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Learning through a Game

Exploring Fun and Learning in a Project
Management Game

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Master of Science in Informatics
Submission date: August 2016
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Problem Description

The goal of this thesis is to explore the teaching capabilities of games by motivating players through fun. We do this by first exploring perspectives of fun and learning in games; project management concepts and previous games. From these findings we implement our own game prototype where the player learns project management concepts simultaneously as they learn the game. This prototype is then evaluated through a number of experiments. Finally we discuss the results of the experiments and conclude upon the viability of the game as a tool to learn about project management.

Assignment given: January 2015
Supervisor: Alf Inge Wang

Abstract

In recent times, academics and professional circles alike have opened their eyes more and more the possibility of using games as an augment and even replacement to traditional education. The belief is that these games, so-called ”serious games”, may offer a much needed boost of motivation and enjoyment that traditional learning cannot provide. In this thesis we seek to explore the capabilities of games as a promoter of both fun and learning, and investigate the viability of a game created specifically for this thesis with the aim of teaching project management concepts in an enjoyable way.

In this paper, we map game concepts that promote learning and enjoyment and try to integrate these concepts into game elements that simulate project management. We then discuss and conclude upon the viability of the game as a tool for learning project management. This work is performed in three parts, which largely cover one research goal each.

In Part I we attempt to get an understanding of the elements in games that make games promote enjoyment and fun, and how to interpret this to project management. We do this by analyzing and compare two models for game enjoyment: Malone’s three categories for immersing a player and the ”Gameflow Enjoyment Model”. From these two models we have created a framework for supporting the design and development of our game. An analysis of a number of games based on their educational values or approaches to project management was performed to gain further insight into practical applications of the strategies that are detailed in the two models. To get more insight project management, we chose to research PRINCE2, as this is a well known and popular method. It is a structured project management method that details many of the common themes and concepts without relying on specific tools and techniques. This part concludes with a framework with conditions that should be present for a game to promote flow and to be enjoyable.

In Part II we present a game proposal for *Freelance Team* based on the framework. Using this game proposal we built a game prototype that is described to detail in this part. While II covers much of this work, the preliminary research on what technologies to use are detailed in Part I.

In Part III we evaluate our project management game, pointing out what game concepts that were found to increase enjoyment of the game, offering suggestions on how the game could be improved and finally concluding upon the viability of using it to learn about project management. We invited a number of people to try our game for as long as they felt it was fun and then to answer a questionnaire that we had devised. A smaller study of three people were also observed during playing and interviewed more thoroughly afterwards.

Preface

This report and our implementation of the game presents the work done for our Master's Thesis in Informatics at the Department of Computer and Information Science at NTNU. It was written in the period between August 2015 and August 2016 by David Storjord and Daniel Sollie Hansen.

First we wish to thank Alf Inge Wang for his invaluable support and help during the writing of this thesis.

We would like to thank Per Storjord for his assistance during our reseach into project management and for the feedback and help during the development of the game.

We also would like to thank everyone who answered the questionnaires and let themselves be observed and interviewed during and after playing the game. You feedback has been very important when shaping this thesis.

Lastly, we wish to offer our most humble gratitude to all the creators and innovators out there who shaped our childhood and gave us the interest for computer games of which this thesis would not have existed without.

Trondheim, August 5, 2016

David Storjord Daniel Sollie Hansen

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Chapter 1

Introduction

1.1 Context

This thesis is the product of work undertaken at NTNU during the school year 2015/2016. It began as a proposed thesis by supervisor Alf Inge Wang, where the topic was ”A Project Leader Survival Game”. This master thesis concludes our education within the field of Information Science / Informatikk.

For the past twenty years, computer games have had a rapid development: from the crude 2D sprites of early 70s games to the modern super immersive and high-quality worlds of the ”Assassins Creed” franchise. Regardless of technological advancement, there can be no doubt that computer games have always had an ability to immerse its player into its world, telling stories as advanced and immersive as any literature, and with the effect of any movie. Today the video game industry has long surpassed the movie industry and is considered one of the fastest growing industries in the world, much because of the introduction of game applications on mobile units and moving the focus away from physical mediums to internet accessible mediums Nasdaq.com (2016).

Even when computer games were seen more as a fringe interest for certain individuals, games were thought of as a potential vehicle for education, with educational games such as *Math Rescue* and *Word Rescue* (1992) which taught math and reading comprehension to children while providing a platform-jumper challenge. Or the Doom-clone *I.M Meen* (2005) which sought to teach children about grammar.

However, despite rapid rise of the games industry, we are failing to see a similar rise in the tendency of incorporating specially crafted educational games into the curriculum of education. There are some attempts at creating immersive games with education in mind but none of these edutainment titles seems to have caught the same kind acclaim or possess the same addictive qualities. Not in the same way as games like *World of Warcraft*, *Sim City* or *Civilization*, known for exactly these qualities.

1.2 Personal Motivation

Both of us have had a passion for games for the past twenty years, and seeing how inspirational and immersive some of these games can be we wanted to perform research on what makes these games so immersive and sometimes even addictive. This particular medium has a potential to give context and be more engaging than most other forms of media, and both of us have experienced that playing games have allowed us to gain knowledge about the world in which these games are set in. We wanted to explore these qualities and include them in our own game: Freelance Team, a game focused on teaching the players about project management.

1.3 Goals

With this thesis, we seek to explore games potential within the realm of education by developing and researching the effects of a project management game which aims to teach the player different aspects of project management. To this end, our thesis is split up into three goals with a logical progression from one goal to the next:

1. Understanding what elements in games make them fun and promote learning, and find out how to use these techniques to teach about project management game.
2. Design a project management survival games, using project management as basis for the player is going to learn.
3. Evaluate the viability of using our game in project management training.

1.4 Readers Guide

This section gives a short description of each part and chapter so readers can get a quick overview of this report.

Part I - Prestudy

The first part describes the prestudy, it contains information about project management, what elements of games make them fun, game-based learning compared to traditional learning. It also contains a description of technologies that was considered for this project, and a game study of five games.

Chapter 3 explains the different aspects of project management.

Chapter 4 presents the technology choices that were considered.

Chapter 5 discusses the differences between game-based learning and traditional learning, and compared the two.

Chapter 6 explains what makes games fun to play and which elements of a game helps achieve this.

Chapter 7 presents a game study of games that have some degree of educational learning or contains concepts of team or project management.

Part II - Solution and Design

The second part details a framework for developing similar games, the game proposal and a detailed description of the game and how it was implemented.

Chapter 8 describes a framework based on the research done in the literature study and presents how it will be used in this project.

Chapter 9 covers the game proposal.

Chapter 10 explains the design of the game and how it was developed and implemented

Part III - Experiment, Results, and Discussion

The third part presents the experiment and how it was conducted. It also describes and discusses the results from the experiments.

Chapter 11 describes the experiments and how they were conducted.

Chapter 12 presents and discusses the results from the experiments.

Part IV - Conclusion and Further Work

The final part presents the conclusion of the thesis and the proposed further work.

Chapter 13 covers the conclusions of the thesis

Chapter 14 describes the possible further work to be done.

Chapter 2

Methodology

Various methods and strategies are used to help shape the process of the research. To create concrete goals for our thesis, we use the Goal Question Metric (GQM)-method (See figure 2.1). Using this method, we will create a set of top-level goals for our thesis. For these goals we will then create a set of research questions for each goal that needs to be answered before we can consider the goal to be fulfilled. Each question will be answered by using a specific metric. These metrics are gained by a combination of research strategies: Using literature and game studies, we will gain a comprehensive overview of research already performed in the field. We will then use literature along with the defined research goals to design and create an educational game. Finally we will perform a case-study on the prototype of this game.

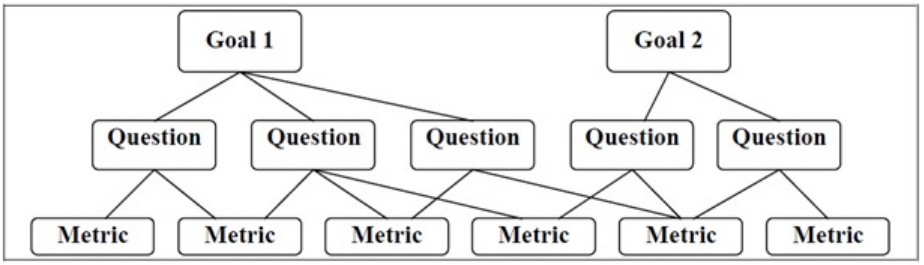

Figure 2.1: Goal Question Metric Layout

2.1 GQM - Goal Question Metric

Goal/Question/Metric is a top-down approach to find and make concrete specific goals to a project. In GQM a set of specific goals are decided upon first. From these goals are extracted a number of questions which will help attain the goals. These questions are in turn answered by using a set of pre-defined metrics. A number of questions are defined per goal, and any number of metrics can be used to answer a question. A metric can also be used to answer several questions (Incyclesoftware.com (2015)).

When using GQM, the goals, questions and metrics are normally organized into table. (See table 2.1 for an example with unrelated data.)

Table 2.1: Goal Question Metric Example

Goal	Purpose Issue Object Viewpoint Context	Improve the reliability of object X for the user within organization Y
Question Metric	Q1 M1	What is the average speed of cars on the freeway? Average Speed Calculations
Question Metric Metric	Q2 M2 M3	What are the benefits of building a new freeway pass? Questionnaire Interviews
...	...	...

2.1.1 Research Goals

In this section we present our research goals. These goals will further be split into sub-questions.

RG1 **Investigate what makes a game fun, and map these techniques to project management concepts for sake of learning**
We will attempt to identify the mechanics that makes games fun, and find ways to translate common concepts and techniques of project management into these mechanics for the sake of improved project management learning gains.

RG2 **Develop a pedagogical game with the goal of teaching about project management**
To determine games' potential for increased learning, we will develop a game prototype where the intention is to let the players implicitly learn about project management concepts to complete the goals of the game.

RG3 **Examine the viability of promoting learning experiences by using our game in education**
By giving out questionnaires to a number of prototype-users, and performing interviews on a smaller number of users, we will attempt to measure the effectiveness of learning experiences in games.

2.1.2 Research Questions

RG1 **Investigate what makes a game enjoyable, and map these techniques to project management concepts for sake of learning**
When we decomposed RG1, we identified the following RQs:

RQ1 What are the basic concepts of project management?
Before developing a game dedicated to project management learning, a better overview of the project management process must be attained. This will be done using a literature study.

RQ2 What concepts of games make them fun?
If we are to determine if games can make educational learning more enjoyable, we must try to identify techniques and elements of games that are - for a lack of a better word - fun. Using a literature study on relevant scientific literature, we will identify and group techniques and elements of game development that makes a game be considered fun. From hereon out, these techniques and elements will be referred to as 'concepts'. We will also perform a game study on a number of games to see practical examples of concepts that promote enjoyability in games.

RQ3 What concepts of games promote learning? We will try to identify what concepts in games promote learning. This learning can be either educational in nature or simply relate to the learning and mastery of the game itself. Using a literature study and a game study, we try to understand what parts of games

that encourages and motivates the player to learn it. In our game study we will also try to identify concepts in the game that promote learning.

We will examine some examples of how games have promoted learning in the past and how different approaches changes the gameplay.

RQ4 What principles of project management can be translated into a game?

Project Management is a large field, with many theories. Due to the scope of this thesis, we will have to be effective in our choice of project management representation, where the focus will be on fun. To do this, we will continuously evaluate the game and its concepts.

RG2 **Develop an educational game to help project management understanding**
When we decomposed RG2, we identified the following RQs:

RQ5 What technologies are suitable to develop a game on project management? Here we will justify our choices for technology and platform for the design of our games. This will be done by performing a literature study, as well as collecting documentation on different technology platforms that are relevant for us.

RQ6 What game mechanics should be included in the game? Some game mechanics are more suitable to simulate project management than others. Using a framework, we will list up important game mechanics that should be included in the game.

RG3 **Examine the viability of promoting learning experiences by using our game in education**
When we decomposed RG3, we identified the following RQs:

RQ7 What mechanics in our game make it enjoyable?

By performing questionnaires, interviews and observations, we will identify if and what game mechanics present in our game made it more enjoyable.

RQ8 How can the game be improved to promote a higher degree of enjoyment?

By performing questionnaires, interviews and observations, we will identify any shortcomings of the game that caused reduced enjoyment, and suggestions for mending these shortcomings for the future.

RQ9 How viable is the game for game-based learning?

By analyzing our game using our framework, literature studies and the experiment conducted, we will investigate the viability of using our game to promote project management learning.

2.1.3 GQM-Table

The following tables presents the research goals and questions and the metrics that will be used to answer them. (See Table 2.2, 2.3, 2.4 for RG 1, 2, 3 respectively):

RG 1	Purpose	Adapt
	Issue	the principles of enjoyment
	Object	from games into game mechanics teaching about project management
	Viewpoint	for the developer
	Context	developing the prototype
Question	RQ1	What are the basic concepts of project management?
Metric	M1	Literature Study
Question	RQ2	What concepts of games make them enjoyable?
Metric	M1	Literature Study
Metric	M6	Game Study
Question	RQ3	What concepts of games promote learning?
Metric	M1	Literature Study
Metric	M6	Game Study
Question	RQ4	What principles of project management can effectively be interpreted into features of a game?
Metric	M1	Literature Study
Metric	M2	Design and Create

Table 2.2: GQM Table for Research Goal 1

RG 2	Purpose	Develop
	Issue	for the purpose of educational gains
	Object	a project management game
	Viewpoint	for researchers
	Context	of game-based learning
Question	RQ5	What technologies can be used to develop a game?
Metric	M1	Literature Study
Metric	M2	Design and Create
Question	RQ6	What game mechanics should be included in the game?
Metric	M1	Literature Study
Metric	M2	Design and Create

Table 2.3: GQM Table for Research Goal 2

RG 3	Purpose Issue Object Viewpoint Context	Evaluate for the purpose of our research the project management game tested by students of project management
Question Metric Metric Metric	RQ7 M3 M4 M5	What mechanics in our game made it enjoyable? Questionnaire Interview Observation
Question Metric Metric Metric	RQ8 M3 M4 M5	How could the game have been improved to promote a higher degree of enjoyment? Questionnaire Interview Observation
Question Metric Metric Metric Metric	RQ9 M1 M3 M4 M5	How viable is the game for game-based learning? Literature Study Questionnaire Interview Observation

Table 2.4: GQM Table for Research Goal 3

2.2 Research Strategy

In our thesis we utilized four research strategies to answer our research questions: Literature Study, Game Study, Design and Create and Case Study.

2.2.1 Literature Study

Initially, we will perform a literature study to get an overview of relevant literature within our topic. Literature studies are important because they help attain a required level of overview of previous research in a specific topic beforehand.

2.2.2 Game Study

We will perform a game study on five games selected either for their educational values or their focus on project and team management. In the Game Study we analyze a number of games and try to identify and extract concepts that promote learning and enjoyment. These games are:

- Game Dev Tycoon
- The Curious Expedition

- I.M. Meen
- Math Rescue
- The Assassins Creed franchise

2.2.3 Design and Create

To structure our research, we have drawn heavily from Oates (2006) description of a Design and Creation research strategy (p. 108). Design and Creation, as opposed to normal research, also includes creating artifacts in the form of an IT application, and then performing research on this IT application. While Design and Creation is not the only Research Strategy used in this master thesis, the heart and soul of the thesis stems from this strategy.

Design and Creation typically follow a process in five steps: Awareness, Suggestion, Development, Evaluation and Conclusion.

While the process is iterative and not firmly bounded, our thesis will be structured after these steps. This goes well with the masters thesis as it is itself an iterative process where the different parts will be updated and edited as new knowledge is attained.

- In *Awareness* we will recognize and try to express the problem. We do this in the Context, Personal Motivation and Prestudy section of this thesis.
- In *Suggestion*, a possible solution will be provided. The solution is presented in the Research Questions, the Research Methods and the Game Proposal part of the thesis.
- In *Development*, documentation of the steps of the development process, along with descriptions and illustrations will be provided. The Development section of the thesis contains this material.
- In *Evaluation* we evaluate the prototype to answer the questions related to Research Goal 4. The findings are discussed in the Discussion part of the thesis.
- Finally, in *Conclusion* we discuss whether or not our original goals were successful and if we were able to draw research conclusions from it as intended. This will be covered in the conclusion section of our masters thesis.

2.2.4 Case Study

In a case study a specific thing is examined in-depth. It can be an organization, an information system, or ,as in this case, the prototype that we developed during our Design and Create process.

We will perform a case study on the prototype by generating data through observations, interviews and questionnaires from the users using this prototype.

2.3 Data Collection Methods

Here we will discuss the methods we will use to collect data during the case study.

2.3.1 Questionnaire

A questionnaire will be given out to a number of subjects who have tried the game. With this survey we will

I Measure the perceived learning from the game

II Measure the enjoyment of the game

III Understand what mechanics of the game made it more or less enjoyable

Questionnaires are useful because they allow us to generate data over a potentially large number of users for a comprehensive amount of quantitative data. We can use questionnaires to gather easily standardized data, making it easier to notice patterns in the answers. However, questionnaires are limited in their ability to get a deeper understanding from a topic, and we will be unable to understand a direct causality between answers. Questionnaires only allow the communication to go one way, and so, if the researcher sees interesting patterns, it is not possible to make follow-up questions.

2.3.2 Observation

For a smaller number of participants, we will ask for permission to observe a play session. The observation conducted will be in the form of a participating observation where the observer can participate and assist during the session. Data collected from the observations will be in the form of video recordings of the gameplay session, as well as transcriptions of the conversation going on during the session.

From the observations, we will do the following:

I Observe interaction between the player and the game to understand what works well and what does not.

II Gain talking points for the following interview

Participatory observations will help us because they allow us to witness the game being played first-hand. It can also assist in understanding the causality of the data points acquired during the questionnaire. However, participatory observation have a few disadvantages. For one, it is impossible to know for sure if a single observation reflects the truth: We cannot know if a player will behave differently when they play alone from when they play while being observed. There is also the danger of the observer unintentionally affecting the observed through conversation or assistance in a detrimental way to the research.

To remedy these disadvantages we will use the results from the questionnaires. Similar patterns between questionnaire and observation, and between observations, should provide us with stronger data than each data collection method separately. It is also important for the observer to be conscious of their own ability to affect the observed.

2.3.3 Interview

To compensate for the limits of questionnaires and observations, interviews will be conducted on a smaller subset of users to get a deeper understanding of the data. With interviews we will:

I Understand if and why some mechanics of the game promote more enjoyment than others

II Understand how our users experienced our game, and learn in what way it engaged the users into learning

Where questionnaires can give an indication and a pattern in user responses, the interviews are apt to explain exactly how these patterns emerge. An interview gives a good basis for more in-depth responses and open-ended questions. These questions allow for spontaneous new discoveries, and a deeper exploration of these discoveries.

Interviews can be conducted structured, semi-structured or unstructured.

- Structured interviews are, in essence, a questionnaire. It has a fixed number of questions and a predefined set of answers. As opposed to a questionnaire, it is performed with the subject and researcher together with the researcher registering the answers given by the interviewee. In a structured interview it is important for the researcher to only ask the questions from the predefined script.
- In semi-structured interviews, the researcher keeps a list of predefined questions, but are allowed to change the order of these questions or add new ones as the interview is conducted and new information emerges. The interviewees are also able to freely provide information they feel is relevant.
- In unstructured interviews, the control is left to the interviewee. The researcher may set a specific topic and then let the interviewee speak freely about and around this topic. The researcher should try not to interrupt this process or inject themselves too much in the conversation.

We have decided to perform a semi-structured interview, where a list of questions will be devised from the patterns that emerges in the questionnaire. The concept of learning in games is a highly complex one, and there is a good chance that the interviewee has points of views that we could not foresee. It is important that we allow the freedom in the interview to express these points of views. At the same time we want to structure the interview around the previously attained data.

More details on the data gathering methods and how they were executed in the making of this thesis can be found in Chapter 11.

Part I

Prestudy

The prestudy presents a literature study on relevant literature associated to our thesis. We did this by doing topic searches on Google Scholar, and we also received some tips on articles that could be of interest by our supervisor. In addition, the articles we came across often linked to other relevant articles or books. In some cases these have also been included. This part includes studies of project management, technology, games and learning, and immersion.

Chapter 3

Project Management

Projects come in many shapes and sizes. The common denominator among them is that they are all temporary endeavours to create a ”[...] unique product, service or result” (Institute, 2013, p. 2). Early on we decided what parts of project management we wanted our game to focus on. The game will focus on planning the project, the development team and how to interact with them and finishing the project. The field of project management is so wide that including all aspects into one game would be almost impossible given the time available to us. Here we will discuss what these themes are and why we chose to implement some over others. Details about their implementation will be discussed in Chapter 10 about design.

We decided that we wanted to explain project management and what a project is from the perspective of PRINCE2. Since PRINCE2 is a structured project management method. It encompasses quality management, control and organization of a project with consistency and review to align with project objectives. It is not a guide on how to complete a project and does not cover things like techniques and tools. Therefore, it is a good starting point in understanding project management. The following information about PRINCE2 is based on Axelos.com (2015).

3.1 Elements in PRINCE2 and definitions

First, we will go over some fundamental elements and definitions of PRINCE2. In Figure 3.1 we see the seven themes in the PRINCE2-method that supports the seven processes. There are no individual relationship between themes and processes, and each theme can be used in different processes

Before going into the principles of PRINCE2, it can be helpful to understand a few definitions. According to PRINCE2 a project is: ”a temporary organization established with the intention of delivering one or several products which contributes to achieve an agreed Business Case” (Axelos.com (2015)). Project management is ”planning, delegating, monitoring and controlling all aspects of the project. This includes to motivate everyone involved

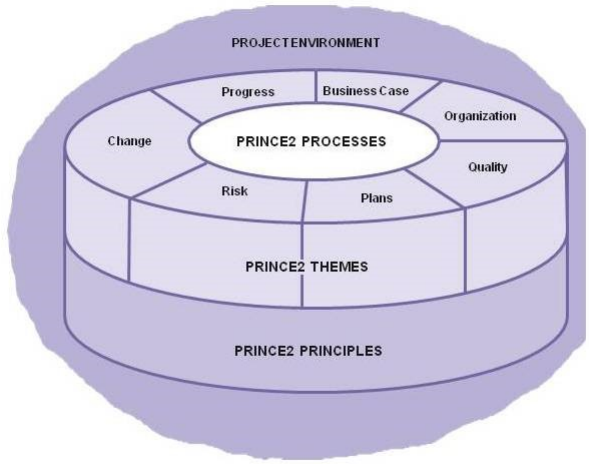

Figure 3.1: PRINCE2 structure

to contribute to achieve the projects goal within defined requirements and expectations related to Time, Cost, Quality, Scope, Gains and Risk." (Axelos.com (2015). Each project contains these six aspects mentioned in the definition of project management, below is a list describing each of them.

- *Time*, it is vital to know when the project is supposed to end and how long it will take.
- *Cost*, a project will start with a specific budget which can change during a project, there are many factors that can result in raising the cost, or maybe reduce it.
- *Quality*, to finish a project within the time and budget is of no use if the result of the project cannot be used.
- *Scope*, what the project must deliver have to be clear to, and accepted by, all parties involved in the project. The project manager must take care not to deliver out of scope of the project, as this is a common source of delays, overspending and uncontrolled changes.
- *Gains/Benefits*, the project manager must understand the purpose of the project as an investment and ensure that what the project delivers can achieve the desired returns.
- *Risk*, all projects have some risk, how much are we willing to accept?

3.2 PRINCE2 principles

PRINCE2 is based upon these principles: Manage by exception, Learn from experience, Define roles and responsibilities, Manage by stages, Focus on product and Tailoring.

- A project must have **Continued business justification**. This means that a project must be justifiable to start and that this justification is valid throughout the entire project. It is also important that this justification is documented and approved in the business case document. The business case is the most important document, it is updated at every stage of the project to ensure that the project is still viable. If this ceases to be the case the project should be terminated.
- When a project is **Managed by exception** work packages are assigned by team managers to team members, including deliverables with time and quality tolerances. If work progresses as planned then workers have no need to interfere with team manager's time. If tolerances appears to be exceeded, then the next management level will decide how the project will continue.
- The **Learn from experience** principle is used mainly in three stages of the project. The project start-up stage, where one reviews experiences from other projects. The development stage, where experiences are used to improve the project and the projects ending stage, where experiences are kept for future projects.
- A PRINCE2 project have **Defined roles and responsibilities** within a project management structure. Every project have three main stakeholders. *Business* which is responsible for the business case, the user who uses the product after the project is completed to achieve the planned gains and the supplier that gets the necessary resources that is required to complete the project.
- PRINCE2 projects are **Managed by stages**, this means that the project is planned and controlled on a stage by stage basis. This includes updating the business case, risks, overall plan, and detailed next-stage plan after each stage in the light of new evidence.
- The project has a **Focus on products** and each work package is defined by one or more deliverable products, preferably with tolerance to time, cost, scope and quality quantified in advance.
- PRINCE2 is a framework that must be **tailored** to the projects environment, size, complexity, priority and risk. Small, simple projects require very little formal project management, while large, complex projects demand greater levels of project management with stages and documented requirements that support the projects conditions and allow control.

3.3 Processes

PRINCE2 has seven Processes, these Processes cover the whole of the projects cycle. We will describe each below.

Project start up, or SU, is a short process that starts before the project is initiated. The main goal of this process is to determine whether or not the project is viable and if it will be profitable. There are several factors that determine this, e.g., is there enough available information to determine the scope of the project, have other alternative ways of delivering the project been evaluated, time frame or acceptance criteria. The project board is formed during SU, it consists of decision makers who represents the business, the users and the suppliers. This board is responsible for the success of the project and controls it through overall management and key decisions.

Other key activities in SU include: appointing an executive and a project manager, Designing and appointing a project management team, Preparing a project brief, Defining the project Approach, Preparing an outline business case, Consulting the Lessons Logs of previous projects and Planning the next stage

The purpose of the ***Initiating a project***, or IP, process is to establish a foundation for the project, and establish a understanding on the expected gains of the project, the time frame and cost, the products to be delivered, and their quality. An understanding on organisation, roles and responsibilities is also established in this process. This process also looks to answer a few questions:

- How to achieve quality
- How a baseline should be established and controlled
- How risks, issues and changes shall be identified, assessed and controlled
- How progress will be monitored and controlled
- What will be communicated, to whom and when
- How the project model will be adapted to this specific project

The general management product from this process will be a collection of all the information listed above. This is called the project initiation documentation, which consists of Configuration strategy, quality strategy, risk strategy, communication strategy, business case, project plan, control mechanisms for deliveries, gain realization plan and potential changes in structure of staffing of the projects management team.

The ***Directing a project***, or DP, process dictates when the project board should control the overall project. The process also ensures that:

- Authority is given to initiate a project
- Authority is given to deliver products
- The project board has control over the development of the project throughout the life cycle of the project
- Authority is given to end the project, if, for instance, the commercial benefit no longer exists
- benefits realization is planned and monitored

The ***Controlling a stage***, or CS, process describes the day-to-day management of the project and the project managers activities when delegating work. It ensures that a stage goes as planned and helps to deal with unexpected events. This process is used in every delivery stage of the project. It ensures that the project management team focuses on the product within the given tolerances

- Work packages will be distributed to team managers
- The planned products is delivered according to quality criteria within time and cost limits
- Risks and issues is handled
- Exceptions are handed to the project board if tolerances are exceeded
- The project management team focuses on delivering within the given tolerances

The project manager assigns work packages to the team managers, which in turn is responsible that the work is done. The project manager monitors and controls the project and reports to the project board. Additionally, the project manager insures that all issue are caught and taken care of. If the consequence of an issue are expected to endanger the tolerance limit the project board must be notified.

Managing product delivery, or MP, process has the purpose of controlling the link between the project manager and the team manager, it ensures that planned products are developed and delivered by:

- Ensuring that work on products allocated to the team is authorised and agreed upon
- Performing the work
- Ensuring that the planned products are delivered to expectations and within tolerance
- Determining the frame and scope of the work packages
- Get approval of finished products

Managing stage boundaries, or SB, process produces information for the project board that can then decide if the project should continue. The purpose of the SB-process is to:

- Ensure the project board that all products in the stage plan for the current stage has been completed and approved
- Give information so that the project board is capable of evaluating the projects viability
- Prepare the stage plan for the next stage
- Archive experiences that could be important in the later stages of this or other projects

- Ask for authorization to start the next stage

The CS-process describes what should be done within a stage, the SB-process describes what should be done towards the end of a stage. It includes a review of the status so far and the plan for the next stage. The project manager prepares all necessary information for the project board to review. They will then decide whether or not the project should continue or be stopped.

Closing a project, or CP, process dictates what should be done at the end of a project, whether it is at the end of the project or at a earlier point. The project manager will summarize the project and prepare information for the project board to get approval to end the project. the CP-process includes:

- To assess the extent to which the goals in the project initiation documentation have been realized
- Confirm that all products have been delivered and approved by the costumer
- Check that maintenance and operating conditions are in place, this includes training if it is relevant
- Ensure that users are ready to begin realizing the benefits
- Plan review of the unrealized gains
- Ensure that follow-up actions is assigned all open issues and risks

3.4 Themes in PRINCE2

While there is no direct link between a specific theme and a specific process each theme can be used in several processes as illustrated by Figure 3.1. There are seven themes in PRINCE2:

- *Business Case*: A principle in PRINCE2 is that a project must have continued business justification. The business case is the most important document, and it will be updated at every stage. It is used to ensure that the project is still viable. If this ceases to be the case the project could be terminated.
- *Organisation*: The purpose of the organisation theme is to establish the structure of roles, responsibilities and decision-making in the project. This theme supports the principle of defined roles and responsibilities.
- *Quality*: The purpose of the quality theme is to define and implement means that will be used to create products and verify that products are suitable. Quality itself is defined as conditions relating to the projects products that make them suited to cover the defined needs.

- *Planning*: This themes purpose is to simplify communication and control through defined deliveries of the products (where, what and how, by whom, when and how much). The theme gives a framework for how to construct, develop and maintain the projects plans. This theme supports the focus on products, manage by exception and manage by stages principles.
- *Risk*: The purpose of the risk theme is to identify, evaluate and control risk, and through that increase the chance of completing a successful project. This theme supports the continued business justification, learn from experience, manage by stages, manage by exception, focus on products and tailoring principles.
- *Change*: The purpose of this theme is to identify, evaluate and control all potential and approved changes. The theme supports the manage by exception and focus on products principles.
- *Progress*: The purpose of the progress theme is to establish mechanisms to monitor and compare actual progress to the planned progress, to give a forecast for the project goals and the projects viability, and to maintain control over all unacceptable deviations.

3.5 Summary

Important aspects that should be included into the game are the six aspects listed in Section 3.1: Time, Cost, Quality, Scope, Gains/Benefits, and Risk. Given the decision to put most of the games focus on the development team and the early planning phases, the process ”Initiating a project” should be included in the game since this process covers the planning of a project. The ”Controlling a stage” process also fits our game well as it describes the day-to-day management of the project and the project managers activities. Finally the ”Closing a project” will also be included as it servers to show the finalization of a project.

Chapter 4

Technology

A study of existing technology has been conducted. In this search we focused on technology that allowed for rapid, iterative design. Things that was taken into consideration when choosing the technology was: how experienced we were with the platform, the rate and ease of development, the availability of the technology and how many platforms it supports.

We considered the following technologies:

- HTML5, JS and CSS3
- Node.JS
- Unity 5
- Unreal Engine 4

4.1 HTML5, JavaScript and CSS3

Historically, a web application consists of a client-side part and a server-side part. Together, HTML (Hypertext Markup Language) JavaScript and CSS3(Cascading Style Sheets 3) is the dominating technology when it comes to client-side development of web applications. HTML is a tagging language used to set up the general structure of a website, CSS controls the appearance of sites, such as fonts, colors and appearance of buttons or widgets, while JavaScript controls the behaviour of the webpage.

A game developed in HTML5, JavaScript and CSS3 would be very easy to distribute to users. Its technologies are recognized by all modern web browser, independent of the user's operating system.

However, while simple webpages can exist almost solely with client-side code and it is possible to create a game using only HTML, JS and CSS, one major drawback of this approach is that all the code is visible and editable to the player. This is not a big problem

if the game has no sensitive information, such as player information, and if the game's progress should not be stored on a remote server. But a project of this kind has a large potential for extensibility into the realms of social gaming some time in the future, even if this was not a plan for this prototype.

Another drawback to pure HTML5, JavaScript and CSS3 is that it would require us to write a lot of game-related code for very basic game functionality. Both of us were familiar with HTML5, JS and CSS3, but this would, in essence, require us to create our own game engine, something we lacked both the time and experience to do. After some research into a couple of the more popular engines we found that they had more scarce learning resources, something that could become a problem if we were to choose this platform, as we did not have that much knowledge in it.

4.2 Node.JS

While simple webpages can exist almost solely with client-side code, most advanced web applications such as Facebook or Finn.no also include server-side processes. As the name implies, these are performed on the server where the webpages are hosted, and are therefore entirely invisible to the client. HTML5, JavaScript and CSS3 is highly integratable with many different server-side technologies such as PHP, ASP (Active Server Pages) and Java Server Pages. In recent years, usage of JavaScript has risen as a contender on server-side development, most prominently by the use of the Node.JS framework. We had some experience with creating Node.JS applications earlier, but ultimately the lack of time and expertise opted us away from using Node.JS to create a game.

4.3 Unreal Engine 4

Unreal Engine 4 is a suite of tools and program libraries to ease the development of both 2D and 3D games. UE4 has been used for several commercially available game such as the fighting game *Street Fighter 5*, the exploration game *SUBMERGED* and the horror game *The Park*. Despite its commercial nature, it is still free in development for low-end or entirely non-commercial games. Unreal Engine 4 is written in C++ and this is also the language used when programming in it.

Unreal Engine 4 offers a multitude of libraries that simplifies and makes game development easier. However, we are not too experienced in programming in C++, and have little hands-on knowledge of the engine from earlier. During a comparison between Unreal Engine 4 and Unity 5, the following points were mentioned about Unreal Engine 4 (Makinggames.biz (2015)):

- Unreal Editor 4 is entirely free. The price is based solely on a 5% royalty from purchases.
- Unreal Editor 4 comes with an extensive number of tools that help development, but the community is lacking in answering questions and the documentation around

C++ is lacking. This could make it harder for new beginners (such as us) to learn to use it effectively.

- It is released with full source code, making it possible to do make changes to the editor directly.
- The use of Blueprints makes it easy to reuse code and collaborate together, however the blueprint system can often become cluttered with blueprint nodes.
- Integration of C++ works very well.
- Mobile development is mentioned as slow and somewhat buggy, but this is of little consequence for this particular project.

4.4 Unity 5

Next to Unreal Engine 4, Unity is the biggest and most popular game engine for small and independent developers. As is the case with Unreal Engine 4, it contains a number of tools and libraries to simplify development. Unity is developed in C++ and games using Unity are developed using any combination of C# or Javascript. It has been used to create commercially successful games such as *Hearthstone* and *Kerbel Space Program*. Unity has a very healthy community with a lot of guides, tutorials and support available where questions can be asked.

During comparison between Unreal Engine 4 and Unity 5, the following points were mentioned about Unity 5 (Makinggames.biz (2015)):

- Unity comes as a free version and a pro version. The free editor should be more than enough to support this particular project.
- Unity's Component system makes modular development very simple and easily structured.
- Unity comes with a number of precoded components that help the developer focus less on setting up the engine logic, and to focus more on the game logic.
- The editor itself can be extended with C# or Javascript code. Additionally, more features for the editor is available in the asset store for free or for a price.
- Unity was early with mobile game development support and this works well in Unity, however this is of little consequence to us.
- Unity has a big community and good documentation for how to use both languages to develop in Unity.
- Unity Engine is closed sourced and if a bug in the source code interferes with development, one must rely on the Unity development team to fix the bug.
- It is somewhat difficulty to scale different display sizes. The previewing of these settings in particular is a problem.

4.5 Summary

When choosing technology, these were the main considerations: what technologies we were familiar with beforehand, that it would be available for as many different devices as possible, even if we intended to develop mainly for standard desktop computers initially. We also preferred that the development would be as simple as possible, wanting to use preexisting code where possible rather than programming everything by ourselves. During the technology search we also realized we needed to use a platform that had a strong community to support us where needed.

Unity was selected as the technology we wanted to build our game on, given its reputation as a solid and simple game engine that already contains a lot of the logic that we required for our game. Unity has a strong support community and many preexisting components downloadable from the Asset Store that can extend the editor or reduce the amount of new code needed to develop the game. Finally, Unity was early with allowing developers to design towards several types of devices at the same time. The combination of these factors made Unity the best choice for our project.

Chapter 5

Games and learning

This chapter contains information on traditional and game-based learning, it consists of four parts. The *first* part presents traditional learning. The *second* presents game-based learning and what we can learn from game design about teaching. The *third* part compares the two and then finally the *fourth* part, a summary.

5.1 Traditional learning

Learning is, on an academical or professional level, often considered synonymous with boring or demotivational (Prensky, 2003). Kids, teenagers and now even adults, would now rather do something they think is fun than doing something they think is useful. Today there is a large subgroup of people who will feel demotivated from having to repeat tedious tasks presented to them through work or education with the promise of tangible gains now or in the future. At the same time, they will voluntarily, sometimes even at the cost of money, perform virtual tedious tasks (endearingly described as grinding) in computer games for the purpose of in-game gains.

The subjects of learning itself have changed (Prensky, 2001) and there is a discontinuity between the young and adult generation of today and the ones that preceded them. At the same time, modern technology has opened up whole new ways to experience multimedia: While this group will reluctantly accept the tedium of education today, they will happily consume computer games even despite the existence of equal tedium in the games and sometimes even because of this tedium. Digital game-based learning is the process of attaining skills or knowledge with the help of a game environment. It is based on these two assumptions: that something is different between the prime receivers of learning, and that technology has now opened up for new possibilities in the realm of learning. (Prensky, 2001)

The idea of using computer games to elevate learning is not a new one. Already in 1970, in the dawn of the modern age computer game era, studies were conducted on the effect of using computer games to enhance learning (Van Eck, 2006). The results indicated that

games could indeed be used to enhance the learning experience, but that does not automatically imply a great learning gain from using games. It was also found that the elements perceived by the player to be enjoyable within games could vary significantly from person to person. Later, several meta-studies on the subject has shown that games do increase the effectivity of learning (Van Eck, 2006). Additionally, an experiment using a specially designed application to teach IT-subjects for a high-school class showed a significant effect to the educational value of DGBL Papastergiou (2009).

5.2 Game-based Learning

Gee (2003) concludes that we have much to learn about teaching from good computer and video games. In an effort to encourage the player to learn and master the techniques of playing, games give information ”on demand” and ”just in time”. The information required to learn and master the principles of a game are put inside the worlds the player moves through, and make clear the meaning and importance of such information and how it applies to the world. In short, it provides a context and reason for why the player must learn the things they must learn. This context is important because people are quite poor at understanding and remembering information they have received out of context or too long before they can make use of it (Gee, 2003).

Challenge in games is an important part of what makes games fun, and it is important that games have an uncertain outcome (Malone, 1980). They will operate at the outer and growing edge of a player's competence, remaining challenging, but do-able. This makes games pleasantly frustrating, which according to Gee (2003) is a very motivating state. The early levels of a game will confront players with problems that are designed to allow them to form good generalizations about what will work well later when they face more complex problems (Gee, 2003). In many games the early parts are actually specially designed to help the player learn these generalisation. The game themselves provide the initial learning required, performed through explicit or implicit tutorials. It is important that the player is presented with problems that matches their skill. If the challenge gets too complex early on the player can often come up with creative solutions, but these solutions may not be very helpful when working on problems later on. We will go more in depth about challenge in the next chapter (Chapter 6).

A good game will create what is called ”a cycle of expertise” (Gee, 2003). A game will repeatedly confronts the players with a similar type of problem until they achieve a mastery of certain skills that is taken-for-granted. The game then confronts players with a new problem which cannot be solved with this skill alone. This forces the players to rethink the taken-for-granted mastery and to master a new skill and integrate this with their old skills. The game will then repeat these new problems until a new taken-for-granted mastery is achieved. This cycle can be repeated throughout the whole game and in many games the last boss also requires the players to rethink their mastery. Such a cycle is the basis for gaining expertise in an area, and as Gee (2003) puts it ”Good games are models for the production of expertise”.

Gee (2003) describes something he calls ”action at a distance”, he compares it to controlling a robot remotely, but even more fine-grained. This causes humans to feel like their

minds and bodies stretch into new space. this is a highly motivating state, he also states ”that books and movies cannot achieve this same state”. A player will get more invested in a character and in the game at a deeper level when the player have the ability to manipulate and make decisions that impact either the character or the world the game is set in. This investment into the game seems to be the foundation of the player's motivation. He also mentions that all learning can be seen as ”playing a character”. For example in a science classroom learning works best if a student can think and act like a scientist.

Games that aim to educate and instruct are often called serious games. This is a game that has more than just story, art and software. They also have pedagogy (Zyda, 2005). This means that they have activities that aim to educate or instruct, but this should be subordinate to story and entertainment, or else we might fall in the same trap as the edutainment games which was an awkward combination of educational software with small game-like interfaces. An example of a serious game is Americas Army, it initially served as a recruitment tool for the army, but was also used to help recruits that had trouble with obstacle courses or the rifle range, with success.

A study by Penelope Sweetser et. al (2005) showed that individuals using the most immersive intervention did better than individuals given similar, yet more focused information. They compared four different instructional design conditions; expository textbook condition, simplistic framing condition, immersive world contidtion, and single user immersive world condition. They explain this difference by arguing the importance of facilitating learning environments with a sense of transformational play, which grounds ones understanding of the underlying science concepts and ones relations to them. In transformational play the learner uses science content to transform a particular context, but it is also important that it involves a sense of narrative, perceptual, interactive and social immersion. Transformational play should also do more than just contextualize the content, it should position the learner in the context and have their actions have consequences on the game-world.

5.3 Comparing traditional- and game-based learning

In current education the learners can be positioned as passive receivers, and are expected to memorize content without getting much context. As stated in Section 5.2, context is important since people are poor at understanding and remembering information received out of relevant context. Game-based learning has the potential to put information inside the world and give it more context. Additionally, Games-based learning can also provide a better challenge level when it manages to operate at the edge of the learners competence, while traditional learning usually stays at the lowest common denominator and may not be challenging enough for some. The investment into the character and world in games caused by ”action at a distance” is something, according to Gee (2003), books cannot do.

Both traditional learning and games have ”a cycle of expertise”, where the learner is confronted with a similar type of problem, in games this can be, for instance, similar puzzles in a puzzle game, in traditional learning these similar problems could be homework, until the learner achieve a routinized, taken-for-granted mastery. Then a new type of problem

will be presented and the mastery has to be rethinked. This cycle is repeated throughout until the final challenge is encountered, in a game this could be the final boss and in traditional learning this could be an exam.

5.4 Summary

This chapter discussed traditional learning and game-based learning. It discussed what strengths game-based learning has and how good games teaches the player and what we can learn from this when educating. When developing our game these discussions presented here are important, we have to use the mediums strengths.

Chapter 6

Immersion

This chapter present Malone's (1980) findings on what makes games "fun" to play and his three main categories that immerses the player. It then presents Sweetser & Wyeth's 2005 "Gameflow Enjoyment Model" that discusses eight elements which contributes to the enjoyment and the feeling of flow in gameplay.

6.1 What makes games "fun" to play

Malone (1980) found several principles that contribute to motivation and fun in games. He categorized them into three categories: fantasy, challenge and curiosity. In the following sections we will discuss each of these categories.

6.1.1 Fantasy

Fantasies have the ability to make instructional environments more interesting. Fantasy can be either intrinsic or extrinsic. An extrinsic fantasy is where the fantasy depends on the skill, but not the other way around. An example can be that the answer to a question affects a fantasy, factors like how close the answer was or how fast it was given can also affect it. These exercises, however, are not dependent on the fantasy, they can be done with no fantasy or with a different fantasy altogether. These fantasies are therefore domain-independent. These types of fantasies can have a potential problem with catastrophe fantasies, where the players may be so interested in the catastrophe that they might get the answers wrong on purpose to see what happens.

Intrinsic fantasy are also depends on the skill, but here the skill is also dependent on the fantasy. An example of an intrinsic fantasy for a skill is if a game simulates a situation where that actual skill could be used. Here problems are usually presented in terms of the fantasy world. So events in the fantasy world not only depends on whether the skill is used correctly, but on how its use is different from the correct use. Fantasies in games

also derive some of their appeal from satisfaction of emotional needs, and for that reason fantasies like war, destruction and competition will likely be more popular.

6.1.2 Challenge and Goals

For a game to be appealing it must have an appropriate goal and it must have an uncertain outcome. For a game to provide an appropriate goal it must either be, an obvious goal, this is better for simple games. For complex environments where there are no built-in goals the game should be structured so that the user will be able to generate their own goals. The best goals are practical or fantasy goals rather then goals of using a skill or similar. Feedback is also important as the player must be able to tell if they are getting closer achieving a goal. A game should have an uncertain outcome as a computer game is not challenging if the player is certain to lose or certain to win. There are four ways to make an outcome uncertain.

- With a *Variable difficulty level* the game can be played on different levels of difficulty. This can be determined automatically, by the player or by the opponents skill.
- *Multiple level goal* where the game has several different levels of goals. For example a basic goal and a meta goal. Meta goals can, for example, be score-keeping or speed related.
- *Hidden information* makes the outcome uncertain by hiding information from the player and selectively revealing it, as this seems to provoke curiosity and contributing to the challenge.
- *Randomness* is another way of making outcome uncertain is to introduce randomness into the game.

6.1.3 Curiosity

Malone (1980) distinguishes between two types of curiosity, *sensory curiosity* and *Cognitive curiosity*

Sensory curiosity is curiosity relating to sensory stimuli of an environment, such as changes in light or sound. He discusses a hypothesis that television manipulates this curiosity using a ”technical event”, such events can be a change of camera angle or a zoom. Similar effects can be utilized in games and Malone notes that ”computers provide even more possibilities for audio and visual effects.”

cognitive curiosity is evoked by the prospect of modifying higher level cognitive structures. This type of curiosity is ”a desire to bring better form to ones knowledge and skills”. A way to engage a learner’s curiosity is to make the feedback surprising. This could be done by randomness, but a deeper way is to have environments whose underlying consistency is revealed by things that seem surprising at first. To be educational the feedback should be constructive, it should reveal that the learner’s knowledge is incomplete or inconsistent. It should also help them see how to change their knowledge so that it is more complete.

6.2 Gameflow

Sweetser & Wyeth (2005) constructed an enjoyment model that could be used to review games based on eight elements. Each of these elements has a set of criteria for achieving enjoyment, and in their article they were able to distinguish between a highly rated game and a low-rating game using this model. The eight elements of GameFlow are:

- *Concentration* is required for a game to be enjoyable, and how absorbing it will be depends on how much concentration a task requires. If all of a person's relevant skills are needed then that person's attention is completely absorbed. If this is the case there will be no energy left to process other things. It is important that the game grabs the players attention early on and maintains it through the entire game. It can do this with a detailed game world that draws the player into the game. The game should increase the players workload, but should keep it at an appropriate level as to not overwork the player.
- *Challenge* is considered the most important aspect of good game design. A game should match the players skill, but also vary the level of difficulty. An important precursor to flow is the difference in the players skill level and the challenge of an activity; if the player's skill is too high the player might feel apathy, if the challenge is too great the player might feel anxiety.
- The next element is *player skills*, for the player to experience flow their perceived skills must match the challenge in the game. It is important that the game supports development and mastery of these skills in order for the player to enjoy the game. There are two good ways of teaching players, through interesting and absorbing tutorials or to let the player learn as they play.
- *Control* over actions is required for the player to experience flow, which means that the player must be able to translate intention to the game and feel in control of, for example, a character and how that character interacts with the environment. The player should also feel that they are making an impact on the game world and not feel forced to make decisions that have no impact on whether they win or lose, or on decisions that do not feel important.
- *Clear goals* at appropriate times helps achieve flow. A players should be presented to a clear overriding goal early in the game which can be done with, for example, a cinematic or text, to introduce the player to the background story of the game.
- *Feedback* must be given at appropriate times and during flow concentration is possible because a task provides immediate feedback to the player. Such feedback helps the player determine distance and progress towards objectives. If the player loses they should get feedback if and how they are moving in the right direction.
- *Immersion* is an element of flow that is described as "deep but effortless involvement that often can result in loss of concern for self". This loss of concern for self can also lead to a altered sense of time. Games are often played to think thoughts and feel feelings that don't relate to work, to calm down or escape everyday troubles and worries.

- The last element is *social* interaction, and while it is not an element of flow, it can interrupt immersion and flow since it provides a link to the real world. It is, however, a element in enjoyment.

6.3 Similarities and differences

There are several similarities between these two models, such as challenge, goals and feedback; both mention these elements in similar ways. The most important similarities are that player skill and challenge is properly balanced, that clear goals at appropriate times is important and that feedback is also given at appropriate times. There are some differences however, while Malone focuses on the fun aspects and how fantasies in games affect this, the Gameflow article focuses more on the flow of gameplay and how it feels to play as well as a social element.

6.4 Summary

This chapter has presented two models which will help when developing the game. Based on these two models we want to construct a framework that we can use to help develop our game and give us some guidelines as to what we should focus on when developing a educational game. We will also use these models to evaluate our game by using elements in the models in the questionnaires, and questions for the interview.

Chapter 7

Game Study

In this section we describe a number of games and examine how they promote motivation and learning. Two educational games have been included in this study. *I.M. Meen* is a game designed to teach children about good grammar (See Section 7.3) and *Math Rescue* is designed to teach children about the basic four mathematical operators (See Section 7.4). But learning in games can come in several forms, not all educational in nature. A player learning to master new concepts and skills in a game's cycle of expertise (See Section 5.2) attains learning even if this learning is not educational. For this reason we have included games that are not strictly educational in nature, but also containing concepts that are relevant for our project, such as project work in Game Dev Tycoon (see Section 7.1) and utilizing strengths and mitigating weaknesses of individuals in *The Curious Expedition* (see Section 7.2). Finally, we have included *Assassins Creed* (See Section 7.5) as an example of where the educational effect is primarily through the immersive qualities of the game.

7.1 Game Dev Tycoon

Figure 7.1: Game Dev Tycoon

In Game Dev Tycoon (See Figure 7.1) the player takes the role as the owner and manager of his own game development company. At the beginning of the game the player is a self-made game developer operating from his basement. As his game studio grows more successful, more and more options for expanding the business with several employees and bigger workspaces are made available. Game Dev Tycoon has many of the basic elements of project management.

A project begins with the player proposing a new game. The player sets the topic, genre and platform of the game, and then adds a number of technologies to be used when designing (such as '2D Interface' and 'Mouse Support'). When the development first starts, the player chooses the focus areas of the game, allocating a percentage of manpower to engine, gameplay and story/quests. The choices done here and their success are dependent upon the combination of genre and topic earlier. For example, a focus on Engine would be wise in a Sim City-like game, but Story/Quests are more important in a Role-playing Game. It is important that the player experiments to learn and understand what combinations are advantageous. Then, for each development stage, the player has three focus areas and must allocate a percentage to each (See Figure 7.2). The optimal priorities are based on the combination of genre and topic, and the player learns the best combinations by experimenting.

During development — if the company has several employees, these can be assigned to the different disciplines of game making, and their personal skills will decide how effective they generate quality to the game.

Figure 7.2: For each development stage the player must assign a percentage of focus to three aspects of the game in development

The development is illustrated graphically with small orbs appearing by the employees, with a pleasant sound, and collected into the game's two main areas: Design and Technology. As the development progresses, these two acts as indicators for the player how well the development is going. There is no scale, but a higher number is always better. Using these indicators, a player knows how well they are doing and can challenge themselves to perform better on future games.

When the game is ready for release, it will generate a number of review scores along with a generic remark about the game, such as "This game is fun" or "Needs tweaking". The player's previous experimentation in combinations of genre and topic of the game may be noted with comments such as "This combination of genre and topic worked very well", and the player may be given feedback on if his priorities were correct or not with comments in the spirit of: "This games focus on world design wasn't very impressive".

This summarizing feedback, as well as a counter showing how the released game sells over time allow the player a sense of achievement and helps quantify how well they did in an engaging and immersive way, motivating the player to try again if their combinations and focus were not optimal, and also to best their own score even when they did very well.

Besides the development of games, the player can gradually unlock new facilities such as a research facility and a marketing section. These add a feeling of achievement for the player and allows for gradually unlocking new tactical approaches, allowing the player to experiment with new tools and features, and keeping the gameplay feel fresh.

7.2 *The Curious Expedition*

Figure 7.3: The Curious Expedition — The map of the current expedition as well as well as the current party members

The Curious Expedition (See Figure 7.3) is a rogue-like[1] explorer game where the players assume the role of one of several fictional or historical adventurers in a quest to explore the world and find fantastical treasures. The game uses a mixture of exploring a mostly uncharted map and making hard decisions through multiple choice dialogues to craft a difficult exploration experience for the players. The goal of the game is to be the most famed explorer by picking exotic travel destinations and searching for artifacts and treasures while simultaneously looking for the ultimate goal: the golden pyramid. Finding this will immediately complete the expedition and send the explorer home.

The game is split up into five levels where the goal of each level is to discover the golden pyramid within a large hexagonal map. The players must recruit members to their expedition, and if they have the funds for it, buy supplies and tools to help them in their quest. When the expedition has started, the player decides the trek of the expedition along the hexagonal map. Moving from one cell to another costs the expedition a certain amount of sanity points, where some cells are more expensive than others (moving through a jungle, or on top of a mountain). Only a small portion of the map is visible at the beginning of an expedition, and the player must move through the map to gain an understanding of the surroundings. When more parts of the map are revealed, important locations are revealed, but their specific nature is not until they come within a few cells of it. These locations can

[1] A rogue-like game is inspired by the old roleplaying-game *Rogue*, hence the name. Its features vary, but often includes punishing gameplay where the player must expect to lose often, limited ability to save, randomly generated worlds where no to games are alike, and a focus on random encounters that enhance the difficulty.

be native villages, old temples or hold other risks and opportunities for fame, fortune or an untimely death. The player's only help in finding the golden pyramid is a compass that will become more and more accurate as the map is explored.

If the expedition's sanity points reaches 0, the chances of bad encounters increase dramatically. Such encounters include disappearing expedition members, sudden illness, or the off-chance that one of the members turns cannibalistic and eats another expedition member.

Each expedition member has their own strengths and weaknesses. The priest, for example, will increase the base number of sanity points and also allow the expedition to rest without cost in local missions. The scout will allow the expedition to see further, and the Scottish soldier will increase the expedition's Sanity when drinking whisky. Each team member can also have numerous illnesses and negative attributes which are visible for the player, through symbols and name, but are not very well explained. An exploration member can be kleptomaniac, which effect is not made apparent until the exploration rests in a native village, and the member steals the village holy idol on his own accord, making the entire village hostile to the expedition.

The Curious Expedition challenges the player to create a synergy from the expedition members and always forces the player to take risks while also punishing them greatly for it. A concept in *Curious Expedition* is the obscurity of party members, items and events. The player learns the rules by playing and failing, and even after failing and having to restart, they may have learning valuable knowledge about the items, party members and locations for future playthroughs. This is a game that draws its addictive features from its difficulty and the immediate requirement to always learn and understand by own failures. The game never assists the players with outright explanations. Just as the character in the game explores new lands and learns from it, so does the player as he explores and learns from the game mechanics. As the players understanding of the game improves, so does his ability to play it. When five expedition's have completed, the player receives his final score in the amount of fame he has acquired. This is stored and displayed in a list of recent explorations, and the player will always know when he did better or worse than before.

7.3 *I.M. Meen*

Figure 7.4: I.M. Meen — When not solving grammar issues, the player must fight fantasy monsters

I.M. Meen (see Figure 7.5 is a first-person adventure game aimed at kids and released in 1995. The layout and basic gameplay closely resemble that of Doom, a first-person shooter game created for mature audiences in 1993.

The protagonist (a boy or a girl, at the players choice) is kidnapped by the evil magician I.M. Meen and locked in his magical dungeon. The game has two different and prominent means of gameplay: Much of the time will be spent by the player orienting themselves through various maze-like dungeons with a variation of themes such as a sewer, tower, laboratories, and libraries. While finding their way through these levels, they must overcome enemy creatures and find and open hidden or locked doors. Finding secret rooms can yield helpful tools such as health potions or a temporary bonus to fighting power against creatures. The short-term goal is to complete a single level by finding and opening all scroll doors and freeing the children inside. The last child on each level will give the player a key that unlocks access to the next level. The long-term goal is to complete all levels and escape, thereby winning the game.

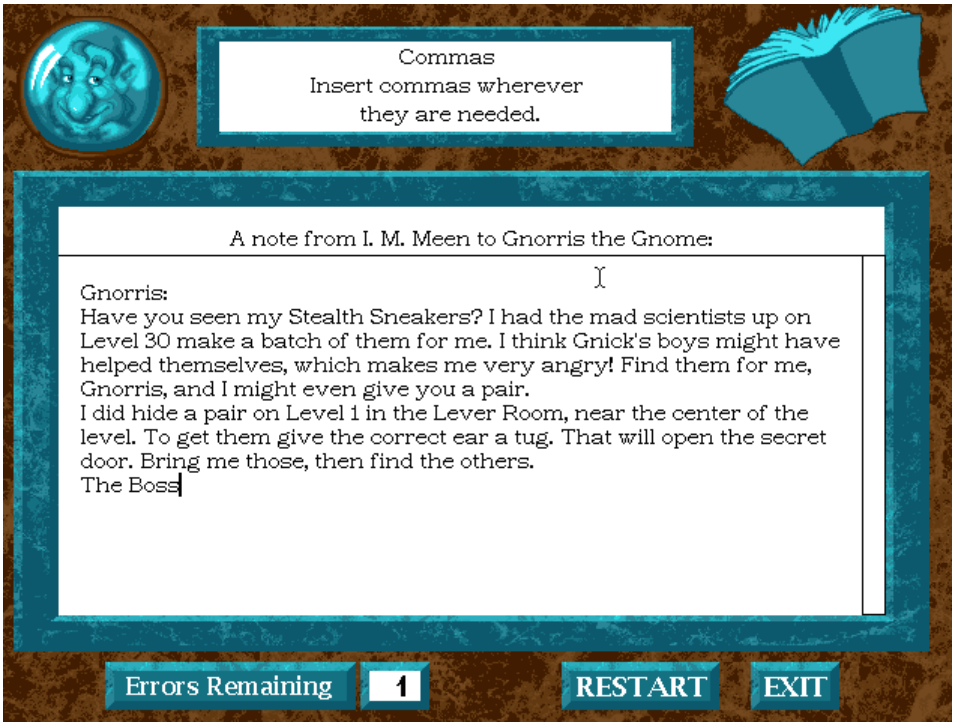

Figure 7.5: The player must solve grammar mistakes to open special ”scroll doors”. This particular text also holds clues to a secret location.

The scroll doors presents the player with the other prominent feature of the game: hunting for grammar mistakes. To open the doors, the player must read through a text of I.M. Meen’s writing and correct all grammatical errors. The difficulty and complexity of the grammar errors increase as the player progresses through the game. In the beginning they are simple, such as inserting missing punctuation. Later levels provide more complicated tasks such as correcting verb tenses, and also presents more errors per door and more advanced language. If the player has problems, they can always consult a built-in dictionary that concisely describes the relevant rules they must adhere to to correct the grammar problems of the game. The dictionary also provides practical examples, by providing clear feedback on how to improve.

An interesting observation to note is the lack of interaction between the two main gameplay types. Exploring the maze does not affect neither the difficulty or the way the grammar puzzles are solved. The vice versa also holds true: beyond providing the key for the dungeon exit and providing occasional clues, the grammar puzzles does not affect the exploration of the maze in a significant way. A possible reason for this is that the educational aspects of the game are hard to integrate with the maze exploration in a way so they mutually affect each other.

To avoid repetitive gameplay, the theme of the dungeons the player orients through are changed, offering new themes every four levels. These themes changes the texture of the

graphics and introduces new enemies. To mark the shift and chanage of theme, at the end of each fourth level the player must fight a particularly difficult creature known as a boss. These creatures are mostly versions of famous and mythical creatures mixed with I.M. Meen's name (such as "Frankenmeen" or "Meenotair") and facial features. The grammar-correcting gameplay gradually introduces new and fresh challenges to the player, and if the player pays attention, they might realize that the written text often tells parts of bigger stories, the continuation of which can be found in future levels. This might be intended to introduce the joy of reading to the player, or further encourage it for those a bit more experienced.

7.4 *Math Rescue*

Figure 7.6: The player is presented with a story-relevant math question in text-form and must form the answer by jumping on the numbered boxes

Math Rescue (see Figure 7.6) was released in 1993. It is a platform game aimed at children from 4 years and up and is designed to teach about the four basic arithmetic operations: addition, subtraction, multiplication and division. The game has three difficulty settings, one recommended for children of ages 4-7, one for children 7-10 and one for children aged 10 and older.

The main gameplay is a 2D platform game. The players goal is to find the key on each level by solving a number of math problems. Each problem unlocks a new piece of the key. The player must then find the door the key unlocks. The players explore each area to find the math problems, shaped as boxes labeled with the numbers 0 to 9. When found, the problems are accessed by jumping onto the boxes and doing so in the right order (so box 0 must be visited before box 1 and so on) provides a bonus to the players score. They will then be transported "into the box" where they are given a math problem either in text form or number form (See Figure 7.6).

The game is similar to *I.M. Meen* (see Section 7.3) in that both games have two seperate and clearly different gameplay mechanics that does not strongly interact. In *Math Rescue*, the main gameplay is the platformer: The player must explore each area, finding the boxes while jumping from platform to platform and dodging or destroying enemy creatures (keeping with the age-range of the game, the creatures are harmlessly 'slimed' by a helper character). When they jump onto a box, the gameplay changes into the more educationally focused math minigame. However, the educational gameplay are slightly more intertwined with the platformer gameplay than *I. M. Meen* as the player are introduced to two other mathematically inspired challenges:

- Finding and opening the boxes in the right order gives further bonus points, possibly as a means to keeping a bit of the players attention towards the math by encouraging them to count up to 10.
- The player always have a math problem at the center-bottom of the screen. Finding and jumping on a small truck holding a number corresponding to the answer of this math problem, will give them a bonus score.

The goal of the game is to attain the highest possible score per level as well as finish all the levels themselves. The player is thus rewarded by performing well on the math-related gameplay (by completing the problems correctly, in the right order, and as quickly as possible) and by exploring each level, picking up items that give extra scores. Beyond keeping track of progress, the scores themselves have little functionality, but serves to motivate the player. Other plausible motivations for the player are to unlock new levels with new graphical themes and music, and also to get the feeling that they are getting better at solving math problems.

7.5 The *Assassins Creed* franchise

Figure 7.7: Assassins Creed — The player takes the role of a sneak assassin during many real time periods

In the *Assassins Creed* franchise (See Figure 7.7) the player takes the role of several assassins throughout different epochs throughout the world. While progressing through the games, they are active participants in a number of real life events as well as interacting with historically important characters.

Throughout their journeys, the player must learn the gameplay mechanics which focuses on the tricks and trades of the assassin: gathering information on victims, blending in with the background to avoid detection by enemies, using the environment to help them by running across building in a parkour like fashion and — if all else fails — combat their enemies with a number of weapons. As they get further through each game, new weapons and abilities are unlocked, giving the player a larger array of possibilities. Mastering these will make their assignments simpler, and make the player feel they are mastering the exciting arts of the sneak assassin, contributing to the immersion. At the beginning of the game, the player also only have access to one city, but as they progress, more cities unlock.

The *Assassins Creed* franchise' focus does not rely on education as a key feature. Instead it is a story driven adventure where fighting and exploring are the main game mechanics. While the storyline is filled with nonfactual events, the epochs are portrayed closely to their real-life counterpart and offers valuable insight into the life and world of the epochs they portray. Modern technology allows the player to walk through the streets of Florence during the Renaissance and interact with Leonardo Da Vinci, or to be in the raging crowds during the French Revolution, or getting a sense of the intrigue that lead to the American Revolution.

It is the focus on this immersion where the educational value lies. The games can create a sense of interest, and have several optional activities that let the player go in depth with this interest. One particular optional activity revolves around discovering important structures around the cities, and the player can consult an in-game encyclopedia giving historical recounts of events and characters they meet. Some of these activities rewards the player by providing a metric of in-game activity completion, but the main motivation for going in-depth to the history is on the player's own accord.

While the educational value of games such as *Assassins Creed* are still not quite understood or certain, it has garnered some interest within academics of fields outside of gaming. After playing *Assassins Creed: Unity*, which revolved around the French Revolution, history professor at the University at Trois-Riveries stated: *"Games like Assassins Creed are sparking interest in different eras of history. I think its useful and we have to do something in universities to integrate these things into our teaching. We've done so much work with Ubisoft, recreating 18th Century Paris, I hope to create environments to use in lectures and research, for college and high school students to get a better sense of what Paris was like. Like a historical Google Streetview."* (Casvean, 2015, p. 53) which goes to show that even games without a predominantly educational focus might still have a part to play in the future of interesting students in specific fields.

7.6 Summary

7.6.1 Learning

The presence of learning and presence of motivation is evident in all the games in this game study, but appeared in different form. In this section we present a quick recap of the observations we made during the game study.

- **Varieties of exploration**
  Exploration comes in many forms in the games we have studied. The most obvious varieties in explorations rely on exploration through 2D and 3D spaces. In *I.M. Meen* (See Section 7.3) the player must find their way through a number of mazes to uncover and open scroll doors, whereas in *Math Rescue* (See Section 7.4) they must explore a side-scrolling 2D world, jumping on platforms to find number boxes to solve. We call this form of exploration *spatial exploration*.

  Less obvious in the exploration factor in *Game Dev Tycoon* (See Section 7.1) where the exploration relies on experimenting with different genres and types of games and correctly assigning amounts of focus on the right disciplines for each stage of development. In *A Curious Expedition* (See Section 7.2), the player must explore unexplored territory by moving their party across a map, but they must also explore their party members good sides and bad sides and understand and master various game mechanics to master the game. We call this form of exploration *game mechanic exploration*.

  For the educational games and to some extent *Assassins Creed*, we want to also suggest a presence of *educational exploration*. This exploration has its basis in

exploring and learning the ”real-life” knowledge from the game. In *I.M Meen*, the player must explore the ”world” of grammar to solve the scroll puzzles, while in *Math Rescue*, they must explore the ”world” of math. In *Assassins Creed*, this exploration is entirely optional, but the possibility is there to learn more about the historical figures and locations that are present in the game if the player should want to.

Most of the games we studied had a combination of spatial and game mechanic exploration, with the exception of Game Dev Tycoon, which relied solely on game mechanics exploration. The educational games and *Assassins Creed* also contains educational exploration, which links the game up to educational learning.

- **Integrating education with game learning.**
  In the games that had a clear educational motive the gameplay elements that promoted educational learning were independent and only loosely connected to the gameplay elements that dominated the rest of the game. This poses an interesting question: Is seamlessly combining gameplay learning and educational concepts impossible?

- **Immersion may itself promote educational gains.**
  In the *Assassin's Creed* franchise, a lot of focus is put into the immersive qualities of the game. There's a potential that simply allowing the player to immerse themselves in the universe of a game can be enough to motivate or even promote educational gains. Even without a strong focus on the educational values, games such as Assassin's Creed can promote education in history or art simply by presenting the universe and letting the player learn from it through their own exploration through the game.

7.6.2 Enjoyment and immersion strategies

Enjoyment must be a key factor when designing a game. When we performed the game study, we tried to discover patterns or concepts present in the game to promote a sense of enjoyment and immersion when playing the game.

- **Starting off simple — expanding the possibilities**
  Game Dev Tycoon, *The Curious Expedition* and *Assassins Creed* all start off with a limited number of options and abilities, and as the game progresses gradually unlocks more upgrades and ways of playing, increasing the challenge level but also the possibilities. This happens either automatically as the player progresses to a certain point, or the player can buy in-game upgrades. Often the games operate with a combination of these two means of expanding the gameplay.

- **Thematic variation keeps the sensory curiosity fresh**
  Most of the game offers thematic variations. When the player has progressed to a certain point or level, they are offered new areas with new visual styles and music. This seemed to be in particular the games with a focus towards spatial exploration. These thematic variations helps to keep the game look and sound fresh, and helps to combat feelings of repetition.

- **Hidden information keeps the cognitive curiosity fresh**
  Many of the games feature hidden information, and does not tell the player everything outright. The player is instead tasked to experiment with the gameplay to come up with their own optimal playstyles and figure out secrets of the game by themselves. This can be a very strong tool to increase replayabiltiy, as the player will want to replay previous parts of the game, having learned something new.

- **Exploration as motivation**
  A game with the ability to give a sense of having learned to mastering its gameplay and environment seems to be an enjoyment factor, and might be a strong motivational factor for the player.

- **Difficulty can be a motivationa**
  This point is connected with the previous points and relates mostly with *The Curious Expedition*. The udeniably most difficult game that was studied. Sometimes the frustrations of trial and error, and the growing desire to master these difficulties can provide encouragement in itself.

- **Immersion as motivation**
  Besides the clear learning advantages, immersing the player into a world they know to be historical and factual might itself invoke an interest and enjoyment. It is not entirely clear whether it is immersion (regardless of in a factual or fictional universe) itself that provides the enjoyment, or if immersion into a historical world has extra magnitude.

Part II

Solution and Design

This part contains three chapters: In Chapter 8, we present a framework constructed to aid the development of the game with game enjoyment in focus. Chapter 9 presents the game proposal, which explains how we interpreted project management concepts into game concepts. Chapter 10 presents the more in-depth technical design and development of the game.

Chapter 8

FrameWork

Below is a list of combined elements taken from Malones ”What makes things fun to learn” (Malone, 1980) and ”GameFlow: A model for evaluating player enjoyment in games” (Sweetser and Wyeth, 2005). These elements describe different aspects of games and how they should be used to make a fun and educational experience. We will use this list to aid us in the early stages of development.

8.1 Player Skill

A very important point is that the game must not be boring to play, since this will cause the player to lose interest and stop playing. One way we hope to solve this is to give the game some humor and hidden information, which will hopefully engage the learners curiosity, discussed in Section 6.1.3. The player could also lose interest if the game seems too complex so we will implement some form of tutorial, or if pressed by time at least some form of explanation to ease the learner into the game.

- The process of learning the game should not be boring.
- The game should provide in-game tutorials or initially easy first levels.
- The difficulty of the game should increase together with the skill of the player.
- Interface and mechanics should be easy to learn and use.

8.2 Control

The interface of our game is important for the player to feel in control of the game, this means giving enough feedback, preventing errors and giving the player a sense of having an impact on the game world. In our case this will mainly be done with having the player earn money, so the player can buy some form of upgrades etc, and prestige. Prestige

represents the players reputation as a project manager and will unlock future project if the player preforms well.

- Players should feel control over the game interface and input devices.
- Players should not be able to make errors that cannot be recovered.
- Players should feel a sense of control and impact on the game world.
- Players should feel a sense of control over actions taken.

8.3 Feedback

Feedback could be a potential pitfall for us, as immediate feedback is on our list, but we also want the player to be able to make mistakes during a sprint planning and to realize after the sprint is done that the planning was done wrong or suboptimally. This is where we have to balance what information to give at what time.

- Actions should provide immediate feedback.
- The player should get feedback on their performance (for example through status or score).
- Feedback should be constructive and help the player attain new knowledge.

8.4 Concentration

We noticed early on that balancing the workload could become a bit tricky as the early part of the game would be quite slow in the planning stages, but during development we want the game to be more hectic. This will better simulate a real project, but could be bad for the pacing of the gameplay.

- Players should be easily immersed and easily maintain such immersion
- Players should have a good balance of workload. Too much will make it unovercomeable. Too little will make it boring

8.5 Challenge

Our game will not be a complex environment, therefore it is important that we give obvious clear goals at appropriate times, we must also give an overriding goal for the player early on that the player can work towards. The goals we give the player must match their skill level throughout the game, so they should be more difficult as the player skill increases. The game should also have some uncertain outcome. One of the ways we want to do this is giving all the employees a number of traits, where some are known to the player, others are hidden and must be discovered through interacting with them and seeing how they act.

We are not planing on having variable difficulty level, but instead using score keeping, or similar.

We aim to make the skills intrinsic as this would be better for immersion. These skills would then be things project managers actually do. An example of such a skill is assigning a team member to a task, or get status reports from the team.
In the game we are looking for a humorous tone, for example with ridiculous customers or customers wanting strange products. It will be important to evoke some emotional response from the player for them to invest in the game.

- Best goals are often practical or fantasy goals rather than goals of using a skill
- Clear goals
  - Overaching goals should be clear, given early
  - intermediate goals should be clear and presented at appropriate times
- A goal must match the skill level of the player
- Uncertain outcome
  - Multiple level goals. Example: two levels of goals can be having a basic goal of popping balloons and then a metagoal (do this efficiently)
    - Score-keeping, metagoal of getting a highest or lowest score possible
  - Information is hidden for the player, and only selectively revealed throughout the game.
- Immersion
  - Game should make the player less aware of surroundings
  - Game should make the player less self-aware and less worried about everyday life.
  - Fantasy
    - Intrinsic and extrinsic fantasy
      - Intrinsic seems to be better than extrinsic. One way to create for given skill is to simulate a situation where the skill is used. Other way is to think of situation that involves useful analogies to the skill being used
  - Audio and visual effects
    - to enhance fantasy, evoke fantasy association

- As reward, used to reward good performance, can increase salience of the goal and thus add to the challenge of the game.
  - The challenge of reaching a goal however, can sometimes distract from exercising their curiosity, and might decrease certain kinds of learning
- As a representation system, perhaps the best use of sound and graphics in games is to represent and convey information more effectively than with words or numbers

8.6 Summary

This chapter highlighted elements from the framework that should be present in the game. This framework will be used when developing the game and when making the questionnaire. The full list of elements can be found in the appendix under Section A.1.

Chapter 9

Game Proposal - Freelance Team

Freelance Team is a casual educational-inspired game to be designed for PC and Mac with the Unity game engine. In this chapter we present our game proposal. This proposal is based on the work done in the prestudy, using the Framework detailed in Chapter 8 with the relevant project management theory (See Section 3) and drawing inspiration from the findings during the Game Study in Chapter 7. Contrary to the clear split beteween fantasy and educational elements of *I.M Meen* and *Math Rescue* discussed in Chapter 7, the game should seamlessly incorporate project management learning with the fantasy aspects of the game, and learning how to play the game should optimally also teach the player about project management skills.

9.1 What project management elements to include in the game

Since the field of project management is so large we could not include everything in the game. This meant that we had to focus on certain aspects. The game is intended as an introduction to project management, therefore it is safe to assume a large portion of the players probably has very little knowledge about it. A decision was made to to focus the game around the development team and not on tasks outside that a project manager does unrelated to the development team, such as all communication with customers, stakeholders, users, and the project board.

With this in mind, an analysis of the PRINCE2-method was performed; the parts that would suit the game and was most crucial when learning the fundamentals of project management was selected. The aspects listed in Section 3.1 was found to be very important to include to give the player a feeling of control over these aspects would be vital.

9.2 Features

The following is a short-list of features that the final game should contain:

- A deep project management simulator wrapped in a casual style and gameplay.
- Numerous projects to participate in, each requiring different tactics and playstyles to successfully complete.
- Each team member has their own good and bad qualities. Some of them are apparent, but others must be discovered by the player through analyzing their work flow.
- Learn concepts of Project Management while enjoying a game.

9.3 Basic Concept

In *Freelance Team*, the player takes charge as the administrator of a team of project development experts. A project is selected and a deadline is given. The team will then work on the project in work sprints. As the manager of this team, the player must plan the execution of a project making sure that the correct tasks are performed while the customers requirements are met while making sure that budget constraints are followed and the project is completed in time. During the development they must also monitor their employees closely and make sure that each is working as effectively as they can, as well as making case to case decisions that will affect the end product. These are the most important concepts of Freelance Team:

- Project
- Delivery
- Qualities and Requirements
- Sprint
- Task
- Employees and Participants

9.3.1 Project

In *Freelance Team* a project is presented as a specific objective that must be completed. The player manages a team of project execution experts.

9.3.2 Delivery

A project consists of smaller, more specific parts: the deliveries. A delivery is a specific feature that is attained by completing a number of customer requirements. Two equal projects may have different deliveries. A delivery has a set of tasks connected to it; these tasks are connected to this delivery, and completing them will add a number of qualities to the same delivery.

This concept gives the project a ”Focus on products” as summarized in Section 3.2

9.3.3 Qualities and Requirements

A delivery is complete when its requirements have been fulfilled. Delivery requirements are met when the delivery has attained the required qualities. These qualities are attained when employees complete a number of delivery-related tasks. Deliveries consist of predictable and unpredictable requirements. The predictable requirements are the requirements that are always present and always revealed to the player. An example of this is that a requirement for ”Building” would be the quality ”Building Built”. Unpredictable requirements are customer-specific requirements that change between projects. Some customers may expect the building to be tall, while other customers may expect the building to be safe. These requirements are often hidden, and are discovered by the player when their employees complete research tasks.

9.3.4 Sprint

A sprint is a period of time in which the execution of tasks are performed. In *Freelance Team*, each sprints last 2 game weeks (80 game hours per employee). During the sprint execution, one hour of game time is performed per second of real time, making each sprint last for about 80 seconds. Each project typically has four sprints. During the early parts of the game, the player assigns deliveries to sprints, and as long as this plan is not changed, only the assigned deliveries can be worked on, on these sprints.

These sprints will be the stages in the ”Manage by stages” principle, Section 3.3, although a little simplified and altered it will show the player that a project is done in stages and after each stage one updates the plan and reevaluate.

9.3.5 Task

Tasks are assigned to employees during the sprint planning phase and executed during the sprint execution phase. They contain a predefined amount of work that must be performed before they can be considered completed.

When moving the mouse over a task, all team members will give an estimate to how long it will take them to complete the task. The calculation will be based on their current motivation, how skilled they are as well as any other effect they may be affected by. Employees can under- or overestimate how fast they will work, and the player needs to analyze their behaviour to learn who tends to overestimate or underestimate.

There are several types of tasks:

- Project Tasks
- Customer Tasks
- Office Tasks
- Unfinished Tasks

Project Tasks are invariably connected to a specific delivery, and will only be assignable to employees in the sprints where its parent delivery is assigned. These tasks are often dependent on another task being completed before they can be started.

Customer Tasks relate to gaining more understanding about the projects and its requirements. These tasks can contribute to revealing new requirements that the player was previously unaware of, and also to verify the quality of tasks already performed.

Office Tasks are performed to increase the skills, motivation and other attributes of the team members. These include sending them to improvement courses, having a break to increase their motivation, or sending them to a personality analysis expert to help understand their strengths and weaknesses.

Whenever an employee starts a task, but is unable to finish it in time, it will be available in the list of *Unfinished Tasks*. These tasks have the progress the previous employee performed, and will be quicker to complete.

These tasks ties into the ”Focus on products” principle of PRINCE2, see Section 3.2.

9.3.6 Employees and Participants

Employees are the key resource to Freelance Team. They must be controlled, organized and assigned to tasks. But the team members in Freelance Team are not passive and lifeless objects, they have their own positive and negative properties. These can be identified by paying attention to the participants, or sending them to a personality specialist who will reveal a hint as to their personality type.

The player has a quick overview of their employees motivation, understanding and skills. This is just an estimate, however. Just as in the real world, getting a full and honest picture of your employees will require a bit of work and guessing.

The employees have skills that affect how well they perform some tasks:

- Design - The ability to make things look and feel beautiful.
- Physical Competency - The ability to make stuff with hands.
- Analytical - The ability to understand and draw conclusions.
- Charm - The ability to make people understand and agree to your opinions.

9.4 Gameplay

A game session of Freelance Team is split into several phases:

- Project Selection - The player chooses a project to work on and finish.
- Mandate Planning - The player decides what deliveries to work with in what sprints, and also the amount of participants that should be working each sprint.
- For each sprint in the project, the following phases happen:
  - Sprint Planning - Assigning tasks to be finished during the current sprint
  - Sprint Execution - The current sprint is executed
  - Sprint Result - Results of the current sprint is shown
- Project Result - Results of the project is shown

Initially, the player chooses a project that they wish to pledge to in the *Project Selection* screen. Some projects may have requirement such as Prestige Points (see Player Goals). When a new project is started, the player performs a *Mandate Planning*. They assign deliveries to sprints and also decides how many participants each sprint should have. It is important to note that the number of participant per sprint is changeable at the begining of that sprint. The mandate planning is based the method ”Initiating a project”, Subsection 3.3, it is simplified to fit the game and focuses more on the products to be delivered, time frame and cost and the expected gain.

When the *Sprint Planning* begins, the player chooses amount of participants for the given sprint. They then assign tasks to these participants. These tasks should be finished during the upcoming sprint. Some tasks require other tasks to have finished before they can be started, and it is important for the player to assign the tasks so that as many of them as possible can be finished concurrently by all participants.

After the sprint planning is complete, the *Sprint Execution* phase begins. This is the phase in which the participants work on the tasks. Each second progress is added to the task based on the participants ability to work. Once this progress surpasses the required amount of progress for the task, the task is considered finished and the qualities it awards will be added to the delivery connected with the task. Other effects, such as random events and other happenings are also calculated. One second of real time corresponds to one hour of game time. One second of game time during the sprint execution phase is known as a ”tick”.

During this phase, the player must also be wary of the amount of progress that is made. To help them, they are given a Burndown Chart (REFERENCE LINK) that shows an estimate of how much work should be remaining for each hour of development as well as how much work is actually left at the same tick. Using this graph, the player is able to make decisions on how well they planned the sprint, if their employees are working as well as they could and if they need to make decisions to improve the work.

Both the sprint planning and execution is based on the ”Controlling a stage” method from Section 3.3

After a sprint is finished, the player receives the *Sprint Result*: an overview of all the project tasks they had planned in the completed sprint. If the task was correctly finished, it will display in green, and the qualities associated with the task will be added to the delivery.

When the project is completed, the player receives the *Project Result*: an overview similar to the sprint result, but instead of tasks they are given an overview of all deliveries along with all requirements. If the requirement was met, they will receive a number of points. If a requirement is not met, they will lose a number of points. Factors such as managing to stay within budget and other bonuses will also give positive or negative points. Based on this score, the project is either considered a success or failure. Success will give the player prestige points and a bonus to their personal budget. A failure may result in no prestige points or even a detriment to their prestige points. The project results is based on the ”Closing a project” method described in Section 3.3.

9.5 Player Goals

The players goal is to try to attain as high project score as possible by completing the requirements and finding secret bonuses during the execution. Each project has a personal high score and the player is given feedback when he has managed to attain a higher score. In addition, a higher score means more prestige points that will unlock new projects, and an increase in the players personal budget that can be used to buy upgrades for the employees.

9.6 What elements was not included

The PRINCE2 principles we chose to not include was:

- ”Continued business justification”, Section 3.2. Mostly because we chose not to include any form of project board or communication with customers.
- ”Manage by exception”, Section 3.2. This could have been implemented in some way, but we chose not to for two reasons: the first being that without any team managers the only manager in the game would be the player. The player would not see that there are multiple levels??. The second reason was that we wanted to encourage the player to check up on their participants and get an overview themselves instead of the game notifying the player when something has gone wrong.
- ”Defined roles and responsibilities”, Section 3.2. Since we chose not to include communication with users, project board or suppliers the roles and responsibilities available in the game are few.

Chapter 10

Design and Development

In this chapter we elaborate further on how the Unity Game Engine was utilized to design and create the game, based from the game proposal (See Section 9). First we quickly touch in on the most important elements of the Unity Game Engine, we then describe how the various elements of the game was utilized, and then go into detail on how we realized the conditions set in the framework.

10.1 The Unity Game Engine

Freelance Team is built upon the Unity Game Engine. It is a close-source programming environment using a number of libraries and components. UnityEngine is written in C++ and at this time accepts three different programming languages: C#, Javascript and Boo.

As it is close-sourced, it can be considered an omniscient layer that surrounds the entire architecture. The most important aspects of the Unity Game Engine are:

- The GameObject
- The Component
- The Scene

A *GameObject* is a specific object that the Unity Game Engine can identify and interact with. Every element in a game created by the Unity Engine is a GameObject. In themselves they do very little; instead they act as behaviour containers consisting of any number of behaviours. Among many other things, these behaviours control what a GameObject looks like, what input they accept and how they respond. In Unity such a behaviour is known as a *Component*. Components hold the information about a single piece of behaviour in the form of code. They are used to control the GameObject and to allow a GameObject to change its behaviour during run-time. All GameObjects are presents in a *Scene*. A game consists of a number of scenes, which in turn consists of a number of

GameObjects. This is what the player sees when they start a game. It can be a main menu, a list of projects or a window for the execution of the project itself. There can be multiple scenes visible at one time, but in our game we use only one scene at a time.

10.2 Game Architecture

The game architecture was based on the Abstraction Layer architecture. Abstraction Layer abstract different responsibilities of the software into layers and control the flow of data between them. The Layers are controlled by a connected controller. (See Figure 10.1)

- Unity Layer (abstracted)
- Game Layer — Controlled by GameController
- Current Project Layer — Controlled by CurrentProjectController
- Sprint Layer — Controlled by CurrentSprintController

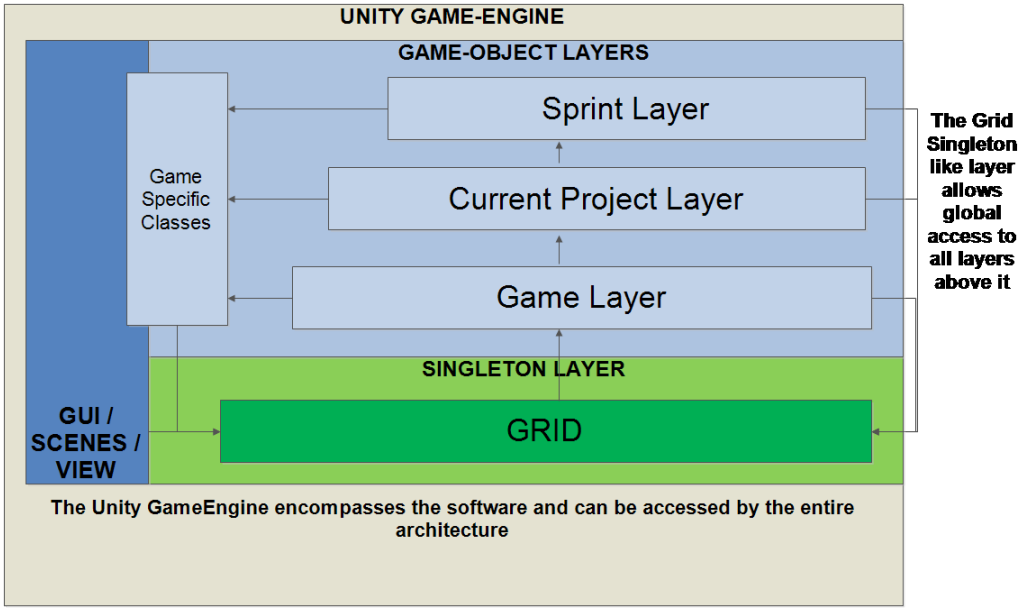

Figure 10.1: Layer View of the game

The layers were realized by creating a number of GameObject controllers during run-time, and letting the flow of data run through these. The Grid Layer is a single static Singleton class that the entire application has access to. At the initialization of the game, this class instantiates a number of important GameObjects, the most important one being the Game Controller. It also handles automatic imports of important resources that resides in the source code's resource folder.

The Game layer contains GameObjects that are relevant and should be present for the entire game. Game Controller controls the game-states and global variables that should be persistent and accessable throughout the entire game. It also handles the initialization of a project when the gamer selects it.

When a project is selected, a new controller for CurrentProject is instantiated. This contains information that should be persistent during the current project. The Current Project Controller holds the logic and variables specific to the project that the player is currently working on. When a new sprint begins, it creates a new instance of the CurrentSprintController. When the project is finished, this controller is destroyed.

The Current Sprint layer holds the logic and variables specific to the sprint that the player is currently working on. When the current sprint is finished, this controller is destroyed.

10.3 Gameplay: Project Selection

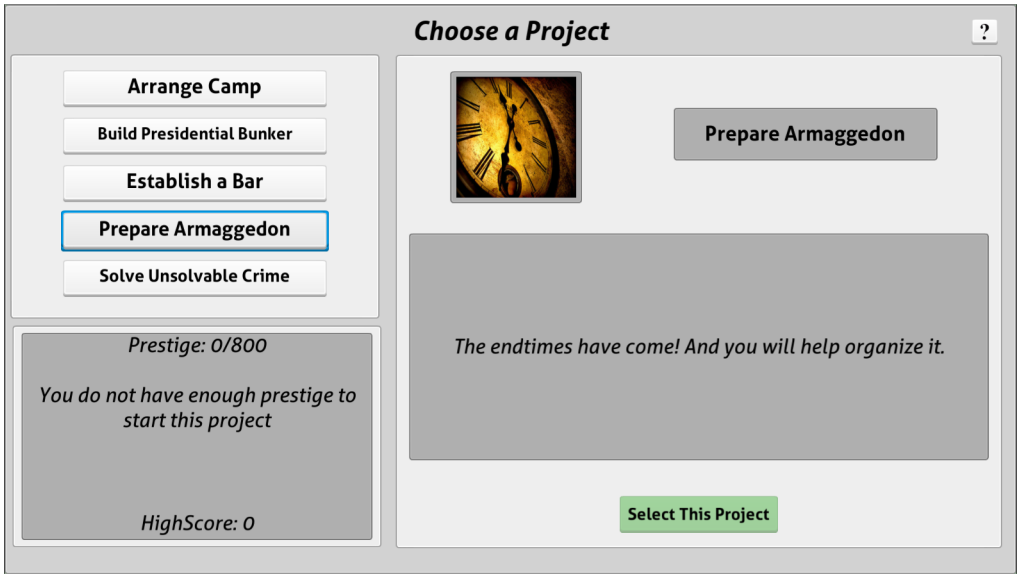

Figure 10.2: Selecting a project

Initially, the player selects a project from a list (See Figure 10.2). This list provides a name and description for each project. Some of the projects require that the player has acquired prestige before selecting. Prestige are acquired by performing well on other available projects. As every new project provides different variations, a project that has already been completed can be selected again and still offer new challenges. The player also has an overview of their best performance on the selected project.

The intention of the prestige score is to balance the difficulty level, requiring the player to perform easier projects well before undertaking more difficult projects. It also serves as

a long term goal, where the player will want to perform well on projects to unlock new exciting projects.

The highscore is there as a means to challenge the player to perform better in already completed tasks to reduce the feeling of repetition, and increase the feeling of mastery the player gets when he beats his own score.

10.4 Gameplay: Project Planning

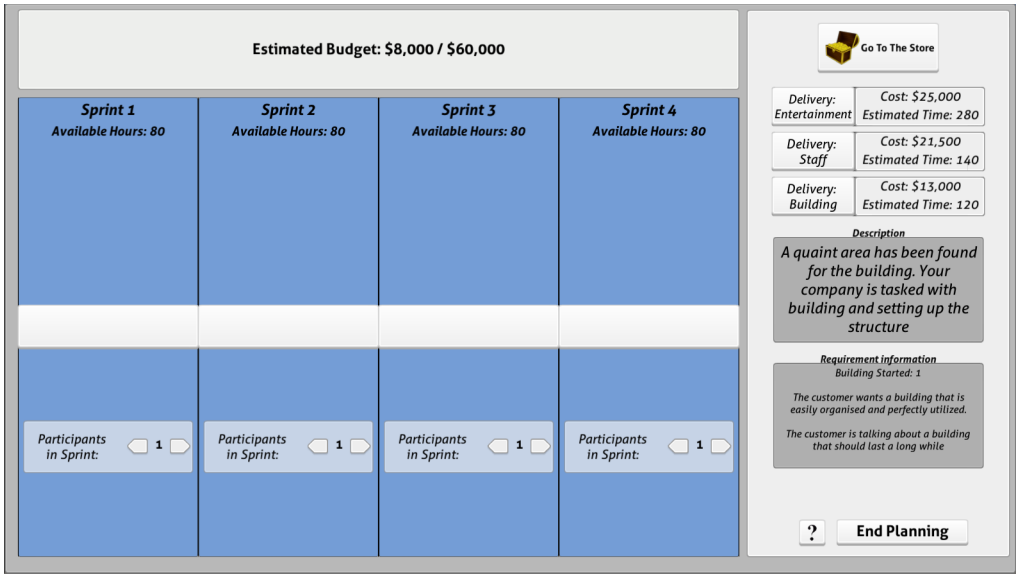

Figure 10.3: Planning the project

In the Project Planning screen (see Figure 10.3), the player sets up a preliminary plan for the entire project. This plan can be changed as new information about the project emerges during its execution, but making changes to this plan after the project has begun will disgruntle the employees, making them work slower.

By dragging a delivery to the white area in the sprint, they assign that delivery to this sprint. By hovering the mouse cursor over a delivery, the player gains a description about the delivery and requirement information about the delivery.

Assigning a delivery to a sprint will add an estimated impact on the budget. It is also possible to select the number of participants per sprint, which will also add an estimated impact on the budget. These are just estimations, and may not reflect the actual impact, as estimates are predetermined: each employee adds $2000 to the budget, while each delivery has a hardwired average cost.

Requirements are in the forms of qualities that must be realized by completing tasks. There are two kinds of requirements:

- Generic requirements that is always present in the specific delivery
- Vague requirements that are determined by the delivery's variation

The generic requirements are always present. In the example above, the player views the details for the Building-delivery. "Building Started: 1" is always present as a requirement. That means that the player must gain the "Building Started: 1" quality. Since it is always known, it is presented in this form. Below are two requirements that are more vague: "The customer wants a building that is easily organized and perfectly utilized" and "The customer is talking about a building that should last a long while". These are requirement extracted from the delivery's unique variations. These requirements are not entirely known and must be discovered by completing tasks.

After completing a number of these tasks, the vague requirements are replaced with more specific qualities. (See Figure 10.4)

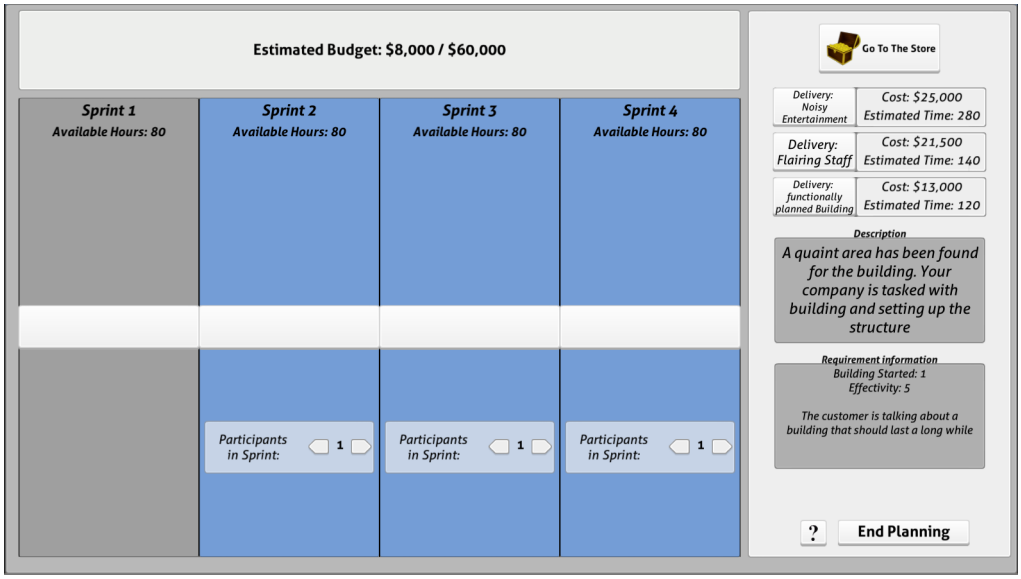

Figure 10.4: Some qualities are revealed, reflected both in the requirement information, and the name of the delivery

The vague requirement "The customer wants a building that is easily organized and perfectly utilized" has been replaced with the more specific: "Effectivity: 5." The player must strive to choose the tasks so that the delivery will have attained at least 5 points in the effectivity-quality. The delivery name has also been appended with a prefix or a suffix to reflect the changes to the delivery.

This simulates the real-life situation in a project where the customer is vague or unsure of what they actually require. It is the players job to discover these vague requirements, and choose to complete the right tasks to realize them.

10.5 Gameplay: Assigning Tasks

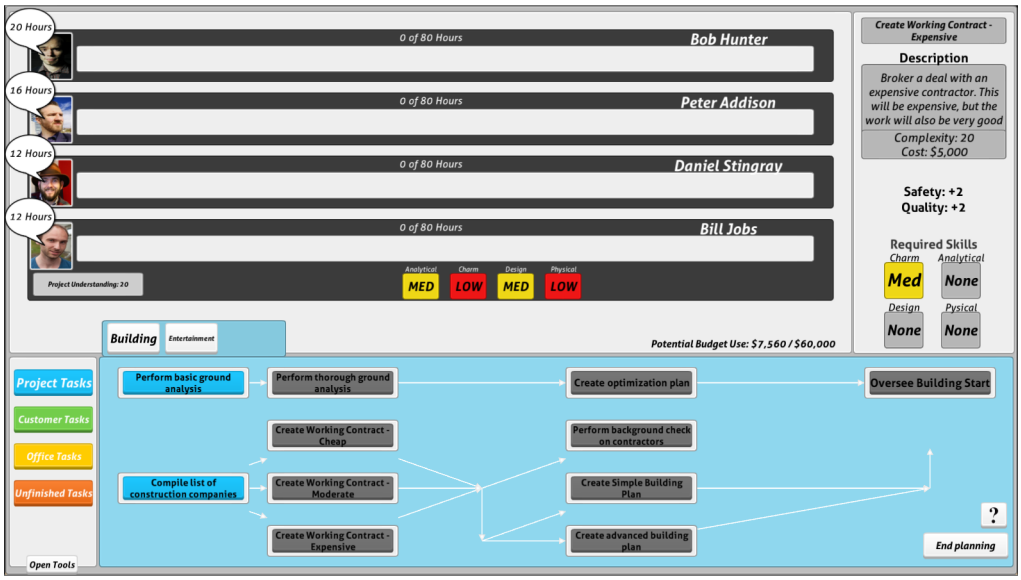

Figure 10.5: The player assigns tasks to employees

At the beginning of each sprint in the project lifecycle, the player must assign tasks to the selected employees for that sprint (See Figure 10.5). Each player has a set of attributes that determine how long they will use on tasks. From this they give an estimate in a speech bubble over their name when the player hovers over a task. The following attributes determine their estimate:

- An employee's baseWork attribute — A base number of work they manage to perform on a task each tick.
- The employee's motivation — A high number will give a bonus to the baseWork attribute. A low number will have a detrimental effect.
- The employee's skill levels — If these are higher than a tasks required skills, a bonus will be given to the baseWork attribute.
- The employee's confidence level — A high confidence will boost the employee's perceived baseWork, while a low confidence will detriment it. However, these only affect the estimate, and not the employee's actual baseWork value. That means that a highly confident employee will underestimate the time he takes, while opposite for a low confident employee. This reflects real life, where employees often base their estimates on miscalculations of their own skills.
- Any active effects — An employee can have any number of positive or negative bonuses (known as buffs). These will also a affect the estimate. For example, a sick

or exhausted employee may give a much higher estimate, but will work better once these buffs have been removed.

The player can assign project-specific tasks belonging to any of the deliveries that was assigned in the Project Planning phase.

10.6 Gameplay: Project Execution

During the project execution phase of the development (See Figure 10.6), the player must perform actions, maintain their employee effectiveness and handle unexpected events as the development is underway in real time.

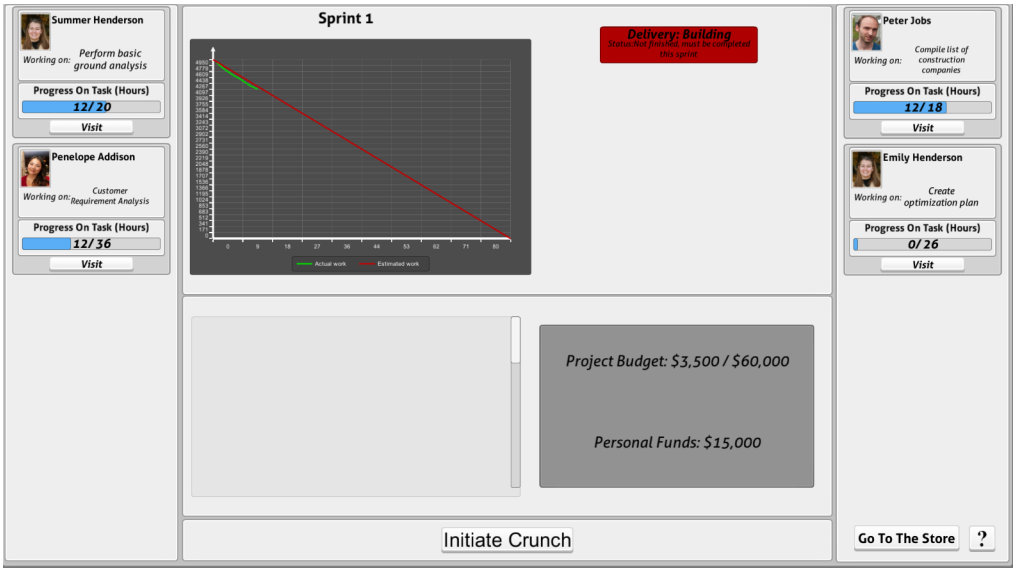

Figure 10.6: Project Execution is underway and the employees are currently on time, as demonstrated with the green line under the red in the burndown chart

10.6.1 Ticks

This phase of the project is performed continuously. This differs from the rest of the game, where the player has an unlimited time to make choices. For each second passed of real-time a number of game state computations are performed. This process is referred to as a ”tick”. A sprint consist of 80 ticks, representing two weeks of working 8 hours a day.

Every tick, the following happens:

- For each task that is currently worked on by an employee, progress is added to it corresponding to the employees work ability

- If the progress made on the task surpasses the progress needed, the task is complete, and the employee begins a new task. If there were any events connected to the task, these will start.
- A random event may happen.
- A predetermined event may happen.
- Employee attributes may change, such as motivation or understanding.
- A new point is added to the burndown chart.

10.6.2 The Burndown Chart

When the project starts, the player is treated to a burndown chart detailing the amount that is left each tick (the green line) contrasted with the amount of work that should be left every tick (red). The red line is computed based on the total amount of work divided by amounts of ticks. The Burndown Chart is a pivotal part of Agile development processes such as Scrum, and was implemented into the game because of its very visual representation of progress. The burndown chart provides progress feedback to the player, and the player should quickly understands when work is lagging behind. However, while the burndown chart provides a metric for how well the work is going, the reasons why work is going particularly well or particularly unwell can not be extracted from it, requiring the player to use other means of investigation.

10.6.3 Performing Actions

Figure 10.7: Player actions available after buying the coffee machine

The player can perform actions during the project execution phase (See Figure 10.7). At the start of the game only a single action is available: ”Initiate Crunch”. This will increase all the employees work ability and increase motivation for a number of ticks, but will be followed by an equally long period of reduced work ability and motivation, reflecting real life crunch periods where employees work long hours overtime and weekends to finish a project in time. In this prototype another action — the ”Make Coffee” action — is made available after buying the ”Coffee Machine” upgrade. This action will prepare coffee for the employees, making them work better for a short amount of time. Actions may have different cooldown times — a period of time after the action has been used where it cannot be used again.

10.6.4 Visiting employees

As the project leader, the player is responsible for making sure their employees are doing their job properly. While the burndown chart is essential for providing feedback on how

the project is progressing, visiting the employees continuously is important to understand why the project is progressing as it is.

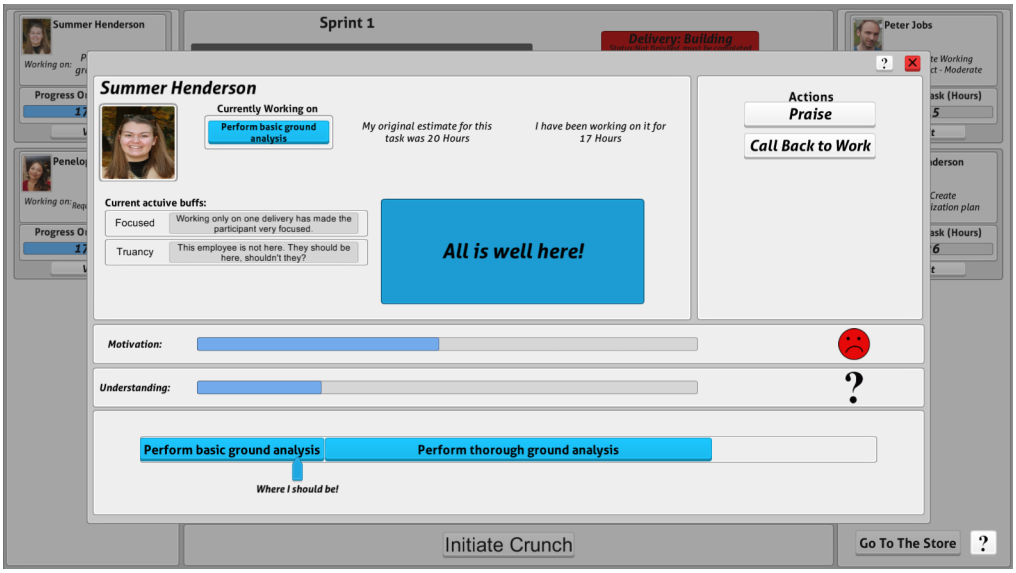

Figure 10.8: Visiting an employee gives valuable information on how well they are performing their task and why

Visiting an employee (See Figure 10.8) will give the player information about their motivation and understanding. It provides them with the employees current task, the original estimate for the task and how long they have been progressing on the task. If the latter is greater than the former, it could mean the employee has underestimated their task or that some behaviour trait are affecting their work ability. In this example, Summer Henderson is truant from work, visible by the buff visible on the left side of the window. This is connected to one of her inherent behaviours and she will be regularly absent, meaning she won't perform any work at all. When this happens, the player can choose — from a number of employee actions (which differs from player actions in that they only affect the given employee) — to call her back to work, which will resolve the effect and remove the buff, allowing her to continue work as normal. In this example, Summer is also demotivated, which will reduce her ability to perform work. Praising her will increase her motivation and she will work better. However, praising can only be done once every three ticks, so the player must think tactically and praise the right employees at the right moment.

10.6.5 Events

During a project, unforeseen things can happen. This is reflected in the game by the presence of game events. An event can appear as an additional choice the player must make or it can appear as an informational message box (See Figure 10.9), informing the

player that something has happened. Some events also happen silently, leaving the player to discover them for themselves.

Figure 10.9: Message given when completing a 'Customer Requirement Analysis' task

The following are the different types of events that exist in Freelance Team.

- Random events — These happen entirely at random based on an internal dice roll. An example of this event is the sickness event. Employees will occasionally become sick, which hinders their ability to work effectively on tasks.
- Task events — These happen after a task is finished. They often simply provide feedback on what the player has achieved by completing the task, but can sometimes also provide the player with additional choices. An example of this event is the Perform Risk Assessment, where the player is prompted to select a risk area they find especially important (See Figure 10.10).
- Behaviour events — These happens as a result of an employees behaviour attribute. An example is the demotivated behaviour. An employee with this behaviour that is demotivated for too long will prompt a player with the possibility to give them salary bonuses to raise their motivation.

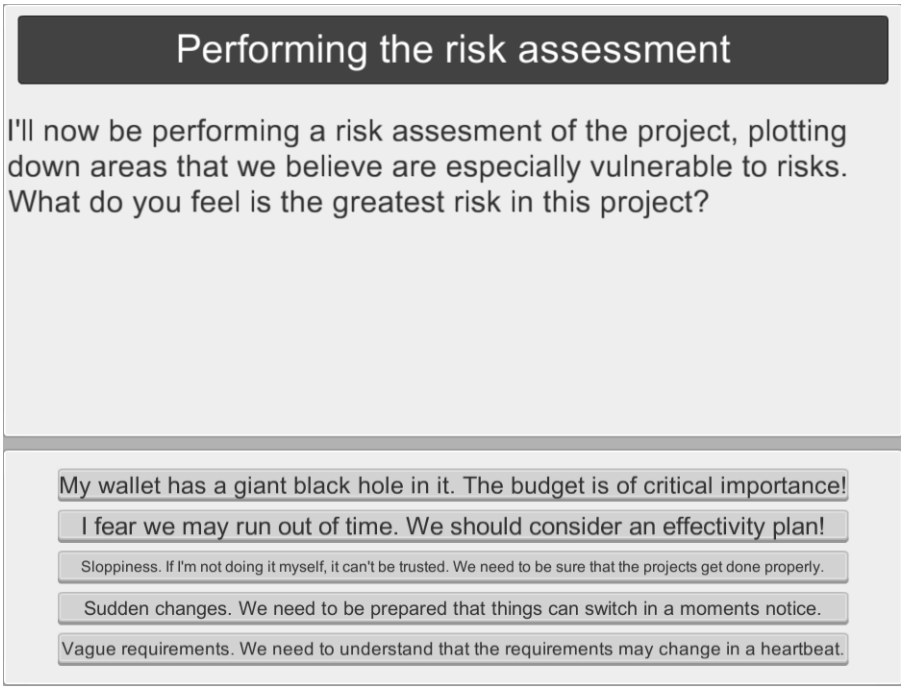

Figure 10.10: Player has completed a Risk Assessment task and must now make a choice

Events were implemented with several considerations in mind. Firstly, they add a degree of unpredictability and randomness to the gameplay: The player does not know when or if an event will happen, but, at least for the non-random events, they can learn to predict them as they continue to play the game, possibly increasing the sense of accomplishment and mastery. Random events may keep the players engaged, knowing that there are circumstances which cannot be planned for, but must be expected. Secondly, events that offer choices increases the possibilities for the players, in particular when the choices are important. An example of this is the 'Perform Risk Assessment' task, which will always trigger an event when it is completed. This event offers the player an amount of choices, each of which will subtly change the gameplay in different ways. While the choice text offers hint, it is up to the player to surmise exactly what each choice does.

10.7 Gameplay: Sprint and Project Results

10.7.1 Sprint Results

When a sprint has ended, the player is taken to a screen that presents how well they did in the previous sprint (See Figure 10.11). All project tasks are listed, grouped by their delivery, and given a status as either incomplete or complete. Incomplete tasks are any task that was planned for the sprint but not completed due to time constraints. The player is also given a list of the qualities they attained by completing tasks.

From this window, they can either proceed directly to task assignment screen for the next sprint — following their predetermined plan, or they can go back to the project planning screen (referred to as the mandate) to make delivery changes for the rest of the project.

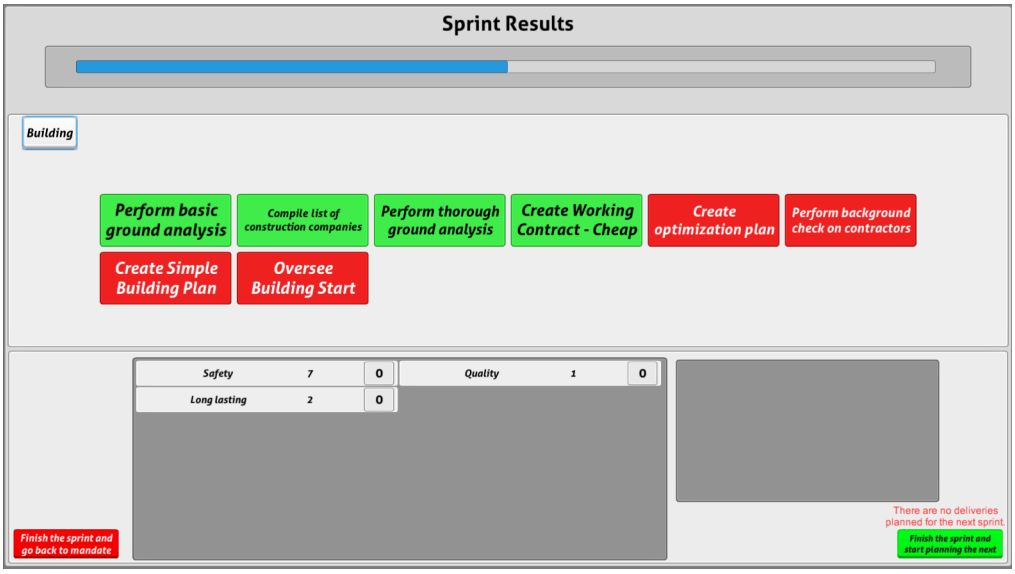

Figure 10.11: After a sprint is completed, the player is presented with all tasks and their status. Red means they were not finished as planned and green means they were successfully completed

10.8 Upgrades

Upgrades are intended as an essential part of the gameplay by acting as a motivation for the player, tempting with bonuses and new tools to expand the players playstyle with new functionality. Having an upgrade system can also be a very encouraging way for the player to plan their own goals in Freelance Team. The thought is to give the player a feeling that ”In two projects, I should be able to afford upgrade X. That will give me this new tool Y and that will make the game much simpler”.

As the difficulty of new projects rises, the player will need to balance the budget to continuously perform upgrades to more easily deal with the new challenges ahead. In Freelance Team there are primarily two ways to perform upgrades:

- Upgrade Employees — Performed by sending employees to various courses, which will improve their skills and other attributes that affect how well they work. Makes an impact on the project budget.
- Upgrade Office — Performed by visiting the Store. The stores provides both passive bonuses (bonuses which are always active) and active bonuses (bonuses that the player themselves must activate through the use of actions). The store takes personal budget money.

Part III

Experiment, Results, and Discussion

This part presents two chapters. The first, Chapter 11, details how the experiment was conducted. The second, Chapter 12, presents the results of the experiments and discusses the findings.

Chapter 11

Experiment

In this chapter we detail how we conducted the experiment. The experiment consisted of a quantitative data element and a qualitative data element. For the quantitative data, a questionnaire was made and given to a number of users. For the qualitative data, we performed an observation of a number of participants playing the game, and then we performed an interview where we touched upon issues within the game.

11.1 Questionnaire

The questionnaire was created on an online platform and could be accessed anywhere given the right link (A PDF-version of the questionnaire is included in Appendix A.2). Having the questionnaire and game available online made it possible for the respondent to play the game in their own time and answer the questionnaire at their own convenience.

When development was complete, the game was made available for PC and MacOS operating systems. Though an experimental web version of the game was included, we recommended the users to use one specific for their operating system due to some screen resolution issues and limited number of web browsers that could play Unity games. All participants were given a link to the website, which included installation instructions and gameplay instructions. They were asked to play the game as long as they felt it was fun and also to note how long they played and the reason why they stopped.

After a week of having the game available, we released the questionnaire. Out of the 40 participants who expressed interest in participating in the experiment, we received 21 answered questionnaires.

Many of the questions asked the players to rate statements based on a Likert-scale. Likert-scales uses the choices ”Strongly Agree”, ”Agree”, ”Neither agree nor disagree”, ”Disagree” or ”Strongly Disagree”. Due to the small number of respondents, we decided to simplify these results during the discussion, having only one response-category for ”Agree” and one for ”Disagree” regardless of weight, and keeping the ”Neither agree or disagree”.

11.2 Observation

In addition to the questionnaire, we performed observation and interview on three of the participants. During the observation period, the observed sat by and watched the participant played the game. The participants were asked for permission to record their screen playing time and also to record the audio of the game session, all three participants accepted this. The observer took the role of an participant-observer. Participant observers are allowed to take part in the observed's session and participate where they can.

11.3 Interview

After the observation, an interview was conducted with the observed participants. The interview was based on the questionnaire, but in a more free context, allowing the interviewer to change the order of questions, and to add and remove questions as they saw appropriate to the flow of the conversation.

Chapter 12

Results & Discussion

This chapter presents and discusses the results of the questionnaire, interviews and observations. Many of the questions in the questionnaire consists of two questions. The first question asks the respondent if they agree or disagree to a particular statement. The second question relates to how their answer in the first question affected the enjoyability of the game. This data is represented with a bar chart showing the results of the first question, and two separate pie charts for the second. One for showing the results of the second question from those who answered that they agreed with the first question statement, and one for those who said they disagreed with the first question statement.

12.1 Viability of promoting learning

One of the research goals of this project was **"RG3 - Examine the viability of promoting learning experiences by using our game in education"**, this was decomposed into 3 research questions:

- **RQ7** What mechanics in our game make it enjoyable?
- **RQ8** How can the game be improved to promote a higher degree of enjoyment?
- **RQ9** How viable is the game for game-based learning?

In the following sections we will look to primarily answer these questions when presenting and discussing the data collected from the questionnaire, interviews and observations to determine the viability of *Freelance Team's* ability to promote learning experience.

12.2 Demography

40 people expressed an interest in participating in our experiment. Out of these, 22 actually played the game and answered the questionnaire. While we did seek out respondents with

a variation of ages, interest and academical levels, the subject nature of the academical research may have affected what respondents decided to play through the game and answer the questionnaire. There is a danger of sampling bias, as someone very interested in project management, games and game-based learning would plausibly be more likely to play the game than someone who had no strong interest in either of these subjects. This sampling bias might have an even greater impact given the low amount of respondents, and we take this into consideration when the results are discussed.

The respondents were grouped in age, with the three groups 20-25, 26-30 and 30+ represented. The majority of respondents were in the age group of 20-25 with 61%, while 22% were in the age group 26-30. 17% were in the age group of 30+. Almost half of the respondents had completed an Bachelor's Degree (48%), while 28% had completed a Master's Degree. 24% respondents had finished a high-school degree. The vast majority of our respondents were familiar with games with 90% citing that they had experience in playing them. An equal amount of respondents answered that they enjoyed playing games.

To get an overview of the respondents preexisting experience with project management, we asked them to rate the following statements on a scale of "Agree", "Neither agree nor disagree", or "Disagree".

- I have experience in project management
- I enjoy participating on projects
- I enjoy managing projects

71% confirmed that they agreed with having experience with project management, while 14% disagreed and 14% were neutral. We interpret the last finding as someone who have some experience in project management, but not as much as the group who agreed.

A large majority supported the statement "I enjoy participating on projects" with 95% agreeing.

When it came to managing projects, 62% agreed that they enjoyed project management, while 38% neither agreed nor disagreed. We interpret the latter to mean that they did not feel they had enough experience managing projects to answer decisively one way or the other.

Of our respondents, almost three quarters preferred game-based learning over traditional learning. While this suggest that the interest of game-based learning is definitely high among our respondents, the aforementioned sampling bias means that these findings should be considered through a skeptical lens in terms of being a correct representation of a broader population. Also, while the idea of game-based learning is not a new idea, the amount of practical applications of game-based learning is still limited. Traditional learning, on the other hand, is already well known and practiced. This preference of game-based learning over traditional learning may stem from an idealized image of what game-based learning can and should be instead of the learning advantages of game-based learning today.

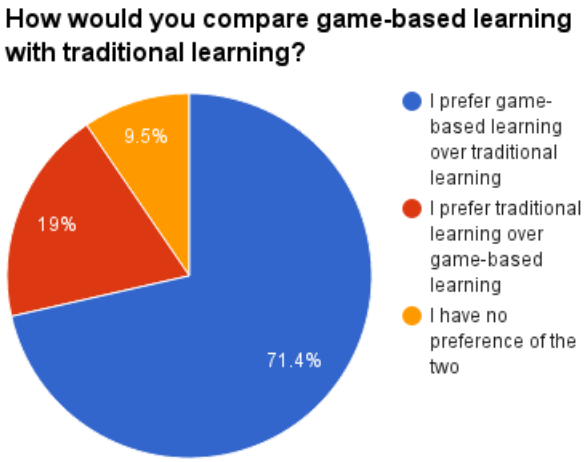

Figure 12.1: How would you compare game-based learning with traditional learning?

12.3 Overall experience with the game

These findings represent the broad-stroked experiences that the players had playing the game. There are too many factors for these to be discussed in this section. Instead they are discussed throughout the rest of this chapter, and where applicable suggestions of improvement are offered.

When the game was made available for testing, the respondents were told to play for as long as they felt the game was fun and engaging. They were also asked to keep track of their total playtime while playing. The playtimes were divided into three groups: less than 1 hour, 1-2 hours and more than 2 hours. A playtime below one hour suggests that the respondent had not been sufficiently engaged or entertained. 1-2 hours was considered within par of the game content for the game prototype, while more than two hours was an indication that the player reached an above expected enjoyment of the game. The result are shown in Figure 12.2.

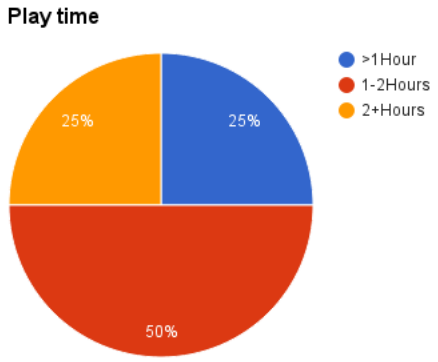

Figure 12.2: The play time of the players, categorized into three groups

The respondents were asked to give a quick free-text explanation for what made them stop playing the game. The answers were grouped together into five groups (See 12.3):

- **Completed**: the respondent felt they had completed the game.
- **Bugs**: stopped because one or several bugs prevented further play.
- **Repetitive**: the game became repetitive and the respondent did not wish to continue.
- **Difficulty**: the respondent felt that the game became to difficult.
- **Time**: stopped playing because the respondents did not have more available time to play.

22 percent of our testers considered the game completed, about 39% of the respondents stopped playing because they felt the game was too difficult or the gameplay was too repetitive.

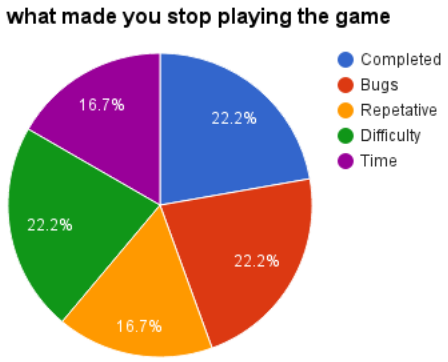

Figure 12.3: Reasons for stopping play

When asked if they enjoyed the game or not, 48% of the respondents agreed to the statement. 10% disagreed with the statement, and 43% had no strong feelings one way or the other (See Figure 12.4).

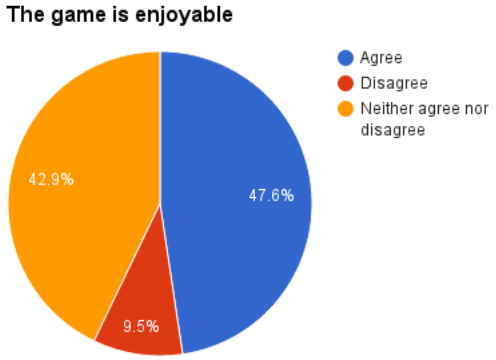

Figure 12.4: Enjoyment of the game

When asked if they found the game to be repetitive, 14 out of 21 felt that the game was repetitive, while one disagreed and six neither agreed nor disagreed. Out of those who agreed to the statement, 57% stated that it had a negative effect of their enjoyment, and 14% said it had a positive effect. 29% felt it had no bearing of their enjoyment.

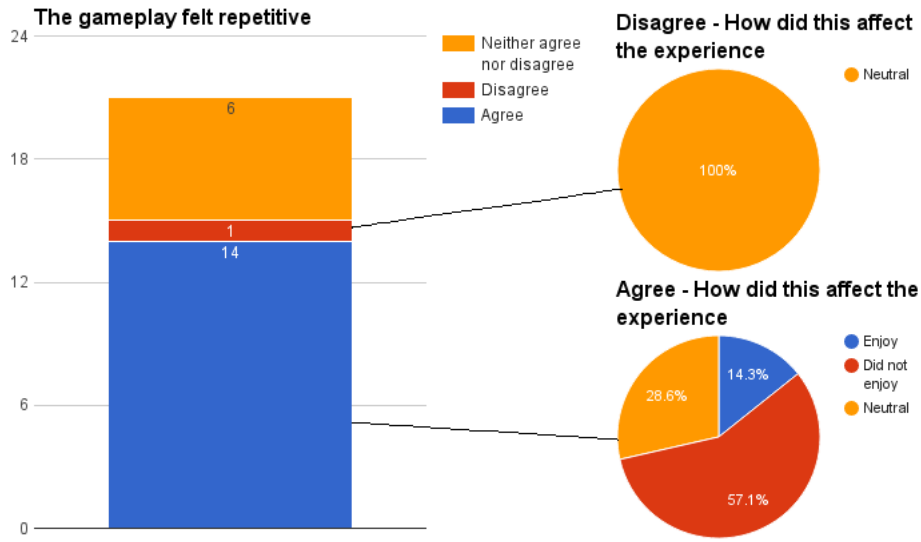

Figure 12.5: The gameplay felt repetitive

12.4 Short term and long term goals

In Section 6.1.2 we talked about Malone's opinions on Challenge and Goals in games, and how they are important for the appeal of the game. As discussed in Section 6.2, clear goals at appropriate times helps the player achieve flow. The player should also be introduced to a overarching goal early on. Goals can consist of multiple levels, and in our game we wanted to find out how the respondents perceived the existence of two types of goals: short-term goals, goals that are completed within a relatively short time frame; and long-term goals, goals that are completed within a longer time frame, often through the completion of several short-term goals. There are several examples of both long-term and short-term goals in Freelance Team. Completing a full project or unlocking a new project might be considered long-term goals by the player, while completing sprints and deliveries within the project can be considered short-term goals.

There was an even split between those who agreed and disagreed that the game has clear short term goals (See Figure 12.6). Of those who disagreed about 71% did not enjoy the lack of goals. Of those who agreed that the game has clear short term goals 75% said that they enjoyed them.

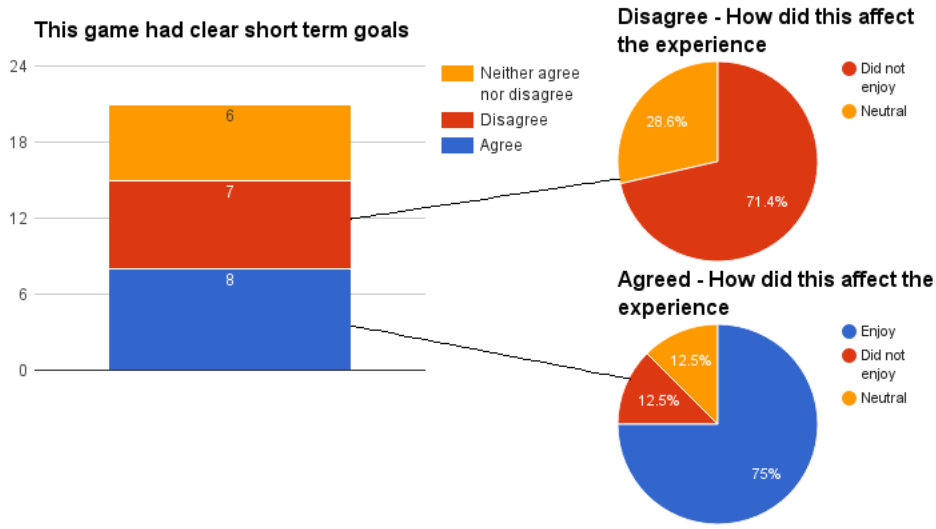

Figure 12.6: Game has short term goals

When asked about clear long term goals (Figure 12.7), about 42% responded that they agreed that game had them and 4 respondents, about 19%, said that they disagreed. 55% of those who agreed that the game featured long term goals said it made the game more enjoyable, while the rest stayed neutral. Of those who did not feel the game did not have long term goals all of them noted that it made the game less enjoyable.

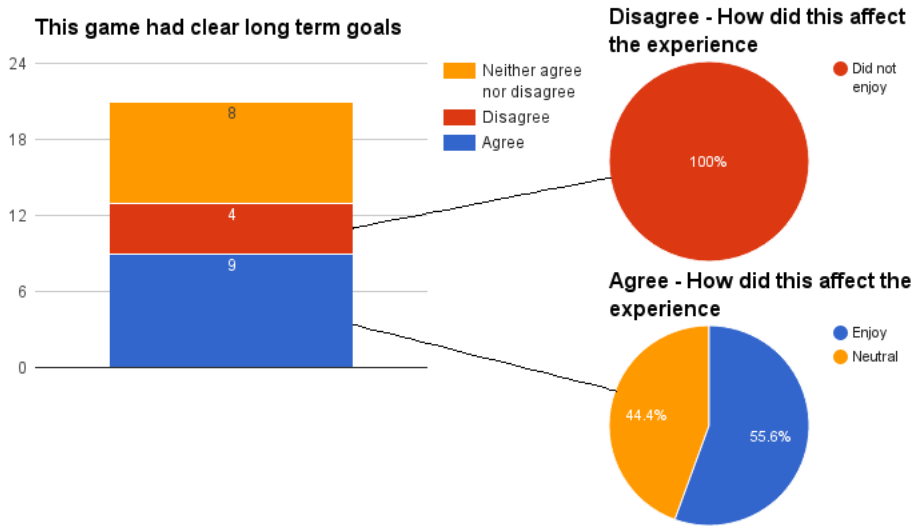

Figure 12.7: Game has long term goals

12.4.1 Goals maintain the flow, but not all goals interest everyone equally

While some of the respondents agreed that the game has a long term, or overarching, goal, the majority neither agrees or disagrees with the statement. One of the interview participants noted that they understood intuitively the relationship between short-term and long-term goals. They felt the long-term goal was finishing a project, while the short-term goal was finishing a sprint. However the presence of the short-term goals was not perceived to be engaging in itself by the interviewee. Instead these smaller goals served as a helpful tool to separate the overarching goal into smaller pieces. Another interview participant stated that it felt easier to focus on the short-term goals than to focus on the bigger picture. They felt that finishing the long-term goal was secondary to finishing the short-term goals and they therefore did not feel as clearly the presence of the former. The third interview participant stated that they felt the presence of short-term goals and that this helped the flow of the game by keeping their attention towards smaller, more manageable goals. This participant also felt that the lack of more variations in the projects was damaging to the perception of long-term goals, suggesting that their own goal focus was to unlock and experience newer types of project.

The perception of goals seems to be subjective to the player. Not only do the results indicate that the respondents had different ideas of what the short- and long-term goals in the game were, the amount of interest invoked in the players also varied. Even if they did acknowledge the existence of a goal, the goal itself did not engross all respondents equally.

There are a number of possible solutions to this problem:

- **Explicitly state the end goals of the game early**
  Freelance Team does not explicitly state the end goals of the game. While finishing a project is considered the optimal outcome for a play session, this is not the end of the game, nor is it the only possible long-term goal. In fact, the open-ended and unlimited playtime of Freelance Team may have contributed to the lack of a sense of long-term goals. Instead of this openendedness, the game might explicitly state the goals of the game. One approach of doing this is to present a story where the motivation of the player is detailed. Another is to define a definite game ending, after which the game is over and the player receives feedback on how well they performed. The downside to this solution is that the rigid end goals might only appeal to a number of players, whereas a more dynamic goal system may open for different play styles that appeal to many.

- **Give the player a clear understanding of how the short-term goals affect the long-term goals**
  While the player was given feedback on how well they performed per sprint, this feedback might have to be even clearer in demonstrating how the short-term goal affected the long-term goal. One participant stated during the interview that they would like to see more direct consequences of their actions. For example: finishing a house-delivery would yield feedback in the form of a picture of the house that had been been built.

- **Allow the player a greater sense of freedom to set their own short and long-term goals**
  Instead of explicitly stating the goals of the game, allow the player the freedom of choosing their own goals, and altering their playstyles accordingly. This solution may engage a larger number of players with different interest and perceptions of what goals should be, but it might not be a viable solution for many learning-based games with a narrow focus. We reflect further on this solution in Section 12.4.2

12.4.2 Letting the player set own goals through upgrades

In Section 6.1.2 we argued that while simple games present the goals to their players, more complex games may offer its players to set their own goals in the game. Freelance Team was designed to allow the player to set their own goals by offering upgrades that would have practical effects for the player (See Section 10.8). Optimally, the player would be able to plan ahead and set for themselves a goal to upgrade their employees through courses or to purchase items at the store that would give the player advantages. Optimally, a player would be able to say: ”Okay. So as soon as I get $20000 in personal funds, I will buy this upgrade. This will make my workers a lot stronger!” This is a goal that transcends the borders set by the game, and is instead negotiated between the player and the game.

When asked whether the respondents felt that they could set their own goals when playing, nine respondents (43%) said that they disagreed with this statement, 4 respondents (19%) agreed and 8 respondents had no strong opinion one way or another. (See Figure 12.8)

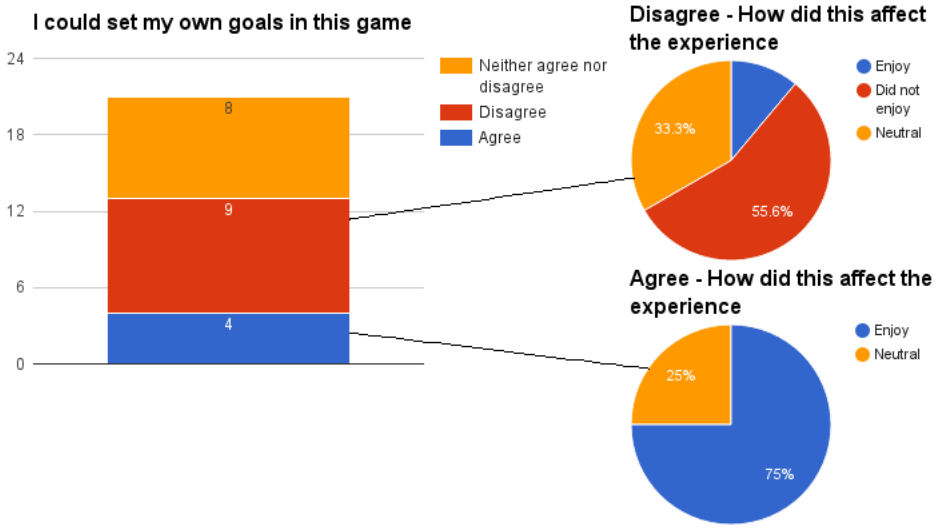

Figure 12.8: I could set my own goals

Out of the 9 respondents who did not feel they could set their own goals, 56% felt this had a negative impact on the game experience, and 33% felt it had no bearing. Interestingly, one respondent felt that the lack of ability to set own goals had a positive bearing to the final experience, but given the small sample rate, we have chosen to not consider this significant.

Out of the four respondents that felt they could set their own goals in the game, 75% (3 respondents) felt this affected their experience positively, while one felt it had no bearing.

The questionnaire asked respondents specifically about the upgrades in the game, as we wanted to know if the respondents felt that they were present and had any effect on the gameplay. One of the goal of the upgrades was to give the players a possible goal to work towards as some upgrades cost money that could be attained by finishing a project.

12 out of 21 respondents agreed with the statement ”The upgrades are an important part of the game” (See Figure 12.9), of those 12 92% answered that this positively effected their experience with the game. Four respondents did not agree with the statement and 75% of them answered that this had a negative effect on their experience.

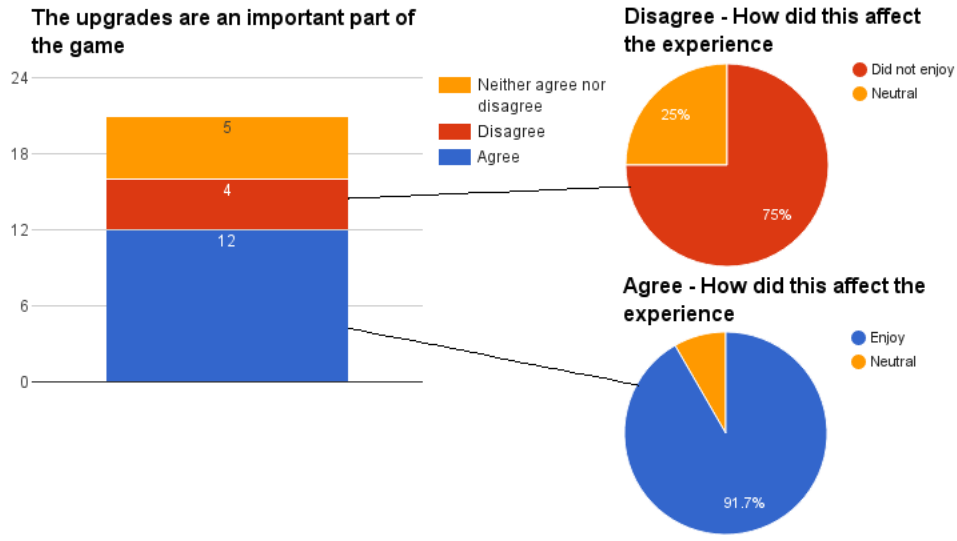

Figure 12.9: The upgrades are an important part of the game

About half the respondents agreed that the upgrades were an important part of the game and 92% of those enjoyed this. Based on these results the addition of upgrades in the game seemed to increase the enjoyment for the players overall. This was, however, not reflected in the interviews. One interviewee, when asked if they felt upgrades was present in the game, answered: ”I didnt feel there was a big effect, at all. I understood it was there. Buying things, and upgrading. But I didnt get impression that it did anything”. Another interviewee was asked if they felt they could set their own goals through the upgrade system: ”I didnt think like that at all. I was mostly focused on staying within the budget, because I had figured that that was important. The rest was mostly random.”, and a third interviewee answering that they did not feel that upgrades was present at all.

One interviewee said the following on the subject: ”If it’s made clearer that if you do very well, you’ll get a higher budget, and then you can buy a better coffee machine that is double as effective.” When asked by the interviewer if they felt a better overview of what bonuses could be bought would make it more engaging, they agreed. Another interviewee felt that the game was entirely linear and that they had no control in setting their own goals, while the third interviewee felt that for their own sake, most of the focus was to stay within the budget.

From these results, we argue that giving the player the ability to set their own goals have a potential in increasing game enjoyment, and that it should be encouraged. However the players may feel lost or confused if they are not given a clear overview of their choices. A system of allowing the player to set their own goals is also best fitted in a game where the core gameplay is easily learned and understood. The difficulty that the players had with learning the game (See Section 12.6.1) in combination with a lack of overview of the

upgrades may have made the process to complicated to encourage experimentation with setting own goals.

To mitigate this and in an attempt to enhance the feeling of setting own goals we propose for the future iterations of Freelance Team an introduction of a tree-like structure where all upgrades and their dependencies are listed. This might decrease the difficulty curve for the player and allow the player to feel safer when making choices. We discuss this further in 14.1.5.

12.5 Storytelling as a means of immersion

As discussed in Section 6.1.1, fantasy has the ability to make instructional environments more interesting. An engaging fantasy connected through the game through in-game texts might therefore be a boon for game immersion. As opposed to the story in the classical sense, with a three-part structure, clearly defined goals and protagonists and antagonists, the storytelling features in Freelance Team was mainly through small snippets of text designed to set the tone of the game and the universe it takes place in. It was written to have a light tone and to be humorous with the intention of invoking feeelings of fun and enjoyability. Additionally, the aim was to have it as a motivational factor, with the player being curious as to what joke or funny snippet of storytelling might come next.

12.5.1 Was the fantasy enjoyable?

When asked if the respondents enjoyed the storytelling in the game 47% of the respondents agreed that they had enjoyed it, while 24% disagreed. 29% had no strong feelings about the storytelling. (See Figure 12.10).

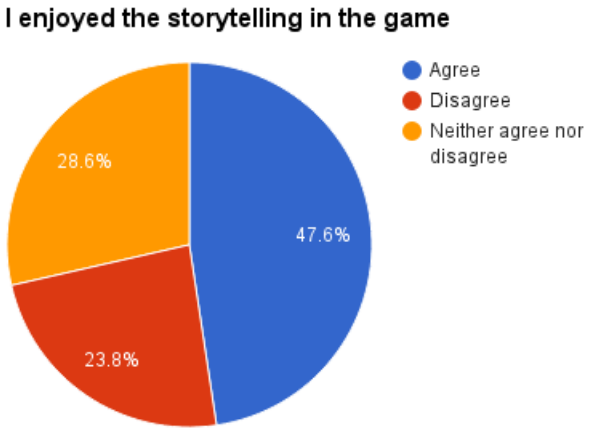

Figure 12.10: I enjoyed the storytelling in the game

To investigate the relationship between enjoyment of the game fantasy and the enjoyment of the game. We also asked the respondents to rate two statements regarding the enjoyment and addictive qualities that storytelling gave the game.

When asked to rate the statement*"The storytelling made the game more enjoyable"*, 43% of the respondents agreed, 29% disagreed and 29% had no strong feelings (See Figure 12.11).

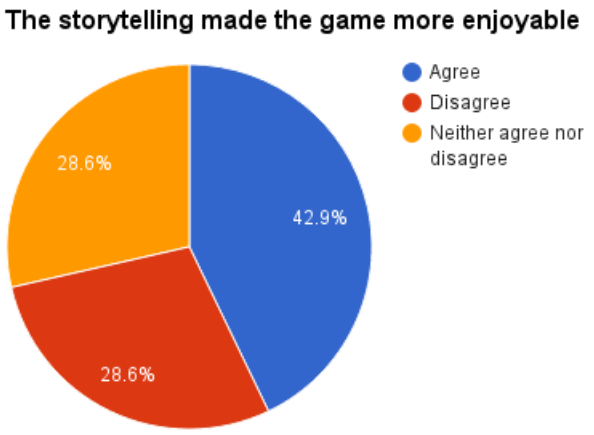

Figure 12.11: The storytelling made the game more enjoyable

When asked to rate the statement *"The storytelling made the game more addictive."* 38% agreed to this statement, while 24% disagreed. 38% had no strong feelings (See Figure 12.12).

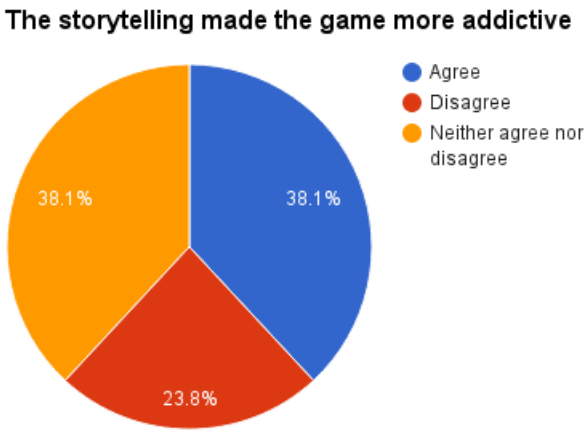

Figure 12.12: The storytelling made the game more addictive

The results between finding the fantasy a benefit to the game are very close to Figure 12.10, but a small number of respondents found the games' storytelling to be enjoyable while disagreeing that it made the game more enjoyable. In Freelance Team, the game quality seems to have benefited from its story aspects, but from the results we can also conclude that finding the storytelling of a game to be enjoyable does not always improve the perceived quality of the game. However, the statistical significance of this finding is uncertain, and might be an interest point of research in a future study with more respondents.

- Was the content of the storytelling appealing to the player?
- Was the presentation of the storytelling appealing to the player?

The *content* of the stortytelling is the story itself, and here lies the qualities such as humour and drama. Just as people have different tastes within movies or music, so must we assume that they will have different tastes in game story. The epic story and dramatical elements of *Assassins Creed* series are different from the casual and simple story in *Math Rescue*. During development, the storytelling in Freelance Team was intended to be humouristic and somewhat dry-witted. An attempt to distance itself from the humourless tone that tends to be a hallmark of classical learning.

Figure 12.13: A snippet of text when an employee has finished their break

The *presentation* of the storytelling relates to how the story is told. The presence of storytelling in games varies greatly. Some games have no story at all, while others present a simple snippet of text in the beginning or end of the game. In games like *Assassins Creed* the story is an integral part of the game, using modern game techniques such as voice-actors, cinematics (movie-like cutscenes where the player has little interaction) and a full orchestral music score.

In Freelance Team, the story is told by text through the random events, the description texts of tasks and the feedback that the game occasionally gives the player. Much of the story is optional to read, but also serves as feedback to the player. (See Figure 12.13).

In the free-text field of the questionnaire, several respondents commented positively upon the humour in the game. One respondent noted it at as one of the game's strong point, while another remarked that a particular piece of text had made them laugh out loud.

During the interviews, two respondents felt that a stronger connection to their employees, by use of text, would have benefited the fantasy and that they would have enjoyed simulating the social aspects that comes with managing and participating a team work. One of these noted that they felt the game generally lacked a feeling of storytelling, and while the fantasy elements were not directly negative, the results was that the storytelling did not contribute to the enjoyment of the game, even while the participant found the snipppets of text that were presented through the game amusing.

The third interviewee noted that he did not care for the story saying "I did not get any of the story. But then again, I never do". Instead this participant had a personal preference on focusing on game mechanics. During the observation, this particular interviewee often skipped the text and thus lost much of the story aspect of the game. It is possible that he represents the group of respondents who puts less focus on the storytelling and more focus on gameplay mechanics and other means of motivation, such as getting a feeling of mastering the game. or attaining as high a score as possible. For these players, a story presented in a non-captivating way might only serve to detriment the enjoyment as it forces them to read through text they do not want to read. Also, this shows that different players

have different preferences for a game. For a player who's main preference is on gameplay, an enjoyable fantasy may not be beneficial if the gameplay is bad or has bugs. For a player who has a strong liking to storytelling, a strong story in a game may serve to immerse them to the point where the storytelling itself gives the game an addictive quality.

In this particular thesis, the respondents was asked to rate the storytelling as a combined term. While the amount of respondents are too few to draw any firm conclusions, the positive feedback given was directed at the content, while the negative feedback was directed at the presentation. Humor seems to have been an effective tool that many of the respondents enjoyed while playing the game. However the presentation may have benefited with more focus on a simulated social interaction between the simulated employees and between the employees and the player. For future iterations of this experiment, asking specifically about content and presentation may be prudent. The effectivity of storytelling as a benefit to the gameplay seems to also rely on the personal preference of the player as well as the quality of the storytelling present.

12.6 Player skill

To keep up player engagement and motivation, the game should cater to the players skill level and adapt as the players skill level increases. If a player feels the game is too hard, it might cause them to give up, but if a player feels the game is too easy, it will remove the feeling of mastery.

12.6.1 Learning the game

Learning the game should not be cumbersome, but an interesting and engaging part of the process of playing the game. Especially important is this when designing a game where learning the basic gameplay also means acquiring important skills that are usable outside the game's realm. At the same time, the game should provide an engaging simulation of project management. Such a simulation would necessarily require the player to have a large variety of tools accessible to him, emulating the actual choices made during project development. For these project management tools, a number of game mechanics were implemented (see Section 10). The choices a player could make increased and complexity grew. However, regardless of level of complexity an ideal game should be easy and fun to understand, but hard to master. How easy a game is to understand is not the same as the challenge of playing and master it.

The main strategy for teaching these mechanics was a built-in tutorial system, one tutorial help box for each screen. These explains step-by-step the important buttons and information in the particular window and what they do and mean. During the observations we saw that the participants were reluctant to use these buttons, one commenting that they would rather figure the game out on their own. It is possible that using the tutorial could feel like an admission of ignorance for the player, making them reluctant to use it. Upon giving in to clicking the tutorial however, the player vocally expressed a new found understanding of how the game worked. The observer also noted that another participant often skimmed the tutorials without giving it much notice.

Despite the usage of tutorials, a majority 69% of the respondents disagreed with the statement that the game was easy to understand how to play. 25% agreed, and 6% were neither agreeing nor disagreeing.

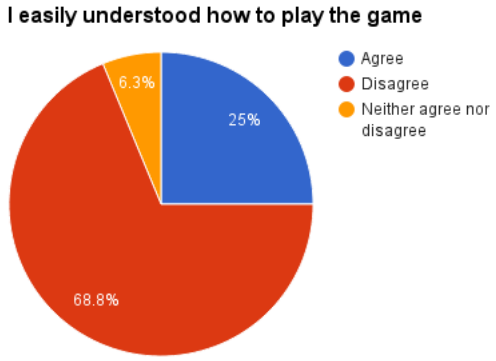

Figure 12.14: Ease of understanding the game

When asked if the game was so hard it might deter newer players, an interview subject admitted that it might, adding ”I did not have a complete overview of what I was doing. There should be a [minimum amount of information given]. Not necessarily [revealing everything], but a bare minimum to help you.”

As the results of the questionnaire show, some of our players felt managed fine without the use of tutorials. However, a majority didn't. This points to a tutorial system that failed to engage the player. While the tutorial system should optimally be as engaging and fun as the rest of the game, this one seemed more like a chore. A chore that had its uses when first utilized, granted — but a chore nonetheless.

There are two strategies that could have simplified the learning curve in the game:

- **Slowly introduce each game mechanic in a introductory tutorial project**
  In this variation, we could have introduced the player to the game using a specific tutorial project. The game mechanics would be introduced gradually throughout the project. This would allow the player the chance of understanding each part of the game before progressing to another. Keeping in with the fantasy, this could be presented as a training mission for new project managers. This kind of tutorial would keep close to the original intention of the game, which is letting the player have access to all tools and choices early in the game. However, it may also still pose some problems for inexperienced players who feel that the magnitude of choices would be daunting.
- **Gradually introduce new game mechanics throughout the whole game**
  Another solution is to unlock new features and mechanics as the player progresses

through the game. This would make the learning curve much smoother, and would also keep the game feel fresh and not as repetitive as new strategies and choices were made available to the player. However, this design would reduce the depth and choices available to the player, with a chance of the game feeling too simple and straight forward for the seasoned game players or project managers playing. In essence, there is a danger that it might feel more like a showcase, rather than a game.

12.6.2 Adapting to the player skills

The game was designed to be played by both beginners and veterans in either games or project management, and anyone in between. These groups will learn and master the game at different paces. In a case of a large variety of previous experience and skills, having a difficulty level that can be tailored to each player becomes important. The solution to this problem was a system of projects, where completing one project opens another project with a slight increase in difficulty. The more difficult projects are locked and will require that the player had enough ”prestige points” to unlock. Prestige points are given during completion of an already unlocked project and are based on how well the player completed the previous project. In addition, the player receives ”personal funds” for each completed project, which they can use to buy upgrades, making their employee work better or more efficient. If the player feels that a project is too difficult, they are able to repeat one of the projects they had previously completed until they feel they have mastered that project, or they have bought enough upgrades to simplify a future project. The system was realized in the game by having two projects with varying degrees of difficulty. One of them had to be completed with a fair amount of success for the other to unlock.

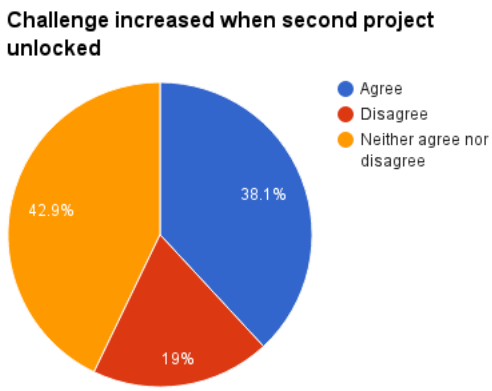

Figure 12.15: Challenge increase in second level

From the results in figure 12.15, we see that a majority of our respondents did not feel a noticeable difference in challenge level. There’s a few possible explanation for this:

- **The second project was not played**
  For some of our players, the project was most likely not played, due to the player losing interest before they could unlock the next stage of the game. Additionally, a bug was discovered late in the testing period that may have hindered the players ability to finish the first project (and thereby unlocking the second).

- **Balancing issues**
  The second project may have had balancing issues. The act of balancing a game means to meticulously perform changes to key attributes and properties, in this case to make sure that the difficulty is just right. A failure to properly balance the game might have made the first project too difficult for the new players and/or making the difficulty too similar between the two projects.

To remedy this situation, balancing should be performed on the game to ensure a greater difficulty as the player unlocks new projects. A number of possible variables that could be adjusted for balancing purposes are:

- How much work is required on a task.
- How much skill is required on a task.
- What positive or negative buffs employees gain from completing tasks.
- What qualities are required to complete a delivery, and how hard these are to attain from tasks.
- The maximum budget for the project.
- The amount of possible deliveries randomly picked to a project, and the amount of variations on these deliveries.

More events could be also introduced for each project, providing unique and gradually more difficult choices for the player. This could also provide a greater feeling of variety and stimulating the curiousity of the player. Additionally, we could implement projects that forces the player to play or rethink how they have completed projects earlier, forcing them to play in new, unfamiliar ways. This could reduce the feeling of repetitiveness, and would be in accordance to McGee's "circle of expertise" as described in Section 5.2.

12.7 Challenge and mastery motivates the player

Malone argues that challenge is an important aspect to engage a player and keep them occupied (See Section 5.2). However, the challenge level must resonate with the player skills. If the game poses too great of a challenge for the player, they may give up, and if the challenge level is too low, the player fails to achieve a sense of mastery when playing the game. Gee links the concept of challenge with fun through suggesting that a good game will always operate at the outer edge of the player's competence, always challenging the player to expand it. This sensation of always having something to learn motivates the player and gives them a feeling of mastery.

But not all games maintains this the feeling of constantly having to learn the game. In a game where the cause-and-effect is unclear and the level of difficulty is too low, a player can easily finish the whole game and not understand how the choices they made affected the outcome of the game. If the difficulty is too great, the player can feel lost in the amount of choices, and no matter how well thought up a plan they set, they never manage to complete it successfully.

From this we suggest three conditions that must be present for allowing a player to get an enjoyable sensation of mastering a game:

- The difficulty level must follow the players skill level, never being too difficult or too easy.
- The game must require the player to learn how to master the game.
- The player must feel that the choices made from the learned knowledge affect the outcome of the game.

Difficulty Level

To measure the perceived difficulty level of the game we asked whether the respondents felt the game was challenging, and if the level of challenge made them enjoy the game (see Figure 12.16)

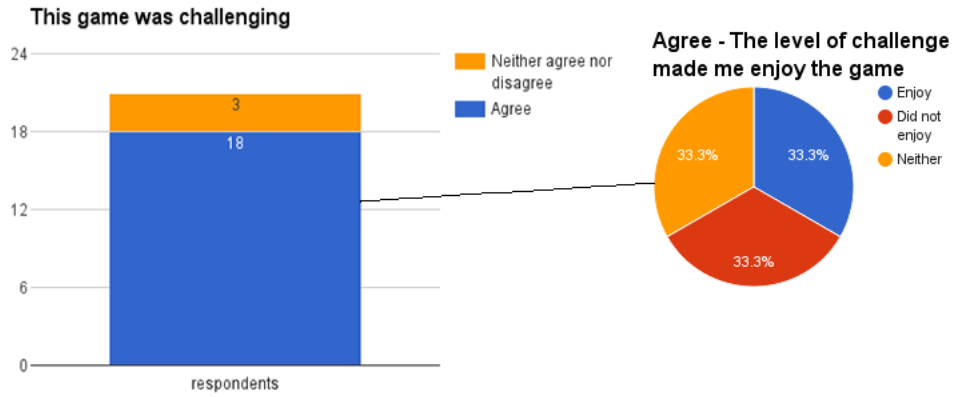

Figure 12.16: Game challenge enjoyment

Out of the 21 respondents, 18 found it challenging and 3 did not find it particularly challenging, but also not downright easy. One third found that the challenge level was a detri-

ment to their enjoyment, one third found that the challenge level increased their enjoyment, and one third felt the challenge level did not affect their enjoyment level.

One interview participant stated that their preexisting knowledge in project management aspects had helped them understand the basics of the game, and that the greatest annoyance when learning the game was a lack of feedback. Another participant stated that their experience with learning the game was a frustrating one, citing a lack of interest in the subject nature of the game a primary reason.

The fact that a so large portion of the respondents felt the game was negatively impacted by the challenge level, implies that that we failed to implement a challenge curve allowing player of any skill level to start from the beginning of the game without problems. The game was simply too challenging for some, resulting in a loss of enjoyment. This problem might stem from the baseline challenge level that many respondents found too high (see Section 12.6.1) Some players may have been intimidated by the steep learning curve, finding the game even more difficult.

Mastering the game

To understand to what an extent, if any, the game demands the players to learn and master the game, we asked our respondents to answer the following statement: ”I had to learn how to master the game to make progress in it”.

19 out of 21 respondents agreed to the statement, while one respondent disagreed and one respondent neither agreed nor disagreed. From the ones who agreed, 58% answered that they felt it made the game more enjoyable, while 28% felt it made the game less enjoyable. 16% said having to learn how to master the game had no bearing of their enjoyment (See Figure 12.17).

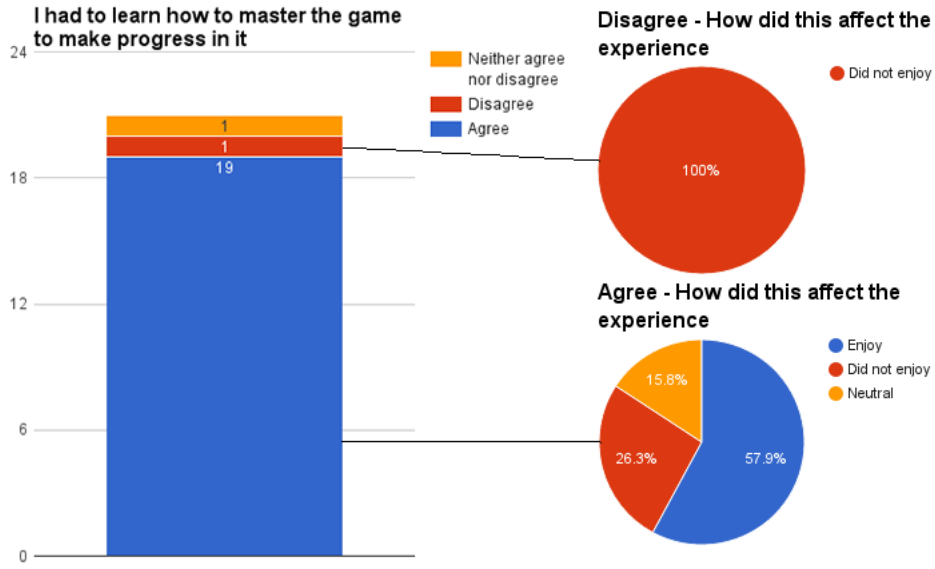

Figure 12.17: master the game to make progress

It is clear from the results that while the majority of the respondents who felt that they had to master the game enjoyed this fact, a smaller but noticeable amount of respondents felt this was a detriment to their enjoyment. While all the subjects during the interviews agreed that they felt they had to learn to master the game and that this contributed to the enjoyment of the game, the respondents had some other insight. One respondent wrote in the questionnaire that they found it hard to understand how they could master the game, while another described the game as ”hard to understand”. A third respondent stated that they stopped playing because they felt the feedback only described when something was wrong, and not what, or how to mitigate it. We cover the problem of lack of feedback to a greater detail in Section 12.8.1.

While these results indicate that the respondents felt the demand of having to learn to master the game was present in the game, we also propose that the enjoyment derived from this comes with a condition of providing the right tools and the right assistance to the player as they try to fulfill these demands. If the player feels the demands are unreasonable, they will draw less enjoyment from the game. The game no longer operates from the outer edges of player's competence, instead operating from outside it.

Choices affect the outcome

When asked to rate the statement: ”I had to make choices that mattered to the outcome of the game”, 18 out 21 respondents agreed, while one respondent disagreed and two neither agreed or disagreed. Of those who agreed, 83% stated they found it to make the game more enjoyable, while 17% felt it had no bearing of their enjoyment (See Figure 12.18).

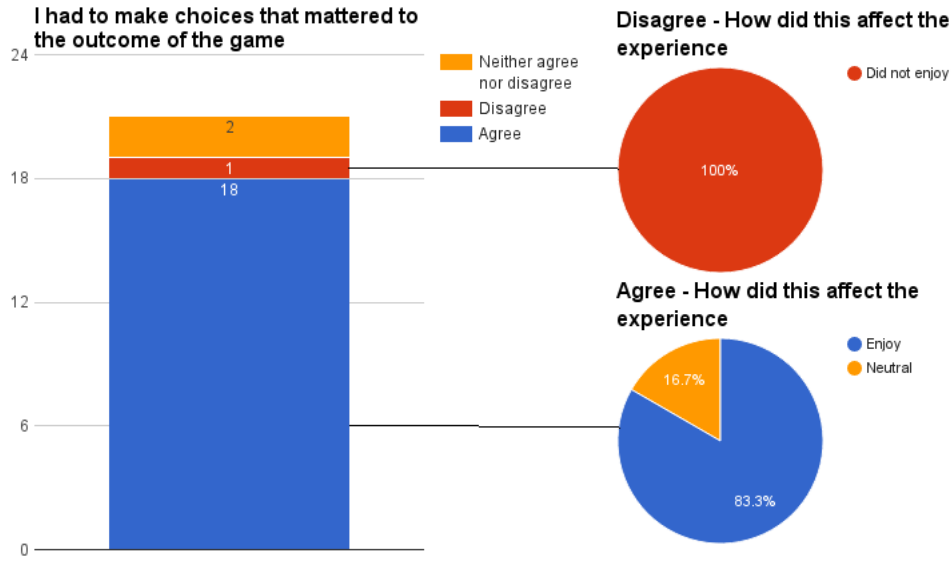

Figure 12.18: Had to make choices that mattered to the outcome

Most of the respondents were more positive to the presence of making choices in the game, suggesting that the players felt that player agency was present in Freelance Team and enjoyed this fact. This relates to the sensation of *Control* as a means of achieving a game flow, described in Section 6.2. A feeling of impacting the game world and that their choices matter is described as an important part of the flow. One interviewee stated that they felt a clear causality between how they arranged their tasks and the outcome to the game, but felt a stronger lack in causality between how they handled the random events such as an employee getting sick or the seemingly random event of an employee being demotivated. This could indicate that concepts such as randomness or hidden information, while providing curiosity and uncertainty to the player (as discussed in Section 12.8.2), may come at odds with a feeling of being in control, especially with a lack of feedback.

To promote enjoyment from mastering the game, Freelance Team fulfills a feeling that the player must learn to master the game to make progress in it, and gives the player a feeling that their choices matters in the outcome. However it is possible that it is too difficult for some players, making the enjoyment derived from this demand of mastery a detrimental factor for some players.

12.8 Feedback and Curiosity

The questionnaire distinguishes between two different kinds of feedback: feedback on progress and feedback how to improve the players skill. The first is feedback that helps the player determine distance and progress towards objectives, in Freelance Team this would be, for instance, the progress on a delivery. Feedback on how to improve a players skill

helps the player improve through constructive feedback on how to gain new knowledge and feedback on the players performance. As presented in Section 6.2 about Gameflow, feedback must be given at appropriate times. It helps the player determine progression towards objectives or goals, and if the player loses they should get feedback on whether or not not they are moving in the right direction.

In Freelance Team the Result scene, described in Section 10.7.1, serves to give the player feedback on their performance after a sprint is completed. The burndown chart, described in Section 10.6.2, provides the player with feedback on how they are doing during a sprint.

12.8.1 Lack of feedback

When asked to rate the statement *"The game gave good feedback about my progress"* there were an even split with 7 participants answering "Agree", "Disagree" and "Neither agree nor disagree". Of the 7 that agreed to the statement 85% answered that they enjoyed the feedback, while of the 7 that disagreed 71% did not enjoy the feedback (See Figure 12.19). This could indicate that the game gives some feedback on progress, but maybe not enough or it does not show it well enough.

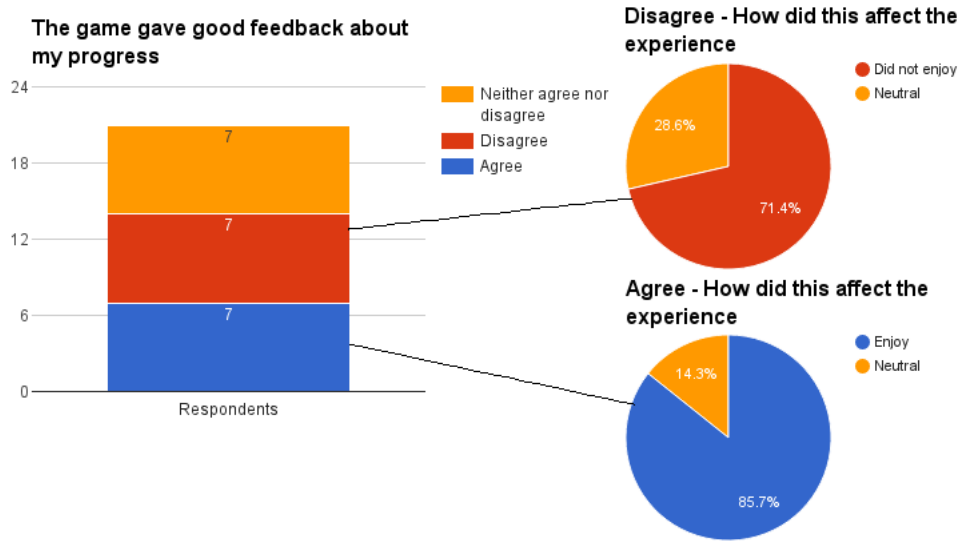

Figure 12.19: Feedback about progress

When asked *"The game gave good feedback about how to improve my playing skills"* 13, about 62%, said that the game did not provide this feedback and 84% of those 13 said that they did not enjoy this. Of the 3 that responded that the game had good feedback on how to improve playing skills only 33% said that they enjoyed this feedback.

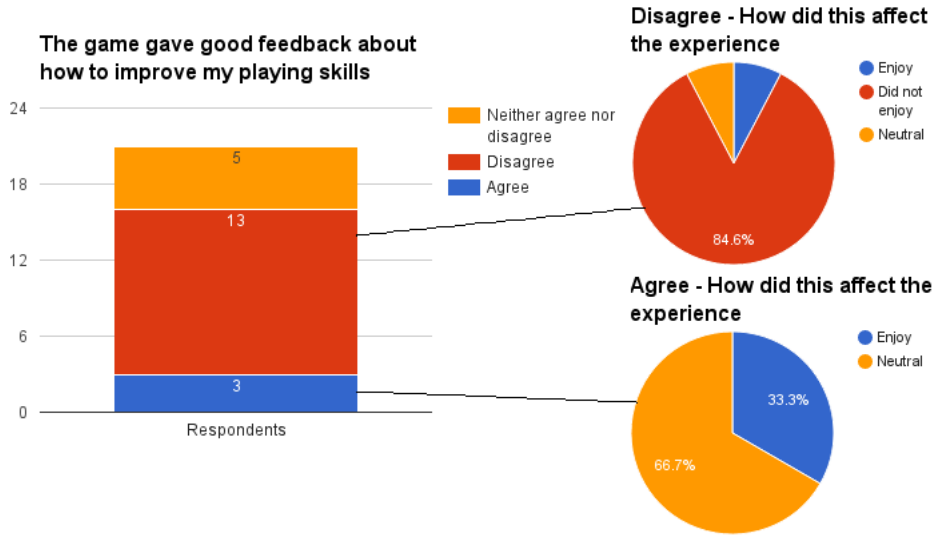

Figure 12.20: Feedback on how to improve

Many of the respondents felt that the feedback was not immediate and that it was not constructive nor helpful in helping them improve in the game. During the interviews an interviewee noted that he wanted more feedback on how to achieve goals. He also missed clearer feedback on the new information gained when doing the customer tasks in the game (see Section 9.3.5 for more information on tasks). Another interviewee stated that ”the overview of how far along the employees have gotten with the tasks they have. Thats good. And when youre done with a sprint, you get points. And then when the project is done, you get a new overview. Thats pretty good.” but also stated that ”I was missing some kind of confirmation that the project was done”. So while this interviewee did feel they had some feedback on how the participants are doing and how well the project went after is was completed, they still felt that they needed more during the sprints.

A possible improvement would then be to give more feedback during a sprint, rather than after, during the result screen. This is also something we noted in Chapter 8, about the framework. Another possible improvement could be to instead of just telling the player what they failed or passed, give them more information on how to improve and how to avoid these mistakes.

12.8.2 Curiosity

A way of engaging the learner’s curiosity is to make feedback surprising. One could do this by having some form of randomness, in this game the random element comes from the random events during the development stage of the game, such as participants getting sick during the project execution phase.

As presented in Figure 12.21 16 out of 19 respondents agreed that the game had random events and 62% of those 16 answered that they enjoyed the random events of the game and 19% answered that they did not enjoy them.

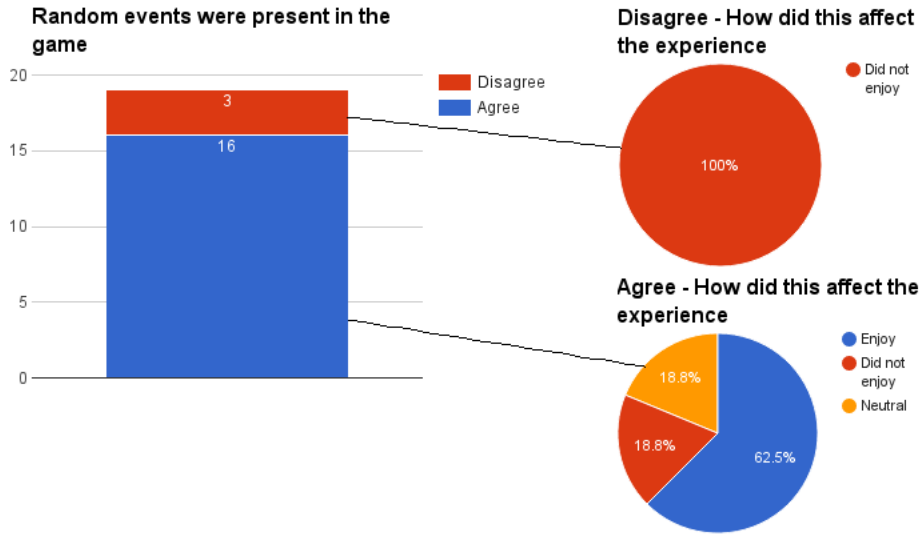

Figure 12.21: Random event

Majority of the respondents agreed that random events were present in the game and well over half of those also said that these random events positively effected their experience with the game. There were some feedback from the interviews that there should have been more varied random events. As one interviewee answered, when answering if they felt that random events was part of the game, ”The sneezing for example. It could have been cooler, or there should have been a lot more of them. Instead of just the same all the time”. It can be concluded that the random events did increase the enjoyment of the game even if it at times can be seen as repetitive in some cases and as discussed in Section 12.7 under the discussion on ”Choices affect the outcome” we noted that these concepts such as randomness and hidden information could potentially hinder the feeling of control for a player.

Another way of engaging the learner’s curiosity is to have feedback that seem surprising at first, but reveal an environments underlying consistency. In Freelance Team we do this by having hidden information. Hidden information, as discussed in Section 6.1.2 makes a outcome uncertain by hiding some information from the player and selectively revealing it. An example of this in Freelance Team would be the employee properties (See Section 9.3.6). Employees all have properties that are not directly known to the player, but can be discovered by playing the game.

Figure 12.22 shows that 16 out of 21 respondents agreed with the statement ”The game

had hidden information I had to understand by playing the game" and of those respondents 83% answered that they enjoyed this feature, while 0% answered that they did not enjoy it.

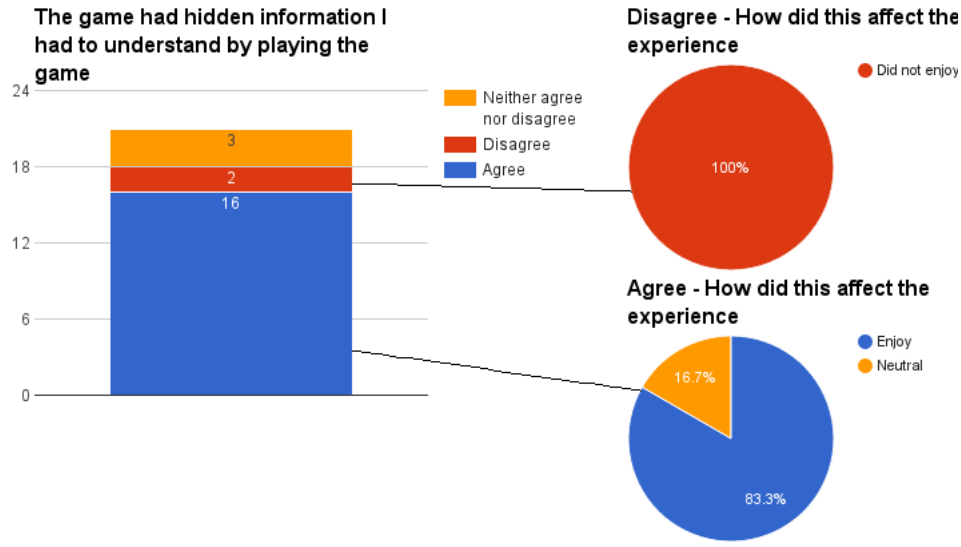

Figure 12.22: Hidden information

The majority of respondents agreed that the game had hidden information they had to understand. Also 83% of those agreeing answered that this positively affected their experience with 0% disagreeing. This indicates that it is clear to the players that while some feedback is surprising there is some hidden information behind it that they could learn by playing the game.

12.8.3 Altered sense of time

An important part of the enjoyment of a game is the players ability to immerse themselves in the game, as described in Section 6.2. Immersion into a game can result in loss of concern for self and even a altered sense of time.

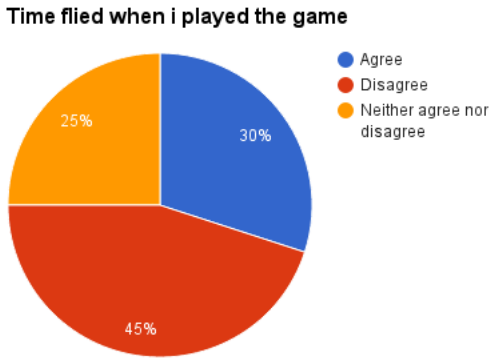

Figure 12.23: Time Flied

The respondents were asked if they felt that time flied when they played Freelance Team to see if they experienced this altered sense of time. This was meant to see if any of the testers experienced immersion and an altered sense of time as discussed in Section 6.2. 30% of participants agreed with the statement, 45% disagreed and 25% neither agreed nor disagreed (See Figure 12.23).

One possible reason for a player to not experience a altered sense of time is to loose their sense of control, see Section 6.2. This sense of control is required for a player to experience flow. In other words a player must feel able to translate their intentions into the game, if they are not able to do this their sense of flow could be broken. If we look at back at Figure 12.3, which shows the data from why participants stopped playing, in Section 12.3 it can be seen that 22% of players stopped because of bugs. The participants experiencing bugs or error could be an explanation for these numbers. We shall discuss bugs and loss of control further in the next section (Section 12.9.2).

From the data presented here it is hard to draw any firm conclusion, and while the majority of respondents did not agree that time flied, almost one third thought it did. During the interviews 2 of the interviewees also agreed that time flied when they played the game, the third interviewee noted that they wanted a ”skip to the end button” and found it annoying to have to wait for the development stage to end.

12.9 Usability

This Section presents and discusses data from the usability related portions of the questionnaire. Such as the visual style of Freelance team, the bugs that the respondents encountered, how it affected their experience, and if they felt that the music matched the setting of the game.

Visual style and sound to enhance fantasy

Fantasies have the ability to make instructional environments more interesting, as we discussed in Section 6.1.1, we wanted the games visual style and music to enhance the fantasy and to evoke fantasy association. The respondents where therefore asked to rate some statements relating to the visuals and music in the game.
They were asked to rate the statement ”I found the visual style appealing” . Majority of the respondents did not agree with this statement, with 10 out of 21 (47%) disagreeing and 5 agreeing. 80% of those who disagreed with the statement said they did not enjoy it.

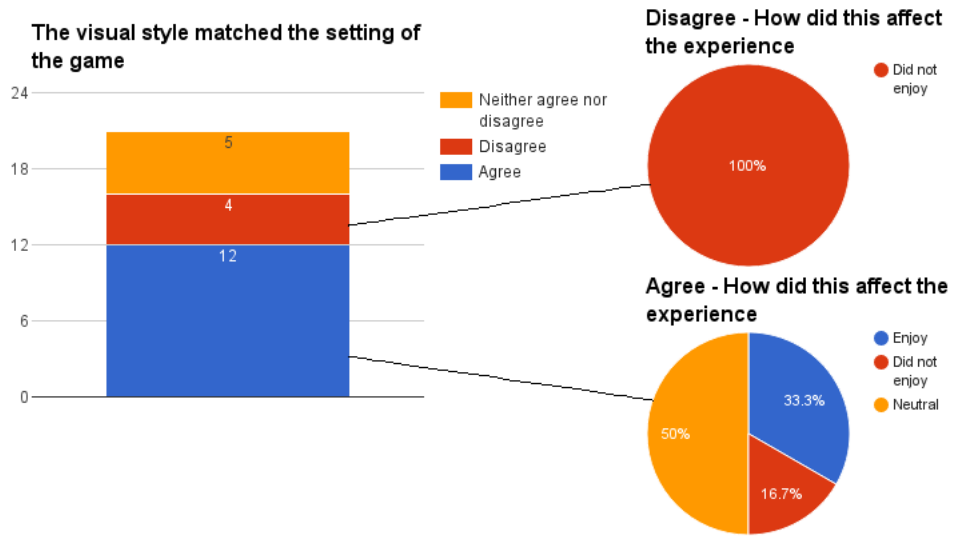

Figure 12.24: The visual style matched the setting of the game

The respondents were also asked to rate the statement ”The visual style matched the setting of the game” 12 out of 21, or 57%, respondents agreed. Of these 12, 50% answered that this had a neutral effect on the enjoyment and 33% enjoyed it. (See Figure 12.25)

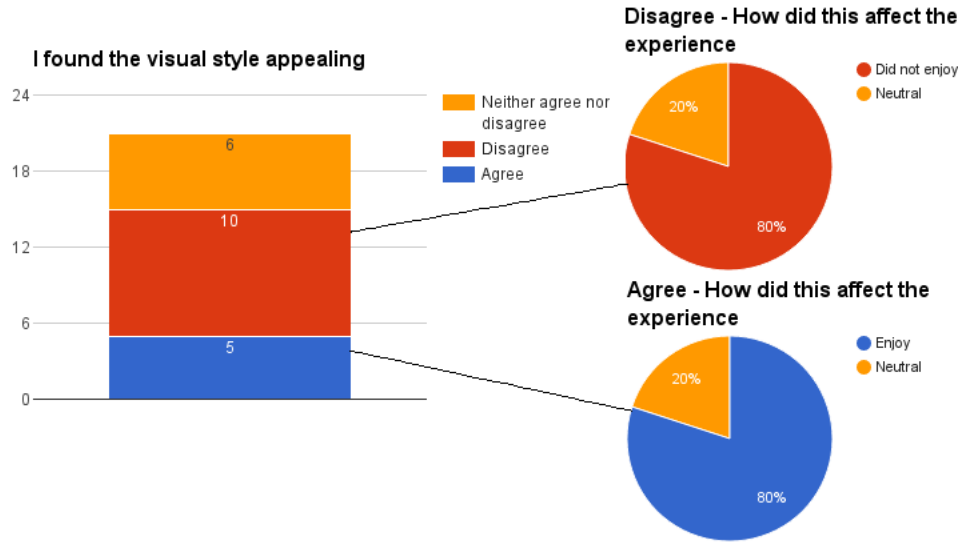

Figure 12.25: Found the visual style appealing

The majority of the respondents agreed that the visual style matched the setting of the game, but 50% of those agreeing felt that the visual style neither was enjoyable nor not enjoyable. This could indicates that the visual style gave the right associations and was functional, but did not necessarily contribute to the enjoyment.

Based on this data it seems that we succeeded somewhat in this. The visual style was deliberately made minimalistic to make it easier to navigate and make the game less confusing. The interviews also back this up with one interviewee answering, about the visual style matching the game, ”Yes, I didn’t think there was anything wrong with it” and that they felt it was easy to orient in.

12.9.1 Music matched the setting of the game

The respondents were asked to rate the statement ”The music matched the setting of the game”, the result is shown in Figure 12.26. 15 out of 21, or 71%, agreed with the statement and 80% of those 15 answered that this mad them enjoy the game more.

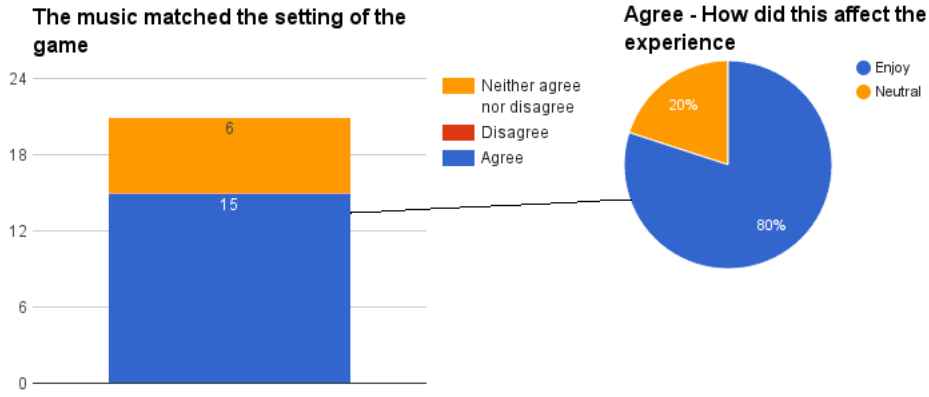

Figure 12.26: The music matched the setting of the game

Majority of the respondents did agree that the music matched the setting of the game and all 3 of the interviewees also agreed that they enjoyed the music, but it was also noted during one interview that the interviewee got annoyed with the music after a while and that it was a bit repetitive. Another interviewee also noted that they felt the music was calming and that it helped with motivation.

12.9.2 Bugs, errors and loss of control

For a player to get immersed and get into a state of flow a game should have as few bugs and errors as possible as this can result in the player losing their sense of control in the game. Control, as presented in Section 6.2, is required for a player to achieve flow. If a bug or an error hinders a player in translating their intention to the game and makes the player not feel in control, their sense of flow will be broken.

The respondents were asked to rate the statement ”I encountered minor bugs in the game” (See Figure 12.27) 12, or 60%, of the respondents agreed that they encountered minor bugs and 50% answered that these bugs were severe detriment to the enjoyability of the game.

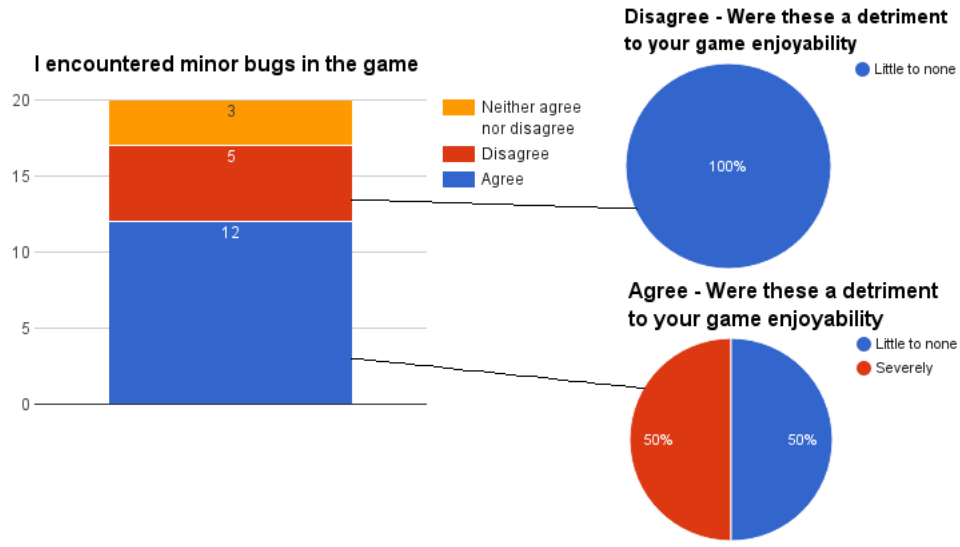

Figure 12.27: I encountered minor bugs in the game

They were also asked to rate the statement ”I encountered major bugs in the game” 10, or 50%, of the respondents agreed that the game has major bugs, and of those 10 80% answered that these bugs were severe. 9 respondents disagreed with the statement and 100% of them answered that these where a detriment to the game enjoyability. (See Figure 12.28)

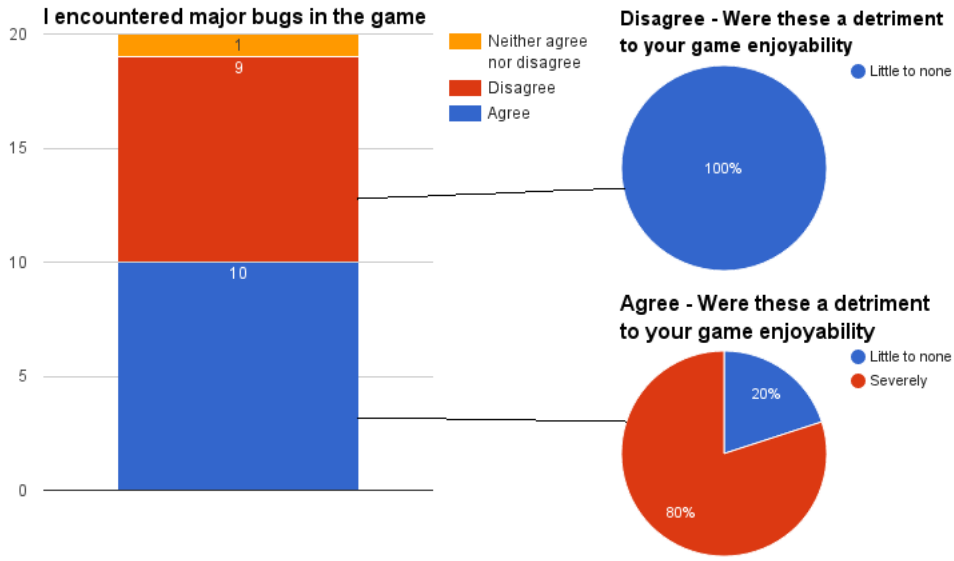

Figure 12.28: I encountered major bugs in the game

We found that most of the respondents found minor bugs and error in our game and about half found major bugs. One of the reasons for this could be the MacOS version of the game, which was more error prone than the PC version. As neither of us had access to MacOS, we did not test this version as much, and it is possible that some bugs may affect one OS while not affecting the other.

Another possible reason for it could be that a bug was discovered in the later stages of testing that hindered some players in finishing the first project, making the second project impossible to unlock. These bugs could also be part of the explanation of the high percentage of respondents that did not agree that the time flied when playing the game in Figure 12.23.

Game affecting bugs represent the sum of all evils in a usability context. It enables events where the player loses all control of their own performance in the game. They can achieve the best possible performance and still be penalised by the game in the form of unintended behaviour or even crash. Even when they are not game breaking, they may cause confusion, as noted in observations during the gameplay where bugs were encountered. The bugs provide no feedback on what the player did wrong and are sometimes uncorrectable without a restart. (Some bugs can even destroy the progress of the game up to that point). As evident, both the minor and major bugs had a high amount of detriment to the respondents, with 50% of th those who encountered minor bugs said it was a detriment to their enjoyment, while 80% of the respondents who encountered major bugs said it was a detriment to theirs.

For future iterations of *Freelance Team*, we should take even greater care of removing bugs before future experiments.

12.10 Project management

This section covers the questions related to project management in the questionnaire and discussion on the project management concepts what was included in the game.

12.10.1 Represented project management

The respondents was asked to rate the statement ”The game represents the basic concepts of project management in a realistic way” 76% agree with this statement, 23% neither agree nor disagree, and none disagree (See Figure 12.29).

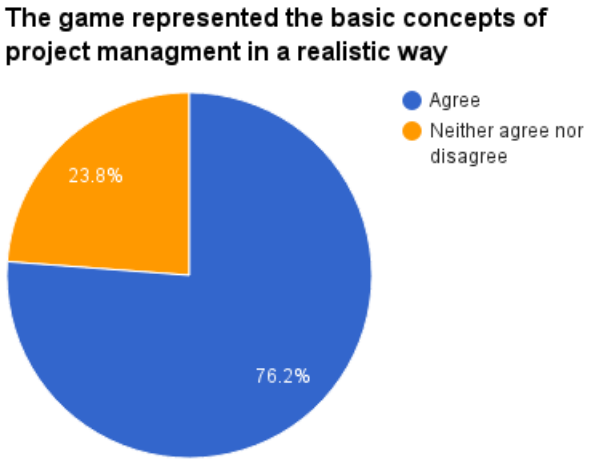

Figure 12.29: The game represented the basic concepts of project management in a realistic way

Next the respondents were asked to rate the statement ”I have learned something about project management by playing this game” 57% agreed, 23% did not agree with this statement, and 19% neither agree nor disagree (See Figure 12.30).

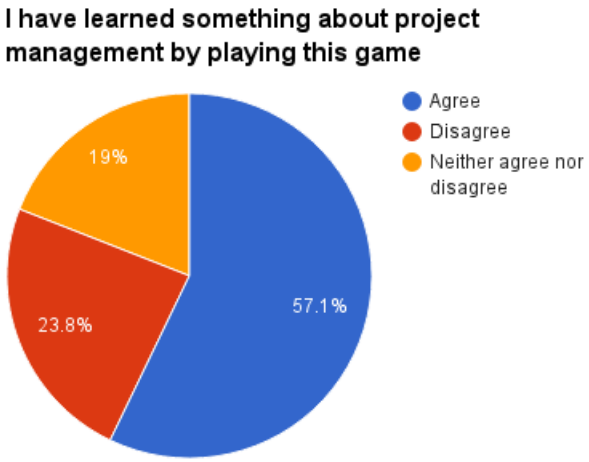

Figure 12.30: I have learned something about project management by playing this game

About three fourths of the respondents did agree that the game represents the basic concepts of project management and a little over half of the respondents also agree that they felt they learned something after playing the game. One interviewee stated that they felt their already existing knowledge in project management had helped them make progress in the game, which could indicate that at least some elements of project management are represented realistically in the game. However, it is important to point out that this only indicates that the respondents felt they learned something. The games effect on actual learning project management through playing the game is difficult to verify in this study as the knowledge gain of the participants were not tested. This would require a more extensive and detailed study, which we will discuss further in Section 14.2.1 in the chapter about further work.

It is worth noting that Figure 12.29 shows that there were none who did not think the game represented the basic concepts of project management and figure 12.30 shows that about 24% did not feel they learned anything. This could indicate that while they might agree that the game represents the basic concepts of project management they might already know these concepts either through school or experience. This was the case in two of the interviews where both interviewees agreed with the first statement, but stated that they already knew most of what the game wanted to teach. This might be explained by the sampling bias towards respondents interested in project management, games and game-based learning, discussed in Section 12.2. It could also indicate that the principles chosen are commonly known.

Traditional learning can be seen, by some, to be boring or demotivational. Game-based learning have the potential to be more motivational and ”fun”, as discussed in Section 5.1.

The respondents where asked to rate the statement ”For me, learning was a motivational factor to make me keep playing”. 43% disagreed with the statement and 33% agreed (See Figure 12.31).

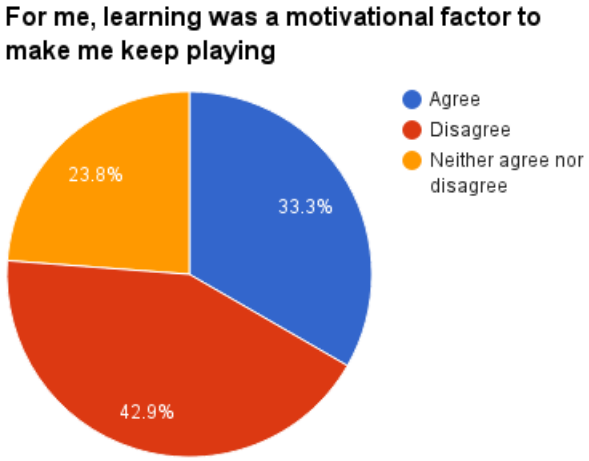

Figure 12.31: For me, learning was a motivational factor to make me keep playing

We wanted to know if the respondents felt that learning in itself was a motivation to keep playing once they started playing the game. From the data we that slightly more respondents did disagree with this statement than the ones agreeing, which does not show any strong indication one way or another.

12.10.2 Chosen concepts included in the game

In RQ2.1 we wanted to find out ”What principles of project management can effectively be interpreted into features of a game?” as discussed in chapter 9 a focus on the development team and how to plan and execute sprints was decided. Based on the answers, see figures 12.29 and 12.30, about three fourths of the respondents did agree that they felt the game represented the basic concepts of project management in a realistic way while no one disagreed while the rest neither agreed or disagreed. This indicates that the concepts chosen can be effectively be interpreted into features, but as mentioned in earlier there is a potential sampling bias, which should be kept in mind.

A potential pitfall could be that the game does not go deep enough into these elements, or does not include enough and the player already knows most of the concepts the game is trying to teach, which could account for 24% saying that they disagreed with the statement that the felt they learned something while 0% disagreed that the game represents the basic concepts of project management.

12.10.3 Identifying basic concepts of project management

When researching project managements we started by looking at PRINCE2, see Chapter 3. The core concepts of project management that should be implemented in the game were identified, the first was the six controllable aspects discussed in Section 3.1, Time, Cost, Quality, Scope, Gains/Benefits, and Risk. It was also decided that we would focus three out of the seven processes discussed in Section 3.3, ”Initiating a project”, ”Controlling a stage, and ”Closing a project”.

Part IV

Conclusion and Further Work

Part 4 presents Chapter 13 about the conclusion of the thesis and Chapter 14 about potential further work.

Chapter 13

Conclusion

13.1 Summary

This thesis project started with three goals, presented in Section 1.3. First, investigate what makes a game fun, and map these techniques to project management concepts for sake of learning. Second, to develop a pedagogical game with the goal of teaching about project management. Finally third, to examine perceived learning enjoyment by using our game to teach about project management.

The goals were structured using the GQM-method, described and detailed in Section 2.1, and a number of research questions were extracted per research goal, along with a number of metrics suggested to answer these questions. To determine the process of our thesis, we used the Design and Create research strategy which is detailed in Section 2.2.3.

The bulk of Design and Create's first step: *Awareness* stems from a prestudy performed introductory to the work on the thesis. To get a good overview of the topic, a literature study was performed to investigate what elements of project management could translate into a game, what makes games fun, how game-based learning compares to traditional learning, and relevant technologies for the game. A game study was also performed during the prestudy, for practical examples of how feelings of learning and motivation are achieved in games. After this research was concluded, a framework was constructed based on the findings from the literature study.

Using this framework and the research from the literature study a game proposal was created. This proposal can be seen in Chapter 9 and is the logical next step of the Design and Create strategy: Suggestion. The next step of the Design and Create strategy is Development. Development of "Freelance Team" started early in 2016 and the details of the implementation can be seen in Chapter 10.

When development was finished, we performed a Case Study on the game as a part of the Evaluation step of Design and Create. In the Case Study two individual experiments were done. In the first, we asked a number of respondents to play the game on their own volition

and as long as they found it fun. They were given a questionnaire to be answered when they felt they had outplayed the game. In the second experiment, we observed a smaller group of subjects as they played the game and performed interviews on them afterwards. They were also asked to answer the questionnaire. The results of these experiments and the evaluation of these results can be found in Chapter 12.

In this chapter and the next we perform the final step of the Design and Create strategy: Conclusion, by concluding upon our findings.

13.2 Goals of the thesis

A full overview of research goals and questions can be found in Sections 2.1.1 and 2.1.2.

13.2.1 RG1 - Investigate what makes a game fun, and map these techniques to project management concepts for sake of learning

With Research Goal 1 we attempted to get an understanding of what mechanics makes games fun and also translate common concepts and techniques of project management into theses mechanics. We do this by answering the following three research questions:

RQ1 - What are the basic concepts of project management?

We chose to use PRINCE2 to explain project management (see Chapter 3), as it is a popular model and it is flexible and not dependent on tools or techniques, and should not be viewed as a guide on how to complete a project. It does explain the concepts of project management well, and helped us identify the concepts we wanted to implement in this project.

RQ2 - What concepts of games make them fun?

As presented in Chapter 6 there are many factors that make a game ”fun”. Flow is an important part of making a game enjoyable, and in Section 6.2 we presented a model by Sweetser and Wyeth (2005) with 8 elements, each of which has a set of criteria for achieving enjoyment and flow. Malone (1980) presents 3 categories for achieving ”fun”, discussed in Section 6.1, each contributing to the enjoyment of a game. Based on these two approaches we constructed a framework. A condensed version with the most important parts is explained in Chapter 8, for the full list see Appendix A.1.

RQ3 - What concepts of games promote learning?

In Section 5.2 we detailed how games promote learning by always challenging the player to expand their already existing knowledge by always presenting a new and harder challenge, lying in the outer edge of the player's competence. We argue now that this is probably the clearest connection between enjoyability in games and its promotion of learning. In this sense, the learning takes its form through the exploration of the game, exploring

its mechanics and learning how to master them. This sort of exploration and learning is highly motivating to the player.

In Section 7 we performed a game study on five games. Two of them educational, two of them fun-oriented and one fun-oriented, but with recognized potential for educational gains. In this study we found that the games all had a main focus on exploration as a main gameplay feature. We identified three forms of exploration as present in some or all of the games:

Game mechanic exploration Understanding and utilizing the game mechanics to perform well in the game.

Spatial exploration Exploring and mapping spaces, such as 2D or 3D mazes.

Educational exploration Learning educational principles, either as an optional part or to perform well in parts of the game.

The educational exploration was only present in the purely educational games as well as *Assassin's Creed*. We found that the educational exploration of the games were not as closely integrated together with the game mechanic exploration or spatial exploration and while two educational games are in no way representative for all existing educational games, we are left wondering if mixing educational elements with the other game mechanics seamlessly is a bigger challenge than we first assumed.

Assassin's Creed is an interesting example of a game that includes educational elements while still being a game where the focus is on fun. We found that *Assassin's Creed* use of modern technology and principles of storytelling has crafted an immersive space that may be viable for educational gains.

RQ4 - What principles of project management can be translated into a game

In Section 3.5 we summarized the most important aspects of project management. To limit the complexity of the game both in terms of development and gameplay, we chose to focus our game on a subset of these aspects:

- The development team.
- How to plan and execute a sprint.
- and the six aspects listed in Section 3.1: Time, Cost, Quality, Scope, Gains/Benefints and Risk.

Given the results presented in Section 12.10 where about three fourths agreed that the game represented the basic concepts of project management while no respondent disagreed. This does indicate that the concepts we chose can be translated into the game, but it still means that one third were unsure. One should also keep in mind the potential sampling bias of the respondents here as this could potentially affect the result.

13.2.2 RG2 - Develop a pedagogical game with the goal of teaching about project management

RQ5 - What technologies can be used to develop a game?

There are many viable technologies that can be used to make games as we discuss in Chapter 4. We decided to use Unity 5 as this is the biggest and most popular engine and it has a healthy community. Unity uses C# and Javascript as a script language, which we both have experience with. Being a prominent game development tool for both hobby game makers and commercial companies, Unity is a solid choice for simplifying much of the programming that is required in a current generation games. The best choice of game engine (or not using a game engine) for a game will always be a matter of personal choices and prerequisites for the game.

RQ6 - What game mechanics should be in the game

We used the Framework in Chapter 8 and the elements defined with the PRINCE2 project management method in Section 3.1 to devise a game proposal. This proposal, seen in Chapter 9 was a first draft and rough plan for the game content. The details of what mechanics were implemented and how they were implemented can be seen in Chapter 10.

13.2.3 RG3 - Examine the viability of promoting learning experiences by using our game in education

RQ7 - What mechanics in our game made it enjoyable

According to the results found in Chapter 12 several of the mechanics in our game made it more enjoyable, according to the respondents.

- From Section 12.5 we could not draw a firm conclusion whether or not the **Story-telling** made the game more enjoyable, but we did note that the positive feedback on the story was directed at the content itself and the majority of the negative feedback was directed at how it was presented.
- **Random events**, as discussed in Section 12.8.2 was seen as having a positive effect on the participants experience with the game by the majority, even if it could become repetitive in some cases.
- **Hidden information** was a well received mechanic and the majority of respondents agreed that it positively affected their experience with the game, discussed in Section 12.8.2. However it was noted that if used excessively, it may contradict the usage of feedback to help the player improve their performance and so potentially increase difficulty and frustrations when learning the game.
- The majority of the respondents enjoyed **mastering the game to make progress**, but it was noted in the discussion in Section 12.7, the enjoyment from this mechanic comes with the condition that the game provides the right tools and assistance to the player.

- Most of the respondents enjoyed getting **choices that mattered** to the outcome of the game, and as discussed in Section 12.7, this suggested that a feeling of player agency was present.
- **Clear short and long term goals** were considered enjoyable, but many respondents did not find that the game defined them well enough. Of the respondents who did not feel goals of either kind, a large number of them felt this had a negative effect to the enjoyment of the game. This is discussed to more detail in 12.4
- Based on the questionnaire the **upgrade** mechanic was by the majority of respondents seen as an enjoyable part of the game. However, during the interviews, we found that the interview subjects had more mixed feelings. Because of that, is difficult to draw a firm conclusion on the extent of enjoyability that the players derived from the upgrade system. Given that the upgrade system was designed as a way for the player to set their own goals, and that a large portion of respondents felt they could not do, we have suggested means of improving the upgrade system to promote a feeling of being able to set own goals, as discussed in Section 12.4.2.
- It can be concluded from the data, see Section 12.9.1, that the **music** was by the majority of participants, as an enjoyable part of the game.

RQ8 - How can the game be improved to promote a higher degree of enjoyment

From the data presented and discussed in Chapter 12, the game could be improved in several ways to improve the players enjoyment.

One of the possible improvements found was the visual style itself, see Section 12.9, while the visuals was functional and gave the correct association it was concluded that the visual style did not necessarily contribute too the enjoyment of the game. It was also found that most of the negative feedback on the storytelling was directed at the way it was presented and not at the content itself.

Another element that could improve the enjoyment is to improve the feedback the game provides to the player. As discussed in Section 12.8.1, the feedback did not always feel immediate or constructive for the respondents and only told the player what had gone wrong after a sprint was completed and did not give the player information on how to avoid these mistakes in the future.

Understanding how to play Freelance Team was found to be difficult, as discussed in Section 12.6.1. The tutorial that was implemented failed to engage the players and was seen as more of a chore than an engaging and helpful part of the game. Possible improvements were:

- Slowly introduce each game mechanic in a introductory tutorial project
- Gradually introduce new game mechanics throughout the whole game

These will be discussed further in Chapter 14, where we discuss the potential further work.

RQ9 - How viable is the game for game-based learning

To consider how viable our game is to teach about project management, we must consider the effectivity and enjoyment of the using the game in this context. The game can only be considered viable if either or both of the following is true:

- Enjoyment of learning through our game must be equal or higher than how project management is typically learned.
- Effectivity of learning through our game must be equal or higher than how project management is typically learned.

A large majority of our respondents stated that they preferred game-based learning over traditional learning, but we believe that this finding may have been affected by potential sampling bias. Almost 50% of respondents said they enjoyed playing *Freelance Team*, and we believe that this degree of enjoyment increases even more as we perform the improvements detailed in 14. While we cannot draw any hard conclusions of how enjoyable the game is compared to traditional project management, from the results discussed in this chapter, we find that there is a plausible chance that the learning enjoyment from Freelance Team is greater than traditional learning.

in Section 12.10.1, we concluded that a majority of the respondents felt they hard learned something about concepts of project management. While some respondents did respond that the concepts Freelance Team tries to teach was already known to them, the majority agreed with the statement *"I have learned something about project management by playing this game"*. During the interviews, one respondent said that he felt his already attained knowledge in project management had helped him make progress in the game. As stated in Section 14.2.1, there is a difference between perceived learning and actual learning, and we are unable to draw hard conclusions regarding the actual learning. We propose a method in doing this in Section 14.2.1.

While the research is not conclusive, there are indications that *Freelance Team* is viable as a source of learning, given the mostly positive results towards the elements of learning during this study as well as the enjoyment derived from it considering the prototype nature of the game.

Chapter 14

Further Work

Game-based learning is a young and still broad subject. While we have attempted to answer some of these questions, many of them still remain, and possibly a few new ones have appeared. At the same time, the game itself is still a prototype in the early stages. Through this thesis we have gained some very valuable experiences and suggestions on how to improve the game further. In this chapter we present both the way forward for the game, and the way forward for the academical research.

14.1 Further work on the game

For a future iteration of the game, the following improvements should be made:

14.1.1 Improving the beginning stages of the game

As discussed in Section 12.6.1 Freelance Team needs to improve its early stages when it comes to teaching the player how to play it. The section presented two possible strategies that could improve the learning curve:

- Slowly introduce each game mechanic in a introductory tutorial project.
- Gradually introduce new game mechanics throughout the whole game.

Both of these approaches could increase the engagement of the player when learning how to play the game.

14.1.2 Balancing the projects

In addition to improving the beginning stages of the games, we should balance the difficulty so that later projects are clearly more difficult than the ones who preceeded them. A project with a higher prestige requirement should always be harder, either by demanding more time, balance or having a more complicated task tree. Additionally it may affect the

enjoyment of learning if some projects challenge and require the player to rethink their playstyles.

14.1.3 Improved feedback and usability

The interface of Freelance Team could use more development. It was intended to be functional and minimalistic, mostly because of time and skill limitations. The feedback the game provides now is slightly lacking as discussed in Section 12.8.1, so if the interface is to be improved upon, the feedback it provides should be a priority for improvement. Many of our respondents felt that the feedback focused to a higher extent on showing that there *was* a problem, but not *what* caused this problem or how to mitigate it. For the next iteration of Freelance Team, the feedback should present clearer clues on how to solve the problems that arises.

14.1.4 More variation

Due to time limitations, we were unable to include as much variation in the game as we had hoped. This became clear as many respondents felt the game felt repetitive and many of the same actions and events often repeated themselves throughout the game. The following are a number of possible examples of how to add more variation:

- More behaviour types for the employees
- More random events that can happen at any time
- More events that are triggered when the user completes a task
- Several new projects, each with unique project-related tasks and custom music
- More shop items to buy that alter or improve the players possibilities when performing projects

The last one is particularly important to improve the players feeling of being able to set their own goals, as we noted in Section 12.4.2.

14.1.5 Improve the upgrades

For the future iterations of Freelance Team an introduction of a tree-like structure where all upgrades and their dependencies are listed. From the parent upgrade there are a number of child upgrades; these are themselves parent to other upgrades. Hovering over one of the upgrades would present the effects of buying it, along with the price of the upgrade. The player would be able to buy a significant amount of upgrades throughout the course of the game, but may not be able to buy all of them, encouraging experimenting with different playstyles. Having such an overview already from the start would give the player an insight into how different upgrades would benefit their own personal playstyle, and may have to a greater extent encourage planning ahead to buy a particular chain of upgrades. A prototype as to how this could appear in the game can be seen in Appendix

14.1.6 Bug fixes

While we attempted to root out the worst bugs during the final phases of development, bug fixing is difficult. Especially, perhaps, in games where the user have many choices and may act or make unpredictable decisions. During the start phases of the next iteration of the game, we should rid the most serious bugs by performing an extensive session of game breaking, where we try to act in strange and unpredictable ways to find game states that may be vulnerable for errors.

14.2 Further work on the research

To further advance the research, we believe that these areas of research have potential for further research:

14.2.1 Degree of learning

Originally we wanted to test the degree of learning instead of perceived learning. This would involve two user groups of test subjects go through an assessment of their knowledge on project management. One user group would then learn more about project management through playing the game and the other half would learn it through traditional learning, for example by reading articles, books or attending lectures. At the end of a period of a time, a new assessment would then be given to both user groups. Afterwards the scores compared against the baseline set in the first test should provide valuable insight into the actual learning effectivity and gains of our game as compared to traditional learning. Sadly, due to time constraints and a lack of resources, we did not manage to devise a test with the quality to yield reliable results, opting instead to focus on a perceived sense of learning in this thesis.

14.2.2 Pedagogical interdisciplinary cooperation

As students of Informatics, we have limited knowledge of educational viewpoints, such as philosophies on pedagogy and important techniques for learning. In future research we believe an interdisciplinary cooperation between pedagogical researchers and informatic researchers would serve game-based learning research well.

14.2.3 Improving and validating the framework

The framework detailed in Chapter 8 was created as a means to guide the game proposal and design phase of our Freelance Team game. However, it may hold some value as the groundwork for a more general framework for creating future game-based learning games. Improving and validating it may prove to be an interesting research topic.

14.2.4 The value of immersing a player into a factual world

A point that we discovered during our research was how Assassins Creed uses a mix of fact and fiction to form the universe it takes place in. It is not clear whether or not the enjoyment value is stronger when when the game immerses the player into a world they know have real-life factual elements, or if it is the immersion itself that draws the most interest. A study might be conducted to see if games that let the player experience historically accurate locations, characters or events may hold a greater immersive value than the games that let the player experience exclusively fictional locations, character or events.

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Appendix

A.1 Full framework

- Player Skill
  - The player can play without reading a manual
  - The process of learning the game should not be boring
  - The game should provide in-game instructions so the player can learn in the game itself
  - The game should provide in-game tutorials or initially easy first levels.
  - The difficulty of the game should increase together with the skill of the player
  - The player should be rewarded appropriately for their effort and skill development
  - interface and mechanics should be easy to learn and use
- Control
  - Players should feel that they are in control over their character (or units) and their movements and interactions in the world
  - Players should feel control over the game interface and input devices
  - Players should feel control ver the game states (Starting, stopping, saving, etc)
  - Players should not be able to make errors that cannot be recovered
  - Players should feel a sense of control and impact on the game world
  - Players should feel a sense of control over actions taken.
  - Players should feel a freedrom to use the strategies they want.
- Feedback
  - Actions should provide immediate feedback

  - The player should get feedback on their performance (for example through status or score)
  - Gameplay should have unpredictable elements
  - Feedback should be constructive and help the player attain new knowledge

- Concentration
  - The game should provide a sense of stimuli from different sources
  - Players should be easily immersed and easily maintain such immersion
  - Players should have a good balance of workload. Too much will make it unovercomeable. Too little will make it boring
  - The game should not have distracting elements

- Challenge
  - Simple games should provide obvious goals.
  - Complex environments without preexisting goals should be structured so users easily can generate appropriately difficult goals
  - Best goals are often practical or fantasy goals rather than goals of using a skill
  - Clear goals
    * Overriding goals should be clear, given early
    * intermediate goals should be clear and presented at appropriate times

    Player should receive feedback on how far along to attain a goal they are
  - A goal must match the skill level of the player
  - Uncertain outcome
    * Variable difficulty level
      · Can be determined automatically based on the performance of the player
      · Can be chosen by the player
    * Multiple level goals. Example: two levels of goals can be having a basic goal of popping baloons and then a metagoal (do this efficiently)
      · Score-keeping, metagoal of getting a highest or lowest score possible

        - Speeded responses: metagoal of doing something as fast as possible
    - Information is hidden for the player, and only selectively revealed throughout the game.
    - Randomness heightens interest
- Immersion
    - Game should make the player less aware of surroundings
    - Game should make the player less self-aware and less worried about everyday life.
    - Game should alter the players sense of time
    - Fantasy
        - Intrinsic and extrinsic fantasy
        - Intrinsic seems to be better than extrinsic. One way to create for given skill is to simulate a situation where the skill is used. Other way is to think of situation that involves useful analogies to the skill being used
        - Extrinsic is domain-independent. Problem with catastrophe may be interesting.
        - Emotional aspects of fantasy
        - Derives appeal from the emotional need they help satisfy in the people who play them
        - Difficult to know emotional needs people have and how these might be met
        - games that embody emotionally-involving fantasies like war, destruction, and competition are likely to be more popular
    - Audio and visual effects
        - Decoration, used regardless of what the player does. Enhances initial interest, but will quickly become boring
        - to enhance fantasy, same as above but evoke fantasy association
        - As reward, used to reward good performance, can increase salience of the goal and thus add to the challenge of the game.
        - The challenge of reaching a goal however, can sometimes distract from exercising their curiosity, and might decrease certain kinds of learning
        - As a representation system, perhaps the best use of sound and graphics in games is to represent and convey information more effectively than with words or numbers

A.2 Questionnaire

Questionnaire - Game-based learning and "Freelance Team"

This questionnaire relates to the Project-Managment Game "Freelance Team". Before finishing this questionnaire, you will be required to play the game "Freelance Team" for a while. Where possible, you can answer in Norwegian if you'd prefer that.

1. **What is your age?**

2. **Highest educational level**
   Markér bare én oval.
   - ◯ Less than High School Degree (Ikke fullført videregående skole)
   - ◯ High School Degree (Yrkesfag og Allmennfag på videregående skole)
   - ◯ Bachelor's Degree
   - ◯ Master's Degree
   - ◯ PHD

Your previous experiences

Please evaluate the following statements

3. **I have experience playing games**
   Markér bare én oval.
   - ◯ Strongly agree
   - ◯ Agree
   - ◯ Neither agree nor disagree
   - ◯ Disagree
   - ◯ Strongly disagree

4. **I enjoy playing games**
   Markér bare én oval.
   - ◯ Strongly agree
   - ◯ Agree
   - ◯ Neither agree nor disagree
   - ◯ Disagree
   - ◯ Strongly disagree

5. **I have experience in project managment**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

6. **I enjoy managing projects**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

7. **I enjoy participating on projects**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

The Game Experience - Overall Experience

Please play the game "Freelance Team". You should play the game in a period where you have time to focus solely on the game. Keep track of how long you play for. If you play in several periods, you should write the total time you used playing in the field below.

8. **How long did you play? (answer in the format hh.mm)**

.....

9. **Please give a short description describing what made you stop playing the game / what made you keep playing the game**

.....

.....

.....

.....

.....

Please rate the following statements in terms of how much you agree with it

10. **This game is enjoyable**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly Disagree

11. **Time flied when I played this game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly Disagree

12. **This game was challenging**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

13. **The challenge level increased when I unlocked the second project**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

14. **The level of challenge made me enjoy the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

15. **I easily understood how to play the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

Hopp til «Game Experience»

Game Experience

In this section you will be asked to rate a number of statements relating to your game experience and how you played the game. You will then also be asked to rate how this affected your overall enjoyment of the game

Hopp til spørsmål 16.

Clear short term goals

The overview and understanding of player goals that are completed within a short timeframe. For example a sprint.

16. **This game had clear short term goals**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

17. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Clear long term goals

The overview and understanding of player goals that are completed within a longer timeframe. For example gaining enough prestige to unlock a new project.

18. **This game had clear long term goals**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

19. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less	◯	◯	◯	◯	◯	It made me enjoy it much more

Setting own goals

The possibility of being able to set your own goals for yourself in the game. Examples of this can be to consciously plan for buying a specific upgrade, unlocking a specific project or finishing a specific task.

20. **I could set my own goals in this game**
Markér bare én oval.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

21. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less	◯	◯	◯	◯	◯	It made me enjoy it much more

Random events

Events that happen in the game - seemingly at random - that might award, punish or force the player into making decisions.

22. **Random events were present in the game**
Markér bare én oval.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

23. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It's presence (or lack of) made me enjoy it much less	◯	◯	◯	◯	◯	It's presence (or lack of) made me enjoy it much more

Upgrades

The ability to upgrade or improve aspects of the game to attain better results.

24. **The upgrades are an important part of the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

25. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Hidden information

The understanding and feeling that there is information in the game that is not shared directly with the player, but still holds a bearing in the game.

26. **The game had hidden information I had to understand by playing the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

27. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Feedback

To receive information about the players performance, as well as information that can help the player improve their performance.

28. **The game gave good feedback about my progress**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

29. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less	◯	◯	◯	◯	◯	It made me enjoy it much more

30. **The game gave good feedback about how to improve my playing skills**
Markér bare én oval.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree or disagree
- ◯ Disagree
- ◯ Strongly disagree

31. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less	◯	◯	◯	◯	◯	It made me enjoy it much more

Learning to succeed

The presence of a feeling that you had to understand and utilize the tools in the game effectively to make progress in the game.

32. **I had to learn how to master the game to make progress in it**
Markér bare én oval.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

33. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less	◯	◯	◯	◯	◯	It made me enjoy it much more

Important choices

A feeling that your choices in the game mattered and had bearing for your performance in the game.

34. **I had to make choices that mattered to the outcome of the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

35. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Visual style

36. **The visual style matched the setting of the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

37. **I found the visual style appealing**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

38. **How did the visual style affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Music

39. **The music matched the setting of the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

40. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

Replayability

41. **The gameplay felt repetitive**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

42. **How did this affect your experience with the game?**
Markér bare én oval.

	1	2	3	4	5	
It made me enjoy it much less						It made me enjoy it much more

43. **The game could be replayed several times and still feel exciting**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Bugs and errors

Here you will be asked to answer some statements regarding bugs you found in the games. Minor bugs are considered game errors that does not impede in a big way you playing your game, but serve as annoyances or obstacles. Major bugs are game errors that severely impede or may even make the game unplayable.

44. **I encountered minor bugs in the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

45. **To what a degree were these a detrament to your game enjoyability?**
Markér bare én oval.

	1	2	3	4	
None at all					Severely

46. **I encountered major bugs in the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

47. **To what a degree were these a detrament to your enjoyability?**
Markér bare én oval.

	1	2	3	4	
None at all					Severely

Game Experience - Fantasy

How did you feel about the storytelling in the game?

48. **I enjoyed the storytelling in the game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

49. **The storytelling made the game more addictive**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

50. **The storytelling made the game more enjoyable**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Learning experience

51. **The game represented the basic concepts of project managment in a realistic way**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

52. **I have learned something about project management by playing this game**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

53. **For me, learning was a motivational factor to make me keep playing**
Markér bare én oval.

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

54. **How would you compare game-based learning with traditional learning? Choose the answer that most closely resembles your own**

Markér bare én oval.

- I strongly prefer traditional learning over game-based learning
- I somewhat prefer traditional learning over game-based learning
- I have no preference of the two
- I somewhat prefer game-based learning over traditional learning
- I strongly prefer game-based learning over traditional learning

55. **(Optional) Write a short text about your experience with this game**

.....

.....

.....

.....

.....

A.3 Upgrade Tree Prototype

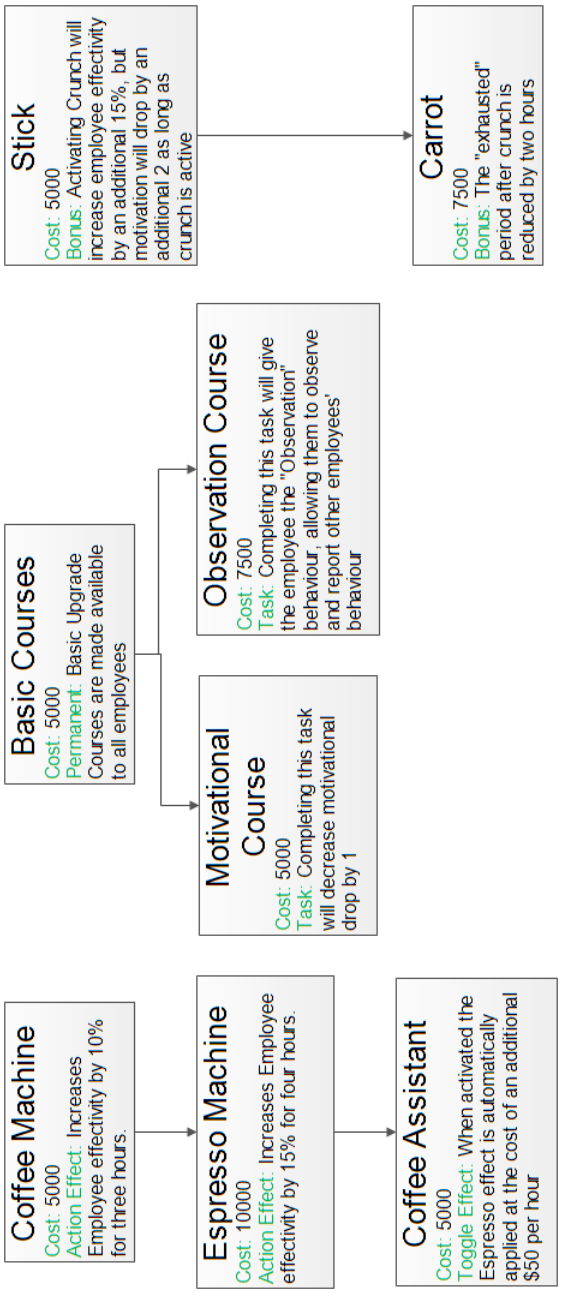

Figure 1: A prototype of a possible new Upgrade Tree system