TÉCNICO LISBOA

"CASTLES: influence of Complexity on the plAyer experience. a Study Towards ameLiorating emergent Storytelling"

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Resumo

Ao longo dos anos, criadores de videojogos têm tentado criar sistemas de narrativa onde o jogador tenha a liberdade de poder mudar o mundo, de ter agencia, e de se deparar com as consequências das suas escolhas. Estes sistemas tomaram uma variedade de formas e uma variedade de soluções foram adoptadas. Independentemente da solução escolhida, o factor decisivo para que estes sistemas tenham, ou não, sucesso é no quão envolvido eles conseguem que o jogador se sinta com o mundo do jogo e com as suas historias no mesmo. Por outras palavras, o sentimento de que têm importantes, e muitas vezes dificeis, decisões a tomar. Estas decisões estas que os irão afectar, e também à historia do jogo.

Este trabalho aborda a relação entre mecânicas de jogo complexas e a experiencia de jogo sentida por um jogador, ao interagir com um sistema de narrativa emergente, num ambiente *singleplayer*. Neste documento começamos por descrever os testes por nós feitos com o intuito de explorar uma possivel relação entre estes aspectos e também os sistemas que implementámos de modo aos testes serem possiveis.

Para alcançar os nossos objectivos com este estudo, descrevemos igualmente as componentes da experiência de jogo que desejamos analisar, como o Interesse, a Competência, a Agencia, o Esforço e a Tensão, e também os cenários de teste desenhados para os explorar, baseando-nos no jogo *Crusader Kings 2*, como ponto de partida.

De seguida, descrevemos extensivamente a nossa metodologia de teste, como também as analises estatisticas realizadas com os dados obtidos e como apenas encontrámos diferenças significativas na dimensão da competência.

Finalmente, comentamos sobre os resultados extraidos e apresentamos sugestões para trabalhos futuros nesta área.

Palavras-chave: Historias Interactivas, Narrativa Emergente, Experiência de jogo, Complexidade

Abstract

Over the years video game creators have tried to create narrative systems where the player could have the power to change the world. To have agency, and face the consequences of his choices. These systems took a variety of shapes, and a range of solutions were adopted. Regardless of the chosen approach, the deciding factor on whether these systems succeed or fail at their main goals lies in how engaged they can make the player feel with their world and their personal stories. In other words, the sense that they have meaningful engaging and often difficult, decisions to make, decisions that will affect them and the games' story later on.

This work addresses the issue of complex game mechanics and their relation to the player experience while engaging with an emergent narrative single-player game. In this document we describe the tests made in order to try and discern a possible correlation between the two, as well as the systems implemented to be able to carry out the tests themselves.

In order to achieve this, we present the components of player experience we desire to test, such as Interest, Perceived Competence, Agency, Effort and Tension, and the testing scenarios we built to test these, using Crusader Kings 2 as a base framework.

Furthermore we extensively describe our testing methodology as well as our statistical analysis of the data recovered, and how we've only found significative differences in the competence dimension.

Finally we comment on the results extracted from this experiment and our suggestions for further work and exploration into this topic.

Keywords: Interactive Storytelling, Emergent Narrative, Branching Storyline, Player Experience, Complexity

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Chapter 1

Introduction

1.1 Motivation

Similar to other entertainment media, stories in games play a big role in increasing immersion, and adding interest to the player. However, one main difference that separates videogames to other media formats is that they are interactive; they expect participation from the player and in turn the player expects to interact with them and be involved in the games' events.

Games have often followed a linear approach in their storytelling, where the sequence of events is presented in a pre-defined way and interactivity is kept only for game play mechanics and in no way can they affect the overarching plot, as is the case with the Final Fantasy series [1], or even Shadow of the Colossus [2].

However, it can be argued that following a static, pre-defined story can detract from the games' interactivity, as the players' interaction is not affecting outcomes and events[1].So, for videogames to benefit the most from their interactive nature they must embrace non-linear story structures.

Interactive Storytelling involves telling a tale while allowing a user to take part in it, shaping its development. To achieve this, one of the central goals for every Interactive Storytelling system is to provide the user with the feeling of Agency.

Agency can be defined as "the satisfying power to take meaningful action and see the results of our decisions and choices" [2]. If this feeling of agency is achieved, it will greatly help players become more engaged with the game and enjoy it to a greater degree.

"Story making is a pleasurable activity".[3]. It, allows the player to be further engaged in the fantasy of a game. Not only experiencing it but take part in the creation of their own sub-fantasy within the one presented by the game, this ability to engage with fantasy is something that J.R.R Tolkien believed was a great boon in literature (by using the readers' imagination in filling in the blanks on the stories descriptions) as opposed to other forms of media "Fantasy remains a human right: we make in our measure and in our derivative mode, because we are made" [4].

[1] Final Fantasy Series, *Squaresoft, Square-Enix* http://en.wikipedia.org/wiki/Final_Fantasy

[2] Shadow of the Colossus, *Team Ico, Sony Computer Entertainment 2006,* http://en.wikipedia.org/wiki/Shadow_of_the_colossus

This concept can be extrapolated to videogames, although in a different fashion, as interactive stories allow the player to partially make their own fantasy within the games' structure.

Interactive storytelling concepts have started to be used used to varying degrees of complexity in a number of modern titles, however, creating branching storylines can be a time consuming and expensive process. As such companies usually gravitate to practical manageable approaches.

These approaches consist mostly of constructing all possible outcomes for given discreet player choice moments. Taking this approach would rapidly create a huge overhead of content to plan and build, and as such, either the choice moments become very few and far between (and mostly only at the end of the game itself) or certain design tactics are employed to minimize the amount of varying content that needs to be produced.

To break from these exponential costs, alternative methods were taken in order to provide agency to players. One such way is to simply provide a fictional world simulation in which the player can interact through a set of rules and mechanics. With the consequences and gains from action upon this world, and with the chain of decisions and results that make up a game session, complex sequences of situations and consequences can emerge.

As these sequences were not previously planned and designed to happen, and are purely based on the players actions and the resulting consequence, they will be unique and personal to the player in question, hence giving him the sense that his volition was what created that outcome. To this approach we call Emergent Narrative[5].

To achieve this, we shift the structure of a game from telling a story to presenting a simulation, which presents new challenges. One such challenge lies in the design of the interactive mechanics themselves, how complex should they be? How many actions, and how many variables they need to affect to provide a fulfilling simulation? Does this simulation need to be made of many moving parts, or does a simpler design evoke the same sense of agency as a fuller system?

This aim of this thesis is to explore these issues, the correlation between complexity in the presented simulation and the player experience, such as his sense of agency. Our work attempts to find if there are hints towards the existence of correlations, and which factors affect the experience given to players in scenarios of differing complexities.

1.2 Problem Description

With videogames spreading across the globe and becoming more and more inclusive, the industry has reported a worth of over $74bn dollars [3], however, as profits grow, so do development costs, as assets such as graphics, animations and even scenarios require more and more manpower. For costs at the order of millions the risk of failure is excessively high, and as such, game companies hesitate in experimenting with unproven game designs.

Complexity in game mechanics is often seen as something overly detrimental, and in an effort to

[3] Keith Stuart, *Global games market to be worth $74bn in 2011*, http://www.guardian.co.uk/technology/gamesblog/2011/jul/06/gartner-global-game-spending (Jul 2011).

avoid risks, simpler mechanics are employed, as in general, ”simple to learn, hard to master” is the best way to design an appealing game. We, however, desire to explore complexity, and how it can be effectively used to improve the player experience in emergent narrative story systems. We believe that complex game mechanics have their place on the market, even if only to niche audiences. As such, we will explore the hypothesis that there is a positive correlation to be found between complexity in the presented simulation and the player experience.

We aim to explore 5 dimensions, in relation to complexity:

D1 - Interest

D2 - Perceived Competence

D3 - Sense of Agency

D4 - Tension Felt

D5 - Effort

In order to achieve our goal of exploring these possible correlations, we endeavor to build two testing scenarios, similar in all aspects apart from how complex they are to a player. We define this complexity, in our scenarios, as the amount of actions a player has to undertake in order to achieve whatever goal he desires. We see as more complex a system where the player needs to successfully realize a number of small tasks that work towards his objective, and as simpler a system where the player can abstract from some of the menial tasks, asking other people to worry about them, and instead only engage in high level decisions of what he wants to do.

After we have the 2 variations constructed, we run player tests using these scenarios. These tests will consist of a play session, followed by a questionnaire so we can collect data on each of our hypothesis. Following this, a statistical analysis occurs where we compare values between the two scenarios of differing complexity and were we hope to find hints towards the validation of the hypothesis presented above.

In the end, contributions from this work aim to empower game designers with data gathered through experimentation towards the potential use of complex game mechanics in order to build a better game for players to feel engaged and empowered with a complex, single player emergent story system.

1.3 Document outline

The remainder of this document is divided into four parts.

In Related Work, we report on existing works on emergent narrative systems, to better illustrate the field in wich our research took place, and then we will present some commercial videogames of note which inspired the hipothesis this thesis is based upon.

In Solution, we describe the processes of developing our test scenarios and their descriptions. We begin by extensively describing our methodology in designing two scenarios of differing complexity but similar in other regards. We present our usage and manipulation of *Crusader Kings 2* in which we based our experiment. Afterwards we explain the experimental procedure applied to gather data from both of the built scenarios, and simultaneously which tools we used to measure the player experience in these

procedures.

In Data Analysis, we analyze the results obtained from our testing sessions and their significance over our hypothesis. We present a series of statistical analysis over the collected data and finally, we debate the meaning of these findings regarding the correlation between complexity and player experience in emergent story systems.

In Conclusions, we sum up the important aspects and decisions taken during the course of this work as well as discuss the observable results and their significance. To finish up we discuss potential future work based that could emerge from the results here gathered.

Chapter 2

Related Work

In this section we present the theoretical backgrounds on which this work stands.

Unfortunately, there's very little previous work int this topic. Both because it's a very fresh field of investigation, but also due to the very specific nature of this work. As such, we will present related works in the field of interactive storytelling in emergent gameplay systems as well as commercial products that have succeeded by using systems like the ones we wish to explore.

Firstly we'll present existing works in the field of emergent storytelling to better describe the field in which this work took place. Following that we showcase some commercial videogames that inspired our hypothesis and our work.

Finally we'll cover the definition of Agency

2.1 Emergent Narrative Systems

The relevance of these systems in conveying agency is that through the interaction between the player and the simulated world, complex sequences of situations and consequences can emerge. As these sequences were not previously planned and designed to happen, and are purely based on the players actions and the resulting consequence, they will be unique and personal to the player in question, hence giving him the sense that his volition was what created that outcome.

Seeing as our work focused on emergent narrative systems, in this section we will present some existing approaches into the field, to better define the environment of our work.

2.1.1 MIST

MIST[6], aims to provide an architectural design for creating open-ended, interactive storytelling systems in which story structure emerges in real time and in response to player actions, thus providing a greater variety of game experiences than more scripted approaches.

MIST, or Multiplayer Interactive StoryTelling, is a system, for interactive storytelling in a dynamic virtual world, where NPC's (non-player characters) can perform tasks autonomously to satisfy their in-

ternal motivations as well as interacting with each other in various ways. An important goal in MISTs' approach to interactive storytelling is to provide human controlled characters with greater freedom in the interactions that they choose to perform in the world than would be possible in a strictly plot based approach.

The system is based on a two-tiered architecture. The lower tier is a virtual world consisting of locations and game objects, populated by players and autonomous NPCs'.

A second tier consists of a Drama Manager, which is responsible for ensuring enactment of stories that it generates by assigning story-related tasks to NPCs'. The Drama Manager injects narrative into the game, re-planning in response to world state changes, and generally keeping the game moving towards a valid conclusion.

The stories are represented at an abstract level, enabling them to be applied in a variety of ways, depending on the world state. This Drama Manager was introduced by MISTs' authors, due to the belief that purely autonomous NPCs' would not provide sufficient dramatic interest (Figure 2.1).

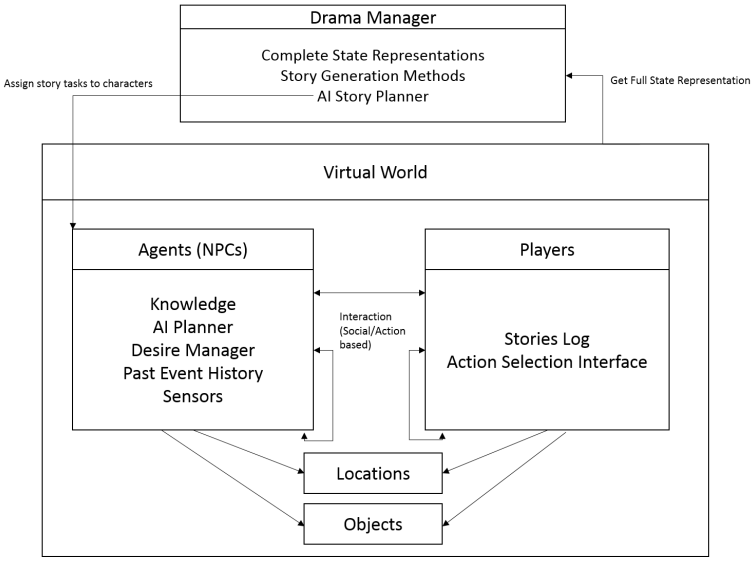

Figure 2.1: MIST System Architecture.

Non-player characters operate under a Belief-Desire-Intention framework (BDI). An NPC acquires its knowledge about the world from sensors, such as his possessions, affiliations to other NPC's, current desire, current location, relevant game objects, and locations of nearby NPCs'.

Each NPC has then the following desire types: get warm, drink, eat, rest, make money, increase safety, socialize, reproduce, and increase respect. It is ensured that each NPC only has one active desire at any given time (Figure 2.2).

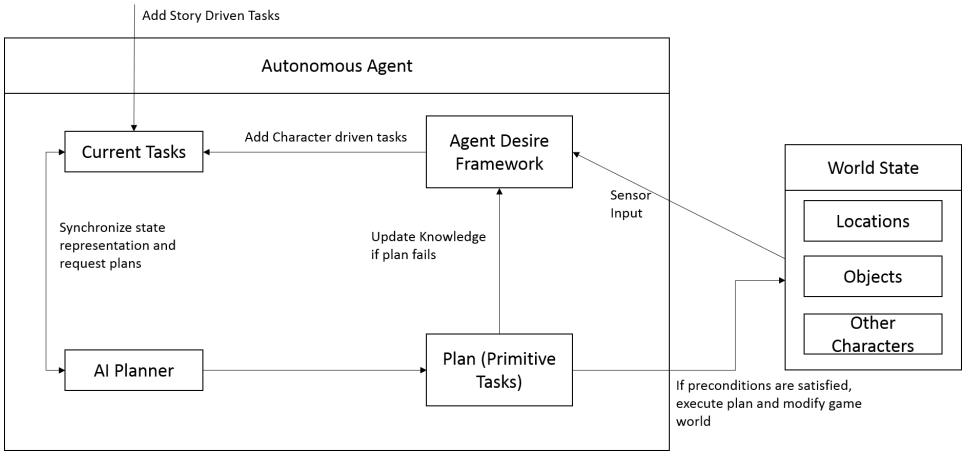

Figure 2.2: MIST NPC Architecture.

By means of the socialize desire (and resulting activities), NPCs' can also share information about the world state between each other.

The actions of these NPCs' coupled with the players' action affect the overall state of the game, thus hoping to generate interesting story situations.

MIST didn't explore the sense of agency provided by their system, but instead focused on stress tests with multiple AIs, obtaining satisfactory results on up to 100 concurrent AIs.

2.1.2 Character-based interactive storytelling

This is a paper by Marc Cavazza, Fred Charles, and Steven J. Mead, [7] where they discuss a character-based approach where autonomous actors, whose roles are implemented using real-time planning systems, should dynamically interact to generate the story.

Their prototype used the Unreal Tournament game engine as a development environment. The interactive story appears as a real-time 3D interactive animation with subtitles corresponding to the characters' dialog or important events. Users can physically interact with the characters and navigate through their environment using normal game controls.

The chosen test scenario is inspired by the popular US television sitcom Friends [1]. A sitcom was chosen because, in this genre, the story ending and intermediate situations are equally relevant, which provides a more appropriate testbed for story generation.

In the system prototype, they modeled the graphic environment using the Unreal Engine editor and modeled additional objects using 3d studio max and textures from several online resources. They implemented the AI layer, in C++ and integrated it in Unreal as a set of dynamic link libraries. UnrealScript defines all the functions that interface with Unreals' events, that is, those functions dealing with object interactions.

[1] Sitcom Friends, `http://en.wikipedia.org/wiki/Friends`

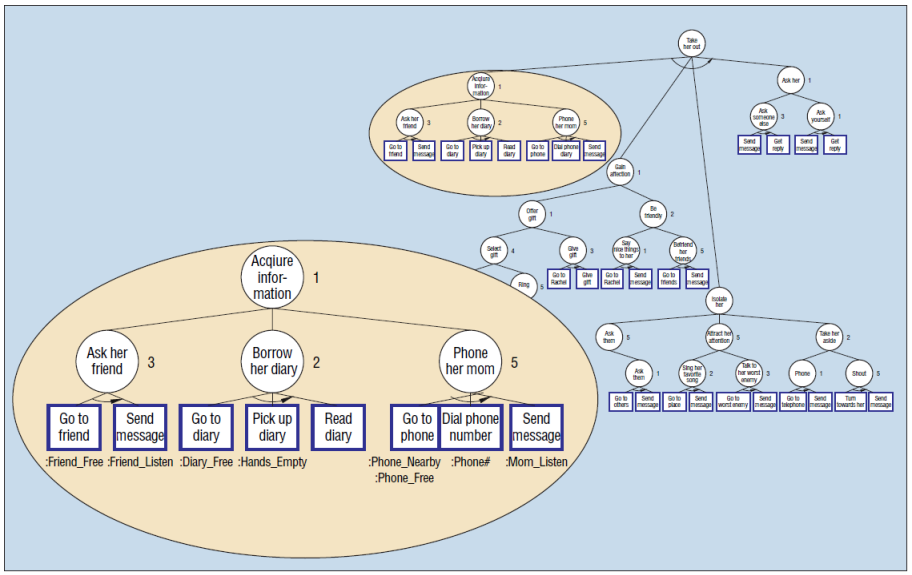

Figure 2.3: Example character HTN (Hierarchical Task Networks)

They were mainly interested in the emergence of story variants from the interaction of autonomous actors, so the emphasis was on the actors' behavior rather than on explicit plot representation or narrative control.

The characters actions were modeled as HTNs (Hierarchical Task Networks), A single HTN corresponds to several possible decompositions for the main task—in other words, we can view HTNs as an implicit representation for the set of possible solutions. In the present context, each ordered decomposition constitutes the basis for a characters' plan, and each HTN associated with an artificial actor contains the set of all possible roles for that character across story instantiations (Figure 2.3).

Story generation results from dynamic interaction between the main characters' plans, which correspond to a top-down approach, because characters' behavior is generated from their predefined HTNs. However, in the course of the action, situations might emerge that do not form part of the initial plans. The interaction between characters' plans results in random onstage encounters between agents that have the potential to create situations of narrative relevance. These interactions constitute a bottom-up approach (because plan-based behaviors don't account for these situations) and thus create a need for two specific mechanisms: situated reasoning and action repair. Situated reasoning in plan-based actors' behaviors originates from the discrepancy between an agent's expectations and action preconditions. One defining aspect of situated reasoning is that it is oriented toward obtaining a specific resulting state in a given situation. Situated reasoning should include avoiding an undesirable result.

Currently, the system can generate complete stories up to three minutes in duration. During dramatic action the user can switch between viewpoints of various character or freely explore the stage while the plot unfolds. The action progresses until a specific character asks another out, and the story concludes with the other characters' answer.

The authors concluded that character-based approaches have good potential for story generation. Despite the deterministic nature of their underlying techniques, many different factors contribute to the unfolding plots unpredictability from the users' perspective. Character-based systems provide a unified

principle for story generation and interactivity.

2.1.3 Analysis

In this section we presented two projects that served as inspiration for our study.

On the one hand, MIST showed that simulation AI's acting only according to their needs desires and knowledge in an interactive environment has the potential to generate complex sequences of events for each character which in turn become their own little stories, along side the player.

In Character-based interactive storytelling, we can see that even when a system has an underlying deterministic nature, the amount of different parts contribute so that the resulting plot is unpredictable from the user perspective, which is clues us in to our hypothesis, that sufficiently complex systems, can enhance the players' agency by becoming too unpredictable from their perspective.

However, none of the two attempted to measure the player experience while engaging with these systems.

2.2 Commercial Videogames of Relevance

In this section we will highlight some recent commercial videogames which have succeed in employing interesting design decisions with the purpose of providing player agency in the development of a story. Each of these games can clue us in on potential elements that can be used to provide a good player experience in emergent storytelling environments.

2.2.1 Crusader Kings II

Crusader Kings II[2] is a grand strategy game set in the High and Late Middle Ages developed by Paradox Development Studio and published by Paradox Interactive.

The game is a dynasty simulator where the player controls a Medieval dynasty from 1066 to 1453. Through the strategic use of war, marriages and assassinations among many other things, the player works to achieve success for his or her dynasty. The simulation is open-ended so the definition of 'success' is completely defined by the player.

The only in-game objective is to obtain as many prestige points as possible in order to surpass the various historically relevant Christian dynasties in a fictional prestige ranking. The game ends when the player's current character dies without an heir of the same dynasty to succeed him/her.

Crusader Kings II functions by simulating the entirety of medieval Europe (and northern Africa) through territories and regent characters. From emperors' to counts, every country (including Portugal) is represented by their provinces and those who ruled over them.

Every single ruler in the simulation is an independent AI with his own beliefs and desires. These characters are defined through their proficiency in 5 attributes (Diplomacy, Stewardship, Martial, Intrigue

[2] Crusader Kings 2, *by Paradox Interactive, 2012* http://www.crusaderkings.com/

and Learning), through a sample of a vast array of character traits (such as Dwarf, Genius, Greedy, Ambitious, Content, Lustful, etc...) and through their opinions on every other AI in the game. This opinion is simplified to a single number ranging from -100 to 100 and is based off the two AI's attributes and traits (for example, an ambitious duke will have negative modifier on his opinion of his king is said king is content).

The AIs' can engage in a variety of actions, such as declaring war on one another, plotting assassinations, arranging marriages and a good number more. The Simulation runs in real time and the characters interact with one another in order to fulfill their desires.

The player, at the start of the game, can choose to personify any character from the time period. The chosen character will no longer be controlled by an AI and will instead be fully controlled by the player.

From the start of the game on, there is no telling what might happen in the world, as the players' choices will undoubtedly affect how history rolls out. For instance, playing as the Portuguese House of Burgundy during the *Reconquista* [3] it's possible to start conquering eastward instead of south and grab land that was in historically conquered by *Castille* and *Leon*.

Figure 2.4: Example of how history can be radically altered in Crusader Kings 2

This game is of relevance for our work as it naturally provides a great sense of agency in the way it allows the player to completely and irrevocably change history. The amount of information and the continent spanning repercussions of player actions enable him to truly feel like he matters in the world (Figure 2.4).

This game however, is an incredibly complex game, filling the needs of a very niche audience as a result. However, we think that this complexity plays an important role in enhancing the sense of agency felt by the player and his choices, as it prevents the player from mathematically determining the best

[3] Historical Period, `http://en.wikipedia.org/wiki/Reconquista`

course of action (due to the large amount of variables and the real time nature of the game) and instead rely on subjective and in-character motivations for his choices.

2.2.2 XCOM: Enemy Unkown

XCOM: Enemy Unkown[4] is a turn-based tactical role-playing video game, developed by Firaxis Games and published by 2K Games. The game is a "re-imagined" remake of the 1994 cult classic strategy game UFO: Enemy Unknown (also known as X-COM: UFO Defense) and a reboot of MicroProse's 1990s X-COM series.

Set in the near future during an alien invasion of Earth, the game puts the player in control of an elite multinational paramilitary organization called XCOM and tasked with defending the Earth. The player commands troops in the field in a series of turn-based tactical missions.

Much like its predecessor, XCOM: Enemy Unknown casts the player as the commander of an elite military organization. As commander, the player directs their soldiers in turn-based combat missions against alien enemies. Between missions, the player directs the organization's research and engineering divisions in creating new technologies and improving XCOM's base of operations, and manages the organization's finances.

The turn-based ground combat uses an isometric 3D perspective. The player controls a squad of between four and six human soldiers or robotic units as they hunt the aliens on the map and attempt to complete other objectives dependent on the mission. Map layouts are not randomly generated, but enemy placement is.

Fog of war hides the aliens and their actions from view until the player's soldiers are in range and have line of sight on them, and enemies normally do not act at all until the squad initially comes within line of sight. Soldiers can carry items and perform special abilities; use of these items and abilities is controlled through a tool-bar on the head-up display (HUD).

A few examples of abilities include firing on enemies automatically after they emerge, launching explosives, and healing allies.

[4]Xcom: Enemy Unknown, by Firaxis Games, `http://www.xcom.com/enemyunknown/entry`

Figure 2.5: Turn-based ground combat in xcom

Due to its high difficulty (and especially if the player is playing in ironman mode where he can't revert to a previous savegame) this tactical layer and its abundant use of soldier attribute-based randomness in whether a shot will hit or miss, makes it so every alien encounter is extremely stressful as each of the players' customized and highly trained soldiers can permanently die due to a bad decision or, sometimes, plain bad luck.

This layer of gameplay gives it the ability of creating emergent stories where its players revel in retelling their stories from the battlefield, for example, how their awesome sniper saved the day only to get ambushed as the rest of the squad was retreating and dying a hero, or how a mission went so catastrophically bad that every soldier died.

Due to the way this game generates these moments with a great deal of sentiment of agency, it's clearly of note for our work and hints that difficulty coupled with hard to predict outcomes can be a possible element that enhances the sense of agency.

2.2.3 Papers, Please

Papers Please[5] is a puzzle video game developed by indie game developer Lucas Pope, focusing on the emotional toll of working as an immigration officer in the fictional communist country of Arstotzka.

The gameplay of Papers, Please focuses on the work life of an immigration inspector at a border checkpoint for the fictitious country of Arstotzka. The player inspects would-be immigrants' documents and uses a sparse array of tools to determine whether the papers are in order for the purpose of keeping spies, smugglers and other unwanted individuals out of the country.

When discrepancies are discovered, the player can interrogate the applicant about the discrepancy, and demand further information, such as fingerprints or a full body scan. If further discrepancies are discovered, the player can have the applicant arrested, or the applicant can attempt to bribe the inspector.

At the end of each in-game day, the player earns money based on how many immigrants they pro-

[5]Papers, Please, by Lucas Pope, `http://papersplea.se/`

cessed and bribes collected, less any penalties for mistakes, and then must decide on a simple budget to spend that money on rent, food, heat, and other necessities in low-class housing for themselves and their family.

Figure 2.6: A moral decision in Papers, Please

As relations between Arstotzka and nearby countries deteriorate due to multiple terrorist attacks, each day introduces a new set of rules for immigration based on the game's story, such as denying citizens of specific countries or demanding more exacting identification from citizens.

The player may be challenged with moral dilemmas as the game progresses; such as allowing the supposed spouse of one immigrant through despite them lacking complete papers, even though they may be planning to attack your fellow guards. The game uses a mix of randomly generated entrants, along with some special encounters. Pre-made templates are used to generate characters.

The game has a scripted story mode with multiple possible endings depending on the player's previous actions, as well as an unlockable, randomized endless-play mode.

Papers, Please is a very interesting gameplay experience for player agency. Because of the way the player can make money (by letting people pass the border) to feed and warm his family, and pay medical fees in case any get sick, the game progressively makes the player desperate for more and more as a normal days work is simply not enough to maintain everyone alive and in good condition.

At this point the game introduces morally grey choices through gameplay, where, for instance, one of your fellow border guards gives you bonus money if you arrest people (even if all they have is an expired passport) or letting him take defused bombs from terrorist attacks for his friend to disassemble and sell parts giving you a cut.

Besides this constant need for money, the game also throws moral choices for the player to decide upon, as exemplified above. This game makes an excellent case for how even a supposedly boring task can be made interesting by having gameplay, story and consequence so closely tied together.

2.3 Agency

The concept of Agency is crucial to this body of work, as its main focus will be to discern whether complexity has an effect in enhancing the sense of agency a player feels while experiencing a system with an emerging narrative. As such, it's important that we understand how agency is defined and how certain gameplay factors affect it, to further help the process of designing experiences that can provide a better sense of agency to a player.

In the social sciences, agency refers to the capacity of individuals to act independently and to make their own free choices.[8]

More specifically though, what we understand as agency in the context of videogames and interactive narrative is as follows "the feeling of empowerment that comes from being able to take actions in the [virtual] world whose effects relate to the players' intention"[9] So we can see that agency mostly refers to the subjective feeling that a given action can affect the world around us in a meaningful way. In other words, it's the feeling that our choices matter, and our presence in the virtual world will have repercussions in it.

However, this feeling isn't very easily satisfied. A player wont feel a sense of agency if a racing game allows him to turn right or left, or if a puzzle platformer has various ways of traversing a level. In fact, agency is a bit more complicated than that. "Agency is an experiential pleasure. As such, it can fade in and out; it can fail altogether. Agency is not automatic, and so simulated environments should be cleverly constructed to help users/players get there. [10] A multitude of options and choices is not necessarily agency, any more than a highly structured game with limited choices denies it.

Therefore we can try to define what does give a sense of agency. "A player will experience agency when there is a balance between the material and formal constraints."[9]

What this means is that the structure and design of a game and the choices available within it communicate information to the player that allows them to make an informed choice of action with a consequence that reflects their intent. Theoretically, if this is achieved, the game will provide a sense of agency, but, as stated above, it isn't enough. These choices need to be sufficiently interesting, the consequences need to be sufficiently meaningful (not necessarily positive). But we can also ask, how complex must be the structure of the game? If a game's mechanics are too simple, is it possible for the player to imerse himself in a narrative of his own?

Answering these questions is the focus of this body of work.

Chapter 3

Solution

In order to achieve our goal of studying the correlation of complexity in game mechanics and a potential improvement in the player experience, our main objectives were the development or modification of a game system that allows for user experimentation and measurement of modifications in complexity. For this, it was critical to use a design that could be slightly altered while maintaining all of it's remaining properties, thus keeping the same overall strucure in differing testing scenarios allowing us to be confident that the only change in the design is the one we purpusefully build into it.
A more complete list of the objectives of this work is as follows:

- Identify an existing, single-player emergent narrative game which is sufficiently modifiable to fulfill our goals in altering the complexity of it's design and measuring agency felt by players.
- Design a controlled and testable scenario within the framework provided by the chosen game.
- Define the component of complexity we feel is the most appropriate to modify within the game framework and the scenario built.
- Create a secondary scenario with modified complexity, thus having two separate but very similar testing scenarios.
- Define and prepare the testing methodology and environment in which we use the built scenarios.
- Use the testing sessions to collect data on the feeling of agency on both scenarios.
- Analise the data, while comparing it to our proposed hypothesis, and draw the appropriate conclusions from it.

The following sections of this chapter will endeavor to extensively describe our methodology and it's implementation in order to accomplish the proposed goals of this study. We will describe in depth the construction of the testing scenarios as well as our testing methodology and application.

3.1 Choosing our Framework

To properly achieve our stated goal of evaluating the influence of complexity in an emergent storytelling environment, we needed a base system where we could perform changes and evaluate their effects. These changes needed to be in the shape of at least two differing scenarios where we could tweak the amount of complexity presented to the player and evaluate how that affects the overall experience.

We could build a system of our own, however, building a videogame that could satisfy our testing needs would be an overly complicated task, as well as a potential risk of not having a sufficiently well made base system which could in turn hinder our ability to test, and potentially not even being sufficiently capable of generating emergent narratives through gameplay, invalidating potential data we could retrieve from its use.

As such we looked towards other options.

Grand Strategy games [1], such as Civlization [2] prove to be inherently good at providing an emergent narrative environment, as their usual lack of a storyline, focusing instead on sandbox play with AIs', and their overall abstraction of details, focusing instead on overall events represented through game mechanics and states are key ingredients for emergent play, as defined in Section 1.

Among Grand Strategy games, the one which stood out to us the most was Crusader Kings 2 [3](previously described in chapter 2), due to its documented success in generating interesting stories through player interaction [5], its inherent complexity, and above all its ability to be "Modded" (the possibility of a game to be modified by its players. A good number of moddable games provide tools for modding, such as Crusader Kings 2).

Due to these elements, we decided to choose Crusader Kings 2 as the base system where we can build our scenarios for testing. As previously described, Crusader Kings 2 is an extremely complex game, which draws a small niche audience. We see this as beneficial to our efforts in two ways

- Due to it's inherent complexity, we can focus on removing some of it instead of adding complexity, which would a be a more arduous task to accomplish without compromising the base design of the game.
- And due to it's niche audience we can be confident that most, if not all, of our potential test vounteers will not have previous experience with the base game, thus ensuring that all our test session players have an equal understanding of the game systems.

With our base framework chosen, we will start by defining our test scenario design and it's implementation within Crusader Kings 2, which will be the topic of the next subsection.

[1] Grand Strategy Games, *http://en.wikipedia.org/wiki/Grand_strategy_wargame*
[2] Civilization Series, *by Firaxis Games, http://en.wikipedia.org/wiki/Civilization_series*
[3] Crusader Kings 2, *by Paradox Interactive 2012 http://www.crusaderkings.com/*

3.2 Scenario Design

In the base game of Crusader Kings 2, the player is presented with an extensive and detailed map of the entirety of Europe as well a western Asia and northern Africa, where he is free to choose his starting point, as any Count, Duke, King, Emperor, Caliph, etc... that lived in any period from the 800s to the 1500s.

During gameplay all these characters interact amongst themselves and have differing goals, and differing actions that can completely change the landscape and events during the game. While this is an impressive system teeming with possibilities, it would be a nightmare for user testing, as it would be extremely difficult to have any kind of insurance that all players would start in equal circumstances, with equal choices and an equal chance at victory.

As such, we felt we needed to depart from the scenario presented in the base game, and implement our own scenario, where we could handcraft all characters and their motivations, potential events, actions that can be undertaken by the player as well as ensuring that all would start with the same character, in the same year with the same goal. It would also allow us to remove some components of the base game, that would not be relevant for a reasonably long test session, such as the technology system, the construction system and the religious system.

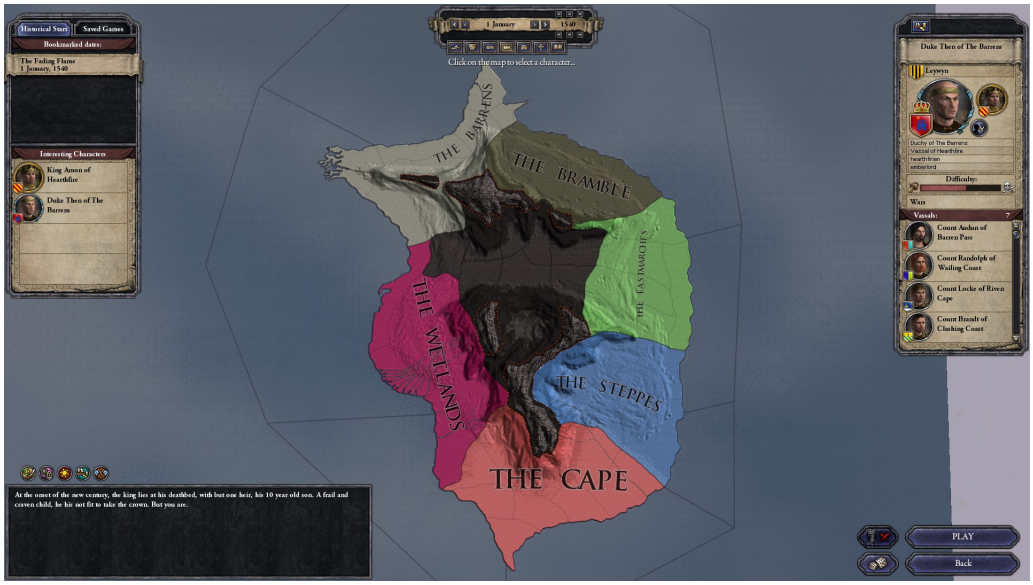

Figure 3.1: Kingdom of Hearthfire, the scenario for testing our hipothesis.

In the base game of Crusader Kings 2, these systems are long time goals that have to be manipulated over a span of hours to be of any use. As such, they would mostly be clutter for a contained and (relatively speaking) short test session, that wouldn't be able to rip any benefits of their use, and potentially waste time that the player could using to manipulate more relevant mechanics.

For all these reasons, to accomplish this design goal, we replaced Europe, with our own island Kingdom of Heathfire (Figure 3.1). The kingdom is a much simpler use of the Crusader Kings framework, as it is self contained, with a controllable number of characters and intentions.

This section will focus on meticulously detailing our methodology in the design and implementation

of this scenario within the constraints of Crusader Kings 2. As we were set on building a scenario from the ground up to guarantee the validity of our experimentation tool, we had the following main concerns:

- Overall structure of the land and character hierarchies and titles.
- Starting position and end goals for the player.
- Potential high-level strategies that can be undertaken by the player.
- Opponents and Allies.
- Side-stories and world building.

In **Overall Structure** we describe the overall design of the world, and how it was built to be easy for play testers to understand, as well as being highly informative to the players' goals and his options.

In **Player Character** we describe the creation of the player controlled character, his traits, his position in the world and his goals, as well as his possible actions.

In **Goals** we present the high level strategies we built into the scenario as possibilities for the player to achieve his goal.

In **Opponents and Allies** we talk about the creation of the computer controlled characters, their dispositions towards the players, and their own conflicting or cooperative goals in the kingdom, and how these influence the player experience and strategies.

Finally in **Side-stories and world building** we talk about the small side-stories that can happen to the player character during the course of the experiment that serve to enrich the world and empower the player with choices that can potentially ease his chances to accomplish his goals.

3.2.1 Overall Structure

In designing the scenario of the Kingdom of Hearthfire, we had, from the very beginning, the goal of making it easy to understand, and for it to be able to present a simple, direct goal for the play testers. This chosen primary goal is *Become King*. We felt this would be an easy goal to explain and to present. And from this goal, stemmed most, if not all, of our decisions in design.

As such, we set to design an island kingdom, with no other neighboring lands. If the player is to become king, the political map must reinforce this goal, and so we avoided having other kingdoms as distractions.

As there is only one kingdom, becoming King is holding the highest possible title in this world, so we decided to represent this as having a hierarchy of power with the King at the top, followed by the Dukes, each Duke lording over his Counts, and each Count holding power over cities and castles. These primary decision informed the political landscape that can be observed above, in figure 3.1.

Another major concern in the design of the land was it's uniqueness and it's identifiability. Each area of the map, and each duchy, needed to have striking names that described their territory. The purpose of this is to facilitate the first contact a player has with the scenario. In the base game, there are notifications and events that inform the player of the happening in the world, and we maintain these

systems in our scenario. However, many times, these notifications and events mention places by name, such as for example *The bishop of Westminster tried to have the mayor of Kingsbridge assassinated! My Liege how would you like to respond to this affront?*, these mentions are bit confusing when the player still doesn't have a string grasp of the names and locations of every territory in the realm and to minimize this hindrance we concern ourselves with having distinct and recognizable names that even a first time player can easily find on the map.

Having stated our primary concerns in the design of the Kingdom, we now show how we accomplished our goals in it's implementation. The land is composed of seven major duchies, each duchy holding an average of 6 counties, the major duchies are as follows:

- Duchy of The Hearth. This is the center of power, the duchy controlled by the King. This duchy is localed in the bed of an inactive volcano, and as such it is called the Hearth, both to invoke the sense of it being the *heart* of the kingdom and, since it lies in a vocano, the center of *heat* for the realm (figure 3.2).

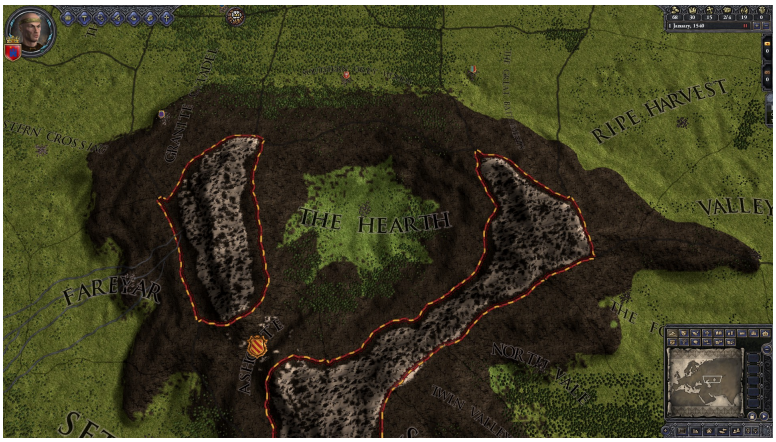

Figure 3.2: Duchy of the Hearth

- Duchy of the Barrens. The northern highlands, called the barrens to invoke the barren rock hills and plateaus that make up it's territory (figure 3.3).

Figure 3.3: Duchy of the Barrens

- Duchy of the Bramble. The entire duchy is made up of a gigantic forest. It's called the Bramble to invoke the thought of a deep forest filled with roots and brambles. (figure 3.4).

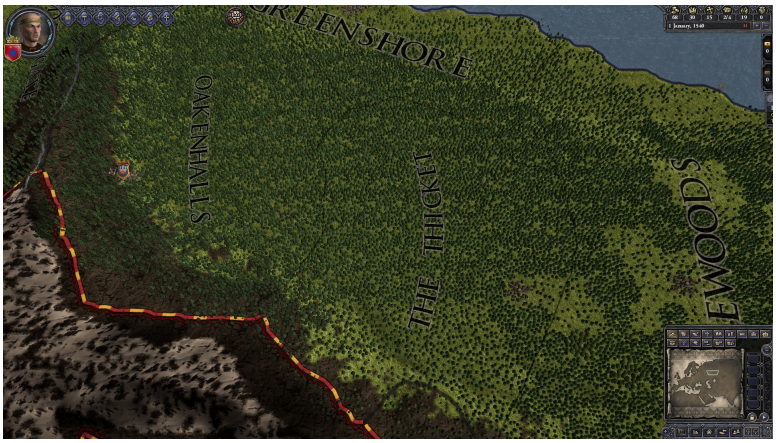

Figure 3.4: Duchy of the Bramble

- Duchy of the Eastmarches. This duchy is rich in sprawling plains. It's called the Eastmarches both by being the easternmost duchy as well as using the word *marches* to invoke the sprawling plains were one can easily march an army. (figure 3.5).

Figure 3.5: Duchy of the Eastmarches

- Duchy of the Steps, placed on an area with fertile valleys from which rivers pour into forests and grasslands. It's called the Steps to invoke the thought of stairs climbing the valley towards the central castle in this duchy. (figure 3.6).

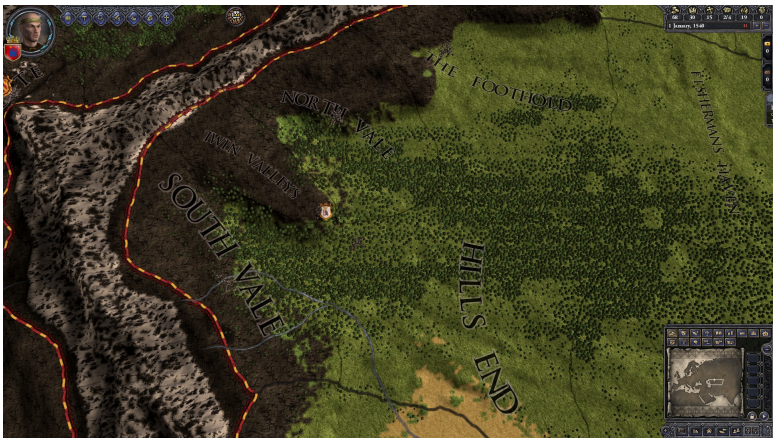

Figure 3.6: Duchy of the Steps

- Duchy of the Cape, placed on the southernmost part of the island. It's called the Cape due to it consisting mostly of a vast promontory that forms the cape at the south of the land. (figure 3.7).

Figure 3.7: Duchy of the Cape

- Finally, the Duchy of the Wetlands, placed on a great river delta. It's called the wetlands to invoke the thought of rivers and swamps that make up the composition of this duchy due to the rivers that cross it.(figure 3.8).

Figure 3.8: Duchy of the Wetlands

Implementation of this land in Crusader Kings is done by creating a set of bitmaps to define the land and territories, as well as writing a variety of scripts to assign each territory to a specific color in the bitmap file. The game requires a province bitmap, to define borders and territories. A tree bitmap to place all the trees on the map. A Terrain bitmap, to define what kinds of terrain can be found (which affects troop movement). A Rivers bitmap, defining all the rivers and crossings. And a Height map, to model the map with mountains, hills and valleys. Bellow we present some examples of the work we've done to define the land.

Figure 3.9: Map of all the provinces defined for our scenario. Each province required a different RGB value. This value identifies the province and connects the script definition to the actual place on the map.

Duchy of the Cape	1	255	51	51	Sandperch	Hearthfire	The Cape	hearthfirian	emberlord	3	Sandperch Castle (B)
	2	255	91	51	Calmwaters	Hearthfire	The Cape	hearthfirian	emberlord	2	Calcastle (B)
	3	116	28	51	Vineyard	Hearthfire	The Cape	hearthfirian	emberlord	2	Vinefort (B)
	4	255	215	51	Sunmeadows	Hearthfire	The Cape	hearthfirian	emberlord	2	Sun Bailey (B)
	5	65	0	0	Midland	Hearthfire	The Cape	hearthfirian	emberlord	2	Rurefort (B)
	6	255	133	28	Valewash	Hearthfire	The Cape	hearthfirian	emberlord	2	Crossing Keep (B)
	7	198	170	0	Hillrise	Hearthfire	The Cape	hearthfirian	emberlord	2	Nargothrond (B)
	8	255	153	51	Waveclash	Hearthfire	The Cape	hearthfirian	emberlord	2	Sandcastle (B)
	9	184	139	0	Sliver	Hearthfire	The Cape	hearthfirian	emberlord	2	Sliver Tower (B)
Duchy of the Wetland	**10**	220	80	210	Cove Coast	Hearthfire	The Wetlands	hearthfirian	emberlord	2	Cove Fortifications (B)
	11	255	136	164	Ford of the Hearthwash	Hearthfire	The Wetlands	hearthfirian	emberlord	2	Waterways Castle (B)
	12	168	0	211	Hook Coast	Hearthfire	The Wetlands	hearthfirian	emberlord	3	Claw (B)
	13	215	130	211	Sethland	Hearthfire	The Wetlands	hearthfirian	emberlord	2	Watchtower Fort (B)
	14	168	128	211	Fareyar	Hearthfire	The Wetlands	hearthfirian	emberlord	2	Breza Keep (B)
	15	213	128	211	Shieldplains	Hearthfire	The Wetlands	hearthfirian	emberlord	2	The Bastion (B)
	16	65	0	82	Western Crossing	Hearthfire	The Wetlands	hearthfirian	emberlord	2	Pathfort (B)
Duchy of the Barrens	17	184	218	184	Barren Pass	Hearthfire	The Barrens	hearthfirian	emberlord	2	Frostgate (B)
	18	238	218	255	Wailing Coast	Hearthfire	The Barrens	hearthfirian	emberlord	2	Lightkeep (B)
	19	184	255	204	Riven Cape	Hearthfire	The Barrens	hearthfirian	emberlord	2	Fjord's End (B)
	20	122	255	255	Promontory Rock	Hearthfire	The Barrens	hearthfirian	emberlord	2	The White Citadel (B)

Figure 3.10: Excerpt of a the spreadsheet defining the territories in relation to the provincial map. note how each territory has an RGB value to connect it to the map above. In here we also define hierarchies among the lands, and what kind of settlements they contain. This spreadsheet is then compiled into a variety of different script files that are read by Crusader Kings 2 on startup

3.2.2 Player Character

Among the created lands and characters, we needed to pick the right one to be the player controlled character. It needed to be a character that had a chance at the throne, and had enough power to make this a feasible goal in the duration of a test session. It was clear that the character needed to be one of the Dukes. As such, we chose to give the player character the title of Duke of the Barrens Duchy. The player character was created as such, and named Then Leywyn (figure 3.11) .

Figure 3.11: Player character Then Leywin, Duke of the Barrens

Within the framework of Crusader Kings 2, all character are defined by their adptitude at 5 base abilities (Diplomacy, Martial, Stewardship, Intrigue and Learning) and character traits which influence what tasks the character is good at. For starters, we gave Duke Then a set of base ability points to reinforce the kinds of actions that could most help him gain the throne. As seen in figure 3.12, we

focused on giving him a greater Martial ability, that enhances his ability at leading armies in battle, and Intrigue, which improves his ability to succeed in plots against other characters, such as sneaky assassinations and falsification of claims to titles.

Figure 3.12: Ability distribution for Duke Then

To define the player character and give him the tools needed for his goals while also to defining what kind of man he is, hinting at what kind of actions he would take, we chose a set of character traits we felt could represent a ruthless duke who desires the throne and is willing to do anything for it:

Figure 3.13: Traits for Duke Then

- **Proud**, which gives him a bonus to all actions, as he his proud in his successes.
- **Cynical**, which gives him a bonus in Intrigue, and paints a character who would be unhappy with the current ruler.
- **Ambitious**, which gives him a bonus to all attributes, and presents a character that wishes to rise up in life.
- And finally, **Cruel**, which improves Intrigue, and makes the duke seem like the ruthless character we wish him to be, as we want the players to feel like their characters would be willing to commit murder to achieve their goals.

We also wanted to give the player some diplomatic tools. In Crusader Kings, as it takes place in the middle ages, diplomacy is mostly achieved by carefully arranged marriages. To give the player some, but not too many, options we start the game with Duke Then already having two daughters and a son (figure 3.14), which he can marry to the offprisng of other characters to obtain a diplomatic bond.

Figure 3.14: Children of Duke Then

Defining characters in Crusader Kings 2 is a task done by writing scripts within .xml like files, which are interpreted by the game. We use these scripts to define a big part of what makes this mod work, such as characters, lands and titles, dynasties and even character events that occur during gameplay. To exemplify the use of these scripts this, here is the character script that defines the basis for the main character:

```
2={
name=Then
dynasty=2
dna=chbfh0k0fe0
properties=0000h0
martial=9 diplomacy=7 intrigue=8 stewardship=5 learning=6
religion=emberlord culture=hearthfirian
father = 220
mother = 221
add_trait=proud add_trait=cynical add_trait=ambitious
1508.2.12={ birth=yes }
1527.11.4={ add_spouse=211 }
1560.9.20={ death=yes }
}
```

In this script we define his name, and the ID of his dynasty (defined in another file, similar to this), we also define his basic stats at birth, as well as his traits, mother and father (both in character IDs, defined elsewhere), and we also model his life events, such as

```
"1527.11.4=\{ add_spouse=211\ }"
```

meaning he married on the 4th of November of 1527.

3.2.3 Goals

As previously stated, we wanted the main goal of the player during the test session to be *Becoming King*. To give him this goal, and a strict time limit to achieve it, we defined the King as very ill and unable to properly rule. In five in-game years, the King dies, and by that point, the player must have a grasp on the throne, otherwise he fails. To achieve this, we enable the player to engage in a number of possibilities, either sticking to one or pursuing multiple at the same time. All these possibilities were built to make sense for the character given to the player, described in the previous section. The X high level strategies that we allow the player to pursue, in 5 years, to claim the throne are as follows:

- **Marriage**, where the player can attempt to marry his heir to the heir of the kingdom.
- **Fabricating a Claim**, where the player seeks to fabricate documents that state he his a rightful heir to the throne, allowing him to send an ultimatum demanding the throne.

- **Assassination**, where the player can attempt to assassinate the Kings' heirs, thus inheriting the throne upon the Kings' death, as Duke Then is the Duke that holds the greatest amount of counties in the kingdom.
- **Independence**, where the player declares an Independence war, to try and make the Duchy of the Barrens its own kingdom, effectively becoming King.
- And finally **Conquest**, where the player attempts to take over, and control enough of the other Duchies to the point where he holds more land than the King, and can effectively demand himself crowned.

As can be infered, some of these strategies are easier, and more likely to produce results than others. For instance, the King won't in his right mind accept a marriage that remove the throne from his lineage, unless he is convinced or forced to such. On the other hand, some strategies go hand in hand, and multiple can be pursued to increase the chances of success for the players. It's up to the then what they desire to do. With this, we keep the core design of the game, in allowing the player to chart his own course, using the mechanics presented to him.

Each of these goals and strategies have their own sub-steps within the structure of the game, and aren't simply a choice in a dialogue. Each requires manipulating the relevant systems in the game, and making small decisions within them. For example, to accomplish an assassination, the player has two choices, either he can work to obtain money (by taxing his counts and subjects, institute tax collectors to roam his fiefs, etc...) and simply purchase the services of an assassin, who has a fixed chance at success (that can be increased by other means), or, he can start an assassination plot, and try to bribe and convince people in the targets court to help him, by gaining support, he can then attempt the assassination that translates into events with decisions where the player muts chose a strategy that can succeed and fail in a variety of ways. To describe the remaining sub-steps for all the high level strategies would be too pedantic for the purpose of this document, and so we leave this one as an example of the interactions the player must go through to achieve any of his goals.

3.2.4 Opponents and Allies

Besides the player character and the King, we also needed to build the remaining characters to populate all of the created duchies, counties and cities. These were also to be the characters the player could and should interact with to further his goals. The remaining characters were built with their own character abilities and traits, to both create a suggestion of a personality and demeanor and also to influence the AI system that runs the Crusader Kings 2 system. Unfortunately this system is not open to modding, so the only ways we could influence the behavior of the AI characters was through the manipulation of their statistics and ambitions.

Without a doubt the most important characters to build and have acting according to what we expected from them were the other major Dukes, and the King himself. We follow with a brief description of our goals for each character, and what we built them to be:

- **King Amon Blackwood**, with Amon we wanted to build a fallen king, who was once great and honorable, but was now struck down with disease and unable to rule effectively. To achieve this, we gave him the traits like *Genious*, *Honourable* and *Tough Soldier*, but also *Sickly*, *Ill* and *Wroth*. These traits slightly contradict themselves and sometimes make the king act irrationally, such as inviting someone with the*honorable* trait to court, and rapidly kicking him out in a fit of rage.

- **Duke Cael Earnor** of the Bramble, with this character we wanted to build a likely ally for the player. He shares traits with the main character, such as *Cynical* and *Proud*, but apart from that, there is already a light familial bond, as Duke Cael is a distant cousin of the main character.

- **Duke Jon Hewett** of the Eastmarches, is a potential, and probable enemy for the main character as he is his polar opposite. Duke Jon is *Loyal*, *Trusting* but also a *Brilliant Strategist*. He is most likely to defend the king against the main character, either by uncovering plots, or by leading troops in war.

- **Duke Dayne Narroway** of the Steps is by far the most capable Duke in the realm. He is a *Schemer*, *Patient*, *Attractive* and also *Paranoid*. He doesn't hold any strong opinion for or against the main character, but is very likely to be plotting to become king himself...

- **Duke Tristan Santagar** of the Cape is a flamboyant man, given to the arts and to love. He is an *Hedonist* and a *Poet* but is also *Gluttonous*. He has 5 children so it should be easy to form a an alliance with him, however it might prove difficult to convince him to plot alongside the main character, as there is much in life to distract him.

- Finally **Duke Edward Mermill** of the Wetlands is a paranoid schemer, whose daughter is the current queen. He is an *Elusive Shadow* (a master at intrigue) and of course *Paranoid* he will do his best to defend his daughter, the King, and his grandchildren from assassination plots and other grim schemes, should the player attempt them.

Apart from the dukes, the counts of each duchy were also built, but not to such a big detail. In each duchy there will be partially randomly generated counts. What is always ensured is that there will be infighting amongst each realm that will demand the attention of the respective duke. This will also be a concern for the main character, as he will have to deal with the issues of his vassal lords. Similarly to the main character, all of these dukes and their vassals were defined using character scripts within Crusader Kings 2. These scripts define their personalities as stated above.

3.2.5 Side-stories and world building

Apart from setting up all the major pieces of the scenario, we also felt we could add some more flavor to the world, so we set-up a collection of randomly occurring small story events, that present some decisions the player can take in order to flesh out his character. These side stories have very little impact on the main scenario, and the main goal but server as more of an opportunity for self-expression,

where the player can slightly alter the traits of the main character, such as losing the cynical trait, or gaining the ruthless trait.

These side-stories are presented as in-game events (figure 3.15), and can happen at any time during the 5 year period. The player is free to ignore them if he instead desires to focus on his goal and not be side tracked with the small contained stories.

Figure 3.15: Example of an in-game side-story event

The more important side-stories that we built into this scenario, are the following:

- **Meet the merry man**. Robin Hood and his merry man appear in the woods around the players domain. The player can go under cover as a civilian, joining the merry man, and going on raids with them. At any time, it's possible to throw aside the cloaks of a peasant, and imprison the merry man, gaining a popularity bonus with all of the vassals, and the *Conniving* trait. Otherwise, the player can take the event to the end, and finally reveal himself and hire the merry man to his court, giving him extra defense against intrigue and the *Mischevious* trait.

- **A strange book**. A strange book is passed onto the player from a hooded man that swiftly disappears. The player can choose to read this book of the occult, or throw it away. If he reads it, there's a chance the player will gain a boost to his diplomacy and intrigue ability points.

- **The annoying neighbour**. An annoying neighbor from the hill tribes close to the barrens keep sending couriers to the player demanding a monetary tribute. The player can send the couriers away, give the tribute to the hill tribes or have the courier killed to send a message. If the Couriers are always sent away, the neighbor will eventually stop. If the couriers are killed, there's a chance

the hill tribes will declare war, and start raiding the players lands. If the tribute is given a couple of times, the player will eventually have the support of the hill tribes, giving him a bit more troops should he go to war.

- **Infighting Counts**. The counts under the Barrens will be constantly struggling for power, namely towards being members of the players council (figure 3.15). often they will demand to be made councilor as they see themselves better than the count currently holding the position. The player must manage carefully who he promotes and who he fires, risking to evoke the ire of a particularly strong count.
- **Rebellion**. If a player manages to sufficiently offend one of his counts, or if one of them sees weakness in the player, or is ambitious, they might start plotting a coup. Upon discovering about it the player can try to seize the count as prisoner. However thing may not go as planned and a civil war can break out.

To exemplify how we scripted these events, we present here an excerpt of the Merry Man event, the first time it shows up:

```
#Meet the Merry Men
narrative_event = {
id = 10030
title = "EVTNAME10030"
desc = "EVTDESC10030"
picture = GFX_evt_bandits

is_triggered_only = yes

option = {
name = "EVTOPTA10030"
narrative_event = { #S.F.T.R.G.T.T.P
id = 10031
days = 5
random = 10
tooltip = "EVTTOOLTIP10031"
}
}

option = {
name = "EVTOPTB10030"
narrative_event = { #Adventure!
id = 10032
days = 5
```

```
random = 10
tooltip = "EVTTOOLTIP10032"
}
}

option = {
name = "EVTOPTC10030"
any_courtier = {
limit = {
NOT = {
trait = honest
}
}
opinion = {
modifier = clever_deceive
who = ROOT
years = 2
}
}
narrative_event = { #Arrest leader
id = 10040
days = 5
random = 10
tooltip = "EVTTOOLTIP10040"
}
}


option = {
name = "EVTOPTD10026"
scaled_wealth = -0.02
clr_character_flag = lure_robin
clr_character_flag = ignore_robin
clr_character_flag = do_something
clr_character_flag = robin_hood
add_character_modifier = {
name = modifier_outfoxed
duration = 1825
}
```

```
random_demesne_province = {
limit = {
NOT = { has_province_modifier = highway_robber_band }
}
province_event = {
id = 68030
days = 2
random = 10
tooltip = "EVTTOOLTIP68030"
}
}
}
}
```

Apart from these bigger stories, smaller events can also happen at any time. Like a count asking for an honorary title, to one of the players' kids needing education, or even the players wife being pregnant and birthing a new heir. These events were mostly re-purposed from the base game.

3.3 Complexity modification

After the main scenario was built and sufficiently stable, we set ourselves to build a second scenario, with a differing level of complexity, in order to do our comparative study of it's effects on the player experience. In this section we will describe how we defined the component of complexity we wished to modify, and how we implemented this change withing the scenario and world we built.

In order to explain how we modified the complexity of our scenario, we must first state what we understand as complexity. This work focuses only on the effects of a specific type of change in complexity. Many more could be explored, but they are outside of our scope and must remain as suggestions for future work. In defining complexity in our scenario, the first values we look towards were the number of options and strategies a player could follow at any given time. This however did not reveal itself as an ideal change, as limiting the player to a smaller subset of options could potentially damage the core design of the game, and sap it of it's potential to generate emergent narratives.

As such, we instead turned towards the concept of complexity of execution. As stated above, each strategy demands of the player the execution of a number of sub-steps, which usually involves manipulating sub-systems present in the framework of Crusader Kings 2. Our goal was to simplify these sub-steps, while maintaining the overall breatdh of goals that can be achieved by the payer. In this way, we hopefully simplify the game, without compromising it's core ideals.

To achieve this goal, we designed The Deputy.

3.3.1 The Deputy

The players Deputy is a character he can consult at any time, and talk about all the main strategic goals available to him. The deputy not only gives the player some council on his option, but more than than, takes actions on his behalf. We use this plot device to justify the simplification of tasks that would otherwise be the players responsibility. The deputy did it.

Figure 3.16: Starting dialogue when the player consults his deputy

To briefly describe the actions that can be taken upon by the Deputy, in relation to the goals presented in the previous section:

- **Marriage**. The deputy can help the player find his most likely allies, and suggests two potential marriages between to other houses who are most likely to align with the player. If not for this, the player would need to investigate all of the dukes, their traits, and family trees, to come to the informed decision that the deputy can give him right away, thus simplifying the investigation process that many times is crucial to success in Crusader Kings 2.
- **Fabricating a Claim**. In Fabricating a claim, the Deputy will work towards having the falsified documents for the player to press a false claim on the throne. If not for the deputy, the player would

have to manipulate his Chancellor or deal with a plot, and all the intricacies of that subsystem to ever have a chance at obtained the documents he needed.

- **Assassination**. The deputy can also help with the assassination strategy, by simplifying the process of conducting one. The player can imediatly ask him to attempta double assassination of both of the kings daughters (figure 3.17), however this does have a monetary cost. The deputy presents three potential assassins for hire, and the player must hedge his bets on who to hire. This greatly simplifyies the assassination process, where the player would either have to manage plots, or singularly assassinate each one of the heirs.

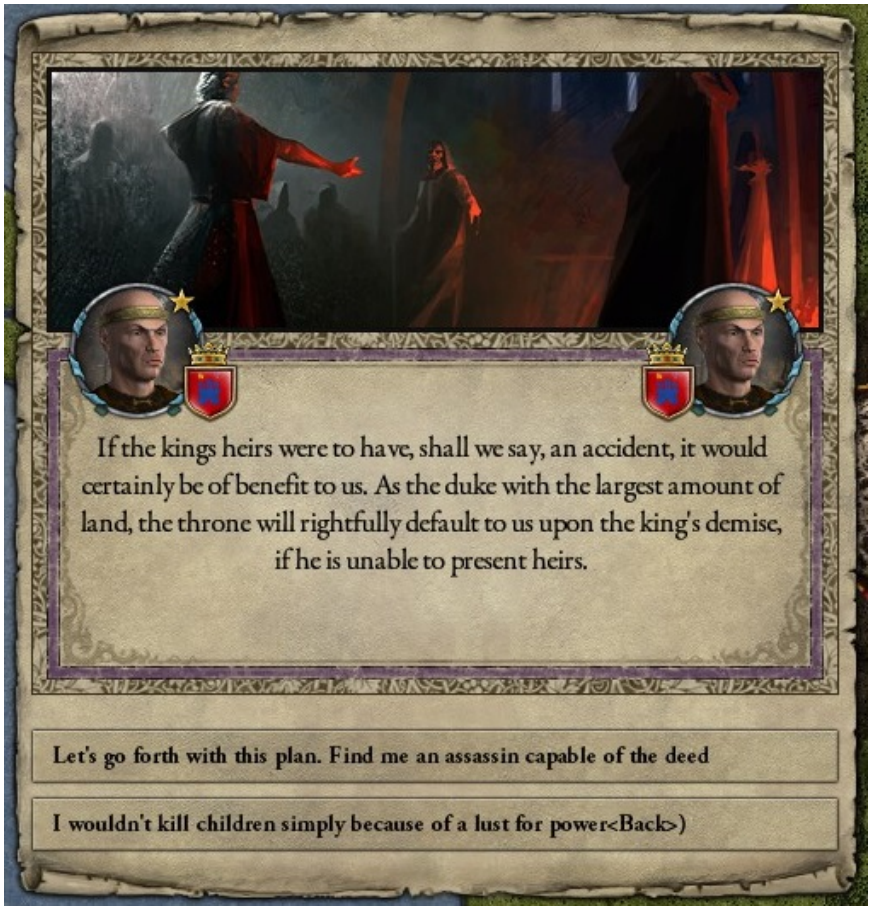

Figure 3.17: Asking the deputy about assassinating the Kings Heirs

- **Independence**. The Deputy warns the player about all the consequences of this move, and both encourages the player to find alliances through marriage (redirecting to the marriage dialog line), or to try and recruit the hill tribes of the Barrens. If the player decides he wants the hill tribes, the deputy will take upon himself to find these mercenary bands, liberating the player from having to manage the military system, and worrying about upkeeps, resources and army composition.

- And finally **Elective Succession**. Which involves the changing of the law. In here, the deputy simple discourages the player from even attempting it, as changing the law requires great effort with little realistic guarantee of success.

As stated the deputy was fully modelled inside the event system of the game, as such, as example of the scripts that model the Deputy interactions is as follows:

```
##Deputy Events
character_event = {
id = legacyoffire.3
desc = DEPUTY_MENU_ROOT
picture = "GFX_evt_shadow"

is_triggered_only = yes

option = {
name = "Marriage"
character_event = { id = legacyoffire.10 days = 0 }
}
option = {
name = "Independence"
character_event = { id = legacyoffire.20 days = 0 }
}
option = {
name = "Fabricating a claim"
character_event = { id = legacyoffire.30 days = 0 }
}
option = {
name = "More options..."
character_event = { id = legacyoffire.4 days = 0 }
}
}
character_event = {
id = legacyoffire.4
desc = DEPUTY_MENU_ROOT
picture = "GFX_evt_shadow"

is_triggered_only = yes

option = {
name = "Elective Succession"
character_event = { id = legacyoffire.40 days = 0 }
}
option = {
```

```
name = "Selective Assassination"
character_event = { id = legacyoffire.50 days = 0 }
}
option = {
name = " (<Close>) Nevermind..."
}
option = {
name = "<Go Back>"
character_event = { id = legacyoffire.3 days = 0 }
}
}
```

With this Deputy built into the events system of the game, we felt confident we had a simpler version of our main scenario, while also retaining the essence of the scenario between the two versions.

3.4 Testing methodology and data collection

Having described the construction of both of the testing scenarios above, we now show how we prepared the test sessions, our methodology in running them, and the data collection that took place both at their start and end. The methodology remains the same regardless if the tester is engaging with the more complex version, or the simpler one.

Demographic Test

First off, after greeting the play testers, we presented them with a demographic test, to better categorize the results of their experiments afterwards. This is a very small set of questions, consisting of age, sex and their experience in playing videogames, this questionnaire takes about 1-2 minutes to fill out. The full questionnaire can be found in annex A.

Explaining Crusader Kings 2

Afterwards, we engaged the volunteers to know if they have previous experience with Crusader Kings 2. In case they didn't, we explain the basis of the game, already inside the scenario built for the purpose of the test. We explain all the basic subsystems that are relevant (such as plots, military, etc...) and present the player to the main character, his territory, his subjects and more importantly, their goal in this demo, as well as their time limits to achieve it. We take great care not to influence the player towards any one option in the scenario, as well as not betraying any more details that could give them an advantage over other testers. In case the player is playing the simple version of the scenario, we also explain he can consult his deputy, and show him how to do it. Explaining the entirety of the scenario takes about 5-8 minutes, depending if the volunteer desires to ask questions.

Test session

When all is explained, the tester is ready to pick up the game himself and get into the experience. During this period, we carefully watch his progress, taking notes of events we wish to ask the tester about in the end of the session. We do not give any hints to the tester, nor do we council him in achieving his goals, even if asked. All we respond to are purely mechanical questions, such as ”I don't remember, where is the plots menu again?”. Test sessions take between 20 - 35 minutes, depending on how long the player spends considering his options during events.

Post Test data collection

Following the play session, each subject was presented with an Intrinsic Motivation Inventory (IMI). The Intrinsic Motivation Inventory (IMI) [4] is a multidimensional measurement device intended to assess participants' subjective experience related to a target activity in laboratory experiments. It has been used in several experiments related to intrinsic motivation and self-regulation [5]. The instrument assesses participants' interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six sub-scale scores.

We use almost the entirety of the IMI questionnaire to provide us with a measurement of 5 components of their experience in the scenario they played:

- Interest.
- Perceived competence.
- Sense of agency.
- Tension felt.
- And effort put into succeeding.

We omit the value/usefulness component as we didn't not felt it relevant to the validation of our hipothesis, nor did we feel it was appropriate in the context of this study.

We setup all of the question of the IMI, slightly altered to be more closely related to this scenario, as is suggested in the IMI documentation, and we then shuffled the questions for each participant, so as to not have all questions of a given component all together.

Joined with the IMI questionnaire, we also ask the player to write a small paragraph containing his description of his strategy and what happened when he attempted to execute it. We use this to discuss with the player after the questionnaire is over, and also to also gain an understanding of what elements of the scenario stuck to the testers memory during the session. The full questionnaire presented to the players can be found in annex B.

Discussion

After the session is over, we engaged in a small discussion with the volunteer, questioning him about the notes we took in order to clarify some of the decisions he made during his playthrough. In many

[4] Intrinsic Motivation Inventory, *http://www.allaboutux.org/intrinsic-motivation-inventory-imi*

[5] Ryan, 1982. Ryan, Mims Koestner, 1983. Plant Ryan, 1985. Ryan, Connell, Plant, 1990. Ryan, Koestner Deci, 1991. Deci, Eghrari, Patrick, Leone, 1994

cases, volunteers were also curious to know the purpose of the test and what we aimed to achieve with it. After this discussion, the volunteers are thanked for their contribution, and the test session ends.

3.5 Solution summary

Our methodology was extensively described in this chapter to give a good grasp of the work developed and to clarify how we prepared both the scenario as well as the processes to correctly collect all the necessary data for the analysis of our hypotheses.

We describe the design and construction of the testing scenarios, going into the main details and concerns that we had in it's implementation. We talked about our strategy to build a modified scenario with modified complexity, and how we understand this complexity. And finally we presented our testing methodology and how we conducted our experiments with volunteers.

Obtained data and results from the experiment, as well as further analysis that helps improve our methodology is depicted in the next chapter.

Chapter 4

Results

In previous sections we described how we built our scenarios and our experimental process to acquire user data by running experiments using the two versions with differing complexity. In this chapter we present the data acquired and the statistical analysis that were made in order to try and discover any correlation between the complexity level and the user experience. We also comment on the obtained data and attempt to draw conclusions and justifications for the results obtained

Sample Population.

Our experiment collected data from thirty individuals, mainly between 20 and 30 years old, averaging on 2.80 interval (With 2 as the interval between 19-23 and 3 being 24-35) and a std. deviation of .805 (figure 4.2). Most of these people were *gamers* (figure 4.3 and 4.4) and had some experience with strategy games, but none of them had ever played Crusader Kings 2. Of these individuals, 5 were women (figure 4.1). 16 of the volunteers played the most complex version, and the other 14 engaged with the simplified scenario(figure 4.5) .

The demographic information was acquired using the questionnaire in annex A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	5	16.7	16.7	16.7
	Male	25	83.3	83.3	100.0
	Total	30	100.0	100.0	

Figure 4.1: Male-female frequencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-23	11	36.7	36.7	36.7
	24-35	16	53.3	53.3	90.0
	36-50	1	3.3	3.3	93.3
	Above 50	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

Figure 4.2: Sample age distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	casual	3	10.0	10.0	10.0
	...	1	3.3	3.3	13.3
	midcore	7	23.3	23.3	36.7
	...	12	40.0	40.0	76.7
	enthusiast	7	23.3	23.3	100.0
	Total	30	100.0	100.0	

Figure 4.3: Casual or Enthusiast gamer distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I don't usually play games	4	13.3	13.3	13.3
	1-5 hours	4	13.3	13.3	26.7
	6-10 hours	10	33.3	33.3	60.0
	11-20 hours	7	23.3	23.3	83.3
	20+ hours	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Figure 4.4: Hours playing video games per week

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hard	16	53.3	53.3	53.3
	Easy	14	46.7	46.7	100.0
	Total	30	100.0	100.0	

Figure 4.5: Distribution of samples by the scenario variant played. Hard meaning the most complex, and easy the simplified scenario.

4.1 Experimental results

Having conducted our experiment, we used the data collected to evaluate the potential effects of complexity in player experience. In this section we will show our results regarding each of the tested dimensions, Interest, Perceived Competence, Agency, Tension, and Effort. We will also explore the shown

connections, as well as comment on their significance. We will also endeavour to explain how this data could have been influenced by the sample we collected from.

As described by the IMI, all these questions use a scale of 1 to 7, from *1 - not at all true*, to *7 - very true*.

4.1.1 Interest

Firstly we look at interest. In this category, the IMI questions presented to the player were:

- **I1** - Plotting to achieve my goal was fun to do.
- **I2** - I enjoyed plotting to achieve my goal.
- **I3** - I thought playing this scenario was quite enjoyable.
- **I4** - This scenario did not hold my attention at all.
- **I5** - While I was playing the scenario, I was thinking about how much I enjoyed it.
- **I6** - I would describe playing this scenario as very interesting.
- **I7** - I thought playing this scenario was boring.

After running a Cronbach-alpha validity test, we reach an alpha value of 0.805, which is a good value indicanting that all questions are relativetly valid, meaning we can use their total value as is.

In these questions, we observe that, generally speaking, our test sample were interested in playing the scenarios and were not overly bored, as all means for positive questions aproach 5, and 2/3 for negatives, as can be seen in figure 4.7.

This data helps to ensure us that the demo engaged the players, and as thus, we can assume that these volunteers were not overly bored, or disconnected from the experiment, which raises our confidence towards the collected data.

By running an indenpendent sample non-parametric *Mann-Whitney U* test with the *variant played* variable as the control group, we can observe that apart from the first question, all the others dont show sufficient variation between the two variants to support a potential coorelation between complexity and Interest.

	Variant Played:	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Plotting to achieve my goal was fun to do.	Hard	.218	16	.041	.898	16	.073
	Easy	.292	14	.002	.801	14	.005
I enjoyed plotting to achieve my goal.	Hard	.197	16	.098	.870	16	.027
	Easy	.290	14	.002	.794	14	.004
I thought playing this scenario was quite enjoyable.	Hard	.197	16	.096	.880	16	.039
	Easy	.248	14	.020	.892	14	.087
This scenario did not hold my attention at all.	Hard	.239	16	.015	.869	16	.026
	Easy	.290	14	.002	.794	14	.004
While I was playing the scenario, I was thinking about how much I enjoyed it.	Hard	.243	16	.012	.804	16	.003
	Easy	.179	14	.200*	.867	14	.038
I would describe playing this scenario as very interesting.	Hard	.240	16	.014	.884	16	.044
	Easy	.233	14	.037	.865	14	.036
I thought playing this scenario was boring.	Hard	.254	16	.007	.884	16	.046
	Easy	.284	14	.003	.781	14	.003

Figure 4.6: Interest dimension - Normality Tests

	N	Minimum	Maximum	Mean	Std. Deviation
Plotting to achieve my goal was fun to do.	30	3	7	4.77	1.040
I enjoyed plotting to achieve my goal.	30	3	6	4.97	1.033
I thought playing this scenario was quite enjoyable.	30	2	6	4.57	1.073
This scenario did not hold my attention at all.	30	1	5	2.53	1.042
While I was playing the scenario, I was thinking about how much I enjoyed it.	30	1	5	2.43	1.455
I would describe playing this scenario as very interesting.	30	2	7	4.83	1.177
I thought playing this scenario was boring.	30	1	6	2.50	1.253
Valid N (listwise)	30				

Figure 4.7: Interest dimension - Descriptive Statistics

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Plotting to achieve my goal was fun to do. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.043[1]	Reject the null hypothesis.
2	The distribution of I enjoyed plotting to achieve my goal. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.240[1]	Retain the null hypothesis.
3	The distribution of I thought playing this scenario was quite enjoyable. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
4	The distribution of This scenario did not hold my attention at all. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.257[1]	Retain the null hypothesis.
5	The distribution of While I was playing the scenario, I was thinking about how much I enjoyed it. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.355[1]	Retain the null hypothesis.
6	The distribution of I would describe playing this scenario as very interesting. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.377[1]	Retain the null hypothesis.
7	The distribution of I thought playing this scenario was boring. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.697[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Figure 4.8: Interest dimension - Non-parametric, *Mann-Whitney U* independent sample test

Looking at question **I1** (figure 4.9), we can observe that players engaging with the easy version, found more fun in the act of playing than people playing the hardest version. We can speculate that, due to the easy version providing clearer information regarding the potential strategies and goals, the players could more easily understand what they could do, while those engaging with the more complex version were less clear on what was going on.

In conclusion, we can't find hints of a correlation in interest towards playing the scenario. Regarding these results, we can observe that, while in general all tested individuals were somewhat engaged with the experiment, averaging on 4.8s on positive questions and on 2.5 on negative ones, perhaps

there wasn't enough of a gap in complexity between the versions to present any meaningful variation in interest. It's also possible that the more complex version wasn't so hard as to the point of absolutely disconnecting the player, which we can a only see as a positive outcome. Regarding the easy version, there is a very slight increase in *fun*, but nothing sufficiently substantial to suggest that this is maintained outlook.

We can also comment that, as most of the sample were familiar with strategy games, it's natural that interest tends towards positive values. Experimenting with a more diverse population might be necessary to reveal a connection in this dimension.

Plotting to achieve my goal was fun to do. * Variant Played: Crosstabulation

Count

		Variant Played:		
		Hard	Easy	Total
Plotting to achieve my goal was fun to do.	...	3	1	4
	somewhat true	6	1	7
	...	5	7	12
	...	1	5	6
	very true	1	0	1
Total		16	14	30

Figure 4.9: Interest dimension - Question 1 Frequencies

4.1.2 Perceived Competence

We now take a look at perceived competence. In this category, the IMI questions presented to the player were:

- **C1** - I was pretty skilled at plotting to achieve my objectives.
- **C2** - After playing this scenario for awhile, I felt pretty competent at it.
- **C3** - Playing this scenario was someting that I couldn't do very well.
- **C4** - I am satisfied with my performance in plotting to achieve my objectives.
- **C5** - I think I am pretty good at playing this scenario.
- **C6** - I think I did pretty well at plotting to achieve my goals.

After running a Cronbach-alpha validity test, we reach an alpha of 0.838 , which is a good value indicating that all questions are relatively valid, meaning we can use their total value.

In the feeling of competence at playing the scenarios, we observe that, in general, our test sample felt incompetent, or unable to understand the game to it's fullest, as can be seen by means approaching the value 2 (figure 4.11).

These results don't come as much of a surprise, as Crusader Kings 2 is a very complex game, unlike many on the market currently. As none of the play-testers were familiar with it, feeling less than

	Variant Played:	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
I was pretty skilled at plotting to achieve my objectives.	Hard	.220	16	.038	.819	16	.005
	Easy	.216	14	.076	.902	14	.120
After playing this scenario for awhile, I felt pretty competent at it.	Hard	.244	16	.012	.878	16	.036
	Easy	.237	14	.032	.887	14	.074
Playing this scenario was someting that I couldn't do very well.	Hard	.187	16	.137	.920	16	.171
	Easy	.237	14	.031	.879	14	.056
I am satisfied with my performance in plotting to achieve my objectives.	Hard	.257	16	.006	.822	16	.005
	Easy	.187	14	.197	.928	14	.288
I think I am pretty good at playing this scenario.	Hard	.296	16	.001	.770	16	.001
	Easy	.210	14	.096	.895	14	.096
I think I did pretty well at plotting to achieve my goals	Hard	.249	16	.009	.809	16	.004
	Easy	.157	14	.200*	.914	14	.177

Figure 4.10: Perceived Competence dimension - Normality Tests

	N	Minimum	Maximum	Mean	Std. Deviation
I was pretty skilled at plotting to achieve my objectives.	30	1	5	2.17	.986
After playing this scenario for awhile, I felt pretty competent at it.	30	1	5	2.60	1.133
Playing this scenario was someting that I couldn't do very well.	30	2	7	5.40	1.303
I am satisfied with my performance in plotting to achieve my objectives.	30	1	7	2.97	1.829
I think I am pretty good at playing this scenario.	30	1	4	2.30	1.149
I think I did pretty well at plotting to achieve my goals	30	1	5	2.50	1.358
Valid N (listwise)	30				

Figure 4.11: Perceived Competence dimension - Descriptive Statistics

competent on a first impact is very natural. Perhaps future tests in this regard should take longer than simply 30 minutes of engagement with the game, to allow a more smooth learning experience for the player.

By running an independent sample non-parametric *Mann-Whitney U* test with the *variant played* variable as the control group, we can observe that there is a connection in half of the questions **C2, C4, C6**, some with a very high degree of certainty. With this result, we can say with some certainty that there are hints of a correlation between complexity and perceived competence, as would be natural to assume.

Looking in more detail at questions **C2, C4, C6**, (figures 4.13,4.14,4.15), we can very clearly see that players playing the easiest version found themselves feeling more competent at it. As with the interest dimension, we can speculate that, due to the easy version providing clearer information regarding the potential strategies and goals, those players could more easily understand what they could do, and thus, they understood better how to achieve their goals, and potentially, why they achieved and failed at them.

In conclusion, there are hints of a connection between perceived competence and complexity in our scenarios, and that players engaging with the easier version found themselves more competent at it. These results were to be expected, players should feel more competent when playing the easier version, and the opposite on the hardest version. This data suggests that our scenarios, and the complexity variation between them, were correctly implemented, a conclusion that is compounded by the fact that all of these are independent samples, meaning that a single subject engaged with only one of the versions of the experiment.

4.1.3 Sense of Agency

We now take a look at sense of agency felt while playing. In this category, the IMI questions presented to the player were:

- **A1** - I felt like I only had one option.
- **A2** - I believe I had some choice in how I attempted to fulfil my goals.
- **A3** - Reflecting upon the outcome of my strategy, I appreciate my choice and feel that out of the all the paths I could have taken, this one was the best.
- **A4** - I didn't really have a choice in defining my strategy.
- **A5** - Reflecting upon the outcome of my strategy, I don't feel like I truly had any other options.
- **A6** - Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better.
- **A7** - I executed my strategy because I wanted to.
- **A8** - I felt like the path I took in this scenario was not my own choice.
- **A9** - I executed my strategy because I felt I had no other choice.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of I was pretty skilled at plotting to achieve my objectives. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.294[1]	Retain the null hypothesis.
2	The distribution of After playing this scenario for awhile, I felt pretty competent at it. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.015[1]	Reject the null hypothesis.
3	The distribution of Playing this scenario was someting that I couldn't do very well. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.918[1]	Retain the null hypothesis.
4	The distribution of I am satisfied with my performance in plotting to achieve my objectives. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.002[1]	Reject the null hypothesis.
5	The distribution of I think I am pretty good at playing this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.120[1]	Retain the null hypothesis.
6	The distribution of I think I did pretty well at plotting to achieve my goals is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.019[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Figure 4.12: Perceived Competence dimension - Non-parametric, *Mann-Whitney U* independent sample test

After playing this scenario for awhile, I felt pretty competent at it. * Variant Played: Crosstabulation

Count

		Variant Played:		
		Hard	Easy	Total
After playing this scenario for awhile, I felt pretty competent at it.	not at all true	4	2	6
	...	7	1	8
	...	4	5	9
	somewhat true	1	5	6
	...	0	1	1
Total		16	14	30

Figure 4.13: Perceived Competence dimension - Question 2 Frequencies

I am satisfied with my performance in plotting to achieve my objectives. * Variant Played: Crosstabulation

Count

		Variant Played:		
		Hard	Easy	Total
I am satisfied with my performance in plotting to achieve my objectives.	not at all true	7	1	8
	...	4	3	7
	...	3	2	5
	somewhat true	2	1	3
	...	0	3	3
	...	0	3	3
	very true	0	1	1
Total		16	14	30

Figure 4.14: Perceived Competence dimension - Question 4 Frequencies

I think I did pretty well at plotting to achieve my goals * Variant Played: Crosstabulation

Count

		Variant Played:		
		Hard	Easy	Total
I think I did pretty well at plotting to achieve my goals	not at all true	7	2	9
	...	5	3	8
	...	2	3	5
	somewhat true	2	3	5
	...	0	3	3
Total		16	14	30

Figure 4.15: Perceived Competence dimension - Question 6 Frequencies

- **A10** - I executed my strategy because I felt it was the most promising of my options.
- **A11** - I executed my strategy because I felt it was the most appropriate for the character I was playing.

In the questions regarding agency, we observe that, in general, our test sample felt a clear sense of agency in their decisions while playing the scenarios but not an overly strong one. Results hang around 5, in 7 (figure 4.17).

We see these results as a natural outcome of our experiment, Crusader Kings 2, as been seen as a success in generating interesting stories through player interaction [5]. That said, the values of agency were not very strong. We can attribute this to our results in the competence dimension. As player felt genrally incompetent at the game, it's easy to speculate that they would easily score very high on agency, as they might not have understood their choices and consequences to their full extent.

By running an independent sample non-parametric *Mann-Whitney U* test with the *variant played* variable as the control group, we can observe that there is no connection between the sense of agency felt by players (figures 4.18 and 4.19), and the scenario complexity level. Apart from question A6, which might be more due to it's regret component rather than agency itself.

Looking in more detail at question **A6** we can observe that there's a slight tendency for players of the easy version to feel more regretful towards their chosen strategy (figure 4.20). We can perhaps attribute this to the results obtained in the competence dimension, as easy players might have understood the game better, they were more clear on the alternatives to their strategy, and as such, they would more easily understand why their choice was wrong, and what else they might have chosen.

Due to some conflicting results that were observed, we ran a cronbach alpha reliability analysis, on our responses, and we found that some questions in the Agency dimension were problematic, as we were reaching a reliability rating of 0.307, which is unacceptable. Namely, **A3** and **A6** presented the biggest problem to the reliability in this dimension, removing these we reached an acceptable alpha of 0.622 but still a low score. Furthering this pursuit, removing **A7**, **A10** and **A11** raises our alpha to 0.796 which is very much an acceptable value.

We can hipothesise that these problematic questions were not fully understood by the play testers, or not as connected to the sense of agency as the remaining ones. Hence the incoherent values. Should future work occur in this field, we suggest a validation of the questionnaires to prevent these situations. We endeavored to use IMI, a pre-validated questionnaire, but somewhere in translation some questions became a problem. Some of the problematic questions, **A10** and **A11**, were were included by us and were not in the original IMI questionaire, these inclusions would necessitate validation in relation to the remaining questions.

In conclusion, there are no hints of a connection between the feeling of agency felt and the differing complexities in our two scenarios. We can speculate that perhaps there wasn't a sufficient gap in complexity for any relevant results to surface, or perhaps our sample population was too homogeneous, and different people with different degrees of experience with games, age, and personalities could potentially present different results. No hints towards a correlation were felt with out sample, but perhaps

	Variant Played:	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
I felt like I only had one option.	Hard	.201	16	.084	.880	16	.038
	Easy	.219	14	.068	.855	14	.026
I believe I had some choice in how I attempted to fulfil my goals.	Hard	.258	16	.006	.883	16	.043
	Easy	.245	14	.022	.874	14	.048
Reflecting upon the outcome of my strategy, I appreciate my choice and feel that out of the all the paths I could have taken, this one was the best.	Hard	.239	16	.015	.888	16	.052
	Easy	.208	14	.103	.892	14	.086
I didn't really have a choice in defining my strategy.	Hard	.168	16	.200*	.943	16	.388
	Easy	.368	14	.000	.760	14	.002
Reflecting upon the outcome of my strategy, I don't feel like I truly had any other options.	Hard	.235	16	.018	.878	16	.037
	Easy	.236	14	.034	.889	14	.078
Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better.	Hard	.270	16	.003	.895	16	.068
	Easy	.308	14	.001	.790	14	.004
I executed my strategy because I wanted to.	Hard	.263	16	.004	.838	16	.009
	Easy	.359	14	.000	.750	14	.001
I felt like the path I took in this scenario was not my own choice.	Hard	.197	16	.096	.880	16	.039
	Easy	.157	14	.200*	.954	14	.626
I executed my strategy because I felt I had no other choice.	Hard	.249	16	.009	.888	16	.051
	Easy	.276	14	.005	.914	14	.180
I executed my strategy because I felt it was the most promising of my options.	Hard	.255	16	.006	.873	16	.030
	Easy	.320	14	.000	.835	14	.014
I executed my strategy because I felt it was the most appropriate for the character I was playing.	Hard	.125	16	.200*	.972	16	.872
	Easy	.267	14	.008	.866	14	.037

Figure 4.16: Agency dimension - Normality Tests

	N	Minimum	Maximum	Mean	Std. Deviation
I felt like I only had one option.	30	1	7	2.67	1.688
I believe I had some choice in how I attempted to fulfil my goals.	30	2	7	5.47	1.224
Reflecting upon the outcome of my strategy, I appreciate my choice and feel that out of the all the paths I could have taken, this one was the best.	30	1	7	3.50	1.757
I didn't really have a choice in defining my strategy.	30	1	7	3.57	1.654
Reflecting upon the outcome of my strategy, I don't feel like I truly had any other options.	30	1	7	2.87	1.358
Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better.	30	2	7	5.13	1.548
I executed my strategy because I wanted to.	30	1	7	5.20	1.157
I felt like the path I took in this scenario was not my own choice.	30	1	6	3.33	1.184
I executed my strategy because I felt I had no other choice.	30	1	7	3.23	1.478
I executed my strategy because I felt it was the most promising of my options.	30	4	7	5.73	.828
I executed my strategy because I felt it was the most appropriate for the character I was playing.	30	1	7	4.37	1.650
Valid N (listwise)	30				

Figure 4.17: Agency dimension - Descriptive Statistics

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of I felt like I only had one option. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.400 [1]	Retain the null hypothesis.
2	The distribution of I believe I had some choice in how I attempted to fulfil my goals. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.085 [1]	Retain the null hypothesis.
3	The distribution of Reflecting upon the outcome of my strategy, I appreciate my choice and feel that out of the all the paths I could have taken, this one was the best. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.294 [1]	Retain the null hypothesis.
4	The distribution of I didn't really have a choice in defining my strategy. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.423 [1]	Retain the null hypothesis.
5	The distribution of Reflecting upon the outcome of my strategy, I don't feel like I truly had any other options. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.759 [1]	Retain the null hypothesis.
6	The distribution of Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.047 [1]	Reject the null hypothesis.
7	The distribution of I executed my strategy because I wanted to. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.525 [1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Exact significance is displayed for this test.

Figure 4.18: Agency dimension - Non-parametric, *Mann-Whitney U* independent sample test, part 1

	Null Hypothesis	Test	Sig.	Decision
8	The distribution of I felt like the path I took in this scenario was not my own choice. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.822 [1]	Retain the null hypothesis.
9	The distribution of I executed my strategy because I felt I had no other choice. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.886 [1]	Retain the null hypothesis.
10	The distribution of I executed my strategy because I felt it was the most promising of my options. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.208 [1]	Retain the null hypothesis.
11	The distribution of I executed my strategy because I felt it was the most appropriate for the character I was playing. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.142 [1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Exact significance is displayed for this test.

Figure 4.19: Agency dimension - Non-parametric, *Mann-Whitney U* independent sample test, part 2

		Variant Played:		
		Hard	Easy	Total
Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better.	...	2	1	3
	...	2	1	3
	somewhat true	1	0	1
	...	6	2	8
	...	4	6	10
	very true	1	4	5
Total		16	14	30

Figure 4.20: Agency dimension - Question 6 Frequencies

wider studies must be conducted to ensure that this is in fact the case.

4.1.4 Tension Felt

Following is the tension during play felt by participants. In this category, the IMI questions presented to the player were:

- **T1** - I was anxious while plotting to achieve my goals.
- **T2** - I felt very tense while playing this scenario.
- **T3** - I felt pressured while trying to achieve my goals.
- **T4** - I did not feel nervous at all while playing this scenario.
- **T5** - I was very relaxed in playing this scenario.

After running a Cronbach-alpha validity test, we reach an alpha of 0.867 , which is a good value indicating that all questions are relatively valid.

In this set of questions, we can see that our volunteers didn't feel overly anxious or tense during the testing session, but they were also not fully relaxed (figure 4.22). This is, of course, a natural result, as playing Crusader Kings 2 is generally a calm experience. Due to it being an experimental environment, it's also expected that people are not entirely at easy, as their actions are being monitored.

As stated, these values are expected due to the nature of the game being play-tested and the testing environment itself. Due to this, we can expect that responses in other dimensions of this experiment were not potentially affected by tension, as for all we can discern, this was not a prominent factor among testers.

By running an independent sample non-parametric *Mann-Whitney U* test with the *variant played* variable as the control group, we can see that there is no suggestion of a connection between complexity and tension felt while playing (figure 4.23). In this dimension in particular, there isn't even a single question that dismisses the null hypothesis, as such we can only conclude that with this sample of play-tester, with some experience with video-games and strategy games, there isn't a noticeable increase, or decrease of tension between our two scenario versions.

	Variant Played:	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
I was anxious while plotting to achieve my goals.	Hard	.179	16	.180	.884	16	.044
	Easy	.225	14	.054	.831	14	.012
I felt very tense while playing this scenario.	Hard	.271	16	.003	.810	16	.004
	Easy	.289	14	.002	.793	14	.004
I felt pressured while trying to achieve my goals.	Hard	.212	16	.053	.892	16	.060
	Easy	.322	14	.000	.733	14	.001
I did not feel nervous at all while playing this scenario.	Hard	.210	16	.057	.894	16	.065
	Easy	.175	14	.200*	.901	14	.115
I was very relaxed in playing this scenario.	Hard	.149	16	.200*	.914	16	.133
	Easy	.219	14	.069	.911	14	.164

Figure 4.21: Tension dimension - Normality Tests

	N	Minimum	Maximum	Mean	Std. Deviation
I was anxious while plotting to achieve my goals.	30	1	7	3.17	1.895
I felt very tense while playing this scenario.	30	1	7	3.00	1.983
I felt pressured while trying to achieve my goals.	30	1	7	3.07	1.660
I did not feel nervous at all while playing this scenario.	30	2	7	4.97	1.712
I was very relaxed in playing this scenario.	30	1	7	4.30	1.685
Valid N (listwise)	30				

Figure 4.22: Tension dimension - Descriptive Statistics

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of I was anxious while plotting to achieve my goals. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.224[1]	Retain the null hypothesis.
2	The distribution of I felt very tense while playing this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.313[1]	Retain the null hypothesis.
3	The distribution of I felt pressured while trying to achieve my goals. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.667[1]	Retain the null hypothesis.
4	The distribution of I did not feel nervous at all while playing this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.759[1]	Retain the null hypothesis.
5	The distribution of I was very relaxed in playing this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.294[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Figure 4.23: Tension dimension - Non-parametric, *Mann-Whitney U* independent sample test, part 1

4.1.5 Effort

Finally, the effort put into the demo during play by participants. In this category, the IMI questions presented to the player were:

- **E1** - I put a lot of effort into getting to my objectives.
- **E2** - It was important to me to do well at this scenario.
- **E3** - I didn't try very hard to do well at this scenario.
- **E4** - I tried very hard to succeed in this scenario.
- **E5** - I didn't put much energy into this.

After running a Cronbach-alpha validity test, we reach an alpha of 0.796, which is a good value indicating that all questions are relatively valid.

In the effort put into succeeding at the scenario, we can see that participants avoid extremes. They didn't put much effort into success, but simultaneously, they feel they didn't totally disregard the experi-

	Variant Played:	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
I put a lot of effort into getting to my objectives.	Hard	.273	16	.002	.899	16	.076
	Easy	.236	14	.034	.873	14	.047
It was important to me to do well at this scenario.	Hard	.230	16	.023	.877	16	.035
	Easy	.271	14	.006	.780	14	.003
I didn't try very hard to do well at this scenario.	Hard	.228	16	.026	.835	16	.008
	Easy	.209	14	.098	.922	14	.235
I tried very hard to succeed in this scenario.	Hard	.199	16	.090	.910	16	.118
	Easy	.206	14	.111	.845	14	.019
I didn't put much energy into this.	Hard	.194	16	.108	.917	16	.151
	Easy	.246	14	.022	.867	14	.038

Figure 4.24: Effort dimension - Normality Tests

	N	Minimum	Maximum	Mean	Std. Deviation
I put a lot of effort into getting to my objectives.	30	2	7	3.90	1.373
It was important to me to do well at this scenario.	30	1	6	4.00	1.619
I didn't try very hard to do well at this scenario.	30	1	6	3.80	1.270
I tried very hard to succeed in this scenario.	30	1	6	3.90	1.470
I didn't put much energy into this.	30	1	5	2.90	1.125
Valid N (listwise)	30				

Figure 4.25: Effort dimension - Descriptive Statistics

ment (figure 4.25). Like with tension, these results appear quite normal, and innocuous to the remaining data.

By running an independent sample non-parametric *Mann-Whitney U* test with the *variant played* variable as the control group, we can see that there is no suggestion of a connection between the effort put into succeeding and the complexity of the scenario being played (figure 4.26). This is also an expected result, as the players were uninformed about what scenario they were playing, and even uninformed about the existence of another scenario, it's expecteable that this data is consistent for both groups.

4.2 Result Significance

After the data analysis presented above, our experiment suggests that there isn't a strong connection between the complexity of the scenario presented to the players and the dimensions of the play experience we tested, which lies in contradiction of the hypothesis that drove us to run this experiment.

Due to the sample subjected to this study, we can't affirm any connection with a great degree of

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of I put a lot of effort into getting to my objectives. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.313[1]	Retain the null hypothesis.
2	The distribution of It was important to me to do well at this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.886[1]	Retain the null hypothesis.
3	The distribution of I didn't try very hard to do well at this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.580[1]	Retain the null hypothesis.
4	The distribution of I tried very hard to succeed in this scenario. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.179[1]	Retain the null hypothesis.
5	The distribution of I didn't put much energy into this. is the same across categories of Variant Played:.	Independent-Samples Mann-Whitney U Test	.552[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Figure 4.26: Effort dimension - Non-parametric, *Mann-Whitney U* independent sample test, part 1

certainty. Wider tests must be conducted on this subject to achieve a greater certainty regarding these connections.

These results might be related to our test sample, not being large enough to be significant, needing a wider spectrum of personalities and backgrounds, or perhaps a wider gap in complexity would be required for any relation to surface.

However, the data also indicates that, for the most part, our methodologies in creating the testing scenario and experiment were sound. We suggest that, should a future test occur, the questionnaires are validated before hand. We used a pre-validated IMI questionaire, but due to some changes in translation, not all questions retained their significance.

Chapter 5

Conclusions

Emergent story systems have the great potential of being able to provide a countless number of personal narratives to players in each new play through, by setting them inside a framework and providing the tools to shape it to their wills. The question is then raise, on how complex these systems must, or can be, in order to engage the player without overwhelming him while also retaining the great sense of agency felt by having the power to change the game world. We began our work with the intent of exploring the effects of complexity in the player experience in a single player emergent narrative system, by trying to find correlations between complexity and five different dimensions, Interest, Perceived Competence, Agency, Tension, and Effort.

We began by defining and designing a set of 2 testing scenarios, with differing complexity levels, in order to run player tests and collect data on the five dimensions. We developed these scenarios within the framework of Crusader Kings 2, as it was an excellent example of a successful emergent story game, which also allowed us to *mod* it to our purposes. Afterwards, we defined a testing methodology and prepared the experiments to correctly collect our data.

We collected both demographic data as well as data on the 5 dimensions by using the Intrinsic Motivation Inventory, a pre-defined suite of validated questionnaires.

Finally we ran a statistical analysis on the collected data to evaluate if there were hits towards a correlation between complexity and any of the 5 dimensions of the experience we set out to test.

After this analysis we came to the conclusion that no strong correlation can be found, apart from a difference in perceived competence, which was an expected result, as 2 scenarios with different complexity levels should have a different level of difficulty in playing them. This result, however, does give us some confidence that our methodology was sound.

While these were the results we observed, we believe that further studies need to be conducted to have a greater degree of certainty in them. Our sample was, unfortunately, very homogeneous, tending towards male subjects between 20 and 30 years old with experience in playing game, and in particular, experience with strategy games. The sample was gathered mostly from individuals closely related to the field of Computer Science, so closeness of personality types is also to be expected.

With a more broad heterogeneous sample, might further cement our results, or perhaps show a

correlation that we could not find in our limited sample.

For **Future work** we suggest an adaptation of this study to incorporate a greater test sample, as well as a longer exposure to the game scenario being tested, to allow the player to get to grips with the system he's experimenting with. We also suggest careful validation of the questionnaires presented to testers, as even when adapting a validated set of questions we ran into some reliability issues.

We would also suggest, in the dimension of agency, to conduct group sessions with participants, after their individual sessions. As agency is related to how the player perceives the importance of his choices and the uniqueness of his experience, a groups sessions where each participants told his story could potentially simulate the reality of Internet communities and message boards were the sharing of experiences can reveal that in the end, not all choices are are crucial as it initially seems, thus modifying how the player feels about the agency he had.

Appendix A

Demographic Questionaire

CASTLES - Pre Test Questionaire

* Required

What's your age group? *

- 14-18
- 19-23
- 24-35
- 35-50
- Above 50

Are you male or female? *

- Male
- Female
- Other

How many hours a week (on average) do you spend playing games? *

- 1-5 Hours
- 6-10 Hours
- 11-20 Hours
- 20+ Hours
- I don't usually play games

Would you consider yourself a casual gamer, or more of an enthusiast? *

	1	2	3	4	5	
Casual	○	○	○	○	○	Enthusiast

Do you have experience with strategy games? (check all that apply) *

- [ ] Yes, with RTSs (Command & Conquer, Starcraft, Age of Empires, etc...)
- [ ] Yes, with 4Xs (Civilization series, Sins of a Solar Empire, Total War series, etc...)
- [ ] Yes, with Real Time Tactics (XCOM, Wargame: European Escalation, etc...)
- [ ] Yes, with Grand Strategy games (Crusader Kings 2, Europa Universalis, Victoria, Hearts of Iron, etc...)

- [ ] Yes, with strategy boardgames (Risk, Agricola, Twilight Struggle, etc...)
- [ ] No, I don't usually play strategy games (But I play other games)
- [ ] No, I don't usually play games.

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Appendix B

IMI Player Experience Questionaire

CASTLES Post-Test

* Required

Please briefly describe your strategy during this scenario and how it's execution went: *

For each of the following statements, please indicate how true it is for you, using the following scale:

1	2	3	4	5	6	7
not at all true			somewhat true			very true

I was pretty skilled at plotting to achieve my objectives. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

Plotting to achieve my goal was fun to do. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I felt like I only had one option. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I enjoyed plotting to achieve my goal. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I thought playing this scenario was quite enjoyable. *

1	2	3	4	5	6	7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

I was anxious while plotting to achieve my goals. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

After playing this scenario for awhile, I felt pretty competent at it. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

I put a lot of effort into getting to my objectives. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

Playing this scenario was someting that I couldn't do very well. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

It was important to me to do well at this scenario. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

I believe I had some choice in how I attempted to fulfil my goals. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

Reflecting upon the outcome of my strategy, I appreciate my choice and feel that out of the all the paths I could have taken, this one was the best. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

I didn't really have a choice in defining my strategy. *

1 2 3 4 5 6 7

Not at all true ◯ ◯ ◯ ◯ ◯ ◯ ◯ Very true

I felt very tense while playing this scenario. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I didn't try very hard to do well at this scenario. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I felt pressured while trying to achieve my goals. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

This scenario did not hold my attention at all. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

Reflecting upon the outcome of my strategy, I don't feel like I truly had any other options. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I am satisfied with my performance in plotting to achieve my objectives. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

Reflecting upon the outcome of my strategy, I regret my choice and believe that other options could've have turned out better. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

I executed my strategy because I wanted to. *

	1	2	3	4	5	6	7	
Not at all true	○	○	○	○	○	○	○	Very true

While I was playing the scenario, I was thinking about how much I enjoyed it. *

1	2	3	4	5	6	7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I think I am pretty good at playing this scenario. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I think I did pretty well at plotting to achieve my goals *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I felt like the path I took in this scenario was not my own choice. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I executed my strategy because I felt I had no other choice. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I would describe playing this scenario as very interesting. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I executed my strategy because I felt it was the most promising of my options. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I tried very hard to succeed in this scenario. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I thought playing this scenario was boring. *

1 2 3 4 5 6 7

Not at all true ○ ○ ○ ○ ○ ○ ○ Very true

I executed my strategy because I felt it was the most appropriate for the character I was playing.

*

	1	2	3	4	5	6	7	
Not at all true	◯	◯	◯	◯	◯	◯	◯	Very true

I did not feel nervous at all while playing this scenario. *

	1	2	3	4	5	6	7	
Not at all true	◯	◯	◯	◯	◯	◯	◯	Very true

I was very relaxed in playing this scenario. *

	1	2	3	4	5	6	7	
Not at all true	◯	◯	◯	◯	◯	◯	◯	Very true

I didn't put much energy into this. *

	1	2	3	4	5	6	7	
Not at all true	◯	◯	◯	◯	◯	◯	◯	Very true

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