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SYSTEMS-BASED GAME DESIGN IN DWARF FORTRESS

Procedural Generation and Emergent Gameplay

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Bachelor's Thesis

Business Information Technology
Bachelor of Business Administration

2023

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Abstract of Thesis

Business Information Technology
Bachelor of Business Administration

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Supervisor	Juha Orre		
Commissioned by	Lapland University of Applied Sciences		
Title of Thesis	Systems-Based Game Design in Dwarf Fortress: Procedural Generation and Emergent Gameplay		
Number of pages	60 + 2		

This thesis explores the concept and application of systems-based game design and procedural generation techniques in Dwarf Fortress, a popular fantasy settlement building simulation game. The study contains an analysis of the game's various systems, mechanics and modes, focusing on the role of procedural generation in creating emergent gameplay experiences.

The research methodology includes a literature review, game analysis, and survey. The literature review provided a conceptual overview of procedural generation, emergent gameplay, and systems-based game design principles related to Dwarf Fortress, while the game analysis further examined the systems and modalities present in Dwarf Fortress, compared to other, similar games. Finally, the survey investigated players' perceptions of procedural generation in Dwarf Fortress, and assumptions that can be made in this regard.

The results show that procedural generation plays a significant role in creating both emergent and engaging gameplay experiences in Dwarf Fortress. The study concludes by recommending future research on systems-based game design and procedural generation in games.

Keywords	Dwarf Fortress, systems-based game design, procedural generation, emergent gameplay, game analysis, survey
Other information	This thesis includes a short video for the wider audience

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Opinnäytetyön tiivistelmä

Tietojenkäsittelyn koulutus
Tradenomi (AMK)

Tekijä	Niilo Lehner	Vuosi	2023
Ohjaaja	Juha Orre		
Toimeksiantaja	Lapin ammattikorkeakoulu		
Työn nimi	Järjestelmäpohjainen pelisuunnittelu Dwarf Fortressissa: Proseduraalinen generointi ja emergentti pelattavuus		
Sivu- ja liitesivumäärä	60 + 2		

Tämä oppinäytetyö tutkii Dwarf Fortress -nimisen suositun fantasiapelin järjestelmäpohjaisen pelisuunnittelun ja proseduraalisen generoinnin käsitettä ja soveltamista. Tutkimus sisältää analyysin pelin erilaisista järjestelmistä, mekaniikoista ja tiloista, keskittyen proseduraalisen generoinnin rooliin luotaessa emergenttejä pelattavuuksia.

Tutkimusmenetelmään sisältyy kirjallisuuskatsaus, pelianalyysi ja kysely. Kirjallisuuskatsaus tarjosi käsitteellisen yleiskuvan Dwarf Fortressin proseduraalisesta generoinnista, emergentistä pelattavuudesta ja järjestelmäpohjaisista pelisuunnitteluperiaatteista. Pelianalyysi puolestaan tutki tarkemmin Dwarf Fortressissa esiintyviä järjestelmiä ja tiloja, joita vertailtiin myös muihin vastaaviin peleihin. Lisäksi kysely selvitti pelaajien käsityksiä Dwarf Fortressin proseduraalisesta generoinnista ja oletuksia, joita voidaan tehdä tässä suhteessa.

Tulokset osoittavat, että proseduraalinen generointi on merkittävässä roolissa luotaessa emergenttejä sekä sitouttavia pelikokemuksia Dwarf Fortress -pelissä. Tutkimus päättyy suositukseen tulevasta tutkimuksesta järjestelmäpohjaisesta pelisuunnittelusta ja proseduraalisesta generoinnista peleissä.

Avainsanat	Dwarf Fortress, järjestelmäpohjainen pelisuunnittelu, proseduraalinen generointi, emergentti pelattavuus, pelianalyysi, kyselytutkimus
Muita tietoja	Työhön liittyy lyhyt video laajemmalle yleisölle

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FOREWORD

I have always had a deep passion and love for video games, ever since I first saw their pixels animating a television screen. I was fascinated by the kind of worlds, characters and stories that these games could create and immerse me in. As I grew older, I also became interested in the development of games, especially the indie variety, which would attempt to offer something truly unique to its players.

One of the aspects in game design that consistently intrigued me the most—and would lead to these sorts of unique experiences—is procedural generation, as it has the potential to create endless variety, surprise and replayability in games which make intelligent use of it, as well as to reduce their development time and cost, very important factors in indie-development. But procedural generation also comes with its own challenges, such as how to balance randomness and coherence, how to ensure both quality and consistency, and, last but not least, how to design such game systems in a way that truly adapts to player input.

This thesis is the consequence of many-a-night spent discussing these concepts with my friends, playing the games that inspire me, and desiring to understand how to make games that engage their audience the same way in which I was captured by them originally. It is also the result of the advice, insight, criticism and time that my teachers, friends and fellow students lent me in this endeavour. I would like to take this opportunity to thank them all for being awesome.

I also want to thank Tarn and Zach Adams, the makers of Dwarf Fortress—the particular case study of this thesis—Bay 12 Games and Kitfox Games, for having made, and allowing me to research, their masterfully crafted example of a game.

I hope that this thesis will be useful and interesting to anyone who wants to learn more about procedural generation and systems-based game design, or who shares my passion for games as a vehicle of creativity and escapism.

SYMBOLS AND ABBREVIATIONS

DF	Acronym for Dwarf Fortress.
“Fun”	Term of endearment for the various ways that Dwarf Fortress can challenge, frustrate or surprise the player with unpredictable and emergent situations.
NPC	Acronym for Non-Player Character.
PCG	Acronym for Procedural Content Generation.
TTRPG	Acronym for Tabletop Roleplaying Game.

1 INTRODUCTION

1.1 Subject and Research Questions

Systems-based game design and procedural generation are two emerging trends in the video game industry offering new possibilities in the creation of rich and dynamic gameplay experiences (Gordon 2021). Such type of design involves creating a series of interconnected mechanics that react to player actions, and each other, in complex and ideally consistent ways, subsequently leading to dynamic and highly reactive game worlds (Sellers 2017). Procedural generation refers to the utilization of algorithms in creating content (maps, characters, items, etc.) dynamically and programmatically, instead of manually by designers (Barriga 2018). These techniques enable deep and emergent gameplay experiences, where players can ideally continuously explore, experiment, and discover unexpected outcomes and interactions (Bycer 2017; Polack 2018).

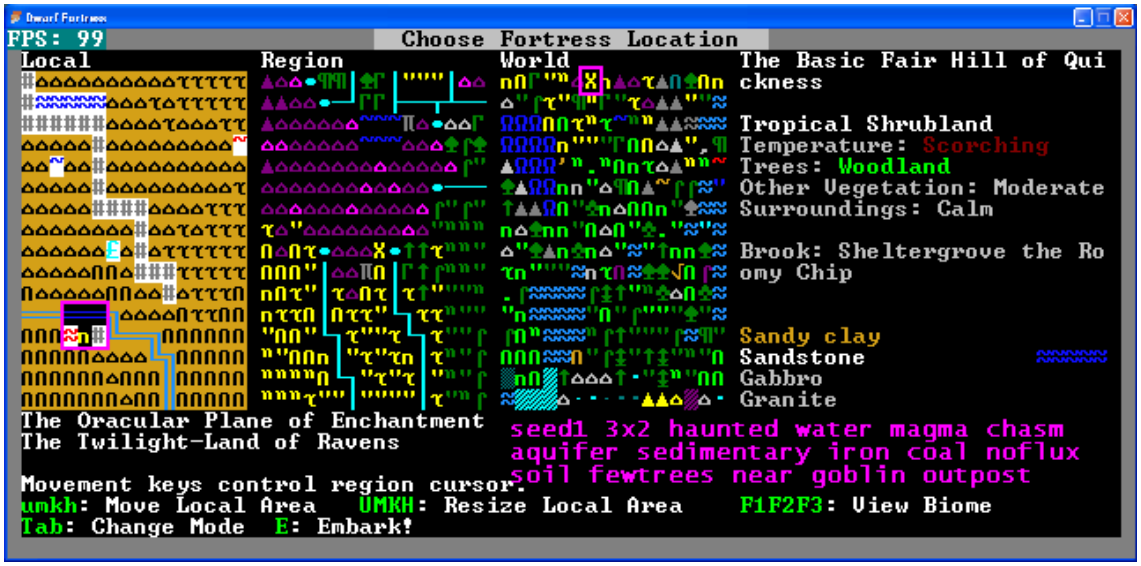

Figure 1. *Dwarf Fortress in ASCII*. Screenshot from Dwarf Fortress Wiki (n.d.)

Arguably one of the most prominent examples of a game that combines systems-based game design and procedural generation is Dwarf Fortress (Adams & Adams 2002), a cult hit (Metacritic 2023) developed by Bay 12 Games and published by Kitfox Games. Dwarf Fortress is a simulation game that allows players to create and manage a settlement of dwarves in an expansive and fully procedurally generated fantasy world. The game is known for its depth, complexity, emergent gameplay, ASCII graphics (Figure 1) and steep learning

curve. (Bolding 2022.) A game like Dwarf Fortress—gargantuanly scoped, yet with only a two-developer sized team—is perhaps a near ideal vehicle to examine procedural generation approaches, in a booming multimillion-dollar industry where games are often developed on shoestring budgets (Dealessandri 2022).

The main motivation behind this research is therefore to analyse how systems-based game design and procedural generation work together in Dwarf Fortress in order to create engaging and emergent gameplay experiences. Consequently, the main research question of the thesis is: How are systems-based game design and procedural generation implemented and experienced in Dwarf Fortress? Supporting research questions are: What specific elements and techniques of procedural generation contribute to emergent gameplay in Dwarf Fortress? What systemic and emergent aspects of Dwarf Fortress do players find most important and enjoyable? How could the findings of this thesis be applied by game developers interested in using similar approaches for their own games?

To answer these questions, the reader is invited to follow the case study approach of this thesis, wherein the phenomenon of Dwarf Fortress is analysed in detail through a variety of methods, in which not only expert sectorial opinion and scholarly sources are examined, but also the player base—the ultimate and intended target audience for any video game—has a voice.

1.2 Relevance and Significance

Game development—the process of creating games for various platforms, which involves different stages and aspects such as design, writing, audio, art, coding, music, animation, modelling, testing and marketing (freeCodeCamp n.d.)—comprises a relevant part of the author's studies. In fact, the author spent an entire semester learning about these topics. The author also acquired practical skills in game development through summer courses and personal projects adjacent to his studies. Therefore, as an aspiring solo indie game developer, the author is very eager to learn how procedural generation is used, as this technique employs algorithms to scalably produce content instead of handcrafting it with great effort (Van Brummelen & Chen n.d.). Procedural generation can benefit game developers in many ways, such as by more easily creating rich and diverse

content for their games, overcoming the challenges of working solo or in a small team, improving the quality, variety and replayability of games and reducing the costs and time of production. (Kazemi 2019.) A very successful example of this technique is Dwarf Fortress—the case study of this thesis—an overwhelmingly positively acclaimed game (Metacritic 2023) made by only two developers (Adams & Adams, 2002). The game development sector as a whole, but other indie developers in particular, may have a vested interest in paying attention to, and better understanding, this phenomenon.

Figure 2. *Reworked Steam release graphics*. Screenshot on Steam Store (2022)

Indie game developers face a significant dilemma; they want to create rich and diverse content for their games (Figure 2), but they often lack the resources and skills to do so by themselves (Dealessandri 2022). Procedural generation offers a possible solution; it uses algorithms to create content automatically, or semi-automatically, which can save time and money (Barriga 2018) and possibly allow more development focus to be instead put on the core mechanics, which in systemic concert (Sellers 2017) then possibilitate emergent gameplay (Bycer 2017). However, procedural generation is not without its challenges and limitations; for example it could result in loss of control and quality, and in some cases, it might even compromise the coherence and consistency of the game world. (Francisco 2016.) By exploring the concepts and methods of procedural generation and systems-based game design in a game like Dwarf Fortress, one

of the signified goals in writing this thesis is exactly helping indie game developers, such as the author, to a better understanding of these techniques for use in designing and developing their own games.

1.3 Structure and Methodology

After this first introductive chapter, in the second chapter, the author conducts a narrative literary review (Grant & Booth 2009) of sources considered important to the thesis subject matter and understanding of its key concepts, which involves the finding, examining and summarization of existing literature (Fink 2014). In the third chapter, there is a combination of various types of game analysis of Dwarf Fortress—comparative, case study and formal—specifically to examine and identify the elements and techniques used within the game that are relevant to the subject matter. This also involves a closer examination of relevant DF systems and mechanics, in order to gain a broader understanding of its design and functioning (Massachusetts Institute of Technology 2011). In the fourth chapter, to gather data from the Dwarf Fortress community, qualitative research methods are used. This involves administering a survey to gather information about the player bases preferences, stances and experiences related to the chosen lens (Creswell & Creswell 2014) of the thesis, exemplified by its title.

Each of the subsequent and above-mentioned chapters has a short preface, wherein the author delves a little deeper into the definitions, explanations and reasoning behind the chosen research methodologies in particular, as both theoretical and methodological aspects of the thesis are closely tied. The literature review provides a theoretical foundation for understanding (Fink 2014) systems-based game design, procedural generation and emergent gameplay, while the game analysis (Massachusetts Institute of Technology 2011) and survey offer more practical insights (Creswell & Creswell 2014) into their implementation, player experience and reception in Dwarf Fortress.

1.4 Objectives and Desired Results

The main objective of the thesis is to explore how systems-based game design is implemented and experienced in Dwarf Fortress, with special emphasis on the role of procedural generation in enabling and enhancing emergent gameplay.

This thesis provides insights into—and draws connections between—the specific elements and techniques of procedural generation that contribute to the above said gameplay in DF, as well as the aspects of it that players of the game deem most influential in their engagement and enjoyment. The findings are intended to result in a useful resource of information for game developers interested in incorporating similar approaches into their own games, as well as for game researchers and amateurs alike who are looking to gain a deeper understanding of the titular game, its inner workings and concepts behind its design.

Another desired outcome is the production of a short video about the topic of the thesis that is designed to be accessible to potential indie game developers as well as the wider general audience. This video is intended to distil the research results of the thesis into a more accessible and entertaining format.

2 LITERATURE REVIEW

2.1 Definition, Method and Sources

An advisable first step in research is to conduct a literature review of sources considered important to the subject matter, which involves identifying, analysing and synthesizing existing literature produced by professionals and scholars, in order to provide a foundation for further research and understanding. (Fink 2014.) There are several types of literature review, in this thesis a narrative review method is pursued, which consists in the summarization of recent or current literature on the chosen topic and its concepts. It is typically presented in a narrative format and this type of review aims to describe the characteristics of the literature without necessarily including comprehensive searching or quality assessment. (Grant & Booth 2009.)

The sources herein are acquired in different ways; through journalistic articles, professional texts and academic papers available online, but also other origins and formats, such as interviews, video essays and panels. Fortunately, the authors of Dwarf Fortress have shared a lot of original content about their game by writing essays, giving talks and interviews, or publishing theses themselves (Adams 2015, 2019; Dwarf Fortress wiki n.d.; Short & Adams 2017).

2.2 Systems-Based Game Design

Systems-based game design is a holistic, project-wide approach in creating games. This approach involves designing games as simulations of complex and dynamic worlds, where the player can interact with various elements of the game world through its mechanics. These interactions can lead to emergent outcomes, which are not predetermined by the game designer, but arise from the interplay of the game systems. (Adams 2015; Sellers 2017.)

2.2.1 Concept

According to Advanced Game Design: A Systems Approach (Sellers 2017), systems-based game design is a way of thinking which considers games as a whole system rather than a collection of isolated elements, it involves planning

and analysing how the various components of a game—such as its rules, mechanics and player actions—interact with each other and affect the resulting gameplay experience. Systems-based game design applies systems-thinking principles to game design, which helps designers in creating games that are not only creative, but ideally also both coherent and engaging. Systems-thinking itself is a way of understanding how complex systems operate and behave in different contexts, and by utilising it developers can uncover and evaluate the underlying workings of their games, optimizing design, balance and functionality. Systems-centered design is not only useful in the creation of video games, but also present in other domains with real-world applications, in other words, it could be said that because the real world is made from a collection of interconnected systems, having a similar holistic approach to game design also makes said games feel more life-like, dynamic and thus engaging to their players. (Sellers 2017.)

2.2.2 Examples

As discussed within Simulation Principles from Dwarf Fortress (Adams 2015), Dwarf Fortress has several systems contributing to the dynamics of its game world. One such system is the world generation process. The game procedurally generates the entire world from scratch, starting with an elevation map and then creating various further layers for temperature, rainfall, drainage, vegetation and salinity. After this, the game assigns biomes, but instead of directly defining these through fractal spawning, DF considers their different aspects, such as the aforementioned values, separately. The interplay of these aspects then determines the final biomes, resulting in a more natural and internally consistent representation of the game world. The game bases its simulation on real-world analogues, for example by also considering rain shadows to improve overall biome realism. By incorporating real-world principles, Dwarf Fortress achieves an intuitive representation of how things work in reality. (Adams 2015.)

2.2.3 Techniques and Principles

Sellers (2017) further describes how systems-based game design is fundamentally built upon an iterative process, consisting in ideating, planning and also finetuning those parts and loops of a game and its systems which together

compose the whole. This can begin in various ways, such as in the designer's mind, on a whiteboard or even on scraps of paper, but should also then be documented, for the benefit of everybody on the development team—in order to gain a better common understanding of the intended workings and purpose of said systems at play—and subsequently prototyped. Playtesting these prototypes, even more so very early ones, is a key step in allowing designers to then improve upon the results of their designs through continuous feedback, iteration and finetuning of the involved systems. (Sellers 2017.)

Adams (2015) also presents four useful principles which have been used while creating the simulative systems for Dwarf Fortress. The first principle is to avoid overplanning a system, instead starting with a simple version, and then to iterate on it. This allows for emergent gameplay and unexpected outcomes to manifest, which make the game, and even its development, more enjoyable. The second principle is to understand and break down a system into its most basic elements and interactions, instead of immediately focusing on a specific intended end-result, feel or look, of it. This helps in creating a realistic and functional experience from the ground up, which has a richer interplay of aspects, and can solve certain issues, such as how to reach a specific outcome, all by itself. The third principle is to avoid unnecessary complexity in a system, operating at the level of what the player sees, or one layer below. This simplifies the finetuning and development process, preventing getting stuck on details that do not matter to the actual experience. The fourth principle is to base a system on real-world analogues, which can help improve the immersion and realism of a game. (Adams 2015.)

2.3 Procedural Generation

Procedural generation is a technique of creating game contents algorithmically, rather than manually. This technique can be used to create game worlds that are not fixed or predefined but generated in the moment, based on a set of chosen rules and parameters. PCG can offer several benefits in game design and development, such as greater variety, replayability and scalability of game worlds. (Barriga 2018; Short & Adams 2017.)

2.3.1 Concept

As defined in A Short Introduction to Procedural Content Generation Algorithms for Videogames (Barriga 2018), procedural generation is the automation of media production, including various forms of content, such as poetry, paintings, music, architectural drawings and film. In the specific context of video games, PCG refers to the use of algorithms in generating content that would typically otherwise be hand-made by human developers. Procedural generation algorithms can produce different types of content for games, ranging from the most basic elements like textures and vegetation, to more complex aspects such as entire levels, dialogues and stories. This approach can help with reducing the costs associated with content creation in game development, lessening the burden and reliance on human designers, while at the same time increasing variety and replayability of games made by utilising PCG methods. (Barriga 2018).

2.3.2 Examples

In Procedural Generation in Game Design (Short & Adams 2017), several different methodologies of PCG are examined, such as the use of random number generators, seeds, random walks, cellular automata and tree mapping. Random number generators introduce randomness into generation processes, determining aspects such as object placement and/or entity characteristics. Seeds, instead, are used in order to ensure consistent parameters for content generation, wherein the use of a specific generative seed results in the same outcome. Random walks are used to create paths by iteratively moving in random directions, this is usually utilised in the generation of river and road systems, caverns, sewer layouts or connecting corridors. Cellular automata operate on discrete cells, changing them based on adjacent cell states, this technique is commonly used for generating terrain, vegetation or other similar and interdependent patterns. Tree mapping is a way of dividing a rectangle into smaller rectangles starting from a set of values. The area of each rectangle matches the size of the corresponding number, this can be used to make city streets and buildings, or the rooms of a building from the side. These methods enable game designers to algorithmically generate a vast diversity of game

worlds and even assets, providing a unique experience for the player with each new playthrough. (Short & Adams 2017.)

2.3.3 Challenges, Present and Future

Barriga (2018) notes that one important challenge in the adoption of procedural generation methodologies for game content is the lack of guarantees that most of them offer. Ensuring playability while maintaining a balance between the PCG and player experience can be difficult. While procedural generation algorithms for basic content such as textures and vegetation are mature and widely adopted in the video game industry, more complex aspects like generating detailed forests or entire cities are still relatively niche. Developing advanced algorithms that can generate high-quality and believable content in these areas remains a challenge requiring further development. Adapting general-purpose PCG algorithms to work seamlessly in different videogame projects can also prove to be challenging, as off-the-shelf, ready-to-use tools for procedural generation are so far only available for basic content, making it difficult to apply PCG to diverse game development scenarios. Barriga (2018.)

Short & Adams (2017) acknowledge that, while procedural generation has been used for decades, there is still much unexplored potential. There are many things which have not yet been attempted, and that even beginning developers can jump into, exploring new possibilities. PCG is a diverse field within game design, and it resists generalisation, while at the same time providing the ability to create unimagined visions, vast replayability and unique, emergent player-guided gameplay and narratives. There are ongoing debates among designers about whether satisfying stories can be truly generated, and whether a player's perception of content as machine-authored changes its value. These questions may or may not be definitively answered in the future. (Short & Adams 2017.)

2.4 Emergent Gameplay

Emergent gameplay is a phenomenon that can occur when players experience unexpected and novel situations in a game. These situations are not planned or scripted by the game designer, but dynamically arise from the player’s interaction with the game systems and its mechanics. Emergent gameplay can create a

sense of agency, challenge and creativity for the player, as they explore different possibilities and outcomes within the game world. (Adams 2019; Bycer 2017.)

2.4.1 Concept

The article How to Design a Game Around Emergent Gameplay (Bycer 2017) explains emergent gameplay in the context of structuring a game in a manner such that it allows its players to create novel solutions with the interplay of distinct elements already present inside of it, but that never specifically have been designed to work in that particular way, or with an exclusive end to them. It is about the player being able to generate new forms of gameplay within the game-space itself; this ranging from rather simplistic min/maxing—or so called breaking of game mechanics—to the more complex idea, and possibility, to transform the game with a set of player-defined objectives and approaches. (Bycer 2017.)

2.4.2 Examples

As brought up in Emergent Narrative in Dwarf Fortress, a chapter of Procedural Storytelling in Game Design (Adams 2019), DF has been ideated from the ground up in order to allow for a high potential of emergent gameplay, and therefore resulting narrative, to occur. By designing the game with a focus on player directed and interpreted stories, mechanics have been created with the objective in mind of leading to narratives which are thematic, yet both dynamic and surprising. For instance, a player might recount an event where a kobold snuck into a workshop, stealing a masterpiece sceptre and leaving a particular dwarf, let’s say Urist—the maker or owner of the item—distraught for days. This simple made-up scenario can be used to raise several questions about designing the desired interplay of game elements and systems that could lead to it, such as the definition, behaviour and frequency of kobolds, the presence of stealth mechanics, the role of time, the impact of item quality on emotions and the player's ability to interact with workshops and prevent theft. By addressing these questions in the game's design, without necessarily predefining a specific outcome, Dwarf Fortress leaves the door open for each player to tell their own unique and engaging gameplay stories. (Adams 2019.)

2.4.3 Criteria and Enablers

Bycer (2017) further mentions that it is not merely enough for a game to be open-ended to manifest emergent gameplay. Designers also have to define mechanics in a way to provide ample capabilities to the player, while at the same time leaving the systems, obstacles and goals of the game flexible enough in order to enable multiple solutions. In other words, give the player a starting point, widely defined goals, impactful tools, and then let them loose in the game world. (Bycer 2017.)

2.5 Dwarf Fortress

Arguably one of the more successful videogames connecting all of the concepts explored in this chapter, is Dwarf Fortress. This is a systems-based game at its very core, as it simulates a massive and detailed world with rich histories, cultures and biomes. The game effectively utilizes procedural generation to create these elements, which may be different every time that the player starts a new game. The player can—in the main mode of the game, called fortress mode—control a settlement of dwarves and witness emergent gameplay in the form of unpredictable events, conflicts, disasters and stories. Dwarf Fortress is widely praised for its depth, complexity and creativity, as well as its ability to generate endless and emergent narratives. (Bolding 2022; Metacritic 2023.)

2.5.1 Background

Inside the GameRant article Dwarf Fortress' New Release Culminates Decades of Indie Game Development (Robinson 2022) the background and development history of DF are thoroughly explored. The Adams brothers' love for games and game development specifically, was sparked at a very early age by their father, who taught them programming in BASIC. They were particularly fascinated by text-based games, which were capable of portraying incredibly deep game worlds, despite their relatively simplistic graphics. This early exposure to games with vast possibilities influenced their whole approach to game development. They decided to stick with what they knew, focusing on creating a good simulation game, prioritizing their game-engine over graphical complexity. This decision later led to the use of ASCII characters in Dwarf Fortress, reminiscent of those

games they loved from 20 years prior. However, the game's development journey was not without its detours, as the brothers briefly also explored 3D games, before returning to their 2D roots. Dwarf Fortress continued to grow and inspire other titles in the base-building genre, such as Minecraft and RimWorld. Now, after two decades of development, Dwarf Fortress is set to reach an even wider audience with its Steam release, featuring a new graphical UI, tutorials, soundscapes and pixel graphics. The two brothers have also gained recognition outside of the gaming sphere, as their game is currently shown in New York's Museum of Modern Art, as a milestone of videogaming history. (Robinson 2022.)

2.5.2 Critical Reception

According to the game's review on IGN (Bolding 2022), the Steam release of Dwarf Fortress is a dedicated renewal for an already-legendary video game. The game has been brought to a level where even the casually interested can finally dive into it and play. IGN gave DF a perfect score of 10 out of 10, stating that the game is infinitely explorable in its complexity, and equally rewarding in the depth that is to be found in it, purposedly calling it the quintessential world simulation and building management game. (Bolding 2022.) Dwarf Fortress has also been doing well on Metacritic (2023), a website dedicated to the aggregation of reviews for various media, including videogames. For every product, the scores from each review are averaged. Based on critic reviews, DF has received a meta score of 93, indicating "Universal acclaim", with a user score of 8.5, suggesting that both critics and users have received the game very positively. (Metacritic 2023.)

3 GAME ANALYSIS

3.1 Definition, Purpose and Methods

The entirety of this chapter closely draws from, and follows, the Game Analysis Guidelines of the Massachusetts Institute of Technology (2011), to paraphrase it; game analysis is a tool used for the critical examination of a video game, or specific aspects of it. It involves the study and evaluation of its various elements in order to gain a deeper understanding of how it was designed, the themes and mechanics that it has and the impact of them. The purpose of game analysis is not to review a game in regard to its quality, but rather to highlight and rationalize those aspects which make it a worthwhile case to be studied, and that contribute to a better understanding of video games as a whole.

The Game Analysis Guidelines of the Massachusetts Institute of Technology (2011) also go on to say that, beyond allowing the exploration of cultural, social and artistic significance in video games, game analysis can be used to provide insights into their design and development. By examining mechanics, gameplay and narrative of a video game, the elements which make it engaging, immersive or innovative, can be identified. This is invaluable for game designers, developers and players alike who aim to create, study or simply more fully appreciate games.

There are several approaches and methods mentioned in the Game Analysis Guidelines of the Massachusetts Institute of Technology (2011), of which three are applied in this chapter. The first method is comparative analysis; wherein a game is compared to other media or games. This approach helps understanding the unique aspects of a game, and how it relates with other, similar forms of media or video games. The second method used is the case study approach; where a game is analysed in-depth to prove or disprove a series of theoretical assumptions. The game becomes an example for a specific theory or approach, in this case procedural generation, allowing explorations of its implications and significance. The third applied method is a more formal analysis; this involves the examination of the formal qualities of a game, such as aesthetics, mechanics and gameplay. This method is focused on understanding how these formal elements contribute to the overall experience and meaning of a game.

3.2 Dwarf Fortress vs. Other Games

Dwarf Fortress (Adams & Adams, 2002) is a seminal and highly influential game drawing deeply from techniques of procedural game design and systems-based game design, creating a vast and detailed fantasy world, which can be different every single time the player starts a new game. The game is also heavily centered on emergent gameplay, wherein player is able to leave a permanent mark on the world and its history through interaction with the games various systems. (Bolding 2022.) Similar techniques have been adopted and experimented with by many game developers over the years; few before DF, many after (Gordon 2021).

Consequently, the sections of this subchapter compare a number of such milestone titles with Dwarf Fortress, to examine how they shape up in comparison to it, which elements have a possible connection to DF, perhaps even have been inspired by it, but also how they are different and the gameplay manifestations of these differences. It is worth prefacing that all of the studios herein listed for pushing the envelope on the boundaries of PCG are—or, at the very least were at the time of releasing their respective games—small indie game developers.

3.2.1 Rogue

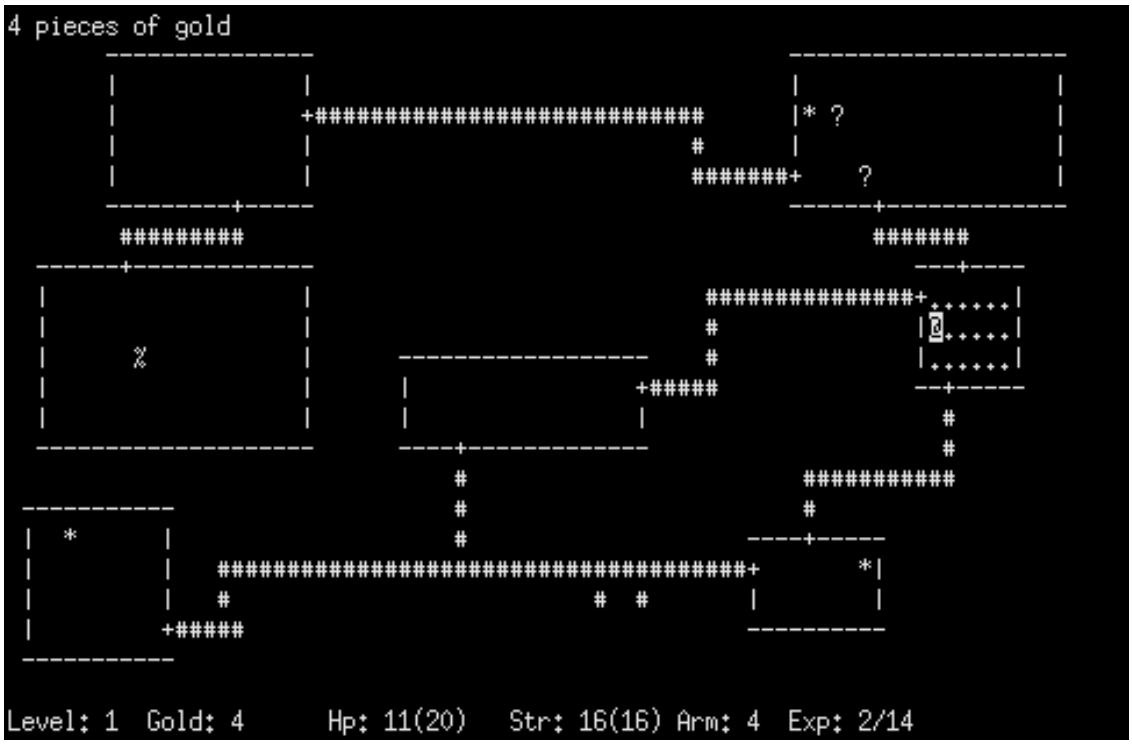

Figure 3. *Dungeon layout in Rogue*. Screenshot by Thedarkb (2021)

Rogue (A.I. Designs 1980) is a dungeon crawling game using procedural generation to create random levels and items, and also ASCII graphics to represent the game world. It is perhaps one of the earliest examples of procedural content generation in gaming and is the progenitor of all roguelikes, hence its namesake given to the whole genre (Moss 2020).

Rogue and Dwarf Fortress share a number of common features originating from their usage of PCG, these include a new and unpredictable world at every new run of the game, challenging permadeath mechanics, random item generation and emergent gameplay, wherein the player does interact with the game world and its systems, and, last but not least, the usage of ASCII graphics (Figure 3). Rogue and DF also present significant differences, reflecting their diverging design and scopes. While Rogue focuses on a singular mode, wherein the player explores a dungeon in search of the Amulet of Yendor, with a simple and abstract representation of the game world and a finite and linear progression, Dwarf Fortress has two—if you count legends three, even though legends has no real active gameplay, more on that later—main modes instead: Fortress mode, where

the player manages a community of dwarves to build and defend a settlement; and adventure mode, where the player controls an individual adventurer, that can explore the entirety of the generated world. DF has a complex and detailed representation of its game world, similarly to Rogue utilizing ASCII characters to depict its terrain and adversaries, but Dwarf Fortress goes way beyond, also depicting many other aspects of the world, such as weather, seasons, biomes, plants, animals, entire civilizations, history, culture, emotions, injuries, and so on. In comparison to Rogue, Dwarf Fortress also has a near infinite and non-linear progression, wherein the player can explore the world almost endlessly; a world evolving over time according to its own simulated history, events and what the player does, even over the span of several game sessions within the same world. In conclusion, Rogue can be seen as a possible forefather of Dwarf Fortress, or at least as a source of inspiration for some of its core elements, but DF also expands on Rogue's ideas in many ways, creating a much more elaborate and immersive game that simulates a detailed, living and evolving fantasy world.

3.2.2 Minecraft

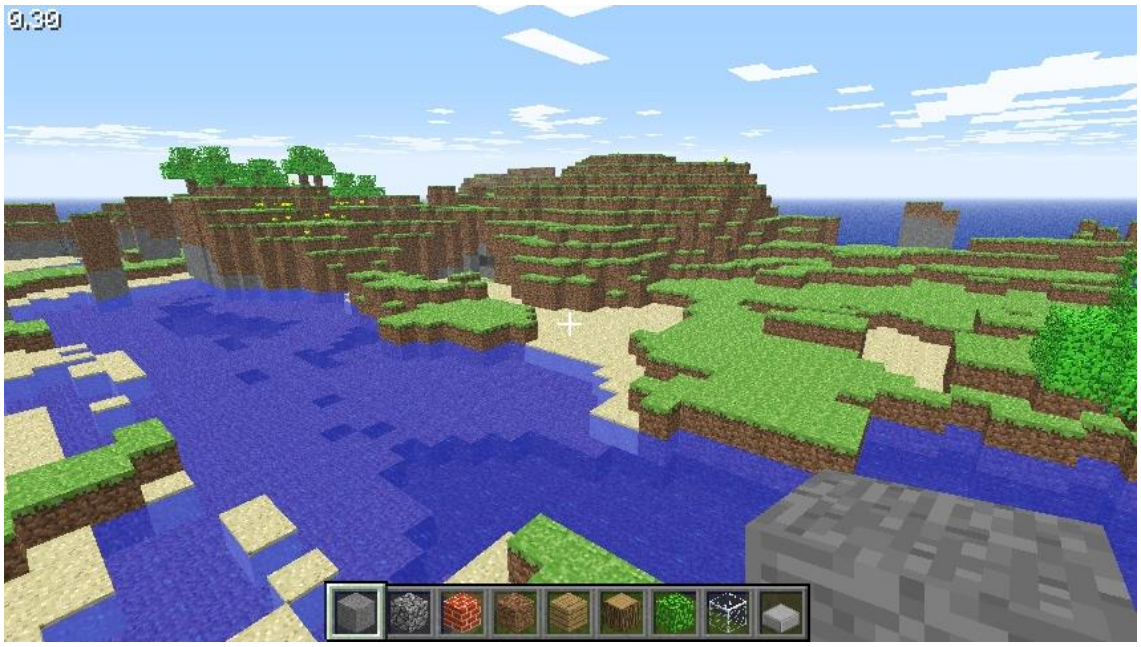

Figure 4. *A world made of blocks*. Screenshot from Minecraft Wiki (n.d.)

Minecraft (Mojang 2011) is a sandbox game that uses procedural generation to create infinitely varied blocky worlds, allowing the player to craft, explore and

survive in them. It is perhaps one of the most popular and influential games of all time, with over 238 million copies sold, as of 2021 (Sirani 2023).

Minecraft and Dwarf Fortress share a few common features that stem from their use of PCG, such as their dynamic and interactive environments made of discrete units that can be mined, placed, or manipulated by the player (Figure 4), or even other entities. The game world is split into many layers made up of different materials, such as stone, dirt, sand, water, lava, and so on, which can reveal valuable resources and/or often dangerous hazards. The worlds of the two games also have different biomes that affect their terrain, the climate, flora and fauna. Water and lava represent a resource and also an obstacle in both of the games. Minecraft and DF also have important differences, both in their design, gameplay and the technologies used. While Minecraft focuses on a first or third -person perspective, wherein the player controls their character, which can freely move and interact with a 3d game world, Dwarf Fortress instead has a top-down experience, where the player focuses on a more hands-off, 2d overview perspective when interacting with the world and its entities. Minecraft has a rather simple and very recognizable representation of its environment, using colourful blocks and pixelated textures, instead of the sometimes difficult to decipher ASCII, or more recent and optional, but still rather static, sprite art in Dwarf Fortress. Minecraft also offers a purely creative outlet with its creative mode, and while it has a finite yet mind-bogglingly large world size, which is practically impossible to fully explore in a single player’s lifetime, DF is also huge, but arguably not to the same extreme extent. In a reversal of paradigms, while Minecraft has a rather minimalistic and predefined story—leaving most of the narrative to the player’s imagination—Dwarf Fortresses world history, artifacts and creatures are fully procedurally generated with each new world creation. In conclusion, Minecraft and DF have notable similarities in their usage of PCG to create dynamic, layered and interactive worlds made of discrete units, but there are also big differences in their presentation, most of all in granularity of detail and gameplay styles, which end up appealing to different audiences.

3.2.3 RimWorld

Figure 5. *Colony in RimWorld*. Screenshot by Yoshida (2017)

RimWorld (Ludeon Studios 2013) is a sci-fi colony sim that simulates the struggles of a group of planetary survivors, including their psychology, ecology, diplomacy and combat. It represents one of the more popular and successful games—which was, as pointed out by its author in an interview—directly inspired by Dwarf Fortress itself (Game Developer 2016).

RimWorld and DF are both colony simulators, where the player manages a group of characters that have to survive in a more or less hostile environment. The characters of the two games also have a set of specific skills, needs and personalities that bring with them advantages and disadvantages. Similarly, the player can assign tasks to the colonists, such as farming, mining, crafting, researching, fighting, and so on, but they also have a quite large degree of autonomy, and will act according to their own preferences and moods. In both cases procedural generation is used to create vast and varied worlds that can be very different, depending on the selected parameters, every time that the player starts a new game. Continuing on with the similarities, the game worlds are composed of tiles representing different biomes, terrains, resources, plants, weather, etc (Figure 5). The players can choose a location on the world map to

start their colony and send expeditions to the surrounding area. Both of the game worlds are also populated by other factions which have their own agendas and relationships with the player's colony. Emergent gameplay is strongly present in RimWorld too, where the actions and choices of the player can have consequences that can shape not only the narrative, but also the world. Both games have a systems-based approach in their design, creating unexpected situations and challenges for the player. For example, a fire can spread quickly and destroy crops, buildings and equipment, a raid can result in injuries, deaths or kidnappings; a disease can wipe out an entire colony, a social conflict can lead to a fight or a breakup, a mental breakdown can cause a character to go berserk or catatonic, and so on and so forth, there's really an incredible depth and potential for variety in both cases. The games also have events that trigger, such as sieges or faction requests, which add variety and drama to the gameplay. However, there are also differences. To start, RimWorld has a sci-fi theme, while Dwarf Fortress is rooted in the fantasy genre. This affects the aesthetics and mechanics of the games, and also their narratives. For example, RimWorld features firearms, robots, spaceships, aliens, etc., while DF features dwarves, elves, goblins, dragons, magic, and so on. RimWorld also has a more minimalist, albeit cartoonishly animated-graphics style, while Dwarf Fortress has more detailed—albeit abstract in their ASCII form, and simulationistic—graphics, though both games can be extensively modded to change their appearance. RimWorld was also designed to be fully used with the mouse and keyboard from the get-go to the point it's fully playable with a controller and available on consoles, while DF, until its Steam release interface rework, required players to memorize key-binds and navigate its complex menus without mouse support. In conclusion, RimWorld has been clearly inspired by Dwarf Fortress, adopting similar techniques of systems-based game design and PCG, which manifest emergently in its gameplay, but it also has its own identity and style that makes it stand out from DF. RimWorld is arguably more accessible and user-friendly than Dwarf Fortress, but both games are excellent case examples of how procedural generation can help in creating rich, dynamic and immersive game worlds.

3.2.4 No Man's Sky

Figure 6. *Player ship in orbit*. Screenshot by Coruscant-Republic (n.d.)

No Man's Sky (Hello Games 2016) is a space exploration game generating a virtually infinite universe of planets, alien fauna, geology and flora, as well as alien civilizations and anomalies. It is one of the most ambitious and impressive games of its genre, featuring an estimated 18 quintillion planets (Baines 2016).

No Man's Sky and Dwarf Fortress are both remarkable examples of how procedural generation can be used effectively in creating vast game worlds (Figure 6), which never cease to amaze the player, and while superficially not having a lot of commonalities beyond this aspect, both of the games concentrate on making their environments unique, each with its own resources, terrain, climate, geology, flora and fauna, as well as other civilizations, and the ruins of past ones. The games also allow their players to build, trade and fight to their hearts content with these other factions. In other words, both games use PCG and their systems in order to create dynamic game worlds and experiences. But No Man's Sky differs from DF in many aspects, most immediately notable of which is the player perspective and controls; first or third person -based, versus the top-down view, but also in what granularity of detail and scale their respective techniques of procedural generation are used for creating, and what kinds of experiences players are able to have thanks to these systems working in concert.

While DF simulates a detailed and complex world with a great number of interrelated sub-systems and entities, No Man's Sky has a more simplified and minimalist approach to representing its world, utilitarian to the intended—both exploratory and yet more linear—experience. For example, planets in No Man's Sky, while each one being unique, do not possess realistic orbits or rotations, their meteorological patterns are not affected by terrain or atmosphere, flora and fauna do not have overly realistic behaviours or interactions in an ecological sense, and the members of alien races, while each having their own language that players have to learn to effectively communicate, also follow very similar scripted and linear patterns of behaviour oriented to the ends of their utility as NPCs, such as that of vendor, pirate, quest-giver, etc. Furthermore, while Dwarf Fortress generates stories and events based on player actions and the interactions and consequences of its systems and entities, No Man's Sky, as already mentioned, offers a more linear and predetermined narrative structure. The game has an overarching breadcrumb-style plot that involves seeking out the mystery around an entity known as The Atlas, as well as several side quests and missions, which are randomly generated, yet follow a similar pre-determined pattern, such as exploration, extermination and gathering missions. These missions do not have a significant impact on the world if fulfilled, nor do they create particularly unexpected stories for the player, as they become more familiar with the superficiality of the systems involved in generating these missions. It is notable that No Man's Sky was built from the ground up with the idea of multiplayer in mind, where players would be able to name and share discoveries with their friends, while DF always has been, since its inception, designed as a single player endeavour. In conclusion, No Man's Sky and Dwarf Fortress are games that use PCG to create diverse worlds to great effect, yet they vastly differ in their usage of systems-based game design in creating meaning and experience for their players. They are excellent examples of the polar opposite extreme; No Man's Sky delving into macrocosm—and DF into microcosm—of game world simulation.

3.3 Procedural Generation in Dwarf Fortress

In the following section the nitty gritty is examined, of how procedural generation is used to in Dwarf Fortress, to the effect of creating a dynamic game world for

the player, and the emergent gameplay stemming from it. The analysis is based on empirical and practical observation, in other words the description of these systems through the lens of a player, as well as by utilizing the insights that have been gained from the theory in the literature review.

3.3.1 World Generation

World generation is one of the first and most important steps in creating a game in Dwarf Fortress. It involves the creation of a uniquely detailed fantasy world which then serves as fundament and setting for the player's gameplay experience. It is possible to create a new world using either basic or advanced parameters, or to load a previously generated world from a list of saves.

The basic parameters allow the player to choose the size of the world, length of its history, number of civilizations, maximum number of sites, number of beasts, natural savagery and mineral occurrence. These parameters affect the complexity and diversity of the resulting world, as well as difficulties and challenges potentially encountered in it. In more detail, a larger world will offer more regions, biomes, and features to explore and colonize, but will also take longer to generate and load. A longer history will result in more historical events, artifacts, and legends populating the game world, but will also increase the chances of entire civilizations collapsing, or to being conquered. Concurrently, a higher number of civilizations will offer more potential allies and enemies for the player, but this will also make diplomacy, war and trade more complicated. The beast setting does not govern your garden variety beasts, what it governs is the presence of mega beasts, semi-mega beasts, titans and the like. Setting it higher will increase their variety and the danger that they pose, but also provide more opportunities for encountering, fighting and even harvesting them. A higher natural savagery will make the worlds biomes generally more hostile, but it will also increase the rewards and satisfaction for surviving in them. A higher mineral occurrence makes it easier to find valuable ores and gems, but also reduce the challenge of resource management.

The advanced parameters allow the player to customize the world generation process in a much, much more extensive and granular manner, such as by setting

the seed values, or specific parameters such as terrain, poles, mountain peaks, oceans, volcanoes, mega and semi-mega -beast caves, titans, demon types, night troll types, bogeyman types, nightmare types, vampire curse types, were-beast parameters, and so on and so forth. These settings affect not only the physical characteristics of the world, but also its mythical, more magical elements. In greater detail, changing the seed values results in a wholly different world, with another geography and history. Terrain parameters affect how elevation, rainfall, temperature, drainage, volcanism and savagery are distributed across the world. Poles affect where ice caps form and when the seasons change. Mountain peak number affects how many high-altitude areas are available. Oceans affect how many continents and islands are present. Volcanoes obviously affect how many active or dormant volcanoes there are. Mineral scarcity affects how rare or common minerals are in each region. Mega and semi-mega -beast cave settings affect how many lairs of these powerful creatures are generated. Titan parameters affect how many colossal monsters are roaming the world, and under what conditions they will attack. Demon types affect how many varieties of infernal beings are present in hell, yes, spoiler alert, there is a hell layer the dwarves may dig into. Night troll types affect how many varieties of these insidious creatures are present in the land, hiding among its peoples. Bogeyman types affect how many varieties of nightmarish creatures can manifest in the more dark and lone places. Nightmare types affect how many varieties of these night-haunting creatures are summonable by necromancers or demons. Number of vampire curse types affect how many varieties of blood-sucking creatures are present, lurking among the civilizations. And finally, changing the were-beast parameters affects how many varieties of shape-shifting creatures can be present, and under which conditions they attack settlements.

The following world generation process itself consists of several steps that are represented graphically on screen as they happen: Rejection criteria check, map generation, history generation—more on that in the following section about history generation—and finishing. The rejection criteria check is a preliminary step which makes sure that the world meets a few basic requirements, for the sake of its playability, like, for example, having at least one civilization, one mountain peak, one volcano, and one ocean present in it. If any of these criteria

are not met, the world is rejected and a new one is generated instead, with different seed values. This step can be changed or skipped at the players own choice and risk, by modifying its parameters or disabling it entirely in the advanced parameters.

The map generation step is wherein the physical features of the world are actually generated, based on the chosen parameters. This step involves creating elevation, rainfall, temperature, drainage, volcanism, and savagery maps that determine the shape and climate of the world. These maps are then combined to create biome maps, which determine the type and distribution of vegetation, wildlife and the minerals in each region. These biome maps are then subsequently used to create site maps, that determine the location and size of settlements, fortresses, caves, lairs and other such places in each region.

The finishing step is—as its name already implies—the step wherein the world is finalized and ready for play. This step involves the player looking at the generated maps and legends, which summarize and display the features and history of the world. Once satisfied, the player can then choose to proceed to the actual game modes, which are analysed in the following subchapters and sections about gameplay modes in DF, or to generate another, new world.

3.3.2 History Generation

History generation is a key step of world generation in Dwarf Fortress. It is the process of creating a rich historical backdrop which serves as a contextualizing agent, a connecting thread for the player's generated game world as well as its many sites and denizens. History generation is based on a number of parameters chosen by the player that have already been explained in the preceding subchapter section about world generation of this chapter, like length of history, number of civilizations, number of beasts, natural savagery and so on. The history generation process is influenced by several sub-steps, and the historical events are displayed on screen chronologically as text: happenings about entire civilizations, particular religions, important historical figures and mythical beasts.

The civilizations sub-step is wherein the major factions of the world are created and assigned to different races. Each civilization has a name, symbol,

government type, culture, religion and a leader. The civilizations also have preferences for certain biomes, resources or animals. For example, this can be as granular as having a civilization with access to only metallic weapons, but no ability to craft socks of any kind. These civilizations are then placed and spread on the world map, according to their preferences and availability of space.

The religions sub-step is wherein the different belief systems of the world are created and assigned to different civilizations. Each religion has a name, a symbol, a deity or deities, a sphere or spheres of influence, and a set of tenets and rituals. The religions also have preferences for certain buildings, such as temples, or objects, such as holy relics, worshipped animals or plants. For example, elves typically worship nature, and are very protective of trees in particular. The religions are spread among the civilizations, each according to their given similarity and influence.

The historical figures sub-step is wherein the different heroic or villainous feats and characteristics of the worlds higher-profile individuals are specified, which are chosen from the different entities already present in the world, this can include mega and semi-mega -beasts, unique demons, forgotten beasts, titans, and even creatures such as necromancers, vampires, were-beasts, night trolls or the bosses of criminal organisations, or particularly important animals, and their lineages. Each such figure has a name, description, set of values and goals. These personalities also have their own preferences for certain activities, friends, and enemies, very much like any other character generated in the game world, more about character generation in a following section of this subchapter.

The interactions between these civilizations, religions and historical figures lead to the historical events of the world being simulated over a chosen period of time, this can, for example, be as short as 100 years, or for as long as 2000. Each event has a type, a date, location, and a set of participants and outcomes. This may include the starting and ending of wars, migration of races or individuals, the starting and breaking of alliances, the creation of artifacts, the slaying of a mythical beast, the conquest of a settlement, the founding of a religion, etcetera, as the generation of history goes on until the specified date.

3.3.3 Item Generation

Item generation in Dwarf Fortress is a process which involves many factors. Items are generally objects that can be used, worn, traded, stored or crafted by dwarves and the other inhabitants of the game world. They can belong to various categories, like weapons, armour, clothing, furniture, tools, crafts, foods, drinks, plants, animal parts, gems, trash, metals and ore. Each item has a material, a quality, value, weight and a durability associated with it. Some items may also have decorations, names or even, in the case of artifacts, histories.

Material of an item determines its basic properties, such as colour, density, hardness, melting point, boiling point and value. Different materials have different advantages and disadvantages for different ends. As an example, steel is a very strong and durable material for cutting edge or piercing weapons and armour, but it requires a whole metallurgical industry in order to be made. Silk is a soft and light material for clothing, but it is expensive and difficult to source—it coming from giant cave spiders—and not very protective. Wood is a cheap and abundant material for doors, furniture and crafts, but it is also relatively weak, and the elves will hate to see it used that way in a fortress. The material of an item can be influenced by the availability of resources in the world, the preferences of the crafter, buyer or seller, or the requirements and inspiration of a given project.

Quality of an item determines its craftsmanship and performance. These qualities range from ordinary to masterpiece, with higher tier items being more valuable and effective at their usage. Quality can be influenced by the skill of the crafter, type of material used and/or even the mood of the crafter. Quality of crafted items is indicated by symbols surrounding the name of an item. As an example: +Sword+ is a finely crafted sword; ≡«Sword»≡ is an exceptional sword with improvement or decoration; ☼Sword☼ is a masterpiece sword.

Value of items determines their trading worth and general attractiveness, as they can be admired and/or loathed by dwarves, and other creatures. Value is influenced by the material, quality, form, improvements and decoration of an item. Higher valued items are generally more desirable for trade or display. Value can also affect the happiness of the owner or user of an item.

Weight of an item determines its mass and heaviness. Weight of an item can be influenced mainly by the material, size and the form of it. It can affect the speed, damage and the stamina use of the carrier or the user of the item. Weight can also affect the storage and the ability to stack or transport of an item.

Durability of an item determines its resistance to wear and tear when gradually damaged by use, an attack or other such things, like burning in a fire or being melted by magma. This can be influenced by material and quality. As an example, obsidian is a magma and fire -safe material, dwarves are not. Durability affects the functionality and value of an item. This is indicated by symbols surrounding its name. For example: xSwordx is a sword showing some wear; XSwordX is a heavily worn sword; XXSwordXX is a sword that is in complete tatters.

Some items may also have decorations and improvements that enhance their appearance. Decorations and improvements are additions to an item that increase its value, but not its quality. Decorations can include things such as gems, metals, bones, shells, teeth, horns, ivory, pearls, silk, leather, cloth, glass, pottery, wax, soap, or cheese! Types of improvements can include engraving, etching, spiking, studding, encrusting, or sewing. Decorations and improvements can be influenced by the skill of the crafter, the availability of the materials, or the preferences of the crafter.

Some items may also have names or histories that make them particularly unique or legendary. Names are given to items that are created as artifacts or holy relics by crafters in special inspiring moods. Items that are used to kill notable enemies or creatures by adventurers or heroes are also named. Histories are records of events that involve items such as their creation, destruction, ownership, use or trade. Objects also may include depictions of particular historical events of a settlement, civilization, historical figure, divinity or even another object that the crafter witnessed. Names and histories can increase the value, fame and significance of these items. Particularly named items and their histories can also be tracked in legends mode, a modality which is further explained in its own section of the subchapter dedicated to game modes, legends mode.

3.3.4 Character Generation

Character generation in Dwarf Fortress revolves around the creation of a unique creature to play as in adventure mode or to control or interact with in fortress mode, see subsequent subchapter and sections about these modalities. Characters are made up by their race, civilization, name, attributes and skills. The simulation of their personality also involves the assignment of a set of preferences, beliefs, facets, memories, relationships and goals.

Race of a character or creature may determine its basic physical characteristics, like body plan, size, appearance, lifespan and natural abilities. Different races have different advantages and disadvantages, to different ends. For example, dwarves, which are the main playable race in DF, are short and sturdy, with an incredible penchant for industry, building underground halls and waging war, but also strongly dependent upon alcoholic beverages from a very early age, and tend to throw deadly tantrums when feeling neglected or otherwise wronged.

Civilization of a character or creature may determine its cultural and historical background, such as language, religion, government, ethics, values and enemies. It follows that different civilizations have different relations and interactions with other civilizations and creatures. For example, a dwarf from The Proud Tabards will have a different background than a goblin from The Hidden Mouldy Daggers, versus an elf from The Vindictive Tree Huggers.

Name of a character or creature is randomly generated, based on the race, type and/or civilization of it. The name usually consists of a first name and a last name, which may have meanings or origins in the language of the character. The name may also be a nickname, or an epithet based on the character’s deeds or traits, epithets usually replace last names, and false names can be used if the character or creature is a villain with some nefarious goal or other that requires secrecy.

Attributes of a character or creature are numerical values representing the physical and mental abilities of that character. Attributes include strength, agility, toughness, endurance, recuperation, disease resistance, analytical ability, focus, willpower, creativity, intuition, patience, memory, linguistic ability, spatial sense, kinaesthetic sense, empathy and social awareness. Attributes can affect the

performance of the character in various tasks and situations. These attributes have a numerical value, but are translated into a range of textual descriptions, such as, for example, in the case of the kinaesthetic sense attribute: an astounding feel for the position of their own body ranging to an unbelievably atrocious sense of the position of their own body. Attributes may change depending on different factors such as training or injuries.

Skills of a character or creature are, instead, numerical values representing their learned abilities, these numerical values are translated into a range of textual categorizations, as an example, a dwarves cheese maker skill could range from novice to legendary. Skills include weapon type, armour type, dodging, wrestling, swimming, climbing, writing, bookbinding, persuasion, negotiation, judging intent, lying, intimidation, leadership, teaching, organizing, weaponsmith, armoursmith, surgeon, wound dressing, diagnostician -skills and many other. Skills can affect the success rate of the character in various tasks and situations, they can get better or worse through usage or neglect, and they are also the defining factor when determining the given profession of a character.

Preferences of a character or creature are lists of items, materials and sometimes other creatures or characters, that the character likes or dislikes. These may include favourite foods, drinks, colors, shapes, animals, plants and/or various poetic forms. Preferences can affect the happiness, motivation and overall personality of a character. For example, a dwarf with happy thoughts about drinking his preferred type of beer will produce higher quality items when crafting. The opposite is also true, a dwarf sharing their workshop area with another dwarf that they loathe may possibly lead to worse goods being made, or even a scuffle.

Beliefs of a character or creature are sets of ethical values that the character holds in regard to a range of topics. They include views on life, death, marriage, family, loyalty, friendship, honesty, justice, law, tradition, progress, peace, war, violence, nature, knowledge, art, religion and magic. Beliefs can affect the behaviour, reactions and opinions of a character, similarly to preferences, but these are more conceptual, less physical factors, and also more granular, as, similarly to skills and attributes, they have a numeric range that is then translated textually, as an example, beliefs about leisure time may range from: believes that

it would be a fine thing if all time were leisure time to believes that those that take leisure time are evil and finds the whole idea disgusting.

Facets of a character or creature are instead, as compared to beliefs, rather how they tend to behave. Facets may include love, anger, altruism, gregariousness, perfectionism, pride, self-control, curiosity, and so on. Facets also have a numerical range and are translated textually, such as, in the example case of the propensity for vengefulness: from is vengeful and never forgets or forgives past grievances to has no sense of vengeance or retribution. Dwarves specifically are infamous for having long memories when it comes to holding grudges.

Memories of a character or creature are the thoughts and emotions that form based on their interactions with the surrounding world. Memories can be either short-term or long-term, and they do affect the characters personality, mood and stress levels. Short-term memories can either fade away or be transformed into long-term memories if they are strong enough. Long-term memories are recalled periodically, possibly reinforcing or even changing personalities over time. Some memories can also become core memories, which are permanent and have a significant impact on the characters personality. See the comment in the preceding paragraph about dwarves and holding long grudges.

Relationships of a character or creature are the bonds that the form with other creatures, like friends, family, lovers, spouses, enemies, deities, pets and so on. They are usually formed by spending time with another entity, but they can also be influenced by shared beliefs, goals and/or experiences. Relationships can affect a characters happiness, loyalty, social skills and behaviour. As an example, talking to friends over a mug of booze gives happy thoughts, while a memory about the gruesome death of a loved one gives unhappy thoughts. Relationships may also lead to marriage, children, friendships, grudges, feuds, worship, or a combination of these things.

Goals of a character or creature are the aspirations that they have for their lives—or unlives—in the case of the undead. They are determined by a combination of the other personality traits. Goals can be personal or professional, short-term or long-term, sometimes achievable, sometimes not. A few examples of goals are learning a skill, crafting a masterpiece, starting a family, becoming immortal,

bathing the world in chaos, etc. Goals can affect stress and mood. Achieving a goal gives happy thoughts and possibly a memory of it, while failing, or giving up on said goal, gives unhappy thoughts and possibly a memory of that, as well.

3.4 Gameplay Modes in Dwarf Fortress

In the following section the modalities of gameplay found in Dwarf Fortress are identified—the particular forms that these take—and the different meanings which these modes lend to the game as a whole. This is done, once again, by analysis through empirical observation and practical experience of the game through the lens of a player, in combination with the insights already gained from the theory in the literature review.

3.4.1 Fortress Mode

Fortress mode is perhaps the most popular, main and complex mode in Dwarf Fortress. The player gets to control a group of dwarves which embark on a quest of building a successful and wealthy fortress in one of the tiles in the larger and procedurally generated world.

Various aspects of the fortress have to be managed by the player, such as mining, farming, crafting, trading, military, nobility and diplomacy. There are also various threats and challenges that have to be dealt with or overcome, like goblin invasions and kidnappings, legendary beasts and monsters paying a visit, bandit sieges, undead hordes, vampire infestations, were-beast infections, hauntings by ghosts of dead dwarves with unresolved troubles, dwarven tantrums, cave-ins, floods, fires, and the infamous “fun”. A few examples to illustrate DFs concept of “fun”: Losing your entire fortress to a goblin invasion, a dragon attack, a vampire infestation, a tantrum spiral, a cave-in, a flood, a fire, or any other such disaster. Discovering that your legendary artifact is a sock, a cheese wheel, or a wooden mug. Encountering a forgotten beast, a titan or a night creature, made entirely of fire, acid or cheese. Having your dwarves get into deadly fights over socks, cheese, mugs, or other trivial items. Having your dwarves get drunk, vomit, pass out, or die of alcohol poisoning. Finding out that your mayor is a vampire, your captain of the guard is a were-beast, your expedition leader is a necromancer, or your king is a goblin spy. Having your dwarves create masterpieces of art or

literature that depict gruesome or absurd scenes from their lives or history. Having your dwarves look at said art, or read said literature, and consequently start to worship strange gods, join bizarre cults or perform weird rituals. And so on and so forth. The possibilities of “fun” are endless. “Fun” is closely tied to the PCG and systems of the game working in concert, it is what is meant by unpredictable and surprising outcomes, and in no small part what makes the game so fascinating and worthwhile playing. Fortress mode has a steep learning curve, it’s easy to fail in it, but, as per the motto of Dwarf Fortress: “Losing is fun!”.

One of the main features of fortress mode is the procedural generation of the world and its history, which we have already covered in detail in the preceding subchapter about procedural generation, world and history generation of this chapter. The player can choose an embarkation site for their fortress from a huge variety of possible locations, each with its own advantages and disadvantages. The world in fortress mode is dynamic and evolving, the same way as it is during its procedural generation of history; events such as wars, migrations, plagues, famines, coups, rebellions and discoveries can also keep happening during fortress mode and will affect the larger world and the fortress. During the game, it’s not unusual to have dwarves create artifacts and items of great value, which can attract unwanted attention from other factions and/or entities, such as thieves, but also gain great prestige for the settlement and increase its value. We have already examined how such items are handled in the preceding subchapter about procedural generation and item generation of this chapter. Another key aspect of fortress mode is the simulation of dwarves and their personalities, which was also already covered to greater extent in the preceding subchapter about procedural generation and character generation of this chapter. The dwarves have their own opinions and reactions to events in the fortress; they can praise or criticize each other; hold grudges, celebrate, mourn, honour, betray, revolt or rebel. Dwarves are simulated living beings with their own stories, needs and personalities within the greater context of the settlement.

To summarize, fortress mode allows the player to create their own epic saga of dwarven civilization. The mode offers almost endless possibilities and challenges. This experience, as is true also for the other modalities, is highly customizable, as various aspects of the game can be modified, such as graphics

by using tile sets, sounds by using sound packs and gameplay by using mods, or even total conversions.

3.4.2 Adventure Mode

Adventure mode is another modality in Dwarf Fortress, which allows the player to create their own character and fully explore the entirety of the procedurally generated world in a roguelike fashion, see the preceding section which describes Rogue (A.I. Designs 1980) in the comparative analysis subchapter, and the preceding section of the subchapter which describes world, and respectively, history generation. The player can choose from various races, like human, elf, dwarf, goblin, or even be an animal person, customize their skills- which are the same as any dwarf can have in the more traditional fortress mode, and equipment, which, again, is the same as possible in fortress mode. The player can then embark on various quests, such as slaying monsters, rescuing prisoners, retrieving artifacts and assassinating enemies, or simply wander around the world to freely explore it. It is also possible to interact with other characters, like villagers, merchants, soldiers, nobles or bandits, and join their factions, such as kingdoms, fortresses, settlements or gangs. The player character can also learn and master new skills, like such as fighting, dodging, swimming, climbing and so on, or come across other acquirable special abilities present in the world, such as magic, vampirism, lycanthropy or necromancy.

Perhaps the biggest attraction of adventure mode is, as already hinted at before, that it can be based on the same world procedurally generated for fortress mode. This means that the player can visit their own civilizations' settlements, including those they made, even the ruins of the failed ones. The player can therefore see the effects of their actions and choices in fortress mode on the world and its history, experiencing first-hand the consequences of their wars, trades, alliances or disasters. It is also possible to encounter characters or creatures that were met or influenced by the player in fortress mode, find their old friends and enemies and discover their own artifacts or records of legends. Adventure mode is a manner of experiencing the world from a different perspective; a way of continuing the stories and events that have started in fortress mode.

To summarize, it could be said that adventure mode is not only a mere game modality, but that it is almost a new game in and of itself, much like a separate roleplaying game or a roguelike, where all of the “fun” can be experienced from a different perspective. As for fortress mode, adventure mode is fully moddable.

3.4.3 Legends Mode

Legends mode is the third mode in Dwarf Fortress, which allows players to fully view and explore the current and procedurally generated history of the game world in a graphical—or straight up textual—format, see the preceding subchapter section about procedural generation, world and history generation of this chapter. This modality allows for browsing through various categories of information, such as regions, sites, civilizations, entities, historical figures, events, artifacts or myths, and to see the details and relationships between each of them through hyperlinks. Players can also search for specific things or filter them by criteria, like name, type, date and/or location. It is also possible to export this data to various formats external to the game, such as XML or bitmap, for further analysis or visualization. This could be used to, for example, creating the setting of a more traditional TTRPG, completely outside of Dwarf Fortress.

The main purpose of legends mode is to make it possible to learn more about the world and its inhabitants: To trace the origins and evolution of entire civilizations, their cultures, religions and wars waged. To uncover the hidden stories and secrets of the world, see the lives, treasures, deeds and misdeeds of its heroes, villains, gods and monsters, and the differences present in its various eras and regions. To understand the world that was created by the PCG, and an alternate way to witness the history shaped by the gameplay.

In conclusion, legends mode is a vehicle—and different perspective—to gaining a deeper understanding of the richness and complexity of the world, It could be looked at as a sort of interactive, in-game encyclopaedia of the game world, a record of its events and stories. It could be said that the only sure things in Dwarf Fortress are “fun”, and the legends left in the wake of it.

4 SURVEY

4.1 Definition, Purpose, Method and Ethics

A survey is a research method involving the collection of data from a sample population in order to provide a quantitative and/or qualitative description of trends, attitudes or opinions. The purpose of a survey is to collect data that can then be analysed and interpreted to gain insights and draw conclusions through inference about the larger population. (Creswell & Creswell 2014.) This survey pays attention to the following ethical issues: Informed consent, participants are to be informed about—and can choose to take part or withdraw from—the survey. Privacy and safety, questions are to be respectful, private and confidential, and also protect minors and vulnerable people. Disclosure of interest, conflicts of interest, biases, limitations, and shortcomings are to be disclosed. Reporting and dissemination, results are to be honest, accurate, and verifiable, and should not be shared without consent. (Fisher 2020.)

4.2 Survey Design, Administration and Data Collection

The survey was designed, created, and administered by following several steps and considerations. The first step was to define the guiding research question that we seek to answer within the scope of this survey: What systemic and emergent aspects of Dwarf Fortress do players find most important and enjoyable? This closely inspired the survey questions.

The second step was to actually create the survey questions and answer options, which can be found in Appendix A. The questions and answer options were designed to call back to the various elements of importance identified throughout the literature review and game analysis chapters. An “other” answer option is always given to respondents, as to offer a way of expressing views not represented in the survey, allowing for more qualitative insights.

The third step was to recruit the participants from the population we are interested in, which is situated within the larger context of the international online indie game development scene, as well as online modding, fandom and gaming communities associated with Dwarf Fortress. Specifically, we recruited participants from the

following communities: the /r dwarffortress subreddit on Reddit (https://www.reddit.com), the DWARF FORTRESS! group on Facebook (https://www.facebook.com) and the Dwarf Fortress community on Steam's store game page (https://store.steampowered.com).

The fourth and final step was to distribute the survey through a link posted to the various communities already mentioned in the preceding paragraph. The responses, herein also referred to as data, were received and are stored entirely online on Google Forms (https://www.google.com/forms). The survey closed on September 21, 2023, with a total of 288 respondents.

4.3 Survey Results

In the following subchapter sections the acquired data is both descriptively presented and qualitatively analysed, in order to answer the guiding research question of the survey and to identify emerging themes and patterns. A full, online and read-only and public copy of the responses can be found here: https://docs.google.com/spreadsheets/d/1zmfMPoK25DlGNliZhWVhzrwEkcNubu4bbWMAiwPaywI/edit?usp=sharing. The responses are minimally edited to maintain complete anonymity, as some respondents signed their open responses with their names/nicknames.

4.3.1 Data Presentation

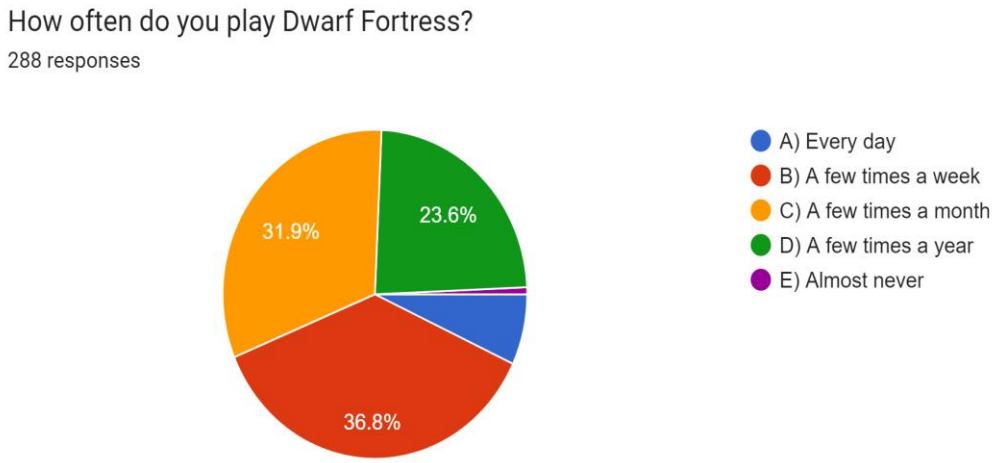

Figure 7. *Graph of responses to question 1.*

Question 1. (Figure 7): How often do you play Dwarf Fortress?

A total of 288 responses were received for this question. This was a mandatory question. One answer possible. The distribution of responses is as follows:

A) Every day: 6.9% (20 respondents)
B) A few times a week: 36.8% (106 respondents)
C) A few times a month: 31.9% (92 respondents)
D) A few times a year: 23.6% (68 respondents)
E) Almost never: 0.7% (2 respondents)

The majority of respondents reported playing Dwarf Fortress either a few times a week or a few times a month. Additionally, there is a small group of players who engage with the game every day, while a still significant number of respondents revisit the game at least once a year. On the other hand, there is a marked minority of respondents who do not engage with the game much at all.

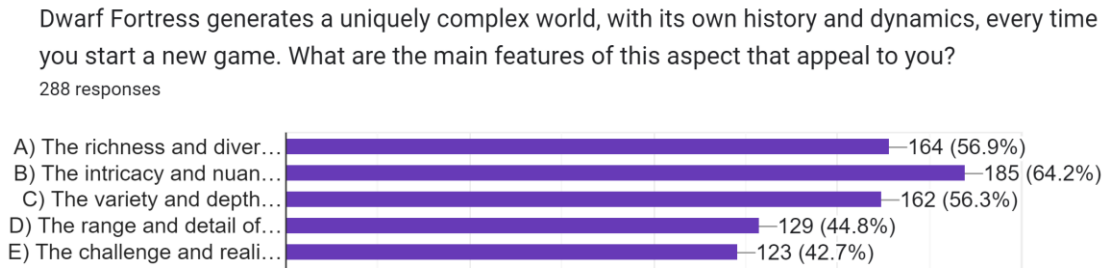

Figure 8. *Graph of responses to question 2.*

Question 2. (Figure 8): Dwarf Fortress generates a uniquely complex world, with its own history and dynamics, every time you start a new game. What are the main features of this aspect that appeal to you?

A total of 288 responses were received for this question. This was a mandatory question. Multiple choice answer. The distribution of responses is as follows:

A) The richness and diversity of the world's geography, biomes and creatures: 56.9% (164 respondents)
B) The intricacy and nuance of the world's legends, history and characters: 64.2% (185 respondents)
C) The variety and depth of the game's skills, professions and industries: 56.3% (162 respondents)
D) The range and detail of craftable and discoverable items and objects: 44.8% (129 respondents)
E) The challenge and realism of the game's harsh combat and survival: 42.7% (123 respondents)

The majority of respondents appreciate the intricacy and nuance of the world's legends, history and characters in Dwarf Fortress. This is closely followed by those who enjoy the richness and diversity of the world's geography, biomes and creatures, as well as the variety and depth of the game's skills, professions and industries. A significant number of players also value the range and detail of craftable and discoverable items and objects, along with the challenge and realism of the game's harsh combat and survival aspects. 27 respondents chose to detail their answer with the "Other" option, analysed in the following section.

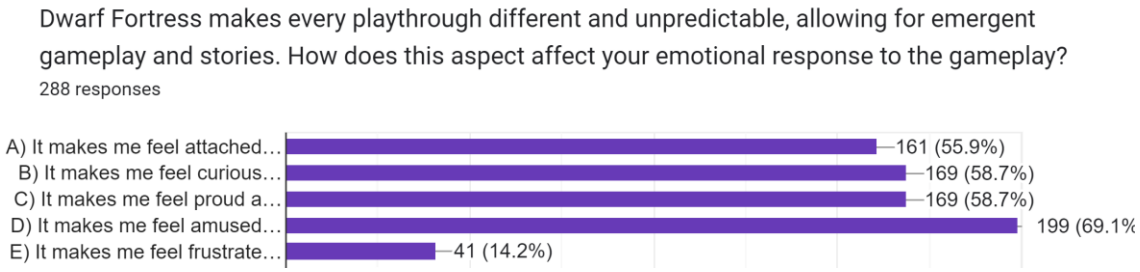

Figure 9. *Graph of responses to question 3.*

Question 3. (Figure 9): Dwarf Fortress makes every playthrough different and unpredictable, allowing for emergent gameplay and stories. How does this aspect affect your emotional response to the gameplay?

A total of 288 responses were received for this question. This was a mandatory question. Multiple choice answer. The distribution of responses is as follows:

A) It makes me feel attached and empathetic to my dwarves and their stories: 55.9% (161 respondents)
B) It makes me feel curious and excited about discovering new things: 58.7% (169 respondents)
C) It makes me feel proud and accomplished when I overcome difficulties: 58.7% (169 respondents)
D) It makes me feel amused and entertained by the absurdity and humour: 69.1% (199 respondents)
E) It makes me feel frustrated and disappointed when things don't go how I planned: 14.2% (41 respondents)

The majority of respondents expressed feeling amused and entertained by the absurdity and humour of the game, followed by curious and excited about discovering new things and feeling proud and accomplished when they overcome difficulties, at a tie. Additionally, a slightly lower but still significant number of respondents reported feeling attached and empathetic to their dwarves and their stories. Only a marked minority of respondents reported feeling frustrated and disappointed when things don’t go as planned. 10 respondents chose to detail their answer with the “Other” option, analysed in the following section.

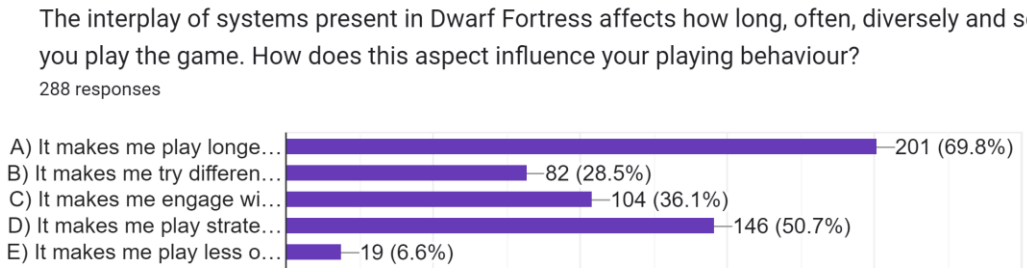

Figure 10. *Graph of responses to question 4.*

Question 4. (Figure 10): The interplay of systems present in Dwarf Fortress affects how long, often, diversely and socially you play the game. How does this aspect influence your playing behaviour?

A total of 288 responses were received for this question. This was a mandatory question. Multiple choice answer. The distribution of responses is as follows:

A) It makes me play longer sessions and frequently revisit the game: 69.8% (201 respondents)
B) It makes me try different modes and experiment with their settings: 28.5% (82 respondents)
C) It makes me engage with the community and share my experiences: 36.1% (104 respondents)
D) It makes me play strategically to overcome the game's challenges: 50.7% (146 respondents)
E) It makes me play less or quit the game due to the game's difficulty and complexity: 6.6% (19 respondents)

A marked majority of respondents selected playing longer sessions and frequently revisiting the game. Right behind that option respondents chose playing strategically to overcome the game's challenges, with subsequently fewer engaging with the community to share experiences, trying different modes and experimenting with settings. A marked minority reported that it makes them play less or quit the game due to its difficulty and complexity. 21 respondents chose to detail their answer with the "Other" option, analysed in the following section.

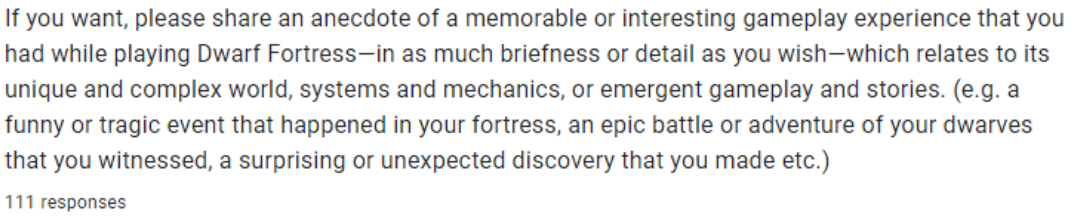

Figure 11. *Screenshot of question 5.*

Question 5 (Figure 11): If you want, please share an anecdote of a memorable or interesting gameplay experience that you had while playing Dwarf Fortress (…)

A total of 111 responses were received for this question. This was an optional question. Long text answer.

See beginning of this subchapter for link to read-only public copy of responses.

4.3.2 Themes and Patterns

Question 1. analysis:

It's unsurprising that the active fanbase of Dwarf Fortress, which is the main target of this survey and comprises its respondents, is highly engaged with the game that they are a fan of. Considering this finding, and in context with the rest of the resulting survey data, it is indeed likely that the survey responses may provide an insight as to why the majority of respondents continues to find DF an enjoyable and worthwhile use of their gaming time.

Question 2. analysis:

The relatively even distribution of responses suggests that there is not a single overwhelmingly dominant reason that players appreciate Dwarf Fortress; instead, they value a broad variety of its features. This is further confirmed by the respondents who chose "Other" and mentioned storytelling (akin to option B), building huge projects (a blend of options C and D), and the uniqueness of each world (a mix of options A and B). This diversity in player preferences underscores the multifaceted approach of DF when it comes to player engagement.

Question 3. analysis:

The responses seem to confirm that the emergent gameplay and resulting stories in Dwarf Fortress do have a positive impact on players emotional response, which may consequently also have an influence on player engagement. Among respondents who chose “Other” it is possible to note the mention of novelty and surprise (basically a variation of option B). Unexpectedly, only a relatively small number of players gets frustrated by the often-times unpredictable nature of DF, which seems balanced out by the dark humour that the game can be full of.

Question 4. analysis:

Based on the responses, it does indeed seem that players engage more with Dwarf Fortress due to the interplay of its systems. Notably, when compared to question 3. responses, E) does not have as much traction in question 4., so it may be that, while players are sometimes frustrated by the unpredictability of DF, this does not necessarily make them play less. The responses under “Other” are interesting, because it seems that, while some of the respondents are very aware of Dwarf Fortresses different systems at play, others are not, and therefore did not really understand the question. A portion of players in fact state that, in an effort to understand these game systems better, they spend a lot of time outside of it doing research and learning, for example on wikis.

Question 5. analysis:

The responses to question 5. are entirely qualitative, and each is unique. Despite being optional, 111 respondents provided a detailed and often extensive answer. This may indicate that Dwarf Fortress players enjoy sharing their war stories, and that the game creates memorable moments which captivate its audience also after playing. The responses describe epic, amusing, tragicomic and unforeseen situations arising from interactions of the various systems and mechanics at play, further catalysed by the setting of DF and the players own imagination. In other words, these are signs of emergent gameplay and storytelling. The responses are too extensive to quote here in their entirety but are available for anyone who wishes to read them beyond this analysis at the link already provided.

5 SHORT VIDEO

Along with this thesis, the author has also produced a short video to inform and entertain a broader audience about the topics of its research. This video is titled “Dwarf Fortress Unearthed, with David and Gotrek”, and the first episode of a playlist called “Pixel Architects”. It is a companion piece to the thesis, showcasing some of the features, inner workings and game design principles of DF, as told by the fictional and caricatural characters of David, an Oxfordian videogame documentarist, and Gotrek, a typically gruff and funny dwarf. The video is intended for potential game developers and players, who may be interested in learning more about the unique and influential game that is Dwarf Fortress, yet who do not have the time or inclination to read an academic paper. The video is publicly available at the following link: https://youtu.be/hnzv2BE_KZc

6 CONCLUSION

6.1 Summary of Main Findings

This thesis analysed how Dwarf Fortress, a game that utilizes systems-based game design and procedural generation, creates engaging and emergent gameplay experiences for the player. For review, the main research question was: How are systems-based game design and procedural generation implemented and experienced in Dwarf Fortress? The supporting research questions were: What specific elements and techniques of procedural generation contribute to emergent gameplay in Dwarf Fortress? What systemic and emergent aspects of Dwarf Fortress do players find most important and enjoyable? How could the findings of this thesis be applied by game developers interested in using similar approaches for their own games?

The main findings of this thesis were that Dwarf Fortress implements systems-based game design by simulating various aspects of a fantasy world, such as individual dwarves' needs and personalities, and the wider management of resources and construction of items, buildings and defences. These systems are broken up, built upon and structured "from the bottom up", never allowing the simulation running in the background to stray too far away from what is actually shown to the player, and immediately useful to inform and shape the game world.

The game utilizes procedural generation to create a uniquely detailed fantasy world for the player, which can be different every time a new game is started. This includes the generation of terrain, geology, weather patterns, civilizations, objects and creatures. The game's emergent gameplay stems precisely from the coherent interactions between these elements and systems—the open ended yet thematic procedural nature of its mechanics—allowing for unexpected outcomes and interactions that players can near-infinitely explore and experiment with.

The surveyed players seem in agreement that one of the main draws of the game is the creation of memorable moments through the complex interaction of its various systems and mechanics, which captivate its audience even after playing, engaging players and making them come back consistently to play more. They also seem to see the game as a storytelling device, appearing more often than

not amused by the details of how things play out, despite the sheer depth, complexity and un-foreseeability of the game sometimes working against itself.

6.2 Implications of Findings

The implications of the findings of this thesis are that Dwarf Fortress does indeed exemplify how systems-based game design and procedural generation can create a rich and dynamic game world, not reliant upon predefined scripts or narratives, but rather emergent from the player's choices, in concert with the systems at play. DF also shows how games like it can be seen as storytelling devices that allow players to create their own stories and objectives based on the game's events and outcomes, appealing to a niche but loyal audience, which enjoys its depth, complexity, humour and unpredictability.

Developers may draw inspiration from Dwarf Fortresses systems-based and procedural design philosophy, which could inform the implementation of game worlds not only minimalist in the usage of development resources, but also maximalist in the scope of gameplay and player engagement produced. A potential problem in reproducing the success of DF by utilising its design philosophy, though, is the non-wide availability of mainstream game development tools when it comes to procedural content generation in the videogame industry, at least at the time of writing this thesis. To benefit, these tools have to be built and customized for each game idea, a lot of the time starting from nothing more but generative algorithms.

7 DISCUSSION

7.1 Reflection on Research Process

To review, the research process of this thesis consisted of three main steps: Firstly, conducting a narrative literary review of sources related to systems-based game design, procedural generation and emergent gameplay. Secondly, performing a comparative, case study and formal game analysis of Dwarf Fortress, to identify and examine its elements and techniques of systems-based game design and procedural generation contributing to the emergent gameplay. Thirdly and finally, administering a survey to gather data from the Dwarf Fortress community about their preferences, stances and experiences related to the game's systems-based design, procedural generation and emergent gameplay.

The research process was challenging but rewarding for someone wanting to be an indie game developer, and to understand the design principles underpinning Dwarf Fortress. It allowed for gaining substantial and in-depth knowledge about the game's design philosophy, mechanics, history and player base. The process also allowed for learning how to use various research methodologies and tools to collect, analyse and present data in a coherent and, hopefully, convincing way.

7.2 Evaluation of Research Quality

The validity of the research in this thesis may be high, as the literature review provided a solid theoretical foundation for understanding the key concepts and context of the research topic, the game analysis provided a detailed and systematic examination of the game's design and implementation, while the survey provided relevant data from the target population. The reliability of this research may also be high, as the literature review followed a search strategy based on finding literature relevant to the key words and research questions, furthermore, the game analysis followed a consistent analytical framework based on existing methods, and the survey followed an ethical data collection procedure based on anonymity and informed consent. The generalizability of this research may be only moderate, as the findings are specific to Dwarf Fortress as a case

study, but also may provide some insights and implications for other games that use similar design approaches and techniques or are aspiring to do so.

7.3 Recommendations for Future Research

Future research could investigate how systems-based game design and procedural generation creates emergent experiences in different games, contexts, and genres. Also, what algorithms are used in them, and to examine those at a deeper technical level. Finally, what game development tools or frameworks are needed, or are already available—for example in game engines—to facilitate the utilization of PCG in game development.

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LIST OF FIGURES

APPENDICES

Appendix A. Full copy of the survey questions.

Appendix A

Dwarf Fortress: The Impact of its Dynamic World and Emergent Gameplay on Players

This survey aims to understand how the systems and procedural mechanics within Dwarf Fortress affect player engagement, emotional response, gameplay behaviour, and last but not least, which of its elements the audience considers most important in the contribution to a memorable and enjoyable experience.

Answers will be kept anonymous, and will only be used for academic research purposes.

* Indicates required question

1. How often do you play Dwarf Fortress? *

   Mark only one oval.

   - ◯ A) Every day
   - ◯ B) A few times a week
   - ◯ C) A few times a month
   - ◯ D) A few times a year
   - ◯ E) Almost never

2. Dwarf Fortress generates a uniquely complex world, with its own history and dynamics, every time you start a new game. What are the main features of this aspect that appeal to you? *

   Check all that apply.

   - ☐ A) The richness and diversity of the world's geography, biomes and creatures
   - ☐ B) The intricacy and nuance of the world's legends, history and characters
   - ☐ C) The variety and depth of the game's skills, professions and industries
   - ☐ D) The range and detail of craftable and discoverable items and objects
   - ☐ E) The challenge and realism of the game's harsh combat and survival
   - ☐ Other: _____

3. Dwarf Fortress makes every playthrough different and unpredictable, allowing for emergent gameplay and stories. How does this aspect affect your emotional response to the gameplay? *

Check all that apply.

- [ ] A) It makes me feel attached and empathetic to my dwarves and their stories
- [ ] B) It makes me feel curious and excited about discovering new things
- [ ] C) It makes me feel proud and accomplished when I overcome difficulties
- [ ] D) It makes me feel amused and entertained by the absurdity and humour
- [ ] E) It makes me feel frustrated and disappointed when things don't go how I planned
- [ ] Other: _____

4. The interplay of systems present in Dwarf Fortress affects how long, often, diversely and socially you play the game. How does this aspect influence your playing behaviour? *

Check all that apply.

- [ ] A) It makes me play longer sessions and frequently revisit the game
- [ ] B) It makes me try different modes and experiment with their settings
- [ ] C) It makes me engage with the community and share my experiences
- [ ] D) It makes me play strategically to overcome the game's challenges
- [ ] E) It makes me play less or quit the game due to the game's difficulty and complexity
- [ ] Other: _____

5. If you want, please share an anecdote of a memorable or interesting gameplay experience that you had while playing Dwarf Fortress—in as much briefness or detail as you wish—which relates to its unique and complex world, systems and mechanics, or emergent gameplay and stories. (e.g. a funny or tragic event that happened in your fortress, an epic battle or adventure of your dwarves that you witnessed, a surprising or unexpected discovery that you made etc.)

_____

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