Project Report

“Active on Wheels”

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1. Introduction

The "Active on Wheels" project is done in collaboration with Matthijs Wouda at Sunnaas Sykehus HF, and our project statement is simply put to design a useful, inspiring, and motivating interface for the "Active on Wheels" app. The app combines a smartphone, fitness-armband, and a heart rate monitor belt to provide accurate energy expenditure (how many calories you use) for wheelchair users. The app exists today with a functional, but bare bones design (See Fig 1), which our task is to change. The goal of the app is to enable exercise measuring and tracking for disabled people outside of hospital settings, in order to motivate and support them to exercise and work out.

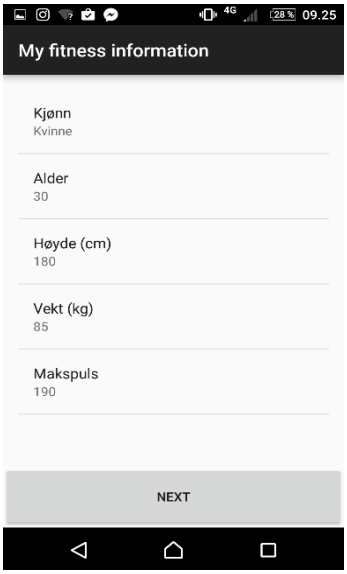

Figure 1: Bare Bones App

1.1 Actors and target group

Client: Matthijs Wouda

Matthijs Wouda is the leader of the clinical physiological laboratory at Sunnaas Sykehus HF1, the largest rehabilitation hospital in Norway, and works daily both clinically and for research with spinal cord injury patients. The "Active on Wheels" service is developed as part of his work at the clinical physiological laboratory.

User group: Wheelchair bound people with spinal cord injury

Our primary user group is, to be specific, wheelchair users with incomplete spinal cord injuries[2] (SCI). This means that they (often) have had injuries that damaged their back, and to varying extent their spinal cord. Depending on where in the spine (from low in the back and up to the neck) and the severity of the damage, the users have different functional capabilities. Some (those with a low injury) may have full control of most muscles above their legs, whilst others (with higher injuries) may have limited functionality of their torso and arms. People with higher and/or complete injuries often have no functioning arms of legs and are thus not part of our target group.[3]

[1] https://www.sunnaas.no
[2] http://www.spinal-injury.net/incomplete-spinal-cord-injury.htm
[3] In the future, the Active on Wheels app should however be available and suiting to all wheelchair users, but this is outside our project.

The project group

The project group consists of Brage Westvik Bråten, Kaitlyn Hua, Mona Andresen, and Stian Jessen. The group is diverse and comes from different backgrounds. Bråten is a second-year interaction design student at IFI. Hua has a master degree in Higher Education from UIO and is currently a second-year student in interaction design. Andresen studied informatics for two years at University of Aalborg, and is now finishing her bachelor degree at IFI. Jessen has a master degree in technology enhanced educational science and is currently a PhD student at Oslo University Hospital, studying the use of game design thinking in eHealth interventions for chronic patients[4].

Hani Murad from UiO-IFI provided supervision on this project.

2. Background

As both the efficacy and efficiency of our health systems improve, more and more people are surviving traumas and accidents. Many of these are however not fully cured and rehabilitated, but must rely on support physical utilities such as a wheelchair. Simultaneously, sedentary and inactive behavior is a large cause for negative health outcomes (Lyons et al., 2014). This is particularly true for people in wheelchairs, often unable to use their legs to move. Thus, activating this group of former and current patients is an important goal of healthcare – both during and after hospitalization.

As for everyone, physical exercise is healthy. However, de Groot et al. (2016) argues it is important for people with SCI to keep fit as this group may have a faster deconditioning than compared to the aging general population. In a review on the effects of exercise for adults with SCI, Hicks et al. (2011) conclude that exercise further increases the physical capacity, and suggest exercise three times a week. Norwegian guidelines recommend 5 sessions of workout weekly for patients with SCI, separated to two sessions of strengths exercise and three sessions of aerobic exercise (cardio) (Landsforeningen for Ryggmargsskadde, 2012). Interestingly, even though wheelchair users expend considerably less energy than able bodied people (wheelchair users do not carry their own weight), the Norwegian recommendations for this group people are even higher, with seven exercise sessions of 30 minutes a week. Still, getting people to exercise more than they currently is of course the point of this app. Every positive increment counts. However, people sitting in wheelchairs have access to fewer of the typical recreational/sports opportunities and facilities in our society (Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004), and are possibly physically unable to do things without their wheelchair, or sometimes cannot access these opportunities, for instance mountain climbing (although Lars Monsen

[4] http://spsresearch.no/research-projects/strength-finder/strength-finder-phd-project/

with his TV program *Ingen Grenser*[5] to some extent have disproved this). And even though there are many types of exercise machine/devices or services that fit this user group, they are often not available and live outside of big cities. Even though municipalities are required to offer good enough support structures for people during and after rehabilitation, this also varying a lot throughout the country. Thus, one of the goal of the app is to also make it as accessible and usable for as many as possible, potentially also for a wider user group.

As a quick browsing in app-store will show, it exists an abundance of apps and services for supporting people both during and between workouts, and for monitoring (daily) activity. These apps usually work on your smartphone with the addition of a tracker such as an armband or smartwatch to collect data on movement. Combined with information on your weight, height, age, and often maximum heart rate, the apps then present you with estimates both on activity and energy expenditure (how many calories you use during your activities). The measurements of expenditure are the results from advanced calculations using some or all the beforementioned inputs. This necessitates a pre-programmed algorithm in the app for doing these calculations and estimations. However, such algorithms are not accurately measuring or reporting the activity of wheelchair users (Wouda, Lundgaard, Lannem, Mowinckel, & Berntsen, 2011). With this as a point of departure, Wouda as part of his Doctoral project has developed, and is currently validating an algorithm for estimating the energy expenditure in wheelchair users. Using this information, the ” Active on Wheels” app, runs on an Android (Google, 2014) smartphone and combines heart rate information from a POLAR heart rate monitor belt (Polar Electro Oy, 2014) with accelerometer information from a Microsoft Band (Microsoft Corporation, 2014). Taken together, the users heart rate and arm movement, allow the “Active on Wheels” app to accurately estimate, report, and log its users’ activity and its intensity. Building on this, our design projects brief is to create a useful, inspiring, and motivating design for the “Active on Wheels” app.

2.1 Structure of this report

In this report, we will present the methodology regarding the design process of our project, and all its inherent phases. Following this is an assessment of appropriate literature that governs the development of the application, and a detailed description of the design process and the final system. There will also be a brief process evaluation and discussion.

[5] https://tv.nrk.no/serie/ingen-grenser/KMTE62002110/sesong-1/episode-1

3. Design and research methods

This section presents our chosen research methodology as well as the evaluation methods for research conducted in this project.

3.1 Choosing research methodology--User-centered Design

To succeed in designing something our user group would want to use, including the users in the design process is important. However, due to time constraints, slow and difficult recruitment, as well as the hardship of gathering several users at once, we settled on user-centered design (UCD). UCD is a design methodology that sets users' needs at the core of the design process, and is well suited to develop our designs into something that is user-friendly, fun, and immersive.

Norman (1988) describes UCD as a philosophy in which users and usability put in front of aesthetics. We also focus on users and usability during the whole design process with the guide of three principles of Gould and Lewis (1985), which are now accepted as the basis for a user-centered approach (Mao, Vredenburg, Smith, & Carey, 2005). Firstly, we have an early focused on the users and tasks by observing them doing their normal tasks, studying users' behavior and context of use, and consulting users in the whole design process. Secondly, we collect qualitative data by observing and analyzing the reactions and interactions of users to low-fidelity and high-fidelity prototype, which help us to choose among alternative designs from user experience. Lastly, we repeat identify-design-evaluate-analyze-redesign cycles as often as necessary for the design and development iteration.

3.2 Recruiting users

Owing to the difficulty of both finding and recruiting wheelchair users with spinal cord injury we started our recruiting with two contacts supplied by Wouda. Luckily, we were able to further do a snowball sampling with the one of these two contact. It is generally acceptable to have 5-10 users with a specific impairment take part in a study (Lazar, Feng, & Hochheiser, 2010). However, it is challenging to recruit wheelchair users with spinal cord injury, and even when offering to come to people or doing interviews over videochat, we still just managed to get 4 users involved in our design process. To counter possible issues with a small number of users, we have used some proxy users within parts of the process. Spinal cord injury doesn't influence communication skills and information processing skills, and we considered able bodies people as useful proxies. We of course tried to involve the main target group as much as possible.

3.3 Ethical consideration

Working with human participants in research and/or design requires us as researchers to thread carefully and make sure our work conflicts with the participants interests. Particularly when working with a potentially vulnerable group, maintaining their dignity is of utmost importance. This means also during all phases of our design process carefully considering both the different physiological and psychological distresses and capabilities our users may have.

Participants was sent an information letter about the project in advance of their participation, and everyone signed letters of consent[6]. To maintain the participant's anonymity, any recordings and transcriptions of interviews do not contain or mention their names. We did not ask questions concerning our participants' medical history.

3.4 Data types and collection

The goal of our data collection is to help form the design and functions of the active on wheels app. We do this by triangulating several points of data. 1. We try to find out wheelchair users' needs and requirements for such an app. 2. We look to literature on designing both for and with wheelchair users. 3. We get input and ideas from Matthijs Woudas clinical experiences, and lastly 4. We perform user evaluations of our different iterations. By combining several types of data our aim is to make decisions based on a more valid foundation, than by just a single source. This following section presents these four main approaches in data collection and how we are using these.

Researching literature

We have reviewed literature on topics related to our project, focusing on motivation and how to promote activity, as well as how to design for and with disabled users. This is further presented in section 4.

Interviews and meetings with Wouda

We visited Wouda at Sunnaas Hospital and got input from him. As both the client, and a future stakeholder, he pointed out some desired functions in the app related to what type of exercise data that are more essential to wheelchair users. We also visited the physical rehabilitation center in the hospital and observed several wheelchair users doing exercises. In addition to taking notes during, we recorded these meetings when practically possible.

[6] Do to limitation in pages available for this report, the letter of consent is available on this link: www.uio.no/studier/emner/matnat/ifi/INF2260/h16/presentations/active-wheels/documents/declaration-of-consent.docx

Interviews with users

We conducted semi-structured interviews (Lazar et al., 2010) with our users. Being semi-structured, we followed an interview guide, but we were also able to be flexible and contextually adjust the interview as they went by. Before we conducted our first interviews, we piloted our entire interview to tease out possible faults or problems in our interview guide or the plan. We recorded audio[7] from the interviews and transcribed these partially (Gillham, 2005), focusing on relevant passages. Two group members listened through the interviews and made this selection. In Addition, after each interview the interviewer would write a short note on the interview, detailing his/her experience. This was done to provide contextual and framing information that is difficult to get from recordings or transcripts. When more than one of us partook in the interviews, the notes were combined. The group then worked together to organize the main points into an organized list of the users different needs, requirements, and general inputs.

Interviews conducted in the later stage of the project was focused on formative usability testing. We presented the participants with different design solutions in low-fidelity prototypes and got feedback on functions, user journey and the motivation support structures.

Usability testing

Usability testing is used to measure a system, and to improve the quality of the interface where flaws are found. The idea behind the usability testing is to let the actual user test the system, and use their input to improve the issues they find. While conducting a usability test we also use the "thinking aloud" method (e.g., Ericsson & Simon, 1993). This requires the user to think aloud during the test. This way it is possible to understand what the user think of the system, and how they understand the system. Some findings show that the technique Instant Data Analysis can identify 85% of the critical usability problems in the evaluated systems but only use 10% of the time required in the video data analysis (Kjeldskov, Skov, & Stage, 2004).

We also got an expert to give us some analytical evaluations on our high-fidelity prototype. Expert-based testing can efficiently check the system, and point out where the usual fall pits are. Based on experience and guidelines an expert will be able detect most flaws in the system, so these can be corrected before evaluating the system with the users (Lazar et al., 2010).In addition, as mentioned above, we also got a few proxy users to test our different prototypes and got feedback from them. Reflection on the usability will be presented in 6.2.

[7] Due to a technical error, the recording of the first user interview is only partial

3.5 Reflection on research credibility

In quantitative research, talking of reliability points to stability or consistency un responses (Creswell, 2009). In research of a qualitative nature, such as this project, addressing validity is not any signle verification of date, but rather a process using accepted validation strategies to document the accuracy on one's study (Creswell, 2007, p. 207). Further, Creswell (2007) also argue for several steps one can take to improve the validity of qualitative research, of which we comply to several. First and foremost, the authors have been part of the entire process, from idea stage, through data collection, design work, and finally the writing of this report. Secondly, we utilize several sources of data.

Though we argue for the validity of our data, we do not argue generalized inferences should be drawn from it. This is a small scale qualitative project with a small user/sample population, and seeking generalizability was never a goal.

In summary, our chosen methodology for this project is user-centered design, as this approach allows us to create something based on both the needs and requirements of wheelchair users, whilst at the same time being open for input and information from other relevant sources such as findings from literature and Woudas experiences from working with our user group.

4. Literature findings

This section presents the data that forms the foundation for our design rationale. As presented in the previous section, we do not only lean on the needs and wishes from the users, but also on literature, general principles and ideas of universal design and design for people with disabilities.

4.1 Universal design / designing for disabled users

Making ones designs accessible to its user group is obviously important, particularly when designing for disabled users. It is therefore useful to follow some guidelines or framework to achieve this. The WCAG (W3C World Wide Web Consortium Recommendation, 2008) guidelines covers these four main points.

- Information and interface components are presentable to users in ways they can perceive
- Navigation and interface components are operable
- The information given and the operation of the interface is understandable
- The designs are robust enough to be interpreted by a wide variety of users

With these in mind, we should seek to create something that can be both understood and used by our users, considering their various disabilities. With respect to gamification (mentioned later) this is also

important. Designers of games typically assume that difficulty in games is experienced the same for all users alike, that is however not the case in games used for rehabilitation or with disabilities (Proffitt, 2015). These are rarely equally disabled or hindered in their performance abilities. Thus, making users compete against one another or by set standards of performance is tricky.

This is not to say that typical exergames are non-compatible with disabled users, but they do however demand some adjustments to fit the user group (Wiemeyer et al., 2015). For instance by simplifying the user interface, adjusting difficulty to fit the individual, and/or securely fastening the device to the wheelchair (Wiemeyer et al., 2015). On a similar note, Lister et al. (2014) in a review on available apps in the apple iTunes store, argues that the way many apps are designed necessitates to much effort in use whilst the return benefit is small.

To us this means designing an interface that is informative, yet easy to navigate for the users. Including those who may have reduced strength and function in hand and fingers.

4.2 Motivation & gamification

As we understood an approach similar to a typical exergame or fitness-app was suitable, we then needed to investigate how we should approach this app in terms of designing appropriate and functional affordances (Gibson, 1979), or of you will - opportunities for interaction, for our user group. In terms of our project then, we decided to focus on creating positive and motivational situations for the users, and not pushing negativity or sanctions for not completing tasks.

As Active on Wheels is developed to help motivate its users to exercise, it is intended to work as a form of external, or *extrinsic motivation*. This is a form of motivation that leads you to do "an activity as means to an end" (Schunk & Zimmerman, 2008, p. 236) and not for the sake of the activity itself, which is termed *intrinsic motivation* or inner motivation (Ryan & Deci, 2000; Schunk & Zimmerman, 2008). To motivate the users, Active on Wheels will include a set of *challenges* that the users can fulfill. Further, as to maintain user sense of autonomy and enhance the intrinsic motivation (Ryan & Deci, 2000), users can themselves add their own goals.

Reinforcing users (and their behavior) with positive feedback, often termed rewards, is also an often used approach used to motivate and engage users (Linehan, Kirman, & Roche, 2014). Simply put, you are rewarded for doing something, on the assumption that you will do it again. Opposite to this, when designing for disabled users negative feedback should be avoided as they can take this more personally (Wiemeyer et al., 2015). When it comes to longer engagements with a service, the scheduling of the rewards becomes important. Variable ratios of rewards, for instance not a reward every N^{th} hour of exercise, but delivered on a schedule that seems random to the user, often creates high and stable use (Linehan et al., 2014).

A popular approach to create motivational affordances is the use of gamification, or gameful designs. In the simplest of terms, gamification refers to the use of game-elements outside of typical game contexts (Deterding, Dixon, Khaled, & Nacke, 2011). Such elements can for instance be competitive features, avatars, or narratives providing a red thread through the service – these with the overall goal of increasing the users value creation (Deterding et al., 2011; Huotari & Hamari, 2016). In other words, gamification is about making the use of any service more interesting and "worth it", and is in a recent review (Johnson et al., 2016) argued to be a good strategy to motivate users in fitness contexts.

In our case, the addition of game elements is there to make our service more motivating and fun, helping users through their workouts by providing feedback, but also between the workouts by allowing the users to track and compare their performance and results.

4.3 Thus, the outset from literature

As we can surmise, an exercise app for wheelchair users is feasible, without too radical changes from other such apps, and can be beneficial for the users. And our approach to this will focus on creating an interface/user experience that puts positive motivational affordances at the forefront, and avoid negativity as far as possible throughout the app. By having the three different types of goals and rewards, intrinsic, extrinsic and variable integrated in the app we hope to design positive and motivational support for a diverse user group.

5. The Design Process

Through this section the design process will be described and explained. The design process consists of several iterations, illustrated in Figure 2. We started with the process of getting input from the users of the system. From this we developed the user path, and the design, simultaneously. The user path was illustrated in the first prototype, before we combined the first prototype and the design to a second prototype. This was again evaluated, before the last iterations found place. The third and last prototype was tested using a usability method, before the final prototype was done.

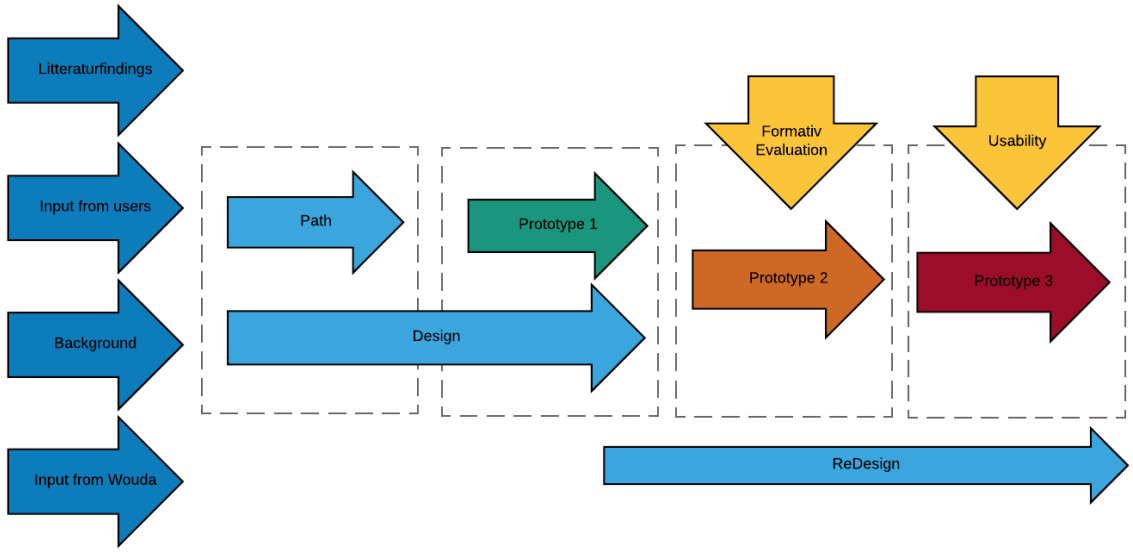

Figure 2: The design iterations throughout the project

5.1 Early ideas and drafts

To understand the system better, and get an overview of the content of the app, we drew maps to see the user path through it. As this illustration show (FIG REFERENCE), the app can be divided by layer. The first layer is the startup screens, the second is the main page, the third is the different main categories that should be present in the app, while the last layer are all the functionality connected to the main functions. The arrows also show how it's all connected. This was a good base to discuss the further development from, and to make sure everybody on the group agreed on what features we would include and not. Several iterations were made of this overview illustration, to understand the whole of the app

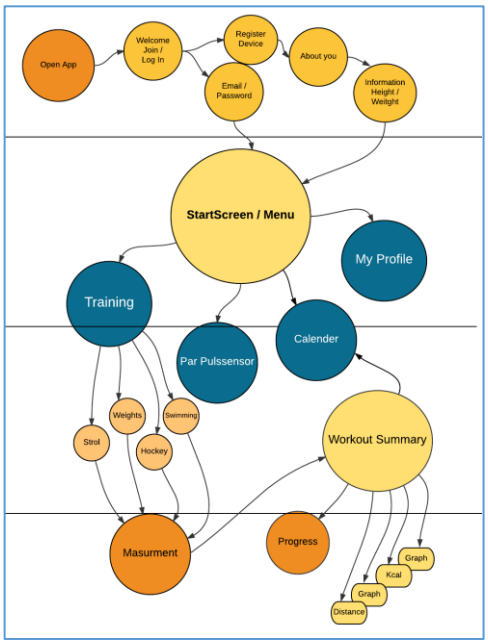

Figure 3: User path - early stage

both and without added functionalities.

Together with this we also made a somewhat more realistic first prototype - a Low Fi prototype. Using paper prototypes, we can get both something tangible, but also something easily changeable. We also made some more concrete drafts, primarily of the main page, which will be the base in the app.

5.2 Prototype 1 – Low Fi

When developing the first prototypes we had two processes going on simultaneously; one which focus was on the visual design, and one where the focus was the overall functionality of the app and the user path through it. The prototype is developed based on the interviews from the users.

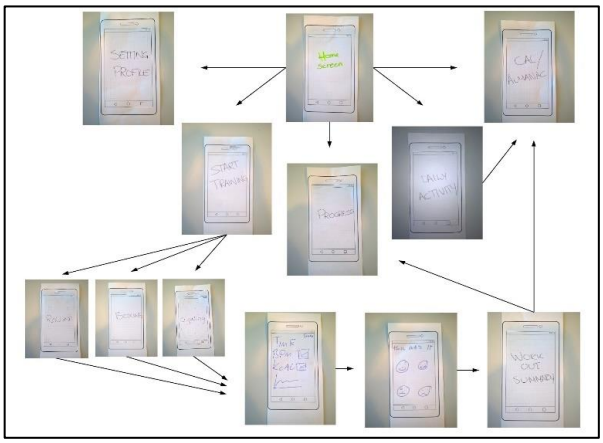

Figure 4: Low-Fi prototype

Input from users

We interviewed several users to get feedback from our them to lead our design phase forward. By asking about habits, how they work out now and training motivation, we got input on what to focus on in our design work. We presented both the path and the low-fi paper prototype to user we were interviewing. By showing the user the path, they gave us input and feedback about what functions would be useful and what motivated.

From the interviews, we learned that several of the users had limited function in their hands, so scaling the buttons to fit this was important. Zooming in, or sliding the screen could also be difficult, as this requires more control and feeling in the fingers. As wheelchair users mainly use their hands while working out, there is little use of the screen during workout. We also learned that it was important for the users to move throughout the day, meaning changing sitting possession or something similar. These too get the blood-circulation going and avoiding pressure wounds.

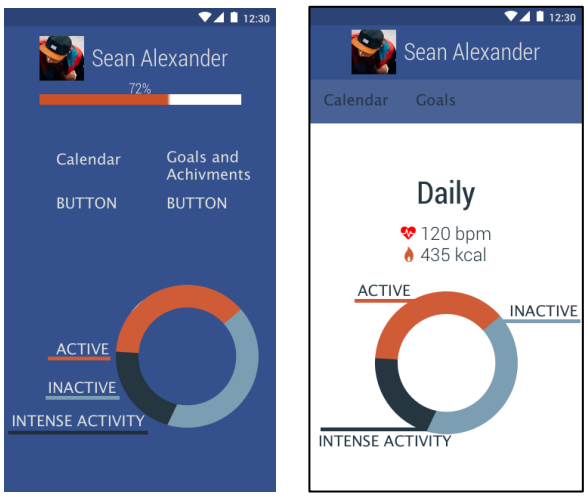

Figure 5: Design draft

Design

The first prototypes were developed with the intention of trying to get the theme settled, by

experimenting with colors, fonts, and placements of elements. When this was settled the rest of the app would build on the same theme.

To adjust the theme and design we used the WCAG guidelines (W3C World Wide Web Consortium Recommendation, 2008). This especially when designing the buttons, as several people with spinal cord injury had trouble using their hands. This require we meet by having as few buttons as possible, and make them larger so they would be easy to use. We also took the decision to limit the use of swap screens, as this can both cause frustration, get in the way of other buttons, and be hard to use if functionality is limited. The only swap screen present is at the start-screen, where you can swap to the activity feed. The information of the activity feed is also present under "goal", so the content is easily accessible even if the user has trouble using the swap function.

User Path

The path of the app shows the first draft of all the different functionality that are included in the system, and all the screens included in each part of the system. The map is focused on how all the different screens are connect, and which screens that is included. With an overall picture, it was easier to see the whole picture, and harder to forget some parts of the system. This map started out with just the log in screens and the main functions, and has later been developed further.

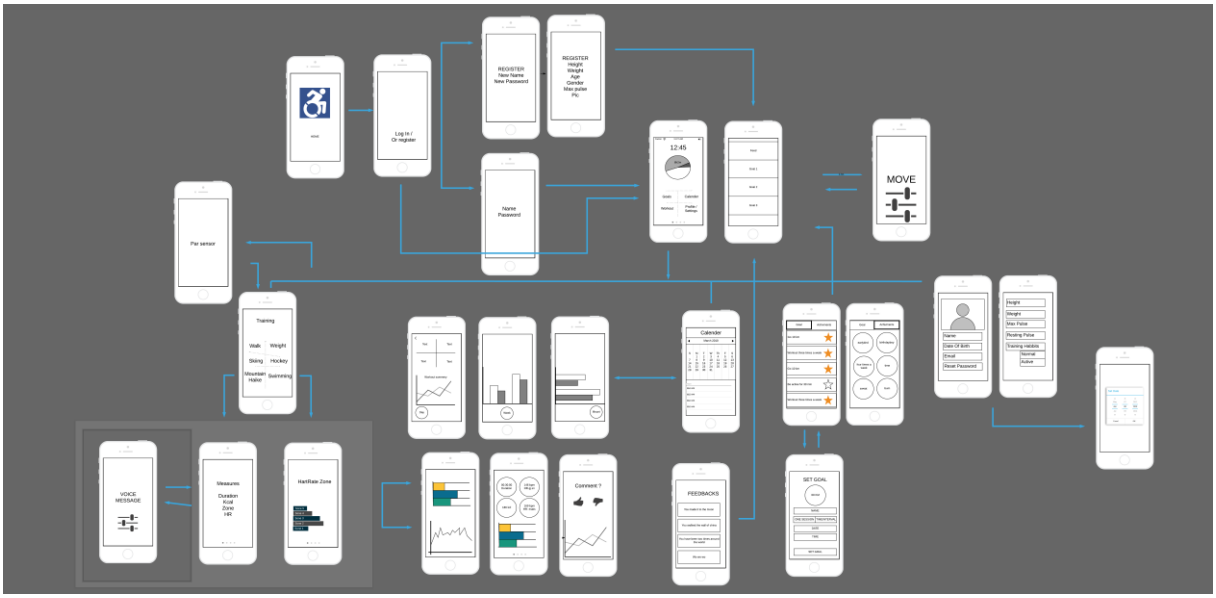

Figure 6: Map of the app

To get a more palpable impression of the app we developed a low-Fi prototype using the popapp.in/ in addition. We developed simple drafts of all the screens included, to see how the functions of the app where going to work. With this we could see if the screen where properly connected, which screens that lead where, and what as wot working.

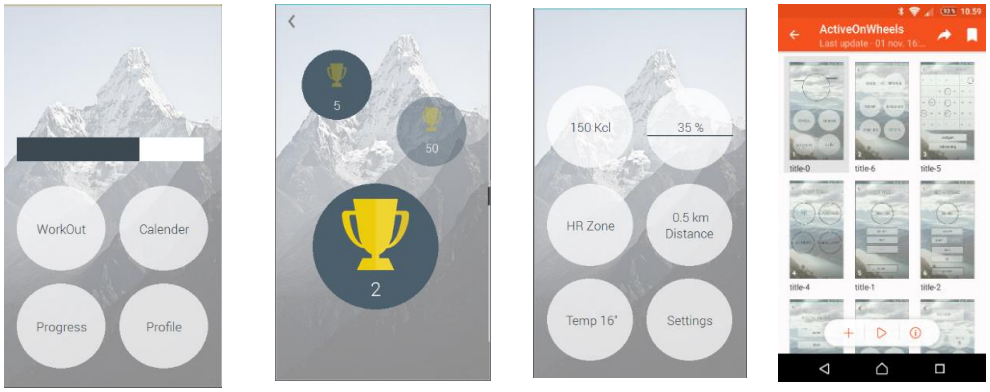

Figure 7: PopUp prototype

6. Evaluation

This phase where evaluated by users during second round of interviews. We did not do a usability test with this prototype, as the product was far from finished. This was a first low-fi mockup prototype, for the user to get a first impression, and give input on further process. As we did this early in the process, the user could lead the process to a higher degree, and the app would develop based on their need. We conducted A/B-testing with users by showing them different design choices. Several users were positive to the possibility of sharing routes, and share information on how the trails is a given day. They would also like to include information about weather and temperature.

6.1 Prototype 2 – High Fi

The second prototype developed is a high-fi prototype, developed for the overall experience for the user; including the design, and the pathway. With this prototype the goal was to develop the concept as far as we could, to get the "real feel" of the product.

We developed the map further based both on the feedback from the Low-Fi prototype, and conversation with Wouda. The group was also more focus on developing other parts of the app, beside form the main screen.

Development

The second prototype where developed in Sketch, and made interactive using the program InVision. Through InVision we could makes the app interact as it would have been if it was programmed. As by doing this it is easy to create changes in the interface throughout the process, or at a later point. Using a cognitive walkthrough while creating the buttons and interactions you have to thoroughly think through the structure of the app and see if the buttons takes you to the place you want or/and expect.

Design

The design is also further developed. A background picture was chosen to get a feeling of being in the nature, and boost the motivation. And the wheel on the main screen was developed to motivate the user through the day, and to give the user some kind of pinpoint concerning their everyday activity. The main screen is kept as clean as possible, but with just the amount of information needed. With the training itself the user can chose between different activities, and go through with the workout, this will again be saved in the calendar of the app.

Gamification

Further we have focused on the gamified aspects of the system, and the motivational support the user will be meet with through the app. We have chosen to focus on three different motivation factors, goals, achievements, and fun facts. The goals are the challenges you set for yourself, focusing on intrinsic motivation. This can be “weightlifting four times within the next two weeks” or something similar. Achievements are predefined and extrinsic goals, provided by the system. At first the user is presented with 6-8 achievements, and as these gets done, new achievements will show. An example of an achievement can be “workout on your birthday” (simply exercise on your birthday), or “burn a pizza” (burn the number of calories typically found in a pizza). The last form of gamification in the system is the fun fact pop-up. These facts are rewards the user get for having exercised for so and so many hours and minutes. These rewards, although coming in preprogrammed intervals with increasing distance, seems random to the user to make them a nice and positive surprise. As presented in the literature findings, using these three approaches to gamification and rewards may hopefully allow these to be appreciated and found meaningful by different users and personalities.

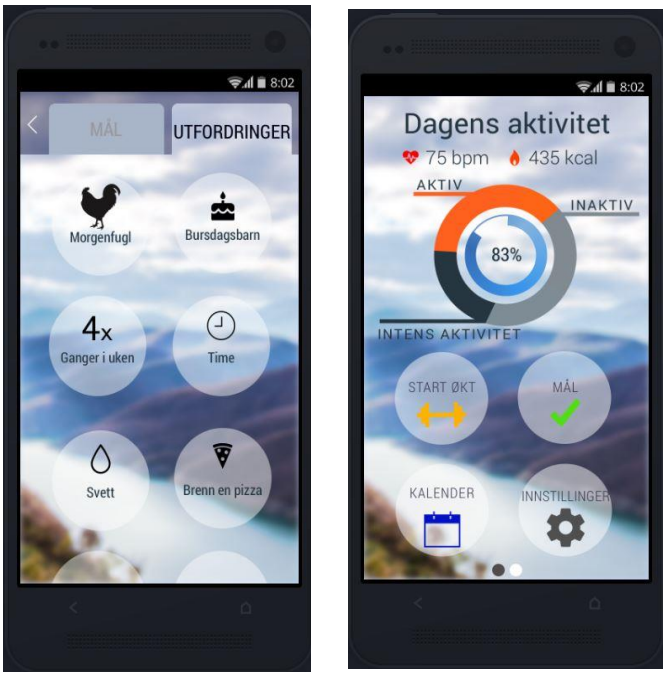

Figure 8: High-Fi prototype

6.2 Evaluation Process

Usability

To test our prototype, we conducted a usability test with the user. Before the evaluation, we made some assignments that the user would conduct using the system. These tasks where mainly based on how the normal use of the app would be, and the user got to go through all the main categories of the system. We had eight assignments for the users. Some examples of these are (1) find the results for the workout done the 04.10.2016, (2) accept the challenge to work out before 7 o'clock, and (3) change your name on your profile. Beside conducting the assignment given, the user would also give some feedback on his/her opinion of things, and remark if there was anything either missing, or drawn to far.

After the evaluation, we sat down doing the IDA, and ended up with a form describing all the flaws found in the system, together with a number, the placement of the problem in the app and a categorization with level of severity. Based on this again we completed a Moscow form, placing all the flaws in the suited category. This way we could see what to work further on, and what we could disregard (Benyon, 2013).

	Where	**Flaw**	**Category**	**Moscow**
1	Settings	Information on how to measure max hart rate?	Critical	Would have, but won`t at this point
2	Feedback	Max BMP does not show on feedback screen	Cosmetic	Must Have
3	Calendar	Lacing feedback on average of activity of the week / or average of the day	Cosmetic	Could have
4	Calendar	Information on the y-axes on presentation of weekly activity	Cosmetic	Must Have
5	Homescreen	Be able to categorize / sort the achievements / goals	Serious	Should have
6	Homescreen	Find achieved goals, and achievements	Critical	Must Have
7	Settings	Split name into firstname / lastname	Cosmetic	Could have
8	Settings	Split male / female	Critical	Must Have
9	Main screen	Goal of the day: how is this measured? What is the base for this?	Serious	Should have
10	Settings	Bedtime / sleep cycle – How does this work?	Serious	Must Have
11	Settings	The metabolism while resting --> Deksia test		Would have, but won't at this point
12	Start activity	Use workout activities relevant to the wheelchair user	Cosmetic	Should have
13	Achievements	How to see accepted goals?	Cosmetic	Could have
14	Pop up	Close fun fact popup	Serious	Must Have

Table 1: Detected usability problems and Moscow evaluation

Expert evaluation

We also did an expert evaluation of our prototype, with a student from Westerdals that works with creating UIs and websites. He gave us feedback about font sizes and color contrast, the placements of

buttons and navigation around in the app. To exclude as much bias as possible the expert was told he was evaluating another project group at ifi, and that the other project was doing the same. This way the expert was not too afraid to be harsh or critical. The main feedback we got was the buttons on the main screen was too close to each other and that the font sizes were too big. The buttons were a major flaw. Since our target group has limited dexterity in their hands was the feedback about the buttons crucial for our design to be user friendly. Another flaw was that our font was way too large and took up too much screen space.

6.3 Final prototype

The final prototype is further developed based on the feedback from the usability test. The goal and achievement site is changed.

In addition, we developed the notification screen to make the user remember to move throughout the day. This is meant as a friendly pop-up and not as a demand the user should do. Because of this the message is friendly and not demanding.

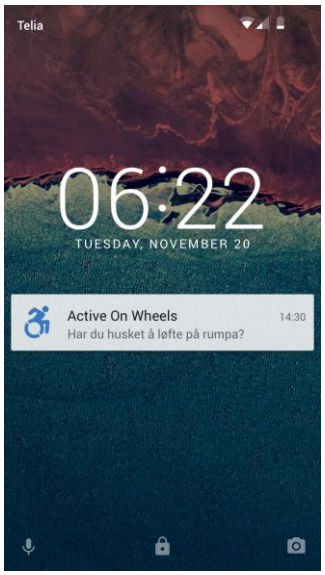

Figure 9: Notification from app

6.4 Ideas for future development

Community

While gathering information and developing the app we saw the opportunity for a social aspect in the app. We thought about the opportunity to share information about you progress, and workout habits, but thorough interviews we saw that the users where more interested in the aspect of sharing information about routes, trail conditions and weather conditions. This would make it easier to find possible routes optimal for wheelchair users. Users also mentioned the possibility of tracking, so they could share with their family if necessary. We were not able to fulfill this in this project as this would be too hard to implement, as our programming skills are limited. This would also be hard to test without an extended and unnecessary workload.

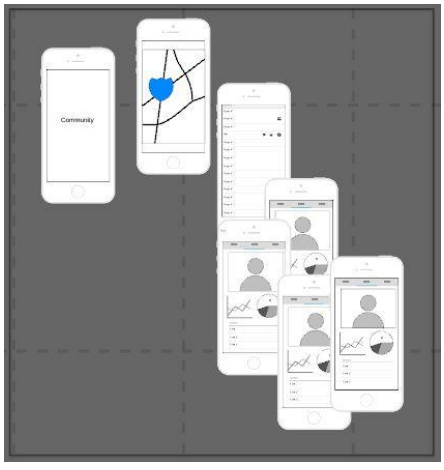

Figure 10: Social aspect of the app

Nutrition plan

Another aspect possible to implement in an is a nutrition plan. The possibility to measure food intake as well as workout results gives a more complete picture of the overall health, and the opportunity to customize a health plan for each user. The nutrition plan would both contain registration of food intake, amount of water drank, tips and tricks, as well as food recipes.

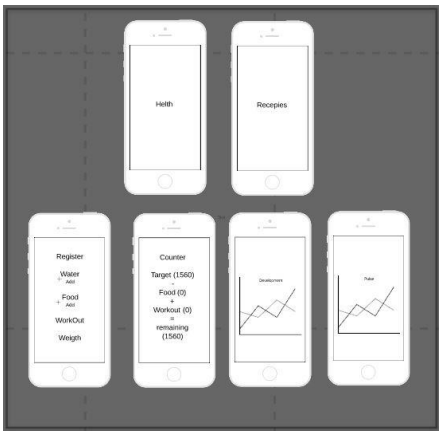

Figure 11: Nutrition Plan

7. Reflection of scope and limitations

It is important to highlight some points on the limitations in both the scope and overall generalizability of our project. Even though we have spent quite a bit of time working on this project we have not attained the number of participants (users) we wanted to achieve. Ideally, we would have had a higher number of users so that we could have done design workshops on several of our iterations with them. This did however prove very difficult, and we were not able to do it. Also, to get a more ecological valid (e.g., Cole, 1996) evaluation we would have like to put parts of our design into the app as it exists today, and had users actually use it. Further, all our users are highly motivated and already quite active. By snowball-recruiting we tried to get in touch with less motivated wheelchair users, but these are as we found out, hard to reach. And Finally, though the findings from the interviews matches up with the literature, our review of this is not very exhaustive or systematic.

Still, all shortcomings considered, there is an exercise inequality in the society today. By allowing wheelchair users to monitor and track their exercises and energy expenditure, Active on Wheels can hopefully make it easier for its users to exercise, be active, and live healthier and happier lives.

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