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Promotion of Reflective Learning through Gamification

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Abstract

This thesis suggests that the use of game elements may improve the results in processes of reflective learning. The inclusion of game elements in an existing application called "Timeline" is used as a case study for testing our hypothesis.

During the last few years there has been an explosive interest in gamification for a wide range of purposes, from marketing to education. The term gamification may be defined as the use of game elements to motivate people in performing non-game tasks.

The effects of gamification have been proven in various environments before, but are not yet widely studied in the field of reflective learning. Reflective learning is the process of looking back on an experience and breaking it down into significant aspects in order to gain a deeper understanding of the factors affecting the outcome, and thereby improving future action.

The thesis explores academic literature on gamification and reflective learning, and the possible impact of gamification on reflection is tested in a case study, where we incorporate game elements into an existing application for reflective learning. The new application is then tested on a group of participants who afterwards answer a survey.

The results indicate that game elements can effectively motivate users to enjoy performing non-game tasks in reflective learning, specifically the task of data collection. The study also highlights possible side effects of incorporating game elements with competition and scores. Some users exploited the application's weaknesses to achieve higher scores in a way that did not enhance the act of reflection.

Our conclusion is that gamification may be a useful tool in the field of reflective learning. It should, however, be used with care as it is more effective on certain tasks and some users may exploit weaknesses to achieve higher scores.

Sammendrag

I denne masteroppgaven antyder vi at bruken av spillelementer kan forbedre resultatene i prosesser av reflekterende læring. Inkluderingen av spillelementer i et eksisterende program kalt "Timeline" brukes som et eksempelstudie for å teste vår hypotese.

I løpet av de siste årene har det vært en eksplosiv vekst i interesse for gamification og dens bruk til et bredt spekter av formål, fra markedsføring til utdanning. Begrepet gamification kan defineres som bruk av spillelementer til å motivere folk til å utføre oppgaver som ikke er tilknyttet spill.

Effektene av gamification er blitt påvist innen forskjellige områder tidligere, men er ennå ikke mye studert innen reflekterende læring. Reflekterende læring er prosessen av å se tilbake på en opplevelse og bryte den ned i mindre deler for å oppnå en dypere forståelse av hvilke faktorer som påvirker utfallet, og dermed forbedre ens utførsel av fremtidige aktiviteter.

Avhandlingen utforsker akademisk litteratur om gamification og reflekterende læring. Virkningen vi kan oppnå av å gamifisere refleksjon er testet i et eksempelstudie, hvor vi integrerer spillelementer i et eksisterende program for reflekterende læring. Den nye versjonen av programmet blir deretter testet på en gruppe frivillige deltakere, som så svarer på en spørreundersøkelse.

Resultatene tyder på at spillelementer i reflekterende læring effektivt kan motivere brukerne til å nyte utførelsen av oppgaver som ikke er tilknyttet spill. Da spesielt oppgaven med å samle informasjon som man senere kan reflektere over. Studien belyser også mulige bivirkninger av å integrere spillelementer som konkurranse og poeng. Noen brukere utnyttet programmets svakheter til å oppnå høyere poengsum på en måte som ikke fremmer refleksjon.

Vår konklusjon er at gamification kan være et nyttig verktøy innen reflekterende læring. Det bør imidlertid brukes med forsiktighet da det er mer effektivt for visse oppgaver og enkelte brukere kan utnytte svakheter for å oppnå høyere poengsum.

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List of Figures

Acronyms and Glossary

PBL Points, Badges and Leaderboards

SUS System Usability Scale

GAE Google App Engine

NTNU Norwegian University of Science and Technology (in Norwegian: Norges teknisk-naturvitenskaplige universitet)

SDK Software Development Kit

IDE Integrated Development Environment

GUI Graphical User Interface

GPS Global Positioning System

CSRL Computer Supported Reflective Learning

RQ Research Question

SQ Subquestion

Preface

This is the Master's thesis of TDT4900, written by Sondre Løberg Sæter and Bjørnar Valle from January 2013 to June 2013 at the Norwegian University of Science and Technology (NTNU). The Master's thesis is the final delivery of the civil engineer programme in Computer Science.

We would like to thank our supervisor, professor Monica Divitini, and her assistant supervisors, research scientist Ines Di Loreto and PhD candidate Simone Mora, for valuable feedback and advice throughout the Master's thesis period. We also want to thank them for the opportunity to evaluate our application in Italy.

We would also like to thank Birgit R. Krogstie for the support on reflection theory. Thanks are also given to the members and participants of the CoorCuneoSafety2013, who participated in the evaluation of the application. In addition, thanks to friends and family for testing our application and proof-reading our report.

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Part I Introduction

1 Introduction

Contents

1.1 Background

Over the autumn of 2012 we, the authors, conducted a literary review on the concept of gamification. [1] Different forms of gamification have been intuitively used by humans ever since they developed a sense of play. A universally accepted definition of the concept has yet to be presented, but on our part we recognize Karl M. Kapp's definition as the most accurate definition to date: "Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems." [3]

It can be as simple as pretending to fly an airplane into its hangar when feeding a child, or it can be so complex that you have to bring in a team of designers and experts in the field of psychology to get the job done. Even in its simplest form, it can be analyzed and broken down into elements with roots in human psychology and motivational theory.

The digital age has provided us with tools and platforms which are now starting to unleash the full potential of gamification as a science. The video game industry has defined and utilized game elements for tens of years, and paved the way for gamification in the digital world. Gamification can now be used to motivate to extents never before possible.

Our literary review inspired us to want to explore gamification from a more practical point of view. Being students of computer science, the clear way to go would be to implement an application in which we could incorporate gamification tools and evaluate our results. An opportunity arose when our supervisor, professor Monica Divitini, suggested that we gamify an application that was developed in a Master's Thesis she had previously supervised. In June 2011 Andreas Storlien and Anders Kristiansen delivered their thesis on a mobile application which they had developed. It was called Timeline, and it was developed for use with Android devices. [2] Timeline is an application which tries to enhance the users' reflection by letting them capture experiences and organize them in a timeline. These experiences would be captured through pictures, video and/or audio recordings, written notes, moods or file attachments (like in emails).

The problem with Timeline however, is that it can be a dull task to collect data that captures an experience. Moreover, once the experience actually has been captured, Timeline

does not necessarily start or influence a reflection process in its user. Is it not enough for the user to know that capturing experiences could lead to valuable reflective insight? Are the users content with just having captured an experience, without actually doing the most important part of reflecting? One of gamification's biggest strengths is that it can motivate and engage people if used correctly. Could we give the users stronger motivation to use Timeline for data gathering and reflection by incorporating gamification in the application?

Through studying gamification and the available literature on the field, we have found a high number of warnings on how, if taken too lightly, it can be very hard to implement gamification that is actually successful. Couple with this the fact that the gamification concept is in no way proven to be eligible for all types of contexts, and we understand that finding the right type of gamification for Timeline may be hard.

To be able to perform a successful gamification of an application like Timeline, we need to understand the concept of reflection. According to Boud et al. we can divide reflective learning into three main parts: the *experiences* we have, the *reflective process* in which we return to and re-evaluate our experiences, and the *outcomes* that are produced from the reflection session. [13] The goal of the Timeline tool is to support the *reflective process* by capturing the *experience* as a snapshot not only with pictures and written notes, but also with the belonging behavior, ideas and feelings. [2]

We found it interesting to explore more advanced reflection theory, like the research which has been done on technical support of reflective learning, and the cycle of reflection. By reading up on data gathering, initiation of a reflection session and how to conduct a reflection session, we came in a better position to combine gamification and reflection.

Our intention was to find out if the domain of reflection can benefit from the engagement and motivation enhancement that gamification has the potential to bring to the table. Is it possible to "trick" users into reflecting, or is this theme too dependent on a genuine intrinsic motivation to reflect in the user for gamification to be effective?

1.2 Research Questions

The main purpose of Timeline is to help the user with reflecting. By gamifying the applciation our hope was to enhance the user's motivation to both collect data and to reflect on previous experiences. Subsequently, we formulated a main research question (RQ), followed by two subquestions (SQ) which address the main aspects of Timeline's reflection support.

RQ How can gamification be utilized to promote reflection in the Timeline application?

SQ1 Can gamification enhance Timeline's users' motivation to collect data which can help them recall or revisit previous experiences?

a) Can the use of gamification enhance Timeline's users' motivation to collect data?

b) Which gamification elements may best enhance the Timeline's users' motivation to collect data?

SQ2 Can gamification enhance Timeline's users' motivation to reflect on their collected data?

a) Can the use of gamification enhance Timeline's users' motivation to reflect?

b) Which gamification elements may best enhance the Timeline's users' motivation to reflect?

1.3 Research Approach

The research approach we adopted in this thesis is inspired by agile development, and is iterative. The figure below shows a model describing the approach we used.

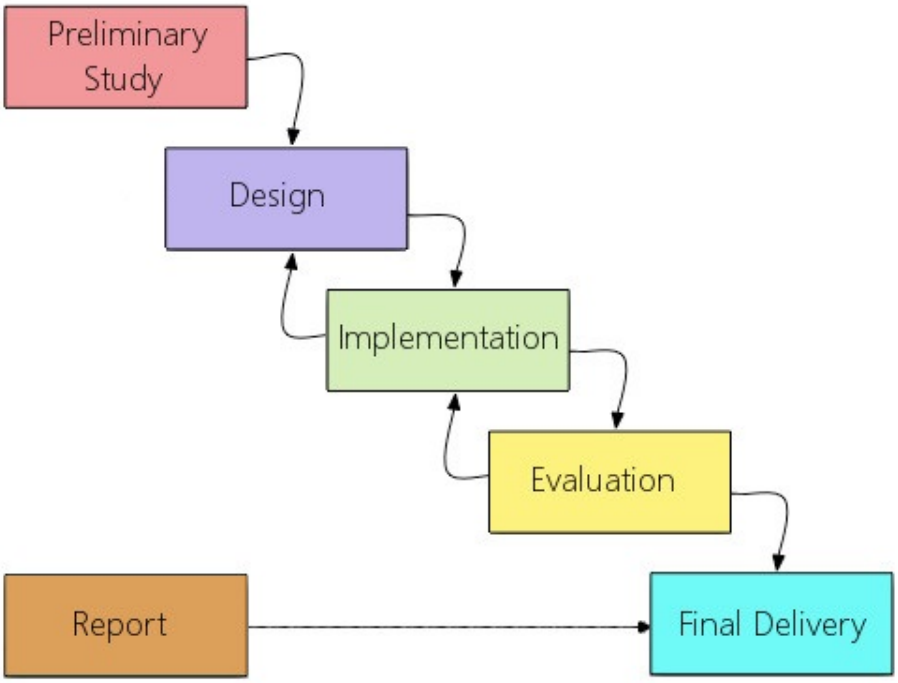


Figure 1.1: Model of Approach

The project period started with conducting the preliminary study, refreshing our knowledge of gamification and looking into the field of reflection. Following the preliminary study, we performed iterations of design, implementation and evaluations of the application to see if the gamification elements implemented could prove to enhance the users' motivation. During the project we continuously documented our progress in the project report.

1.4 Report Outline

The following list contains short descriptions of each of the three main parts of the report.

Part II - Preliminary Study
Part two presents chapters two through five which comprise theoretical information that is important for the manner in which we gamify Timeline. It starts with chapter two, which contains our most essential findings from our literary study on gamification. Chapter three is about reflection theory and how it relates to Timeline. Chapter four describes the Timeline application and its features. In the last chapter of part two we discuss the current state of the art connected to our research.

Part III - Design of New Timeline
Part three consists chapter six and seven. The first of the two chapters contains three scenarios created to illustrate the use of Timeline, while also demonstrating the weaknesses which gamification can improve. The second chapter takes a close look into applicable gamification elements, and discusses how we can use them when designing for the changes we want to make to Timeline.

Part IV - The Process of Gamifying Timeline
Part four presents five chapters. The first chapter covers our method of work. The three following chapters describe the three iterations we have conducted. Within these three chapters we explain our implementation and describe our evaluations. To conclude the part, we have a chapter where we discuss our findings.

Part V - Conclusion and Recommendations for Further Research
Part four is the last part before the appendices. It contains the conclusions we have drawn from our project, reflections we have made throughout the project, as well as our propositions to what could further be done with Timeline and the tools of gamification.

Part II Preliminary Study

This part of our report is comprised of summaries of the knowledge we acquired in the initial phase of our project in order to answer our research questions. The chapters that ensue will introduce the reader to gamification theory, reflection theory, the Timeline application and the current state of the art related to our thesis.

2 Gamification

Contents

The contents of this chapter is a short summary of our literature review on gamification from 2012. [1] We will discuss the definition of gamification, and introduce information important to understanding and implementing gamification.

2.1 Defining Gamification

"Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems." [3]

There are many ways to describe the term gamification, but we feel that Karl M. Kapp's definition, which is cited above, captures its essential meaning very well. It is a technique that can be applied to a lot of activities and processes, like for instance when feeding a baby with the infamous airplane trick, or rewarding children with gifts for cleaning their room. It is only the last five or so years that gamification has become a widespread term and even a field of expertise that can be applied methodically to a process or activity. The reason for this is much thanks to the constant growth of the IT world, where social medias and mobile applications have had big success with using various gamification techniques to engage their users.

By breaking down the aforementioned definition, it becomes easier to understand gamification. We will now explain the different parts.

Game-based mechanics are the rules and structure created to make a game or promote game play.
Game-based aesthetics are used to design the look and feel of the user interface. Users feel more safe in an interface they are used to.
Game thinking refers to game design, and using the knowledge that has been acquired in that area.

Games are known to induce a desirable experience, keeping the users engaged with both duration and intensity not seen anywhere else. [5] Through the use of these game related aspects, the ambition of gamification is "to engage people, motivate action, promote learning, and solve problems."

As the definition shows through its many aspects, gamification has widespread usability. The last few years, the use of gamification in software applications has flourished. There are examples of both failure and success, but to emphasize the possibilities of gamification, we will describe in short one example for each of the four aspects mentioned in the definition.

Engage people
Fantasy Premier League is a competitive game where you pick soccer players from teams in the real world, and build your own fantasy team in the game. The user is rewarded points which are based on the actual real life players' performances in league matches. The goal of the game is to get the most points and beat your friends. It is designed to draw in and engage people in the English Premier League. [9]
Motivate action
Zombies Run is one of many mobile applications where the user is motivated to work out. The player is motivated through story telling and missions that he has to complete while zombies chase him. [8]
Promote learning
DragonBox is a famous math learning application for mobile devices, where players learn basic algebra. It has been successful in teaching children algebra before they are even old enough to have encountered algebra in math class at school. [7]
Solve problems
Foldit is an online puzzle game that simulates protein folding. Players can learn how to beat protein folding puzzles in a game setting, and eventually try to solve actual scientific challenges. This is among other things used to contribute to HIV/AIDS research. [6]

2.2 Game Elements

There are many different elements that are used in games. These have been organized by Kevin Werbach, and are illustrated in figure 2.1. [10]

The dynamics are the elements that constitute the big picture, and can be thought of as the "grammar". Constraints, narrative and progression are some of the elements in this classification. The dynamics are built on top of mechanics, which is the middle layer in the pyramid. The elements at this level drive action forward, and can be though of as "verbs". Common and well known examples are rewards, competition, cooperation, challenges and several others. These are again a composition of lower level elements. Components, the

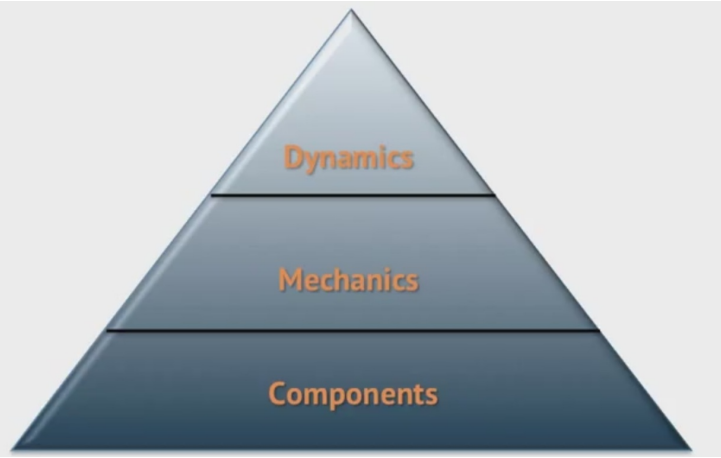


Figure 2.1: Pyramid of Elements

lowest level in the pyramid, are specific instantiations of mechanics and dynamics, and can be thought of as "nouns". Some of the most used examples are achievements, avatars, boss fights, content unlocking, levels and points, and leaderboards. There are many components that can be used. The following list shows a few of these.

1. **Achievements**
   Giving the player a reward for completing specific tasks.
2. **Avatars**
   Showing the player a graphical representation of their character or their alter ego.
3. **Badges**
   Visual tokens of achievements or completed objectives.
4. **Boss fights**
   A stronger enemy or a harder challenge that the previous obstacles have lead up to. Often the last challenge of a level.
5. **Collections**
   The player has to acquire a set of things that belong together. I.e. assemble pieces of a map, put together a set of items.
6. **Combat**
   Fighting either enemies with artificial intelligence or other players.
7. **Content unlocking**
   The player gains access to something by meeting a set of requirements.
8. **Gifting**
   Allow players to give away things. People feel good about giving to others.
9. **Leaderboards**
   Display for everyone to see who is the best player. Highest level, most points, most

units of some kind. Appeal to players' sense of competition.

10. **Levels**
    The player's level increases as he progresses in the game. The higher the level, the stronger the player.

11. **Points**
    The player receives points for doing something well.

12. **Quests**
    Stories within the game with objectives and often rewards. Sometimes called missions.

13. **Social extension**
    Letting you see and interact with your friends as an extension of a social network.

14. **Teams**
    Let players form alliances, guilds, clans and work together.

15. **Virtual goods**
    Things within the game. Weapons, pieces of clothing, and other items.

For a broader and more thorough explanation, see our literature review from 2012. [1]

It is important to remember that this pyramid and its elements is only one of several parts of the total experience. A game is more than just the sum of its parts, and it is the overall experience that matters. This pyramid has for example not included aesthetics, which also are important for the game experience.

2.3 Motivational Psychology

To be able to utilize gamification well, it is important to understand how and why people react to different events. Here we will briefly introduce two models of thinking.

2.3.1 Behaviorism

Behaviorism is the study of why people do what they do. Through looking at a person as a "black box", explaining behavior is simplified to simple rules of stimulus (input) and response (output) pairs. As this way of thinking does not include the persons feelings or former experience, this is a statistically based way of thinking.

2.3.2 Intrinsic and Extrinsic Motivation

When looking at intrinsic and extrinsic motivation, we use a cognitive point of view.

Intrinsic motivation is when the person finds the task or action rewarding in itself. Sense of accomplishment, the feeling of control and meaningful choices are important feelings the user should experience.

Extrinsic motivation, on the other hand, finds motivation "outside" the person, often through rewards. A soldier receiving orders, increased status or payment is a typical kind of extrinsic motivation.

Of the two, intrinsic is the most powerful, but also the most difficult to create or obtain.

2.4 Game Design

There are two main rules for game design. The first rule is that you need to get people to play your game. The second rule is that once they have started playing, you have to find a way to make them continue playing. There are three important things to think about to accomplish that. First off, the player needs to be the center of the game. Secondly, the player needs to feel that he or she is in control and has the possibility to make meaningful choices. This refers back to intrinsic motivation. Third and last, is to make them feel like they *are at play*, and to do this, the players need freedom.

Over the years there have been made many games, and certain design decisions have been found to work better than others. The list below is quoted from our literary review on gamification. [1]

- Onboarding - Get the player to start the journey.
- The Play Journey - Start at the beginning, and progress up to mastery.
- Scaffolding - Help the player overcome challenges that would otherwise get him stuck. A good analogy is training wheels for bicycling.
- Pathways to Mastery - Enable the player to get to a point of mastery.
- Balance - Not too hard. Not too easy.
- Create an Experience - Make it an enjoyable experience.

2.5 What Makes Games Engaging

What is it that makes games so engaging? The general answer is that "it is fun". To be able to utilize this in designing for gamification, we need a basic understanding of what *fun* really is. We will here look closer into how Nicole Lazzaro and Mark Leblanc define fun, and try to get a better understanding of the expression.

Nicole Lazzaro - Four Kinds of Fun

Nicole's way of describing fun is by classifying it into four categories. [10] [11]

- Easy Fun - Goofing off with friends; it is easy.
- Hard Fun - Overcoming challenges or completing something.
- People Fun - Being social or working with others; social interaction in general.
- Serious Fun - Doing meaningful things, giving or helping others; doing something you find meaningful.

3 Reflection Theory

Contents

In this chapter we take a look at the most central part of Boud et al.'s article on reflective learning, summarize Rivera-Pelayo et al.'s findings on how technical tools can support reflective learning, and explain MIRROR's model of computer supported reflective learning. [13] [28] [22]

3.1 Reflective Processes

Reflecting is an active action, performed by one or more persons. By looking at earlier events with critical eye, new insight can be acquired and used in the future. Learning through reflection has been defined by Boud et al. as "those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations." [13] Furthermore, Boud et al. divide reflection into experience(s), reflective processes and outcomes. Figure 3.1 is a model which illustrates the relationships between the three stages with some added context.

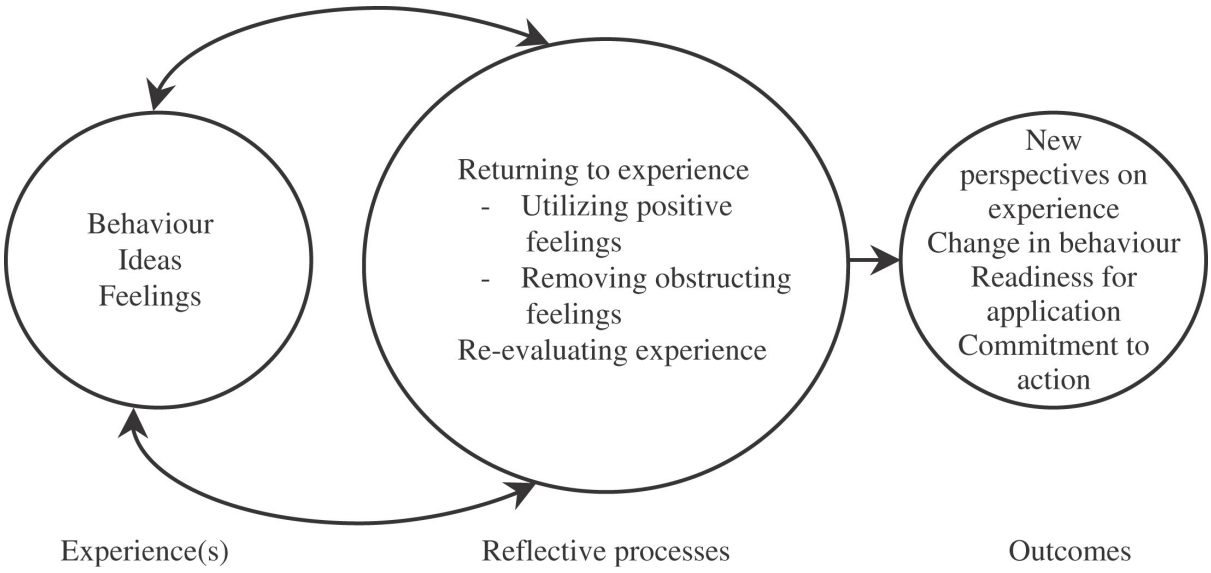


Figure 3.1: Boud et al.'s reflective process model [13]

The experience is something that has to have taken place before the reflective process can start, as the process of reflecting is based upon the experiences of the learner. After the

reflecting has started, though, the learner will return to his experience(s) and re-evaluate as many aspects of the experience as he can. Thus the two first stages of the model, experiences and reflective process, have some overlapping once the process has started, and can happen interchangeably without having a specific order.

A successful reflective process will produce outcome in form of either new perspectives on the experience, a change in the behavior of the learner, readiness for application of new skills or commitment to actually acting on the changes from the reflective process.

3.1.1 Technical Support of Reflective Learning

Rivera-Pelayo et al. have identified three main support dimensions where technical tools can aid reflective learning. [28] The three dimensions are:

- Tracking cues - gathering data as basis for the reflective learning process.
- Triggering - doing something that initiates the reflective process in the learner based on gathered data.
- Recalling and revisiting experiences - presenting data in ways that help the learner recalling and revisiting past events.

There are two main ways of tracking cues: manually inputting data like for instance feelings or written notes to a software, or hardware sensors that automatically track data like thermometers, microphones or gyrometers. The manual input comes through **software sensors**, while the automatic input comes through **hardware sensors**.

Also when it comes to triggering we differentiate between two approaches: active and passive triggering. **Active triggering** means that the tool is actively trying to trigger reflection in its user by sending notifications or making other attempts at catching his attention. **Passive triggering** confines to displaying the tool's collected data in a way that might trigger a reflection process in the user if he himself chooses to look at the data.

Recalling and revisiting experiences can be supported in four different ways: contextualizing, data fusion, data analysis and visualization. The collected data can be **contextualized** with other sources of information like social data from Facebook, spacial data from GPS, statistical trends or other data like monitored heart rate. These are things that could enrich the dataset and help the user recall better. **Data fusion** is helpful in uncovering discrepancies between data gathered by different sources. There might be differences in what the user has reported himself and what sensors or other members of a group have gathered. This is helpful for maintaining an objective approach, and discoveries made here can lead to new and valuable insights. **Data analysis** can support the user by presenting useful averages and aggregations of data, like tag clouds or number of medicaments taken per day. **Visualization** of the tool is important, as it should be

intuitive and easy on the eyes of the user. It should also present analysis of data in a way that helps the user with reflective learning.

3.2 The MIRROR Computer Supported Reflective Learning model

MIRROR is a project that describe themselves as follows: *"The focus of 'Mirror' is the creation of an easily used set of applications ('Mirror' apps), that enable employees to learn lessons from their own and others experiences to perform better in the future. The project facilitates learning 'on the job', at the workplace, through collaboration and reflection technologies."* [25]

The MIRROR Computer Supported Reflective Learning (CSRL) model describes how to incorporate reflection into the daily routine at work through a reflection-learning cycle. According to the model, reflection can be broken down to four phases. We will now briefly go through these phases, which are shown in figure 3.2 in the MIRROR CSRL model. [22]

The first phase of the cycle is "Initiate reflection session", which basically is the act of deciding to reflect, or having the reflection triggered by an incident. The initiation of a reflection session carries over to the next phase with a *frame* or a setup for the reflection session.

The second phase is "Conduct reflection session". The one(s) reflecting look back at a previous experience to learn from it and improve on it. Using their senses, feelings, ideas, behavior and outcome to revisit the event, is a good way to start. This is made easier if there is information like pictures, notes and video to help recall. Using this information to reconstruct the event, then critique it. Through being critical, new and better ways to perform or handle an event can be found. The reflection session produces an *outcome*, which is the basis of the next phase.

"Apply reflection outcome" is the third phase and the act of putting the newfound insight into play, by acting according to your new, and hopefully better, way of performing or handling that kind of events. It should result in either a change to the work arena, or to fuel further reflection. The *changes* that the reflection participant(s) want to make leads to the fourth phase.

The last phase of the cycle is "Plan and do work". This is where our experiences come into being, while performing an action or task. Planning and doing work lead to output in form of *data* about the work arena that can lead to the initiation of new reflection sessions.

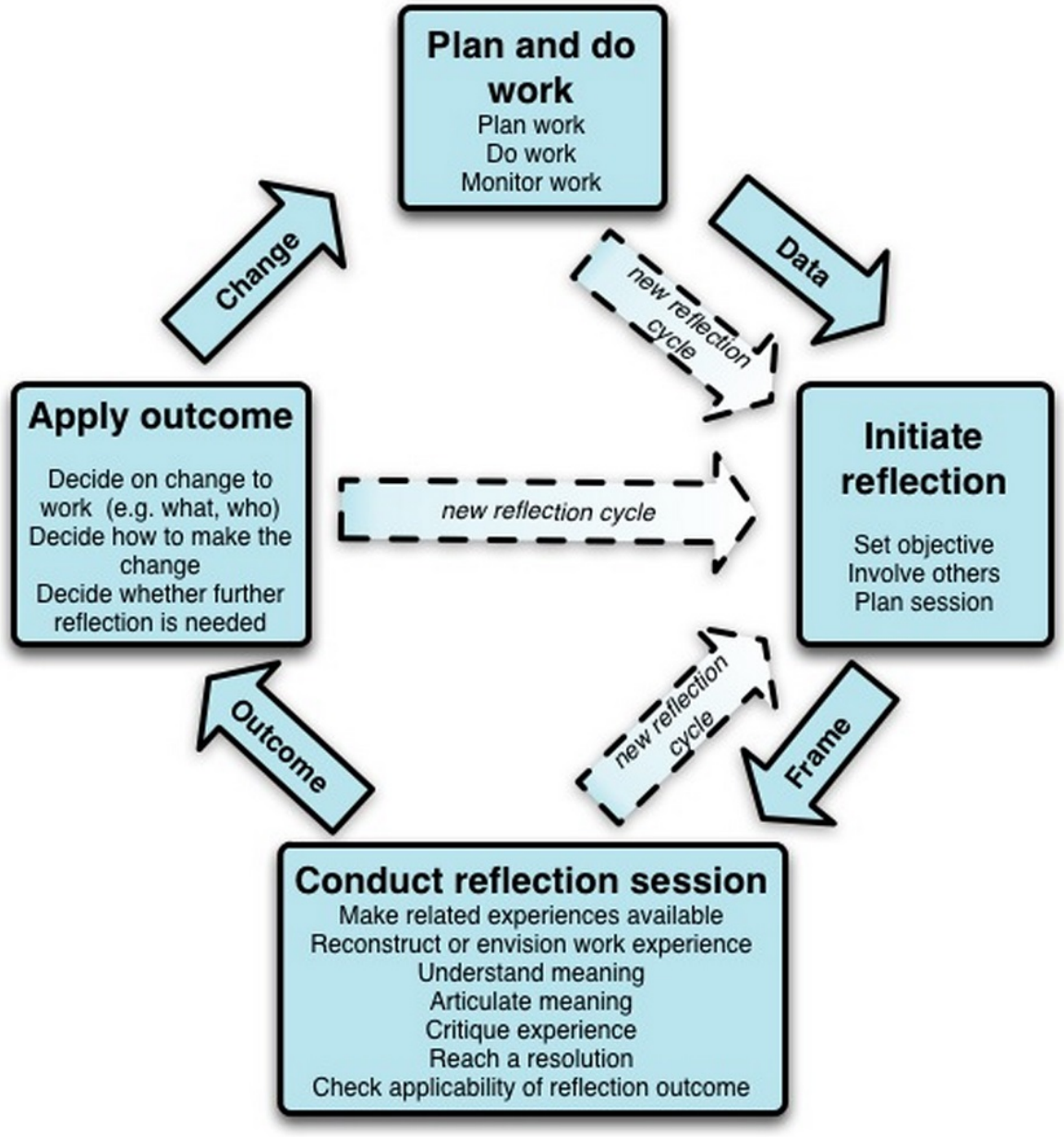


Figure 3.2: MIRROR CSRL model [22]

4 Original Timeline

Contents

In the following section, we will describe how the Timeline application worked when delivered in 2011.

4.1 Description of Timeline

Timeline was developed in 2011, as a master thesis project by two students at the Norwegian University of Science and Technology (NTNU). The idea was to make a tool that could help the user reflect over passed events. Through adding experiences in a timeline the user can revisit these to enhance the effect of reflection. With a reference back to figure 3.1 from chapter 3, we can say that it is a technical tool that tries to capture the events in experience-part of the figure, as a snapshot in the timeline.

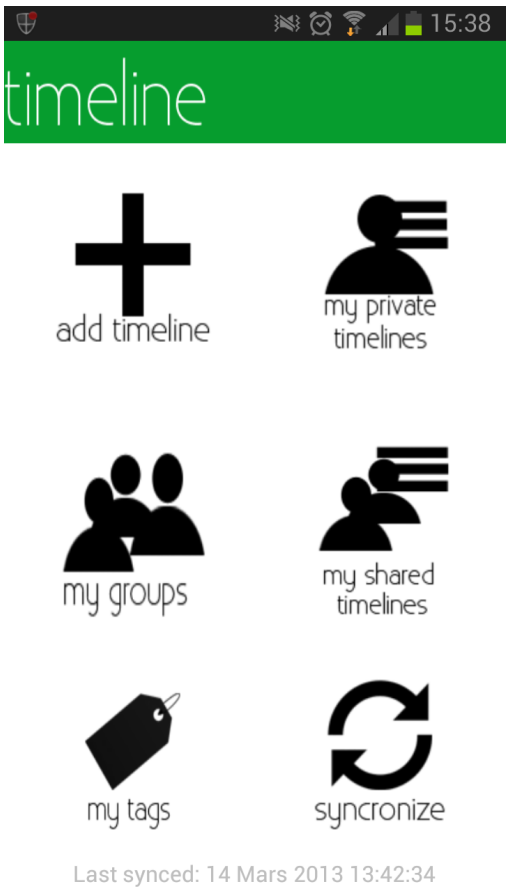


Figure 4.1: Application dashboard

The general idea of the application was that the user should be able to create his or her own timelines. The default view of a timeline is visualized as a calendar where you can zoom in on specific dates.

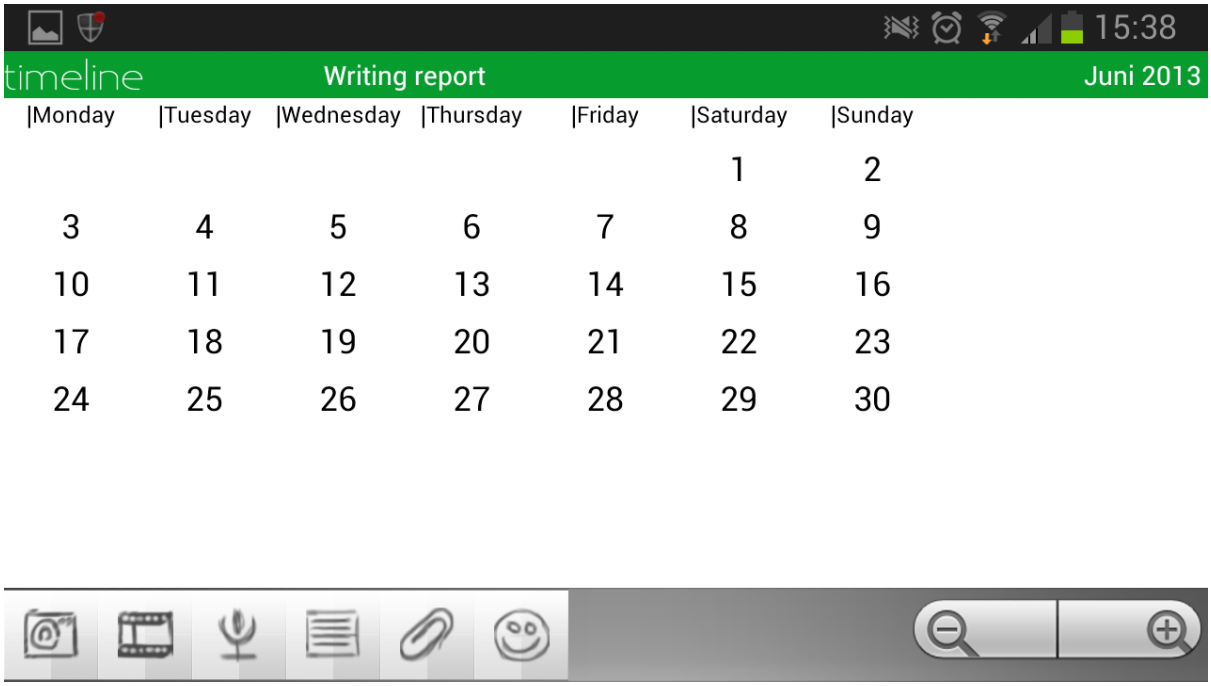


Figure 4.2: Timeline month view

The user can have multiple timelines, but must choose one specific timeline to use before posting elements to it. The different elements that can be added to the timeline are listed in table 4.1.

Input type	Icon
Picture	
Video Recording	
Audio Recording	
Note	
Attachment	
Mood	

Table 4.1: Input icons

These elements are then represented by an icon in the timeline, placed at the time of making. Elements can only be added in real time. Additionally the current location of the phone is appended to the element, so that the user can look at a map and see the GPS location that belongs to the different elements.

After picking a date in the calendar view, the application will "zoom in" to the chosen date, and the user will see a more classic timeline with timestamps spread out horizontally in familiar timeline style.

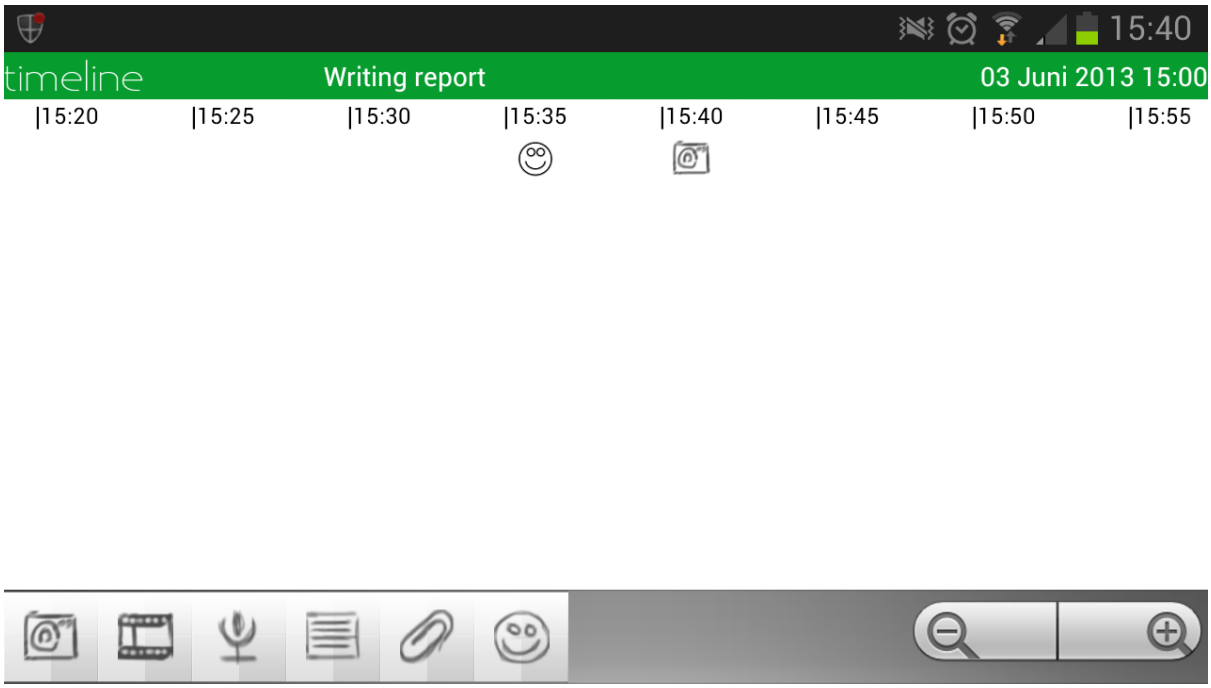


Figure 4.3: Timeline hour view

All elements and timelines are by default stored on the phone. In addition, they can be shared with groups, and they will then be inserted to a database on a Google App Engine (GAE) sever. Groups can be created by any user. Creating groups, the user can choose from a list with all users that are registered on the GAE server of Timeline. All users are automatically registered with the default Google account of their phone when they open Timeline for the first time.

The user has the possibility to create tags which can be connected to the elements, so that the user can classify elements with ease.

4.2 Suitable Work Environments for Timeline

Timeline is a very general application, which can be used in many settings and workplaces. The aim of this application is to help and increase its users' motivation to reflect. The most suitable work environments for Timeline are where the user's reflections have a direct impact on the effectiveness, quality or handling of tasks or events. Examples of use are given in scenarios in chapter 6.

5 State of the Art

Contents

The use of gamification has skyrocketed the last few years. Gamification is now integrated in numerous applications, with focus on motivating us to for example get better health, stay loyal to certain brands and companies, or just to make us continue using their product. However, most of these examples have little focus on reflection. In this section we have chosen to discuss an assortment of successful applications because they excel in terms of data gathering, visualization and motivation, and because they have used some sort of gamification to achieve this. We will now present five instances of technical tools that have used gamification to influence their users' reflection process.

5.1 Jawbone UP

The Jawbone brand has developed an armband called UP, which tracks sleep, movement, calories burned, activity intensity and active time. UP also "makes it fun and easy" to track food and drink, as well as mood. Food and drink can either be added manually through a menu, or you can just take a picture. The mood is added easily, where different moods can be chosen by dragging a finger up or down on the touch screen which the UP application is running on. So far there is not much gamification to speak of. The gamification that can be found in the use of this armband is with the possibility to connect and transfer information to other services which are gamified. Examples of these are MapMyFitness and Lose It, which use gamification like leaderboards, badges and competition between friends or teams.

These are applications that focus on fitness and health, and the gamification is thus designed to help the users towards reaching their goals. Leaderboards, badges and competitions are all game elements that will motivate the users to exercise more, which means gathering more data. This relates to reflection through the tracking cues that we presented in section 3.1.1. [23]

(a) Jawbone UP (b) Jawbone UP Armband

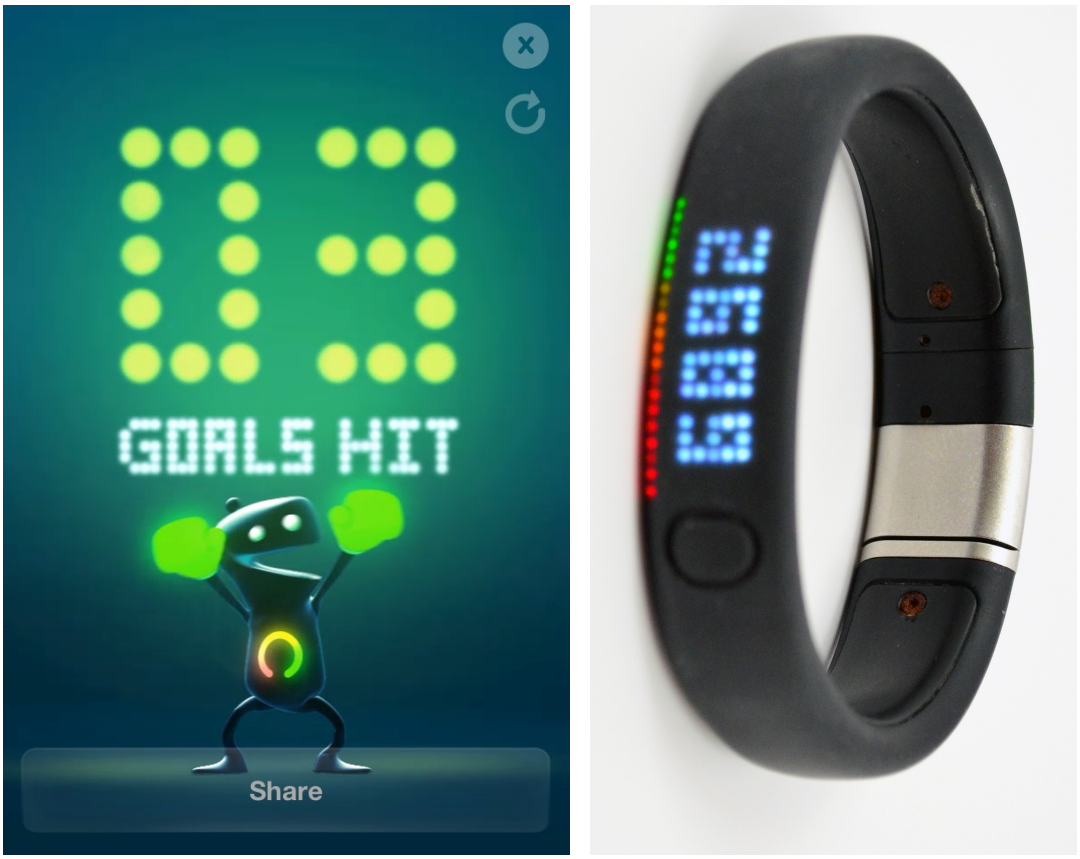
Figure 5.1: Jawbone wristband and application screenshot

5.2 Nike+ FuelBand

Nike+ FuelBand is a competitor to the Jawbone UP. It is also an armband that tracks running and movement, but can not be used to measure sleep, mood or food and drink intake. On the other hand, the FuelBand has a good mobile and computer user interface, as well as gamification. It has a progress bar which you can see both on the wristband and in the accompanying software application. For every day, the progress bar starts out red. The goal is to make it green throughout the day by staying active and in motion. Activity is recorded automatically, and the progress bar goes from red through yellow to green, if the goals of the day are met. In addition to this motivating bar, it has "trophies". Trophies are earned through completion of milestones, such as "25k Fuel Earned". When a trophy is received, an animation is shown of a cartoon celebrating your accomplishment. The application also has a highscore list, showing how your statistics compare to your Facebook friends'.

The act of reflecting is, as for the Jawbone UP, not gamified in itself. What they have gamified in this tool are the tracking cues, the recalling of experiences and keeping the user continuously involved. The progress bar engages and stimulates the user visually, as it gives him a very simple way of monitoring his own road to accomplishing his goals. The

motivation he experiences from witnessing that the exercise he is doing really matters drives him to gather more and more data. The application processes the gathered data and presents it in useful ways like graphs and patterns. This will help the user with recalling and reflecting over his day, so he can be more active the next time. Seeing these processed data might also have a passive triggering effect. [26] [27]



(a) Animation (b) FuelBand

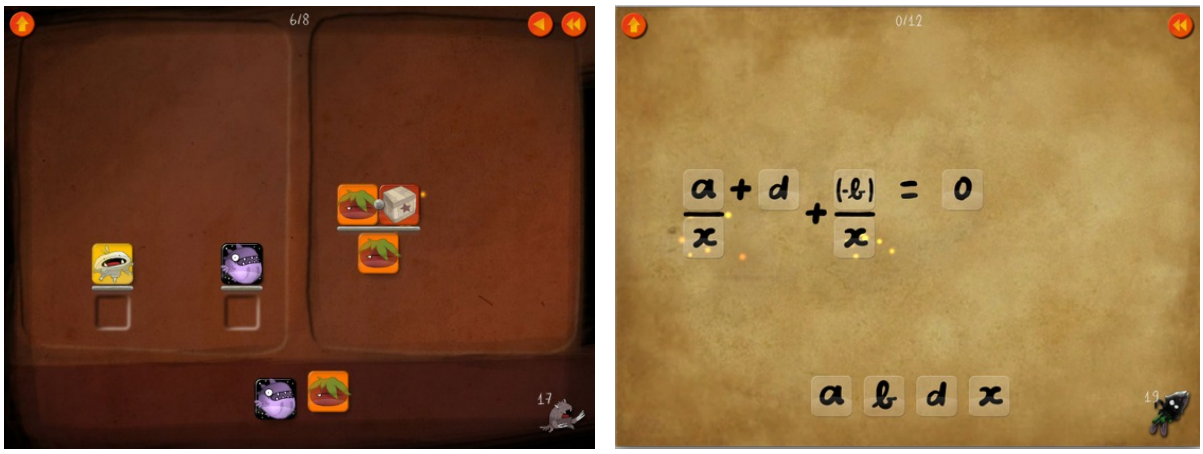
Figure 5.2: FuelBand wristband and animation screenshot

Figure 5.3: Example graphics from the FuelBand application

5.3 DragonBox

DragonBox is a much praised gamified application, which was made so that young people can have fun while learning basic algebra. But while having fun, it also requires the player to reflect in order to be successful. Let us briefly explain how the game works. At the start of the game there is no normal recognizable algebra. To give a more game like experience, the game starts with boxes and other figures. The game gives the player instructions of how to solve the puzzle of figures, but as the game progresses, the puzzles become more and more similar to typical algebra. In the end the player is solving real algebra equations.

When the player solves a puzzle, he receives a rating of how effective he solved it. Often times the player needs multiple attempts to get the highest rating, which is three stars. By thinking back on how they did last time, and how they can improve, the player has to go through a reflective process. [7]



(a) DragonBox starting level (b) DragonBox ending level

Figure 5.4: Screen captures of two different DragonBox puzzles

5.4 Stack Overflow

Stackoverflow.com is a question-and-answer site about programming. Users ask all kinds of questions related to programming, and other users can answer their questions or help solving their problem by participating in discussion. The credibility of users and their contributions are hugely based on their reputation, which is an accumulation of the number of upvotes and downvotes they have received from other users for past contributions. Reputation can also be increased by spreading links to questions to social media like Facebook or Twitter. Additionally the users are awarded badges for a lot of the things they do. There are several different privileges on the site that can be gained by reaching reputation milestones, one example being the privilege to vote on the quality of questions or answers. This is awarded to the user once he reaches 15 reputation. [29]

The voting system on Stack Overflow motivates people to ask *well thought out* questions, as they will gain more upvotes and recognition if their question can create a discussion that helps as many other users as possible. Asking a well-formed and articulate questions will make it easy for other users to answer, which will lead to upvotes from users that are happy about the thoroughness of the asker. A bonus effect the asker will have from doing this, is that formulating a structured question will initiate a reflection process in himself that might help seeing his own problem clearly, and maybe even help him solve the problem on his own. Much of the same can be said about the users that post answers to questions, too. Consequently, a fortunate side effect of the vote system is that it motivates users to reflect. It has a passive triggering effect.

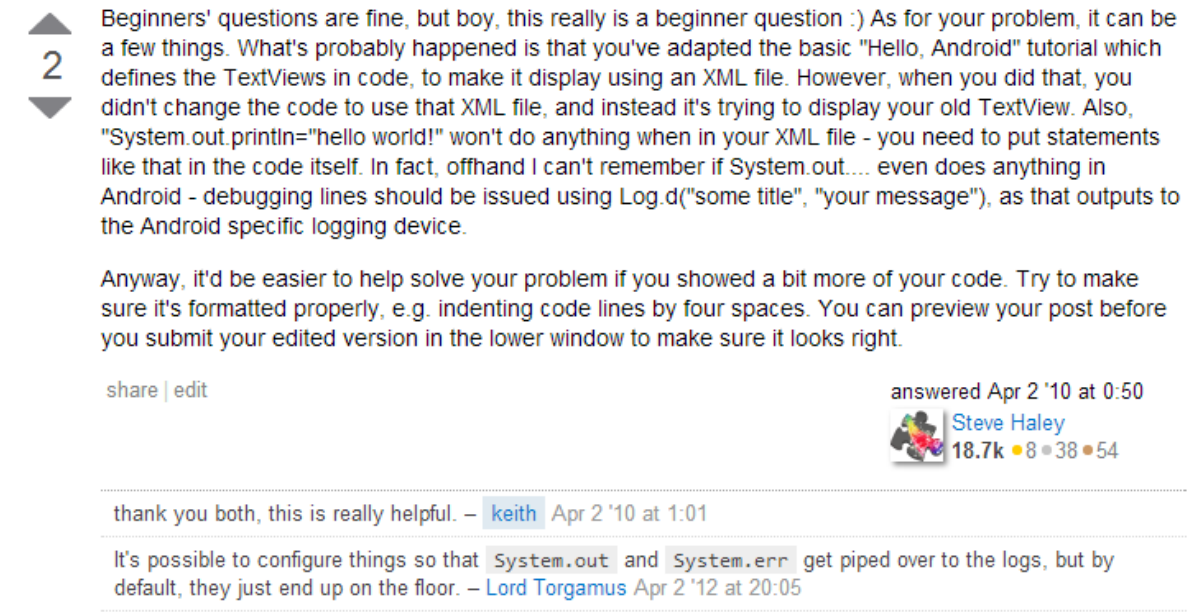


Figure 5.5: Screenshot of a random answer to a question on Stack Overflow

5.5 Social Media

Nearly all social media, like Facebook, Twitter, Google+ and LinkedIn, are gamified in some way. Having likes, follows, or other such mechanisms is a way of gamifying which focuses on the users sense of accomplishment. Having a high number of followers gives the user high status, and most "posts" on Facebook or Google+ are made with a side goal of getting as many likes or "+1"s as possible. It is not uncommon that users show off pictures of their latest acquired item or write about their accomplishments, while on some level hoping that all of their friends will give them a little token of recognition in form of a thumb up or something of the sort. This all goes back to the "aspirational self", which is the person we want the world to see us as. Most people will have a reflective process triggered by the thought of sharing something with all their friends on a social network, where they reflect over how this new piece of data they put out there will affect how their friends' see them. [24]

Figure 5.6: Buttons for voting, like, +1, follow and share from Stack Overflow, Facebook, Google+, Twitter and LinkedIn respectively.

5.6 Summary

We have discussed five different instances of gamified technical tools that influences the reflective cycle in one way or another. None of the five instances have the sole purpose of promoting reflection the way Timeline does, but still we can let the most interesting aspects of them inspire us in our work with gamifying Timeline.

It is interesting how Jawbone UP and Nike+ FuelBand automatically gather and visualize data that trigger their users into initiating a reflection session. We find the progress bar of FuelBand particularly interesting, and the Jawbone UP application's ability of recording what you eat with just a picture is fascinating. Using just a picture, and letting the application do the rest, makes it easy and fast for the users, versus manually adding food. These two tools have automated the user's gathering of data excellently, and this ease of input is something that could potentially be very valuable for an application like Timeline.

DragonBox, with its rating of algebra solutions, constantly drives the user to go through the entire reflection cycle again and again, making the players review their performance in order to get the three stars that endorse their mathematical skills. It would not be easy to recreate this aspect in Timeline, but it would undoubtedly be a very valuable addition if we could come up with something similar.

Stack Overflow uses social reputation, achievements and badges to create a good environment for sharing of knowledge, which induces a continuous need for reflective learning among their active users. Their reputation points and badges have successfully motivated a high number of people to use their spare time helping strangers in need, giving them feedback and answers of high quality. Implementing a similar voting- and reputation-system in collaborative timelines could possibly increase a lot of users' level of involvement.

Social medias appeal to our aspirational self and makes us reflect over how we are perceived by our peers. This is a factor that would reinforce the effect of a potential voting system as previously described. Altering Timeline into something more similar to a social media could therefore have a beneficial influence on the users' involvement and motiva-

tion to reflect, but it would be much too extensive for us to be pursuing in our thesis. Thus, we will leave it at that, although still keeping the principle of the aspirational self in mind.

In the next part of our report we will let ourselves inspire by the most interesting aspects of these topics which we have discussed, as we try to design game elements that will promote the reflective process that Timeline was intended to support.

Part III Discussion of how to Utilize Gamification

6 Scenarios of Use for the Timeline Application

Contents

Timeline is an application with a quite wide and general appeal, which can be used in a diversity of situations. But its purpose is first and foremost to aid *work related* reflection, and our supervisors have suggested some example occupations that would benefit from a reflection tool like Timeline. Based on the examples that our supervisor gave us, we will here describe some scenarios of use for Timeline, which will help us demonstrate how we with gamification can contribute to making it a better tool.

6.1 Firefighter

John is in the locker room, changing into his work clothes. His shift is starting soon. He takes up his Android phone, goes into Timeline and selects the timeline where he collects work related data. He writes a note, explaining that his shift is starting. When he is finished in the locker room, he moves into the common area, where the other firefighters are. Noticing the good atmosphere, he takes a photo, and attaches a mood: happy.

While they are at the fire station they work out, play cards and watch television. They urge each other to log statistics from their workouts and results from the card games in a shared timeline, but only about half of the firefighters can be bothered to do so. Consequently, their shared timeline does not hold everyone's statistics, and loses some of its purpose and usefulness.

During a fire drill, John is using his mobile phone to record a video of how effective everyone is. At the end of the day, he creates a new note, saying that his shift is over. Afterwards, he goes home to watch some television with his family.

6.2 Nurse

Jane is on the bus, going to work. Her shift starts soon, at 8:00 PM. She opens her work-timeline and writes a note, trying to describe her energy level, what she has eaten and

how she slept last night. Then, as she enters the hospital locker room, she writes a new note, saying that work has started. While going about her business, helping patients, she notices that one of the older patients seems to be having trouble sleeping. While making a note in Timeline about the patient, she moves on to the next patient. While continuing her round, Jane finds a cobweb. Documenting this with a picture, she adds an attachment note with its location. At the nurse's meeting at 11:00 PM, she uses her timeline to remember special events that she wants to take up on the meeting. Informing the others that a certain patient has trouble sleeping, one of the other nurses is issued to give the patient some sleeping pills. After the meeting, she informs the cleaning personnel about the cobweb, showing them the picture. With that done, she continues on her shift, checking that no patients need help, and are as comfortable as possible. As she has the night shift, she then sits down, talking with some other nurses. While sitting there, she writes a new note, describing her energy level and her work day so far.

In the middle of the night, the alarm of one patient goes off. Hurrying to the location, she notices she is first to the scene. The patient seems to be sleeping, but the heart rate monitor shows is not detecting a heartbeat. She checks the patient's pulse, and finds nothing. Another nurse arrives, and Jane tells her to get a doctor. While the other nurse is getting a doctor, Jane notices a little blood trickle out of the patients nose. Using a towel she quickly removes it and starts mouth-to-mouth resuscitation. When the doctor finally arrives, Jane is exhausted. Taking a break while the doctor and the other nurse takes over, she rests. In the morning, there is a summary meeting before her shift is over. She tries to recall all that has happened, telling them about the alarm, the patient and the heart rate monitor, and the other nurse getting a doctor. Also adding that she did mouth-to-mouth resuscitation, she forgets the trickle of blood she dried away.

6.3 Rescue Personnel

Carl has just received an emergency call from the person on-call tonight. There has been a potentially fatal head-on collision between two cars, and everyone available has to get to the location of the accident immediately. His colleague Kyle picks him up on his way to the location. While sitting in the passenger seat of the car, Carl opens Timeline and presses the synchronize button to check if anyone has created a timeline for the accident. It turns out nobody has done it yet, so Carl does it himself. He shares the timeline with the group "Work", and presses synchronize so it uploads to everyone else. He writes the first note in the timeline, describing at what time he received the call and how long it took before he was picked up.

When they arrive at the location he writes a new note with their time of arrival. He steps out of the car and takes a picture of how the car wreckages look from far away. He puts down his phone and talks to the coordinator at the location. They have already started getting the victims of the accident out of their cars. Carl is assigned the task

of assessing the extent of the injuries of the victims that have been extracted from the wreckage. He talks to the victims to find out what they can tell him about their injuries themselves while he checks for external signs of injuries. He asks if he can take some pictures of them, and they agree. He takes a couple of pictures and quickly dictates an audio recording with observations and summaries of what the victims could tell him. He notices that the timeline has started to be populated by a note and two pictures from another colleague too.

After the rescue operation is over, everyone returns to the headquarters to have a short meeting on how it went. They attach an Android phone to a projector so they can get the shared timeline for this rescue operation on the big screen. They discuss what happened in the different phases of the operation, and try to use the data in the timeline as supplements to the discussion. The discussion works like a reflection session, where everyone takes turns on contributing with their opinion on what went well, and what could have been done better. Unfortunately, Carl and Clara are the two only people who have contributed to the timeline with any data, because all the others either forgot or did not feel like there was time to take up their phone and input data as they worked. The session is characterized by people having difficulty with piecing together each other's stories and finding a common ground.

6.4 Analysis of Scenarios

In these three scenarios, the user is using Timeline in work related events, collecting data either in their own timeline, or sharing it with others. Although they all describe ways that Timeline can be useful, they also highlight some unfortunate aspects of the application. We will now analyze the scenarios with focus on these unfortunate aspects.

In the first scenario we follow the firefighter John. He is very organized in his use of Timeline, and inputs data to his timelines often and at regular intervals. However, he very rarely goes back to take a second look at his gathered data. He feels content just by having documented the most notable events during his days at work, and does not focus much on reflecting over past incidents.

While John is very good at data gathering, the rest of his squad is rather variable at this. Only about half of the firefighters added their data to the collaborative timeline with exercise- and card game-statistics. There could be two possible explanations to this: they think it is too cumbersome or too much hassle to input data, or they do not think reflecting on such events is worthwhile.

In the nurse's scenario, we can see that she uses the information added in the timeline as a reminder for things to talk about in meetings. This works well for her as long as she is thorough with inputting data during her workday. However, when she forgets to add an important piece of information to her timeline, she also forgets to report this information

at the meeting. This incident exposes one of Timeline's weaknesses, which is the attention it requires from the user that provides data. It can be time consuming to navigate to a timeline and then to press the button of the input type you want. In hectic situations like the one Jane was in, it is completely unrealistic that she will stop what she is doing to pull up her mobile device. To make matters worse, she would have to go through an interaction sequence that could require her to press eight or more buttons:

1. Turn on the screen of the mobile device.
2. Unlock the screen-lock (simple swipe, password, PIN, pattern).
3. Open the Timeline application.
4. Press "my private timelines".
5. Press the relevant timeline.
6. Press the desired type of input.
7. Provide the input. Adding mood requires one interaction, taking a picture requires two interactions (take picture, then confirm saving it to timeline), writing a note requires however many letters necessary to convey the message.

She might not have to do step three, four and five if she has already opened the right timeline earlier, and let the application run in the background. Still, it would require her to go through at least five interactions. Nobody has time for that if they are trying to save someone's life.

In the last scenario, Carl feels that the use of a collaborative timeline is very important for his work. Unfortunately, he is almost the only one who thinks so. Similar to scenario two, there are lives at stake in this rescue scenario too. Much of the same can be said about the inconvenience of gathering data, but the difference in this scenario is that they have summoned a high number of rescue personnel to the location of the accident, so they know they will have enough manpower in such an unpredictable situation. There is a high probability that multiple rescue personnel will be mostly observing, consulting and giving advice and performing lighter tasks than lifesaving. It would be very valuable for the team if they took some time to document the scene in Timeline for reflective learning purposes, but in this scenario there were only two people who did this. The rest of the less busy personnel might have forgotten about Timeline, or thought that it would suffice with what other people added to the timeline.

After analyzing the scenarios, we can identify the problem areas in two main ways, each with two subproblems:

- Users do not conduct reflection sessions upon the data which have been collected.
  - Users are not interested in reflecting upon the collected data.
  - Users are not *triggered* by Timeline to start a reflection session.

- Users do not collect the data which are necessary for a reflection session.
  - Users avoid collecting data because they do not want to.
  - Users forget to collect data. It does not come to mind when they experience something they should record in Timeline.
  - Users cannot collect data because they are too busy with their work. They have no free hands for the task.

6.5 Gamification's Impact on Problems in Timeline

The previous section analyzed three scenarios, and pointed out five problem areas of Timeline that hinder the users from using the application as it is intended. In this section we will discuss which ones have potential for improvements, and how we think gamification can contribute to solving these problems.

- *Users are not interested in reflecting upon the collected data.*
  If the users are not interested in reflecting in the first place, it is going to be very hard, if not impossible, to change their minds with gamification. With the use of very engaging game elements we *might* be able to lure them into playing with the application, but it is very unlikely that they will get to the point where they actually reflect. One could argue that users who are not interested in reflecting should not be using Timeline anyway, and we will not be addressing this problem any further.
- *Users are not triggered by Timeline to start a reflection session.*
  The user collects all the data he needs, but never gets to the point where he actually reflects on it. This might be improved by doing something similar to the Nike+ FuleBand's progress bar, which we discussed in section5.2 of the state if the art. Such a progress bar in Timeline could serve as a reminder for the user to reflect every time it is filled. Other helpful features could be to have a dialog in the application where the user is asked to summarize their day, or sending automatic notifications to their phone which reminds them to reflect.
- *Users avoid collecting data because they do not want to.*
  There can be several different reasons to why a user would not want to input data, like he or she finds it too cumbersome, too boring or too time consuming. They might find it hard to motivate themselves for doing something that does not pay off until they take some time to reflect on it at a later stage. It could also be directly related to the first problem, that the user is not interested in reflection, and therefore has no use for the data. The latter case is not very interesting to us, as previously discussed.

We think that this problem could be vastly improved by rewarding input using game elements like achievements, badges, points and content unlocking, which we introduced in section 2.2. This would give the user an extrinsic motivation to collect data. Instead of thinking "oh no, another incident that I should document in Timeline", we want the user to think something like "yes, this picture takes me one step closer to that big achievement". Additionally, unlocking such a reward will give the user instant feedback, which feels good. For every piece of data collected without gamification, it will not bear any fruit until a reflection session is completed. It is motivating for the user to feel that he progresses towards another achievement or badge for every data he collects.

- *Users forget to collect data. It does not come to mind when they experience something they should record in Timeline.*
  This is also problem where we can see gamification have a big impact. Like with the previous problem, achievements, badges, points and content unlocking should have a desirable effect on the user. By motivating the users with rewards for collecting data, we could change their state of mind to go actively looking for something to input to their timeline, so that they can get a new badge or achievement. After a while, data collection with Timeline will become a habit that they do not forget so easily.

- *Users cannot collect data because they are too busy with their work. They have no free hands for the task.*
  This is first and foremost a problem that is solved by employing hardware sensors, and not by implementing gamification. It would be helpful to track the movement of the user like Jawbone UP and FuelBand+ do, so for instance a firefighter can use his timeline to see at what time his movement was most intense. Such information can help him recall and revisit his experience for reflecting on it. Tracking the user's heart rate can be helpful in the same way. Other ways to ease input could be with a microphone attached to a jacket, or a device attached to the user's body or clothes with buttons or sensors for registering mood.

  These solutions are not the same as gamifying Timeline, but the data from tracking movement could be used for gamification. Distance covered could be combined with number of input added to give achievements like "Quick feet! You have traveled 500 meters in less than a minute since the last time you recorded something!".

In the next chapter we will go into more detail about how gamification can contribute to solving the problems in Timeline, through the use of explicit game elements from section 2.2.

7 Promotion of Reflection through Gamification

Contents

In this section, we will look closer at how to promote reflection through the use of gamification. We have already briefly looked into gamification and reflection one by one, and this is where we look at how well they combine.

7.1 How Gamification Can Help

Gamification is a tool that can be used to increase the motivation for doing a certain task or activity. Therefore, when we say that we want to promote reflection through gamification, we mean that we plan to increase the Timeline users' motivation to reflect. But how?

As we have mentioned in section 2.2 there are many different game elements that can be utilized when implementing gamification. We will discuss which of these elements that are most suitable for what we want to achieve, while also keeping in mind the psychological perspectives on motivation which we introduced in section 2.3.

As gamers ourselves we have tested our share of different game elements, and seen many of them utilized by game designers for better or for worse. Coincidentally, we personally both find that, out of all the game elements, competition and progression motivates the two of us the most. However, we realize that this will not be the case for every person, and we will strive to leave all sorts of bias out of our design process.

From motivational psychology, we can conclude that intrinsic motivation is the best thing you can do in gamification. It is what you always want to achieve, but it is not easy to induce. Extrinsic motivation, on the other hand, is easier. Giving the user rewards for his efforts is a game element that gives the user immediate positive response, which increases motivation.[14]

There is another effect that can come from gamification. Some people will react well to receiving rewards. By rewarding people, the action they completed will subconsciously be noted as an action that yields a reward. These rewards can become obsessive for the user, because the brain releases dopamine in response to rewards that appeal to us. Since

the release of dopamine feels good, it gives us a learning process where the action or happening is connected to the release of dopamine. This makes us want to do it again, and therefore makes us more likely to get addicted to activities that release dopamine. Thus, the user can make a habit of using it. We could utilize this in the gamification of Timeline, where an example could be to implement achievements that require a user to add a note every day for a week, and then a month. This could help the user to make a habit of reflecting. [1]

Through gamifying Timeline, we hope to enhance the process of reflection. There are three subprocesses; gathering data, initiation of reflection and the process of reflecting. With gamification we will try to add to the motivation of the user, in regard to both collection of data and the act of reflecting.

On this basis, we decided to look closer into a set of game elements. These elements will be presented with explanations and suggestions of use in the following section.

7.2 Which Gamification Elements to Implement and Why

How do we best gamify an application like Timeline? It depends on what we want to achieve by gamifying it. We are not trying to make it more profitable or increase its user database. We want to give the users a stronger incentive to use the application for its intended purpose, which is reflecting on work related incidents. We want to engage the users and motivate them to try and learn from their own experiences. Can we find gamification elements that are more suited for this purpose than others? The list in the section 2.2 is an overview of some gamification components that are available to us.

Let us take a closer look at these tools and analyze how we can utilize each of them.

Points and levels are a well tested and well received way of representing progression in games. The later years, it has started to be more and more included into other types of applications as well. These elements were something we wanted to include from early on, as this is something that is well incorporated into many peoples daily activities for recreation. In all its simplicity, we want points to be received through the input of data. These points then are used to calculate the users level. Points and levels would give us a way to make the user have a feeling of progression as he or she uses Timeline. By giving the user bonus points for input of data multiple consecutive days, or for varying their type of input, we can stimulate the user's motivation to collect data even further. Points and levels can also be used as a basis for content unlocking.

Content unlocking can also be used to give the user a sense of progression. In addition, it can be used to personalize or improve a player's character or avatar. Content unlocking can therefore be used as a kind of reward or payment, either for tasks performed, points

redeemed or achievements acquired. There are more uses of this game element which we have not added here. Examples can be unlocking new areas or abilities. Such use of content unlocking would in this case not be of interest though, and we leave them out. [16] We would like to use this element in connection with the users avatar or profile picture.

Achievements are a motivating tool that is used in a lot of games and applications. The "sense of accomplishment" you get through unlocking achievements is a form of intrinsic motivation. For Timeline, this could be utilized to get the user to explore the application, get to know it, as well as make it a habit of performing certain tasks.

We want to implement achievements as a reward for performing certain tasks, or a set of tasks. Examples of such in the case of Timeline could be:

- Creating your first note (also for other data types)
- Creation of the tenth note (also for other data types)
- Found profile
- Have created one of each data type
- Have earned a new level

Profiles have started to flourish, both in games, game platforms and social networks. Examples of these can be, Heroes of Newerth (game), Xbox (user profile with avatar), and Facebook. In all these applications, it is used to show the progression, either through levels, avatars or statuses.

The profile is quite important to be able show points, levels and such information in a structured and intuitive way. Profiles can also be motivating in itself, as personalizing avatars increases pleasure of use. [15]

For Timeline, the profile will be the the place where points and levels are shown. In addition to showing points and levels, we plan to have user name, profile picture or avatar, and number of achievements.

A leaderboard is something that can bring out our competitive side, showing how we are doing compared to our friends, or other players. Therefore, we want to use this to create an extra incentive to add data.

Progress bar is a well known example of progress indicators, both from games and other applications. Typical examples is process progression, file tarnsfer, or in case of games, health bars or the remaining time for completion of buildings or tasks. In Timeline, we want to use the progress bar to show the level progression.

Boss fights represent difficult obstacles in a game. In a case like this, it seems to be quite counter productive for the most part. The elements that we can turn into obstacles

are either input of elements, or the acquisition of achievements and points. The only part of this we can see a use for is to make some achievements harder to get.

Combat can in this setting be the competition between users or groups of users. This is partly integrated in the leaderboard functionality. Also duels could be an idea that could go under this category.

Badges serve as a reward, and is in that sense very similar to achievements. Instead of text, these are rewards in form of illustrations, often depicting something relevant to the performed task or action. Since badges and achievements are so similar, we will not prioritize both badges and achievements.

Reputation acts as a currency earned through recognition for good reflections, providing the user with an incentive to provide quality reflections. This is inspired of the gold, silver and bronze badges- and reputation system, that are used at stack overflow to show experience, difficulty of answered problems, willingness to help and if the help has been useful.

Quests could in Timeline be used as a connection between the profile and achievements. With the achievements screen showing both the achievements done and undone, this seems to be a lot of work for little gain.

Chance Gambling in different forms have been quite popular throughout time. Poker, casinos, betting on football matches and other such chance games rely on the good feeling, and money prize pool, the user gets when luck runs his way. For gamification, chance can also be used to create something of the same feeling. There could be an algorithm that makes the points received vary, or maybe the user has a 1 percent chance of getting 4 times the points. It could also be used to rewards achievements or badges, like "You just got lucky!".

Storyline Storyline is in many games used to get the user interested and emotionally engaged. [30] This is usually for games where the player follow a certain character or set of characters. As this has no, or little, use in an application as Timeline, it is not further discussed.

Social Extension makes it possible to connect with social media, connecting friends and enabling posting of information. We want to make Timeline's users be able to forward information to social media, for example Facebook and Twitter.

Teams can in this setting the group of people sharing a timeline. These could then cooperate with input, reflections and opinions.

Virtual goods have little use in an application like Timeline, if the users do not have avatars they can personalize. In Timeline, such goods could be avatar clothes, equipment and trinkets. To distribute such, a shop could be used.

Avatars can be used to represent the player, and also show progression. An example

could be a fire fighter, whom can buy equipment, starting with a fire blanket, going up through the different equipment, ending up with a fire truck and modern fire fighter clothes.

We want to give the user the ability to make his, or her, own avatar. As stated earlier, this gives the user a more pleasurable experience. An avatar should preferably have the ability to be customizable, both in regard of look and clothing.

Feedback is an important aspect of computer games. Bringing this into the application, in regard to the gamification aspects that are to be implemented will help to motivate the user as he, or she, can see the immediate effect of performed actions. An example here could be "You just added a note. You received 10 points!".

Resource acquisition in our case would be the points. In addition to be used in the calculation of levels, these points could be used to by buy items, new looks and such for the avatar.

Transactions between users in Timeline is a little tricky. As the users do not have items, or other such stuff, which are in normal games, there has to be other product the users could sell and buy. Here, it could be reflections, but that is quite counter productive, as this is an application to motivate and help people to reflect. Could make it to share reflections to friends, and that reflections outside by users which are not your friends could be bought.

Another problem here would be currency. Would be unwise to use points, as these are used to define the users level and giving points to another user would then make his, or hers, level increase. Using reputation would be bad as well, as this is something that should be earned, not traded.

Win states in an application like Timeline does not make much sense. As the goal of timeline is to motivate, help and scaffold the user to reflect over past events, it would be counter productive to give the user a sense of "Now I have done everything in this application. I am done with it now." As a win state is something that can be achieved, this is somethhing that should be kept out of Timeline.

Cooperation is something that is integrated into our daily activities. Work, sports, like football, and recreational activities, like computer games, board games, card games or just a walk in the park. Shareable timelines are a for of cooperation, and this could also be integrated into duels.

Competition is something that permeates our daily lives, just like cooperation. From the beginning of time, there has been competition. Survival of the fittest, corporations warring for monopoly and the fight for status. Competition in Timeline can come through leaderboard and duels.

7.3 Chosen Game Elements

After looking into all these different elements of gamification, we decided that we would continue with just a subset. We took the ones we believed could best motivate the users, while simultaneously be integrated with the rest of the application in a good way. This subset is presented below.

- Achievements.
  The users receive achievements for completing tasks like creating their first note. There will also be achievements for adding their first item of the other data types. To continuously motivate through achievements, data element number ten for all types will also reward the user with an achievement. Other examples of utilization possible for Timeline is an achievement for being active the whole week or reaching a certain level.
- Avatar.
  The avatar is the graphical representation of the user, giving a recognizable visual to the profile. It should increase the user's general use of the application.
- Avatar items.
  Items can be bought, or received as a reward, and used to personalize the avatar and make it unique. User's will experience an increased feeling of ownership and control.
- Badges.
  Badges are graphical objects or diplomas used to reward acts or tasks performed. They could be used to reward the same type of behavior as we mentioned for achievements.
- Bonus points for consecutive and varying input.
  Consecutive creation of reflection notes will reward the user with additional points. Varying the use of the other input types will also reward the user with extra points.
- Duel / challenge.
  Being able to challenge friends can motivate people to add more data and reflection notes. Depends on what the focus of the duel is.
- Leaderboards.
  Leaderboards adds another competitive element to the application. Through adding data elements, the user gains points which are used to climb the leaderboard. This will appeal to some users' competitive instincts and motivate them to collect more data.
- Points and levels.
  Through adding data elements the player receives points, which are used to calculate

the user's level. Levels can unlock new items, which will drive the user to always look for data he can collect to rise in level.

- Progress bar.
  The progress bar shows the players progression towards the next level, and confirms to the user that his actions are making a difference.
- Reputation.
  We will implement a new type of input: the reflection note. The reflection note will be a normal note, but with a set of predefined questions that the user has to answer. These questions will try to trigger a reflection session for the user, and will be formulated like "please sum up your day", "what did you learn today?" and "what could you have done better?". Through the user's reflection notes being rated by others, the player gains reputation. Reputation can unlock new items, and gives a social status among Timeline's users.

These elements will be prioritized for implementation in section 8.3.

7.4 Integration of Gamification and the CSRL Tool

Researchers have come up with tools for use in the different phases of reflection. We will now see how the application, and our planned gamification, supports the different phases of the CSRL model. The *initiate reflection* stage is in general motivated through the application's integration of reputation points, while the *conduct reflection session* stage is motivated by the possibility to receive reputation points from other users. *Plan and do work* is supported by the enhancement in motivation to collect data which comes from achievements, points, levels and leaderboards. *Apply outcome* is not very well supported in our solutions. Quoted from Krogstie et al., the following tools applied in their stage can: [22]

Plan and do work

1.3 *collect data that can later be used for reconstructing work experiences*
Collection of data is supported by gamification through achievements, points, levels and leaderboard.

1.5 *by providing scaffolding, e.g. guiding the steps or making the user(s) aware of relevant tool features*
The tutorial will provide information about the application and its use.

Initiate reflection

2.1 *set the objective for reflection*
The reflection note contains questions helping the user to reflect.

2.1 *involve others in reflection*
Through shared timelines and notes other users can come with their thoughts. Motivated through reputation points.

2.3 *plan/organize the reflection session (i.e. create the reflection frame)*
The questions in the reflection note structures the reflection session.

2.4 *by providing scaffolding, e.g. guiding the steps or making the user(s) aware of relevant tool features*
The tutorial will provide information about the application and its use.

Conduct reflection session

3.1 *recall/reconstruct work experiences*
Information gathered in Timeline will help the user recall or reconstruct the experience.

3.4 *share work experiences with others*
Shareable timelines and objects makes it possible to share experiences. This is motivated by the possible recognition from other users, in form of reputation points.

3.5 *re-evaluate work experiences*
Re-evaluation of experiences is done when answering the reflection note questions.

3.7 *collect data about the reflection session (e.g arguments, decisions)*
Collected in the answers of the reflection note. Information about the session itself can be added using other data types.

3.8 *capture the reflection outcome*
The reflection note is saved in a timeline.

Apply outcome

4.2 *decide what will be the actual change to work*
Through questions in the reflection note, we support user in reflecting on how to change work.

Part IV The Process of Gamifying Timeline

8 Preliminary Work for Iterations

Contents

In the following sections we will first look into what work method we are using, then how we gamifiy timeline.

8.1 Work Method

Choosing a work method that fits the plan is important. At the start of the project period we planned that we would run two evaluations, one in April and one one in May. Thus, we came to the conclusion that an iterative work method would suit us best. Scrum was a familiar concept for us that has worked well for the both of us earlier. Designing our iterations as sprints came naturally, as each sprint would consist of first an implementation phase, then a test period and an evaluation of our implementation thus far.

8.1.1 Short Introduction to Scrum

Scrum is one of many agile development methods. Being an iterative and incremental way of working, it is built up by sprints. The sprints can vary in duration, normally between one week and one month. Each sprint should end with a functional prototype of the product, ready for testing. The overall model of scrum is visualized by the figure below.

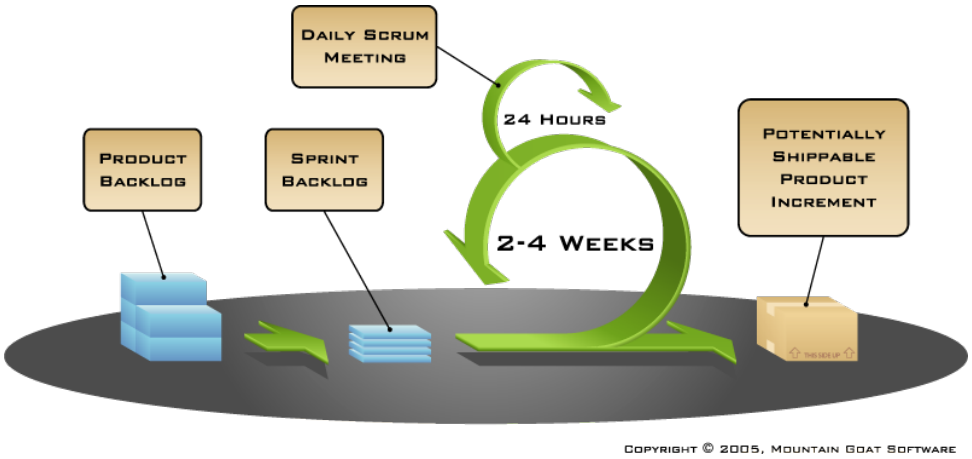


Figure 8.1: Scrum Model

Each day starts with a "daily stand-up meeting". As we are only two persons, we have taken the liberty of simplifying this meeting. We discuss what we want to accomplish during the day, things we find problematic and how to structure the day.

8.2 Gamification Software Development Kits

Before we started implementing our ideas into Timeline, we did some research on whether there already existed relevant frameworks or libraries that we could integrate in our solution. Gamification has had explosive growth the last years, and it has proven to have certain components that tend to recur in a lot of gamified solutions. Achievements, badges, avatars and leaderboards are some of these. We were looking for something that could provide easily implementable game elements like these, which could reduce the amount of time we would have to spend on reinventing the wheel, so to speak. In the following sections we will quickly introduce the different gamification Software Development Kits (SDK) we found the most promising, and why we chose the one we did.

8.2.1 Skiller

Skiller was the first solution we looked into. It is free of charge, and describes itself as a mobile social gaming platform. Through their websites we learned that it is available for both Android and Windows Phone, making it a good fit for us, as Timeline is an Android application. [19]

- Leaderboards
- Achievements

- Multiplayer
- Challenges
- Monetization
- Social Features

We downloaded it and made a test-implementation with Skiller integrated. Our first impression of the Skiller user interface was immediately that it was *too playful*, or maybe even too "childish". It seemed to be designed for integration with actual games, not for integration with more formal applications like Timeline. Our goal is not to turn Timeline *into* a game, just to gamify it. We want to implement certain game elements that increase users motivation to use Timeline the way it is, not to alter the Timeline user experience into a game experience. It gave us a feeling that Skiller might not be suitable for our purposes.

8.2.2 Badgeville

Badgeville is a very promising gamification platform that seem to have it all. [20] It is very business oriented, and designed to be used by companies. Therefore, it also costs money to use. Badgeville includes:

- Points and levels
- Achievements
- Missions
- Leaderboard
- Multiplayer
- Monetization
- Social Features

Is interesting as it would have been to see what we could have accomplished with Badgeville, it was not an option for us to spend our money on an SDK. There were still other options which we could explore.

8.2.3 Beintoo

Beintoo is another free of charge platform that we considered. However, it described itself as a mobile engagement tool rather than a gamification tool. [21] They have a lot of focus on monetization, meaning that the developer can earn money through their framework

from having a lot of users. This is not interesting to us at all. The following is a list of what they could offer:

- Monetization
- Achievements
- Contests

The gamification Beintoo offers seemed a little thin, and did not include much more than achievements. One of their business strategies is that the user is rewarded with coupons for completing achievements, which can give them offers like 10% off on a new laptop or on a clothes line etcetera. This is not something we want in Timeline at all, and it seemed like Beintoo included a little too much advertisement. The "contests" they advertise with were vaguely described, and seemed to also involve coupons.

8.2.4 Swarm

Swarm was the third free of charge SDK we found that is compatible with Android. [18] Screenshots and demonstrations gave us a good impression of its user interface, which seemed to be a little more formal than Skiller. This is an SDK that incorporates the following gamification elements:

- Leaderboards
- Achievements
- Monetization
- Friends list
- Messages

Except for monetization, these are all game elements that we would like to have in Timeline. Leaderboards and achievements are both among our prioritized game elements, and friends lists and messaging gives Timeline a social dimension that could help engaging the users more. After downloading and implementing a test-version of Timeline with Swarm, we could tell that it was well documented and easy to integrate.

(a) Skiller user interface (b) Swarm user interface

Figure 8.2: Skiller and Swarm UIs. Swarm is more mature and pure in style.

8.2.5 Choosing an SDK

After checking out the different SDKs, we chose not to use the Bagdeville platform as that meant we had to pay for it. We then tested Skiller and Swarm, as Beintoo had less to offer, and too much advertisement. After testing, we decided to go with Swarm. Out of the gamification elements which we had decided on in our design phase, Swarm and Skiller both offered four of the game elements we wanted to integrate into Timeline. The main difference between the two SDKs is that Skiller has the ability to integrate multiplayer and challenges. The multiplayer aspect does not really apply to Timeline, as you are never *playing*. Challenges, however, could have been very interesting for the duels we wanted to implement. We found Swarm to have a little easier implementation and integration, compared to the Skiller. Swarm could also offer better documentation of its SDK. In addition, the look and feel of Swarm is not as childish as it is in Skiller. In the end we decided that we would rather have the good documentation and the good looks of Swarm, even though it meant that we had to implement the game element of duels from scratch.

8.3 Feasibility of Implementing Game Elements

In section 7.3 we listed the game elements which we plan to implement in Timeline. We decided to put the elements into a table where we could prioritize them and analyze how feasible they were. The different elements were discussed relative to the categories in bold below. We gave scores from 1 to 10, the higher the number, the more feasible.

Difficulty is the category where we try to asses how hard it would be to implement the element in a way that would work well in Timeline. Low scores means that it is hard to implement, while high scores means it is not so hard.

Time is our assessment of how long it would take to implement the element. High scores means that we think it will take little time, while a low score means much time.

Effect is the assessment of how much motivation a certain element can arouse, how effective it would be in regard to gamifying. Low score means little increase in motivation.

Generality is where we try to assess if there are specific user groups that will be motivated by this element, or if the element is motivating for everyone. Low score means it is motivating only for a more specific user group.

Name	Difficulty	Time	Effect	Generality	Sum
Achievements	8	8	5	8	29
Avatar	2	2	8	5	17
Avatar items	4	3	7	4	18
Badges	5	4	7	8	24
Bonus points for consecutive and varying input	8	8	6	7	29
Duel / challenge	6	4	8	5	23
Leaderboard	8	8	4	7	27
Points and levels	8	7	6	6	27
Progress bar	8	7	5	8	28
Reputation	8	6	8	7	29

Badges and achievements are very similar, the only differences being that achievements are represented with texts, and badges are represented with graphics. Since they both appeal to the user in the same way, we decided that we will only implement and test one of them. We chose the one that received the highest score in the priority-table.

The bonus points received a high score, and will be one of the first things we implement. It is, though, dependent on having a points-system in the first place. Therefore we will prioritize points and levels over leaderboards, which have the same sum.

To make the user's level visible to him, we will implement a personal profile. The profile will contain the user's number of points, his level, a progress bar that illustrates how

many points he needs to reach the next level, and his avatar.

Avatars and avatar items received the two lowest scores, mostly because we have rated them as harder and more time consuming than the other elements. It would be complicated to make graphical avatars that can be customized with unlockable avatar items like pieces of clothing, hairdos, glasses, guitars and so on. If Swarm had supported making avatars, this would not have been a problem, but unfortunately it does not. Therefore, they ended up being the least prioritized set of elements in our implementation.

The next chapter describes our first sprint and how we implement the first game elements.

9 Sprint 1

Contents

9.1 Introduction to Sprint 1

After the preliminary study and the design phase, we had a good idea of what we wanted to implement. For this first sprint, we wanted to get the Swarm SDK integrated into the application, so that we could get the friends list, messaging, leaderboard and achievements up and going. In addition to introducing gamification, we had to update Timeline's source code and make the application work as it did two years ago.

After the implementation phase, we went to Italy to have an evaluation of our implementations. We had to prepare for the evaluation and the trip, which included making a questionnaire, tutorial, prepare test phones and wiggle through NTNU's travel system to get clearance for the trip.

In the coming sections, we will look into the implementation, the preparation of our evaluation and its results.

9.2 Implementation in Sprint 1

This is a short summary of the programmatic implementations we did in sprint 1. We will not be focusing on the technical details of the programming. The purpose of this section is to give the reader an overview of the gamification elements we implemented into Timeline.

The first thing we had to do was solving some issues with the source code we had received, and make Timeline work like it did two years ago. The main difficulty here was getting

the application to share with other users. Timeline was using a GAE server, as described in chapter 4. The problem we encountered with the server was that the Master/Slave Datastore, which was used in the original Timeline implementation, had been deprecated. [31] We spent several weeks trying to update the source code and convert to their new High-Replication Datastore, but in the end we had to concede that it was taking too much time, and we had to start implementing our gamification. We had limited time left before we were going to Italy, and we had to prioritize gamification over collaborative timelines.

To make up for the fact that Timeline would no longer have the collaborative element, we implemented support for sharing notes to other applications on your phone. This means that users could write a note and then press a share-button, which would bring up a menu similar to the one in figure 9.1. From this menu the user can choose an application like Twitter or Facebook and share their note.

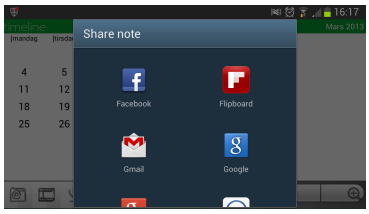


Figure 9.1: Sharing a note to other applications.

Unrelated to gamification, we implemented a new type of input the user could add. We called it a "reflection note". This works the same way as a regular note, only in the reflection note there is a set of questions which the user has to answer. These questions are designed to make the user reflect over his day, and can be seen in figure 9.2

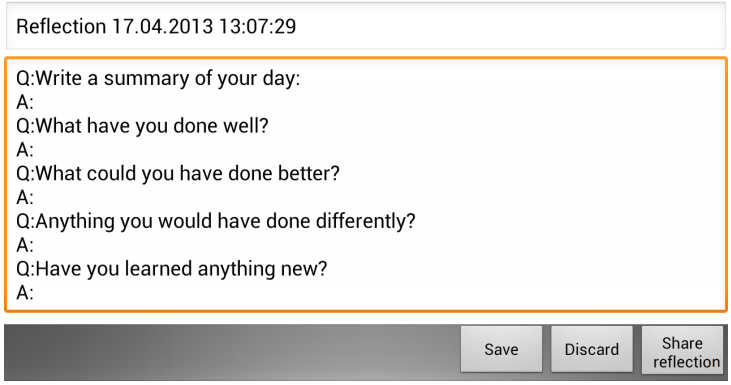
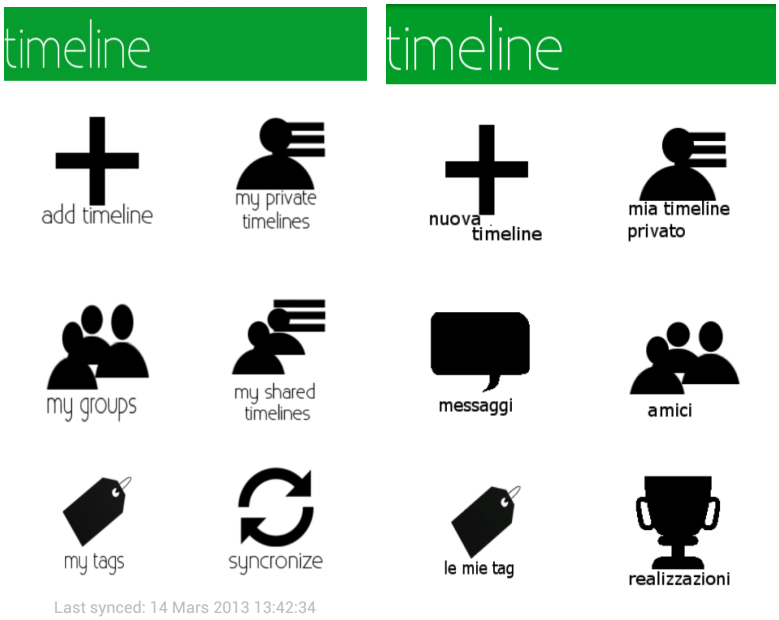


Figure 9.2: Adding a new reflection note.

In this sprint we tested the Skiller and Swarm SDKs, introduced in section 8.2. After testing and evaluating them, we chose to integrate Swarm into the application. We then tested how basic functions like achievements and messages could best be integrated into

the application. Subsequently, we implemented achievements, friends and messages from Swarm into the dashboard activity. We also had to redesign the menus of Timeline, as we removed three of the features of the original Timeline, namely shareable timelines, groups and synchronize. They were replaced with friends, messages and achievements.

During the implementation period we also translated the Timeline application to Italian, so that a phone with Italian language settings would also present the application in Italian.



(a) Old Timeline (b) New and Italian Timeline

Figure 9.3: Old Timeline and new Timeline.

9.3 Evaluation in Italy

Midways through the semester we got a great opportunity to attend an event in Italy where we would be able to test the Timeline application on volunteer emergency personnel. We traveled to Italy at the 4th of April with our assistant supervisor, PhD candidate Simone Mora. In this section we will describe our evaluation trip to Italy and the answers we got.

9.3.1 Preparation for the Trip

In preparation of the trip we made a set of questionnaires, task lists and user guides. The questionnaires were based on a MIRROR evaluation toolbox. Since the Italian people are traditionally not fluent in English we had all the documents translated to Italian

by Simone Mora. He also helped us translate the Timeline application to Italian. We installed the application on four Android smart phones and configured them to Italian. These were the phones that we would hand out to our testers so they would not need to have Android smart phones of their own.

The task list consisted of a set of tasks that we wanted our test subjects to complete with the use of Timeline. Each tester got a user guide that was supposed to help them if they got stuck or could not figure out how to complete a task. The questionnaires were for our test group, or testers, to fill out after having tried our application. All three of the aforementioned documents can be found in the appendices.

9.3.2 Description of Trip

The event was called *CoorCuneoSafety2013* and was located in northern Italy. There would be arranged simulations of disasters like floods, earthquakes and car crashes. This event was a training exercise for volunteer emergency personnel. There was one disaster for each of the three days we were there.

Event Schedule

Friday	Saturday	Sunday
Flood simulation	Flood simulation	Car crash simulation
19-23	08-12	08-12

The events were coordinated from a headquarters by radio communication. The field groups carried a walkie talkie each. For the first two days we stayed at the headquarters instead of going out in the field. We had decided that it would be better to introduce test subjects to the application in a relaxed environment than to have them learn everything about Timeline while moving around and searching for victims of the disaster. Add to this the fact that we would be unable to instruct them and help them vocally since we do not speak Italian.

Figure 9.4: Inside of the headquarters

Our supervisor Simone Mora had made arrangements with a person named Michele to be our translator. Michele is a native Italian who spoke fluently English, and was hired from an Italian business that develops systems for emergency workers. Consequently Michele was very competent with technical solutions and was able to explain our situation very well to emergency workers and ask them if they would like to test our application. Unfortunately Michele fell ill after the first day of simulation and was unable to assist us the last two days. Without Michele we were unable to convey to the volunteer emergency workers that we wanted them to test and evaluate our application. Thus, the questionnaires that we got back from our testers were all filled out the first day.

9.3.3 Features of Timeline

This section describes the state in which Timeline was when we were at the CoorCuneoSafety2013. When the Timeline application was opened there were six main features that the user could choose:

Figure 9.5: The dashboard screen of Timeline in Italy

- New Timeline
  Identical to the original Timeline application except that we had removed the option

to share your Timeline.

- My Timelines
  Identical to the original Timeline application. After choosing a Timeline, the user is taken to the Timeline screen where we had made some changes. We had added a new button for adding a reflection note to the Timeline. This is similar to a normal note, but it comes with a set of questions that are supposed to trigger reflection for the user.
- Messages
  Brings up a list with all conversations the user has had with his friends.
- Friends
  Brings up a list with all the user's friends. Shows how many achievement points your friends have.
- Tags
  Identical to the original Timeline application.
- Achievements
  Brings up a list of all available achievements, and shows which achievements the user has unlocked and not unlocked.

9.3.4 Questionnaire and Results

In this section we will look closer into the questionnaire and the answers we got from the testers of Timeline.

Questionnaire

The questionnaire consisted of 32 multiple choice questions, and was based on a template for application evaluation made by MIRROR. It can be read in full detail in appendix A. All the questions had seven possible answers, ranging from strongly disagree, through neutral, to strongly agree. The questions were categorized in five different groups:

- Application
  This group of questions focused on the effect of the application, in the sense that it could help to reconstruct events and reflect.
- Learning Outcomes
  As the name suggests, these questions focused on the learning experience of Timeline.
- Work Behavior
  This question focused on the work improvement gotten through the use of Timeline.

- Usefulness/Satisfaction
  This group of questions are to rate the satisfaction and usefulness for training purpose.
- General App Effects
  These questions were to see if the user found the use of Timeline to be productive in ways the questionnaire had not yet asked for. In addition, there were questions about the gathering of data and the effect on the user.

Of these 32 questions, eight were created by ourselves, meaning there were only eight questions about the gamification part of Timeline. In hindsight we wish we had added more questions, but at the same time we think it would have been of limited use when asked to the user group that evaluated our application. We will get back to this point in section 9.3.5 about the testers and the context.

Results

The questionnaire with results can be found in appendix A.

Due to the unfortunate sickness of our translator, Michele, we only managed to get five test subjects to test and evaluate the application. Consequently we only have five filled out questionnaires to go off. While this hardly is enough for the statistics to have conclusive significance, we can still look at the most interesting tendencies and analyze them.

What we know about our testers is that there were four male and one female person. It would have been useful to also know their age and occupation, but we forgot to include fields for such information in the questionnaires. However we know from observation that four of the testers looked to be at least 35 years old, while one was in his early twenties. Below are the questions which we are the most relevant to our research. The rest of the questions can be found in appendix A.

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
CA42	Timeline motivated me to collect information relevant to reconstructing experiences from work.					1	3	1
CA43	Timeline helped me shape a mental overview of incidents that happened at work.				1		4	
CA44	Timeline distracted me from work with its achievements.		1		2	1		1
CL3	The data I collected helped me learn more than I would have learned otherwise.				1	2	2	
CL4	I became more aware of work related details.					2	3	
GAE04	Timeline helped me to find motivation for reflecting.					3	2	
GAE21	Data gathering with Timeline was fun.						2	3
GAE23	Data gathering with Timeline was motivating.						3	2

In hindsight we feel like we did not really ask the right questions to our testers. At the time we felt like it would be valuable for evaluating the gamification to ask questions like "data gathering was fun", "data gathering was motivating", and "Timeline helped me to find motivation for reflecting", but when we sat down to analyze the results we realized that the questions were too vague and too loosely connected to the gamification to really help us. But this is not to say that we got *nothing* from them.

The testers answered very similarly on all but question CA44, where the answers ranged from disagree to strongly agree. Two testers felt that the achievements in Timeline distracted them from work, one of them even strongly so, while two others remained neutral towards the question. Only one user thought the achievements were not distracting. Thus we can say that there was an overweight of users who thought that achievements in a work related application was not good. Of course, with only five testers, we would just need one more tester who had answered the question with "strongly disagree" and there would be a slight overweight for the other side of the argument. Therefore we are cautious to draw conclusions from the answers to this question, though it should be noted that the one tester who did not think that the achievements were distracting was the person in his early twenties. This could mean that achievements have a stronger appeal to younger people, or it could mean that *our* achievements appeal more to younger people. We will evaluate our achievements and consider whether we could design them for user groups of different age.

Other than that the answers were largely clustered around the same alternatives. Ques-

tions CA42, GAE04 and GAE23 are all about whether using Timeline gave them motivation, to which all the testers agree. Our intention with asking these questions was to evaluate if the gamification in Timeline had a motivating effect, but looking at them now they do not really give us a very good feedback on this. It would be a stretch to interpret them as positivity towards the gamification in the application. They do, though, tell us that the testers thought that *the Timeline application* was motivating to use for gathering data and reflecting.

9.3.5 Field Observations

The people that volunteered to test the application were Italian emergency volunteers, coming from the vicinity of Cuneo. They were all attending the training event. The testing of Timeline was performed at the head quarters. They each received a user guide, a list of tasks to complete and an Android phone with the application already installed. Michele then gave them a short introduction to the application and got them started.

An immediate drawback with the test situation that we noticed right away, was that the testers were eager to get out in the field and learn about the practicalities of rescuing injured people. Most of them were not very enthusiastic about staying indoors and fooling around with smart phones. When they received the test devices they seemed confused with using smart phones, and our translator Michele explained to us that they were quite inexperienced with Android devices.

Figure 9.6: Three of our test subjects in the foreground, Michele in the background

One of the problems we encountered was that when the testers flipped the phone to horizontal view, they had a tendency to inadvertently pressing the native back-button of Android phones with their thumbs. This seemed to happen quite often for several of the testers, and our translator again explained that it seemed to be a case of them not being used to Android smart phones. One possible explanation for this could be that the Italian people are much more used to iPhone than Android phones, since iPhones do not have the same native back-button that Android devices have. It certainly seemed that there were more emergency workers with iPhones than Androids, which we barely saw.

Four of the five testers were in their thirties or forties, the last one was a student in his early twenties. The older testers did not use more than about 10 minutes in testing our application, and seemed to hurry through the testing so they could get on with it and start their field work. The student, on the other hand, fiddled with the application for about 1 hour, and seemed very intrigued with it. He actually knew some English, and when we spoke with him he talked about how he could see a use for our application in a lot of other scenarios than emergency situations. Even just in his daily life he said he could see himself using Timeline to write down ideas and thoughts as he goes through the day.

As a comment to the context in which we got to test Timeline at this emergency simulation event, we feel that we might not have communicated to the testers which context Timeline is supposed to be used in. Like the youngest tester suggested, Timeline is designed for

much more general use than just for emergency workers. Maybe the reason that most of the testers showed so little enthusiasm was that they did not understand how Timeline could be useful for them in an emergency situation.

We observed how the older testers struggled with figuring out how to use the Android device and our application. This was disappointing in regard to how easy-to-use we want Timeline to be. It seemed though that the testers were having a hard enough time with figuring out how to use the Android device in general. For instance one of the testers accidentally closed Timeline, and then opened up Android's clock application. She then came over to us and showed us the screen, seemingly confused about what had happened and how to proceed. It is then understandable that she would lose any motivation to try and learn how to use Timeline, when the learning curve is that steep. Therefore we do not feel like these observations necessarily mean that Timeline is hard to use.

Gamification of Timeline

The gamifications that we had added to Timeline at this point in time were the achievements, the friends system and messages between friends. The achievements are weighted with a number of achievement points that the user gains upon unlocking the achievement. Users can see the sum of their friends' achievement points in their friends list. This will engage some user's competitive instinct and drive them to unlock more achievements than their friends.

We had planned to have more gamification features implemented by this time, but we were unable to make them work in time for the trip. After all, testing what kind of impact gamification would have on the use of Timeline was the most interesting part of the evaluation for us. Therefore we wish we had implemented more different kinds of gamification to try them out.

It was disappointing then that the users did not seem to get past the barrier that was general use of the Timeline and the Android device. It felt like they never got comfortable enough with the navigation to explore and even notice that they could see each others achievement points in the friends list and chat with each other. The questionnaire answers indicated that they liked the gamification, but we still do not feel like we got a lot of good answers on the subject from our evaluation.

Usability Related Issues

Most of the testers struggled with using Timeline. Does that mean that Timeline has poor usability? Is it hard to use the application?

Timeline

The competence level needed to use the basic and normal functions of Timeline is low. The design is simple and minimalistic. All buttons are designed to illustrate the use, and many have describing text as well. In case anything was hard to understand though, we included a user guide that explained and illustrated the possibilities and performable actions listed in Timeline, so that they should be able to complete the task list.

Android

Android has over the years become a well known brand across the globe. With their phones and tablets, the usability and user interface has been tested and improved over several years, and is now quite intuitive for people who are used to computers, tablets and other smart phones. [4]

The Android phone used for testing was a HTC Desire HD.

Figure 9.7: HTC Desire HD

9.3.6 Implications for Design

This section discusses some of the problems with Timeline which we were aware of after the evaluation in Italy.

As this application does not have any other interaction possibilities than the screen of the phone, it is a problem for users that are in a hurry or need to have their hands free for use. I.e. volunteer rescue teams that are in a stressful situation. The application does not support adding information at an earlier point in time, only at current time. Geolocation data is automatically attached to any input the user provides. Consequently the value of the application comes down to how much data the user can submit in real time. It would probably be desirable to be able to add data to a specific date and time other than current time. This would also mean that the geolocation data should be possible to add manually to avoid completely losing its value. There are of course situations where the application's current gathering method is well suited. But for someone who is out doing *the hands on* work, it might not be very well suited.

9.3.7 Solutions

A possible solution to the problem described above is to automate, and ease, the gathering of data.

Data that can be gathered automatically:

- Location
  Location is already gathered when the user provides an input. In addition, the location could be gathered at a specific interval, or at other indications like increased heart rate. If the intervals between gathering are short enough it could provide the user with a graphic path of where he has been walking.
- Heart rate
  Heart rate can be gathered and displayed in a timeline, for instance in the background of the main timeline view. This would provide the user with an indication of when he or she was stressed, hurrying somewhere or doing something that was exhausting. This could trigger memories of past events that the person has not had time to add information about. It would make it easier to piece together the course of events and reflect over what actually happened as it triggers his memory to recall what happened at the time. Our supervisors have introduced us to Arduino, which is an open-source electronics prototyping platform, that we could use to enable Timeline to gather data about the user's heart rate. This data would be gathered continuously as time passes.

Data that can be gathered more easily:

- Mood
  Mood data gathering could also be simplified with the use of Arduino. In fact, our supervisors already have a project called WatchIT where they use an Arduino based bracelet with radio-frequency identification (RFID) sensors to register moods.
- Specified events that would be interesting (person found, etc)
  Same idea as described for moods would apply to registering interesting events.
- Audio / vocal notes
  For the audio / vocal notes it should also be possible to design a solution with Arduino. A microphone attacked to the user's jacket that activates by the push of a button would certainly ease the process of dictating vocal notes while moving around.

While these features all are suggestions we think would be valuable additions to Timeline, we would not have time to actually implement them in the time period of our Master's thesis. We do however hope our suggestions can be useful in eventual later works.

10 Sprint 2

Contents

10.1 Introduction to Sprint 2

In the first sprint we implemented friends, messaging and achievements into the application. For this sprint, we wanted to add points, levels, user profile and duels to the mix. In the end, we were planning to have a usability evaluation of the resulting application. Implementation and evaluation will be discussed later in this chapter.

10.2 New Scenario of Use

With what we learned during the evaluation in Sprint 1, we have came up with a new scenario of use. Except for one, all the emergency workers who tested and evaluated Timeline at CoorCuneoSafety2013 did not seem to like Timeline very much. The one who actually did like it, however, told us that he could see himself using it in his daily routines as a student. This is the basis we used for designing a scenario which demonstrates the further improvements we needed to make at the start of sprint 2.

10.2.1 The Student

James is working on a project for one of his classes in a group of four people. He sits down and logs onto the computer. While starting Eclipse, his integrated development environment (IDE), he opens his planning tool and defines the work packages that needs to be done. He then opens a project in Eclipse and starts working. While coding, he meets an obstacle. After a while he finds the answer to his problem on Stack Overflow. When the issue is fixed, he uploads the new version of the project to GitHub, which

is the version control system he uses. While uploading, he grabs his smart phone. He opens the Timeline application, and chooses the timeline that he uses for his project. He creates a note, describing the problem he encountered and its solution. When pressing save, Timeline shows him a message saying he got a new achievement for adding his tenth note. Smiling, he navigates to the achievements, scrolling down to check how many achievement-points he had received. Afterwards, he writes a message to his friends in Timeline, saying he just got 15 new achievement-points, and now has a total of 105. Then he returns to his work. Ten minutes later, a friend answers his message, saying "Congrats. But what is the use of those points anyway?" Unable to produce a good answer, James goes straight back to work. Throughout the work session, James adds data to his timeline. He adds notes about bugs he has found in, takes pictures to document ideas and drawings created on paper, and occasionally registers the mood he is in. Later, when he rides the bus home from the university, he takes up his phone to pass the time. He considers writing a reflection note with today's summary and new thoughts, but he quickly decides to play a game of Angry Birds instead, since he would not receive a new achievement for writing the reflection note anyway.

The next morning, the whole group has a "stand-up meeting", where all participants give a summary of their previous day, explaining what went well and what was hard. In addition, they describe what they are about to do, and all foreseen difficulties they might encounter. The group members are short in their answers, saying vague things like "It went OK..". James on the other hand, takes up his phone and opens his timeline with notes and pictures. He takes an extra look at all the items in his timeline to be sure he relays the correct information. When James is finished talking, one of the other group members says that he has the same problem as James had yesterday, and asks for a more detailed explanation. James opens his note describing the problem, and shows it to him.

10.2.2 Analysis of New Scenario

In accordance to earlier scenarios, this scenario shows the application in use in a work situation - a student project. We will now analyze the scenario with focus on the unfortunate aspects in regard to gamification.

In this scenario the user, James, is structured in his input of data, only adding data of relevance to his work. He thinks it is fun that he unlocks achievements for documenting his project, but he does not quite see the value in the points he receives from unlocking achievements. This is shown through the messaging between James and his friend. They can see how many achievement-points their friends have in their friend-list, and compare who has the most. But this does not motivate him enough to want any more achievement-points.

Another weakness we see in the scenario, is that James does not feel motivated to add a

reflection note at the end of his workday. He does not suffer from his lack of reflection at the meeting the next day, but his refraining from adding a reflection note still exposes how the gamification implemented thus far does not motivate users to reflect.

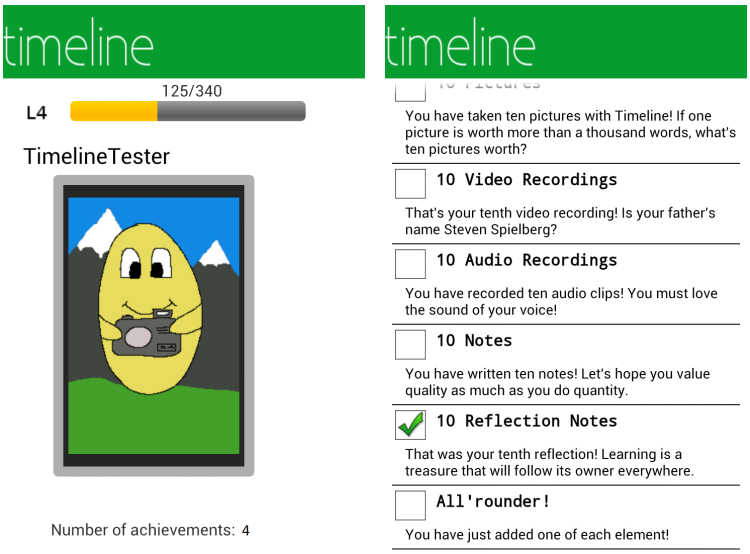
Improvement Points for Gamification in Timeline

In the previous section we analyzed the weak points of gamification. In this section, we will discuss if they have potential to be improved upon, and if so, how.

- *The gamification implemented thus far does not enhance motivation to reflect.* In this sprint, we need to give the user an incentive to reflect. Originally, we wanted to implement system where users rate each other's reflections, adding up to the users' *reputations*. This would be very similar to how voting and reputation works on Stack Overflow, like we talked about in section 5.4. However, this will not be possible since we do not have shareable timelines. Instead, we will implement a point-system where we reward the users with points for every piece of data they input. Out of all the data types, reflection notes will reward significantly more points than the others. This will hopefully motivate users to write a reflection note every day. The points will be used for determining the users' level, which will give them a constant feeling of progression.
- *The points received along with achievements are worthless, since they are not used to anything.* The points that are received along with achievements have no use. It is just an accumulation of points that give the user nothing. This can be solved in two ways. One way is that they can add up to the total sum of points that the user receives for collecting data. The other solution, which keeps them separate, is to set the points received for all achievements to 1. This way, the sum of achievement-points is the same as the user's number of achievements unlocked, and we can use it to show in the user's profile how many achievements he has unlocked.
- *Timeline needs more than just achievements to provide enough motivation for users to use Timeline as intended.* As the scenario illustrates, James is not motivated enough to create the reflection note on the end of the day, because he does not feel that he will receive an instant payoff for it. Besides adding a wider range of achievements, we will rectify this by adding other rewards as well. The points and levels that are introduced in section 8.3 is a good way to start. Additionally, we will make heartening and fun profile pictures that the user can unlock by reaching higher levels.

10.3 Implementation in Sprint 2

In this sprint we implemented all of the gamification we had in the final version. We created a private profile for the user, where the user could see his Swam user name, his level, and a progress bar with his points. For the users to be able to see their progression through the profile, we added a points and level system which allowed the user to gain up to six levels. We also added new achievements, a leaderboard based on the total amount of points acquired, as well as unlockable profile pictures. The unlockable profile pictures were implemented in a way such that it would unlock a new picture when the user reaches level two, four and six.



(a) The user profile. (b) The achievements list.

Figure 10.1: Two new features, profile and achievements

We ended up with designing our own user interface for the Swarm achievements and leaderboard, so that the users should feel that they did not switch between different services. This could be done fairly easily, as the Swarm SDK had good documentation and methods for getting the necessary data.

We also added a system that gives the user bonus points if he varies data input type, as well as consecutive reflection note bonus. The system that gave the users extra points if they varied the input was based on the use of an array. This array had slots enough to contain the different kinds of input, and when a user made an input, this element was moved to the front of the array. This way, we could easily implement an increasing bonus based on which position the element had in the array at the time it was added to a timeline. The position was used as a multiplier for the bonus points.

After the collaborative timelines were removed due to deprecated datastore model, we

wanted to implement a different way of sharing reflection notes. Our assistant supervisor, PhD candidate Simone Mora, came with a good suggestion to how we could do it. He introduced us to MIRROR Reflection Spaces, which could be implemented with an SDK that was made for Android development. Mora was already sharing data collected by a wearable device that allows emergency workers for capturing information to the reflection spaces, so by also connecting Timeline reflection spaces the two devices could have utilized information that they share with each other. Our main motivation for using the reflection spaces, though, would be to allow user to share reflection notes with each other.

We worked with the reflection spaces SDK for ten days, and struggled with a nasty bug all the while. We contacted the developers of the SDK to inquire for assistance, and we kept a dialog going by email for three days before they gave us an extremely unfortunate message: There was in fact an error in the SDK that prevented us from sharing to the spaces. They fixed the error, but by the time they came back to us with a new version of the SDK, it was too late for us. We had to abandon the reflection spaces and proceed to our evaluation without sharing of reflections.

10.4 Evaluation: Usability Test

During our first application evaluation we saw that most of the testers struggled with the usability of Timeline. Therefore, on the 10th of May we performed a usability test to determine how user friendly the application was after we had implemented the gamification elements discussed in section 10.3. We performed two rounds of testing with five and four test subjects respectively. The goal of the test was primarily to weed out any last issues that might lower the user experience before our final evaluation.

We got nine test subjects to participate in the evaluation. All of the participators were students we knew from before. Four were students of computer science, and the five others were all from different fields of study. One from real estate, one from archeology, one from music, one from geology and one from construction science. Each participator got up to fifteen minutes to get to know the application and complete a set of tasks we gave them. After the fifteen minutes they answered our questionnaire, which we have included in appendix B.

10.4.1 Usability Test Questionnaire

The questionnaire consisted of 28 statements, where the testers could choose to answer in range of *strongly disagree*, through *neutral* to *strongly agree*. The first ten statements were taken from the widely used system usability scale (SUS). SUS helps us giving our application a general usability score [17]. The next eighteen questions we designed ourselves. They were mainly created to determine how user friendly the gamification components

were, but they will also give us an indication of how user friendly Timeline is as a whole. Below are the eighteen questions we designed ourselves. The numbers in the columns to the right represent amount of testers that checked this alternative.

		Strongly disagree				Strongly agree
11	The icons were easy to understand and consistent throughout the application.	0	0	1	5	3
12	It was easy to navigate in order to find information.	0	1	4	4	0
13	It was easy to check my score.	0	1	0	3	5
14	The points and level system were easy to understand.	1	1	2	3	2
15	It was easy to keep track of my progress.	0	0	2	5	2
16	The connection between level and profile progress was intuitive.	0	3	5	1	0
17	The connection between leveling and new profile pictures was intuitive	3	3	2	1	0
18	Your actions induced a logical response from the application.	0	0	1	6	2
19	Adding elements to a timeline was easy.	0	0	0	4	5
20	Adding elements to a timeline was intuitive.	0	0	2	4	3
21	The difference in design of some of the menus confused me.	2	4	2	1	0
22	I received feedback on my progress.	0	1	1	5	2
23	The tutorial was useful.	3	0	3	3	0
24	The tutorial was intuitive.	2	2	3	1	1
25	The tutorial was easy to find.	2	3	2	1	1
26	Moving around in the application was easy.	0	1	3	5	0
27	Moving around in the application was intuitive.	0	0	4	5	0
28	I am experience with the use of Android devices.	1	2	2	0	4

10.4.2 Discussion of Results from Usability Test

On a general note, the testers found the application to be intuitive, both in regard to how the application behaved when used and how actions were performed. The testers also found the application's icons to be used consistently throughout the application.

From our evaluation in Italy, it seemed to be a big problem for most of the testers that they were not accustomed to using Android devices, or smart phones at all. Therefore, this time we wanted to see if there were any differences between the testers whom were experienced with the use of Android devices, and those who were not. To separate experienced users from inexperienced we asked question number 28. Four of our testers strongly agreed with the statement that they were experienced with the use of Android

devices, while the five remaining testers answered two for neutral, two for slightly disagree, and one strongly disagree. We split the questionnaires twofold, and grouped up the answers of the four experienced and the five inexperienced testers separately. These can be found in appendix B.

We found the differences to be very minor, and could not really find any trends as to the application being more intuitive for either group. However, all of the testers that did not own an Android phone did own an iPhone. This means that they were all comfortable with using smart phones. We feel that we can draw from this that the application is generally intuitive in use for users that are used to interacting with smart phones. This probably means that our test subjects from the evaluation at CoorCuneoSafety2013 were not just inexperienced with Android devices, but with smart phones altogether.

We implemented Swarm into Timeline to get features like friends list and messaging, which meant that these parts of Timeline would be characterized by Swarm's graphical user interface (GUI). Swarm's theme is blue and gray while Timeline's is mostly green and white, which means that the differences are quite striking. This is why we made statement number 21, which says "the difference in design of some of the menus confused me". Two answered strongly disagree, four answered disagree, two answered neutral, while one tester agreed. What we draw from this is that although it would be preferable to have a similar design in all aspects of the application, it generally does not seem to confuse users, and it works out quite alright for testing purposes.

When it came to the gamification, there were two things the testers did not find intuitive: The connection between levels and profile progress, and the connection between leveling and new profile pictures. We can see from statement 16 and 17 that out of these two, the profile pictures were the most unintuitive. What we think this means is that the testers did not understand that gaining levels would automatically reward them with new and "better" profile pictures. This issue could easily be improved by changing the feedback message they get when they level up from "You have reached level X! You are awesome!" to a message that informs them that they have also unlocked a new profile picture.

There were three other statements regarding gamification, namely number 13, 14 and 15, which cover checking score, keeping track of progress and points and level system. Statement 14 about understanding the points and level system received a mixed score, as each answer alternative got at least one pick. It is hard to know what difference in understanding there was between the tester that answered strongly disagreed, and the testers that strongly agreed, but we would assume that it might have been the consecutive reflection bonuses and diversity-of-input bonuses that were confusing. This could have been improved by giving the users more feedback on *what* they were receiving points for, and not just telling them the sum of points that they received for taking a picture or writing a reflection.

The other two gamification statements, 13 and 15, tells us that checking their own score and keeping track of their progress was intuitive and easy. By "keeping track of progress"

we mean observing that your level and progress bar is increasing as you use the application for populating your timelines and reflecting.

The average SUS score we received in this evaluation was 67.2 out of 100. This is not a very convincing score, but keep in mind that the first statement is regarding use of the system. Most of the testers said that they would not use this system, which of course lowers the overall score. This rather mediocre score tells us that the general usability of the application could have been improved by quite a bit. In order to make users of Timeline utilize the application in the way it is intended, it might be just as important to improve the usability issues as it is to add gamification features or other functionality. However, Timeline should still serve as an effective tool for us to evaluate the effects gamification can have on an application with such a serious context.

10.4.3 Implications for Re-design

We learned that we would have to make to following fixes in the next sprint:

- Make tutorial more visible.
- Reconstruct tutorial to be more useful.
- Feedback from gaining levels.
- Feedback from unlocking profile pictures.
- Inform the user that he receives bonus points for adding reflection notes consecutive days.
- Inform the user that he receives bonus points for varying his input.

11 Sprint 3

Contents

11.1 Introduction to Sprint 3

After we had tested the usability of Timeline, we uncovered some issues that we needed to fix before our final evaluation. This sprint will consist of how we fixed these issues, and the final evaluation of our gamified Timeline solution. We will in the following sections look closer into the implementation and the evaluation of the implemented gamification.

11.2 Implementation in Sprint 3

This usability test helped us make a few last changes to Timeline before our final big evaluation, where our testers would receive the application for using it over the course of an entire week.

This sprint consisted of minor fixes based on the results from our usability evaluation. We fine-tuned some of the elements of the application that had been found lacking in the usability test. We raised the level cap by four more levels, and added unlockable profile pictures for level eight and ten. We improved the feedback of the application by showing the user popup-messages for reaching a new level, and we fixed a couple of achievements that did not work as intended.

We moved the tutorial to the dashboard. Under the usability evaluation, the tutorial was hidden in the pop-up menu that comes when pressing the native android menu button. This led to users not finding the tutorial at all. We also restructured the tutorial to try make it more intuitive and useful.

The feedback of the application was improved to relay an extra message to the user if/when he leveled up. This was something we found to be lacking after analyzing the questionnaire feedback.

Before the usability test we had already made agreements with our test group for the next evaluation that the test period would start May 14th, only four days after the usability test. Sadly, we did not manage to implement a message that would inform the user that he had received a new profile picture time for this evaluation, due to a tight time schedule. This is something that we understand is a problem, and which we know will have consequences for the appeal of this feature in our final test.

11.3 Final Evaluation

After the usability test, we made some improvements to Timeline and started on a week long evaluation to measure the benefit of the implemented gamification. The start time of the test period was the 14th of May. Unfortunately, all of the improvements that we wanted to implement after our usability test were not completed in time for the start of the evaluation. We did however upload a patched version of Timeline to Google Play the day after the test period started, expecting that the testers would get a notification from Google Play that there was a new version of the application available on the store. It seems, though, as if none of the testers were alerted about this new version, which means that the test went on without Timeline having the full set of features that we wanted.

11.3.1 Preparations for Final Evaluation

In preparation for this test, we needed to find people with android phones who were able, and willing, to test Timeline. By asking around at the university, as well as friends and family, gave us 9 testers. These testers were informed to get the application from Google Play, and that they would get a questionnaire and some questions when the test was over.

After informing the testers, we started creating the online questionnaire. Being of the same type of questions used in the usability test, we constructed statements where the tester could choose between five alternatives, within the range of *strongly disagree* through *neutral* to *strongly agree*. The questionnaire consisted of 31 such statements.

We also created some questions where the testers were supposed to answer with text, to be able to give explanations or suggestions.

The last part of the questionnaire contained questions with text answers for those that did not have the availability or possibility to attend to an interview. These questions were identical to the ones used in interview, so that the testers would have the same basis for answering.

11.3.2 User Group

For this test, we got some fellow master students to test the application. Five of these were master students from informatics, while two were from computer science. In addition to these seven testers, we had two testers who were not from NTNU. One of which also studied informatics.

In the questionnaire we asked some questions to classify the users' interests and preferences in regard to games. Eight out of nine considered themselves a gamer, while the last was neutral. Games that incorporated competition was a big hit with our users, where 78 percent answered strongly agree, while the rest agreed. Challenging and discovery oriented games were also appreciated as a general trend, though not to quite the same degree. Social games were the least appreciated of the game types, with an answer distribution of 0-1-1-2-5.

When we asked them to answer the statement "I am experienced with the use of Android devices", 11 percent agreed, while the remaining 89 percent *strongly agreed*. This indicates that this study consisted of only adapt Android users, which is a natural consequence of the fact that we needed to find testers who owned their own Android device.

In general this is a group consisting of competent computer users, who are also used to smart phones and games. This could prove to be both positive and negative. The positive is that our testers would more easily than non-computer students be able to create a mental model of the application, understand how it works and what to do to achieve the desired outcome. On the other hand, it is a user group which may not be representative for the common man.

11.3.3 Questionnaire and Results

In this section, we will look closer into specific questions and answers where the answers either prove or disprove the statements as a trend. A summary of all the answers can be found in appendix C.

Questionnaire Answers

The statement *"The level and point system motivated me to add elements"*, was by all participants answered either neutral or positive, with the answers distributed as follows: 0-0-2-4-3. This proves, for our test subjects, that these two game elements made it more motivating to give input to a timeline.

For the most part, leveling up seemed to give the testers motivation to continue to add elements. The answer distribution for *"Leveling up motivated me to continue adding elements"*, was 0-1-1-7-0, which as a general trend makes it quite positive.

The discovering of new profile pictures turned out to be something that did not really motivate users to level up. The distribution of the answers was 2-3-4-0-0, which means that none of the testers found it motivating. It is probable, though, that if Timeline had displayed a message that notified the player that he had unlocked a new picture, it would have been more motivating for him. This is something we also discussed after the usability test, in section 10.4.2.

The consecutive bonus for adding reflection notes had a motivating effect on only one user. The distribution of answers we received were 1-3-4-0-1. About half of the testers were neutral, one strongly agree, but the rest disagreed with our statement that consecutive bonuses were motivating. It should be mentioned, though, that a couple of the testers realized that they could add a lot of empty reflection notes and use the consecutive bonus points to climb to the top of the leaderboard.

The response to the bonus points for adding different elements was very mixed. With answers as follows, 0-3-1-3-2, it seems that this is an element that does not motivate everyone. It will still have a positive impact on many users' data gathering, as more than half of the users agreed that it motivated them.

The leaderboard motivated many of the testers to compete with the other users. 1-0-2-3-3 shows quite clearly that this is something that the testers found motivating. However, competitive game elements is not something that will appeal to everyone, which we can see from the one tester that strongly disagreed with the statement. Other than trying to structure and limit what is displayed in the leaderboard, we can only hope that the leaderboard does not have a *de*motivating effect on the users that do not care for it.

Overall, the statement "achievements motivated me to add more elements" tells us that the testers were motivated to add elements by the achievements they were rewarded with for doing so. With one tester answering disagree, one neutral and the rest distributed between agree and strongly agree, this is clearly true for our testers. The one we interviewed said that achievements was the feature that motivated him the most.

The users, as a general trend, did not find the application lacking achievements for any of its functions. With three being neutral, and the rest either on agree or strongly agree, this is clearly an answer which shows they did not find anything missing. That does not mean that we have designed our achievements perfectly, or that they necessarily cover everything. But it does mean that they cover the most important and visible parts of the application.

In an interview, one tester pointed out that he would have liked to have some additional achievements to make it even more motivating. These achievements should have been to cover daily, weekly and monthly use of the application. The interview can be read in appendix C.

To see if it was the same for achievements in other games, we asked our tester if they agreed with statement number 9, which goes as follows. *"I am usually motivated by*

achievements in games/apps/programs". The response to this statement was very positive: 0-0-1-0-8 clearly shows the potential of achievements. The fact that our testers agreed more strongly with this statement than the previous could mean that there is potential for improvement in Timeline's achievements, or it could mean that the wording of the statements encourages two slightly different types of answers. The statement that says "achievements motivated me to add more elements" applies to a specific part of the Timeline application, while "I am usually motivated by achievements in games/apps/programs" is very general.

As we had originally planned to implement a kind of "duel" between Timeline users, we asked if the testers thought this would have motivated them. Two strongly disagreed, four were neutral, two agreed, while one strongly agreed. These mixed answers do not really point us in a direction. It goes to show that the users have different preferences, which of course is no surprise.

"Playing mini-games within the Timeline app would have motivated me to reflect". By mini-games we meant variations of games like the duel from the previous question. This was also explained below the question in the questionnaire. The answers got allocated as follows: 2-0-3-0-4. For the most part, this shows a positivity towards these "mini-games", but it is a vague statement, and would need more specific suggestions to really hold much value. What the statement really says is that users would like to have mini-games in Timeline *if* it is a *good* mini-game. Whether or not we could come up with constructive and fun mini-games that actually helps the users with reflecting remains an unanswered question. It is more likely that mini-games could help with data gathering.

As a test to see if the users would have used the application more without gamification, we gave them the statement *"I would have used the application more if it didn't have achievements, points and leaderboards."* The answers to this statement were 8-1-0-0-0. Our first thought was that this shows us that the gamification was a positive addition to the application, but this might not necessarily be the case. One of the most common warning labels on the gamification-box, is that gamification will not make subpar software into the next big hit. Or to use an old Norwegian idiom, gamification will not turn granite into gold. Our point is that if the testers would not have wanted to use Timeline in the first place, it would not make a difference if there are achievements and leaderboards or not. But if the testers had answered agree or strongly agree, it would have been a clear sign that the gamification we had implemented did not work out well. So, although the answers to this statement do not give us anything conclusive, we can take it as an indication that gamification is a step in the right direction for Timeline. This is reinforced by some of the questions we asked them. One tester wrote about gamification as follows: *"I think it was suitable and that it made the app more fun to use"* while another said that he was *"Generally satisfied with the gamification parts".*

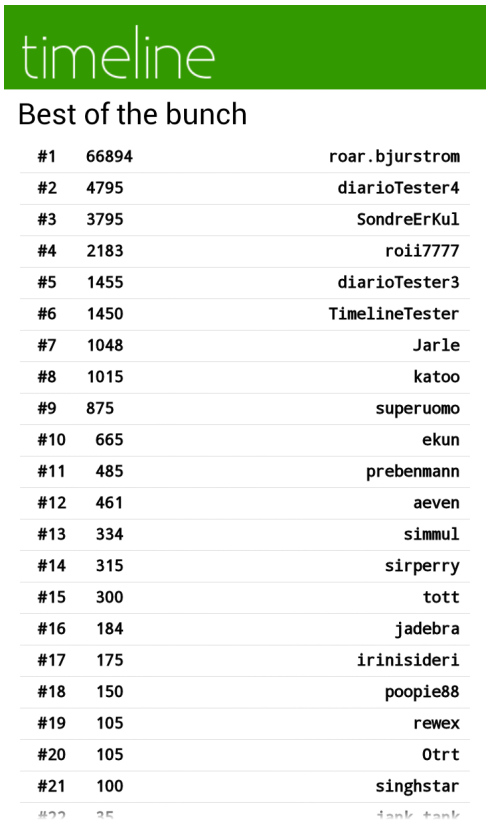


Figure 11.1: The leaderboard after the evaluation.

Textural Answers and an Interview

During the interview, we learned that it was quite demotivating that users could "cheat" the leaderboard. There was mainly one feature that made this possible, namely the consecutive reflection note bonus. He suggested that it could be a limited amount of reflection notes per day, for example one, or at least a fixed amount of reflection notes that rewarded points. Another suggestion was to remove points from the reflection note entirely. In addition, he wanted the application to check for empty data elements, to remove the possibility to add empty notes and reflection notes.

For the application to be more motivating for the person we interviewed, he suggested adding more achievements and more different leaderboards. To quote him, "Daily achievements gives the user more motivation to do something every day. Also a daily leaderboard, and maybe even weekly and monthly."

What he means with "daily achievements" is not quite clear. We see two types of achievements that could go under that category. Either, he wants the achievements to know how many days in a row he has made input to a timeline, unlocking an achievement when certain milestones are reached. Such milestones could be a week, month, two months and so on. This is in fact very similar to something we have implemented, which makes it

less probable that this was what he sought. The other possibility is that he wanted new achievements for each day, which had not been available before. This is something that would be very resource demanding, and would therefore not be feasible in a project such as ours.

The interview object had some suggestions for scenarios where he could see himself use an application like this. He did not, however, leave much emphasis on the reflection part of the application. His suggestions for use were as a travel application, using it to store images and such of things that happened and place he had been. He also wanted to be able to tag buildings and locations, so that he could see where he had been. This is all feasible as the application is now, just without reflection.

Another proposed use for such applications were for privately logging projects, such as a Bachelor's project, using it as a kind of backlog. In such a case, he could see it reworked to be able to put in other types of input such as project types and document types.

One of the other testers, who answered the same question using the questionnaire, had a totally different scenario of use. He could see himself using such an application to track and reflect on his mood and stress, to easier remember why he was sad or happy. In addition, he could see use for the application in regards of work out and food consumption, to see and reflect how this affects his performance in sports.

To try figure out if gamification was a step in the right direction for this application, we asked the following question: "Did you think that gamification was suitable for the app, or was it more of a distraction?". One of our testers answered that "gamification is important or the user will only use the application for a day and then never again". Others pointed out that some parts of the gamification was fitting, while other parts still needed to be refined such as the possibility for cheating to climb the leaderboard.

11.3.4 Summary of the Final Evaluation

After our final evaluation, there are still things that could have been implemented better. Both we and the testers are aware of the following issues:

- **Leaderboard**
  The leaderboard as it is now shows the points that a user has acquired. By having this in the leaderboard implies to the user that it is the act of adding data that is important, rather than the act of reflection. If the leaderboard had focused on something else, another kind of points, it could have been more motivating. A tester, who also thinks this would have been better, wrote as follows:

  "The leaderboard as of now does not fit with the application, as it makes you do actions to increase your rank (such as spamming reflection notes), instead of for doing them for their intended purpose (actually reflecting) If there was a way of sharing

reflection/timelines/photos then gamification in form of upvotes/downvotes/reputation could be a way of motivating people to really reflect. (And then reputation could be used as a leaderboard).”

This is something we also thought would be better, but without sharing of elements, this was unfortunately not possible.

- **Reflection notes**
  As mentioned above in the tester's quote, the motivation for adding reflection notes at the moment is to get the points, and not to reflect. By adding the possibility to “like” or “dislike” other users' reflections, it would be the content of the reflection note that is important, more so than the points for adding it. The number of such likes or dislikes, could sum up to the players total reputation, or reflection score, which would then be based on what other people think of that input. This would help to remove the focus on creating many reflection notes, to moving the content and the reflection itself into focus.

- **Profile**
  The profile as it is now is very static, altered only by leveling up. It would be better to give the users the possibility to personalize it themselves.Better feedback when something in the profile is unlocked is something that would have increased the motivation of use. [16] [15]

Some of the game elements were a fairly big success, and have proven to be motivating for our testers:

- **Levels and points**
  Levels and points, in general, proved to be motivating to the users. One of the test subjects came with the following argument: *“Having points/level system/achievements is okay, as these are used to add to the players self-motivation”*. Additionally, the questionnaire showed us that the great majority of our testers were motivated by levels and points.

- **Achievements**
  The achievements also proved to be overall successful. Some testers found the achievements to be the most motivating feature in the application, and one tester answered the question about what motivated him the most in Timeline as follows: *“Getting achievements for trying out new things.”* The quote we used above, when talking about levels and points, also gives credit to achievements as a tool for adding to the users self-motivation.

12 Discussion of Results

Contents

We will in the following sections discuss our findings in regard to both the points of improvement found in the final evaluation and our research questions. As a basis we are using the answers we got through our evaluations, especially those discussed in section 11.3.3.

12.1 Subquestion One

SRQ1 *Can gamification enhance Timeline's users' motivation to collect data which can help them recall or revisit previous experiences?*

a) *Can the use of gamification enhance Timeline's users' motivation to collect data?*

The data we gathered through questionnaires and an interview with our testers in our final evaluation, proves that it is possible to enhance the motivation of users to collect data in Timeline. It is plain to see that gamification had a positive motivational effect in regard to adding data to a timeline. Looking at the statistics from the questionnaire, 78 percent found that points, levels and achievements motivated them to collect data, representing the great majority of our testers.

b) *Which gamification elements may best enhance the Timeline's users' motivation to collect data?*

Our test group was evidently motivated by points, levels and achievements. They were not, however, motivated by the bonus points they could receive for adding multiple consecutive reflection notes. Only 11 percent of the testers were motivated to write a reflection note, and 44 percent were not, making it the least popular gamification in Timeline.

The bonus points for varying method of input had a better reception, with 56 percent answering that it motivated them.

Two of the gamification elements in Timeline were focused on increasing the users' general use of Timeline, and not specifically on collecting data. These two elements

were the friends list and the messaging. Through motivating the testers to increased use of the application we thought that they indirectly might also be more likely to collect data and reflect. We do not have a good way of checking if that was the case in our evaluation, but the statistics may give some indications. 78 percent of the testers knew someone else in the test group. 71 percent of these added the testers they knew to their friends list. Only 43 percent of the testers with populated friends lists sent each other messages, which means that the whole friend system had very little influence on the test period. This probably means that friends lists and messaging systems are not very useful at all for enhancing users' motivation to collect data.

When it comes to the leaderboard, we know that 67 percent of our testers felt motivated to compete with others. This should cause users to collect more data, which was confirmed in our evaluation. However, although quantity of input increased, quality drastically decreased. The problem was that some users realized that they could spam empty reflection notes to climb the leaderboard. Not only is this kind of input useless for reflective learning, it also means that the motivational effect of the leaderboard is effectively ruined for all other users who want to compete fairly. The problem could have been avoided by only awarding points once a day for writing reflection notes, since its intention is to trigger reflection in the user after a work day, when he is summing up his day. Other ways to avoid the problem could be to use an algorithm that checks if the content of the note seems to be meaningful, but this is much harder to accomplish.

We previously stated that points, levels and achievements were equally well regarded by all our users. However, that was according to the questionnaire only. When we also take into consideration the textual answers and the interview, the element of gamification that proves to enhance data collection the most is achievements. One user said "Gamification with achievements motivated me to add data for reflection". When we asked which feature in the application that motivated them the most, two users answered "Getting achievements for trying out new things" and "achievements, unlocking stuff". There was one user who did not like the achievements, though. When we asked which feature he found the least motivating, he answered "Getting points and achievements for mundane things". It sounds from his answer like he expected it to be more challenging. This is a good example of the fact that different people like different types of games, as we discussed in section 2.5. Some like hard fun, and some like easy fun.

To answer subquestion 1 b) we can say that the following three gamification elements best enhanced Timeline's users' motivation to collect data:

- Rewarding points for input of data.
- Leveling up from receiving points.

- Unlocking achievements for input of data.

Gamification has, in our final evaluation, proven to enhance Timeline's users' motivation to collect data.

12.2 Subquestion Two

SRQ2 *Can gamification enhance Timeline's users' motivation to reflect on their collected data?*

a) *Can the use of gamification enhance Timeline's users' motivation to reflect?*
After the test period in our final evaluation, we asked our test group if they were motivated to reflect, and if they could describe why or why not. None of the testers answered yes. One tester said that he has never written down a reflection in his life, and that it was frustrating for him to write reflection notes on the tiny screen of his phone. Another tester answered that the most notable reason to why he was not motivated to reflect, was the template questions of the reflection note. Two things we can take from these answers is that we should look into a smarter way of implementing the reflection note, and that it is hard to motivate someone who is not interested in reflecting in the first place.

44 percent of the test group said that playing mini-games within the Timeline application would have motivated them to reflect. This is a surprisingly high number. What we had in mind when we asked them about mini-games was the duels between users. We were not planning to make the duel focus on increasing the motivation for *reflection*, as we do not think it would have been suitable for that. We were planning for it to increase motivation to collect data. The reason why the testers think that duels would increase motivation for reflection is probably because they are having a hard time separating collection of data from actual reflection. We will, tough, take this as an indication that they think it would help motivation for collecting data.

In summary, we have in this case study been unable to enhance the users' motivation to reflect with the use of gamification.

b) *Which gamification elements may best enhance the Timeline's users' motivation to reflect?*

The results from our final evaluation does not prove that gamification can enhance motivation to reflect. However, our hypothesis on a system with reputation scores indicates that gamification is capable of increasing the motivation to reflect, and hence improve the function of Timeline. As mentioned above, we think the best way to do this is

through the use of an additional point system, which is linked up with quality rather than quantity.

There are, however, problems with motivating people to reflect based on points, levels and achievements alone. Our investigation shows that some users fall for the temptation to add empty reflection notes in order to gain a massive amount of points. For this reason, we think it would be better to remove points from the reflection aspect of the application while keeping points and levels for the input of data. We think that inclusion of users' evaluation of other participants performance will improve quality of reflections and prevent cheating. Such an evaluation can be in form of reputation points. The important thing is that this system does not make it possible to spam for points. In order to give the users a chance to evaluate other participants' reflections, the application must give some kind of access to reflections made by others.

12.3 Main Research Question

RQ *How can gamification be utilized to promote reflection in the Timeline application?*

The results of our study indicates that gamification can be utilized to promote the collection of data which can help them recall or revisit previous experiences. We can not with any certainty state that gamification will enhance Timeline's users' motivation to reflect on their collected data. We can, however, based on our research and our testers' feedback, suggest a method that we think is likely to succeed.

We think that inclusion of users' evaluation of other participants performance will improve quality of reflections. Such an evaluation can be in form of reputation points which will motivate for quality rather than quantity. In order to give the users a chance to evaluate other participants' reflections, the application must give some kind of access to reflections made by others. Sharing of reflections could be done with the collaborative timelines from the original version of Timeline, or it could be done with the reflection spaces developed by the MIRROR project.

12.4 Ideas That Came After Evaluations

After evaluating our implementations and discussing the results, we have had a number of new ideas to features we could have added or improved. As these ideas were not implemented in the game elements we introduced in our tested version of the Timeline application, we have no empirical evidence of their potential impact. We will, however, in the next and last part of our report present some thoughts on what they could have achieved.

Part V Conclusion

13 Summary

There are many applications and utilizations of gamification that proves it has the power to motivate. None of these, however, have had the same pure focus on reflection as Timeline. Through the evaluations of our gamified solutions, we have found that gamification can indeed be a powerful motivator in an application that supports reflection.

Based on the results from our final evaluation, gamification undoubtedly had a positive effect on our test users' motivation to collect data. The gamification element that proved to be the most motivating for adding data to a timeline for our testers, were achievements. Other elements that proved to be quite effective, were points and levels. By using a points system that rewards the user for collecting data, the test users were motivated to input an increased amount of data.

Having the competitive factor of a leaderboard vastly increased the motivation of a small sample of our test users, while most others did not care about it at all. A problem with our implementation of the leaderboard, though, was that the users could add a high number of empty reflection notes to gain massive amounts of points. For the leaderboard to have a constructive motivational effect, we would have to limit users from spamming useless input for the sole purpose of gaining points.

While we have successfully enhanced our test users' motivation to collect data, we have found that it is very problematic to increase our users' motivation to reflect based on points, levels and achievements alone. It would probably be better to separate rewarding of points from the reflection aspect of the application, while keeping it for the input of data. We do, however, believe that it is possible to promote reflection through the use of gamification. We think the best option is that users rate each other's reflections. This would create an environment where status and reputation is received through good ratings. We think that this has big potential, because it motivates for quality rather than quantity.

14 Reflections on Our Work

Throughout this interesting and exciting thesis, we have developed our skills as Android developers, gained valuable insight into the emerging field of gamification and learned much about the intriguing process of reflection. We have also learned some valuable lessons, which we will summarize in this chapter.

First off, it is important to keep in mind that this study is based on a small test group, and thus cannot be regarded as conclusive proof. It can, however, point us in the right direction, so that future implementations and related attempts are more suited to help users gain motivation to reflect. The five testers from our first evaluation, together with the nine from the final evaluation, is not enough to give any statistically significant answers. We could probably have bettered this situation by searching wider for testers, which would have given our evaluations more statistical authority, as the results would cover a larger subset of potential users. Additionally, we would very likely have had a significantly larger test group when we went to Italy if our translator had not been so unfortunate to fall ill.

We have to take self-criticism for how we prepared for the the CoorCuneoSafety2013 event. The user guide should have been more elaborative on how Timeline could and should be used in the context of the event. The task list should also have been more imaginative with scenarios and objectives. We underestimated the importance of preparing such documents in good time before traveling, and it led to a fall in the quality of our evaluation.

With Timeline being an unpolished result of a Master's thesis, there were aspects of it that were rather mediocre, most notably the usability. In a perfect world we would have wanted to fix this before it was gamified, but there was not enough time. It still proved to be a useful tool for us to explore gamification's impact on the serious process of reflective learning, and we are happy that we got the opportunity to work with it.

A lesson learned is that it is very important to give users immediate feedback to the users of an application. In our case, we should have covered all rewards and unlocking of elements with good feedback to the user. We should also have better informed the user of why he received the amount of points that he did.

With the change from reputation to points, we should have been more careful with the use of gamification, so as not to undermine the intention of the application. Specifically we should not have made it possible for the user to exploit the applications weakness of reflection notes to massively increase their points, as it gives the users incentive to regard quantity higher than quality. This is, however, a very good example of how extremely hard it can be to foresee every single detail of an implementation, be it big or small.

Lastly, our supervisors have indicated that they are most interested in the use of this application in crisis scenarios. After our evaluations, we think it is difficult to find a suitable scenario where this application can be used in such a way, since the users in a crisis situation will in most cases not have any time to spare for adding data to a timeline.

We have, though, in our chapter on further work suggested some ways in which we think Timeline could have been changed to support crisis situations very well.

Even though we think there are things that we could have done better, we are overall satisfied with what we have achieved and learned during this thesis.

15 Recommendations for Further Work

Contents

15.1 Further Improvements of Timeline

We think there are a couple of aspects of Timeline that could, and should, have been improved before it was gamified. Granted, gamification *has* had a positive impact on Timeline, but to make it into a emphgreat tool in work environments, there are other things that arguably should be improved before going all in with gamification.

15.1.1 Improving Collection of Data

As of now, Timeline requires the user to input the information themselves. Several of the testers found this to be a boring task, and wanted to decrease the amount of interactions they have to do while creating data input to a timeline. Through feedback from our testers and our research on the current state of the art, we have three suggestions to how collecting data could be improved.

- **Automatic gathering**
  By automatically adding information to a timeline, the users can focus on their work without being slowed down by the application. There is, though, no good way to automatically add written notes or pictures to a timeline. Video could possibly be continuously recorded with a head camera, but this is expensive and heavy equipment, and it takes a lot of time to go through the video footage after it is recorded.

  Other types of information could be very useful to add to a timeline, namely heart rate, movement and physical activity. The possibility of having the user's heart rate illustrated with a graph in the background of the timeline is something that intrigued us from the start. We did not pursue this option as it does not go under the domain of gamification, which was our main focus for our Master's thesis.

  It would be useful to have statistical data on heart rate and intensity of movement with time stamps. This would for instance make it much easier to find the critical

parts of video footage. Such data would also help triggering the user's memory in recalling how their experiences were.

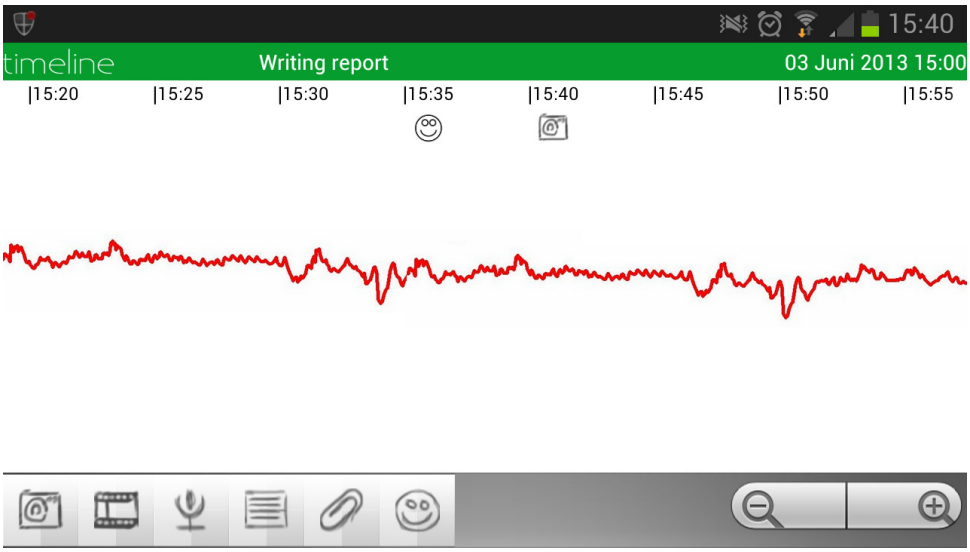


Figure 15.1: Illustration of how the timeline could look with heart rate data.

Our supervisor introduced us to a device called WATCHiT. [32] This is a wearable bracelet device which can capture stress levels and environmental data. It can also with the use of RFID sensors be used to collect mood data with ease. This is another good example of how data collection with Timeline could be improved.

- **Ease of input on the Android device**
  The dialogs to add data in Timeline require a lot of interactions and take too much time. Some effort should be put into decreasing the number of buttons the user has to press.

  After the user has created his first timeline, this should be the default start screen of the application. This saves two interactions for the user, as he normally has to open up his list of timelines, and then choose a timeline. The user will still of course be able to access the main menu, and can from there choose if he wants another timeline to be his default start screen.

  Adding pictures, video and audio should not require the user to confirm that he really wants to keep the data he has just recorded. Data that the user does not want to keep can easily be deleted from the timeline.

  Even better than this, though, would be to implement widgets that the user can put on the home screen of their phone. According to Android's own developer website, you can imagine widgets them as "at-a-glance" views of an application's most important data and functionality that is accessible right from the user's home screen. [33] The menu in figure 15.2 could be made into a widget, which would

allow the user to collect data to their default timeline without even having to open the application. This menu should be customizable, so that they can have only the input types that they want in the widget.

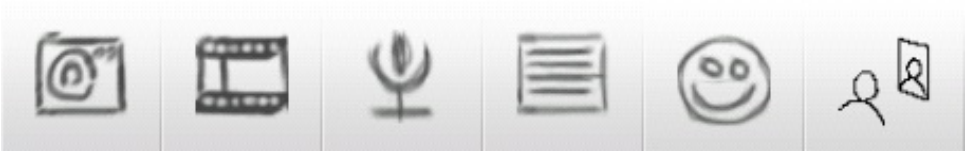


Figure 15.2: Illustration of how the input widget could look.

15.1.2 General Improvements for Timeline

We received comments from several users that tested Timeline that they did not care much for the timeline view. The forced horizontal screen in particular was something that they disliked. It could be confusing that, when opening a timeline, it did not default to the current month or day, and that there was no indication in the calendar view of which day it currently is. Another moment of confusion was the fact that data was added in real time, so that they could not go back and attach an event to a time stamp of their choosing.

These are all examples of bad usability. We did not want to use our time on improving the usability, as we had more than enough to do with implementing gamification. The usability is, though, something that should be improved for Timeline to become a great tool.

15.2 Gamification Implementations that were Never Realized

During our implementation phases we unfortunately were unable to make sharing of elements work. As a consequence of this, we had to drop two gamification elements that we had a lot of faith in.

- **Reputation points for reflection notes**
  As we we discussed on multiple occasions earlier, this is a system that we believe could contribute heavily to motivate for reflection. The first thing that needs to be in place for this idea to work, is away of sharing reflections. Once this exists, we need to create a new system that makes it possible for users to rate other users' reflection notes, grounding the motivation for creating these refection notes in quality rather than quantity. If we had to pick *one* thing that should be implemented from this chapter about further work, it would be the reputation system.

- **Duel**
  A duel, either between two users or two groups of users, is an idea to increase the both data collection and the users' general level of use. It does, though, open up for new ways for competitive users to exploit the system, like they did with the points and leaderboard. It has to be implemented in a way that users cannot spam the application with data which has no real use. The best way might be to use the reflection score (reputation, not points) as a basis to measure each team's effort. It is important to keep in mind that the teams can be biased in their voting on the other team's reflections to gain an advantage. This is a problem that is hard to solve. It might not be a big issue if the application gets a huge user base, though, as the downvotes of the other team would "drown" in the general opinion of the big user base.

- **Progress Bar Widget**
  This is an idea that did not occur to us before we were finished with our implementations. Similar to the Nike+ FuelBand which we discussed in section 5.2, we could make a widget with a progress bar like the one on the FuelBand armband. The progress could either represent the points the user need in order to gain a level, or it could represent a goal of number of data input the user has set himself for the day. It should serve as motivation for data collection.

15.3 Further Improvements to our Existing Gamification Implementations

In regard to our final gamification implementations, there is still much that can be improved. Let us take a look at the elements.

- **Better content unlocking**
  As it is now, the content unlocking is *very* simple. Through making this more advanced, with titles, alternative avatars, avatar equipment, and whatnot, the users' motivation to collect data could be even further enhanced. The content unlocking can be based on different things like points, levels, achievements and reputation.

  For increased interest of the content unlocking, there should be a personal avatar for the user.

- **Avatar**
  As stated above, the avatar is needed for two of the possibilities for content unlocking to be of interest. Avatars that can be personalized with equipment, looks and clothing have proved to make games or applications more enjoyable. [**?**]

- **Better feedback**
  The user needs to receive more feedback on gamification elements that he does not

immediately see while using Timeline. He has to be informed that something has happened in his profile when they actually happen, or chances are that he will not understand what he has to do in order to achieve things, or he might not notice the changes at all. Timeline needs a clearer connection between levels and profile pictures, and this connection should be provided through improvements in feedback.

- **Prevent user exploitation of leaderboard**
  Measures to prevent users from gaining huge amounts of points by spamming notes and reflection notes need to be implemented. It could be done by having an algorithm that checks if the notes are empty or not, which at least stops users from inputting empty notes. There could still be users who spam notes with only one word, though, and preventing this is harder. Maybe the solution is to only reward the users with points for inputing notes once every hour or something similar.

  Achievements can also be used as a measure to stop users from inputting useless reflection notes. By having achievements that require for example 20 reflection notes with an average reputation score of 35, people can not just add random reflections.

Part VI Appendices

A Appendix: Documents from Evaluation in Italy

Contents

The first document we have included in this appendix is a questionnaire from our evaluation at CoorCuneoSafety2013 in Italy. For each question we have checked the answer boxes with numbers representing how many testers chose that alternative. The results are discussed at length in chapter 9.3.

The second document is the user guide we gave to our test subjects. It explains how all the menus of Timeline work in Italian.

A.1 Questionnaire from Evaluation in Italy

This section contains the questionnaire which our testers answered after having tested Timeline. Everything was translated to Italian and printed out before the trip, but we have included the English version here in the report.

MAXI Simulation CuneoCoorSafety2013
Evaluation questionnaire (after app usage)

The Application

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
CA1	[The app] helped me to collect information relevant to reconstructing experiences from work.						4	1
CA2	[The app] helped me to reflect on experiences from work.				1	1	2	1
CA6	[The app] helped me to reconstruct a work experience.				1	1	2	1
CA7	[The app] helped me by capturing my reflection outcomes.				1		2	2
CA8	[The app] helped me by making reflection outcomes available for later use					1	1	3
CA10	[The app] helped me by reminding me to reflect.					1	3	1
CA12	[The app] helped me by providing accurate information about my work.			1	1		2	1
CA25	[The app] helped me by supporting sharing of experiences.				1	1	2	1
CA26	[The app] guided me in sharing experiences with others.				1	2	1	1

CA27	[The app] guided me in reconstructing and remembering the experience/situation.				1	1	2	1
CA40	[The app] provided relevant content for reflection.				1	1	3	
CA41	[The app] guided me through the reflection process.					2	2	1
CA42	[The app] motivated me to collect information relevant to reconstructing experiences from work.					1	3	1
CA43	[The app] helped me shape a mental overview of incidents that happened at work.				1		4	
CA44	[The app] distracted me from work with its achievements.		1		2	1		1

Learning Outcomes

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
CL1	I made a conscious decision about how to behave in the future.				2	1	2	
CL2	I gained a deeper understanding of my work life.				3	1	1	
CL3	The data I collected helped me learn more than I would have learned otherwise.				1	2	2	
CL4	I became more aware of work related details.					2	3	

Work Behavior

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
CB1	The app helped me improve my [work performance].				1		2	2

Usefulness/Satisfaction

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
SAT01	I am satisfied with the App				1		3	1
SAT02	I think the app is useful for professional training					2	2	1
SAT03	I think the app can be used to complement professional training					1	3	1

General App Effects

ID	Question	strongly disagree	disagree	slightly disagree	neutral	slightly agree	agree	strongly agree
[The app] helped me to ...								
GAE02	find situations on which we should reflect.				1	1	3	
GAE03	understand my emotions better.				2	1	1	1
GAE04	find motivation for reflecting.					3	2	
Data gathering with [the app] was ...								
GAE17	accurate				1	1	2	1

GAE18	effortless				1	2		2
GAE19	relevant				2	1	1	1
GAE20	timely				1	1	1	2
GAE21	fun						2	3
GAE23	motivating						3	2

A.2 User Guide from Evaluation in Italy

This section contains the user guide which we provided to the testers in Italy. The text was translated to Italian and printed out in an adequate number before the evaluation, but we have included the English version here in the report.

TimelineApplication

User guide

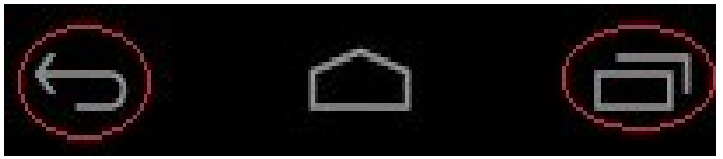
What it is

- An Android application that allows you to:
  - Create timelines to preserve your experiences and invite friends to take part in your discoveries. Share notes and information through services like Facebook, Twitter or mail. Collect data from your phone create new experiences by capturing the world using your mobile phone which places it directly into your timelines.

Home Screen

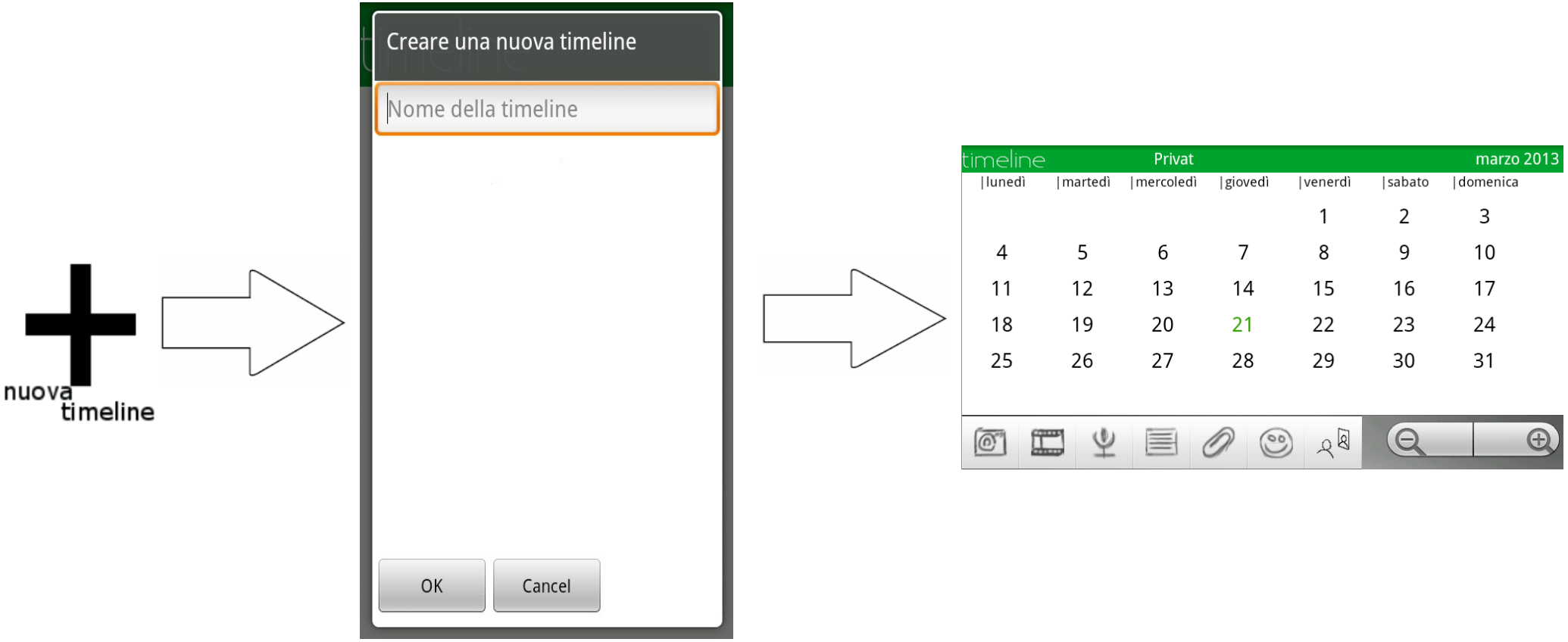
The application uses standard android navigation:

- Back button - takes you one level back
- Menu button - gives additional options to current screen
- Long click - gives additional options to the pressed item



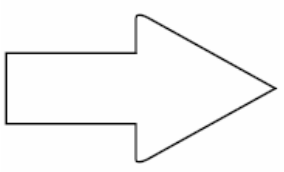
Create a new timeline

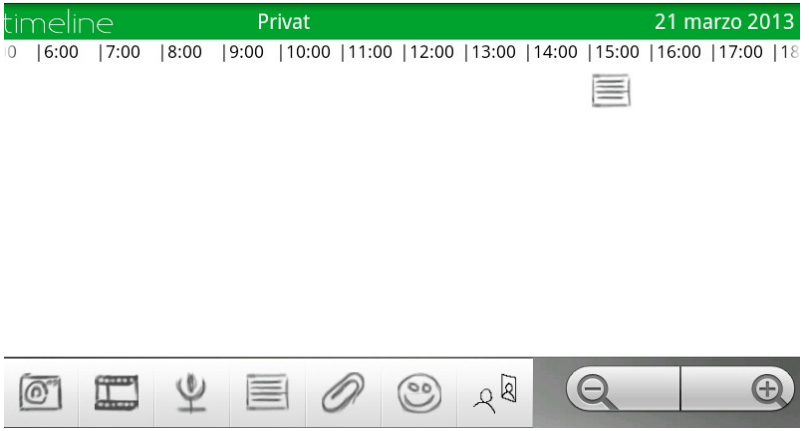
- Click on the "add timeline" button
- Give your timeline a name and click OK:



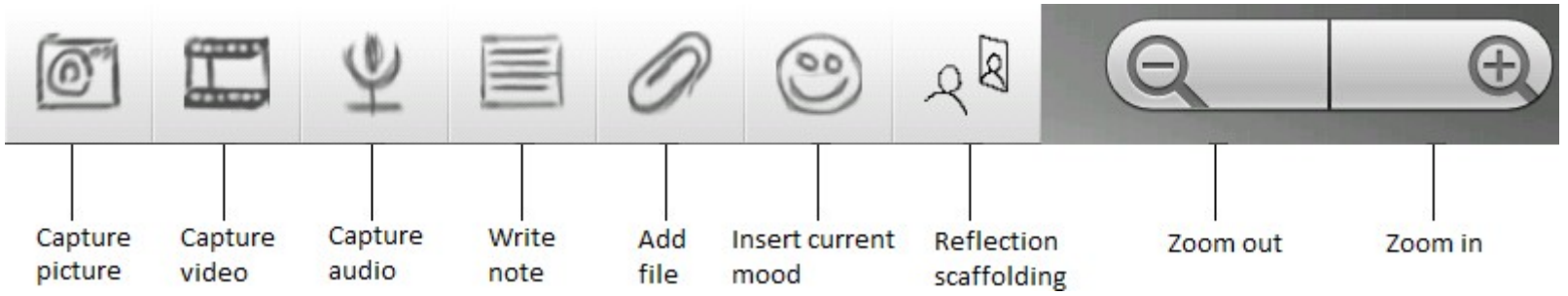
Using the timeline

- Add different kinds of content to your timeline with the buttons in the bottom of the screen
- By clicking on a green date you zoom in to see an overview of your added content





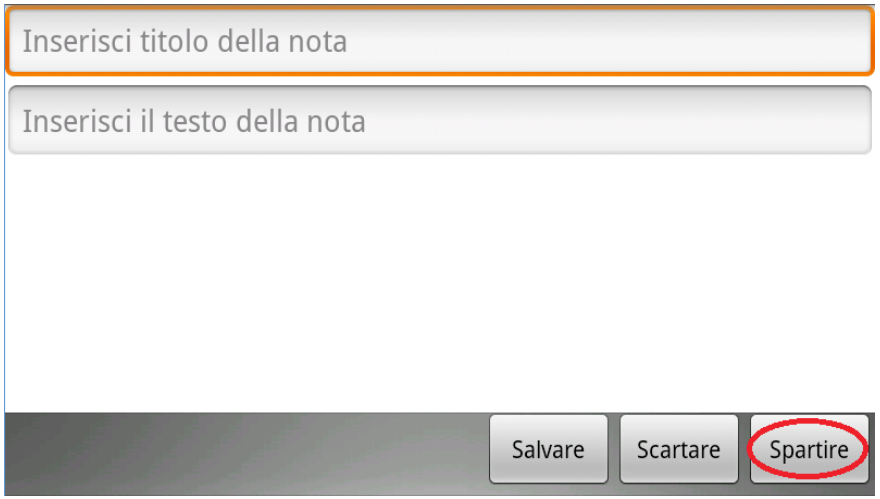
Adding content

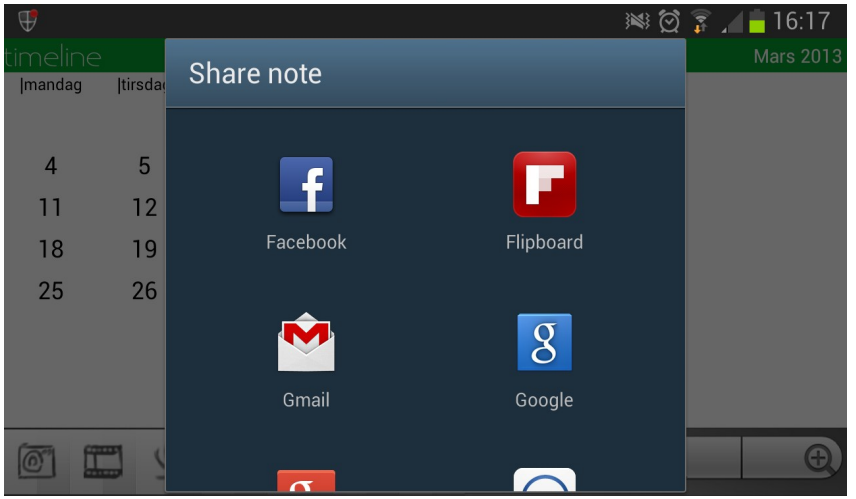


- Short explanation of how the buttons in your timeline work

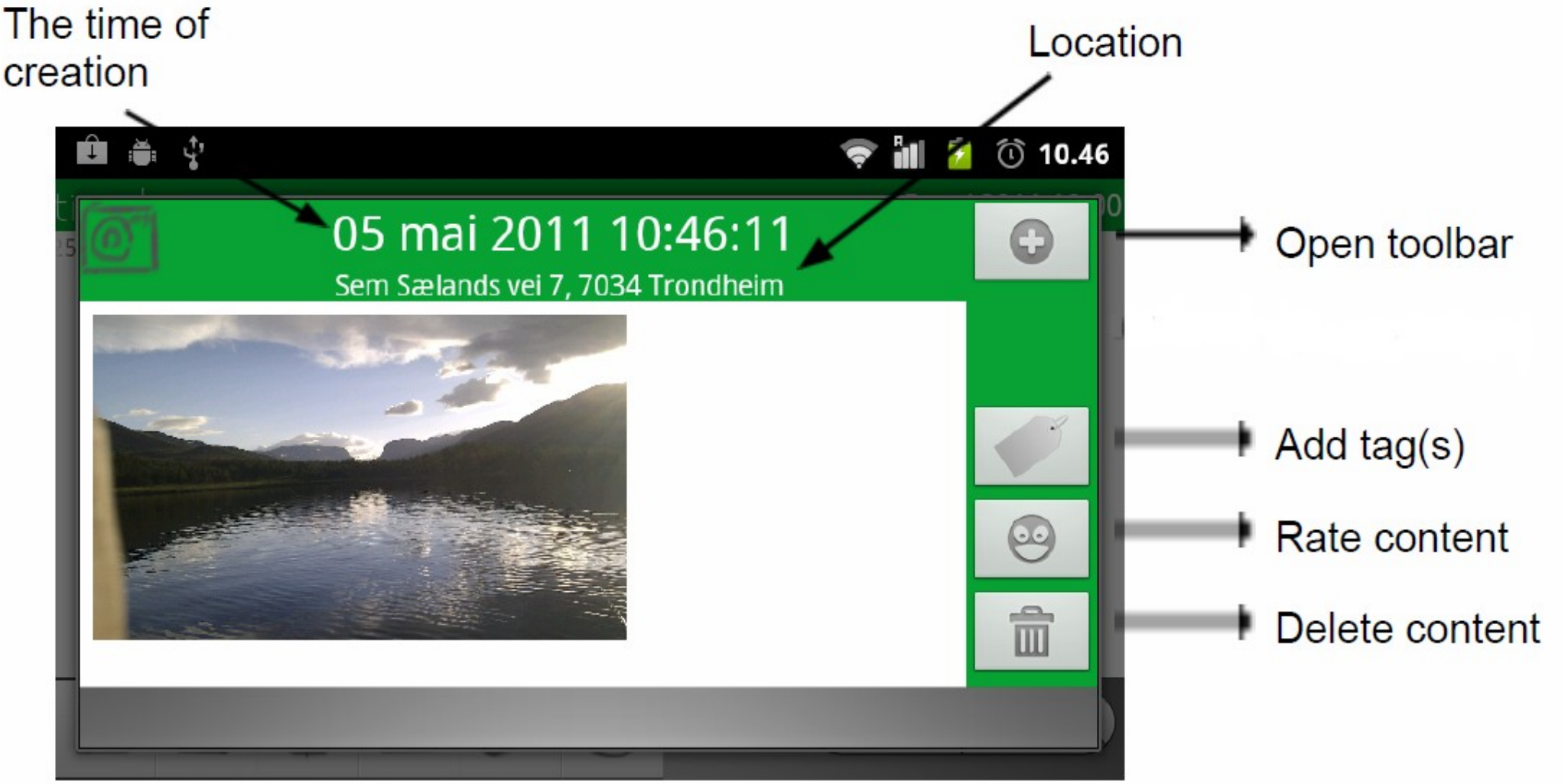
Sharing content

- Notes and reflections can be shared through other apps like Facebook, Twitter, Gmail and many more.





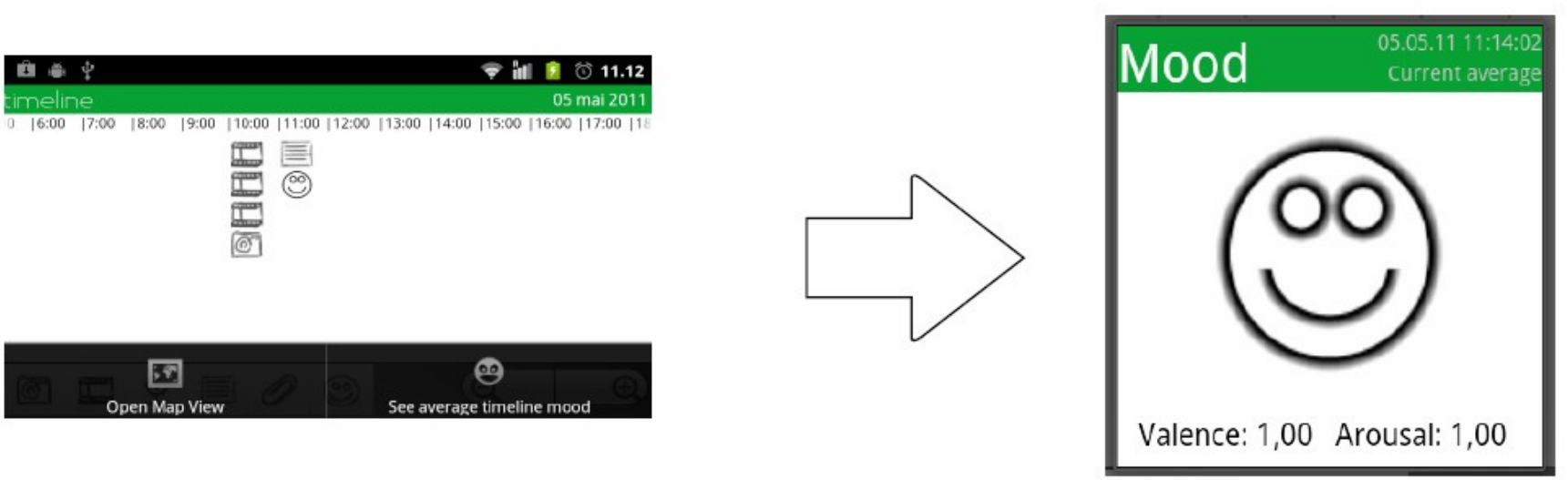
Viewing content



Open toolbar: you can add more items to this content.

Average timeline mood

In a shared timeline you can see the average mood of the timeline by clicking the **menu** button while viewing the timeline and select "**see average timeline mood**":



This relies on users sharing their mood in the timeline

Extra features

- See all content in a timeline in a mapview:

- Use tags to organize your content:

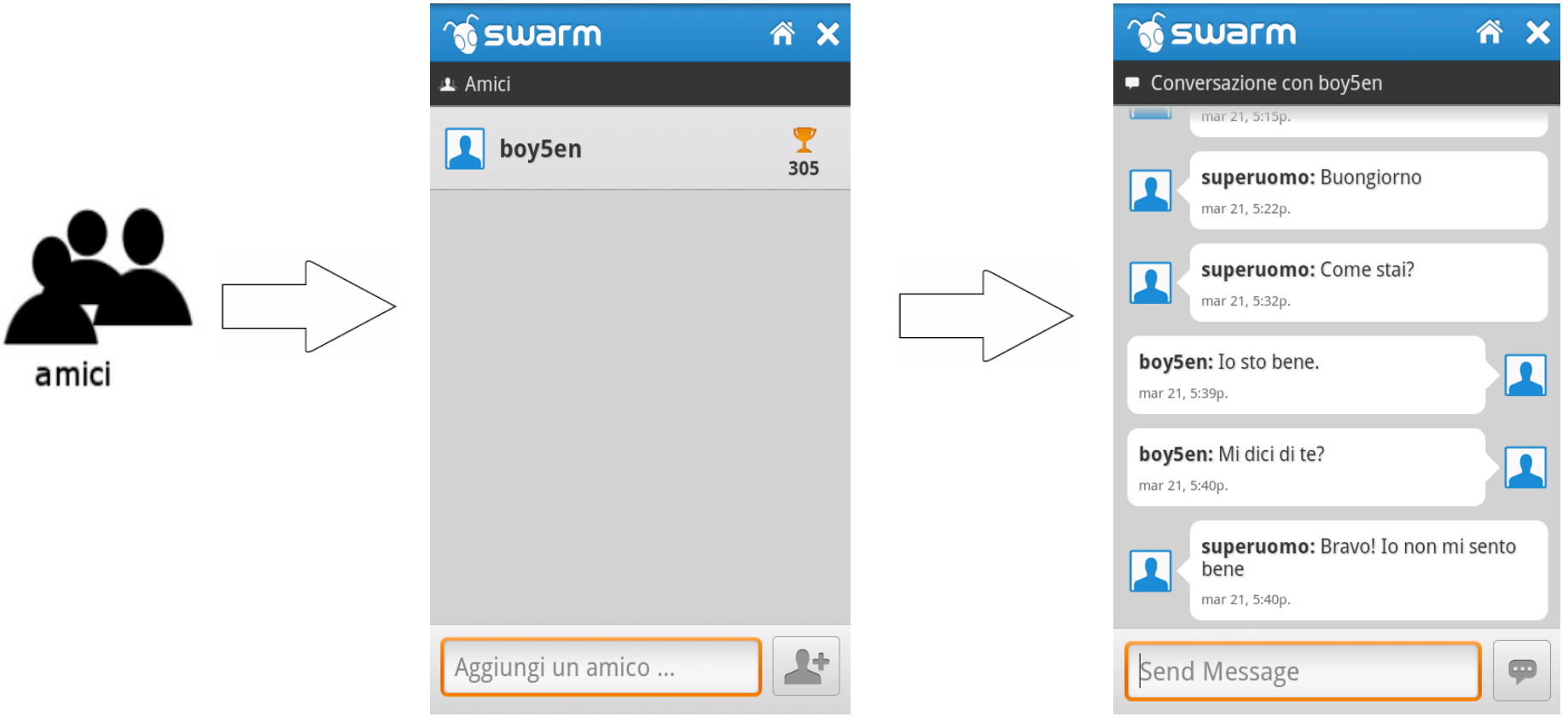
Extra features

Send activity report:

From the dashboard (main menu screen) click the menu button on the phone and select "send activity report". You will then receive an e-mail with a report of all the activity in the timelines you are a part of:

Extra features

- You can add friends, send instant messages and see how many achievement points they have



A.3 Task List from Evaluation in Italy

This section contains the task list which we provided to the testers in Italy. The text was translated to Italian and printed out in an adequate number before the evaluation.

Prova dell’applicazione “Diario Timeline”

1. Creare un nuovo diario
2. Aggiungere un’informazione per ciascuna tipologia:
   - Nota testuale
   - Foto
   - Audio
   - Video
   - Umore
   - Nota di riflessione
3. Aggiungere 10 elementi a propria scelta. (esempio 10 foto oppure 10 note)
4. Aggiungere amici e comunicare tramite chat
5. Controllare i propri risultati
6. Creare alcune etichette
7. Eliminare alcuni elementi dal diario
8. Aggiungere un commento
9. Condividere un elemento del diario sui social network

B Appendix: Questionnaire from usability test

In this appendix we have included a questionnaire from our usability test. For each question we have checked the answer boxes with numbers representing how many testers chose that alternative. The results are discussed at length in chapter 10.4.

We also sorted the answers for who were used to android, and those who were not. The first answer sheet are the one with all answers, the second for the ones that are used to android, while the third are from those that are not.

Questionnaire

Name :_____

Email :_____

Age :_____

Gender:_____

Studies:_____

		Strongly disagree				Strongly agree
1	I think that I would like to use this system frequently.	1	4	4	0	0
2	I found the system unnecessarily complex.	2	4	3	0	0
3	I thought the system was easy to use.	0	0	1	7	1
4	I think that I would need the support of a technical person to be able to use this system.	6	3	0	0	0
5	I found the various functions in this system were well integrated.	0	2	3	3	1
6	I thought there was too much inconsistency in this system.	1	5	2	1	0
7	I would imagine that most people would learn to use this system very quickly.	0	2	2	2	3
8	I found the system very cumbersome to use.	1	3	5	0	0
9	I felt very confident using the system.	0	2	1	4	2
10	I needed to learn a lot of things before I could get going with this system.	3	4	2	0	0
11	The icons were easy to understand and consistent throughout the application.	0	0	1	5	3
12	It was easy to navigate in order to find information.	0	1	4	4	0
13	It was easy to check my score.	0	1	0	3	5
14	The points and level system were easy to understand.	1	1	2	3	2
15	It was easy to keep track of my progress.	0	0	2	5	2
16	The connection between level and profile progress was intuitive.	0	3	5	1	0

17	The connection between leveling and new profile pictures was intuitive	3	3	2	1	0
18	Your actions induced a logical response from the application.	0	0	1	6	2
19	Adding elements to a timeline was easy.	0	0	0	4	5
20	Adding elements to a timeline was intuitive.	0	0	2	4	3
21	The difference in design of some of the menus confused me.	2	4	2	1	0
22	I received feedback on my progress.	0	1	1	5	2
23	The tutorial was useful.	3	0	3	3	0
24	The tutorial was intuitive.	2	2	3	1	1
25	The tutorial was easy to find.	2	3	2	1	1
26	Moving around in the application was easy.	0	1	3	5	0
27	Moving around in the application was intuitive.	0	0	4	5	0
28	I am experience with the use of Android devices.	1	2	2	0	4

Questionnaire

Android skills 5

Name :_____

Email :_____

Age :_____

Gender:_____

Studies:_____

		Strongly disagree				Strongly agree
1	I think that I would like to use this system frequently.	0	3	1	0	0
2	I found the system unnecessarily complex.	0	2	2	0	0
3	I thought the system was easy to use.	0	0	1	2	1
4	I think that I would need the support of a technical person to be able to use this system.	3	1	0	0	0
5	I found the various functions in this system were well integrated.	0	1	2	1	0
6	I thought there was too much inconsistency in this system.	0	2	1	1	0
7	I would imagine that most people would learn to use this system very quickly.	0	0	2	1	1
8	I found the system very cumbersome to use.	0	2	2	0	0
9	I felt very confident using the system.	0	1	0	2	1
10	I needed to learn a lot of things before I could get going with this system.	0	2	2	0	0
11	The icons were easy to understand and consistent throughout the application.	0	0	0	2	2
12	It was easy to navigate in order to find information.	0	1	1	2	0
13	It was easy to check my score.	0	1	0	1	2
14	The points and level system were easy to understand.	1	0	1	1	1
15	It was easy to keep track of my progress.	0	0	1	2	1
16	The connection between level and profile progress was intuitive.	0	1	3	0	0

17	The connection between leveling and new profile pictures was intuitive	2	1	0	1	0
18	Your actions induced a logical response from the application.	0	0	1	2	1
19	Adding elements to a timeline was easy.	0	0	0	1	3
20	Adding elements to a timeline was intuitive.	0	0	0	2	2
21	The difference in design of some of the menus confused me.	1	2	1	0	0
22	I received feedback on my progress.	0	0	0	3	1
23	The tutorial was useful.	2	0	1	1	0
24	The tutorial was intuitive.	2	0	1	0	1
25	The tutorial was easy to find.	2	2	0	0	0
26	Moving around in the application was easy.	0	0	2	2	0
27	Moving around in the application was intuitive.	0	0	2	2	0
28	I am experience with the use of Android devices.	0	0	0	0	4

Questionnaire

Android skills < 5

Name :_____

Email :_____

Age :_____

Gender:_____

Studies:_____

		Strongly disagree				Strongly agree
1	I think that I would like to use this system frequently.	1	1	3	0	0
2	I found the system unnecessarily complex.	2	2	1	0	0
3	I thought the system was easy to use.	0	0	0	5	0
4	I think that I would need the support of a technical person to be able to use this system.	3	2	0	0	0
5	I found the various functions in this system were well integrated.	0	1	1	2	1
6	I thought there was too much inconsistency in this system.	1	3	1	0	0
7	I would imagine that most people would learn to use this system very quickly.	0	2	0	1	2
8	I found the system very cumbersome to use.	1	1	3	0	0
9	I felt very confident using the system.	0	1	1	3	0
10	I needed to learn a lot of things before I could get going with this system.	3	2	0	0	0
11	The icons were easy to understand and consistent throughout the application.	0	0	1	3	1
12	It was easy to navigate in order to find information.	0	0	3	2	0
13	It was easy to check my score.	0	0	0	2	3
14	The points and level system were easy to understand.	0	1	1	2	1
15	It was easy to keep track of my progress.	0	0	1	3	1
16	The connection between level and profile progress was intuitive.	0	2	2	1	0

17	The connection between leveling and new profile pictures was intuitive	1	2	2	0	0
18	Your actions induced a logical response from the application.	0	0	0	4	1
19	Adding elements to a timeline was easy.	0	0	0	3	2
20	Adding elements to a timeline was intuitive.	0	0	2	2	1
21	The difference in design of some of the menus confused me.	1	2	1	1	0
22	I received feedback on my progress.	0	1	1	2	1
23	The tutorial was useful.	1	0	2	2	0
24	The tutorial was intuitive.	0	2	2	1	0
25	The tutorial was easy to find.	0	1	2	1	1
26	Moving around in the application was easy.	0	1	1	3	0
27	Moving around in the application was intuitive.	0	0	2	3	0
28	I am experience with the use of Android devices.	1	2	2	0	0

C Appendix: Survey from Final Evaluation

Contents

In this appendix we have included the survey from our last test, as well as the answers. The answers for each question are summarized with diagrams, numbers and percentages. The survey was made with Google Drive. The results are discussed at length in chapter 11.3.

C.1 Survey

Timeline Evaluation Survey

This form is a way for us to get feedback from you after having tested our application for about a week. Please be honest and constructive. We will not be using your names or your emails in our report, it is just information we will use to hunt down and punish people who may try to skip taking our survey :)
* Required

Name: *

Timeline username: *

Email: *

Age: *

Gender: *

Studies: *
(or work)

The level and point system motivated me to add elements. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Leveling up motivated me to continue adding elements. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Discovering new profile pictures motivated me to level up. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Consecutive reflection note bonus motivated me to make a reflection note every day. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The bonus points for adding different elements motivated me to vary the input element I used. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The leaderboard motivated me to compete with others. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Achievements motivated me to add more elements. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I tried to complete all the achievements. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I am usually motivated by achievements in games/apps/programs. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I did not feel like the application lacked achievements for any of its functionalities. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I discovered useful information in the tutorial. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I knew other people who used the application in the evaluation period. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I added the people I knew to my friends list. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I sent messages to my friends. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I would have enjoyed to be able to challenge my friends to duels. *
I.e. most points/achievements/levels gathered within a period of time.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Playing mini-games within the Timeline app would have motivated me to reflect. *
By mini-games we mean variations of games like the duel from the previous question.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I enjoyed using the application. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I used the application more because of the automatic reminder notifications.
Only answer this if Timeline sent you any automatic notifications.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The automatic reminder notifications were annoying.
Only answer this if Timeline sent you any automatic notifications.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I would have been more motivated by having the possibility to personalize my profile with an avatar. *
Unlocking equipment etc.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I would have used the application more if it didn't have achievements, points and leaderboards. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

The application was useful for my work. *
'Work' can also mean studies.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I usually take time to reflect on incidents related to my work. *
'Work' can also mean studies.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

During my evaluation period I reflected more than normally. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I think the core functionality of the app is useful. *
'Core functionality' means making timelines and adding things like pictures, notes etc.

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I am experienced with the use of Android devices. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I would consider myself a gamer. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I enjoy social games. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I enjoy games where I can compete with other players. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I enjoy challenging/hard games. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

I enjoy discovery/exploration oriented games. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

If you have any ideas for improvement of the gamification, please write below.
Gamification is the part of the application that is trying to increase your motivation and engagement in the app: points, levels, achievements, leaderboards, friends.

The following questions are for those that are not going to be interviewed due to distance or other agreements.

What feature in the application motivated you the most?

What feature did you find the least motivating?

Can you think of ways that the app could have motivated you more? If so, how?

How could this application have been changed to suit you better?

Did you think that gamification was suitable for the app, or was it more of a distraction?
Gamification is the part of the application that is trying to increase your motivation and engagement in the app: points, levels, achievements, leaderboards, friends.

In what scenarios can you see yourself use an application like this?

Were you motivated to reflect? Describe why, or why not.

Would it have been useful for you to get automatic notifications from Timeline that reminded you to reflect?
Answer if you did not receive any automatic notifications that reminded you to reflect.

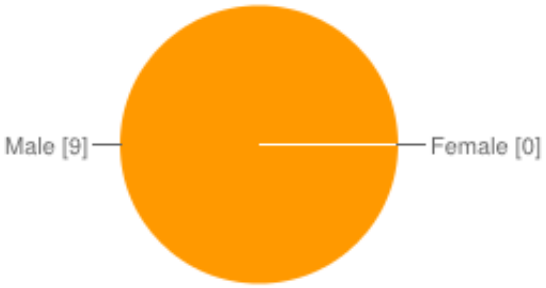
Submit
Never submit passwords through Google Forms.

C.2 Survey Answers

There are remnants of a question on the top where we asked about age. There is also missing a graph in the end, which is not interesting to this study.

28	**0**	0 %
29	**0**	0 %
30 or more	**0**	0 %

Gender:

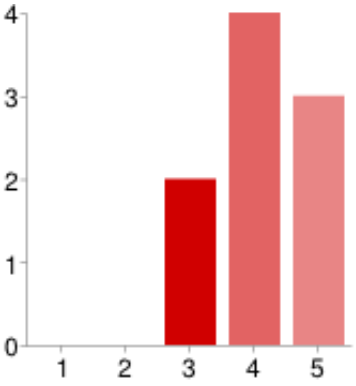


Male	**9**	100 %
Female	**0**	0 %

Studies:

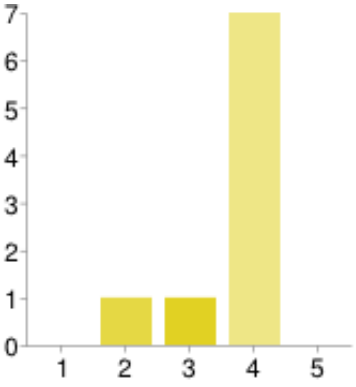
Informatics Computer Science Computer Science Computer Science Informatics Computer engineer MTDT Telematikk informatikk

The level and point system motivated me to add elements.



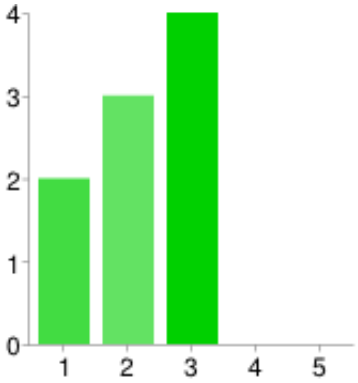
1	**0**	0 %
2	**0**	0 %
3	**2**	22 %
4	**4**	44 %
5	**3**	33 %

Leveling up motivated me to continue adding elements.



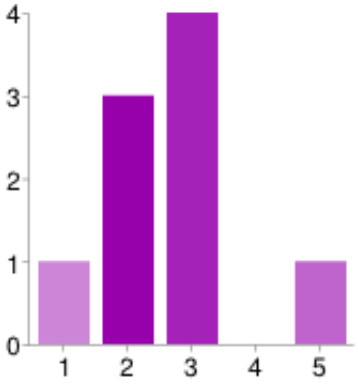
1	**0**	0 %
2	**1**	11 %
3	**1**	11 %
4	**7**	78 %
5	**0**	0 %

Discovering new profile pictures motivated me to level up.



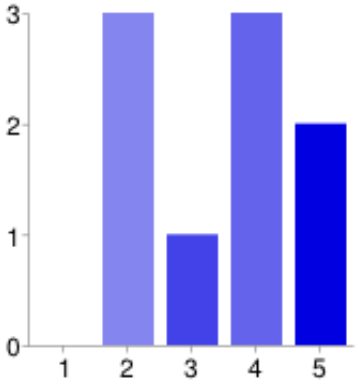
1	**2**	22 %
2	**3**	33 %
3	**4**	44 %
4	**0**	0 %
5	**0**	0 %

Consecutive reflection note bonus motivated me to make a reflection note every day.



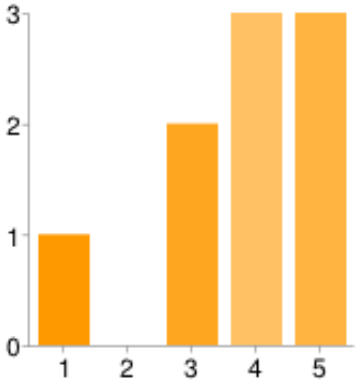
1	**1**	11 %
2	**3**	33 %
3	**4**	44 %
4	**0**	0 %
5	**1**	11 %

The bonus points for adding different elements motivated me to vary the input element I used.



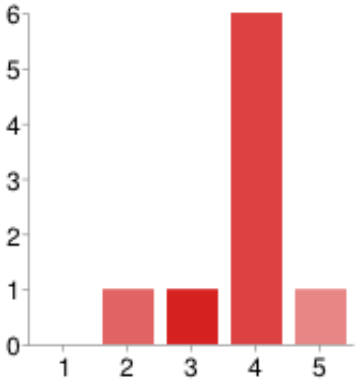
1	**0**	0 %
2	**3**	33 %
3	**1**	11 %
4	**3**	33 %
5	**2**	22 %

The leaderboard motivated me to compete with others.



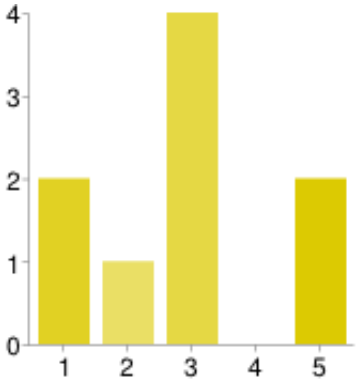
1	**1**	11 %
2	**0**	0 %
3	**2**	22 %
4	**3**	33 %
5	**3**	33 %

Achievements motivated me to add more elements.



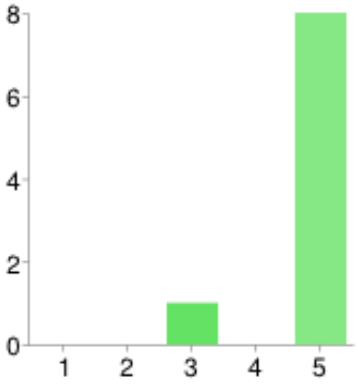
1	**0**	0 %
2	**1**	11 %
3	**1**	11 %
4	**6**	67 %
5	**1**	11 %

I tried to complete all the achievements.



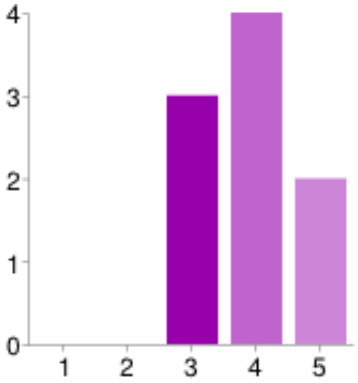
1	**2**	22 %
2	**1**	11 %
3	**4**	44 %
4	**0**	0 %
5	**2**	22 %

I am usually motivated by achievements in games/apps/programs.



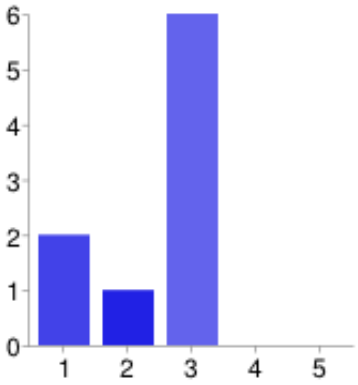
1	**0**	0 %
2	**0**	0 %
3	**1**	11 %
4	**0**	0 %
5	**8**	89 %

I did not feel like the application lacked achievements for any of its functionalities.



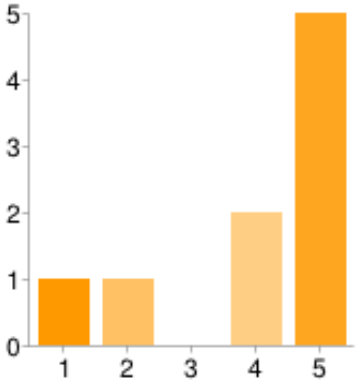
1	**0**	0 %
2	**0**	0 %
3	**3**	33 %
4	**4**	44 %
5	**2**	22 %

I discovered useful information in the tutorial.



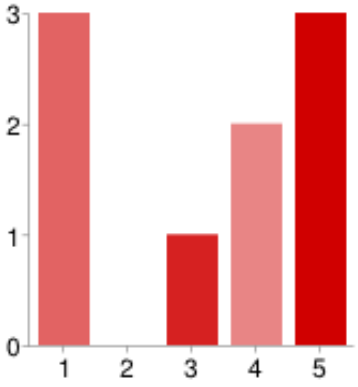
1	**2**	22 %
2	**1**	11 %
3	**6**	67 %
4	**0**	0 %
5	**0**	0 %

I knew other people who used the application in the evaluation period.



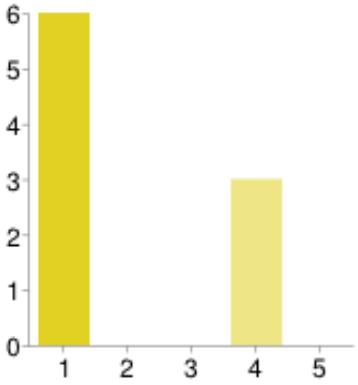
1	**1**	11 %
2	**1**	11 %
3	**0**	0 %
4	**2**	22 %
5	**5**	56 %

I added the people I knew to my friends list.



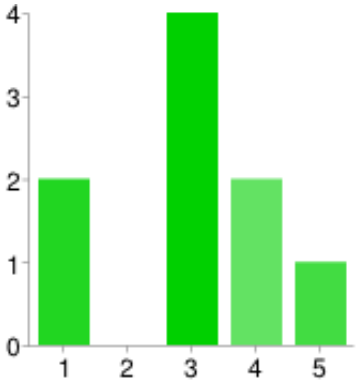
1	**3**	33 %
2	**0**	0 %
3	**1**	11 %
4	**2**	22 %
5	**3**	33 %

I sent messages to my friends.



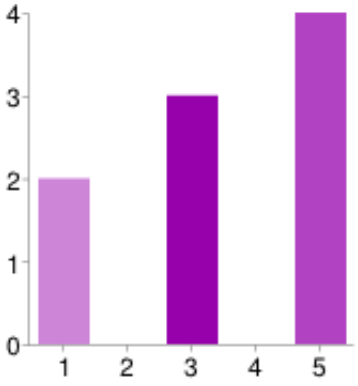
1	**6**	67 %
2	**0**	0 %
3	**0**	0 %
4	**3**	33 %
5	**0**	0 %

I would have enjoyed to be able to challenge my friends to duels.



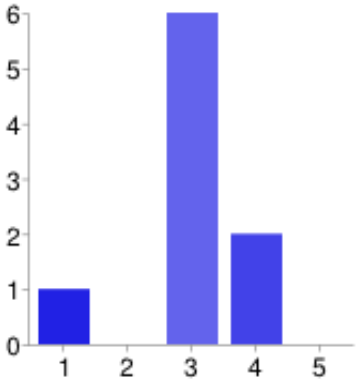
1	**2**	22 %
2	**0**	0 %
3	**4**	44 %
4	**2**	22 %
5	**1**	11 %

Playing mini-games within the Timeline app would have motivated me to reflect.



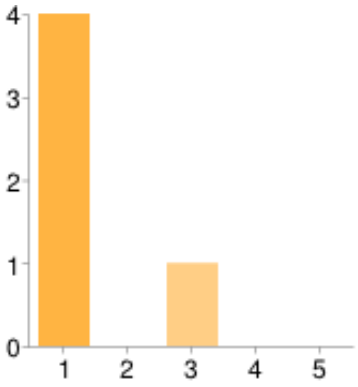
1	**2**	22 %
2	**0**	0 %
3	**3**	33 %
4	**0**	0 %
5	**4**	44 %

I enjoyed using the application.



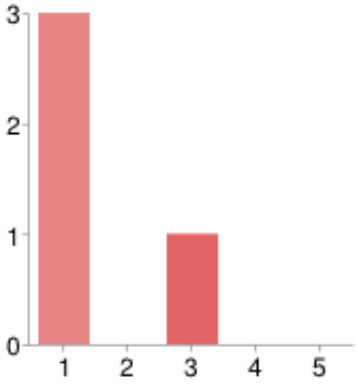
1	**1**	11 %
2	**0**	0 %
3	**6**	67 %
4	**2**	22 %
5	**0**	0 %

I used the application more because of the automatic reminder notifications.



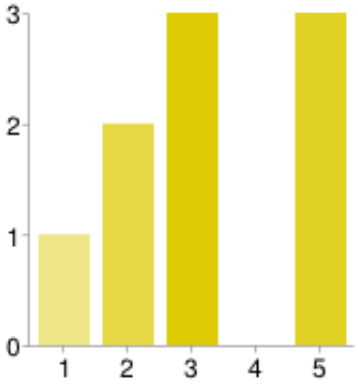
1	**4**	80 %
2	**0**	0 %
3	**1**	20 %
4	**0**	0 %
5	**0**	0 %

The automatic reminder notifications were annoying.



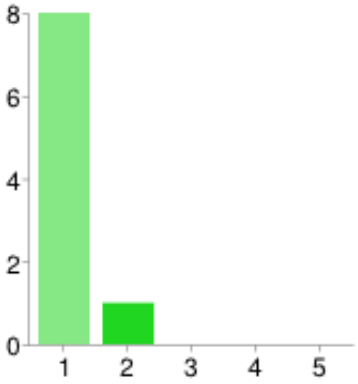
1	**3**	75 %
2	**0**	0 %
3	**1**	25 %
4	**0**	0 %
5	**0**	0 %

I would have been more motivated by having the possibility to personalize my profile with an avatar.



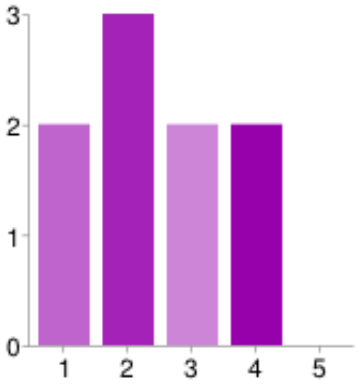
1	**1**	11 %
2	**2**	22 %
3	**3**	33 %
4	**0**	0 %
5	**3**	33 %

I would have used the application more if it didn't have achievements, points and leaderboards.



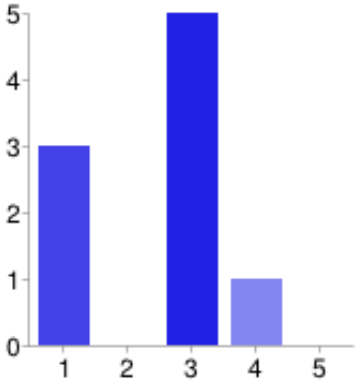
1	**8**	89 %
2	**1**	11 %
3	**0**	0 %
4	**0**	0 %
5	**0**	0 %

The application was useful for my work.



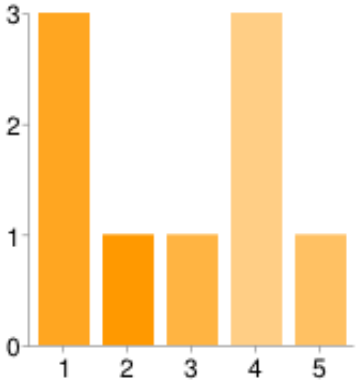
1	**2**	22 %
2	**3**	33 %
3	**2**	22 %
4	**2**	22 %
5	**0**	0 %

I usually take time to reflect on incidents related to my work.



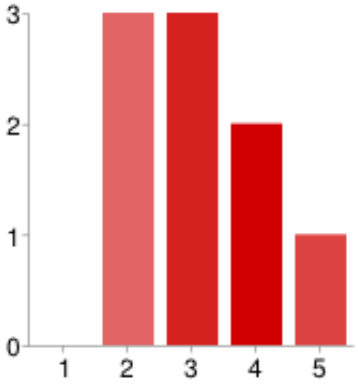
1	**3**	33 %
2	**0**	0 %
3	**5**	56 %
4	**1**	11 %
5	**0**	0 %

During my evaluation period I reflected more than normally.



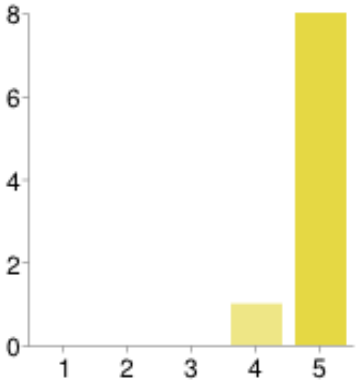
1	**3**	33 %
2	**1**	11 %
3	**1**	11 %
4	**3**	33 %
5	**1**	11 %

I think the core functionality of the app is useful.



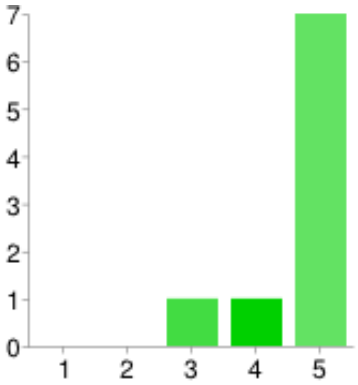
1	**0**	0 %
2	**3**	33 %
3	**3**	33 %
4	**2**	22 %
5	**1**	11 %

I am experienced with the use of Android devices.



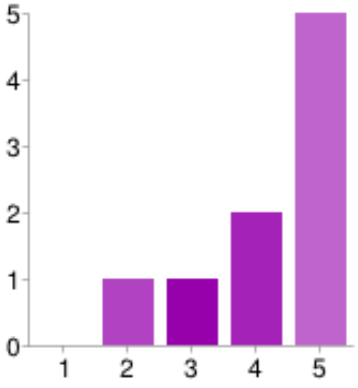
1	**0**	0 %
2	**0**	0 %
3	**0**	0 %
4	**1**	11 %
5	**8**	89 %

I would consider myself a gamer.



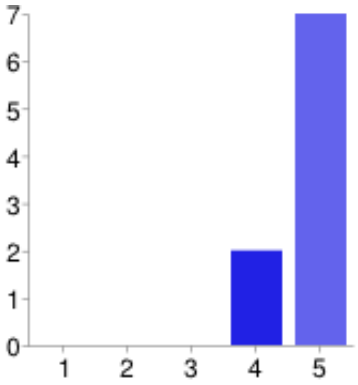
1	**0**	0 %
2	**0**	0 %
3	**1**	11 %
4	**1**	11 %
5	**7**	78 %

I enjoy social games.



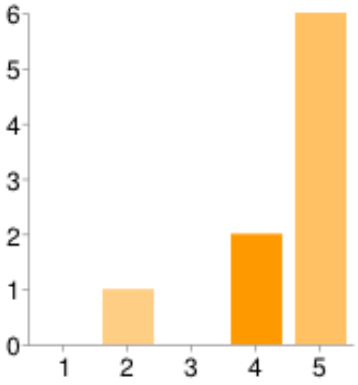
1	**0**	0 %
2	**1**	11 %
3	**1**	11 %
4	**2**	22 %
5	**5**	56 %

I enjoy games where I can compete with other players.



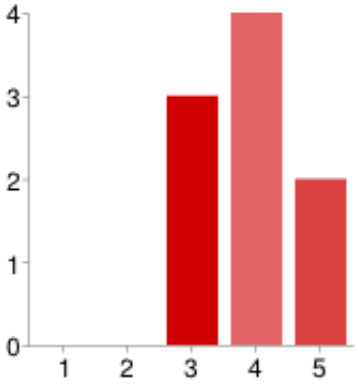
1	**0**	0 %
2	**0**	0 %
3	**0**	0 %
4	**2**	22 %
5	**7**	78 %

I enjoy challenging/hard games.



1	**0**	0 %
2	**1**	11 %
3	**0**	0 %
4	**2**	22 %
5	**6**	67 %

I enjoy discovery/exploration oriented games.



1	**0**	0 %
2	**0**	0 %
3	**3**	33 %
4	**4**	44 %
5	**2**	22 %

If you have any ideas for improvement of the gamification, please write below.

hmmm The leaderboard as of now does not fit with the application, as it makes you do actions to increase your rank (such as spamming reflection notes), instead of for doing them for their intended purpose (actually reflecting) If there was a way of sharing reflection/timelines/photos then gamification in form of upvotes/downvotes/reputation could be a way of motivating people to really reflect. (And then reputation could be used as a leaderboard). This would also make the friends-functionality useful (you could share with only friends, etc) Generally satisfied with the gamification parts, the timeline app in itself is a

bit tedious and invasive I think. It should be more streamlined and easier to use, too much clicks to do stuff. That players shouldn't being able to "cheat" by spamming stuff. Like making unliminited reflections notes/mood rings etc. Mood rings should be limited to the number of smileys in the app and so on. Burde ikke kunne spamme seg til poeng. Poengsystemet burde vært balansert. Føler nåværende gamification "oppfordrer" meg til å spamme reflection notes, selv om hovedfokuset kanskje burde være at jeg faktisk skriver skikkelig reflections (og at jeg får noe ut av de). Spesielt at man får mer poeng per refleksjon per dag funker ikke. Ser for meg at f.eks et mer sosialt poengsystem ville fungert bedre. Slik at andre brukere måtte bestemme poengene, f.eks ved likes. The push-notifications did not work on my device (samsung galaxy s2)

The following questions are for those that are not going to be interviewed due to distance or other agreements.

What feature in the application motivated you the most?

achievemtns, unlocking stuff. Posting photos to the timeline + leaderboard Getting achievements for trying out new things Leaderboardet. Selv om det fikk meg til å abuse appen.

What feature did you find the least motivating?

for lite kjepp The frustrating act of writing reflections. Getting points and achievements for mundane things. The fact that the GPS didn't turn itself off when closing the app, making it drain my phone battery. Å skrive reflection notes når det er så mye jobb å få vekk templaten som er der.

Can you think of ways that the app could have motivated you more? If so, how?

By making it clear how it could be more useful in my work / daily life Svarte nok litt på det over, men, må eventuelt være å sosialisere appen mer.

How could this application have been changed to suit you better?

Make you able to share things, build upon photo/video-timeline functionality. Remove the reflection aspect, (and the extreme amount of points you got for reflecting). By making it clear how it could be more useful in my work / daily life Ja. F,eks: Hvis man kunne brukt appen som en slags bildetimeline der man tok 1 bilde om dagen, som en slags instagram/blogg.no mix. Også delt det med andre. Egentlig måtte appen blitt totalforandret hvis jeg skulle vurdert å bruke den.

Did you think that gamification was suitable for the app, or was it more of a

distraction?

gameification is important or the user will only use the application for a day and then never again. I would say that it in some way was suitable and some ways unsuitable. Having points/level system/achievements is okay, as these are used to add to the players self-motivation, but the leaderboard does not fit the application in its current state, in my opinion. The reason is that reflection is a self-motivating activity. Adding competition in form of a leaderboard to see who has reflected the most does not make people reflect more for the purpose of reflecting, but to climb the leaderboard, which kind of defeats the purpose. I think it was suitable and that it made the app more fun to use. gamification i nåværende form får meg nok mer til å abuse enn å bruke den riktig.

In what scenarios can you see yourself use an application like this?

registering mood to be able to reflect on my mood and stress during the day I think will be useful for me. Then it is easier to reflect and remember why I was sad or happy at a certain time. I could also see myself using the application to track how I feel after eting certain food, and how I perform in sports like cycling depending on notes about food and such. Placing photos/videos on a timeline could be interesting if you could share the timeline with others. None whatsoever aldri

Were you motivated to reflect? Describe why, or why not.

Gameification with achievemnts motivated me to add data for reflection. I have never done written reflection in my life (except during Experts in Team), and it is not something I will ever do. The fact that my mobile has a tiiiny screen and reflection required you to type, made it a frustrating experience. No. I don't understand why I need to reflect and the app didn't give me any good reasons to reflect. Nei, og det er først og fremst pga den forferdelig templaten. Tastaturet går jo over skjermen også, så jeg ser jo ikke spørsmåla på bunn.

Would it have been useful for you to get automatic notifications from Timeline that reminded you to reflect?

Yes. Or else it is easy to forget. (bekalger rævva englesk, er på fylla) If I wanted to reflect, it would have been useful! No, that would be very annoying. Kanskje hvis jeg fikk den akkurat når jeg la meg hver natt. Men tror timeline ikke er for meg. Yes!

Antall svar per dag

C.3 Interview With a Tester

We managed to get an interview with one of the testers from our final evaluation. The interview took place after the test period was over. We asked the same questions that were optional in the survey. The test subject is a 26 years old male who studies computer engineering.

Transcript of interview with one of the test subjects

1. **What feature in the application motivated you the most?**

A: Achievements. Games with achievements always motivate me, since it makes me want to get them all. Except for the audio/video achievements, as I don't really like to film and record stuff, especially not myself.

2. **What feature did you find the least motivating?**

A: Hard to rememeber to use it in the test period.

Not really an app I would want to use, so it was not very motivating in the first place.

The least motivating feature was that people could cheat to gain points on the leaderboard. There should be no points for multiple reflection notes on the same day, or at least a max limit of points you can gain per day. Or maybe you should check if the reflection notes are empty, and don't award points if they are.

Did not like the forced horizontal view of the timelines. Felt very locked.

3. **Can you think of ways that the app could have motivated you more? If so, how?**

A: Daily achievements - gives the user more motivation to do something every day.
Also a daily leaderboard, and maybe even weekly and monthly

Maybe it would have been more motivating to use the app for traveling. I could take pictures and make timelines of the places I go.

4. **How could this application have been changed to suit you better?**

A: More achievements and leaderboards like I said earlier.

Also it is boring with the same reflection note questions every day. It becomes a routine that I just want to get over with quickly. And I don't think you should have yes/no questions. It's too easy to just give a simple yes/no and be done with it. It should be more like "did you learn something today? If so, what did you learn?"

5. **Did you think that gamification was suitable for the app, or was it more of a distraction?** *Gamification is the part of the application that is trying to increase your motivation and engagement in the app: points, levels, achievements, leaderboards, friends.*

A: The problem with gamification in this instance was that people could spam their timelines for

points and dominate the leaderboard without really doing anything constructive. Not only was it not motivating, it was directly demotivating to see the one user with ten times as many points as anybody else. I think it would have served the purpose of the reflection note better if the user only had one reflection note each day, since that is the kind of thing you would only do once a day anyway. But if there was no gamification in this app I would have used it even less.

6. **In what scenarios can you see yourself use an application like this?**

A: As I said earlier, I could have used ot as a travel application. But it would be nice if it was reworked a bit for that purpose, so I could be tagging known buildings or cities, and putting pictures and experiences in a timeline to log my trips. That way I could build a kind of database with information of all the places I have been.

Also maybe it could have been used for Scrum at work, as a kind of stand up meeting. Everyone writes a reflection note with what they have done for the day and share it with each other.

And maybe I could have used it privately to log projects, using it as kind of a backlog. I guess I could have logged my entire bachelor's project in Timeline if I had started using it from the start. But it would have been nice to have a different sort of input in timelines, with project types and document types instead of just notes.

7. **Were you motivated to reflect? Describe why, or why not.**

A: No, I felt that reflecting was something that I had to do during the test period, but did not really see any purpose in it. In the reflection notes I basically just wrote that I had been to the dentist and that I had been jogging, and that I could have jogged a bit longer.

By the way, it could have been useful if you made Timeline a little more Twitter-like where I could put tags on things and get statistics on how many times I had been out jogging and things like that.

8. **Would it have been useful for you to get automatic notifications from Timeline that reminded you to reflect?**

A: Yeah, especially since it was in a stressful period and I had a lot on my mind. I did forget to use it some days. But it would have nice if I could have the option to turn notifications on and off too, so I don't have to feel forced to get notifications.

Bibliography

Contents

[1] Gamification Literature Review (2012). *Sondre Løberg Sæter; Bjørnar Valle*. Last accessed 2013.05.16

[2] Enhancing reflection by collaboratively capturing experiences in a timeline (2011). *Anders Kristiansen; Andreas Storlien*. Last accessed 2013.05.16

[3] The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education. (2012). *Karl M. Kapp*. Available: ISBN 978-1-118-09634-5 Pages: 9-15 Last accessed 2013.04.17

[4] Is Android really an un-intuitive operating system? (2013). *Josiah Bruner*. Available: `http://infinite-josiah.blogspot.no/2013/04/is-android-really-un-intuitive.html`. Last accessed 2013.04.19

[5] Gamification: Toward a Definition. (2011). *Sebastian Deterding; Dan Dixon; Rilla Khaled; Lennart E. Nacke*. Available: `http://hci.usask.ca/uploads/219-02-Deterding,-Khaled,-Nacke,-Dixon.pdf` Last accessed 2012.10.27

[6] Discover Magazine (2011). *Ed Yong* Available: `http://blogs.discovermagazine.com/notrocketscience/2011/09/18/computer-gamers-solve-problem-in-aids-research-that-puzzled-scientists-for-years/` Last Accessed 2013.20.05

[7] DragonBox - The Math Game (2012). *WeWantToKnow AS* Available: `http://dragonboxapp.com/` Last Accessed 2013.20.05

[8] Zombies Run (2012). *Six to Start* Available: `https://www.zombiesrungame.com/` Last Accessed 2013.20.05

[9] Fantasy Premier League (2013). *Premier League 2013* Available: `http://fantasy.premierleague.com/` Last Accessed 2013.20.05

[10] Gamification Course by Kevin Werbach (University of Pennsylvania) through Coursera.org. (2012). *Kevin Werbach*. Available: `https://www.coursera.org/course/gamification` Last accessed 2012.10.27

[11] Game Design Workshop - A Playcentric Approach to Creating Innovative Games (2008). *Written by: Tracy Fullerton with Christopher Swain and Steven S. Hoffman* Available: ISBN 978-0-240-80974-8 Last Accessed 2012.11.26

[12] MDA: A Formal Approach to Game Design and Game Research. (2001). *Mark LeBlanc*. Available: `http://www.cs.northwestern.edu/~hunicke/pubs/MDA.pdf` Game Developers Conference, San Jose 2001-2004 Last accessed 2012.11.08

[13] Reflection: Turning Experience into Learning. (1985). *Boud, D.; R. Keogh; D. Walker*. Available: ISBN 9780850388640. Publisher: Routledge Falmer Page: 19 Last accessed 2013.22.05

[14] On the Effect of Immediate Feedback. (2006). *Ido Erev; Adi Luria; Anan Erev*. Available: `http://telem-pub.openu.ac.il/users/chais/2006/05/pdf/e-chais-erev.pdf` Last accessed 2013.22.05

[15] Avatar Customization and Emotions in MMORPGs. (2006). *Shun-an Chung; Jim Jiunde Lee*. Available: `http://alturl.com/fw2ix` URL information: Has been shortened using `http://www.shorturl.com`. Last accessed 2013.23.05

[16] Body and Mind: A Study of Avatar Personalization in Three Virtual Worlds. (2009). *Nicolas Ducheneaut; Ming-Hui "Don" Wen; Nicholas Yee; Greg Wadley*. Available: `http://alturl.com/msffs` URL information: Has been shortened using `http://www.shorturl.com`. Last accessed 2013.23.05

[17] "SUS - A quick and dirty usability scale." Usability evaluation in industry. (1996). *John Brooke*. Available: `http://hell.meiert.org/core/pdf/sus.pdf` Last accessed 2013.29.05

[18] SwarmConnect. (2013). *Swarm*. Available: `http://swarmconnect.com/` Last accessed 2013.30.05

[19] Skiller. (2013). *Skiller*. Available: `http://www.skiller-games.com/` Last accessed 2013.30.05

[20] Badgeville. (2012). *Badgeville*. Available: `http://www.badgeville.com/products/mobile` Last accessed 2013.30.05

[21] Beintoo. (1996). *Beintoo*. Available: `http://www.beintoo.com/business/developer/sdk.html` Last accessed 2013.30.05

[22] Understanding and Supporting Reflective Learning Processes in the Workplace: The RL@Work Model. (2013). *Krogstie, B., M. Prilla, and V. Pammer*. Available: ECTEL 2013, Springer: Paphos, Cyprus. Last accessed 2013.17.06

[23] Jawbone UP. (2013). *Jawbone*. Available: `https://jawbone.com/up` Last accessed 2013.10.06

[24] We Are Our Scores: The Aspirational Self. (2012). *The Aspirational Self*. Available: `http://techcrunch.com/2012/04/14/we-are-our-scores-the-aspirational-self/` Last accessed 2013.10.06

[25] MIRROR Reflective Learning at Work. (2013). *The Aspirational Self*. Available: `http://www.mirror-project.eu/` Last accessed 2013.10.06

[26] Nike FuelBand Review: An Exciting Entry into the Gamification of Health. (2012). *iMedicalApps; David Ahn*. Available: `http://www.imedicalapps.com/2012/04/nike-fuelband-review-exciting-entry-gamification-health/1/` Last accessed 2013.10.06

[27] Nike+ FuelBand. (2013). *Nike, Inc*. Available: `http://www.nike.com/us/en_us/c/nikeplus-fuelband` Last accessed 2013.10.06

[28] Applying Quantified Self Approaches to Support Reflective Learning. (2012). *Rivera-Pelayo, V.; Zacharias, V.; Müller, L.; Braun, S.*. In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (pp. 111-114). ACM. Last accessed 2013.10.06

[29] Stack Overflow. (2013). Available: `http://www.stackoverflow.com/` Last accessed 2013.12.06

[30] Fun, Play and Games: What Makes Games Engaging. (2001). *Marc Prensky*. Available: `http://www.marcprensky.com/writing/prensky%20-%20digital%20game-based%20learning-ch5.pdf` Last accessed 2013.14.06

[31] Google App Engine Blog. (2012). Available: `http://googleappengine.blogspot.no/2012/04/masterslave-datastore-thanks-for-all.html` Last accessed 2013.12.06

[32] WATCHiT. (2013). Available: `http://www.mirror-project.eu/showroom-a-publications/mirror-apps-status/166-watchit` Last accessed 2013.17.06

[33] Android. (2013). Available: `http://developer.android.com/design/patterns/widgets.html` Last accessed 2013.17.06