

A Comparison of Traditional Game Design vs. AI-Driven Game Design



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Taha-Yassine ENNABILI

Author Taha-Yassine ENNABILI

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Supervisors Lasse Seppänen

ABSTRACT

The field of video game design has evolved significantly over the years, with traditional game design approach being used to create immersive game experiences. However, the emergence of artificial intelligence (AI) has introduced a new era in game design, that allows developers to create games that adapt to the player's behavior and preferences. This theoretical thesis aims to compare the traditional game design with AI-driven game design to determine which approach is better for both sides: players and developers. The integration of AI in traditional game design will also be explored, and insights into the future of the gaming industry will be provided.

Video games have come a long way since their inception, with game designers relying on traditional approaches to create memorable game experiences. However, the advent of artificial intelligence (AI) has introduced a new dimension in game design, enabling developers to create games that adapt to the player's behavior by scaling game difficulty and game environment accordingly.

This research provides valuable insights into the future of game design and the role of AI in creating compelling game experiences. It helps to inform game developers, designers, and researchers about the strengths and limitations of traditional game design and AI-driven game design, as well as identifying areas for future research. Ultimately, this study contributes to the ongoing dialogue surrounding game design and innovation, as well as the impact of technology on the entertainment industry.

Keywords AI, Artificial Intelligence, Video Games, Design, Traditional game design, AI-driven game design, Development, Nostalgic.

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Glossary

AI: Artificial Intelligence (AI) refers to the ability of machines to mimic human intelligence and perform tasks, such as learning, problem-solving, decision-making, and perception. (Russell & Norvig, 2020)

Artificial: Artificial refers to something that is made or produced by human beings rather than occurring naturally. In the context of technology, artificial typically refers to computer-generated simulations or machine intelligence. (Oxford, n.d.)

Videogames: Video games are a form of interactive entertainment that involves players interacting with virtual environments and challenges presented on a screen. They typically involve a variety of gameplay mechanics, such as exploration, puzzle-solving, combat, and strategy, and can be played individually or with others. (Juu, 2010)

Game development: Game development refers to the process of creating and designing games for various platforms, including consoles, mobile devices, and computers. It involves a wide range of tasks, such as conceptualizing game ideas, writing code, designing characters and environments, creating sound effects and music, and testing and debugging the final product. Game development can be a complex and time-consuming process, requiring a team of professionals with a diverse set of skills. (Coursera, 2023) (Rowland, 2023)

PCG: Procedural content generation is a technique used in game design that involves using algorithms to create game content such as levels, maps, characters, and items in real-time rather than designing them manually. (Unreal Engine, n.d.)

FPS: First Person Shooter. (Velasquez, 2022)

NPC: Stands for Non Playable Character. (NPC, 2023)

FSM: Finite State Machine (Bors, 2018)

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1 Introduction

Video games have become so popular over the last years, with game design being a crucial aspect in creating an immersive and engaging experience for players. Traditional game design has dominated the industry for decades, with developers relying on their creativity and expertise to craft compelling game experiences. However, the emergence of artificial intelligence (AI) has introduced a new pattern in game design, enabling game developers to create games that adapt to the player's behavior and preferences. Video games have evolved tremendously since their inception in the 1950s, and game designers have consistently sought to create more immersive and engaging experiences for players. The industry has always relied on traditional game design, with game designers using their imagination and keeping a human touch to craft engaging game experiences. However, the emergence of artificial intelligence (AI) in game design has introduced in a new paradigm, allowing designers to produce games that adjust to the actions and preferences of players.

In the past few years, there has been an increasing trend towards integrating AI technology into the process of game design, with games such as Minecraft and Mario Kart incorporating AI algorithms to create procedurally generated levels and vivid game content. The integration of AI in game design has the potential to transform the gaming industry by providing players with personalized and dynamic game experiences that adapt to their skill level, preferences, and play style.

- What is the difference between traditional game design and AI-driven game design?
- What are the strengths and limitations of each approach?
- How has the advent of artificial intelligence changed the video game industry?
- What is the impact of each approach on player engagement and satisfaction?

2 Traditional Game Design

For many decades, traditional game design has been the fundamental basis of the video game industry. It encompasses the process of creating games using the imaginative skills of game developers and designers who rely only on their own human abilities and knowledge to craft captivating and interactive gaming experiences for the players (Smithsonian, n.d.; Uitti, 2023). Traditional game design has an established record of producing some of the most memorable games of all time, including Street Fighter, Super Mario Bros, and The Legend of Zelda. These legendary games have made an everlasting impression on the gaming industry, underscoring the lasting importance of conventional design (Best Retro Games, 2023). Although the industry is shifting towards AI-driven game design, traditional game design will remain a critical and an important element of the video game industry.

Figure 1 illustrates four of one of the most iconic retro titles that shaped the future of the industry, “Street fighters, Sonic, Super Mario, The legend of Zelda”. These games shaped the industry of video games (Chacksfield, 2023).

Figure 1: Traditional game design of some old titles (Chacksfield, 2023)



2.1 Definition of traditional game design

Traditional game design refers to the conventional approach of designing video games, where game mechanics, rules, and storyline are created based on the designer's experience and skills. The goal of traditional game design is to provide a challenging and enjoyable experience for players through carefully crafted game mechanics, balanced difficulty levels, and a compelling storyline (Adams, 2010). This approach has been the industry standard for decades, and it has produced many successful and engaging games (University of Minnesota Libraries, 2016).

Table 1: Old video games and its date of release (DOOM, n.d.; FINAL FANTASY, n.d.; HALO, n.d.; Super Mario, n.d.; The Legend of Zelda, n.d.)

Game Title	Publisher	Release Year
Halo: Combat Evolved	Microsoft Game Studios	2001

Final Fantasy VII	Sony Computer Entertainment	1997
Doom	GT Interactive	1993
The Legend of Zelda	Nintendo	1986
Super Mario Bros.	Nintendo	1985

In the gaming time capsule, a lineup of iconic titles that have left their mark over the years is showcased. "Halo: Combat Evolved," set the stage for futuristic battles, was released in 2001 by Microsoft Game Studios. "Final Fantasy VII," taken on an unforgettable journey through a captivating fantasy world and brought to life by Sony Computer Entertainment in 1997. The birth of "Doom" in 1993, paving the way for the first-person shooter genre, was witnessed in the early '90s and published by GT Interactive. Timeless classics introduced by Nintendo – "The Legend of Zelda" in 1986 and "Super Mario Bros." in 1985 both became the building blocks of gaming nostalgia. A unique legacy is carried by each of these games, contributing to the rich tapestry of gaming history (Chacksfield, 2023; Reynolds, 2023).

2.2 Strengths and limitations of traditional game design

Embarking into the vast world of game design, we encounter a dynamic landscape filled with both strengths and limitations. Traditional game design, relying on human creativity and expertise, has been the cornerstone of the gaming industry, offering captivating experiences that stand the test of time. However, like any art form, it comes with its set of challenges, shaping a fascinating journey where the strengths and limitations intertwine, influencing the way players experience and engage with games (Schell, 2008, p. 113). Let's dive into the unique aspects that define the strengths and limitations of traditional game design.

2.2.1 Strengths

Traditional game design has numerous strengths and advantages. It all starts with good old-fashioned human creativity that game developers and designers get to put their artistic talents and storytelling skills into crafting amazing game worlds and stories (Bowman & Wulf, 2018; Wulf et al., 2018). These games are known for their fun and engaging gameplay, with clever challenges that keep you hooked. And who can forget the stories and nostalgic soundtracks? They're like the heart and soul of these games, making you feel things as you play. Classics like Super Mario, GTA, and The Legend of Zelda are proof of how timeless these games can be entertaining new generations as well. They're not just games; they're art, with cool graphics, music, and worlds. Plus, there's always something for everyone from action-packed adventures to brain-teasing puzzles (Melissinos et al., 2012). They hit you right in the feels, whether it's nostalgia, excitement, or just a connection to the characters. Craftsmanship is key, and anyone can pick up and play them. And don't even get started on the cultural impact that these games have left their mark on players' hearts all over the world. So, traditional game design isn't going anywhere; it's here to stay and keeps getting better (Bowman & Wulf, 2018; Melissinos et al., 2012).

2.2.2 Limitations

Traditional game design, although beloved, does have its fair share of challenges and limitations. First, making these games can be a real time and money drain. Crafting all the artwork, levels, characters, and testing takes a lot of effort and resources. Some traditional games can also feel a bit repetitive, with similar tasks and gameplay throughout, which can lead to repetition and boredom (Hunicke & Chapman, 2004; Vu, 2018). In addition, they often stick to a set path, so your choices while playing the game might not matter as much (Vu, 2018). And for a player looking for something fresh and new, it's not always easy to find. Learning curves can be steep, making some games hard to get into. Once you've finished a traditional game, replaying it might not be as exciting, as you'll know all the twists and turns so the repetitions is inevitable (Tekinbas & Zimmerman, 2005). Making changes or adding new stuff can be tough, especially for smaller game makers. And sometimes, traditional games might not feel like they're made just for you, they follow a standard formula that doesn't adapt to your tastes. Finally, in the big world of gaming,

getting noticed and standing out can be a real challenge especially that players are so hard to please and satisfy (Rollings & Morris, 2003b, pp. 105–120). These limitations, though, don't take away from the charm and appeal of traditional games, but they're things to keep in mind.

Additionally, traditional game design may not always accurately predict player behavior and preferences and it is almost impossible to do so in most cases, which can result in a less personalized game experience affecting the whole experience that the game supposed to offer. Also, it can be time-consuming and expensive to create high-quality graphics and art since that will require a big number of human resources, and this can limit the scope and variety of the game (Schell, 2008, pp. 113–128). In addition, traditional games can often feel static and unchanging, lacking adaptability and personalization which might lead to repetition and boredom, and by consequence the end of the game, especially with new generation of gamers that are very demanding and always looking for new challenges (Rollings & Morris, 2003a, pp. 141–170).

Table 2: Strengths and limitations of traditional video games side by side (Bowman & Wulf, 2018; Roth, 2020; Vu, 2018)

Strengths	Limitations
- Offers more creative freedom to game designers, allowing them to come up with unique and innovative ideas.	- Limited adaptability to individual players, as the game experience is generally the same for all players.
- Can create a more cohesive and immersive game world, as designers have greater control over the overall game experience.	- Can be more time-consuming and expensive to develop, as game designers have to create all aspects of the game manually.
- Can be easier for players to understand and navigate, as the game mechanics are generally consistent throughout the game.	- May not be as engaging for players in the long-term, as the game experience may become repetitive or stale over time.
- Offers a nostalgic feeling and evoke positive emotions.	- May not offer as much replay value, as the game experience is generally the same each time it is played.

The crafted table has laid out strengths and challenges side by side, presenting a clear picture of the complexities involved. Now, the journey shifts from the developer's canvas to the player's heart, where the magic truly happens. An exploration into the immersive world of traditional game design and how it leaves an indelible mark on those who embark on its pixelated adventures is set to unfold.

2.3 Impact of traditional game design on players

Traditional game design has a significant impact on player engagement and satisfaction (Sailer et al., 2017). Game designers depend on their creativity and expertise to create immersive game experiences that appeal to players (Rollings & Morris, 2003b, p. 169). Traditional game design often focuses on linear game progression and predetermined outcomes, which can result in a sense of satisfaction when players achieve their goals. However, this approach may also limit player choices and exploration, which can lead to disengagement. According to a study by (Ryan et al., 2006) player motivation and engagement are influenced by the degree of autonomy and competence provided by the game design (Gallego-Durán et al., 2019, pp. 4–10). Therefore, game designers must balance the benefits of linear game progression with the need for player autonomy and exploration to create a satisfying game experience (Gallego-Durán et al., 2019, pp. 6–13).

According to (Ryan et al., 2006) gamers around the globe are divided into four main categories: Killers, Achievers, Socializers and Explorers, based on their playstyle and motivations. Killers are always looking for competition and challenges, most likely player versus player battle. Now the achievers, on the other hand, are motivated by a sense of accomplishment (Ryan et al., 2006). They set goals, strive to earn achievements, and eagerly collect rewards in their gaming journey. Socializers tend to give a great importance on forging connections and friendships within the gaming community. They thrive on collaborative efforts, communication, and the joy of forming communities. Lastly, explorers are captivated by the allure of the unknown. They seek the exhilaration of discovery, bravely venturing into unexplored territories, unraveling hidden secrets, and embracing the vastness of the game world (Ryan et al., 2006). These playstyles highlight the many ways individuals engage with and find immense enjoyment in their gaming experiences. In

order to fulfill that enjoyment and satisfaction, game designers have an important role in achieving all the playstyles needs and requirements, that's why they are so called "Wizards" because they possess a remarkable ability to captivate individuals in virtual worlds and adding their "human" touch (Granic et al., 2014, pp. 70–71). They possess the expertise and knowledge to create experiences that motivate people of various age groups to strive for significant objectives, persist despite encountering numerous setbacks, and experience a sense of exhilaration upon overcoming difficult challenges. These challenges in the gaming environments can foster a style of sustained, uplifting motivation (Granic et al., 2014, p. 70). According to the American Psychologist (Granic et al., 2014), this motivational style can also be applied to school and work (Granic et al., 2014, p. 71). Also, certain types of games are more likely to promote this healthy motivational style, while others may not. In addition, individual differences in player personality and game genre preferences can also affect motivation scores differently (Granic et al., 2014, pp. 74–76).

Figure 2: Main Genres of Video Games with examples (Granic et al., 2014, p. 70)



Thanks to its human touch, traditional video games offer a range of positive effects that contribute to various aspects of cognitive development and skill enhancement. Engaging with video games can improve concentration, attention to detail, and the ability to make rapid decisions (Granic et al., 2014, pp. 70–71). It also facilitates the development of memory capabilities, logical thinking, and problem-solving skills, while promoting the acquisition of new knowledge and abilities (Granic et al., 2014, pp. 68–70). Video games can aid in processing large amounts of information effectively, while also enhancing visual-spatial skills (Galanina, 2018, pp. 2284–2285). Furthermore, they contribute to the improvement of motor skills, hand-eye coordination, reading comprehension, and inductive reasoning (Galanina, 2018, p. 2284). These are just a few examples of the numerous benefits that traditional video games can provide. Maximizing the enjoyment and satisfaction of players across different categories. Leaving touchable and memorable memories.

As mentioned the last lines, traditional video games hold a special place in the hearts of gamers, evoking a profound sense of nostalgia that endures over time. These games take players back to golden moments of their childhood, reviving the feelings of excitement, wonder, and joy they experienced during those formative gaming experiences. The pixelated graphics, catchy soundtracks, and simple gameplay mechanics. The memories associated with these games are often intertwined with personal stories, friendships, and shared adventures. As gamers revisit these classic titles, they not only reconnect with the games themselves but also with the versions of themselves that existed in those moments of play. (Galanina, 2018; Ryan et al., 2006)

The nostalgic feeling goes beyond the games themselves; it becomes a portal to the past, offering a sense of comfort, familiarity, and a reminder of the simpler times. It is this profound emotional connection that continues to draw gamers back to traditional video games, allowing them to relive and rekindle the magic of their gaming heritage. Not only that, but gamers in the recent years have also introduced a new concept called “MODS”. Mods, short for modifications, are user-created content that can alter or expand upon the original game (De, 2021). They provide an avenue for gamers to express their creativity and take an active role in shaping their gaming

experience. By developing mods, players can introduce new gameplay features, characters, quests, environments, and even entirely new game modes (De, 2021). This creative outlet allows gamers to personalize and customize their favorite titles, breathing new life into them long after their initial release. Mods also foster a strong sense of community among players, as they can share their creations with others and collaborate on projects (Livingston, 2018).

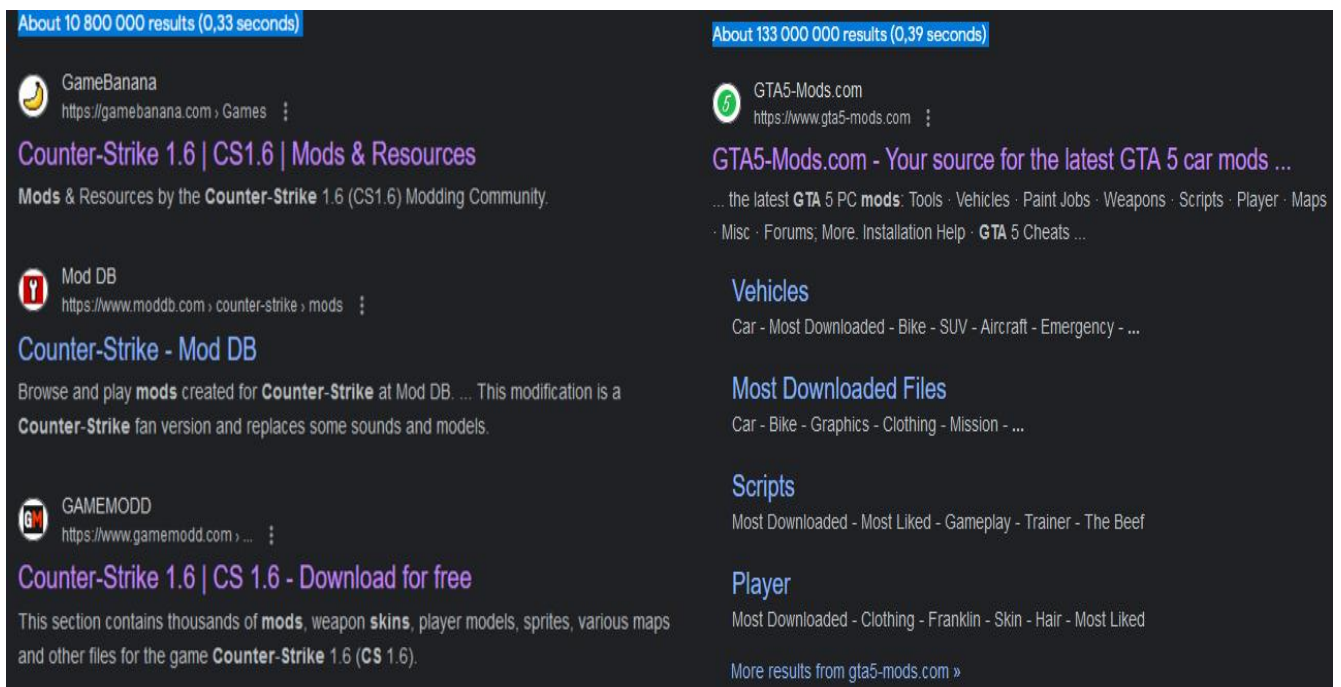
Figure 3 shows how player/fans are still trying to revive an old classic game GTA I that was first introduced by RockStar games in 1997 (GTA Wiki, n.d.). Showing that players are still attached to old games, and hoping to see them back again with advanced graphics.

Figure 3: Grand Theft Auto I (GTA I) 3D concept by fans (Fortress of Solitude, 2023)



A simple Google search about Gta and Counter-strike shows how large and widespread the mods communities among players worldwide. Represented in Figure 4.

Figure 4: Results about mods for GTA and Counter-Strike



A touching example that clearly shows the nostalgic and remarkable impact of traditional video games on players is a study result was done by (Wulf et al., 2018) where a survey involving 582 participants from the United States, to explore their thoughts on various gaming experiences (Bowman & Wulf, 2018). They randomly assigned gamers to write one of four essays, focusing on either past or recent video game encounters and whether they played alone or with others. The purpose of these essays was to immerse participants in their memories, enabling them to later reflect on the intrinsic psychological needs fulfilled by those experiences.

As anticipated, individuals who wrote about older memories reported stronger feelings of nostalgia compared to those who wrote about recent ones. The essays centered on older, more nostalgic memories tended to emphasize the significance of challenge and enjoyment in shaping the gaming experience. Additionally, they often recalled memories from the writer's childhood, further contributing to the sense of nostalgia (Wulf et al., 2018). Essays that explored social memories also evoked nostalgia, particularly when those memories were linked to a strong sense of belonging with people from the past. Some of these essays, especially those involving family and friends, carried significant emotional weight. One participant shared a poignant sentiment

(slightly edited to maintain confidentiality) stating, "My dad passed away when I was 10, so playing Mario Kart with him is one of my most cherished memories." (Wulf et al., 2018, p. 12).

Table 3: Themes in the survey conditions were categorized and sorted based on the overall prevalence of each theme (Wulf et al., 2018, p. 11)

Theme	Nostalgic Solo	Nostalgic Co-Play	Recent Solo	Recent Co-Play	Univariate ANOVA		
					<i>F</i> (3, 578)	<i>p</i>	η_p^2
Specific console	71.2% _{a,b}	63.4% _a	73.4% _{a,b}	79.4%_b	3.27	.021	.017
Game enjoyment	39.0%_a	41.0%_a	16.2% _b	17.5% _b	13.42	<.001	.065
Bonding	37.4% _a	42.9% _a	48.5% _{a,b}	61.5%_b	6.35	<.001	.032
Friends	2.8% _a	43.9%_b	2.2% _a	49.7%_b	65.92	<.001	.255
Family	5.8% _a	33.5% _b	2.9% _a	57.3%_c	64.79	<.001	.252
Loss of time	16.6% _b	22.4% _b	3.7% _a	51.8%_c	40.94	<.001	.252
Childhood	27.3%_b	29.3%_b	17.7% _{a,b}	11.2% _a	6.42	<.001	.032
Challenge	30.2%_b	40.9%_b	4.4% _a	4.9% _a	35.76	<.001	.157
Achieve	22.3% _a	16.5% _a	19.6% _a	22.4% _a	0.743	.526	.004
Fondness	20.9%_a	11.0% _b	22.1%_a	12.6% _b	3.46	.016	.018
Hedonic feelings	20.1%_a	28.1%_a	3.7% _b	5.6% _b	17.52	<.001	.083
Mood repair	12.2% _a	12.8% _a	15.4% _a	12.6% _a	0.258	.856	.001
Positive emotions, broadly	14.4% _{a,b}	7.3% _a	19.9%_b	11.9% _{a,b}	3.60	.013	.018
Recreate and replay	15.1% _a	12.8% _a	10.3% _a	14.0% _a	0.514	.673	.003
Specific game	11.5% _a	13.4% _a	9.6% _a	12.6% _a	0.384	.765	.002
Narrative transportation	12.6% _b	3.1% _a	25.0%_c	6.3% _{a,b}	14.39	<.001	.069

The next table show how deep and nostalgic the relationship between the players and the traditional video games. Leaving a big impact in their memories.

Table 4: Common themes arising from players' memories, arranged in order of their prevalence (Wulf et al., 2018)

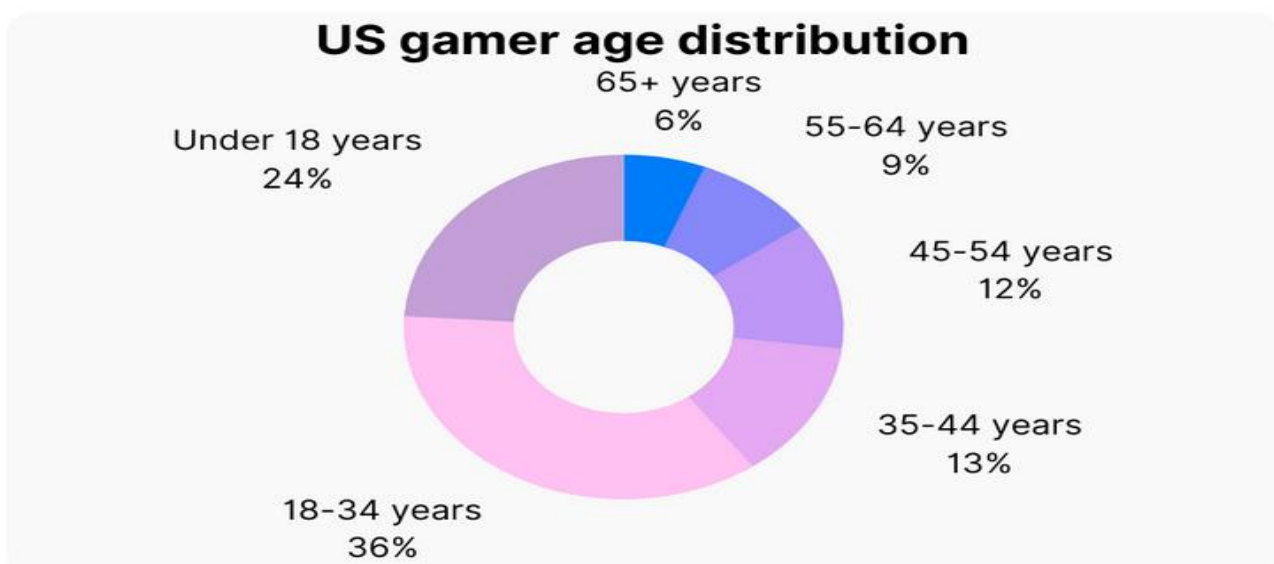
Theme	Defined	Examples from data	Frequency
Specific game	Naming a specific game	"I completed playing the Final Fantasy XIII"	416 (71.5%)
Specific console	Naming a specific console	"I remember playing Nintendo [NES]"	168 (28.9%)
Game enjoyment	References to the game as being fun or enjoyable	"I enjoyed video games so much"	276 (47.2%)
Bonding	Engaging others	"We usually played with one player and took turns working together"	150 (25.8%)
Friends	Mentioning friends in gaming memory	"Me and all of my friends would play it"	149 (25.6%)
Family	Mentioning family in gaming memory	"My brother and I used to play"	145 (24.9%)
Loss of time	Losing track of time, specifically mentioned	"I don't recall how long it took, but I know we were in the basement for a while"	126 (21.6%)
Childhood	Recalling one's youth	"Oh to be a kid again"	122 (21.0%)
Challenge	Reference to the game's challenge	"I battled one level where ships are moving and cannons are constantly firing at you"	117 (20.1%)
Achievement	Reference to the player's skill or accomplishments	"I finally mastered it . . . I was able to finish the highest level"	95 (16.3%)
Fondness	Expressing a fondness or longing for the experience	"the memory of those times is cherished forever"	87 (14.9%)
Hedonic feelings	Thrilling or exciting experiences	"The games . . . were exciting and thrilling"	77 (13.2%)
Mood repair	Playing to relieve stress or relax	"I will play it whenever I need a break and to escape the humdrum work I do"	76 (13.1%)
Positive emotions, broadly	General feelings of happiness and joy	"It made me feel happy"	76 (13%)
Recreate and replay	A desire to recreate the experience	"I wish I could experience it over and over again"	69 (11.9%)
Narrative transportation	Feeling wrapped up in the narrative	"You can actually just put yourself into the story"	66 (11.3%)

Another study by (Sweetser & Wyeth, 2005) found that players appreciated the sense of accomplishment and pride that came from overcoming difficult challenges in traditionally designed games. The carefully designed levels and progression systems in traditional games provided a sense of structure and reward that motivated players to continue playing and achieving their goals. Moreover, the deliberate pacing and narrative arcs in traditional game design allowed players to become emotionally invested in the story and characters, enhancing their overall satisfaction (Sweetser & Wyeth, 2005, p. 10).

However, traditional game design is not without its limitations. One limitation is the lack of adaptability and personalization. Traditional games generally follow a fixed set of rules and content, which may limit the level of individualization and customization available to players (Kurland, 2023). The development process for traditional games can be time-consuming and

resource-intensive, resulting in longer development cycles and potentially higher costs which will lead to a long waiting times, extended deadlines and higher cost video games (Rollings & Morris, 2003b, pp. 182–188), expensive video games always make gamers hesitate especially that most of gamers are teenagers according to a study by the Entertainment Software Association (Fitzgerald, 2020) in 2020 found that 97% of teens in the United States play video games, with an average of 8 hours of weekly gameplay.

Figure 5: Pie chart of age distribution of gamers in the United States of America (Fitzgerald, 2020)



Despite these limitations, traditional game design continues to be a beloved and impactful approach in the industry. The handcrafted nature of traditional games creates a unique and immersive experience for players, creating a sense of nostalgia and appreciation for the artistry involved. It provides a solid foundation for game development, with established design principles that have stood the test of time (Irfandi, 2023).

2.4 Reasons traditional game design continues to attract players

According to WIRED traditional video games continue to be played and enjoyed by millions of people worldwide for several reasons. First, these games often possess a timeless appeal that transcends generations. Classic titles such as “Super Mario Bros.”, “The Legend of Zelda”, “GTA San Andreas/ Vice City” and “Resident Evil”, have captivated players for decades with their engaging gameplay mechanics, deep and complicated storytelling full of twists and memorable characters and soundtracks, and immersive worlds (Irfandi, 2023; Wulf et al., 2018, pp. 11–12). Second, a sense of nostalgia is offered by traditional video games, especially when considering the soundtrack and simple relaxing music, allowing players to revisit their childhood golden memories or experience the games that shaped the industry's history (Irfandi, 2023; MCCARTHY, 2021).

For example, “Grand Theft Auto Vice City” which is an open world game holds a special place in the hearts of many gamers, the game was released in 2002 where you play as “Tommy Vercetti”, as a player you have the right to freely take or “steal” all kind of vehicle in the game or play the game main and side missions while discovering the game’s map and meeting new characters. The game transports players to the neon-lit streets of Miami in the 1980s (Deep House Amsterdam, 2016; Downes, 2022). One aspect that adds to the game’s nostalgic charm is its carefully selected soundtrack, featuring a diverse collection of iconic music from the 80’s era. As players drive through the city, they can tune into various radio stations (Flash FM, Wave 103, V-Rock...), each representing a different genre of music, such as rock, pop, and hip-hop (Battaglia, 2022; Otty, 2020). These stations play hits from the '80s, including tracks from renowned artists like “Michael Jackson”, “Madonna”, “A-ha”, and more. The radio stations in Grand Theft Auto: Vice City create a dynamic and immersive environment, allowing players to not only enjoy the gameplay but also time travel into the cultural references and musical nostalgia of that era (Battaglia, 2022; Deep House Amsterdam, 2016; Downes, 2022; Dudley, 2021; Otty, 2020; Sahbegovic, 2021).

Furthermore, the simplicity and accessibility of traditional games attract both casual and hardcore gamers alike. Unlike some modern games that can be complex and demanding, traditional games often have straightforward controls and intuitive gameplay, making them easy to pick up and play, as the idiom says “less is more”. Lastly, traditional video games frequently encourage social interaction and friendly competition (MCCARTHY, 2021). Whether through multiplayer modes or local co-op, these games provide opportunities for players to connect, bond, and share memorable gaming experiences with friends and family. These combined factors contribute to the enduring popularity and widespread appeal of traditional video games.

Figure 6: Metacritic scores from reviewers and users on classic titles (metacritic, n.d.)


GRAND THEFT AUTO: SAN ANDREAS PlayStation 2
 Rockstar Games | Release Date: Oct 26, 2004 | Also On: iPhone/iPad, PC, PlayStation 3, PlayStation 4, Xbox 360

Summary	Critic Reviews	User Reviews	Details & Credits	Trailers & Videos
	95 Metascore Universal acclaim based on 80 Critic Reviews	9.1 User Score Universal acclaim based on 2433 Ratings	Developer: Rockstar North Genre(s): Action Adventure, Modern # of players: 1-2 Cheats: On GameFAQs Rating: M More Details and Credits >	What's this? Summary: [Metacritic's 2004 PS2 Game of the Year] Five years ago Carl Johnson escaped from the pressures of life in Los Santos, San Andreas... a city tearing itself apart with gang trouble, drugs and corruption. Where filmstars and millionaires do their best to avoid the dealers and gangbangers... Expand > Buy Now Buy on amazon.com


GRAND THEFT AUTO: VICE CITY PlayStation 2
 Rockstar Games | Release Date: Oct 27, 2002 | Also On: PC, PlayStation 3, PlayStation 4

Summary	Critic Reviews	User Reviews	Details & Credits	Trailers & Videos
	95 Metascore Universal acclaim based on 62 Critic Reviews	8.8 User Score Generally favorable reviews based on 1461 Ratings	Developer: Rockstar North Genre(s): Action Adventure, Modern # of players: 1 Player Cheats: On GameFAQs Rating: M More Details and Credits >	What's this? Summary: [Metacritic's 2002 PS2 Game of the Year] Welcome to Vice City. Welcome to the 1980s. Having just made it back onto the streets of Liberty City after a long stretch in maximum security, Tommy Vercetti is sent to Vice City by his old boss, Sonny Forelli. They were understandably nervous about... Expand > Buy Now Buy on amazon.com

SUPER MARIO ADVANCE 4: SUPER MARIO BROS. 3 Game Boy Advance
 Nintendo | Release Date: Oct 21, 2003

Summary	Critic Reviews	User Reviews	Details & Credits	Trailers & Videos
	94 Metascore Universal acclaim based on 25 Critic Reviews	9.0 User Score Universal acclaim based on 295 Ratings	Developer: Nintendo Genre(s): Action, Platformer, 2D # of players: 1-4 Cheats: On GameFAQs Rating: E More Details and Credits >	What's this? Summary: A combination of exciting platforming action, wild power-ups, and charming Mario style has made Super Mario Bros. 3 a classic. With Super Mario Advance 4: Super Mario Bros. 3, you have your chance to partake in the special adventure anywhere you go on your Game Boy Advance. Your mission is to rescue the Mushroom Kingdom monarchs who have been transformed into animals by Bowser and his mischievous offspring, and in the process save the princess kidnapped by Bowser. Traverse eight huge worlds and encounter fun minigames and frantic boss battles as you explore the first Mario game to use an overworld map. Collapse > Buy Now Buy on amazon.com

THE LEGEND OF ZELDA: OCARINA OF TIME Nintendo 64
 Nintendo | Release Date: Nov 23, 1998

Summary	Critic Reviews	User Reviews	Details & Credits	Trailers & Videos
	99 Metascore Universal acclaim based on 22 Critic Reviews	9.1 User Score Universal acclaim based on 7878 Ratings	Developer: Nintendo Genre(s): Action Adventure, Fantasy # of players: 1 Player Cheats: On GameFAQs Rating: E More Details and Credits >	What's this? Summary: As a young boy, Link is tricked by Ganondorf, the King of the Gerudo Thieves. The evil human uses Link to gain access to the Sacred Realm, where he places his tainted hands on Triforce and transforms the beautiful Hyrulean landscape into a barren wasteland. Link is determined to fix the problems he helped to create, so with the help of Rauru he travels through time gathering the powers of the Seven Sages. Collapse > Buy Now Buy on amazon.com

2.4.1 Mario Maker

NINTENDO's "Super Mario Maker" shows how developers skillfully took advantage of the nostalgic feelings that the Mario franchise has left in the memories of players. By providing a platform where players can create and share their own Mario levels from different styles and generations (8-bits, 3d, sketch...). The game managed to create a deep sense of engagement and satisfaction for players and revisiting the players' memories as well as the realm of SUPER MARIO from different generations (Nintendo, n.d.).

According to (Whitehead, 2015) from Nintendo Life Super Mario Maker's charm lies in its ability to tap into our nostalgic love for all things Mario. What makes it so popular is the chance it gives the players the change to be the game creators, crafting our own levels with beloved characters and iconic elements. It's like having a playground of creativity within the Mario universe. In Mario Maker 2, The game's easy-to-use design tools make it accessible for everyone, whether the user is a seasoned gamer or just looking to dip your toes into game design. And the beauty is not just in creating; it's also in sharing (Frushtick, 2019).

The game fosters a community spirit where players can showcase their creations, play each other's levels, and even collaborate in this pixelated universe. With millions of user-generated levels, the game keeps surprising us with new challenges and innovative designs (Frushtick, 2019). Nintendo's ongoing support with updates ensures that the fun never stops (Klepek, 2019). Super Mario Maker isn't just a game; it's a canvas for creativity, a nostalgic trip, and a shared adventure in the ever-expanding world of Mario. (Frushtick, 2019; Hernandez, 2015)

The game has great reviews from different developers and games testers also players and still popular and has a large community until today. (Figure 7)

Figure 7: Super Mario Maker (Super Mario Maker, n.d.)

The image displays two screenshots of the Metacritic website, showing the review pages for Super Mario Maker and Super Mario Maker 2. Both pages feature a large image of the game's cover art on the left and a summary of reviews on the right. The top navigation bar includes the Metacritic logo, categories (Games, Movies, TV Shows, Music, News), a search bar, and a Register button. The breadcrumb trail indicates the game is in the Nintendo section.

Super Mario Maker (Wii U)

- Released On: SEP 11, 2015
- METAScore: **88** (Generally Favorable, Based on 87 Critic Reviews)
- USER SCORE: **8.7** (Generally Favorable, Based on 924 User Ratings)
- MY SCORE: (Hover and click to give a rating)

Super Mario Maker 2 (Nintendo Switch)

- Released On: JUN 28, 2019
- METAScore: **88** (Generally Favorable, Based on 106 Critic Reviews)
- USER SCORE: **8.5** (Generally Favorable, Based on 1,031 User Ratings)
- MY SCORE: (Hover and click to give a rating)

3 AI-Driven Game Design

Now for the part where this thesis will elucidate the role of artificial intelligence in the design of video games.

AI-driven game design refers to the process of designing video games that incorporate artificial intelligence techniques to enhance player experiences (DSouza, Jul 29; Wang, 2022). It involves the use of algorithms and machine learning to create game elements that adapt to the player's behavior and preferences in real-time (DSouza, Jul 29; Kolahn, 2023). This allows game designers to create dynamic and personalized experiences that are tailored to each individual player. AI-driven game design can also help to automate game design tasks, reduce development time, and increase the overall efficiency of game development. Examples of AI-driven game design techniques include procedural generation, reinforcement learning, and natural language processing (DSouza, Jul 29; SYNCED, 2020). AI-driven game design is an emerging field that has the potential to revolutionize the gaming industry by creating more immersive and engaging games that provide a unique experience for each player.

AI-driven game design is a relatively new approach to game development that uses artificial intelligence (AI) to create games that can adapt to the player's behavior and preferences (Jones-Read, 2023). In this approach, game developers incorporate algorithms and machine learning techniques that analyze player data and interactions with the game in real-time (DSouza, Jul 29). This information is then used to dynamically adjust the game's mechanics, difficulty levels, and other parameters to provide a personalized gaming experience (Aleksandra, 2023). AI-driven game design allows for the creation of games that can learn and evolve as players progress, providing a more engaging and immersive experience (Aleksandra, 2023; DSouza, Jul 29; Wang, 2022).

Table 5 provides brief descriptions of AI-utilizing games, all of which received high scores from both developers and gamers on Metacritic.

Table 5: Example of games that implement Ai-driven design.

Game Title	Genre	Description
<i>Left 4 Dead</i>	First-person shooter	This cooperative first-person shooter game uses AI to create dynamic gameplay experiences. The AI system, called the Director, adjusts the game's difficulty and pacing based on player performance and behavior.
<i>The Sims 4</i>	Action-adventure	This life simulation game uses AI to control the behavior and actions of non-playable characters. The game's AI system, called the Autonomous Causal Agent, allows NPCs to make decisions based on their needs and desires, creating a more realistic and immersive gameplay experience.
<i>Assassin's Creed origin</i>	Action-adventure	This action-adventure game uses AI to generate crowds of non-playable characters with realistic behaviors and movements. The game's AI system, called the AnvilNext engine, also controls the behavior of enemy AI, making them more challenging and unpredictable.
<i>Forza Motorsport</i>	simulation racing	This racing game uses AI to create a more realistic and challenging driving experience. The game's AI system, called Drivatar, creates a unique AI driver profile for each player, based on their driving style and behavior, which is used to generate opponent AI in races.
<i>StarCraft II</i>	Real-time strategy	This real-time strategy game uses AI to create challenging and adaptive opponents. The game's AI system, called the Adaptive AI, adjusts the behavior and strategy of enemy units based on the player's actions, making the gameplay experience more dynamic and engaging.

F.E.A.R.	First-person shooter	AI-controlled enemies with advanced decision-making and combat tactics
-----------------	----------------------	------------------------------------------------------------------------

In each title, a unique narrative is crafted, highlighting the pivotal role played by artificial intelligence (AI). In the cooperative first-person shooter "Left 4 Dead", the Director AI is employed to tailor gameplay based on player performance, elevating and improving the experience (Edlund, 2015, p. 1; Fandom, n.d.). In the life simulation game "The Sims 4," the Autonomous Causal Agent AI is used to give non-playable characters a life of their own, responding to needs and desires (Electronic Arts, n.d.). "Assassin's Creed Origins" showcases the AnvilNext engine (Ubisoft, n.d.), which leverages AI to create realistic crowds and challenging enemy behaviors in the action-adventure realm. Racing takes a step further in "Forza Motorsport," where the Drivatar AI is utilized to craft unique opponent profiles based on players' driving styles. In the real-time strategy game "StarCraft II," the Adaptive AI dynamically adjusts opponents' tactics based on player actions. Finally, in the first-person shooter "F.E.A.R.," advanced AI-controlled enemies are introduced with sophisticated decision-making and combat tactics. A fascinating narrative is unfolded by each game, showcasing how AI enriches the gaming experience, rendering it more dynamic, challenging, and immersive.

3.1 Background

In the early days of video games, artificial intelligence (AI) was used to create basic behaviors for computer-controlled opponents or non-player characters (NPCs). The concept of AI in video games began to emerge in the 1970s and 1980s, although the capabilities were relatively limited compared to modern AI systems (Russell & Norvig, 2020) .

According to "Bigcloud.Global", one notable early example of AI in video games is the game "Space Invaders" released in 1978, where the enemies had programmed behaviors to move and

attack the player. Another milestone came in 1982 with the release of "Pac-Man," which featured AI-controlled ghosts that exhibited different movement patterns and behaviors. (Big Cloud, 2016)

As technology is advancing, game developers started exploring more sophisticated AI techniques. In the 1990s and early 2000s, games like "F.E.A.R." and "Black & White" and "The Sims" introduced more advanced AI systems that allowed NPCs to adapt to the player's actions and make decisions based on dynamic game environments (Spronck et al., 2018, pp. 113–114).

Today, AI in video games has developed significantly. Game developers utilize some new techniques such as machine learning, neural networks, and data-driven algorithms to create more intelligent and realistic behaviors for NPCs that can match real human behavior (Huynh-The et al., 2022). AI-driven game design encompasses various aspects, including procedural content generation (PCG) (Hendrikx & Meijer, 2011), adaptive difficulty, realistic physics simulations, and player behavior analysis (DSouza, Jul 29; Huynh-The et al., 2022; Togelius et al., n.d.) .

In open world titles, AI has improved the design and development of open world games, bringing a new level of realism, and dynamic gameplay (Aleksandra, 2023; DSouza, Jul 29; Ijarotimi, 2023). In these vast virtual worlds, AI algorithms play a crucial role in creating lifelike environments and interactions (Aleksandra, 2023). One notable example of AI in open world games is the implementation of advanced NPC behaviors (Aleksandra, 2023; DSouza, Jul 29; Ijarotimi, 2023). Non-player characters now have more realistic and adaptive behaviors, such as reacting to the player's actions, engaging in realistic conversations, or following daily routines (DSouza, Jul 29; G. N. Yannakakis & Togelius, 2015). Games like "Red Dead Redemption 2" and "The Witcher 3: Wild Hunt" feature AI-driven NPCs that engage in various activities, from hunting and fishing and farming to even socializing with other characters (Dailey, 2020). Another area where AI shines in open world games is procedural content generation (Togelius et al., n.d.; G. N. Yannakakis & Togelius, 2015). AI algorithms can generate expansive landscapes, and dynamically changing weather patterns, resulting in a living, breathing world for players to explore, as a good example of that Rockstar's big title "Grand Theft Auto V" that was published in 2013. For instance, "No Man's Sky" utilizes AI to create an entire universe with billions of procedurally generated planets, each

offering unique environments and ecosystems (Kharpal, 2016; SYNCED, 2020). AI-powered enemy AI in open world games can exhibit complex behaviors, adapt to the player's strategies, and provide challenging combat encounters. Games like "The Witcher 3: Wild Hunt" employ AI-driven enemy AI that can coordinate attacks, tactical maneuvers, and adjust their difficulty based on the player's skill level.

Figure 8: No Man's Sky open world (Marshall, 2022)



Overall, the incorporation of AI designed and has come a long way since its inception, revolutionizing the way games are designed, and enhancing player experiences by providing more immersive and challenging gameplay.

3.2 Insights on how AI functions in video games

Artificial Intelligence in video games involves the use of computational algorithms and techniques to simulate intelligent behavior in non-player characters (NPCs) or opponents and enemies in the

game (Huynh-The et al., 2022; G. N. Yannakakis & Togelius, 2015, pp. 99–104 & 127). There are also different approaches and methods are employed to create realistic and engaging AI experiences (Russell & Norvig, 2020). For example, decision-making algorithms, such as finite state machines (FSM), behavior trees, or rule-based systems, enable NPCs to make choices and react dynamically to the game environment or player actions (G. N. Yannakakis & Togelius, 2015).

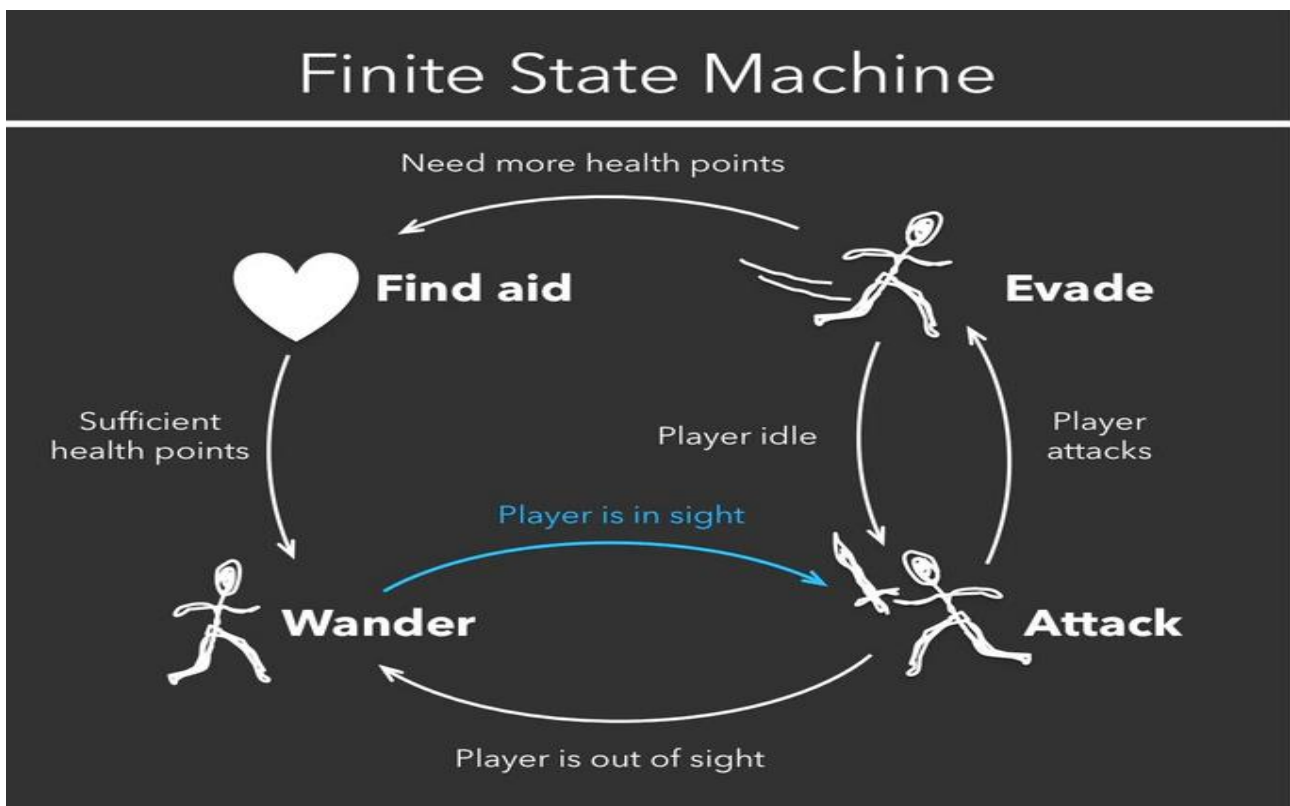
Pathfinding and navigation algorithms allow NPCs to move efficiently through complex game worlds (Huynh-The et al., 2022; G. N. Yannakakis & Togelius, 2015). Machine learning techniques, including neural networks, are used to train AI agents by providing them with large amounts of data and feedback, enabling them to improve their performance over time (Huynh-The et al., 2022; Ijarotimi, 2023). Procedural content generation (PCG) algorithms are employed to automatically generate game content, such as levels or maps, enhancing replayability (Hendrikx & Meijer, 2011; G. N. Yannakakis & Togelius, 2015). Additionally, adaptive difficulty systems analyze player behavior and adjust the game's difficulty level dynamically (Aleksandra, 2023; DSouza, Jul 29; Hunicke & Chapman, 2004). These techniques collectively contribute to the making of an immersive and challenging gaming experiences (DSouza, Jul 29; Hunicke & Chapman, 2004).

According to Time magazine, Elon Musk recently expressed concerns about the rapid development of AI with learning capabilities by companies like Google and Facebook, cautioning that it could pose a threat to humanity (Lou, 2017). This warning has generated significant public interest in the field of AI. The vision of AI presented by these tech giants often revolves around self-teaching programs that become increasingly powerful with more data. While this holds true for AI systems like AlphaGo, which learned from millions of historical Go matches and continues to learn from playing with human players online, the term "AI" in the context of video games encompasses more than just self-teaching AI. (R. CHOW, 2023) (Lou, 2017)

In the world of video games, AI is primarily employed to enhance the gaming experience of human players, rather than only focusing on defeating them. One common application of AI in games is the control of non-player characters (NPCs). Game designers employ various techniques to make NPCs appear intelligent. One widely utilized technique is the Finite State Machine (FSM) algorithm

Figure 9), which was introduced in the 1990s (Lou, 2017). With FSM, designers define all possible situations that an AI may encounter and program specific reactions for each situation. Essentially, an FSM-based AI promptly responds to the actions of human players with pre-programmed behaviors. For instance, in a shooting game, the AI would attack when the player appears and retreat when its own health is low. Well known games like "Battlefield", "Call of Duty", and "Tomb Raider" feature successful implementations of FSM-based AI (Lou, 2017). Even the turtles in "Super Mario" have a basic form of FSM design. The drawback of the FSM design is its predictability. Since all non-player characters' behaviors are pre-programmed, players may become less interested in an FSM-based game after playing it a few times, as they can anticipate and predict the NPC's actions (Aleksandra, 2023; DSouza, Jul 29; G. N. Yannakakis & Togelius, 2015).

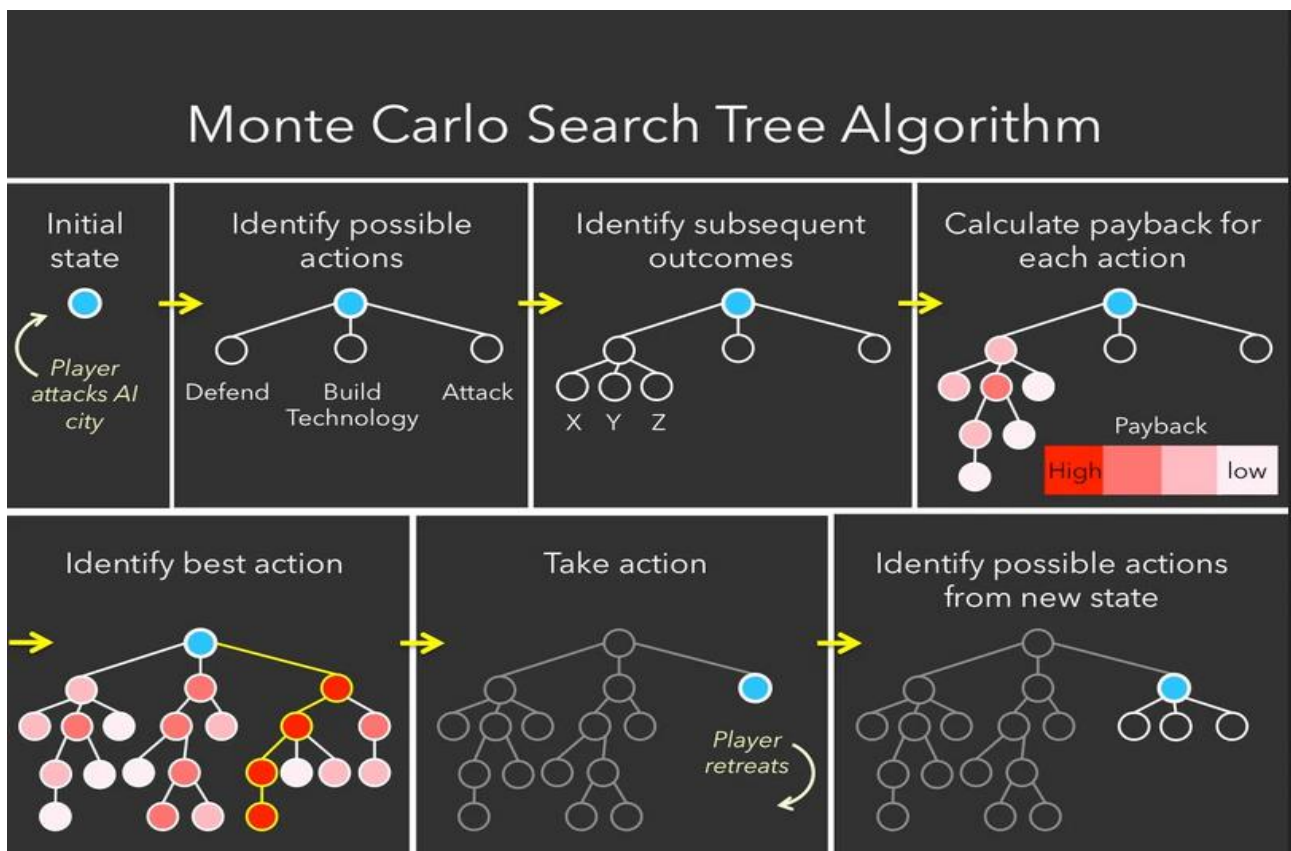
Figure 9: A simple flow chart of how the Finite State Machine algorithm works in a shooting game (Lou, 2017)



The Monte Carlo Search Tree (MCST) algorithm is a more advanced method used to enhance the personalized gaming experience. It employs a strategy of utilizing random trials to solve a problem, drawing inspiration from the AI approach implemented in Deep Blue, which famously defeated a human chess champion in 1997 (Lou, 2017; Roy, 2019). Deep Blue utilized MCST by considering all possible moves at a given point in the game, including human player moves in response, and subsequent responding moves. This process creates a "search tree" as the possible moves expand, resembling branches growing from a stem (Lou, 2017; Roy, 2019). By repeating this process multiple times, the AI calculates the payback and determines the best branch to pursue. After executing a real move, the AI repeats the search tree based on the remaining possible outcomes. In video games, an AI employing MCST can calculate numerous possible moves and select those with the most favorable payback, such as acquiring more in-game currency (Lou, 2017).

A similar approach has been applied in strategy games, although the larger number of possible moves makes it impossible to consider them all. Instead, the MCST (Figure 10) in these games randomly chooses a subset of possible moves as a starting point, resulting in more uncertain outcomes for human players. For instance, in Civilization, a game where players develop a city while competing with an AI, pre-programming every move for the AI is impractical. Instead of solely relying on the current game state like a finite state machine (FSM), an MCST-based AI evaluates various potential next moves such as technology development, attacking human players, defending fortresses, and so on (Lou, 2017). The MCST is then employed to calculate the overall payback of each move and selects the most valuable or best option. (Roy, 2019)

Figure 10: Simple illustration on Monte Carlo Search Tree Algorithm (Lou, 2017)



3.2.1 No Man's Sky

In the world of 'No Man's Sky', AI is the invisible hand that shapes the universe players explore (SYNCED, 2020). Even though there are more planets in No Man's Sky than there are stars in the Milky Way, you will never be able to locate a duplicate planet there (Kharpal, 2016). The main selling point of No Man's Sky throughout the years-long hype cycle leading up to release has been the game's enormous amount of material. No Man's Sky uses procedural generation, a programming approach that programmers have been utilizing for more than 35 years, to accomplish its enormous galaxy construction accomplishment (Kharpal, 2016).

The game has a humongous universe, where planets, creatures, and landscapes aren't just handcrafted by designers but are born out of AI algorithms. It's a galaxy of procedural wonders where every planet feels like a new adventure, thanks to AI's ability to generate diverse and one-of-a-kind environments (Kharpal, 2016). But AI doesn't stop there. The creatures roaming these

planets behave with a lifelike realism, from their hunting instincts to their reactions to changing weather. Even the Sentinels, robotic watchdogs of the galaxy, are driven by AI, deciding when to go from guardians to foes based on how players treat the environment (Kharpal, 2016).

The game even uses AI to craft a dynamic narrative, reacting to your choices and actions with ever-evolving missions (Kharpal, 2016). AI also lends a hand in translating the languages of alien species, bridging the gap for players eager to explore these cultures. As you soar through the cosmos, AI ensures the space around you feels alive, calculating celestial movements and events. Behind the scenes, it keeps the game's balance in check, ensuring a smooth and engaging experience. In essence, 'No Man's Sky' showcases how AI can create an expansive, ever-changing universe where the boundaries of exploration and adventure are pushed further with every planetary landing (Kharpal, 2016).


The procedural generation method for No Man's Sky must take all of those factors into consideration. When Sean Murray, a lead programmer of No Man Sky and managing director of Hello Games, talks about the "math" that powers the game, he is referring to this algorithm (Kharpal, 2016; Purdom, 2018).

According to Sean Murray, a lead programmer of No Man Sky and a managing director of Hello Games, it would take around 584 billion years to find every planet in "No Man's Sky" if one were discovered per second. That's not an imaginary or exaggerated number because there are more than 18 quintillion planets in the "No Man's Sky" universe, or 18,446,744,073,709,551,616. People can explore the cosmos, improving their spacecrafts and weaponry, finding, and naming new plant and animal species as well as new animal and planet species. (Kharpal, 2016)

Figure 11: No Man's Sky humongous universe (Kharpal, 2016)

About 296 000 000 results (0,55 seconds) « Add Grepper Answer (a)

The universe of “No Man's Sky” is gigantic with over 18 quintillion – or 18,446,744,073,709,551,616 – possible planets to visit. People can travel through the universe, upgrading weapons and spaceships, discovering new plant species, animals or even planets then naming them. 10 Aug 2016

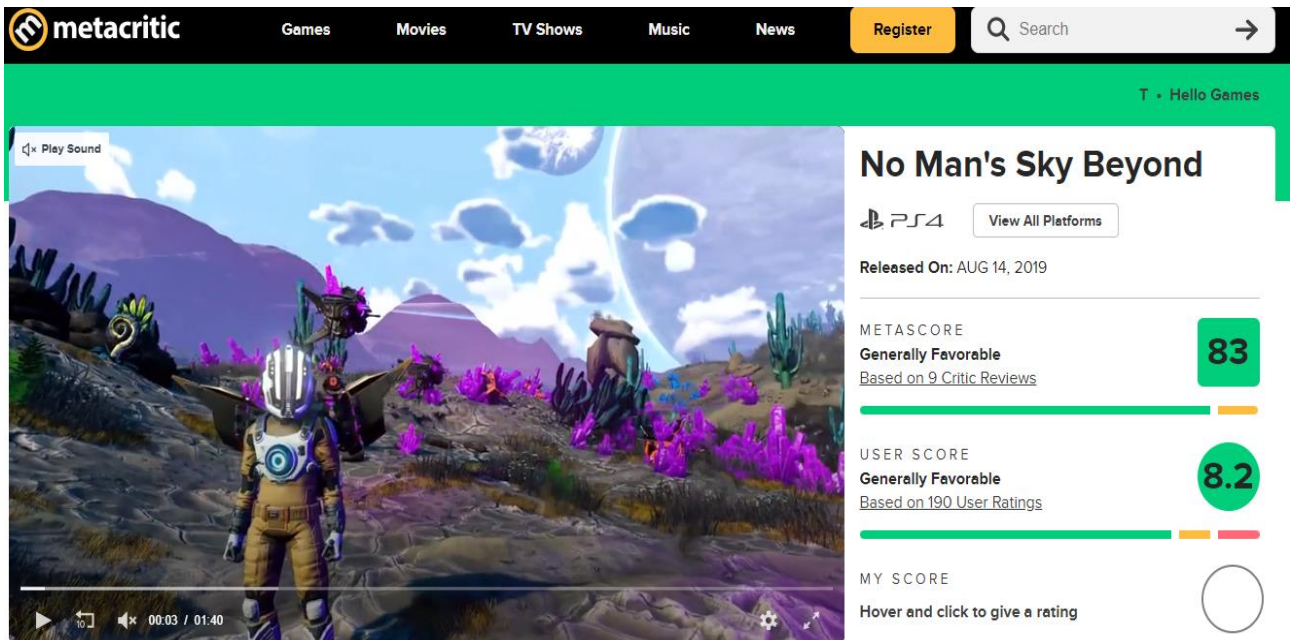


CNBC
https://www.cnn.com > 2016/08/10 > no-mans-sky-rele... ⋮

'No Man's Sky': Would you play a game that takes 584 billion ... ✓

The game also scored high ratings from various game testers, reviewers, and also players from different platforms. Showing the big success of the game among players.

Figure 12: No Man's Sky ratings (Metacritic, 2019)



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T • Hello Games

Play Sound

No Man's Sky Beyond

PS4 View All Platforms

Released On: AUG 14, 2019

METASCORE
Generally Favorable
Based on 9 Critic Reviews

83

USER SCORE
Generally Favorable
Based on 190 User Ratings

8.2

MY SCORE
Hover and click to give a rating

3.3 Strengths and limitations of AI-driven game design

Stepping into the realm of AI-driven game design is like navigating uncharted territory where innovation meets challenges. This dynamic landscape brings both strengths and limitations that shape the gaming experience. Let's delve into the powerful capabilities and potential hurdles that AI injects into the heart of interactive entertainment.

3.3.1 Strengths

AI-driven game design has introduced a new paradigm in the gaming industry, enabling developers to create games that adapt to the player's behavior and preferences (Spronck et al., 2018, pp. 87–88). One of the strengths of AI-driven game design is the ability to provide a personalized gaming experience. AI can analyze player data and behaviors to customize the game to each individual player, creating a more engaging and satisfying experience (Spronck et al., 2018, pp. 118–119). Additionally, AI can enhance game mechanics, such as enemy behavior, difficulty level, and level design, to create a more challenging and rewarding game (Hunicke & Chapman, 2004). The strength of AI lies in its ability to adapt and respond dynamically to player actions, crafting personalized and immersive gameplay. Whether through adaptive storytelling, procedural content generation, or predictive difficulty adjustment, AI enriches the gaming landscape by providing tailored and engaging experiences for players (Clustox, 2022; DSouza, Jul 29; Hunicke & Chapman, 2004). This transformative capability of AI-driven game design marks a significant stride in creating dynamic, responsive, and captivating virtual worlds (Clustox, 2022; DSouza, Jul 29).

3.3.2 Limitations

There are also limitations to AI-driven game design. One potential issue is the risk of over-reliance on AI, which can result in a loss of creativity and originality in game design (Chi, 2023). Additionally, AI algorithms can be biased or flawed, leading to unfair or frustrating gameplay experiences for players. Another limitation is the challenge of balancing the game's difficulty, as AI algorithms can make the game too easy or too difficult for certain players (Hunicke & Chapman,

2004). However, one of the limitations of AI-driven game design is the risk of over-reliance on data analysis. In some cases, developers may prioritize data over creative design, resulting in a lack of innovation and variety in game experiences (Garg, 2023). Moreover, the use of AI can also be expensive and time-consuming, which can be a limitation for smaller game development teams or indie developers (Mehrafrooz, 2020).

Relying on AI itself can lead to a reduction in creativity, games will often feel similar and look alike. As a consequence, it ended up making games less playable and more boring. As stated in the previous paragraph, the game industry focused more on the creativity of creating video games, being simple and familiar to all types of games, and having diverse tastes and demands. A clear example of that is the UBISOFT title "Assassin's Creed". The first generations of the game gained tremendous success, but over the years, the game started receiving waves of criticism and bad reviews. Being unable to offer new gameplay chained the game in a loop of repetition (same NPCs' intelligence, same behavior...) and caused a loss of its special touch, which of course impacted the players' enjoyment of their beloved game (McNulty, 2023; Rohit, 2023). Additionally, AI requires a huge number of resources and requirements to keep the game up and running (Ambolis, 2023). Furthermore, servers' maintenance is a critical and expensive problem. Speaking of servers, maintaining them 24h running is not that easy to achieve. It requires a whole technical support and maintenance team that will cost studios, especially small ones, a huge amount of money (Columbia Engineering, n.d.). As an example, ROCKSTAR's famous game "Grand Theft Auto V" has cost the studio a fortune. The game is known for its immense and immersive world, advanced NPCs, dynamic environment (Langley, 2013)... But it's also known for being one of the most expensive games that was ever created (back in 2013, when it was first released) (Dutta, 2023; Selway, 2023). Another good example is the EA (Electronic Arts) battle royale game APEX Legends. The game offered a unique past-paced game play and managed to emerge all types of players, because it used AI to generate "human-like" NPCs in order to create a dynamic and adjustable difficulty in order to create emergence and integration for new players in the world of APEX (W., 2023). After a couple of days after the release, the game faced waves of problems and bugs, being unable to create or find matches, players were kicked from the game for no reason (Mathur, 2023). All these problems occurred because of technical problems with the game servers. Which led to frustration and a lack of satisfaction among the players who loved playing and enjoying the

game (Marie ZT, 2023), as well as a huge waste of money for the studio. Taking that into consideration, those were big studios with a net worth of millions of dollars. For today's studios, in order to cover the cost of servers and maintenance, they went to microtransactions, which is a service where you have to pay for skins, open new tools in the game... Players often call it "pay to win" which is a concept that has ruined the enjoyment of most of today's games for its effects on players. Being in a situation where you have to pay for skills or to upgrade your character, or you have to play for "ages" to unlock something that you were able to achieve in a fair amount of time, causing less engagement and enjoyment (Bahri, 2022; Cooney, 2019; Fox, 2019).

It is important for game developers to carefully consider the strengths and limitations of AI-driven game design when creating new games and to strive for a balance between AI-driven design and traditional game design approaches.

3.4 Impact of AI-driven game design on players

Artificial intelligence (AI) in game design has revolutionized the gaming industry by enabling games to adapt and personalize the player's experience. AI-driven games can adapt to the player's behavior and preferences, creating a unique and personalized experience for each player (Data Science Wizards, 2022; Liapis et al., n.d.). The fundamental concepts and foundations of AI in games, including techniques such as search algorithms, decision trees, neural networks, and evolutionary computation. It then delves into the specific applications of AI in game design, character behavior, player modeling, game balancing, procedural content generation, and player experience enhancement. The researchers (G. N. Yannakakis & Togelius, 2015) provide examples of how artificial intelligence is utilized to create more intelligent and adaptive game NPCs, leading to improved gameplay challenges and more realistic human-like behaviors. They also highlight how AI techniques can be employed in player modeling and adaptation, allowing games to dynamically adjust difficulty levels, provide personalized experiences, and optimize engagement (Liapis et al., n.d.; G. N. Yannakakis & Togelius, 2015).

AI has the capacity to fulfill three main functions: "modeling", "generating", and "evaluating". An artificial neural network could replicate a specific playing pattern, while a genetic algorithm can

create game assets. Additionally, AI tools or benchmarks can be employed to assess the quality and effectiveness of anything that has been modeled or generated. When examining the player-game interaction aspect of game AI, it becomes evident that the player modeling domain has the most immediate and significant influence on the player experience. This is because it is directly linked to the interaction between the player and the game (G. Yannakakis & Togelius, 2011). On the other hand, the impact of search and planning techniques on the player experience is more indirect, as they influence the game itself, which subsequently affects the player's experience (G. Yannakakis & Togelius, 2011).

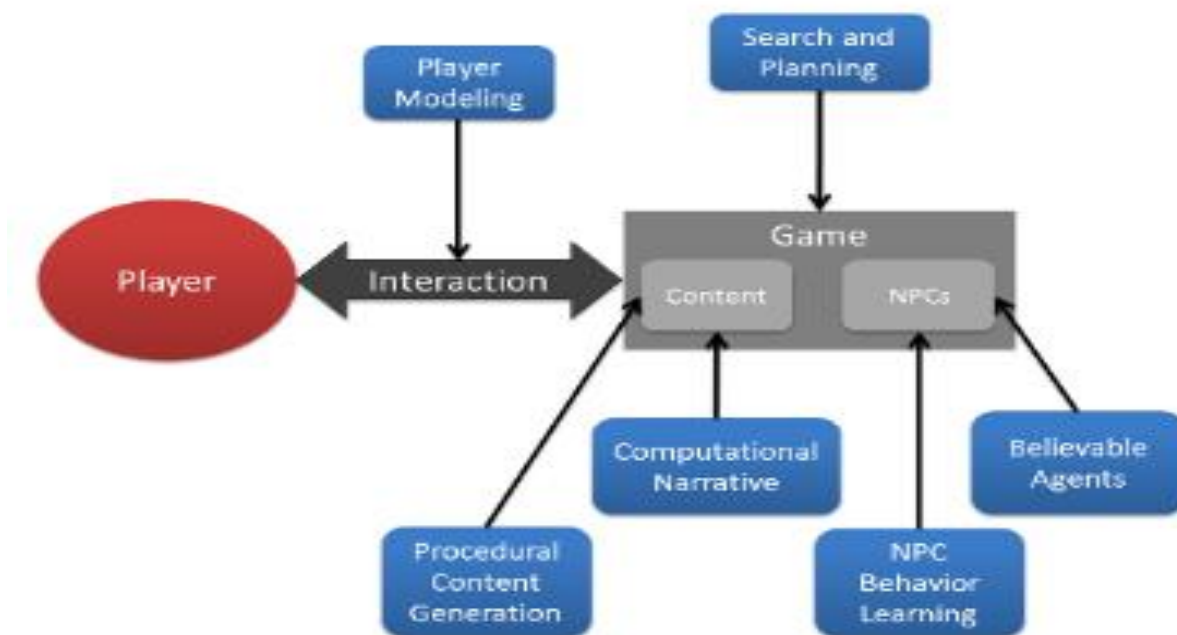
Among the remaining areas, procedural content generation (PCG) has the greatest influence on the player's experience. This is because all games incorporate some form of environment representation and mechanics, and PCG plays a key role in shaping those elements (Barreto et al., 2014). Believable agents and NPC behavior learning, on the other hand, are specific to games that involve agents or non-player characters. The player experience is affected by the realism and intelligence exhibited by these agents. Computational narrative, meanwhile, influences the player experience when a narrative component is incorporated into the game, adding depth and engagement (G. N. Yannakakis & Togelius, 2015).

The four areas not directly considered in this game AI perspective have a more remote impact on the player. However, it is worth noting that research on general game AI primarily engages game AI researchers, but its findings could potentially be transferred to NPC agents, leading to improved player experiences (Liapis et al., 2021; G. N. Yannakakis & Togelius, 2015).

By looking at Figure 13, it can be clearly seen that the viewpoint of game AI on player-game interaction is evident. Since the player modeling area is the only one directly connected to the player-game interaction, it stands to reason that it has the greatest immediate and direct influence on the player experience. Planning and searching affects the game and, in turn, indirectly affects the player experience. Ultimately, out of all the other categories, player experience is most influenced by PCG because all games feature some sort of environment depiction and gameplay. While NPC behavior learning and believable agents are limited to games

with agents or non-player characters, computational storytelling influences the player experience when a game incorporates a narrative (G. N. Yannakakis & Togelius, 2015).

Figure 13: The perspective of player-game interaction offers a panoramic view of AI research in the field (G. N. Yannakakis & Togelius, 2015)



An article in the “Medium” has shown that AI-driven games can lead to higher levels of player engagement and satisfaction compared to traditional game design (Data Science Wizards, 2022) . The adaptive nature of AI-driven games can also provide new challenges for players, keeping the game fresh and exciting but also simple. However, there are also potential limitations to AI-driven game design, such as the risk of players feeling like they are being manipulated or losing control of the game. It is important for game developers to balance the benefits and limitations of AI-driven game design to create an enjoyable and engaging gaming experience for players.

AI-driven game design has revolutionized the gaming industry by providing personalized and adaptive experiences to players. AI-driven games could learn from the player's behavior and adjust

the game accordingly, resulting in a more immersive and engaging gameplay. This personalized approach to game design has shown to significantly increase player engagement and satisfaction. Studies have found that players who experienced AI-driven game design reported higher levels of engagement and enjoyment compared to those who played traditionally designed games. However, the use of AI in game design also has its limitations, as it may lead to a lack of control over the game's outcome and a potential loss of creativity in the development process. Additionally, AI-driven game design may face challenges in balancing gameplay difficulty and ensuring fairness for all players. Despite these limitations, AI-driven game design has shown promising results in enhancing player engagement and satisfaction.

A survey was made by (Yildirim Yayilgan & Stene, 2010) presented a comprehensive exploration of the role and importance of artificial intelligence (AI) in game agents. The researcher conducted a survey to gather insights from game developers and designers regarding the need for AI in creating intelligent and engaging game characters.

The study begins by discussing the fundamental role of game agents in providing interactive and dynamic gameplay experiences. It highlights the significance of AI techniques in enhancing the behavior, decision-making, and responsiveness of game agents (NPCs) making them able to predict and learn players behaviors.

Through the survey, the researcher identifies key motivations for incorporating AI in game agents. These include improving the realism of NPCs, enhancing the challenge and enjoyment for players, and enabling adaptive and responsive gameplay experiences.

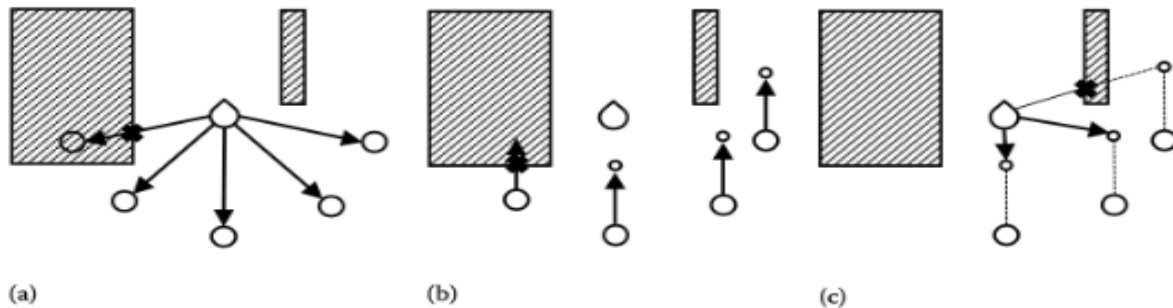
Furthermore, the study explores the different AI techniques employed in game agents, such as rule-based systems, finite state machines, neural networks, and machine learning algorithms. (Yildirim Yayilgan & Stene, 2010)

Speaking of NPCs, they play a significant role in the difficulty of the game. In the past, players were the ones who selected the game's difficulty, ranging from easy to hard to impossible. However, with the introduction of AI, this process is now handled by the AI itself. The AI has the ability to analyze the player's game style and scale the difficulty accordingly based on the player's progress

and skills in the game. Especially, in stealth games that focus on intelligence of the NPCs/enemies to create a challenging and fun game for the players. A good example of that is from Naughty Dog's masterpiece "The Last of Us". According to a case study by (Harsh Panwar, University of London), The Last of Us achieved a big success and garnered immense love from players primarily due to its remarkable AI that strived for a sense of realism being able to make a companion able to outsmart the enemies and behave like a real human, that will help in making an advanced and adaptive AI companion that will have a big influence over player's experience, it's also a big progress in the advancement of creating games that are meaningful and captivating for the players. Unlike other games, The Last of Us introduced a unique approach by emphasizing coordination between NPCs, thereby enhancing the intelligence of the in-game characters. Through the AI-driven character "Ellie", players were able to form genuine connections with Ellie as if it was a living character through the storyline how she was able to change her character and personality according to the events in the game environment and the sequence of the events, with each of her gestures carrying significant meaning (Madigan, 2014). Leaving a deep impact on players engagement and immersion, enhancing the overall gaming experience by seamlessly integrating innovative features and dynamic narratives, capturing the player's attention and fostering a heightened sense of connection with the virtual world.

The level of dedication showcased by the developers of The Last of Us becomes apparent when they discuss concepts such as "her personal space" and "her choices" in their written papers on the character. The developers were committed to avoiding shortcuts and cheating methods, utilizing teleportation sparingly and only when absolutely necessary, ensuring a seamless experience for players. This attention to detail and commitment to authenticity contribute to the game's high level of engagement and player satisfaction.

Figure 14: The Last of Us pathfinding raycasts for following positions (Panwar, 2022)



As mentioned in last paragraph, in-game characters have an important effect in improving players engagement by giving a realistic feeling and look in the games and reacting with the environment and the storyline (dialogues, conversations, making choices and often telling a joke or a silly comment...) (Bakkes et al., 2012). So Artificial intelligence has greatly enhanced storytelling in video games, revolutionizing the way narratives unfold. With the implementation of AI, game developers are able to create more immersive and dynamic storylines (Bakkes et al., 2012). AI algorithms can adapt to player choices and actions, allowing for personalized and branching narratives that provide a sense of agency to the players, while in traditional games, NPCs were often felt somewhat disturbing the immersive experience and players engagement (Bakkes et al., 2012; Fraser et al., 2018). This level of responsiveness and interactivity adds depth and engagement to the storytelling experience, as players feel their decisions directly impact the unfolding plot. Furthermore, a study by (Fraser et al., 2018) explored the world of spoken conversational AI in video games and its impact on user engagement. The researchers focus on the role of emotional dialogue management and how it enhances the interactive experience between players and in-game characters. The results of this study contribute to the understanding of how conversational AI, particularly emotional dialogue management, plays a pivotal role in shaping player experiences in video games (Fraser et al., 2018). By employing sophisticated dialogue systems that recognize and respond to emotional cues, game developers can create more immersive, interactive, and emotionally resonant gameplay. The study also conducted a survey to examine the impact of emotional dialogue management on user engagement in video games (Fraser et al., 2018). The survey explored how integrating emotional dialogue into conversational AI systems enhances the interactive experience between players and in-game characters by

answering four questions concerning enjoyment and immersion. The findings of the survey indicated that emotional dialogue management significantly increased user engagement, fostering stronger emotional connections and enhancing overall gameplay experiences (Fraser et al., 2018). Highlighting the importance of incorporating realistic and emotionally nuanced interactions in video games to create more immersive and captivating gameplay.

Table 6: Results of the survey made by researchers (Fraser et al., 2018)

Table 1: User Enjoyment: Q1

	Emotions enabled	Emotions disabled
Strongly disagree	0	0
Disagree	0%	12.5%
Agree	75%	50%
Strongly agree	25%	37.5%

Table 2: Emotion effect on Immersion: Q2

	Emotions enabled	Emotions disabled
Strongly disagree	0	0
Disagree	25%	75%
Agree	62.5%	25%
Strongly agree	12.5%	0

In summary, this study provides insights into how emotional dialogue influences and affects various aspects of management in spoken conversational AI within video games. The research underscores the significance of incorporating realistic emotional interactions between players and in-game characters, demonstrating how such enhancements can significantly heighten user engagement and overall gaming experiences (Fraser et al., 2018).

4 Comparison of Traditional and AI-Driven Game design

Traditional game design and AI-driven game design represent two distinct approaches to creating video games. While traditional game design relies on the creativity and experience of the developer, AI-driven game design utilizes algorithms to adapt the game experience to the player's behavior and preferences. Each approach has its strengths and limitations, and understanding these can help game developers create more engaging and immersive experiences for players. By comparing the two approaches, developers can identify the best practices for game design and create games that are both enjoyable and rewarding for players. Several studies have explored this topic, analyzing the effectiveness of traditional and AI-driven game design on player engagement and satisfaction.

4.1 Comparison of the strengths and limitations of both approaches

Traditional game design and AI-driven game design have their own unique strengths and limitations that impact the gaming experience and players engagement. Traditional game design relies heavily on human creativity and expertise, which can result in games with deep and complicated storylines, well-designed levels, and memorable characters. However, traditional game design can also be limited by the creative capacity and biases of the game designers, which can lead to repetitive and boring gameplay, linear storytelling, and predictable outcomes. Additionally, Traditional game design allows for greater control and creativity for the game developer, as they have complete control over the game mechanics and story. This often results in more immersive and emotionally impactful experiences for players. It also allows for a greater level of accessibility, as it does not require specialized technology or resources to develop.

On the other hand, AI-driven game design offers the potential for a more personalized and dynamic gaming experience. AI algorithms can analyze player behavior and adjust gameplay, difficulty, and storyline in real-time to keep players engaged and challenged. This can result in a more immersive experience that caters to the preferences of each individual player. It allows for greater player personalization, as the game adapts to the player's preferences and behavior. This often results in a more dynamic and responsive gameplay experience. AI-driven game design also

has the potential to significantly reduce development time and costs, as the AI can generate game content and mechanics on its own.

However, AI-driven game design can also be limited by the accuracy and complexity of the algorithms, which can lead to glitches, unexpected outcomes, and a lack of creative diversity. The AI's decision-making process may not always align with the developer's intended design or the player's desired experience. AI-generated content may also lack the creativity and emotional impact that can be achieved through traditional game design. Additionally, AI-driven game design requires specialized technology and resources, which can limit accessibility for some developers and players.

Ultimately, the strengths and limitations of traditional game design and AI-driven game design will depend on the specific context and goals of the game development project. By considering these factors, game developers can make informed decisions about which design approach will best serve their needs and the needs of their players.

Overall, the strengths and limitations of traditional game design and AI-driven game design should be considered when creating games that prioritize player engagement and satisfaction. A balance between these two approaches can result in a game that offers both the creativity of traditional game design and the adaptability of AI-driven game design.

Table 7: Strengths and limitation of both approaches side by side

	Traditional Game Design	AI-Driven Game Design
Strengths	- Allows for greater creativity and flexibility in design	- Can adapt to player behavior and preferences
	- Games can be tailored to a specific audience	- Can create unique and personalized experiences for players

	- Offers a sense of familiarity to players	- Can provide real-time feedback to players
	- Can be less expensive to produce than AI-driven games	- Can generate content automatically
		- Can provide intelligent opponent behavior
		- Can enhance immersion and realism
Limitations	- Limited player feedback during gameplay	- Can result in predictable or repetitive gameplay
	- May not be as engaging or challenging for some players	- May lack the creativity and unpredictability of humans
	Does not adapt to player behavior or preferences	- Requires a large amount of data and processing power
	- May not be able to provide realistic opponent behavior	- Can be costly to develop and implement
		- Can be prone to errors and bias
		- May not be able to replicate the human touch

Traditional game design thrives on creativity, making well-crafted games to specific audiences with a touch of familiarity. However, it may lack player engagement and adaptability. On the other hand, AI-driven game design excels in adapting to player preferences, providing real-time personalized experiences and intelligent opponent behavior. Yet, it faces challenges like the risk of predictability and the need for substantial data and processing power. Both approaches contribute unique flavors to the gaming landscape, each with its strengths and limitations in delivering captivating player experiences.

4.2 Comparison of the impact of both approaches on players

Traditional game design and AI-driven game design have different impacts on player engagement and satisfaction. It relies on the designer's experience and creativity to create an engaging game experience. It is a well-established approach that has produced many successful games over the years. However, traditional game design has limitations in terms of adaptability to individual player preferences and behavior.

On the other hand, AI-driven game design uses machine learning algorithms to analyze player data and behavior, providing a more personalized game experience. This approach has the potential to create games that are tailored to the player's preferences and playing style, leading to increased engagement and satisfaction.

Research has shown that AI-driven games can enhance player engagement and satisfaction by providing more personalized experiences. For example, a study by (Zhang et al., 2020) found that players who played an AI-driven version of a popular game reported higher levels of enjoyment and engagement than those who played the traditional version. However, AI-driven game design also has its limitations, such as the potential for algorithmic bias and the lack of creativity and unpredictability in game design.

Overall, both traditional game design and AI-driven game design have their strengths and limitations when it comes to impacting player engagement and satisfaction. The choice between

the two approaches ultimately depends on the specific goals and constraints of the game development project.

Table 8: Impact of both approaches on players side by side

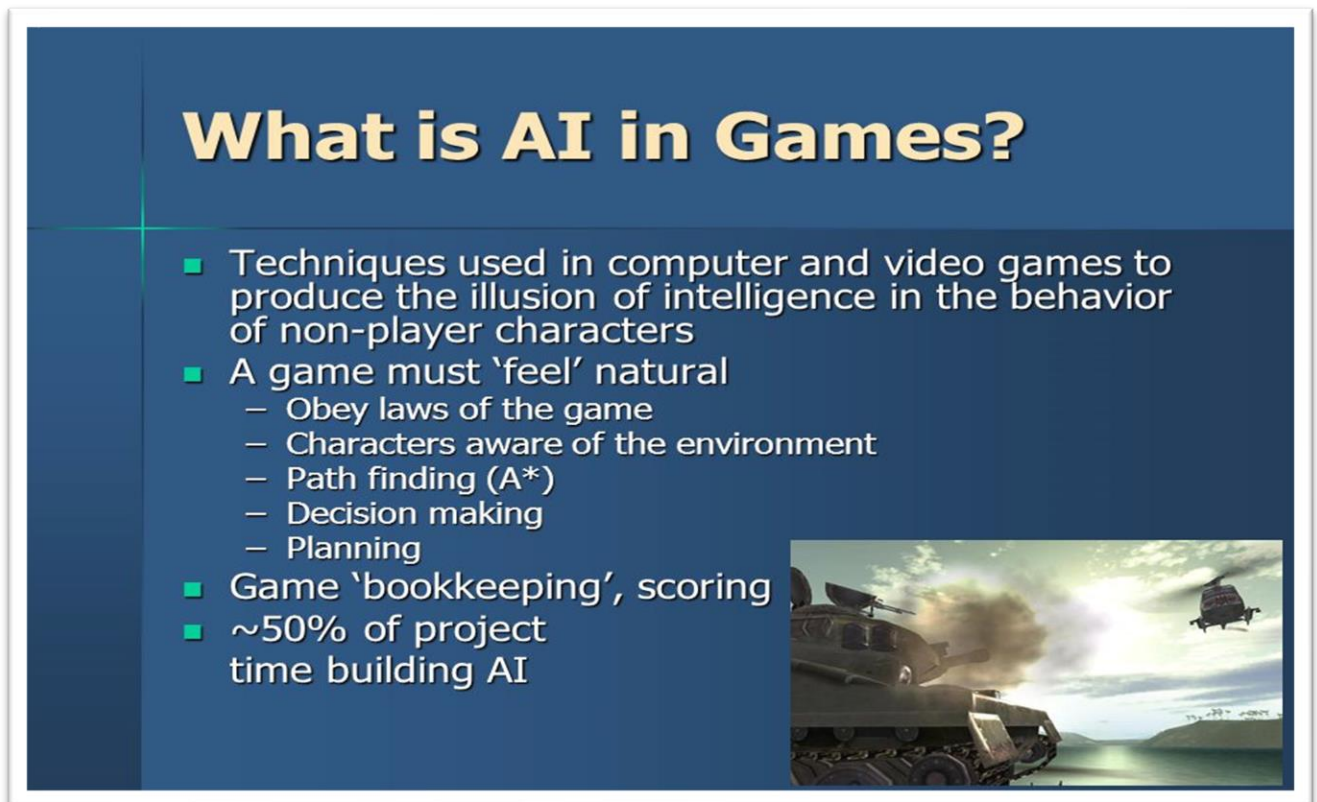
Game Design Approach	Impact on Player Engagement	Impact on Player Satisfaction
Traditional Game Design	Strong focus on storytelling and game mechanics, which can create immersive experiences for players. However, gameplay can be predictable and may not adapt to player behavior.	Players may enjoy the familiarity of traditional game design but may also become bored with the lack of variation and adaptivity.
AI-Driven Game Design	Allows for greater adaptivity and personalized experiences for players. AI can create dynamic game worlds and adjust gameplay based on player behavior. However, there is a risk of players feeling like they have less control over the game experience.	Players may enjoy the novelty and personalized experiences of AI-driven games but may also feel like the game is not challenging enough or lacks a sense of accomplishment.

In the world of game design, traditional approaches focus on captivating storytelling and intricate game mechanics, providing players with immersive experiences. However, a challenge arises with somewhat predictable gameplay that may not adapt to individual player behavior, potentially leading to a sense of monotony. On the other hand, AI-driven game design offers adaptivity and personalized journeys, creating dynamic game worlds shaped by player behavior. Yet, players may grapple with feeling less in control, questioning the level of challenge and sense of accomplishment in these novel and personalized experiences. Each design approach brings its unique flavor, balancing engagement, and satisfaction for players.

5 Advent of artificial intelligence and its effect on video game industry


No one can deny that artificial intelligence has revolutionized many industries, and the video game industry is not an exception. The advent of AI has opened new possibilities for game developers, allowing them to create more dynamic and interactive games that can adapt to the player's behavior in real-time. By using machine learning algorithms, game developers can design games that can learn and improve over time, leading to a more engaging and satisfying gaming experience for players. However, with the increasing use of AI in game design, questions arise about the impact of AI on the gaming industry. The effects of AI-driven game design on the gaming industry will be explored from different perspectives in this chapter.

Figure 15: AI contribution in video games (Donnelly, 2014)



What is AI in Games?

- Techniques used in computer and video games to produce the illusion of intelligence in the behavior of non-player characters
- A game must 'feel' natural
 - Obey laws of the game
 - Characters aware of the environment
 - Path finding (A*)
 - Decision making
 - Planning
- Game 'bookkeeping', scoring
- ~50% of project time building AI



5.1 Emergence of AI in Game Design

In the last few years, there has been a growing interest in using artificial intelligence (AI) in game design. While the idea of using AI to enhance the gaming experience has been around for some time, it's only now that technological advancements have made it feasible. With AI, game developers can create games that are more engaging, dynamic, and personalized. AI can be used for various game design aspects, such as generating game content, adjusting difficulty levels, and even creating personalized narratives. As AI continues to evolve, it's exciting to see how it will shape the future of game design and the gaming industry (Ijarotimi, 2023). As an example of that, the iconic title introduced by CD Projekt "THE WITCHER 3: WILD HUNT". The game employs AI to create a dynamic and immersive adventure. As the richly detailed landscapes are traversed, the AI-driven NPCs (non-playable characters) react to your actions, making the world feel truly alive (Jahagirdar, 2023). From the bustling streets of "Novigrad" to the eerie swamps of Velen, every encounter with AI characters is unique (Daisie Team, 2023; Jahagirdar, 2023). Whether it's a bar brawl, a contract negotiation, or a chance meeting in the wilderness, the AI responds in ways that keep you engaged (Daisie Team, 2023). This dynamic AI ecosystem, combined with the game's branching narratives, contributes to an immersive experience where your choices truly matter (Daisie Team, 2023; Jahagirdar, 2023), making 'The Witcher 3' a standout example of AI's role in modern game design (Daisie Team, 2023; Jahagirdar, 2023).

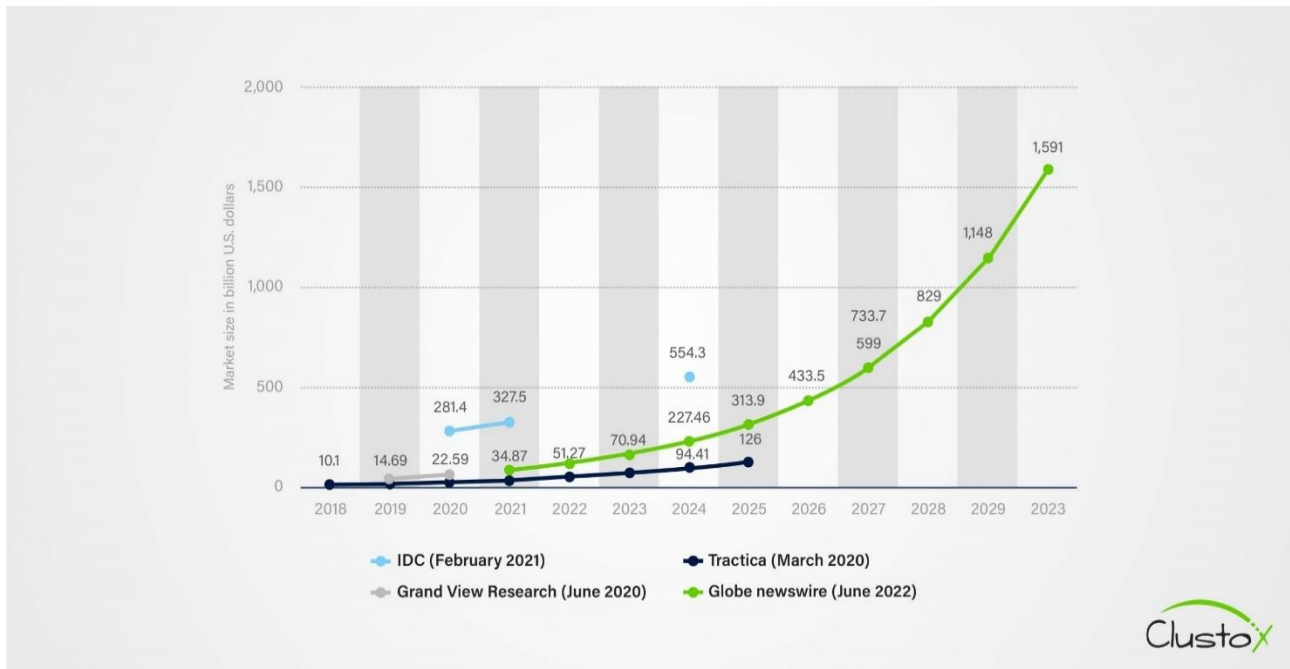
Figure 16: Geralt's beard grows over time in the game (Dailey, 2020)



Artificial intelligence (AI) is becoming a critical technology in game design. For many years, game designers have explored the possibility of using AI to create more immersive and engaging gaming experiences. Recent breakthroughs in AI and machine learning have turned this dream into a reality. AI is now opening new opportunities for game developers to create dynamic, responsive, and personalized game experiences (DSouza, Jul 29; Koch, 2023). These innovative approaches include procedural content generation, adaptive difficulty, and even personalized narrative, which are revolutionizing the gaming industry (Koch, 2023; G. N. Yannakakis & Togelius, 2015). The ongoing evolution of AI-driven game design is pushing the boundaries of what is possible in the gaming industry, and the future looks bright for AI-driven games that will continue to push the limits of creativity and innovation (Hendrikx & Meijer, 2011; Togelius et al., 2007) .

Additionally, AI has fueled the growth of indie game development. With limited resources and budgets, an indie developer can use his AI tools and techniques to create amazing games that rival those of big studios. From AI-assisted asset generation to automated error detection and checking, AI has provided independent developers with accessible, cost-effective solutions to solving their development challenges. (Clustox, 2022)

Figure 17: AI in The Gaming Market (Clustox, 2022)



5.2 Impact of AI on Game Development

As the field of artificial intelligence (AI) continues to advance, its impact on the game development industry has become increasingly evident. AI has transformed the way games are designed and experienced, with developers using the technology to create dynamic, responsive, and immersive game experiences.

One of the biggest impacts of AI on game development is the ability to generate content. Procedural content generation (PCG) is a technique that uses algorithms to generate game content, such as levels, environments, and even characters (Barreto et al., 2014; Hendrikx & Meijer, 2011; G. N. Yannakakis & Togelius, 2015). This approach allows developers to create vast game worlds that are unique and unpredictable, providing players with endless possibilities and replay value (Barreto et al., 2014). Procedural generation is an incredibly innovative application of AI in the realm of gaming. It involves the use of algorithms to dynamically generate various elements within a game, including landscapes, levels, quests, and items (Hendrikx & Meijer, 2011, p. 1:13-1:14; G. N. Yannakakis & Togelius, 2015). This approach not only saves valuable

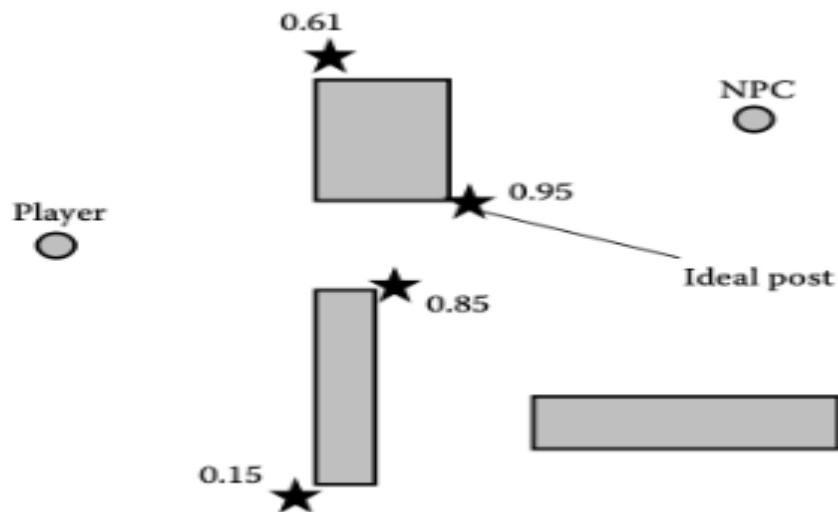
development time and resources but also opens a world of virtually limitless gameplay possibilities for players (Barreto et al., 2014; Hendrikx & Meijer, 2011; G. N. Yannakakis & Togelius, 2015).

A prime example of the power of procedural generation can be seen in the highly acclaimed game "No Man's Sky" (Kharpal, 2016). Through the implementation of sophisticated AI algorithms, the game creates an entire universe full of planets, each with its own unique ecosystems, creatures, and terrains. This results in players being fully immersed in a vast and endlessly diverse procedurally generated universe, allowing them to embark on boundless explorations (Kharpal, 2016). With each step, they unveil uncharted planets and encounter entirely new species, constantly experiencing fresh and exciting encounters along their journey.

A case study titled "The NPC AI of The Last of Us: A Case Study" dived into the artificial intelligence (AI) systems implemented for non-player characters (NPCs) in the game "The Last of Us" (Panwar, 2022). By focusing on this specific case, the researchers analyze the complex AI behaviors and decision-making processes exhibited by NPCs within the game. The study investigates various aspects, including NPC navigation, interaction with the game environment, combat strategies, and adaptive behaviors. Through a detailed examination of the AI systems employed in The Last of Us, the researchers aim to provide insights into the development and implementation of advanced NPC AI in video games (Panwar, 2022).

The findings of this case study contribute to the understanding of how sophisticated AI techniques can enhance player experiences and create more immersive and realistic gameplay interactions (Panwar, 2022, pp. 2–3).

Figure 18: NPCs being able to find the best spot to take cover (Panwar, 2022, p. 6)



Another area where AI is having a significant impact is in adaptive difficulty. Some games that are too easy can be boring, while others are too difficult in a way, they become frustrating and almost unplayable (Vu, 2018). With AI, game developers now can create games that adjust and scale the level of difficulty in real-time, based on the player's skills level and performance. This ensures that the game is always challenging, but not too difficult. As an example, The Last of Us demonstrated the utilization of AI in scaling the difficulty or level of NPCs according to the player's level in the game. (Panwar, 2022, p. 5)

Figure 19 shows the high score the last of us got from Metacritic reviewers, developers, and gamers worldwide.

Figure 19: Metacritic from reviewers and players on The Last Of Us (Metacritic, 2013)

THE LAST OF US PlayStation 3

SCEA | Release Date: Jun 14, 2013

Summary Critic Reviews User Reviews Details & Credits Trailers & Videos

95 **Metascore**
Universal acclaim
based on **98 Critic Reviews**

9.2 **User Score**
Universal acclaim
based on **14213 Ratings**

Your Score: 0

Developer: Naughty Dog
Genre(s): Modern, Adventure, General, Action Adventure, General, Modern, Linear
of players: Up to 8
Cheats: On GameFAQs
Rating: M
More Details and Credits >

Summary: Twenty years after a pandemic radically transformed known civilization, infected humans run amuck and survivors kill one another for sustenance and weapons - literally whatever they can get their hands on. Joel, a salty survivor, is hired to smuggle a fourteen-year-old girl, Ellie, out of a... [Expand](#)

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AI is also transforming the narrative of games. With the use of machine learning, developers can create personalized stories that are unique to each player. The game can learn from the player's choices and preferences, adapting the narrative to provide a customized experience. This personalized approach to storytelling can create a deeper emotional connection between the player and the game. (Liapis et al., 2021)

Overall, AI is changing the game development landscape, offering developers new tools and techniques to create engaging and immersive game experiences. As technology continues to evolve, it will be exciting to see what new possibilities emerge and how game development will continue to evolve in the years to come.

6 Results

During this journey, the realms of traditional and AI-driven game design were explored with the aim of understanding player experiences and preferences. In the world of traditional games, a consistent thread of feelings and nostalgia was found to be run through the player feedback. These games were observed to be touched by players' memories, evoking deep emotional connections. The creativity and personal touch that flowed through these titles, including handcrafted levels and compelling storytelling, were adored by players.

In the world of AI-driven game design, a different kind of magic was unveiled through our explorations. Here, dynamic and immersive experiences were enjoyed by players. The AI opponents, adapting and evolving with each move, injected a palpable thrill into the gameplay. The worlds created by AI seemed to breathe, responding to the players' actions in real-time. The narrative arcs woven by AI-driven algorithms were observed to leave players utterly engrossed.

However, as preferences were gathered from different studies and surveys, a compilation of tastes was observed to emerge. Comfort in traditional games, guided by nostalgia and the unmistakable human touch, was found by some. In contrast, particularly the younger generation less steeped in classic gaming lore, was observed to be drawn to the dynamic nature of AI-driven games.

In light of the discoveries, game designers were noted to stand at a crossroads of creative possibility. The synthesis of traditional and AI-driven game elements was suggested to potentially hold the key to crafting truly unique gaming experiences that could resonate with a broad spectrum of players.

7 Conclusion

Concluding this exploration, the realms of traditional game design and AI-driven game design were deeply delved into, uncovering the unique qualities inherent in each approach. Traditional games, characterized by their nostalgia and human touch, were found to possess a timeless appeal resonating broadly among audiences. In contrast, AI-driven games were observed to introduce an entirely new experience with dynamic environments, adaptive gameplay, and intelligently crafted characters.

Throughout this journey, it became evident that these two approaches are very similar to “apples and oranges”, each possessing its own strengths and characteristics. Traditional games, with their charm, simplicity, and personal connection, were likened to comfort food for gamers. Meanwhile, AI-driven games, with their intelligence and adaptability, were compared to a thrilling rollercoaster ride, keeping players consistently on the edge of their seats.

The inquiry did not stop there. A glimpse behind the curtain was taken to observe how artificial intelligence has stirred things up within the gaming industry. It was discerned that AI is not merely a tool but a transformative force, reshaping the production landscape, market dynamics, and player expectations. The result is an emerging era in gaming, replete with unexplored possibilities and unforeseen marvels.

And, of course, the focal point remained the players. Through surveys, discussions, and an exploration of gaming experiences, a sense was gained regarding what truly captivates their interest. Traditional games were found to strike a chord with their sweet spot of nostalgia and familiarity, drawing players in like old friends. Conversely, AI-driven games were observed to bring in the wow factor, with their dynamically evolving worlds and intelligent components consistently captivating and engrossing players.

Thus, a journey through pixels, nostalgia, algorithms, and the heart of gaming was undertaken. The story, however, does not conclude here. As technology advances, the trajectory of the gaming world remains uncertain. Whatever lies ahead, one certainty remains—the gaming world is a

vibrant tapestry, woven with the threads of tradition and the sparks of innovation. It is a playground where nostalgia converges with the future, and every level introduces a new adventure. Here's to the gamers, the creators, and the boundless potentials of pixels and play.

By recognizing these distinctions, developers can better Meet the needs and expectations of players. Traditional game design holds the charm of nostalgia, simplicity, with the human touch, appealing to a wide audience. On the other hand, AI-driven game design introduces dynamic environments, adaptive gameplay, and intelligent NPCs, offering a whole new experience.

By understanding these differences, game developers can utilize the strengths of both approaches to create engaging and innovative gaming experiences that captivate players and drive the industry forward.

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Material management plan

As I start on this thesis adventure, it's important to chart out how I'll navigate the treasure trove of data, materials, and resources that will fuel my research journey. It's quite similar to planning a grand expedition! I'll be connecting with various sources, from insightful surveys to diving into the dusty archives of previous case studies.

When it comes to the previous case studies and surveys, think of it as a puzzle. There's a bit of preprocessing and going through involved to make sure everything fits just right. Permissions and copyrights are like treasure maps, guiding me to ensure I have all the rights to use the materials I discover. And to make sure nothing is ever lost at sea, robust backup and redundancy systems are in place.

Time is of the essence, so I'll be tracking my progress like marking milestones on a map, ensuring I stay on course. And if I'm not alone on this quest, coordination and collaboration with fellow adventurers will be key to keeping our compasses aligned.

This Material Management Plan isn't just a guide, it's more of a promise of integrity and organization as I navigate the uncharted waters of this thesis project. As “Nathan drake” from “Uncharted” .