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Theme: Designing from both sides of the screen
Subtheme: Consumption
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Abstract

The first aid application *Førstehjælper-Spillet* is a game developed for Android smartphones to help users refresh or memorize their first aid skills. Through a collection of mini-games the user experiences different simulated emergency situations. By means of repetition the user will learn to recognize specific accidents and know how to act - and more importantly, will not be afraid to act.

The goal with *Førstehjælper-Spillet* is to reduce the number of people who end up at the hospitals each year due to bad on-scene first aid. A bed hour at the hospital costs approximately DKK 10,000. If the number of people getting hospitalized or the time spent at the hospital is reduced, then resources will be saved. A prototype was developed and tested through a questionnaire. It showed positive results: the test participants were interested in the concept and found it useful. 67% of the participants who didn't know about the correct procedure of CPR (cardiopulmonary resuscitation) beforehand, learned the proper technique and showed progress in their general understanding of first aid.

Foreword

Do you have the knowledge and skills to save people? Do you think you will be able to save your friend if he suddenly dropped down on the floor? Maybe you have taken a first aid course, but it has been so long time ago, so you don't really remember that much, do you? Then you are like almost everybody else; you were on a first aid course when you took your driver's license, at your workplace or in the military, but these days the memory of how to do it seems vague. If this is the case, you should continue reading this, because our goal is to help people become better and more confident in doing first aid. How would we do this, you ask. Simple, dear reader: by providing an Android application teaching you first aid skills.

It has always been hard to reach out to the masses, but in the age we are living in now it's harder than ever. We are fighting for the attention not only against other people, but also from TV's, blinking commercials, the computer with the always entertaining Internet, newspapers and whatnot. The modern generation has learned to filter out information. We are used to being bombarded with things from everywhere, and therefore we also get very easily bored. In other words, our attention span is getting smaller and smaller.

So how do we get the attention of the modern man? And how do we keep him interested? We are so used to everything and everyone trying to get our attention, and therefore it takes more than a "listen to me" to actually get someone listening to you. You need to stand out between all the blinking lights and popular videos on the Internet. It's important to make it interesting for people to actually pay attention.

This is a university project from 1st semester at Aalborg University 2011. The theme is *Designing from both sides of the screen*. Design has lead us to think about the cognitive process of paying attention, where the cognitive processes include attention, remembering, solving problems and making decisions. Modern technology as television and Internet may have the effect of decreasing the attention span of humans, because it enables the users to easily move from one field to another. Attention covers a major area of the research done within the field of education, and here technology can be used to make education entertaining and by that maintain an audience while incorporating informative content.

A good design is the first step on the road of maintaining the selective attention of the modern man. New products should be outstanding and different from others. An impressive design with an alluring appearance will remain in the memory of the user and keep their attention longer. The design will also affect the way the user interacts with technology, since design is more than the visual appearance. Interactivity, usability and interfaces are just as important factors, and today no one will waste their time on a badly designed product.

The process of P1 started October 10th 2011 and ended December 20th 2011. It has been a process of focusing on teamwork and learning in a group. The goals were high from the start and this has caused a persistent level of drive within the group. During the P1 period the group had courses in graphical design and programming. This knowledge was applied in the process of designing and developing the prototype application. We also had the opportunity to personally learn more about first aid. It is no lie to claim that a person would be better off with collapsing next to one of the group members after December 2011 than before October 2011, since our first aid knowledge have increased. The most important lesson learned is "*Don't be afraid to act*", and for that we have to thank the first aid trainer André B. Nielsen for taking his time to help us.

Table of Contents

Chapter 1
PREFACE

1.1 Theme and subtheme

The purpose of this project is to study and explore the main theme Designing from both sides of the screen. On one side, users have tasks they want to carry out, and on the other side the system should help to solve those tasks. Human-computer interaction is a basic example of interactive communication and is a way for people to use the new media and digital devices. For this study, the focus is on the design, which should feature functionality and a user-friendly interface. The usability and therefore ease-of-use, demands an intuitive display. The *Look* and *Feel*, where *Look* refers to the visual design, and the *Feel* refers to its interactivity, will in the end determine whether or not the design can live up to the expectations of the users.

The given subtheme is *Consumption* and by that the use of resources. It was chosen to make a first aid game to manage the task of better memorizing the first aid routines. First aid fits into the subtheme in many ways. The first way is that if a user of the first aid game gets better and faster in performing first aid: this saves time when the person comes in an emergency situation, since he is more clear on what to do.

So the first resource that the application saves is time at an accident. The second resource saved is human lives and damages on the victim. It seems plausible that faster and better first aid also leads to less consequential damages, so the injured person spends less hours at the hospital which leads to lower costs for the government.

1.2 Vision

The ultimate vision of this project is to examine whether or not a first aid game can be made fun and at the same time educational. A key concept is edutainment, derived from the two words *edu*-cation and enter-*tainment* - a term first used by The Walt Disney Company in 1948 during the production of the *True-Life Adventures TV series*[1]. It's a form of entertainment designed to educate as well as to entertain. With interactive learning the project should include the audience and their actions into the learning process to create better and longer interest in first aid.

On one side of the screen the goal is to specify and analyze the problem of performing proper first aid, as well as people's misgivings about their own first aid skills, which makes them afraid to act. The aim is to come up with a suggested solution and identify its appertaining target group, as well as investigate the users' requirements and wishes.

On the other side of the screen it will be necessary to specify the requirements of the interface and design a solution that can be converted into an application. The design will define both interaction and the application's underlying mechanics. Lastly, implementation of the design should be accomplished and a testing phase will be taken into perspective to check whether or not the solution reaches the demands and expectations of the users.

1.3 Initiating Problem

People are often afraid to act in emergency situations. Is it possible to design a fun and user-friendly application that will make people feel more comfortable about their first aid skills?

Chapter 2
PROBLEM ANALYSIS

2.1 Research on first aid and health care

The group used triangulation of data to find sources about health care/first aid statistics. Using triangulation of sources, different sources added to the validation of the data.

The importance of on-scene first aid is crucial for the survival of the patient. When a person is struck by a heart-attack, the patient needs urgent first aid. If the patient hasn't received any help in the 10 minutes after the attack, the chances of survival are close to non-existing[2]. This states why it is so important, that as many people as possible is capable of performing efficient first aid. This is one of the main goals of the application.

According to a Megafon measurement conducted by Politiken and TV2 in May 2010, only few Danes are able to or confident enough in performing first aid at an accident. First aid was performed by bystanders in only 1/4 accidents before the patient ended up in professional hands[3]. This is a problem. It seems that people are too afraid to act in an accident situation, even though they have taken a first aid course.

In Denmark it is an requirement to attend a first aid course to get a driver's license[4], a pedagogical education[5] or in government schools[6]. Of all of the participants who have completed a training course only 26% maintain their obtained first aid courses within 3 years, as recommended by the first aid organizations[7].

It seems highly probable that this could be a reason for the general insecurity at accidents. For the people to get more confident their first aid knowledge has to be regularly refreshed.

Each year accidents alone account for 2,000 cases of death and 46,000 lost years of living. They are a burden on society at a great expense. Accidents are one of the most frequent causes to hospitalization. Injuries hospitalize 100,000 people a year and most often because of accidents[8].

	0 år	1-14 år	15-24 år	25-34 år	35-44 år	45-54 år	55-64 år	65-74 år	75- år
1	Perinatale sygdomme (9700)	Åndedræts-sygdomme (18.500)	**Skader (11.700)**	**Skader (10.100)**	**Skader (11.700)**	Kredsløbs-sygdomme (14.600)	Kredsløbs-sygdomme (29.900)	Kredsløbs-sygdomme (34.500)	Kredsløbs-sygdomme (46.600)
2	Åndedræts-sygdomme (6000)	**Skader (10.600)**	Fordøjelses-sygdomme (5000)	Fordøjelses-sygdomme (7000)	Fordøjelses-sygdomme (9900)	Kræft (13.700)	Kræft (27.000)	Kræft (25.700)	Åndedræts-sygdomme (25.300)
3	Infektions-sygdomme (2700)	Infektions-sygdomme (6000)	Åndedræts-sygdomme (4100)	Urin- og kønssyg-domme (6100)	Urin- og kønssyg-domme (8100)	Fordøjelses-sygdomme (12.100)	Fordøjelses-sygdomme (15.300)	Åndedræts-sygdomme (15.800)	**Skader (23.100)**
4	Misdannel-ser (2500)	Fordøjelses-sygdomme (5100)	Urin- og kønssyg-domme (3500)	Bevæge-apparat-sygdomme (4100)	Kræft (7200)	**Skader (11.800)**	**Skader (14.100)**	Fordøjelses-sygdomme (13.300)	Kræft (19.700)
5	Fordøjelses-sygdomme (1300)	Kræft (4600)	Bevæge-apparat-sygdomme (2600)	Åndedræts-sygdomme (3900)	Kredsløbssy gdomme (7100)	Bevæge-apparat-sygdomme (8800)	Bevæge-apparat-sygdomme (12.100)	**Skader (12.200)**	Fordøjelses-sygdomme (19.400)

Figure 1 - Accidents are one of the most frequent causes to hospitalization[8].

"Denmark has a state-run health system. Financing, planning and management are fully subject to the authorities. The services are financed through income tax and there exists only one legal state-run health insurance[9]."

"In 2005 total health care expenditure in Denmark equalled approximately 16.8 billion USD[10]."

The application can make economical difference when it comes to a hospital context, by improving people's first aid skills and self-confidence. The app shouldn't be a replacement for proper first aid courses, but instead a supplement for the course participant's already-acquired knowledge. The mobile application will affect the state in the long-term run: the time saved at the emergency accidents will lead to hospitals saving time and bed hours. A hospital bed is expensive: DKK 10,000+ per day[11,12].

This will lead to money saved for the Danish government and a more sustainable economy in general. The government is pursuing a difficult goal. For the last 10 years it has been attempted to raise the efficiency level at hospitals, while also bringing the operating expenses into focus. The government's attempt hasn't supported the quality improvements as much as the cutbacks[13].

P1 approaches the problem from a different angle - it may not reach the goal of reduction on expenses, but it can help to get nearer the goal that the government aims for. The group's attempt with the first aid game is to raise general awareness of first aid in the society, and by that lowering the expenses on health care.

2.2 Target group analysis

The target group for the application is limited to the Danish market at an age range between 12-40 years. By choosing only the Danish population, the group could use their knowledge about the Danish culture and mentality. Since each culture has its own way at looking on things, it would be difficult to target multiple countries at once. Instead of spending time on researching international markets, the group chose to limit its focus to Danish-only. This resulted in having everything in the application written in Danish.

At around the age of twelve the child begins to develop a capacity to think in much broader terms and begin to see how things are connected. The 12-year-olds may not be able to perform first aid, but they are capable of learning and conceptualize broad issues[14].

The target group should own or be able to use a smartphone, which demands that they are not afraid of using technology. This is why the design and graphical layout is centered around the younger age group, which are born digital natives.

When doing target group analysis, the Social Construction of Technology (SCOT)[15] can be used as a tool to describe the connection between technology and humans. The group has considered how smartphones work in a social context. The SCOT model argues that one cannot understand technology without looking at how the technology is embedded in a social context. A key aspect in the SCOT model is the fact that we as humans shape how the technology is formed and used. SCOT holds that those who seek to understand the reasons for acceptance or rejecting of technology should look to the social world.

The decision of choosing a smartphone app is based on the importance of the modern man's desire to be mobile, and the choice landed on a development of a game which fits the app format very well. Humans have been playing games for thousands of years (attested as early as 2600 BC[16]) , as well as performing first aid for hundreds of years[17]. Combining games and first aid on a new platform of mobile technology gives the user an opportunity to refresh his knowledge about first aid whenever and wherever.

According to the Minerva model, the target market is defined to be in the idealistic and modern segment. This is because the target group should be in possession of a smartphone while also being idealistic enough to want to be able to act in emergency situations.

Figure 2 - The target group is defined to be in the green segment, in the right upper corner .[18]

The problem with this concept is the fact that people in theory want to be idealistic, but in practice they are often not. One thing is to download the application, wanting to be taught first aid. Another thing is daily use, and whether or not it will in fact help them if they should ever get in a real emergency situation.

In 2011 the numbers of smartphones in Denmark has been estimated to 2 million[19]. As of October 2011 there were 500,000 apps and 18,000,000,000 downloads of apps on the Apple App Store[20]. As of November 2011 there were 349,000 apps on the Android Market[21]. In December 2011, Google announced that they hit 1 billion app downloads[22]. These numbers show that the market for mobile apps is huge and that a first aid app will be able to reach a very broad field of people.

The reason for choosing to develop for the Android OS and not other platforms is mostly because of the Java programming lectures during 1st semester - Android programming is based on the Java language, which makes it fit very well with our app implementation. One could imagine that the concept of the app could easily be transformed to the Apple's iOS.

2.3 Meeting with first aid teacher

To make sure exactly what was needed in the app, a meeting was arranged with the first aid teacher André B. Nielsen from Aktiv Førstehjælp Aalborg.

He pointed out that when you call the emergency center, the line operator will start by asking about the accident and location and then send an ambulance or doctor to your location. After that, you will be redirected to a person who can guide you through what to do in the apparent situation[23].

The first aid teacher was asked what he thought would be the most important thing for people to remember from their first aid courses and what people seem to have trouble either remembering or doing. The most crucial problem, according to the first aid teacher, is that people are too afraid to act[24]. This has also been stated by the Danish register of heart failures.

They simply don't feel confident enough to actually do something when there is an accident. According to the first aid teacher, the passive behaviour is way worse than doing something wrong. The chances of permanently hurting the person receiving the first aid treatment are minimal, compared to the chances of making a difference in actually saving the person's life[25]. You add to the probability of the person surviving.

According to the first aid teacher, most people who teach the first aid courses are the driving teachers themselves[26], who for the most part do not care if the students are learning or participating in the course.

The first aif teacher found it important to give the user a positive feedback, since people who for example fail a first aid course will not do anything when they finally are in an emergency situation, because they feel insecure.

The first aid teacher also suggested that a mini-game was made, teaching how to use a heart starter. The heart starter is a small first aid machine placed in most public and private places[27]. The heart starter is very intuitive to use, and the person is guided through the whole procedure. The heart starter is considered idiot-proof, but still people are afraid to use it, because they think they might do something wrong.

The teacher also made it clear that it is important that the user learns that he should always call 112.

Naturally, everyone wants to be able to save lives, but with a price of DKK 4,000 for a course (10 people, defibrillator course[28]), its importance drastically decreases because of financial issues.

2.4 Questionnaire

A questionnaire were developed to check if people liked the concept or had some request or suggestions. An anonymous survey was done through the website surveymonkey.com. The number of participants was 100.

The success criteria for the survey was to investigate how many people have taken first aid courses and by that get a better picture of how big our target group is. Likewise, we wanted to check people's attitude about their own first aid skills, and whether or not they have had a previous need for using first aid. The survey was also conducted to get a better picture of the target group's needs and if there really is an interest or demand for the concept.

Question 1:

The first question was if the person ever had taken a first aid course. 88% percent replied "Yes" which was expected, since first-aid courses are a requirement to get a driver's license. This also shows how broad the target group for a first aid app is.

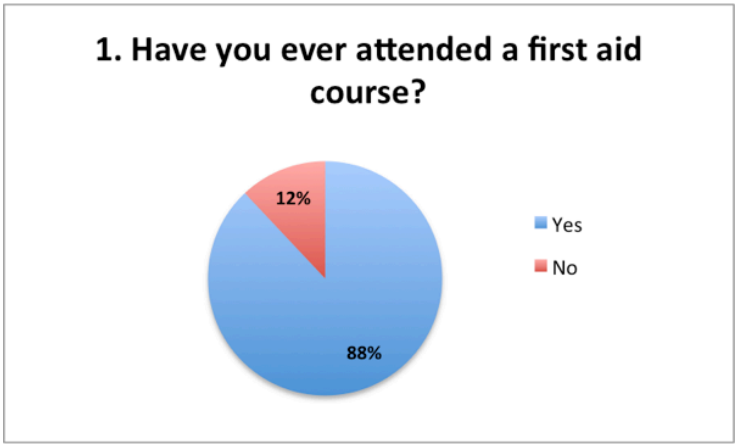

Figure 3 - 88% responded that they had taken a first aid course at some point.

Question 2:

Next question asked if the person had ever been in a situation where knowledge of first aid was needed. 30% answered that they had been in a situation like this once or multiple times.

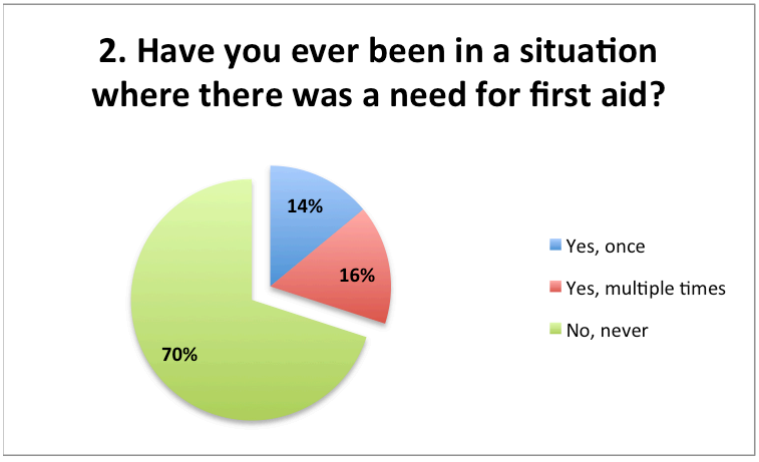

Figure 4 - 30% answered that they had been in a situation where knowledge of first aid had been needed.

Question 3:

Out of the 100 participants in the survey, only 11 of these were completely confident about their ability in first-aid. The majority of 38 indicated that their skills are a bit *rusty*. The 14 who answered they were *very insecure* shows the need for a way to become secure again in one's skills in this area.

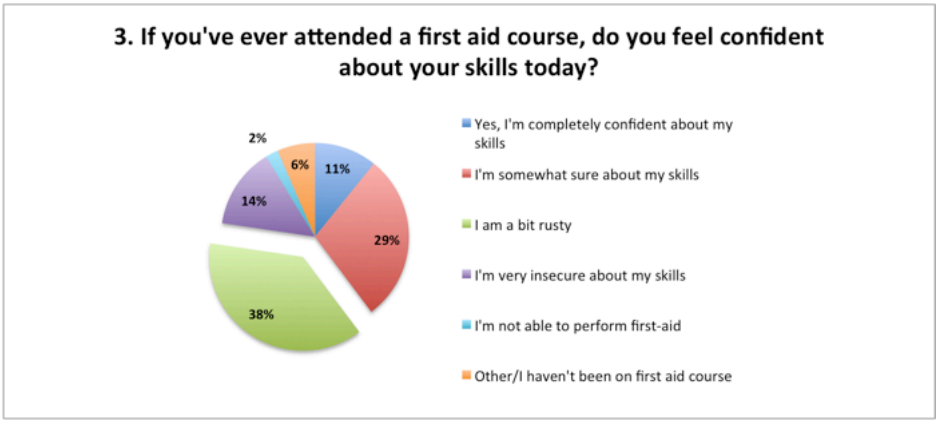

Figure 5 - The majority answered that they are a bit rusty when it comes to their first aid skills.

Question 4:

When asked how they reacted when in an emergency situation (if they had ever been in one) the majority answered that they were *somewhat calm*. The fact that most people answered that they were *somewhat calm* instead of just *calm*, might indicate that they were a bit unsure on what to do.

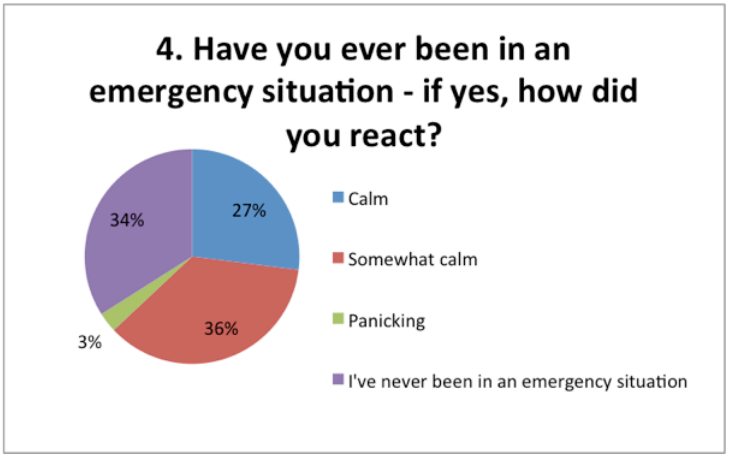

Figure 6 - When asked how they had reacted when in an emergency situation, most participants answered that they were somewhat calm.

Question 5:

This question was asked to test if the participants were able to remember how to perform CPR (Cardiopulmonary resuscitation). 5 of the 100 participants skipped the question. This can be seen as a sign of people being afraid to give a wrong answer and simply choosing to not answer at all. In total 49% were **either wrong or decided to skip the question. This shows the huge need** to refresh basic first aid knowledge many people need.

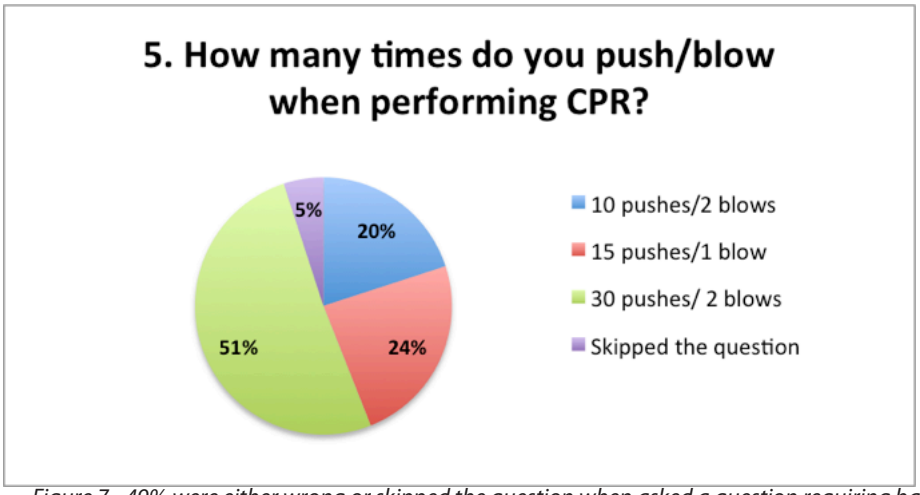

Figure 7 - 49% were either wrong or skipped the question when asked a question requiring basic first aid knowledge.

Question 6:

Would you be interested in a mobile application, which through mini-games will help you to be more sure about first aid? For this there were a lot of different answers, which didn't only consist of "Yes" and "No". The different answers have been divided into 3 categories: Positive Answers, Neutral Answers and Negative Answers. These answers were divided as follows:

Positive answers (54):

From all the positive answers the most were simple "Yes" answers (37). Other people did have comments such as suggesting that each game should be followed up by a fact box, like a test, or that it is important that the application informs the user fast and simple.

Neutral answers (22):

The neutral answers were either "Maybe" answers, no answer at all, or suggestions to do something else. The biggest wish (13 out of the 22) from the participants when it came to changes of the concept seemed to be making the app an on-scene emergency application or simply a guide instead of a game.

Negative Answers (24):

Out of the 24 negative answers, 14 were simple "No". While others mentioned that they either wouldn't use it because they already know everything about first aid or that they would rather have people go to a 2nd first aid course instead.

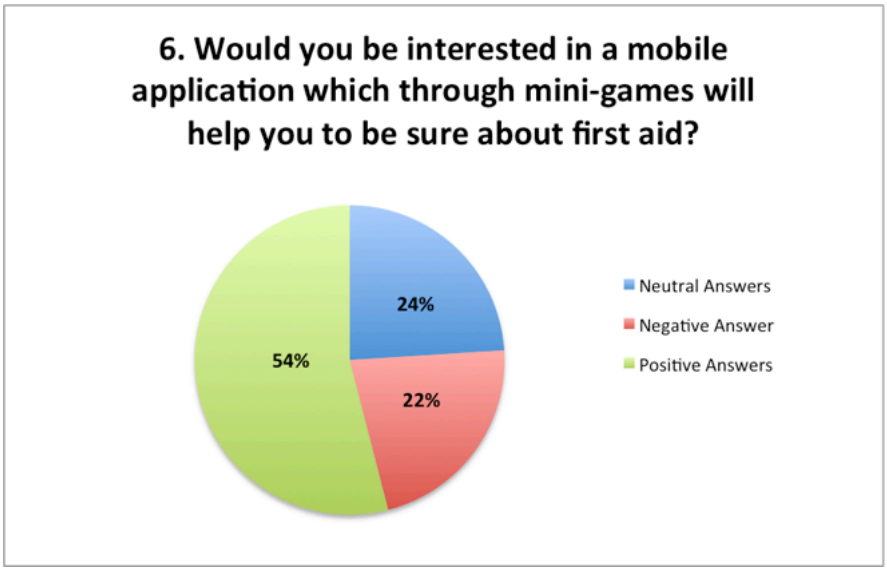

Figure 8 - The amount of Positive, Neutral and Negative answers given when asked if the participants were interested in the concept.

Question 7:

Last question went: "*What would motivate you to play first aid mini-games?*". This was to get some keywords to what the participants would consider a good game. The answers are separated into 3 categories (Inspiring answer, Helpful and Not helpful) and they gave a good picture of what exactly the audience require from a game.

Inspiring answers (2):

These two inspiring answers were a big help:

quote 1

Inspiring answers

"If it's a game then the learning needs to be secondary. Focus on a good story and good gameplay. A coherent game where my avatar learns new things concerning first aid through puzzles or to help solving these. Exciting and very relevant project"

quote 2

Inspiring answers

"If the game provoked me to see if I know first aid. Then you can take it as a challenge and then either confirm that you are on track with your first aid or you find out that 'Hey, I don't remember anything about that!' Personally I would like to refresh it, how to do it. I think playing on peoples emotions (go pathos!) will interest a lot of people in getting the app"

The first answer points out that it's important to focus on the game being fun and letting learning be secondary. This way the player doesn't feel like he is being forced into learning something. The second answer makes it clear that it is important to challenge and also play on his emotions.

Helpful (66):

From the helpful answers the most common word was fun, while others wanted variety, challenge, excitement, simplicity, good and professional design and realism. From the more interesting answers were the ones asking for ways to be able to share high score with their friends, that being from phone to phone or through social networks such as Facebook. One person stated that he likes the idea, but probably would not use the application himself since at his age (in his comment he mentioned that he's 50 years old) he didn't find it appropriately to play games. This confirms that it's the right decision to aim for people in the 12-40 year range. Another person said that it for him is important that the academical content covers everything and therefore is of very high standards.

Not helpful (32):

Most of these answers were simple "I don't know", "Nothing" or just no answer at all. While constructive criticism is desired these bland answers were not helpful.

2.4.1 Conclusion on the target group analysis

The answers to question 3 and 5 confirmed that our concept was needed. The fact that only 11% of the participants were completely confident about their first aid skill is unsettling, especially since 30% had answered they had been a situation where there had been a need for first aid at least once. Lastly, 49% answered the question about CPR incorrectly, showing a lack of basic first aid skills. Luckily, the response to our concept, expressed in question 6 and 7, were positive with a lot of great constructive criticism and suggestions, which we involved in our development of the final product. An example of a feature which was included in the concept after the questionnaire session is the social sharing feature. Using Facebook and Twitter, the player would be able to share his progression to friends and followers, thereby making it socially appealing.

According to the questionnaires people find it hard to remember all the important information. This application is a good way to remember the information by repeating the training exercises.

2.5 Problem Statement

Is it possible to make a smartphone application about first aid, that on one hand is so fun that somebody would use it and on the other hand still so educational that it can make the user feel more comfortable about his first aid skills, and by that make him act more efficient in a situation where first aid is needed? Also, would it lead to lower expenses on the health care system?

2.6 Methods

Agile project management

In software development there are numerous methodologies one can choose when managing a project. This is especially important in big and long-term projects, where the work from multiple individuals needs to be tied together. P1 stretched from October to December 2011. It's important to be aware of how the project is managed, especially in regarding to timetables and deadlines.

The group decided to take an agile approach to compensate for the limited time and programming experience. Agile software development is based on an iterative model, which is a dynamical way of increasing and evolving concepts and implementations. It's an adaptive way of working where the team regularly looks at and reflects on what has been completed up to this point, and what needs to be worked on. This approach welcomes changing requirements midway: if the team sees a need for a feature, even though it hadn't been discussed in the design phase, the team can adapt to the new specifications and implement it[29].

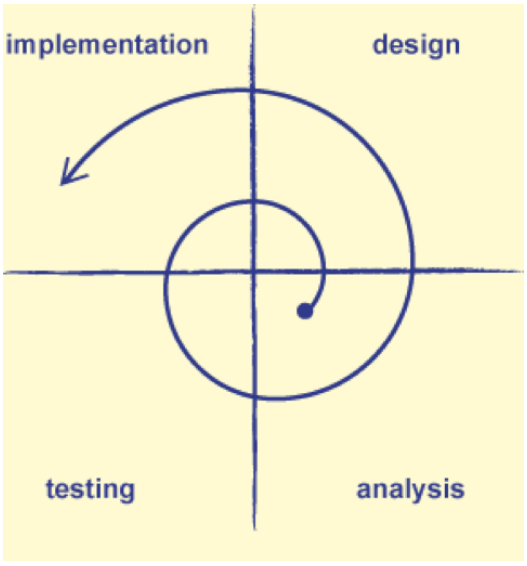

Figure 9 - A simple illustration of the Spiral model and its four phases[30].

As illustrated in the figure below, the group worked in four iterative phases in what can best be described as a spiral. This way of working combines design with prototyping with the goal of making the product as good and usable as possible.

First phase is to analyze something - in this case, using the theme Designing from both sides of the screen together with the subtheme Consumption to find an initiating problem. Building on this a design is being made. Following the design phase is the actual implementation - programming the application - which will then be tested. Under ideal circumstances, the project will go back to the analyzing phase again and change things if needed. A new version of the design will be made, and then needed features get implemented. Like previously, everything goes to the testing phase again, which will bring new feedback and start another iterative phase lifecycle[31].

Even though, the group didn't follow the spiral model completely, since there were a lot of unknown factors during the project, such as task assignment and coding experience. Put simply, the group had only a vague feeling on how much skills and time were needed to complete the project. The group members had to learn how to program at the same time as they actually made the prototype. Therefore the group took inspiration from the method called Scrum[32]. Where the spiral model has a more linear, predictably approach, the Scrum model provides a more flexible working condition and take into account that you don't know all specification from the beginning.

We especially used the so-called Scrum board to group each needed task/feature onto a board using post-it notes. Each task were categorized by priority of importance:

Red = Essential, for the product's core features

Yellow = Not essential, but makes the product function better

Blue = Not important, but could be nice to have

A three-step process was also used. Either a task is due to be implemented ("To-do"), is in progress or has been finished.

Figure 10 - Scrum board used in the group.

Research methods

It was decided to have a meeting with a first aid expert in the beginning of the project in order to get feedback on the idea as early as possible. A lot of changes were made after the meeting, and it turned out to be very useful to have it at this early stage, when nothing big had been decided yet.

Triangulation of sources was used to crosscheck the sources validity and reliability. By having several sources stating the same arguments, the project would contain a wider view of theories from different research environments[33].

By using triangulation of theory, the project utilizes several theories to cover different perspectives. The report withholds a sociological perspective on smartphone applications and first aid, as well as a psychological perspective

on games[34].

Triangulation of data has been used by collecting data from different places at different times with different people. The same questionnaires were completed with different respondents, as well as the same interview questions were asked before and after testing of the prototype[35]. Triangulation of methods is the use of several methods. Interview, questionnaires and physical prototyping testing were used all together for this study[36]. Triangulation was in general used to confirm and complete knowledge, as well as integrate different perspectives, reducing bias and validate data[37]. Validity is examining the truth of a conclusion and stating whether a given objective is a valid indicator of the concept that's being investigated[38]. Reliability also calls in question whether or not the investigated data can be trusted, with focus on how the data can be reproduced, and if the results will be the same at different times[39].

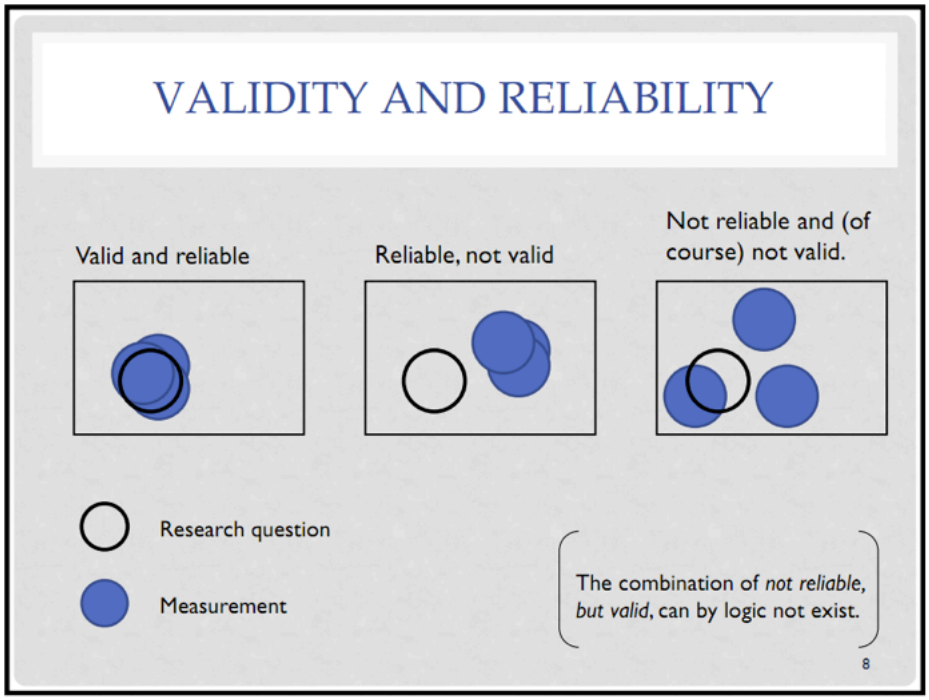

Figure 11 - The measurement according to the research question – a combination of not reliable, but valid, can by logic not exist [40].

Chapter 3
DESIGN

3.1 Initial Application Concept

The first vision was to make an app that would help when the user was in an emergency and needed to refresh exactly how to deal with the situation. This idea emerged because many of the members in the group felt unsure what to do in an emergency. A step-by-step guide for the actual situation seemed as a useful concept. The group imagined an application for a mobile phone which could be used on the spot, instructing the user what exactly to do. It would provide an easy-to-follow and interactive flowchart for various emergency situations.

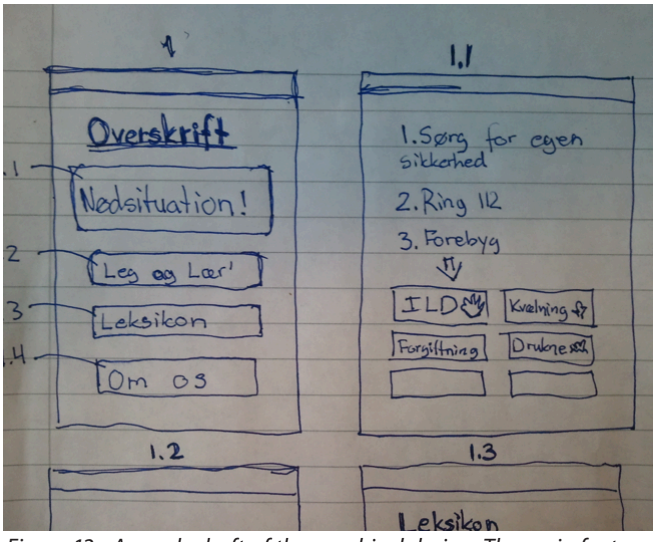

Figure 12 - An early draft of the graphical design. The main feature would be an emergency feature with guides of how to react on the spot.

On the main screen (screen 1) a huge "EMERGENCY" (1.1) button would be placed. When clicked upon, the user would go to screen 1.1 where there would be the 3 first-aid tips when in an accident[41]:

1. Ensure safety
2. Call 112
3. Prevent

And then an arrow pointing to the different scenarios the user could be in:

- Fire
- Suffocation
- Poisoning
- Drowning
- Hemorrhage
- Etc.

By clicking any of these the user would be taken to small on-scene mini-guides to limit the damages while waiting for the ambulance. Besides this function there would also be a Play and Learn (1.2) function, involving small mini-games, which would train the user in basic first aid such as CPR. This would only be a minor part of the application itself. Another function would be an Encyclopedia (1.3) containing the information from the on-scene mini-guides as well as information about minor injuries and how to treat them yourself. Lastly, the About Us (1.4) function would have a small summary about the authors of the application as well as disclaimers.

Research and interview with the first aid trainer, André B. Nielsen, has shown that a mobile guide application in an emergency situation will contradict to the idealistic concept of acting concentrated and fast. Furthermore, calling 112 will not only guide you specified for the exact situation you are in, it will also add human contact, which will be more trustworthy than a digital app. Human interaction gives the possibility of asking questions and being calmed down. You are not forced to look at the screen while calling 112, but you

can turn on the speaker phone and perform first aid while being guided. Another disadvantage of the emergency app would be the necessity of having a smartphone instead of just a normal phone where you can call 112.

On request from the questionnaire the implementation of small guides was though added to the application. The guides explain how to handle different accidents and are there to refresh the user's memory when needed.

When researching the smartphone app market for first aid applications, it was found that the already-existing applications focused on traditional textbook learning. Therefore it was decided to take a different, more entertaining, approach with a focus on games.

3.2 Final Application Concept

The final concept is an app, which through games will teach about how to do first aid. It was chosen to use the game format to make the concept more accessible for the target group, who, as mentioned before, is in the age group of 12-40. According to a study from Entertainment Software Association in June 2010, the average game player today is 37 years old, and the average game buyer is 41[42]. This fits well with the chosen target group: on one hand it has the possibility of reaching out to an younger audience who likes playing videogames; on the other hand older people, as the mentioned study shows, are also willing to buy and play games. It has been estimated that around 20% of the Danish population is able to provide first aid[43], and since that population is around 5, 6 million[44], with about 2 million smartphone devices in circulation[45], there is a huge potential for a first aid game to break through.

In the games industry a term has evolved over the years about taking a product and use game elements to make it more appealing. This has been termed gamification. It's still a relatively new concept, so no official definition has been settled on yet. However, the general consensus is that gamification is:

"…the use of game design techniques and game mechanics to solve problems and engage audiences.[46]"

Often this can be seen as traditional software services with added gameplay elements such as feedback in the form of points and rewards. An example of this is the social networking service Foursquare[47], where a smartphone application is used to "check-in" at certain locations.

Each check-in rewards the user with points and badges, and if you are the first one to check in at the location, you become the "mayor" of that place. This leads to a game experience about dominating real-life locations in a virtual context.

Basically, the reason for using gamification is to encourage the users to perform actions that are normally not very engaging. First aid is not typically associated with the word fun, but having *Førstehjælper-Spillet* mixing up traditional learning software with a collection of mini-games will hopefully make it be engaging. Repetition is often not very enjoyable, but in the context of first aid it is necessary. Using the game format would make this more fun and entertaining - and hopefully make the player remember the taught material better than if he just read it in a textbook. In *Førstehjælper-Spillet*, the player is controlling a hero who is watching over a town and helps people by performing first aid. The training is done through mini-games, even though there is also a training section, which contains all the information in a non-game form.

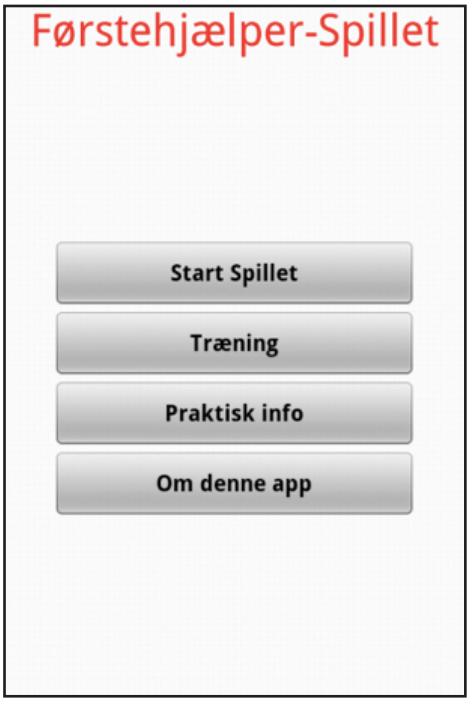

Figure 13 - The application's start menu is minimalistic and non-intrusive. Everything is held in clear, white colors.

When starting the application, the first screen displays a *Terms of Use/ Disclaimer* which the user needs to accept. Since the application tries to teach people how to provide first aid, and this, when applied incorrectly, can go severely wrong and lead to injuries, it is important that we abandon any responsibility when it comes to how the user applies the knowledge acquired from the application.

When the user has accepted *Terms of Use/Disclaimer* he is guided to the main screen. Starting the game will bring the user to the main map. Here an overview of the city is shown. Whenever an accident happens, it will pop up as a small icon on the map.

When pressing on the small icons, the user will enter a mini-game where he needs to perform first aid. Each icon has a timer, which indicates how much time the player has to perform the first aid before it is too late. The tracker at the bottom shows all the timers on a timeline, so the user can keep track on how much time he has left to save the people. When an icon on the tracker reaches 0 (the timer runs out), the user receives a message stating how many people he managed to save and that he lost the game. The number of people saved indicates the player's high score.

Following the concept *the worst thing you can do is doing nothing*[48], lead to the decision of making sure that there's only one way to lose a mini-game: if a timer runs out. Even if the player is bad at a certain mini-game, his only punishment is that he is taking longer at finishing the game. When you do something wrong, the game will correct you in your mistakes and tell you to repeat the exercise, but you're only being punished by having to use longer time, making it more likely for the timers to run out. In the beginning of the game only a small map will be available, but as the player progresses and gets better, the game will eventually move to other, bigger locations such as cities with more accidents. Over time the hero's reputation will grow, and therefore he will explore new areas. This will add to the stressful situation of being a hero who needs to save a lot of people, since he can only be one place at a time. The map will also be bigger than what the phone's screen can show, which means that the player needs to move around on the map, zooming in and out.

Figure 14 - The game's overview map screen, showing each accident happening, as well as the timeline bar in the bottom.

"Træning" is the training section of the application. Each icon represents different emergency scenarios from the game. When selected, the user can practice the first aid without having to play the game under time pressure. This tutorial part would be a good place to start for those who is not very competitive-minded and just want to practice in their own pace."check-in".

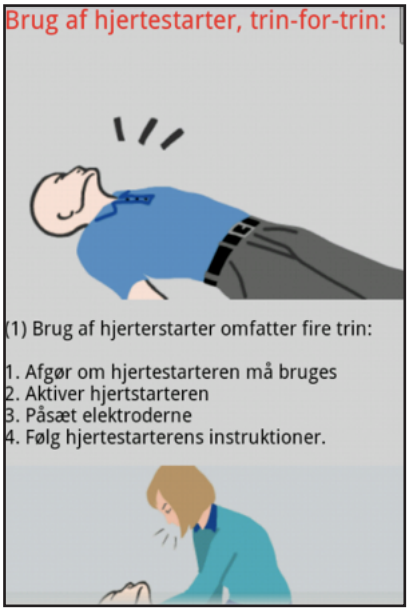

Figure 15 - In the training section more in-depth instruction for each first aid action can be found. Here is a description of how to use a heart starter with many images to illustrate each step.

"Praktisk information" presents different kinds of practical information such as:

- Shows the numbers to the world's emergency telephone numbers.
- A "where am I" function that uses the phones built-in GPS to give your current location so you can easily state this when calling the emergency central
- A handbook telling the user how to handle small accidents such as snakebites, abrasions or tick bites.

"Om denne app" gives a short description of the project and who we, the developers behind, are.

3.2.1 CPR (Cardiopulmonary resuscitation)

This mini-game is a simulation of how to perform CPR. The common use of CPR as of 2011 is to push thirty times and blow two times (30:2)[49]. The pressure frequency should be 100 pushes per minute, and the two blows together shouldn't take longer than 5 seconds to do. A person is lying on the floor and is in need of CPR. The player will have to both maintain a steady rhythm and be sure not to push too hard nor too gentle. This is done until the ambulance arrives.

Figure 16 - The pushing mini-game tasks the player with following a steady rhythm. Visually, a circle will appear when the player should push on the chest. Adding to this is a small sound effect, making it easier to follow the timing.

Two meters will indicate how well you are performing:

Rhythm meter: This meter is a horizontal meter which is colored red in the two ends and green in the middle. A counter goes from side to side in a rhythm that, if the player pushes on the screen whenever it reaches the green part of the bar, the rhythm will be just right. The closer the counter is to the center, the faster he will finish task.

Pressure meter: The pressure meter is a vertical version of the rhythm meter. This time, though, the counter will only move when the player is pressing the screen. If the player is pressing too long, the pressure will be too big and the counter will end up in the red side of the bar. Also if the player presses too little, the counter will again end up in the red side of the bar. Just when the player presses with the right pressure, the pushes will be counted as actual pushes.

A last meter is used to indicate when the player has completed the task:

Ambulance meter: This meter indicates how far away from the player the ambulance is located. If he has managed to successfully give CPR all the time, until the ambulance arrives, then the player has completed the game. This gives a way to see the remaining time, as well as putting the player under time pressure.

Figure 17 - After finishing the pushing part, the player is prompted to make two blows into the microphone.

The 2 blows will be performed by blowing 2 times into the microphone of the smartphone.

3.2.2 Detached Body Parts

The player is faced with a dilemma: a finger has been cut off - what does he do with it; where should it be stored until it can be transported to the hospital in the hope of being able to sew it back on again. The game takes place in a kitchen, and the player needs to find the items required to make a bag to transport the finger to the hospital[50].

A list of the items required is shown for the player at start:

- 2 plastic bags
- Some water
- Some ice

To find these items, the player needs to click through the kitchen, opening the drawers to find for example the plastic bags or opening the freezer to find some ice. If the player clicks on a wrong item a message will show , telling the player to try again.

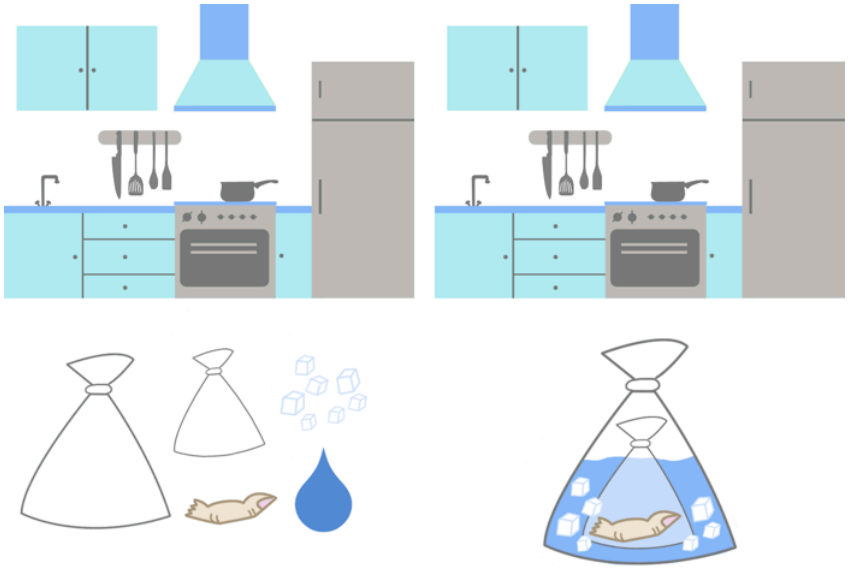

Figure 18 - The player needs to search the kitchen for the items.

Examples on messages when clicking a wrong item:

Knife - "A knife? Don't we have enough cut off body parts?"

Some cake in the fridge - "Hey! Hey you! It is no time for eating!"

A cat - "No! Put the cat down!"

Spoon - "Ahem yeah. NOT going to need that."

Hot water - "Too hot, too HOT!"

Leftovers in the fridge - "Maybe you should look in the freezer for the ice?"

The user then needs to use the item together in the right order to complete the game[51]:

1. *Put the finger in a plastic bag and close it.*
2. *Take the second plastic bag and fill it with water and ice.*
3. *Put the plastic bag with the finger in the second plastic bag with the water and ice and close it - this will keep the finger cold and away from bacteria, so it can be taken with the patient to the hospital and sewed back on.*

3.2.3 Acid In The Eye

This mini-game is a simulation of how to deal with an accident in which a person has gotten acid in his eye. The player needs to spray eye wash (saline) in the eye, while holding the bottle steady[52]. This game is played by physically holding the phone steady in a specific angle. While the user is trying to find the right angle, he can see the person with the bottle over his head on the screen. When the player turns the phone, the bottle rotates accordingly to the phone's accelerometer.

The player has to move the phone around until he finds a good angle to wash the acid out of the eye. When he has found it, he has to touch the screen to squeeze the liquid out of the bottle. While he is squeezing it, he has to keep the angle of the phone steady to complete the game.

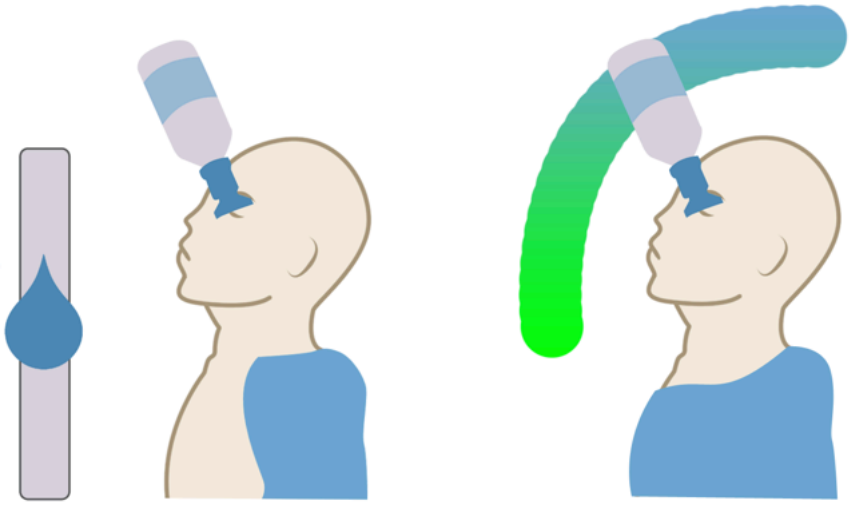

Figure 19 - The player needs to help spraying eye wash while holding the bottle steady.

3.2.4 Burns On a Leg

Here the player is presented with a game about what to do when a leg has been burned. A person gets his leg on fire near a bonfire. To help him, the player needs to pour water on the leg with a water faucet, and be sure to balance the temperature so it is neither too cold nor too hot[53]. The temperature of the water should be balanced on the thermometer by dragging a finger on the scale.

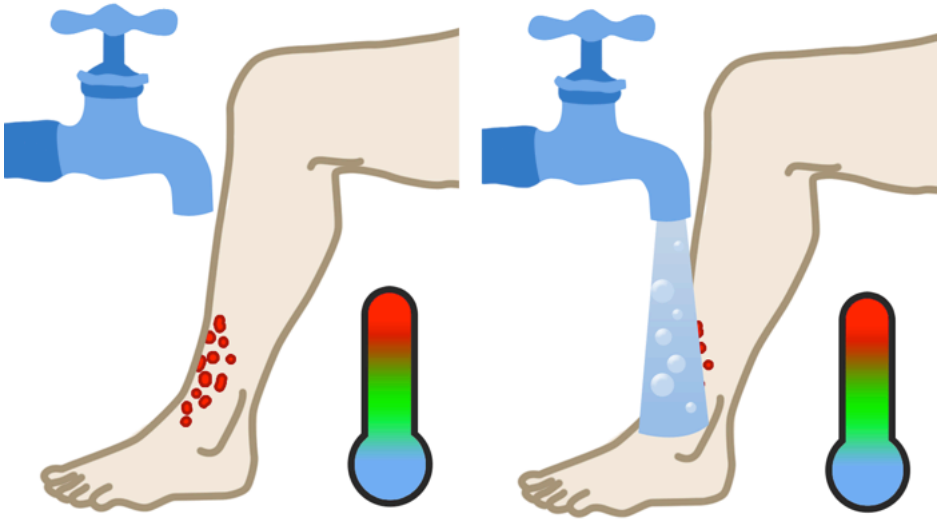

Figure 20 - The player needs to balance the temperature to make it comfortable for the victim.

The key part of this game is the feedback, which will be delivered, in the form of spoken lines. The injured man will tell you how he feels - if the water is too hot, too cold or comfortable. The man will continue speaking out his lines, depending on what state he is in. This will make it both challenging and fun, because the player has to unscramble his messages. The lines would be recorded in Danish.

Feedback from the patient:

When the water is too hot

"I'll be boiled in a couple of minutes"

"It's so hot, it feels like I'm on fire again!"

When the water is perfect

"Oh My God! This feels like Heaven!"

"You are born for that!"

When the water is too cold

"Are you planning to freeze off my leg?"

"Is it just me or the winter early this year?"

When there's no water

"Did you pay the last month's water bills?"

"Can't you do anything right?"

3.2.5 Heart Starter

To simulate using a heart starter, this game tries to make the player be more comfortable using it, by providing the instructions a heart starter gives[54].

The game starts out with a person lying on the floor. First of all you have to find the place where the nearest heart starter is. The application will use the GPS and a map to show the player's current location and nearby heart starters (using information from a heart starter database).

The player needs to use a heart starter to revive the patient and should quickly pick one on the map before returning to the injured person. The person is seen from above so the player has an overview of the body. The player now needs to remove the shirt of the unconscious person, set the diodes correctly on the body, and begin with the heart starter. The heart starter's instruction voice will be read out, and the player has to follow what the voice says.

Heart starter instructions:

"Analyzing"

"Shock is recommended"

"Click the button and step back"

"STAND BACK, STAND BACK, STAND BACK!"

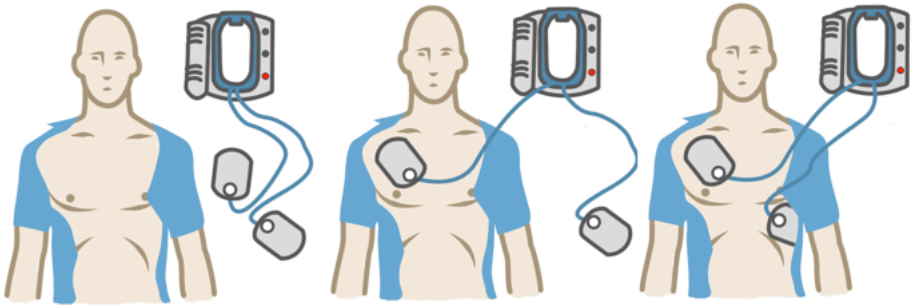

Figure 21 - The player needs to place the electrodes properly and follow the instruction from the heart starter.

3.2.6 Bleeding

This mini-game is a simulation of how to deal with heavy bleeding. A person has cut his arm in the artery. The player needs to apply the different objects available to him; paper, bandage and a stone, onto the arm in the right order[55]. This is done by dragging the objects around with a finger on the screen. If the player is doing the bandaging in an incorrect order the game will correct him and explain what to do, through text and audio feedback. The game is completed when the bandage is done accurately.

Figure 22 - The different items are applied to the wound by dragging them onto the arm, using the touchscreen. When done in the right order the game is won.

3.2.7 Calling 112

The Calling 112 mini-game is a simulation of how to call for the ambulance. The goal of the game is to pass on the necessary information to the alarm central, like in real life, when the player would have to call 112[56]. A map will show the player's location, using the GPS capabilities of the phone. If no GPS functionality is available, the game will start by showing a pop-up with a pre-programmed location. Next a short animation will show what kind of accident has happened and the number of people involved.

Then the player has to dial 112 on the screen. This will stress the user. To simulate that, the dial-pad is moving on the screen and is getting blurry, while the phone is vibrating. When the player has dialed 112, he has to take the phone to his ear. Like in a real accident, he will hear a voice asking him questions and giving instructions. When the player wants to answer, he has to say the answer, using the voice recognition of the phone. When he answers correctly, the application will go on to the next question, but when his answer is wrong the the application will keep asking him if he is sure about the priority of his answers.

Figure 23 - The Calling 112 mini-game is a simulation of how to call for an ambulance while under stress. Here the user has to remain calm when describing the accident to a emergency line operator.

For the first question the player has to tell where the accident has happened. The player has to clearly pronounce the sort of accident he is in.

- *1st question: Where are you?*
- *Answer: (e.g. Strandvejen 14)*

For the second question the player has to determine what kind of accident that has happened.

- *2nd question: Describe the accident.*
- *Answer: (e.g. Heart attack)*

For the third question the player has to tell how many is involved in the accident.

- *How many people are involved?*
- *Answer: (e.g. 4)*

3.2.8 Skill challenge

This mini-game is a combination of different challenges. The player unlocks the possibility of this mini-game appears on the map when he has completed the CPR and Heart starter mini-games flawlessly, without making any mistakes.

In this mini-game the player needs to apply his previous-gained knowledge about first aid. The player needs to investigate a person lying on the ground[57].

At first the breathing mini-game starts where the player must check if the person is breathing, which is done by listening to the phone's speakers. The player then needs to determine if the person is breathing or not by either pressing "Yes" or "No". If the player gives a wrong answer, the breathing mini-game will restart.

If the person turns out to be breathing, the player is tasked with a mini-game about putting the person in a recovery position.

If the person turns out to not be breathing, then the player has a choice of either searching for a heart starter or start performing CPR- each of them are their own mini-game, as previously described.

Figure 24 - Recovery position mini game.

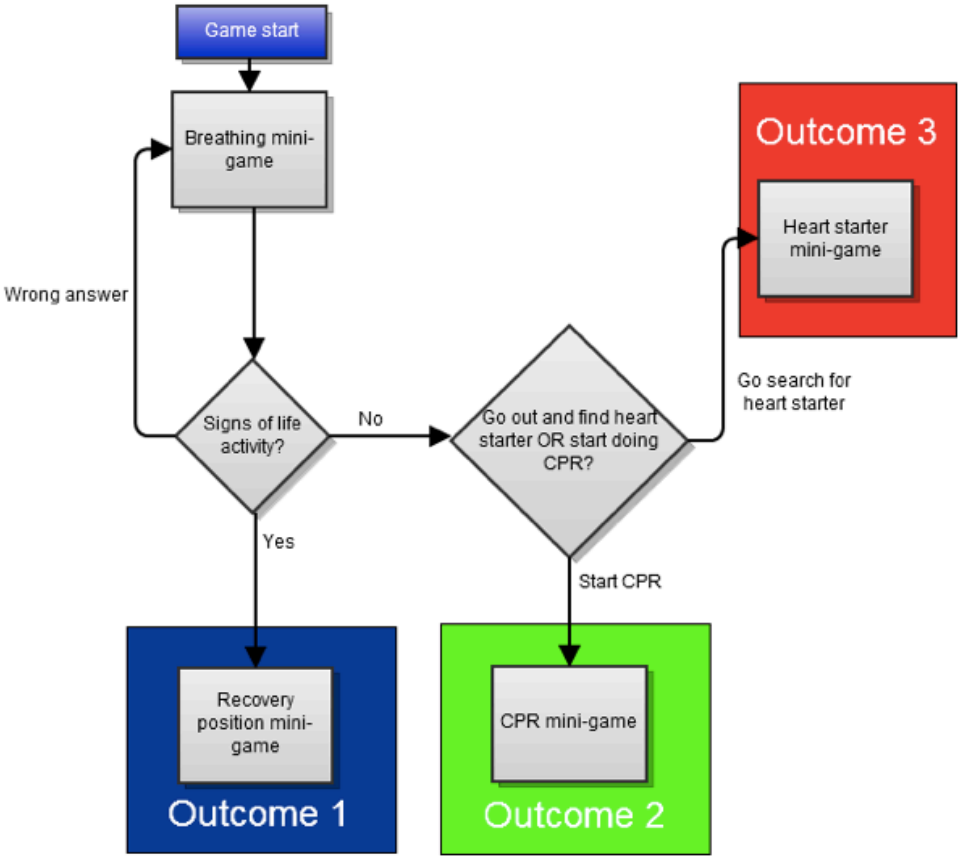

Figure 25 - This is a flowchart of the test challenge showing the different outputs

3.3 Game design

3.3.1 Gameplay

In game design, the term gameplay is quite ambiguous. A lot of game developers have their own definition of what the word gameplay means. One of the most acknowledged game designers is Sid Meier who states that a game is "*[a] series of interesting choices.*"[58]. This quote describes a more broad understanding of what a game actually is, but it also helps to set a certain focus. Fundamentally, a game (be it digital or analog) is about making choices. For these choices to have a context, rules need to be a part of the decision-making. Similarly, to make decisions interesting, there should be different consequences and outcomes for each choice.

Gameplay can be described as the interaction between the game and the player. In other words, it is how the player can influence the game system; it's what he is able to do in the virtual world. In the study Dissecting Play – Investigating the Cognitive and Emotional Motivations and Affects of Computer Gameplay, Craig A. Lindley et al. describes gameplay as;

"The experience of gameplay is one of interacting with a game design in the performance of cognitive tasks, with a variety of emotions arising from or associated with different elements of motivation, task performance and completion."[59].

Looking from a more practical-oriented point of view, gameplay often is what actions the player can do in the game. In a game such as Super Mario Bros. (Nintendo, 1985), the core gameplay could be described as running and jumping.

In *Førstehjælper-Spillet*, the gameplay is based around the theme of providing first aid. Using the smartphone's touchscreen capabilities, as well as other hardware features, the player has to simulate various accident situations. For instance, the CPR mini-game faces the player with clicking on the screen to a certain rhythm to simulate a push on the chest. Afterwards, the player has to blow into the microphone, again simulating how actual CPR is done in real life. Here, the gameplay is based on repetition, with the hope of making the player remember the steps needed to provide first aid.

Other gameplay features are the use of the phones sensors and accelerometers; feedback in the form of audio and vibration; voice-recognition; and the use of GPS location. Combining these different game elements adds to a more interesting game experience.

Another gameplay element is the timing system with the goal of adding a challenging element. It's important to have some limitations in the game's design to make it interesting playing - if not, it would just seem as a playground without any real context. In *Førstehjælper-Spillet*, the limit is mostly time and the associated time-pressure. By limiting the amount of time the player has for each accident, it provokes the player to optimize his skills and actions.

3.3.2 Goal and choices

The goal of the game is to act. It is to help victims and save as many lives as possible. It is the player's choice how to reach the goal.

The game operates on two levels/perspectives: macro level and micro level.

Macro is the overall game about saving as many lives as possible, before one of the timers runs out. This mostly takes place on the game's map, where the player can see all available accidents. It is also here that the player needs to make decisions of who he wants to go saving. Knowing that different accidents require different amount of time and skill, he has to analyze and estimate the situation and make a choice.

On the micro level is the actual mini-games, where the player has to perform different actions to save the person. Since the purpose of the app is to convey the message of not being afraid to act, the player cannot fail a mini-game. There is only option for doing the correct action; if he does something differently, the game will not react, correct his mistakes, or in some cases (such as the test challenge that combines various mini-games into one) tell the player to start all over.

To link the macro and micro perspectives together, a timeline will also be shown in the bottom of the screen. This will display all current accidents and how much time each has left, which will make the player aware of his progression and whether or not he is in a hurry.

As mentioned earlier, the game will start with just few accidentes appearing on a small map. As the game progresses, more accidents will occur, as well as that the map goes from a small town to a big city. By moving to a larger, more difficult, location, the game opens up and gives the player more choices. He now has to prioritize his time, since he can't be at multiple places at once.

3.3.3 Feedback and rewards

To make games fun and engaging, one has to consider how the game communicates with the player. Feedback is extremely important; the player constantly has to be aware of how good he is performing. Another element is rewards. The player has to feel like he is achieving something. In other words, he should be motivated to using the application. To do this, many games gives the player rewards such as points, badges, coins and other kinds of gifts. However, *Førstehjælper-Spillet* is not a traditional game in that sense. The player is playing not just for his own enjoyment, but also for the knowledge about that he might, at some point, come in a situation where his help is needed. Said in another way, the game is played in the hope of being able to help other people than oneself. Still, the fact that one has the power to help others is a great feeling. It not only benefits other people (e.g. by saving their lives). The player feels happy, because he knows that if it so be necessary, he is ready to act in an emergency situation. This is a huge motivation factor.

In psychology studies about motivation there are two major concepts: intrinsic and extrinsic rewards. An intrinsic motivation is driven by one's personal interest in the actual task itself, without relying on getting any external rewards. Doing the task itself is enjoyable, even though one is not getting paid for it in any way. Extrinsic rewards, on the other hand, build upon the motivation of external factors such as grades, money and acknowledgement from others[60].

Studies have shown that intrinsic motivation is much more likely in regards to making people learn new things. You are more willing to improve your skills and capabilities, especially if you feel that you have a certain amount of control in how things are taught. By having autonomy in the learning process, and by being interested in the subject at matter, rather than just rote-learning because someone tells you to, your chances of learning are higher than if extrinsic motivation had been applied.

This was proven in a study made by psychologist M.R. Lepper et al. called *Undermining Children's Intrinsic Interest with Extrinsic Reward: A Test of the "Over-justification" Hypothesis*. Here, a group of children in the age of 3-5 years were drawing pictures - a common activity for preschool kids. The psychologists rewarded one group with a certain "good player ribbon", while another group didn't receive anything. When they later returned to observe the children, they discovered that a significant part of the kids who had received a reward played less with the drawing pens than the other kids. What the psychologists deduced was that extrinsic rewards greatly undermines intrinsic motivation - i.e. enjoying doing something just for the sake of it.

A similar study was conducted by psychologist Edward Deci who wanted to test the effect of extrinsic rewards in regards to learning. He had two groups that both received the task of solving a so-called Soma puzzle cube. The first group received an extrinsic reward for doing so (money), while the other didn't receive a reward. After they had solved the puzzle, Deci left both groups alone and secretly watched them. Those that had been paid for doing the puzzle had stopped playing with the cube, while those who were not paid kept playing with it. Using this observation, he concluded, "*Monetary rewards undermined people's intrinsic motivation. Rewards seemed to turn the act of playing into something that was controlled from the outside: It turned play into work, and the player into a pawn. Rewards and recognition are important, but as the research has so clearly shown and I have reiterated many times, when rewards or awards are used as a means of motivating people, they are likely to backfire.*"[61].

As these two examples show, external rewards have the risk of backfiring if not used appropriately. It is important to consider what means of motivation are applied to an application such as *Førstehjælper-Spillet*. It has been chosen not to focus on external rewards such as points or praise. Instead, the games, and especially what are taught in the games, should be fun on their own terms. Giving the player clear and good feedback will contribute to the feeling of being more secure, more in control, of how to do proper first aid.

Having said that, one other element should be taken into considerations: personal relevance. Often you don't really think about life-threatening accidents - you think it will never happen to you, but always to other people. Only when you, or someone in your circle of acquaintances, happen to be in an accident situation, first aid will become relevant and important to you.

Therefore personal recommendation is a key factor in how to spread the word about *Førstehjælper-Spillet*. There is a lot of potential in utilizing people's friends and family to recommend using the application. This could be achieved by having the game automatically send out status updates to social services such as Facebook and Twitter. Having a close friend recommending to download an application is much stronger than having an impersonal company marketing the app.

The player character in the game - his avatar - is a hero. This hero is watching over a town, looking for accidents to assist and give first aid. He would not really be a superhero, but more a everyday-man hero similar to a fireman. The hero could be further developed into several different characters, so the player could choose between a variety of colors, different clothes, genders and so on. The avatar will be connected to the personality of the user, since it is a representation of themselves in the virtual world.

Figure 26 - An early draft for how a hero could look like.

3.3.4 Challenges and flow state

Each mini-game faces the player with different kinds of challenges. Some requires the player to time his actions (e.g. the CPR mini-game), while others are more about keeping calm and observe the situation before acting (e.g. the heart starter and the detached body part mini-games). Having said that, it's important that each game provides a challenge in some sort of way, as well as choices of how to solve the problem at hand. A game requiring no skills will eventually become boring. Game players like to feel they've become better or mastered a game. A psychology phenomenon called *flow* can be applied here. Psychologist Mihaly Csikszentmihalyi defines flow as:

> *"…a sense of that one's skills are adequate to cope with the challenges at hand in a goal directed, rule bound action system that provides clear clues as to how one is performing."*[62].

In other words it's the balance of challenge versus skill, as illustrated in the picture below.

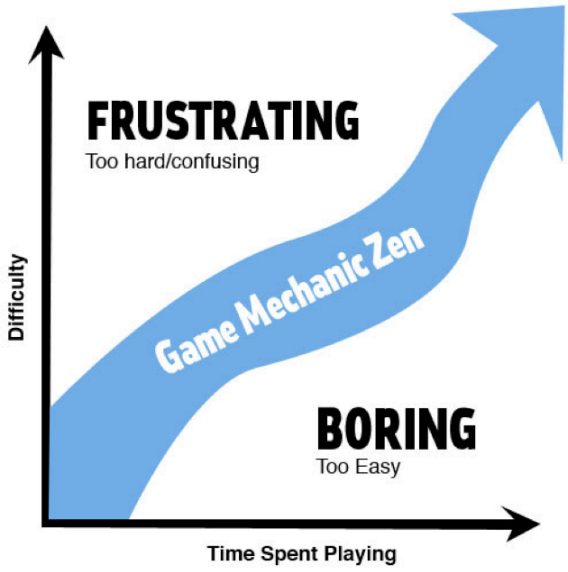

Figure 27 - A game should be well-balanced in difficulty. It should neither be too hard nor too easy, since both will leave the player in undesired: frustrated if too hard, bored if too easy .

To utilize this flow state, *Førstehjælper-Spillet* would gradually progress and become more difficult in tandem with the player getting better at the mini-games. More mini-games would appear, and the map would become larger and harder to navigate.

Chapter 4
IMPLEMENTATION

4.1 Introduction to the Android OS

Android is a mobile operating system (OS) developed by the Open Handset Alliance, founded in 2007. This group consists of handset manufacturers, wireless carriers and software developers - most notably, Google. Their goal was to make a non-proprietary platform based on open standards - also called open source - giving developers full access to the handset features[63]. Android is based on a Linux kernel, with various libraries, middleware, and APIs (Application Programming Interface) written in the programming language C. Applications run on a Java-based framework and use the Android Dalvik virtual machine. Applications are mostly developed in the Java language, but it is also possible to use a Native Development Kit or extensions in C and C++[64]. Android makes it easy and cheap for developers to write their own programs (called apps) and release them on the Android Market. The Android Software Development Kit (SDK) is freely available on http://developer.android.com. A free plug-in for Eclipse, which is a popular Integrated Development Environment (IDE), is also available, making it easy to start programming applications for Android. Adding to this is the Android Virtual Devices (AVD): a virtual emulator that makes it easy to run and test Android applications directly on a computer. It is also possible to debug on a connected phone device.

Figure 28 - Shows the game running in the emulator through Eclipse IDE.

4.1.1 Choosing the Android platform

The reason for choosing to develop for Android smartphones and not other platforms, such as Apple's iOS, was because of the low barrier to entry and the fact that the first year students at Medialogy were learning the Java language at the programming course during P1. Android especially seemed appealing because of the Eclipse plug-in, since the group has experience with the Eclipse IDE from the programming lectures. It could be interesting to develop for iPhone as well, but it was chosen to delimit this project and solely focusing on Android. Likewise, Android version 2.1 was chosen (at the time of writing, the latest version is 4.0[65]) , since the majority of the group is in possession of devices running this version, which would make testing and debugging easier. Also, a lot of reference materials such as books and video tutorials, are based on Android 2.1. Each program written for Android must have a specified API level, which is the minimum version of the Android platform a device must have. In this case, Android 2.1 has API level 7, which means that phones with Android 2.1 or higher will be able to run the application[66].

4.1.2 Basic structure in an Android program

When an Android application is started, Android launches a Java class file. This Java class is the entry point for the program and is defined in a so-called Manifest file. The Android system uses this Manifest file to determine settings for the application configuration, and what permissions are needed to run the program. When the user installs a program (e.g. from the Android Market), he has to agree to the terms of permissions written in the Manifest. This could be that the application wants to access the phone's camera, its contacts, current location, hardware control or network communication[67]. The Manifest file is like a register, where all the classes of the application are registered. In Android programming, these Java classes are called activities. An activity is the core component of Android, representing a task that the application can do. An activity is often tied to a corresponding screen in the application user interface[68].

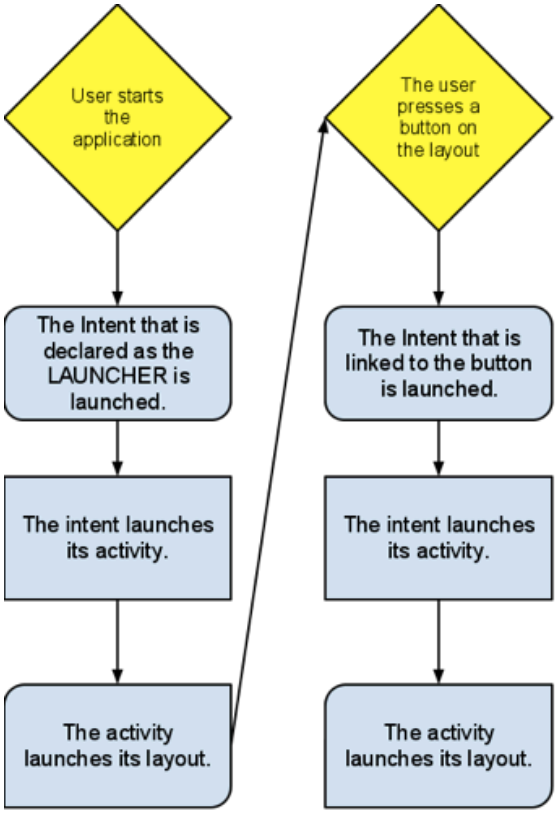

Figure 29 - This diagram shows what happens if the user starts a new activity.

Below is an example of how to register an activity in the Manifest file. This will launch the file MainMenu.java and have the screen orientation locked to portrait mode (vertical orientation).

```
<activity
        android:label="@string/app_name"
        android:name=".MainMenu"
        android:screenOrientation="portrait">
        <intent-filter >
            <action android:name="myPackage.com.MAINMENU" />
            <category android:name="android.intent.category.DEFAULT" />
        </intent-filter>
</activity>
```

You register all activities inside the Manifest file. Then you can refer to it in the Java code and launch new activities by using its package name.

To define the launching activity, the entry point, you write the following in the Manifest file:

```
<category android:name="android.intent.category.LAUNCHER" />
```

To make a specific activity be the entry point for the program, its intent category should be set to "LAUNCHER".

This will launch a new activity, containing Java code. To show something visual on the screen, you set a new ContentView. The view is defined as a so-called layout, which is basically a collection of XML code. Similar to a web page, it often consists of images, buttons and text. Below is an example of how to set up a ContentView, in this case a layout showing the "About this app" page:

```
setContentView(R.layout.about);
```

To navigate to another view in the program, the programmer sets the buttons of the page to launch different intents. Intents are linked with the activities; they are an abstract description of an operation/instruction that should be performed (such as starting an activity). For instance, you could set the program to detect when a user presses a button (virtual or physical), or when a certain amount of time has passed, and then start the appropriate activity:

```
startActivity(new Intent("myPackage.com.MAINMENU"));
```

In this case the intent would have been defined as "MAINMENU" in the Manifest file. When the new intent is launched, Android starts a new activity with a new layout, overlaying the previous layout. However, by hitting the back button it is still possible to navigate back to the previous screen.

Since it is a minimum requirement for Android devices to always have certain buttons available (Back, Home, Menu)[69], we did not implement buttons to navigate back to previous layouts/screens, but instead rely on the phone's Back button (be it physical or virtual).

4.2 Visual design & layout

When developing Android applications, one needs to use a programming language such as Java, as well as the markup language XML (Extensible Markup Language) to design the graphical layout. XML is basically a collection of rules used for encoding documents. The Android plug-in for Eclipse contains a Graphical Layout Editor that makes it easy to set up layouts without writing any code. Despite this it is possible to get into the XML file and edit the code, which provides more freedom and control. Here you can define various things such as buttons, text fields, images and other screen widgets. Everything is placed on a defined layout - per default, a LinearLayout. Using this layout, all elements will be ordered linearly after each other. A RelativeLayout can also be used to align elements relative to each other. It is also possible to put layouts into layouts, giving the opportunity to make things look exactly as needed. After the objects are set up, the developer can give them different attributes such as size, color, alignment and so on.

```
<Button
    android:id="@+id/javaButton"
    android:layout_width="250dp"
    android:layout_height="wrap_content"
    android:gravity="center"
    android:text="Text on the button"
    android:textSize="15dp" />
```

This code snippet shows how to make a button in XML with the ID "javaButton" and text "Text on the button".

When the graphical layout has been set up, the Java class files can access, implement and use it. An example would be to declare a button that does something when clicked upon. First the button (which is a built-in widget class in Android) needs to be linked to the button created in the XML layout. A special ID is used to refer to the correct button, which is declared in the XML file as an attribute. When the ID is declared, Eclipse automatically generates a reference in a Java file that is called R.java, in which all the IDs are stored.

After the button from the XML file has been connected to the button from the Java file, it can access all its functionality from the Java class button. The following code example shows how to use this button. First a button is declared, by finding the appropriate ID from the XML layout file, then an OnClickListener is set, which is an interface definition for a callback to be invoked when the user clicks. This will launch a new activity, hereby going to a new screen.

```
// Button Practical Info
Button buttonPracticalInfo = (Button) findViewById(R.id.practical);
buttonPracticalInfo.setOnClickListener(new View.OnClickListener(){

    @Override
    public void onClick(View v) {
        startActivity(new Intent("myPackage.com.PRACTICALINFO"));

    }
});
```

This code snippet shows how to set up a button, using a previously defined button in the layout file. When the button is clicked, a new activity will be launched, in this example a screen showing practical info.'

4.3 Activity lifecycles

Each activity has its own lifecycle that the programmer has to be aware of. All activities are managed as a so-called activity stack. Every time a new activity is started, it's placed on the top of this stack. The previous activity will then go below that, in the background, and will not come in focus until the new activity has been stopped, either by the user or the system[70].

An activity can basically have one of four states:

1. Running/active - if the activity is in the foreground of the screen (ie. at the top-level of the stack)
2. Paused - the activity has no focus, but is still alive with all its states and member information
3. Stopped - no longer visible to the user, but will still maintain all state and member information
4. If an activity is paused or stopped, it can be finished or killed by the system in need of memory

The following diagram displays the most important states that an activity can have:

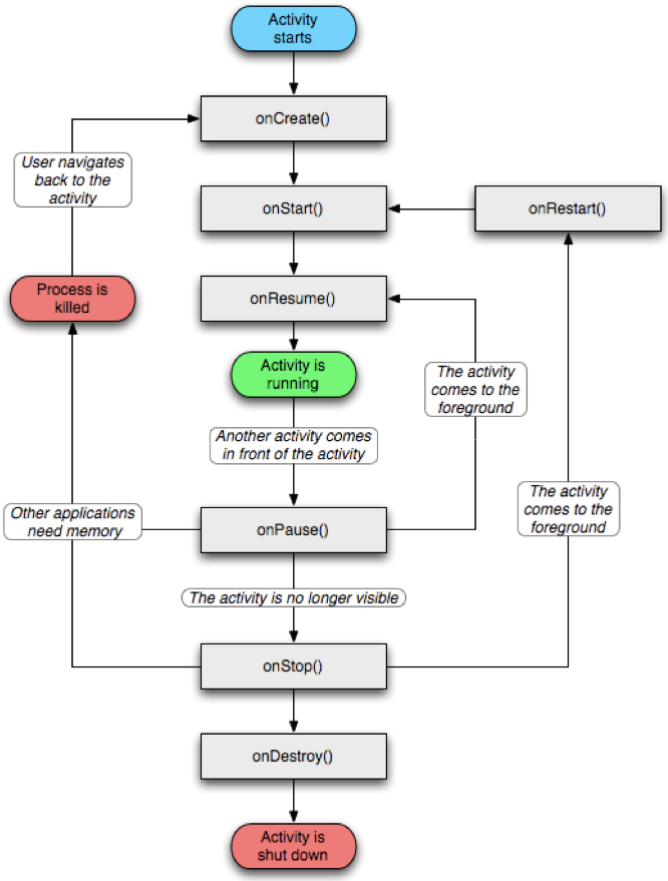

Figure 34 - The rectangles represent callback methods that are available when an activity changes state [71].

For instance, you could make sound files start playing in the onCreate() method. This sound will continue playing, even though the user navigates to another layout or stops the application. To prevent this, you could make the sound stop in one of the activity's callback methods:

```
MediaPlayer backgroundMusic;

@Override
protected void onCreate(Bundle savedInstanceState)
{
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    backgroundMusic = MediaPlayer.create(this, R.raw.dopp);
    backgroundMusic.start();

}

@Override
protected void onPause()
{
    super.onPause();
    backgroundMusic.stop();
}

@Override
protected void onStop()
{
    super.onStop();
    backgroundMusic.stop();
}
```

In this example a MediaPlayer is defined to play some background music. When the activity has been created, it will first set a ContentView (a graphical layout), and then start playing some music. This music will keep playing forever, so therefore a call to its stop() functionality has been implemented in the on-Pause() and onStop() methods. For instance, if the user receives a phone call, the music should stop playing.

4.4 Application structure

The structure of the application is quite simple. When the user starts the application, he will first be greeted with a disclaimer message, telling him that the developers are not responsible for any real-life accidents or misuses of the app; what the app provides is only guidelines and nothing more. If the user agrees to this, the main menu will appear. If the user chooses to touch on the games button, a new screen will launch with the main map. On this map a range of small icons are scattered around, each representing a different emergency situation. Under the icons small timers are counting down. If any of the timers reaches zero, a person will die and the whole game ends. The user's goal is then to try saving as many people as quickly and efficient as possible, by playing the mini-games. As the player progresses, more mini-games will appear on the map. The following flowchart graphic explains the flow of the application:

Figure 36 - Moving through the menus and the actual game part. When the user completes a mini-game, he will go back to the map again, getting ready to play a new mini-game. This is the game loop that will continue until one of the timers reaches zero, which results in a game over

4.4.1 Explaining the timer system

All accidents have their individual time counter. This is made possible by using the CountDownTimer class from Android. Here a time interval is specified, i.e. how much time should pass before the method onFinish() should be called. A CountDownInterval is also set to control how much time should pass by each system tick.

In the example below a self-made class called AccidentCounter is extending the CountDownTimer class. It has two local variables: an integer called “id” and a TextView called “localAcTimerTextView”. These are used to find the specific accident on the game map, by passing its id through the constructor. The “id” is simply the id for the chosen accident, which is a text field showing the count-down integer.

```
public class AccidentCounter extends CountDownTimer
{
    int id;
    TextView localAcTimerTextView;

    public AccidentCounter(long millisInFuture, long countDownInterval, int textId)
    {
        super(millisInFuture, countDownInterval);
        this.id = textId;
        localAcTimerTextView = (TextView) findViewById(id);
    }

    @Override
    public void onTick(long millisUntilFinished)
    {
        int timer = (int) (millisUntilFinished / 1000);
        localAcTimerTextView.setText(String.valueOf(timer));
    }

    @Override
    public void onFinish()
    {
        localAcTimerTextView.setText("En patient er død!");
        if (gameIsPlaying == true)
        {
            gameIsPlaying = false;
            startActivity(new Intent("myPackage.com.GAMEOVER"));
        }

    }

}
```

The onTick() method is being overwritten to change the value of the text field on each tick. Since a TextView can’t directly take in an integer, it needs to be converted to a string using the String.valueOf() method. Also, the timer is being divided by 1000 to go from milliseconds to seconds.

When the chosen time interval has been passed, onFinish() will be caused. This method first checks to see if the game is still running. If it is, it will then make it stop by starting a game over activity, which is a screen telling the player that the game has been lost and asking if he wants to try again.

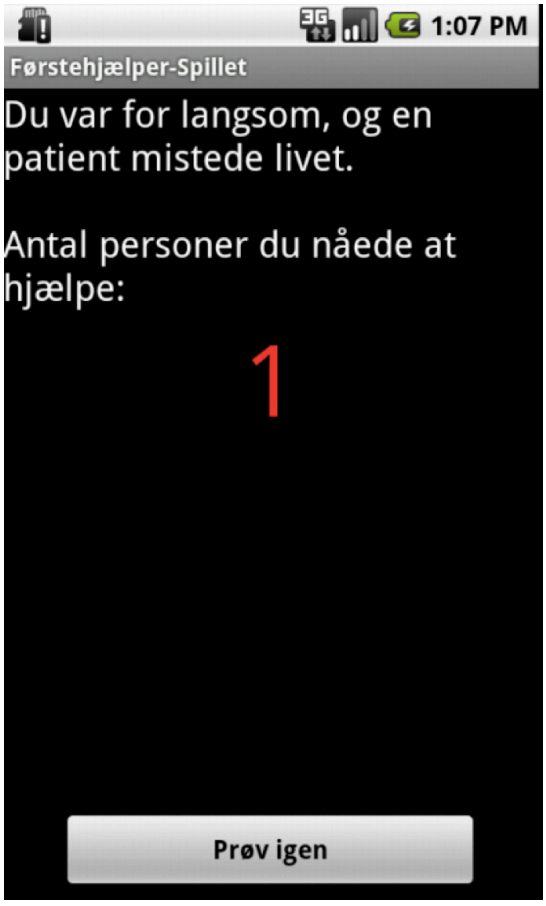

Figure 37 - When a mini-game's timer has run out, the game will end and display this screen.

4.4.2 Game loop

If the player succeeds in saving a person by completing a mini-game (each game has its own subgoals), he will be taken back to the map screen and can now go into a new mini-game. This can be defines as the game's loop, also shown in this flowchart:

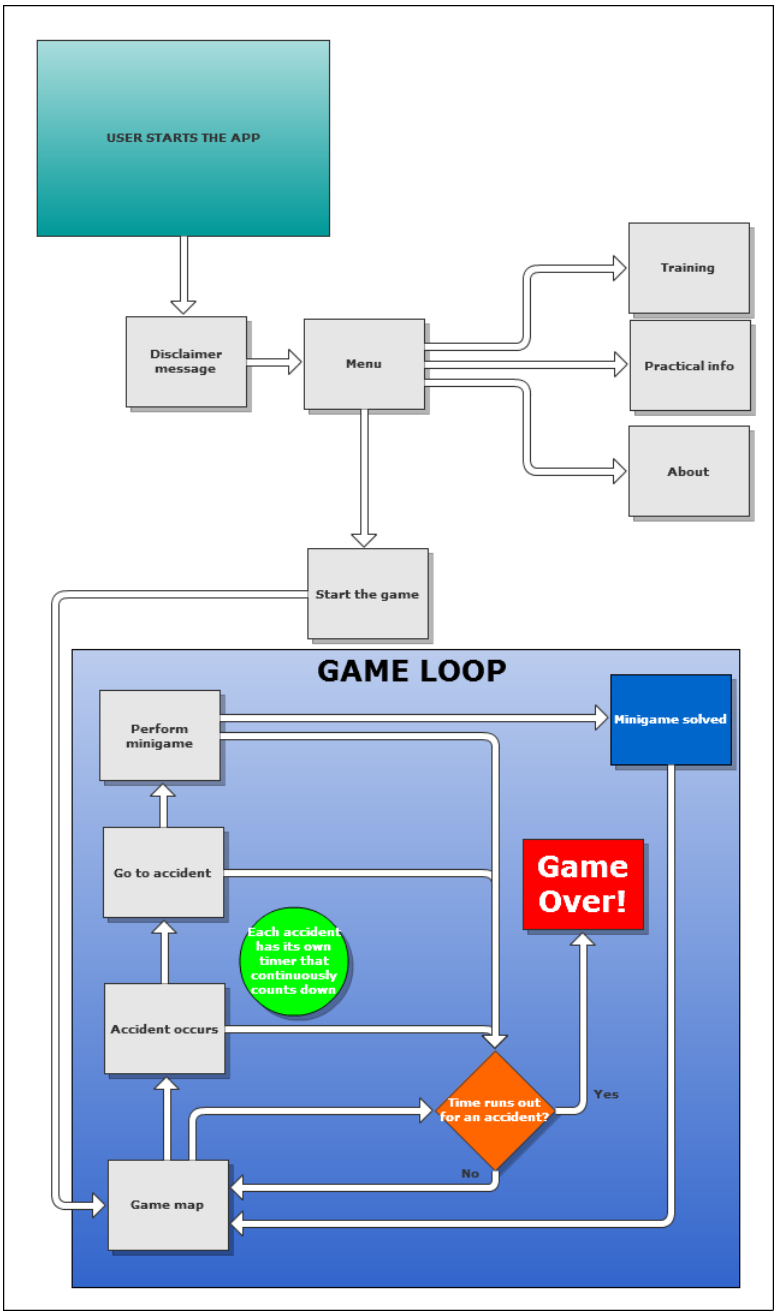

Figure 38 - This diagram shows the flow of the app, as well as its game loop.

In the working prototype only one of the mini-games has been implemented. However, other games have been placed on the map for showcasing purpose. Clicking on these will display a screenshot of the intended mini-game. Even though they have no working functionality, they show the overall concept.

Chapter 5
EVALUATION

5.1 Prototyping and usability testing

5.1.1 Questionnaire for Førstehjælper-Spillet

Besides the online survey on surveymonkey.com questionnaire, the group had a face-to-face usability testing involving the prototype with one working mini-game. The following questions were used in this survey; the first 7 before the participant had tried the app and the last 5 after he/she had tried it.

20 people were tested in two days, with a majority of them being fellow first year Medialogy students. The rest of the participants were encountered in the shopping mall Friis during early shopping hours. At first, every person became familiarized with the concept. All ideas, implemented and not implemented, were presented to the participant. The following part of testing was a face-to-face questionnaire. It consisted of two parts – one before trying the application and one after. During testing the app, participants were able to play one game and see and check the entire menus.

Before starting the usability testing some success criteria were defined. The group wanted to investigate if the application is user-friendly and self-explanatory. Likewise, there was a need to check if people liked the idea, as well

as examine whether they could improve their first aid knowledge by playing *Førstehjælper-Spillet*.

The survey was done on both Danish and English participants. The questions were originally formulated in English, but translated to Danish when interacting with Danes who were unable to express themselves thorough in English. Since having to speak past a language barrier could change the participant's response, it was important to make them as comfortable as possible when doing the test and questionnaire.

(1) **Age** - It's important to know the participant's age, since the application isn't targeting everyone.

(2) **Gender** - The gender will determine if the app is equally interesting to both genders.

(3) **Have you ever taken a first aid course? If yes, why and how?** - Since the application is aimed towards people who already have taken a first aid course, it is important to know if the participant has done so. It was also asked when and in what context the participant took the course - for instance during driver's license or working circumstances.

(4) **Do you have a smartphone, if yes, which one?** - This was asked to first check if the participant is used to a smartphone, and whether he/she had an Android phone or another device.

(5) **Have you ever been in a real accident where you need to do first aid? Describe the situation** - Had the participants ever been in an accident where there was a need for first aid? If yes, participants were asked to go into more detail about the situation: how had he reacted, and was it difficult to remember his first aid knowledge?

(6) **Do you feel comfortable with your first aid skills? If yes, why, if no, why not?** - To get a general feel of the participant's courage in its own first aid skills.

(7) **How many times do you have to push/blow when performing CPR?** - This was a simple test of basic knowledge about first aid.

After the questions the participant was presented with a phone with the prototype application and was asked to try out the CPR mini-game.

_____

(After the test)

(8) **How many times do you push/blow when performing CPR?** - The question was asked again after the test to see if the participant had actually learned something and if the mini-game was clear enough in its presentation to get through with its message.

(9) **What do you think about the app concept? What could be improved?** - This was asked to get some simple feedback on the application. What did and didn't the participant like?

(10) **Has your knowledge/opinion about first aid changed after trying the app?** - This was asked to check if the participant's knowledge/opinion about first aid had changed after trying out the app. This could for example be a realization that their first aid skills aren't as good as they thought.

(11) **If the concept would be developed into a real application with a lot of mini-games, would you consider using it?** - This was to check if people actually are interested in the app and the concept behind it.

(12) **How much would you pay for the app?** - Just checking what participants think about the app price. Should it cost money as most apps, be completely free, or maybe be a part of an official first aid course?

The application is for younger people, the age from 12 to 40. It was tried to test people in this age, but there were also a few older participants. The average age of the participants were 27 years.

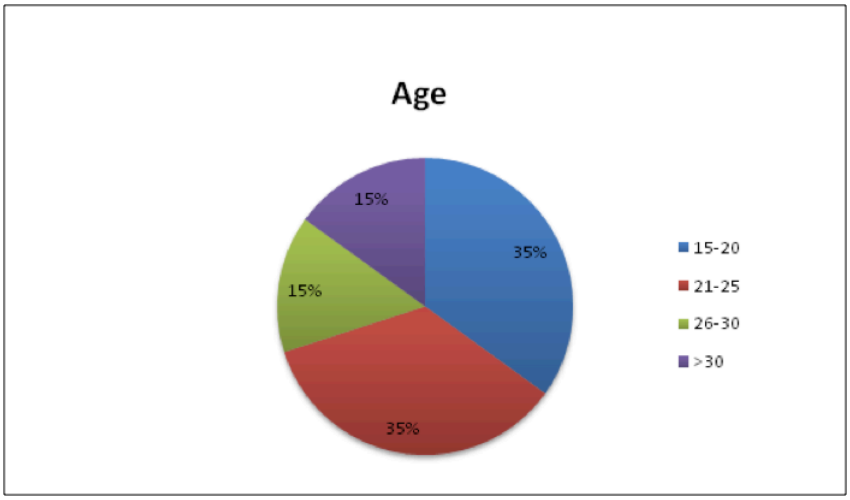

Figure 39 - The chart shows the age groups of participants.

85% of the participants had taken first aid courses in the past. Some of them had taken it several times. None of the participants had taken the courses on own initiative. The most common reason of taking it was driving licenses; followed by reasons such as military or work.

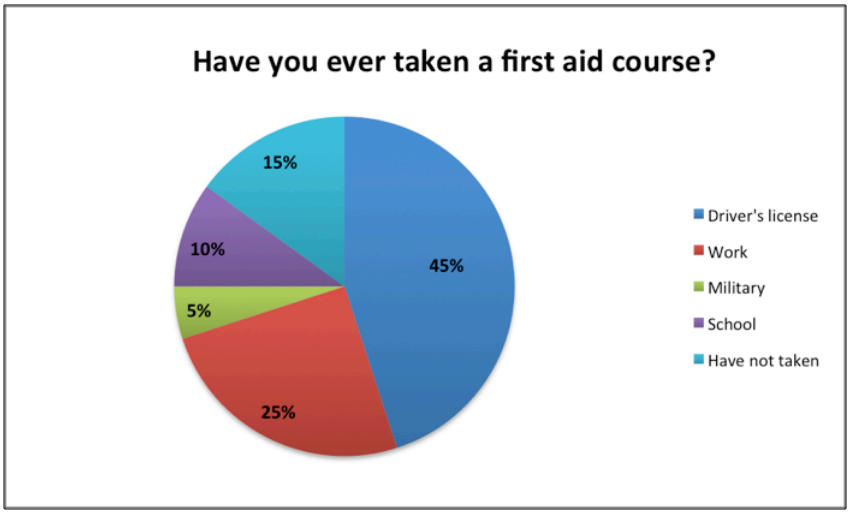

Figure 40 - The chart shows the amount of people who has taken first aid.

65% of the participants had a smartphone, and 54% of those had a phone running Android.

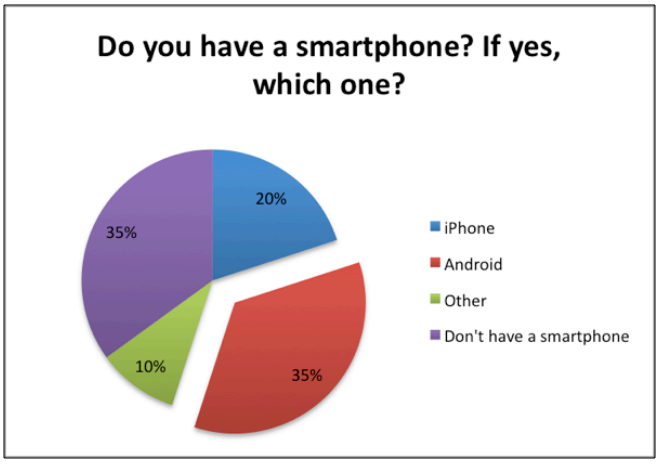

Figure 41 - The chart shows how many people that have a smartphone.

15% of the participants had been in a real accident where they needed first aid skills. 60% of people who had never been in such a situation said that they would not be able to help because they don't feel comfortable enough with their knowledge. People who had taken first aid courses more than 1 year ago were not sure about their knowledge and felt scared to do something wrong.

Participants got confused when they were asked about the number of pushes and blows when performing CPR. 25% answered correctly and the rest just guessed, hoping they would be right.

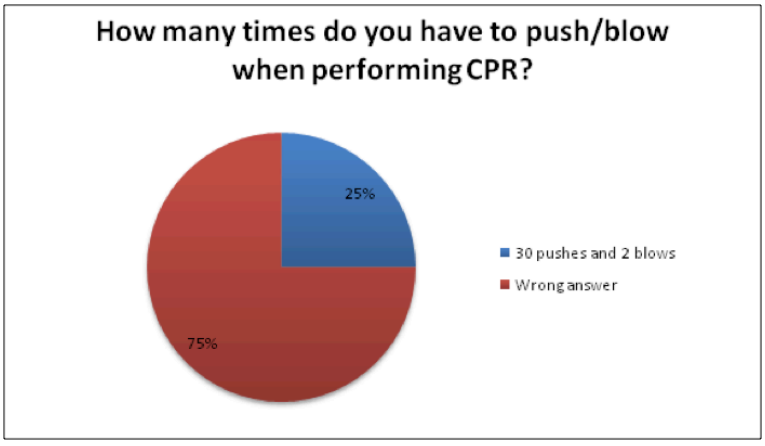

Figure 42 - The chart shows the number of participant's who know or do not know how to perform CPR.

After this part of the questionnaire, participants had to try the application. It was noticed that people were having fun during this part of testing. People who had answered incorrectly in the question regarding CPR were surprised to find out that their answers were very far from the 30 pushes and 2 blows.

Continuation of questionnaire started with the same question about CPR. 67% of those who were wrong first time answered it right after playing the game. It shows that game helps to learn.

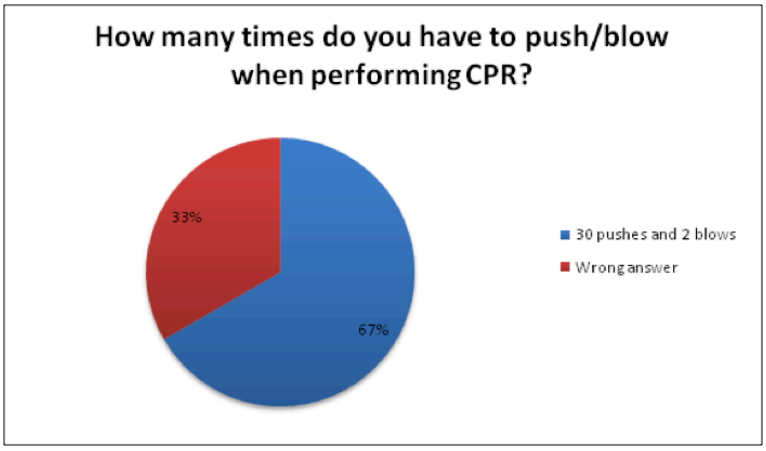

Figure 43 - The chart shows how participants knowledge have changed after testing.

Then the participants were asked about the concept. People said they liked the idea, and if it was finished and polished they would be eager to use it. They said the application helps to learn, is fun and entertaining, informative, and that it's a good tool for specific situations. On the other hand, some participants shared negative criticism. However, these participants didn't fit our target group, since they were older than 40.

50% of the participants said that their knowledge about first aid had changed after trying the application. They learned something new or it helped to refresh their knowledge.

Every person said they would use the application in their spare time, because it is a good and interesting way to learn. There were people who agreed that it is more for a younger audience, for educational purpose and since it is for education it should be free. There also were people who thought that they do not want to spend more than DKK 30 on it.

5.1.2 Conclusion on the prototyping and usability testing

The survey showed that 85% of the participants had first aid knowledge but most of them did not remember how to perform it properly. Despite that, everyone said they are not sure how they would react on the accident, but while there is no real emergency situation they think that at least they would try to help victims, even with lacking knowledge. Participants liked the idea about a game that refreshes their knowledge. They said that if the application would be fully finished they absolutely would use it, or they would like their children to use it. Some of the participants said they are ready to pay for it.

5.2 Conclusion

The group set out to make a smartphone application that would be fun and easy to use. The main goal was to present learning material about first aid in a new and fresh way that people would enjoy using. The game format was chosen in connection with the theme *Designing from both sides of the screen*, with the hope of having interactivity making the mundane routines of first aid learning more playful - that people would enjoy learning instead of feeling forced to do it. If the audience isn't motivated and paying attention to what they're learning, the obtained information won't make any difference.

Pursuing this goal, the games utilize various features of a modern smartphone such as accelerometers, GPS and the touchscreen. By providing intuitive and enjoyable ways of performing first aid in a non-critical setting, such as a game, the user will hopefully feel more confident and secure if he should ever come in a real-life accident situation. Games are a perfect tool for practicing in a isolated setting without having to worry about big consequences - however, the games should still simulate the risks involved in doing first aid.

One can have huge ambitions of making a great smartphone application, but in the end the only thing that matters is whether people are actually willing to use it or not. Therefore it was very important for the group to have a working prototype - an app running on a real, physical phone - that could be used to showcase and test the concept. This resulted in a lot of useful feedback, as well as confirming that there is an interest in the concept. Every single test participant appreciated and understood the concept: they thought it was a very good idea, and they would definitely like to use it if it was to be developed into a full-fledged smartphone application.

This confirmed our thoughts about that people generally like to be capable of doing first aid, but their knowledge fades away over time. Having a mobile application is a convenient solution, since you always know that you can go back and practice again.

The prototype and usability test states that 67% of the involved participants who answered wrong the first time, got the answer right after trying the application. This indicates that people learned from using the application. If people can improve their memory of first aid by playing *Førstehjælper-Spillet*, this will also improve their way of reacting in an emergency situation. Even though their quality of first aid may not be directly improved, gained knowledge will lead to less insecure attitudes towards first aid. Most important is the will to act - don't be scared, be prepared.

The Danish government is trying to lower the expenses for the health care section. *Førstehjælper-spillet* is trying to help getting nearer the goal that the government is aiming for. A general improvement of the first aid skill level in Denmark, and also making the Danes aware of the importance of acting regardless to one's skills, can prevent unnecessary hospitalization.

There is definitely a potential for an application like *Førstehjælper-Spillet*. Working only a few months on the project gave a good basic understanding of the needs and demands in not only the health care system but also regarding the Danish society in general. We truly think that if we had the time and resources, this could be turned into an actual application and sold through the various smartphone markets.

5.3 Perspectives

When we first began designing the initial concept, we had a look the two major app markets: Android Market and Apple's App Store. We found that the content almost only consisted of learning material similar to traditional textbooks - at least in the Danish app markets . We see the smartphone as a great opportunity for innovation. It seems obvious to use all the technology that is housed inside a modern phone and make something interactive and fun out of it.

During the design process two status seminars were held by the university, where we had to present and explain the concept.

We received a good amount of feedback, but even though we chose to hold onto our main concept, we still got inspired by various game-related suggestions, such as how the game should provide choices and difficulty should advance over time.

By the end phase of the project we discovered that the Danish game company Serious Games Interactive had developed a similar game for smartphones. This was released late October for both Android and iPhone[72]. It came as a surprise, since their concept seems very familiar to ours. What this shows is that there is a lot of potential in doing games about first aid. Making something as dull as learning first aid more fun and entertaining is ostensibly a solid and useful concept.

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Apendix 1

A video walkthrough of the application has been recorded. This is attached on a CD and has also been uploaded to YouTube: http://youtu.be/iYgXD4PdzrE

Apendix 2

Questioneer for *Førstehjælper-Spillet* Date:

(1) Age

(2) Gender

Male: Female:

(3) Have you ever taken a first-aid course? If yes, why and how?

(4) Do you have a smartphone, if yes, which one?

(5) Have you ever been in a real accident where you need to do first aid? Describe the situation:

(6) Do you feel comfortable with your first-aid skills? If yes, why, if no, why not?

(7) How many times do you have to push/blow when performing CPR (hjerte-lunge-redning)?

(After the test)

_____

(8) How many times do you push/blow when performing CPR (hjerte-lunge-redning)?

(9) What do you think about our concept? What could be improved?

(10) Has your knowledge/opinion about first aid changed after trying the app?

(11) If the concept was developed into a real app with a lot of mini-games, would you consider using it?

(12) How much would you pay for the app?