacks from opponents, and the secondary objective of protecting an NPC companion. The identity of the companion was randomly assigned as either male, female or robot. The game was publicly released on-line and played 173 times.

The data from this game provided evidence that the players treat NPCs differently based on their perceived identity, despite the underlying AI being identical. Specifically, the players were more protective of human identity than robot identity NPCs. Furthermore, we noted that the players were slightly more protective over the female identity companion than the male.

6.1 Future Work

Our research so far has highlighted a need to establish a standard and useful method for understanding behaviour during the time-line of a game. At present the most robust method is to video the game and watch the playback but this does not allow for easy comparison across different game-plays. We would like to look into existing and novel ways to present a games data which would be more robust and establish a standard for this type of research.

Although our experiments have yielded distinctive results, we also wish to carry out further experimentation with many different types of game to confirm whether our results are independent from the experiment itself. For example, we may draw different conclusions if the experiments were carried out in a different in-game environment. As a result of this, we are developing an open-source toolkit and benchmarking system for video game experimentation. This benchmarking system will provide a modularised approach to experimentation, and will help decouple the dependence between the NPC AI and the game itself. We aim to use this benchmarking system to evaluate the observed effect with many different types of game, in-game environments and NPC types.

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