

Evaluation of NPC Behaviour in a Simulated Video Game Environment Through Player Perception

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Abstract: This paper explores the relationship between non-player character (NPC) behaviour and the effect it can have on the player and their overall experience of the video game through a survey-based evaluation. The experimental part of this paper describes the process of creating a simulated video game environment in Unity, a cross-platform game engine, with the addition of Adventure Creator, a Unity toolkit. It showcases certain NPC behaviour and analyses the results of the survey that was conducted after the players finished playing the simulation. The survey was completed by 23 participants (n=23). Convincement, interactivity and consistency of the behaviour were the most mentioned qualities when it came to positive experiences, while unclear and unnatural behaviour compounded with technical difficulties greatly diminished the player's experience. The participants tended to assign meaning, intentions and even emotions to relatively simple programmed behaviours, emphasizing the impact of the player's interpretation when it comes to interacting with an NPC and showing that even the simplest variations in behaviour can greatly impact the way it can be perceived and interpreted; thus it was concluded that NPC behaviour has an important role in the process of shaping the experience and opinion of the player. This study contributes to the ongoing discussion of the ways that NPC behaviour can be developed to create an impactful impression on the player and challenge the ways a player can interact with the world of the video game.

Keywords: non-player character (NPC); player experience; video game; NPC behaviour; player immersion; interactive systems; video game design; user perception.

1. Introduction

Although the term "non-player character", or NPC, is considered mostly a video gaming phrase today, it appeared before video games even existed - in role playing games such as Dungeons and Dragons. NPC refers to any character in a game that is not the player themselves and whom the player cannot control, only interact with [1]. The purpose of non-player characters varies depending on the type of video game they are in and how they are meant to interact with their environment and the player. They can be more akin to decorations, there to visually enrich the world around them, while others can greatly impact the gameplay and have important and frequent interactions with the player [2]. If done well, the player can easily and quickly become immersed in the world of the video game, increasing the likelihood that they

will remain engaged and continue playing even multiple times after completing the game, since each playthrough can offer a different experience [3]. However, when done incorrectly, the player can get frustrated to the point of quitting the video game altogether. While the players generally prefer a challenge, if it arises due to bad game design (which can be very apparent in the behaviour of the NPCs) it will almost certainly turn the player away from playing the game [2].

While designing a well implemented NPC, it is important to consider the perception window. Meaning that the non-player character does not have to be intelligent and run by a plethora of complicated algorithms; they just need to seem intelligent. Not all processes need to be visible for the behaviour to be executed properly. Additionally, context and well thought out game mechanics can work in tandem to

create the perception of intelligent behaviour. In some cases, creating a complex infrastructure is significantly less efficient and effective than simply playing the right animation at the right moment [5]. The focus must remain on the perspective of the player and the way they will see and explore the environment.

It is important to show the motives of non-player characters so they can give the impression of being logical and capable of making intelligent decisions [6]. Furthermore, adding certain changes in behaviour and dynamics greatly increases the believability of the NPC. If an NPC acts a certain way with no changes and variations, they will be perceived as acting unnaturally and seem artificial, which can often shatter the player's immersion [3]. The question this paper poses is if the differences in NPC behaviours have a significant positive impact on how the player will experience and perceive the game. In the context of this study, realism refers to the extent to which NPC behaviour appears consistent, believable, and aligned with expected reactions within the game world, regardless of its underlying technical complexity. Emotional depth refers to the perceived ability of NPCs to express or suggest emotions, intentions, or personality traits through their behaviour, dialogue, and interaction patterns, as interpreted by the player.

1.1. Related Work

A growing body of research has examined how NPC behaviour influences players' experiences in video games. Much of the research focuses on the presence and design of NPCs as spectators or companions, and it has been shown that the presence of NPC audiences with feedback can significantly enhance players' performance and immersion [7]. Furthermore, other research has explored how the perceived personality and interaction style of non-player characters affects player engagement and behaviour. Investigations into player preferences for NPC interaction methods reveal that more dynamic and flexible dialogue systems tend to be perceived as more engaging and satisfying than predefined dialogues [8]. Other work highlights how believable, human-like NPC behaviour contributes to perceived authenticity and immersion in game worlds, whether through advanced AI or traditional logic

systems [9]. Emerging studies indicate that adaptive NPC reactions to player emotions and behaviour can strengthen attachment and engagement, though they raise ethical considerations around data use and privacy [10]. These findings are very diverse in their approaches, ranging from social NPC roles to advanced AI dialogue and emotion modelling. They reinforce the idea that NPC behaviour can significantly shape player experience.

2. Experimental Part

The experimental part describes the process of planning and creating a simulated video game environment with non-player characters that display certain behaviours, along with the survey that participants would fill in after completing the simulation.

2.1. System Architecture and Environment Design

The term simulation refers to a simple scene whose main purpose is to display NPCs with different behaviours and interactions available to the player. The simulation was made in the style of a retro point-and-click video game with simple 2D pixelated graphics. The sci-fi theme of a spaceship prison was chosen due to personal preference and due to the fact that making the simulation be set in the distant, unfamiliar future makes it easier for the player to immerse themselves in a world that cannot be compared to real life, which in turn makes them more receptive to the suggested personalities and roles of the characters.

The simulated video game environment was made in Unity (ver:6000.1.13f1) on a PC running Microsoft Windows 10 (64-bit), a free software for making videogames of various genres. Unity is built around a modular, component-based architecture. Every entity in a scene is a game object, and behaviour is defined by attaching components (transform, collider, scripts). Its architecture separates editor and runtime environments: the Unity Editor provides asset management, scene authoring, and build pipelines, while the runtime executes platform-specific builds. Additionally, Adventure Creator was used, a Unity toolkit specifically designed for point-and-click games with 2D or 3D graphics made for designers and artists, requiring little to none prior coding

knowledge. Its intuitive system for adding both player and non-player characters into the game, the Character Wizard, and its "ActionList" component allows for creating behaviours through creating behaviour trees or through editing the preset character settings by adding dialogue and determining when and under what conditions the dialogue will occur. For the visuals, free assets from the Unity Asset Store were used, but with the style of the simulation in mind, since consistency is crucial to achieve immersion.

Firstly, a 2D game template was created using Adventure Creator, determining the basic mechanics of the game, such as player movement and how the game camera is positioned.

As for the visuals, the background is made up of a combination of assets and custom-made background elements to make a spaceship prison scenario. It was important to make it sufficiently full of details while also not cluttering the scene with needless information. Next, the player character named Captain is created, assigned a sprite and given the appropriate idle and moving animations through the Adventure Creator's system for setting conditions for certain animations to play (specific time, after a specific condition has been met, etc.). Lastly, it was tested if all the elements are correctly placed and to make certain that the player cannot move through what they are not supposed to or disappear off screen.



Figure 1. The simulation in Unity.

2.2. NPC Behaviour Design and Implementation

Three non-player characters were added, each displaying a certain type of distinct behaviour. In order to immediately visually communicate to the player what behaviours could be expected from each of the characters [5], the appropriate sprites were chosen.



Figure 2. The NPC sprites; Angry Monster, Scared Monster, Slime.

The NPC behaving in an aggressive manner, called Angry Monster, is a wolflike monster that

looks intimidating and violent, and it will chase the player once they approach. It communicates to the player what kind of behaviour can be expected from it. To add more complexity to the character, it can be reasoned with, after which it will stop pursuing the player. If the player tries to engage with it again, it will ignore them. Angry Monster remains idle at its starting position until the player enters the area defined by the HotSpot object that, once triggered by entering it, in turn triggers the aggressive behaviour. Careful consideration was taken when determining the size of the Hotspot element, as it shouldn't be too big (it can cause confusion in the player as to what triggered the NPC attacking) or too small (the NPC seems blind and unintelligent).

To activate the Hotspot element, the ActionList component was added, a part of Adventure Creator that allows for the creation of behaviour trees, with the starting state being waiting

and playing the idle animation. After, a variable named “NPCIsCalmed” was added, with its value being either TRUE or FALSE. The value is considered TRUE only after the player has spoken to the NPC and went through the few lines of dialogue that occur, where the misunderstanding is cleared up. Through the behaviour tree the NPC checks if the variable’s condition

is met, and if it is then it executes an action according to the assigned sequence. The simulation does not have a health system or any battle mechanics, but they are not needed to create the illusion of a dangerous entity, visually and through the implications and perceived intentions of its behaviour [11].

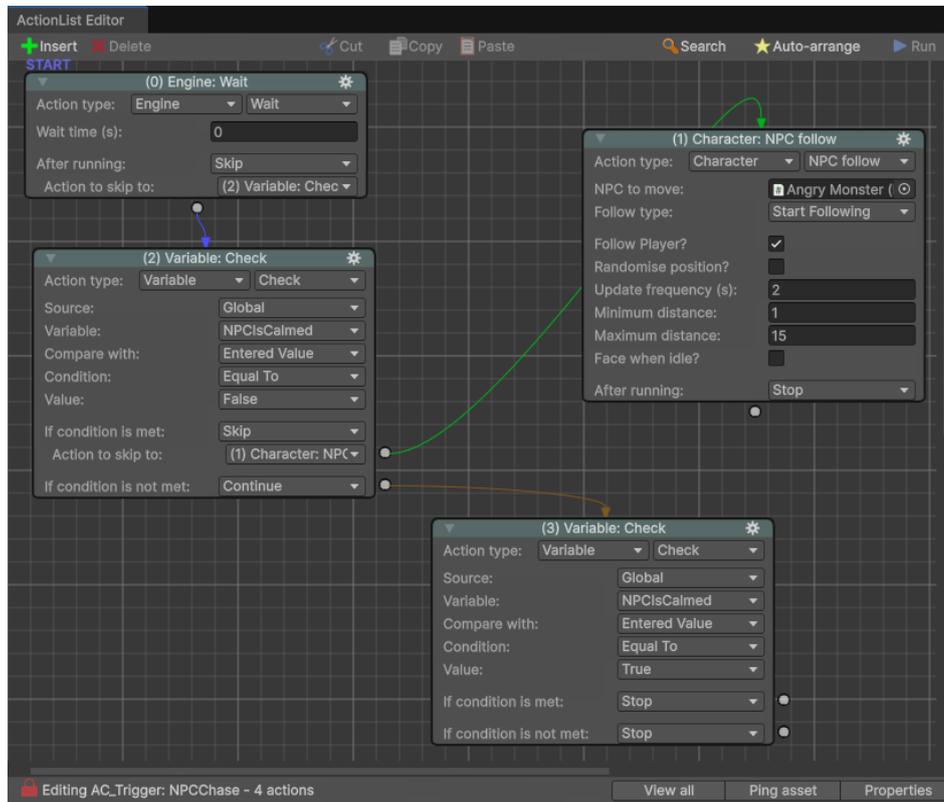


Figure 3. The ActionList component for Angry Monster behaviour.

Next, an NPC displaying fearful behaviour, named Scared Monster, was added. Both through short dialogue and behaviour it shows that it is scared - when approached by the player, it moves away and continues to move away as the player moves closer towards it.

For this behaviour a C# script was needed, since Adventure Creator did not have sufficiently specific options to create such behaviour. In the script, parameters were set to ensure precise movement of the NPC (speed, distance). Additionally, every 0.2 frames the NPC will check if the player is in their set “reaction zone”, and it will not return to its starting position until the player is out of the zone. The speed of fleeing was set to be faster than the speed of returning to the starting position, giving the impression that the monster is displaying cautious behaviour.

Additional dialogue was added to make the character seem more complex and to add some depth to it. If talked to before calming Angry Monster, it will repeat basic dialogue. If Angry Monster has been calmed, it will change its dialogue line. Humour was added to make the character appear more natural and realistic, enabling the player to easier connect with it.

Finally, a non-player character displaying friendly behaviour, named Slime, was added. It acts passively at the beginning and can only be interacted with through dialogue, not moving away or approaching the player. It tells the player it fears Angry Monster, and after Angry Monster is calmed, Slime follows the player.

To create that behaviour, a new ActionList component was added in Adventure Creator, determining the initial state (idle animation) and what lines of dialogue will happen once

approached, depending on whether the NPCs-Calm variable is considered TRUE or FALSE.

Visually, this NPC is much smaller and simpler than the other characters, making it appear non-threatening. Furthermore, its behaviour does not only rely on the player, but also on

other NPCs, which makes it seem more complex and realistic while also adding some variety [11].

Lastly, the game was built using the WebGL extension, allowing it to be published on the Unity website for anyone to play.

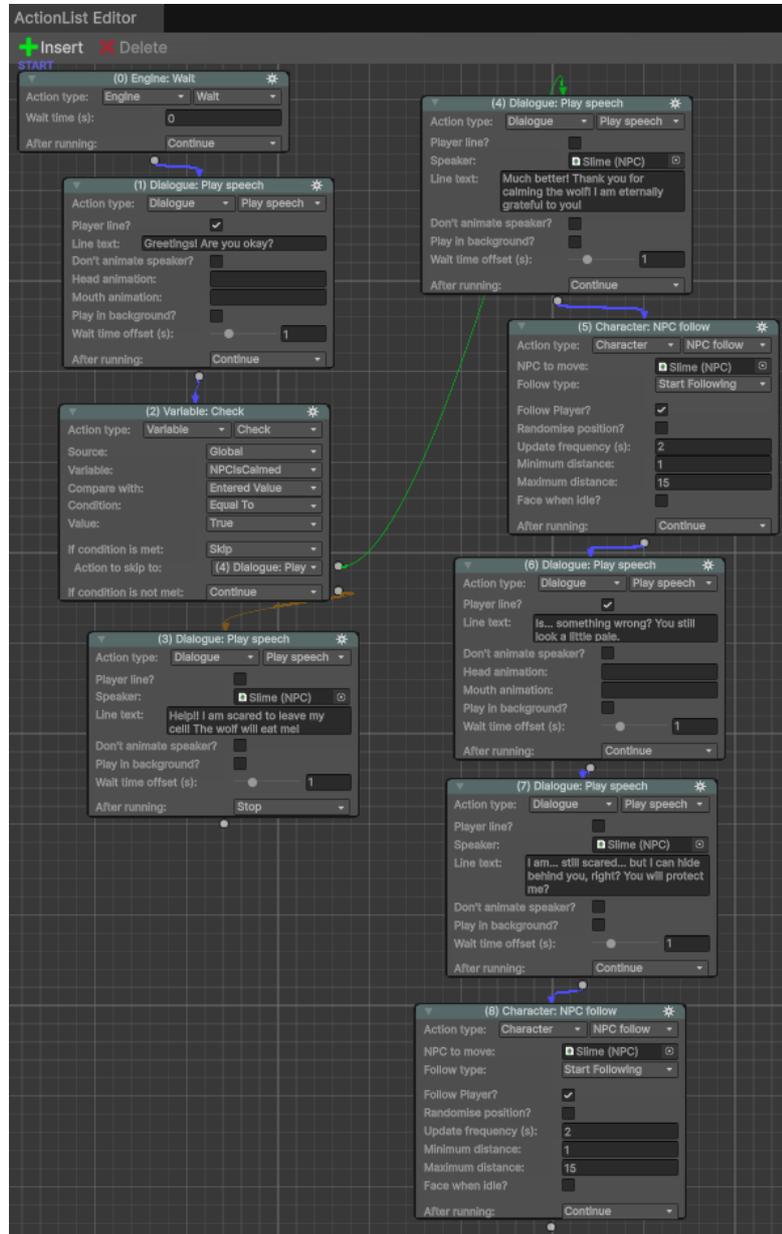


Figure 4. The ActionList component for Slime behaviour

2.3. Survey Methodology

The goal of the survey was to analyse how the players experience non-player characters. The focus was on general preferences when it comes to NPCs, evaluating the quality and believability of the behaviour and the perceived personalities of the characters. It consisted of

the introductory part, the part with general questions and the final part that could only be answered after the simulation has been played through. The purpose and goal of the survey were explained along with giving the participants additional information about the whole process of completing the survey. For how long the simulation was meant to be played was left

intentionally vague and left for the player to decide. Some basic guidelines were set, but a lot of freedom was given to the player in order to enable them to explore as they naturally would and to interpret the world and the situation by themselves. In this study, realism and emotional depth were evaluated as subjective perceptual qualities, based on the participants' interpretation of NPC behaviour rather than objective technical measures.

In the first part of the survey the participants answered general questions to establish the demographic and age range of the respondents through Likert scales (rating, frequency, quality satisfaction), as well as their gaming habits and their already established opinions on NPC characters in the games they usually play.

In the final part, the participants were asked to evaluate the behaviour of the three NPCs from the simulation through various questions about the believability of the characters and how immersed they were in the world. They were also asked to describe any factors that might have affected their experience.

The survey was available for 3 days on Google Forms and the sample method that was used was non-probability sampling, specifically voluntary response sampling. The link was given to friends and acquaintances who play video games, as well as posted on Reddit on the /survey subreddit, to make the demographic more varied and get input from both casual and more intense players.

3. Results and Discussion

The survey was initially completed by 24 participants, but one had to be removed due to not filling in the survey correctly. Most of the participants, 65.2%, were in the age range of 26-30 years, while 26.1% of them were in the 18-25 age range. 78.3% of the participants were male and the remaining 21.7% female. 52.2% played video games on a regular basis, 39.1% a few times a week and only 8.6% even less than that. Based on these results it can be concluded that the variety in the sample was satisfactory.

When asked to choose their preferable video game genres, the majority chose role playing games and adventure games. After them came strategic games, which were represented in almost the equal amount as action games and simulator games. Platformers and sports video games were the least preferable genres. Although all the mentioned genres can (and often do) contain non-player characters that have an impact on the gameplay and the player experience in a way characteristic to each genre, it is expected that the participants chose role playing and adventures games over the other genres, as they put great importance on NPCs and the player is encouraged and expected to interact with them, as opposed to, for example, sports games, where there is usually significantly less focus being put on the world in which the video game takes place [12].

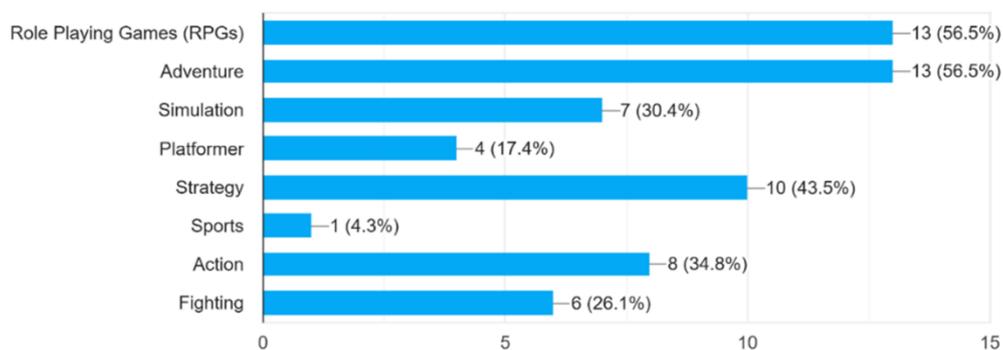


Figure 5. Players' preferred video game genres.

Next, the participants were asked about their opinions and relationships with the NPCs they usually come across in the games that they play. 70.8% of participants said the games they play contain NPCs, while 75% of them said they

interact with the NPCs they encounter, meaning most players assign them some importance. When asked what qualities they value the most in their NPC interactions, the most chosen answer was interactivity (30.4%), then

unpredictability (21.7%), realism (17.4%) and humour and emotional depth were the least chosen ones in equal amounts (both 13%). These results show that no answer prevails, which supports the idea that the impression the NPC will leave on the player is highly individual and there can be no behaviour created that will have the exact same effect on every player [13], showing how subjective the players' experiences really are.

In the final part of the survey the participants were asked to evaluate their experience with the simulation after playing it to their liking. Firstly, to get the general idea of how successful the simulation was, the participants

needed to evaluate their overall experience with the simulation. While the ratings differ, the two highest ratings were the most chosen, with the combined percentage of 60.9% of the participants, making the simulation a success. Additionally, they were asked to rate the intuitiveness of the gameplay on a Likert scale from 1 to 5 (1 being the least and 5 being the most intuitive). While most gave it high scores, the two top scores being chosen by a combined 65.2%, the average score being 4.6, the score would likely have been lower if the number of participants who play video games often was lower, since, for someone with gaming experience, the gameplay needed no explanation [14].

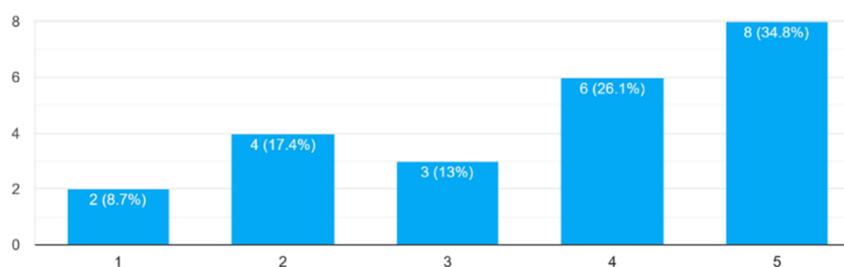


Figure 6. Players' overall experience with the simulation.

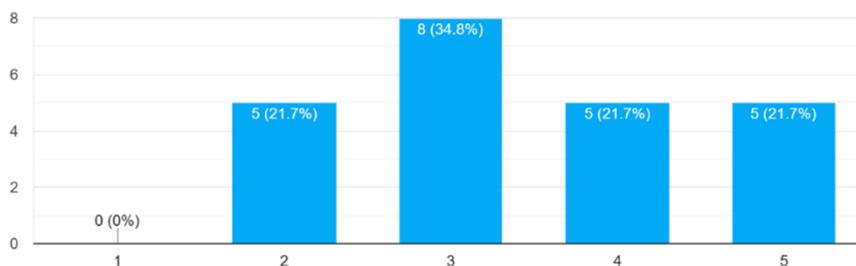


Figure 7. The general rating of the behaviour of non-player characters.

Next, the same 1-5 Likert scale was used to rate the behaviour of the three non-player characters the participants had the chance to encounter. The rating with the most votes was 3/5, chosen by 34.8% of the participants, averaging out to 4.6. No one chose the rating 0, and the rest were equally represented with 21.7% of the participants voting for each one. This result indicates that the participants opinion and experience was significantly split and reinforces the idea that the impact that non-player characters have on the player and the opinion that the player will form is highly individualized and varies from person to person, making it impossible to please every type of player [13]. The fact that the majority rated the behaviour of the NPCs a 3 out of 5 shows that the players

most likely encountered some problems or discovered, or rather perceived, some behaviours that made them lower their rating. It should be taken into account that not every player will interact with an NPC in an expected way, and although the thought put into the character's behaviour makes a great impact and can steer the player's opinion and experience how the developer intended, the player will still personalize their experience, most likely unintentionally, and view it through the lens of their own life experiences, their own personality and relationships in real life [15]. This shows that when making a game, it is crucial to study the target audience and understand their habits and lifestyles.

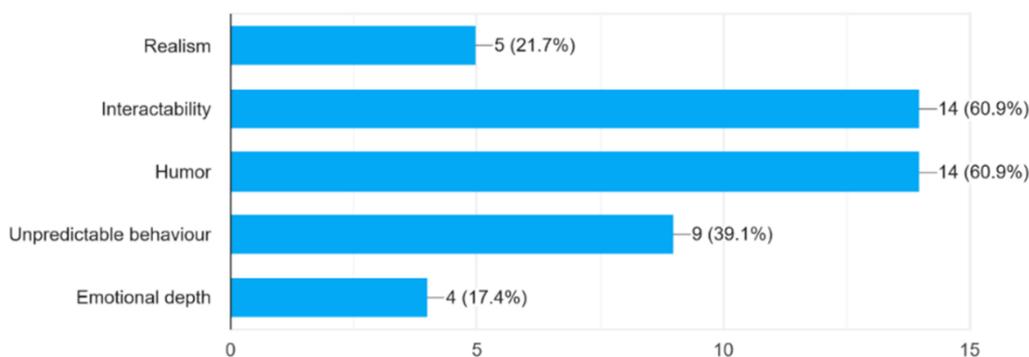


Figure 8. The qualities that the players perceived in the NPCs.

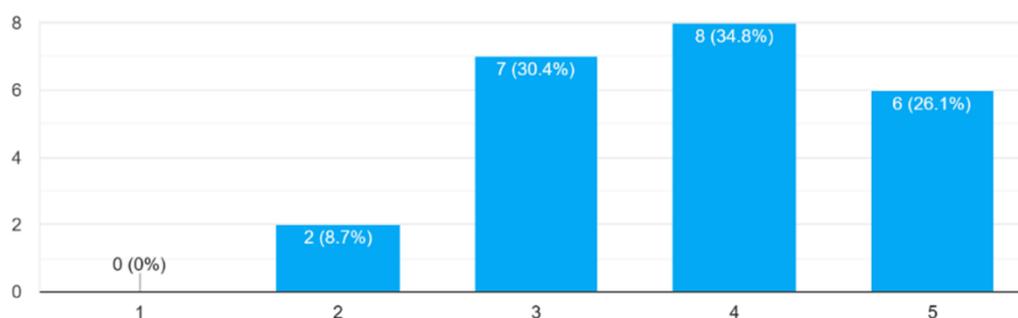


Figure 9. Players' ratings on how big of an impact the NPCs had on their gameplay experience.

To further analyse the exact reasoning behind the ratings given, specific questions about the participants' experience were asked. When asked a multiple-choice question of which of the before mentioned NPC behaviour characteristics the NPCs in the simulation had, 60.9% chose humour, 60.9% chose interactivity, 39.1% unexpected behaviour, 21.7% realism and 17.4% chose emotional depth. It was expected that the least number of players would choose emotional depth, since the simulation was short and had a light-hearted tone. Non-player characters with great emotional depth require more time to create and are very unlikely to successfully come across as such in a short simulation [16]. Furthermore, humour and interactivity were the most notable qualities that the players chose, which is a positive result because those qualities were also highly desirable when it came to previous questions about video games in general. Realism was unsuccessfully implemented, and unpredictable behaviour was a likely combination of possible technical difficulties and some unexpected behaviours that may have occurred. Although the simulation was adequately tested before being published, it's impossible to predict every way a player might interact with the video game, which is precisely why video games are usually

play tested by a large group of players before being published.

When asked if they could differentiate the behaviours and personalities of the NPCs, 69.6% answered "yes", 21.7% answered "somewhat" and 8.7% answered "no". This result means that the intended behaviours were perceived and that the participants took note of the variety of behaviours.

Again, using the Likert scale from 1 to 5, the participants rated the impact that the NPCs had on their gameplay experience. 34.8% of participants chose 4, 30.2% chose 3, 26.1% chose 5 and 8.7% chose 2, meaning that, overall, the NPCs positively impacted their gameplay experience.

Lastly, the participants were asked to describe any behaviours or gameplay mechanics that might have diminished their experience and disrupted their immersion. 65.2% did not encounter any of those issues, but the 34.8% that did cite some collision bugs and irregularities in the physics, as well as the repeating dialogue.

It can be concluded that the respondents felt positively about the simulation and expressed that the behaviour of the NPCs greatly impacted their experience of the simulation. The qualities considered the most well implemented

were interactivity, humour and unpredictability, while realism and emotional depth weren't so strongly perceived. The relatively lower perception of realism and emotional depth can be attributed to the short duration and simplicity of the simulation, which limited the possibility of more complex behavioural and narrative development. Despite that, the different behaviours and personalities were easily perceived by the participants, and it was successfully communicated to them what kind of NPC they were interacting with and what behaviour to expect of them. The amount of interactivity and how the NPC behaviours were connected to each other and the player was noticed and positively received. The participants did notice some unexpected technical issues which negatively impacted their immersion. The limitations when conducting and analysing the survey were the sample size, the availability of diverse participants and the technical limitations of the game, the latter affecting the players' experience and perception of the NPCs.

4. Conclusions

How much and with which NPCs the player will interact with often depends on the player themselves, since some players prefer to play the game in a more straightforward and goal-oriented way, while others choose to explore slowly and give great attention to details, uncovering everything the game has to offer. Empty and non-interactive video game worlds and non-player characters that do not react to and communicate with the player will make the game seem boring, depressing and even uncanny. On the other hand, adding interactivity allows the player to immerse themselves into the game, connect with it and explore it in more detail [3].

The results of the conducted survey confirm the hypothesis that the observed differences in NPC behaviour have a significant positive effect on the players' experience and perception of the game, and that they play a significant role in the process of experiencing a video game. The respondents were easily able to identify the different NPC behaviours and their intended perceived personalities, and their experience of the simulation was positively impacted by the interactions with the non-player characters. This shows that it is important for the player to

feel that the decisions they make and the interactions they have are important and can have influence and purpose. This study contributes to already existing research concerning the ways that NPC behaviour impacts the player, specifically how different types of behaviours and perceived personalities affect the players' immersion and their experience of the game.

4.1. Limitations

This study had several limitations. First, the relatively small sample size limited the statistical power of the findings, making it difficult to generalise them. Additionally, the participant group lacked demographic diversity, which may restrict the applicability of the results across broader gaming populations with varying cultural backgrounds, ages, and gaming experience levels. Furthermore, since the simulated environment was developed by the researcher, who is a beginner in game development, as a result the technical quality and the sophistication of the NPC behaviours do not reflect more advanced implementations, which may have influenced the participants' evaluations. Finally, the study relied on self-reported survey data following a short gameplay session, which may not fully capture longer-term or behavioural aspects of player experience.

4.2. Future work

Future work with larger, more diverse samples and more refined prototypes would strengthen the reliability and applicability of the results. A larger, more demographically diverse sample size would improve generalizability. Further studies could also use more technically advanced and complex NPC behaviours to better isolate the specific effects of different behaviours on the players. Additionally, creating a longer simulated game environment experience could give insight into the long-term effects of NPC behaviours.

Conflict of Interest: The authors declare no conflict of interest.

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