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What Makes Videogames Engaging?

A deep dive into the Design, Mechanics and Psychology of Games.

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Bachelor's thesis
April 2023
Bachelor of Business Administration – Game Production

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Description

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What Makes Videogames Engaging?
A deep dive into the psychology of gameplay and game mechanics.

Jyväskylä: Jamk University of Applied Sciences, April 2023, 58 pages.

Degree Programme in Business Administration, Game Production. Bachelor's thesis.

Permission for open access publication: Yes

Language of publication: English

Abstract

The thesis aims to explore the key factors that drive player engagement in video games through a comprehensive study of core mechanics successfully implemented in popular games. The gaming industry is a multibillion-dollar industry and projected to continue growing. By examining its trajectory, the reader can gain a contextual understanding of its evolution and the successful franchises that have implemented innovative core mechanics. This research utilizes both qualitative analysis of literature and gameplay, as well as quantitative analysis of sales data and player engagement time to identify correlations between technology, history, demographics, design, marketing, artistry, and development through case studies and comparative analysis. Key findings include the effectiveness of building, exploration, combat, and problem-solving mechanics in promoting player engagement, as well as the challenges and excitement created through competitive multiplayer modes, in-depth narratives, and well-realized virtual worlds through art, sound, and immersion. By shedding light on the key drivers of player engagement, this thesis provides valuable insights for companies looking to develop successful games and stay competitive in a rapidly evolving industry.

Keywords/tags (subjects)

Game mechanics, Player engagement, Game design, Videogame industry, Videogame psychology, Videogame genres.

For example, the confidentiality marking of the thesis appendix. See Project Reporting Instructions, Section 4.1.2.

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Introduction

Video games have become one of the most popular forms of entertainment worldwide, with millions of people playing games every day. The gaming industry has grown rapidly over the years, with new games and platforms being introduced regularly. A key factor in the success of any game is its ability to engage players and keep them invested in the gameplay experience.

This thesis aims to explore the core gameplay mechanics that influence player engagement, as well as the numerous factors that impact engagement in different genres of games. Additionally, it will examine how art styles, graphics, and audio affect engagement, and how narrative plays a role in the overall gameplay experience. This thesis will also investigate how demographics affect playing habits, and the extent to which hardware and modern technology influence player behaviour.

Chapter 1 will discuss the methodology used in this study, including data collection and analysis methods. Chapter 2 will provide an overview of the research topic and introduce the research questions that will guide the study. Chapter 3 will review literature on gameplay mechanics and engagement, drawing on research from psychology and game studies. Chapter 4 will present the findings on how core gameplay mechanics influence player engagement, and how they vary across different game genres. This chapter will also examine the impact of art styles, graphics, and audio on engagement, as well as the importance of narrative in the gameplay experience. Chapter 5 will aggregate data on the highest selling games of all time and the most played in 2022 with correlations between their genres, mechanics and target audiences. This chapter will also discuss the ways in which hardware and modern technology influence player behaviour, and how these factors may affect engagement in different games. Finally, Chapter 6 will summarize the key findings of the study and discuss their implications for game design and future research. The conclusion will also reflect on the limitations of this study and suggest directions for future research in this area. Overall, this thesis aims to provide a comprehensive understanding of the factors that influence player engagement in video games, and to offer insights into how game developers can create more engaging gameplay experiences for players.

1 Research Methodology

The focus of this thesis is primarily a literary study based on qualitive research from books, articles and videos from game developers, journalists, and influencers. The sources are from respected outlets and the track records of many of the creators are amongst the most successful in the industry. There are a series of interviews conducted with game developers by the author and their answers are used in context with the reported findings. These methods are used because they provide various insights from a broad set of quality sources that provide deep insights and nuanced understanding of the subject matter.

1.1 Case Studies

A series of influential games and their mechanics are analyzed and discussed. There are references to their genre as well as historical context provided. Topics discussed are the elements of successful cognitive gameplay, particularly in the context of single-player adventure games. It explores the concept of game loops, feedback, and processes that drive player engagement and the impact of various game mechanics such as exploration, open world, and RPG elements on the player experience. Featured titles include popular game franchises such as Final Fantasy, The Legend of Zelda, and Pokémon to illustrate its points. This method provides deeper detail into specific game mechanics that have defined successful genres and franchises.

1.2 Market Research

Quantitative Research has been carried out on software sales, hardware, and monetization models as well as market trends, demographics, and the influence of technology as a market driver. A historical analysis of the average age demographic has been carried out also to provide an overview of consumer behavior and gain a better understanding of what factors have driven the industry forward. This method provides insights into consumer behaviour, trends, and technology, which can help contextualize the findings from the literary study.

1.3 Comparative Analysis

Two games in the Metroidvania genre Super Metroid (Nintendo, 1994) and Hollow Knight (Team Cherry, 2017) are cross examined, and their features compared. The author played the games

themselves and reported the findings, discussing the mechanics of the games, their controls and movements, combat systems, unique mechanics, art styles, audio, and user interfaces. This approach offers primary findings backed with historical data on how game design has evolved over time. Seeing a direct evolution from where game mechanics started to where they are now is useful for imagining and manifesting where they can go in the future.

1.4 Acronyms and Definitions

Cognitive Gameplay - Game mechanics or features that are designed to challenge players' cognitive abilities, such as memory, attention, problem-solving, or decision-making skills.

Crafting - A set of mechanics and interactions by which players thoughtfully manipulate materials to create a new entity in the game world.

Fps – Frames per second – modern games usually run at 60 animation frames per second. Differentiated from **FPS** – First Person Shooter by the number preceding it and the lowercase p and s.

Frame Data (Fighting games) - The data pertaining to the frames of animation of any given move, as well as the properties of that move on any given frame.

Start-up - The initial phase of a move in a game, from when the animation is activated from a button press to when it can hit the opponent.

Active -The middle phase where the move can hit the opponent and deal damage.

Recovery - The period immediately following the active phase of a move, during which your character returns to a neutral state after executing the move.

JRPG - "Japanese role-playing game" - a type of role-playing game developed in Japan, often featuring anime-style graphics, turn-based combat, and story-driven gameplay.

Metroidvania - a subgenre of action-adventure games that often feature non-linear levels, upgrades that unlock new areas, and a focus on backtracking to previous areas with new abilities popularized by the Metroid and Castlevania franchises.

MMO - "massively multiplayer online" - a type of video game that allows many players to interact with each other in a virtual world.

MOBA - "multiplayer online battle arena" - a type of video game where two teams of players compete against each other in a strategic battle, usually in an isometric view.

MMORPG - "massively multiplayer online role-playing game" and refers to a type of video game that combines elements of role-playing games (RPGs) and MMOs. Players create their own characters, develop their skills, and interact with other players in a persistent virtual world. Examples include World of Warcraft, Final Fantasy XIV, and The Elder Scrolls Online.

Modding - The act of modifying a video game or software to change its functionality, appearance, or gameplay mechanics.

Sandbox - a style of game in which minimal character limitations are placed on the gamer, allowing the gamer to roam and change a virtual world at will. In contrast to a progression-style game, a sandbox game emphasizes roaming and allows a gamer to select tasks.

SNES – Super Nintendo Entertainment System. a 16-bit home video game console developed by Nintendo that was released in 1990 in Japan and South Korea, 1991 in North America, 1992 in Europe and Oceania, and 1993 in South America.

(Grow, et al., 2017, Jett, 2012, Learn English Team, n.d, Rouse, n.d, Wikipedia, 2023)

2 Players, Markets and Mechanics – An Overview

"The gaming industry has grown exponentially in recent years, with an estimated 2.7 billion gamers worldwide. The industry reached $202.7 billion in revenue in 2022." (IMARC Group, 2021, para. 1). Over the past 45 years, advances in technology and changes in player preferences have shaped the evolution of the industry.

2.1 Market Segments

Online gaming has been the most significant variable affecting the industry in the last decade. (Jones, 2020). The development of faster internet speeds has allowed players to connect with others from around the world, leading to the growth of MMORPGs and MOBAs (Multiplayer Online Battle Arena). Games such as DOTA 2 (Valve, 2013) and, World of Warcraft (Blizzard Entertainment, 2004) have been influential in this regard. Online gaming has also enabled players to socialize and interact with others, developing team-working and social skills.

Competitive gaming has become mainstream, with a growing fanbase and predictions of the industry growing to $1.5 billion by 2023. Games such as Fortnite (Epic Games, 2017) and League of Legends (Riot Games, 2013) are now a significant element of eSports, with many people watching others play games online through services such as YouTube and Twitch. (Abdulla, 2021). Another significant shift in the industry has been the growth of mobile gaming, which has dominated revenue generation in recent years. Social games, such as Farmville 3 (Zynga, 2021), Candy Crush Saga (King, 2012), and Angry Birds (Rovio, 2009), have been extremely popular on mobile devices. Since the advent of smartphones in the late 2000s, mobile gaming has become accessible to more people, with high-quality games available on pocket-sized devices. (Abdulla, 2021). The development of AR and VR technology has also been driving growth in the industry. The market for AR and VR gaming is predicted to reach $11.0 billion by 2026, with an annual growth rate of 18.5%. This technology allows games to create realistic environments and sensations, making players feel physically present in the game world. (Abdulla, 2021). The consoles of Sony, Nintendo, and Microsoft have also been a notable feature of the industry, with the development of new hardware continuing to this day. Studios have seen mass success with landmark titles and mascot characters throughout their iterations of the PlayStation, Nintendo Entertainment System, and Xbox, respectively. (Abdulla, 2021).

2.2 Core Gameplay Mechanics

The base of player engagement is the core gameplay mechanics of a game. These mechanics can include elements such as feedback, progression, challenge, exploration, social interaction, personalization, and immersion. Games that provide immediate feedback to players, offer a sense of progression, and provide a reasonable level of challenge, can keep players engaged and motivated to continue playing. (Klastrup, 2019).

Variables that Affect Core Mechanics

The impact of these mechanics can vary depending on the genre of the game. For example, the core gameplay mechanics that drive engagement in a first-person shooter game may differ from those in a 3D platformer. Similarly, the impact of art styles, graphics, and audio on player engagement may vary depending on the genre of the game.

In addition, the narrative of a game can also plays a significant role in player engagement. Games with a compelling story and well-developed characters can create a sense of immersion and investment in the game's world, keeping players engaged in the overall gameplay experience.

Demographics such as age, gender, and cultural background can also play a role in playing habits, with diverse groups of players showing preferences for diverse types of games and gameplay mechanics. Finally, hardware and modern technology can also influence player behavior, with new features and platforms offering new opportunities and ease of access enabling engagement and interaction in games.

3 The Psychology Behind Successful Game Mechanics

3.1 Why Do People Play Games?

According to Koster (2005), "The first word that might come to mind is fun, but what makes a game fun is the challenge that comes along with mastering gameplay. This applies to all games including board games and simple games like tick tack toe" (p. 17).

Koster observed that players lose interest once the game is mastered signaling the end of the learning curve. His research identifies a vital ingredient required for a successfully engaging game. The ability to learn and expert said game. The notion of challenge can also work in the inverse, if a game is too difficult players will also lose interest as their skill level is not high enough to yield any results or positive feedback from the game. Koster takes the stance that games should be viewed through the same lens as literature of films. Although interaction is the key difference separating the mediums, narrative and storytelling are still present in most games and are as effective in this point as any cinematic or literary experience. (Koster, 2005).

One can point to the adaptation of games such as The Last of Us (Naughty Dog, 2013) into a successful film series, the novelization of Metal Gear Solid games and the evolution of storytelling in multi path narrative options in game series like Mass Effect, Deus Ex, and Fallout.

Social Benefits, Cognitive Growth and Mental Health Impacts

Recent research suggests that gaming can have numerous social, cognitive, and mental health benefits. Kowert, Vogelgesang, Festl, & Quandt (2019) found that engagement in MMOs correlated with a stronger sense of social identity, higher self-esteem, greater social competence, and lower levels of loneliness. The study involved over 700 players of MMOs and demonstrated that gaming can help build valuable social connections and relationships.

In terms of cognitive benefits, a study published in 2022 showed that children who played video games for around 21 hours a week had better cognitive performance, particularly in tasks related to memory and response inhibition, compared to those who didn't play at all (Pozuelos, et al.,

2022). Another study from 2013 demonstrated that video games, particularly open-world mission-based games, can improve problem-solving skills (Gee, 2013). Additionally, gaming can improve the brain's grey matter, which contributes to motor skills, memory, and emotional intelligence. One study found that expert players of action-based video games had increased volumes of grey matter compared to beginning players (Kühn, et al., 2015).

Furthermore, video games can also have mental health benefits. A 2014 paper published in Frontiers of Psychology found that video games are aligned with attributes of well-being and can provide opportunities for flourishing mental health (Russoniello, et al., 2014). Another study from 2009 found that casual video gaming created changes in brain activity consistent with improved mood and less avoidant behavior (Klasen, et al., 2009).

It is clear that a big part of player engagement is the stimulation that occurs when executing mechanics coupled with the social aspects of online communication and cooperation required in online multiplayer games. The ability for people to find others that they identify with outside the confines of geography or traditional communities as well as the cognitive rewards players experience is a strong driver towards the appeal of a game and the growth of that game's player base. It is important to create a strong systematic framework to support and encourage human interaction within the game as well as designing mechanics that reward teamwork and carefully planned strategies.

Human Motivation Drivers

Humans have psychological and physiological needs and there are several theories that explain the innate desire to create, build, nurture and ultimately be accepted within a society. In "Motivation and What Really Drives Human Behavior", Beata Souders (2019) outlines some of these theories such as:

"Self Determination Theory" (Deci, Ryan, 1985) - suggests that people have three innate psychological needs that must be met for them to feel motivated and engaged.

- Autonomy - the feeling of control over oneself and situation.
- Competence - feeling capable and effective.
- Relatedness - feeling connected to others.

Gaming allows the player to control the game to varying degrees. It rewards competence when tasks are completed and can achieve relatedness through narrative, multiplayer and fandom.

"*Goal Setting Theory*" (Locke, Latham, 2002) - suggests that setting specific, challenging goals can be a powerful motivator. When people have clear goals to work toward, they are more likely to feel engaged and focused on their work (Souders, 2019).

Every game has a goal, a quest or a mission whether explicitly stated or otherwise. The repeated act of taking an action, completing a task, and receiving positive feedback as the challenge and effort increases, is what makes engaging game loops.

"Intrinsic and Extrinsic Motivation" (Deci, Ryan, 1985) – can be described as motivation to perform for its own sake, enjoyment or personal fulfilment and extrinsic motivation as the motivation to earn a reward or avoid punishment (Souders, 2019).

Vriend (2017) offers a good example stating that *Gamification* is an excellent illustration of games that rely on extrinsic motivation as they aim to add excitement to mundane tasks by offering rewards to the player. Many games, however, comprise a combination of both intrinsic and extrinsic motivators. You may begin playing a game because of your preference towards a certain character, art style or genre, which is an intrinsic motivator. Conversely, failing at a level or losing a life is often an extrinsic motivator, particularly if it incites you to make another attempt. Duolingo incorporates gamification as a way of making language learning more enjoyable and engaging, but the desire to learn a new language is an intrinsic motivator (Vriend, 2017).

3.2 Risk and Reward

Throughout the YouTube series “Masahiro Sakurai on Creating Games,” Kirby and Super Smash Bros creator and director Masahiro Sakurai repeatedly references the need to create a situation that requires the player to take a risk and then reward them if they complete the action successfully. This is best exemplified in fighting games as the whole premise of the genre is based on risk and reward (Sakurai, 2022).

Take Tekken Tag Tournament 2 (TTT2) (Namco Bandai, 2012) for example. The character *Kazuya Mishima* has good offensive and defensive options and is generally well rounded, but he does possess some high risk, high reward moves that deal plenty of damage on hit but can leave the player open to punishment if the move is poorly timed and successfully countered. One such move is the *Lightning Screw Uppercut* (**Figures 1,2 & 3)**. The *Frame Data* of that move shall be examined here to analyze how risk and reward are built into its’ design. **Note that the footage in the video is slowed down rendering the timestamps in the screenshots inaccurate.*

Figure 1 -Start-up phase - Lightning Screw Uppercut in TTT2 (Jinjamoku Tekken, 2014)

According to Jinjamoku Tekken (2014), the *Start-up* for the move is 63 frames after controller input which is a long time especially if you compare it to Kazuya's basic jab which has a start-up of 10 frames. That leaves just over a full second for the opponent to counter.

Figure 2 - Active phase - Lightning Screw Uppercut in TTT2 (Jinjamoku Tekken, 2014)

In the *Active* phase on a successful hit the move will *Launch* the opponent into the air rendering them helpless until they exit their recovery state, usually after the opponent has hit the ground and stood up again. The Active phase lasts for 10 frames. The move cannot be blocked and will launch as a counter hit. The move deals 80 damage. Comparing again to the basic jab that deals 8 damage (Jinjamoku Tekken, 2014).

Figure 3 - Recovery phase - Lightning Screw Uppercut in TTT2 (Jinjamoku Tekken, 2014)

Finally, Kazuya's *Recovery* phase is 27 frames which again is a long time to be vulnerable if the opponent moves out of range of the attack. The regular jab has a 15-frame recovery time (MetalMusicMan, n.d.).

Lightning Screw Uppercut is an important move in Kazuya's arsenal and the developers have successfully designed the move in a way that sets it apart from basic punches and kicks providing Reward feedback with the damage it deals on hit, the lightning and impact effects, both visual and auditory. The Risk of using the move is increased with the extended start-up and recovery times during which the player is vulnerable. There is challenge introduced to pull off the move that take three simultaneous button holds to pull off compared to a single button tap for a jab. The timing in which the move must be executed is also a challenge to prevent it from being countered. The result is a hair-raising experience and careful consideration for use in a competitive matchup that is very satisfying when pulled off correctly especially at the end of a match when the stakes are raised even higher.

Stress, Relief, Growth and Progress

Another game design philosophy Sakurai applies to his games are the stages of “Stress, Relief, Growth and Progress.” (Sakurai, 2023). Sakurai provides specific examples in his videos, but new examples shall be dissected here based on those principles.

Stress in gameplay, Sakurai claims, is the process of dealing with an enemy, obstacle, or challenge. The moment the player takes the risk. There are many mechanics that can create the stress or squeeze on the player through mechanics, fighting, jumping for a ledge, saving up or paying for resources to powerup enough to face an enemy, completing a task within a time limit or high narrative stakes where the player action can affect the outcome going forward. (*Spoilers for Metal Gear Solid ahead*).

Metal Gear Solid (MSG) (Konami, 1998) is known for its deep, enriching narrative and uses several mechanics to create stress and squeeze the player in the final boss battle against *Liquid Snake*. In the story Liquid has captured *Solid Snake’s* love interest *Meryl* with whom the player has been interacting with and playing alongside throughout the game. Assuming some other prerequisites have been met during the game, the player must defeat Liquid in three minutes. If the player succeeds Meryl lives and if they fail, she dies. This dramatically changes the end of the game and the outcome of the story. The game alludes to what is at stake in cutscenes, and the battle is not easy thus stress is created through combat, a time limit and consequences for the gameplay and narrative outcomes that follow this event.

Figure 4 - Stress - Boss battle in MGS (SourceSpy91, 2016)

Relief is when the threat is over. The loop of tension and release is key to an engaging game mechanic. This is followed by *Growth,* the reward which can be in the form of gold, experience points or new abilities that will enable the player to *Progress* by moving forward in the game, whether that is gaining access to new areas, story progression or finally being powerful enough to defeat a challenging enemy as a direct result of previous actions (Sakurai, 2023).

In Legacy of Kain Soul Reaver (Crystal Dynamics, Eidos Interactive, 1999) the player controls *Raziel*, a wraith. Raziel's core mechanics are his melee attacks and ability to consume the souls of his dispatched enemies. Consuming souls of regular enemies replenishes Raziel's health. In the first boss battle, Raziel must defeat his brother *Melchiah* who is much bigger and stronger than him. Not being able to confront him directly, the player must use the surrounding environment to defeat Melchiah. The stress comes from the bigger enemy chasing the player who can't use their established tools to fight back. The relief comes from trapping the enemy in environmental hazards and the *Growth* comes from the player learning the strategy required to win the battle coupled with the rewards that enable player progression.

Figure 5 – Relief - Raziel impales Melchiah using an environmental trap (Shirrako, 2022).

When Melchiah is defeated Raziel consumes his soul and learns a new ability to phase through certain barriers giving the player access to areas previously sealed off allowing the player to *Progress* in the game.

Figure 6 - Growth and Progress, Raziel gains a new ability (Shirrako, 2022).

The progress stage is a great catalyst for introducing new mechanics and scenarios to keep the player stimulated in the game world as well as set the stage for new challenges and story developments.

The Stress, Relief, Growth and Progress philosophy ties in with Koster's theory of creating challenge and achieving proficiency, growing, and progressing through a series of events. This is part of what creates the "addictive" feeling of playing through an experience and is applicable to all game genres in some form. In a single player action-adventure game, it may be the progression through levels and obstacles. (Koster, 2005). In RPG's it may be the development of your character stats, abilities, or personality and how they affect your ability to interact with the world. In any Esports, or competitive multi-player experience it is defeating your opponent through strategy and awareness. Often players will communicate and compete as a team, which adds a layer of social interaction and cooperation. The requirement of players to make quick decisions that affect an outcome creates an excitement that fuels the purpose and drives them to work towards a shared goal (Sakurai, 2022).

4 The Evolution of Game Mechanics and Their Influence on Video Game Genres

“A game is a system in which players engage in artificial conflict, defined by rules, that results in a quantifiable outcome” (p. 80, Salen, Zimmerman, 2004).

According to Sedig, Parsons, and Haworth (2017),

> "Videogames are specific types of games: they are systems; they engage players in non-real or artificial conflict that is defined by rules; and they have quantifiable outcomes. In addition, they operate on interactive, electronic, computational devices or platforms. Successful engagement can be defined within cognitive gameplay, a term used to describe events that influence cognitive processes" (p. 18).

4.1 Game Loops, Feedback and Processes

A player’s interaction with the virtual world is shown below known as the “Interactive Cycle in the Play Experience” (Fabricatore, 2009).

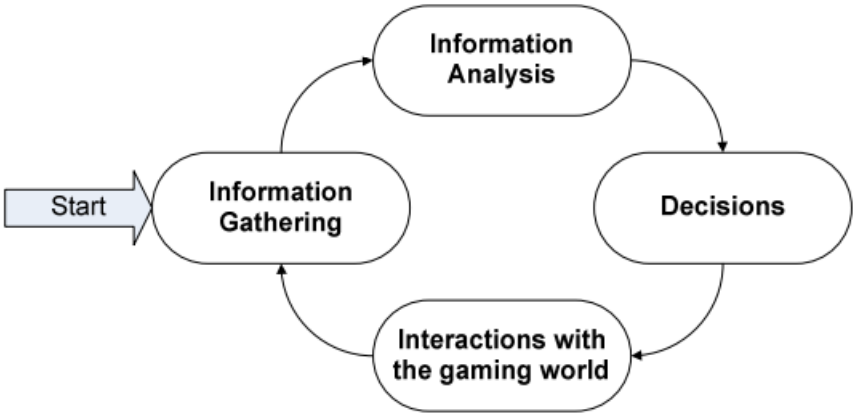

Figure 7 – Interactive Cycle in the Play Experience . (Fabricatore, 2009).

To achieve effective cognitive gameplay information must be presented to the player that can be analysed and understood quickly. The player’s ability to decide on their analysis of the information

affects their interaction with the gaming world and the feedback from those interactions then become the information the player gathers, repeating the loop until gameplay ends. (Fabricatore, 2009).

Indicators and Feedback

Feedback from game world interactions drive the momentum of the cycle. The feedback loop has improved steadily over the years to the point that players can measure their progress in detail. In game achievements for example are awarded to the player for completing certain objectives within the game. These milestones highlight the progress gained and reveal new goals to work towards.

Within a game world, objectives will often be referenced or highlighted to alert the player that the object is interactable. In Horizon Forbidden West (Guerrilla Games, 2022) the player can toggle interaction indicators on and off. This makes it much easier for the player to determine where they want to explore and where they can explore.

Figure 8 – Climbing Interaction Indicators in Horizon Forbidden West. (Alva, 2022)

4.2 Exploration and Open World - Ocarina of Time and the Influence of JRPG's

In single player adventure games exploration is a huge appeal. Technology has allowed level designers to create complex detailed worlds that players can explore and interact with in a multitude of ways. By creating more to do, see, solve, fight and experience, players can immerse themselves in these sophisticated worlds that grow and change around them.

Complex Systems – Role Playing Games and Deeper Gameplay

RPGs are defined by their complex battle systems with many weapons, abilities, items, spells, player stats and class systems that allow for numerous strategies and freedom of choice in how a player tackles the game's challenges. This makes for unique and engaging experiences that drive immersion in the game world.

Final Fantasy along with Dragon Quest popularized the JRPG genre in the late 80s and early 90s and has pushed the boundaries of what is possible in games with every iteration. The series character development, storytelling, music, and visuals often set the standard for the hardware it ran on, building on the games that came before it. It also introduced several game mechanics that have become staples of the genre such as the Active Battle Time System, Limit Breaks and Summons.

Pokémon

In Pokémon, a top-down RPG, the player fills the Pokedex by capturing each variation of Pokémon spread across the game world while defeating rivals and gym leaders to earn badges and become the ultimate Pokémon master.

Pokémon was likely inspired by the Final Fantasy series due to its massive success especially in Japan ("1994 Consumer Game Software Sales," 1994). Final Fantasy and its numerous sequels introduced or popularized many staple mechanics found in RPG videogames.

Some shared mechanics between the two series include:

- Level up gained through experience points, leading to increased stats and new abilities.
- Elemental weaknesses and resistances: Both games feature creatures with elemental attributes (fire, ice, electric) that are strong or weak against certain types of attacks.
- Turn Based Combat
- Status Effects such as poisoning or buffs that increase Attack or Defence.
- Evolution of characters, Pokémon evolving and classes such as Monk or Thief in Final Fantasy. The Summon mechanic and Chocobos could also be an influence on Pokémon.

The Legend of Zelda

In the Legend of Zelda Ocarina of Time (Nintendo, 1998), the player explores the world from Hyrule Field the game's central hub which connects various other areas of the game. As the player explores each area, they must solve puzzles and defeat enemies to progress further.

One of the main tools that the player has for exploration is the ocarina. By playing different musical motifs on the ocarina, the player can unlock hidden paths, activate switches, and time travel. The mechanic is effective as the simple musical motifs become memorized and familiar to the player and it requires a call to action from the player by requiring them to play the notes of the motif through controller inputs. In addition, the game features a variety of items such as the hook shot allowing the player to reach areas of the environment previously out of reach, bombs that destroy enemies and barriers, and a boomerang that can be used to access new areas and defeat enemies.

The Zelda series contains some RPG elements like dungeon crawling, item collecting and various weapons, healing items and spells although it is not the focus of the gameplay. It is far more focused on puzzle solving, movement and action.

The impact of Zelda and Final Fantasy and the endurance of the Pokémon formula

The three series account for some of the most popular and critically acclaimed games ever released and all employ mechanics to aid in worldbuilding and exploration. (IGN 2019, GLHF 2023). Each has unique takes on their genres, and each has had their game mechanics utilized extensively

in future franchise titles. Ocarina of Time has influenced countless other 3D action-adventure games and was among the 1st titles after Super Mario 64 to explore the open world in a modern 3D setting. (Balasubramanian, 2022). The Pokémon formula has gone unchanged throughout its history with continued success. (Minor, 2021, Benoit, 2021).

As some mechanics of the RPG genre have become dated in the mainstream sphere, most notably level grinding and turn based combat, landmark franchises have sought to adapt their gameplay mechanics to suit modern tastes.

Square Enix's Final Fantasy XV (PS4, 2016) made a robust design choice in designing its battle system to be closer to another Square Enix series Kingdom Hearts which itself draws heavily on the battle system introduced in Ocarina of Time, with targeting systems, real time combat and assigning skills and abilities to different buttons.

It also placed far more emphasis on open world exploration than in previous entries. It signaled a big shift in the series core mechanics. Soon after God of War 4 (Sony Interactive, 2018) and Assassin's Creed Odyssey (Ubisoft, 2018), two action-adventure games franchises influenced by Zelda began incorporating more RPG elements into their core mechanics.

Modern designers have begun cherry picking game mechanics from closely related genres to increase immersion, engage the player and create unique experiences. This results in incredibly complex and interrelated game loops that work together to create a cohesive experience unique to the title and to innovate on the series established gameplay.

Series Mainstays

The main musical themes of these games have persisted since their series inception. There is an argument that game music will be a mainstay of the contemporary orchestral and jazz repertoires in the years to come as they are already regularly performed all over the world and Final Fantasy, Zelda and Pokemon are staples of that repertoire (Neely, 2023). Final Fantasy, particularly with a new story and characters in every mainline game, has the potential to become its own subgenre of performed music. The sound effects, although updated with every iteration, have also persisted. The jingle of your Pokémon being healed in the Pokémon center, the sound Link makes when he

swings his sword in Zelda and the UI sounds, spell sounds and victory fanfare that have remained in Final Fantasy entries evoke nostalgia for fans of the series and the power of that cannot be underestimated. The image of the Triforce, Pokeball and Moogles and Chocobos are iconic and instantly recognizable. Zelda, Final Fantasy and Pokemon are 37-, 36- and 27-year-old franchises respectively as of 2023 and Nintendo and Square Enix bank on those legacies with every new entry. The mechanic of Link collecting pieces of heart to upgrade his overall health or discovering the master sword, the strategy of forming your six Pokemon team to compete in the Pokemon League and iterations on the Active Time Battle system in Final Fantasy will probably remain in the series as the mechanics have proven to be effective, engaging, and recognizable across many gaming generations.

4.3 Crafting

One of the most popular game mechanics today is crafting. Crafting has existed since the early 80s text adventure games such as Zork I (Infocom, 1980). That game featured a mechanic allowing players to combine a rope and a hook to create a grappling hook that could then be used to progress the player in the game (Woyke, 2017). Crafting has evolved since then into a complex economy, as seen in games such as Age of Empires (Ensemble Studios, 1997), which requires players to mine resources such as wood, stone, and livestock to create structures advancing the in-game civilization. This type of crafting mechanic is referred to as "Resources vs Money," as described by Project Hive (2022), in which resources act as an additional currency to pay for an item or objective (The Evolution of Crafting in Games, para. 4).

Another type of crafting mechanic, as defined by Grow, Dickinson, Pagnutti, Wardrip-Fruin, and Mateas (2017), is "Recipe-based Crafting," which “effectively forces players to follow predetermined links between input and output to craft anything” (p. 311). An example of this system can be found in Kingdom Hearts (Square-Enix, 2002), where players find recipes, resources, and ingredients in the game world.

Perhaps the most immersive crafting system is one with undefined recipes. This allows the player to experiment and discover combinations of ingredients to create new items and encourages them

to be creative, employ resource management and decision making to determine the best outcome. Project Hive (2022) states that, "Ultima Online, released in 1997, was one of the first games to introduce a crafting system with undefined recipes." (The Evolution of Crafting in Games, para. 3). The game would go on to influence several other popular games decades after its release.

Grow et al. (2017) described systems with undefined recipes as follows:

> "Combining components without a recipe is more akin to real-world art-making than real-world cookbook-following. A given set of components may be combined in many different ways to produce many potential results. There is not a hard-coded link from input to output but, rather, a large space of possibility reachable from a given set of input components. Players can create things that are individual and perhaps even unique, if the possibility space is large enough. They can express themselves through crafting; they can take actions and make choices that not all — and sometimes not any — other players will make. Players can create things that surprise even the developers…." (p. 316)

The success of Minecraft and its popular adaptation of undefined crafting mechanics has had a significant impact on the video game industry, as other developers have sought to replicate its success by incorporating similar mechanics into their own games. God of War 4 introduced a recipe-based crafting system that allows players to create and upgrade a variety of equipment using resources found throughout the game world (Mazique, 2021). Another example is the open-world action game Horizon Zero Dawn (Guerrilla Games, 2017), which features a refined recipe-based crafting system also that allows players to create a wide range of weapons, armour, and other items using resources obtained from hunting and scavenging (Muller, 2017).

In both cases, the integration of a crafting mechanic has been seen to enhance the overall gameplay experience and provide players with a greater sense of agency and creativity although the games did stick to the recipe formula likely to keep the system simple and add depth to their combat systems which could be considered as some of the core mechanics of those games. By giving players the ability to create and customize their own equipment and tools, these games provide a level of player choice and control that is highly valued by modern gamers.

4.4 Narrative as a Mechanic

An important aspect of expansive open-world exploration and the proficiency in various RPG-influenced mechanics employed in games is the story itself. Games now stand alongside films and television as players develop emotional empathy for the characters in the game world. For example, in God of War 4, players witness the interactions between father and son as Kratos takes Atreus on a dangerous journey to spread his wife's ashes at her requested resting place. In the Horizon series, players control Aloy, an outcast who slowly discovers how the world was destroyed and how she can defend the post-apocalyptic land she has come to call home. Mortal Kombat's (NetherRealm Studios) 2011 reboot used an extensive story mode that capitalized on almost two decades of lore, characters, and locations that its loyal fanbase have come to know well over the years. In addition to the updated mechanics of the series' staple 1 on 1 fighting action, the narrative creates an extra layer of immersion that enhances the addictive gameplay. Because of this, narrative itself can be considered a game mechanic, especially in the emergence of non-linear storytelling in games.

As game technology and scope have advanced, designers have given game characters their own identities and opinions, thanks to the increased use of cutscenes and cinematic techniques. While some protagonists, like Link from The Legend of Zelda and various Pokémon characters, remain silent, this is often a design choice to keep the player character neutral and allow players to absorb the world without any predetermined agenda.

The popularization of complex narrative in games can again be traced back to the Final Fantasy series as the stories from Final Fantasy IV (Square, 1991) onwards have been incredibly detailed and rich with well-defined characters and worlds that translated very well into modern 3D games. The success of Final Fantasy VII (Square, 1997) cemented the franchise's place as an innovator in game design and its powerful worldbuilding was a huge part in that success.

Multi-Branching Path Narrative

In series such as Elder Scrolls, Fallout, The Witcher and Mass Effect, players through stat selection and dialogue choices can choose to the detail, how their characters look, behave, their gender, their fighting style, and their personality.

Tim van Kan, accredited Unreal Trainer, and Technical Design Lecturer at Breda University of Applied sciences, cites the Mass Effect series as his favorite:

> "The Mass Effect trilogy is my favorite; it tells such an awesome story and as a Star Wars fan it is epic to experience a sci-fi game with such freedom of choice. It really turned my enjoyment for video games into love for video games." (Imbert, 2023, BUAS Interviews).

Van Kan's statement echoes the sentiments of many fans of epic action blockbuster films that have been beloved over generations. The ability to choose the trajectory of these epic stories.

The original Deus Ex (Ion Storm, 2000) is a well-known game that was innovated with the multi-branch narrative approach. Warren Spector deliberately combined RPG and immersive sim designers to jointly create one of the most ambitious and significant games to date. (Ars Technica, 2022). While the main gameplay mechanics could be seen as an FPS, it is really in the dynamic choices the player must make concerning the complex themes of transhumanism, politics, and ethics that result in consequences that affect the rest of the game. However, the more action-oriented aspects of the gameplay have aged poorly. Nonetheless, the influence of Deus Ex can be found heavily in the Mass Effect, Dragon Age, and Fallout series. These games succeeded in their narrative aspirations and in the fluidity of their game mechanics. Mass Effect perfected the FPS style of play with narrative dialogue events and a great feedback loop for player choices. (Reeves, 2015).

The Power of Choice in a Digitalized World

The power of choice, which is a step closer to the immersion players seek, the shift of societies towards digitalization, the rise of social media, and one's digital avatar have created an ardent desire for choice and freedom in games. This is where the bridge is built between epic single-player adventures and MMORPG, MOBA, and other online multiplayer immersive genres. The power to communicate online, as well as the addictive nature of total immersion in these types of games, is something that has been noted by AAA studios and is becoming more commonplace in new games. (IGN, 2020). This is effective in attracting players who are not typically gamers. Many players now play through a game to enjoy the story, and often there are difficulty settings built into games that allow for this type of play. These settings are available in games such as Horizon, God

of War, Assassins Creed, Deus Ex Human Revolution (Eidos Montreal, 2011) and Deus Ex Mankind Divided (Eidos Montreal, 2016) to name a few.

5 The Role of Engagement, Sales, Demographics and their bearing on Genre

Sales and demographics are important in discussing successful and engaging game mechanics as they give us information about what types of games people play and who plays them.

5.1 The 10 Popular Games by Copies Most Sold

In **Figure 9** below a list of the 10 most popular games by copies sold as of March 2023 reveals some correlations between game genres, brand recognition, accessibility, broad appeal, and age demographics.

Rank	Game Title	Copies Sold (Millions)	Year	Platforms	Genre
1	**Minecraft**	**238**	**2011**	**Multi-platform**	**Sandbox, Survival**
2	**Grand Theft Auto V**	**145**	**2013**	**PlayStation 3, PlayStation 4, Xbox 360, Xbox One, PlayStation 5, Xbox Series X/S, PC**	**Action-Adventure, Open World**
3	**EA Tetris**	**100**	**1984**	**Multi-Platform**	**Puzzle**
4	**Wii Sports**	**82.9**	**2006**	**Wii**	**Sports**
5	**PUBG: Battlegrounds**	**75**	**2017**	**Xbox One, PlayStation 4, PC, Mobile**	**Battle Royale, FPS**
6	**Mario Kart 8 / Deluxe**	**37.4/23.4**	**2014/2017**	**Wii U, Nintendo Switch**	**Racing**
7	**Super Mario Bros.**	**48.24**	**1985**	**NES, Game Boy Advance, Virtual Console**	**Platformer**

8	**Overwatch**	**50**	**2016**	**PlayStation 4, Xbox One, PC, Nintendo Switch**	**FPS**
9	**Red Dead Redemption 2**	**38**	**2018**	**PlayStation 4, Xbox One, PC, Stadia**	**Action-Adventure, Open World**
10	**Pokémon Red / Green / Blue / Yellow**	**47.5**	**1996**	**Game Boy, Nintendo 3DS Virtual Console**	**RPG**

Figure 9– Most Popular Games by Copies Sold (James, 2023a)

Genres

There is genre diversity in the list such as Open World Sandbox, FPS, RPG, Racing, Sports Simulation, Puzzle and Platforming. However, many of the games can be broadly categorized as action adventure and share mechanics of combat, exploration, puzzle solving and narrative driven events. Exploration and building appear to generally be the most frequent mechanics across the list.

Brand Recognition

3 of the games on the list are sequels and 7 have had numerous updates over the years resulting in improved mechanics and iterations on the original formula, tried, tested and beloved by an established audience. Nintendo as a developer has the most entries on the list with 4 and the Mario series is the most represented with 2 titles and Mario Kart now being its own sub series. As all 10 games are now part of major franchises it's reasonable to assume there has been tremendous marketing power thrown behind them, which gives them an advantage of market visibility.

Accessibility

Secondly is their availability on multiple platforms whether it be from initial release or through re-makes, remasters, or ports that has kept them in the public consciousness long after their release. Some of the games such as Wii Sports, Super Mario Bros and Red Dead Redemption II were bundled with their consoles at launch.

Broad Appeal

Another correlation is their wide appeal to a diverse range of audiences. This is helped by their high-quality gameplay designed and developed at AAA studios which in most cases had a huge budget to develop and test with. Many of the games on the list innovated in their genre with some inventing their genre. And finally, many of them are multiplayer which is an important factor in re-play value.

Age Demographic

The average gamer globally is 35 years old. (Jovanovic, 2023). This means they were born on average in 1988-89. Assuming they played games from a young age one of the first games they may have played were on the Super Nintendo (SNES) or Sega Genesis. As the SNES took the market share the average gamer at this time might have played Super Mario World (Nintendo, 1991) or Super Mario All Stars (Nintendo, 1993) which contained a remake of the first three Super Mario Bros games. At the age of 7 or 8 they would have heard about Pokémon which became a huge media franchise after its release in 1996. Both these series are family friendly and appropriate for a young audience.

As this demographic became teenagers, they may have played Grand Theft Auto III (Rockstar North, 2001) released on the PS2, (the bestselling console of all time, (Lewis,2023)) and PC. The game was controversial for its violent content, causing mass hysteria which helped its sales, but it is also noted for its immersive open 3D world and in-depth narrative. (Morris, 2023).

By the time of the 2010's, gaming's biggest demographic was adults with more spending power and that is reflected in the list as 6 of the 10 games in the best-selling list are from the 2010's. In

addition to this there were now multiple generations of gamers, more inclusion and diversity in the types of game characters, greater customization and personalization within games and greater variety of games produced. improved technology and graphics and the emergence of digital sales that increased accessibility to titles. Marketing and promotional efforts increased exponentially as gaming became more accessible through mobile gaming, social media and the emergence of VR and AR. (Beresford, 2019).

But let's not forget where it all started. The first commercially successful video games emerged in the 1970s and that player demographic could be anywhere from their 40s to 60s today. These gamers' first gaming experiences may have been text-based adventures or popular titles such as Pong (Atari, 1972). Many of these gamers still play today accounting for 12% of the US audience (Howarth, 2023).

85% of teenagers in the US aged 12 to 18 tend to play on console and PC at 60%, with 50% playing on mobile. This demographic is shown to switch between platforms regularly (Play Today, 2023). They account for 20% of the US market (Howarth, 2023).

Gender

Gamers until recently were thought of to be majority male. However, according to the Play Today (2023), almost half of US gamers in 2022, or 48%, identify as female. The proportion of female gamers has hovered at around 40% since 2008, but has been steadily growing over the last decade, resulting in the near equal representation of male and female gamers.

5.1 Most Played Video Games by Player Count (2022)

There is more to gamer engagement than how many copies are sold. Since the 2010's "games as a service" have become a phenomenon with higher internet speeds and bandwidth available to the average consumer. These online capabilities have changed the industry allowing studios to continue profiting from their games after the initial release. (Zaiets, 2020). **Figure 10** shows the most played video games by player count or number of registered users considering peak players logging in on a single day for a particular game.

Rank	Game Name	Number of Players (Billions) in 2022	Year of Release	Platforms	Monetization Method	Genre
1	**Candy Crush Saga**	**2.73**	**2012**	**Mobile, Web**	**Free-to-play with in-app purchases**	**Puzzle**
2	**PUBG: Battlegrounds**	**1.2**	**2017**	**PC, Xbox, PS4, Mobile**	**Paid game with free-to-play lite options**	**Battle Royale, Shooter**
3	**Crossfire**	**1**	**2007**	**PC**	**Free-to-play with in-game purchases**	**First-person Shooter**
4	**Dungeon Fighter Online**	**0.85**	**2005**	**PC**	**Free-to-play with in-game purchases**	**Action RPG**
5	**Minecraft**	**0.738**	**2011**	**PC, Xbox, PS4, Mobile**	**Paid game with free-to-play lite options**	**Sandbox, Survival**
6	**QQ Speed / GKART / Speed Drifters**	**0.7**	**2008**	**PC, Mobile**	**Free-to-play with in-game purchases**	**Racing**
7	**Pac-Man Doodle**	**0.505**	**2010**	**Web**	**Free-to-play on the web**	**Arcade**
8	**Among Us**	**0.5**	**2018**	**PC, Mobile**	**Paid game with free-to-play lite options**	**Party**
9	**Microsoft Solitaire**	**0.4**	**1990**	**PC, Mobile**	**Free-to-play with ads or ad-free payment**	**Card**
10	**Mini World**	**0.4**	**2015**	**PC, Mobile**	**Free-to-play with in-game purchases**	**Sandbox**

Figure 10 - Most Played Video Games by Player Count 2022 (James, 2023b)

Branding, Genre and Gameplay

Most of the games on the list are multiplayer games that allow players to compete against or co-operate with other players. Many of the games have simple and intuitive gameplay mechanics that are easy to pick up and play, making them appealing to a broad audience. Several of the games on the list have achieved massive popularity with the average year of release being 2009, giving these games and brands well over a decade to become ingrained in the public consciousness.

Battle Royale games are new but have been extremely successful. It's likely the FPS style of play that emphasizes fast-paced, skill-based gameplay with many players often up to 100 until 1 is left standing will grow and evolve into other Multiplayer games.

That said, the games on the list span a variety of genres, including puzzle games, first-person shooters, racing games, and sandbox games, each with its own unique gameplay mechanics and style. Some of the games on the list, like Candy Crush and Pac-Man Doodle, are relatively simple and casual, while others, like PUBG and Crossfire, are more complex and require a higher level of skill and strategy.

Accessibility and the Free to Play Model

A large reason why gaming has become so popular is due to the increased accessibility of games particularly on mobile devices. The rise of digital media consumption has created new monetization opportunities for companies most notably the free to play method. Kati Alha (Tampere University, 2020) in her dissertation "The Rise of Free-to-Play: How the Revenue Model Changed Games and Playing" explains the normalization of the free to play model:

> "The free-to-play model has influenced player audiences as well. Due to the new possibilities and ways to play games and lower barriers of entry, games are being played by larger audiences than ever. The audiences of free-to-play games are more diverse in gender and age than in other forms of gaming, helping to break some of the structural diversity problems. Diversity can be also seen in game types, and the free-to-play model has given more space for casual gaming and helped in popularizing game types such as multiplayer battle arenas, battle royale games, and location-based games." (p.117).

The free to play model has proven to be an effective strategy for increasing a game's player base. All 10 games on the Most Played Video Games by Player Count 2022 list have free to play options with only 3 requiring payments for the full game. 5 have in app purchases, 1 has ads that can be removed with a one-time payment and 1 is completely free on the web.

Chapter Conclusion

This chapter has highlighted the importance of sales and demographics in understanding successful and engaging game mechanics. We can see that exploration is a popular mechanic as is building and crafting. The game genres are diverse but many fall under the umbrella of action adventure. Puzzle solving and narrative driven events are also strong contenders. Multiplayer may be the most important feature for online play and replay value. Accessibility across multiplatform is important as is visibility in the market, brand recognition and high-quality gameplay with AAA resources to develop and test with. Many of the games have redefined or invented genres. Battle Arena games are growing in popularity. Age demographic plays a large part in the consumer behaviour and the demographics are becoming more diverse marking success for games that have a broad appeal and are inclusive of a wide variety demographics. Finally, the industry as a whole but especially the mobile market is growing due to the ease of access and casual nature of the gaming styles so far.

6 Research Results

To obtain direct reporting on the impact of game mechanics two studies were conducted for this thesis in addition to the literary analysis. The first is a playthrough of two games in the Metroidvania genre, analyzing and observing the various features that create the core gameplay experience and examining the core game mechanics and how they have been developed over time.

The second is a series of interviews with established industry professionals gaining insight on their favorite gaming experiences and their inspiration to become developers. The results are then compared with the findings of the literary study to determine the key factors that engage players while providing a comprehensive review of the core gameplay mechanics that make up these experiences.

6.1 Super Metroid and Hollow Knight – Perfecting Metroidvania

Hollow Knight (Team Cherry, 2017) is a 2D Metroidvania game that has perfected many of the game mechanics of the genre. It is compared favorably to Super Metroid (Nintendo, 1994), the game that is credited for defining the genre. Super Metroid is still played frequently today, and its mechanics have stood the test of time. However, Team Cherry successfully iterated on the mechanics of Super Metroid and improved them significantly while adding their own individuality to their game. This analysis is not intended to convince the reader which game is better nor is it fair to rank two games released on different platforms with a 23-year technological gap between them. This comparative analysis attempts to demonstrate how innovative mechanics from the past have persisted and been improved over time.

Testing Environment and Hardware Used

The playing method was made as consistent as possible for the study with Super Metroid playing as it was originally released on the SNES mini with a SNES controller (See **Figure 11**). Hollow Knight was played on PC with an Xbox One controller also in line with its original release (See **Figure 12**). Note that the playthroughs were completed in 2022 and Hollow Knight has received several updates to fix bugs, balancing issues and add DLC since its 2017 release.

Figure 11 – SNES Controller. (Alexander, 2022).

Figure 12 – Xbox One Controller. (Amazon, 2023).

Controls and Movement

The controls in Hollow Knight build upon those of Super Metroid, not just in terms of mechanics, but also in the way they feel. When playing Hollow Knight, the controls are responsive and tight, which makes it easy for the player to execute precise movements and actions. This is especially important in a game where platforming and combat are such significant aspects of gameplay. For example, the dash ability in Hollow Knight feels smooth and fluid, allowing the player to quickly move around and dodge attacks. Similarly, the attacks and abilities in Hollow Knight feel impactful, which adds to the overall satisfaction of combat in the game. Additionally, the game's use of button combinations for certain actions, such as combining a jump and a dash to perform a higher jump, adds depth to the controls while still feeling intuitive and natural. In Super Metroid, the controls are functional, but they can feel stiff and clunky by today's standards. Some of the physics are a little unbalanced by today's standards also. For example, Samus feels weighty when walking and running but exceptionally light and floaty when in the air. This is due in part to the limitations of the technology of the time. It is important to note that the two games were designed very differently despite their similarities. Super Metroid emphasizes exploration and backtracking over tight

platforming and combat for example which would have affected how the development team designed the controls.

Combat System

Super Metroid primarily focuses on ranged combat, Hollow Knight emphasizes both melee and ranged combat. The player character in Hollow Knight wields a nail, which is a close-range sword weapon, and can also use spells for ranged attacks. This allows for more diverse combat strategies and provides a greater variety of options for players to experiment with. Hollow Knights combat mechanics put a greater focus on precision and timing. The player must carefully time their attacks and movements to avoid enemy attacks and deal damage effectively. This requires a bit more from the player in terms of proficiency in the mechanic whereas the weapon system in Super Metroid is designed for specific situations.

In Super Metroid, enemies often move along a fixed path or have a set patrol route, and their attacks are usually straightforward and easy to predict. However, some of the more powerful enemies can be quite challenging to defeat and require careful strategy. On the other hand, in Hollow Knight, enemies have more complex AI behaviors and can be more difficult to defeat. Many enemies have a wide range of attacks, and they can change their behavior based on the player's actions. Some enemies are highly mobile and can dodge the player's attacks. Additionally, some enemies have unique weaknesses that must be exploited to defeat them. Hollow Knight also features a wider variety of enemies and bosses, each with their own unique abilities and attacks. This means that players must adapt their combat strategies to face each new challenge, adding a sense of discovery and exploration to the game's combat system.

Unique Mechanics

Pins are items that can be equipped to your character's charm notches to provide various abilities and benefits. Pins are divided into combat, exploration, and passive categories, and provide benefits such as increased attack speed, improved mobility, and increased health. Pins can be combined to suit your playstyle and are a vital component of overcoming challenges and uncovering secrets.

Soul abilities are skills that consume your character's soul energy to perform various actions. There are five soul abilities:

- Focus, which restores health.
- Shade Soul, which shoots a powerful bolt of energy at enemies.
- Abyss Shriek, which unleashes a shockwave that damages all nearby enemies.
- Desolate Dive, which allows your character to perform a downward smash attack that breaks through cracks in the ground.
- Howling Wraiths, which creates a blast that damages enemies in front of your character.

These abilities vary in their power and the amount of soul energy they consume and can be upgraded with certain charms. The combination of these two mechanics offers an alternative to weapons and armor. It also allows the player to master use of the nail and the movement mechanics through enhancement and buffing.

Super Metroid focuses on upgrading Samus's suit and weapons with specific purposes for certain areas of the game. It builds on the concept of Metroid (Nintendo, 1986) using bombs and missiles to destroy blocked paths or locked gates. The Morph Ball allows the player to squeeze through small tunnels. The beam upgrades allow for more powerful attacks but also in the case of the Ice Beam, create platforms from frozen enemies. The suit upgrades allow the player to move through heat and water areas and upgrade the jump ability to reach new areas.

There is some overlap with the functions of abilities here between the two games and the line of influence can be seen clearly. What is also revealed is the amount of iteration and originality derived from a successful and beloved gameplay formula.

User Interface

Super Metroid's UI includes the player's health and ammunition, as well as the current weapon and power-up selections. There is also a basic map screen that the player can access to help navigate the game world. The UI in Super Metroid is serviceable but can feel dated compared to modern games. Hollow Knight's UI, on the other hand, is more detailed and visually appealing. The UI includes a health bar, a Soul meter that is used for casting spells, and several icons that represent

the player's abilities and items. The game also has a map screen, which is more detailed than the one in Super Metroid and includes icons that represent specific points of interest. Additionally, Hollow Knight's UI includes a compass that helps the player keep track of their location in the game world.

Narrative and Worldbuilding

Super Metroid's story is told through its environment and visual cues with almost no exposition. The player is subtly guided through the world with various areas blocked off and some hints pointing the player in a direction. However, more advanced, and adventurous players may veer off the path and take on the games challenges in a different order providing they have the correct powerups and abilities to proceed. There is a loneliness that is often used to describe the experience of playing Super Metroid because the character does not interact with anyone except for killing enemies. The game contains three endings, determined by the time it takes the player to complete the game.

Hollow Knight also features this desolate loneliness, but the world and lore are bigger and deeper, there are dialogues with characters and the world is far more fleshed out. Characters have individual narratives and purposes for being where they are in the game and the player can progress in the game by interacting with them. Hollow Knight borrows Metroid's mechanic of gaining access to areas through abilities gained, usually by defeating bosses. Some bosses can be avoided or fought later in the game with more abilities allowing for a natural choice in playing difficulty. Completely inspired by Metroid there are more options, secrets, and bonus areas to be discovered in the world. Hollow Knight contains five endings that require different conditions to be met to complete. Both games heavily encourage exploration offer variation in the experience with each playthrough.

The worlds themselves are interconnected labyrinths. Planet Zebes in Metroid features a futuristic sci fi setting with hostile aliens, laboratories, and caverns with strange vegetation.

Hollow Knight's Hallownest is similarly intricate but larger and more densely packed. (See **Figures 13** and **14** below). There are many ways to get in and out of areas with the world changing depending on events in the game and the presentation and progression through the world is more realized than Super Metroid but can sometimes be a little too big for its own good. That said, the many ways to enter areas reduce the need to backtrack as much and can keep the experience

fresh. There is an argument to made that by mastering the world of Super Metroid players can perfect their traversal through the rooms through repetition, but these are again specific design decisions by developers based on their intent and the limitations of the technology they had to work with.

Figure 13 - The regions of Super Metroid pasted together to display the full in game playing map. (Cthulhufhtagn, 2008, Super Metroid Map.)

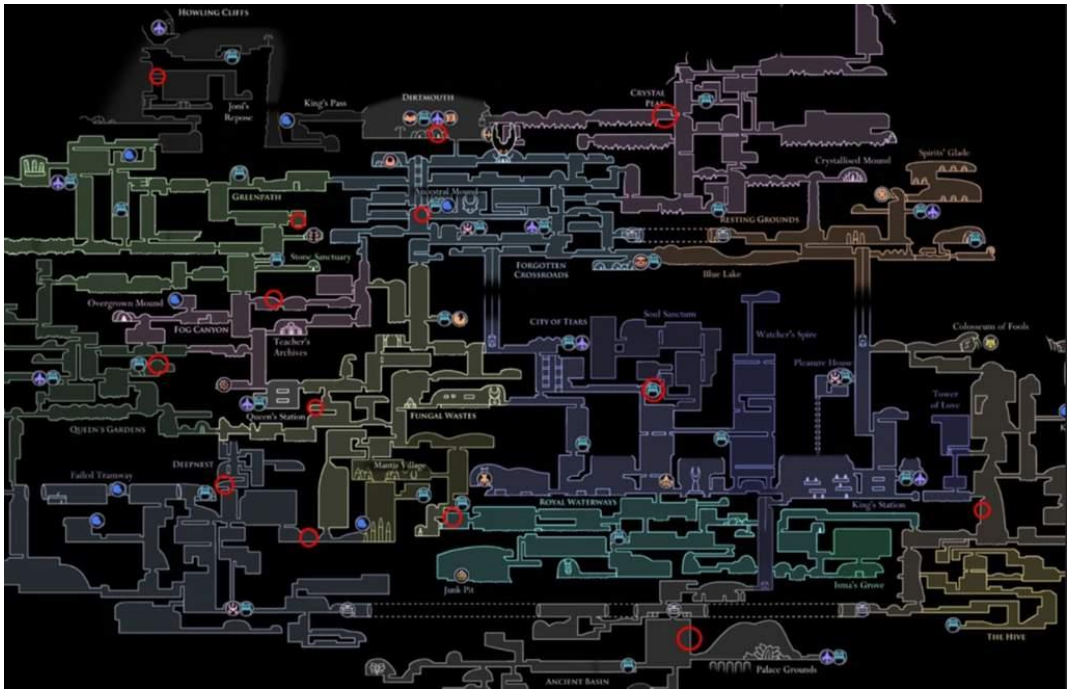

Figure 14 - Hollow Knight in game World Map. (Tallin, n.d, Cornifer the Cartographer.)

Atmosphere, Audio and Art Style

Super Metroid features a dark, moody, and lonely atmosphere. The color palette is extremely limited and was created pixel by pixel. It is a marvel in the pixel art style and looks particularly good to this day. The lighting is atmospheric and varied and the design of the aliens, especially the bosses, is impressive. (See **Figure 15**).

Figure 15 - Super Metroid Boss encounter Kraid. (Matsuoka, Mashimo, Kimura. 1994. bover_87. 2015).

Its minimalist style carries over to the audio that is arranged sparsely throughout and punctuates certain moments in gameplay. This was unusual at the time as many soundtracks would play constantly, were often upbeat and melodic. Its limitation of audio on a 16-bit system gives it a retro electronic charm that fits with the sci fi aesthetic. (Click **Figure 16** below to listen).

Figure 16 – "Lower Brinstar" - Super Metroid in game music. (Yamamoto. 1994. MetroidMusicChannel, 2016)

Hollow Knight adopts this philosophy and iterates on those concepts. The mood of Hallownest is also very desolate but the world is richer with a 2D painted art style each room looks like it could hang in a gallery. The characters, although minimal in design, are purposefully designed with clear personality and the colours are rich and vibrant, (See **Figure 17**). The world has its own ecosystem with each section blending into the next, clearly inspired by Super Metroid but taken further. It is this seamlessness that makes the world realistic and immersive. The variance of environment encourages the desire to explore as it changes in each section leaving clues as to what previously existed there.

Figure 17 - Hollow Knight Screenshot. (Gibson, 2017, Nintendo.com)

The music uses full orchestration again used sparingly and creates the atmosphere of a place lost to time. The musical sequences are fully realized pieces rather than 8 or 16 bar loops. Through audio stabs and other modern techniques, the cues are placed with precision and purpose and incredibly impactful. An example can be observed in the piece “City of Tears” (See **Figure 18**).

Figure 18 – “City of Tears” – Hollow Knight in-game music (Larkin. 2017. Amellifera. 2022).

The effect here is full immersion as the music never overstays its welcome but provides an atmospheric palette that blends seamlessly with the striking visuals. The player may find themselves noticing beautiful orchestral moments at seemingly peculiar times but the intention behind the placement of the cues is completely intentional and links the action to other important beats and moments in the game.

Key Takeaways

This study provided a great insight into the development of an established genre. Hollow Knight is an exemplary example of how to iterate on a successful formula while adding a personal and unique voice to a modern gaming experience. By making the controls more fluid the game successfully improves on the Super Metroid combat system while forging its own path with the Pins and Souls systems. In turn it demonstrates how the mechanics of Super Metroid have persisted over time and how old gaming styles can be effective today. Super Metroid itself is still very playable and enjoyable after some adjusting to the controls. There is a charm to its limitations. The sound design becomes like an old friend, hearing similar sounds repeatedly. The music becomes part of the architecture affecting the playing experience throughout each section of the game. The exploration and nonlinear nature of the progression is a masterclass in giving the player autonomy over their playing destiny. Hollow Knight taking these concepts further and adding more layers interestingly doesn’t make it a better game, but a different one. It challenges notions that bigger

and newer is better. This comparative analysis shines a light on the importance of learning from the past and the importance of design constraints. Hollow Knight very much feels like an indie title. It holds back in so many areas but is full of detail and nuance. Super Metroid was limited by the technology of the time but delivered a game ahead of its time. Hollow Knight's visuals are unquestionably superior and fully showcases the value of the 2D experience, but Super Metroid's pixel art style has a retro charm that is beloved by gamers of all ages. Both games strike a balance between flexibility and purpose. The player is seemingly free but carefully guided through the world to learn the mechanics and use them in various ways. It makes for individual and personalized experiences which is exciting, engaging and makes people want to play all the way through and then play again with the chance to have a different experience the second or third time through. These games and the design principles behind them are marvellous case studies into what makes games engaging from a pure gameplay point of view.

6.2 Interviews with the Developers

Why Design Games?

Why do designers give years of their life at a time to developing a concept in their head? The reasons vary from person to person but in many cases, it is the love of gaming itself, or a particular experience with a game that unlocked a designer's creativity and acted as catalyst to strive for greatness. Interviews with the accomplished staff at BUAS showed a desire to create experiences for players that they experienced themselves. When asked what inspired them to become designers and enter the industry here is what they had to say:

The 3D Platformer

Rene Dirks (Sony, Vanguard Games, Senior Lecturer at BUAS)

> "The game that made me want to become a game developer was Super Mario 64. I was awestruck by this 3D world and the freedom it gave, and as I started to learn about game development it was an enormously interesting rabbit-hole to dive deep into." (Imbert, 2023, BUAS Interviews).

The influence of Super Mario 64 (Nintendo, 1996) cannot be understated. The first open world 3D roaming game, the Nintendo 64 launch title highlighted a massive leap in technical capabilities but also a huge amount of game mechanics to work with compared to what had been available on 16-bit consoles. It was the creation of the 3D open world action-adventure game as a genre. Dirks, who was a game enthusiast before the Nintendo 64, saw the innovation and possibilities granted by an emerging technology and was inspired by how deep and flexible the game mechanics were. He is not alone as Super Mario 64 is one of the bestselling, most played, most modded, and most frequently talked about games ever released. (Thorpe, Albiges, 2021).

The Tools of the Trade - Learning and Modding

Tim van Kan, (Epic Games and Technical Design Lecturer at BUAS) had a similar experience of discovering a new and innovative take on the gaming medium but in addition it was the tools themselves that inspired him while he was studying. DayZ (Bohemia Interactive, 2013) is a MMORPG

survival game that started out as a mod for the game Arma 2 (Bohemia Interactive, 2009) a military simulation game.

> "Probably DayZ, the fact that a mod could make such an impact really made me more interested in learning more about game development. When I started at BUAS I still did not really find my spin until Unreal Engine became free. When I saw that I was capable of really turning ideas into experiences is when I really knew I wanted to be a game developer." (Imbert, 2023, BUAS Interviews).

Again, technological innovation, and the possibility to create a deep and meaningful experience with access to powerful game development tools such as Unreal Engine.

A Convergence of Interests – Creating an Industry

Lastly Merlijn Eskens (Indie Developer and Technical Design Lecturer at BUAS) described his journey into game development as a natural one but once again the catalyst is the ability to design, create and iterate on a concept. Modding again was a factor in Esken's decision to enter the game industry as well as the realization of being able to make a hobby a profession.

> "I have been making games since elementary school. Proper games too. I would make card games, change the rules of chess, etc... My friends' brother was making his own maps in Warcraft III. This was impossibly cool to me! I learned the entire engine and spent HOURS working away at it while in high school. One of my maps was well received and I was immensely proud. At this point I knew others did not make games, so I started to realize this was my thing…I went to one of those orientation days that you had to attend to for high school and met a game developer by pure chance. I do not remember him, but I do remember him saying that this was his job. I was STUNNED. This was the event where I learned that game developers existed and that it was a job." (Imbert, 2023, BUAS Interviews).

Like Super Mario 64, the real time strategy game Warcraft III (Blizzard Entertainment, 2002) birthed a genre. (Moss, 2020). The map editor and multiplayer modes in Warcraft III encouraged players to insert their own creativity into the game as well as devise their own strategies. This was the catalyst for the massively successful MMORPG, World of Warcraft. (Atkinson, 2018). Using a

subscription model, the game was able to generate $9.23 Billion US dollars by 2017 and had well over 100 million registered users. (Leack, 2017).

Another genre credited to Warcraft III is MOBA. Defense of the Ancients (DOTA) began life as a community created mod of Warcraft III. Its sequel DOTA 2 (Valve, 2013) became one of the most influential MOBA games of all time peaking at 709,000 concurrent players in 2016. (Wong, 2023).

Another spinoff from the DOTA mod is League of Legends (Riot Games, 2013). To date it is the most successful Esports game and the most popular MOBA game. (GameSight, 2023). The game is noted for its simple premise and attractive art style but deep gameplay with numerous champions and strategies and team combinations. (Atkinson, 2018).

It is no surprise Eskens was inspired by Warcraft III considering how far the mechanics of a single game have been taken and the massive success it has achieved. Esports is now an industry unto itself with MOBA games being the driving force in its success.

7 Conclusion

Throughout this thesis 53 games, 30 genres, 15 platforms and 9 console generations spanning 50 years have been referenced to illustrate what makes video games engaging. 11 games were analyzed in detail and several of their gameplay mechanics examined thoroughly. Mechanics were identified and categorized and their development across time in successful games and franchises were documented. The literary study covered some basic psychological studies to explain how human motivational drivers function and how game mechanics can stimulate those drivers. Game Design philosophies by industry veterans were then dissected highlighting how they affected human motivation and desire. Art, sound, narrative, and character development were analyzed in conjunction with their accompanying mechanics and the combination effect of both on mood and atmosphere were critiqued. Specific mechanics and genres of how they have evolved over time were case studied as well as the influence of landmark titles on newer ones. Market research was featured heavily, specifically to identify consumer behaviour and observe market trends while trying to observe market variables outside of pure game design as popularity and sales are the result of many factors besides the game or its features. Demographics were studied to highlight the ever-increasing diversity and market growth of the industry. Online gaming, technological advancements, growing online communities and new monetization methods were observed and their effect on the industry noted. Interviews with game designers and what inspires them to create were covered.

The research methods were successful and effective. They managed to provide an overall look at the industry while digging deep into specific concepts and genres explaining and supporting why they were successful and engaging. From the literary study we can conclude that storytelling is important in games and often a key factor in immersion. The challenge involved in mastering gameplay is a vital ingredient that triggers intrinsic and extrinsic motivation. Gaming has numerous social, cognitive, and mental health benefits with the potential for forming deep social connections. Designers can, should and do design their games with social and online capabilities in mind and this benefits all parties involved from creator to consumer. These should be built into the gameplay to encourage teamwork.

Risk and reward are important design philosophies to consider when designing engaging mechanics. Stress, relief, growth, and progress stages are critical elements in game design. These stages

help to create a loop of tension and release that keeps the players engaged in the game. Fighting game fundamentals heavily rely on risk and reward as shown in the breakdown of the lightning screw uppercut move in Tekken Tag Tournament 2. Action-adventure games like Metal Gear Solid and Soul Reaver with strong enriching narratives use those narratives get players emotionally invested and tie that investment into clever mechanics such as alternate endings based on previous actions or problem solving encounters that require players to devise new strategies to defeat an enemy, rewarding the player in a way that gives their character new skills that progress them to the next stage of the game.

Video games are systems that engage players in artificial conflict defined by rules and have quantifiable outcomes. Cognitive gameplay happens when information that is presented to the player is analyzed and understood quickly. The player's ability to make a decision based on the information affects their interaction with the gaming world, and the feedback from those interactions then becomes the information the player gathers, repeating the loop until gameplay ends. Feedback from game world interactions drives the momentum of the cycle. Indicators and achievements improve the feedback loop.

Exploration is very important in games, especially in single player modes. RPGs tend to have complex battle systems that allow for numerous strategies and freedom of choice in how a player tackles the game's challenges. Final Fantasy and Dragon Quest popularized the JRPG genre and introduced several game mechanics that have become staples of the genre. Pokemon brought the top-down RPG to huge global mainstream success and many of its mechanics were inspired by early Final Fantasy games. The Legend of Zelda Ocarina of Time is one of the most critically acclaimed games ever released and is known for its worldbuilding and exploration mechanics that have carried over into many recent releases.

Crafting has been around for years and evolved steadily. There are different types, such as resource vs. money, recipe-based, and undefined recipe systems. The undefined recipe system is the most immersive and allows players to experiment and create unique outcomes. The success of Minecraft has had a significant impact on the video game industry, shining a spotlight on crafting and many developers have incorporated similar mechanics into their games. Narrative is also an important game mechanic that has become increasingly complex and detailed over the years.

Players now develop emotional empathy for the characters in the game world. Non-linear story-telling has emerged in games, and game characters now have their own identities and opinions, thanks to the increased use of multi branch narrative, cutscenes and cinematic techniques.

What types of games people play and who plays them can be found in sales and demographics data. There is a wide variety of genres that people play over multiple platforms and the research found that many of the games could be considered action-adventure titles with shared mechanics of combat, exploration, puzzle-solving, and narrative-driven events.

Engaging mechanics are not the only factors that determine the success of a game.
Brand recognition, sequels, popular games that are regularly updated over years improving mechanics and iterating on the original formula also factor in. Marketing power and development funding also play a large part in a game's commercial success. Accessibility is vital whether it be through availability on multiple platforms or remakes, remasters, and ports of classic titles. Free to Play has become a commonly accepted way to attract and build a player base with monetization methods such as in game ads and in game transactions being used as tools for profit. Broad appeal to a diverse range of audiences is a correlation among popular games. The average gamer globally is 35 years old. Family-friendly games such as Super Mario and Pokémon were some of the first games this demographic might have played. By the time of the 2010s, gaming's biggest demographic was adults with more spending power reflected in the sales of games released in the 2010's.

The conducted research explores the game design principles of Super Metroid and Hollow Knight and how they have influenced the "Metroidvania" genre. It examines the similarities and differences between the games, focusing on their mechanics, level design, and sound design. They have been shown to be spectacular examples of how to create engaging and memorable experiences by building on established game mechanics, iterating on them, and adding unique features. Learning from the past was an important takeaway and enforcing design constraints was valuable in creating compelling gameplay. Themes that popped up in the literary study were relevant here as themes such as exploration, player choice, risk and reward, stress, relief, growth, and progress and increasing challenge were all employed to great effect in both games.

Lastly, the interviews with the developers demonstrate that the love for games and the engagement with mechanics often in formative years can act as a powerful motivator for future game developers and game designers. Gaming experiences like Super Mario 64, DayZ and Warcraft III inspired designers by demonstrating technological innovation and the potential for powerful game development tools such as Unreal Engine to turn ideas into experiences. Modding and the ability to design, create, and iterate on a concept also played a role in inspiring game designers.

Some limitations of this study include the omission of deeper analysis for brevity. The study would have benefited from more practical research and less reliance on theoretical concepts and secondary sources. As it was, however, the points were successfully illustrated.

The interviews could have benefitted from more diversity with only three subjects interviewed, all male, all Dutch and two of close age. The study of demographics itself was limited with general references to sales and playing engagement with little consideration towards gender, culture, or geography. Female demographics and non-binary denominations were not covered meaningfully and should have been. There is an over reliance on American data and Asia is not properly covered despite being the biggest market. The mobile and VR/AR markets are not covered in depth despite their increasing influence on the gaming landscape. There is no mention of Sega or its impact on the game industry with Nintendo dominating the discussion.

The thesis successfully outlined the positive effects of playing games but failed to outline the negative effects in any detail. The importance of social game mechanics embedded into the gameplay experience were mentioned but no examples or technical breakdown was provided. The discussion of psychology was elementary at best as the focus was shifted towards game design, mechanics, and consumer behaviour. This was done to keep the work as industry relevant as possible, but a deeper analysis could have been interesting.

Crafting mechanics were explained in enough detail to support what the thesis is arguing but it must be noted that there are several other detailed and commonly used crafting systems that were not discussed or mentioned. More analysis into systems and level design would have been desirable.

Overall, the process was highly valuable and educational, and the hope is that the information will be valuable and informative for the reader as well. Games exist in carefully designed systems that benefit from established patterns and practices but at the same time are always growing and evolving as are the players and creators that play and design them.

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