

ENGL 3040 - Business Writing

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Analyzing the Successes, Failures, Challenges, and Future Opportunities of Implementing
Artificial Intelligence in Non-Player Characters Using the Unreal Engine 5

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Executive Summary

This research project will find and analyze different examples of developers or popular games that have implemented Artificial Intelligence (AI) in their Non-Player Characters (NPCs) using Unreal Engine 5 (UE 5). This project will focus on the successful examples, common failures and challenges, and future opportunities for AI enhancement. And using the conclusions drawn from the research, provides insights and guidance on how to approach AI in NPCs for game developers.

Project Objectives

- **Implementation Successes:** Analyze the instances where games have successfully implemented AI within their NPCs using UE 5.
- **Failures and Challenges:** Analyze the common failures of implementing AI using UE 5 in NPCs, and what challenges await developers during the implementation process.
- **Future Opportunities:** Analyze current to future trends and new innovative approaches to AI implementation.
- **Guidance and Insights:** Use the analyzed information from the successes, failures, and opportunities to advise developers about using AI implemented NPCs.

Research

Throughout the evolution of video game design and development, key elements of these games have been modified and advanced to increase immersion and player engagement. One of these elements being NPCs or Non-Player Characters. An NPC is a character in a game that is not controlled by the player and is instead programmed into the game. Its purpose is to add depth to a game's world with roles ranging from delivering information to the player or to populate a background. UE 5 or Unreal Engine 5 is a video game development engine created by the video game developer Epic Games. It is a very powerful tool that allows creators to make games with hyper realistic and detailed objects, characters, and worlds.

Implementation Successes

Senua's Saga: Hellblade II

Abstract:

"Senua's Saga: Hellblade II" is a deep psychological horror game that was created by the developers Ninja Theory. To create a very personal and immersive gameplay, the NPCs throughout the game are advanced AI-driven algorithms.

Applications:

The gameplay of "Senua's Saga: Hellblade II" relies heavily on the role of NPC's and how they are implemented into the game. To ensure realistic NPC actions and behaviors within the environment, the developers used a tactic called motion matching that makes sure the NPCs have constant natural movements and animations when it comes to interacting with elements in their environment and what their current emotion was. When it comes to NPC's interacting directly with the player, circumstantial AI algorithms are used to allow the NPCs to react appropriately to the decisions of the player and other environmental events. This allows for the narrative of the story to be deeper and more dimensional to the player since this gives them more meaningful and dynamic interactions. An AI algorithm that is not implemented on the NPCs directly but instead aids them in their interactions with the player is an advanced audio integration. Where audio is processed and then immersed into the game as audio cues based on certain interactions with the NPC. Reinforcing an emotional impact the player has with the in game character.

Evaluation:

Feedback from players indicated that there were very high levels of player engagement with the NPCs through advance conversations from both parties. In game analytics were able to track higher than expected player and NPC interactions throughout the game.

CyberPunk 2077

Abstract:

CD Projekt Red's "Cyberpunk 2077" was originally made and released using REDengine. But when UE 5 was released with its advanced AI technology, the developers decided to use what the engine offers to slowly add elements of UE 5 to future updates to the game. Specifically for enhancing the actions and behaviors of NPCs to create a more immersive experience.

Applications:

CyberPunk's gameplay is heavily centered around NPCs. As players explore the interactive world they are able to interact with a wide range of NPCs for information, side quests, or just to feel more connected with the world. The world of CyberPunk takes place in a densely populated city, made evident by the number of NPCs. So to make this world feel like an actual city populated with actual people, the developers used a tactic called crowd simulation. This is where AI is used to create individual NPCs with their own different routines and tasks but are able to adapt when faced with an interaction with another NPC. This is able to create the feel of a bustling city filled with individuals with their own goals. Another tactic used was an AI algorithm that allows NPCs to navigate the complex worlds using adaptive pathfinding algorithms. This allows for very smooth movements and decisions of the NPCs that make them appear very realistic as they move through the urban environment of CyberPunk. But even though the intentions of the developers for the power of the AI in the NPCs was high, upon initial release the expectations of players were not met. The NPC and AI algorithm improvements however were made in future game updates, satisfying players.

Evaluation:

In game and platform analytics and other statistics allowed for developers to track NPC actions and interactions with players. This tool allowed for them to determine what was working and what wasn't when it came to these interactions. This allowed for improvements to be made later on and eventually increased player interactions with NPCs.

Hogwarts Legacy: Action RPG with Adaptive NPCs

Abstract:

"Hogwarts Legacy" is an action RPG (Role Playing Game) by Portkey Games that is set in J.K. Rowling's Harry Potter Universe. The game was created using UE 5 and many of its NPC's players interact with throughout the game are implemented using AI. Their dynamic interactions with both the player and environment create a unique immersion within the world as well as realism.

Applications:

Throughout the gameplay, players are able to interact with and view independent interactions of different NPCs. A social AI technique allows NPCs to exhibit complex behaviors and actions that directly react with the players actions or reactions. The NPCs are able to evolve and adapt based on player responses, creating a very realistic identity for players to interact with. Besides direct interactions with players, the NPCs also have a wide environmental awareness. They are able to independently react to different environmental factors, for example ducking behind an object to avoid fire during combat or interacting with other NPCs. This gives the impression of a self acting and reacting entity, creating a deeper immersion into the game. Similar to this application is the NPCs being given tasks and routines that they repeat but modify based on the circumstance of their environment. Specific to “Hogwarts Legacy” is the NPC ability to adapt to different circumstances and player choices through the act of performing specific spells. The AI algorithm allows NPCs to assess the choice/circumstance and based on that decide what spell to use. This can enhance the realism of the NPC behaviors allowing them to appear independently responsive.

Evaluation:

This game received a lot of positive feedback especially with regards to its realism and dynamic NPC interactions. Game statistics show a very high player engagement throughout the game but especially with the NPCs that create a deep immersion within the world for players.

Failures and Challenges

CyberPunk 2077: Initial release

Abstract:

On its early releases “CyberPunk 2077” received immense backlash for its failure in implementing realistic AI algorithms in NPC’s as well as faced major challenges with what the developers did eventually accomplish in releasing.

Failures:

An obvious failure brought to light by many players is the obvious repetition of the NPCs. While the algorithm they used was aimed at giving NPC’s a routine of actions to complete in an effort to mimic a real individual completing daily tasks, the NPCs ended up exhibiting repetitive and predictable routines and did not continuously adapt to their environment. This ended up breaking the immersion for many players. Another issue was the performance across different platforms. The NPC routines created by really complex AI algorithms were not created properly, hence when the game was played on older consoles or hardware players there was a significant drop in performance.

Challenges:

Creating NPCs using AI in UE 5 presents several technical and design challenges, as evidenced by developer interviews and their experiences. UE 5's complex environment requires a significant time investment to train developers on its proper use, and even seasoned experts find that there is always more to learn. This steep learning curve is compounded by the need for developers to balance AI implementation with maintaining peak game performance. The process of creating realistic NPCs involves making immersive dialog options, realistic movements and reactions to events. Additionally, developers must ensure that NPCs can adapt to unpredictable player decisions in a natural and realistic manner, which adds another layer of complexity to the development process. These challenges underscore the intricate balancing act required to leverage UE 5's powerful capabilities while delivering an immersive and responsive gaming experience.

Future Opportunities

Developing advanced AI has the potential to revolutionize gaming, enabling the creation of games that players can replay multiple times with new experiences each time. When NPCs in games can adapt to different events and make varied decisions, it enhances the diversity of the game's content, making each playthrough unique. This diversity is achieved through the implementation of sophisticated machine learning algorithms, which allow NPCs to become more adaptive and intelligent. By advancing these algorithms, the possibility of creating NPCs that can react dynamically to players' actions and the game environment increases significantly, leading to a richer and more engaging gaming experience. For instance, recent studies have shown that machine learning can enable NPCs to learn from players' behaviors and modify their responses accordingly, creating a more immersive and interactive game world.

Analysis, Findings and Guidance

After analyzing After finding and evaluating different cases and researched information regarding successes, failures and challenges, and future opportunities of implementing AI to NPCs using UE 5; the conclusions drawn from the research, provides insights and guidance on how to approach AI in NPCs for game developers. Three main points that can be analyzed and used for guidance are: importance of quality assurance and testing, supporting the collaboration of different teams, player feedback, and continuous learning.

Quality assurance (QA) and testing are important in implementing AI in NPCs to ensure a realistic and immersive gaming experience. These processes verify that NPCs have realistic actions, respond naturally to player actions, and maintain game performance without causing glitches or extreme lag. QA and testing can find and solve errors, make meaningful and seamless interactions, and help NPCs adapt to different player choices, enhancing replayability. Constant consistency across different game scenarios is maintained, and continuous testing allows for integrating player feedback, making sure the game evolves and meets player expectations.

Supporting the collaboration of different teams in implementing AI in NPCs is important for several reasons. It fosters the integration of diverse expertise, which enhances the quality and realism of the NPCs. For instance, AI developers can work closely with writers to create engaging dialog options, ensuring that the character's speech patterns and choices are both realistic and narratively consistent. Similarly, animators can collaborate with AI developers to synchronize movements and reactions, making NPCs' actions appear natural and believable. Supporting collaboration can improve the performance and efficiency of the game. By working together, teams can better balance the computational demands of AI with the game's performance requirements, ensuring that NPCs are both intelligent and resource-efficient. This balance is essential for maintaining high frame rates and overall game performance, particularly in complex environments like those created with UE 5.

Once a game is launched and available for the public to start buying and playing, the work of the creators is not over. Collecting and receiving consistent feedback from players is imperative to helping guide developers to problems that may have been overlooked and make a priority list of the items that need to be improved first. Issues ranging from cross-platform performances to glitches in AI algorithms in the NPCs causing them to not adhere to environmental physics. In addition to improving the product that is being produced, using player feedback can also foster a stronger community surrounding the game. Players who see their suggestions taken seriously by developers in order to improve the game will feel valued which in turn will garner loyalty leading to more engagement. This can be critical to long term success of the game even if its first launch(es) were not a success.

An all encompassing piece of guidance that the research of different cases supports is the continuous learning of these developers. AI tools and the world of gaming in general is a field that is constantly evolving and advancing. Every year new applications and algorithms are invented or perfected to enhance the development of future projects. Heavily pushing the importance of learning these new tools is imperative to keeping up with the market. These teams of coders, developers, designers, etc need to be continuously learning and adapting to the trends in order to stay relevant to players especially in the realm of visual entertainment. New AI techniques in engines like UE 5 can be invaluable assets to game creators trying to elevate a player's experience within their game.

Conclusion

This research project has examined successful implementations and challenges integrating AI into NPCs using UE 5. Examples of successful cases such as "Senua's Saga: Hellblade II," "CyberPunk 2077," and "Hogwarts Legacy" show how advanced AI algorithms like natural motions and adaptive actions can increase player immersion and narrative depth. These successes highlight the transformative potential of UE 5 in creating NPCs that react differently and realistically to player actions, contributing to more engaging gameplay experiences.

On the other hand, challenges observed in initial releases like "CyberPunk 2077" highlight the importance of quality assurance and testing, supporting the collaboration of different teams, player feedback, and continuous learning. Problems like repetitive NPC behaviors and cross platform performance issues show developers' complexities in balancing AI complexity with game optimization.

Future opportunities lie in improving AI emotions, advancing machine learning algorithms, and integrating player feedback to continuously improve NPC interactions continuously post-launch. By embracing these insights and fostering collaborative development practices, developers can leverage UE 5's capabilities to innovate and deliver immersive gaming experiences that resonate with players worldwide.

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