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The Impact of AI on NPC (Non-Player Character) Behavior

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Abstract

The influence of the development of artificial intelligence on non-player character behavior in video games is analyzed. Emphasis is put on player interaction with NPCs from a designer's perspective – how the interaction between real-life players and NPCs has changed over time, how the gamers' expectations and designs of NPCs have evolved in return, and how NPCs have been controlled in video games since the creation of the gaming medium.The process of playing a video game involves interaction between a human player and a virtual game world. The player's focus has gradually shifted to immersion and narrative elements, as graphics have improved and game worlds grown larger. The player begins perceiving game characters, including the non-player characters (NPCs), as real entities. As the industry matured, game narratives improved and games began successfully mimicking real life. However, key – non-player – characters jeopardized the otherwise believable atmosphere. This spawned an effort, on the part of the developers, to make NPCs more believable by making them seem intelligent and responsive, as though controlled by a real person. This sparked the birth of video game AI. For the purpose of a video game, an artificial intelligence controlling an agent must create or imitate its behavior. This creates the need to make decisions – time-slices of choosing the behavior. This decision making process, deeply rooted in an agent's implementation, contributes to the development of the overall character of the agent. Since then, much research has been directed towards the creation of NPCs that seem more believable by adopting various tactics – from means of overt behavior, to more

complex and layered strategies. These research approaches, however, oftentimes neglect the influence of the players. In video games, player character – NPC character interaction is a two-way street.

Keywords AI, NPC behavior, player interaction, game design, immersion, narrative elements, decision-making, character development

1.1. Introduction

Non-Player Characters (NPCs) represent a growing field of research in the development of artificial intelligence. As essential components in games, online worlds and training environments, NPCs help create atmosphere, cater for necessary roles and provide additional entertainment. Over the years, NPCs have evolved from miners wandering through a dungeon waiting to be slain, to intelligent life-like creatures that clearly have an existence beyond the parts of the game they effect. Designers have a variety of options in determining the behaviors of their NPCs: from simple scripting to complex adaptive systems. An understanding of the issues and approaches allow a more informed design that will more effectively meet the desired goals. Players, far from passive consumers, actively question, interpret and manipulate game content . As a result, understanding the design of NPCs and their place in the world, the implications of that placement, and the design goals of the NPCs themselves is critical for good world design and game balance. Subsequently, an attempt to examine the changes and implications of non-player character (NPC) behavior as a result of the development and implementation of artificial intelligence. In the beginning, the impact after these changes is explored, namely the problems that can be created or ignored with regard to player expectations and designer constraints. The role that the NPC filled in the player's experience of the game is considered, this role is situated in both a historical context and the context of the predominant function the NPC fulfils in games today. Some of the potential design ramifications that AI technology could have on NPC behavior in games are also

examined. Finally, the impact of AI on NPCs is considered in greater detail, with reference to the effects of automatic behavior selection and dynamic difficulty adjustment. From the relationships that emerge from examining these topics, an attempt is made to shed new light on the dynamic between AI and NPC behavior, arguing that, rather than enhancing the player's experience of a game world, the increased reliance on AI has altered the player's perception of the NPC's role and by extension the game world itself. With the increased importance of AI in NPC behavior, the role of the AI programmer becomes even more crucial as numerous complexities arise that the designer may never have considered. (Toh, 2022)

1.2. Current State of AI in NPC Behavior

This section offers an analysis of how artificial intelligence (AI) is currently employed to shape the behavior of non-player characters (NPCs) within video games. It provides a snapshot of contemporary uses of AI in NPC design and behavior, utilizing a wide range of AI methodologies applied in diverse genres of video games. AI solutions to common challenges in designing NPC behavior are discussed, as are new challenges that arise as both player expectations and industry standards evolve. Drawing on the state-of-the-art research, the effects of proposed or predicted trends within the field of AI on the future of NPC behavior are reflected.

Within the virtual environment of video games, NPCs are entities who perform actions and interact with players without direct, one-to-one control by the players themselves (N. Yannakakis & Conference on Computing Frontiers, 2012). The behavior and design of NPCs are directly manipulated by developers to create specific experiences for the player. These experiences can vary greatly depending on the genre of the game. With online game worlds becoming more popular, there is an increasing focus on believability and human-likeness of NPC behavior. As games and player experiences continue to grow in complexity, there are new challenges in creating NPCs who are emotionally aware and

who can adapt to their context. This offers a broad overview of how AI has been integrated in a variety of ways to shape NPC behavior and design for different genres of video games. Machine learning, heuristic-based decision-making, and emergent behavior techniques are examples of AI methodologies. The benefits of NPC behavior shaped by AI are outlined both from the perspective of developers and players, focusing on enhanced engagement and immersion through intelligent NPC behavior. Case studies are examined where AI algorithms have been used to enhance realism and responsiveness of NPC design within video games. These case studies paint a picture of the current AI-heavy landscape of NPC behavior. Genres from MMORPG to FPS games demonstrate a wide variety of uses of AI in shaping NPC behavior. From a focus on representation of goal states to the co-creation of levels with NPCs, the NPC AI in games takes on a wide and varied role. Contextual and emotional awareness are shown to play significant roles in player satisfaction. Finally, the characteristics of complex social NPC interactions emerge as a near-future trend, exploring how NPCs can manipulate and maintain ur-denected social states. (Hubble et al.2021)

1.3. Challenges and Limitations

This analysis focuses on the challenges and limitations of using AI to drive NPC (non-player character) behavior. Given the complexity and richness of NPC AI, the reader finds this backdrop useful before reading about the innovations and adaptive models discussed by the paper. Although AI technologies currently provide satisfactory solutions for many tasks related to the behavior of game characters, there are directions not well covered in the extant literature or beyond the adoption of state-of-the-art technology that could further enhance NPC (game-controlled character) capabilities. While the methodologies and underpinning artificial intelligence of game agents are of interest, several of the most popular and important game development platforms still carry hardcoded agents. In a study on the believability of NPC agents based on a racing game,

participants consistently performed better than chance at distinguishing between algorithmic characters and commercially developed content. A set of tools for practical composable game AI with greater believability are suggested (N. Yannakakis & Conference on Computing Frontiers, 2012).

It is a tremendous challenge for contemporary game AI to deliver lifelike relationships. The design of games demands that the agents to shape relationships are created through a lot of hand-created entities, the result of which is a fascinating discussion on rich emergent relationships. However, it of course might also result in a large commission of NPCs who communicate with each other on an even greater range of topics and in a particularly transparent way. Game characters driven by algorithms currently have no capacity to form relationships; they are often somewhat static collections of behavioral models that output some simple spatio-temporal movements or dialogue based on rules or finite state machines. (Siemens et al.2022)

1.4. Innovations and Future Directions

As game AI has been one of the major driving disciplines for AI within the last perhaps 15-20 years, a closely related field within game AI is the control of non-Player Characters (NPCs). Building believable, engaging, and indeed challenging NPC behavior for videogames is a hard problem, but also a relevant, as well as lucrative one. This has lead to a wide diversity of approaches and solutions, including rule-based systems, scripting, planning, production systems, and more recently, generic learning methods. However, an interesting trend over the last few years is that academic research aimed at domains beyond games is increasingly bleeding back into the games domain. This is coupling with the fact that many players' expectations of games have risen, and so AI researchers and game developers are starting to look at new ways to address the problem. Some of these ways involve the use of relatively new AI approaches to the field, such as deep learning and natural language processing . Nonetheless, these approaches are

already showing (or are seen as) competitive, and so some attention is given to technologies or approaches not yet widely explored or exploited within the NPC domain. In particular, these includes the use of procedural generation for more dynamism and better game-NPC interactions, as well as noting the increasing push for adaptive learning within AI methods (like neural networks). Finally, as the study of games and game AI is maturing beyond the industry and a tighter coupling between developers and academic or research labs established, a number of speculations are thrown out instead describing current practice: what are the major forms of NPC innovation likely to emerge in games within the next decade? How are games – at least within the mainstream – likely to evolve development methods or player experience? To what extent will AI be a driver or vital component of this change? This work is not restricted to one particular style of player feeling or NPC role, but rather seeks a fairly broad set of responses to some questions. Some speculation on future trends in gaming, games, and game-NPC AI as a driving technology are seeded. We see whether the planting takes and whether new trends can be seen to have sprouted. (Goh et al., 2022)

1.5. Conclusion

This essay demonstrates the transformative potential of AI in defining and redesigning NPC behavior and the strategic determinants of NPC and player behaviors. It outlines NPC behaviors on the basis of coherence, emotion, and adaptability, and redefines communication competence. Then, it designs strategic games to investigate the interplay of player strategies and NPC behaviors. Furthermore, it presents a new design concerning the NPC's response time strategy and demonstrates the player's optimal time-withholding strategy on the commitment of the NPC's game state.

In studies aimed at determining what patterns are present in player activity and how they are related to player performance and player experience, machine learning is a commonly used statistical tool for the purpose of analyzing and modeling data in two related studies.

However, using machine learning for data analysis and modeling in the research field necessitates making a series of difficult decisions. In the configuration of experiments and the preparation of data, these choices are implicit and may influence reported results and potential scientific progress (N. Yannakakis & Conference on Computing Frontiers, 2012). As a result, examining the choices underpinning the use of machine learning is valuable for the community.

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