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# AI-driven design and enhanced immersion in open-world games

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**Abstract.** The essay conducts a systematic analysis of the present condition and difficulties faced by AI application in open-world games by means of a literature survey. The text delves into strategies and techniques for augmenting the level of immersion in games, expanding the interaction with non-player characters (NPCs), and advancing customized gaming experiences through the utilization of artificial intelligence (AI) technology. The ultimate objective is to augment players' self-awareness within games and investigate novel approaches to social interaction. In order to accomplish this objective, a novel open-world game prototype has been designed with the purpose of advancing AI game development. This is achieved through the exploration of several game types that use AI. The objective of designing AI games is to augment players' self-awareness in gaming and advance the creation of novel social interaction techniques for future games.

**Keywords:** artificial intelligence, open world game, social interaction, immersion.

## 1. Introduction

In recent years, the industry has witnessed a plethora of popular open-world games due to their quick development. Nevertheless, there remains a deficiency in social engagement, non-player characters exhibit rigidity, and the level of immersion is inadequate. In response to this, this papaer has developed a video game called "The World" that utilizes artificial intelligence (AI) technology and offers an expansive virtual environment. The objective of the game is to use AI in order to improve the link between the game and the physical world, therefore heightening the authenticity of the gaming encounter and augmenting players' self-consciousness. Simultaneously, the game employs AI to generate diverse personas, thus establishing a novel form of social engagement. By enhancing the genuineness of player encounters and incorporating social elements into the game, the game fulfills players' psychological requirements. Moreover, a survey pertaining to AI games was created, which aims to assess players' happiness with different AI-driven game designs in order to explore their viewpoints on the role of AI in future gaming endeavors. According to the findings of the questionnaire, players have a strong desire for game designs that incorporate artificial intelligence (AI) and they express the expectation that AI-driven games can be effectively utilized in real-world scenarios. This comments can be applied to enhance and perfect the games.

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## 2. Related work

The wealth disparity among players in games is often evident. Based on various experiments conducted by AI economists, this article proposes intelligent taxation, verifying the feasibility of AI-driven tax policies in balancing economic equality and productivity [1]. Furthermore, the utilization of AI procedural content generation methods effectively creates game levels with varying degrees of interest, enhancing players' gaming experiences. By assessing the playful ability and appeal of levels and establishing adaptive functions to evaluate their interest, the viability of this method is demonstrated [2]. Surveys investigating human expectations regarding AI teammates' gaming skills and communication abilities fully illustrate human expectations for AI teammates [3]. Additionally, utilizing pre-trained large-scale language models in narrative scene generation dynamically creates game scenes in response to player choices, enabling personalized game narratives. In this regard, SCENECRAFT proves its ample creativity, adaptability, and consistency [4]. The potential impact of AI and Web3 technologies on the metaverse is emphasized, particularly the role of generative AI technologies like ChatGPT, which can significantly contribute to content creation and dissemination, supporting the development of the Web3 era and reducing creation barriers and costs [5]. Finally, research indicates that AI can play a crucial role in addressing balance issues in game development, particularly by dynamically adjusting game difficulty to accommodate players at different skill levels [6]. These studies collectively demonstrate the vast potential for AI's widespread application in the future gaming industry.

## 3. Game Concept

### *3.1. Motivation and Innovation*

This game prototype is an open-world, role-playing type that will encompass a variety of cutting-edge technologies, all aimed at enriching and deepening the player's game experience. The motivation behind designing "The World" is to create a virtual world that satisfies human desire for fantastical realms while also simulating an AI-driven virtual society. The game's innovation lies in its design, which provides better inspiration for future AI involvement in game development and addresses gaps in this area. The game is divided into virtual, real, and standalone worlds that are interconnected, with AI controlling the main aspects to better create a world where players feel fully immersed. This gradually blurs the lines between reality and virtuality, making players feel like they are in control rather than following a predetermined main storyline.

### *3.2. Setting and Story*

This game is set against the grand backdrop of the cultivation world found in Chinese fantasy novels. The world is relatively vast, consisting of one domain, four realms, and various secret realms beyond.

*3.2.1. Standalone Virtual World.* In this world, players can have their own stronghold where they can make any changes to their dwelling or place any items, which can either come with the game or be synthesized by AI based on player needs. As players advance in their cultivation (similar to leveling up), their dwelling space will gradually expand, encompassing a large area where they can grow herbs, raise pets, and do other activities. Players can also invite friends to visit their stronghold, enhancing social interaction, and even control AI-generated NPCs to guide their friends on a tour. Players can teleport back to their dwelling using a teleportation charm from their backpack (subject to distance limitations), but this feature becomes available after reaching a certain level. Additionally, once players reach a certain level, they can change the location of their dwelling.

*3.2.2. Online Main World.* The gathering place for all players outside their homes reflects the aforementioned one domain and four realms. In this world, players can undertake various quests, explore secret realms, and team up to explore specific locations. However, a clan can only explore within one realm initially. Only after reaching a certain level of cultivation can they venture into other realms to explore different regions and obtain rare items from those areas. TA special area, the realm beyond the

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heavens, is only open at certain times. The game's AI overseer will announce the conditions required for entry. Players can explore this realm only during specified times and possibly in teams once they meet these conditions. After reaching a certain level, the realm beyond the heavens, which serves as the second world in the game's setting among the three worlds, becomes freely accessible to players from the four domains. This location is controlled by AI, where players can obtain resources by participating in various competitions and meeting friends, showcasing the social aspect of our game. Each realm is home to numerous cities and populous areas, as well as regions with very low population density, with differences between areas, such as specific items spawning in certain regions. Human Realm is predominantly inhabited by humans, and the primary mode of combat in this world involves the use of spiritual weapons and various auxiliary means.

**Figure 1.** Human Realm:Image Generated from AI @DALLE

Demon Realm is dominated by demons. The combat in this world mainly utilizes demonic weapons, which is complemented by other techniques.

**Figure 2.** Demon Realm:Image Generated from AI @DALLE

Beast Realm, in which the main inhabitants are beasts, has combats focusing on the use of their own physical strength.

**Figure 3.** Beast Realm:Image Generated from AI @DALLE

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Ghost Realm is inhabited by ghosts, where combat primarily involves the use of ghostly beings themselves.

**Figure 4.** Ghost Realm:Image Generated from AI @DALLE.

**Figure 5.** Beyond the heavens: Image Generated from AI @DALLE

*3.2.3. Player's Real World.* Items from players' real-life can be AI-generated and mapped into their virtual world, which will be detailed later.

## 4. Game Mechanics

### *4.1. Goal and mechanics*

The sole objective of this game is to achieve a certain state of enlightenment and ascend to a higher realm.

The introductory narrative temporarily transports players to the online world. With the assistance of NPC sidekicks, they reach a certain level, gain a dwelling, and unlock their personal standalone world. Finally, through various means, players aim to achieve the game's ultimate goal of ascension.

Players possess various attributes, with the basics being health and mana. Reaching new realms unlocks new abilities, for instance, humans cannot use spiritual weapons or other means at the start of the game. However, as players level up, they gain the ability to control spiritual weapons, even dictating their flight paths, attacks, and defenses.

The game features many shops and auction houses where players can acquire resources for upgrades. Outside the cities, resources grow in the wild for player collection. The main AI occasionally opens secret realm entrances, allowing players to enter and obtain resources. These secret realms are fraught with danger, and players can choose to explore them in teams or alone. Teammates can also attack each other, adding to the game's playability.

The four realms have their own distinctions: the Human Realm has sects, the Demon Realm has dynasties, the Beast Realm has races, and the Ghost Realm is more casual. Based on their origins, players can join forces or choose to explore the world on their own. Joining certain forces allows players to undertake AI-generated missions, completing them for rewards that help them improve themselves.

Players can leave items on the map for others, generating a video through the AI module 3.4.1(b) that synthesizes the player's voice, enriching social interactions.

### *4.2. World Connection Mechanism and special mechanics*

The three worlds are interconnected. The player's standalone virtual world connects to the online main world. After reaching a certain level, dwellings lose system protection. If discovered by other players, invasions can occur and items can be stolen, with a maximum loss cap of 50%. Players can set up defensive formations and install alarm formations at their dwellings. Teleportation charms have distance

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limits for returning to the dwelling. Also, players can move their dwelling's location to avoid detection. Players can upload real-world items into their virtual world.

The game fully demonstrates properties integrated with AI, designed in three ways: AI-driven social interaction, AI-intelligent NPCs, and a combination of AI with traditional game mechanics.

*4.2.1. Innovative Social Interactions.* The utilisation of Artificial Intelligence in gaming is transforming the gaming experience by improving the link with the real world in diverse manners. During character creation, users have the option to submit images of their face and body features, which the game then uses artificial intelligence to construct a human model that closely resembles the player. This customisation improves the level of engagement and the player's sense of connection with their virtual character. In addition, players have the option to employ AI-generated voices while interacting with non-playable characters (NPCs), which guarantees compatibility and enhances the level of realism. Moreover, AI facilitates the creation of movies that incorporate the player's voice, so boosting the authenticity of the experience when placing objects on the map. If individuals are dissatisfied with their voice or desire a range of options, AI has the capability to meet their preferences. Additionally, AI facial expression capture technology enhances the portrayal of subtle facial expressions in player interactions, promoting deeper connections between players and introducing novel social dynamics. AI systems utilise player behaviour analysis to suggest exploration sites and pair players with like interests, hence augmenting prospects for social interaction. Moreover, AI produces customised material such as characters, missions, and goods that are specifically designed to match the preferences and behaviour of individual players. Furthermore, AI has the capability to replicate authentic life scenarios, such as the movement of pedestrians in urban environments, which aids in the facilitation of non-player character (NPC) interactions and socialisation. Moreover, AI-powered infrastructure development actively creates population centres and cities in response to player activity, ensuring daily supply requirements are met and strengthening the game's connection to reality. Furthermore, the game effortlessly incorporates real-world objects by utilising artificial intelligence (AI). This enables players to incorporate AI-generated representations of actual products into their in-game environment. The AI also assigns certain attributes to these items based on the players' requirements, so blurring the distinction between virtual and real-life experiences.

*4.2.2. AI Controls NPC and Character Generation.* The integration of AI into the gaming experience is revolutionizing player interaction and immersion in multifaceted ways. Firstly, AI emotion analysis combines facial micro-expressions and tone to discern player mood, dynamically adjusting NPC speech tone and providing comfort when needed, thereby enhancing player engagement and emotional resonance. Secondly, team supplementation is facilitated through AI, which generates characters to assist players during missions requiring additional strength or numbers, fostering teamwork and strategic gameplay. Thirdly, as an open-world game with a non-linear narrative, AI plays a pivotal role in generating interactive storylines, enriching story diversity and the overall depth of the game world narrative, thus offering players endless possibilities and immersive experiences. Moreover, NPCs with common goals and missions are intelligently generated based on player requests, aiding in level progression and skill proficiency, while also promoting a sense of community and camaraderie within the game environment. Lastly, growth-oriented NPCs, starting as basic assistants, evolve alongside players through customization of personalities and knowledge bases, adapting and growing based on strategies acquired in the online world, thereby enhancing the sense of achievement and personalization for players as they progress through the game.

*4.2.3. Alternative Applications of AI in the Game.* In addition to its immersive gameplay, the game boasts a sophisticated AI-driven economic system that intricately shapes player experiences. At its core, the game features a multifaceted economic structure overseen by AI, comprising both a central market managed by AI-generated NPCs and a player-specific market operating autonomously. The AI-controlled market dynamically adjusts its supply in response to player transactions, ensuring equilibrium

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by injecting products to meet demand while also regulating transactions through tax collection, with rates tailored to real-time conditions. Moreover, to prevent imbalance caused by excessive recharges, the game imposes strict limitations on its recharge system. Taxes collected are redistributed to players based on their needs, with some benefiting from tax exemptions to sustain the economy's dynamic equilibrium, thus preserving gameplay integrity and enhancing user engagement. Furthermore, the game's soundtrack is dynamically adapted by AI, analyzing player moods and plot developments to enhance the gaming atmosphere and emotional immersion. Additionally, players can independently craft items, with AI generating diverse properties to maintain balance. The game also features a dynamic weather system, with various weather patterns impacting cities and missions, adding unpredictability and depth to the gaming experience. Weather warnings, adjusted by AI probabilities, provide players with foresight to prepare for impending events, further enriching the overall player journey and sense of immersion.

*4.2.4. Basic Game System.* The basic game systems include Combat System (including various skills and techniques), Alchemy System, Rune System, Formation System, and Survival System (providing real-time feedback on players' physical conditions, such as loss of mana and health due to injuries. Most realistically, loss of body parts in-game is irreversible, except with special resources for regeneration).

The game offers four birth options, allowing players to choose from four species to start. AI intervenes in each individual's attributes, possibly endowing them with traits from other races, enabling the use of weapons from different worlds. Birth typically occurs in the player's racial world, but exceptions can happen, including being born with special weapons or items by chance. The four races also have different groups, with AI randomly assigning players to maintain population balance and world biodiversity. Players obtaining certain items might get a chance to specify their birth options and inherent traits.

## 5. Character and Level Design

### *5.1. Character*

Character Design uses a narrative approach that differs from traditional methods, fragmenting the protagonist's story across various missions and providing players with opportunities to interact with the AI-controlled protagonist's narrative. Before achieving the final goal, AI ensures players witness all plotlines, with each individual discovering the story and missions at different times.

The first person in the four realms to achieve ascension, growing through battles and ultimately ascending after protecting the four realms from external invasion. This individual is the subject of legends across all realms. Following the protagonist, another protector of the four realms overturned the resurgence of external enemies and ascended after securing the continent.

### *5.2. Level Design*

Overall, at the game's inception, AI generates NPCs with specific attributes matching the player's birth traits, introducing the player to the game's systems and providing a main introduction.

Narrates players' different origins, then, through crafted shorts, reveals the game's ultimate goal before transitioning players into a temporary standalone scene. The game transfers players to the online world after basic training and combat narratives, where they initially choose a realm to land in. Growth-oriented NPCs appear to guide players through the nearest city and familiarize them with various systems, enriching player knowledge for subsequent gameplay. Players are then presented with four options for missions, such as hunting monsters. AI also provides opportunities to join factions after mission completion. However, players may be born into these factions, influenced by their origins.

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## 6. User study

Based on the gameplay features designed for the game, a questionnaire is developed to assess players' satisfaction with AI-assisted enhancements for self-awareness and the creation of novel social interactions in the game.

The survey participants include individuals from three age groups: 0-18, 18-35, and 35-45. People in these age ranges typically have a high enthusiasm for gaming and are relatively sensitive to related gameplay designs. By gauging their opinions, it is clear to measure their satisfaction with the gameplay designs in the game and thereby evaluate the success of AI-driven gaming in enhancing player self-awareness and creating new social interaction methods.

Firstly, based on the first section of the questionnaire, the effectiveness of AI in enhancing player self-awareness in the game is evaluated.

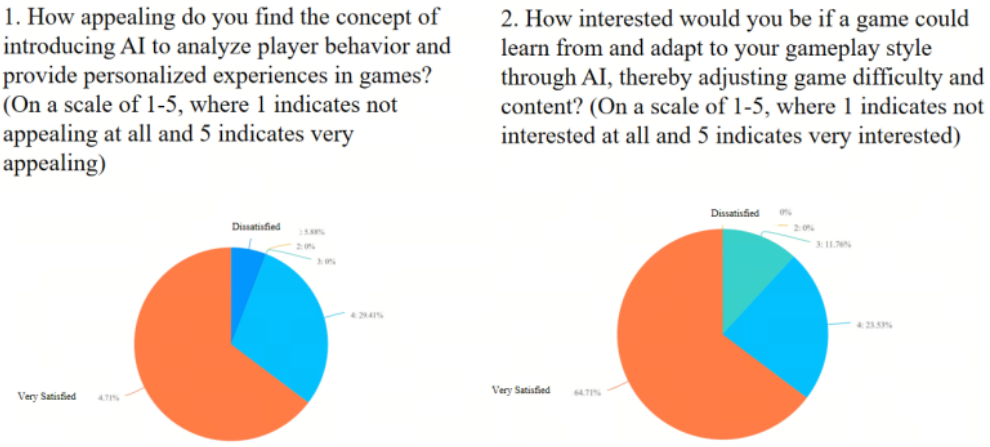


**Figure 6.** Data about Question 1 and 2 of the survey

The majority of players are highly anticipative of the concept of AI introduction and the provision of personalized experiences. This indicates players' expectations for AI games, hoping for games to be less uniform and more adaptable to their own needs. However, 5.88% of respondents show resistance to the concept of AI-driven games, possibly due to doubts about AI capabilities.

Moreover, players express a strong desire for AI to dynamically adjust game difficulty and content based on their preferences. Although this capability currently exists only conceptually, the survey highlights players' expectations for such AI-driven adjustments, which could significantly enhance their gaming experiences. This shift could transform games from mere products into integral parts of players' lives, simultaneously boosting product utilization and maintaining players' interest.

Regarding the creation of in-game characters based on real-life selves and the simulation of real-life scenarios, players generally expect simulated life scenarios. However, some players express reservations about creating in-game characters based on their real selves, possibly due to concerns about privacy breaches. AI-driven simulation of life scenarios enhances player immersion by presenting their virtual selves in a relatively authentic world, allowing them to engage in various activities and bridging the gap between the virtual and real worlds. This enhances players' self-awareness in the virtual world, with the majority expressing high satisfaction. Consequently, the second aspect, creating characters based on real selves, could further strengthen self-awareness. However, privacy concerns may lead to resistance among some respondents.

The second part of the questionnaire is about AI-enhanced social experiences.

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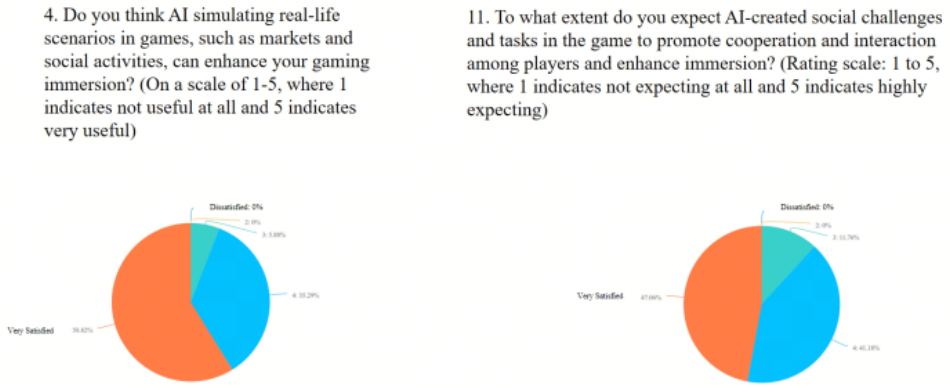


**Figure 7.** Data about Question 4 and 11 of the survey

This part corresponds to another objective of the game design, which is to create novel social interactions by leveraging various AI analyses to help players find like-minded friends to play with. This not only improves the game's playability, but it also helps to sustain players' interest in the game over time.

Ninety percent of players are highly interested in AI searching for players with similar interests, which demonstrates the innovative design approach of the game. Rather than players defining their interests by editing relevant tags, the game combines AI analysis to recommend like-minded players based on their data, which is more effective. Although this approach may raise privacy concerns, survey results show that players overwhelmingly appreciate it. They see it as a way to avoid malicious players and genuinely form friendships online.

Moreover, players competing with and forming friendships with AI-generated characters are widely accepted by 88.24% of players. They may perceive AI as more sincere and less prone to manipulation compared to human players, providing an escape from the complexities of real-life interactions. However, 11.76% of respondents completely reject this idea, feeling that befriending AI goes against common sense and could lead to excessive immersion.

Overall, players are highly anticipative of the innovations brought about by AI-driven games in these two areas This strongly indicates the success of the design from a different perspective.

## 7. Discussion

In designing this game, every effort has been made to enhance players' immersion, blurring the lines between reality and the virtual world. Through various means, we aim to deepen players' sense of immersion. In this game, players can accomplish most of what they wish, meeting their needs and potentially increasing engagement. Additionally, the game uses AI to provide a more diverse sensory experience, particularly with adaptive sound and more stunning visual experiences, further enhancing immersion.

The game introduces a variety of uncertainties through AI, making every player's main storyline unique. There isn't a single repetitive story, but everyone shares the same goal. On this path, players can meet many others. The game features many dynamic and mysterious realms for exploration, satisfying players' curiosity and aligning well with the curiosity-driven theory. Encountering numerous new things, the game is filled with uncertainties, adding to its challenge. Players embody another self in the game, experiencing different stories.

Most open-world games on the market today have relatively fixed overall narratives, and AI combat modes can be somewhat rigid. Players rely on characters they design themselves, but "xxx" involves playing with one's own model. For example, games like "Subnautica" and "No Man's Sky" lack strong immersion and sound design. Incorporating "The world's" AI music system could change everything. "No Man's Sky" and "ARK: Survival Evolved" have weak overall narratives, making it easy for players to lose sight of their final goal, but AI-controlled narrative development could steer the game in the right

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direction. "Seeking Immortality" and "GuJian" are 2D cultivation games with less impressive effects, but with AI control in "xxx," the effects are sure to be more spectacular.

## 8. Conclusion

Analysis of the questionnaire survey reveals that players exhibit a specific expectation for open-world games powered by artificial intelligence (AI). There is a widespread belief that utilising AI-driven methods can enhance the engagement and immersion of open-world games. More precisely, they anticipate improvements in customised storytelling and role-playing elements using AI-powered methods. In addition, they demonstrate significant enthusiasm for our proposed AI-powered social connections, as they believe it can assist them in discovering individuals with similar interests and thereby improve their gaming encounters.

The foundation of our AI-driven game design is significantly dependent on forthcoming technology advancements. Thus, it is now difficult to realise this fundamental idea, even in terms of simple presentation. To assess players' expectations for specific gameplay features, we rely on questionnaire surveys to analyse the effectiveness of particular design elements.

In the future, AI games have the potential to use advanced technologies like augmented reality (AR) or brain-computer interfaces (BCIs) to create very immersive sensory experiences. Our game design includes several gameplay features that can easily be incorporated with these new technologies. We anticipate that further research will help bring these features to life.

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