User centered product development

A comparative study between classic requirements engineering and rapid contextual design

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Abstract

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Martin Björling and Tim Eriksson

The software field constantly strives for improving the design methods used for designing new products and systems. A design method, Rapid Contextual Design, is well defined when it comes to redesigning existing systems but less defined when eliciting requirements and designing new products for the public market. This report compares Rapid Contextual Design with Classical Requirements Engineering to show which method works better in requirements elicitation and designing a new product. This comparison is made by designing the product using both methods in parallel, without one method impacting the other. This report shows that both methods work well when eliciting requirements and developing a new product. In some areas of the project, Rapid Contextual Design worked better than Classical Requirements Engineering, but it does not answer which method works better in general. To answer this, further studies will have to be made.
Acknowledgements

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Populärvetenskaplig Sammanfattning

Mjukvaruutvecklingsmetoder finns in många olika utföranden, vissa av dem har vitt skilda infallsvinklar och arbetssätt. Med hjälp av dessa metoder designas och utvecklas system för många olika ändamål, allt från administrativa lösningar till högprecisionssystem. Många av metoderna har relativt abstrakta metod- och arbetsbeskrivningar, och därför skulle metoderna kunna appliceras på andra typer av projekt än bara mjukvaruutveckling.

Till skillnad från utvecklingsmetoder för mjukvara har produktionsmetoder och designmetoder för fysiska produkter länge sett likadana ut, och de ligger mer och mer efter mjukvaruutvecklingsmetoderna. Examensarbetets ena syfte är att utvärdera om det är möjligt att använda mjukvaruutvecklingsmetoder för att designa och skapa en fysisk produkt. För att utvärdera om det är möjligt, har arbetet tagit del i utvecklingen av en affärsidé; att kunder ska kunna designa sin egen träningsdagbok. I detta fall innebär det att kunder bestämmer vilket innehåll de vill ha med i sin dagbok. Målet med arbetet är att använda två olika mjukvaruutvecklingsmetoder för att skapa ett sådant designverktyg. Metoderna är Classic Requirements Engineering (CRE) och Rapid Contextual Design (RCD).

Första delen av arbetet resulterade i två olika prototyper, en från varje metod. Prototyperna i sig innehöll kravspecifikationer samt en design för den fysiska träningsdagboken och en design för ett webbverktyg i vilket kunderna skapar sin fysiska dagbok. Metoderna har inriktats mot att alla beslut ska grundas i användarnas åsikter för att slutprodukten ska vara så nära användardesignad som möjligt.

Det andra syftet med examensarbetet är att utröna om någon av de två metoderna är bättre lämpad än den andra för utveckling av det här slaget. I denna jämförelsestudie låg fokus på metodernas arbetssätt och resultat, samt prototypernas nivå av användarbarhet. Arbetsättet analyserades med vikt på hur utvecklarna uppfattade lättigheter och svårigheter i att arbeta med metoderna och deras delmoment. Resultaten undersöktes genom att metodernas kravspecifikationer analyserades och jämfördes för att hitta likheter och skillnader i dem. Slutligen gjordes en användarbarhetsstudie där ett antal testpersoner fick prova att använda och sedan utvärdera prototyperna.

I slutet av projektet utvecklades en slutgiltig prototyp, baserad på prototypen från den ena metoden, men med några delar inkluderade från den andra prototypen. Den slutgiltiga prototypen hade en högre nivå av funktionalitet, design och innehåll. Den uppfyller mer än vil de, av uppdragsgivaren, utsatta kraven men det finns även kvar att det är en produkt färdig att lanseras för allmänheten. Även jämförelsestudien av de två metoderna skulle behöva utvidgas för att säkerställa resultaten från det här projektet. En mer omfattande studie med mer tid, större ekonomiska möjligheter, större antal medverkande utvecklare och tillgång till fler testpersoner skulle kunna ge ett tydligare och mer konkreta resultat.
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Acronyms

CRE  Classical Requirements Engineering
CSS  Cascading Style Sheets
HTML HyperText Markup Language
JS   JavaScript
PDF  Portable Document Format
PHP  PHP: Hypertext Preprocessor
RCD  Rapid Contextual Design
UI   User Interface
1 Introduction

Miscommunication is always a tricky problem. Even when communicating with people who are well informed and experienced in the concerned topic there is always a chance of misinterpretation. This is of great concern in system development, especially since the basis of any system development is a threeway-communication between customers, users and developers. Each one of these speak a different language from the other two, and getting everyone on the same page is a slim chance at best.

Navigating everyone to a consensus is a narrow path to walk and the pitfalls are many. Customers have their needs, users have their wishes and developers must do their best to accommodate both while balancing what is worth keeping, cutting unrealistic parts and trying to minimize personal influence. To achieve this, the developers need requirements from both the customers and the users, but putting thoughts into words is not always easy, and help is often needed to find the right ones. There are several methods and processes designed to help developers to coax information from their project partners and help them navigate their projects to success, but not every method is a match for every project and finding the right fit can be a lengthy process by itself.

1.1 Background

Software development is a continuously expanding and changing field. Well established theories and process methods exist next to new ones, some rising in popularity and some falling out of memory. Universal for all of these methods and processes is their goal of creating well functioning and successful products, in as little time and with as low budget as possible. As things currently are, it seems likely that this trend of improvement and experimentation of software development methods will likely continue indefinitely.

Similarly, to the software industry, companies that produce physical products strive to improve their designs and overall product efficiency. The similarities continue in the creation of these products; designers, users, economists and domain experts are involved just as in any software project. But unlike a software product, once physical products are released they cannot be altered in any way. Faults found after launch can only be corrected in an updated product, which calls for either a new release or for the customers to wait for the next version of the product to leave the production process; both cases are very costly and takes a lot of time.

This report aims to investigate the possibility of applying two existing and well established methods for eliciting requirements, Classical Requirements Engineering (CRE) and Rapid Contextual Design (RCD), to the production of a user modifiable physical product. The methods’ success and compatibility rate are being evaluated while producing the product, to see if they can be used at all to create such product. The methods are also compared against each other to see if one is preferable over the other.

1.1.1 The two methods

CRE is a part of the waterfall model, which takes a system from concept to reality. Its basis for requirements elicitation is conducting meetings with a number
of experts from various fields, directly connected to the system’s development, to establish a system requirements specification on which the system is built upon.

RCD is a user centred process model, which uses a set of predefined tasks for development. The requirements for the process are established through one-on-one interviews with intended users of the system, ultimately resulting in an affinity wall that serves as a basic draft of what the users expect of the system.

1.2 Report structure

This report was written by Martin Björling and Tim Eriksson. The two methods were used separately to create two different designs for the user modifiable physical product. Tim Eriksson used CRE in the design process and wrote the chapters concerning this method; Martin Björling used RCD and wrote the related chapters. All remaining chapters were written jointly by both authors.

The chapter called Purpose describes the projects research questions and delimitations. In General Methods, a case study for the thesis is presented along with a strategy for answering the research questions. Chapter 4 describes the theories behind the methods and case study while chapter 5 describes the workings of the two methods in the case study; which task was used and how it was implemented in the study. The chapter called Results contains the results from both methods and a comparative study. The chapter also presents the creation of a prototype made from the results of the two methods and an evaluation of that prototype. The Discussion chapter has a discussion about the conducted comparative study. The final chapter contains the conclusions of the thesis and the case study, along with recommended future work and research.

2 Purpose

The purpose of this thesis is to try to analyse how well CRE and RCD will work compared to each other. The analysis is divided into two parts where the first part tries to determine how well these methods could work when designing a customer modifiable physical product. The second part tries to determine whether one of the two methods is better suited than the other for this kind of development.

2.1 Research Questions

Since the purpose is divided in two parts, two different research questions are asked and answered in the thesis. The research questions are:

RQ1: Can methods from computer software development be used to find requirements for a customer modifiable physical product?

RQ2: Two common methods are CRE and RCD. Is either of these better suited?

RQ1 is answered by using a case study where both CRE and RCD are used to design a customer modifiable physical product. The case study is described in section 3.1. RQ2 is also answered as a part of the case study, where the
requirements from the two methods will be subjected to comparative research. In addition; the results from the methods are also evaluated by potential users.

2.2 Delimitations

The project will primarily centre around [CRE] and [RCD] as design and developing methods. Other methods and theories, that are used in addition or as supplements to [RCD] and [CRE] are added because the two methods may need these as part of their processes. The total time available for the project as a whole is about twenty weeks. Half of the time was used for designing and developing the product; the remaining time was used to learn more about the methods by studying literature. Some time was also used to write this report and document the product for the client.

This project will not deliver a complete finished product. The final delivery will include an advanced prototype of the product that will be as close to the final product as time will allow. This final prototype will include several modification possibilities for the customer modifiable physical product. The prototype will also include a tool that the customers can use to modify the physical product to fit their own needs and wishes.

3 General Method

In this project, a case study is made to answer the two research questions. The case in this study is further described in the first section of this chapter. The second section describes how the case was used in answering the research questions, and the third section describes a comparative study, which purpose is to answer the second research question.

3.1 Case Study

This project includes a case study concerning training journals. This is one of the best tools you can use when your goal is to improve your training. Performance trends can be hard to identify when observing one day at a time but becomes clear when viewed in recorded form. For example, a single read of the heart rate does not provide information about your general condition/performance but if previous readings are recorded the user can easily monitor variations. Those who use training journal also describe them as a great confidence boost and a great motivational tool.

Today, training journals exist in both pen and paper form, as smart phone applications, and as web tools. In the pen and paper form, some people use notebooks with templates, others prefer empty notebooks which can be filled according to their own preference. Different kinds of smart phone applications exist that can be used either during or after a training session. Some applications can be connected to other training applications like Run-keeper\textsuperscript{1}. Web tools often have the same functionality as a smart watch, but may also have additional functionality like a diet journal and different diagrams.

\textsuperscript{1}An application for recording running, biking, walking and other training forms that includes distance travelled.
In this project a tool to interactively create a personalized training journal was designed. This web tool will be in the form of an interactive guide and the journals, which the user will create, will be in paper form. The guide will give the users a set of pages, which can be chosen for their journals. The case study will involve the design of these pages, and the tool for choosing the pages.

3.2 Answers to the research questions

The first research question, RQ1, was answered by using both CRE and RCD to find requirements and to design simple prototypes for the tool and the journal, mentioned in section 3.1. These results were then combined to create one final functional prototype. Both the simple prototypes and the final prototype were evaluated by comparing them to their requirements. This was done by allowing users to test the prototypes, and to answer online surveys, to see if the prototypes are usable, easy to understand and if the outcome was as expected.

To answer RQ2, two different simple prototypes and sets of requirements were developed, one using CRE and the other using RCD. During this development the two authors were not discussing the design of the journals, nor the web tool, with each other. The reason for not discussing the designs was to avoid influencing each others’ results. When the designs were finished the requirements from both methods were compared, using both qualitative and quantitative comparisons. As mentioned before, the simple prototypes were also evaluated by users to see if one of them was more usable than the other.

3.3 Method of the comparative study

3.3.1 Division of the comparative study in two parts

The requirements for the training journals and the web tools were compared separately and with different methods. This division was made because the RCD-process does not evaluate a web tool within the process, only the use of a training journal. In the RCD-process the web tool is created based on the resulting journal pages, together with other interface design theories. The web tool is therefore not suitable to include when comparing the processes.

3.3.2 The training journal

The training journals were compared using three different methods. Firstly, a quantitative analysis of the requirements was made. All gathered requirements were compared, and the intentions of each were interpreted, to detect any matching requirements. Afterwards, the requirements were divided into three categories; requirements that were present in both processes, those unique to the CRE-process and those unique to the RCD-process. The requirements in each category were counted and presented with a Venn-diagram.

Secondly a qualitative analysis of the requirements was conducted for the two categories with the unique requirements from the respective method. The primary question was whether there were any significant differences in the two categories, and if those differences had any meaning that could be traced back from the methods themselves.
The last examination of the training journals was to create a survey, where the resulting journal pages were evaluated by the same participants who evaluated the simple prototypes' and a few new participants. Since both processes have a three-part-journal, the resulting surveys were similar for both processes.

3.3.2.1 Qualitative analysis of the training journal

The requirements of the journal were divided into three topics to find different trends and eventual differences in the outcome of the methods. These topics were appearance, functionality, and content. Appearance handled requirements regarding the design of the journals as a whole, specific pages or type of pages. Functionality handled how the participant should be able to use the journal. Content is what the participant should be able to choose to include when they design their own journal.

All different requirements were put into the corresponding topic, and each topic was then studied to find any possible patterns where the gathered requirements differed in the two methods.

3.3.3 The web tool

The web tool was primarily evaluated through an online survey sent to the participants of the processes. The questions were added as an extended part of an earlier survey concerning the journal pages, where the web tool questions were designed to provide a brief analysis of the web tools functionality and usability. The survey is described in more detail in section 3.3.4.1.

Following the methods previously used for the journal pages, quantitative and qualitative analyses of the requirements regarding the web tool were also made. As previously, the primary focus here was the web tools functionality and usability, as well as to distinguish any distinguishable differences between the produced requirements of the processes.

3.3.4 The user survey

The survey was made online and sent to all participants of the two processes. This survey concerned both the web tool and the content of the training journal. The part concerning the web tool focused on its intuitiveness and functionality. The questions for the journal pages required a much wider scope in the survey due to the complexity of handling the possible journal types.

Different surveys were sent depending on which process the participant belonged to, CRE or RCD. The questions were essentially the same to make it easier to compare the answers. The questions were formulated a bit differently in each survey because of the differences in the respective prototypes.

Before the participants answered any questions, it was stressed that it was important that they had gone through the web tool prototype at least once and looked at the possible contents of the journal. This was made possible by including links in the surveys to the respective web tool prototype and journal page prototypes.
3.3.4.1 The web tool

The following questions were sent out regarding the web tool. “Pages” concerns the web tool from the RCD-process and “tabs” concerns the web tool from the CRE-process. Questions with answers 1-5 were constructed such that 1 meant “really hard” and 5 meant “really easy”. The only exception was question three below, where 1 meant “disagree completely” and 5 meant “agree completely”.

1. How easy was it to understand the different pages / tabs in the tool? Answer 1-5.

2. Are there any pages / tabs that you didn’t understand? Free text as answer.

3. I could walk through the tool without getting stuck. Answer 1-5.

4. If you don’t agree, where did you get stuck? Free text as answer.

5. How did you think that the tool worked in general? Answer 1-5.


7. Other comments. Free text as answer.

3.3.4.2 The journal content

After answering the above questions, the participants stated which type of journal they would have chosen if they were using the web tool in reality. This statement was made by answering which type of journal they chose when they tested the web tool. The questions about the journal content were divided into three parts, just as the results from the methods divided the journals in three parts according to their contents (section 5.1.2.3 and 5.2.2.1). The questions were also the same for each part, but some of the questions had different answering possibilities depending on which of the methods the survey belonged to.

1. Did you think that the pages you could choose were relevant? Yes / no answer.

2. If not, why? Free text as answer.

3. If you had chosen in reality, which pages would you probably have chosen?
   (a) Part 1: Possibility to choose multiple pages using check boxes.
   (b) Part 2: Choice of one of the possible pages, using radio buttons.
   (c) Part 3: Possibility to choose multiple pages using check boxes.

4. Did you miss any page to choose from? Free text as answer. Only part 1 and 3.

Part 2 had some differences in the questions depending on which type of journal the participant chose. If the participant chose a single sided journal, they only answered the questions for the single side. If the participant chose a double sided journal, they answered the questions for both the left and the right side.
and if the participant chose to have a diet journal for the RCD-process or an additional page for the CRE-process, they answered the question both for the training (left) page and for the diet / additional (right) page.

The RCD-process also had an extra question regarding the possibility of a note box at the bottom of a journal page. The CRE-process did not include this possibility, and therefore this question was not included in the CRE survey.

4 Theory

This chapter describes the theories between the two methods. It is divided into three sections, where the first section describes the theories behind CRE and the second section describes the theory behind RCD. The third section gives theories about the three parts of the comparative study; qualitative research, quantitative research and user surveys.

4.1 Classical Requirements Engineering

4.1.1 The Waterfall model

The waterfall model in its original form consists of five phases that, once completed, cascades from one phase to the next. This model is also known as the software life cycle. It has since its creation been extended with additional phases but its core principles and make out remains the same. In the original standard form the waterfall model takes the fundamental processes of specification, development, validation and evolution and shapes them into separate process phases, each with its own unique purpose towards the projects goals.

- **Requirements analysis and definition** The system’s services, constraints and goals are established by consulting with system stakeholders. These items are then defined in detail and serve as a system specification.

![Waterfall Model](image.png)
• **System and software design** The system design process categorises the requirements to either hardware or software systems, and establishes an overall system architecture. Software design involves identifying and describing the fundamental software abstractions and the relationships between them.

• **Implementation and unit testing** During this stage, the software design is implemented as a set of programs or program modules. Unit testing involves verifying that each program and module meets its specification.

• **Integration and system testing** The individual programs or program units are integrated and tested as a complete system to ensure that the software requirements have been met. After testing, the software system is delivered to the client.

• **Operation and maintenance** Normally (but not necessarily) the longest life-cycle phase. The system is installed and put into practical use. Maintenance involves correcting errors which were not discovered in earlier stages of the life-cycle, improving the implementation of system units and enhancing the system’s services as new requirements are discovered.

In theory, no project phase should be started before the completion of its predecessors, but in practice these phases overlap and feed information between each other. Problems with the requirements can be found during the design phase, issues with the design can be encountered during coding and so forth. The software process is not a simple linear path but involves a number of iterations of each project phase. These iterations should be kept to a minimum since they are both costly and takes a lot of time, as it involves a significant amount of rework.

4.1.2 **Evolutionary development**

Evolutionary development is another approach to software design. The specification, development and validation process activities of this approach are revisited in a circular fashion. An initial system is quickly developed from abstract specifications elicited from the stakeholders. This system is then refined with client feedback to produce a system that satisfies the clients wants and needs.
This is based on the idea of developing an initial implementation, exposing that implementation to user feedback and refining it through several versions until an adequate system has been developed. Specification, development and validation activities are interleaved rather than separate, with rapid feedback across activities. There are two fundamental types of evolutionary development:

- **Exploratory development** The objective of the process is to work with the client to explore their requirements and deliver a final system. The development starts with the parts that the developers have a working understanding of. The system then evolves by adding new features proposed by the client.

- **Throwaway prototyping** As with exploratory development the goal of the evolutionary development is to understand the client’s requirements and hence develop better requirements definitions for the system. This approach concentrates on experimenting with the client requirements that the developers have a poor understanding of, the thought being that understood parts can be quickly developed later.

Adapting a evolutionary approach to software development is often more effective than the waterfall approach when producing a system that meets the clients immediate needs, rather than focusing on aspects that are not strictly needed and would better be described as clients wants. In addition, using a evolutionary approach gives the advantage of incrementally developing the specification. The incremental evolution of the specification provides the users of the system a better insight into the existing problems and gives them a better understanding of the process, which will be reflected in the resulting software system. For an engineer this process does have some drawbacks. Firstly, managers want to receive regular updates on the process to make accurate measurements of the overall system’s completion and progress. Secondly, if the system is developed to quickly, it is not cost-effective to produce documents to reflect every version.
of the system and the continuous changes to the system over time can lead to a poorly constructed software structure. With poor software construction and documentation it becomes increasingly difficult and costly to implement changes to the software.

4.2 Rapid Contextual Design

There are three different versions of the RCD process:

- **The Lightning Fast** version which takes between one and four weeks in total and uses four to twelve users for the interview part of the process.

- **The Lightning Fast +** version which takes between four and eight weeks in total and uses six to twelve users for the interview part of the process.

- **Focused Rapid CD** version which takes between six and ten weeks in total and uses eight to twelve users for the interview part of the process.

This project will be limited to the time of the thesis course, and the design and construction part is limited to about ten weeks. Since these ten weeks will also need to include some construction of the actual product the design phase can only take about six to seven weeks. Another limitation in this project is that the team will only consist of one developer. This means that the best version to use in this project is the **Lightning Fast +** version.

The project developed in this project has the general private market as aim and not a specific company or a specific type of workplace. This means that there are no specific type of work group to interview during the contextual interviews and no office to go to. The product will be used in similar scenarios every time, during or after working out, but the physical location where people use it may differ a lot.

4.2.1 Contextual interviews

In the book by Holtzblatt et al. contextual interviews are made at a workplace where the interviewer visits the user at their workplace (Holtzblatt et al. 2005, p. 79-100). Here the interviewer follows the user in their work for a couple of hours, asking questions and noting everything of relevance. It is important that relevant things are not only the exact kind of work the user does but also all things happening around the work even things that may seem completely irrelevant.

Artefacts must be collected during the interviews. Artefacts are items, documents, computer programs and other things that are used in and around the work. The physical model should also be collected which means that the interviewer should record what the physical environment looks like; room layouts, desktop, workplace, noise levels, lighting and so on, but also things like distance to the copy machine, toilet and break rooms.

The interview is conducted by one interviewer and should take about two hours. The interviewer should bring a tape recorder with extra tapes and batteries, a spiral-bound notebook and pens (Holtzblatt et al. 2005, p. 85). The interview starts with an introduction and then transits into the field interview. This takes most of the two hours. The interviewer takes notes about everything.
while recording the whole conversation. Questions are asked about everything that is hard to understand or is necessary to clarify. All the data about artefacts and physical space mentioned above should also be collected and recorded here.

The interviews in this project will follow the theory as much as possible, but since the project is quite different from the textbook there will be some major differences. In the project, the interviews will be much shorter, since the work done by the users is filling in their training journals. This normally only takes a fraction of the stipulated two hours. The short time could be a problem since the interviews might not be able to capture everything that can happen during the normal execution of a task. More time would normally increase the probability of different possible affecting things to occur.

One benefit of having shorter interviews is that it might be easier to find users to interview. Filling out a training journal is something that is normally done outside the normal work hours and the users will not be paid for participating in the interviews. Therefore, many users could be reluctant to participate if the interviews take too much time.

The interviews will not be held in a specific location or environment but at the location where the users normally fill in their journals. A tape recorder might be hard to find, instead a smart phone recording application for recording conversations will be used. Some photos will also be taken of the artefacts since it might be very hard to physically collect them.

4.2.2 Interpretation session

The interpretation session (Holtzblatt et al. 2005, p. 101-122) is a meeting conducted after each interview to capture and write down the key aspects of the interview. The session should occur within 48 hours from the interview and should be performed by a cross-functional team (Holtzblatt et al. 2005, p. 101). The interviewer describes what happened during the contextual interview to the other participants in the session, this is called “sharing”.

During the session, the participants will listen to the interviewer and discuss what he or she tells them, ask questions about what happened during different stages of the interview and asks for clarification if something seems unclear. A note taker, also one of the participants and not an outside person, captures key ideas from this discussion in so called “affinity notes”. These notes are unsorted, but each note should cover one key aspect in the interview. It is important that these notes are simple, only cover one key aspect each and are very clear about what they cover (Holtzblatt et al. 2005, p. 116). An example of a note could be “She uses an alarm clock to remind her of when the pH analysis will be done” (Holtzblatt et al. 2005, p. 115).

Holtzblatt et al. (2005) lists that the following should be recorded on the notes:

- Interpretations of events, use of artefacts, problems, and opportunities
- Important characteristics of the work
- Breakdowns in the work
- Cultural influences
- Design ideas (flag with DI:)

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• Questions for future interviews (flag with a Q:)
• Insightful user quotes

Some things that should not be recorded are demographics and information represented on work models.

There are a few major differences to the theory in this part of the project. The first difference is that there will only be one participant in the session; the interviewer. This can be a large disadvantage since there will be no discussion and points that may seem obvious to the interviewer, and not for anyone else, might be missed. Unfortunately, this small project gives no opportunity to include other participants. The second difference is that no interpretation session will be made within 48 hours of any of the interviews. This may seem as a disadvantage, but it could also be an advantage. The participant has to go through each interview again to remember and understand what really happened during the interview. The affinity notes will also be captured in a regular word processor instead of the recommended CDTools™ program (Holtzblatt et al. 2005, p. 103) but this will probably not affect the outcome.

One thing not mentioned above is capturing the user profile and the organization profile. Holtzblatt et al. (2005) mentions that these two should be introduced to the team before the regular session starts. Since this project will develop a product for the general market, this was not considered to be important, and therefore skipped because of the limited project time.

4.2.3 Building and walking Affinity diagrams

The affinity diagram (or affinity wall) is basically a hierarchical representation of the user issues. This is normally built on the walls of a room. The diagram has different coloured notes depending on the level in the hierarchy. Figure 3 shows a clear example of an affinity diagram.
The yellow notes are the printed affinity notes, which are the lowest level of the diagram. Blue labels are distinct work or theme collected together. Pink labels collect blue labels with a common theme and the green labels collect a big piece of a user story \cite{Holtzblatt2005} p. 160. The affinity diagram can be built at the end of all interviews after all interpretation sessions are finished. Another way is to start the build after a few interviews so that the team doesn’t have to build the whole diagram at once \cite{Holtzblatt2005} p. 161-162.

This project will use the first possibility, since the number of affinity notes probably will be much less than the projects described in the book. When the affinity diagram is finished, it is time to walk it \cite{Holtzblatt2005} p. 193-204. This means gathering a team of designers, developers and other stakeholders and go through the diagram together. But this is a process done individually (although at the same time) and the participants does not talk to each other during the walk. Things the participants should look for are holes in the data or notes that raises new or missed questions \cite{Holtzblatt2005} p. 199), key issues that the new system or product must address \cite{Holtzblatt2005} p. 202-203) and hot new ideas that can be implemented in the new design \cite{Holtzblatt2005} p. 203-204).

4.2.4 Paper prototypes and interviews

The last step to be used in the project are paper prototypes. \cite{Holtzblatt2005} suggests that three iterations can be used in building these prototypes.
In the first iteration the team builds very simple mock-ups with post-its, paper and notes. This first step will only test the vision and design ideas, not user interface. The second iteration may have some basic functionality but will still be used mostly to clean up design. The third iteration will be more sophisticated and include enough of the user interface design to test it and the contents together.

First, the team needs to walk storyboards and visions and have brainstorm sessions to find out and define what components to add to the system. There are several questions that can be asked during this phase including checking that components hang together coherently, that they are not too many, that the links between them are clear and so on (Holtzblatt et al. 2005, p. 250). After the components are chosen the team brainstorms and find ideas how to represent different components, often by coming up with multiple ideas for each component. When components are clearly defined, it is time to build the first prototypes. These prototypes should be simple and clearly show the flow between different components. Movable parts should be represented in some movable way to really show how the system works dynamically. After the prototypes are finished it is time for more interviews.

The interviews are made much like the contextual interviews described in section 4.2.1. The major difference is that the user will use the prototypes in their work and the work will not be “real work” but a trial run of the prototypes (Holtzblatt et al. 2005, p. 267-270). It is also suggested not only interview the same users as before but find new users to interview. This will help see if the new system will fit the whole population (Holtzblatt et al. 2005, p. 263) and not only the first group of users. After the interviews are finished and good notes are taken to show what didn’t work well in the prototypes, the design will iterate into the next step in building the prototypes.

### 4.2.5 Designing both training journal and web tool

A web tool such as this one is seldom used by a single user. The idea in this project is that users will use the web tool only once every six months or once every year. Making a contextual interview (section 4.2.1) on a task that is done so seldom is not going to give much relevant data. The user will probably not have any special skills in using a particular web tool. It is not even certain that the user ever ordered a similar product in a web tool. RCD is a design method which mainly looks at tasks used on a regular or even daily basis where the users already have some or a lot of skill in performing the tasks. RCD will therefore only be used in evaluating and designing the different appearances that the training journal might have and not the web tool itself. Here, the user uses his or her journal frequently and good contextual interviews can be made. These contextual interviews will then be developed using the different steps described earlier in this chapter.

The web tool will be designed using different interface design theories described in (section 4.2.6). These design theories will be the base for the layout and functionality in the different pages where the users design their own journal. Much of the content in the web tool pages will be based on the resulting journal pages from the RCD process.
4.2.6 Design theories for the web tool

4.2.6.1 Wizards

The web tool will have the appearance and functionality of a wizard. A wizard is basically a step-by-step tool where the users follow a series of steps to complete a task. Several operating systems today use this approach often. Scott & Neil (2009, p. 161) states the following: “The user should be walked through a complex User Interface (UI) task step-by-step, perhaps because he is computer-naive, or because the task is novel or rarely done (as in a Wizard).” Tasks that are completed using wizards in operating systems can be installing or uninstalling programs, devices (printers, scanners, external drives and so on) or configuring the system. Microsoft Windows is an operating system which in itself is installed using a wizard.

There are many benefits of this functionality. One major strength is that the wizard divides a complex task down to smaller pieces (Benyon 2010, p. 333). The user can complete the task easily, safely and quickly by following the steps. A wizard is particularly helpful if the user is required to complete many steps or if the task at hand is done very infrequently and the learning curve is very steep. But a wizard can also be too limiting if it doesn’t offer the user the choices he or she wants or if it requires unknown information (Dix et al. 2004, p. 403). Experts may also find wizards tedious and limiting especially if the user wants to learn the software or see what their actions really do (Tidwell 2011). The wizards should not be too long either, since it can feel more and more tedious for the user the longer the wizard goes on (Colborne 2011, p. 12).

A good wizard should also be easily manoeuvred, both to the previous and next page but also through the wizard as a whole. There should be a progress indicator that shows how much of the task is completed and how much that remains (Dix et al. 2004, p. 403). The wizard can have “Back” and “Next” buttons which are obvious and well known but may also isolate the UI space so that it shows no context. Titled sections are also useful, especially if the task is heavily branched. Another useful pattern is Responsive Disclosure, which means that the next step in the wizard isn’t showed until the user finishes the previous one (Tidwell 2011).

4.2.6.2 Images or text?

“A picture is worth a thousand words”

There are two different ways in the web tool to display the different journal pages that the user can choose between. Either there can be a string of text naming (or shortly describing) each journal page to choose from or there can be thumbnail images of the pages. Knowing how the human reacts to both images and text is essential in finding out which one of the two ways to have as the main display of the pages. Parkinson (2012) gives many reasons why choosing images is better than choosing text:

1. We are more adapted to reading images than text because text is a new invention evolution wise. Of the roughly 30 000 years of human communication, text has only been present for about 3 700 of them.

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2. Text is held by the short term memory while images go directly into long term memory.

3. Images give stronger responses than text.

4. Most of our decisions are based on intuitive judgement and emotions.

5. Visuals are processed 60 000 times faster than text.

In the text there are several more facts supporting the statement by that images are better than text. But there are also opinions not based in facts that support this. The quote in the beginning of this section is derived from a quote in a newspaper from 1911 and many people would probably agree with this statement. If someone would try to tell someone else about a picture, the teller could probably talk for a long time without the listener being able to recreate the picture truthfully, even if the picture was fairly simple.

4.3 Theory of the comparative study

4.3.1 Qualitative research

Bass et al. (2006) states that one of the most important parts in finding requirements is that the requirements should be architecturally significant. Determining if the requirements from both methods are architecturally significant in equal measure, or close enough, will be done by looking at the requirements from the methods and comparing them.

If two requirements are evaluated and are considered to be similar enough to be equal, these requirements will be put into a category for requirements found in both methods. There will also be two other categories, one for each method. Requirements that are unique for each method will be put in the corresponding category. This is similar to John Stuart Mill’s twin principles of comparison: the method of agreement and the method of difference (Leavy 2014, p. 50). To determine the differences in the methods, the unique requirements will be analysed to see if any patterns emerge that can be considered architecturally significant.

4.3.2 Quantitative analysis

This project will perform a quantitative analysis of the requirements from both the CRE and the RCD processes. The quantitative analysis is a very basic in nature, showing only the number of requirements each process resulted in, and how many of these requirements are similar enough to be considered as equal for both processes. This analysis will show if any of the processes resulted in much more requirements than the other, either when it comes to the training journal or the web tool. Like with the qualitative analysis the requirements are divided into the same three categories.

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4.3.3 User survey

The user survey is a tool for gathering information. In this project, the survey is a tool for gathering data and opinions about the finished prototypes, of both the journal pages and the web tool, from both the CRE and the RCD processes. This data is then analysed to see which process resulted in the best outcome, both in the web tool and the journal pages.

For a survey to be effective, certain requirements need to be fulfilled (Gray 2014). The questions in the survey have to have a logical flow, meaning that the questions should be grouped together with similar questions or questions with the same topics, and that the questions or topics should follow a logical order. Questions should be easy to understand and not need any clarification, they should be appropriate for the audience, the audience should be qualified to answer them and double negatives should be avoided because the questions will be more difficult to answer (Gray 2014).

When the questions are written, the survey is to be tested in conditions as close to their intended reality as possible (UsabilityNet 2006). This is essential to make sure that the survey has the greatest chance of success. All aspects of the survey should be tested, from logical flow to the level of ease the questions can be understood and answered (Gray 2014). When the tests are complete and any necessary changes has been made, the survey will be sent to the participants. A warning may be sent beforehand and then the survey itself is sent. Nonresponders should be followed up with reminders after a specific time. Also, a reward might be offered to responders, which can greatly increase the number of responses (UsabilityNet 2006).

After the responses are collected, an analysis and presentation of the result is made. In this project the result is presented in section 6.1.3. The analysis should be as automated as possible and a spreadsheet is a useful tool for such analyses.

5 Case Study

This chapter will describe how the two methods, CRE and RCD, were used to create content for the training journals and the web tool. Since the two methods were used in parallel, without one interfering with the other, this chapter is divided into a section for each method. The section regarding each method is then further divided into sections regarding method, result and discussion.

5.1 Classical Requirements Engineering

5.1.1 Method

5.1.1.1 The Test Group and the Interview Meetings

The first phase of the waterfall method states that the systems services, constraints and goals should be established by consulting with system stakeholders. In this project this is done by establishing a group of system users, a test group, of sufficient size and with a large enough distribution of different people. If possible, having members of the test group who does not have too similar backgrounds or professions, is very beneficial to the meetings process. Having an
adequate distribution of male and female participants further increases the variety of the group and is also of great benefit. Men and women, along with people from different backgrounds and professions, have been shown to have different viewpoints on subjects and approach problems from different angles. This is important to the meetings because it creates a greater chance of receiving a wider range of ideas and opinions.

This project has some derivations from the described preferred methods for the interviews. The absolute best scenario for the interview meetings would have been to have all participants in one big meeting once or twice a week.

Because of the vast difference in availability of the participants this was not possible and there was no other choice than breaking up the participants into smaller groups. This resulted in two smaller groups, one slightly larger than the other, and made it difficult to have a meeting with each group more than once a week. So out of necessity each group only had one meeting per week during the interview phase. In addition to dividing the participants into groups there was also two participants who could only attend through email due to personal reasons.

The larger of these groups had three participants attending throughout the project while the smaller group had two participants. Both groups had additional participants who could only attend the meetings intermittently due to erratic schedules. Since CRE and the waterfall method simply state that the constraints and goals should be established by consulting with the “system users”, or the test group for this project, having multiple groups is still within method parameters. While the number of participants in the test groups is low, the number of participants still constitutes a adequate gender and background distribution for a project of this size, with a ratio of four male and four female participants.

The members of the test groups were contacted prior to each weeks meeting by email with questions concerning the upcoming topics to consider in preparation of the next scheduled meeting. The two participants who could not attend the meetings contributed to the process by responding to the emails with their own thoughts on the topics. The thoughts of the emailing participants were presented to the participants attending the meetings and further developed if they were considered relevant to the project. The interview meetings were conducted each week for a duration of seven weeks in total.

Ideally the meetings should be held in designated meeting rooms to avoid distractions from outside elements. Due to scheduling factors some adjustments had to be made in order for the project to conduct these meetings. The larger group meet at early evenings and had access to an conference room which suited the needs of the interviews well. The smaller group however, could only meet at late mornings close to midday, which meant that the conference room was unavailable and the group was forced to conduct their interview meetings in a students study room. The study rooms provided an enclosed private space, but did little to dampen the amount of outside noise and could not be locked which caused some interruptions to the meetings.

The Journal

The meetings concerning the journal were conducted in an open fashion. This means that, apart from the absolute first meeting where the participants were
introduced to the project and its goals and constraints as defined by the project owner, when the meetings started there was no predetermined set of topics that should be discussed, rather the initial meetings served as a brainstorming exercise for topics to be discussed and elements to be included into the project. Once both groups had at least a basic understanding of the project the meetings switched over to discussing more focused topics, starting with topics regarding the journal.

The first discussions were aimed at identifying items that should exist in a training journal, where the participants were asked to name instances from journals that they previously used, that they tended to use more than others. In the cases where the participants had never used a training journal before they were asked what they thought they would like to have included. From these meetings the test group successfully came up with what they thought should be included in the journals basic structure, such as pages for exercises in strength and fitness or a combination of both in the journals training section.

As items of interest was discovered the meetings delved deeper into these items and focus was changed to examining these in greater detail where it was appropriate. For instance very little time was dedicated to designing the journals note pad page, since its choices only included an pages which were either blank or lined. While the page for strength exercises, or the result schema, was given more attention and time to identify what fields to include, such as weight, time or average pulse. The fields were later sorted by which were the most important and should be picked first if a selection had to be made.

Once a comprehensive picture of the finished training journal had been created along with a good number of requirements on the journals parts the meetings changed focus over to the web tool.

The Web Tool

The process with the web tool meetings were the same as earlier with the journals design and featured items, but now with the added issue of identifying desired abilities and unwanted traits. Apart from some earlier journal requirements that were directly applicable to the web tool, such as a simple attractive and to read design, new requirements were needed to describe the web tools functionality along with the new desired abilities and unwanted traits.

The test group was given a few web pages with varying designs to browse until the upcoming first meeting regarding the web tool. The web pages were picked for their variation in design, layout choices and their focused fields, as to not limit the inspiration to a single area of use. The intent of having a varied selection of web pages was to give the participants inspiration and give some examples of good and bad design solutions as a basis for the up coming meetings. The web pages used was one fitness supply store, a gym, a outdoors supply shop, an on-line book store and a construction and land development.

The first meeting focused on weeding out undesirable elements on the provided web pages and then discussing why these elements were bad, if they in fact were bad, or simply placed or used badly. The upcoming meetings focused on weeding out which elements were thoroughly positive from the web pages content and designs, and as before entered into a discussion about the identified elements and whether they would be a good addition to the projects’ web tool or if its apparent positive quality was simply circumstantial to its original web
With some basic ideas of what to do and what not to do the test group entered into the final interviews, discussing what the participants thought would be a good design for the web tool with regards to appearance and structure.

It had earlier during the web tool interviews been decided that the web tool and the journal should follow the same design as much as possible, so that the entire projects design would have a continuous theme. To help the participants remember the previous results they were shown the throw-away prototypes from the earlier interview meetings concerning the journal to identify the prototypes characteristics. Once reacquainted with the designs an conceptual empty web browser window was created with the intent of allowing the participants to fill it with content they deemed necessary for the web tool and then modifying the created content until a consensus was formed.

The resulting prototype of the main page was used as a starting point for the participants as a group to imagine using the web tool to order a journal, with special focus on which steps they saw them self using. This lead to an basic structure for the complete web tool, with the intention of matching each of the resulting pages to the already existing parts of the journal. On each of these imagined pages they were asked to identify what functions they needed to complete their desired goals and to describe what those goals was. Once each page had gone through this process the overall web tool was once again worked through from front page to order confirmation to see if any new realization had come up or if some function or design did not fit in with the rest of the prototype. When the participants agreed that they were satisfied with the prototype the interview meetings were concluded.

Overall, the conducted meetings covering the journal took place during the first four weeks while the interviews concerning the web tool was conducted in three weeks. After that time the participants of the test group did not have the time to attend any more meetings. With regards to the projects time constraints it was decided that the interview meetings were to be closed and the project move on to creating the requirements specification document and design work.

5.1.1.2 The surveys

The surveys were done after the requirements specification and prototypes were completed. The purpose of the surveys was in part for the comparison of the CRE and RCD methods and as a substitute for the test phase of CRE. Since the requirements were general in nature, it was difficult to test them using conventional methods. The testing would normally include testing the functionality of the software and searching for bugs in the system. But since the journal is a physical product it would require the manufacturing of a physical prototype to be testable which was not possible until after the project was scheduled to begin production on the web tool. Because of this a survey was created with attached links. One linked to a series of mock-up pictures depicting all the designs that was created for the journal and one linked to a clickable mock-up of the web tool.

The survey was constructed in such way that the participants were first asked to test creating a conceptual journal through a clickable prototype of the web tool. Very little help concerning how to operate the web tool was provided and, except for some described limitations of the prototype, the participants were
left to figure out how to complete an order on their own. The purpose here was
to test the intuitiveness of the web tool and if the design had been successful in
that regard and if the participants felt that prototype followed what had been
discussed at the meetings in terms of content, functionality and design.

After the participants completed designing their conceptual journal they
were asked to answer a number of questions in a web based survey concerning
the web tool and the journals pages. The web tool questions were directed
towards overall usability of the prototype and its functionality. The questions
directed forwards the journals pages as presented in the survey was regarding
the layout of the page content and its design aspects.

5.1.2 Result

The journal project has followed the basic steps of the waterfall model, as pre-
sented in section 4.1.1, with two alterations. Firstly, the client was also used
as a domain expert during the interviews, and because of this the client has
intermittently been involved in the project throughout its development. Sec-
ondly, due to the limitations in time and man-power, when given feedback on
the prototypes from the client nearing the end of the process, it was not pos-
sible to go back and reconfigure the requirements and make a new prototype.
The feedback was instead directly applied to the prototype, after discussing the
desired changes with the client at the presentation. The prototype was cleared
for development by the client directly after the presentation.

Two sets of throw-away prototypes were created with the CRE-process. The
first was a complete set of pages with proposed designs for the journal, some
pages had more than one version while others, like the page containing personal
information, only had one version submitted. The second set was a prototype of
the intended web tool for creating the journal. In addition to designing pages for
the web tool, a second prototype was also made with some basic functionality
to allow the participants of the test group to click through its contents.

5.1.2.1 Journal requirements

1. Functional requirements for the journal:
   
   (a) Result pages should be easy to navigate
   (b) Possibility to fill out planning in advance

2. Design requirements for the journal:

   (a) Possible to choose the journals main layout.
      i. possible to choose between one- or two-sided layout.
   (b) It should be possible to encapsulate the pages with a frame.
      i. The frame should have rounded corners.
   (c) There should be set of exercise templates to choose from.
      i. The templates should have different appearances depending on
         exercise.
   (d) Plenty of writing space, at least a line spacing of 14 mm.
   (e) Possible to choose row layout for exercise templates.
i. possible to choose between single- or double-row layout.

(f) Possible to have either picture or colour as cover.

(g) Several options in colour for the cover.
   i. provide a set of colours, no less than four and no more than eight.
   ii. provide a set of shades for each colour, no less than five.

(h) Journal should be easy to read.
   i. provide a set of easy to read fonts, no more than four.

(i) Include icons to help illustrate purpose of fields.

3. Content requirements for the journal:

   (a) The journal should include pages required for basic training.
   i. Personal information,
      A. With fields for; first and last name, address, postal code and city.
      B. Optional fields for; telephone and cellphone number.
   ii. Motivational pages,
      A. With a preselected set of pictures and texts.
      B. And the possibility to use own pictures or text.
   iii. Planning pages,
      A. With a choice of monthly and weekly calendars.
   iv. Body-building,
      A. With fields for; Exercise, repetition, sets and weight.
   v. Fitness training,
      A. With fields for; Exercise, distance and time.
      B. Optional fields for; Heart rate, speed, intervals and weights.
   vi. Diet journal,
      A. With fields for; Calories, fat, protein and carbohydrates.
   vii. Training statistics,
      A. With fields for; Body dimensions and body weight.
   viii. Test results,
      A. With fields for; number of push-ups, number of crunches and fitness test completion time.
   ix. Notes,
      A. possible to choose between blank and lined note pages.

5.1.2.2 Web tool requirements

In addition to the presented requirements, the web tool is also subject to the functional requirements of the journal. The requirements were made under the premises that the web tool and journal would follow the same theme in terms of appearance and general design.

1. Functionality requirements for the web tool

   (a) Desired objects should be no more than three clicks away.
(b) Ability to save completed journals shall be provided.
(c) Web tool shall automatically save progress of ongoing order at regular intervals.
(d) Web tool shall be easy to navigate.
(e) It shall be possible to go back in orders and make changes without loosing information.

2. Design requirements for the web tool

(a) A clear and easy to read font shall be used.
   i. This font shall be one of the selectable fonts for the journal.
(b) Web tool shall have a clear overview.
(c) The web tools contents shall be centred.
(d) The web tool should be responsive.
(e) The left and right sides of the web tool should be used for buffer space.
(f) Objects in the web tool should be shadowed.

3. Content requirements for the web tool

(a) The web tool shall include a progress indicator.

5.1.2.3 Journal pages

From the client there was a request, and thus treated as a requirement, to divide the journal into three parts, where the first part should be a few introductory pages before the second part, the training journal itself. The second part would include the actual training pages and the final part should include a few pages of extra content. Since dividing the journal was a client request the subsequent requirements and pages were made with this original requirement as a base. In the interest of including as much freedom of choice as possible for the users, another client requirement, several different pages will be selectable in all three parts. Table 1 shows the existing pages, which were create as a result of the interview meetings, and where they are implemented in the journal.

<table>
<thead>
<tr>
<th>Type of page</th>
<th>Part 1</th>
<th>Part 2</th>
<th>Part 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year calendar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body building</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Fitness</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Combined body building and fitness</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Diet</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes lines</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes empty</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Training statistics</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Test results</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Nutrition table</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Table 1: Pages of the different parts of the journal.
Parts one and three are the same in the sense that the pages defined for those parts clearly summarizes their purpose. Part two, the training pages, is more complex and changes depending on the choices made by the user. The user will be able to chose two of the six possible choices for part two in almost any combination, though limited to one choice for the left-hand-side and one for the right-hand-side respectively.

If the user only chooses one of the available pages (body building, fitness or the combination) this page will be shown on both the left and right pages of each turn-up of the journal. Selecting a second page in this part will set the right side page as this choice. For example, if a user chooses both body building and fitness, in that order, the left page becomes body building and the right page becomes fitness. Body building, fitness, the combination and the note pages can be chosen for placement on both left and right pages. However the diet page can only be selected for the right page. So in the case that a user selects diet as his first choice that page will automatically show on the journals right page. This was deliberately made this way because recording or following a diet is not a focus for a training journal.

In addition, if the user chooses only one type of page each page is considered a separate day, where the left page is day one and the right page is day two. In the case of the user picking two pages each turn-up is considered one day. The distinction is made to eliminate unwarranted use of a “information-box” at the top of each page. In the event of a single-sided journal a info-box per page is needed, but with a double-sided journal having an info-box on each page is redundant.

![Figure 4: Concept image of the information-box for each unique day.](image)

The info-box contains general information not directly related to the user’s training such as the date and time, the type of training session, location and the user’s mood.

**Part 1**

In the first part, containing just a few pages, in addition to a personal information page the user can choose from two different pages, the weekly planning and the annual calendar. These are optional choices. Naturally, each can be included individually or both can be selected if desired.

**Personal Information:** The first page in part one is dedicated to the owner of the journals personal information, such as name and address should
the journal become lost. This module is not presented as a choice as it is always included in the journal.

**Weekly Planning:** A tool to plan or record the training sessions. Every day has room for short notes of what the user is planning to do, or did, on a specific day of a week. The weekly planner has two tables on every page and contains three weeks per table. This sums up to a total of nine pages, with an overspill of two weeks into the next year. An example of a single week table can be seen in figure 5.

**Annual Calendar:** This is a calendar containing months in a classic square fashion. There are six pages containing two months each. The annual calendar resulted from some of the users’ wish to have a “big picture” tool for planning and to have a simple overview of their workouts. An example of one month can be seen in figure 6.

<table>
<thead>
<tr>
<th>Vecka</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Måndag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tisdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onsdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torsdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fredag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lördag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Söndag</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5: Conceptual image of the weekly planning, each page holds three columns. Each column represents one week and show that weeks number in the top column field.
As mentioned before, the journal itself can be either single sided or double sided. Depending on that choice, the right-hand-side page of a turn-up may look different.

The left-hand-side page will always look the same. It will have four different page types to choose from; these pages can also be chosen for the right-hand-side page, all including the info box at the top of the page. The left-hand-side pages are body building, fitness, a note page, which comes as lined or blank, and a combination page, that includes a static number of rows from both body building and fitness.

The right-hand-side has two pages to choose from. First, the note pages, both lined and blank as before, which will not be described in detail since they have no special features except for the info box. Second, the diet page, designed to work as a daily meal plan to go with the users training. If the user chooses only one type of page, it becomes a single sided journal and both left and right pages will look the same, with an info box at the top. Choosing a second page turns the journal into a double sided

**Body Building:** The page focused on strength exercises, often conducted in a gym. The page will include fields for the exercise name and a number of set fields, a set is the combination of weight and repetitions (kg / rep). An example of the body building part can be seen in the top row of figure 7

**Fitness:** The page focused on fitness exercises. The page will include fields for the exercise name, distance, time and pulse. An example of the fitness

<table>
<thead>
<tr>
<th>Januar 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>26</td>
</tr>
<tr>
<td>31</td>
</tr>
</tbody>
</table>

Figure 6: Conceptual image of the annual calendar, each page holds two months.
part can be seen in the bottom row of figure 7

Diet: The diet page for part 2 is designed to be a diet compliment to a daily training regime, where exercises and a meal plan is devised in advance. An example of the part 2 diet page can be seen in figure 8

<table>
<thead>
<tr>
<th>Övning - Stryka</th>
<th>Kg/Reps</th>
<th>Kg/Reps</th>
<th>Kg/Reps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Övning - Kondition</td>
<td>Sträcka</td>
<td>Tid</td>
<td>Puls</td>
</tr>
</tbody>
</table>

Figure 7: A cropped image of the concept page for the combination option.

<table>
<thead>
<tr>
<th>Måltid / råvara</th>
<th>Protein</th>
<th>Kolhydr.</th>
<th>kcal</th>
<th>Fett</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frukost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kvällsmål</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mellanmål</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 8: A cropped image of the concept page for the part 2 diet option.

Part 3
The last part are the pages which come after the journal itself. As in the first part, the user can choose all, none or any number of the pages. In this part the user will get about ten pages each for the options chosen. As in part 2 there are the lined and empty notes pages the user can choose. Again there is a diet option, this option however is not the same as the version from part 2. The diet page of part 3 is designed for recording food intake or eating habits and is
meant to be used after training or eating and not in unison. The last type of page the user can choose is a table with different nutrition values.

**Diet:** The diet page for part 3 is designed to be a record of what the user has been eating. If the user wishes, it can also be used to keep track of nutrients of their more common or favoured food. An example of the diet page can be seen in figure 9.

**Training Statistics:** A page for recording progress in body size, for various areas, weight and body fat percentage. Includes two basic strength tests, maximum number of push-ups and crunches and a fitness test with best completion time. The page also has a full figure body representation to illustrate where to take the indicated measurements. An example of the training statistics page can be seen in figure 10.

![Table](image)

Figure 9: A cropped image of the concept page for the part 3 diet option.
5.1.2.4 Web pages

As a starting point, the web page was planned to be designed as general retail web pages usually are, a start page with some illustrated available products, current sales deals, order functionality and a login option. The basic pages like the start page, logging in, selecting desired elements for each of the journal part were designed with this layout in mind. After a few meetings, the test group began to think the design was straying from the intended clear cut and professional look and becoming generic and cluttered. The original premises was abandoned and the test group came up with a single sided layout for the web page using tabs on the top and left sides to function as navigation bars. The top tabs controlled major navigation options, to users personal pages, journal creation and the order placement page, and the left tabs were sub-navigations for each major group. For example, under personal information, one left tab could be current information, one for changing password and one for order history.

Concerning choosing the journal pages in the web tool, the original concept was to have completely selectable elements for a standard training page, where an element would be the fitness, body building or notation pages presented earlier, but instead of a whole page these elements would be combinable into a page entirely designed by the users hand with the use of a drag-and-drop functionality. This solution was deemed the most desirable, and a good complement of the new tab version for the web page design, from the participants of the

<table>
<thead>
<tr>
<th>Lår (cm)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vikt (kg)</td>
<td></td>
</tr>
<tr>
<td>Fett %</td>
<td></td>
</tr>
<tr>
<td>Armhävningar (st)</td>
<td></td>
</tr>
<tr>
<td>Crunches (st)</td>
<td></td>
</tr>
<tr>
<td>Konditionstest (min/sek)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 10: A cropped image of the concept page for the statistics record page.
CRE test group but also the most complicated to create and implement and was moved to possible future work in favour of a simpler concept with a set of pre-made pages to select from.

Because the design was deemed too complicated to create, and the project went in a different direction, the prototype was never developed beyond a mock-up state.

Figure 11: A conceptual mock-up of the tab-solution for the web page.

The following is a complete list of the intended navigation tabs and their sub-options.

**Start Page:** A welcome page with some illustrated possible products. No sub-tabs.

**Personal Info:** **Starting tab:** The user’s personal information including full name, address, postal code and city. All information can be changed but not removed, except for cell- and home phone numbers which are optional.

**Change Email:** Page for changing current email.

**Change Password:** Page for changing current password.

**Create Journal:** **Part 1 - Intro:** Introductory pages with two optional content choices, annual calendar and week planning. Personal information is always included on the first page of the journal.

**Part 2 - Training:** Main part of the journal, available elements are fitness, body building, fitness / body build combination, notation page and daily diet.
Part 3 - Extras: Extra pages for the final pages of the journal including notation pages, diet records and training statistics.

Place Order: Saved Journal: A previously completed journal that the user has saved. Page contains a preview of the journal and a text list of the included elements.

Active Order: Status of users order. Statuses include received, processing and sent. If a order has been placed but not yet sent to be printed the order can be cancelled.

New Order: Page for placing new orders, using a newly created or a saved journal along with the users personal information as standard. Shipping and billing address can be changed if needed.

Log in / out: Simple page for logging in or out.

5.1.3 Discussion

5.1.3.1 Selecting Methods

As mentioned earlier in the section 4.1 there are two main methods of handling a project. Selecting the classic waterfall model approach was an obvious choice for the project, since going with a purely evolutionary development would hinder the clients wish to make the project almost entirely developed on user feedback. The reason for thinking that evolutionary development would hinder user feedback is that once a visual image of a product is presented it can be hard to disregard the original look and explore other options without being affected by earlier works. This left the waterfall model, as presented in section 4.1.1, to be used as primary method for the project and for this project it has worked very well. Since the methods' different stages are so clearly defined and sorted, it was easy to create a schedule for the projects phases, and to keep track of the projects overall progress.

It should be mentioned that while the project did follow the waterfall models life cycle there were parts of the project that utilized an evolutionary approach. In these cases the primary and original requirement or design was created through normal means of requirements elicitation but the subsequent modification was done evolutionary. This approach was only used for graphical designs and requirements directly connected to these designs. For example the structure and header names for the columns in the body building page were produced through standard requirements elicitation and documentation. The changes later made in the combination stage of the pages was directly applied to the design and only after its completion was the requirements related to these items altered to reflect the new design. The move from the more strict waterfall model to the more fluent evolutionary development in these cases was made to keep momentum in the later discussed meetings.

5.1.3.2 The development team

The development team for the journal project consisted of one person, encompassing all the roles needed for this project, leader, developer and designer, from start to end. This is different from the norm of a typical CRE project where a person has a clearly defined role. Even though this role can change
throughout the project it is uncommon to have several roles at any one time. In a typical small project, a team could consist of a project manager, group leaders, a handful of developers and, depending on the project, possibly testers and designers.

If allowing for this team definition, and including the projects stakeholders, the development team could be said to be around ten people in total which is a adequate number of people for a project of this size. Counting the stakeholders as developers, or designers, becomes possible since they had final say for the projects designs and contents aspects.

Allowing for the possibility of the same person holding more than one position this still amounts to at least a hand full of people. This is partly illustrated in the short case study on choosing members of a development, found in (Sommerville 2004, p. 594) along with related entries in Maciaszek (2005) and previous chapters in Sommerville (2004). Despite this lack of personnel for the project the process of moving from role to role was not a difficult one, in no small part thanks to the clear division of phases. As the method is constructed there is a certain order in which you are supposed to do things, gather information, create requirements and so on. Moving from the appropriate role to the next became a almost circular move and provided a kind of focus for the work. The alternating roles also helped alleviate some of the stagnation felt when forced to focus on a singular part for longer time periods.

5.1.3.3 Gathering Information

The Test group

The test group should consist of people intended to be users of the developed system, and are usually brought in only for testing the system prototypes in various stages. But, since this project was aimed to create a product from the user’s point of view, the test group is also the project’s domain experts and therefore also part in creating the requirements of the system they later will be testing. Having the same people as both domain experts and testers does however presents a problem with objectivity. Since they had been involved in the systems design and possess in depth knowledge of the designs, their intended use and the thoughts behind them, it is plausible that the participants became biased towards the project and more willing to overlook missing components or more accepting towards any faults they find. In the meetings and later during the surveys and prototype testing there were no apparent signs of this behaviour and while the result was given good remarks there was comments of desired changes and missing components. So if there was a bias towards the project, it was at least small enough for the participants to still be able to identify weaknesses and continue development.

According to the theory behind CRE, section 4.1, the participants of the requirements elicitation meetings should have varied backgrounds and professions as to not include participants from a single part of development. Having a homogeneous group is likely to throw the project into a one sided development situation and risks neglecting or overlooking critical elements the project could have benefited from. In these regards the test group is well rounded and has a decent distribution in both gender and age. The participants also has a lot of diversity in professions as a group. All of these different view points have been
a great help since early development. The group consisted of about ten people, with varied attendance, which was just large enough to fit the criteria of the desired balance and composition of the group with a small buffer.

The Interviews

Ideally the project stakeholders and test users should meet one or twice a week in one large group to discuss the progress and next step of the project. A large group is preferred as more people can mean more input and opinions. But Sommerville also points out the with a large group there comes a chance that some more outgoing participants may overshadow participants that are less so. As a leader of these meetings one has to control that not only the more outspoken do all the talking, as the discussions then become one sided and potentially valuable input can be missed.

During the earlier interview meetings there was one participant in each of the groups that would interrupt the other participants and was always first to speak when presented a question or possible solution. In the larger of the groups this issue resolved itself within the group. The members of the group were so well acquainted with each other that they would apologise if they interrupted another participant and then let that person finish speaking. Since this behaviour evolved on its own quite quickly and the dynamic of the group was improving, there was no reason to interfere. In the smaller group no such natural behaviour emerged, partly because of the high rate of interchange of its members, so there was a definite need to address certain questions to specific, less outspoken, participants or to invite them to comment on the opinions of the more frequent speaker. Despite this need to manage these overshadowing participants, the amount of time the participants spoke and number of comments they gave was fairly average across the board, with the overshadowing personalities ahead by a little. It should be noted that this is a general observation made during the meetings and not a specific observation point.

During the interview meetings phase, the test users had such difference in availability that the group had to be divided into smaller groups, and as a result some participants fell out of the project. The reason for these participants falling out was that the meetings was to be held with no less than two participants, and their schedules simply never coincided with any other participant. The guidelines for the meetings does not specify that one-on-one interviews are not allowed or should be avoided but it was decided that in the interests of the comparative study it would be better to put emphasize on the differences in the methods. If there had been a few one-on-one interviews among the CRE meetings it would have made it harder to spot differences in the results. The difficulty would lie in differentiating between information gathered as a result of a group meeting and occasional individual interviews. If some new piece of information was discovered during a individual interview it would have been difficult to know if it was just personal preference or solid information to take to the project without the feedback from other participants. As such it was opted to not have individual interviews as part of the CRE process for this project.

The meetings can be conducted in an structured or unstructured fashion, open or guided sessions. Mixing the two methods is common for large projects, where not every topic is suited for a single kind of approach. The same can be said for the journal project. Although the journal project was not a large
project per se, the entire CRE side of the project did rest on a single designer, which in a sense made it a large undertaking.

The initial approach was to have unstructured meetings where the designer asked general questions of positive aspects that the test group participants had previously with other similar products and which of these they would like to see included into the project. Essentially the participants were encouraged to just run with what they came up with and not worry about if it would fit the project. The open approach was used for each new topic of the project. In the open meetings, the participants discussed the new topic without guidance until the designer felt that there was sufficient information to work with or the participants ran out of ideas. This approach was quite successful and a lot of items to consider for the project was discovered. Because of this, the open sessions was most effective when discussing larger design questions where overall usability and appearance was the focus.

The meetings then became more structured and each topic the participants had earlier brought up was systematically divided into smaller components in preparation of the next meeting and subsequently discussed. In these meetings the designer asked several pointed questions per item discussed such as “what makes A better than B?”, “if only one of the presented items could be included, which would be preferred?” and so on until all items of the current topic was covered. This approach did lead to a lot of improvement on most of the discussed topics but was very time consuming and sometimes lead to the group losing focus. During these guided sessions the interview meetings became shorter than the one hour meetings held in the beginning with the open sessions. In most cases a topic discussed at a meeting would have a design that the participants were happy with by the end of the meeting. It is difficult however to with certainty say whether the group had lost interests in discussing the topic or if they were satisfied with the results for every topic. The chance of becoming tired increased the further the meeting went on, so the designer decided that rather than risking having to come back and redo previous work, it was better to shorten the meetings and pick a few more important topics to focus on. This proved to be a good choice as the participants was more alert during the meeting and the meetings regained some of the momentum they had during the open sessions.

5.1.3.4 Results

Requirements List

The requirements list for the CRE process was written over time, following the weekly meetings. As the meetings were held in an alternating structured and unstructured fashion and covered specific parts of the journal at each meeting, a number of draft requirements were created after a structured meeting had been held. The draft requirements were then presented to the test group at the end of the meetings concerning the related topic. If the test group did not agree with the drafted requirements they were reworked, based on the test group’s feedback, and presented again on the next meeting. During the interview meeting phase this method seemed like a simple way to handle the requirements and it made sense having a general idea of a requirement before specifying it through further discussion. However, since the requirements were only written as notes during
the meetings and then kept in that state until a structured meeting had been held, it was at time difficult to place the text into the correct context from its discussion. In hindsight it would have been better to write a rough draft during the meeting or soon after one. This would have made the requirements easier to formulate at a later stage and easier to put into context.

Some requirement drafts were also supported with pictures of designs and notes made on the whiteboard during the meetings. The whiteboard notes and pictures were made “on the fly” during the meetings, so the notes was not written in structured text or categorized but rather written as the topics came up at the meetings in the form of quotes. This made it necessary to translate requirements stated in normal wording into a more focused and technical language. As an example, it was early stated that “there should be plenty of writing space” which was reworked into its final draft “Writing Space - The height of the journals writing fields shall have a line spacing of no less than 14 mm”. With the added support the pictures provided, it was much easier to make a comprehensive requirement regarding the subject. The requirements that were supported by pictures were almost exclusively the first requirements to be incorporated into the requirements specification document, which was only done once the requirement was considered complete.

As the requirements list started to fill out it became increasingly difficult to keep track of the already existing requirements, and with more to be created the list was separated into five categories: Design, Part 1 - Intro, Part 2 - Training, Part 3 - Extras and Web Tool. Above these five categories were three general requirements made by the project owner which served as master requirements and overall guidelines for the project. Loosely put, these stated that the product should have a clear cut and professional design, be simple to use and allow the users to make as many choices themselves as possible without overwhelming them with options. If a requirement from the meetings contradicted or did not work with one of these three requirements it was discarded, or reworked if it was deemed valuable enough. Categorizing the requirements made it significantly easier to track the projects progress and identify areas of the project that needed more attention. Previously, the list had seemed to be quite diverse for the size of the project but after dividing the requirements it was discovered that many of the requirements were focused on overall design for the project, something that had completely escaped the designers notice until then. Thanks to this, the meetings could be directed to focus more on single parts of the product and produce a wider range of requirements.

Prototyping

The prototypes from the CRE process’ journal meetings were created from rough drafts drawn on a whiteboard during the presentations and developed during the meetings, sometimes over several meetings. As such, the prototypes for the journal pages were throw-away prototypes. Only once the entire test group agreed that the prototypes looked the way they wanted, and had all the desired elements, were the designs made into a more definitive medium, in this case digital, to be used as design proposals for the client.

The overall design was created first to have something to work from and then the individual pages were created, page by page. Desired page content was established afterwards, with things such as which columns should be included
on the “strength” page, later renamed “body building”, followed by what a good name for these columns could be, to immediately show the user what the column is meant to be used for. This basic approach was repeated for each subsequent page of the journal.

The web tool prototype was not created using throw-away prototyping but with a version of the evolutionary method. Since the test group had decided that the journal pages and the web tool should have the same design, or similar enough, elements from the prototyping segment of the journal pages was used to envision the basis of the web tool. Elements like font and colour scheme would be applied to both and was not discussed at any length during this part. Focus was instead put on navigation and which pages to include in the web tool.

The test group was asked to envision visiting the completed web page and placing an order for a journal. With some variation there was a rough idea that every participant imagined they would take, which became the base structure for the web page. In addition to this envisioned website, the test users were shown a few varied websites with some elements that the designer thought could be desirable elements for the project’s website. From these websites the participants were supposed to name at least two good and two bad elements that they could find. On the next upcoming meeting these elements were discussed one at the time, with focus on what made them good or bad for that website, and whether the same qualities could be applied to the project’s website.

5.1.3.5 Personal Influence

It is always difficult to gauge how much of the designers that becomes part of the project. Notably more so when an entire project is manned by only that one designer, and a novice designer at that.

In the theory behind the CRE-process there is mention of things to be aware of regarding the influence one has as handler for a group of people. The path on least resistance is always preferred and going with a presented idea is always easier than coming up with a new one. Even when presenting a number of choices the designer must be aware that, by presenting the choices, the scope of the project is narrowed down to these choices and the direction they will give the project. For this reason, providing the participant with visual aid was held back as long as possible. Even drawing discussed ideas on a whiteboard was not done until it became necessary, and the participants expressed it was difficult to visualize what they were discussing, and that they were uncertain that they were all really picturing the same designs. Having held back on the visual aids this long had a negative effect on the project. The participants did not have a unified picture of what they were discussing and instead misinterpreted each others intentions. In this case the discussions were of a broader sense, and the group had not started to delve to deeply into the discussion topics to cost to much time to rectify the issue. Having a visual aids at the meetings at an earlier stage would have prevented this misunderstanding and allowed for more time on development.

There are also some things the CRE-process says to avoid. Among these things there are some general guidelines for phrasing. Loosely summarized the designers should choose their words carefully as even an unintentional negative turn of phrase, even a slight one, could turn the test group away from the current idea. Three examples from (Maciaszek 2005, p. 51) mentions to generally avoid
opinionated, biased and imposing questions, “do we have to do things the way we do them?”, “you are not going to do this, are you?”, “you do things this way, don’t you?”. While it may sound obvious that an interviewer should state questions neutrally, free from their own opinions and ideas, actually altering one’s own practised and natural speech pattern is very difficult to do even when coming to a meeting with meeting questions written in advance. The prepared questions certainly helped during the meetings but there was no way to prepare questions for every eventuality and at some point it always became necessary to improvise. It was noted on no less than three occasions that a question had been negatively worded during a meeting, but judging how much of an effect these phrasings had on the participants was not possible at these times, and no change in the overall design for the project could be seen in the notes when reviewing them.

These things paired with knowing that the journal- and web tool meetings were both structured and unstructured, makes it impossible to state that the designer did not influence the project in any way. In fact, it is very likely that the project would have turned out differently with a different designer in the lead, speculatively even if the same questions had been asked to the test group. While there without a doubt are traces of the designer in the results, the focus and outlines of the product does come from the participants and a compromise of their visions for the project, making the designer’s influence minor in comparison.

5.2 Rapid Contextual Design

5.2.1 Method

5.2.1.1 The Contextual Interviews

The first part of the RCD process is the contextual interviews. There are several quite detailed descriptions of how they should be conducted, which are summarized in section 4.2.1. This project has some deviations from the descriptions in the book (Holtzblatt et al. 2005). Because of difficulties finding people to interview only six people were interviewed. This is within the limit of the Lightning Fast + version of the RCD process. The interviews were not conducted back-to-back, but several interviews were made in the same day. In total, the interviews were made over the course of seven days due to rescheduling.

The location of the interview sessions varied. Normally contextual interviews are supposed to be made at the location where the evaluated work is normally performed. This did not work in this project since the work here, filling in the training journal, is made at a location not very suited for interviews. In almost all cases the interviews were made at the users’ home with only one exception. The last interview was done in a small meeting room at the user’s gym.

The interviews were conducted after a training session. In half of the cases, this was the normal procedure for the interviewees but the other half normally filled out their journals during their training session. Each session started with the interviewer explaining how the interview would be conducted, what was expected of the interviewee and what would happen directly afterwards. Then the interviewee were asked to fill out their journals as they normally do. They were also asked to explain why they did certain things, and the interviewer
would ask questions if something were unclear.

Each interview started and the user filled in their training journal as usual. As they filled in the journal they explained how they were thinking and why they did what they did. Several times during the interviews things occurred that were unclear and the interviewer asked what happened at that time and why it happened. The interviewer took notes during the interview. These notes included both the different steps the user made in filling out the journal, artefacts used, physical environment and other things affecting the task. An example (in Swedish) of those notes can be seen in figure 12.

![Figure 12: Example of notes (in Swedish) taken during the contextual interviews.](image)

Theory also states that a tape recorder should be used to record the interview (section 4.2.1). Everyone agreed to have their interviews recorded. At the end of the interview all interviewee filled in a confidentiality agreement since the developed product was, at the time of the interviews, confidential. Lastly, the interviewer explained more about the project and why the interview was made.

### 5.2.1.2 Interpreting the answers - the interpretation session

After all the interviews were finished the interpretation session took place. This was done quite differently from how the theory states it should be done (section 4.2.2). The two major differences in this project are that only one person did the session and only one single session took place after all the interviews instead of a session within 48 hours after each interview.

This project only has two persons in total, where each person develops independently from the other and should not be part of the others’ developing process. Therefore there were no possibility of having other people coming into the interpretation session. The small amount of material from the interviews led to the single interpretation session, after all the interviews were done, instead of having one interpretation session after each interview.
During the session, each interview was analysed separately. The participant listened to the recording for the current interview while reading through the corresponding notes. Every single defined event or artefact was written down in an affinity note, marked with the user number and a unique number. Each interview resulted in between about 10 and 40 notes. Table 2 shows an example of some notes derived from one of the interviews. After all the interviews were analysed the notes were transferred to a suitable format and printed on yellow paper as yellow affinity notes.

<table>
<thead>
<tr>
<th>User and number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>U2-13</td>
<td>Presses import from Garmin</td>
</tr>
<tr>
<td>U2-14</td>
<td>All sessions not already imported in a list</td>
</tr>
<tr>
<td>U2-15</td>
<td>The users has to choose themselves what type of training they conducted each session</td>
</tr>
</tbody>
</table>

Table 2: Example of affinity notes

5.2.1.3 Sorting the affinity notes; the affinity diagram

The affinity wall was built and walked together with the project client. This was done in two sessions. During the first session the two participants built the wall using the printed affinity notes. In the second session the participants walked the wall to come up with design ideas and holes in the data. The first session took about three to four hours and the second session about half the time.

First session: Building the wall

Placing the different coloured labels was done jointly by the two participants, who got about half of the yellow affinity notes each and a box of map pins. Both persons started making columns with notes. When a note fitted together with other notes in a column, the note was added to that column. When a note did not fit anywhere, a new column was started. The theory states that this part of the building process is supposed to be a group exercise (Holtzblatt et al. 2005, p. 168) but due to limited time and the small group this was done more individually. Often, the participants asked each other where the other one thought a specific note would fit.

After all the yellow affinity notes were placed it was time to add blue labels. Blue labels are the title of a column and are written in a first-person narrative. An example of a blue label is “I want to note discrepancies or special events in my training”. When all columns had a blue label, pink labels were added to group different columns together under a common theme. The pink labels were also written in a first-person narrative and an example from the created wall is “I want to note the different things about a particular workout”. The last part of this session was grouping together the pink labels using green labels. The green labels only had one word which was an overall grouping of different areas. A total of four groupings (green labels) were created: “Technology”, “Design”, “Workout” and “Diet”. The full result can be seen in figure 13.
Second session: Walking the wall

The day after the first session, the second session was conducted. During the second session the participants walked the wall individually without speaking to each other except asking a few questions about the process. Both were given a set of empty yellow notes, pins and two pens, a green and a blue.

Each person started by looking at a green note and then traversing the “tree” under that green note using depth-first, pre-order search (Holte 2015). Whenever an idea occurred from looking at any note, regardless of colour, the person would write the idea on a yellow note, using a blue pen, and pin the note beside the note where the idea occurred. If there were any holes in the data (missing parts or more data needed) the user would instead use the green pen when writing the note. An example of an idea note is “Be able to note discrepancies, empty rows / box” and of a hole note is “Anything more you want to record?”. The result of the walking session can be seen in figure 14.
5.2.1.4 Creating mock-ups and holding mock-up interviews

The plan was to make three iterations with paper mock-ups and interviews. The first iteration was supposed to include creating a basic paper prototype which would then be evaluated using interviews. The result from the interviews would be turned into simple wire frames and new interviews would be held. After that, a simple functional wire frame prototype would be made which would be evaluated using a third set of interviews. Ultimately this plan did not work at all due to outside factors which limited the time to make these iterations. The first iteration was not used at all and simple wire frames were created in the first iteration instead of creating paper mock-ups. In total two iterations were made and the result was a functional wire frame that was operational but very simple.

First iteration

The first iteration started by deciding on a tool to use for making the first wire frames. The first intention was to use pen and paper or basic image software, but a suggestion came from the substance reviewer to use a program called Balsamiq (Balsamiq 2015). A simple set of wire frames were made in Balsamiq, both for the journal pages and for the web tool to create the journal. Together, this became the first prototype.

The pages were created from scratch as a result from the wall walking session. The notes containing ideas were gathered and read through when the different pages were created. Some idea notes were not followed up on since they dealt with questions or topics that were not a part of this project including having other technologies than the paper journal and ideas regarding those technologies.

The web tool was designed as a Wizard (section 4.2.6.1). The wizard first used a lot of text but after some consideration much of the text was replaced by images because images are easier to understand than text (section 4.2.6.2).
This tool was made clickable from the beginning so that the test subjects could try using the prototype tool.

After the design of the pages and the tool, six people were allowed to test the prototype. Three of these people were persons that had an interview in the contextual interview stage (section 5.2.1.1) and the other three persons had not been part of the project in any way before. During an interview the user went through the tool trying it out. The interviewer sat beside the person while he or she was going through the tool to watch for anything interesting such as if the person got stuck or something was missing that didn’t follow logically. Afterwards, ideas were discussed to find out parts that should be added or removed.

Second iteration

The results of all the interviews were consolidated and some pages and parts of the tool were redesigned into the second prototype. Not all ideas and problems that occurred during the first interviews were rectified since some were only present in one or two cases. Some ideas only present in a few cases were also added since they were considered necessary anyway. There were a few things that several users had problems with. A better navigation system was needed and tabs on the left side of the tool were implemented. These tabs made it possible to navigate between different parts of the tool without having to flip through every page. Also, the tool had thumbnail pictures of the possible pages, and the thumbnails were clickable. If the user clicked a thumbnail, a larger version of the page was shown. In the first iteration, it was not clear to the users that they could click on the thumbnail, and this was made clearer in the second iteration. Some other smaller changes were also made, mostly renaming of some pages and aesthetic changes.

The thought was to use the result from the first iteration to develop the product directly but the changes from the interviews were greater in number and more substantial then expected and another round of interviews were conducted. The interviews were conducted in the same way as in the first iteration but only four persons were interviewed due to illness.

Finishing the mock-ups

After these interviews a new consolidation was made. There were a few minor changes that had to be made to answer some small issues that arose during the interviews. After the interviews were done the prototype tool and pages were converted into HyperText Markup Language (HTML) code and put on the web to be used when comparing the result of the RCD and CRE methods (section 3.3.4).

5.2.1.5 Finding requirements

To be able to compare the two methods used in the project this was an extra task added to the RCD process. A list of requirements was deduced from the notes written in the wall walking session. Most of the requirements were taken from the added design ideas, but some of the interview notes on the wall were also put into the requirements list. This was done after finishing the prototypes, since the lack of requirements was not realized until then.
5.2.2 Result

Two different prototypes were created during the RCD-process. The first prototype, the journal pages, was created as a direct result of the process and was derived from the collected and analysed data. The second prototype, the web tool for creating the journal, was not a direct result of the RCD process. The content of the tool includes the journal pages but the tool itself was created using different design theories described in section 4.2.6 and 5.2.1.4.

Apart from the prototypes a list of requirements were made from the notes resulting from the wall walk. This list was divided into four parts and was made mostly to have something to compare with the result of the CRE process. The requirements list is not something that is usually included in the RCD process but most of these requirements became a natural part of the prototype although some may have changed. A few of the requirements (in the list marked as “not developed”) were not considered further because of the scope of the project.

1. Functionality requirements for the journal:
   (a) It should be easy to go back and make changes without losing information
   (b) You should only have to log in once
   (c) It should be easy to find things and there should be clear steps
   (d) One should be able to choose supplementary aids on separate pages

2. Design requirements for the journal:
   (a) The design should be selectable, you should be able to choose different looks
      i. There should be a foreseeable calendar
      ii. There should be a weekly overview
   (b) You should be able to fill in planning in advance
      i. One should be able to browse back and forth easily
      ii. It should be easy to find previous training sessions
      iii. One should not be forced to having to fill out a certain type of data
   (c) There will be pages for each day (diary pages)
      i. The templates will have a different appearance depending on exercise
   (d) There should be templates that one can choose from
      i. It must be optional if one wants the notation box or not
   (e) Different things that should be noted depending on type of training
      i. Exercise, sets, reps, weight for strength
      ii. Exercise, distance, time, heart rate for condition
   (f) One should be able to have relevant statistics and an overview of their training
i. One should be able to maintain statistics of bodily changes, time, pulse, weight, body measurements

ii. It should be easy to flip back and forth between training sessions

iii. One should be able to have the results of various tests

(h) There should be a good diet journal along with training journal

i. One should be able to fill in calories, fat, protein and carbohydrates in the diet journal

ii. There shall be a nutrition table of common foods with calories, fat, protein and carbohydrates, retrieved from the Swedish National Food Agency (Livsmedelsverket)

(i) It should be easy to transfer data from a runner’s watch

(j) There should be descriptions of various exercises in the journal (not developed)

3. Technical requirements for the training journal:

(a) Tablet / smart phone / computer (not developed)

   i. The journal should be compatible with all platforms

   ii. It should be possible to directly transfer from a runner’s watch

   iii. One should only have to log in once

   iv. It should be built so that the journal fills in nutrition values for a meal so you don’t have to count yourself

   v. Different exercises should be described (perhaps animated) so that the users can check how to do

(b) Paper and pencil possibility

   i. It should be in the form of a spiral block (or similar) and not a bound book

5.2.2.1 The journal pages

One requirement from the client was that the journal should have three different parts, where the first part should be a few pages before the journal itself, the second part should be the journal itself and the third part should be some pages after the journal. Several pages will be possible to choose from in all three parts, table 5 shows in which part or parts the different pages are present.
<table>
<thead>
<tr>
<th>Type of page</th>
<th>Part 1</th>
<th>Part 2</th>
<th>Part 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year calendar</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly planning</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empty lines</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Empty page(s)</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Strength</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined strength and condition</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up body measurements</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Follow-up weight</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up time</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Personal goals</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Nutrition table</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Table 3: Different pages in different parts of the journal.

Part one and three will have pages with nothing else than the mentioned content. Part two, the journal itself, will have different appearance depending on the choice of the users. The users will be able to choose from three types of content in the journal part. The users can choose to have a single sided journal, where each individual page will have one day or training session depending on how the users will use the journal. This means that one turn-up in the journal will have two days. The users can also choose to have a double sided journal which means that each turn-up will only be one day and the users will choose the appearance of both the left and the right side of the turn-up. Finally, the users can choose to have a combined training- and diet journal. Here the left side will contain the training page and the right side will contain the diet page.

The users will be able to choose to have a “notation box” on the bottom of a page. Here any kind of note can be made about that day or session. An example of a notation box can be seen in figure 15. There is, however, one exception here. If the users choose to have a double sided journal, they can choose to have a notation box that fills the entire right side. If the users choose this, they will not have the possibility to choose the notation box at the bottom of the page.

In the single sided journal and on the left side of the double sided journal and the food journal, the top of the page will have a small box where the users can fill in date, location and goal for the day. This can be seen in figure 16.
Part 1

In the first part, containing just a few pages, the users can choose from three different pages, the year calendar, the weekly planning and the lined pages. The users do not have to choose any of the pages if they do not want them and they can also choose two or all three of them.

The **year calendar**: This is a calendar containing months in a square fashion. Every page has two months which makes six pages in total. The year calendar was the result of some users wishing to have a more overall planning and also oversight of which days the users did a workout. An example of one month in the year calendar can be seen in figure 17.

The **weekly planning**: Here, the users will have the possibility to plan the week. Every day will have room for a small note of what the users are planning to do that day or that week. The week plan pages have six weeks on every page which will give five pages (30 weeks) in total if the users...
choose the six month version and ten pages (60 weeks) for the full year version. An example of three weeks can be seen in figure 18.

**The lined pages:** These pages contain empty lines. There will be about ten lined pages if the users choose this.

Figure 17: Conceptual example of the year calendar.

```
<table>
<thead>
<tr>
<th>Vecka</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Måndag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tisdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onsdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torsdag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fredag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lördag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Söndag</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Figure 18: Conceptual example of a weekly planning table. Each page contains two tables.
Part 2

The journal itself can be either a single sided training journal, a double sided training journal or a combined training and diet journal. As mentioned before, the pages will look a bit different on the right side of a turn up depending on which type the users has chosen.

The left side will always look the same and will have five different appearances to choose from. There is the lined page and the empty page, which will not be described in detail since they have no special features except for the date box and, if the users choose it, the notation box. Three other types of pages will be possible to choose from, body building, fitness and combined body building/fitness:

**Body building**: Here, the users fill in body building exercises, often completed in a gym. The columns exercise and how many sets, reps and weight will be preprinted. There will be a fourth column for additional remarks.

**Fitness**: Here, the users fill in fitness exercises; which type of exercise, the distance, the time and the average heart rate.

**Combined body building / fitness**: The pages has both the body building and the fitness exercise part, the body building part first, filling about 75 percent of the page and then the fitness part. The thought here is that if you do both body building and fitness exercises in the same day, you normally just do a few fitness exercises.

All of the above includes the box at the top for date etcetera, as usual for the left side, and the users can choose to have the notation box. The two different appearances can be seen in figure 19.

![Conceptual image of fitness (top) and body building (bottom) designs which the users can choose from.](image)

The right page has no date box regardless of whether the users has chosen double sided journal or combined training and diet journal, but the users can still choose to have a notation box. If the users chose double sided journal they have six choices for the appearance of the right side. There are the same five possibilities already described for the left side. The sixth choice is to have a notation box spanning the whole page. If the users instead chose to have the diet journal, there are basically only two choices the users can make; with or
without the notation box. The appearance for the diet page can be seen in figure 20.

![Figure 20: Conceptual image of the diet page design.](image)

**Part 3**

The last part are some pages placed after the journal itself. As in the first part, the users can choose more than one of those pages but does not have to choose any of them. There will be lined pages and empty pages. In this case, the users will get about ten pages each. There are also different pages where the users can do follow-ups; body measurements, weight and time and a page where the users can write down personal goals. The last type of page is a nutrition table.

**Body measurements:** The users can fill in body part, date and measure value.

**Weight measurements:** The users can fill in date, weight, muscle mass and water percentage.

**Time measurement:** The users can fill in type of exercise, distance, time and average heart rate.

These three measurement pages will be two pages each in the journal. Most users will not do this often and one page would probably be enough for them, but it is good to have an extra page for those who want to fill this in more frequently. The appearance of the three types can be seen in figure 21.

![Figure 21: Conceptual image of follow-up of different measurements designs; body sizes (top), weight (middle) and time (bottom).](image)
Personal goals: Here, the users can fill in their personal goals. The columns include which goal to achieve, the date the goal should be reached and the date when the goal was actually reached. This page will also be about two pages. The appearance can be seen in figure 22.

Nutrition table: This is a pre-filled table with nutrition values for food items. The table will be divided into different categories and contain the more common food items in each category. Example of appearance can be seen in figure 23.

Figure 22: Page where the users can fill in their personal goals.

<table>
<thead>
<tr>
<th>Produkt</th>
<th>Energi</th>
<th>Fett</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ris</td>
<td>30 kcal</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>Potatis</td>
<td>45 kcal</td>
<td>0 g</td>
<td>2 g</td>
</tr>
<tr>
<td>Pasta</td>
<td>120 kcal</td>
<td>10 g</td>
<td>5 g</td>
</tr>
</tbody>
</table>

Figure 23: Conceptual example of one part of the nutrition table. The numbers are not corresponding to the real numbers for each food item. This table will also have a column for carbohydrates.

5.2.2.2 The web tool

The web tool is, as described earlier, a result of both the RCD process and other design theories. Most of the content in the tool, which pages the interviewed users want to have in their diaries and some of the appearances they would like to choose comes from the RCD process. The appearance and functionality is mostly a result from the design theories. Below, is a brief description of each page in the tool.

Start page: This is a welcome page which describes what the users are about to do and briefly how the guide works.

Type choice: Here the users choose which type of journal they want to have. The users can choose from the three types described in section 5.2.2.1. The users also chooses if the journal should cover 6 months or a full year.
Create front page: Here the users create the appearance for the front page, choosing background colour and text colour for the front page and if they want to have a picture on the front. The users can also have three rows of text on the front page.

Part 1 description: This page describes the choices that can be made in part 1.

Part 1 choice: Here the users choose to include one or several of the pages described in section 5.2.2.1.

Part 2 description: This page describes the choices that can be made in part 2.

Part 2 left: Here, the users choose the appearance of the left side of the journal or every side if the users chose single page earlier. The possible appearances the users can choose between are further described in section 5.2.2.1.

Part 2 left notation: Here the users choose if they want to have a notation box on the bottom of the left page.

Part 2 right (only double sided journal): If the users chose to have a double sided journal, here is where they choose the appearance for the right side. The possible appearances the users can choose between are further described in section 5.2.2.1.

Part 2 right notation: Here the users choose if they want to have a notation box on the bottom of the right page.

Part 2 diet (only diet journal): If the users chose to have a combined training and diet journal here is where they choose the appearance for the diet page. The choice the users can make here is whether or not they want to have a notation box on the bottom of the diet page. The appearance of the diet journal are further described in section 5.2.2.1.

Part 3 description: This page describes the choices that can be made in part 3.

Part 3 choice: Here the users choose to include one or several of the pages described in section 5.2.2.1.

Part 3 nutrition: The choice whether or not to include a nutrition table is made on a separate page. Here the users can browse through the table to see if the table contains all the users want to have.

Visual summary: The users can browse through their own version to see how it will look, which order the pages will be in and if they have forgotten anything.

Text summary: Last is a text summary of the pages the users have chosen so they can just look through all the choices before confirming the journal.
The above described tool is a guide where the users follow the pages step by step. On the left side of the tool there will be tabs for the different parts of the guide so the users will be able to move back faster if they need to make changes. Since some of the choices are mandatory and cannot be skipped, the tabs will not be shown for parts further ahead in the guide. If the users go back far enough and changes something that will affect a choice made later in the guide, the tabs will also disappear and the users will have to redo those choices.

The bottom of each page will contain a progress bar showing the users how far they have come through the guide and how much of it remains. This bar will change through the pages since some of the choices will result in more steps in the guide than others. There will also be a forward or backward button. If making a choice is mandatory, the forward button will be disabled until the users have made a choice.

In parts 1, 2, and 3, the users choose to include pages or chooses between different appearances on the journal pages. In the guide the journal pages will all be shown as large thumbnails. The users will be able to click each thumbnail to view the full scale version of the journal page. The users will also be able to choose this page by clicking a button below the full scale page.

5.2.3 Discussion
5.2.3.1 Choice of method

[RCD] has three different methods. In this project, the chosen method was called “Lightning Fast +” and it was chosen mainly because of the time limit and possibility of having paper mock-up interviews as a part of the process. “Lightning Fast” is almost the same but without the paper mock-up phases. “Focused Rapid CD” has two additional phases that are not in the “Lightning Fast +” method. The first phase is called sequence model with consolidation and is normally conducted between the interpretation session and the building of the affinity diagram. Omitting the sequence model in this project was considered not to affect the outcome, since there would probably not have been many sequences. The other additional phase, storyboarding, which would have been between the wall walk and creating the paper mock-ups, could have made more difference if it was included.

5.2.3.2 The development team

Normally the [RCD] team should consist of two people. This was not possible in this project since the project as a whole only consisted of two people and they were not supposed to interfere with each other’s development. Many parts of the process are also supposed to be conducted as meetings with a larger team of stakeholders or developers. In the first part, Contextual Interviews, only having one person in the team should not have affected the outcome of the interviews since the theory states that the interview only should be conducted by one person (section 4.2.1).

In the interpretation session, a cross functional team should attend the meetings to evaluate and capture key aspects of every meeting. The interviewer shares the information with the rest of the team which discusses the information and the interview. This project had a definitive disadvantage by only having a single person during the session since this person may very well miss several
aspects that should have been noted. If that person is also the person that conducted the interviews he or she might be too familiar with the data resulting in missed aspects. Whether this affected the project is hard to determine, but the risk that it did should be taken into account.

During the wall building and walk an extra person was taken into the team. This person was the client of the project as a whole which might have had some effect on the outcome of especially the walking session. During the walking session the participants should come up with design ideas from the wall that was built including affinity notes and blue, pink and green notes added in the building phase. It might be hard for a client to disregard their own ideas and requests and only look at the data. Some design ideas written by the client in this project’s wall walk may stem more from their own requests than from reading the various notes, but it is hard to evaluate if this is the case. The instructions given in the beginning of the sessions were that the client should be careful to try not to incorporate own ideas and only write ideas coming from reading the notes.

The last part of the process, designing wire frame prototypes and holding prototype interviews, was again done by one person. The benefit of having more people in a design phase is that more ideas and alternatives in the design might come up on the table. Discussions between people are normally a hotbed for new ideas, and in this project this possibility was lost. It is hard to say how much this really affected the outcome.

### 5.2.3.3 Time aspect and scope of retrieved information

A contextual interview should be around two hours long in total, with the introduction and conclusion of the interview included. The interview in itself should be around one and a half hours. In this project the longest interview was about an hour and the shortest was just over twenty minutes, both including concluding discussions. During the interview, the user filled out their own training journal. This is something that normally only takes a short amount of time and there is no real reason to prolong this. Some journals used took a bit longer to fill out and thus prolonged the interviews.

The result of the shorter interviews was that a smaller amount of information was retrieved than should normally be retrieved according to theory. This, however, probably did not affect the outcome of the prototype negatively since the training journal is a smaller “system” than the systems the literature describes (Holtzblatt et al. [2005] p. 28-30).

According to the theory the interpretation session for each interview should be done within 48 hours after the interview. It is also hinted that each session only should contain one interview. In this project only one session was held in total and that session was held more than 48 hours after almost all interviews. This might also have affected the number of affinity notes coming out of the session and the relevance of them but replaying the recorded interviews and thoroughly reading all notes from the interviews helped focus on the relevant data.
5.2.3.4 Prototype interviews

Again there is a question of the length of the interviews. Holtzblatt et al. (2005) makes very little difference on the contextual interviews and what they call the mock-up interviews. Therefore, again, this interview should be around one and a half hours in length. This time the interviews took about twenty minutes each. The short time did probably not affect the outcome much since the whole task could be both finished and discussed in detail in this timespan.

The real difference was that the evaluated part in the interviews was the tool and not the journal pages. This was chosen because the journal pages could be evaluated within the tool by asking whether the user felt that they could use one or several of the suggested pages. For example, in the first iteration, several people missed the possibility to have a page regarding fitness which in itself showed that the possible pages had to be complemented.

If the users had gotten a printed version of the pages to choose from and to fill out as they normally do, other problems or changes might have occurred that did not occur by evaluating the pages this way. The answer might lie in the answers from the questionnaire that was sent to the participants after the interview (section 6.1.3). Eight of the nine participants answered that there were relevant pages for them to choose from which can be seen as an indication that the method of conducting the interviews did not give a negative result.

5.2.3.5 Results

Requirements list

The RCD-process does not involve the making of a list of requirements as the CRE-process does. This list was therefore done after the mock-up prototypes were already finished. If a requirements list should be done in this process the best time to do it is probably after the wall walk, so that it is not affected by what is done in any later stage and can be used when designing the mock-ups.

In this project only the notes and design ideas were used when making the list. The design idea notes on the wall served as requirements with some supplement from some of the affinity notes created in the interpretation session. If requirements are needed in this process, design idea notes and affinity notes are probably the best source for the requirements.

Prototypes

The prototypes met most of the users’ needs and wishes, but some were only met partially or not at all. For example, the wish to have the journal on an electronic device such as a computer or a smart phone was outside the scope of the project and not considered. Subsequently, some desires in connection with electronic devices also was not considered further, like the possibility to transfer data automatically from a runner’s watch. This is not possible to do without having the journal on an electronic device.

Otherwise, the participating people were satisfied or very satisfied with the web tool according to the questionnaire. The questionnaire also showed that there were pages that most people could use as a journal in some way. Therefore it can be considered that the goals of the project were met with this method.
5.2.3.6 Personal influence

One of the hardest things to evaluate is how much influence the designer in the process had on both the process itself, the people who were interviewed and the outcome of the prototypes.

The RCD process itself is quite clearly defined and might not be so easily influenced by personal biases. The changes in the process in this project depends more on the possibilities and the time available. An argument could be made that personal bias is the reason for the interviews being shorter and that the interviews could have been one and a half hours even with the provided material from the users, but at the same time it is very hard to continue an interview when all questions already seems answered. There is also the question of whether continuing on further would have gotten more accurate data or if the data would have been corrupted by being forced.

The interviewer might have affected the outcome of the interviews because in this case he was acquainted with - or close friends with - several of the people interviewed. This might have caused the answers, especially in the prototype interviews, to be nicer and more forgiving in terms of any problems with the prototypes and mock-ups. It is impossible to say if this is actually the case, but hopefully it is not since many of the answers and issues raised during the interviews seemed honest and straight.

The observer effect in physics refers to changes that the act of observation will make on a phenomenon being observed (Kim 2007). This can in some way be true also for the contextual interviews. When someone follows another person, when the second person is conducting a task, he or she will most likely alter something in the task, possibly without even realizing it. Being followed is an alteration itself and answering questions is a major alteration from the normal work. How much this changes the outcome from the normal work in this case is almost impossible to determine since the observations are needed to know about the work.

The prototypes themselves might very well have been influenced by the designer and his experiences since the functionality of the web tool is more a result of finding relevant theories regarding interface design, wizards and having images instead of text. One example is that the first wire frames only had text descriptions of the journal pages in the tool. Information was given early that images are always better than text in describing things which lead to an early change to the thumbnails even before the prototype interviews. Even though the personal influence on the web tool design is probably quite high, it is probably not possible to avoid since a designer is supposed to at least partially use their own ideas in the design.

6 General Results

The first section of this chapter describes the general results of the comparative study. The other three sections will show how the results of the comparative study was turned into a final prototype, delivered to the client at the end of the project for further development.
6.1 Result of the comparative study

6.1.1 Comparing the training journals

6.1.1.1 The training journal design requirements

The CRE process has 42 requirements concerning the training journal while the RCD process has 46. 23 of these requirements can be found in both processes. A Venn-diagram showing the distribution of requirements can be seen in figure 24 and the requirements are shown in the following list:

![Venn diagram showing the distribution of requirements concerning the training journal.](image)

- Common journal design requirements from both processes:
  - Possibility to choose one- or two-sided layout
  - Possibility to fill out planning in advance
  - Weekly Planning
  - Year Calendar
  - Journal pages for each day
  - Templates to choose from
  - Different appearance on templates with regards to type of training
  - Body-building: Exercise
– Body-building: Reps
– Body-building: Sets
– Body-building: Weight
– Fitness training: Exercise
– Fitness training: Distance
– Fitness training: Time
– Fitness training: Heart rate
– Diet journal: Calories
– Diet journal: Fat
– Diet journal: Protein
– Diet journal: Carbohydrates
– Test results
– Easy to browse the result pages
– Training statistics: Body dimensions
– Training statistics: Body weight

• Unique journal design requirements from the CRE process:
  – Personal Info
  – Motivation Pages
  – Fitness training: Speed
  – Fitness training: Interval
  – Fitness training: Weights
  – Notes: Blank notebook pages
  – Notes: Lined notebook pages
  – Test results: Number of push-ups
  – Test results: Number of crunches
  – Test results: Fitness completion time
  – At least 14 mm of line spacing
  – Possible to have either colour or image as cover
  – Possible to have different colours, minimum 4, maximum 8
  – Possible to have at least 5 shades of each colour
  – Possible to encapsulate pages with a frame
  – Possible to choose from maximum 4 clear and easy to read fonts
  – Illustrated icons to clarify the purpose of fields
  – Possibility to choose single row layout
  – Possibility to choose double row layout

• Unique journal design requirements from the RCD process:
  – Different appearances to choose from on journal pages
– Simple to flip back and forth in the journal part
– Easy to find previous workouts in the journal part
– Not limited to fill out a certain type of data on a certain journal page
– Note box at end of each journal page
– Optional if you want note box or not on the journal pages
– Table of common foods from Livsmedelsverket: Calories
– Table of common foods from Livsmedelsverket: Fat
– Table of common foods from Livsmedelsverket: Protein
– Table of common foods from Livsmedelsverket: Carbohydrates
– It should be easy to transfer data from a runner’s watch
– Training statistics: Time
– Training statistics: Heart rate
– Journal should be compatible with a tablet
– Journal should be compatible with a smart phone
– Journal should be compatible with a computer
– Journal should be compatible with a “pen and paper”, in example a spiral pad or a book
– Only log in to the journal once on electronic devices
– Nutrition values in diet journal automatically calculated for predefined meals
– “Pen and paper” should be a spiral pad and not a bound book
– Appearance should be compatible with information from runner’s watches
– Exercise descriptions
– Exercise descriptions should be animated

6.1.1.2 Qualitative comparison of the requirements

In general, the methods resulted in similar main requirements, but the qualitative analysis did find some patterns in the difference of the requirements. The following list, divided into the three topics described in section 3.3.2.1 shows the more distinctive differences that could be found in the requirements from the two processes.

• Appearance:
  – CRE requirements are general in nature and phrased to be applicable for the journals content overall.
  – RCD requirements are more focused on functionality and page content.

• Functionality:
  – No unique requirements for CRE.
- RCD had varied functionality requirements regarding:
  * compatibility with different technologies,
  * demands for each of these technologies and
  * usability oriented functionality.

- Contents:
  - Both methods had test results as a requirement but only CRE specified which type of results.
  - Both methods had requirements on training statistics and fitness training and specified some content for each of these. In addition to these, CRE specified some content for fitness training that RCD did not, and RCD specified some content for training statistics that CRE did not.
  - RCD had requirements on having a nutrition table from Livsmedelsverket and what it should contain.
  - RCD had requirements on some pages describing different exercises. In appearances, RCD also had a requirement that those descriptions should be animated.

### 6.1.2 The web tool design requirements

The CRE process resulted in twelve requirements concerning the web tool while the RCD process resulted in four. Two of these requirements can be found in both processes. A Venn-diagram showing the distribution of requirements can be seen in figure 25 and the requirements are shown in the following list:

- Unique web tool design requirements from the CRE process:
  - Not more than 3 clicks
  - Clean front
  - Clear overview
  - Progress indicator
  - Web tool content should be centred
  - Web tool should be responsive
  - Web tool should have buffer space at the sides.
  - Objects should be shadowed.
  - Web tool shall provide ability to save completed journals.
  - Web tool shall automatically save the progress of ongoing order at regular intervals.

- Unique web tool design requirements from the RCD process:
  - Clear steps
  - Different pages of supplementary aids

- Web tool design requirements from the both processes:
Easy to navigate
Easy to go back and change without losing information

Figure 25: The Venn diagram showing the overall requirements from the two processes.

This clearly shows that the CRE process has resulted in much more requirements when it comes to the web tool. The additional requirements are primarily design oriented with a few more concerning functionality.

6.1.3 User survey answers

The surveys were answered by seven people from the CRE process and nine people from the RCD process, respectively. The group of participants consisted mostly of people already familiar with using training journals. Some demographic information about the participants can be seen in the following list:

- **CRE process:**
  - Response percentage: 64% (7 participants responded of 11 possible)
  - Sex distribution: Two male, five female
  - Age distribution: Youngest participant was 26 years old and oldest was 53 years old

- **RCD process:**
- Response percentage: 100 % (9 participants in total)
- Sex distribution: Six male, three female
- Age distribution: Youngest participant was 17 years old and oldest was 36 years old

<table>
<thead>
<tr>
<th>Question</th>
<th>CRE process, average answer</th>
<th>RCD process, average answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How easy was it to understand the different pages / tabs in the tool?</td>
<td>3.86</td>
<td>4.33</td>
</tr>
<tr>
<td>I could walk through the tool without getting stuck.</td>
<td>4.14</td>
<td>4.89</td>
</tr>
<tr>
<td>How did you think that the tool worked in general?</td>
<td>4.00</td>
<td>4.11</td>
</tr>
</tbody>
</table>

Table 4: Survey answers regarding web tool. The numbers are the average score between 1 and 5 for each question, a higher number is considered better.

The first part of the surveys asked questions concerning the web tool. Table 4 shows that the resulting tool from the RCD process had slightly higher average score on all questions. A few comments were also made about the tool. In the responses for the RCD process, one participant wanted to have the ability in the tool to choose more of the information on top of the pages. One participant felt that the tool was easy to follow and had a good overview. Regarding the tool from the CRE process, participants liked that it was easy to overview but missed having back and next buttons between the pages.

The second part of the surveys concerned the possible contents of the journal. The first set of questions asked about the introductory part of the journal. Question one asked whether the selectable pages felt relevant to the participants. In the survey regarding the RCD process, all participants responded yes on the question. One of the participants felt some pages were missing, such as goals / vision / dream, personal best and personal measurements. Answering for the CRE process, six of seven participants responded that the pages felt relevant. The person who responded no said that he or she did not understand the circumstances around the question. Additionally, one participant missed pages concerning training results and an “open year calendar”.

The next set of questions asked about the journal pages, and the same questions were asked. Disregarding the choice made by each participant on which journal type they would have chosen if this was a real scenario, almost everyone answered that there was at least one relevant page for them. There was one exception. One of the participants, answering the survey for the RCD process, chose a double sided journal and did not feel that there was a relevant page to choose from for the right side of each day. This person felt that more possibilities to change the preprinted text for the pages was missing.

The third set of questions concerned the concluding part of the journal was similar to the previous two sets. Here, participants also responded yes without any exceptions. Answering for the CRE process, one of the participants missed pages for recipes and personal results, regarding weights and times. In the survey for the RCD process, one participant wanted to have additional pages for a diet journal, recipes, simple diagrams and a follow-up on body building.
The participants in both surveys could choose which page (or pages in the introductory and concluding parts) they would choose if it was a real order being made. Here, the diversity in the choices was substantial and most of the possible pages were chosen at least once by a participant. A few pages were not chosen at all, in the CRE survey no one chose motivational page with text in the introductory part, or additional pages in the journal part. In the RCD process, which had more pages to choose from, no one chose to have only fitness training on the whole page in the journal part, or blank writing pages in concluding part.

In the journal part of the pages from the RCD process, participants could choose to have a small writing area at the bottom of the page, the notation box. The nine participants were asked one or two times if they wanted to have a notation box, depending on their earlier choice of journal type. Six of the participants were asked two times and three participants were asked one time. In total the question was asked fifteen times with eight positive and seven negative responses.

6.2 Creating the Final Prototype

6.2.1 Choosing what to include

After completing the comparative analysis of the methods, a choice was made what to include from the two methods when developing the final prototype. The tool from the RCD method seemed easier to develop and became the foundation for the prototype. The tool from the CRE method was based on a single page layout, which was considered harder to develop than the wizard style tool from the RCD method. The journal content from the two methods was similar enough to be considered equally hard to develop. Most content was taken from the RCD results, but some content was included from the CRE process:

- A page with personal information.
- A body building page with four set on each line, where each set had weight and repetitions.
- The information square where the user can put in date, time and so on. also included “Feeling”.
- Extra diet pages in part three of the journal.

The choice what to include was made together with the client and a few pages were modulated slightly to work better with the rest of the journal. Through deliberation with the client some modifications were also made to the number of pages the books should include. The decision was also made to make it possible for the user to choose whether they want the journal to be six months or a full year. The full year option for the double sided journal and the combined training- and diet journal was removed because the journal was considered to be too thick and less likely to be used.

A decision was also made to add some missing functionalities to the web tool. To have some control over who orders a journal, users have to log in to access the web tool which implies that users has to register their own private account. Additionally, it was decided that the user should also be able to change their personal information, along with email and password, once logged in.
The final web pages were created using InDesign™ by Adobe. All pages created were more or less refined copies of the pages previously created from the RCD process. The pages were exported to Portable Document Format (PDF), with InDesign™, to be used in the journal and the PDF:s themselves were later exported to PNG images to be used in the web tool.

### 6.2.2 Development and coding

PHP: Hypertext Preprocessor (PHP) was used as the codes base with HTML as markup language for the front end. Cascading Style Sheets (CSS) was used for some simple styling of the user interfaces and JavaScript (JS) was used for much of the functionality.

The PHP code was mostly written from scratch with only a few exceptions. A public library called PHPMailer[^3] was used for all occasions where something had to be mailed to either the user or the site owners. PHP has a built in mail function but this does not support attaching files to an email in a simple manner. Being able to attach files is an important function for the web tool because the finished journals will be automatically sent to the printing company via email.

Two other libraries, FPDF[^4] and FPDI[^5] were used to create the journals after the users decided what they want to have in their journals.

Standard HTML was used throughout the website for building the front end of the pages. The styling for the pages were made using CSS. Most of the colour was grey scale since focus was placed on the web tools functionality rather than perfecting the appearance and CSS was therefore mostly used for positioning the different parts and elements on the web pages. Many of the pages had a lot of dynamic functionality and JS functions were used extensively for that purpose. Some of these functions were needed on several pages and they include:

- Hashing of user passwords, so that no passwords are transmitted in plain text.
- An overlay with a larger preview of a journal page is displayed if the user clicks on a thumbnail picture in the web tool.
- Checking that user input on personal information is correctly formatted when creating a user account or changing information.
- Updating user choices every time a user makes or changes a choice in the web tool.

One major change had to be made to the web tool during the development phase. In the original prototypes, the users were supposed to be able to upload an image to use as background for the front page of the journal. This functionality was discarded for two reasons. The first reason was that due to issues with developing that particular function, it was not possible within the time constraints. The second reason was that it became apparent during the development that an image could make the text on the front page hard to read, and again time was not available to find a suitable solution for this.

6.3 The Resulting Prototype

The final prototype consisted of all journal pages from the RCD process together with the added pages from the CRE process described in section 6.2.1. The prototype also included a web tool based on the designs from the RCD process. Lastly the web tool was incorporated into a website with full functionality for creating new user accounts and logging in. If the users was logged in, they could alter their personal information, create their journal using the web tool or log out.

![Image of the prototype](image)

Figure 26: A screen shot of the final prototype. The tabs on the top of the prototype is for the user account system.

6.3.1 Arriving at the website

The first page the user sees, the index page, has some text and three different alternatives to choose from. The user can log in, send for a password reset link or create a new account. If the users wants to log in, they must input their email and password and choose if they want to remain logged in to the website after closing their web browser. If the users have forgotten their password, they can request a new password by submitting the email address they used when creating their account. The users then receives an email with a link leading to a form for creating a new password of their own choice.

The users can also choose to create a new account by clicking the “New user” button. The users are then transferred to a form where the users fill out their personal information and chooses a password. As each field is filled, different verifications are made on the input information, verifying that the information is valid and follows the requested format. After finishing filling out the required fields, the user finalises the form by clicking the Register-button. The user then receives an email with a link to confirm the email address. When the email address is confirmed the new user account is complete and granted login privileges.
6.3.2 After logging in

The user is now transferred to a page with four tabs on the top. The first tab, “Start”, is where the user currently is. The page itself welcomes the users and has some information about the website and what the users can do now that they have logged in.

Clicking the second tab from left leads the users to a page where they can review and change their personal information. The users can change all information they provided when they first registered, including email address and password. The users can also choose to upload a picture of whatever they like. This picture can be seen as something similar to a profile picture, and will also be shown on the personal information page of the training journal. Lastly, the users can remove their account completely.

The third top tab from left leads to the web tool. There are not very many differences between the developed tool and the prototype described in section 5.2.2.2 but there are a few. The users choose the title text of the journal. The blank page users could choose on the single sided journal, the left page of double sided journal or the training page of the combined training- and diet journal was removed. The changes described in section 6.2.1 are also included but the user doesn’t create the personal information page in the journal, it is instead automatically generated by the tool.

6.4 Prototype Evaluation

The prototype was evaluated by the users via a survey similar to the web tool survey described in section 3.3.4.1. A total of twelve people answered the survey which is 60 % of the survey recipients. Five of the respondents were female, the youngest respondent was 18 years old and the oldest was 53.

Some questions were almost the same as in the earlier surveys and some questions were added because of parts that were present in the final prototype but not in the earlier prototypes. Most questions had the possibility to answer 1-5 where 1 represented a very negative answer and 5 represented a very positive answer. Table 5 shows the average answer from these questions.
<table>
<thead>
<tr>
<th>Question</th>
<th>Average answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>When creating the user account, how easy was it to understand which information to provide?</td>
<td>4.42</td>
</tr>
<tr>
<td>After logging in, was it easy to find the different pages and parts?</td>
<td>4.70</td>
</tr>
<tr>
<td>Did you understand which of your user information could be changed?</td>
<td>4.40</td>
</tr>
<tr>
<td>Was it clear how you changed the user information?</td>
<td>4.20</td>
</tr>
<tr>
<td>How easy was it to understand the different pages in the tool?</td>
<td>4.70</td>
</tr>
<tr>
<td>Regarding the navigation possibilities in the tool, were they easy to understand?</td>
<td>4.60</td>
</tr>
<tr>
<td>How do you think the functionality of the tool worked in general?</td>
<td>4.60</td>
</tr>
<tr>
<td>Did the page roughly meet your expectations when it comes to the functionality?</td>
<td>4.30</td>
</tr>
</tbody>
</table>

Table 5: Survey answers regarding the prototype. The numbers are the average score between 1 and 5 for each question.

There were also several simpler questions that only required a “Yes” or “No” answer:

1. When creating an account, did you get the email with a confirmation link?
2. Were you able to log in without any problems?
3. After logging in, did you miss any page or part?
4. Were you able to go through the web tool without getting stuck?

If the users answered “No” on the first question the survey was considered completed since getting the email with the confirmation link was necessary to be able to log in and try out the rest of the web page and the web tool. Of the twelve respondents, two answered “No” on the question and therefore did not answer the whole survey. Regarding the “Yes” and “No” questions, the answers were mostly positive in relation to the project’s goals, with one exception. This user could not go through the web tool without getting stuck at the first page of the tool.

The users also had the possibility to leave comments regarding the above questions. Comments included a few functionalities that were a little hard to understand at first and some missing functionalities. There were also positive comments like “The page works very well” and “The page is very pedagogical”.

7 Discussion

One of the research questions, and goals of the comparative study, was to evaluate if either of the two methods were better suited than the other. The evaluation was conducted with focus on how the two methods was like to work with and how well their respective processes fitted the parameters of the cases study.
7.1 The Methods

7.1.1 Methods compared

In terms of working with the methods for this project there were some differentiating aspects early on. These aspects mainly concerned the two methods’ approach to the development process. When working with the CRE process, the developer felt a sense of security, provided by the comprehensive scope of the project plan, but as each step started out, there was a noticeable difference in the amount of support to be found within the process. The grand plan of the process is well documented and depicted, as can be reviewed in section 4.1, but as the process moved deeper into each phase, the amount of provided guidance decreased. It is probably a conscious decision not to make the method too strict so that it will be applicable to a wider range of projects, but the difference and change of flow from well described to purposefully vague can be quite confusing and make the people involved in the process feel like they have missed something.

The RCD process on the other hand, while not lacking a comprehensive overall plan, continued to provide well defined guidance throughout the project with a strict schedule where one task is directly followed by another until the completion of the process. As a result, there was less time spent on figuring out the next step, which gave the developer time to focus on how to complete the next task on the predefined task schedule. Whether having a predefined schedule is a good thing comes down to personal preference, but for this project, considering the developers’ lack of experience, a clearly defined work process is better. This does not mean that the RCD process is a beginner’s method in preparation using methods requiring more experience like the CRE process, but it is more beginner friendly. Both processes have a lot of flexibility and an experienced developer could probably do a lot more with either of these processes.

7.1.2 Test group meetings

Since this project relies heavily on the input from the test group, there are some aspects, like individual interviews, that makes the RCD process a better fit for a user centred developed project like this one. With the CRE process, there are meetings held regularly with the stakeholders of the project, which means a lot of people in several meetings stretching over a long period of time. This is not a difficult task when working on a company project with stakeholders attending as a part of their job. But with a project as small as this, with meetings with volunteer participants, calling one of these meetings required a lot of planning, a locale and the ability to adapt to the participants’ schedules, all of which required a great deal of time without any guarantee of successfully holding a meeting.

In the RCD process, interviews are conducted one-on-one, and the interview should be held in a location where the product is to be used. This made scheduling much easier and the participants only had to attend a single interview.

The interview meetings themselves were also very different in nature in the two processes. During an interview for the RCD process, the interviewer would observe a similar product being used. This provided a great advantage over CRE’s approach of using observation as a separate task. While the meetings for
the CRE process were held like brainstorming meetings, where a lot of possibly
great ideas would come up, the combination of observing and interviewing at
the same time gave the RCD interviewer the opportunity to see things that the
users were not aware of doing. One thing that the interviewer saw was the user
switching between the mouse and touch pad for certain tasks because the system
responds better to a touch pad for that task. Combining the interview with
observing also gave the RCD process the advantage of keeping the user close to
the type of product being developed, keeping the mind focused on the product
at hand and what improvements could be made to the current design. With
the CRE’s brainstorm approach, there was a weaker connection to the physical
product since the meetings revolved around abstract theories and user desires,
and the possibility of drifting away from reality was substantially greater.

7.2 The Test Groups

The basic goal for the test groups for both methods was simply to have an
as even balance of men and women with varying degrees of expertise in using
similar products compared to the projects. As a whole, the participants that
took part in the project had an adequate distribution regarding age and gender.
The participants also had very diverse backgrounds and professions.

Regarding age of the participants, the age range was between 20 years to 50
years of age. Most participants were around 30 years of age (with a few outliers
in both directions). This range adequately covers the ages of people who use
similar products in real life except for teenagers, of which there was only one
participating in the study. Having a relatively young group does not disrupt the
projects’ findings in any major way. Since the product was designed to be used
by beginners, having young test subjects with less experience may have been
an advantage for the project. Of course, having a greater number of teenagers
in the study may have improved such an advantage. But, as most people start
using a training journal after a few years of activity, the low number of teenagers
should not impact the study in a negative way.

The participants’ occupations included students, web masters, plumbers and
a stay-at-home mother. While the field of work of the participants was known
to the developers, any further inquiries into their specific work titles were not
made in light of the already present diversity in work fields.

The distribution in gender was the weakest link of the test group with an
over-representation in male participants. In total, there were seven women and
ten men. Originally, the distribution would have been closer to half each but on
account of three drop outs from the project, the male-to-female ratio suffered.
Whether this difference in gender is an accurate reflection of the male-to-female
ratio in the fitness world was not researched in this project and without definitive
insight into the subject it was decided that an as equal number of men and
women as possible would best serve the study.

7.3 Analyses

7.3.1 Literature

Three different methods were used in this project to evaluate the two develop-
ment methods, qualitative and quantitative analysis and user surveys. Finding
literature for the analysis methods was hard for the qualitative requirements comparison and became something of an invention. Therefore it is very hard to know whether the results are valid or not, but the impression is that the results could very well be used to evaluate the differences in the requirements. The quantitative analysis looks at the number of requirements from each methods which is a very simple analysis but still provides a little more data for the study to consider.

7.3.2 Comparison of the requirements

In the qualitative analysis, the requirements from the two development methods were compared with each other and divided into three categories (section 3.3.2). When establishing whether a requirement from one of the methods was similar enough to a requirement from the other method, only the actual wording of the requirements was considered and not any background. This made the comparison easier but with the risk that the actual intent of the requirements were different.

This would, however, only have been the case if the requirements were not formulated precisely enough and not divided into an entity small enough which they were before the comparison. If all requirements are divided into the smallest possible entity, they should be clear enough so that the underlying intent of the requirements should become apparent.

In this project, the developers were careful in dividing the requirements into small entities before the comparison was made and the underlying cause should not have been different enough not having them considered the same if the words were similar.

7.3.3 Formulation of the survey questions

The questions in the survey are all formulated with regard to the theoretical guidelines about surveys (section 4.3.3). These questions should reflect the needed data about the resulting prototypes and considered, the two development methods should have got adequate answers for their intended purposes.

There is one problem in the comparison of the survey answers. The questions, although with the same basic meaning, had some differences in their formulation. There is a significant risk that this would affect the understanding of the question or the answers but in this project it is impossible to know if it did. There is no control group to compare the answers with and since the answers are very subjective this would probably not have affected the answers essentially.

7.4 Personal influence

7.4.1 Influencing the interviews

In every interview there is a risk that the interviewer influences the people in the interview. The interviews of the two methods were conducted very differently and therefore the possible influence is also very different.

In CRE the interviewer leads a group of people in establishing which requirements should be placed on the system. Here, the interviewer has some influence over the meetings which the interviewer also chose to use in this project. The
interviewer steers the interview in a new direction if the participants become silent for too long or if they start to discuss a certain topic in too great length or detail. The interviewer might also interrupt the discussion if understanding of the current topic is missing.

In RCD, only two people is present in each interview. The interviewee’s will conduct their normal work using their normal tools. Here, the interviewer should be careful not to interrupt or influence this work but some influence might be unavoidable. The interview itself is a kind of influence in the work and sometimes the interviewer has to ask questions, which is an uncommon interruption in the normal work flow.

The above was also true for this project, which makes the RCD process better when it comes to the interviewers influencing the participants. The influence from the interviewer should be as little as possible because the participants are the experts in the study and if the interviewer starts influencing the interview, expert opinions may be swept aside.

7.4.2 Difference between the developers

Since there are two different developers for the two developing methods, there will be differences in the developing process coming from personal opinions and influence. No two people think exactly the same and the result of the development will include these personal thoughts. If the roles would have been switched and the person now developing using RCD instead used CRE and the other person also switched development method, the result might have been totally different. This cannot be controlled by other means than actually switching the roles, and this in itself will also not be adequate since the developers have already developed the product once and will have thoughts coming from their first development when working on the new one.

The developers in this project have mostly the same educational background and experience. This should not have affected their personal influence on the project in any large way. The experience of working outside of a university does, however, differ between the two developers. The developer using the RCD method had much more experience with creating similar systems, especially when it comes to the web tool, and therefore might have affected the outcome of the RCD tool prototypes by removing things the developer knew would be hard to develop. This should not have affected the result of this project as a whole.

7.5 The Results

After evaluating the individual results and running them through the comparative study it was decided that the project would move forward with the results from the RCD process. From the comparative study it became clear that while both methods had produced results that their respective group liked and thought would fit the project, but there were a number of key points where the RCD results stood out.

Most importantly to note was that the web tool from the RCD method was much easier to learn. Since it utilizes a wizard approach to placing an order, the time a user needs to spend in the tool to use it properly is very low from the start, in contrast to the CRE solution that require some trial and error from the
users until they fully understand the tool. Ultimately the CRE approach could be faster than the RCD tool, but like stated earlier that would require time and practice before the users’ efficiency would increase whereas the wizard approach holds a level amount of needed time and expertise to use the tool from the first use and forwards (table 1).

The reason why the CRE tool became more advanced and lost some of its usability has to do with the brainstorming meetings for the prototype. Having an open group discussion with participants experienced in technical aspects, opens up for a lot of ideas with grounds in realistic solutions. With time other participants would pick up on the participant’s expertise and follow the lead of the perceived expert rather than voice their own thoughts, quicker so when they know the expert or feel that they lack any insight into such practices. The CRE’s final web tool prototype was suggested by one of the participants with skills in web design, and once the idea was brought up the group would only focus on that design. This created a strange situation from the norm of a CRE meeting, where everyone is an expert in some aspect of the project, to a situation where the stakeholders and test users are the same people, and having that insight instead brought the prototype in a less user-friendly direction in favour of a more simplistic design.

The designs for the physical product from both methods were mostly similar. There are, however, a few differences between the prototypes from the two methods. Most notably, is the number of pages and the design focus. The RCD method focused more on designing the content of the product while the CRE method focused more on the appearance.

Since all the participants of the project had used similar products to some extent, it seemed that the existing products shared a similar look, which the participants brought with them into this project. Whether there exists only a few ways to structure the designs, or there are a limited number of products on the market, is not certain. It is possible that since the test group participants were recruited by the same person, that they shared a linked preference to similar products.

7.6 The result of the analyses

7.6.1 Comparing the requirements

It is hard to know if all requirements considered equal in both development methods actually were equal (section 7.3.2). Therefore, it is difficult to know if the result from the qualitative analysis are correct. This might have affected both the qualitative and quantitative analysis. The quantitative analysis basically said that RCD had a few more requirements than CRE and the qualitative analysis gave some differences in the orientation of these requirements.

If many requirements that were now considered to be equal in both processes actually were not equal, due to differences in the background, the results of the analyses is misleading. This is most probably not the case, because when going back and reviewing the requirements, they were considered being categorised correctly.
7.6.2 Survey answers

The answers from the surveys showed that the prototype from the RCD method was slightly more liked than the prototype from the CRE method. All participants that answered the surveys were already part of the specific method, for which they answered the survey, in some way. In CRE they had been part of the group meetings, and in RCD they had either taken part in the contextual interviews, the prototype interviews or both.

Some people, answering the survey for the RCD process, were friends or even close friends to the interviewer. The risk of having friends answer a survey, where they evaluate something that a friend created, is that the answers can be more forgiving and kinder than they otherwise would have been. Hopefully, this was not the case as the interviewer insisted that the participants should answer the survey honestly and truthfully to their opinions.

The participating users are also not necessarily a complete representation of the population due to the small number of people answering the survey (section 7.2). In RCD, the participants were between the ages 17 and 33 and only 3 out of 9 were female. In the answers from the CRE process, the age span was between 25 and 53 and only 1 out of 6 was male. This uneven distribution of both age and gender might very well have affected the results, but because of project confidentiality there was little choice in this matter.

7.7 Personal influence on the result

The developers' personal knowledges, experiences and biases have definitely affected the prototypes and the results of the project as a whole. Knowledge of problems in creating the final systems led to removal of parts deemed to hard to develop in the available time span. These removals were, in some cases, made as early as in the first prototypes, and some were made during the development of the final prototype.

The reason for removing those parts has to do with the available time for the project. If more time would have been available, these parts would most likely have been included. Removing parts because of time constraints is never optimal for any project, but in this project it was unavoidable.

8 Conclusion and future work

The conclusion of this project is that software development methods can work well in developing physical products and that it was successful in this project. Also, RCD worked slightly better than CRE in this project but further more comprehensive studies have to be made to evaluate if this is a general conclusion. Also, the final prototype in this project is still only a prototype and more work has to be done before the product is ready for the market.

8.1 Conclusion

8.1.1 Software development methods for physical products

The first question answered in this thesis was “Can methods from computer software development be used for finding requirements for a customer modifiable...
physical product?”. Based on the work done for this project, applying software development methods onto physical development is entirely possible and in this case successful. Except for a few parts in the theories behind CRE like critical systems, the methods were directly applicable to this project with little effort. The parts of the methods that were excluded in this project were not left out because they were incompatible with physical development, but rather because they were not needed for this project. The RCD method was mostly applicable in its original form without sorting out unneeded aspects or extra work to make it fit. As applied for this project, both of the CRE and RCD processes performed well and have a good potential for usage in larger projects and studies.

8.1.2 Rapid Contextual Design compared to Classical Requirements Engineering

The second research question was “Two common methods are CRE and RCD. Is either of these better suited?” and this report found that RCD performed better than CRE on some points. Firstly, the interviews were much easier to schedule in the RCD method since they were one-on-one instead of in a group. Secondly, in the group meetings in the CRE method, it was discovered that some people were easily influenced by more outspoken participants, something that was eliminated in the one-on-one interviews in the RCD method. Thirdly, observing actual work, as in the RCD method, gave more user relevant results because the requirements were taken from actual work instead of what potential users envisioned they would do in the new system. Finally, the guidelines for the RCD method were also clearer and easier to follow than those of the CRE method.

Since the two methods produced similar main requirements, CRE worked, at least in this case, fairly well. Some companies may have an environment where CRE fits better in the organization, or is already a known and well implemented method. But as the second research question stated, the goal was to see which of RCD and CRE worked better in a project like this. The answer is that, although more data is needed to firmly determine if this is the case, in this small study both methods worked very well but in some ways RCD worked better than CRE.

8.1.3 Success of the product

Nearing the end of the project, the resulting design and prototype was presented to the client with great approval. Although the product was not completed, the prototype was functioning and designed well beyond what the client originally hoped the project would deliver. Before the presentation of the final product to the client, it was evaluated by the participants of the test groups, with overall good remarks and grades as presented earlier in section 6.1.3. The final mark of approval for the project came with the test results of the final prototype, where all users participating successfully registered to the website and completed a product order, with only two mishaps concerning account activation.
8.2 Future work

8.2.1 Further evaluating the methods

This study explored aspects that directly affected the development of its product, but this is by no means a complete study. The study would have been much more definitive if it was made on a larger scale. While the current study gave some good indications of what can be expected in similar studies, these findings are hard to verify without conducting a more comprehensive study. In a larger study both the involved development teams and test groups should be increased. Having one developer per method took a lot of time away from tasks that would have benefited from more attention as well as forcing the developers to essentially be their own managers.

Having a larger test group and, perhaps more importantly, conducting a more thorough recruitment of the participants is necessary to ensure that the test group is diverse and fits the targeted user group. Also, hiring the test group should simplify scheduling and ensure a good base for requirements elicitation. A part of the test group should also be put aside to be kept as a control group to help verify the study.

8.2.2 Further development of the product

The product developed in this project is basically a very high functioning prototype. There is still much more work that can be done to develop and evaluate the product further. Much of the work that can be done is regarding the appearance and design of the web tool where colours, fonts and similar properties are still missing. Additionally, there are some functionalities missing in the web tool and some back end properties that should be changed. Regarding the journal pages, more work on refining the design should be done. Suggestions for further development can be seen in Appendix A.
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Appendix A  Suggestions on further product development

This document show ideas and suggestions on further development of the website and the journal pages. These ideas were mostly not developed due to time constraints on the project as a whole.

A.1  Website back end

The back end is basically what happens “under the hood” of the website. The user does not, and do not need to, see or know what happens in the back end. The back end is mostly written using PHP and data is stored in sessions or in a database.

A.1.1  Storing of orders

At the moment, all active orders are stored as PHP session variables or cookies on the users’ own computers. This was a simple solution while developing the prototype but is not a sustainable solution. If the user chooses to change computer for some reason before the order is finished, that order will not be transferred to the new computer with the consequence that the user has to redo everything. The order will also still be present on the old computer which can be negative when it comes to the design of the front page.

Another problem is that if something happens to the session variables, the orders may be affected. If a session variable is overwritten by the user’s web browser, the order might be faulty. The solution for this is to save all order variables, currently stored as session variables, to a new table in a database. This is not hard to do, but it takes more time then we had for the scope of this project.

A.1.2  Old users

Currently, when users remove their accounts from the website they are just removed from the database. This is not a good solution if an old order has to be tracked back to an old user. Therefore old user accounts should be stored in the database.

A.2  Website front end and user interface

The front end and user interface are what the users see when the visit the website. This include the following:

- Appearance: Colours, fonts, text sizes, layout and so on.
- Content: Text, images, forms, buttons, links and so on.

A.2.1  Appearance

The current appearance is a very simple grey scale appearance with a few colours for the menus. This should be developed further using CSS so that the site as
a whole has a more appealing appearance. Some layout can also be changed if it feels like it is needed.

A.2.2 Content

Some content can also be changed. Most of the text content is “invented” by the two developers to have something to show on each page. This may not even always be correct information at all, such as the price information for the different journal types, and all this information should be gone through thoroughly to find out what is correct and what should be changed.

A.3 Website functionality

Users can already do several things on the website such as create users accounts, log in, change user information and create training journals. There are, however, a lot of functionality that could be added to the site. Examples of added functionalities could be discussion forums or a Facebook-like social site.

One thing discussed is adding an advanced web tool where the users would have more possibilities and more free reins when it comes to creating training journals. This advanced tool will be a complement to the more simple tool already present and the users choose which tool they want to use.

A.3.1 Simple tool

This tool is basically the one already present on the website. The users go through a guide where they can choose between pre-designed journal pages for each part. One addition might be added to this simple part and this addition is to allow the users to upload an image on the front page of their journals. Currently the users can only choose background and text colours for the front page but the possibility to have their own picture would greatly increase the individualisation possibilities.

A.3.2 Advanced tool

Exactly how the advanced tool should be designed is not yet studied but the idea is that the users should have much more freedom in the design of the journal parts and pages. The following is a list of suggestions about what the users could choose to include in their design of the journal pages:

- Own image on the front page (same as in the simple tool).
- Choose text colours, sizes and fonts for the journal as a whole.
- Be able to choose the size of the space between rows.
- Choose to have a frame around the pages in the journal as a whole.
- Choose text in the top information box and headings of the columns.

Another idea is to have a tool where the user completely designs the journal by using some kind of drag and drop system to add elements to the pages. Here the user has complete freedom over all the parts in the journal and can design
the pages exactly as they want. There are several possibilities for designing the advanced tool, depending on the level of freedom it is felt the users should have.

All these solutions should be extensively considered before following through with them. There is a thin line between giving the users more freedom and making the tool too hard to use. This also puts more demands on the back end when it comes to rendering PDF pages, which already takes some time. Therefore another solution for creating PDF from PHP might have to be considered.

A.4 Journal pages

In the description of the advanced tool, some suggestions of changes on the journal pages already have been mentioned. In a living tool, new pages should always be considered and sometimes an evaluation should be made to see if some of the present pages are unnecessary.

One addition mentioned in the advanced tool can also be applied to the simple tool; the possibility to have a frame around the pages. This can be solved using several methods. Either the current pages are remade with a frame using InDesign (the program used to create the current pages) or some similar program. FPDF and FPDI which are the libraries used to create the journal should also be possible to use to add a frame to the current pages while putting the journal together.

Choosing text colours, line colours, fonts, text sizes and / or space between rows could also be possible in the simple tool (using either of the ways described for adding a frame) but it has to be considered if it actually should be a possibility or if the tool looses its simplicity.