CHALMERS

The process of transforming a non-digital game to a digital application

Bachelor of Science Thesis in Computer Science and Engineering

DAVID BERG MARKLUND
ANTON FREUDENTHALER
LINDA HAMP
OSKAR JÖNEFORS
LUDWIG LINDBERG
JESPER OLSSON

Chalmers University of Technology
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Examiner: Olof Torgersson

Department of Computer Science and Engineering
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone: +46 (0)31-772 1000

Cover:
An illustration of the transformation from non-digital game to digital application. The non-digital game used as an inspiration in this project is a board game, explained in chapter 3, and the mobile operation system is Android.

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Abstract

It is becoming more common to transform non-digital games into digital applications. The aim of this project was to explore this kind of transformation in detail, and to investigate what problems and opportunities that follow such a process. To be able to accomplish this, the team subjected itself to this transformation by taking an existing tabletop game, and transforming it into an application for the mobile medium. The design process was built around player experiences from the original tabletop game, and the goal throughout the transformation was to maintain as many player experiences as possible. This report covers the whole longevity of the design process, from the initial ideas and paper prototypes to a final digital prototype. The findings in this project were expressed as a list of seven recommendations covering important aspects of what to consider before attempting to transform a non-digital game into a digital application. In addition to the recommendations, the process also resulted in a functional and playable game prototype.

Keywords: Playcentric design, Usability testing, Experience goals, Design process, Application, Game.

Acknowledgements

Glossary

Android Studio - An Integrated Development Environment (IDE) made specifically for developing Android applications.

BOTD - Board of the Day. Game idea described in section 5.3.1.

Bus factor - The ability to play a game asynchronously for short sessions.

FNOC - Fixed Number of Clues. Game idea described in section 5.3.3.

Game flow - A state where the player is motivated to keep playing.

GUI - Graphical User Interface. A graphical interface that allows users to interact with a digital device.

Partner - Player that cooperates with the playmaster in the game and tries to find the correct words. First introduced in section 5.2.

Playcentric design - A method for designing games.

Player experience goals - Experiences that designers want players to perceive while playing their game.

Playie - The company that supplied the board game to transform.

Playmaster - Player to whom the properties of all words are revealed in the game, explained in section 3.1.

PTB - Pick the Board. Game idea described in section 5.3.2.

Replayability - A game that is replayable is a game where the player is motivated to repeatedly play the game.

Scrum - An iterative methodology for system development.

Sprint - A time frame in the Scrum methodology.

Contents

1

Introduction

In today's society, the use of mobile applications has become a daily routine for a lot of people. According to a study conducted in 2015, participants used their smartphones approximately five hours per day on average (Andrews et al., 2015). In recent years, popular tabletop games have been adapted to the mobile application format (Björk, 2013). One evident example of such a mobile application is Wordfeud, which is based on Scrabble. The game is basically implemented in the same way as the tabletop counterpart, apart from the chat function. Scrabble lends itself very well to this kind of transformation, as all critical interaction during gameplay is carried out by placing letter tiles to form words on the game board. This can be done in a mobile interface by tapping and dragging tiles to their intended position on the board. The more laborious tasks in the physical game, such as score calculation, enforcement of rules, mixing and collection of tiles, can be performed far quicker and more efficiently by a computerized device. A possible drawback with the mobile platform is the lack of flexibility when deciding what constitutes a valid word. Playful discussions around this topic might add substantial value to the experience of the tabletop game.

Studies have shown that the average session with a mobile application only lasts about one minute (Böhmer et al., 2011), which means that a game on a mobile platform needs to be easily accessible for short sessions. Wordfeud satisfies this criterion, since the user is never dependent on the other player being available at the same time. This criterion will from now on be expressed as the *bus factor*, because it refers to the ability to play short sessions while, for example, commuting by bus.

It is not self-evident however that a popular board game makes a successful application for the mobile platform. One of the more perplexing issues is that board games and mobile applications are used in different surroundings and during different circumstances. Board games are often played in a social environment during a longer time span, while a mobile application is used anywhere, at any time, during a shorter time span. The element of time is an interesting aspect of the transformation. A board game

is often slow-paced, but completed relatively quickly. A game on a mobile platform on the other hand is often fast-paced, but might take several days to complete. The mobile platform restricts the game in certain areas, while it offers new opportunities in others.

1.1 Purpose

The purpose of this project is to explore the process of transforming a non-digital game with a substantial amount of social interaction, into a digital application for the mobile medium. Accordingly, this project will explore what problems and possibilities that arise in the transformation process, and how these can be solved or taken advantage of.

1.2 Research question

This project focuses on one research question: What is important to consider when transferring a non-digital game to a digital application? To answer this question, the task in this project is to transform a board game experience to a mobile application. The specific board game was supplied by Playie and is used as the non-digital game to transform in this project. This board game is explained in detail in chapter 3.

The goal throughout the process is to preserve the *player experience goals* - concept described in section 2.1 - from the board game through the transformation. This project investigates the limitations and opportunities that the mobile platform present in regard to player experiences. By doing so, it is possible to answer the main question in this project, evaluate the success rate of the transformation and establish guidelines for others who want to undertake the same transformation.

1.3 Scope

In this report, the process of transferring the experience of a board game into a mobile application is investigated, with the goal of retaining as much of the aspects from the board game as possible, taking advantage of the strengths of the new medium. This includes the iterative design process with prototyping and surveys, as well as the software development process. However, there will be no detailed descriptions or explanations regarding the choice and utilization of technologies in the software implementation. Furthermore, the aesthetics of the application will be of low priority. Cheat prevention, data security or payment strategies will not be taken into account.

2

Theory

When transferring a non-digital game to a digital application, deconstructing the game and identifying its different building blocks is of great importance. In this project, these building blocks are categorized as player experience goals, game features and game mechanics. Other concepts such as game setup and gameplay are important as well, since they describe how to play the game.

2.1 Player experience goals

When designing a product, one of the key elements is user experience (Preece et al., 2015, pp. 12). User experience can be defined as the feelings that a user experiences while interacting with a product (DIS and ISO). User experience is of great importance for product designers, since it is a key factor to why users like and use a product (Kraft, 2012). Hassenzahl argues that the experiences of the user are more interesting than what actually makes the user experience them (Hassenzahl, 2008). Accordingly, Hassenzahl continues, setting experience goals for a product has become another kind of starting point in a product design process, in addition to setting functionality goals. By setting experience goals, designers can measure how well they succeed in transferring these to the final product (Fullerton, 2008, pp. 11).

In her game design process, Fullerton uses the term player experience goals instead of just experience goals, or user experience goals (Fullerton, 2008). Player experience goals focus on the game experience, and beside feelings, they consist of situations that designers want players to experience while playing the game.

2.2 Game features

One definition of a feature is:

"An interesting or important part, quality, ability, etc" (Merriam-Webster.com, a)

Accordingly, a game feature has the same definition in the context of games, and encompasses all parts in a game, including rules, player abilities, audio and visuals (Fullerton, 2008).

2.3 Game mechanics

The definition of game mechanics varies (Sicart, 2008). In this thesis, Sicart's definition is used.

"Game mechanics are methods invoked by agents, designed for interaction with the game state." (Sicart, 2008)

Sicart explains how the methods could generally be seen as the actions that can be taken in a game, and that the agents could be thought of as the human players or game entities (Sicart, 2008). He also states that a clear distinction between game mechanics and game rules is desired when designing a game.

In addition, Fullerton states that the game mechanics are what the player experience goals mostly originate from, and when designing a game it is important to test early on to make sure that the mechanics fulfill the player experience goals (Fullerton, 2008, pp. 10-11).

2.4 Game setup

One definition of a setup is:

"The process of making something (such as a machine or a computer program) ready to be used" (Merriam-Webster.com, b)

Accordingly, game setup is the process of making a game ready to be played. A simple game might only need the player(s) to be ready, but a more complex game might require preconditions such as role creation, resource distribution, world creation, card shuffling or team building.

Usually, the rules and objectives of the game are explained during the setup (Fullerton, 2008, pp. 28-30).

2.5   Gameplay

Gameplay is the structure of how a player interacts with a game and other players (Björk and Holopainen, 2004, pp. 3). This includes all the possibilities, results and reasons for the player to play. Björk and Holopainen also claim that a game could have great gameplay without being graphically appealing, bug-free or having a complete design.

3

The Original Board Game

The board game that is used as a source of inspiration for this project is a game where word association is of central importance. In this chapter, the game setup and gameplay of the original board game are explained, followed by an example of play to make the game easier to understand. An understanding of the board game is crucial to be able to follow the design process in this project.
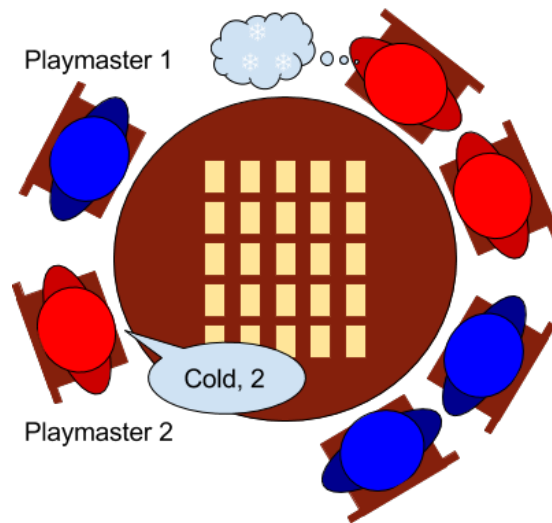
Figure 3.1: Illustration of a play session of the original board game.

(a) The initial state of the game board, which is visible to all players.

(b) The property map given to the two playmasters.

(c) The red playmaster associates two red words with the word *Cold*.

(d) A clue given by the red playmaster, which states that the number of red words he associates with *Cold* is two.
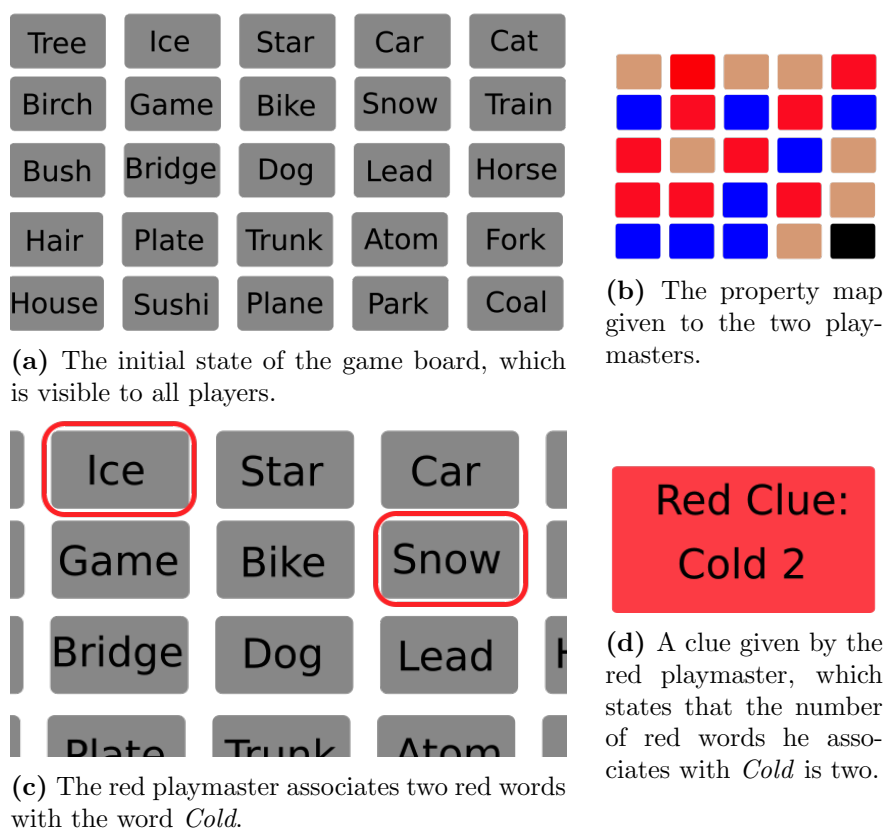
Figure 3.2: Illustration of the game setup of the original game.

3.1 Game setup

A minimum of four players are required to play the game, but six players are preferable. At the start of the game, the players are divided into two teams as equally sized as possible. The teams are called the red and the blue team. Each team has to assign a team member to the role of playmaster. The two playmasters are seated next to each other on one side of the table, while the other players sit on the opposite side (see figure 3.1). The game board consists of a grid made up of 25 words (see the example illustrated in figure 3.2a). The 25 words are randomly selected from a pile of words and are placed on the table. In addition, the two playmasters are given a property map that is not available to the rest of the players. This map assigns a property of either blue, red, neutral or black to each word on the board (see figure 3.2b). The playmasters share this map, meaning that the board looks the same irrespective of which team they are on. The blue words belong to the blue team, and the red words belong to the red team. However, the rest of the players can not see the properties of the words and have no idea which property is assigned to which word. This information is only available to the playmasters.

3.2 Gameplay

The starting team has nine words to find, while the other team has eight. Since the playmasters are the only two players that know the properties of the words on the board, their goal is to help their team find their respective words before the other team does. That is, the red team wants to find all red words before the blue team finds all blue words, and the other way around. The team that finds all of their words first wins the game.

The only way that the playmasters can help their team members find their words is by giving them clues. The clue must consist of one English word followed by a number. The game has many rules determining which English words that are allowed as clues. In general, the clue must be a single word. It can not be one of the 25 words on the board and it has to be a real English word. The English word would be something the playmaster associates with some of the team's words on the board. The number represents the number of words that the playmaster associates with the clue. They give one new clue each time it is their team's turn. To exemplify this, say that it is the red team's turn to make a move. The board is the same as in figure 3.2a and the words have the same properties as in figure 3.2b. The red playmaster associates two of the red words on the board, in this example *Ice* and *Snow* (see figure 3.2c). The clue that the red playmaster gives to the red team is *Cold 2* (see figure 3.2d).

After the playmaster's clue has been revealed to the other team members, the team is allowed to guess which words they believe that the playmaster associates with the clue. The maximum number of guesses they have in each round is one more than the number that the playmaster gives in the clue. For instance, if the playmaster says *Cold 2* (as in figure 3.2d), the team has a maximum of three guesses before the turn goes to the other team. A team guesses on a word by touching it on the table. They can only guess on one word at a time.

When a word is touched by a team, its property is revealed and will be visible for both teams throughout the game. If the word belongs to the team that is guessing, they can continue guessing. It does not matter if the word picked by the team was the same word as the playmaster had in mind, as long as the word belongs to the team. On the other hand, if the word is neutral or belongs to the other team, it will be the other team's turn. The latter will also mean that the opponents are one step closer to victory, which makes it worse to pick one of the other team's words than a neutral. However, the worst thing a team can do is to pick the black word. If the the team picks the black word they lose the game. Therefore, the playmasters have to be very careful to not give clues that in any way can be associated with the black word.

If players think that the game is too slow-paced, they are able to turn an hourglass to speed it up. Doing this will pressure the playmaster to figure out a clue, or the other players to guess on a word, before the time runs out.

3.3 Example of play

To better illustrate how the board game works, an example of play during two rounds will be simulated using figure 3.2. The board in the simulated game looks the same as in figure 3.2a and the playmasters are given the property map shown in figure 3.2b.

Red team begins, since the property map shows that they have nine words to find, while the blue team only has eight. Red playmaster associates *Ice* and *Snow* in the same way as previously mentioned (figure 3.2c) and gives the clue *Cold 2* (figure 3.2d). The red team starts discussing which words the red playmaster might be referring to, while the playmaster sits quiet on the other side of the table, not revealing anything with facial expressions. The red team determines that they want to guess on *Ice*. That is correct, and *Ice* is marked red. Since the red team picked a red word, they can continue guessing. They guess on the word *Snow*. That is also correct, and the team can continue to guess. The team has however picked both words associated with *Cold*, and since they have no information from previous clues, they choose to end their turn. The red playmaster is still not allowed to communicate with the players, and starts preparing the clue for the red team's next turn.

Meanwhile, it is the blue playmaster's turn to give a clue. Blue playmaster gives the clue *Transportation 3*, thinking of *Train*, *Plane* and *Bike* (see figure 3.2a and figure 3.2b). The blue team guesses on *Train*, which is correct, and then *Plane*, which is also correct. Then, however, the blue team guesses on *Car*. *Car* is a neutral word, meaning that the turn ends.

The red playmaster gives a new clue, this time *Animals 2*, thinking of *Cat* and *Dog*. However, the red playmaster has missed the fact that *Horse* is a neutral word that is also on the board. Red team guesses on *Horse*, and is not allowed to continue, since the word is neutral. It is the blue team's turn once again.

The blue playmaster says *Fish 1*, referring to *Sushi*. Blue team guesses on the word *Sushi*, which is correct, and they are allowed to continue guessing. They know that they still have one word left from the previous clue, *Transportation 3*, since they picked a neutral word instead of a blue. They decide to guess on *Trunk*, since they think that the trunk of a car has something to do with transportation. *Trunk* is blue and they are allowed to continue. The fact that the blue playmaster thought of the word *Bike* when giving the clue does not matter. Despite the fact that the blue team were right, they are not allowed to continue guessing. Since the clue in this round was *Sushi 1*, they were only given two guesses. It will once again be the red team's turn.

The game continues until one of the teams have found all of their words, or picked the black word.

4

Method

The project was initially split into four essential phases: producing game ideas, designing the game, implementing the game and testing the game. The game design was done iteratively with a playcentric design approach (Fullerton, 2008). The playcentric approach originates from user-centered design, which was made a household term after Norman and Draper released *User-Centered System Design: New Perspectives on Human-Computer Interaction* in 1986 (Norman and Draper, 1986). Playcentric design is a version of user-centered design, made specifically for designing games (Fullerton, 2008). The implementation was done following the Scrum methodology, which is also an iterative work process (Schwaber and Sutherland). Both of these methods were chosen since an iterative, test driven design process seemed favorable to be able to maintain the player experience goals throughout the transformation. This was due to the fact that the design could be evaluated and improved during the whole time frame of the project.

4.1 Playcentric design

The design and development of the game used a playcentric design approach (Fullerton, 2008). In a playcentric design approach, player experience goals play a central role and are measured throughout the design process. In this section, the design approach is explained with the following concepts: deconstruction of the original board game, brainstorming ideas, prototyping and finally, usability testing.

4.1.1 Deconstructing the original board game

Since the goal was never to translate the original board game directly onto the mobile platform, but rather to transfer the player experiences from the original board game to the mobile medium, game ideas had to be produced and evaluated.

In order to identify what experiences the original board game imparted on players, the game was played and examined in a systematic manner. All members of the group wrote

down the five most distinguishable feelings that were experienced during gameplay, and the results were later summarized and evaluated. For deeper knowledge of the imparted experiences, a number of reviews of the original board game were read. This was also done in a systematic way. For every review, all adjectives and descriptive phrases were noted. Finally, the results from examining the game and the results from reading reviews were compiled into a list of descriptive phrases. These descriptive phases represented the identified player experience goals.

4.1.2 Brainstorming ideas

When the player experience goals had been identified, the next step was to generate game ideas. This was done by letting every member of the group come up with at least one game idea. The idea was not supposed to describe a fully developed concept, but rather to answer some central questions about the flow of the game.

4.1.3 Paper prototyping

A key component to playcentric design is that ideas should be prototyped and playtested early on in the process (Fullerton, 2008, pp. 11). In line with this, a number of game ideas were tested on players in the form of physical paper prototypes. According to Fullerton, it is a good idea to narrow the number of ideas down to three. Those three ideas should then be prototyped in paper format and tested accordingly (Fullerton, 2008, pp. 15). Another reason for prototyping multiple ideas was that, even though game testers were not likely to ever give negative criticism, they would still probably be able to rank the different game types in order of preference. This gave the designers a notion of which ideas to pursue, and which to abandon.

Furthermore, testing with physical prototypes is a good way of evaluating game mechanics early in the development process (Fullerton, 2008, pp. 175-176). Fullerton claims that a physical prototype has several advantages over a digital one. The main advantage of developing a physical prototype is that the designers can focus mainly on the game mechanics instead of implementation details. If modifications are required, a physical prototype is quite easily changed. Code, however, can be hard and time-consuming to alter. Fullerton states that in a physical prototype, a bigger variation of features can be tested as well and therefore, more data and feedback can be collected. In addition, opinions and ideas for improvement from users can be gathered. That is, since a physical prototype does not require any technical knowledge from users, they are able to be more involved in the process (Snyder, 2003).

4.1.4 Digital prototyping

Eventually paper prototypes will reach their limitations when it comes to prototyping a game that is intended for a digital platform (Fullerton, 2008, pp. 214). When that happens, it might be a good idea to construct a digital prototype instead. Furthermore, Fullerton points out that when building a digital prototype, it is important to only focus

on one single aspect (Fullerton, 2008, pp. 213). That is, make sure that the prototype is focused on the area that is to be tested. If testing game mechanics for instance, then leave out aesthetics, usability and technology.

It is also important to work iteratively when creating the digital prototype (Fullerton, 2008, pp. 214). When testing game mechanics, this means adding core features first before adding any additional features.

4.1.5 Usability testing

Testing the prototypes is an important part in a playcentric design approach. The methods of testing can vary depending on what feedback is sought (Fullerton, 2008, pp. 248). In this project, the group wanted to perform *usability testing* on each of the three ideas, to discover which one was most desirable to develop into a digital prototype. The concept of usability testing means observing users perform a certain task when interacting with a product (Barnum, 2010, pp. 13). In this project, that task means playing a game. Usability testing is important, since designers can not fully predict how users will interact with their product (Nielsen, 1993, pp. 4-5). Accordingly, without usability testing, ambiguities in the interface might be overlooked by the designers.

During the tests, to gather unprompted reactions, a think-aloud process was used. A think-aloud process means having users share their thoughts, actions and arguments while interacting with the product (Barnum, 2010, pp. 19). By doing so, the designers are able to understand the users' reactions, emotions and actions when playing the game.

While the think-aloud method is useful for gathering general impressions and ambiguities with the prototype, it does not render any quantitative data. As a complement to the qualitative data that the think-aloud method rendered, quantitative data had to be gathered through other means. Interviews and questionnaires were the two options that were proposed. In the end, a decision was made to create a questionnaire for users to fill in rather than to interview them. There was one argument for the questionnaire that carried the most weight. Fullerton writes that it is best to have outsiders as game testers, since they have nothing to lose by being completely honest (Fullerton, 2008, pp. 251). However, it was not possible to bring in testers from the outside to test the prototypes. Consequently, a questionnaire was chosen as the way to gather feedback from the testers, where they could be anonymous and thus, be more likely to give an honest opinion on the game.

After every testing session, the game testers were given a questionnaire with questions about the game. The questionnaire also included questions where the game testers were asked to describe their feelings and impressions they had when playing. This was done both with free-text questions, rating questions and with a word map consisting of a large number of adjectives that could describe their experience. The game testers answered the questions, and selected a number of words in the word map that they felt were descriptive of their experience. Among these words the player experience goals were stated, but they were never revealed to the testers. Consequently, the degree to which the player experience goals have been met were gauged by seeing how many of them that were chosen by the testers.

4.2 Implementation of the application

Going from a game idea or a prototype to a mobile application is a design process in itself. One has to decide what tools and methods to use, and what the goal of the implementation should be.

4.2.1 Scrum

During the software development phase of the project, the team worked according to the agile methodology Scrum. In Scrum, the product owner plays a significant role (Schwaber and Sutherland). A product owner is the person that is responsible for constructing the backlog for the project. A backlog is a list of all the features that may be needed in the product. According to Schwaber and Sutherland, it is then the product owner's job to divide these items into sprints, which are time-boxed development cycles with a clear goal. It is also the product owner's job to organize the items as to best achieve that goal. The initial idea was that a representative of Playie AB - the company that introduced the idea of transforming the original board game to a digital application - was to act as the product owner. This idea was never realized, as the group itself ended up acting out the role of the product owner.

Another key role in the Scrum methodology is the Scrum master (Schwaber and Sutherland). The Scrum master serves both the product owner and the development team, by helping the product owner manage the backlog, keeping the items clear and concise. The Scrum master also coaches the development team through the work process, making sure they understand and adhere to the Scrum rules and works to remove any obstacles they might be facing.

4.2.2 Development tools

The group's previous knowledge of development for Android and the lack of development tools for iOS, such as Apple Computers and iPhones, lead to the choice of developing the application for Android. It was also decided to use Android Studio, as it provides a lot of helpful tools for the Android developer. The integration of an Android Emulator, build tools for deployment on an Android phone, integrated build tools for compiling the application and the group's familiarity with similar IDEs made Android Studio an obvious first choice as development environment.

The provided guidelines, material design and API for Android development were also used and followed as a best practice method. Although this thesis does not go into detail about what the mentioned tools and guidelines are, they will be mentioned when they influence design decisions for the product in making.

5

Design Process

This chapter explains the design process that was used in this project, with all significant parts of the transformation described in detail. Since all decisions that were taken are motivated and explained, it will be possible to follow the development of the product and understand all aspects that affected the design of the final application. A review of the steps in the design process can be seen in figure 5.1.
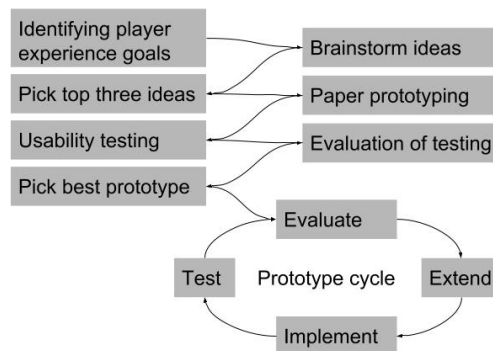
Figure 5.1: Illustration of the design process used in this project. The process was conducted in a linear fashion up until the best prototype had been chosen. Subsequent stages of the process were iterative.

5.1   Identifying player experience goals and game features

To be able to transfer the player experience goals from the original board game into the mobile application, the experiences that the original board game imparts had to be identified. To do this, the group played the board game and read multiple reviews online to see how others experienced the game. By analyzing the reviews of the game found

online and our own experiences, thoughts, and evaluations, we established the player experience goals. These were later categorized in groups of feelings that players would experience while playing the game.

The player experience goals were identified as follows:

Challenging

- The playmaster has to cleverly figure out associations that his team will understand, without breaking the rules of the game.

- The playmaster has to choose these associations carefully, to not give clues that lead his team to making bad decisions.

- The playmaster has to overcome this difficult task, which is comparable to solving a puzzle.

- The playmaster and his team has to take some time to rethink their strategies, depending on the outcome of the previous turn(s).

- The team members are put in a position where they oftentimes have to make a difficult decision.

Social

- The team members can interact with each other, sharing associations and reasoning about how they believe that the playmaster thinks.

- The team members can interact with the playmaster after the game has ended, asking how the playmaster was thinking.

Fun

- Finding out how people reason and associate.

Frustrating

- Partially solving the task leads to different experiences depending on the outcome. Feelings such as regret, frustration, surprise, stress, relief, or hope are oftentimes experienced in a happy or competitive manner.

- The playmaster is forced to be silent, while listening to his team discussing.

- There is a bit of randomness to the set of words that the playmaster is supposed to associate with.

Exciting

- The players can choose between different tactics. For example, they can choose between playing it safe or taking a gamble.

- Including as many words as possible in the same association.

Elevating

- Successfully solving the task creates a bond between the players and gives a feeling of being clever and successful.

Several of the core game features are merely there to unlock the capacity of association of the human brain. Some are there to limit the amount of correct associations, which makes it more difficult. These are the identified game features:

- Randomly selected set of words where each word usually is polysemantic.

- Teams of at least two players.

- There are words that only one of the teams wants to pick.

- There are words that neither of the teams want to pick.

- There is one word that ends the game immediately.

- Discussion among team members.

- The playmaster can give clues.

- The playmaster hears his team members discussing.

- The team hears the other team's discussions.

- There is a choice to pick one or several words per turn.

- There is an optional time limit.

5.2　Brainstorming ideas

The next step in the process, after identifying player experience goals, was to produce game ideas. With the player experience goals in mind, the team members individually had to come up with game ideas. All ideas were then discussed and evaluated thoroughly. The evaluation was based partly on the fact that the ideas would be implemented on a mobile device, but mostly on the fact that as many experience goals as possible should be imparted on the user. The ideas that were considered good allowed a certain game feature to be preserved, a certain experience goal to be maintained, short play sessions, asynchronous play sessions and a game to function with no more than four players. All ideas also had to be possible to implement during the time frame provided for the project. Therefore, it was important that the ideas would be easy to prototype for early testing, in order to gather data and feedback as early as possible in the process.

After evaluation, there were eight ideas remaining. These were the ideas that were discussed further in depth and that underwent some simple testing to validate the hypothesis made about them. These eight ideas were selected since we considered them to

be the ideas that kept most of the player experience goals from the original board game. Among these ideas were several variations of two teams, each consisting of two players, playing against each other. There were also ideas with only two players, some where the players were opponents and some where they cooperated. In the latter, one player was the playmaster and the co-player was called the partner. Other ideas were simulating the playmaster, or having one playmaster and several partners. A more detailed description of the top eight ideas is available in appendix A.

5.3 Top three ideas

Three out of the top eight ideas were selected for paper prototyping. These were called *Board of the day*, *Pick the board* and *Fixed number of clues*. These ideas will hereby be referred to as BOTD, PTB and FNOC. They are all meant to be played by two players cooperatively, one-with-one. There were mainly two arguments for only choosing one-with-one ideas. Firstly, it seemed best suited to a mobile device. Secondly, cooperative play would be most suitable for the application to possess the bus factor, since the player would not be dependent on anyone other than the co-player. In one-with-one teams, both the playmaster's and the partner's roles are kept, as well as them striving towards a common goal. However, all of the three prototypes lacked an opposing team, and therefore the competitive angle of the game could be lost. In addition, the possibilities for communication between the players would be lost as well. As far as the group was concerned, there could be no good way to implement such a social aspect of the game in a mobile application, while still maintaining the bus factor.

All ideas share the trait that a word can have one of three different properties: correct, incorrect or fatal. Correct words and incorrect words correspond to either blue or red words in the original game, depending on which team the player is on. Fatal words correspond to the black word. There is also a selection of neutral words in each idea. The number of words in each idea was determined later on in the process, see section 5.4.1.

5.3.1 Board of the day (BOTD)

Unlike the original board game, the words for each board are not randomly selected in the BOTD idea. They are instead selected by the designers. That is, the designers compose a set of boards that are available for teams to play. By doing so, the quality of the content of each board is ensured. The difficulty of a board will thereby be determined by designers and not by chance. The same boards will be available for all teams playing the game and the idea is that a new board is released every day.

The appearance of the board is similar to the board from the original game (see figure 5.2). The playmaster can see which words are correct, incorrect and fatal (see figure 5.2a and figure 5.2b). Based on that knowledge, the playmaster's goal will be to associate as many correct words as possible. To help their partner select the correct words, the playmaster is allowed to give a clue to their partner in the shape of one English
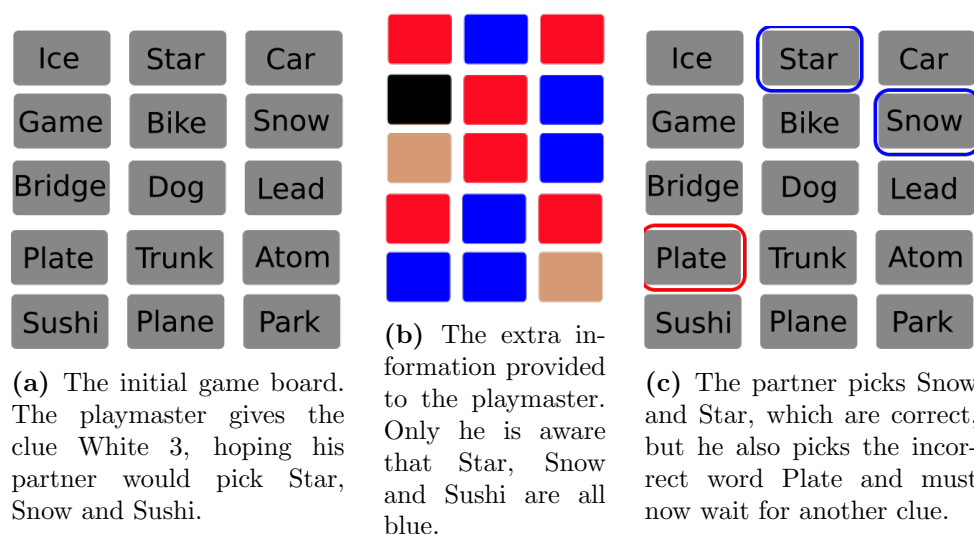
(a) The initial game board. The playmaster gives the clue White 3, hoping his partner would pick Star, Snow and Sushi.

(b) The extra information provided to the playmaster. Only he is aware that Star, Snow and Sushi are all blue.

(c) The partner picks Snow and Star, which are correct, but he also picks the incorrect word Plate and must now wait for another clue.

Figure 5.2: Play session example of Board of the day, a prototype where the words are picked by the designers. This allows several teams to play with exactly the same game setup.

word followed by a number that represents the amount of words that is associated with that clue. The partner will see the same board as their playmaster, but without the properties of the words (see figure 5.2c). The goal in this game is to find all correct words by using as few clues as possible. The fewer clues needed to find all correct words, the better the score of the team. The playmaster must be careful with the associations to prevent their partner from selecting an incorrect word, or even worse, the fatal word. If a correct word is selected, the partner can continue to guess, or ask their playmaster for another clue. However, if an incorrect word is picked, the playmaster must give a new clue, and the team receives less points. The round is finished when all correct words have been picked by the partner. In total, there are four rounds in a game. If the fatal word is picked, the team will not be allowed to continue playing. The game will end immediately, and there will be no more rounds. When the game is finished, the properties of all words will be revealed to the partner.

Since the boards are identical for all teams, it will be possible to compare results with other teams on that board. This will add a competitive spirit to the game.

5.3.2 Pick the board (PTB)

Out of the top three ideas, this idea has the least in common with the original board game. The differences lie mainly in three components: the playmaster board, the clues and the pace of the game.

As the name suggests, the idea is that the playmaster composes the board that their partner sees. The playmaster will initially receive a selection of words without any hidden properties (see figure 5.3a). It is then the playmaster's task to assign the different properties to a subset of these words (see figure 5.3b). The words that are not

given any properties are by default neutral. When the playmaster is finished, the neutral words will be removed from the board and the board will be sent to their partner. When the partner receives the board, it exclusively consists of words that are either correct, incorrect or fatal. Those properties are hidden to the partner (see figure 5.3c).
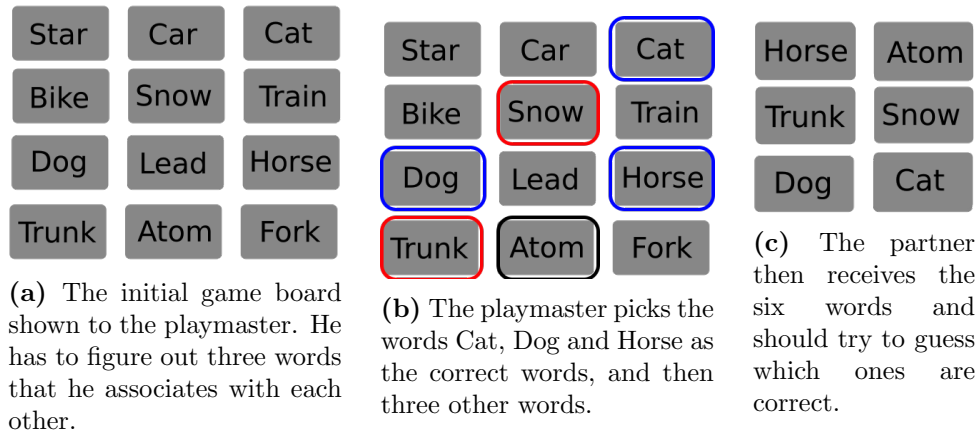

(a) The initial game board shown to the playmaster. He has to figure out three words that he associates with each other.

(b) The playmaster picks the words Cat, Dog and Horse as the correct words, and then three other words.

(c) The partner then receives the six words and should try to guess which ones are correct.

Figure 5.3: Play session example of Pick the board, a prototype where the playmaster composes the board and the partner has to guess without further clues.

In contrast to the original game, the playmaster is not allowed to manually write any clues. The only aid that the partner has when trying to find the correct words is the fact that their playmaster has chosen all words for the board. If the playmaster has been clever, the incorrect and fatal words should be difficult to associate with any of the other words on the board, making it easier for their partner to detect the correct words.

Each round in this idea is very short, consisting of only one turn for each player. The playmaster creates the board, their partner guesses on the board, and then the round is completed. This makes the game fast-paced, which is desirable in order for the game to possess the bus factor. The partner guesses on one word at a time. If the word is correct, the partner can continue guessing. If the word is incorrect, the round is terminated. When this occurs, the roles of the playmaster and partner switch, meaning that the player previously being playmaster becomes the partner, and vice versa. This will continue on as long as the fatal word is not picked. If the fatal word is picked, the game ends immediately. To play again, the players will have to start a new game with the score reset to zero. Otherwise, players collect scores depending on how many correct words they pick in each round. Those points are kept in the next round, increasing the total score as long as the fatal word is not picked.

5.3.3   Fixed number of clues (FNOC)

FNOC is similar to BOTD in many ways. Since BOTD is explained in detail in section 5.3.1, this section will only clarify what separates the ideas. All aspects of the game that are not mentioned in this section, are identical to those in section 5.3.1.

Visually, the boards in FNOC and BOTD look the same. However, the set of words in the two ideas is selected in two different ways. FNOC has no fixed board, meaning that all words are randomly selected every time a game starts. The boards in FNOC are thus composed in the same way as the boards in the original board game.

In contrast to BOTD, the number of rounds are limited in FNOC. The team competes against a computer that picks incorrect words each round (see figure 5.4). This adds a competitive angle to the game that can be found in the original game, but not to the same extent as in BOTD. The round ends either when all correct or incorrect words are found. How many words the computer will pick each round can be randomized or predetermined by the game designers. This feature also motivates the playmaster to associate as many words as possible each round.

(a) The partner was given the clue *White 3* and picked the three correct words: *Star*, *Snow* and *Sushi*. Despite this, the two incorrect words *Ice* and *Car* was picked and he had to wait for a second clue.

(b) The second clue *Luggage 2* was given and yet again the partner only picked correct words but even so an incorrect word was chosen. This way the players only have a fixed number of clues before the game is over.

Figure 5.4: Play session example of Fixed number of clues, a prototype where the team competes against a computer.

5.4 Usability testing

Usability testing is a task that requires a lot of preparation. The paper prototypes have to be illustrated, the goals of the tests need to be clearly stated, the testing sessions have to be planned for, and the gathering of data has to be prepared.

5.4.1 Paper prototyping

To be able to perform usability testing of the ideas, they had to be converted to physical prototypes. Based on all advantages mentioned in section 4.1.3, the group decided to use paper prototypes to test the ideas, before initializing the development of a digital

prototype. Hence, three handmade paper prototypes were developed, one for each game idea. Pictures of these prototypes can be found in appendix B. The priorities in the paper prototyping process were to test the fundamental mechanics of the game, to see which player experience goals were preserved, and to possibly detect new player experiences. The tests were also used to collect data and feedback from users to determine which one of the three prototypes that was most desirable to implement digitally.

The process of developing paper prototypes involved many design decisions for each prototype. The questions regarding the transformation from board game to mobile application were as follows:

- How many words are to be considered appropriate for each prototype when adapting the board game to the mobile format?

- How should the rules of the game be displayed?

The selection of words had to be large enough to keep the player experience goals from the original board game, but small enough to fit on the mobile screen. The set of 25 words on the board in the original game offered a good diversity of words. That diversity made it possible for the playmaster to at least find some words to associate with each other, which is a vital aspect of the game. However, in the mobile application, it was the group's desire to make the entire board visible at the same time on the screen, without having the users scroll to access words. As a result, 25 words would be too many to include in the prototypes. On the other hand, the collection of words could not be so restricted that the playmaster would be unable to associate any words at all. If that scenario occurred often, the entertainment aspect of the game could be jeopardized. Therefore, the discussion concerning the number of words displayed on the screen was an important part of the paper prototyping process.

In FNOC, where players compete against a computer, it was desirable to keep the same structure of words as in the original board game. That is, the number of incorrect words should be one less than the number of correct words. The number of neutral words should be one less than the number of incorrect words, and there should be only one fatal word. With that structure settled, the total number of words had to be decided. Apart from the requirement of fitting on the screen, the speed of the game also had to be taken into account. Since the point of FNOC was that only a certain amount of rounds were permitted, too many words would have caused problems. By trying different amounts of words, it was concluded that 16 words would be a good choice for the mobile format. It could fit on the screen, but still offer enough diversity to enable the playmaster to make reasonable associations, and the number of rounds could be limited to a maximum of four.

BOTD, being similar to FNOC, would logically have a similar amount of words. However, it was desirable to investigate the effects of varying the number of words and therefore, 18 words were chosen for BOTD. 18 words was the maximum amount of words that could be imagined to fit on the screen. The distribution of properties would be seven correct words, five incorrect, one fatal and five neutral. By adding one correct word, it

was possible to investigate how the playmaster's ability to associate fluctuated with the number of correct words.

The number of words in PTB - in gameplay being the prototype most different from the original board game - came to depend only on our own taste and reflections. We wanted the playmaster to have a selection of words to choose from, but we had no deeper knowledge of how big that selection had to be to keep the difficulty level of the game appropriate. By playing the game ourselves, we decided to start with ten words for the playmaster to choose from. From those, the playmaster would choose six words for the other player, three of them being correct, two incorrect and one fatal.

Another important design question was how the rules should be displayed. A board game often comes with a manual, something that was not desirable to transfer into the mobile application. We wanted the game to be explained solely by the graphical user interface. Accordingly, we decided that the pop-up notifications we wanted in the digital application should be illustrated by post-it notes in the paper prototypes. The messages written on the post-it notes were short and concise. Our goal when phrasing the notes was to see if the player could perceive how to play the game when given a minimal amount of information. The reason we phrased them so sparingly was that we considered it better to add information if users did not understand the notes, rather than to add superfluous information from the start.

5.4.2 Planning for the tests

After finishing the paper prototypes, we needed to plan for the usability testing. We followed some of the most essential planning steps, such as determining goals for the tests, setting up tasks for users to perform and determining how the tests should be conducted (Barnum, 2010, pp. 105). There were two main goals of the usability testing. Firstly, we wanted to see how users interacted with our prototypes. We wanted to see which one they preferred, where they became confused, what they liked and disliked with each prototype and so on. In direction with Fullerton's steps in the iteration process (Fullerton, 2008, pp. 15), we aimed to choose one of the three prototypes to develop digitally based on the feedback and data. Secondly, we wanted to see how well the player experience goals from the original board game were preserved in each prototype.

The task we wanted users to perform in the usability test was to play through each prototype. We wanted the users to be able to understand and interact with the paper prototype interface, without any help from the designers. We decided to perform the tests with two users and a maximum of two designers at the same time. One of the designers would observe the participants and take notes, and the other one would act as the computer and show the GUI messages at the right occasions. If it was not possible for two designers to be present, one designer would perform both of these tasks. We also wanted participants to describe their actions and feelings in a think-aloud process to better understand their choices. All in all, we attempted to conduct as many tests as possible during two weeks of time.

5.4.3   Questionnaire

To investigate if player experience goals were preserved, we wanted to ask participants a few questions after they had completed the usability tests. This was done in the form of a questionnaire. There were two different options for what type of questions that should be asked: Open or closed questions (Preece et al., 2015, pp. 234). An open question means that the answer can be of any kind, with no specific template to follow. A closed question on the other hand, expects one specific answer out of an amount of possible alternatives. It was desirable to have a mixture of open and closed questions. There are great advantages with open questions, where participants can freely express themselves. However, closed questions were also included to make sure that measurable data was collected.

As a result, a questionnaire consisting of open and closed questions was composed (see appendix C), inspired by Fullerton's postgame questions (Fullerton, 2008, pp. 263). We used the same questionnaire for each prototype's usability tests, so that the results would be comparable afterwards. In addition to open and closed questions, the questionnaire also contained ranges and Likert scales. We used ranges for the age of the participants and Likert scales to measure how well player experience goals were preserved. Likert scales are commonly used to measure user satisfaction (Preece et al., 2015, pp. 246), which in our case was very fitting. To force users to choose the positive or negative answer to a question, the middle alternative of the scales was eliminated. That is, instead of using a scale from 1-5, a scale from 1-4 was used.

5.5   Evaluation of testing and deciding on one final prototype

All in all, ten users participated in the usability testing. None of them had played the original board game before. The only background information that was collected about these ten participants was their age. Six of them were between 15-25 years old and the rest of them were widely spread over the age of 25. We wanted to have participants of mixed age to get as realistic feedback as possible. We also argued that it would help us receive different kinds of improvement suggestions for the game.

At first, the goal was to have 20 participants, but as soon as the usability tests were started, we discovered that they took a lot more time and effort than we had anticipated. All three prototypes were tested on the same participants. With questionnaires to fill in after each prototype, the usability testing was a long procedure. We discovered that the order in which the prototypes were tested affected the response to each prototype. The prototype tested last was always the prototype the participants liked the least. The most likely reason for that was that participants were tired at the end of the long test procedure. The second prototype tested was often the one that participants liked the most. Our theory is that, since they got an understanding of the game by playing one prototype already, they could better understand the second prototype from the start. However, in the usability tests, the order of the three prototypes was always varied, so

that the order in which they were tested would not have affected the overall opinions on which prototype participants preferred.

The most appreciated aspect of PTB was that the game was easy to play and understand. After the first round, everyone understood how to play the game. However, users also experienced that they lacked some sort of challenge in the game. They would have preferred some sort of ranking, competitive angle or clues. The three player experience goals that participants most associated with the game were *fun*, *tricky* and *social*. Only three participants could imagine paying for the game. Four participants stated that PTB was their favorite.

FNOC was overall very appreciated. Participants enjoyed that there was a competitive angle to the game when playing against a computer. They liked that the game was tricky and that it was a challenge as the playmaster to associate as many words as possible in the same round. On the downside, some participants considered the game difficult to understand at first. They did not instantly grasp that they were playing against a computer. Some participants also considered the process of associating words to be very difficult and therefore only provided clues for one word at a time.

One suggestion for improvement of FNOC was categories for the game words. For instance, the categories could be animals, geographical places or some other group of words. Another suggestion for improvement was to include the ability of adjusting the difficulty of the game by, for instance, varying the number of words on the board. Participants also suggested some sort of ranking and time limit. The three player experience goals that participants most associated with the game were *tricky*, *fun* and *competitive*. Five participants could imagine paying for the game. Six participants stated that FNOC was their favorite.

According to participants, BOTD was fun because, as the playmaster, it was thrilling to think of a way to associate as many words as possible. Participants did not appreciate the absence of a time limit. They argued that it made the game a bit tedious. Additionally, some of them had a hard time understanding when the game would end.

Suggested improvements for BOTD were categories for game fields and enforcement of a time limit. Participants also believed that the game lacked a competitive angle and suggested that playing against another couple would make the game more interesting. The single player experience goal that participants most associated with the game was *fun*. Half of the participants also considered the game *difficult*, *tricky*, *social* and *competitive*. Only three participants could imagine paying for the game. One did not want to play the game again at all when asked, which did not occur in any of the other two prototypes. None of the participants stated that BOTD was their favorite.

Altogether, the results from the usability testing aided the group in making some important decisions. Although FNOC and BOTD were quite similar, all of the participants favored FNOC over BOTD. This was most likely not a result of the different number of words in each prototype, but rather the fact that FNOC had a more competitive angle to it. The difference in the number of words was not big enough to affect the ability of the playmaster to make associations, according to participants in the usability tests. Since BOTD was the least preferred of the three paper prototypes, it was eliminated as

an option for the digital prototype.

The choice between PTB and FNOC became a lot more difficult and resulted in many discussions. Four out of ten game testers preferred PTB and six out of ten preferred FNOC. All in all, the feedback on the two prototypes was similar, but the reactions to FNOC were a bit more intense. At first sight, FNOC seemed like the better option. However, the group realized that FNOC had a major disadvantage. In FNOC, the playmaster had to manually type a clue to the other player. Text input is laborious on a mobile device, prone to typing errors, and often results in an on-screen keyboard breaking the game flow by obscuring most of the game view. As a result, implementing FNOC would be problematic if the keyboard issue remained unsolved. It was not desirable to make the game cumbersome to play due to the keyboard taking too much space on the screen. PTB, on the other hand, was more suitable for the mobile application medium, since it did not require any manual typing.

Despite extensive attempts, a good solution for typing in FNOC was not found. Consequently, it was decided that PTB should be implemented digitally.

During the prototype tests of PTB, we realized that the penalty for picking an incorrect word - simply moving on to the next board - was not harsh enough. Merely moving on to the next board meant that the players could keep a game alive for a very long time by simply avoiding the fatal word, and in the process achieve very high scores. We therefore unanimously agreed to introduce the concept of game lives, a concept present in many games. At the start of each game, the players would be assigned three lives. If picking a fatal word, all lives would be lost and the game would be over. If picking an incorrect word, one life would be lost, and the players would move on to the next board. When no lives remained, the game would be over.

It also came to our attention during the testing that the prototype PTB was perceived to be a bit difficult at times. To remedy this problem without adding any additional features, we decided to increase the number of words that the player was initially presented with from ten to twelve. By giving the player more options when picking words, we hoped that the game would better achieve the balance of being challenging, but not so much that it only led to negative frustration.

5.6   Extending the prototype

Choosing PTB offered a multitude of advantages when starting the implementation. It was well-suited to the mobile application format, lacked the need for free text input and offered short play sessions. However, the radical difference in comparison with the original board game implied a high risk of not living up to the player experience goals initially set up in the project. To remedy this, the prototype would have to be extended with additional features. These features would be created by taking concepts from the original game, and manifesting them in the prototype in a manner suitable for the mobile format.

5.6.1 Deciding on features

The group came up with a number of possible features, which were discussed and evaluated. They addressed many different suggestions on how to ease the playmaster's task, how to aid the partner and how to motivate both players to find all correct words. They included lifelines, predefining selections, the ability to swap words, and various rewards in the score system. Other ideas concerned the addition of a competitive angle and thrilling experience to the game by adding a time limit, including the ability to compete against another team or showing a score ranking. The ideas were based on feedback from users in the questionnaires, inspiration from features in other games such as Scrabble, and features from the original board game. A more detailed list of each feature idea can be found in appendix D.

    The features were narrowed down through voting. When performing the usability testing for PTB, participants proposed the inclusion of some sort of clue system. Participants also stated that they lacked some sort of challenge in the game. When testing the other prototypes, participants stated that a time limit would be a welcome addition, and a good way to add some challenge to the game. In addition, both clues and a time limit are parts of the original board game. All of the above resulted in the features lifelines and time limit gathering the most votes, becoming the features chosen for usability testing.

5.6.2 Definition of features

Once the features had been chosen, they were conclusively defined. The version of the lifeline feature to be tested was the ability to reveal one of the correct words, thereby sacrificing the score point that the word could have given. The time limit was defined as a one minute limit. In contrast to the original board game, both the playmaster and the partner would have a mandatory time limit during their respective rounds. In the original board game, players only have a time limit if the other players decide to flip the hourglass (see section 3.2). The reason we wanted to try a mandatory time limit on both players was to keep the game fast-paced and thrilling. We also wanted to investigate if it was possible to have a mandatory time limit for the playmaster, and if it would affect the creativeness of the associations.

5.6.3 Testing of features

The usability testing was conducted with paper prototypes in the same manner as when deciding on a prototype. However, both features were tested at the same time using the same prototype. Since we learned in the previous usability testing cycle that the process was more time-consuming than we had anticipated, we tried to remedy it by limiting testing time. In total, the features were tested on ten participants, to see whether they improved the experience of the game. It quickly became apparent that the time limit was too short. Consequently, it was early in the usability testing process extended to two minutes. The results from the usability testing showed that participants found the

time limit to be a very welcome addition to the game, and they felt that it made the game more thrilling. However, participants preferred to only have the time limit imposed when playing as the partner and not as the playmaster. The clue system was rarely used by participants and was in general considered unnecessary. Therefore, the clue feature was abandoned. The team decided to continue with the time limit idea and implement it in the mobile application.

5.7 Software Implementation

The process of transforming the paper prototype to a digital prototype included not only coding, but also specifying and defining the prototype further. In this chapter, the more technical details regarding the code will be left out since they are outside of the scope for this thesis. The focus will lie on the work procedure and the decisions taken throughout the software implementation process, which will come to explain the final structure of the application.

5.7.1 Scrum

As mentioned in section 4.2.1, Scrum was chosen as the methodology to be used throughout the software development. Features from the paper prototypes were gathered in the backlog and four sprints, each two weeks in length, were planned for the software development. It was argued that the sprints were few enough to result in clear overarching goals and long enough to make the fulfillment of these goals feasible. Broadly, the goals with the sprints were as follows:

- Sprint 1: Have a complete implementation of the menu in the application. It should be possible to log in, register a new user, add friends and search for friends.

- Sprint 2: Users should be able to play the game.

- Sprint 3: The extended features *time limit* and *clue system* should be implemented and work properly.

- Sprint 4: Finishing touches to the application.

In hindsight, the time frames of the initial sprints were too short, and thus, the deadlines were not met in the first two sprints. This severely affected the subsequent sprints, leading to a revised schedule containing five sprints in total.

5.7.2 Sprint 1: Implementation of menu

The goal of the first sprint was to implement a menu in the application. At first glance, implementing a menu might seem unnecessary for this project, since the main focus was to transfer a board game experience to a mobile application. Yet, after taking into consideration all the work needed for testing and gathering results, it was quickly noted that a proper navigation system could help in facilitating the testing phase. By making

the menu interactions intuitive and simple, the user could focus on the game without getting sidetracked. To help with this, Android's Material Design was used. According to Google, by following the guidelines given by the material design, the user would feel familiar and more at ease with the application (Google, Inc). In addition, a well made menu also makes it possible for users to use the application without any of the designers present. That is, the user should be able to find other players and play the game without additional aids besides those added in the interface of the application.

With this in consideration, the first sprint was centered around the application's fundamental structure: Enabling the user to register, log in and find other users. Accepting games and a view for all active games were also added to the first sprint. However, these were later postponed because, as it turns out, creating a simple menu was not simple at all. This resulted in the first sprint requiring more time than expected.

While implementing the first sprint we encountered several technical issues, but our problem with landscape orientation was the only one affecting design choices. Allowing the application to be viewed in landscape orientation proved to be more difficult than anticipated. As landscape orientation would not have any impact on game mechanics - seeing as turning the screen sideways does not change how the game is played - we came to the conclusion that it was not worth the effort to implement it. Other technical issues such as problems when merging code were deemed to be caused by inadequate communication. To address these issues caused by miscommunication, it was decided that more short meetings during the sprints were needed.

At the end of the first sprint, the application had functional views for login and registration. It also had, as can be seen in figure 5.5, views for active games and friends. However, these were both lacking in functionality.

(a) The game list view, which lists all current and finished games.

(b) The friend list view, which lists all of the user's friends.

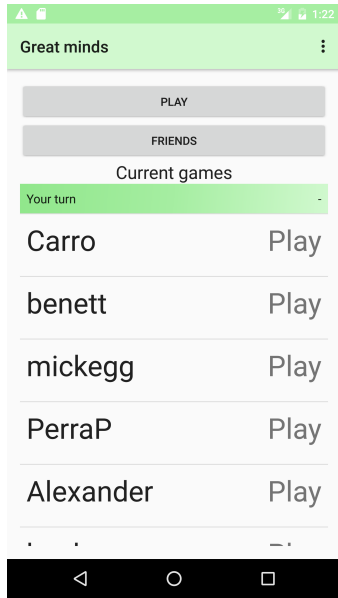**Figure 5.5:** The state of the application after sprint 1.

5.7.3 Sprint 2: Implementation of gameplay

At first, the general goal of the second sprint was to have a playable game ready for testing. This, as it turned out, was a tall order. Despite the fact that we worked according to Scrum, and split the game design into smaller parts suitable for modular and quick implementation, we still had multiple problems during the second sprint. Our inexperience with designing games, as well as Android applications, was causing problems. Due to our lacking knowledge of how the built-in classes for Android communicated with each other, and how to properly structure the development, we had to change some of our original layouts for the internal structure of the code. It was also quickly discovered that the code from the first sprint was not as functional as we had first thought. As a result, time had to be spent on completing half-finished tasks from the first sprint, which consequently delayed the second sprint. Another problem discovered was that we had not planned how to handle the user exiting the application in the middle of picking or guessing on a word. Our solution to fix this problem was to save the internal state of a game board whenever the user exited it. This solution required some time to implement, which delayed the second sprint even further.

The design decisions in the second sprint concerned interaction. The layout of the game so far followed the paper prototype. However, it was time to decide how the interaction was going to work. For picking words, a drag and drop function was implemented. The reason being that we thought it would be an intuitive way of interacting

with the words. The other views were considered simple enough to use a standard menu navigation.

After completing the second sprint, the views in the game looked like figure 5.6. Unfortunately, the game was barely playable and certainly not ready for testing. In addition, there were many bugs left that had to be fixed.
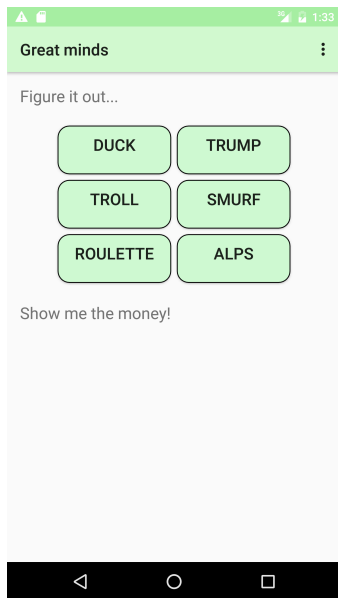
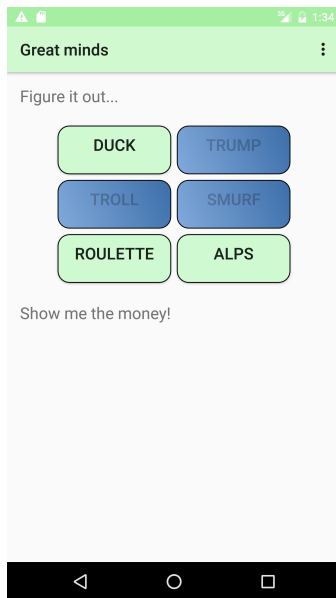**(a)** The game list view, which lists all current and finished games.

(b) The pick view, where the user will assign properties to words. In the picture, no properties have been assigned.

(c) The pick view, where the user will assign properties to words. In the picture, all properties have been assigned. The blue words have been assigned the *correct* property. The red words have been assigned the *incorrect* property. The black word has been assigned the *fatal* property.

(d) The guess view, where the user has to guess which words has the *correct* property. In the picture, no guesses have been made.

(e) The guess view. In the picture, three correct guesses have been made.

(f) The result view, where the user should see the properties of all six words. At the end of sprint 2, it had not been fully implemented.

Figure 5.6: The state of the application after sprint 2

5.7.4 Sprint 3: Playable digital prototype

Our initial goal was to have our first playable prototype ready for distribution by the end of the second sprint, and use the third sprint to implement additional gameplay features such as a time limit and a clue system. During the third sprint - in parallel with the software development - we planned to test the game and collect feedback and data from game testers. Consequently, we would be able to dedicate the entire fourth sprint to polishing the application, as well as fixing bugs and annoyances that the game testers had found. However, the delays in the development work made this impossible to achieve. Upon concluding the second sprint, we tried to assess the circumstances and produce a revised plan with attainable goals that would make the best of the situation and give good results. The state of the application was reviewed. In this review, we realized that a number of features that had previously been considered to be implemented were severely lacking, both in functionality and software quality. Several views contained placeholder content and there was an abundance of bugs in the application. Consequently, we decided to devote the third sprint entirely to fixing the implementation issues. This would expedite future implementation tasks by providing a solid foundation to extend, and fixing the issues would result in a fully playable prototype of the base game. The fourth sprint was shortened to last one week, and was aimed to provide the first prototype ready for distribution and testing. Additionally, a fifth sprint was introduced, dedicated to fixing of any issues reported by game testers and result in a final prototype for distribution and testing.
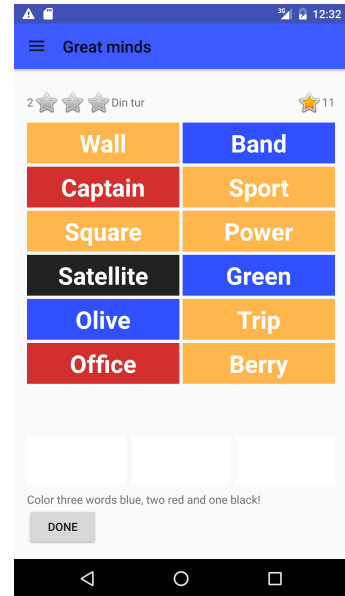
We realized, from our earlier mistakes in the development process, the great importance of having a clear definition of what constitutes a finished task. It can be tempting to rush through a task, especially when on a tight schedule, and implement a feature that will only work for specific cases, just to arrive at a result that can be demonstrated as soon as possible. However tempting it may be, these results are often very hard to extend with additional functionality without resorting to ugly workarounds. To avoid tasks being rushed through, they must be detailed enough to demand a quality result. Our learning experience was very noticeable in this sprint, as all goals were met on time, and the end result was a very functional game (see figure 5.7).
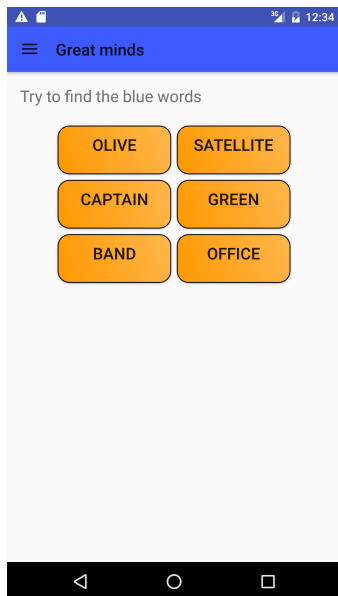
(a) The game list view, which lists all current and finished games.
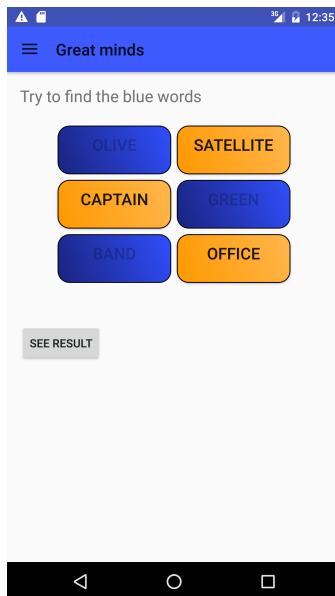

(b) The pick view, where the user will assign properties to words. In the picture, no properties have been assigned.
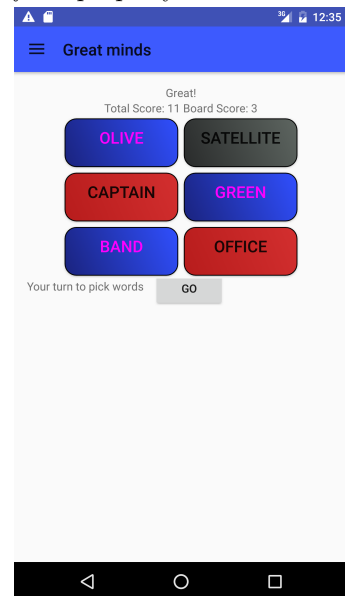

(c) The pick view, where the user will assign properties to words. In the picture, all properties have been assigned. The blue words have been assigned the *correct* property. The red words have been assigned the *incorrect* property. The black word has been assigned the *fatal* property.

(d) The guess view, where the user has to guess which words has the *correct* property. In the picture, no guesses have been made.

(e) The guess view. In the picture, three correct guesses have been made.

(f) The result view, where the user can see the properties of all six words. At the end of sprint 3, it had functionality-wise been fully implemented.

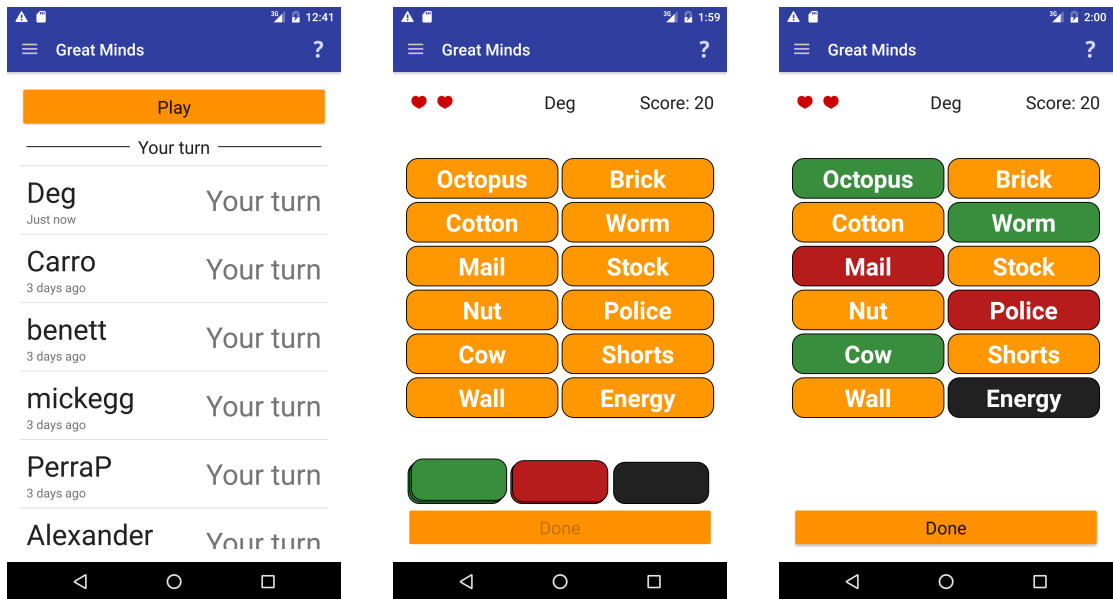**Figure 5.7:** The state of the application after sprint 3

5.7.5 Sprint 4: First release

Our revised goal for the fourth sprint was to have a prototype ready for the first distribution to game testers. The prototype would include a survey regarding the experience of the game, evaluating the player experience goals. This would hopefully result in a larger amount of data than we could reasonably gather by on-location testing. The survey for this release can be found in appendix E.

Playtesting of the prototype after the third sprint showed that users were very confused by the interactions in the graphical user interface, which severely impeded their ability to play the game. Therefore, the interface had to be improved in terms of usability during the fourth sprint.

To ensure that the feedback gathered from the surveys was relevant to the project, and that users would spend enough time playing to get a good notion of the game mechanics, a number of features were deemed necessary. Instructions of how to play the game would have to be included in the application, so that users could understand the game without any additional explanation. The colored properties that the player had to assign to words were reworked into a card stack with easily countable cards, to make it more clear how many properties remained. The color of the *correct* property was changed from blue to green. Our reasoning was that green would be a stronger indicator of something positive, an idiom reoccurring in many areas, from games to traffic lights. The blue color used previously was an unfortunate remnant from the original board game, where it was more suitable since it referred to the blue team. To make it apparent to both players which words had been guessed on, white rings were added to them (see figure 5.8f). In the game list, the timestamps were revised to a more easily readable format, stating the time passed since the last activity, rather than the exact time of the last activity. The inclusion of push notifications to notify users when it was their turn to play was argued to be an effective method of encouraging continued play.
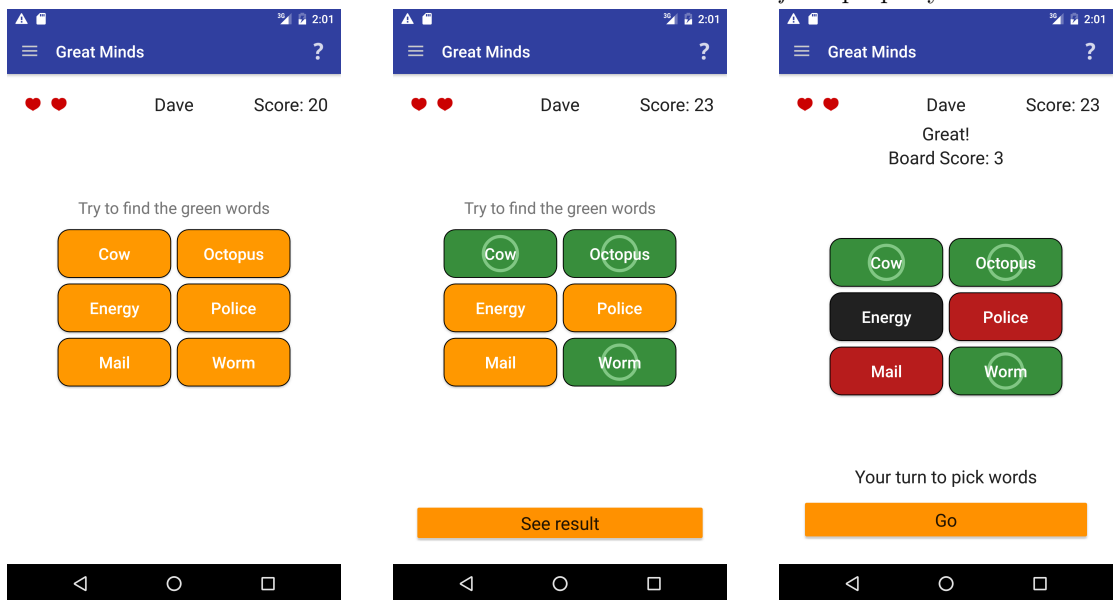
By the end of the sprint, all planned tasks had been completed, and we were able to distribute the game to a group of game testers.

(a) The game list view, which lists all current and finished games.

(b) The pick view, where the user will assign properties to words. In the picture, no properties have been assigned.

(c) The pick view, where the user will assign properties to words. In the picture, all properties have been assigned. The blue words have been assigned the *correct* property. The red words have been assigned the *incorrect* property. The black word has been assigned the *fatal* property.

(d) The guess view, where the user has to guess which words has the *correct* property. In the picture, no guesses have been made.

(e) The guess view. In the picture, three correct guesses have been made.

(f) The result view, where the user can see the properties of all six words. The rings indicate the cards that have been guessed on.

Figure 5.8: The state of the application after sprint 4

5.7.6 Sprint 5: Final release

The results collected from the survey in the first release showed that there was a great deal of confusion about the game among the game testers. Many of them did not realize that they were supposed to cooperate with their partner. The meanings of the different word properties were not fully understood by many testers, and the feedback to user actions was not always successful in conveying whether the actions performed were good or bad. Some users were not able to locate the instructions we had included in the game menu. We felt that it was more important to address these issues and minimize user confusion, rather than add complexity in the form of a time limit or a clue system. Therefore, the goal of the final sprint was to make the game as easy to understand as possible. This would hopefully mean that the final test results would give an accurate account of the gameplay experience, rather than frustration over an awkward or confusing graphical user interface.

To make the game easier to understand, we established a number of tasks that would improve usability and user feedback. The word properties were previously only represented by color, where green represented the correct property, red the negative property, and black represented the fatal property. The distinction between green and red was not sufficient to convey that the green was superior to the red, and the danger in choosing a black word was not apparent. To make this clearer, a descriptive symbol was added to each property. The correct words would have a checkmark, the negative words an X, and the fatal word a skull similar in style to that found on a Jolly Roger flag (see figure 5.9).

**Figure 5.9:** The property card stack with new descriptive icons

In addition to this, descriptive animations of score changes and the loss of game lives were added, as well as audio cues. This was intended to make consequences clearer when guessing on words. To help users find the instructions, we decided that the instructions for every game view should be shown to a user the first time they entered it.

To facilitate game flow and replayability, rematch buttons were added to every game as it finished. To motivate players to strive for higher results, a global top score view was implemented, as well as a top score between users and all their friends. The users would thus also be motivated to achieve higher results with specific friends and not only aim for the global high score list. The application also received a visual refresh, with a more consistent color scheme and use of fonts, as well as a new logo.

With all these improvements in place, the game was distributed to an even wider audience than before, together with an updated survey that focused solely on evaluating the fulfillment of player experience goals.

5.7.7 The final prototype

In this section, we present our final prototype, and how it is played. Although it is quite far from being as polished as most professional applications, it is substantially more intuitive than it was in previous iterations.
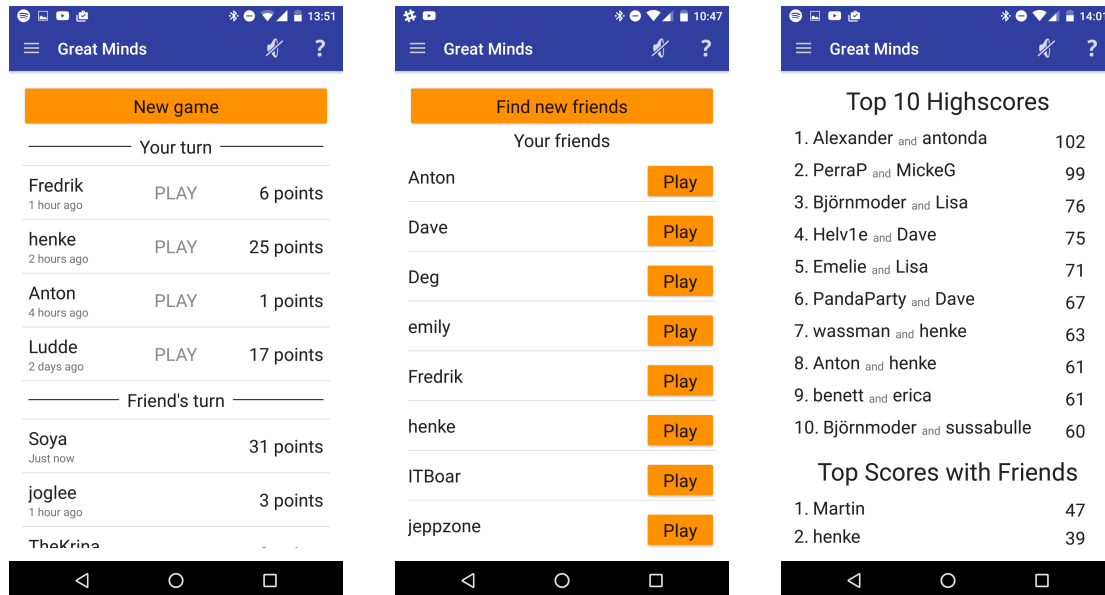
(a) The game list view, which lists all current and finished games.

(b) The friend list view, which lists all of the user's friends.

(c) The high score list view, which lists the global top scores reached by couples of users, and the best scores the user has achieved with every friend.

Figure 5.10: Various menus

When starting the application, the player is presented with the game list (see figure 5.10a), which shows the active and finished games the player has participated in. From the game view, the player may either enter one of the active games, or tap *New game* to proceed to the friends view (see figure 5.10b). In the friends view, the user may either start a game with a friend, or search for a new one.

Figure 5.11: The picking game sequence, and the list of boards in a game

When starting a new game, the player takes on the role of the playmaster and arrives at the picking view (see figure 5.11a). In the picking view, the playmaster is supposed to assign properties to six of the words present on the screen. Three words that the player feel are associated with each other are to be given the *correct* (green) property. Two words that are not associated with either the correct words or each other are to be given the *incorrect* (red) property. Another word that is not associated with either the correct or incorrect words is to be given the *fatal* (black) property. When all properties have been distributed (see figure 5.11b), the playmaster sends the words with properties over to the other player with the role of the partner, who is immediately notified of the event.
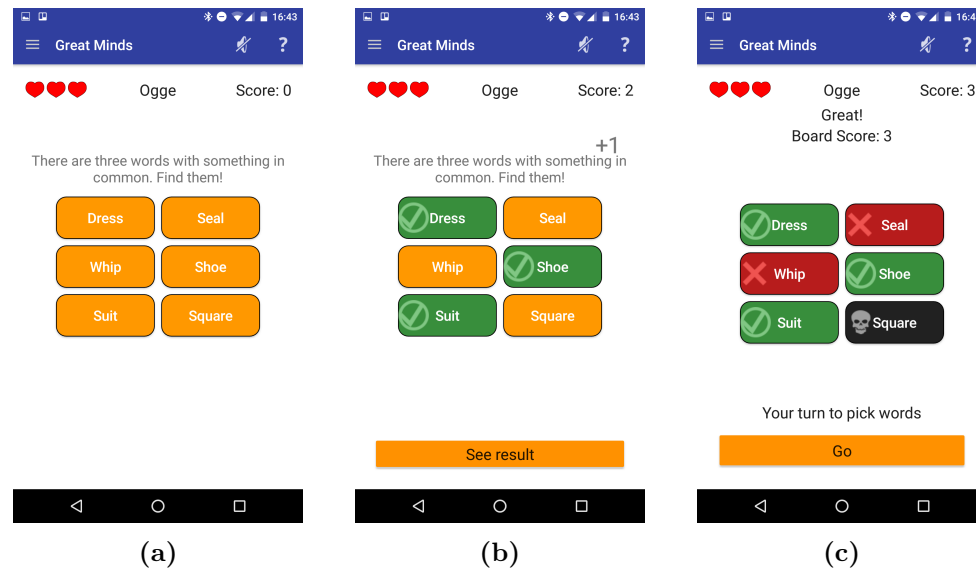
Figure 5.12: The guessing game sequence

Upon entering the game, the partner arrives at the board view (see figure 5.11c), which shows an overview of all boards completed so far in the game, and whose turn it is to act upon the current one. Tapping the current (topmost) board brings the partner to the guessing screen (see figure 5.12a). Here, the partner is shown the six words that the playmaster sent over. The partner is then supposed to guess which the three connected correct words are, by tapping them one at a time. If a correct word is picked, the score is increased. If an incorrect word is picked, a life is lost, and the partner is not allowed to guess on any more words. If a fatal word is picked, all lives are lost, and consequently, the game is over. After guessing (see figure 5.12b), the partner may tap *See result* to see the properties of all words (see figure 5.12c). Finally, the partner may tap *Go* to move on to the next board. When doing so, the roles of the players switch and the partner becomes the playmaster and is the one to assign properties to words. The previous playmaster thereby becomes the partner. The change of roles occur every time the players move on to a new board. The game continues like this until the players have lost all lives, or have picked the fatal word.

Figure 5.10c displays the high scores in the game. The first list contains the global high scores, and the second one contains the best scores the player has reached with all their friends.

5.7.8 Results from the final questionnaire

In total, 47 game testers answered the final questionnaire. The top six feelings that users associated with the game were: *tricky, fun, challenging, frustrating, social* and *addictive.* More than 95% of the users stated that they would play the game again. Nearly 35% stated that they would consider paying for the game.

6

Findings

During a design process, problems are often encountered in unexpected areas. It is therefore important to learn from these experiences, and to spread this gained knowledge to others who want to perform something similar. The findings in this project are in this chapter formulated as recommendations regarding what should be considered when transferring a non-digital game to a digital application. The seven most important recommendations are presented below:

- Do not get too attached to the original game

- Utilize the possibilities of the new medium

- Identify the important experiences

- Be conscious of complexity

- Consider the tempo of digital games

- Keep the usability in mind throughout the process

- Experience goals from the original game can be modified

In the following sections, these recommendations are explained in further detail.

6.1 Do not get too attached to the original game

In the beginning of a design process, it might be tempting to try to emulate the original game in the digital application. However, even though the original game is successful in a non-digital medium, this does not imply that an exact copy of the game will be successful as a digital application. As can be seen in section 5.7.7, the digital application is quite different in comparison to the original game described in chapter 3. The prototype that

was chosen for implementation was the one of the three candidates that had the least in common with the original game. It is therefore important to not be afraid to deviate from the original idea, even though it might seem frightening at first.

6.2   Utilize the possibilities of the new medium

The new medium provides both opportunities and limitations that need to be accounted for. It is tempting to focus on how to solve these problems when they are encountered. However, it is better to consider whether the new medium presents any new possibilities that can be utilized to reach a certain goal, rather than coming up with a compromised solution. Take the clue system in the original board game as an example. Instead of finding a way to restrict free text in a digital game, try to use the opportunities provided by the new medium to create a new clue system, better adapted to the mobile platform. A clue system without free text is presented in section 5.6.2 and some ideas of other clue systems are included in appendix D.

6.3   Identify the important experiences

The player experiences are important to identify early in the process, in order to know what feelings are perceived when playing the game. These experiences should be the main focus of the transformation, rather than the game mechanics that they originate from. Despite a change of mechanics, the same experiences can be maintained. An evident example of this is found when comparing the initial player experience goals, described in section 5.1, to the perceived experiences of the final application, mentioned in section 5.7.8. One of the most significant game mechanics of the original board game is giving clues. This mechanic is not present in the transformed application, but the experience goal connected to it, *challenging*, is still an experience that is perceived by many users when playing the transformed game. This is just one example among several others, but the lesson learned from this is to not focus too much on game mechanics, but rather on what experiences they generate.

6.4   Be conscious of complexity

When designing a digital application, it is important to remember that a mobile game is often less complex than a non-digital game. It is important to consider implementability, and as a result, the complexity of the game might have to be modified in the transformation process.

It is also important to be aware that a mobile application should be user-friendly, and that users might not be as patient when playing a mobile game as they would be when playing a board game. A too complex set of rules and graphical user interface might therefore result in confused users (see section 5.7.6). Consequently, the entertainment level of the game might be jeopardized.

6.5   Consider the tempo of digital games

Non-digital games and digital games have different tempos. As mentioned in chapter 1, the average session with a mobile application only lasts about one minute (Böhmer et al., 2011). The tempo for the non-digital game is probably very different, as it is more centered around the social experience, rather than the actual gameplay. A digital game on the other hand is seldom centered around the social experience. Consequently, gameplay becomes more important in digital games. Due to the fact that mobile applications are often used for short sessions, the game on the mobile platform needs to be fast-paced in order to satisfy users. In that way, working with and changing the tempo of the game is an important part of the design process.

6.6   Keep the usability in mind throughout the process

Although pure graphical aspects should not be heavily focused on in the prototyping phase, it is important to have a clean and functional application throughout the test process. If the usability of the graphical interface is not considered, it can severely affect test results. This was the case in the fourth and fifth sprints in the development process (see sections 5.7.5 and 5.7.6). Even if the purpose is to evaluate a set of mechanics in the application - such as a game idea - it is important to keep the whole application easy to use and understand. This includes the surrounding menus. Failing to do so might aggravate users, detract attention and affect their overall impression of the application.

6.7   Experience goals from the original game can be modified

Do not consider it a failure if the identified experience goals from the original game are not the exact same in the new medium. The new medium comes with new possibilities, meaning that it can impart new experiences on users. In the same sense, the new medium comes with restrictions, meaning that there is no guarantee that it is possible to maintain certain experiences. In this project, two of the most important experience goals were missing in the final product, but two new had appeared. As can be seen in section 5.1, the six most important player experience goals from the original game were identified as: *challenging*, *social*, *fun*, *frustrating*, *exciting* and *elevating*. However, in the review of the final project, which can be found in 5.7.8, the experiences that were most associated with the game were: *tricky*, *fun*, *challenging*, *frustrating*, *social* and *addictive*. That is, *exciting* and *elevating* were exchanged for *tricky* and *addictive*. The bottom line is, it is important to weigh the lost experiences against the new experiences, rather than consider it a failure if the experiences of the transformed game are not exactly identical to the ones of the original game.

7

Discussion

In this chapter, we evaluate our findings and refer back to the main question asked in the beginning of this project. We reflect on what went as planned in the transformation process, what did not, and what could have been done better. Finally, we critically examine the methods described in chapter 4 and discuss to what extent they were followed.

7.1 Project goals

Our research question in this project was: What is important to consider when transferring a non-digital game to a digital application? After evaluation of the project, the answer to this question resulted in the guidelines provided in the previous chapter. The guidelines are put together by the project team to help others who want to go through the same design process. They are based on knowledge and experiences that the project team gained during the project. Hopefully, by following these guidelines, other teams will take the most valuable experiences from this project as a tool to maximize the success of their own projects.

It should also be mentioned that among the listed findings in this project, only guidelines based on the specific lessons learned in this project are listed. Common recommendations of what to include in a design process are therefore not included.

So what experiences formed a base for the specific findings in this project? Many of these experiences were connected to the limitations and opportunities we discovered with the mobile platform. When reviewing the project, it is obvious that these had a huge impact on the development of the application. This impact can be noticed from how different the final release of the application is from the original board game. Without limitations and opportunities of the platform, the final release of the application would probably have been more similar to the board game, just as Wordfeud is to Scrabble.

So which were the limitations and which were the opportunities of the mobile platform? To us, one aspect that had a huge impact on the process of the application was

the bus factor. The bus factor can be seen as both a limitation and an opportunity. It is an opportunity in the sense of providing players with the possibility to play wherever and whenever they wish. Players could also play individually, independent of others, for shorter periods of time. However, in the transformation process from board game to mobile application, it was also a limitation. It took away certain aspects regarding the complexity of the game, since it had to be possible to play in shorter periods of time. It also made the implementation of communication possibilities between players more difficult, since an active communication would require players to be active in the game at the same time, something that did not work well with the bus factor. Accordingly, it was the bus factor that made us eliminate all ideas that were not fast-paced in an early phase of the project. This included all ideas that had more than two players, since those ideas were not considered to be very compatible with the bus factor. Playing against another team would imply that players had to wait for each other, which was not as fast-paced as was desired. Thus, the bus factor was one main reason for the guideline concerning the tempo of digital applications in the findings of this project.

Another limitation of the mobile platform that made us diverge from the original board game was, as mentioned in section 5.5, the ability to have free text in the application. Despite the fact that we did not consider cheat prevention in this project, the free text still managed to become a big problem, since the keyboard on a smartphone takes up a lot of space on the screen. As a result, ideas including free text were eliminated, and the keyboard function must therefore, in this design process, be considered a limitation on the mobile platform. As discussed in section 5.4.1, another problem concerning the complexity of the board game was how to transfer the manual explanation of rules to the mobile application. To directly transfer the instruction manual is not appropriate, since it is not desirable to have multiple lines of text in a game application. The conclusion to be drawn from all this is that the complexity of the game has to be considered during the transformation. Therefore, being conscious about the complexity is one of our guidelines.

Since the mobile platform provides limitations and opportunities, it is important to understand that the game might have to be modified. Therefore, in order to fully be able to use the possibilities of the new medium, it is important not to get too attached to the original game. This is one of the most important findings of this project.

Another thing to reflect upon is that we in the first part of the project might have connected player experience goals too much with features instead of feelings. Take for instance the social aspect of the game. To be able to talk and discuss within teams in the original board game is a big part of the original game. We spent much time discussing how to keep the social aspect of the game in the mobile application. We discussed two teams playing against each other, free text options and chat features. In the end, we decided that it would be best to eliminate all possibilities to communicate between players, even though we would loose the social aspect of the game. However, in the questionnaire for the first release of the application, a majority of all users stated that the game was a social experience. They considered the user experience to be social since they were playing together with a friend. Social is also one of the top six experiences

associated with the game in the final questionnaire. In that way, we learned that although we knew that user experience should not be connected to a feature, we still found it hard to disconnect it completely. The guideline concerning identifying important experiences, was established to highlight that these experiences should be completely separated from the game mechanics. We also learned from this experience that we might have focused too much on how to work around the limitations of the mobile platform, rather than how to use the advantages it had to offer. Therefore, this experience is also one of the reasons we have a guideline stating that it is important to utilize the possibilities of the new medium.

7.2 Transformation goals

As mentioned in section 1.2, the goal throughout the design process was to keep the player experience goals from the board game after the transformation. Therefore, it should also be discussed to what extent the project team succeeded in doing this. The player experience goals we wanted to transfer from the board game to the mobile application were *challenging*, *fun*, *social*, *frustrating*, *exciting* and *elevating*. The top six experiences that most game testers associated with the game were *tricky*, *fun*, *challenging*, *frustrating*, *social* and *addictive*. That is, based on the results from the final questionnaire, four out of six experience goals were kept from the board game. The experiences kept throughout the process were *challenging*, *fun*, *frustrating* and *social*. The other two original experience goals, *exciting* and *elevating*, were associated with the game as well, but not to the same extent. Hence, these experiences did not qualify as two of the top six experiences associated with the game. However, *exciting* and *elevating* were not completely lost since some of the game testers still associated those experiences with the application. These experiences were simply just outnumbered in the top six by *tricky* and *addictive*. However, that does not mean that they can not be associated with the game. Furthermore, both *tricky* and *addictive* are experiences that the project team consider a success to have associated with the game, even though they are not among the original experience goals. Therefore, the entire transformation process is considered successful.

Working with preserving player experience goals has helped us make some important observations. One of these is that experience goals are hard to define, especially from an already existing game. We also discovered that many of the experiences overlap. *Tricky* and *challenging* are two examples of that. They are very similar, and it can therefore be discussed whether *tricky* should have been an experience goal associated with the original board game as well. Based on these understandings regarding experience goals, we established the last finding in this project. That is, the guideline that experience goals can be modified without affecting the success of the transformation.

7.3   Suggested improvements for the application

The developed application is still a raw prototype, and it has room for a lot of improvements. In this section, some suggested improvements are discussed.

To further improve the application, it is crucial to evaluate and distinctively state which player experiences to enhance. See appendix D for some possible extensions that have been discussed within the team.

To impart a more challenging experience, a time limit has been discussed and briefly tested. A time limit seems like a good way to increase the difficulty level of the game, while also shortening the waiting time for players. A time limit is also believed to enhance the feeling of frustration and excitement during gameplay.

Imparting a more social experience could be achieved by giving the player a possibility to comment on a game, or by inviting friends to play the same game. Allowing players to invite more players to a game is believed to not only make the game more social, but also more fun, frustrating, exciting and elevating. Being given a way to see how others solve the same problem should be highly prioritized in further work.

It is realized from testing that the distinction between incorrect and fatal words is confusing for players. Hence, it would be interesting to remove the fatal word and test if less confusion gives a more desirable player experience over all. This comes with a risk of making the game less exciting and frustrating, which must be taken into account.

What should also be accounted for is that changes that are argued for because of the experiences they impose tend to achieve a more desirable outcome than extensions that are argued for because they share functional similarities with the original game. The possibility of giving a clue could be a possible feature in the application, since the possibility exists in the original game, but one should instead thoroughly evaluate what kind of experiences a clue could impart on the gameplay.

7.4   Evaluation of method

Playcentric design governed most of our actions during this project and while we did manage to follow it, there were a few surprises along the way. Mainly because of the fact that gameplay, user experience and usability are three completely different aspects. To test them separately in a mobile application was complicated.

7.4.1   Testing with prototypes

As described in section 4.1.4, Fullerton points out that when building a digital prototype, it is important to only focus on one single aspect (Fullerton, 2008, pp. 213). That is, if testing game mechanics, which was our focus, then leave out aesthetics, usability and technology. This was something we found to be very difficult. Not only was it hard to separate them when implementing the game on a mobile application, it was also difficult to make our game testers understand this. We often found when trying to test the digital prototype (section 5.7.5) that if the graphical interface was confusing, it would steal the

focus of our testers, giving us less feedback on the actual mechanics. When it came to usability, things became even worse if the interactions within the prototype were not smooth and intuitive enough. This would lead to the game being completely disrupted.

We could perhaps have simplified this by only testing game mechanics with paper prototypes and used digital prototypes for testing the look and feel of the application instead. This might have helped since it seemed to be a lot easier for the testers to focus on game mechanics when using paper prototypes, perhaps because the expectations for aesthetics and usability were lower in these prototypes. However, as has been noted in section 5.5, it was very difficult and time consuming to amass a high amount of testers with paper prototypes. This probably means that we would have only exchanged one problem for another.

Paper prototypes were however very useful to us. Even though it was hard to gather large quantities of test results, those that we did receive were very qualitative. They often lead to discussions about possible improvements. In contrast, the digital prototypes were easier to distribute and test on a large number of testers, but it was harder to collect the results, since we had to rely on the testers filling out the questionnaires.

Making sure that the prototypes are focused on the question in mind still seems like a good idea to us, but it certainly was not as easy as advertised and that is something that anyone who wants to use this method needs to take into account.

7.4.2   Compound of questionnaires

As seen in appendices C, E, F and G, we have used multiple questionnaires in this project. The disparity of the content of the questionnaires depends on where in the process we designed them. Initially, we used a rather vast questionnaire, since we wanted a lot of feedback and data. However, during the process, we became increasingly aware of the fact that some of the questions filled no purpose for us in this project. Therefore, some questions were removed each time a new questionnaire was compounded. Out of all our questionnaires, the final questionnaire is best designed in regard to player experience goals. It also does not include any free text questions, since we only wanted to use the questionnaire to measure player experience goals, and not for improvement. What we could have done better was keeping the questionnaires shorter from the start, and also compound them better in regard to player experience goals. We should have reflected more about what measurable feedback and data we intended to receive from the questionnaires, that would complement the think-aloud method in the best way possible. That is a wisdom we have gained from this project.

7.4.3   Scrum together with playcentric design

Since the team used a playcentric approach to the game design of the application, it was desirable to have several playable prototypes during the development of the application. Our goal was to have a playable software prototype after every sprint, making it possible to test the prototype before or during our next sprint and change the sprint goals according to the received test data. Since we were unable to meet our original sprint

goals, we were unable to get sufficient test data and thus, we made no changes to our game design or the sprint goals.

This should not put blame on the playcentric approach together with the Scrum methodology, but rather on the low amount of time allocated for testing. The integration of playcentric design and Scrum was on the contrary rather successful. With the right amount of time put between the sprints for testing, the two iterative work processes should go hand in hand. The evaluation and testing phase of the prototype is well suited together with the sprint review if a clear distinction between functionality goals and experience goals are maintained. As mentioned in section 2, these goals can easily be confused with each other, which should not be underestimated.

Testing the experience goals before the upcoming sprints is also something to strive for. Since experience goals are harder to evaluate than functionality goals and also play a greater role for the outcome of the final product, it is considered that allowing them to influence the functionality and the backlog tasks accordingly would achieve a more desirable result. With an agile process we believe this is easier to accomplish, since only a few things are planned in advance and because it adapts to changes when they occur.

7.5　Mobile applications in society

Mobile applications and games in today's society is a fast-growing market. All fast-growing markets invoke concerns regarding societal changes since their size alone affects society as a whole. Mobile applications are no exception to this, as they are nowadays an integral part of many people's everyday life, affecting the way people interact with the world. The impact of this digitalization can not be denied, but whether it is a good one or a bad one is up for debate. In many ways, our lives have become richer by facilitating for example global social interactions. At the same time, it can be said that human contact is being replaced by mobile screens.

The application developed in this project, being a mobile game application, contributes to society in much the same way as regular applications, but differ in some aspects. Games are often used as a form of entertainment or escapism, giving the user an outlet for experiences in a controlled environment. The application in this project gives the user a venue where they can get educated about words, keep their minds active, and a way to interact and keep in touch with friends.

8

Conclusions

The purpose of this project was to explore the process of transforming a non-digital game with a substantial amount of social interaction, into a digital application for the mobile medium. The main focus however was not the final application itself, but rather to identify important considerations when performing such a transformation.

Exploring this process resulted in a list of seven recommendations for future reference, as well as a playable prototype of the game in question. These recommendations originate from problems that occurred during the process, things that were done well and things that, when reflecting back, could have been done better. When performing this type of transformation it is important to not get too attached to the original game, since a direct copy might not work as intended in the new medium. Furthermore, utilizing the possibilities of the new medium rather than trying to elude the problems that can come with it is of great significance. It is also critical to keep in mind that a physical game might be highly complex, and that it is important to consider what complexity suits the new medium. This aspect is something that played a big role in this project, as the developed application is of significantly lower complexity than the original game.

Something that was stated early in the project was that the digital game should be considerably more fast-paced than its physical counterpart, making it possible to play for short sessions. As mobile games are often played during short time frames, it is important try to increase the tempo of the game in the digital application.

For testing purposes, it is vital to keep the application clean and free from distractions. This is something that was learned the hard way, as some game testers were distracted by an unclear interface, shifting their focus from what was intended to be tested, which was the gameplay.

Finally, it is not a failure if some experience goals from the original game are absent in the digital application. Even though it is desirable to strive towards maintaining the experience goals from the original game, it is not a failure if they are not all present. Some experiences might get lost and new ones might appear. This is a consequence of

the new medium.

Similar projects can utilize the recommendations given in this project, but will most likely encounter new problems and can therefore establish new recommendations for other projects to use.

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Appendices

A

Top eight ideas

Name	Idea
Two against two	This version of the game will keep as many features as possible from the original board game. Two teams play against each other with two players in each team. One player in each team acts as the playmaster, and the other one is the partner. Players would be randomly assembled using an algorithm in two possible ways, either all four players are randomly put together, or players first form teams and then the teams are randomly assembled.
Board of the day	The board of the day idea has predefined boards. The idea is that a new board will be released each day. In contrast to the original board game, the words are not randomly selected, they are selected by the designers. Only one team plays a board at the time. That is, there is just one team consisting of two players in the game. However, since the boards are predefined, many teams will be able to play the same boards. By doing so, teams can compare their results on a board with other teams. Therefore, the board of the day idea will keep the competitive spirit of the original board game, despite only having one team playing at the same time. The goal is to finish the game using as few clues as possible.

Same playmaster	One playmaster has two partners. However, the partners do not cooperate with each other, only with the playmaster. That is, the partners will compete against each other and the partner that finishes the game on the lowest amount of clues will be the winner. The partners can not communicate with each other or see each others moves until the game is finished. The playmaster will be neutral and give as good clues as possible, since the playmaster will gain points depending on the partners' performance.
One big team	Multiple players are connected to the same board. There is one playmaster that gives clues to all players at the same time. All players except the playmaster can communicate through a chat. In that way, players can communicate how they decode the clue and how they associate words, just like the original board game. Players will be in the same team, and points are given depending on how many of them that guessed on a correct word.
Pick the board	A one with one game consisting of one playmaster and one partner. In this idea, the playmaster will compose the board. That is, a selection of words are given to the playmaster. From these words, the playmaster makes some associations and then marks which words are correct, incorrect and fatal. The board is then sent to the partner who guesses which words the playmaster have associated.
Vote to win	Vote to win is similar to the idea called one big team. There is one playmaster and a group of other players connected to the same board through a chat. However, in this idea, the players can not guess individually. Players must vote for the word that they want to guess on, and the word with the most votes is picked. Voting is done through clicking on the word the player wants to vote for.
Predefined playmaster	This idea is a single player variant. The board and clues for the board are predefinied, meaning that the only player on the board acts as the partner. All clues given by the playmaster will be simulated. The partner receives a clue and guesses accordingly on a word. If the word is correct, the player gets the option of guessing on another word. If it is not correct, the next clue is given by the computer.

Fixed number of clues	A one with one game consisting of one playmaster and one partner. As in the original board game, they form a team and have a board with correct, incorrect and fatal words. Playmaster guides the partner to pick the correct words by typing clues. However, in this idea, the team will compete against a computer. If the computer picks all incorrect words before the team has picked the correct words, the team looses. After the team finishes a round the computer picks some incorrect words. How many words the computer will pick and how that is decided can be done in multiple ways. For instance, the number of words picked by the computer can be randomized, or predetermined for each round. By competing against a computer, the team will be put under pressure to find the correct words and it will add a thrill to the game.

Table A.1: Top eight game ideas. The three ideas highlighted were picked as top three and went into paper prototyping.

B

Paper prototypes top three ideas
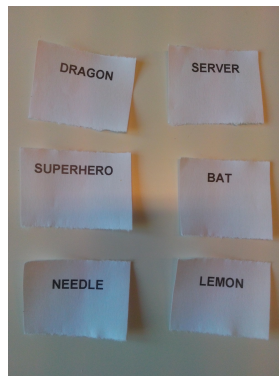
Figure B.1: Board visible to the partner in paper prototype Pick the board
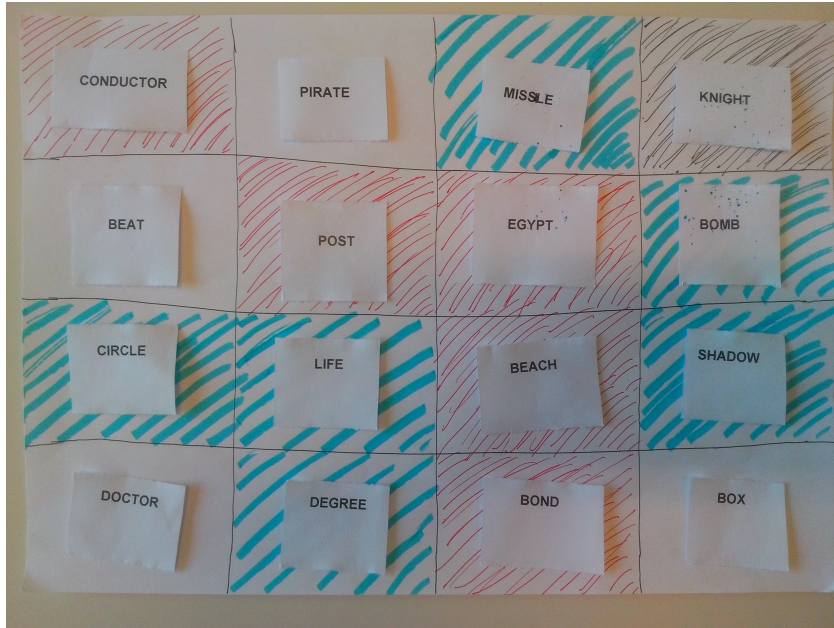
Figure B.2: Board visible to the playmaster in paper prototype Fixed number of clues
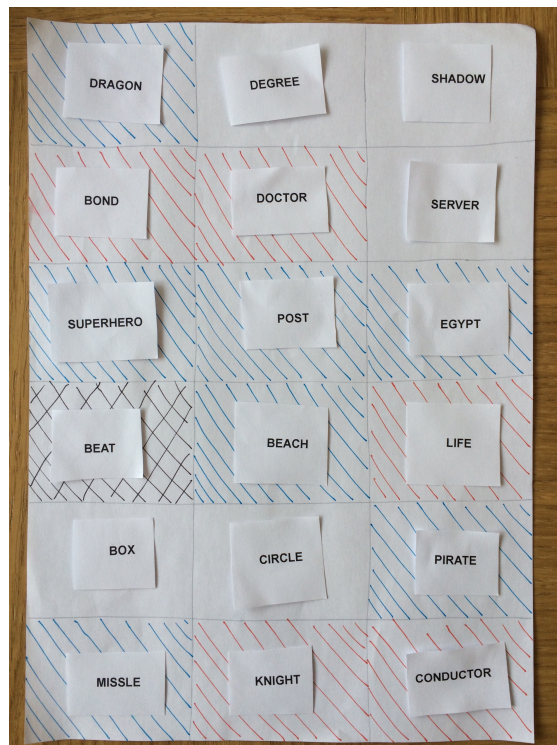
Figure B.3: Board visible to the playmaster in paper prototype of Board of the day

C

Questionnaire top three prototypes

	15-25	26-35	36-45	45+
How old are you?	☐	☐	☐	☐

	Not at all			Very much
How entertaining was the game?	☐	☐	☐	☐
How frustrated were you?	☐	☐	☐	☐
How difficult was it to associate words?	☐	☐	☐	☐
Was the game challenging?	☐	☐	☐	☐
How much did you want to communicate with your partner?	☐	☐	☐	☐
How much easier did it get during the game?	☐	☐	☐	☐
How fun was it when your partner identified words?	☐	☐	☐	☐
How surprised were you over your partner's picks?	☐	☐	☐	☐
How exciting was it to wait for your partner to make a move?	☐	☐	☐	☐
How fun was it to pick a correct word?	☐	☐	☐	☐

Would you have played the game again? If yes, how much would you have been prepared

to pay for it?

No	Yes, if for free	Yes, for 5-10 SEK	Yes, for 10-15 SEK	Yes, for 15-20 SEK
☐	☐	☐	☐	☐

In the following questions we would like you to speak freely of your experience of the game. All of your input will be valuable to us in the future design process.

- What was fun with the game?

- How can the game be made more fun?

- Was there anything you did not like with the game?

- What is missing in the game according to you?

- Was anything unclear?

- If you would have given this game away as a gift, who would you have given it to?

Last, mark the words you associate with the game: Exciting
Frustrating
Fun
Stressful
Challenging
Easy
Tricky
Social
Boring
Quickly played
Time-consuming
Clear
Unclear
Confusing
Addictive
Rewarding
Joyful
Competitive
Elevating
Other (please specify):

Thank you for your participation!

D

Ideas of extended features

Name	Idea
Lifelines	A way of representing the clue system from the original game. If the player choose to use a lifeline, the property of a card is revealed. At the same time as this might aid the partner to find the correct words, it will also imply some disadvantage for the partner. For instance, the partner will also lose the possibility of getting a full score in the round, lose a life and so on. However, using a lifeline and accepting the disadvantage might be a better choice than to risk picking the fatal word. The extended feature lifelines can be introduced in three different ways: Reveal one of the correct words, reveal one of the incorrect words or reveal the fatal word. The idea is to impose one of these in the game, not all of them.
One revealed word	This would be another way of representing the clue system from the original board game. This idea is very much alike Lifelines above, but in this case, the lifeline is always appearing and is not optional for the partner. That is, the property of one random word is always revealed when the partner starts the round.

Predefined set of words	A way of representing the random properties of words in the original game. That is, the selection of words that are blue, red and black are determined by the board and not by the playmaster. In this feature, the playmaster gets a selection of correct, incorrect and fatal words, and then get to choose which words to send to the partner. The playmaster still has to pick three correct words, two incorrect words and one fatal word. The difference is that the playmaster can not choose from the entire selection of words, but has to choose properties from different property selections.
Two against two	Two teams play against each other with the same selection of words, much like in the original game. The game will be played in the same way as when only one team plays, but the teams can after each round compare their results with their opponents' results. In that way, this feature will add a competitive angle to the game just like the original board game has.
Bi-directional play	Instead of one player starting as the playmaster and one player starting as the partner, both players have the same role at the same time. That is, both players are initially playmasters with two individual selections of words. When both players have picked words, they send the respective boards to each other at the same time. Then, both players act as the partner at the same time. The difference with this feature is that the play will be done in parallel instead of players switching roles. That is, two games are played at the same time with the same players instead of one.
Time limit	As in the original board game, this feature will add a time restraint to the game. It will put pressure on players, induce a competitive angle to the game and reduce the time the players have to wait between turns. In contrast to the original game, this feature will apply to both the playmaster and the partner.

Grey-out words	A feature that will show the entire selection of words to the partner, not only the ones that playmaster has chosen. That is, the same selection of words is shown to both players. However, the playmaster is the only player that can choose words from the entire selection. The partner will see the entire selection of words, but can only click on six words. The other words will be greyed-out. The purpose of this is to show the partner which words the playmaster has removed, and based on that, provide an aid in choosing the correct words. If the partner knows which words the playmaster cast aside, it might be easier to understand the connection between the words on the board.
Values for words	Inspired by Scrabble, some words are worth more points than others. That is, the scoring system is not only dependent on how many words the partner picks, but also on which words the partner picks. The value of each words is set by the playmaster. This feature would add an additional incentive to pick all correct cards.
Change words	Another feature inspired by Scrabble. If the playmaster gets a selection of words that are hard to associate, it should possible to replace some of the words in the selection with other randomized words. By doing so, the selection will be changed and the possibility that the playmaster can associate words and ease the guessing for the partner will increase. To prevent the game from getting easy, the number of times playmaster can replace words is either limited or doing so incurs some sort of penalty for the players.

Multiplier	A feature that awards players for picking all correct words. This can be done in multiple ways. For instance, if all correct words are picked by the partner, the players can be awarded by a higher score, or by the possibility to collect more points in the next round. That is, they might get one point for one correct word, two points for two correct words, and five points for three correct words. Another way of implementing multipliers is scoring one point per correct word the first round, but if all three correct words are picked, the players get two points per word in the next round and so on. If the partner does not pick all three correct words in a round, the score per word will be one again in the next round.
Ask for help	If the partner has a hard time understanding the associations done by the playmaster, it will be possible to invite friends to help. This feature is inspired by the British television show Who Wants to be a Millionaire?, where it is possible to use a lifeline and call a friend to ask for help.
Ranking	Makes it possible for players to compare themselves with their friends. Each team's total score will be displayed on a results list with the total score being the total number of points for all rounds in a game.

Table D.1: Ideas of extended features

E

Questionnaire first release of mobile application

	15-25	26-35	36-45	45+
How old are you?	☐	☐	☐	☐

	Not at all					Very much
How entertaining was the game?	☐	☐	☐	☐	☐	☐
How frustrated were you?	☐	☐	☐	☐	☐	☐
How difficult was it to associate words?	☐	☐	☐	☐	☐	☐
Was the game challenging?	☐	☐	☐	☐	☐	☐
How much did you want to communicate with your partner?	☐	☐	☐	☐	☐	☐
How exciting was it to wait for your partner to make a move?	☐	☐	☐	☐	☐	☐
How fun was it to pick a correct word?	☐	☐	☐	☐	☐	☐

Would you have played the game again? If yes, how much would you have been prepared to pay for it?

No	Yes, if for free	Yes, for 5-10 SEK	Yes, for 10-15 SEK	Yes, for 15-20 SEK
☐	☐	☐	☐	☐

In the following questions we would like you to speak freely of your experience of the game. All of your input will be valuable for us in the future design process.

- What was fun with the game?

- How can the game be made more fun?

- Was there anything you did not like with the game?

- What is missing in the game according to you?

- Was anything unclear?

- If you would have given this game away as a gift, who would you have given it to?

Last, mark the words you associate with the game: Exciting
Frustrating
Fun
Stressful
Challenging
Easy
Tricky
Social
Boring
Quickly played
Time-consuming
Clear
Unclear
Confusing
Addictive
Rewarding
Joyful
Competitive
Elevating
Other (please specify):

Thank you for your participation!

F

Questionnaire paper prototype with features

	15-25	26-35	36-45	45+
How old are you?	☐	☐	☐	☐

	Not at all					Very much
How entertaining was the game?	☐	☐	☐	☐	☐	☐
How frustrated were you?	☐	☐	☐	☐	☐	☐
How difficult was it to associate words?	☐	☐	☐	☐	☐	☐
Was the game challenging?	☐	☐	☐	☐	☐	☐
How much did you want to communicate with your partner?	☐	☐	☐	☐	☐	☐
How exciting was it to wait for your partner to make a move?	☐	☐	☐	☐	☐	☐
How fun was it to pick a correct word?	☐	☐	☐	☐	☐	☐

Would you have played the game again? If yes, how much would you have been prepared to pay for it?

No	Yes, if for free	Yes, for 5-10 SEK	Yes, for 10-15 SEK	Yes, for 15-20 SEK
☐	☐	☐	☐	☐

In the following questions we would like you to speak freely of your experience of the game. All of your input will be valuable for us in the future design process.

- What was fun with the game?

- How can the game be made more fun?

- Was there anything you did not like with the game?

- What is missing in the game according to you?

- Was anything unclear?

- If you would have given this game away as a gift, who would you have given it to?

- How did you experience the time limit?

- What did you think of the fact that you could choose to show a blue word as a clue?

	Yes	No
Did you use the clue?	☐	☐

Last, mark the words you associate with the game: Exciting
Frustrating
Fun
Stressful
Challenging
Easy
Tricky
Social
Boring
Quickly played
Time-consuming
Clear
Unclear
Confusing
Addictive
Rewarding
Joyful
Competitive

Elevating
Other (please specify):

Thank you for your participation!

G

Questionnaire final release of mobile application

	15-25	26-35	36-45	45+
How old are you?	☐	☐	☐	☐

Mark the words you associate with the game: Exciting
Frustrating
Fun
Stressful
Challenging
Easy
Tricky
Social
Boring
Quickly played
Time-consuming
Clear
Unclear
Confusing
Addictive
Rewarding
Joyful
Competitive
Elevating
Other (please specify):

	Not at all			Very much
How entertaining was the game?	☐	☐	☐	☐
How social was the game?	☐	☐	☐	☐
How frustrated were you?	☐	☐	☐	☐
How challenging was the game?	☐	☐	☐	☐
How exciting was the game?	☐	☐	☐	☐
According to you, how good were you at the game?	☐	☐	☐	☐

Would you have played the game again? If yes, how much would you have been prepared to pay for it?

No	Yes, if for free	Yes, for 5-10 SEK	Yes, for 10-15 SEK	Yes, for 15-20 SEK
☐	☐	☐	☐	☐

Thank you for your participation!