University of Bergen
Department of information science

# A social cooperative fitness application promoting an active lifestyle

*Author:* Kristoffer Marthinsen
*Supervisor:* Duc Tien Dang Nguyen


May, 2020

**Abstract**

The world health organization (WHO) lists insufficient activity as one of the leading risk factors for death worldwide. Insufficient activity can lead to many fatal cardiovascular diseases, obesity, cancer and diabetes. The world health organization recommends that adults should do at least 150 minutes of moderate-intensity physical activity a week. Physical activity like running, cycling, playing sports and organized exercise can decrease the health and disease risks associated with a sedentary lifestyle.

In this research project , an application has been developed for a social cooperative fitness application that logs training data for friends, families or work place colleagues that have similar fitness goals in mind. The goal of the application is to encourage exercise and keep each member accountable of each other to promote physical health.

The research suggests that having small groups consisting of friends with similar fitness goals are more motivated to exercise and the users keep each other accountable. Using leaderboards in smaller groups is also more beneficial for motivation and can lead to knowledge and information sharing between the users.

This research will help the field of human computer interaction to understand how users interact in a social setting while staying motivated by using technology to log their physical activities and exercise.

**Acknowledgements**

I am forever thankful for the help, support and encouragement from my family, friends and colleagues who have asked questions about the project, helped with testing and made recommendations.

Dedicated to my dear father Arnt who passed away in march. Thank you for the curiosity, thank you for being involved and asking questions, thank you for everything.

`Kristoffer Marthinsen`
01 June, 2020

# Contents

# List of Figures

# List of Tables

# Chapter 1

# Introduction and Research Questions

## 1.1 Introduction

Inactive and sedentary lifestyles are becoming a big issue around the world. "People are spending more and more time doing sedentary activities. During our leisure time, we are often sitting: while using a computer or other device, watching TV, or playing video games."[39]. Most of the jobs are becoming increasingly sedentary as well, as most jobs consists of long days in front of a desk. The situation is similar for the younger generation as they spend long days sitting at schools or universities.

Sitting promotes deconditioning, which negatively affects employees' abilities to meet the demands of increasingly physical workloads.[34] The average person spends a big portion of their day sitting still and prolonged sitting and sedentary lifestyles may lead to premature aging and contribute to chronic disease, prelude to lost productivity.(ibid). Not only are people sedentary, they are also inactive during their off time. An inactive lifestyle is a lifestyle with a lot of sitting and lying down with very little to no exercise [40] .

The world health organization (WHO) lists insufficient activity as one of the leading risk factors for death worldwide. Insufficient activity is a key risk factor for many diseases like cardiovascular diseases, cancer and diabetes. [41]. They state that more than 80% of the world's adolescent population is not active enough, and more than 25% of the adult population. The world health organization recommends that adults should do at least 150

minutes of moderate-intensity physical activity a week. Physical activities like running, cycling or playing sports can decrease the health and disease risks associated with a sedentary lifestyle.

Another way of encouraging physical activity is to organize exercise, a physical activity that is planned, structured, and repetitive and has as a final or intermediate objective the improvement or maintenance of physical fitness [18]. Exercise increases the physical fitness, which is the ability to carry out daily tasks with vigor and alertness. With ample energy to enjoy leisure pursuits [18]. Increasing the physical activity has many health benefits, which are measureable in terms of health and skills. Attributes that include cardiorespiratory fitness, muscular strength and endurance, body composition and flexibility, balance, agility, reaction time and power (ibid). To reduce the sedentary lifestyle, one should encourage physical activity through exercise by going to the gym or fitness centers.

There are many smart devices and fitness applications on the market currently where the goal is to help users achieve a more active lifestyle. The problem with them are that users quickly abandon their devices and applications and feel that the data is not useful and the maintenance of the devices are unmanageable [29]. Users abandon their devices and applications because they do not let them have short-term interventions, very little interaction with other users and the applications do not respond to users‘ needs and preferences throughout time [50] . As many as 75% abandon their devices in the first three months [2] and from figure 1.1 you can see the fast abandonment rate from a research project where 50% abandoned their devices within two weeks of one project and 34% in another. [30] .

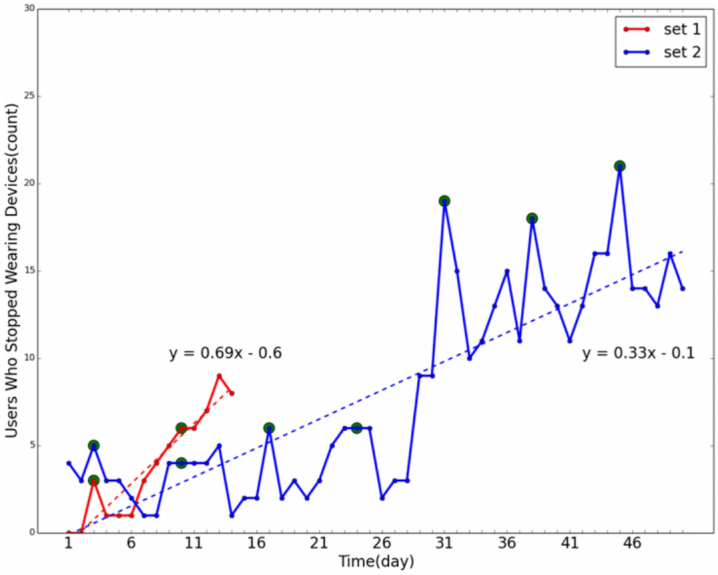



Figure 1.1: Activity tracker abandonment rate [30]

To try to deal with the problem of an inactive lifestyle and high abandonment rate of activity trackers and application, this project will develop a high-fidelity prototype with a focus on social cooperative fitness. The functionality from the prototype will log training data for friends, families or work place colleagues that have similar fitness goals in mind. The goal of the application is to encourage exercise and keep each member accountable of each other to promote physical health by achieving short-term and long-term goals.

**The hypothesis is that the social logging functionality would improve the accountability and motivation for using activity trackers and applications by letting users stay accountable of each other with small groups where they can log their workouts and having both short-term and long-term goals.**

The scientific approach will be design science which provides methods where relevant solutions will be designed for real people and environments with the goal of contributing to the existing knowledge base. Working with the user group, potential users have been interviewed and presented with different design choices and contributed with their information needs and preferences.

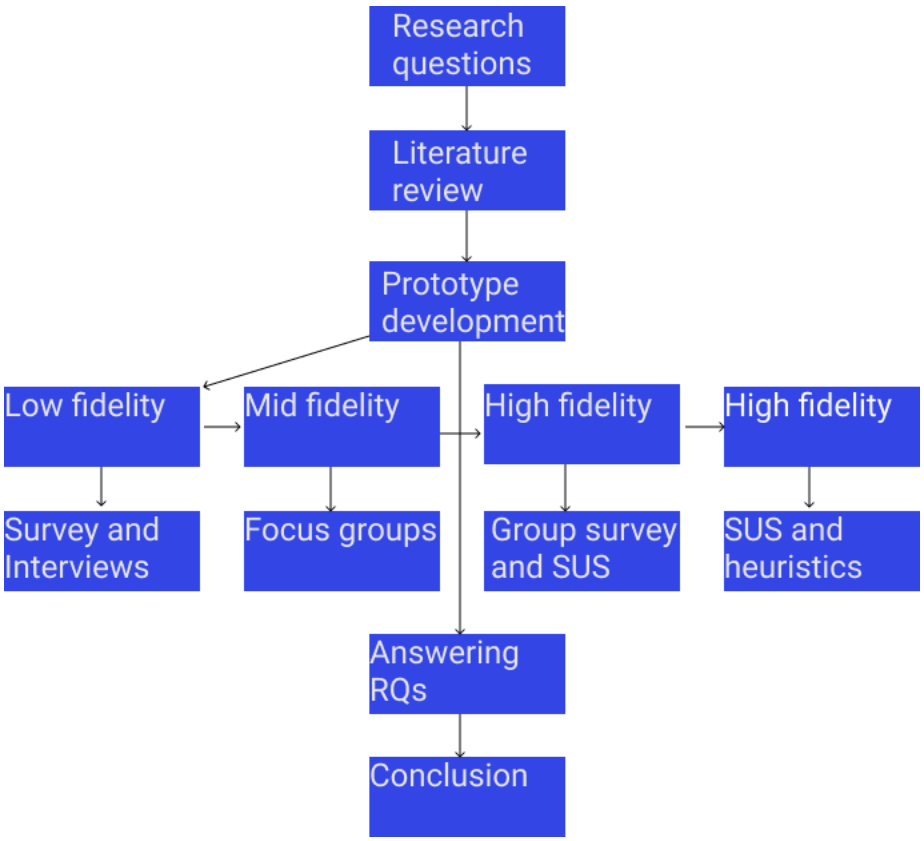



Figure 1.2: The flow of the thesis, starting with the research questions. A literature review was done to show the dangers of a sedentary lifestyle and review the current research in human-computer interaction. The prototype development shows all the data gathered throughout this project from surveys,interviews, focus groups and user testing. The discussion answers the research questions and last is the conclusion.

## 1.2 Research Questions

1. What functionality should be included in a social fitness application for users who struggle with a sedentary lifestyle, that would motivate them to improve their lifestyle?

2. Can the application functionality assist users in staying accountable for working out and logging their progress?

### 1.2.1 Goals

The goals of the research are:

1. Identify what social group features works for fitness applications
2. Present feature recommendations which can be used by established fitness applications
3. Develop a prototype for testing the features
4. Do development iterations, implement feedback and present potential improvements of the prototype functionality

The goals of the features are to get users to staying accountable to working out and logging their workouts and progress while cooperating with friends and families to meet their personal and group goals. This thesis will contribute recommendations on how fitness applications should incorporate social features and functionality to keep the users engaged, motivated and accountable.

## 1.3 Outline of research project

The following is the outline of the research project:

**Chapter 2: Sedentary lifestyle and benefits of exercise** Shows the dangers of sedentary lifestyle, explains exercise and strength training, looks at how people are motivated and benefits of exercise.

**Chapter 3: Literature review** Summarises the literature and related work for this project, relevant literature in human computer-interaction and computer supported cooperative work. References studies done with work colleagues, friends, how information is shared and the social incentives for fitness applications. Overview over fitness tracking and devices and the benefits of using them.

**Chapter 4: Methodologies** Explains the methodologies that are used in this project and the contributions, the target group, participants of the project and the requirements that was gathered from the users

**Chapter 5: Prototype development** Shows the design iteration, the scientific process and summaries of each iteration from the user feedback

**Chapter 6: Features of application** Shows the high-fidelity prototype and the functionalities

**Chapter 7: Evaluation** Summarises the results from all the evaluations from this project

**Chapter 8: Discussion** Answers the research questions and the use of the different methodologies and the development process

**Chapter 9: Conclusion and future work** Concludes the project and recommendations for future work

# Chapter 2

# Sedentary lifestyle and exercise

This chapter highlights what exercise and strength training is, how it can be done and the benefits of exercising. The chapter also looks at the different problems that can arise from living a sedentary lifestyle. What motivation is in terms of exercise, how users can be inspired and motivated.

## 2.1 Benefits of exercise

There are many benefits of working out and increasing your physical activity for health. As a sedentary lifestyle may lead to lifestyle diseases like cardiovascular problems and diabetes, staying active and in shape has benefits to everything from decreasing the chances of lifestyle diseases to improving mental health, sleep and cognition. Exercise has positive influences on cognitive abilities and sleep quality improves with exercise [34]. Workers, who are physically fit, usually have a low resting heart rate.

## 2.2 Problems of sedentary lifestyle

More problems Besides the physical problems of being sedentary, there are other problems that are related to being inactive,people who has experiences with weight stigma were related

to lower self-esteem, increased depression and increased body dissatisfaction [17]. A person who lives a sedentary lifestyle might be afraid of going to the gym [58]. Embarrassment caused by actual or anticipated negative evaluations from others might motivate some people to actively avoid public exercise situations, such as fitness centers and swimming pools. This is a common way of thinking where people are afraid of doing exercises the wrong way and are afraid that others will make fun of them. A way of eliminating this issue is to increase the knowledge among potential gym goers and people who live a sedentary lifestyle, encouraging them through technology to increase their own knowledge about exercise and physical fitness.

## 2.3 Daily steps and cardiovascular health

As regular physical activity is suggested as an important method to prevent cardiovascular diseases. There have been suggestions made that only walking is enough to stay physical fit and that people who walk 10000 steps a day has less chances of having cardiovascular risk factors. The correlation have been verified that people who walked more than 10000 steps a day had less body mass index, body fat percentage and triglycerides. Whereas the people who did not walk 10000 steps a day had greater chances of being overweight and dyslipemedia [48]. Thus concluding that there is an association between daily steps and cardiovascular risk factors. However it is not enough to remain physically fit as regular exercise is needed as well [41].

## 2.4 Exercising and strength training

A way of staying physically active is to exercise and do strength training, strength training is exercise that develops the strength and endurance of large muscle groups. It is also called "resistance training" or "weight training[59]. Strength training increases the fitness level, muscular strength, endurance, changes the body composition and more power. Even for frail elders it is understood that exercise and resistance training is positive. Supervised and controlled resistance training represents an effective intervention in frailty treatment [33].

By progressively overloading the weights that are lifted, or increasing repetitions or sets of exercises, people have a quantitative way of logging the progression. By setting short

term or long-term goals like wanting to lift 100 kg in bench press makes it possible to both see progression, as you get stronger and stay motivated as you have a long-term goal. if people want to stay active, motivated and encouraged it is good to get a partner. Exercising with a friend or relative can make it more fun. An exercise partner can offer support and encouragement [52]. Exercising with friends and family will hold you accountable, Also, you will be less likely to skip a day of exercise if someone else is counting on you. And that when you work out, you should vary your routine. You are less likely to get bored or injured if you have some variety in your exercise routine. Keep track of your exercise to stay motivated. Use an app on your phone or a wearable activity tracker. You can even just mark a calendar with a checkmark each day you exercise [52].

## 2.5 Motivation and exercise

Motivation is a key feature of exercise and can account for individual differences in behaviours, inspiring people to engage in exercise [42]. Motivation for exercise can be divided into two categories, intrinsic motivation and extrinsic motivation. "Intrinsically motivated actions are experiences of competence, interest and enjoyment" [47], these are desires to engage new challenges and expand the skills. "Extrinsic motivated behavior are those that are performed in order to obtain rewards or outcomes that are separate from the behavior itself' (ibid). These are body related motives, improving the appearance by losing weight or gaining more muscle, or fitness related motives like lifting more weight in the deadlift.

A study done by Kilpatrick et al[26] researched the motivation for physical activity for college students and reported that "results indicate that participants were more likely to report intrinsic motives, such as enjoyment and challenge, for engaging in sport, whereas motivations for exercise were more extrinsic and focused on appearance and weight and stress management. Since exercise has increasingly become a programmed activity [47] they made the suggestion that making exercise or physical activity more intrinsically motivating(fun, personal challenging) might be a viable route to enhance persistence." Another motivation for exercising is the increase in positive affect, the positive feelings about yourself, being able to relax and having increased energy, exercising gives the exerciser an enhanced sense of self in a pressure-free environment[16].

# Chapter 3

# Literature Review

This chapter is about the literature review for this project. In this chapter, the relevant literature and theories will be reviewed. The literature review will examine the dangers of an inactive lifestyle and the benefits of exercising and the existing tools and technologies that have been proposed to solve the issue Reviewing the current research in human-computer interaction that involves exercise and health. What research has been done with health and exercise tracking with colleagues in work places and friends. The chapter looks at the social incentives, competition, cooperation and social influence that comes from fitness application. It looks at gamification, what it is, and what effect leaderboards have on users.

## 3.1 HCI and promoting physical activity

Ahtinen et al[1] did a study on wellness and the effect of using ubiquitous technologies and mobile phones to see the social interaction and information sharing in groups that had similar fitness goals. They found that using communication technology to spread wellness-related information and applications as gifts within a network of trusted of people. This gives the initial motivation and push to start using wellness applications and working towards better wellbeing. They also suggested that having peer-support from people with similar goals can increase the motivation to reach a better wellness level. One of the interviewed participants in the study noted that maybe there could be some option of also uploading some new[exercise] combinations which you have discovered, and you want to share with other users.

Sharing a fitness goal and activities with friends can increase the motivation for users and impact the general health of those that share them publicly. Announcing commitments can catalyze support and accountability from existing social networks for health behavior change [37]. However, they found that announcing your public fitness goal creates a selection effect that decreases the probability of making commitments (ibid). By having private groups consisting of friends and families instead of sharing your fitness goals on social media could increase the probability of participating and increase the follow-through.

A study by Chen et al[7] looked at the effect of using a leaderboard as a social incentive to track fitness data and researched the difference in interaction between workplace colleagues and chronically ill. The research showed that both groups were motivated by having a leaderboard for their fitness tracking. The healthy groups of participants saw the leaderboard as a competition whereas the chronically ill groups used it as a way of obtaining information from other patients.

## 3.2 Health tracking in work places

Many companies have health incentives for their employees where they can get gym membership discounts and even monetary incentives as motivation for reaching a goal. A study by Chung et al[8] researched the health tracking in work places that had wellness programs for their employees. The study suggests that sharing fitness data between the employees supported the fitness tracking. Having a collective goal such as walking 7000 steps every day was also beneficial to the fitness tracking. individuals participating in team-based step-counting initiatives become accountable to each other for both the number of the steps they take and their reasons for walking. [5]

A study done by Xipei et al[46] explored this further to see if cooperative fitness tracking in work places encouraged physical activity. The study had participants that were divided in to groups of two and each group had a collective goal for daily steps. The study found that the participants were more active compared to the initial baseline week. The participants that were in the same office or proximity of each other did more physical activity than the participants that were in different offices. In addition, the participants that were closer would communicate more with each other and share information and knowledge of workouts.

## 3.3 Social incentives for fitness applications

A paper by Chen and Pu[7] looked at social incentives for mobile fitness applications where they developed a mobile game to understand how users interact in groups for competition or cooperation. The participants increased their physical activity significantly when paired up in the groups, however they found that "competition motivates dyads if they have equivalent performances and availabilities, but is likely to demotivate them if otherwise"[7]. A better social incentive for a fitness application if the groups have different levels of performance is for them to cooperate with each other instead of competing. "Cooperation setting is more likely to stimulate users to interact with each other via messages than competition settings"(ibid), having the users cooperate increases the interaction and possibly the knowledge sharing in between them.

Another social incentive is social influence, which consists of social comparison and social support." In fitness apps, using leaderboards, people could easily check their relative performance positions"[61] for comparing themselves in social networks, and receiving social support by receiving positive feedback and comments.

Using cooperation as a social incentive, it is better to use strong ties consisting of friends, families or colleagues than strangers with weak ties. "Participants found community competition and the support from strong ties motivating, however, pairing up with weak ties was reported demotivating"[6] Also suggesting that by creating a community effect for the competition will increase the cooperation and maybe have mentors that share knowledge.

## 3.4 Gamification and fitness applications

Gamification in fitness applications refers to the "the use of game design elements in nongame contexts" [10]. It is a popular strategy as a way of motivating users to adopt and use their application. A way of gamifying fitness applications may refer to the use of augmented reality where the users can run routes and pick up objects in the game, or just having an overall leaderboard for the people that have worked out the most in a period.

"Gamification may be an effective means of targeting motivational components, and games may be effective at triggering individuals and increasing popularity of apps"[32] and "external

incentives are enough to sustain (health) behavior responses without using other components of games like problem solving, storytelling, and fantasy"(ibid). For long term health change and motivation, the external incentives are enough, the study shows there is no need for augmented reality, 3d technology or storytelling. The same study shows that gamification mostly works for easy physical activity like walking, "complex behaviors such as diet and physical activity"(ibid), which may lead to more knowledge and a better long term health change for the users.

## 3.5 Comparison, competition and cooperation in fitness applications

Social support and social pressure positively influence user motivation[5], most fitness applications have features where the users are able to either compare, compete or cooperate with other users. Comparison in fitness applications is defined as "the design that facilitates benchmarking individual's fitness performance with that of others, and hence provide an opportunity for enhanced motivation in target behaviors" [60]. The users can compare their own results with others, for example compare how much time spent doing a given task. Another popular feature is competition, which in fitness applications is "the design that motivate enhanced physical activity performance by leveraging human's natural drive to compete" (ibid). This is usually done with a leaderboard where users are ranked on how much they have worked out or their time or how many steps they have done within a timeframe. Lastly there is cooperation in fitness applications is "the design that motivates users to adopt physical activity behavior by leveraging an individual's natural drive to cooperate" (ibid). Users can cooperate and work for a common goal, share information and knowledge and form social bonds with each other.

## 3.6 Fitness tracking and devices

People track their fitness activity in diary reports and blogs.[19] Tracking your activity is beneficial for fitness behaviour change [35], logging workouts to show the progress in terms of weights lifted as well as tracking other goals like losing or gaining weight helps the overall

behaviour change. Many mobile fitness applications design revolves around tracking activity and goal setting where the aim is to increase the users physical activity [9]. The majority of HCI research that investigates fitness technology use and tracking is for the purpose of evaluating specific fitness technologies[42].

People that use devices and fitness trackers often abandon devices because they do not fit with their conceptions of themselves, the data collected by the devices are perceived to not be useful, and device maintenance became unmanageable. [29]. Unless the goal of a person is to track their steps and activity, devices purchased often do not appear to map to goals[29]. Goals like becoming a better table tennis player, or obtaining knowledge from others. People perceive the data collected as not useful because they are not interested in the level of information the data gives them. Many people mention that the number of steps they take is not interesting[29].

The ability for users to set their own primary and secondary goals is key for technology-based health interventions to be successful[36]

## 3.7 Related work and fitness tracking applications

There are several applications within the area of fitness and exercise. The applications allow users to obtain information and workouts, track their food consumption and daily exercise and even get personalized templates from personal trainers or buy training programs from fitness influencers. Some of the similar applications are: Fitbit: "Without a tracker, the Fitbit app can count your steps (provided your carry your phone all day long), help you track the calories you consume, log your weight, and record other health information, such as blood pressure and glucose levels. If you do own a Fitbit tracker, the app is even easier to use because it logs a good amount of information about your activity automatically."[12] FitStar: "FitStar creates custom workouts for you based on your fitness level. You start by doing a few workouts with the app and you give it feedback as you go about which exercises were too tough, too easy, or just right. The app uses that information to create a routine that challenges you in all the right ways."(ibid) Lose it: "The free website and app Lose It!, designed for counting calories and logging exercise, can help you lose weight, especially if you tend to eat name-brand American foods. Lose It!, which has been around

for years, has an incredibly strong community of supportive people to help you stick to your goals."(ibid) MyFitnessPal:" MyFitnessPal is a mobile app and website that gives you a wealth of tools for tracking what and how much you eat, and how many calories you burn through activity"(ibid) Google Fit:" it's extremely serviceable and it's one of the better free fitness apps. It can do a lot of stuff. You can track your fitness using a point system as well as active minutes. The app also features fitness goal tracking, customized tips, and integration with a variety of other apps like Runkeeper, Strava, MyFitnessPal, and others. [25] Gravitus: "Gravitus is the app for weight lifters. We live in a digital world and yet lifting is done completely offline. We're building the future of lifting. Enter the gym knowing exactly what you need to do. Record your workouts with a tool designed for speed. Celebrate your progress and break through plateaus. And connect with friends and others to stay motivated. Gravitus helps you reach your goals at the gym and have more fun doing it."[20]

# Chapter 4

# Methodologies

This chapter is about the material and research methods that will be used for this project. The methodologies are important in research to help with the design and evaluation of the project.

## 4.1 Design Science

"Design science research is a method that establishes and operationalizes research when the desired goal is an artefact or a recommendation" [11]. It includes users, the developers and research experts of various backgrounds. Figure 4.1 refers to the environment in which the artefact is observed, the environment is the people, the organizations and the technology. Design science research supports the development of the artefact that solves a problem and the goal is to increase the existing knowledge base. The artefact is evaluated and justified and the knowledge base can be used for the existing foundations and methods that are recognized by the scientific community.

The relevance cycle goes from requirements and field testing to the design cycle and rigor cycle and then adds to the knowledge base.

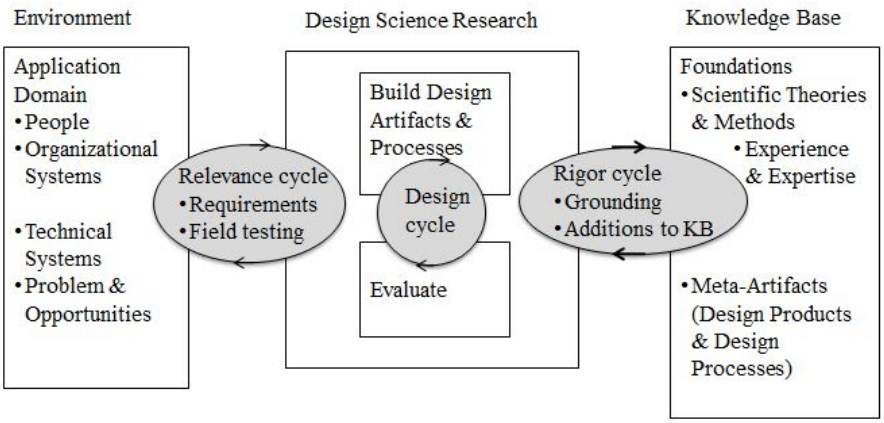



Figure 4.1: Design science in information science research [22]

Hevner et al [24] lists seven criteria that are essential for design research. The first criteria is the creation of a new artefact that has to solve a specific problem. The utility of the artefact has to be explained and later evaluated. The contribution of the artefact has to be clarified for academics and professionals interested in solving problems to increase the knowledge of the area. The validity of the artefact has to be rigorously tested and demonstrated to show that the artefact is suitable for the proposed use. The researchers have to understand the problem, and the results should be communicated in a proper way to those that are interested in the area.

Hevner and Chatterjee suggests a checklist for researchers to ensure that all the key aspects of design science research are being covered [23]. The questions from the checklist can be seen on page 18 . Design science includes the users, developers and experts with a variety of backgrounds. With documentation about the research process it is possible to get a good development process with relevant results to the research.

Table 4.1: A checklist for researchers, key aspects of design science research.

| | Questions |
|---|---|
| 1 | What is the research question (design requirements)? |
| 2 | What is the artifact? How is the artifact represented? |
| 3 | What design processes (search heuristics) will be used to build the artifact? |
| 4 | How are the artifact and the design processes grounded by the knowledge base?<br>What, if any, theories support the artifact design and the design process? |
| 5 | Which evaluations are performed during the internal design cycles?<br>Which design improvements are identified during each design cycle? |
| 6 | How is the artifact introduced into the application environment and how is it field tested?<br>What metrics are used to demonstrate artifact utility and improvement over previous artifacts? |
| 7 | What new knowledge is added to the knowledge base and in what form<br>(e.g., peer-reviewed literature, meta-artifacts, new theory, new method)? |
| 8 | Has the research question been satisfactorily addressed? |

## 4.2 Conceptual Design

Conceptual design uses the established requirements for the application and transforms it into a conceptual model[44], the model shows the main functionalities of the application and lets the users interact with it. The key principles of conceptual design is to have an open mind, but not forget the users and their context. To discuss the ideas with other stakeholders. Use prototyping to get rapid feedback and do many iterations [44]. A conceptual model is very beneficial in the beginning phase of development.

## 4.3 Prototyping

Prototypes are a simplified version of an artefact design that are created with the purpose to test design features. “Prototyping is a key activity within the design of interactive systems” [4]. Users are able to test and evaluate functionalities of the system before the artefact is finished and give feedback. The evaluation and feedback from the prototype testing will lead to improvements of the prototype. Prototypes are divided between levels of fidelity, ranging from low-fidelity to high-fidelity. This research project will use three different levels of fidelity for the prototyping.

Low-fidelity prototyping [44] can be used to create a layout and test different design options. Low-fidelity prototyping includes three different methods that will be used in to project.

1. Sketching, cheap and time effective way of testing different design options, drawn by hand.

2. Wireframing, represents the layout and the content.

3. Mock-up, displays how the design looks with colours, content and in-depth descriptions.

Mid-fidelity prototyping is a mixture between the correct content and some functionality.

High-fidelity prototyping is closer to the end product of the application. With this prototype it is easier to do usability evaluation and let users test the functionalities and look at the content-

## 4.4 Design Principles

Design principles [53] are guidelines and design considerations which interaction designers focuses on for the user experience and user interface of a product. There are five principles that are important to consider while integrating features for an interface.

Visibility is the first principle that states that the more visible an item is, the more likely a user will know it and use it. [45] The user interface should be intuitive.

Feedback is the principle of making it clear what action has been taken and what has been accomplished [45]. The user should not have to guess what their action accomplished and there should be feedback in the form of visual, tactile or audio.

Constraints is about limiting the range of interaction possibilities for the user to simplify the interface and guide the user to the appropriate next action [45]. Constraints makes it harder for a user to make mistakes.

Consistency refers to having similar operations and similar elements for achieving similar tasks [45]. The design should not have any surprises.

Affordance refers to an attribute of an object that allows people to know how to use it [45], by using symbols that users are accustomed to, they will already understand what the action is.

## 4.5 Data Gathering

This chapter covers the evaluation methods that will be used for this project. The evaluation methods are important for the research rigor and design research process to demonstrate the utility, quality and efficacy of the artefact. Quantitative methods are focused on gathering large quantities of data and is collected through polls, questionnaires, surveys and more. The data can be used for statistical analysis. The qualitative research in this project will be based on semi-structured interviews, observations and focus groups. Qualitative research focuses more on in-depth research and fewer data collection cases.

### 4.5.1 Literature Review

A literature review is gathering of published articles, reports, books and other relevant documents by searching with keywords in academic journals and search engines. The literature review shows a summary of relevant information about methods, data gathering and what the research accomplished. The literature review can contribute to finding and establishing requirements for the artefact development.

### 4.5.2 Semi-Structured Interview

Semi-structured interviews uses pre-defined questions to create a structure of an interview. The prepared questions are asked and are open for answers and discussions. The method allows for follow up questions and exploring discussions. This method was used during the interviews with ... An interview guide approved by NSD can be found in appendix ..

### 4.5.3 Survey

A survey is a quantitative method of gathering data with the purpose to produce statistics about some aspects of a sample population. A survey collects information by asking people questions and the answers are the data that is analyzed [15]. The questions are mainly close-ended with few open-ended questions at the end for free form answers.

### 4.5.4 Focus Groups

A focus group is a group interview with several participants at the same time with a moderator present to ask questions and guide the conversation. "Focus groups explicitly use group interaction as part of the method. This means that instead of the researcher asking each person to respond to a question in turn, people are encouraged to talk to one another: asking questions, exchanging anecdotes and commenting on each other's experiences and points of view"[27]. The experiences and points of view can be used to identify common knowledge and get feedback in a setting that is more relaxed than in a laboratory. The focus group will consist of many members.

### 4.5.5 Case Study

A case study is an intensive study about a person, a group of people or a unit where the aim is to generalize over several units [21]. In this project, a group of people were asked to explain how they log their workouts and how they would interact with the application.

## 4.6 Evaluation of Prototypes

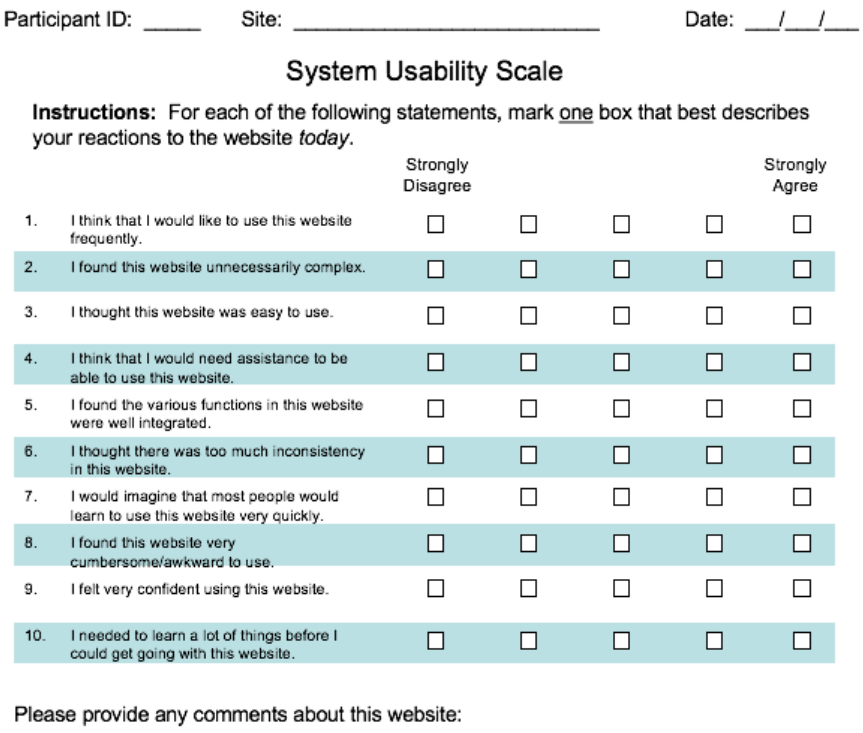
Evaluating a prototype is part of the developmental phase and is performed at the end of each iteration. There are different ways of evaluating a prototype. Experts and users can be included to be certain that the prototype is relevant and the design is easy to use, easy to learn and the design is intuitive.

### 4.6.1 Usability Testing

Usability testing is testing a prototype with participants that represent real users [13] . The users play around with the prototype and perform real tasks while their actions are observed and notes are taken. The goal of a usability test is to improve the usability of a product, analyse data and find problems and reiterate the development phase to improve the prototype.

### 4.6.2 System Usability Scale

Another way of evaluating HCI is to use the system usability scale by John Brooke [3]. This evaluation method differs from the heuristic evaluation by having regular users that are not experts in the field of HCI to evaluate the system. The system usability scale consists of ten statements, every statement gets a score where strongly disagree is the weakest and strongly agree is the strongest. The SUS score can be calculated and there are different ways of measuring it, grades, adjectives or percentages can be used [31] . The ten statements are structured so that odd numbers have positive loaded questions and even numbers have negative loaded questions. To calculate the score, the odd numbers will have 1 subtracted from their value and the even numbers will subtract their number from the value 5. Adding this together and then multiplying it with 2.5 will get a SUS score out of 100. A SUS score above 68 is considered as a good score [31].



Participant ID: _____ Site: _____ Date: ___/___/___

System Usability Scale

**Instructions:** For each of the following statements, mark one box that best describes your reactions to the website *today*.

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I think that I would like to use this website frequently. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2. | I found this website unnecessarily complex. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3. | I thought this website was easy to use. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4. | I think that I would need assistance to be able to use this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5. | I found the various functions in this website were well integrated. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6. | I thought there was too much inconsistency in this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7. | I would imagine that most people would learn to use this website very quickly. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8. | I found this website very cumbersome/awkward to use. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9. | I felt very confident using this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10. | I needed to learn a lot of things before I could get going with this website. | ☐ | ☐ | ☐ | ☐ | ☐ |

Please provide any comments about this website:

Figure 4.2: System usability scale template

### 4.6.3 Nielsen‘s Heuristics

To evaluate the usability of a system, Nielsen [38] developed ten heuristics as a guideline to test and estimate the usability of a product. The ten heuristics can be used by human computer interaction experts to evaluate the interface of an application. The evaluation is performed by a small set of usability experts individually and only requires a few experts to identify 75% of the problems 4.3.

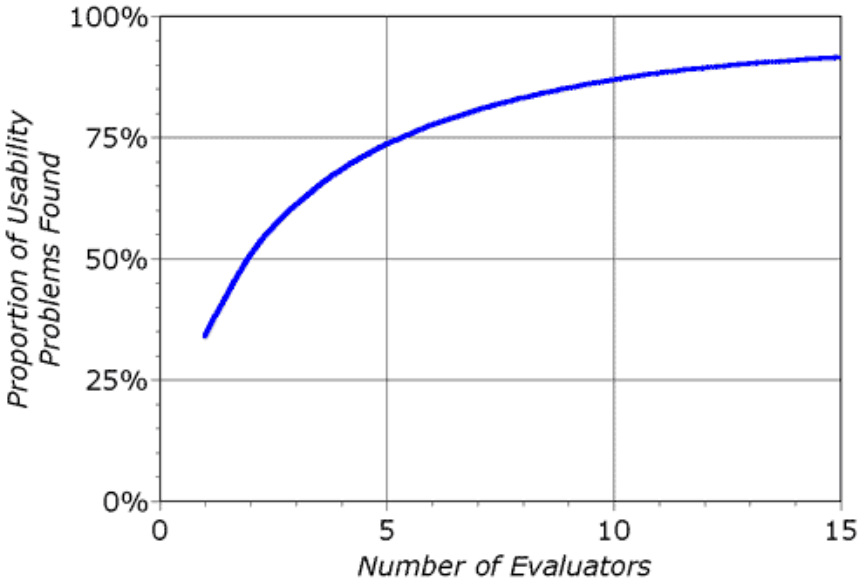



Figure 4.3: The proportion of usability problems in an interface using various numbers of evaluators[38]

Nielsen‘s heuristics will be tested by experts in information science.

Table 4.2: Nielsen‘s heuristics to follow for user interface

| Nielsen‘s Heuristics | |
|---|---|
| Visibility of system status | The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time. |
| Match between the system and the real world | The system should speak the users' language, with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order. |
| User control and freedom | Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo. |
| Consistency and standards | Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions. |
| Error prevention | Even better than good error messages are a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action. |
| Recognition rather than recall | Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate. |
| Flexibility and efficiency of use | Accelerators — unseen by the novice user — may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions. |
| Aesthetic and minimalist design | Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility. |
| Help users recognize, diagnose, and recover from errors | Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution. |
| Help and documentation | Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large. |

### 4.6.4 Observations

Another qualitative method to evaluate an application is observations. "Individuals are observed performing specified tasks within a controlled environment"[43]. The evaluator has a script and predetermined tasks for the participants. They are encouraged to communicate while they are performing the tasks and use the think-aloud technique which is a technique developed by Erickson and Simon[14]. The technique requires the participants to say out loud what they are thinking and trying to do. Thus making it easier for the evaluator to take notes, which can be analyzed later.

## 4.7 Target Group

The target group is young adults between the ages of 18-30, who lives a sedentary lifestyle or exercise rarely and want to change. This was to focus on potential users who want to make adjustments and improve to maintain an active and healthy lifestyle. For the research it is important that the target group were interested in technology and were willing to use new applications.

| Target group | |
|---|---|
| Gender | male/female |
| Age | 18-50 |
| IT Criteria | smartphone, active on social media |

Table 4.3: Target group requirements

## 4.8 Research Participants

### 4.8.1 Users

The users were recruited through personal connections. The users in the focus group which consisted of one female and three males. Two of the users work in banking and investment, one masters student and one consultant. The focus group members averages one to two workout a week. The users in the case study and usability testing were two females, both are business and economics students and usually workout once or twice a week.

### 4.8.2 Physical exercise experts

The physical exercise experts consisted of a researcher in physiotherapy, a personal trainer and a former personal trainer who works as a developer. They were recruited through personal connections and took part in semi-structured interviews.

### 4.8.3 Usability experts

Six usability experts from the University of Bergen were recruited to evaluate the application with Nielsen‘s heuristics or SUS. The experts were one female and five males. The usability experts are all information science master students. The usability experts have a varied workout background, from being professional athletes that workout five to six times a week to living a sedentary lifestyle with no workouts.

## 4.9 Requirements

To establish requirements it is important to know who the users are, what features to implement and how to implement them. The requirements for a system are descriptions of services that a system should provide and constraints on its operation [49]. The requirements are the needs of the features and are often divided in to functional requirements and non-functional requirements.

### 4.9.1 Functional Requirements

Functional requirements are the statements of services the system should provide, how the system should react to particular inputs, and how the system should behave in particular situations [49]. For the functional requirements it is important to understand what the user needs from the application. A survey on social media was conducted for the purpose of analysing what features users need.

**The application needs to**

- store information the users want to share
- let users select a cooperative goal
- display common goals for the groups
- compete and cooperate towards goals
- be able to see their own progress and group members progress
- log workouts

### 4.9.2 Non-Functional Requirements

The non-functional requirements are the constraints on the services or functions offered by the system. The non-functional requirements include timing constraints, constraints on the development process and constraints imposed by standards [49] . These requirements apply to the system as a whole rather than individual features.

**The interface needs to**

- be user-friendly (fast responding, lean design)
- be responsive
- be aesthetically pleasing with modern design
- be designed within the delivery of this paper(1st june 2020)

# Chapter 5

# Prototype Development

## 5.1 Iteration overview

This chapter presents four design iterations and methods that were used while prototyping. The table below summaries the iterations and shows what methods were used and how the prototype was evaluated.

Table 5.1: Overview of design iterations

| Overview of iterations | | | | |
|---|---|---|---|---|
| Iteration | 1 | 2 | 3 | 4 |
| Define/Redefine | Literature review and survey | Redefine after expert interview | Redefine after focus group | Redefine after SUS with experts |
| Fidelity | Low | Low-mid | High | High |
| Method | Interview with experts | Focus group design principles | Group survey | SUS with experts |
| Evaluate | Evaluate with experts | Interview | SUS with experts | SUS with users heuristics with experts |

## 5.2 First Iteration of Research Project

The first design iteration started with the requirements established from the literature review and a survey conducted through social media to gather data. The survey went through two

pilot studies to establish the best way to get data and was shared on Facebook. The purpose of the survey was explained in the introduction, so that the people who answered knew what they were contributing to. They were shown an example of logging exercises 5.1 and were explained how a likert scale works. 44 people answered the survey.

Oppvarming
Knebøy: 20kg x 10 repetisjoner | 40 kg x 10 repetisjoner | 60 kg x 10 repetisjoner
Benkpress: 20kg x 10 repetisjoner | 40 kg x 10 repetisjoner | 60 kg x 10 repetisjoner
Løping: Vanlig tur, 30 min + 5 x 100 m stigningsløp

Figure 5.1: Example of logging a workout

### 5.2.1 The survey

To establish some background information on the people that were surveyed, they were asked how often they work out and whether or not they already use an activity tracker. The majority of people that answered worked out more than 10 times a month and less than 30% answered 5 or less.


Figure 5.2: Background information

45.5% answered that they use an activity tracker and they were also asked to list which tracker they used which can be seen in the table below.

Table 5.2: Survey Activity Tracker

| Activity Tracker | |
|---|---|
| Apple Watch | 2 |
| Fenix | 1 |
| Fitbit | 5 |
| Garmin | 5 |
| Kadens | 1 |
| Polar | 3 |
| Suunto | 2 |

They were asked to list what kind of data they think is interesting besides logging workouts from the activity trackers and applications. Some of the answers are shown in the table below. Most people answered that knowing the heart rate, average heart rate and max heart rate is important. Also the amount of daily steps, distance of a run, amount of sleep and performance analysis were listed.

Table 5.3: Data from activity trackers

| Data from activity tracker | |
|---|---|
| Norwegian | English translation |
| Distanse løpt/gått | Distance run/walked |
| Puls, tid og hastighet | Heart rate, time and speed |
| Puls | Heart rate |
| Følge med om økten holder seg innenfor mål satt før trening | If the workout stays within the pre-deterimined limits |
| Puls, søvn, søvnforstyrrelse/urolig søvn, skritt, kalorier, stigning/høydemeter | Heart rate,sleep, sleep disturbances, steps, calories, climb/ascent/acclivity |
| Puls, løpedistase og tid | Heart rate,distance run and time |
| Skritteller,søvn og trenings analyse | Steps, distance, sleep and workout analysis |
| Antall skritt gått | Daily steps |
| Performance, energiforbruk, treningseffekt og restitusjonstid | Performance, energy spent, training effect, recovery time |
| Gjennomsnittspuls | Average heart rate |
| Makspuls | Max heart rate |

To get more knowledge about the surveyed people‘s workout habits, they were asked if they logged their workouts seen in figure 5.3. The majority answered they do not log their

workouts. From the 41.9 % of people that log their workouts were asked if they do it after or during and 70% of them do it after they are finished with the workout.


Figure 5.3: Workout logging

To get an understanding of how people view others progress 5.4. They were asked if they feel extra motivated to workout by seeing friend‘s progress, whether its strength progression or physical changes. 20 people answered that they agree or strongly agree. 13 answered neutral and 11 in total answered that they disagreed or strongly disagreed.

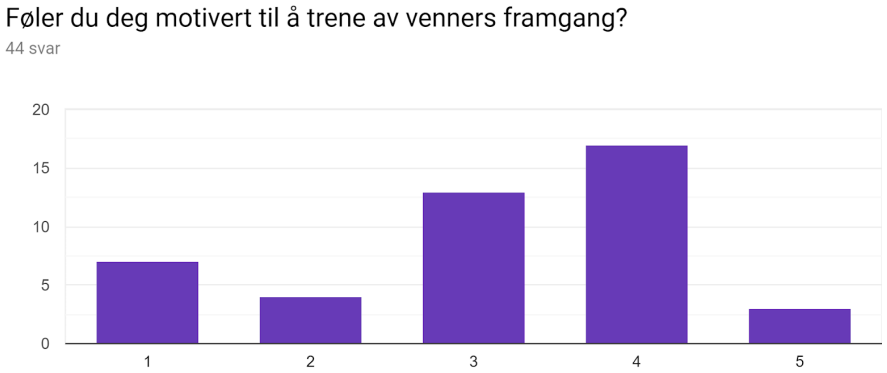



Figure 5.4: Motivated from others progress

Since most people do not log their workouts, it is interesting to know if they would feel motivated to log their workouts if their friends could see the workout logs. However most people strongly disagree with this statement.

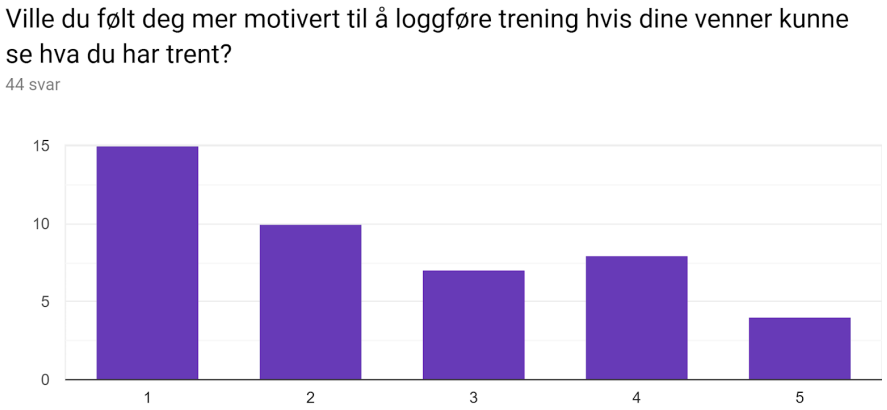



Figure 5.5: Motivated to log workouts if friends could see the logs

The next question was about accountability and whether or not they would feel accountable to log their workouts if their friends could see them. The answers from figure 5.6 were almost identical to the motivation answers shown in figure 5.5 where the people mostly disagreed with the statement.

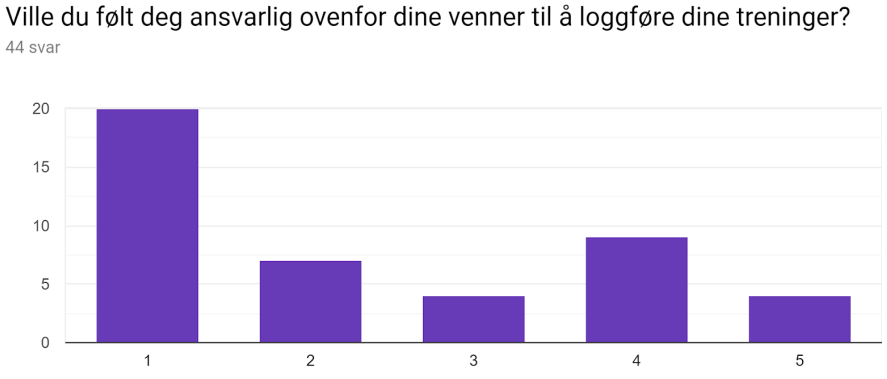



Figure 5.6: Accountability from friends to log workouts

To find out if the surveyed people are interested in their friends workouts, they were asked if they were interested in friend‘s progression in running, or if their friends gathered for a football game. The answers were quite mixed as shown in figure 5.7, however the answers mostly disagreed with the statement.

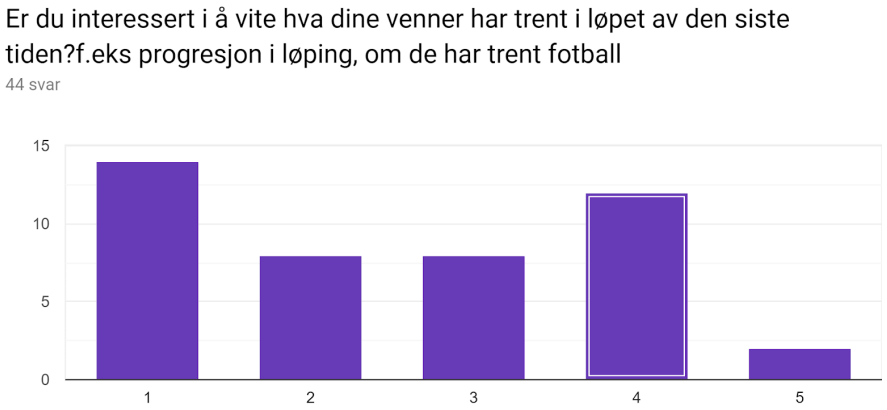



Figure 5.7: Interested in friends workouts and progress

As suggested in the literature review, having common goals is important to both stay motivated and accountable. The survey asked if it would be extra motivating to have a common workout goal that they co-operate with their friends. Examples would be running 5 kilometers together, lifting weights together or daily step challenges. The answers were mostly positive as seen in figure 5.8. Only 7 answers disagreed or strongly disagreed.


Figure 5.8: Motivation from common goals

As a follow up to the last question, the surveyed people were asked if it is motivating to compete with friends towards a common goal. Again the answers were mostly positive to the suggestion as most people strongly agreed with the statement.

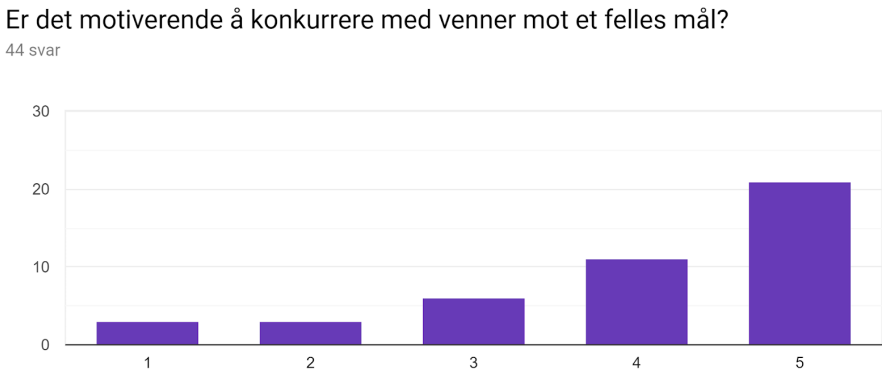



Figure 5.9: Competing with friends

To get an idea of how members of a group would interact with each other, they were asked if they would like to get instant notifications if a member of their group was working out. The idea here is that if a member is working out at the moment, it would motivate the rest of the group to go out and do a workout. As seen in figure 5.10, the answers are mostly strongly disagree or neutral. They prefer to have an asynchronous application instead of a synchronous application with push warnings or instant notifications.

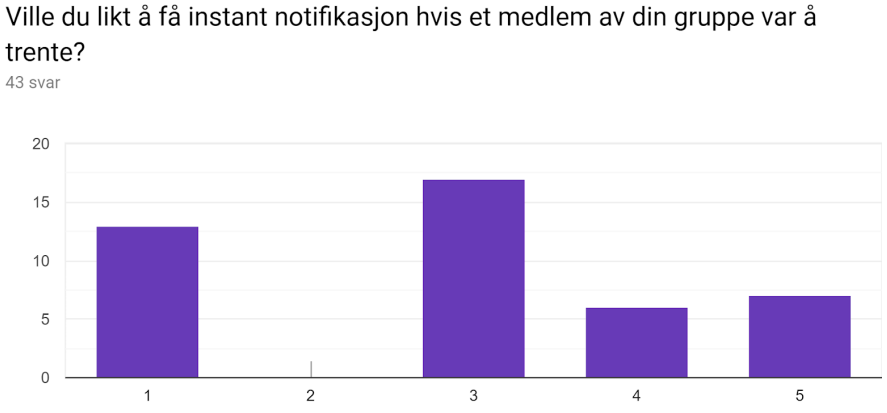



Figure 5.10: Instant notifications


Figure 5.11: Testing workouts from fitness influencers

From the literature review it is suggested that some people take the role of a mentor and having mentors help people in the early stages by sharing information and knowledge. Fitness influencers are people that share exercises and workouts online on social media like Instagram and Snapchat. However the answers were negative and most people disagree that they would try the same workouts as fitness influencers share on social media.

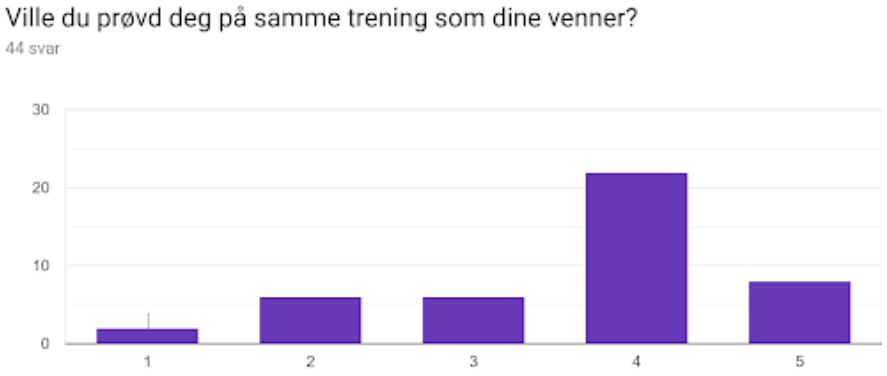



Figure 5.12: Testing workouts from friends

As a follow up to figure 5.11, it is interesting to find that people much rather prefer to copy workouts from friends. Figure 5.12 shows that people would like to try a workout written by a friend.

### 5.2.2 Low-fidelity prototype

The first version of the application was created as a sketch on paper. Several iterations were drawn on paper to test different layouts and features. The sketches were focused on the functionality of creating or joining groups and how to select and share goals. There is a workout logging feature that lets users log their own workouts and look at past workouts and a feature that lets the users look at the group members workout as well. The goals are selected by the group members and will be visible in the social group member part of the application.


Figure 5.13: Wireframes for the application

Figure 5.13 shows some of the screens from the first wireframe that is created in the prototype program Proto.io. The bottom buttons on every screen are inspired from other social media applications. The user icon will go to your own workout log(the second screen) and the group of users will go to a group screen(the third screen) with the common goals and the other users workouts. The Add icon will be for adding workouts. The fourth and fifth screen shows the group screens, where the users will be able to join or create groups, select names for the group and then adding common goals for all their members.

### 5.2.3 Interactive prototype

With proto.io it is possible to add interactions and clickable buttons for the wireframes. This was used to create the first interactive low-fidelity prototype. The interactive prototype

displayed the functions mentioned in section 5.2.2. Instead of adding dropdown menus and clickable lists the features were presented with symbols and descriptive information to illustrate the different functions. Illustrative images were also added to improve the user experience of the low-fidelity prototype.

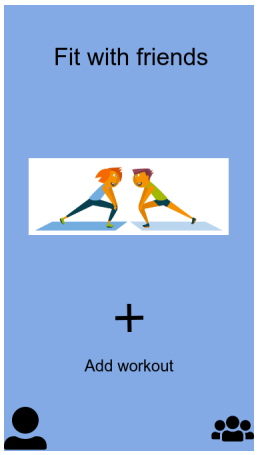



Figure 5.14: First interactive prototype with Proto.io

### 5.2.4 Expert interview

Two experts were interviewed at City Sammen, a physiotherapist and researcher and a developer, both work as personal trainers online and have worked with clients in person before. There was a brief introduction of the goals and ideas of the project, then the experts were introduced to the literature review and the answers from the survey. After a semi-structured interview was done with a set of pre-defined questions about how the personal trainers work, and the development and features of the application.

The experts thought it was an interesting project and both agreed that setting personal goals and providing feedback and accountability is very important to keep improving the physical fitness of their clients. They also believed that having groups would increase the competition between the users and that it would keep the users accountable by "shaming" each other if they fell off. One expert requested a way of visualising the progress towards a goal, with a progress bar or showing the progression percentage. Since it is important to show the progress that the users have made. Giving positive feedback like "great work", when a user logs their workout would be beneficial for accountability. At the end of the semi-structured interview there was a discussion between the experts about notifications. One of

the experts recommended that having notifications with motivating quotes and telling the users that another user just worked out could help for the competition aspect, however the other expert agreed with the survey answers and thought that very few users would approve of this functionality. One of the experts also recommended creating the functionality in ReactJS.

### 5.2.5 Proof of concept

After conducting the literature review and the survey it was clear that there is a demand for group functionality for exercise applications and that it requires further research. The experts also liked the idea of an application with the proposed functionality for exercise accountability and exploring more design and technology solutions.

## 5.3 Second Iteration of Research Project

The second iteration consisted of changing the framework to ReactJS. This was done to test the functionality with a more realistic framework than a prototyping framework. Creating a new low-fidelity interactive prototype and implementing the current functionality there. The requirements were also redefined based on the feedback from the experts. Lastly a group of usability experts performed a SUS evaluation.

### 5.3.1 Redefining after the expert feedback

After the semi-structured interview with the experts some changes were made. The prototyping framework proto.io was switched with ReactJS, as an expert recommended it and it is one of the most popular frameworks for development. The change required some learning time. The progress bar functionality for the group goals was also emphasized in this design iteration.

### 5.3.2 Focus group

The focus group consisted three males(A,B,C) and one female(Z), who are all close friends. They were introduced to the research and were told about the ideas from the literature review. The goal of the focus group was to get the group to discuss what features and content they would like to see and most importantly stay accountable. They were first asked if they use any fitness applications or if they have used any in the past. Two of them had used Fitbit and one had used Myfitnesspal. They had abandoned the applications because they were "boring", "not interesting" and the fun of the application quickly ended.

They were then asked if there are any features that would make them use a social fitness application.

- A: Having long-term goals with workout programs included, the ability to make bets with friends.
- Z: Goals for workout frequency, general goals for working out a couple of times a week
- B: Competing with friends to win prizes, where the members put in money for weekly competitions. Competitions could be going to the gym the most times, working out the longest or doing the most total weight in a week. He mentioned that the application could have GPS locations for gyms, and that it should only be possible to log workouts from the gym. He also thought that having positive feedback when you log a workout is a nice touch, and the other group members should get a notification in the application when a member has logged a workout.
- C Said that he exclusively works out alone and does not think that a social application would get him to log his workout or be interested in what his friends are doing.

The next part was dedicated to visualisation of the goals. They all agreed that the visualisation should be focused on the smaller goals, for instance having 10 workouts in total during a week for the group where every member has to contribute. They mentioned that the bigger goals like working towards completing a marathon, or hitting a 100 kg bench press should be a personal goal and this could be visualised with a percentage bar. The intermediate objective goals could be visualised with check marks, using a green check mark for success and a orange check mark for in progress.

For the last part of the focus group the members were shown the current mid-fidelity prototype created in React. They did a walk through of the application where they could log a workout and go through the current components that had filler content.

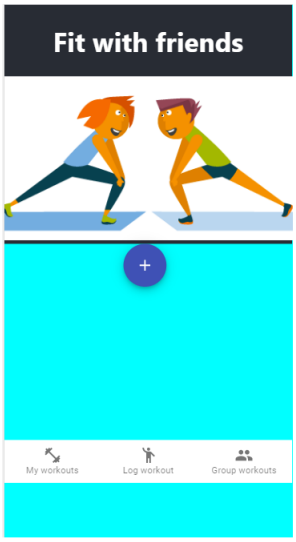



Figure 5.15: Prototype shown to the focus group

They were then asked about design preferences, they all agreed that having intuitive user interface and to stay social was the most important part. They thought the buttons were intuitive enough so that they understood quickly what would happen. For the color preferences they agreed that light colors with dark text is the best option, and that it looked more professional without ”aggressive screaming colors”.

### 5.3.3 Design principles

In order to improve the prototype for testing, the five design principles were reviewed and integrated to the prototype design. For the visibility principle, text was added and replaced some of the content filler that was in ”your workouts” and ”your friends workouts”, this added to the constraint and feedback principles as well as now it is easier to understand where in the application a user is and makes it harder to do mistakes.

For the feedback principle the navigation buttons now show a transition to the button that was pressed and the button changes colour to blue and is slightly bigger than the other two

as shown in figure 5.16. The design is also consistent over every screen of the application with the same background colours, images, navigation and font. The same goes for the affordance principle as there are common icons and the layout which is inspired from social media platforms which matches the industry

## 5.4 Third Iteration of Research Project

For the third iteration, the feedback from the focus group was implemented to the prototype. A visualisation bar was added to the group workout to represent the personal goal of the user, and both the personal and group goals are shown as well. The prototype was evaluated by usability experts with SUS and a group survey.

### 5.4.1 SUS and survey with Usability Experts

The evaluation of the third design iteration was conducted by six people. The usability experts were divided in to groups of three to get a feeling of the social aspect of the prototype. They were told about the previous iterations of the research project and answered a survey after doing the SUS analysis.

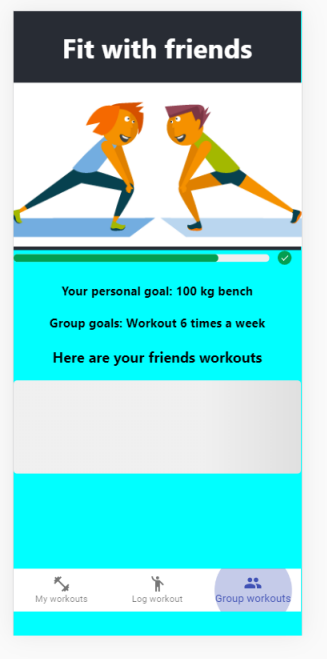



Figure 5.16: Prototype with progress bar, goals and content

The prototype 5.16 was shown to the usability experts on a laptop screen with a responsive layout window of an iPhone X. The evaluating experts consisted of six information science master students. They were guided through the prototype and explained the basic functionality of the application and how the social features would work. The experts had then a couple of minutes to click through the prototype and after they evaluated the prototype with SUS and a quick group survey. The first group gave an average score of 90,8 and the second group gave an average score of 93,3, which is considered as best imaginable. The score might be inflated as the evaluating experts know about the SUS from beforehand and wanted to be nice.

### 5.4.2 Group survey

Each group conducted a group survey about the functionality after completing the SUS. They were asked three questions that prompted a discussion. Question 1: Is there any functionality that you and your group thinks is missing?

- Group 1: Would love to have a graph showing the progression towards the personal goals. Likes when the data is visualised, how much weight has been lifted in a gym session, how far you have run each workout and if there is progress.
- Group 2: Being able to log diet and share what you have eaten today, having a caloric calculator and show how many calories you have approximately used per day. One of the members pointed out that the progress bar should be below the personal goal, and the green checkmark should be changed since it looked like the goal was completed.

Question 2: Would your group be interested in having a leaderboard in the group section that would show which member is working out the most each week or month?

- Group 1: Yes to both, really think both would help motivate the group members and all of them thought that it would help them to stay more active.
- Group 2: Yes, very motivating and would love to have a weekly rapport showing who is on top and what the members have done.

Question 3: Would you use a fitness application with the social functionality? And do you think you would continue using it for a couple of months? ( Assuming your group of friends would too)

- Group 1: Yes and "yes if I actually worked out or my friends guilted me into doing it"
- Group 2: Yes absolutely, especially if our friends joined.

### 5.4.3 Redefining after feedback from usability experts

After the feedback from the usability experts, a leaderboard was implemented to the prototype as well as a few design changes in the group section, the goal was moved above the progress bar, and the progress bar visualisation was changed so that the green checkmark only shows if the progress is complete, and the bar now is blue and shows that the goal is active.

## 5.5 Fourth Iteration of Research Project

The fourth iteration of the prototype consisted of testing the prototype with two users. The users evaluated the prototype with SUS and a usability test. The prototype was evaluated by experts with Nielsen‘s heuristics as well.

### 5.5.1 SUS with users

A SUS evaluation was conducted by two users that contributed to the survey and the usability testing after. The users are economy students and are regular users of fitness applications. They were shown the prototype on a laptop with iPhone X viewport and were allowed to click around to test the functionality and did three usability tasks before evaluating with SUS. Both users gave a SUS score above 90 which is seen as best imaginable and shows that the design of the prototype is intuitive and easy to use.

Additional feedback from the test users suggested adding search functionality for exercises and a calendar to easier portray the days you worked out and what you did for your workout. The results of the SUS can be seen in section 7.4.

### 5.5.2 Usability testing with users

The participants of the usability test performed three different tasks. The tasks were performed on a laptop with iPhone X layout and were timed on every task they were given. The participants were quickly introduced to the functionality of the prototype and the research before the task, and then had some time to navigate around. The participants were presented with four different tasks that would be timed. The users did not make any mistakes and the user interface and design seemed intuitive and easy to use. The results are shown in section 7.5.

### 5.5.3 Heuristics with experts

Three usability experts were contacted to evaluate the prototype with Nielsen‘s heuristics. The users were shown the high-fidelity prototype on a laptop with an iPhone X layout. The results are shown in section 7.6 .

## 5.6 Future iterations

After conducting the user and expert testing there were suggestions for new functionality that could be implemented in a future iteration. One suggestion was to add comments on your own workout and friends workouts to add to the social features and make it more of a social network feeling. Another suggestion which would be hard to implement was to add the data from fitness trackers to the applications or get the daily steps counter from the mobile phones of the users. From the heuristic evaluation there are a few major usability problems that should be prioritised as well. Letting the users change their goals and adding more than one goal and adding more error prevention and easy to understand messages if an error occurs.

# Chapter 6

# Features of Fit with friends

This is the overview of the functionalities from the high-fidelity prototype. This is the final product from this research project and the application consists of three different sections.

## 6.1 Logging workouts

The logging workout section shown in 6.1 is the front page of the application. The bottom navigation includes "My workouts" , "log workout" and "Group workouts". Log workout leads to a user form that consists of three steps.

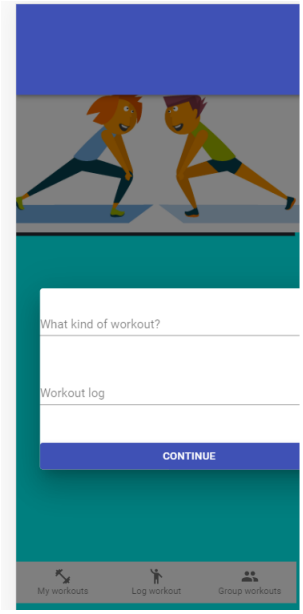



Figure 6.1: Logging workouts

In the first step of the form, it asks the user what kind of workout is being logged (gym, running, swimming or other) and the details of the workout. The next step asks the user to confirm the details and it is possible to go back to make changes.

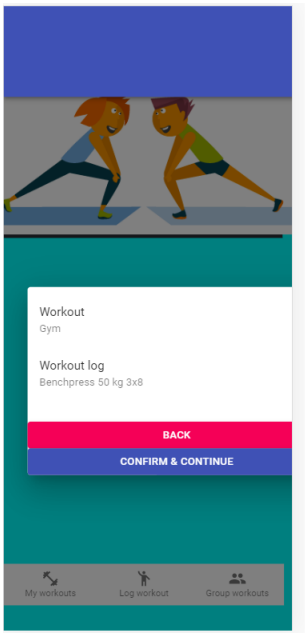



Figure 6.2: Confirming input

The last step is the success form, the user gets a positive message "Great work" and "Your workout will be added to your log".

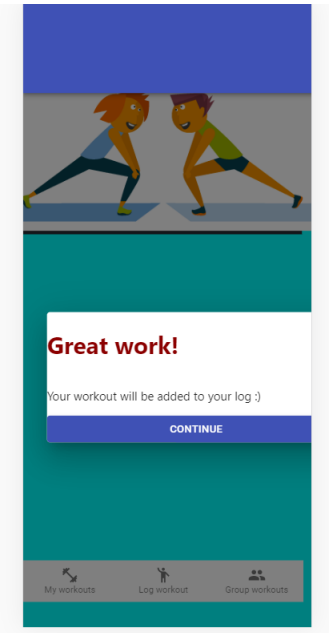



Figure 6.3: Positive feedback

## 6.2 My workouts

My workouts is the personal log of the user. This section consists of all the personal data and information the user has logged in the application. The workout data is presented in tables with the format of exercise, weight, rep scheme. The logged data would show up for the users friends in their social section.

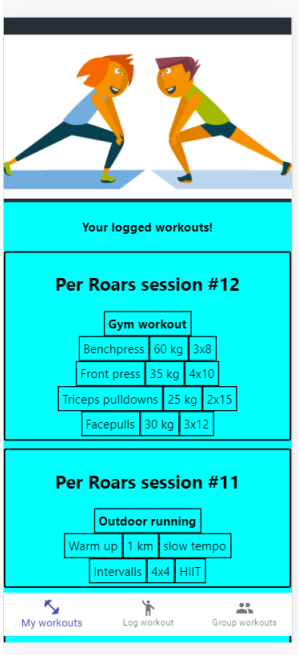



Figure 6.4: My logged workouts

## 6.3 Social section

Group workouts is the social section of the application. It includes a personal goal which is supposed to be a long term goal and displays the group goals which are short term goals for the group like going go the gym a total of 10 times a week. The workout logs of every group member is shown in the social section, this functionality is hidden and if clicked returns a list consisting of all the recent workouts.

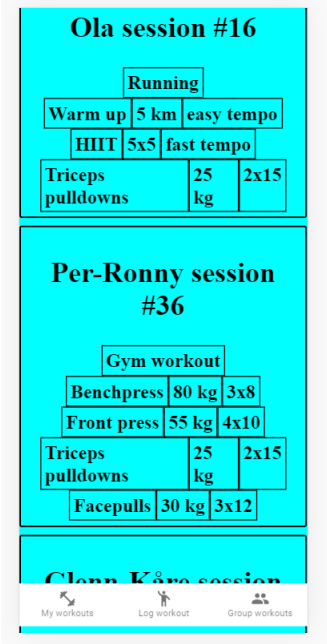



Figure 6.5: My friends logged workouts

This lets the users share information and knowledge about workouts which the users can copy or get inspired and motivated by.

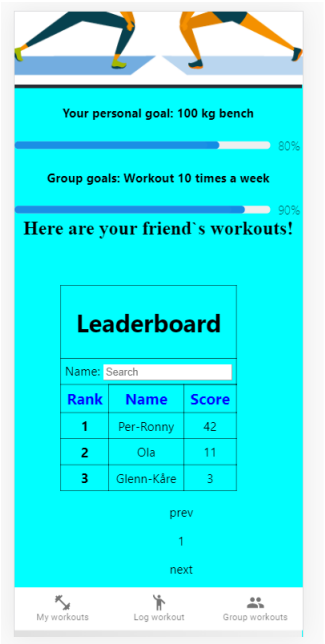



Figure 6.6: Leaderboard, goals and toggleable friend workouts

The leaderboard is a gamification design to encourage the group members to compete with each other, a user would get a point if they log a workout and the points form a rank to see who has the most points. The weekly leader would get a notification stating that they have won and then the leaderboard would reset so the users are competing on fair terms every week for their goal.

# Chapter 7

# Evaluation

This chapter presents the evaluation results of the different design iterations from the SUS, usability testing and Nielsen‘s heuristics.

## 7.1 Participants

Different groups evaluated each design iteration and the project switched between usability experts and intended users. The first group that participated in a focus group consisted of intended users who were a group of friends with a similar fitness level and were all motivated to improving their fitness levels. The other groups were usability experts who have all gotten a IT related degree and have participated in courses with interaction design and human-computer interaction. The two users that participated in the last design iteration are two friends that are business students and are frequent users of fitness applications (fitbit).

## 7.2 System Usability Scale

The usability experts evaluated the application first with a system usability scale (SUS) method. Both the experts and intended users evaluated the prototype on a laptop screen with an iPhone X layout.

## 7.3 SUS with Experts

The usability experts did the SUS evaluation during the third design iteration with a mid-fidelity prototype with some functionality implemented. The usability experts returned an average score of 92. The experts answered the survey individually and were in the same room.

Table 7.1: Results from experts testing

| Expert SUS test | |
|---|---|
| Group 1 | 90,8 |
| Group 2 | 93,3 |

## 7.4 SUS with Users

The users did a SUS evaluation during the fourth design iteration with a mid to high-fidelity prototype with most of the functionality working correctly. The users returned an average score of 91. The users were tested individually and on different days.

Table 7.2: Results from user testing

| Intended user test | |
|---|---|
| User 1 | 92 |
| User 2 | 90 |

## 7.5 Usability Testing

Two users were presented with four different tasks and were timed to find out how effective and efficiently they could use the prototype. The users were not given any instructions on how to solve a task, however they had prior knowledge about the prototype as they were introduced to the research project and were presented a quick walk through of the prototype. The users completed the four tasks with no help or guidance. One noticeable

difference between the users was that one user tried to navigate the prototype by clicking on the image as the user thought it would be similar to a home button to the main page.

Task 1 was to find a prior gym workout where the user trained bench press, the users started from the starting point of the prototype. User 2 was a bit slower on this test, however she explained that it took some time to read each of the mocked workout logs.

Table 7.3: Task 1 results

| Task 1 | |
|---|---|
| User 1 | 4,2 |
| User 2 | 7,6 |

Task 2 was to add a workout that the users could recall they did recently. The users started from the previous workout section. They were given some time before the test started to think of what they would like to log. Both users were similar in time to log their workouts.

Table 7.4: Task 2 results

| Task 2 | |
|---|---|
| User 1 | 25,6 |
| User 2 | 22,7 |

Task 3 was to find a friends(named Ola) workout where he did a 5 km run. The users started from their own workout log. User 2 struggled initially as she went below the leaderboard first before she scrolled up again and clicked on the expandable list of her friends workouts.

Table 7.5: Task 3 results

| Task 3 | |
|---|---|
| User 1 | 6,5 |
| User 2 | 10,3 |

Task 4 was to check the leaderboard and see who is currently in third place, the users were told to navigate back to their own workout log before the timing started. Both users knew from beforehand where the leaderboard was and were very quick to report who was in third place.

Table 7.6: Task 4 results

| Task 4 | |
|---|---|
| User 1 | 3,9 |
| User 2 | 3,2 |

## 7.6 Heuristics with experts

Nielsen‘s heuristics was used as the last step of the fourth design iteration.Three information science masters students evaluated and tested the high-fidelity prototype. The evaluators were presented the prototype on a laptop with iPhone X layout and evaluated the prototype separately. Below is the condensed feedback for all of the ten heuristics. The feedback is divided into four different rates.

- Cosmetic usability problem: Need not to be fixed unless extra time is available on the project.
- Minor usability problem: fixing this should be given a low priority.
- Major usability problem: Important to fix, should have a high priority.
- Usability catastrophe: Imperative to fix, product can not be released.

**1. Visibility of System Status:** Minor usability problem, there is no home screen, there could be a home screen on used on the heading banner.

**2. Match between the System and the Real World** Cosmetic usability problem, in the navigation bar there is little match between icons and real life besides the group icon, the other two should be changed to something that specifies logging a workout and my workouts

**3. User control and Freedom** Minor usability problem, there is no emergency exit, however since there are error prevention in place of logging workouts, this is not a big issue

**4. Consistency and Standard** Cosmetic usability problem, the previous and next icons on the leaderboard should be horizontal and not vertical

**5. Error prevention** Minor usability problem, can not delete training logs,even though the application asks for confirmation while logging workouts, it should be possible to delete the workouts later on

**6. Recognition rather than Recall** Experts thought the applications information was presented so the users would not have to memorize it.

**7. Flexibility and Efficiency of Use** The application is suitable for both experienced and inexperienced users.

**8. Aesthetics and Minimalistic Design** Cosmetic usability problem, the header is hard to read, change the design

**9. Help Users Recognise, Diagnose, and Recover from Errors** Major usability problem, when an error occurred there were no error message, must have error messages to explain what the users can do

**10. Help and Documentation** Minor usability problem, no help or documentation, but the application is pretty easy to use and understand so should not have a high priority to add this

**Other usability problem(s)** Major usability problem, can not change goals

# Chapter 8

# Discussion

In this chapter there is a discussion about the methodologies and the methods that were used, the development, design and limitations. The research questions are also discussed and answered at the end.

## 8.1 Methodologies

## 8.2 Design Science Research

The design science research method was used throughout this research project. The eight design science research questions were used to be certain that the correct steps were followed during the development of the application.

- 1. What is the research question(design requirements)?

The research questions, goals from section 1.2 and design requirements from section 4.9 were formulated to be relevant for the intended target group. The questions and goals were established in the early phases of the research project. This made it easy to go through the different design iterations with a clear focus on what questions needed to be solved.

- 2. What is the artifact? How is the artifact represented?

The artifact is a high-fidelity prototype called fit with friends. The artifact was designed and built with design principles in mind and the user needs and ideas established from the research project. Previous chapter 6 shows the features of the application.

- 3. What design processes were used to build the artifact?

Throughout the design cycle for this project there were different design processes used. Conceptual design (section 4.2 ), Interaction design principles (section 4.3 ) were used to build the prototypes and Nielsen‘s heuristics from section 4.6.3 were utilized too.

- 4. How are the artifact and the design processes grounded by the knowledge base? What,if any theories support the artifact design and the design process?

The artifact and design processes are grounded by the literature review that was conducted in chapter 3. Users and experts were interviewed to gather information and for the whole research project they were used to evaluate the different iterations of the prototype.

- 5. What evaluations are performed during the internal design cycles? What design improvements are identified during each cycle?

The internal design cycles focused on rapid iterations and feedback to reach a satisfactory design suggestion. Different methods were used to evaluate the prototype, such as the usability testing (section 7.5 ) , SUS with experts (section 7.3 ) , SUS with users (section 7.4 ) and Nielsen‘s heuristics (section 7.6 ) .

- 6. How is the artifact introduced into the application environment and how is the field tested? What metrics are used to demonstrate artifact utility and improvement over previous artifact?

The artifact was field tested with a usability test in section 7.5, interviews with experts in section 5.2.4 and the focus group in section 5.3.2 . The metrics varied in each method, SUS with experts and users returned a score which is also a number that represents how successful the user interface is, and the case study returned a time of task completion in seconds.

- 7. What new knowledge is added to the knowledge base and in what form(e.g peer reviewed literature, meta-artifacts , new theory, new method.) ?

The artifact fit with friends is implemented as a high-fidelity prototype and this master thesis is added as new knowledge to the knowledge base.

- 8. Has the research questions been satisfactorily addressed?

The research questions are addressed at the end of this chapter in section 8.8. The questions are answered and the information is presented with details and references from this thesis.

## 8.3 Design Principles

The design principles were used to improve and focus on the usability of the application. Design principles focuses on design over functionality to achieve an intuitive user interface. The principles are used to enhance the design and are crucial in having continuous development with an easy to use design.

## 8.4 Data Gathering

### 8.4.1 Literature review

A literature review was conducted in the first design iteration to gather data. The literature review laid the foundation for the research project and helped in understanding what theoretical and practical work that have previously been done. The literature review showed that technology and social functionality can help people improve their fitness, but that the current research is limited and more research can be done to get more specific information about what users prefer.

### 8.4.2 Survey

The online survey was conducted in the first design iteration and was completed by potential users. The survey provided a lot of information in a short amount of time. The information that was gathered was useful to understand what functionality and data users prefer from their fitness applications and devices.

### 8.4.3 Semi-structured interviews

Semi-structured interviews were used in this project to gather qualitative data and were important to establishing the proof of concept. The experts were online personal trainers and both gave a lot of suggestions and improvements for the application and how information should be shared. The pre-defined questions were important to start the discussions and it allowed for follow up questions. A challenge with interviewing experts was time, as they are busy and had limited time, having a workshop with them, would have been a great addition to the project.

### 8.4.4 Focus group

The focus group was valuable as the information that was gathered came directly from the intended users,a group of friends who lack motivation to workout and want to increase their physical activity. The challenges from the focus group was that two of the members took control and made the most suggestions and led the discussions. The other members did not voice their opinions in some of the discussions and one of the members was quiet for most of the discussion.

### 8.4.5 Case study

The case study was used to gather data and test for the intuitiveness of the application. The test members were observed while interaction with the prototype and performed a SUS analysis as well. The case study provided insight on how users would interact with the functionality and what changes could be done for future designs.

## 8.5 Evaluation of Prototypes

### 8.5.1 Usability testing

Usability testing gives an indication on how intuitive the user interface design is. Usability testing with an intended target group provided useful insight on how potential users would interact with the application. The two users were given three tasks each, which they completed without any help given. This implies that the application‘s user interface is easy and clear to understand.

### 8.5.2 System usability scale

Usability experts and target group users performed SUS analysis as a quick and easy method to determine and evaluate the usability of the application. SUS allowed for the application to be tested by many users, which gave valuable feedback and some of the issues were highlighted in the feedback portion of the analysis. Both groups gave positive results which reflects that the design is user focused.

### 8.5.3 Nielsen‘s heuristics

Usability experts performed the Nielsen‘s heuristics evaluation in the last iteration of the prototype development. The experts discovered issues with the application that could have been better designed and developed. The heuristic evaluation allowed for the application to be tested by experts in a short amount of time, however the evaluation should have been performed in an earlier iteration as the prototype development would have benefited more from it. The usability experts answered that the application was satisfactory !!!!!!

## 8.6 Prototype Development

Having four design iterations allowed for the application to be evaluated by multiple experts and intended users. Using low-fidelity prototypes in the beginning was useful to visualize the design and test out potential functionality and receive quick feedback on different ideas. The mid-fidelity and high-fidelity prototypes allowed for testing the functionality that was created, and see how the users would interact with the application. There were many smaller iterations between each main design iteration, which were helpful to have continuous improvements and discussions with co-students about the design and functionality of the application.

## 8.7 Limitations

The research project had a few limitations throughout the process. Time was the biggest limitation as more design iterations would be beneficial for the users. The Corona virus halted the user testing too, more users could have been tested. However because of the quarantine, it was not possible to continue testing the design of the application and this limited the amount of iterations for the project. The users could be more involved in the design process and having them evaluate the application in an extended amount of time to truly test the social network aspects of the application and have them test it in a more natural setting. Another limitation was learning react during the development phase, as it took some time to learn react and understand how to implement and create components.Fixing usability problems and more functionality could have been implemented, however they are transferred to future work due to time limitations.

## 8.8 Research Questions

The research questions will now be discussed:

**RQ 1**

- What functionality should be included in a social fitness application for users who struggle with a sedentary lifestyle, that would motivate them to improve their lifestyle?

The data gathered throughout this project from potential users, experts in personal training and the expert usability users have provided suggestions for what should be featured in social fitness applications to promote active lifestyle and maintain motivation for people who struggle with a sedentary lifestyle.

The literature review ( from chapter 3) and the survey ( 5.2.1 ) established the main issues with the current fitness applications and the research from the computer supported cooperative work field. Interviews with users and experts provided valuable information and confirmed that there is a demand for a social fitness application focusing on smaller groups of friends and family. Including both users and experts in the development iterations transformed the requirements into implementation and resulted in the prototype fit with friends.

The development process was focused on gathering information about what social features the users would want and what experts recommended. The users contributed to the survey (5.2.1), a focus group (5.3.2), evaluation with users (5.5.1) and usability testing (5.5.2). The groups of users wanted to be able to log their own workouts and work towards their own personal goals. The users also wanted to be able to see what their friends are doing and have weekly competitions to see who is the closest to the social goal set by the group. The users preferred to have simple and easy to learn design and preferred to have applications that worked as it should. The users (5.5.1) made suggestions to functionality that would make the application easier to use, such as having a calendar that showed the days you and your friends worked out, and being able to search through previous workouts to find out weights, set and rep scheme. Competitions was very important to the users that participated in the focus group (5.3.2), the users said that they were very motivated by having small term and

long term competitions with their friends to win prizes. They also suggested that being able to make bets would increase the fun of using a fitness application, but most importantly would make them work hard towards their goals, to stay active and working out. Many of the people involved in testing have jokingly mentioned that they would feel shamed if they did poorly or shame their friends if they were lazy. The usability experts (5.4.1) helped to improve the design by evaluating the prototype with Nielsen‘s heuristics and SUS. The usability experts suggested functionality in interviews too. Progression visualisation, total weight lifted in the workout logs and logging diet. The personal training experts (5.2.4 contributed with information for what would be foundation of features, the importance of visualising the progress for the goals (6.6 and having competitions between the users as a gamification aspect. They recommended giving positive feedback whenever a workout is logged (6.3). The fundamentals of logging workouts (6.1, the overview of the users own workouts (6.4) and the groups logged workouts (6.5).

**RQ 2**

- Can the application functionality assist users in staying accountable for working out and logging their progress?

Personal training experts emphasized the importance of logging workouts to see the progression and use it as motivation. The experts also emphasized having goals as a way of staying accountable, both long-term goals such as completing a marathon and small-term goals like working out three times a week.

All the users from the focus group and user testing except for one were positive to the functionality they tested. One user stated that he was not interested in working out with friends and preferred to work out alone and not share what he did. From the focus group it is clear that having short-term goals and continuous competitions with gamification and leaderboards increases the motivation to work out and be accountable of logging their workouts. Quick and easy competitions with an even starting point makes it easier to win for the users.

Both experts and users that have contributed to this project have mentioned shaming and that they would shame their friends or that they would be shamed by their friends. Since the users can see what the other group members have done, the users said they would feel accountable to logging out as to not disappoint their friends.

The design of the application and the social features are implemented to make the process of logging workouts quick and precise. The results from the SUS are overwhelmingly positive and shows that the functionality is easy to use and easy to learn.

The conclusion is that the application functionality can assist the users in staying active and accountable by logging their progress.

# Chapter 9

# Conclusion and Future Work

## 9.1 Conclusion

This project has contributed with a high-fidelity prototype called fit with friends. Throughout this project the design science research methodology was used to verify relevance, rigor, quality, as well as the design of the artifact. From the user and expert evaluation of the artifact, the results can be considered as meaningful and novel contribution to the existing knowledge base.

The application is committed to increasing the physical activity for sedentary people. Information was gathered by doing a literature review and data from a survey. The data was analyzed and helped establish the core requirements for the application. The application had four design iterations where each phase had user testing or evaluation and the feedback was collected to improve the design and functionality for every iteration. The application started as a low-fidelity prototype drawn on paper and proto.io and ended up as a high-fidelity prototype created in the framework ReactJS. The high-fidelity prototype was interactive and tested by experts and users.

Interviews with experts in personal training helped form the requirements for the prototype development. The first low-fidelity prototype was tested by usability experts with SUS to reassure the design was easy to use and learn. The feedback from the experts was used to create a mid-fidelity prototype in ReactJS. The prototype was evaluated in a focus group

consisting of a group of friends. The focus group was useful to understand how friends would interact with each other through the application, the feedback was used to add more functionality and some minor changes to the design. Next phase had a high-fidelity prototype with most of the functionality working. The prototype was evaluated with SUS and tested by experts, where the experts gave a good usability score. Afterwards the experts answered a group survey to ask if there were any functionality missing, how they would like to interact with the leaderboard and whether or not they would use a social fitness application for the long term. The experts also performed a heuristic evaluation in the last iteration to review the intuitiveness of the user interface, the feedback here is the basis of the future work. Two users performed a usability test and SUS. The users gave a high usability score and performed the tasks without any mistakes.

Fit with friends and the functionality is a recommendation for current fitness applications. Users rapidly abandon their fitness devices and applications and are overwhelmed with data, leaderboards with thousands of users and complicated design. This project shows that users are interested in simple functionality and social features where they can interact with friends. Competing with friends and co-operating by sharing information will help users stay active and accountable.

## 9.2 Future Work

### 9.2.1 Maintaining fit with friends

Maintaining an application is important for the application to survive and stay relevant. As more technological devices are created for the fitness industry to gather data and information it is important to find a valuable way to represent the data. The functionality from fit with friends could be incorporated with popular fitness application to make them social which would let the users interact more with each other. This would be the best case to let developers implement the features and use their own design. The application should be available in Google play store or iTunes to make the functionality visible to potential users. If the application was to be deployed, the feedback from the expert users with Nielsen‘s heuristics for the design and functionality should be considered. The users should be able to delete training logs, change their goals and error messages should be available for the users to explain what happened and what the users can do.

### 9.2.2 New features

New features and functionality for fit with friends are discussed throughout the previous chapters. Adding more features and improving the current features would enhance the application. Features that could be implemented and then let the users chose what to include in their own groups. The focus group suggested adding features that would enhance the competition amongst the users by having the ability to make bets and having weekly competitions. The focus group talked about the importance of long-term goals with workout programs included to simplify the process so they would already know what to do when they arrive at the gym. The users suggested more social features like chatting and group interaction.

The usability experts wanted features that would increase the amount of data gathered by the application. Counting calories, and caloric estimates were welcomed by the experts, visualizing the total volume moved in a workout or steps as well. Functionality like tracking sleep, mood, awareness, restitution with activity trackers is possible, and with artificial intelligence it will be possible to tell a user if they should workout and what they should workout. Many users want an easy path towards their goal, and by adding training programs and a workout plan, and giving them daily recommendations could help the users stay more active.

The overall design of the features should be intuitive and easy to use as there is already risk of early abandonment. Therefore the social features should be the main concern. Community platforms and challenges for the users could have positive effect as well.

# Bibliography


[1] Aino Ahtinen, Minna Isomursu, Muzayun Mukhtar, Jani Mäntyjärvi, Jonna Häkkilä, and Jan Blom. Designing Social Features for Mobile and Ubiquitous Wellness Applications. 2009.

[2] WL Baumgardner.

[3] J Brooke. Sus - a quick and dirty usability scale. 1996.

[4] M Buchenau and J.F Suri. Experience prototyping. in proceedings of the 3rd conference on designing interactive systems: processes, practices, methods, and techniques (dis '00). 2000. doi: http://dx.doi.org/10.1145/347642.347802.

[5] Lorraine R. Buis, Timothy A. Poulton, Robert G. Holleman, Ananda Sen, Paul J. Resnick, David E. Goodrich, Lavaughn Palma-Davis, and Caroline R. Richardson. Evaluating Active U: An internet-mediated physical activity program. *BMC Public Health*, 9:1–13, 2009. ISSN 14712458. doi: 10.1186/1471-2458-9-331.

[6] Yu Chen, Mirana Randriambelonoro, Antoine Geissbuhler, and Pearl Pu. Social incentives in pervasive fitness apps for obese and diabetic patients. *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*, 26-February-2016:245–248, 2016. doi: 10.1145/2818052.2869093.

[7] Yu Chen, Yunan Chen, Mirana Randriambelonoro, Antoine Geissbuhler, and Pearl Pu. Design Considerations for Social Fitness Applications : Comparing Chronically Ill Patients and Healthy Adults. pages 1753–1762, 2017.

[8] Chia-fang Chung, Nanna Gorm, Irina Shklovski, Sean A Munson, and Human Centered Design. Finding the Right Fit : Understanding Health Tracking in Workplace Wellness Programs. 2017.

[9] Sunny Consolvo, Beverly Harrison, Ian Smith, Mike Y Chen, Katherine Everitt, Jon Froehlich, and James A Landay. Conducting in situ evaluations for and with ubiquitous computing technologies. *International Journal of Human-Computer Interaction*, 22(1-2):103–118, 2007.

[10] S Deterding and D Dixon. From game design elements to gamefulness: Defining " gamification "', pp. 9–15. 2011.

[11] Daniel Antônio Valle Antunes Jr José Dresch, Aline Lacerda. Design science research: A method for science and technology advancement. 2014.

[12] Jill Duffy. The 25 best fitness apps for 2017. 2016.
**URL:** `https://uk.pcmag.com/mobile-apps/42450/the-25-best-fitness-apps`. Last accessed: 26.04.2019.

[13] Joseph S Dumas, Joseph S Dumas, and Janice Redish. *A practical guide to usability testing*. Intellect books, 1999.

[14] Simon H A Erickson, T. Protocol analysis: Verbal reports as data. mit press. 1985.

[15] Floyd J Fowler Jr. *Survey research methods*. Sage publications, 2013.

[16] Morrison C. Manning T Frederick, C. M. Motivation to participate, exercise affect, and outcome behaviors toward physical activity. perceptual and motor skills, 82(2), 691–701. 1996. doi: https://doi.org/10.2466/pms.1996.82.2.691.

[17] Reichmann S. K. Constanzo P. R. Zelli A. Ashmore J. A. Musante G. J. Friedman, K. E. Weight stigmatization and ideological beliefs: Relation to psychological functioning in obese adults. obesity research, 13, 907–916. 2005.

[18] Carol Ewing Garber, Bryan Blissmer, Michael R. Deschenes, Barry A. Franklin, Michael J. Lamonte, I. Min Lee, David C. Nieman, and David P. Swain. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Medicine and Science in Sports and Exercise*, 43(7):1334–1359, 2011. ISSN 01959131. doi: 10.1249/MSS.0b013e318213fefb.

[19] E Goodman. Seeing fit : Visualizing physical activity in context. in proc. chi ea 2006, acm, 797–802. 2006.

[20] Gravitus. Gravitus. 2019.
**URL:** https://angel.co/gravitus. Last accessed: 26.04.2019.

[21] Roberta Heale and Alison Twycross. What is a case study? *Evidence-Based Nursing*, 21(1):7–8, 2018. ISSN 1367-6539. doi: 10.1136/eb-2017-102845.
**URL:** https://ebn.bmj.com/content/21/1/7.

[22] A Hevner. Evaluation of the information systems research framework: Empirical evidence from a design science research project. 2007.

[23] A Hevner and S Chatterjee. Design science research in information systems." in, 9–22. springer, boston, ma. https://doi.org/10.1007/978-1-4419-5653-$8_2$. 2010.

[24] Alan March Salvatore T Salvatore Park Park Jinsoo Ram Sudha. Hevner, Alan R. Design science in information systems research. management information systems quarterly. 28. 75-. 2004.

[25] J Hindy. Best fitness apps for android. 2019.
**URL:** https://www.androidauthority.com/best-fitness-apps-android-567999/. Last accessed: 26.04.2019.

[26] Hebert E. Bartholomew J. Kilpatrick, M. College students' motivation for physical activity: differentiating men's and women's motives for sport participation and exercise. journal of american college health, 54(2), 87-94. 2005.

[27] J Kitzinger. Qualitative research: Introducing focus groups bmj 1995; 311 :299. 1995.

[28] Denis Kostrzewa. Is react.js the best javascript framework in 2018. 2018.
**URL:** https://hackernoon.com/is-react-js-the-best-javascript-framework-in-2018-264a0eb373c8. Last accessed: 24.09.2019.

[29] Amanda Lazar, Christian Koehler, Joshua Tanenbaum, and David H. Nguyen. Why we use and abandon smart devices. *UbiComp 2015 - Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, pages 635–646, 2015. doi: 10.1145/2750858.2804288.

[30] Hyunho Lee and Youngseok Lee. A look at wearable abandonment. *Proceedings - 18th IEEE International Conference on Mobile Data Management, MDM 2017*, pages 392–393, 2017. doi: 10.1109/MDM.2017.70.

[31] James R. Lewis. The system usability scale: Past, present, and future. *International Journal of Human–Computer Interaction*, 34(7):577–590, 2018. doi: 10.1080/10447318.2018.1455307.
**URL:** https://doi.org/10.1080/10447318.2018.1455307.

[32] West J. H. Cannon B. Sax T. Brodegard D Lister, C. Just a fad? gamification in health and fitness apps. jmir serious games, 2(2), e9. 2014.

[33] Pinto R S . Radaelli R. Rech A. Grazioli R. Isquierdo M. Cadore E L Lopesz, P. Benefits of resistance training in physically frail elderly: a systematic review. aging clinical and experimental research (2018) 30:889–899. 2017.

[34] A.R Lurati. Health issues and injury risks associated with prolonged sitting and sedentary lifestyles. workplace health safety, 66(6), 285–290. 2018.

[35] Alister McCormick, Carla Meijen, and Samuele Marcora. Psychological determinants of whole-body endurance performance. *Sports medicine*, 45(7):997–1015, 2015.

[36] Sean Munson and Sunny Consolvo. Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. 05 2012. doi: 10.4108/icst.pervasivehealth.2012.248691.

[37] Sean A Munson, Erin Krupka, Caroline Richardson, and Paul Resnick. Effects of Public Commitments and Accountability in a Te c h n o l o g y - Supported Physical Activity Interv ention. pages 1135–1144, 2015.

[38] Jacob Nielsen. 10 heuristics for user interface design. 2016.
**URL:** http://www.nngroup.com/articles/ten-usability-heuristics/. Last accessed: 21.04.2019.

[39] National Institute of Health. Health Risks of an Inactive Lifestyle. 2017.
**URL:** https://medlineplus.gov/healthrisksofaninactivelifestyle.html. Last accessed: 20.04.2019.

[40] National Institute of Health. Exercise and phsyical health. 2017.
**URL:** https://medlineplus.gov/exerciseandphysicalfitness.htmll. Last accessed: 20.04.2019.

[41] World Health Organization(WHO). Physical activity. 2018.
**URL:** https://www.who.int/news-room/fact-sheets/detail/physical-activity. Last accessed: 19.04.2019.

[42] Misha Patel and Aisling Ann O'kane. Contextual influences on the use and non-use of digital technology while exercising at the gym. *Conference on Human Factors in Computing Systems - Proceedings*, 2015-April:2923–2932, 2015. doi: 10.1145/2702123.2702384.

[43] Sharp H. Rogers Y. Preece, J. Interaction design: Beyond human-computer interaction, 4th edition. 2015.

[44] Yvonne Rogers Preece, Jennifer and Helen Sharp. Interaction design i beyond human-computer interaction. 4th ed. http://graphics.stanford.edu/projects/iwork/. 2015.

[45] Sachin Rekhi. Don norman's principles of interaction design. https://medium.com/@sachinrekhi/don-normans-principles-of-interaction-design-51025a2c0f33. 2019. Last accessed: 27.08.2019.

[46] Xipei Ren, Bin Yu, Yuan Lu, and Aarnout Brombacher. Exploring Cooperative Fitness Tracking to Encourage Physical Activity among Office Workers. *Proceedings of the ACM on Human-Computer Interaction*, 2(CSCW):1–20, 2018. ISSN 25730142. doi: 10.1145/3274415.

[47] Christina M. F. Deborah L. S. Rubio N. Kennon M. S Richard, M. Intrinsic motivation and exercise adherence. int j sport psychol, 28(4), 335-354. 1997.

[48] Mota Júnior RJ Dornelas Ferreira Tavares D Rocha de Faria F Costa Moreira O Rodrigues de Oliveira RA, dos Santos Amorim PR. Association between the number of daily steps and the cardiovascular risk factors in basic education teachers. j sports med phys fitness 2018;58:714-20. 2018.

[49] Ian Sommerville. *Software Engineering*. Addison-Wesley Publishing Company, USA, 9th edition, 2010. ISBN 0137035152, 9780137035151.

[50] Coiera E. Laranjo L Tong, H. L.

[51] Unknown. Github pours energies into enterprise – raises $100 million from power vc andreessen horowitz. 2012.
**URL:** `https://techcrunch.com/2012/07/09/github-pours-energies-into-enterprise-raises-100-million-from-power-vc-andreesen-horowitz/`. Last accessed: 24.09.2019.

[52] Unknown. Exercise with a friend. 2018.
**URL:** `https://www.betterhealth.vic.gov.au/health/healthyliving/Exercise-with-a-friend`. Last accessed: 31.08.2019.

[53] Unknown. Design principles interaction-design.org/literature/topics/design-principles. 2019. Last accessed: 27.08.2019.

[54] Unknown. Proto.io, an overview. 2019.
**URL:** https://www.crunchbase.com/organization/proto-io. Last accessed: 24.09.2019.

[55] Unknown. React - a javascript library for building user interfaces. 2019.
**URL:** https://www.reactjs.org. Last accessed: 24.09.2019.

[56] Unknown. Atom.io. n.d.
**URL:** https://atom.io. Last accessed: 24.09.2019.

[57] Unknown. Google forms wiki. n.d.
**URL:** https://en.wikipedia.org/wiki/Google_Forms. Last accessed: 24.09.2019.

[58] Lenny R. Vartanian and Jacqueline G. Shaprow. Effects of weight stigma on exercise motivation and behavior: A preliminary investigation among college-aged females. *Journal of Health Psychology*, 13(1):131–138, 2008. ISSN 13591053. doi: 10.1177/1359105307084318.

[59] R Weil and C Stöppler, M. Resistance training. 2018.
**URL:** https://www.emedicinehealth.com/strength_training/article_em.htm. Last accessed: 31.08.2019.

[60] Duwaraka Yoganathan and Sangaralingam Kajanan. Association for Information Systems AIS Electronic Library (AISeL) Persuasive Technology for Smartphone Fitness Apps PERSUASIVE TECHNOLOGY FOR SMARTPHONE FITNESS APPS. 2013.
**URL:** http://aisel.aisnet.org/pacis2013{%}0Ahttp://aisel.aisnet.org/pacis2013/185{%}0Ahttp://aisel.aisnet.org/pacis2013{%}0Ahttp://aisel.aisnet.org/pacis2013/185.

[61] Ya Zhou and Atreyi Kankanhalli. How does use of fitness applications influence physical activity? *SIGMIS-CPR 2018 - Proceedings of the 2018 ACM SIGMIS Conference on Computers and People Research*, 3(91):156, 2018. doi: 10.1145/3209626.3209733.

# .1 Appendix A

# .2 Ethical Considerations

All participants were informed of their rights to be removed from the research project at any time and that their privacy is respected and secured. The participants were not asked any sensitive questions about their private life.

The research was approved by the Norwegian Centre for Research Data (Norsk Senter for Forskningsdata - NSD). The participants signed an inform consent before being interviewed, testing or evaluating. The approval from NSD can be found in appendix A Inform consent and interview guides can be found in appendix B.

# .3 A 1 -Approval from NSD

NSD sin vurdering

Prosjekttittel

Kollaborativ fitness tracking

Referansenummer

805539

Registrert

20.09.2019 av Kristoffer Torkildsen Marthinsen - Kristoffer.Marthinsen@student.uib.no

Behandlingsansvarlig institusjon

Universitetet i Bergen / Det samfunnsvitenskapelige fakultet / Institutt for informasjons- og medievitenskap

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Duc Tien Dang Nguyen, ductien.dangnguyen@uib.no, tlf: 90409598

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Kristoffer Marthinsen, qaf006@uib.no, tlf: 41637950

Prosjektperiode

20.09.2019 - 01.06.2020

Status

20.09.2019 - Vurdert

Vurdering (1)

20.09.2019 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 20.09.19. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:

https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET

Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.06.20.

LOVLIG GRUNNLAG

Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER

NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen

- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål

- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet

- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER

NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og/eller rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET

NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Silje Fjelberg Opsvik

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

## .4 Appendix B

## .5 B 1 - Informed consent form

# Vil du delta i forskningsprosjektet

## *Kollaborativ fitness tracking*

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å *se om en applikasjon kan hjelpe en gruppe med mennesker til å holde hverandre ansvarlig når det kommer til trening.* I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

**Formål** Dette forskningsprosjektet er en del av en masteroppgave ved instituttet for informasjons- og medievitenskap ved Universitetet i Bergen. Formålet med forskningsprosjektet er å se om små grupper med mennesker kan holde hverandre ansvarlige og motiverte til å trene ved å loggføre trening og la hverandre se hva de har gjort. Fokusområdet for prosjektet vil være å samle inn informasjon om hva brukere ønsker i en applikasjon, hvordan den kan forbedres og hvordan egen livsstil og trening kan forbedres ved bruk av applikasjoner.

**Hvem er ansvarlig for forskningsprosjektet?**
Masterstudent Kristoffer Marthinsen 41 63 79 50 qaf006@uib.no
Veileder Duc Tien Dang Nguyen 90409598 ductien.dangnguyen@uib.no
*Institutt for Informasjons- og medievitenskap, Universitetet i Bergen*

**Hvorfor får du spørsmål om å delta?**
*For å kunne bidra med å skape en nyttig og hjelpsom applikasjon vil personlige trenere og eksperter på trening bli intervjuet angående det faglige. De har blitt valgt basert på deres stillinger og anbefalinger fra eget nettverk.*

**Hva innebærer det for deg å delta?**
*Ved å delta i studien vil man hjelpe å tilpasse applikasjonen etter innspill. Det vil skje via intervjuer. Det vil ta ca 45 minutt og under intervjuet vil det bli tatt notater og lydopptak hvis nødvendig, det vil bli gitt beskjed om på forhånd.*

**Det er frivillig å delta**
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

**Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger**
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Bare masterstudent og veileder har tilgang til personopplysninger. Personopplysningene lagres ikke direkte med navn, de blir anonymisert med et referanse nummer. Navnelisten med kodenøkkel til referanse nummeret oppbevares separat fra oppgaven og materialet. Deltagere i studiet vil ikke bli gjenkjent i publikasjonen med mindre det er ønsket og gis samtykke til at navn kan publiseres.

**Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?**
Prosjektet skal etter planen avsluttes 1.6.2020. Ved prosjektslutt vil alle filer med personopplysninger slettes, med unntak fra dem som samtykker om at deres navn kan presenteres i oppgaven. Navneliste og lydopptak vil bli makulert og slettet.

**Dine rettigheter**
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

**Hva gir oss rett til å behandle personopplysninger om deg?**
Vi behandler opplysninger om deg basert på ditt samtykke.

**Hvor kan jeg finne ut mer?**
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
*Masterstudent Kristoffer Marthinsen 41 63 79 50 qaf006@uib.no*
Veileder Duc Tien Dang Nguyen 90409598 ductien.dangnguyen@uib.no
*Personvernombudet Norsk senter for forskningsdata 555 82 117 personvernombudet@nsd.no*

*Studiet er meldt til personvernombudet for forskning, Norsk senter for forskningsdata.*

---

# Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Kollaborativ fitness tracking* og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i *intervju*
- ☐ at mitt navn kan publiseres i oppgaven

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. *12:00 01.06.2020*

---

(Signert av prosjektdeltaker, dato)

## .6 B 2 - Interview guide for experts

Intervju guide for forskningsprosjektet

Ekspert brukere

Kollaborativ fitness tracking

Dette er en intervju guide for prosjektet som handler om trening og livsstilsendring. Det vil bli lagt fokus på å finne ut hva slags informasjon som blir gitt til personer som ønsker å gjøre livsstilsendringer og om hvordan de kan holdes ansvarlige og motiverte for å fortsette å trene og loggføre trening.

Informasjonen fra prosjektet vil bli behandlet anonymt med mindre annet er ønsket. Hvis nødvendig og ønskelig vil samtalen bli tatt opp.

Her er en forenklet versjon av hvordan et intervju blir seende ut i framtiden.

**Presentasjon om prosjekt om framgang(ca 5 min)** En kort presentasjon om hva som har blitt gjort, fremvisning av prototype og ideer.

**Spørsmål om trening og motivasjon(ca 20 min)** Spørsmål som ønskes å utdype, spørsmål om ønsker på en mobil applikasjon, spørsmål om hvordan man holder personer motiverte

**Diskusjon om hva som kan gjøres videre(ca 20 min)** Spørsmål om hva slags aktiviteter er ønsket, hvordan holde personer ansvarlige for å trene, hvordan holde personer ansvarlige til å loggføre trening, hvordan personer kan samarbeide om trening ved bruk av teknologi.

**Spørsmål som vil bli spurt og utdypet:**

Hva er din rolle:

Hvor ofte er du i kontakt med kunder som sliter med motivasjon:

Forventinger til en applikasjon:

Vil en applikasjon hjelpe til med jobben din:

## .7 B 3 - Interview guide for users

Intervju guide for forskningsprosjektet

Bruker intervju (Gruppe intervju)

Kollaborativ fitness tracking

Dette er en intervju guide for prosjektet som handler om trening og livsstilsendring. Det vil bli lagt fokus på å finne ut hva slags informasjon som blir gitt til personer som ønsker å gjøre livsstilsendringer og om hvordan de kan holdes ansvarlige og motiverte for å fortsette å trene og loggføre trening.

Informasjonen fra prosjektet vil bli behandlet anonymt med mindre annet er ønsket. Hvis nødvendig og ønskelig vil samtalen bli tatt opp.

Her er en forenklet versjon av hvordan et intervju blir seende ut i framtiden.

**Presentasjon om prosjekt om framgang(ca 5 min)** En kort presentasjon om hva som har blitt gjort, fremvisning av prototype og ideer.

**Spørsmål om livsstil(ca 20 min)** Spørsmål angående aktivitetsnivå, trenings vaner, motivasjon, hvorvidt trening loggføres.

**Diskusjon om teknologi og applikasjons ønsker(ca 20 min)** Spørsmål som ønskes å utdypes videre. Spørsmål om ønsker man har fra en mobil applikasjon.

**Spørsmål som vil bli spurt og utdypet:**

Hvor mange dager i uken er du aktiv:

Trener du på en spesiell måte:

Hva slags informasjon om trening har du fått:

Har du et trenings relatert mål:

Konkurrerer du med venner om like mål:

Loggfører du egen trening:

Har du en treningsplan:

Hvordan motiveres du for trening:

Prøver du deg på andres treningsprogrammer:

Trener du med venner:

Apper:

Bruker du apper:

Bruker du treningsrelaterte apper:

Kunne du brukt en app som er lagd for sosial trenings loggføring:

## .8 B 4 - System usability scale form

Participant ID: _____ Site: _____ Date: ___/___/___

# System Usability Scale

**Instructions:** For each of the following statements, mark one box that best describes your reactions to the website *today*.

| | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 1. | I think that I would like to use this website frequently. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2. | I found this website unnecessarily complex. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3. | I thought this website was easy to use. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4. | I think that I would need assistance to be able to use this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5. | I found the various functions in this website were well integrated. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6. | I thought there was too much inconsistency in this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7. | I would imagine that most people would learn to use this website very quickly. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8. | I found this website very cumbersome/awkward to use. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9. | I felt very confident using this website. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10. | I needed to learn a lot of things before I could get going with this website. | ☐ | ☐ | ☐ | ☐ | ☐ |

Please provide any comments about this website:

# .9 Development tools

## .9.1 Proto.io

Proto.io is an application prototyping platform [54] that can can simulate everything an app can do. That includes interactive touch gestures, screen transitions and animations. It allows users to create realistic, shareable prototypes that work as a real app should and experience their prototype on the actual device.

## .9.2 ReactJS

ReactJS is a javascript library for building user interfaces [55]. It is a flexible and efficient front end javascript library for building user interfaces[28]. ReactJS is developed by Facebook and is used by a variety of websites and applications.

## .9.3 Google forms

Google Forms is a tool that allows collecting information from users via a personalized survey or quiz. The information is then collected and automatically connected to a spreadsheet[57]. Google forms was used to create a survey that was shared on social media, which helped gather valuable information.

## .9.4 Atom

Atom is the text-editor that was used to code in for this project. With atom it is possible to import packages, have multiple panes, manage packages and helps you write code faster with a smart and flexible autocomplete [56].

## .9.5 Github

Github provides software development version control using git. It provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project [51] .