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Wireframing in Co-Design with and for Children

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Abstract

This thesis investigates how digital wireframing tools can be included into co-design with children for creating high-tech/low-fidelity prototypes, and how the wireframing activity influences the design process as a whole. An interdisciplinary observation team observed nine 12-year old children in a co-design workshop including paper prototyping and wireframing activities, followed by the children sharing their experiences through questionnaires and a group interview. Both the observed, and self-reported, data indicate that 12-year olds have no problems mastering wireframing tools designed for adults and they are able to continue the creative process while wireframing. Moreover, the children are motivated by creating digital wireframes and most would choose to present their ideas through this medium over paper prototypes, while at the same time acknowledging the benefit of creating paper prototypes first. The real-looking aspect of the wireframes was particularly motivating for the participants. Rather than choosing between digital and paper-based approaches to prototyping, digital wireframing can be successfully included as an additional activity to paper prototyping in co-design workshops. Regarding the value of the produced artefacts, they are of less value to the further design process compared to the conversations they stimulate through their creation. The most valuable aspect of including wireframing in co-design is the space it creates for designers and end users to discuss design solutions. The success of including wireframing further raises the question of how young the participants can be. This thesis is relevant to researchers of child computer interaction and planners of co-design workshops with children.

Sammendrag

Denne oppgaven undersøker hvordan digitale wireframing-verktøy kan brukes i co-design med barn for å lage high-tech/low-fidelity prototyper. Videre ønsker oppgaven å finne ut hvordan designprosessen i sin helhet påvirkes av å inkludere wireframing som aktivitet. Et tverrfaglig team av observatører observerte ni 12-åringer i en co-design workshop som inkluderte både papirprototyping og wireframing med digitale verktøy. Tilslutt i workshoppen fikk også barna muligheten til å dele sine erfaringer gjennom spørreundersøkelser og et gruppeintervju. All innsamlet data tilsier at 12-åringer ikke har noen problemer med å ta i bruk digitale wireframing-verktøy utviklet for voksne, og barna er i stand til å fortsette den kreative prosessen når de bruker verktøyene. Et viktig funn er at barna ble meget motivert av å lage digitale wireframes, og de fleste ville valgt dette for å presentere idéene sine til andre. Det at wireframene så realistiske ut var en stor motivasjonsfaktor. I stedet for å velge mellom papir og digitale verktøy for å lage prototyper, fungerer digitale wireframes godt som et supplement til papirprototyping i co-design aktivitieter. Med tanke på verdien av det som ble produsert, så er det heller diskusjonen som oppstår som er verdifull for designere. Gjennnom å lage realistiske wireframes blir barna motivert til å designe, og dette skaper en arena for diskusjon mellom designere og sluttbrukere. Det at wireframing var sukkessfullt med 12-åringer stiller også spørsmålet om hvor unge deltakere i en slik aktivitet kan være. Denne oppgaven vil være relevant for forskere innenfor 'child computer interaction' og de som jobber med barn i designprosesser.

Dedication

This thesis is dedicated...

> ...to my two eldest daughters, whose patience with their mother during working weekends and summer holiday has been remarkable and of the utmost support.
>
> ...to my youngest daughter, who was born during the course of conducting this research, and whose nap time has provided the opportunity to write large parts of this thesis.

And to...

> ...my husband who has, in addition to taking care of the children, also found time to read and provide feedback to the whole thesis in the midst of making all the arrangements for the family to move houses across the country.
>
> ...all the grand-parents who helped with the children, giving me time to finish the thesis with the knowledge that my children were well looked after, all three of them.

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I would, of course, also like to extend my gratitude to the whole Superteam at NRK Super, who showed interest in the project, and were available for discussion and feedback after Nina moved on to other projects.

Lastly, I would like to express the deepest gratitude to all the participants in the usability tests and the design workshop, along with their parents and teachers, for volunteering their time. Without you, this project could not have taken place.

Contents

Abbreviations

CI	Cooperative Inquiry
D-ID	Dialogue with individual Interaction Designer
DEVAN	DEtailed Video ANalysis
GI	Group Interview
HCI	Human-Computer Interaction
ID	individual Interaction Designer who has been involved in the research project
ON	Observation notes
PD	Participatory Design
PP	Paper Prototyping
Q	Questionnaire
RQ	Research Question(s)
SQ	Sub-Question
ST	Superteam at NRK Super
SUPEX	Structured Usability Problem EXtraction
TA	Thematic Analysis
W-ID	structured interview with Written responses by individual Interaction Designer
W-ST	structured interview with Written responses by Superteam
WF	Wireframing

1. Introduction

1.1 Background

Involving Users in Design Processes

Developing the right product for the right audience is widely accepted as a key factor for determining its success in the marketplace, and the idea to achieve this by involving end users in the design of new products stems from the 1970s. With the growing realization that usability could be improved by involving end users in the design of new technologies, two main movements developed in parallel: user centered design in the US in the 1980s [30], and participatory design with factory workers in the 1970s [7]. While factory workers were the initial target of user involvement, the methods have later been applied, and adapted, to various industries.

Some of the methods which have evolved from the core principles of user centred design include User Centred Design, Participatory Design, Cooperative Design, and Learner Centred Design to name a few. Although they differ in how they involve users and for which purpose, they all share the feature that they originally targeted the adult worker. However, as technology is increasingly integrated into domains other than the workplace, a product's particular context of use is important to consider. The early experiences of participatory design were focused around *adults* at *work*, giving rise to certain requirements, whereas, designing for *adults* and *leisure*, today, would result in a completely different set of requirements.

Moreover, just as 'adults' is not a homogeneous user group, several distinct user groups exist outside of this group as well. Digital products are increasingly making their way into children's educational and private lives as well, and as with any particular user group, they have their own needs and wants regarding digital products.

Involving Children in Design Processes

Involving children into the design process has been extensively researched in recent years [21, 43, 47, 63]. Allison Druin, a pioneer in the field, has identified four different roles children can take as part of interacting with, and designing, new technology [22]. These are: User, Tester, Informant, and Design Partner, and vary in the extent to which children actually influence the final product.

For more than two decades, she has invited children into the Human-Computer Interaction Lab at the University of Maryland where they, as design partners in intergenerational teams, partake in various design processes to design digital products [21, 27, 33]. Initially, many of the techniques she used were inspired by techniques from participatory design. However, in order to meet the needs of the intergenerational design team, the techniques have been regularly adapted and her team has developed a new methodology, called Cooperative Inquiry [21], for working with children as design partners. Cooperative Inquiry is developed primarily with 7-11 year olds, but studies have been conducted with children as young as 4 years old [27]. Today, much of the research on child involvement in design processes draws on her studies.

Paper Prototyping with Children

In addition to being an established technique for quickly visualizing ideas in the early phases of design, paper prototyping is a main component of cooperative inquiry. Through various activities such as observation, mixing ideas [33], and feedback sessions with sticky notes [74], the teams produce low fidelity prototypes of their ideas using arts and crafts materials, or "Bags of stuff" [74]. Creating paper prototypes using such materials is a successful technique for visualizing ideas as the materials are familiar to most participants, and everyone has some experience working with paper, scissors, glue sticks etc.

Digital Prototyping with Children

As paper prototyping is a physical activity, it works best with co-located teams. However, for certain products, working in distributed teams might be desirable, or necessary, and attempts at have been made at digitalising paper prototyping [75]. In these situations, functionality is often added to the digital tool, such as collaborative features for aiding distributed teams. However, most of the literature regarding the inclusion of digital tools in design with children is limited to comparing paper-based activities to tool-based activities, and investigating how one could be replaced with the other [37, 38, 75].

1.2 Motivation

Common practise in design processes is to begin with sketching and paper prototyping to visualize, test, and share early design ideas and concepts, and children are clearly able to partake in such activities. However, as the level of interaction and navigation existing in today's applications differ greatly from the 1990s, professional prototyping tools have been developed to better mimic this new level of interaction and navigation. Once initial ideas are visualized through paper prototypes, digital prototypes or interactive wireframes are created to add more structure and finesse to the prototypes [16, 29]. Such digital prototypes are also easier to organize as navigation is built in, and lend themselves more easily for testing with potential users as they can be shared digitally, eliminating the need for the "wizard" in Wizard of Oz-testing of paper prototypes [53, p. 96].

Apart from a single article simply stating that wireframing was used in a design process in their study [55], the author has not been able to identify any literature whose aim is to extensively discuss the involvement of children in creating digital wireframes, or how this could influence the design process.

In design processes in industry, the creation of digital wireframes is not an activity replacing paper prototyping, but the natural next step for refining and sharing them. As children are already successfully involved in creating paper prototypes, they might even be able to create the digital wireframes themselves, and as a result, further extend their participation in the design process. Whether this is at all possible, or of value to the overall design process needs investigation, and is the topic of this research. This research project aims to involve children even further in the design process, than has previously been done, through studying how children can be involved in creating digital wireframes themselves, and how this influences both them and the greater design process.

1.3 Research Questions

This research project has an overall research aim, which it aims to answer through four related research questions. These are as follows:

Overall Research Aim

How does the design process benefit from involving children in digital wireframing?

Research Questions:

RQ1: To what extent do children master existing wireframing tools?

RQ2: How can wireframing be included in co-design workshops with children?

RQ3: How does creating digital wireframes affect the children's motivation for participating in co-design workshops?

RQ4: What is the value of the produced design artefacts for the design process as a whole?

1.4 Context

A Collaboration with NRK Super

The project is conducted in collaboration with the development team (Superteam) at NRK Super, the children's channel of Norway's national broadcasting corporation (NRK). The channel produces TV shows for children aged 2-12 and Superteam's biggest digital products are a website and app where children can view all NRK Super's shows, play games and consume news relevant to children. NRK Super work closely with children to understand their audience and develop new concepts and have experience involving children into various stages of the design process. Based on this experience, interaction designers at NRK Super acknowledge that the methods

developed for adults need to be adapted when working with children, and they are interested in exploring different ways of involving children into the process.

Thus, the collaboration between the NRK Super and this research concerns the process of involving children into co-design workshops and exploring how wireframing can be used, as well as providing the channel with concrete insight into their target audience. NRK Super will provide a concrete case, based on their ongoing projects, which will allow investigation of the overall research aim.

How *Wireframing* is Used in this Study

Wireframes specify the structure of websites (or applications) by defining the individual pages, their content, and the navigation between them [15, 26]. Wireframes can generally be expressed either digitally or on paper.

In this study, *digital* wireframing tools are used to create high-tech, low-fidelity prototypes, but the tools are *not* digital drawing programs aiming to replace paper prototyping. First, the wireframing tools included in this study let users design graphical interfaces by combining previously designed UI elements. Second, the navigation between the different screens is digitally implemented, resulting in interactive prototypes.

1.5 Scope

Age limits

With all the different developmental stages of children, children do not constitute a homogeneous user group [50], and the scope needs to be limited if satisfactory answers shall be provided to the above research questions. NRK Super's target age range is 2-12 year olds and Cooperative Inquiry targets 7-11 year olds. The scope of this research is limited to 10-13 year olds, and the particular age group has been chosen for three reasons. Firstly, NRK Super finds it especially challenging to reach the older range of their user group and is very interested in involving this age group in design activities. Secondly, the targeted age range pushes the upper age limit of participants in known works on Cooperative Inquiry where similar design activities have proven successful. Lastly, wireframing can be seen as another layer of abstraction on top of paper prototyping, and the upper age range is chosen rather than the lower age range based on their more developed understanding of abstractions.

Design over Programming

When talking about children and computers, there is often a focus on teaching children how to code. Numerous activities and initiatives exist for exposing children to this practical skill of developing their own digital products. However, understanding the development of new technological products is much more than simply knowing how to program. The design process is just as important, or even more important, for ensuring that the right product is created. Creating tomorrow's technology is not only a programming challenge, but also a challenge in understanding and uncovering the needs of end users. Bill Buxton has written a book about the difference between

'getting the design right' (coding) and ensuring the 'right design' (ideation activities) [14]. This project is interested in how to get the right design.

Including in the Design Process versus Teaching Skills

Through involving the children in design activities, the children will necessarily gain insight into design processes. However, teaching children how to design is *not* the aim of this research project. Rather, children are involved in co-design activities for the purpose of revealing insights about the user group they represent. This research project is rooted in the field of interaction design, exploring the inclusion of one specific activity into participatory design, rather than aiming to teach the children certain skills.

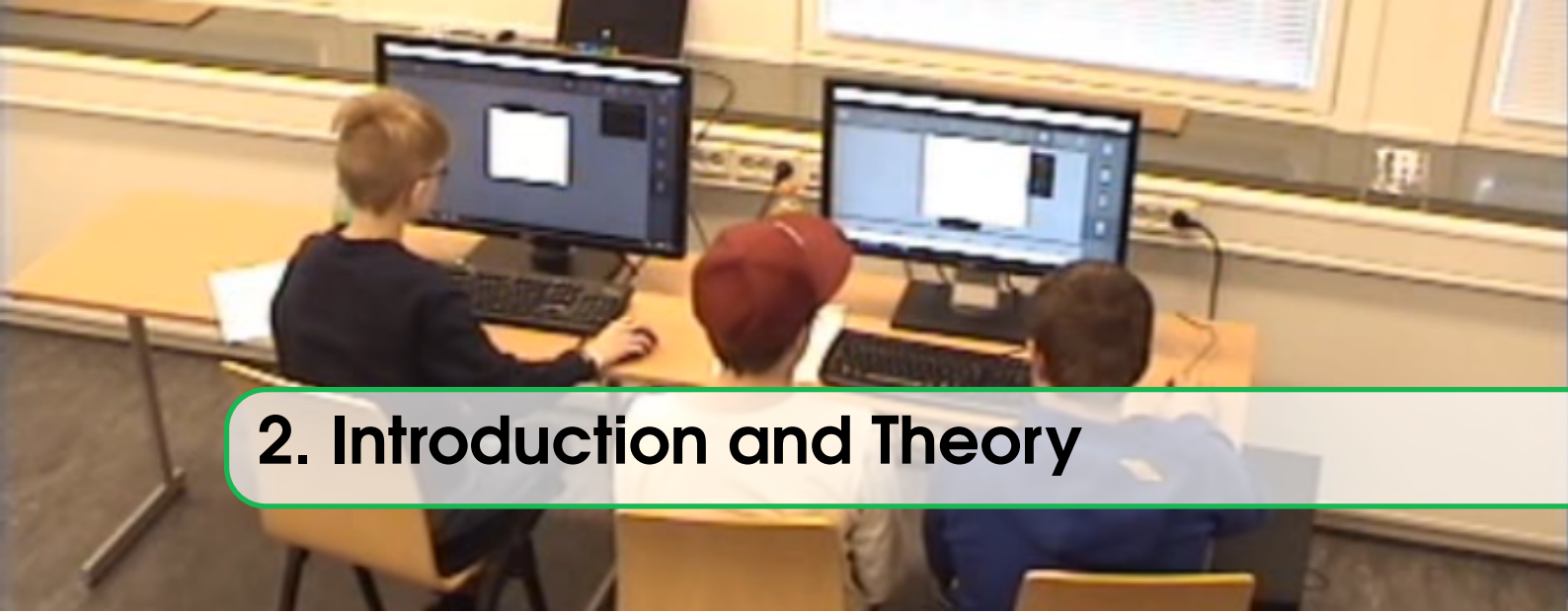
1.6 Outline

This thesis is divided into three parts. Part I is a feasibility study surveying and identifying the existence of necessary tools for investigating the overall research aim. This is done by investigating RQ1.

Part II is dedicated to the research on RQ2-4, and constitutes the main body of research for this research project. After RQ2-4 have been investigated and discussed in detail, Part II ends with a chapter taking a step back and providing a reality check of the findings of the whole study by discussing them in the context of NRK Super.

Part III concludes the whole study and offers suggestions for future work.

Feasibility Study: Usability Testing



2. Introduction and Theory

2.1 Introduction

In order to investigate the overall research aim: *How does the design process benefit from involving children in digital wireframing?* we first need to know whether children master *existing* wireframing tools. This is the first research question, and this research project begins with conducting a feasibility study to determine whether investigation of RQ2-4 can be pursued or not at this stage.

The results of the feasibility study will determine the way forward of this project. If it proves that children are fully capable of using existing wireframing tools designed for adults, further research on RQ2-4 can be undertaken. Otherwise, an adaption of such tools will be the way forward.

Research Question

Naturally, all existing wireframing tools cannot be tested with children. Thus, a limited set of tools needs to be selected before RQ1 can be investigated. This leads to one sub-question related to RQ1, and the aim of this feasibility study is to answer both RQ1 and SQ1:

RQ1: To what extent do children master existing wireframing tools?

SQ1: Which existing wireframing tools should be selected for usability testing with children?

Outline

The rest of this chapter presents the relevant theory for the feasibility study. Chapter 3 describes the overall research design for investigating RQ1 and SQ1 and Chapters 4 and 5 describe how the individual methods and materials are applied in the study. Chapter 6 presents the results from the feasibility study, and Chapter 7 discusses how these results shape the rest of the research. Chapter 7 also includes a section on *Limitations and Lessons* which discusses aspects of the feasibility study which could influence the validity of the results obtained. Lastly, Chapter 8 summarizes the feasibility study and can be read as a stand-alone section. It provides the reader

with sufficient information to read the rest of the thesis without having to read the feasibility study in its entirety, or if in need for a quick recap of the findings.

2.2 Theory

2.2.1 Evaluating Software for Children

The research field of evaluating software and interfaces for children was more active a few decades ago than today [11]. At that point, there was a strong emphasis on evaluating the fun of games and the learning aspect of educational software [64], and less on general usability of software not primarily aimed at education or entertainment. However, lessons from evaluating games and educational software can be used as a starting point for evaluating other types of software. Moreover, inspiration can be drawn from lessons learned decades ago, as long as one is mindful of this fact if applying them in a new context.

Buckleitner [11] investigated the state of children's software evaluation in 1999. He begins by raising several important questions relating to the evaluation of children's software. The questions address the intended purpose of the software, the intended audience, context of use, theoretical orientation of the evaluation process, and whom is performing the evaluation amongst others. He further traces the historical development of such evaluations and states that *software evaluation* were actively published keywords in the 1980s owing to the novelty of computers. Interestingly, however, "the amount of software evaluation activity has decreased significantly in subsequent years, despite the gradual increase in computer use with children and the dramatic increase in the computer's potential for delivering educational experiences" [11, p. 214]. Regarding the future, the biased and often unreliable evaluation practises from the past need improvement. Buckleitner focuses on evaluation methods of educational software and argues that future evaluations need to be more democratic, inclusive of children's own opinions and integrated into lesson plans.

Moreover, depending on who is performing the evaluation, and for which purpose, different considerations will be made. However, as no evaluations are completely unbiased, this bias does not need to prove a problem as long as it is made clear from which viewpoint the software is evaluated.

As an example, one purpose for evaluating children's software is when new software is to be acquired by a school. *brighthubeducation.com* [24] is an online source related to education which addresses the difficulties of having to evaluate software for this purpose and has published an article [76], to help evaluators in this situation. These criteria include the extent to which the content is valuable, the availability of technical support, ease of use, budget fit and free trials to name a few. It also provides a checklist educators can base their selection on and adapt as necessary.

Lastly, a more recent study from 2005 [64] emphasises the importance of usability for children. When investigating correlations between all three aspects: usability, fun, and learning, in educational software, the authors found correlations between *fun and usability*, but not between *fun and learning* or between *usability and learning*. One of the conclusions of the paper is that "usability does matter to children, so getting it right should be a priority for designers and manufacturers." [64]

2.2.2 Evaluating Children's Interaction with Software

PLU-E Framework

Several methods exist for evaluating software and each have their own strengths and weaknesses depending on the type of software being evaluated. Characteristics of the user group can also play a part in which method to choose. To the author's knowledge, much is written on evaluating games and educational software with children, but less on evaluating software such as wireframing tools, which are neither games nor educational in themselves.

In order to determine how to conduct evaluation sessions with children and wireframing tools, the PLU-E framework introduced by McKnight and Read [51] is highly relevant. This framework categorises software for children according to three parameters based on the three different roles children can take when interacting with software: Players, Learners, and Users. The corresponding software parameters are Entertainment, Education, and Enabling. The particular role a child plays in relation to the software affects how the product should be evaluated and consequently which evaluation method to use. If, for example, software is to serve the purpose of entertainment, the Fun Toolkit [57] could be an appropriate evaluation method [51, p. 3]. If, however, the purpose of the software was education, Pre- and Post-Tests could be used to evaluate the appropriateness of the software [51, p. 3].

The PLU-E framework contains 5 steps to ensure an appropriate and systematic evaluation process. The steps are:

1. Decide on the purpose of the product.
2. Identify core users.
3. Project teams agrees on a PLU weighting.
4. Decide when evaluations should take place.
5. Based on 3 and 4, evaluation can be planned.

Steps 1-3 are relevant for selecting an appropriate evaluation method for the tools in this project. Steps 4 and 5, however, are more applicable when planning the different phases of a whole design process, which is not the case in this study.

The purpose of the wireframing tools studied here is, first and foremost, to create wireframes which can be used for testing and visualizing ideas. Wireframing tools can be grouped into the category of word-processing and presentation software, and are, therefore, classified as enabling software according to the PLU-E framework, with children as users.

The relative importance of the three parameters: Entertainment, Education, and Enabling can be visualized as a three dimensional space where the three parameters make up the axes. Wireframing tools are categorized as enabling software, and would be positioned far out on the enabling axis, see Figure 2.1.

Even though children might be entertained by making wireframes and learn something about the design process, entertainment and education are not the primary concerns of the software, nor is it created for this purpose.

According to PLU-E, usability testing is a natural choice of evaluation method if a software's prime purpose is that of enabling a user to perform a certain task [51, p. 3], as is the case here: evaluating software enabling children to create wireframes.

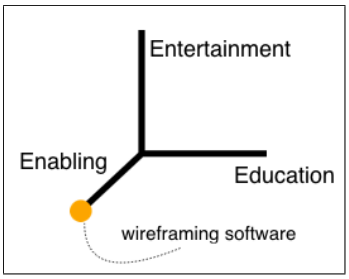


Figure 2.1: Positioning of wireframing software in PLU model

Landscape of User Research Methods

Rohrer [61] also discusses available methods for evaluating user experience of user interaction with a product. He argues that at least 20 methods exist for user-research, but that individual projects only use a few of these methods. Each method has its particular advantages and disadvantages depending on the context of use, and he maps the methods according to three dimensions: (1) Attitudinal vs. behavioural, (2) Qualitative vs. quantitative, and (3) Context of use, see Figure 2.2 [61].

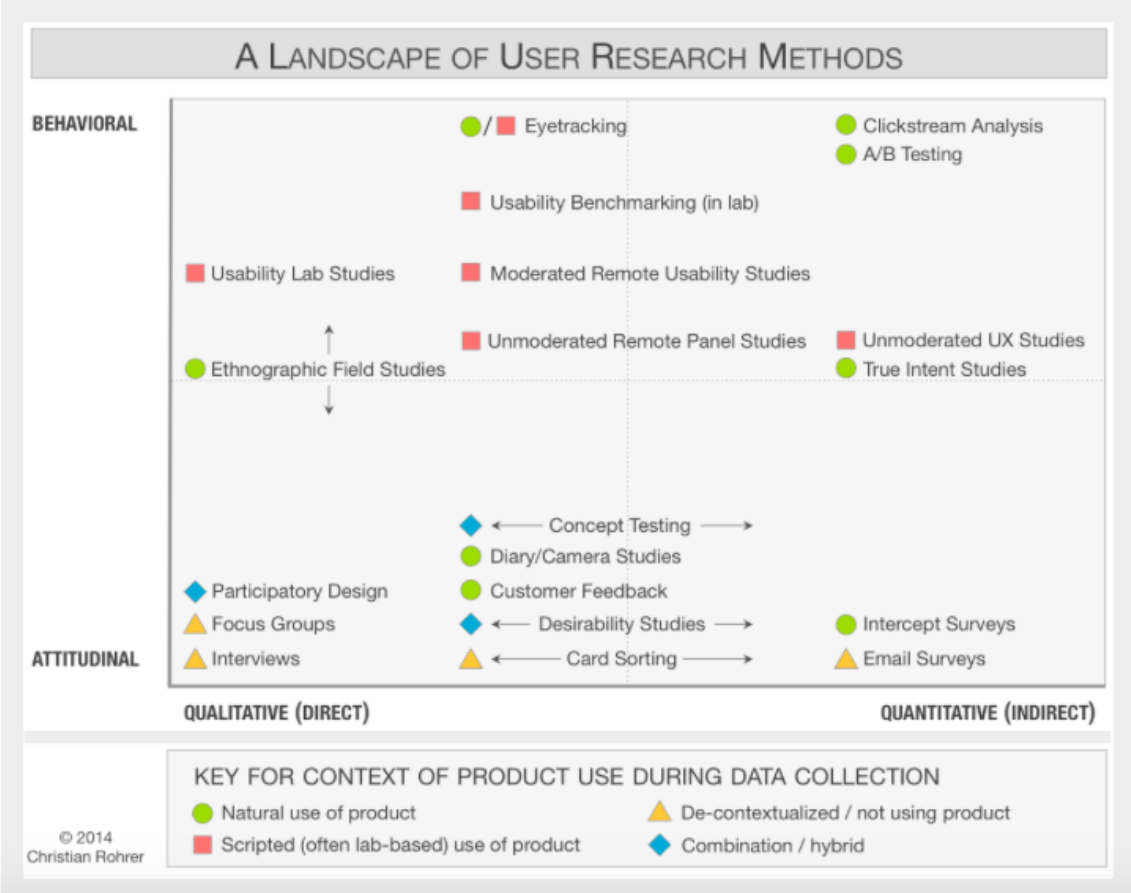


Figure 2.2: Rohrer's landscape of user research methods [61]

Determining whether children are able to work with wireframing tools, or not, is the goal of this feasibility study, and observing a few children from the target age group working with the tool will be sufficient. No extensive quantitative research is necessary for gaining this insight, and a qualitative assessment of observing children will suffice. This places us on the qualitative side of Rohrer's landscape as direct observation of the children is key.

The other dimension, attitudinal/behavioural, is distinguished as follows: Attitudinal relates to "'what people say'" [61], while behavioural relates to "'what people do'" [61]. Behavioural information is of primary concern here as we are interested in the extent to which the children can actually *use* the tools effectively. The children's attitudes towards the tool would be of interest if including it into a bigger design process, but is of lower concern at this point.

Lastly, Rohrer describes three contexts for interacting with products: (1) natural, (2) scripted, (3) not using, and (4) hybrid of the above. In this study, where it is uncertain whether children have even used such tools before, or not, the interaction must be scripted. If there was a natural environment in which to observe the users interacting with the product, the feasibility study would be redundant by definition.

Combining the choices made above, relating to placement along the different axes, again reveals usability testing as an appropriate user research method for this purpose.

Interviews, Think-Aloud and Co-discovery

Usability testing is normally paired with observation and 'think aloud' as data collection methods. However, there exist alternative, or at least additional, techniques to be considered.

Interviews are an additional technique for gaining further insight into the mental processes of the participants. Vermeeren, Bekker and Ridder [72] have previously experienced difficulties with activities such as think-aloud and co-discovery, and have investigated how post-task structured interviews can aid in understanding the children's intentions and actions when interacting with software. In their study, they found that the children were able to answer the questions and that a few more usability problems were detected based on the interviews than from solely analysing video recordings of the tests. However, they propose that structured interviewing is only applied after tasks where the observer feels the need, and not after every single task performed by the child.

Think-aloud is "a very direct method to gain insight in the knowledge and methods of human problem solving" [66, p. 1] and commonly encouraged in usability testing. By having participants say out loud what they are thinking, observers gain valuable insight into which problems participants meet and their thoughts on how to solve them [62, p. 54]. Despite being used successfully with adults, its applicability with children should be addressed. Baauw and Markopoulos [4] state that "the child tester is expected to expend cognitive resources for both using the system under test as well as providing verbalizations...[and]...the child is put in a socially awkward and uncomfortable situation...performing something akin to a monologue in the presence of an adult evaluator" [4].

Baauw and Markopoulos [4] have compared the think-aloud activity and post-task

interviews with children with the aim of identifying which of the two techniques uncovers the most usability problems. They found that when counting the problems identified by the two individual techniques, think-aloud was more successful. However, when using additional measures of usability, such as observation and video analysis, the two techniques were equally successful. The researchers concluded that if evaluators use data from several different sources, the results will not differ much. However, if researchers do not have time to spend analysing videos, post-task interviews can be practical "at the cost of slightly longer evaluation sessions with children." [4].

Co-discovery, or co-participation, is another method developed to address the unnaturalness of think-aloud [1]. It involves users working in pairs when interacting with the software in order to stimulate natural conversation. This conversation is meant to replace or support think-aloud. There are mixed experiences with this technique. Vermeeren et al. [72] experienced that children of 13-14 years old tend to discuss unrelated topics during the usability tests, while [1] observed positive dynamics in pair interactions consisting of students. In their study, "single test participants struggled with think-aloud...[but]...for the co-participants, thinking aloud came naturally because it involved two people having a conversation." [1, p. 14]. Relating to children aged 6 and 7, van Kesteren et al. [44] found that co-discovery was unsuccessful as the children did not collaborate very well, and even to the extent that they "work individually and a form of competition takes place." [44, p. 48].

2.2.3 Usability Testing with Children

Guidelines from Microsoft

In 1997, three usability engineers from Microsoft published guidelines on how to adapt standard usability testing to be used with children [35], where they share some of the lessons they have learned from their experiences of including children's views into design processes.

They begin by dividing children into separate age ranges, pre-school (ages 2-5), elementary school (ages 6-10), and middle-school (ages 11-14), and argue to which extent usability testing needs to be adapted to be suitable for the different age groups. Most change is necessary for the youngest age group, whereas some of the older children are able to participate in ways similar to adults and can even "think aloud".

Next, the engineers divide the usability tests into four stages: (1) Set-up and planning, (2) Introductions, (3) During the test, and (4) Finishing up, and offer concrete advice of how to adapt these stages.

In stage 1, decorating the lab to make it more child-friendly, and scheduling enough time for children to explore the lab is advised. Children's attention spans are shorter than adults, and they can therefore not be expected to come in for long sessions filled only with strictly usability related tasks. Another guideline is to schedule enough time in between children. Working with children can be more demanding than working with adults and the observer will need time between tests in order to perform well. Being critical of children's knowledge is another important aspect. Children with too little experience with computers might make for a challenging usability test, while children with too extensive experience will not give

an accurate representation of the target user group. Thus, recruiting participants from somewhere in the middle is suggested.

In stage 2, just as with adults, establishing a relationship through informal chatting in the beginning is important to create a relaxed atmosphere. Addressing subjects of interest to the children, such as birthdays, favourite subjects or sports, is necessary here. It is also important at this stage to be clear about the limitations of the product and emphasise the fact that it is the product which is being tested and not the child. For older children, they can be motivated by feeling that they have an important role. The test administrator can "tell [the children] that [they] have forgotten what it is like to be a child, and that [they] need their help to make a good product for children all around the world" [35, p. 12].

In stage 3, it is important to "make sure children understand what is being asked of them" [35, p. 13] and check for signs if they are forgetting the task. The authors suggest gentle ways of reminding the child about a task including engaging them in conversation and pretending that they need help from the child. Moreover, positive feedback helps encourage the children, and for longer sessions breaks should be offered.

In stage 4, body language is a much more reliable source of children's true feelings of a product than their answers to questions. Thus, the observer should be mindful of such body language throughout the test. Older children can be asked to offer feedback at the end, perhaps using a child-friendly scale, such as a smileyometer [78], to assess the product. Lastly, it is important to state how the child has been of help, thank them for their efforts and even reward them with a gift certificate to show one's appreciation.

Comments from Usability Experts

Jeff Rubin and Dana Chisnell have written the highly referenced "Handbook of Usability Testing" [62], where they extensively detail the process and purpose of usability testing. In one of their chapters, "Variations on the Basic Method" [62, pp. 293-314], they include a section on children as a particular user group.

They address the challenge of recruiting child participants, but offer a solution contradicting that of Hanna et al [35], discussed above. Where Hanna et al. dissuade from recruiting children of colleagues (as their knowledge might be unrepresentative of the larger child user group), Rubin and Chisnell suggest starting with personal connections.

They further emphasise the role of the parents, and the job of recruiting children is more a job of recruiting the parents. Addressing the parents and meeting their concern with necessary information is important.

Scheduling sessions with two or more children is also recommended in order to take advantage of co-discovery, see Section 2.2.2.

Lastly, given the shorter attention span of children, the authors suggest removing any source of distraction from the "test design, the product, and the room" [62, p. 299]. This could potentially conflict with the advice from Hanna et al. to decorate the room.

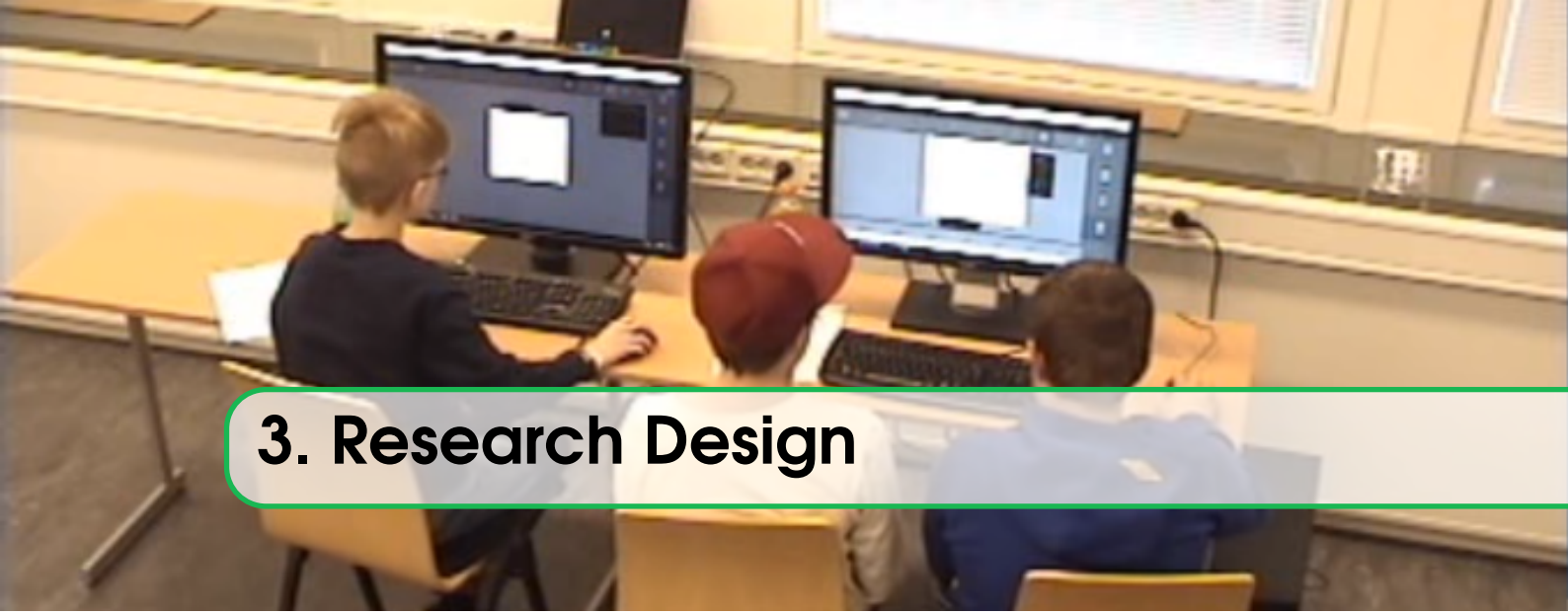
2.2.4 Analysing Video Recordings of Usability Tests

DEVAN

DEVAN is a "tool for detailed video analysis for user test data"[73, p. 403]. By representing user-interface interactions through tables, the aim is to identify potential usability issues by classifying interactions according to a checklist of "breakdown indication types" [73, p. 409]. The authors address the fact that "user testing is often considered the best technique for getting insights into usability problems" [73, p. 403] but that "there is no standard way of analysing data from user tests" [73, p. 403]. In order to analyze user data scientifically, the information in the video tapes needs to be "extracted and compared across users as well as across test conditions" [73, p. 404]. The framework aims to offer exactly this, a method of describing interactions and usability problems so that they can be compared across contexts.

The procedure of applying DEVAN is divided into two main activities, (1) Creating the interaction table and (2) Creating the list of observed indications from breakdowns. In step 1, "logging and transcribing actions" [73, p. 410] forms the basis for further grouping related actions into "interaction segments" based on threshold pause times. Such pause times are determined by analysing a pilot sample of recording. The format of the interaction table is inspired by the SUPEX (Structured Usability Problem Extraction) framework proposed by Cockton and Lavery [18] which "isolates and analyses *episodes* of interaction before it analyses difficulties" [18, page 345].

In step 2, indications for breakdowns are located in the interaction table based on a checklist of breakdown indication types. The identified breakdowns are then further described in the list of observed indications for breakdowns. This list should then provide the researchers with potential usability problems which can be compared across users and contexts.



3. Research Design

The research design for this research question, and the ones to follow in Part II, is based on Oates' model of the research process, see Figure 3.1 [54, p. 33]. Oates has written about 'researching information systems and computing', and describes in detail various research strategies and data collection methods. He further offers suggestions as to how they can be effectively combined. His model presents a clear overview of the research process with all the different research strategies, data collection methods, and data analysis methods he describes in his book, combined in a useful figure to help researchers design and plan their research.

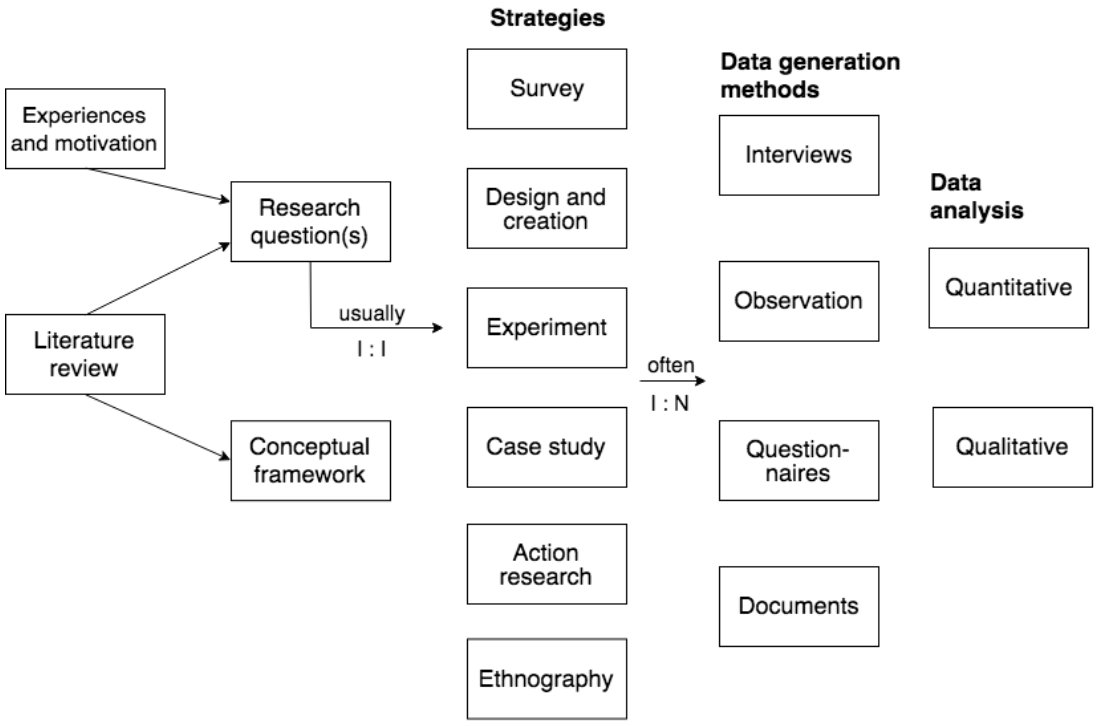


Figure 3.1: Model of the research process [54, p. 33]

This chapter details how different research strategies and methods are combined to collect necessary data, and how to analyse this data, to most effectively answer SQ1 and RQ1.

3.1 Research Process of SQ1

Figure 3.2 outlines the research process for investigating SQ1. The process is based on Oates' model, Figure 3.1 where the relevant elements are extracted.

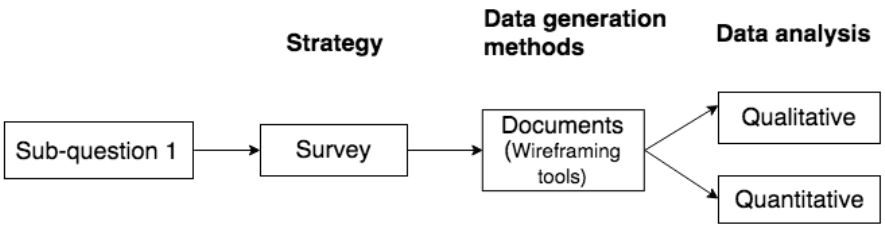


Figure 3.2: Research process for SQ1

For investigating SQ1, existing wireframing tools will be surveyed and a list of tools for further evaluation will be compiled. The specific tools are then treated as 'documents' in Oates' model, and analysed both qualitatively and quantitatively. The evaluation of the specific tools will be based on a set of evaluation criteria, determined by studying existing literature on how to evaluate software for children, see Section 2.2.1. Thus, the individual tools will be evaluated quantitatively according to the same list of criteria and awarded a score. However, some of the items of the list cannot be awarded a numerical value, and a qualitative assessment will be necessary. Chapter 4 describes the whole evaluation process in detail.

3.2 Research Process of RQ1

The resulting tools from SQ1 will become the tools tested in the investigation of RQ1. The research process of RQ1 i outlined in Figure 3.3.

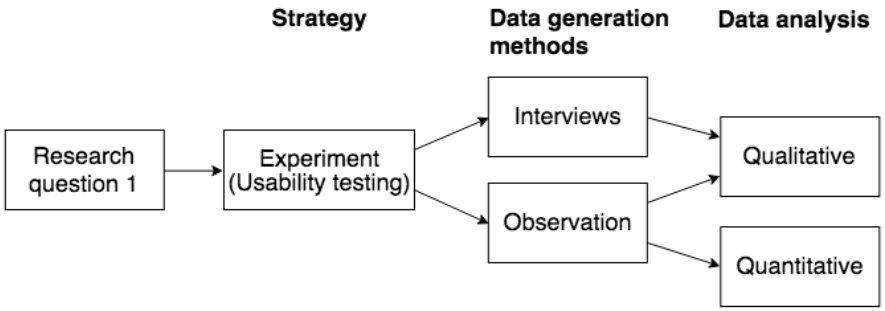


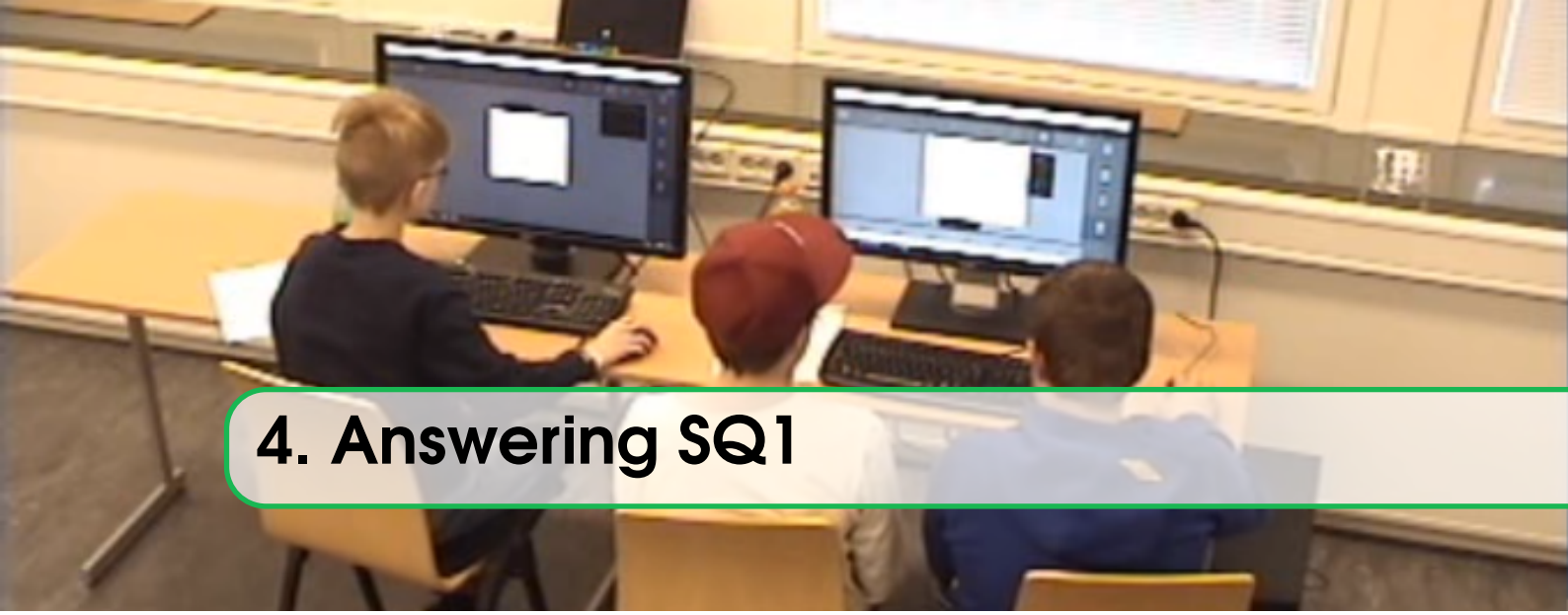
Figure 3.3: Research process for RQ1

First, the selected research strategy is an experiment where specific tools resulting from SQ1 will be used by children in usability tests.

Second, data will be collected from the usability tests through observation and interviews. Both will be audio and video recorded.

Third, the audio and video recording of the usability tests and the interviews will be analysed both qualitatively, and quantitatively. For the quantitative analysis, the DEVAN framework is used.

Chapter 5 further elaborates on the reasoning for selecting the individual methods and describes, in detail, how they are applied in the project.



4. Answering SQ1

In order to select appropriate tools to test with the target audience among the numerous available possibilities, a tool selection process was developed to ensure the tools were evaluated equally according to the same criteria. The steps of the selection process are presented below:

Steps of Tool Selection Process

1. Compile a list of potential tools.
2. Make evaluation criteria list.
3. Evaluate and score tools based on evaluation criteria list.
4. Select 3 tools: 1 of low complexity, 1 of medium complexity, and 1 of high complexity. At least one tool should be open source.[1]

Step 1: To identify existing tools used by the design community, a quick survey of existing tools (in the form of an Internet search) yielded several top lists of tools, both for wireframing and for prototyping. Although wireframing functionality was a requirement, several prototyping tools include wireframing and were also considered. One of the desired aspects to test with the children was whether the more graphic elements of prototyping were more appealing to the target users than the more minimalistic appearance of pure wireframing tools. As there exist innumerous wireframing tools, it was not possible to evaluate every single tool available online. Thus, based on the different top lists offered online, a list of 12 tools to be evaluated was compiled:

- Wireframe cc
- Framebox
- UXpin
- Moqups
- Axure
- Invision
- HotGloo
- Wire Flow
- Pencil Project
- Balsamiq
- Origami
- Atomic

[1]The original idea was to adapt the GUI of the open source wireframing tool to better suit the needs of the target group based on input from usability testing of one less complex and one more complex tool.

Step 2: In order to determine the evaluation criteria, literature relating to the evaluation of children's software was studied. Based on the literature review presented in section 2.2.1, important factors were identified and collected into an evaluation criteria checklist based on [76]. See Figure 4.1 at the end of this chapter for the full checklist used in the evaluation of the different wireframing tools.

Step 3: In this step, all 12 potential tools were evaluated according to the checklist. An evaluation summary for each individual tool can be found in Section, A.1 in the appendix. Once all the tools are evaluated, an overall score was computed for each tool allowing for numerical comparison of the tools. The score was computed as follows:

```
function score(values):
    sum = 0
    count = 0
    for (value in values):
        if (isNumber(value)):
            sum += value
            count += 1

    return sum/count
```

The sum of all available numerical scores from the checklist for a specific tool, was divided by the number of individual scores available for that tool. In other words, if one element was assessed as n/a or ?, it was not included into the calculation of the overall score.

A separate score was also awarded for the complexity of the tool ranging from 1-6 where 1 is very little complex and 6 is highly complex. The results of this step are summarized in Table 4.1. *?* is awarded to a category if the evaluator was not able to find enough information to award a numerical value to that category.

Step 4: The complexity score ranged from 1-6 and three categories of complexity were determined:

Low complexity:	1-2
Medium complexity:	3-4
High complexity:	5-6

See Table 4.2 for the categorizatin of each tool. From the least and most complex categories, the tool with the highest score was selected for usability testing. From the medium category, however, *Pencil Project* was selected despite having the lowest score in its category. The reason for this is that it is an open source tool. One of the possible outcomes of this study was the need to further develop the GUI of a wireframing tool, and thus one open source tool would have to be included. If the interface of existing wireframing tools would have to be adjusted to the needs of

Name	Text is legible	Action provide useful feedback	Appropriate amount of text	Appropriate terminology	Layout	Consistency	Difficult to make error	Nothing inappropriate	Page structure	Navigation	build/edit/run	Technical support	Tutorials	Actively maintained	Modifiability	Usability	Time (in minute)	Complexity	Score (in %)
Wireframe cc	4	2.5	4	3	4	3	2	5	4	5	5	4	5	?	?	3.5	46	2	77
Moqups	5	5	5	4	4	4	5	5	5	5	5	3.5	4.5	4	?	4.5	20	5	91
HotGloo	4	3	5	4.5	5	4.5	3.5	5	5	5	5	?	5	4	1	4	30	5	85
Balsamiq	5	4	3.5	4	5	5	4	5	5	5	5	4.5	4.5	4.5	1.5	4.5	25	2.5	88
Framebox	4.5	2	3	3.5	4	3	2.5	4	3	1.5	4.5	1.5	2	3.5	1	2	n/a	1	57
Axure	4	4	4	4	4	4	?	5	5	5	5	4	4	4.5	?	4	n/a	5.5	86
Origami	4	?	4	3.5	4	?	?	5	3	5	?	4	5	5	?	?	n/a	-	-
UXpin	4.5	4.5	4.5	4	4.5	4	5	5	4	5	4	4.5	4.5	4.5	?	4.5	15	4.5	89
InvisionApp	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-
Wire Flow	5	3.5	4	4	5	4.5	5	5	3.5	2.5	5	2.5	2.5	2.5	2	3	n/a	1.5	74
Pencil Project	3.5	4	4	3	3.5	4	4	5	5	3	1	3	3	5	5	3	30	3.5	74
Atomic	4	4	4	4	4	4	5	5	5	5	5	4.5	4.5	4	?	4	20	4	88

Table 4.1: Summary of tool evaluation

children, before being included in a bigger design workshop, the plan was to adjust the interface of the open source tool based on the input from the three usability tests (of a low, medium and highly complex tool).

Category	Name	Complexity	Score
Minimalistic (1-2)	**1. Balsamiq**	2.5	88%
	2. Wireframe cc	2	77%
	3. Wire Flow Wireframe Design	1.5	74%
	4. Framebox	1	57%
Medium (3-4)	1. UXpin	4.5	89%
	2. Atomic	4	88%
	3. Pencil Project	3.5	74%
Complex (5-6)	**1. Moqups**	5	91%
	2. Axure	5.5	86%
	3. HotGloo	5	85%
Not relevant	Origami InvisionApp		

Table 4.2: Score and complexity of individual wireframing tool. Boldface indicates which tools were selected for further usability testing.

Limitations of the Selection Process

Despite attempting to follow a rigorous process when selecting the wireframing tools, some limitations to the process are discovered and stated in below.

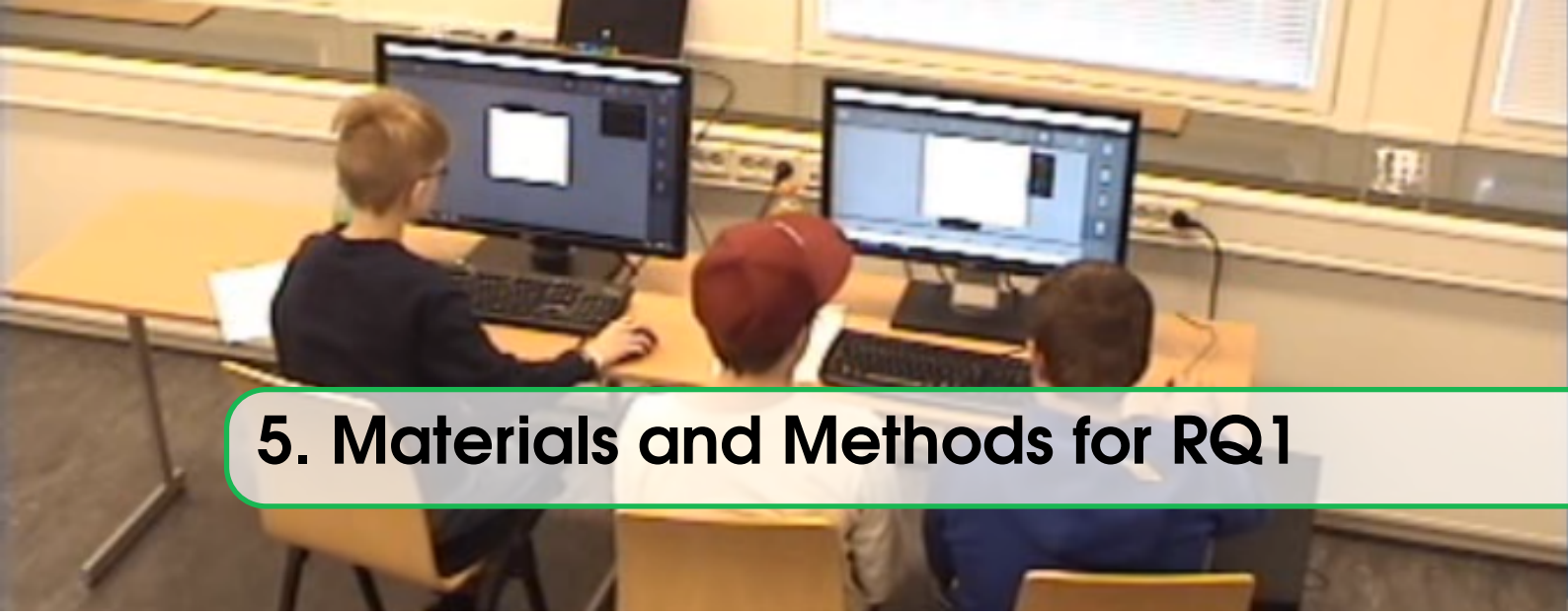
- All numerical items were weighted equally in the total score, but maybe not all were equally important. For example, it could be easy to award a high score for the children specific requirements, but this would be useless if the

wireframe specific requirements were not fulfilled. This was not reflected in the total score.

- How to score textual answers/comments proved a challenge. In the final selection they received no weight in the total score.
- Items awarded the score n/a were excluded from the total score. If a non-existent feature was awarded 0 or n/a, this would greatly impact the total score.
- The time spent on making the wireframes was affected by order of testing. The longest time was spent on the first tools. Thus, spending longer time creating the wireframe does not necessarily imply a poorer user interface or functionality.

Name:	**Total score:**					
Type of tool:	Date og analysis:					
CHILDREN SPECIFIC	**1**	**2**	**3**	**4**	**5**	**n/a**
Text font and size make text easily legible						
All actions provide useful feedback to user						
There is an appropriate amount of text						
The terminology used is appropriate						
The layout is clear and logical						
Elements which behave similarly look the same.						
It is difficult to make an error in the program.						
The tool does not contain any inappropriate material/ads						
Comment:						
WIREFRAME SPECIFIC	**1**	**2**	**3**	**4**	**5**	**n/a**
The tool provides structure (pages, subpages, GUI elements)						
Navigation is possible between structured elements:						
Build/edit <-> Run is quick						
The content is internal or external to the system:						
Underlying conceptual model:						
Comment:						
SOFTWARE SPECIFIC						
input:						
output:						
price:						
interface language:						
Comment:						
TECHNICAL	**1**	**2**	**3**	**4**	**5**	**n/a**
There is a lot of technical support available						
There are several tutorials available						
The tool is actively maintained and updated						
Comment:						
OTHER	**1**	**2**	**3**	**4**	**5**	**n/a**
The tool is easy to modify for an external developer						
The tool provides good usability						
Time to complete task:						
Comment:						

Figure 4.1: Checklist for evaluating potential wireframing tools, inspired by [76].



5. Materials and Methods for RQ1

Materials

Two different wireframing tools, *Balsamiq* [5] and *Pencil Project* [25] were studied with 5 children aged 12-13 through usability testing. *Balsamiq* is a minimalistic tool, while *Pencil Project* is a more elaborate open source tool, and their selection is detailed in Chapter 4. The recruitment of the children is further described below in step 6.

Method

Usability testing was selected because it is one of the standard methods of evaluating 'enabling' software in the PLU-E framework [51] and an appropriate method for qualitatively evaluating behaviour in a non-natural setting, according to Rohrer [61], see Section 2.2.2. The usability tests were planned according to Hansen's "Ten Steps to Usability Testing" [36]. For step 8, conduct the test, adaptions were made to accommodate standard usability testing to child participants according to [35], see Section 2.2.3.

Further, co-discovery was used as far as possible to stimulate natural conversation within the pair about their thought processes, see Section 2.2.2, as *Think Aloud* can be challenging for children [4] individually.

Rohrer's landscape, see Figure 2.2, also revealed eyetracking as a possible method. Although considered for the usability tests, it was eventually decided against in favour of co-discovery, as the equipment does not support multi-user eyetracking.

Lastly, each usability test ended with a semi-structured interview to gain deeper insight into the thought process of the participants, delve further into interesting situations observed in the usability tests and gain an understanding of the background of the participants, particularly related to their experience with computers.

Below follows a detailed description of what was done in each of Hansen's "ten steps to usability testing" when planning and executing the usability tests.

Step 1: Do your homework The motivation and reason for conducting these usability test are explained above.

Step 2: Write the test plan The test plan details all the activities which took place during the time with the participants, from welcoming remarks, to introducing and performing the specific task of the usability test, to closing remarks and a tour of the UX lab. The full test plan can be seen in Figure A.3 in the appendix.

The semi-structured interviews contain questions related to usability, motivation, learnability, and replayability, in addition to questions about participants' previous experience with computers. The full interview guide can be seen in Figure A.5 in the appendix.

Step 3: Design the test The goal of the tests was not to gain an understanding of specific UI elements, but rather to gain initial insights into the suitability of existing wireframinng tool for the target group. Thus, the participants did not receive a very structured task where they had to complete several small tasks in a given sequence. Rather, the task was fairly open to stimulate playing around with the tool where the participants themselves had to decide how to progress with the task. More concretely, the participants were presented with a paper prototype and asked to transform it into a digital wireframe. A translated version of the task is seen in Figure 5.1. The two specific tasks can be seen in Figure A.4 in the appendix.

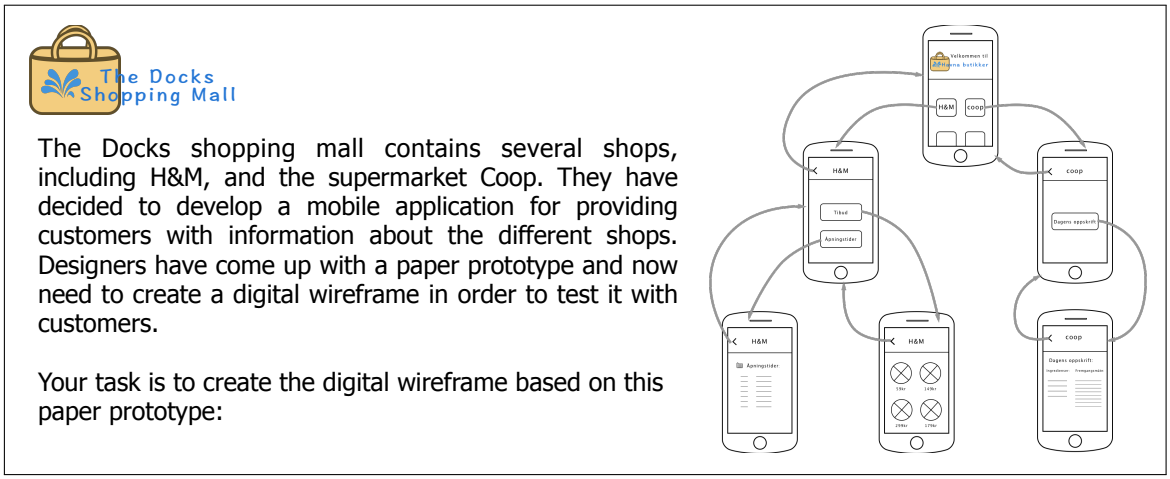


Figure 5.1: One of the usability test tasks (translated)

Step 4: Arrange a test location and equipment The tests were held at the UX lab at the Norwegian University of Science and Technology, NTNU, as it includes all necessary equipment for audio and video recording.

Step 5: Conduct a dry run A dry run was conducted to increase the chances of the test running smoothly. A few issues with the introduction to the tool were discovered and fixed. The allotted time for certain elements on the test plan was also adjusted.

Step 6: Recruit users The volunteers were recruited from the coding club hosted by the university in addition to children of acquaintances. Roughly half of the volunteers had previous coding experience, whilst the other half did not. Apart from this, the volunteers were mainly recruited based on their age, as the main goal of this feasibility study was to gain initial insight into how the target age group coped

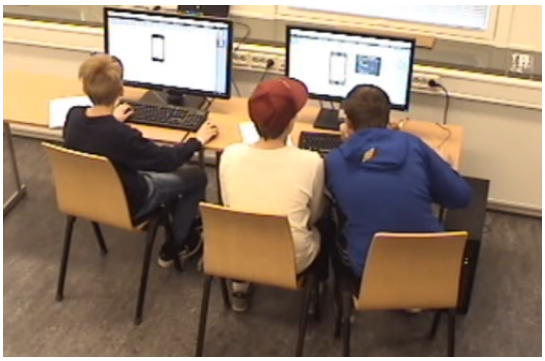
with the chosen wireframing technology.

To recruit the volunteers, the author prepared an information flyer which was presented at the coding club and sent to her contacts upon establishing their interest. The incentives presented were the opportunity to use a digital design tool and a tour of the university's UX lab. The flyer can be seen in Figure A.1 in the Appendix.

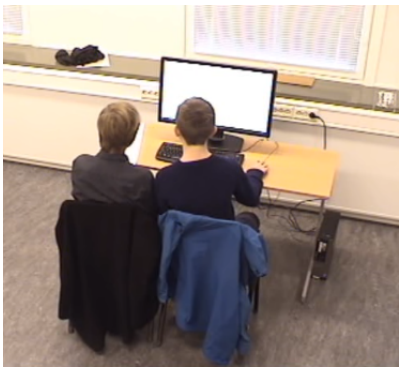
Step 7: Set up the test room The test room was set up with one computer per table, a table with snacks, a fixed screen for the introduction, and a chair for the observer.

For the first usability test, two computers were used as there were three participants. Two worked as a pair, one worked alone, see Figure 5.2a.

For the second usability test, one computer was used as two participants collaborated in solving the task, see Figure 5.2b.



(a) Test 1: set-up



(b) Test 2: Set-up

Figure 5.2: Usability tests: set-up

For the interview, the participants turned their chairs around facing the observer/interviewer, see Figure 5.3.

Figure 5.3: Usability test interviews: set-up

Step 8: Conduct the test The tests were conducted according to the test plan presented in Figure A.3 in the appendix. The only discrepancy between the original

plan and the actual outcome was the number of usability tests. Originally, three tests where scheduled[1] :

Test 1: 3 participants testing *Balsamiq*

Test 2: 1 participant testing *Pencil Project*

Test 3: 2 participants testing *Moqups*

However, the participant from test 2 never showed up and, thus, one tool could not be tested. As it was still a possible outcome that the interface of a wireframing tool would have to be adjusted, the open source tool *Pencil Project* was tested during usability test 3. Moqups was, therefore, never tested.

After completing the task, the semi-structured interviews were conducted according to the interview guide presented above, before progressing with the next item on the test plan: tour of the lab and closing remarks, which included rewarding the participants with gift certificates for the local cinema.

Step 9: Compile and analyse the results and Step 10: Take action These will be treated in Chapters 6 *Results* and 7 *Discussion* respectively.

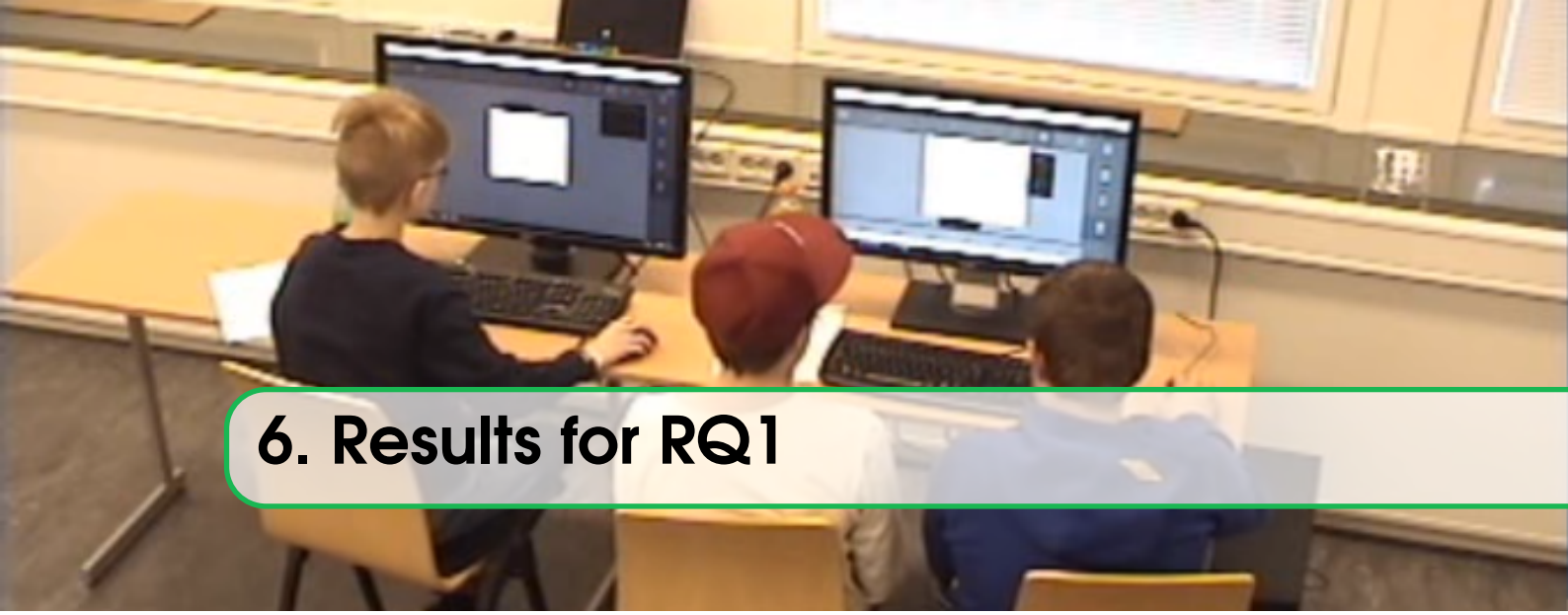
Data Analysis

The data, video and audio, recorded from the usability tests is evaluated in two ways. First, qualitative evaluations of usability problems are identified by observing the recordings. Second, the DEVAN (DEtailed Video ANalysis) framework [73] is applied to parts of the data set.

Given the detailed analysis required by the DEVAN framework, it is too time consuming to analyse the complete recordings according to the framework. Moreover, given the goal and scope of the feasibility study, it is not deemed necessary to perform such a detailed analysis of the recordings at this stage. Thus, only certain parts are selected for analysis based on the DEVAN framework. The reasons for this is to check if more usability problems are detected through this analysis compared to the simpler observation of the participants. The DEVAN analysis is also only applied to the parts of the recordings where the participants perform a new task for the first time, i.e. when creating the first frame of the wireframe and when inserting images.

The data from the interviews is evaluated qualitatively. The combined information discovered from the video material and the interviews will determine if there is a need for adapting a wireframing interface to better suit children or not.

[1]When recruiting, two participants were the aim for each test. However, the availability of the volunteers resulted in the distribution presented.



6. Results for RQ1

For both usability tests, two episodes of the recordings were analysed according to the DEVAN framework: (1) Creating the first wireframe and (2) Inserting the first image. Both episodes were analysed by making *Interaction tables* and corresponding lists of *Observed Indications for Breakdowns*.

Pause threshold values were determined by a pilot analysis. Given the limited sample of recordings, the making of the second frame by the single participant in usability test 1, was used as the pilot sample. Based on this pilot, the primary pause threshold value was set to 5 seconds and the secondary pause threshold to 3 seconds. See Figure A.11 in the Appendix for the *Interaction table* of the pilot study.

The results from the two usability tests and corresponding interviews are presented below. In usability test 1, two groups tested the wireframing tool simultaneously. The team with a single person is referred to as group A, the pair is referred to as group B.

6.1 Results from Usability Test 1

Observation

Based on purely observing the participants, both live and on the recording, some aspects of the wireframing interface are identified as problematic. See Table 6.1 for a summary of the problematic aspects, which actions exemplify this problem and the time stamp for the actions. Other observations made, that are not based on specific actions by the participants, include:

- No/very little use of the properties feature
- Participant uses the "All" category all the time
  (No one uses the search bar to locate elements)
- Time-consuming to have to drag in template device for each frame

Time stamp	Action	Potential problem
05.04 06.08 06.11	- Try to change font size - Deleted text box - Added subtitle	Difficult to change font size
06.15	Struggle to make buttons equal in size	Not aware of alignment functionality
19:21 21:50	- Try to import image - One team asks the other if they have been able to add the images yet	Difficulties importing external images
49:01	Try to take input from users	Identify limitation of wireframing tool

Table 6.1: Problematic aspects observed during usability test 1

DEVAN Analysis

For a more rigorous analysis, DEVAN was applied to parts of the recordings. The *Observed Indications for Breakdowns* are presented below, first for group A, see Figures 6.1 and 6.2, then for group B, see Figures 6.3 and 6.4. The respective *Interaction tables* used as a basis for creating the lists of *Observed Indications for Breakdowns* can be found in Figures A.6, A.7, A.8 and A.9 in the Appendix.

1a: First mockup, OBSERVED INDICATIONS FOR BREAKDOWNS

Time code	Breakdown indication code	Free-form description	Observation	Product mode	Task context
4:53	REP	Resizing label is repeated.	Participant clicks size in properties several times.	Edit mockup	Create first mockup
5:01-5:03	PUZZ	Attempts to change font size.	Participants says: "Du, hvordan får man den der teksten større?"	Edit mockup	Create first mockup
5:15-5:17	PUZZ	Attempts to change font size.	Participants says: "Du, hvordan får man den der teksten større?"	Edit mockup	Create first mockup
5:35-5:40	REP	Attempts to change font size.	Repeats changing label size.	Edit mockup	Create first mockup
6:03-6:07	CORR	Using label is undone	Deletes label	Edit mockup	Create first mockup
6:08-6:10	CORR	Using label is undone	Deletes label	Edit mockup	Create first mockup

Figure 6.1: Observed Indications for Breakdowns for group A creating the first frame

Based on the *Observed Indications for Breakdowns*, the following list summarizes the main interface features which appear to cause confusion for the participants:

1. Changing the font size of labels
2. Inserting images
3. Remove elements
4. Type the character '&'

1a: Insert image, OBSERVED INDICATIONS FOR BREAKDOWNS

Time code	Breakdown indication code	Free-form description	Observation	Product mode	Task context
25:54	DISC	Closes popup without completing the action of adding the image to the mockup	Closes popup	Edit mockup	Insert image
25:58	REP	Opens popup a second time	Double clicks image element to reopen popup	"	"
26:02-26:11	ACT	Moves element instead of deleting it	Moves element	"	"
26:13	ACT	Moves element instead of deleting it	Moves element	"	"
26:20	ACT	Moves element instead of deleting it	Moves element	"	"

Figure 6.2: Observed Indications for Breakdowns for group A inserting the first image

1b: Insert image, OBSERVED INDICATIONS FOR BREAKDOWNS

Time code	Breakdown indication code	Free-form description	Observation	Product mode	Task context
19:16-19:24	ACT	Drag image from folder instead of importing it	Drag image from folder	Edit mockup	Insert image
19:34	ACT	Copy image instead of importing it	Copy image	"	"
20:31-20:36	ACT	Drag image between browser tabs instead of importing it	Drag image between browser tabs	"	"
21:02-21:08	REP	Repeat dragging image from folder	Drag image from folder	"	"
21:15-21:17	ACT	Open image instead of importing it	Open image in new window	"	"
21:27-21:40	REP	Repeat right click image	Right click image	"	"
21:49	PUZZ	Participant unsure how to add images	Participant asks "Har du adda noen bilder ennå?"	"	"
22:14-22:16	ACT	Copy mockup instead of improting image	Copy mockup	"	"
23:16	PUZZ	Participant unsure how to add images	Participant asks "Vet du hvordan man gjør det?"	"	"

Figure 6.3: Observed Indications for Breakdowns for group B inserting the first image

1b: First mockup, OBSERVED INDICATIONS FOR BREAKDOWNS

Time code	Breakdown indication code	Free-form description	Observation	Product mode	Task context
4:17	PUZZ	Indicates verbally that they want to remove the button	Participant says: "Hvordan tar vi den bort?"	Edit mockup	Create first mockup
4:21-4:24	CORR	Corrects adding unwanted button by deleting it.	Deletes button.	Edit mockup	Create first mockup
5:42-6:01	SEARCH	Participants want to type a character they do not know how to.	Participant says:" Hvordan får man til det 'og' tegnet?"	Edit mockup	Create first mockup

Figure 6.4: Observed Indications for Breakdowns for group B creating the first frame

Interview

Following is a summary of the interview responses from usability test 1 regarding the topics: usability of the tool, purpose of the tool, and participants' background.

Usability The participants reported that they found *Balsamiq* overall easy to use. A challenging aspect, however, was finding the right element. A proposed solution by the participants themselves would be to have a menu with mini icons. If users do not know under which category a given element is placed, they have to scroll for a long time under the "All" category.

Relating to motivation, the participants found the tool exciting to use, although 'not as fun as playing FIFA[1]'. Nothing about the tool frustrated them.

Concerning learnability, they found it easy to use once they got going and were allowed to play around themselves. They report that they understood the categories in the menu bar. Without the initial introduction to the tool, they still believe they would have been able to complete the task, but would have spent more time and asked more questions. They found it particularly challenging to add external images to the wireframes.

When asked about whether they were curious about the tool and wanted to learn more, one participant would like to know how much the profession pays.

Relating to replayability, some stated that they would like to use the tool again if they were making a webpage.

Purpose When asked about the purpose of wireframing software, they emphasised the use in app development. Further, they highlighted that wireframes visualize the flow of an application better than paper prototypes and can be tested more easily by others through sending the wireframe to their phones. They also felt that the tool could be used for learning purposes.

In addition to website designers, when asked about who might use such tools in their profession, one participant, surprisingly, mentioned doctors. He felt that doctors cold use the tool to create a letter application aiding patients struggling with illiteracy.

[1]FIFA is a series of popular football video games.

Background One participant worked extensively with computers in his spare time and had some programming experience. The other two did not. All participants used computers almost on a daily basis, but often related to school work. The computers were also used for gaming and some image- and video editing. None had participated in any organized coding classes, but they had some insights into how websites are developed.

6.2 Results from Usability Test 2

Observation

Table 6.2 summarizes the problematic aspects identified by observing the participants in usability test 2. The problematic aspects are listed together with specific actions exemplifying the problem and the timestamp for the actions. Other observations made, that are not based on specific actions by the participants, include:

- Little use of properties
- Want to preview wireframe

Timestamp	Action	Potential problem
02.19	Utterance: "Men det skulle være en meny her" (*Translation: But there should be a menu here.*)	Set font size
03.07	Try to import image. Utterance: "Eller kan vi bare dra den inn?" (*Translation: Or can we just drag it in?*)	Difficulties importing external images
07.14 07.31	Utterance: "Må ha runde hjørner" (*Translation: Must have rounded corners*) Utterance: "Men det pleier å være sånn radius" (*Translation: Normally you have a radius*)	Setting border radius
24.10	All pages are ordered vertically. When pressing a button linking to a new page, new pages are jumped to but it is confusing to know which page the system aims to display.	Testing the interactive wireframe online

Table 6.2: Problematic aspects observed during usability test 2

DEVAN Analysis

The *Observed Indications for Breakdowns* from usability test 2 is presented in Figure 6.5. As inserting an image was included in creating the first frame of the wireframe,

only one list of *Observed Indications for Breakdowns* is included for this test. The *Interaction table* used as a foundation is available in Figure A.10 in the Appendix.

2: First mockup and image, OBSERVED INDICATIONS FOR BREAKDOWNS

Time code	Breakdown indication code	Free-form description	Observation	Product mode	Task context
0:58-1:02	ACT	Uses <fit screen> instead of <fit content>	Clicks <fit screen>	Create prototype	Create first wireframe and insert image
1:04-1:06	CORR	Use of <fit screen> is corrected with <fit content>	Clicks <fit content>	"	"
1:50-1:51	ACT/CORR	Drags element instead of opening properties menu and reverses the process.	Rotates and rotates back.	"	"
1:52	ACT	Right click instead of opening properties menu	Right click label	"	"
1:57	ACT	Right click iPhone instead of opening properties menu	Right click iPhone	"	"
2:01-2:02	ACT/CORR	Moves label instead of opening properties menu	Moves label	"	"
2:03	REP	Right click label repeated	Right click label	"	"
2:13-2:18	ACT	Changes label size instead of font size	Changed label size	"	"
2:57	CORR	Undoes dragging in label	Deletes label	"	"
3:04-3:06	ACT	Uses image element instead of image itself	Drags in image element	"	"
3:15	CORR	Undoes adding image element	Deletes image element	"	"
3:56	CORR	Undoes adding second button	Delete second button	"	"

Figure 6.5: Observed Indications for Breakdowns from usability test 2

Two main usability problems occur in test 2. First, several attempts are made to change the font size of an element. Secondly, inserting an external image needs two attempts. The first problem of selecting *fit screen* instead of *fit content* is ignored as it was most likely attempted based on the example presented in the introduction by the usability test conductor. It would not make any difference to creating the wireframe if this task was attempted or not.

Interview

Following are the interview responses from usability test 2 regarding the topics: usability of the tool, purpose of the tool, and the participants' background.

Usability The participants were able to complete the task using the tool, and did not voice any particular problems. They did however, identify a few aspects of the

tool which could be improved. Firstly, they found it difficult to see which pages were linked together, and would have wanted an overview to check how the pages were linked. Secondly, they wanted an option for making rounded corners on buttons. Thirdly, it was not intuitive were to look for certain elements. Being new users of the tool, they had to search for desired elements, as it was not clear under which category they were organized. However, in order to search for elements, users need to know the names of the elements. Rather, the participants suggested other categories, such as "Buttons" and "Labels", to make it easier to find desired elements. They found the tool to contain too many platform- and OS-specific elements, not relevant for the task they had been given. Another suggestion for identifying necessary elements was to be able to select a preferred device at the beginning of the session, and then only have relevant elements and functionality available. By selecting a device up front, one would also avoid having to duplicate the template for each new frame. Fourth, the participants would have wanted the option of downloading the wireframes to their mobile phones.

Regarding further learning, the participants would have wanted to use input fields so that the wireframe could take input from users. They were very interested in the coding aspect, and would have wanted the tool, and fields, to be programmable. An example would be to validate passwords and usernames, and be able to modify input fields through code. They would have also wanted to include urls to external websites in the wireframe.

When it comes to using the tool again, one participant said he would not use it, but that is because he is not very interested in making websites. If he was to make a website, however, he could consider using the tool.

The other participant had experience with Xcode [40] and Android Studio [20], and would have used these tools over *Pencil Project*. This is because he is more interested in programming the websites, rather than simply using drag and drop interfaces.

Purpose Regarding the purpose of wireframing tools, the participants found it useful for visualizing ideas and for front-end design. They thought it was a good option compared to drawing on paper.

When asked who might use these tools in their profession, designers and small businesses were mentioned. The participants felt that if the desired website was a simple static website presenting information, the wireframe itself could serve the purpose of the website.

Background The participants in usability test 2 were recruited from the coding club related to the university and naturally had previous coding experience. In fact, the two participants had taken every course offered by the coding club including courses on Scratch, Python, Java, Minecraft plugin, microBit, web, and ComputerCraft. They both admitted to spending several hours a day on the computer. Their activities range from watching movies, doing school work (word processing, searching for information), programming and playing games, and using social media. When asked if they had previous experience with wireframing tools, they said they had previously worked with Xcode and Android Studio.

6.3 Combined Results

Observation

Combining the qualitative observation of the participants in usability test 1 and 2 above, eight features have been identified as potentially problematic, or at least deserving more attention, see Table 6.3. U1a refers to group A of usability test 1, U1b to group B of usability test 1, and U2 to the participants in usability test 2.

No.	Potential problem	Identified by
1	Change font size	U1a and U2
2	Align and make buttons equal in size	U1b
3	Import image	U1a, U1b and U2
4	User input	U1b
5	Little use of properties	U1a, U1b and U2
6	Confusing categories	U1a
7	Drag in template	U1a and U1b
8	Preview	U2

Table 6.3: Potential problems of *Balsamiq's* interface identified through observation

DEVAN Analysis

Based on the DEVAN analysis of the two usability tests, four potentially problematic features are identified, see Figure 6.4.

No.	Potential problem	Identified by
1	Changing the font size of elements	U1a and U2
2	Inserting images	U1a, U1b and U2
3	Remove elements	U1b
4	Type character '&'	U1b

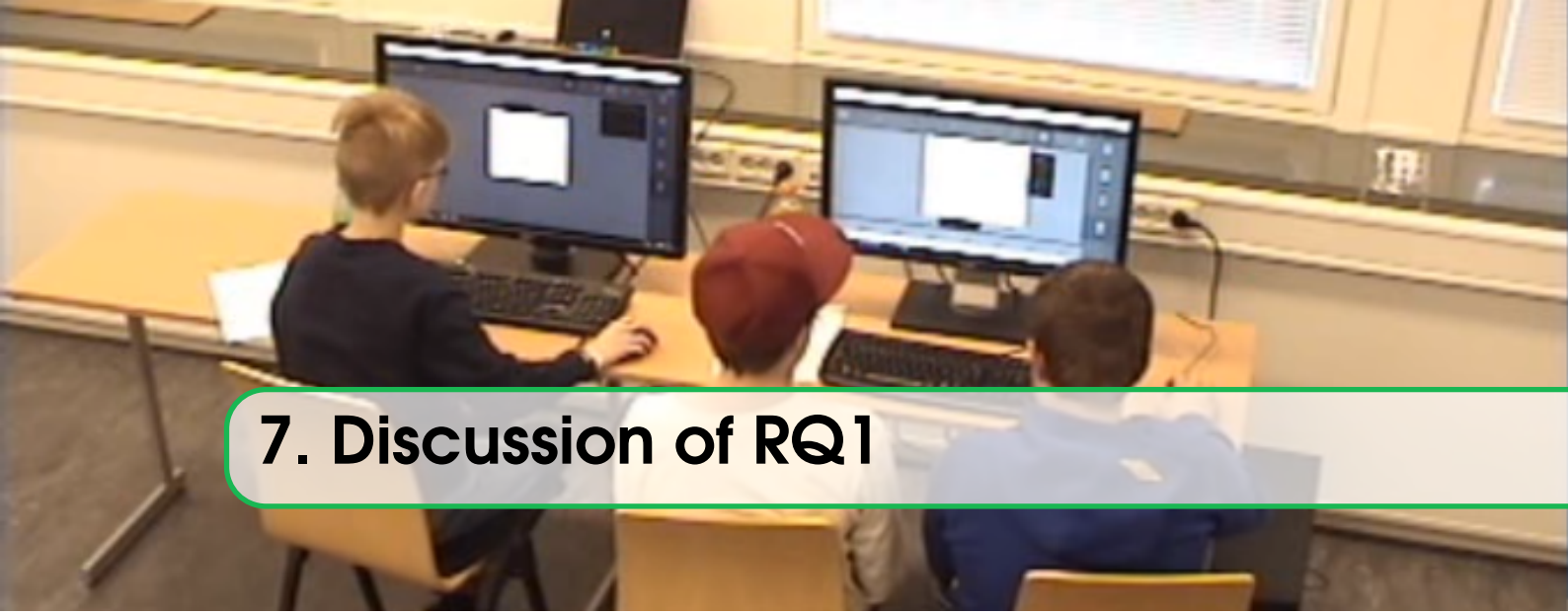
Table 6.4: Potential problems of *Pencil Project's* interface identified by DEVAN

Interviews

Summarizing the responses from all the interviews presented above, the following features are identified, see Figure 6.5:

No.	Potential problem/Desired feature	Identified by
1	A more image-based menu for selecting elements	U1
2	A visual representation of which frames are linked together	U2
3	Preview functionality	U2
4	Select device at the beginning. Would not have to duplicate or drag in same device template on each new frame. After selecting device type, only functionality relevant to that device type should be available.	U2
5	Display finished wireframe on phone	U2
6	Different categories for grouping elements	U2
7	Add programming features to wireframe to accept and control user input	U2

Table 6.5: Potential problems of wireframing interfaces identified by interviews



7. Discussion of RQ1

Based on the results presented in the previous chapter, this section aims to answer RQ1. The implications of the findings are discussed, including how the results shape the rest of the project. Lastly, limitations which might affect the validity of the results are discussed, along with lessons which will be brought forward into the next phase of the project.

7.1 Comparison of Data from Different Sources

Similarities between DEVAN and Observations

Eight problematic features were identified by pure observation, see Table 6.3, compared to four features identified by the DEVAN analysis, see Table 6.4. The common features for both methods are:

- Changing the font size of elements
- Inserting images

Both these features were identified as potentially problematic by several groups in the usability tests. *Changing the font size* took a considerable number of attempts for both groups aiming to do so, where group A of test 1 ended up deleting the element in question and choosing a new element with a greater font size as default, and the participants of test 2 succeeded in the end. Group B of test 1 did not attempt to change the font size, and it is thus unclear whether they would have encountered a problem with this had they tried. This issue is therefore considered significant.

The same goes for *inserting images*. All three groups experienced confusion about inserting external images into their wireframes. Interestingly, the participants in test 1 attempted to drag in the image, when importing it into an image element was necessary, while the participants in test 2 looked for ways to import the image rather than dragging it directly into the wireframing program. This is a feature identified in all groups, and will be treated as one deserving extra attention in a potential development of the interface.

Differences between DEVAN and Observations

Of the four features identified through the DEVAN analysis, see Table 6.4, *Number 3: Remove elements* and *Number 4: Type character '&'* were not specifically noted down by the observers when purely observing the interaction between the participants and the wireframing tool.

Number 4: Typing the character '&' will be regarded as a problem related to input in general and perhaps the specific keyboard, rather than one relating to the wireframing tool in question.

Number 3: Removing an element was resolved within a few seconds and is only identified because one participant asked the question to their partner. This might just as well have been a way of formulating a tactic of what to do next and not represent a bigger interface challenge. It was also only identified by one of the groups in the usability test.

These features are, therefore, not considered problematic for the rest of the project.

Considering the features only identified by observation (Number 2, 4, 5, 6, 7 and 8 in Table 6.3), most were only experienced in *one* of the usability tests and not both. This could indicate a usability issue with the particular tool, and not the concept of wireframing in itself.

Number 5: *Little use of properties* is the only issue pertaining to *all* groups, which was only identified by pure observation. This is not identified as a usability breakdown by DEVAN as users were not required to use such properties. However, it indicates that even young users will stick to a minimalist design if presented with one. They will not change font and colour, but rather stick to the default settings if nothing else is explicitly required.

Similarities between Observations and Interviews

Interestingly, several of the features identified through observation are also raised in the interviews. Table 7.1 states which features are addressed by both the observations and the interviews.

No.	Feature	No. in Table 6.3	No. in Table 6.5
1	Menu organization	No6	No1, No6
2	User input	No4	No7
3	Preview	No8	No2, No3, No5
4	Drag in template for each frame	No7	No4

Table 7.1: Feature addressed by both observation and interviews

These features might have prolonged the duration of the test a fraction, but by no means did these features prevent the participants from completing their tasks. Some are even suggested improvements by the participants themselves, such as Number 7 in Table 6.5, relating to adding programming features to the tool. Thus, these features are not necessarily problems in themselves, but represent aspects of the user interface which deserve further attention in a potential adaption of a wireframing tool for

children. Designers would have to decide for themselves which features/functionality would benefit an adapted tool.

Summary of Data Comparison

Based on the above summaries and differences of the data collected from various sources, the only two aspects of importance extracted from the usability tests are:

- Changing the font size of elements
- Inserting images

However, the most important factor to consider is that no features of the interface prevented the children from completing the task in any considerably less time than novice adults would use. The participants in usability test 1 spent slightly longer time on the task than the pilot test adult, while the participants in usability test 2 spent just as long. These times were almost the same as the time spent by the evaluator of the wireframing tools, when creating wireframes as part of the selection process of wireframing tools. Moreover, the suggested improvement elicited from the usability tests and interviews largely overlap with desired improvements the selector of the tools and the pilot study adult identified.

7.2 Answer to Research Question 1

Based on the above comparison of data, an answer can be provided for RQ1:

To what extent do children master existing wireframing tools?

The results indicate that children are fully able to use existing wireframing tools designed for adults. If the sole purpose of the research was to perfect a wireframing tool for children, this feasibility study has highlighted several areas which deserve attention for improvement. However, the purpose of the feasibility study is to identify to which extent children of the target age group are able to use existing wireframing tools so that suitable tools can be identified. In the context of a co-design workshop, existing wireframing tools are suitable for children. With a 5-minute introduction to the tool, any of the two tools could easily be included as part of a bigger design process.

7.3 Implications

The overall aim of this research project is to evaluate how co-design with children can benefit from including wireframing as a design activity. In order to begin research on this topic, a suitable wireframing tool would have to be identified. If no such tool exists, an existing tool would need to be adapted before the work on RQ2-4 can continue. Thus, this feasibility study was conducted with the purpose of identifying whether existing wireframing tools would need to be adapted for suitable inclusion into co-design workshops with children. Based on the results from the feasibility study, two paths were available for the future work:

1. If existing wireframing tools are not suitable for children, adapt an existing wireframing tool, and iterate and test until it is suitable for inclusion into a co-design workshop, or

2. If existing tools are suitable for children, skip adaption of existing tool and jump straight to further investigation of the overall research aim through researching RQ2-4 in a co-design workshop.

No clear hypotheses was stated at the outset of the feasibility study, but if any, there was an assumption that a wireframing tool would need at least some adaption before being included into a bigger design process. Surprisingly, however, as the children were fully able to use existing wireframing tools, this adaption is not necessary. Thus, based on the results from this study, adapting a wireframing tool is skipped, and the next step of the project is to plan the research for further invesigating the overall research aim: *How does the design process benefit from involving children in digital wireframing?*, through RQ2-4.

For those interested in developing a wireframing tool specifically targeted at children, the results from this feasibility study offer several features which deserve more attention. However, as this is not the goal of this particular project, no more effort will be devoted to identifying problematic aspects with the interface of existing wireframing tools.

A distinction has to be made, though, between the two tested tools as one will be taken forward and included into the research on RQ2-4. Even though both tools have similar functionality and all participants completed their tasks satisfactorily, *Balsamiq* is chosen to be used for RQ2-4. The main reasons for this is that it (1) has an active community and (2) includes preview functionality. One of the most notably lacking features in *Pencil Project* was a preview functionality. Having to export the whole project to test if all navigation is set up properly was time consuming. This was also noted by the pilot test adult and the evaluator of the wireframing tools. This is such a standard feature of most wireframing tools, that it is reason enough to choose *Balsamiq*. Moreover, the participants testing *Pencil Project* felt that many of the elements available in the tool were too device- and OS-specific and were not applicable to the task they had been given. Thus, *Balsamiq*'s simplicity might just be enough, at this stage, for including children into design processes, and is another reason for choosing to go forward with *Balsamiq*.

7.4 Limitations and Lessons

The feasibility study was performed under some limitations and several lessons have been learned of how it could have been improved.

Limitations

Firstly, the sample of participants was small. Originally three tools should be tested with 2 participants working in pairs testing one tool each, a total of 6 participants. As the goal was not to identify which tool was better, but rather to gain insight from a minimalist and more complex tool in order to adapt a mid-complex tool, it was deemed acceptable to not have a larger group or have all participants test all tools.

By allowing all participants to test all tools, a ranking evaluation could be used. If the aim was to discover which tool the children preferred, this would have introduced the uncertainty of ordering, when testing the tools. A second tool might seem to provide better usability simply because the participant has already used a similar tool and, thus, has a different background from when testing the first tool. Thus, it was decided that each pair work with only one tool so as to limit the influence of having seen other tools, even if the sample of participants was small.

Secondly, there was an uneven number of testers of each tool. As stated, the aim was for one pair to test each tool in a total of three usability tests. However, for the first usability test, three participants were present due to unforeseen events. Dividing the participants then became a choice of three, either (1) let all three work together, or (2) let two work as a pair and one alone, or (3) let them all work individually. As collaboration was essential for aiding think-aloud and gaining insight into the thoughts of the participants, (3) was not considered as an option. Two of the participants were good friends, and thus (1) was seen as unfair to the last person who did not know anyone from before. Two people working around the same computer can be difficult enough at times for ensuring equal participation, and having three gave rise to too many uncertainties, including social difficulties. Thus, (2) was chosen. The choice was then whether they should work with the same tool or not.

For the second test, only one participant had confirmed their attendance, and it would therefore have been nice to have one more person test the second tool. However, having two teams working on different tools in the same room, in the dynamic where some were previously acquainted, did not seem like the best option. Thus, all participants in usability test 1 worked with the same tool, but with slightly different tasks. In reality, the task was the same, but the domain and content of the wireframe was altered to appear to the participants as two different tasks. This resulted in all three participants working well together and asking each other questions as they were working with the same tool.

Thirdly, the single participant for usability test 2 never showed up. As the third participant of usability test 1 had tested the same tool as the two other participants, this resulted in no one testing the tool scheduled for usability test 2. For the last usability test, both participants showed up and instead of testing the third tool, it was decided that they test the tool aimed for the previous usability test, the open source tool (*Pencil Project*). If the results indicated that adaption of a wireframing tool was necessary, the open source tool would be the one to adapt and would therefore have to be tested. The result was that the third usability test, where the more complex tool should be tested never took place, as the final usability test participants tested the second tool instead.

Fourth, only a selection of the recordings were analysed by the DEVAN framework. However, as stated in *Data Analysis* in Chapter 5, this was done intentionally as the scope of the feasibility study did not allow for a detailed analysis of the full recordings. The DEVAN framework was mostly applied to see if more problematic features would be discovered compared to pure observation of the participants, but more features were, in fact, discovered by pure observation accompanied by the interviews. DEVAN, thus, served to highlight certain issues, but the results of the overall study do not seem compromised by the fact that the DEVAN framework was

not applied to the full recordings. Moreover, the purpose of the study was not to gain a complete overview of potentially problematic areas of the interface, but rather to to have an indication of whether the children were able to use the tools.

Lessons

First, recruiting participants is challenging and for the next phase of the project, where a bigger design workshop will be planned, recruitment needs to begin earlier. Moreover, the commitment of the participants needs to be ensured. More structured recruitment must also be considered, either from larger arenas or more arenas. Simply recruiting from the coding club at the university was not enough, and personal connections will be exhausted if participants should be new each time. Also, different selection criteria might be applicable next time. In this feasibility study, age was the only requirement.

Second, in order to begin recruitment earlier, the date of the workshop needs to be fixed earlier and more time must be set aside for planning the workshop than the more simple usability tests of this feasibility study.

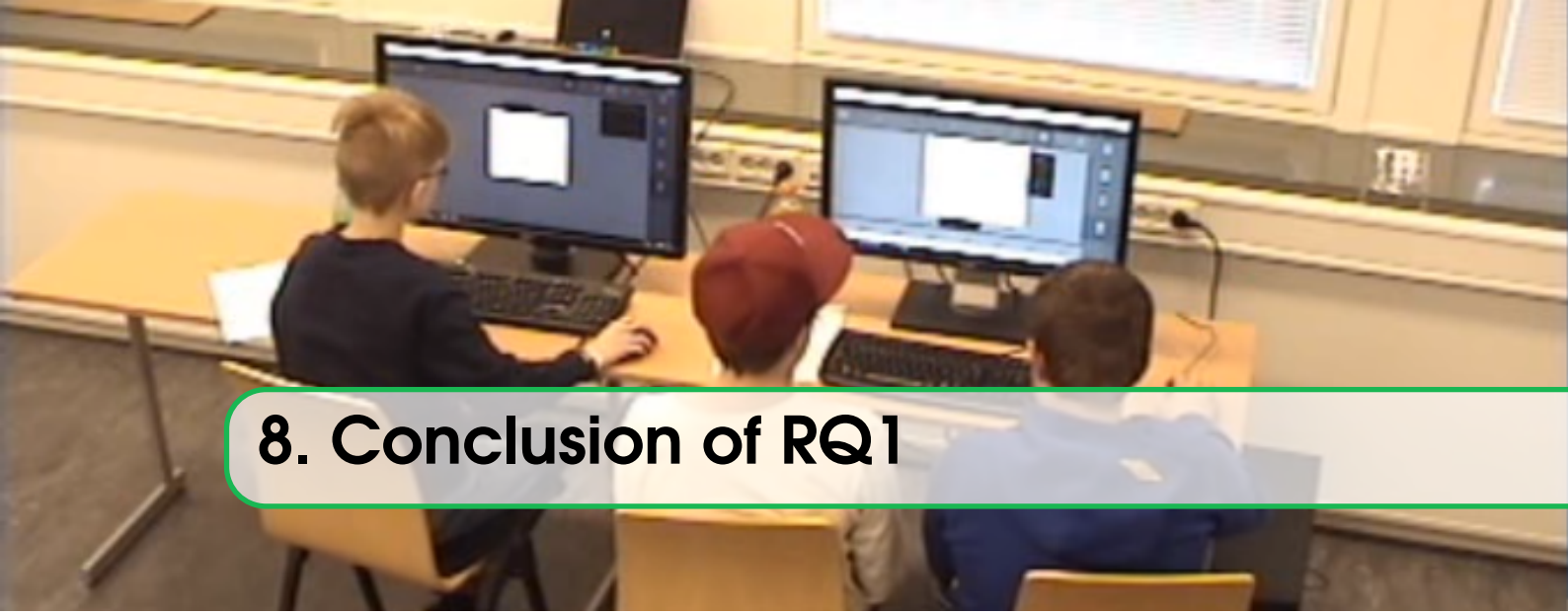
Third, the test plan needs to be tested well in advance and have the flexibility to accommodate for changes. In the feasibility study, three participants suddenly showed up when an even number was clearly preferred. The test plan and task should be able to accommodate such a change on short notice. This will also be relevant if, for instance, some participants fall ill before the workshop.

Fourth, care needs to be taken when devising the task for the children to perform in a test. Even if researchers might find the task trivial, the children can become engrossed in the task. In usability test 1, two participants made a wireframe for an app for a shopping mall where one of the shops sold scarves. When trying to include the external image of a scarf, they accidentally linked the button to a picture of a scarf online so that a new tab would open in the browser and display that scarf when presenting their wireframe at the end of the test. When this happened, the participants exclaimed, "Der ja, det er vi som selger skjerfet, så det er bare å si ifra til oss. Det er vi som selger det." (*Translation: Yes, it's us that's selling the scarf, so just let us know. We're the ones selling it.*). The same participants also voiced dissatisfaction when they received the task related to the shopping mall instead of the same app mimicking the domain of the local football club, even if the tasks were, structurally, exactly the same. As participants can easily become engrossed in the their tasks, the task can clearly influence their motivation.

Fifth, the impact of the introduction to a task or tool needs consideration. It can seem like a trivial task to give a quick introduction to the participants of what is to come, however, the content of this introduction can strongly influence the outcome of the test. In usability test 1, the participants were shown how to create new blank wireframes. They did this successfully, but had to drag in the device template for each new frame. The participants in usability test 2 were instead shown how to duplicate existing frames. This resulted in them not having to drag in the template for each new frame as they simply reused needed elements from previous frames. This could very well be a consequence of what they were shown in the introduction to the tool even if both options (blank frame and duplicate) were available in both tools.

This might also be a reason why the participants rarely used the properties. Had the introduction included the use of properties, the participants might have explored this feature more extensively. There is no way to know this, but it is an aspect to be mindful of when preparing the introduction to the topic, tool or task.

Moreover, all participants used English names for their frames despite being Norwegian. One reason could be the fact that the tool is in English, but another reason might be that, when being introduced to the tool, the demonstrator also used English names for the new frames.



8. Conclusion of RQ1

In order to investigate the overall research aim: *How does the design process benefit from involving children in digital wireframing?*, this feasibility study was conducted with the aim of answering the first research question, RQ1: *To what extent do children master existing wireframing tools?*

First, a survey of existing literature on (1) evaluating software for children, (2) relevant research methods, and (3) analyzing results was conducted. Based on this research, usability testing with co-discovery followed by semi-structured interviews were selected as research methods to identify how children master existing wireframing tools.

Second, a rigorous selection process of which wireframing tools to include in the usability tests was devised, as part of answering SQ1: *Which existing wireframing tools should be selected for usability testing with children?* A list of 12 potential tools was compiled based on an Internet search and recommendations. Based on the literature on evaluating software for children, a checklist of important aspects was created. Each tool was evaluated according to the checklist and awarded a total score along with a complexity score.[1] Based on the complexity score, each tool was placed in one of three categories of complexity, and one tool from each category was selected for the usability tests.

Six participants, aged 12-13, were recruited for three usability tests where pairs would test one tool each. However, in reality, one participant did not show up and three showed up on the same day. This resulted in a total of two usability tests were two tools were tested.

For each usability test, the participants were given a 5-10 minute introduction

[1] The research could take one of two possible paths based on the results from the usability test:

1. If the children displayed difficulties with using existing wireframing tools, a wireframing tool would be adapted, and further tested, before it would be ready to be included in the research of RQ2-4.
2. If the children fully mastered existing wireframing tools, an adaption of the tool would be skipped and work would begin directly on investigating RQ2-4.

If (1) was the outcome, the lessons learned from the usability tests of one little complex, one mid-complex and one highly complex tool would then come together to influence the adaption of the tool in the middle.

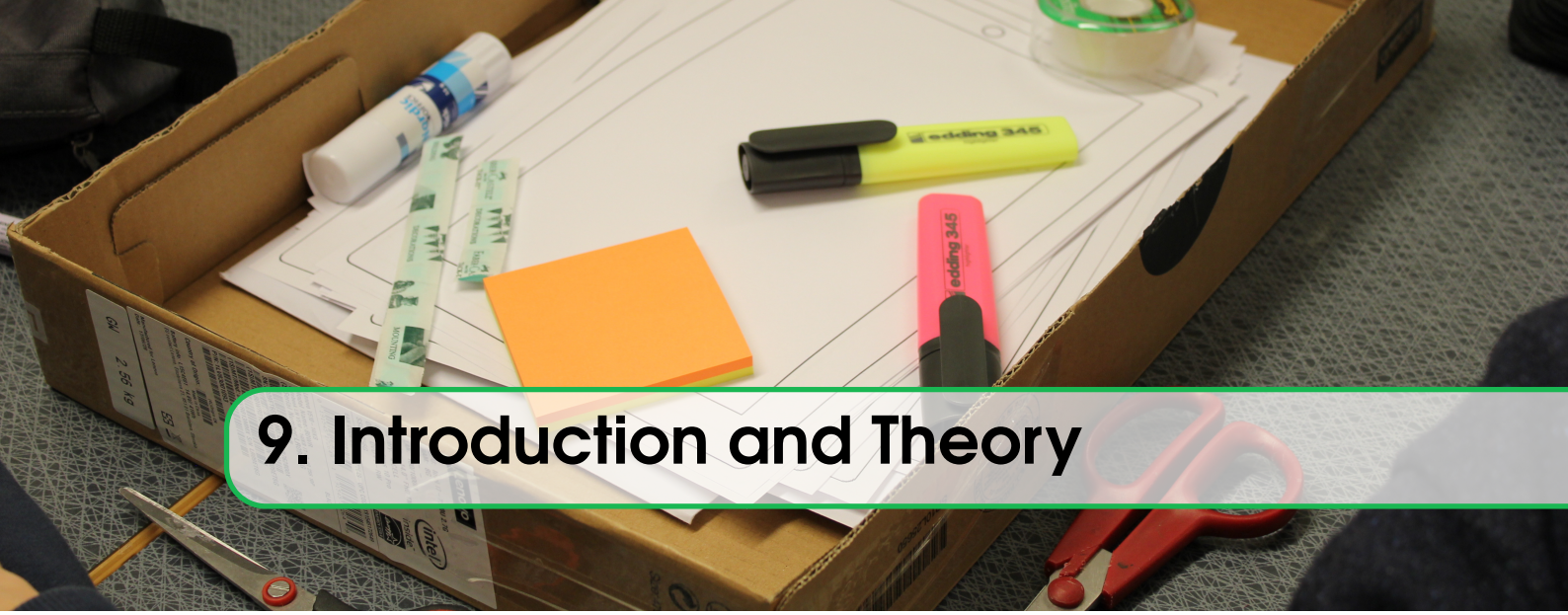
to wireframing and the specific tool before being given a task to complete. As far as possible, the participants worked in pairs to facilitate co-dicovery and each test ended with a semi-structured interview where questions were asked regarding (1) the usability of the tool, (2) the purpose of the tool and (3) the general computing background of the participants.

In addition to observation of the tests and notes from the interviews, the DEVAN framework [73] was used to analyze parts of the recording of the usability tests.

The data from these three methods highlighted some areas of the user interface which deserve further attention if aiming to adapt a wireframing tool to better suit children. However, the most important finding was that the children completed their tasks in approximately the same amount of time as the pilot test adult. Moreover, they did not display any significant struggles with the user interface differing from what adults might experience. The children were fully able to use existing wireframing tools, and adapting a tool specifically for children is not necessary for wireframing to be included in a co-design workshop.

Thus, the outcome of the feasibility study is that no adaption of the tool is required and the project can proceed with using *Balsamiq* to investigate RQ2-4.

II Main Study: Design Workshop



9. Introduction and Theory

9.1 Introduction

As the feasibility study concluded that children are able to effectively use existing wireframing tools, research can proceed directly to investigating the remaining research questions, RQ2-4. The fact that a specific tool (Balsamiq) was selected in the feasibility study to be carried over into this next part of the research, allows efforts to focus directly on planning design workshops, and how to incorporate the wireframing activity.

Research Questions

In order to answer the overall research aim: *How does the design process benefit from involving children in digital wireframing?* this part of the thesis is devoted to investigating research questions, RQ2-4:

RQ2: How can wireframing be included in co-design workshops with children?

RQ3: How does creating digital wireframes affect the children's motivation for participating in co-design workshops?

RQ4: What is the value of the produced design artefacts for the design process as a whole?

Outline

This part of the report is devoted to the main part of the research investigating the overall research aim. The rest of this chapter presents relevant background theory for this new phase of the research. Next, Chapters 10 and 11 describe the *Research Design* and *Method* for the investigation of RQ2-4 respectively. Chapter 12 presents the results of the design workshop, and Chapter 13 discusses the results in relation to the research questions and literature. Lastly, Chapter 14 presents a reality check of the findings, performed by interviewing NRK Super about how wireframing could fit into their design practises.

9.2 Theory

9.2.1 Involving Users in Design Processes

The need for involving end users in the design of new technologies to ensure usability and acceptance of the new products has long been accepted, and was standardized in 1999 with *ISO13407:1999 Human-centred design processes for interactive systems* [41], updated in 2010 with *ISO9241-210 Human-centred design for interactive systems* [42]. However, the idea of involving users was voiced as early as 1985, when Gould and Lewis [30] published a paper describing three principles necessary for creating a computer system with good usability. In fact, prior to publishing the paper, Gould and Lewis had already been recommending the principles in the 1970s [30]. These principles are: (1) "early and continual focus on users", (2) "empirical measurement of usage", and (3) "iterative design" where a cycle of modification and testing is repeated as long as necessary [30, p. 300].

User Centred Design

Gould and Lewis' principles are easily identified in the human-centred design process, see Figure 9.1, which is at the heart of user-centred design. The early focus on users is encapsulated in the first step of the iterative cycle *Understand and specify the context of use*. By defining the human centred design process as a spiral, the iterative design principle of Gould and Lewis is maintained, leading to continued involvement of the user.

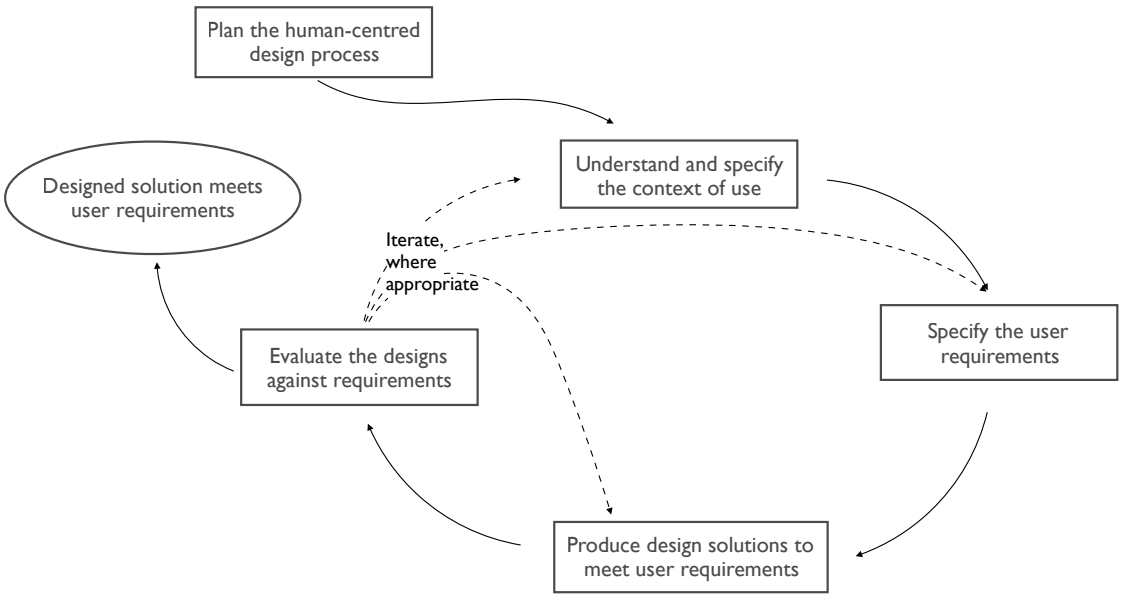


Figure 9.1: Interdependence of human-centred design activities [42, p. 11]

The principal of empirical measurement concerns itself with observing end users interact with actual prototypes, and this principle is observed in step 4, *Evaluate the designs against requirements*, if usability testing is performed as a way of evaluating designs.

In the user-centred design cycle, the user is involved at two points, in steps 1 and 4. However, in step 1, information about end users is collected by representatives from the design team through observations, interviews or other methods. The designers then form an understanding of the end users based on this information, often in the form of personas and scenarios, which in turn form the foundation for designing the solution. Thus, the end users are not directly involved in the design process, but rather represented through the designers who have observed them. The end users have no way of speaking for themselves during the subsequent steps of the design process.

If usability testing is performed to evaluate designs against requirements, this is the next opportunity for users to become involved, but only as testers.

Thus, although the users are centre-stage of the design process and design is based around an understanding of the user group, the users themselves have little direct involvement in the design process.

Participatory Design

As stated above, the principles of user-centred design stem from Gould and Lewis' principles proposed in 1985, but, at the time, "they were not accepted by most developers" [60, p. 328]. The authors themselves say that when they recommended the principles, the typical reaction was that "they are obvious" [30, p. 300], while, in fact, their studies suggest that "these principles are not intuitive"[30, p. 311] and were not applied in practise.

However, in the late 1960s/early 1970s in Scandinavia, factory workers were already being included in the design of technology commissioned for them, by ongoing efforts "in which researchers followed and supported the attempts of local trade unions to influence the use of technology at work."[7, p. 1]. These efforts later gave rise to the Utopia project [68], where newspaper graphic workers would be involved in "the development of powerful skill enhancing tools for graphic workers" [7, p. 1]. This inclusion moved beyond simply observing end users prior to defining requirements. This inclusion invited the users into the design process with "direct participation in all design and development phases of computerized tools and systems in the workplace"[68]. This is what has come to be known as Participatory Design. Moreover, several of the early methods used in participatory design: ethnographic methods, prototyping and mock-ups [67], are still integral ways of involving end users today.

Although participatory design grew out of efforts of involving factory- and graphic workers in the design of technology, its practises were soon embraced by other industries (e.g. consumer electronics) [13], used with other age groups (e.g. children) [21], and exported to other countries [32].

Contextual Design

While not a design framework in itself like user-centred or participatory design, contextual design "is a structured, well-defined user-centered design process that provides methods to collect data about users in the field, interpret and consolidate that data in a structured way, use the data to create and prototype product and service concepts, and iteratively test and refine those concepts with users." [39]. In

short, it aids designers in collecting and interpreting data from the field, necessary for defining and evaluating concepts.

Thus, applying contextual design to traditional user-centred design can enhance the role of the end user, by providing the designers with an even deeper understanding of the users, and the context they operate within, before defining requirements for new systems.

Contextual design contains 6 parts of which contextual inquiry is the first [6] and is briefly described here as it is relevant for cooperative inquiry which is described later in the chapter.

Contextual inquiry concerns itself with getting to know the end user. This is achieved through various activities such as observation and interviews. What is important is that these interviews take place in the end users environment where the system is meant to be used. The difficulty with interviewing end users is that "work becomes so habitual to end-users that they often have difficulty articulating exactly what they do and why they do it" [39]. Thus, these interviews need to take place while designers are observing end users in their actual work environment. In this activity, the designers can inquire into the actions of the end users as they are performed and the designer can slowly build an understanding of the end users in their environment. Most important in this process is that this inquiry takes place in the context where the system will be used, giving rise to the name contextual inquiry.

9.2.2 Involving Children in Design Processes

Children are a distinct user group with needs, wants and abilities different to those of adults. If aiming to include children into design processes, the above mentioned frameworks need to be reviewed in light of these differences to see if they are applicable for use with children. Much research exists on this topic, and much is based on the work of Allison Druin, a pioneer in the field of including children as design partners.

The authors of informant design (see below), argue that children cannot play the same role as adults in user-centred and participatory design. Cooperative inquiry, however, is strongly based on participatory design activities, whereas bonded design is categorized between informant design and cooperative inquiry when it comes to the involvement of children as users.

Informant Design

Despite the several advantages of involving end users throughout the whole design process, questions have been raised about its efficiency and feasibility in some situations. One of the features of participatory design is that designers "respect users more as partners in the design process and in doing so...give them a more equal and responsible role." [63, p. 343]. Scaife et al. [63] have questioned the use of participatory design with children, questioning whether it is really possible for children and adults to view each other as peers.

Classifying themselves between user-centred and participatory design, they propose a new framework called *informant design*, in which children are seen as informants rather than either users or participants [63]. The context in which the framework was first proposed was in the design of interactive learning environments,

and, thus, teachers could also be seen as informants. Informant design is therefore described as "an interplay between privileged observations from potential users and ourselves with another set of skills", *ourselves* being the authors Scaife et al. Thus, informant design distinguishes itself from user-centred design in that designers or researchers should "hope to be able to discover what [they] did not know rather than try to confirm what [they] thought [they] knew." [63, p. 344]. Additionally, it distinguishes itself from participatory design by deliberately not treating children as equal participants, but rather acknowledging and respecting their lack of "time, knowledge or expertise to participate in the collaborative model prescribed in PD [participatory design] approaches." [63, p. 344].

Cooperative Inquiry

Cooperative inquiry is the name of the research method developed by Druin and her team for including children in design. Over the last two decades, she has invited children into the Human-Computer Interaction (HCI) lab at the University of Maryland on a regular basis with the aim of designing new technologies in intergenerational teams. When she began this work in the mid-90s, the methods for including children were based on the already existing methods used for including adults into user centred design processes, such as participatory design and contextual inquiry [21]. Over time, the methods were adapted to the needs of the intergenerational design team, resulting in the development of cooperative inquiry.

Through her work, she has identified four different roles children take take when designing technology for children [22]. These are: User, Tester, Informant, and Design partner. They vary in how much they can influence the final product, see Figure 9.2, the further out of from the centre, the more active participation.

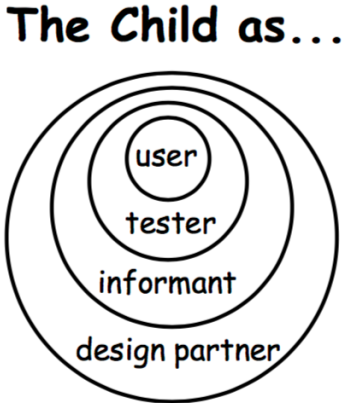


Figure 9.2: The four different roles children can take when designing new technology. [22, p. 4]

As a user, very little influence can be exercised over the final product as it is already released. Testers often come into the process towards the end of an iteration cycle and if important aspects are uncovered late in the process, it is often too late to change the product based on them. Thus, only small alterations can be done at this stage. Informants come in at an earlier stage and can bring attention to aspects which can still be incorporated into the design. Design partners, however, join the

design process from the start and have an equal role to the others in the design team when creating concepts for new products. This role is unique in that it gives children the opportunity to influence which products are developed for their own group, similar to the involvement of users in participatory design. Druin's work with children is mostly focused on them having the role of design partner.

The techniques originally comprising cooperative inquiry as a research method are: Contextual Inquiry, Participatory Design, and Technology Immersion. Contextual inquiry is concerned with the importance of the researchers collecting data in the users own environment [21]. In the case of Druin, however, "at the University of Maryland, the researchers are not just adults who gather data from a child's world. Both adults and children observe, take notes, and interact with child users." [21, p. 594]. When using this technique with children, it became clear that they were not able to approach note-taking in the same way as adults. For example, their written skills were inadequate to convey "meaningful results" [21, p. 594]. However, the children enjoyed drawing and ended up creating "cartoon-like flow charts" [21, p. 594]. **Taking notes**[1] and sharing them is an important part of cooperative inquiry, but note-taking might not take the same form for all participants.

Based on first observing the users, the next technique is **low-tech prototyping** adapted from participatory design. Druin feels that prototyping works best with children aged 7-10 years old [23].

> These children are verbal and self-reflective enough to discuss what they are thinking. They can understand the abstract idea of designing something with low-tech prototyping tools that will be turned into future technologies. Children at this age, however, don't seem to be too heavily burdened with pre-conceived notions of the way things "are supposed to be" [21, pp. 595-596].

Low-tech prototyping is accomplished by providing the participants with craft materials they can use for prototyping. This activity is aptly named **"bags of stuff"** by the children [74, p. 1238]. While some researchers disagree, Druin emphasises that "the selection of low-tech prototyping tools is critical" [21, p. 596], and should be carefully selected based on the nature of the particular design activity.

Brainstorming and using **sticky notes** to provide feedback or critique ideas are also widely used activities. Another activity, closely linked to brainstorming is **"mixing ideas"** [33, p. 40], where individual ideas are combined into new ideas.

In addition to the tried and tested journaling, prototyping, and brainstorming activities, **Layered Elaboration** was developed for the purpose of co-designing mobile and social media [75]. Layered elaboration is a co-design technique which uses transparencies to allow iterative development of ideas while leaving previous versions of the ideas intact [74].

The last technique, technology immersion, focuses on observing children interacting with technology. In order to understand the future needs and wants of children when it comes to technology, they must be allowed to interact with more technology, than what they have access too at home. At this point, we need to take into

[1] The activities used in cooperative inquiry are highlighted in boldface in the text.

consideration that in 1999, when this article was published, children had access to far less technology rich environments than today. Thus, this point might have to be reconsidered in today's climate.

Cooperative inquiry is primarily developed for children aged 7-11 [33], but has also been used with children as young as 4-6 years old [27]. However, in these cases, certain adaptions need to be made to address the differences between such young children and the older children when it comes to attention span and need for adult initiation of activities.

Based on the success of cooperative inquiry for involving children into design, other teams have set up their own intergenerational design teams [45]. Knudtzon et al. [45], set up a new intergenerational design team at the University of Baltimore, with children ages 10-13. Thus, their research was both related to setting up a new team, while at the same time including children older than those involved in traditional cooperative inquiry. Their aim was to extend the cooperative inquiry research already taking place at the University of Maryland.

Bonded Design

Another method, with similarities to cooperative inquiry, is 'bonded design' [47]. This method too is based on intergenerational teams, but in contrast to cooperative inquiry, bonded design shares the concern of informant design and "questions the extent to which equality can exist within an intergenerational team." [47, p. 64]. Thus, bonded design focuses on "bringing together for design purposes a team that unites in diversity" [47, p. 79] in such a way that "two disparate groups...[are] able to draw upon their relative strengths and achieve something neither could do in isolation" [47, pp. 78-79] while at the same time acknowledging that the different groups will not have the same role. This then places bonded design between informant design and cooperative inquiry. Figure 9.3 depicts how the different methodologies rank when it comes to actively involving children in design processes.

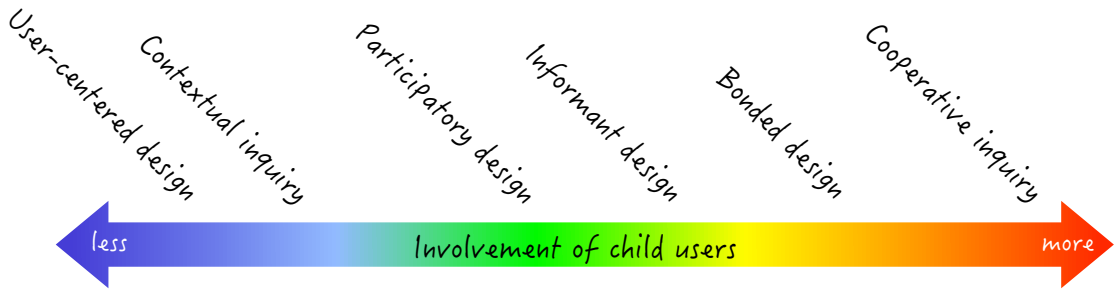


Figure 9.3: Involvement of child users in different user-centred approaches

Key activities to bonded design include: team-building, drawing, brainstorming and consensus building, and games and journaling. Journaling in this method is different from note-taking in cooperative inquiry. In cooperative inquiry, note-taking is included as part of the contextual inquiry technique to observe users. In bonded design, journaling is used as an outlet for individual team members when in need of a break from group activities, and in no way influences the designed product.

Children are Not a Homogeneous User Group

There is much research devoted to children as a separate user group, however, children are not a homogeneous user group, and as much variety can be found within this group as with any other. Owing to the large developmental changes taking place between early childhood and teenage years, one could even argue that defining the characteristics of 'children' is impossible. Often, children denote pre-teens, but still much variation exists within this category.

Markopoulos and Bekker [50] have written about the different age groups comprising what is referred to as 'children' in child-computer interaction. They categorize children's development into four stages. First is the 'dependency/exploratory' stage from 0-2 years old, where they cannot play together, and enjoy repetitive activities. Second, ages 3-7 is the 'emerging-autonomy' stage where the children are still fairly self centred and work best with concepts which are not too abstract. Third, the 'rule/role' stage at 8-12 years old is when the children shift to playing more together and become interested in competition. This is also the age group which is the focus of the research presented in this thesis. Fourth, the last stage is from 13 years and up, and is simply referred to as 'early and late adolescence'.

Whether one agrees, or not, with the characterizations of the separate stages, children still pass through various stages of development, and there are no design methodologies which can target all at once. Thus, it is clear that when working with children, it is necessary to have a clear idea about which age group one is targeting, and treat this age group as distinct from other age groups. Moreover, which age groups is targeted needs to be clearly expressed to readers so that results from one study involving 'children' are not applied to another study involving 'children' as the two groups might have nothing in common.

One of the key reasons for user centred design, and the motivation for so many different methodologies for involving users into the design process, is that "there is no design that fits all" [50, p. 141]. Thus, treating children as one homogeneous user group is in clear contrast to the nature of user centred design practises themselves.

9.2.3 Digital Tools in Design Processes with Children

Although most work with involving children in the design process is based around low-tech prototyping techniques, this section presents some of the existing literature on including digital tools in co-design with children.

DisCo: an Online Tool for Asynchronous Distributed Co-Design

Based on cooperative inquiry, DisCo [75] was developed to facilitate co-design within distributed teams located in different time zones. Cooperative inquiry was long based around co-location of the team, but Walsh et al. acknowledged that, in order to design for users nation- or world-wide, including children and adults in remote areas is important. Thus, a tool to support such collaboration was needed, and DisCo is the result of co-design itself.

DisCo was originally developed as a digital version of layered elaboration, described above. An online version of layered elaboration would let distributed teams build upon other teams' ideas without 'destroying' previous ideas, and would allow

iterations to be rolled-back.

The DisCo interface contains a window for drawing ideas which resembles a simple digital drawing program. Additionally, the interface includes a window for commenting on the designs. Thus, DisCo moves paper prototyping to the screen with the added functionality of undoing recent actions, and distributed team can extend each others' ideas in their own time and communicate about the changes through written comments.

A Comparison of Prototyping with Paper and Software

To fill the research gap of "a formal comparison of paper and software tool[s]" [38, p. 1], Heintz et al. conducted an empirical study where 28 Informatics students were asked to use both paper- and software-based prototyping activities. The research team developed their own software tool based on layered elaboration, and compared its use to paper prototyping based on layered elaboration.

DisCo, presented above, is very similar in this regard as it was developed as a collaborative online version of layered elaboration. However, the success of using the tool was never compared to using layered elaboration with paper. Thus, Heintz et al. aim to make this comparison explicit and document it through their study.

In order to make the comparison, the paper and digital designs were "rated regarding aesthetics, usability and relevancy by two HCI specialists." [38, p. 5], with the result that there was no statistically significant difference between the two regarding aesthetics, usability or relevance. The only aspect of significance was that the digital prototypes outperformed the paper prototypes regarding how 'pleasant' they appeared.

The participants were also asked several questions in relation to which tool they would prefer (paper or software) for different activities within the the prototyping process. There was not a marked difference in preference, but a slight preference was detected for the "paper-based approach for the initial design, but PDotCapturer[the software] for the following round of annotation activities" [38, p. 9].

Paper or Pixel

Another aspect of the design process apart from concrete design activities, is feedback activities. Heintz et al. [37] conducted a study comparing the quantity and quality of comments on a prototype, differing in if the prototype was a paper prototype, or a prototype developed with a digital wireframing tool, Balsamiq.

The authors themselves state, in their article, that "[t]o the best of our knowledge, no study has been conducted to compare systematically a paper-based and tool-based approach to determine to what extent software tools can be used to support or even replace paper-based PD activities" [37, p. 503]. They answer it in part by investigating the extent to which feedback differs in the two approaches.

In their study, they developed two prototypes: one on paper, and the same with Balsamiq and tested them with two schools and a teaching programme. The groups which tested the paper prototypes used the layered elaboration technique to provide feedback on the prototype. By using transparencies laid on top of the original prototype, they could write their comments on the transparencies, while leaving the original paper prototype intact.

The groups which tested the digital prototype created with Balsamiq could drag virtual sticky notes onto the prototype and write their comments on these. In Balsamiq, a layer was added on top of the prototype so than all feedback was contained on this separate layer, leaving the prototype intact. This was the same mechanism as used in layered elaboration.

The paper based approach to commenting led to almost three times as many comments as the software based approach with Balsamiq prototypes. Thus, quantitatively there was a marked difference between the two approaches. Qualitatively, however, they could not identify any significant difference in the quality of the comments. They conclude that Balsamiq "cannot be used to replace the paper-based method" [37, p. 515].

Learner Centred Co-design of Educational Technologies

The Education Development Center (EDC) works with developing "digital resources aimed at encouraging young people to pursue science, technology, engineering, and mathematics (STEM) education and careers." [55, p. 3]. Pillai et al. presents a participatory design method developed with EDC for the design of such educational technologies. The method has several steps of which one is "youth co-design team activities" [55, p. 4], which is the focus of Pillai's paper. The method draws on many of the ideas already discussed above, such as cooperative inquiry and informant design.

However, they have a learner-centred approach rather than the more traditional user-centred approach.[2] First, they work to design educational technology, which implies that the end users are learners. Moreover, they are committed to making the design activities themselves a learning experience for the child participants. They discuss "identifying key topics and skills that youth should gain by being part of the design team" [55, p. 7].

The article describes what is done to develop a co-design method for educational technology for its end users, while at the same time providing a learning experience for its designers.

9.2.4 Ethical Research with Children

Alderson presents three roles of children in research: passive, aware and active [3, p. 3], and argues that, as active participants, children "may enjoy the process more...[and the]...findings may more accurately report children's own views and experiences." [3, p. 3]. However, he further argues that "[r]esearch means collecting, analysing and reporting data and this cannot directly benefit the children who take part. They might incidentally learn, or enjoy the project, but this cannot be promised, and is not the purpose of the research". Thus, a balance needs to be sought between ensuring a positive experience for the children while at the same time ensuring the collection of necessary data.

[2] Learner-centred design was promoted by Soloway et al. in 1994 [65], and focused on interfaces for professionals as learners at work. Computer power had drastically developed since user-centred design was popularised, at least in the literature, and Soloway et al. argued that the added computer power could be used to develop interfaces which could, and should, support learning at work.

When recruiting children for research purposes, incentives are a common strategy. However, the type and appropriateness of incentives will differ from study to study. Different factors which influence the incentives include: age of participants, length of study, type of research, experienced burden of participation, or other local guidelines affecting the study [58]. Moreover, incentives are sometimes given to parents or guardians as well.

Closely tied to incentives, are rewards. If announced prior to the research, these rewards may function as incentives. Regardless, many of the same issues apply to rewards as to incentives when determining what is appropriate.

Another issue related to recruitment of participants is informed consent [3, 31]. The research project should be described in such a way that the participants themselves understand to what they are giving their consent, not just the parents.

To support researchers in conducting ethical research, the 'Ethical Research Involving Children' (ERIC) project [31] was set up as a result of researchers reporting a lack of access to resources of how to conduct ethical research with children. The findings of the project resulted in the ERIC resources which include online and printable material to aid researchers in setting up and conducting ethical research with children, and provides them with an online community in which to share experiences.

9.2.5 Thematic Analysis

This section presents one of the key methods for analyzing the data collected in this research: thematic analysis. Thematic analysis is a qualitative method for analyzing written data, be it observation notes, transcripts, documents etc. The method stems from psychology, but is used extensively in various other fields, including HCI research [10, 52, 71].

For a long time, thematic analysis was a "poorly demarcated...yet widely-used qualitative analytic method" [9, p. 4]. Braun and Clarke [9], thus, set out to describe this process in detail and outlined clear steps of how to apply this analytic method. They describe thematic analysis as "a method for identifying, analysing, and reporting patterns (themes) within data" [9, p. 6], where the process of identifying themes involves "careful reading and re-reading of the data." [59, p. 258] Braun and Clarke suggest 6 steps for performing this analysis [9]:

1. Familiarizing yourself with your data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

Thematic analysis can be either inductive or deductive. In the inductive approach, the themes 'emerge' from the data itself and are not influenced by the researcher's prior interests or agenda. With the deductive approach, the researcher approaches

the data with prior knowledge, hypotheses, or particular interests in the field, and looks for patterns connected to certain theories, or research questions for example.

The two approaches can also be combined. Fereday and Muir-Cochrane propose a "hybrid process of inductive and deductive thematic analysis to interpret raw data" [28, p. 80] to ensure rigour in the process of applying a thematic analysis. They argue that their method maintains rigour as it demonstrates "transparency of how the researcher formulated the overarching themes from the initial participant data" [28, p. 82].

Thematic analysis can be applied in various ways and to various fields. Many researches in the field of HCI, who apply thematic analysis to their data, base their analysis on the steps outlined by Braun and Clarke. However, certain adaptions are sometimes made, or steps are omitted depending on the goal of that particular research. Brown and Stockman [10] found that, as a tool for informing design of new technologies for families, "the first 3 phases of... thematic analysis... were the most fruitful in yielding information about the families' use of technology" [10, p. 1], and concluded that

> [T]hematic analysis can be used in HCI research as a full method (Phase 1-6), when the aim is to present a summary of the data in a form of a high-level thematic map accompanied by the analytic narrative or a partial method (Phase 1-3), when the aim is to use low-level detail to either improve functionality and usability of the existing technologies or inform the design of new technologies [10, p. 5].

Tanaka et al. used thematic analysis in a similar fashion to "extract emerging themes across [their] survey data set...to inform the design of an interactive system" [71]. As opposed to Brown and Stockman, however, Tanaka et al. focused on identifying "high-level themes" [71].

As seen from the examples above, there are various ways of applying thematic analysis. In this project, all of the 6 steps presented above, will be followed.

10. Research Design

This chapter presents the combination of different research strategies and methods for collecting relevant data, and how to analyse this data, to most effectively answer RQ2-4. The respective research processes are described by use of figures based on Oates' model of the research process, see Figure 3.1. This chapter gives a general overview of the overall research design for RQ2-4, while more detailed explanations of the choice, and application, of the individual methods can be found in Chapter 11. The chapter ends with a section on how to ensure validity of the research methods.

10.1 Research Design for RQ2

> Research question 2: *How can wireframing be included in co-design workshops with children?*

Figure 10.1 presents the research design for RQ2. The research strategy for investigating RQ2 is an experiment in which a wireframing activity is included into a co-design workshop following paper prototyping.

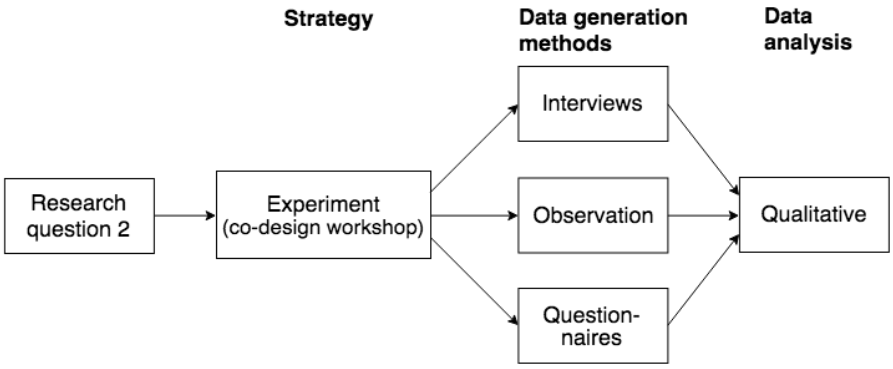


Figure 10.1: Research process for RQ2

In order to assess the success of including wireframing in this manner, data will be collected primarily by means of observation by an interdisciplinary observation team. A few questions related to the topic will also be put to the participants in the form of an interview and a questionnaire.

The collected data will be analysed qualitatively. Observations from the workshop will form a basis for describing to the reader what happened during the workshop, and give the researcher material for evaluating to which extent the wireframing activity was successfully included into the co-design workshop.

10.2 Research Design for RQ3

> Research questions 3: *How does creating digital wireframes affect the children's motivation for participating in co-design workshops?*

Figure 10.2 presents the research design for RQ3. The research strategy chosen is the same as for RQ2: an experiment in the context of a co-design workshop. Oates is primarily concerned with research on information systems and computing, whereas the research presented in this thesis largely overlaps with design research. As co-design is a widely-used design research method, a co-design workshop will be used as an experiment to investigate participants' motivation.

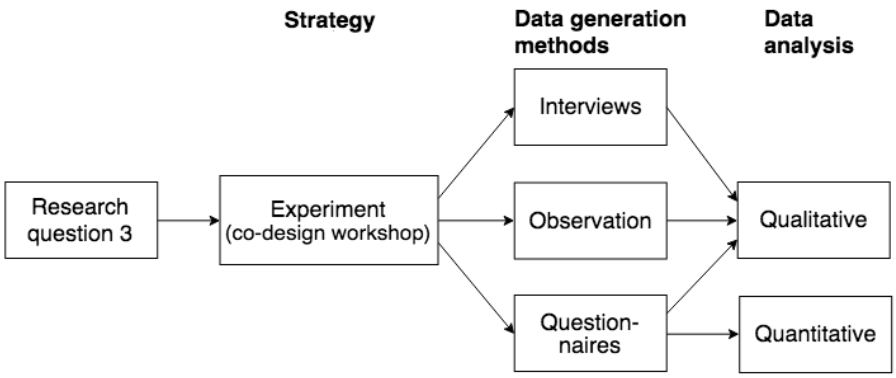


Figure 10.2: Research process for RQ3

In the context of a co-design workshop, data will be collected on the children's motivation by means of observation, questionnaire and a group interview. Again, the observation will be conducted by an interdisciplinary observation team. Moreover, the group interview will be based on the structure of the questionnaire and used as an opportunity for further elaboration of answers to the questionnaire, if applicable.

The data from the questionnaire will be analysed quantitatively. The group interview will be transcribed and analysed qualitatively together with the observation notes. Some of the questions in the questionnaire are open questions and, if applicable, these answers will also be analysed qualitatively together with the interview transcript and observation notes.

10.3 Research Design for RQ4

> Research questions 4: *What is the value of the produced design artefacts for the design process as a whole?*

Figure 10.3 presents the research design for RQ4. The research strategy for investigating RQ4 is also a co-design workshop with children, the same as for RQ2-3. In order to evaluate design artefacts, these artefacts will need to be produced, and the co-design workshop sets the stage for this production.

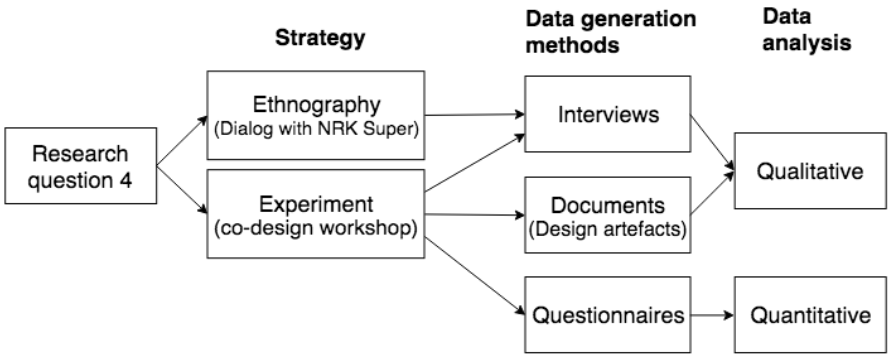


Figure 10.3: Research process for RQ4

Data collection for RQ4 will be based on the produced artefacts. The 'design artefacts' serve the same purpose as 'documents' in Oates' model. The artefacts are the outcome of the workshop and will be assessed for their value to the design process. This assessment is the primary data collection method for RQ4, but as for RQ2, related questions will be put to the participants through an interview and a questionnaire.

Lastly, the produced artefacts will be evaluated qualitatively through dialog with NRK Super (in the role of the customer), in addition to comparing the digital wireframes to the paper prototypes. Adhering to Oates' model, this dialog with NRK Super is classified under the 'ethnography' research strategy, where the purpose of the dialog is to discuss with NRK Super how the produced artefacts are of value to them.

10.4 Combined Research Design for RQ2-4

By inspecting the research designs for RQ2-4 above, it is clear that they all share a co-design workshop as their research strategy, and RQ2-3 both have observation as an important data collection method. RQ3 also collects data through a group interview and questionnaires, but these can also be used to elicit answers from participants in relation to RQ2 and RQ4.

Thus, it is clear that data can be collected for RQ2-4 through holding *one* co-design workshop. By observing this workshop, in addition to conducting a group interview and giving the participants a questionnaire, data can be collected for all research questions through the same workshop. Lastly, the design artefacts produced during the workshop, and the dialog with NRK Super, will form the basis

for collecting data for RQ4. Figure 10.4 presents a combined research design for RQ2-4.

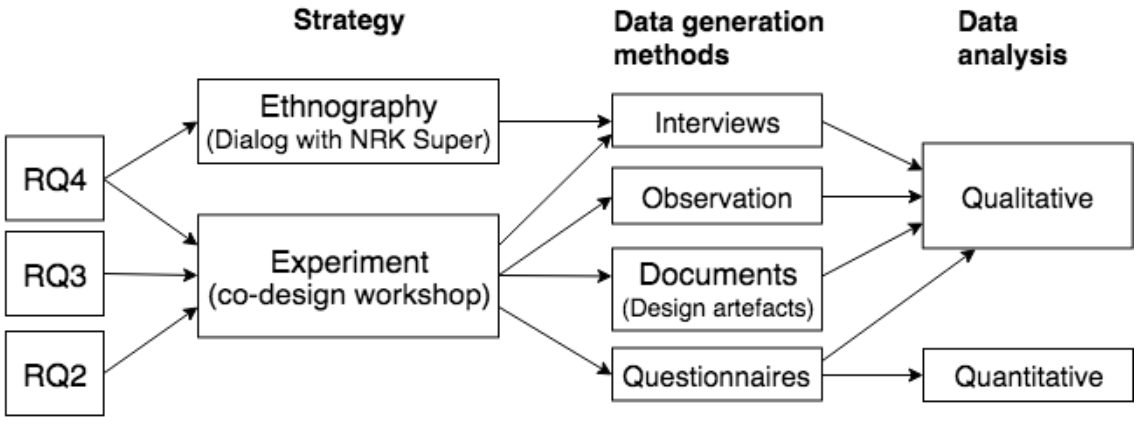


Figure 10.4: Combined research process for RQ2-4

As stated in the respective sections above, most of the data will be analyzed qualitatively with the view of identifying information relevant to answering the respective research questions. In addition, a thematic analysis will be performed on the group interview transcript and observation notes based on the 6 steps of thematic analysis presented in Section 9.2. This analysis will be detached from a specific research question, with the aim of discovering themes relevant to the overall research aim, but not necessarily covered by any of the research questions.

10.5 Validity of Research Methods

This research concerns people, and is not simply a study into natural phenomena though which the scientific method, or the positivist research paradigm, developed. The scientific method is based on two fundamental assumptions: (1) The world is ordered and regular, not random, and (2) It can be investigated objectively [54]. The quality requirements ensuring validity of results in this paradigm are: objectivity, reliability, internal and external validity [54]. However, the research presented in this thesis deals with human beings studying other human beings, who are neither ordered and regular, nor can they be investigated objectively. Thus, the quality requirements for the scientific method cannot be readily transferred to this more interpretivist research paradigm.

Interpretivists concern themselves with the social context of what is being studied: the social processes though which the object of study influences, and is influenced by, its social setting. Interpretivism is based on an understanding that "there is not single version of 'the truth'" [54, p. 292], researchers are inherently biased, and that people should be studied in their natural environments instead of in a constructed lab setting [54]. Assessing the validity of interpretivist research, thus, requires different criteria than the traditional scientific method. One set of criteria described by Oates [54, p. 294] (originally proposed by Lincoln and Guba [49]), contains the following:

1. **Trustworthiness:** to what extent can the research be trusted?
2. **Confirmability:** does the research report contain enough information for readers to judge whether the findings can indeed be discerned from the data and experiences?
3. **Dependability:** is the research process recorded in such a way that an 'audit trail' can be performed?
4. **Credibility:** what has the research done to ensure that the subject of the research is accurately described? Only by an accurate description of the subject can the credibility of the findings be established.
5. **Tranferability:** are parts of the research transferable? Does the researcher give a sufficiently detailed description of the context to allow external researchers to determine whether some of the findings are relevant to their own research?

   [54, p. 294]

As the research presented here shares several elements with interpretivism, the validity of the overall research will be evaluated according to the list of criteria presented above. Aspects influencing validity of the individual data collection methods: observation, interview and questionnaire are discussed in Section 11.3 under the respective data collection method.

Regarding the thematic analysis, Braun and Clarke have compiled a checklist with criteria for evaluating thematic analyses [9, p. 36], see Figure B.1, which will be used for evaluating the thematic analysis in this project.

The extent to which the research results are valid, based on the overall research process, the individual methods, and analysis, will be discussed toward the end of the thesis in Section 13.5.

11. Method and Materials

According to the combined research design presented above, a co-design workshop is key for investigating all remaining research questions. This chapter describes, in detail, the co-design workshop used in this project, in addition to giving a more detailed elaboration of the different data collection methods used throughout the workshop.

11.1 Materials

The participants of the co-design workshop are nine children, aged 11-12. They will produce both paper prototypes and digital wireframes. The digital wireframing tool used is Balsamiq [5].

Participant Selection

The participants, three boys and six girls, are all 7th graders and randomly selected from 70 volunteers at a local school, as challenges with private recruiting were encountered in the feasibility study. The three boys and six girls are split into three groups by their teachers, resulting in one group of boys and two groups consisting of girls.

The particular age group was selected because it (1) targets the upper range of NRK Super's user group (2-12 year olds), a group they struggle to design for, and (2) pushes the upper age limit of the participants in Cooperative Inquiry where similar design activities have proven successful.

NRK Super as a collaborator, in addition to the nature of the design workshop itself, proved attractive for the school, which had no problems justifying their participation in their curriculum.

Consent

As participants are recruited from a local school, consent does not need to be individually sought since the workshop is held at the school during school hours and parents sign a general consent form regarding their child's participation in various activities, and the documentation of these, when they enroll at the school. Regarding

photography, the participants will be orally provided with information about how the images will be used at the beginning of the workshop.

Wireframing Tool Selection

Balsamiq is selected based on the feasibility study (Part I). As a tool with basic functionality, it is easy to learn and use. Moreover, Balsamiq has a great cloud option which is a requirement for using the school's Chromebooks [17], where software cannot be installed on the computer.

Workshop Setting

Acknowledging that the research community disagrees whether research with children should take place in their natural school setting or not [56], this workshop will take place during school hours at the school itself. The participants will give up ordinary classes to participate in the workshop.

While conducting research with children in a separate facility can aid in lessening the common dynamics found in a classroom setting [56], holding the workshop at the school during school hours is preferable when it comes to seeking consent of individual students and does not compete with other extracurricular activities. The children might also feel more comfortable in a school setting [77].

As this workshop is held close to Christmas, a busy time for pupils and parents alike, holding the workshop during school hours is preferable. Moreover, the alternative UX-lab at the university, which would otherwise have been the preferred option regarding video recording for data collection and analysis, is located too far away from the target school, and the duration of the workshop would have had to be shortened. Thus, holding the workshop at the school during school hours was the preferred option.

To limit the common classroom dynamics of teacher/pupil and right/wrong answers, the teacher will not be present. Moreover, the workshop organizers will strongly emphasize that the workshop is held to gain insight into the user group and learn from their ideas. It is not about doing the *right* thing or getting the *right* answers. Everything the participants produce is valuable feedback to the research team and NRK Super. Emphasis will be placed on the participants as experts of their own user group, and the research team and NRK Super are dependent upon insights provided by the participants in order to target that particular user group.

11.2 Research Method: Co-Design Workshop

UX and co-design workshops are organized in numerous ways in the industry and several studies exist describing co-design with children, see Section 9.2. In order to create a workshop which fits the specific constraints (aim, time, place, participants) of this study, elements from different methods and studies are combined.

The workshop schedule is developed in collaboration with NRK Super, and the activities comprising it are based on techniques used in Cooperative Inquiry [21], Bonded Design [47], Good Design Faster [8, 12], and input from NRK Super itself. A summary of where the different techniques and activities are incorporated into the

workshop schedule can be found in Figure 11.4 at the end of the following section, *Workshop Schedule*.

Workshop Schedule

The workshop is planned around the standard break times of the school. Apart from these breaks and a compulsory 15 minutes spent reading in the morning, the whole school day will be spent on workshop activities, just under four hours in total. The original schedule for the day is presented in Figure 11.1.[1]

MAIN ACTIVITY	SUB TASKS	TIME LIMIT
Intro and Icebreaker		15 min
Paper prototyping warm up: Reproduction of existing solution	Introduction to paper prototyping	5 min
	Create prototypes	10 min
	Present in groups	5 min
	Likes/dislikes with stickers	5 min
Main prototyping task	Introduction to task	5min
	Three individual sketches	10 min
	Present sketches to team	5 min
	Create one individual sketch	5 min
	Create one sketch per group (Iteration 1)	20 min
	Sticky note session, groups mixed	10 min
	New design (iteration 2)	10 min
Break		**30 min**
Wireframing	Intro: wireframing	5 min
	Create digital wireframes	55 min
Food break	(The pupils were allowed to keep working on the wireframes)	**20 min**
Break		**25 min**
Present wireframes		10 min
Data collection and wrap up	Questionnaire	10 min
	Group Interview	35 min
	Wrap up	5 min

Figure 11.1: Original schedule

Intro and Icebreaker The workshop begins with an introduction explaining its purpose and structure. The participants are then immediately divided into their groups, and presented with an icebreaker exercise.

[1]This is the planned schedule. As with many workshops, this schedule had to be altered during the workshop. See Figure 12.3 in Chapter 12 for the actual schedule followed in the workshop.

The importance of well functioning teams in design processes is acknowledged in the literature [45]. In [45], the researchers aimed to set up an intergenerational design team based on the principles of Cooperative Inquiry and experienced some organizational challenges related to teambuilding, or the lack thereof. They describe it as follows:

> "Despite advice from Dr. Druin to focus on initially building a strong team, our first two months were primarily spent pursuing research agendas, ultimately in a rather inefficient manner. Due to a lack of team-building activities we weren't truly becoming accustomed to being a team until later in the semester when we shifted our focus to include more team building activities. This shift quickly alleviated our organizational issues and made us questions why we didn't focus on teambuilding activities from the start." [45, p. 54].

Thus, in order to get the groups in this workshop working as teams as quickly as possible, the icebreaker is included. The name of the exercise is *one hand paper airplanes* [46]. This icebreaker is suggested by NRK Super who recommended using an icebreaker related to what the participants would be doing later. Moreover, the icebreaker should lead to all participants feeling comfortable in the workshop so that they can participate actively in the following activities.

The exercise is described online by Kevin Langer in SAP User Experience Community [46]. In this exercise, all team members put their dominant hand behind their back and are instructed to create paper airplanes together as a group. While working on the airplanes, the facilitators are advised to prompt the participants to test their airplanes and make necessary adaptions, as the groups will race each other when the time is up.

Langer states that they use warms ups, generally, to "refocus, energize and motivate" [46]. The additional goal of this particular warm up is to get the groups to make prototypes by "casually point[ing] out a flaw in a plane and suggest they build a second one." [46] As these airplanes are made with paper, they work well to introduce the first part of the workshop which will be devoted to making paper prototypes. As such, the icebreaker is not used to refocus the participants but rather to set the tone of the workshop from the beginning. Thus, in addition to the goals descried by Langer, the icebreaker is included for four reasons:

1. Teambuilding within the groups which will work together through the whole workshop.

2. Setting the tone for the workshop by being thrown right into fast paced activities with tight time limits.

3. Becoming familiar with the medium (paper) they will work with in the first half of the day.

4. Introducing the value of prototypes (testing and making alterations).

Paper Prototyping Warm-Up Paper prototyping begins after setting the mood with the icebreaker. The research team was concerned whether paper prototyping would be too confusing for the participants to understand in the short time designated for the activity. Thus, a paper prototyping warm up exercise is included, to not lose valid time when creating paper prototypes for the main case from NRK Super.

The warm up begins with a live demonstration by the workshop facilitator in which she creates a wireframe of how users can identify and watch an episode of *Peppa Pig*. Using already prepared materials, the workshop faciliator will create this wireframe in front of the participants, focusing on the necessary webpages, and the navigation between them, see Figure 11.2.

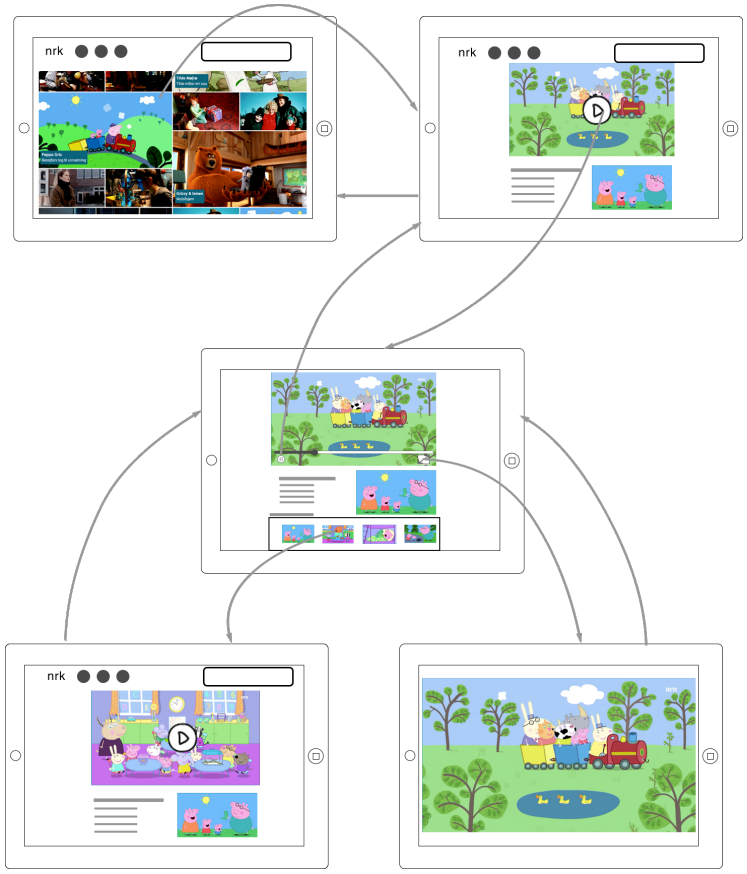


Figure 11.2: Wireframe for live demonstration of paper prototyping.

After this demonstration, the actual warm up task is presented. In this task, the participants will become familiar with the paper prototyping activity, while excluding the added task of coming up with new ideas at the same time, through producing paper prototypes of familiar online media players (Netflix/Viaplay/Youtube). Moreover, the prototypes developed in this stage will also serve as inspiration for the main prototyping task which concerns NRK Super's media player.

In order for all groups to draw inspiration from all three media players (Netflix/Viaplay/Youtube), the groups are mixed so that three new groups are formed. One group is formed for each media player with one representative from all three base groups as seen in 11.3.

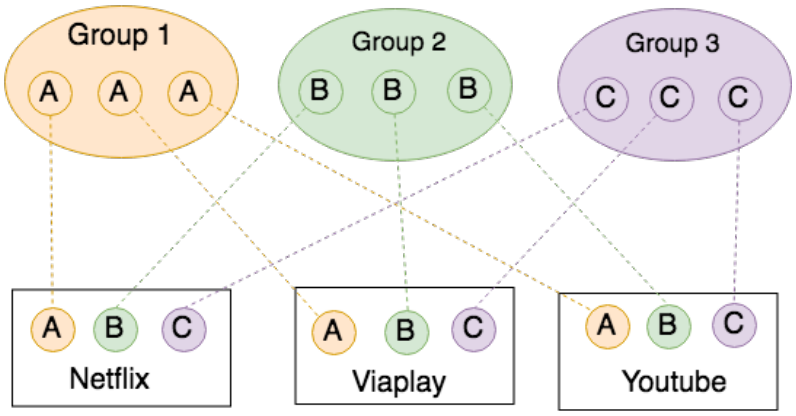


Figure 11.3: Mixing of groups

Each new group will be given the following case:

> **You are watching/have just finished watching an episode of *Shaun the Sheep* on Netflix/Viaplay/YouTube.**
>
> - What happens when the episode is over?
> - Which options do you have and how do you select the next episode?

All participants will be given an envelope with prepared materials which they can use to create their paper prototypes. All envelopes contain material especially prepared for the specific media player the participant is working to replicate. This is a low-tech prototyping activity inspired by "bags of stuff" [74] from cooperative inquiry. As this is a paper prototyping activity, all material is paper-based with relevant images and UI elements in various sizes which can be cut out. Scissors and glue sticks are available. It is Druin, herself, who advocates that the materials should be carefully selected depending on the particular design activity.

Ten minutes are allotted to creating these prototypes, and all participants working with the same media player will work together to help each other create one prototype each. This way, all participants will have a prototype to bring back to their groups for inspiration in later activities. The short time limit for this exercise is intentional. As the workshop schedule, particularly the Main prototyping exercise, is inspired by the fast paced iterations in Good Design Faster, this short time limit is meant to further prepare the participants for what is to come.

After ten minutes, the participants will return to their base groups and present their prototypes, where they will be evaluated with stickers. The participants will attach red heart stickers (representing positive aspects) and yellow circles (representing elements which could need more work) to the different elements of the prototypes. It is important to note that the prototypes should not be evaluated according to the effort of the participants, but rather on what the element represented, i.e. if a yellow sticker is stuck on an element in one of the Youtube prototypes, it means that what this element aims to do needs some improvement, *not* that the participant making the prototype did a bad job of replicating the element. Thus, it is actually the ideas of the different media players which are evaluated and not the

prototypes themselves.

When developing Bonded Design [47], two pilot groups were used to test whether exposure to, and critiquing of, existing solutions was necessary for the children's creativity. With Grade 6 pupils, they found that there was no need for this exposure, but for Grade 3 students it was very beneficial [47]. Although the participants in this study are closer in age to the Grade 6 pupils in Bonded Design, this warm up exercise is included as it serves more purposes than simply stimulating the participants' creativity. Its main function is, as stated above, to prepare the participants for the main prototyping activity, and provide inspiration. Once the main prototyping activity begins, the participants can then focus on creative solutions and not be stuck in confusion about what to do with all the paper and materials presented to them.

Main Prototyping Task Once the participants are more familiar with creating paper prototypes, work on the main prototyping task will begin. NRK Super is interested in receiving input relating to improving its online/in-app media player, and three cases with different variations have been formulated, one for each group. For a description of the concrete tasks themselves, see Figures 11.5, 11.6 and 11.7.

After presenting the task to the participants, this part of the schedule is structured according to elements from Good Design Faster [8, 12]: fast paced iterations with the aim of quickly visualizing one's ideas while not being too critical about one's own work.

The participants will first receive ten minutes to produce three individual sketches, regardless of whether they have finished their sketches or not when the time is up. This is intentional. There is no limit to how long design processes can last, and how much time can be spent on improving an idea. At one point, the process has to stop. Moreover, the short time limit helps the participants start the creative process and not be too self conscious about their own work. Lastly, several activities with strict timeboxing will produce many ideas which can serve as inspiration in the later stages of the design process.

After spending ten minutes sketching, the participants will quickly present their sketches to their group to ensure that all group members can draw inspiration from each other's designs. This activity will not focus on evaluation or critiquing of ideas, but will rather serve as part of the brainstorming process integral to all design processes. It can be compared to 'mixing ideas' used in cooperative inquiry [33].

The next activity is for all participants to, individually, produce one single sketch based on inspiration from the previous sketches. The purpose of this exercise is for all participants to have time to consolidate their own ideas before contributing to a group design. By coming up with a concrete idea and sketching it out, participation by all participants hopes to be ensured as everyone will have something to contribute. Only five minutes are allotted for this activity, meaning the sketches should not be of high quality.

The main activity in this part of the schedule is the creation of a group prototype answering the applicable case. 20 minutes are allotted to this activity, and the created prototype will be a further result of 'mixing ideas', where individual sketches and observations are combined to create a new design. Moreover, this stage is an exercise in *consensus building* [47, p. 75-76] as referred to in Bonded Design.

The several quick iterations up until this point are meant to help the participants overcome the challenge experienced in Bonded Design where participants tended to feel a strong sense of ownership over their ideas.

This first iteration of creating a group prototype is, again, inspired by the "bags of stuff"-technique [74]. The participants will receive a new envelope with paper materials which can be used to create the prototypes. Templates of tablets, images of NRK Super shows, and interactive elements (buttons, menus, icons etc) can be cut out and glued together to create the prototypes. Figures B.2, B.3, B.4, B.5, B.6, B.7 in the appendix contain all the material handed out in the envelopes.

The result of this first group design phase constitutes the first iteration towards a final prototype. Once this iteration is complete (when the time is up), the participants are exposed to a new phase of design, feedback. In the warm up exercise, the prototypes were evaluated with stickers representing likes and dislikes. However, as stated above, the likes/dislikes were related to the idea of the element and not the reproduction of the element itself. Also, as the warm up prototypes were reproductions of existing sites, it is not the participants' ideas which were evaluated. In this feedback session, however, the participants' ideas themselves are the objects of evaluation. The importance of feedback is emphasised in all the design methods inspiring this workshop. In Good Design Faster, sharing ideas for feedback [8] is important, and is achieved by fast iterations where ideas are continuously presented. In Bonded Design, feedback is largely combined with the brainstorming activities. [47]. In Cooperative Inquiry, 'sticky note sessions' [74] are used as a technique for providing feedback on ideas, and will be applied here for the groups to evaluate each others' ideas. In this activity, the groups will split up and return to the groups used in the warm up exercise (Netflix/Viaplay/Youtube), see Figure 11.3, where one participant will present his/her groups' prototype to the others. The other two members have sticky notes of two different colours: one colour for positive feedback, and another for constructive feedback (meaning aspects which can be improved). *One* comment is written on *one* sticky note. When the two observing members of the team have written all their comments on sticky notes, they present them, one at a time, to the participant who presented the prototype. When all comments have been explained, the participants return to their base groups. Now, the participants which presented the prototypes to the other groups, present the feedback to their own group, and they discuss which feedback to incorporate into their design and which to discard.

Once the feedback is discussed and digested, a second iteration of the design is scheduled. As this is a much shorter activity than the initial creation of the prototype, the aim of the second iteration is only to adapt the already existing prototype based on the feedback from the sticky note session.

Wireframing The first half of the day is characterized by fast paced iterations with many new concepts and activities. Therefore, the main activity of the day, wireframing, will begin after the participants have had a break. In this session, the fast paced iterations from Good Design Faster are abandoned, and replaced with one hour-long session instead. This is the activity we are interested in observing and investigating in this project. After a short introduction to wireframing and a

demonstration of the tool, Balsamiq, the participants will be free to turn their paper prototypes into digital wireframes. If the participants wish to further develop their prototypes digitally, they are allowed to do so. Or if they need the whole time to simply digitalize the same ideas as contained in the prototypes, this is also accepted. These are precisely some of the aspects we aim to investigate through the workshop.

Method	Activity	In schedule
Cooperative Inquiry	Team building	Icebreaker at the beginning of the workshop
	Low-tech prototyping "Bags of Stuff"	Paper prototyping warm up and main prototyping task
	Sticky note sessions	Sticky note session following first iteration of main prototyping task
	Mixing ideas	Creating group sketches based on several individually drawn sketches in the main prototyping task.
Bonded Design	Team building	Icebreaker at the beginning of the workshop
	Viewing and critiquing existing ideas	Likes/dislikes with stickers
	Consensus building	Creating group sketches based on several individually drawn sketches in the main prototyping task.
Good Design Faster	Fast paced iterations	Paper prototyping warm up and main prototyping task
	Several individual solutions	Main prototyping task (three individual sketches plus one additional individual sketch)
	Sharing ideas	Presenting sketches to team during main prototyping task, and sticky note session between iteration 1 and 2 in main prototyping task

Figure 11.4: Mapping between known techniques used in design workshops and where they are found in this workshop schedule.

Present Wireframes After spending an hour on creating the wireframes, the participants enjoy another break scheduled by the school. Once returning from this break, it is time to present the wireframes. This activity is not included as a way to receive further feedback before a new iteration, but rather as a way to conclude the design activities of the day. Throughout the day, the groups will have seen and offered feedback on each others ideas. By presenting the final products (the digital wireframes), everyone is able to see the results of their efforts, both creatively and the efforts put into providing constructive feedback. Participants might even find their own feedback incorporated into another group's wireframe.

Data Collection and Wrap up The last part of the day is dedicated to data collection. Observation throughout the day is a major source for collecting data, but having the participants self-report on their experiences will add another dimension to the

findings, as observed behaviour and reported behaviour can differ. The participants will be given a questionnaire to complete, see Figure B.8, and this questionnaire will form the basis for the group interview. Section 11.3 describes these activities in further detail.

The workshop will end with a wrap up of the day, thanking the participants for their participation. The workshop team initially wanted to reward the participants for taking part in the workshop, but this was discouraged by the school. The school felt that the participants had already received favourable treatment by being selected for partaking in the workshop. Thus, the only "reward" allowed was refreshments in the form of biscuits and fruit during the group interview.

Case from NRK Super

The specific case presented to the participants is provided by NRK Super. Being the national TV-channel for children in Norway, NRK Super develops and maintains several digital products. Their biggest digital products are their website and app where children view shows, play games and consume news relevant for children. NRK Super is currently working on a concept related to their online and in-app media player of how to present related content to their users. They are looking for alternatives to binge-watching by presenting to users related content of different formats or different titles. They were interested in input from the target group on how to present to them such content related to the show currently being watched.

To avoid having the three groups work on exactly the same task, three different variations of the same case were formulated, differing only in which content should be presented, and when. The three variations are seen in Figures 11.5, 11.6 and 11.7.

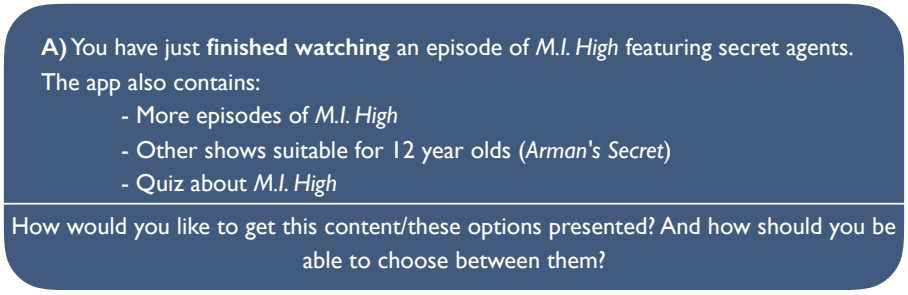


Figure 11.5: Case description A

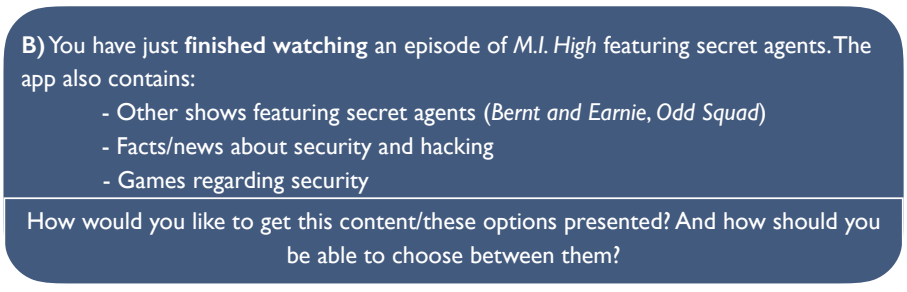


Figure 11.6: Case description B

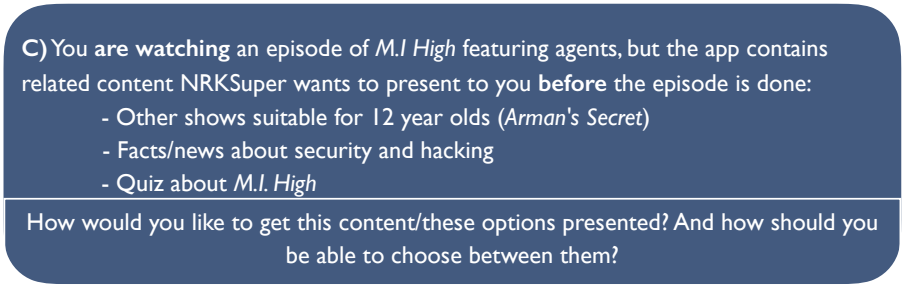


Figure 11.7: Case description C

11.3 Data Collection Methods

With the co-design workshop as the main research strategy for this project, observation, a questionnaire and a group interview are used to collect data from the workshop and its participants. Adhering to the ethical guidelines of the school, which prohibits video recording, the workshop is documented through photography and audio recording of the group interview at the end of the workshop.

11.3.1 Observation

As video recording is not possible, observation throughout the day is very important. However, as acknowledged in the literature, it is rarely possible to play the role of workshop facilitator and observer at the same time [34, 70]. An interdisciplinary team will, therefore, be present to observe the workshop. HCI has interdisciplinary roots and observers from different backgrounds can, therefore, highlight different aspects of the workshop. For this workshop, the team consists of the workshop facilitator (a student of interaction design and the author of this thesis), a technical expert in charge of observing technical aspects of the workshop, and a fourth year student in psychology with teaching experience whose sole responsibility is observation of the participants.

Overt participant observation is chosen as the observation method. Although not completely involved in all activities in the same way as the participants, all the observers will be active during the workshop in different ways. The facilitator is, naturally, heavily involved in the workshop. The technical observer will help with technical issues during the workshop. The psychology student is the least participating observant, but will interact with the participants during certain activities, and for the rest of the time observe in the background. During the icebreaker, all observers will go around prompting the participants to test their airplanes. If participants are stuck on a task at any given time, the observers can be asked for assistance, or give this spontaneously if they see the need. In addition, when the participants are working in groups to create prototypes and wireframes, the observers may ask questions and engage in conversation to gain deeper insights into the thoughts of the participants and their experiences of the situation.

Overt observation is chosen as the age of the observers would make covert observation impossible. Moreover, covert observation is sometimes considered less ethical as the consent process of the participants is not clear. As children are the observed participants in this study, a clear consent process needs to be adhered to

for the research to be ethical, not possible with covert observation. Lastly, the added benefit of being able to interact with the participants outweighs the advantage of covert observation.[2] Thus, a combination of overt observation and light participant observation will enable the observation team to question participants' actions as they are observed.

Data Validity A clear understanding of the roles of the observers and the participants is essential for the participants to feel at ease in the workshop. The observers will be present for the whole day and the participants should not feel intimidated by the observes. Friendly interaction with the observers from the beginning of the day, and throughout, is meant to help the participants feel at ease. This is also important for the group interview which will take place at the end of the day.

In order to make the interaction between participants and observers feel comfortable and natural for participants, the observers will only interact with the participants during activities when the participants are interacting with each other. The feedback and interactions provided by the observers will be made in the same way as that expected by peers, i.e. observers will not behave in ways which would appear unnatural for peers to behave in.

A drawback of participant observation is that it is "sometimes criticized for lack of reliability, since the research depends on the researcher's 'self' and is difficult to repeat by another researcher." [54, p. 215]. In order to enhance the validity of the observations, "verbatim quotations" and "triangualtion" [54, pp. 211-212] will be used. In order to draw conclusions, the observations made will be compared to information gained through the questionnaire and group interview at the end of the workshop.

Other issues relating to validity of the data obtained from the observations are further discussed in Section 13.5.

11.3.2 Questionnaire

While observation is important to gain an overview of the whole workshop, it is limited to understanding the behaviour of the participants themselves. In order to understand the thoughts and feelings of the participants, they need to describe these themselves. A questionnaire and group interview, further described below, are chosen to collect this data. Leeuw and Borgers [19] have written about questionnaires for children and adolescents and argue that "[w]ith special care, children can be interviewed with structured questionnaires or complete self-reports from age 7 onward." [19, p. 410]. Thus, all participants will complete a questionnaire at the end of the workshop surveying participants' background, usability of paper prototyping and digital wireframing, motivation, usefulness of activities and suggestions for workshop structure alterations. See Figure B.8 in the appendix for the full questionnaire.

Data Validity Owing to the different cognitive developmental level of children compared to adults, certain steps need to be taken into consideration when developing a questionnaire for children. Leeuw and Borgers state that more reliable results

[2] The purpose of covert observation is to prevent the observed from altering their behaviour due to being observed.

to questions can be obtained if "vague words" [19, p. 411] are avoided, "response alternatives" [19, p. 412] are kept below five, questions address the "here and now" [19, p. 412], and children are given "more time to answer survey questions" [19, p. 412].

The questionnaire presented to the participants aims to adhere to these guidelines. Unfamiliar words are avoided. For example, the section entitled *Paper and Balsamiq* was entitled *Usability* in the first draft of the questionnaire as it asked questions related to the usability of Balsamiq and paper protoyping activities. *Usability* was deemed too vague or unfamiliar for the participants and, thus, altered to *Paper and Balsamiq*. Words such as *prototyping, wireframing*, and *design idea* would normally be deemed to advanced for participants at this age, however, as they have been used throughout the day, they are deemed familiar by the time the questionnaire is presented to the participants.

Regarding response alternatives, only one question has more than five response alternatives but this is a question where more than one response can be selected. Thus, the participants only have to go through the list and tick a box if it applies to them, or leave it blank if not.

Leeuw and Borgers state that "[r]etrospective questions pose extra problems for young children" [19, p. 412] and answering questions about the immediate will guarantee more accurate results. This questionnaire is presented to the participants after spending a whole school day working with the activities they are asked about. Thus, even if these questions address something that has already taken place, the time since the activities is so short that they are deemed immediate enough for the children to be able to answer questions about them.

The children are given ten minutes to answer the questionnaire. Ideally, more time could have been allotted to this activity, especially since the importance of awarding enough time is emphasised in the literature. However, in trying to fit all the necessary activities into the schedule, time for filling in the questionnaire was cut in favour of having more time for the group interview. The value of a potential discussion in the group interview and the possibility of delving further into interesting topics was deemed more important than having more time for the questionnaire. Moreover, as the group interview is based on the questionnaire, participants will have time to elaborate more on their answers at this point if necessary. This was simply a trade-off which had to be made.

Lastly, the questionnaire should be tested on the target audience before use. This was, however, not possible as the workshop organizers did not have access to a representative sample of children for testing. In addition, words such as *paper prototyping* and*wireframing* (which are familiar to the workshop participants at the end of the workshop), would have been unfamiliar to the children in a potential test sample, complicating pilot testing of the questionnaire. Thus, the questionnaire was only reviewed by fellow researchers.

11.3.3 Group Interview

Based on the questionnaire, a group interview will follow to elicit more details and address areas of interest observed during the day. The interview will be audio recorded.

There are several advantages of a group interview over individual ones. Time constraint is a natural reason for choosing a group interview. In this schedule, it would be impossible to individually interview all nine participants without compromising certain other activities. Ann Lewis [48] has written about several such advantages including "reveal[ing] consensus views", "generat[ing] richer responses", "challeng[ing] one another's views", and "verify[ing]...data gained through other methods" to name a few [48, p.413].

In a group interview, the participants can respond to each other and, through challenging each other's ideas, consensus views may become visible and new ideas stimulated [48, p.414].

In addition to challenging each other's responses, a group interview can, in itself, lead to more responses. Lewis states that "[c]hildren may be less intimidated by talking in a group than when talking individually to an adult, particularly if the interviewer is not well known to the children." [48, p. 416]. On the down side, shy children may be more uncomfortable sharing their opinions in a group setting. Thus, an ideal solution would be to first have a round of individual interviews and then a group interview to confirm individual responses. However, time and participants' motivation may be obstacles to achieving this. In this case, the questionnaires were used as a substitute for individual interviews. By answering the questionnaire, the participants' individual opinions are stated, and the group interview can then be used to challenge these responses, if applicable. Moreover, group interviews can benefit silent participants because "when one child is speaking, other children have 'thinking time', thus...encouraging greater reflectivity in responses" [48, p. 417].

35 minutes are allotted to the group interview and literature indicates that "children 10 to 12 can have longer periods of discussion (30 to 45 minutes) [19, page 422]". Thus, the participants in the workshop should be able to stay focused for the whole interview.

Data Validity Apart from the benefits of group interviews, certain pitfalls need to be taken into consideration. De Leeuw et al. have found that children "are afraid to say something wrong or foolish, especially in a situation that resembles school" [19, p.413] and "from approximately 10 years on, the effect of peers will be more present" [19, p. 413]. Lewis, however, states that "[i]n a class in which children have learned to respect one another's contributions, a group interview can generate a greater range of responses than in individual interviews." [48, p. 424].

Ways to support participation, and limit conformity to peers include a clear description of what is expected from the participants, the right balance of children versus adults, and a beneficial seating arrangement. As a group interview is different from a classroom discussion, explaining clearly what is expected of the children in this context is of the utmost importance [19, p. 420]. This point also applies to the workshop as a whole, where there are no right or wrong answers and the participants should not be afraid to voice their opinions. This is also clearly stated at the beginning of the the workshop and throughout the day.

Lewis further states that "[m]ore grown-ups in the room will disrupt the balance of power in the group" [19, p. 420]. In this workshop, three adults are present during the workshop and the group interview. Due to the fact that the workshop is held at

the local school and not in the university's UX lab, the observers do not have the option of observing the interview from a separate room. However, the observers will have a consistent role throughout the whole day, and the aim is that the participants are not intimidated by the observers at this point. Lewis argues that "[a]dolescents often lack confidence and may be unsure about themselves and their performance. Reassurance and frequent reinforcement is...important for this group." [19, p. 426]. This is what the workshop team aims to achieve and enforce throughout the whole workshop.

In order to further relax the participants and limit the perceived power inequality between participants and facilitator/observers, "moderators should be on the same level as the children" [19, p.422]. In this case, both the participants and the workshop facilitator are all seated around tables with refreshments. The facilitator, however, is seated a bit further away from the participants, so as to not display note-taking.

11.3.4 Dialog with NRK Super

After the workshop is complete, and data analysis has begun, the produced paper prototypes and digital wireframes will be presented to NRK Super along with initial findings from the workshop. The artefacts will be evaluated for the value they bring to interaction designers at NRK Super, while the findings will be discussed to see if NRK Super can provide new perspectives through which to understand the results of the workshop.

As NRK Super functions as both customer and collaborator in this project, the dialog will take the form of a conversation between design partners analysing the results of a workshop, rather than a formal question-answer session.

Concerning data validity, this dialog is not treated as an interview, and is not evaluated according to criteria relevant to interviews, such as interviewer's bias. Rather, as NRK Super functions as a partner in the research, all views reported as belonging to NRK Super will be shown to, and approved by, NRK Super before publishing.

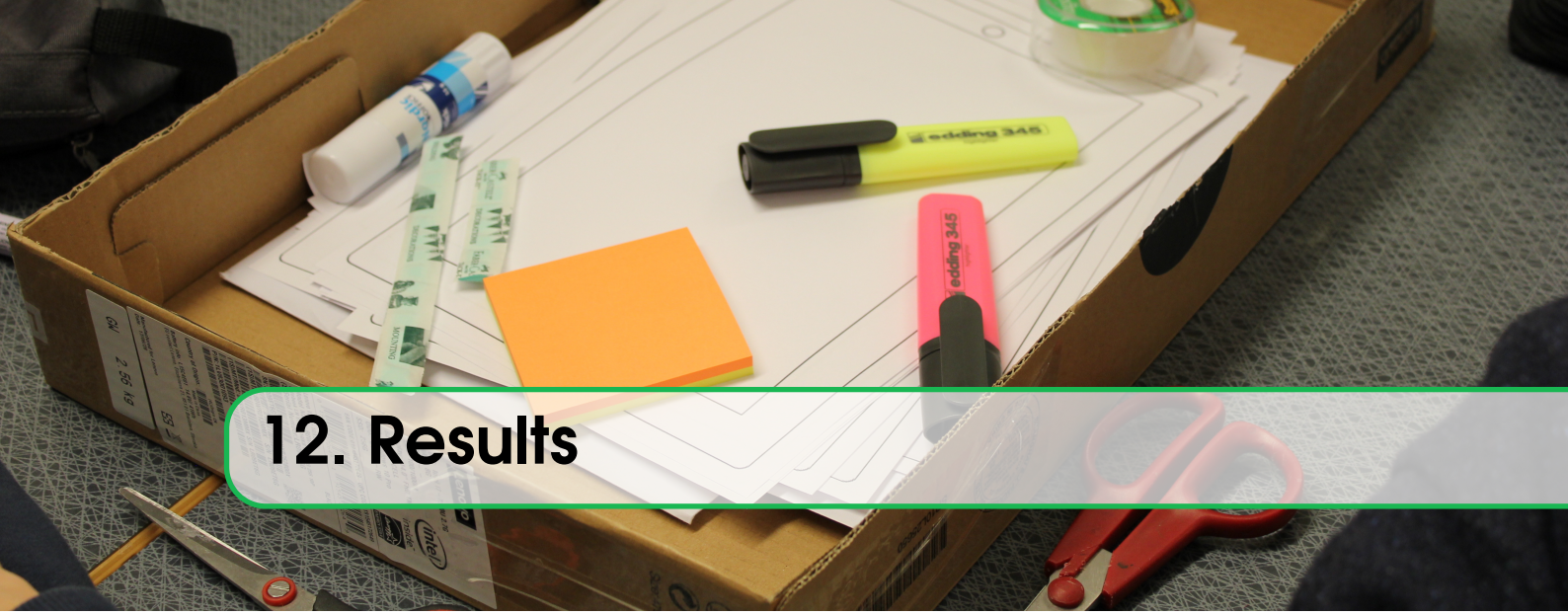
11.4 Data Translation

To ease legibility for the reader, most quotes and excerpts from the observation notes and interview transcript will be translated and quoted in English in the text. Where a translation does not satisfactorily capture the essence of what is said, the Norwegian is retained in the text. In this situation, a translation is provided immediately following the quote or excerpt. All quotes and excerpts are accompanied by the line number(s) where they appear in the raw data (included in the appendix), so that the original can be checked and context provided for the quote or excerpt.

The author acknowledges that translation of other people's statements always carries the risk of imposing the translator's understanding of the quote unto the translation.

The translator (also the author) has tried, to the best of her ability, to provide a translation as close to the original utterance as possible. However, literal translations are often not possible, and the translated material needs to be rephrased to make

sense in the new language. In these situations, the translator might, unintentionally, impose a slightly different meaning unto the quotes. Thus, checking the original quote or excerpt is encouraged.



12. Results

The results of the workshop are based on observation notes (ON), photographs, questionnaires (Q) and a transcript of the group interview (GI). The transcript is contained in full in Section B.4.2 in the Appendix, and the participants' names have been altered to maintain anonymity. The observation notes are also included in full in Section B.4.3 in the Appendix. The observation notes and interview transcript are analysed by a thematic analysis, and the questionnaire data is summarized as charts.

This section begins by presenting an overview of the themes identified by the thematic analysis.

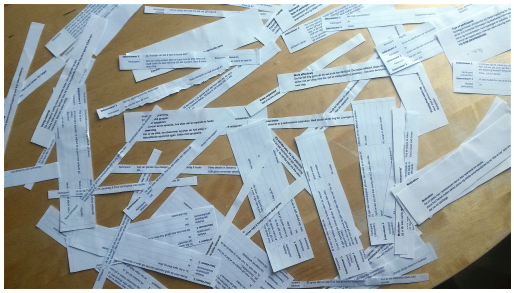
Second, all the results are grouped and presented in three following sections, each corresponding to one of the research questions, RQ2-4. Naturally, all results cannot be strictly classified into one of the three categories, as certain results contribute to answering more than one research question. However, the sections outlined above provide a general categorisation of where the different results can be found.

Lastly, Section 12.5 further describes the workshop participants based on themes identified in the thematic analysis. This description is related to their background with computers and why they, as children, are an asset to the design process.

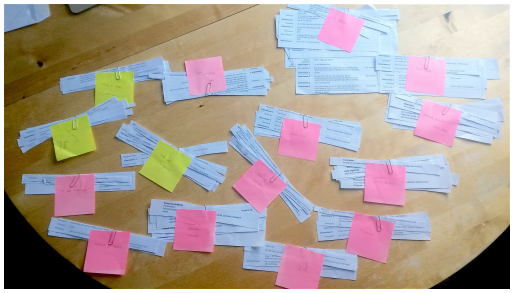
12.1 Thematic Analysis

In order to determine the themes for the thematic analysis, all data items (separate quotes in the transcript and entries in the observation notes) were cut out and scattered around the table, see Figure 12.1a. All items were then assessed one by one, grouped together with similar items, and each group was assigned a preliminary theme, see Figure 12.1b. Time was then spent on identifying which preliminary themes fit together, and the themes were regrouped until a good balance was found of distinct, internally coherent themes, see Figure 12.1c.

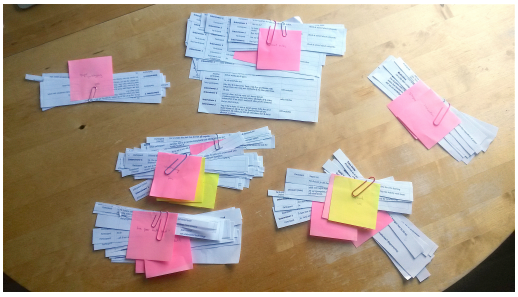
Several themes were identified in the process of performing thematic analysis, but only a limited number were carried forward and will be emphasised here. Some of the the themes from the thematic analysis overlapped with results from the questionnaire, and the themes presented in this section are the themes which highlight *new* information not available from the questionnaire, or provide *complementary* information to the data from the questionnaire.



(a) Scattered data items



(b) Preliminary themes



(c) Final themes

Figure 12.1: Steps of identifying themes in thematic analysis

Five main themes were identified by the thematic analysis: workshop process, wireframing preference, observed motivation, participant background, and participant attributes. Figure 12.2 shows the thematic mind map of wireframing in co-design workshops with children.

Apart from one, all themes are strongly related to the other results, and including a full narrative of each individual theme would only lead to much repetition in the following sections. Thus, only a brief introduction to the themes is given below. The full narration of the themes is split up and included in the following sections where its content is most relevant. These elaborations and examples substantiating the themes are contained in coloured boxes, corresponding to their theme's colour in the thematic map, ensuring easy understanding of which theme the snippets apply to. The full narrative of each theme is repeated as a whole in the appendix, Section B.5.

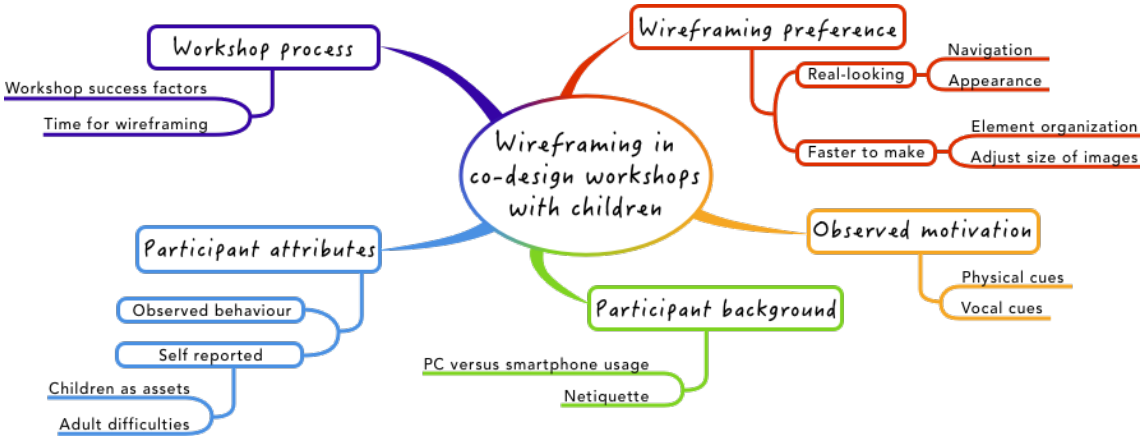


Figure 12.2: Thematic mind map of wireframing in co-design workshops with children.

Workshop Process

Relating to the workshop process, two themes were identified: workshop success factors, and time for wireframing. Regarding *workshop success factors*: teambuilding, wireframing, and timeboxing proved successful, see Section 12.2.1 for examples. The participants themselves, however, felt there was too little time for wireframing, further examplified in Section 12.2.1.

Wireframing Preference

Results from the questionnaire, and group interview, indicate that wireframing was the activity the participants enjoyed the most. The thematic analysis yielded the same result, but also highlighted two additional aspects explaining *why* the participants enjoyed wireframing: real-looking, and faster to make. *Real-looking* says something about how the participants perceived the outcome of wireframing, whereas *faster to make* relates to the usability of the wireframing tool itself.

Regarding *real-looking*, the participants commented on both the navigation and appearance of the wireframes as more real-looking than the paper prototypes. Relating to *faster to make*, the organization of elements, and the possibility of resizing these elements were appreciated by the participants. Examples substantiating these themes are included in Section 12.3.

Observed Motivation

The children reported that they enjoyed all the activities throughout the day, and the thematic analysis also identified *motivation* as an important theme. This motivation is identified by the observation of both physical cues, see Section 12.2.2, and vocal cues, see Sections 12.2.2 and 12.3.

Participant Background

The two sub-themes in this category are: PC versus smartphone usage, and Netiquette. The questionnaire contained questions to ascertain what the participants use computers for. From the group interview, however, it became clear that the participants also use their smartphones extensively. As this information is not captured by the questionnaire, the thematic analysis has a theme devoted to this use, presented below in Section 12.5.

Information also surfaced about how the children are allowed to use the Internet. This is described in the second sub-theme, *netiquette*, presented in the same section.

Participant Attributes

This theme is divided into two sub-themes: observed behaviour, and self-reported by the participants themselves.

Observed behaviour relates to important observations made during the day relating to specific attributes exhibited by the participants which played a role in the success of the workshop. Some required attributes were identified prior to the workshop, such as age and voluntary participation, and participants were recruited accordingly.

On the other hand, certain attributes were observed on the day which could also impact the success, and future planning, of the workshop schedule. These attributes concern themselves with: seeking to understand the task, cooperation and feedback, dividing responsibilities, and ability to present, in addition to some more general comments on required attributes, see Sections 12.2.1 and 12.2.2 for examples.

The purpose of involving children in the design process, and further letting them create wireframes, is discussed in previous chapters. Towards the end of the workshop, however, the discussion moved to having the children themselves explain the benefits of involving children in the design process, and these thoughts are encompassed by *self-reported*. The participants' arguments can be categorised into those that (1) argue why children are an asset to the design process, and (2) the limitations of being an adult in the design process. The answers are largely focused around the use of digital wireframing tools, and examples are presented in Section 12.5.

12.2 Workshop Process (RQ2)

This section presents results related to RQ2: *How can wireframing be included in co-design workshops with children?* Data has been collected on how the original schedule lent itself to the workshop and which changes had to be made. These results are presented in Section 12.2.1 *Workshop Schedule*. Moreover, observations on how the separate activities actually worked, and how the participants participated, are presented in Section 12.2.2 *What Happened*.

12.2.1 Workshop Schedule

Two main alterations were made to the original schedule: (1) Two activities were cut, and (2) time was extended for the wireframing activity. The original schedule was based on tight time limits in the first half of the day and no delays were allowed if all activities were to be completed.

Cutting Two Activities

The participants arrived 15 minutes late, and as a consequence, alterations had to be made. Simply cutting down time on certain activities was not enough. Figure 12.3 presents the changed schedule, which is the same as the original one, see Figure 11.1, with changes marked in yellow.

In order to catch up, the first step was to limit the time for the introduction and icebreaker. Thus, only ten minutes was spent on these activities rather than the 15 minutes originally planned. This, however, posed no problem to the participants. Most of this time was taken from making the paper airplanes, but the purpose of the icebreaker - teambuilding and introducing the value of prototypes - was still attained.

The biggest alteration to the schedule was the cutting of two activities. These activities (crossed out in Figure 12.3) are:

MAIN ACTIVITY	SUB TASKS	TIME LIMIT
Intro and Icebreaker		~~15 min~~ 10 min
Paper prototyping warm up: Reproduction of existing solution	Introduction to paper prototyping	5 min
	Create prototypes	10 min
	Present in groups	5 min
	Likes/dislikes with stickers	5 min
Main prototyping task	Introduction to task	5 min
	Three individual sketches	10 min
	Present sketches to team	5 min
	~~Create one individual sketch~~	~~5 min~~
	Create one sketch per group (Iteration 1)	~~20 min~~ 25 min
	Sticky note session, groups mixed	10 min
	~~New design, iteration 2~~	~~10 min~~
Break		**30 min**
Wireframing	Intro: wireframing	5 min
	Create digital wireframes	55 min
Food break	(The pupils were allowed to keep working on the wireframes)	**20 min**
Break		**25 min**
Present wireframes		10 min
Data collection and wrap up	Questionnaire	10 min
	Group Interview	35 min
	Wrap up	5 min

Figure 12.3: Agenda with changes

1. Developing an individual sketch based on the three individual sketches.
2. A second iteration of the paper prototypes based on the sticky note feedback session prior to the wireframing activity.

The shift from one activity to another takes time, and so the time for the creation of *one* individual sketch was combined with the first iteration of the group prototype. Moreover, as the second prototyping iteration would be cut from the schedule, it was deemed important to give the participants a bit more time for the first iteration to focus on what was to be the main prototyping task of the day.

The second activity to be cut from the schedule was a second iteration of the group-level paper prototypes. In order to have kept this exercise, the sticky note session would have to be cut, or time would have to be reduced for the first iteration. As it was important to have enough time for the first iteration, limiting this time was not an option. Secondly, the sticky note session introduced important elements related to feedback and input from other groups, so this activity was also retained. However, as a compromise, it was possible for the participants to use the input

from the sticky note session to improve, and further develop, their design during the wireframing session.

Thus, by reducing the time of the icebreaker, removing the second iteration, and combining the individual sketches with the first iterations, all other activities could be kept with only minor adjustments to the time limits. Because of the added five minutes to the first iteration, the participants would have almost the same time for prototyping as originally planned. The participants did not know that two activities were cut from the program and the shifts between all activities were kept smooth, although rapid. An example is highlighted by the thematic analysis in that the icebreaker was still enjoyed by the participants even if time was reduced for this activity.

Workshop Process: Success Factor - Icebreaker

The icebreaker also proved fun for the participants (GI, lines 335-340):

Participant: Paper airplanes
Interviewer: Did you find the paper airplanes fun?
Participant: Yes
Interviewer: Who found the paper airplarplanes fun?
Participant: Those who won
Interviewer (counting show of hands)**:** Almost everyone.

The many activities and short time spans led to a high tempo in the workshop, with the implication that the participants were required to remain active and participate. The thematic analysis further identified certain attributes which might be required on behalf of the participants to ensure the successful progression of the schedule.

Participant Attributes: Observed Behaviour

The observer with a psychology background made the following comment about the required attributes of the participants for this particular schedule with strict time limits.

> "Today's schedule requires endurance and the ability to adjust. The schedule demands: Someone with the ability to collect and process information. Personality, skills, intellect, focus and concentration (if the activities are boring). Today's schedule requires this. One would expect longer time limits for activities in a normal learning situation." (ON, line 19).

Moreover, when creating paper prototypes, the participants actively used the material, as well as sticky notes in the sticky note session. Given the short time limits during the prototyping activities, participants who worked well together and who could be effective would support successful progression of the schedule, and let the participants get the most out of each activity.

However, the thematic analysis highlighted timeboxing as beneficial to the workshop schedule.

Workshop Process: Success Factor - Timeboxing

Timeboxing was an intentional part of the workshop schedule, and it was observed that "the [participants] have been able to perform when they know that they have little time. They work efficiently." (ON, line 26). Moreover, "some managed to start another iteration during the presentation..." (ON, line 24).

However, "the problem is optimizing how the time is spent. Things take time in schools. The gluing can take some time." (ON, line 8). "Being able to tidy as you go, and have a clear overview." (ON, line 29) becomes very important.

Extended Time for Wireframing

The second big alteration to the schedule concerned the wireframing activity. By the time wireframing began, the schedule was back on track and this was the activity with the most time devoted to it. However, when nearing the end of the activity, the participants were still eagerly creating their wireframes. It was clear to the workshop team that there was still much they wanted to do with their wireframes. Seeking approval from the teachers, the participants were allowed to keep working on their wireframes during the lunch break when they, originally, were supposed to join their peers for lunch.[1] Thus, an extra 20 minutes was spent wireframing, differing from the original schedule. Some even asked if they could keep working longer than that. The participants' eagerness to continue wireframing is exemplified by the thematic analysis.

Workshop Process: Too Little Time for Wireframing

When asked how the schedule could have been different, the participants reported that they liked the whole process. Four participants would not have changed anything about the day, two would have wanted more time for wireframing, "Everything was really good, only that, maybe, have better time for wireframing" (I, line 426).

When asked what was difficult with using Balsamiq, one participant answered, "The time. Too little time." (I, line 313) followed by another participant saying, "No doubt" (I, line 316).

12.2.2 What Happened

While the section above presents results related to the schedule itself, and how its activities were altered, this section presents observations made *during* the different activities: what the participants did and how the different activities worked as part

[1] To further substantiate this point: During lunch, the rest of the class were watching an episode of "The Julekalender", a series they had been watching every day since December 1st.

of the workshop. The observations are accompanied by photographs and examples from the thematic analysis to further aid the reader in understanding what happened during the workshop.

Eagerness from the Beginning

Upon greeting the participants, the workshop began immediately. After a quick introduction to the purpose of the workshop, the participants were already eagerly delving into creating paper planes with one hand and competing, as part of the icebreaker exercise, see Figure 12.4. Motivating the pupils to get started was no issue, and it was clear from the beginning that NRK Super as a collaborator was very motivating.

Figure 12.4: Icebreaker exercise

Instinctive Engagement in Activities

Introduction to paper prototyping immediately followed the icebreaker, and a key observation was made. When introducing paper prototyping, the workshop facilitator (also the author) gave a live demonstration of how to create paper prototypes and regularly turned towards the blackboard. During her demonstration, she asked several rhetorical questions, upon which many participants raised their hands to answer. However, given the tight schedule, time was not set aside for audience interaction, and two things are important to note in this situation: (1) The workshop facilitator turned so quickly towards the board that she missed the raised hands, and one of the other observers had to make her aware of this when it happened repeatedly. (2) Even when not specifically prompted to provide input, the participants instinctively raised their hands to offer input whenever possible. The thematic analysis below offers a further example of the participants' eagerness.

Observed Motivation: Vocal Clues

Some time into the workshop, it became clear to the participants that the workshop would last the whole day, and one of the participants exclaimed, "So we won't have regular school? YES! Because this is so much fun" (ON, line 25).

Paying Close Attention to Workshop Facilitator

When the first prototyping task was explained, the participants sat in complete silence, paying close attention and nodding. All groups received envelopes with prepared materials relevant to the prototyping task. They contained empty tablet frames, screenshots of the relevant shows and different UI elements. Through cutting, gluing and drawing, this material was combined into paper prototypes. The participants had no difficulties understanding the task, but some chaos was experienced when working with the material, especially after all the material had been emptied out onto their desks. This point was also highlighted by the thematic analysis, see below.

Participant Attributes: Observed - Seeking to Understand

When explaining the different activities, the participants listened attentively, and nodded when asked 'Do you understand the task?'. They answered questions when asked, and asked questions themselves. One observer noted that the participants had no problems understanding what to do.

Paying Close Attention to Peers

After creating their first paper prototypes, the participants presented them to their groups and feedback was given in the form of different stickers representing positive aspects of the solution and aspects which could need some improvement. It was emphasized that, as the prototype warm up exercise was mostly reproduction of popular streaming sites, the feedback should be directed towards aspects of the existing solutions and not towards the individual who made the prototype. The participants all listened attentively to their peers when they presented, and provided feedback with the stickers, see Figure 12.5.

Figure 12.5: Feedback with stickers

Maintained Motivation

Throughout the main prototyping task, the level of motivation was similar to the warm up, with repeated questions of whether their work would be displayed to NRK Super. The first subtask was for everyone to sketch three individual solutions to their respective case and present their sketches to their group. All participants listened attentively to the one presenting, see Figure 12.6.

Figure 12.6: Teamwork

Various Levels of Organization

After sketching and presenting individual ideas, work began on the group level prototype. Again, all groups received an envelope with prepared materials related to their respective case. A substantial amount of images for different shows and UI elements were organized in the envelopes. The desks were small enough for all group members to reach everything on the desks, but perhaps too small for organizing all the material efficiently, see Figure 12.7 for seemingly chaotic working conditions.

Figure 12.7: Small desk size limits overview

However, one group in particular creatively made use of the floor to organize its prototype as it was developed and extended, see Figure 12.8.

Figure 12.8: Using the floor for paper prototype

Interest in All Aspects of the Workshop

After creating the group level prototype, the groups provided feedback to each other by writing sticky notes. The participants were active in both giving feedback and discussing the feedback they received, see Figure 12.9.

Participant Attributes: Observed - Feedback

The feedback sessions also benefited from participants who were comfortable with speaking in groups, and who were able to present their thoughts, in addition to paying attention to others.

One participant, in particular, stated that she really liked the cooperative nature of the workshop where they could receive so much feedback, see thematic analysis below.

Participant Attributes: Observed - Cooperation

The ability to cooperate was important, and when asked what they liked about the day, one participant mentioned cooperation explicitly (I, lines 350-354),

> **Participant:** "I found it quite fun when we were, like, going to tell the others what we were thinking, and, like, how we wanted it to look. And when we were going to put something in, and how we wanted it to look.
> ...
> **Interviewer:** When you were cooperating?
> **Participant:** Yes

Figure 12.9: Feedback using sticky notes

In contrast to the very intense first half of the day with many short activities, the second half only contained one activity: an hour-long wireframing session. One could have expected the participants to be worn out at this point and that a completely new activity would be demanding. However, they all paid close attention to the introduction to wireframing and Balsamiq, before eagerly embarking on creating wireframes from their own prototypes. One observer detected a clear example of their motivation: During the introduction to wireframing, the workshop facilitator

said, “And now you are going to do this”. At this point, all the participants started moving about in their seats, sharing excited looks and smiles, see thematic analysis below. Some had also stated clearly, at the beginning of the workshop, that they were looking forward to working with the computers.

Observed Motivation: Physical Cues

When the wireframing activity was introduced and Balsamiq was demonstrated, the participants sat in complete silence listening and paying close attention. When the navigation between pages was demonstrated with buttons etc, the participants looked at each other and smiled, and their legs started trembling.

Engagement and motivation was maintained in the second half of the day, and the groups seemed to cooperate well. The team members divided responsibilities within the group. The two boxes of thematic analysis below further describe the motivation displayed by the participants and the division of responsibilities.

Observed Motivation: Vocal Cues

While wireframing, loud voices were heard with outbursts of, "Check out what we’ve made" (ON, line 31). When one of the groups had completed their task, they exclaimed "Done!" (ON, line 34), accompanied by thumbs up.

Participant Attributes: Observed - Dividing Responsibilities

When building the wireframes, teamwork within the groups was successful. One group member controlled the PC mouse, while another controlled the keyboard. All team members had their eyes fixed on the screen and paid close attention to what the others were doing.

Figure 12.10 portrays this division of responsibilities.

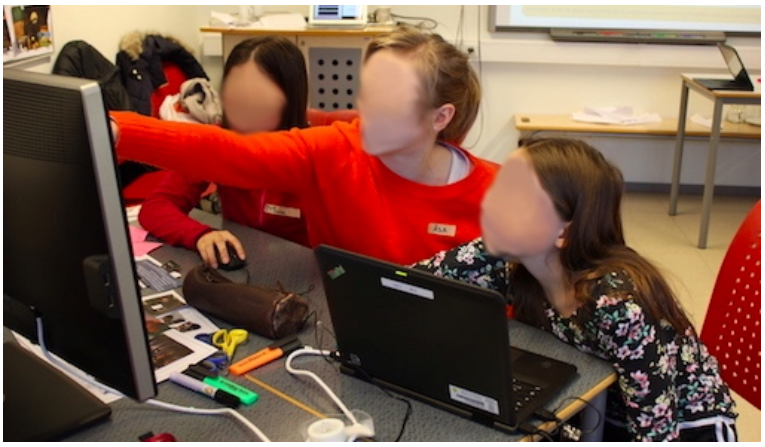


Figure 12.10: Cooperation during wireframing

Whenever the workshop organizers reminded the participants of the time left of the wireframing activity, they were always surprised at how little time was left. Even

after an hour of wireframing, the participants were still eager to continue working, and their teachers allowed them to continue working while eating their lunch if they wished to do so, see thematic analysis below for further elaboration. All participants except one, chose to do this, and an extra 20 minutes was spent wireframing. Many still wanted to keep working after eating, but during this break they had to go outside instead.

Observed Motivation: Physical and Vocal Cues

The participants were allowed to keep working on their wireframes during their lunch break, and when one participants returned from getting her lunch from another classroom, she looked around the room and smiled with acknowledgement, saying, "Everyone is here" (ON, line 38), taking it for granted that everyone was. Moreover, when the participants returned from the break, they returned straight to their computers and continued their work, ignoring completely the biscuits laying right next to one of the work stations.

Impressive Presentations

Coming back from the break, all groups presented their wireframes. As they had been so eager to keep working on the wireframes, little time had been spent on preparing a presentation, and the workshop organizers expected the presentations to reflect this lack of preparation. However, the presentations were of high quality even if barely prepared at all. This was also highlighted by the thematic analysis, see below. All wireframes were explained in detail and all group members contributed.

Participant Attributes: Observed - Ability to Present Wireframe

Based on the participants' collaboration and paying close attention, all participants were able to contribute when presenting their wireframes to the other groups even if they had not received much time to prepare and rehearse the presentations beforehand.

12.3 Feasibility and Motivation (RQ3)

This section presents results related to the participants' own perceptions and experiences of the workshop based on the questionnaire and group interview. The results in this section are strongly tied to answering research question RQ3: *How does creating digital wireframes affect the children's motivation for participating in co-design workshops?*

Feasibility of Children Using Wireframing Tools

On a scale from 1-5 (1=No, very difficult, and 5=Yes, very easy), one child found it neither easy nor difficult (3) to understand paper prototyping while another answered the same for learning and using Balsamiq. All other participants answered moderately easy (4) or very easy (5) on all three questions, see Figure 12.11.

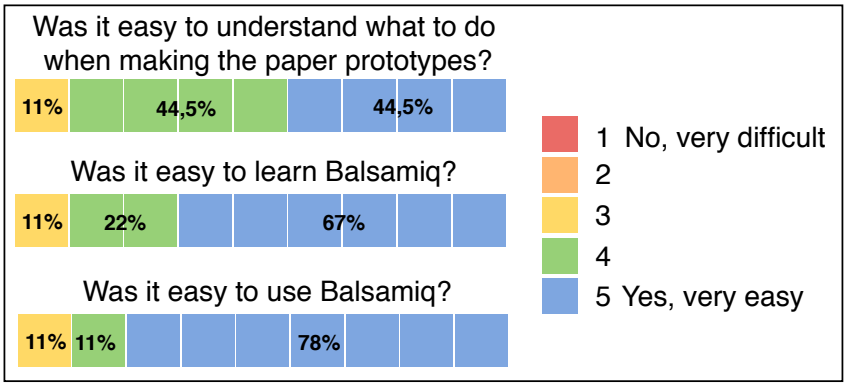


Figure 12.11: Usability

Motivation

Figure 12.12 depicts how much the participants liked paper prototyping and wireframing on a scale from 1-5 (1=No, very little, 5=Yes, very much).

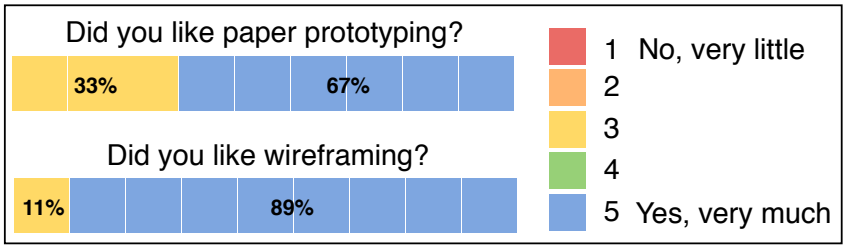


Figure 12.12: Motivation

Six participants reported that they liked paper prototyping very much (5), while three awarded the score 3. When asked what they liked about paper prototyping, freedom was the trending response. Some responses include:

> "There are no limits and one can cut and glue freely" (Q)
> "The freedom was fun" (Q)
> "You could decide for yourself and make it exactly like you wanted" (Q)
> "I liked that there were more ideas and not just one piece of paper with one idea" (Q)
> "...it was a bit easier to find things when working with paper because everything was in front of you..." (GI, line 410)
> "It was really fun because you could, like, it was easy. And then you could do whatever you wanted. You could place everything just like you wanted. You could draw, you could insert images and it was really fun." (GI, line 184)

A few reported drawbacks to paper prototyping were:

> "I didn't like that everything fell apart" (Q)
> "I liked almost everything but it was confusing with all the images" (Q)
> "I'm quite the perfectionist, and the prototype didn't turn out completely perfect." (Q)

"You couldn't press 'play' and then something would come..." (GI, line 207)

On the same scale, regarding wireframing, all participants liked wireframing very much (5) apart from one participants who answered 3. Several positive aspects of wireframing were reported through the questionnaire:

"It was easy to understand and many options" (Q)
"It was easy to make things" (Q)
"One can design and make something that works, and it can be used on websites later" (Q)
"We could make buttons" (Q)
"Design it yourself..." (Q)
"Everything" (Q)
"I learned something new" (Q)
"You could use your creativity. That was very fun!" (Q)
"I liked to use my creativity and cooperate to get more ideas" (Q)

Negative aspects included:

"It might take some time" (Q)
"It was a bit difficult to cooperate" (Q)
"There were quite a few details to remember" (Q)
"Sometimes is was a bit difficult to find the things you wanted to use...Because we didn't know what it was called in English" (GI, lines 320-322)
"There were quite a few details...And difficult to remember..." (GI, line 258)

The thematic analysis also highlighted two main reasons why wireframing was popular: real-looking and faster to make.

Wireframing Preference: Real-Looking

The thematic analysis identified two reasons why participants preferred wireframing to paper prototyping. The first reason is how 'real-looking' the wireframes appeared, "It looked more like it was a real web page" (GI, line 236), as opposed to the paper prototype which "just looked like a cartoon or something" (GI, line 238). Some participants were almost surprised at how realistic the wireframes appeared saying, "It is a bit strange, because it looked so real" (GI, line 232) and "It is easier to, like, envision that it should be web page when it is on the web. When it is, like, digital" (GI, line 394).

More specifically, the participants felt the navigation and appearance of the wireframes made them appear more realistic, "The images also turned out better, I think. They actually looked a bit real" (GI, line 244). Another participant described the navigation in this way: "And then you can press things, and then something new will come without you having to, like, change everything and then..." (GI, line 234).

Wireframing Preference: Faster to Make

Several participants reported that they felt the wireframes were faster to make than the paper prototypes saying, "Det var mye lettere og så gikk det mye fortere" (*Translation: It was much easier, and it went much faster.*) (GI, line 218) and "Det gikk ganske mye kjappere" (*Translation: It went quite much faster*) (GI, line 228).

Contrary to the situation with paper prototyping where all the elements were scattered all over the desks, the elements in Balsamiq were organized into categories, "it was like if you wanted a text box, you clicked it [in Balsamiq], but if you wanted a text box [on paper] you had to start looking for it on the table etc..." (GI, line 224). The participants felt that "Everything was much better sorted" (GI, line 222) in Balsamiq, and this easy access to elements led to the participants feeling that wireframes were faster to make, "Yes, it was just like dragging things in and then another, and then another...and a picture...and that was it" (GI, line 230).

Another reason for preferring digital wireframing was the ability to resize elements digitally. When creating paper prototypes, the participants were limited by the printed material, and some experienced that "All the images were so big that you couldn't fit the image you wanted" (GI, line 205), and "sometimes, there wasn't enough room" (GI, line 198). On the other hand, if they had first glued an image to the paper, the medium did not allow them to change their minds, "Yes, because it wasn't like you could delete" (GI, line 203).

One participant, however, was more concerned with the ideas themselves rather than the medium used to present them, see thematic analysis below. This participant did not have a clear preference between wireframing and paper prototyping.

Observed Motivation: Vocal Cues

One participant was motivated by the ideas themselves, "whether on paper or computer, it was like... the ideas..." (GI, line 352), and another liked the sharing of ideas, "I liked seeing what the others had made" (GI, line 362).

When asked "What was most fun today?" six participants answered wireframing, while one preferred paper prototyping. The remaining two said, "Inserting our ideas" (Q) and "Seeing what the other groups made" (Q), see Figure 12.13 on the next page.

Usefulness

Although motivation and fun are important factors when involving children in the design process, the activities should serve a purpose as well. The children were therefore asked which of the two activities, paper prototyping or wireframing, would be preferable if the goal was so present one's design idea to fellow pupils. Figure 12.14 summarizes the results.

Seven out of the nine participants would have chosen their wireframe for presenting their ideas, whereas only one participant would have perhaps chosen the paper

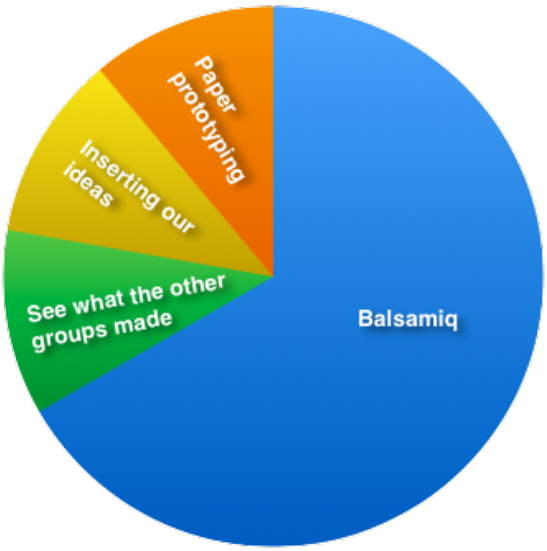


Figure 12.13: Preferences between paper prototypes and wireframing

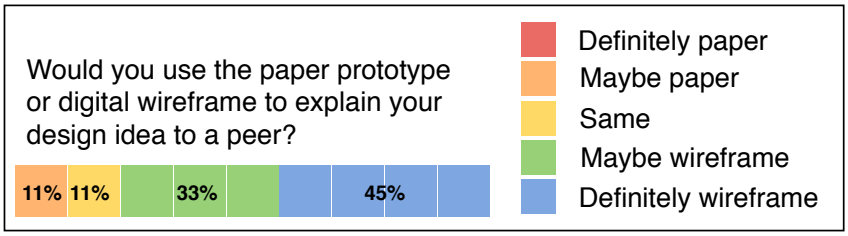


Figure 12.14: Preferred medium for presenting ideas

prototype. The last participant had no clear opinion on the matter. Remarkably, none would have definitely chosen the paper prototype to convey their idea.

When asked if they saw the purpose of first creating the paper prototypes, several participants acknowledged that it might have been more difficult to begin working directly with the computer. Some mentioned that starting with paper prototypes gave the advantage of knowing what to include in the wireframes.

12.4 Value of Design Artefacts (RQ4)

This section provides results related to RQ4: *What is the value of the produced design artefacts for the design process as a whole?* The quality of the resulting design artefacts is important for assessing the value, to UX design, of including wireframing in co-design workshops with children. Through the workshop, three paper prototypes and three digital wireframes were produced as solutions to the three related cases defined by NRK Super.

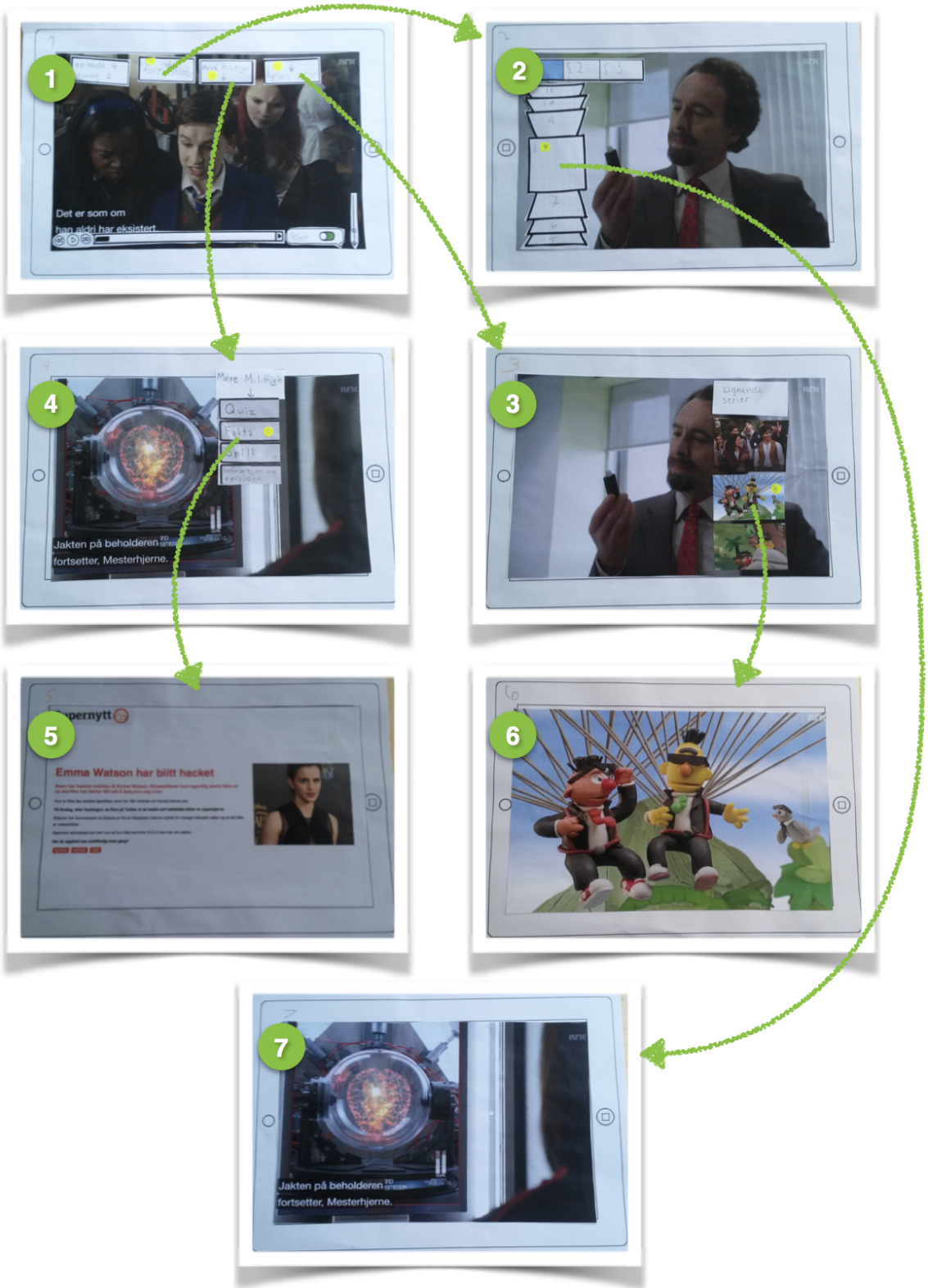


Figure 12.15: Group A's paper prototype

Paper Prototypes

Group A worked very organized and used the floor space for organizing their paper prototype. Their final paper prototype consisted of seven screens with six links, see Figure 12.15.

All screens were numbered (in the upper left corner) and all interactive elements were labelled with a yellow sticker containing the number corresponding to the screen they would lead to, see Figure 12.16. Thus, this prototype was easy to present and understand later, after the workshop had ended.

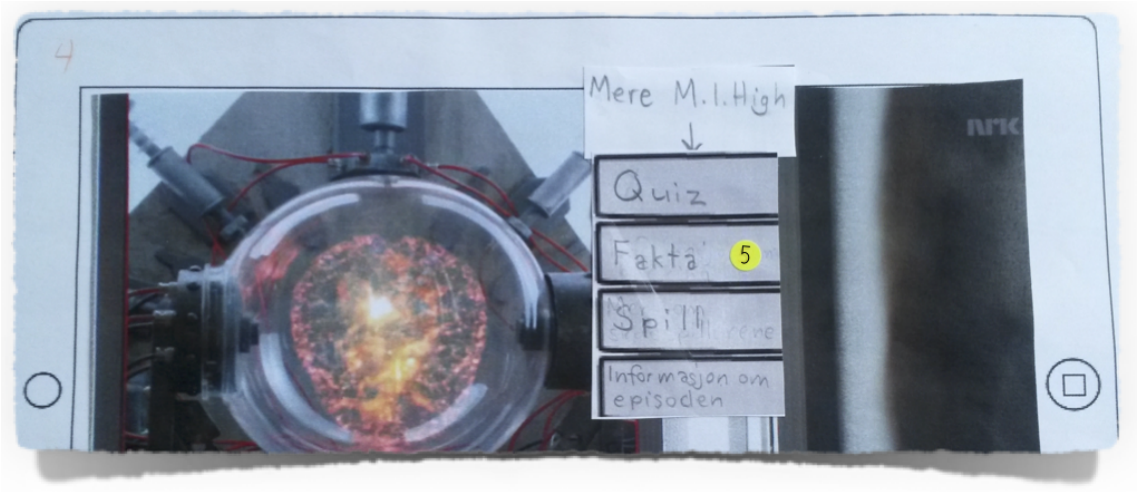


Figure 12.16: All screens of group A's prototype were numbered, along with all interactive elements indicating which screen they would lead to.

Their case was mainly concerned with presenting related content to the viewer at the end of an episode. Their prototype solved the case using a full screen view of an episode with an overlay menu providing these options. It even provided additional functionality as new content was available at any time during the whole show, not simply at the end.

Group B 's prototype comprised three screens in total with three links, see Figure 12.17. The navigation between screens was not documented, so they had to rely on memory when presenting to the other groups. With three screens this was a manageable task, but after the workshop had ended it was a bit unclear to the workshop organizers how the screens were linked.

Group B's case also referred to presenting related content to the users at the end of an episode. However, the starting screen of the prototype contained a menu where the viewer could choose to watch an episode or get information about when new episodes would be released. Having selected to watch an episode, the screen with the episode was presented and this was the last screen of the prototype. There were no new screens presenting related content at the end. The only content not related to watching an actual episode was release dates for new episodes, which was not part of the case description.

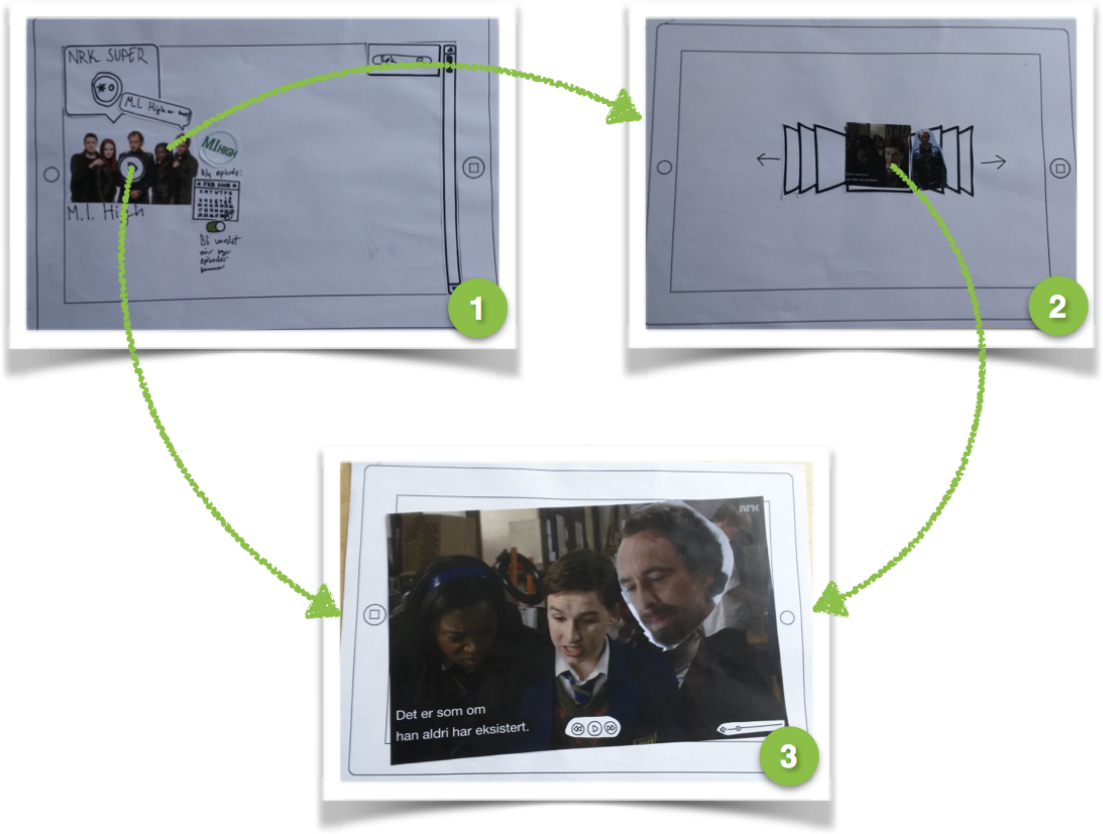


Figure 12.17: Group B's paper prototype

Group C 's prototype consisted of four screens with three links between them, see Figure 12.18. Apart from the screen depicting a full screen viewing of an episode, all screens contained several elements. All screens were numbered, but which interactive element led to which new screen was not documented. However, based on memory and the nature of the screens it was not difficult for the workshop organizers to remember the navigation after the workshop had ended. Similar to group B, the starting screen of groups C's prototype was a menu where the viewer could choose the relevant show. However, after the end of an episode, a similar menu screen appeared a second time.

The difference between groups C's case and the others was that group C was meant to present the viewer with related content *during* an episode and not simply at the end. Similar to group B, the starting screen of groups C's prototype was a menu where the viewer could choose the relevant show. This option led to a new screen with several options. Here, the viewer could either choose to watch an episode or click on other related material. Upon selecting to watch an episode, this episode would appear in full screen. Once finished, a similar menu screen appeared a second time with related content. Thus, related content was presented to the viewer twice in this prototype, both before and after an episode. However, no related content could be accessed during the episode which was group C's case.

Figure 12.18: Group C's paper prototype

Digital Wireframes

The paper prototyping session ended with a feedback session to allow ideas from the prototypes to be further developed. The wireframing session, thus, served as a second iteration of their ideas in addition to creating wireframes.

Group A , having a very organized paper prototype, treated the wireframing session as a reproduction task. The separate pages of the wireframe can be seen in Figure 12.20, and Figure 12.21 details the navigation within the wireframe. The wireframe is a digital reproduction of their paper prototype with two additional screens. See Figure B.10 in the appendix for a comparison of the paper prototype to the wireframe.

A new screen (screen 1 in Figure 12.20) was added of an episode playing in full screen with no menu. This resolved an uncertainty in the prototype of when the menu could be accessed. In order to access the menu, the viewer would have to click somewhere on the screen and the menu would then become visible along with all the standard options of volume control, play/pause buttons and progression bar.

Another issue encountered with the paper prototype was the lack of opportunity to navigate backwards. This was highlighted in the feedback session, and was addressed in the wireframe. A new button was added to the screen, called menu. This button would always be accessible and could be used to navigate back to the original menu.

The last screen added (screen 3) was a menu screen in itself, presenting related

content which could be directly selected without having to browse the drop-down menus. Figure 12.19 depicts how group A treated the wireframing session as reproduction, having the paper prototype laid over the Chromebook while creating the wireframe on the bigger screen in the background.

Figure 12.19: Reproducing paper prototype in Balsamiq

In terms of answering the task, the wireframe does the same as the paper prototype. It answers the task by having related content available to viewers at the end of the episode, but also throughout the episode in its entirety.

Where **group B**'s paper prototype only consisted of three screens, their wireframe consisted of 16 screens with navigation to all. See Figure B.11 in the appendix for a comparison of the paper prototype to the wireframe. The wireframe was clearly based on the paper prototype, but much functionality and examples of viewing episodes were included, see Figure 12.22. Figure 12.21 details the navigation within the wireframe.

A new start screen was added, depicting several apps on a tablet, where NRK Super's app was the one that could be selected. Upon clicking it, the starting screen from the paper prototype was displayed but with several new options, including selecting episodes and a quiz. For all of these new options, the further interactive possibilities were designed in detail. For selecting episodes, a UI carousel was used. Several episodes were added to this carousel and could be clicked leading to a new episode being displayed full screen. The quiz was also fully designed with separate screens for selecting both right and wrong answers with a conscious thought going into where each click would lead. The wireframe preserved the original idea of the paper prototype, but was much more elaborate, detailed and complex.

Although more elaborate, the wireframe presents the viewer with related content at the beginning of the episode, but not at the end as specified in the case description. The content provided before the episode is much more substantial than in the paper prototype, but it still does not present the content specified in the case.

Group C 's wireframe consists of four screens, the same number as the corresponding paper prototype. See Figure 12.23 for the wireframe, and Figure B.12 in the appendix for a comparison of the paper prototype to the wireframe. The navigation in the wireframe is also exactly the same as in the prototype. Thus, no relevant content is accessible *during* the show, as specified in the case. Relevant content is only accessible before and after an episode.

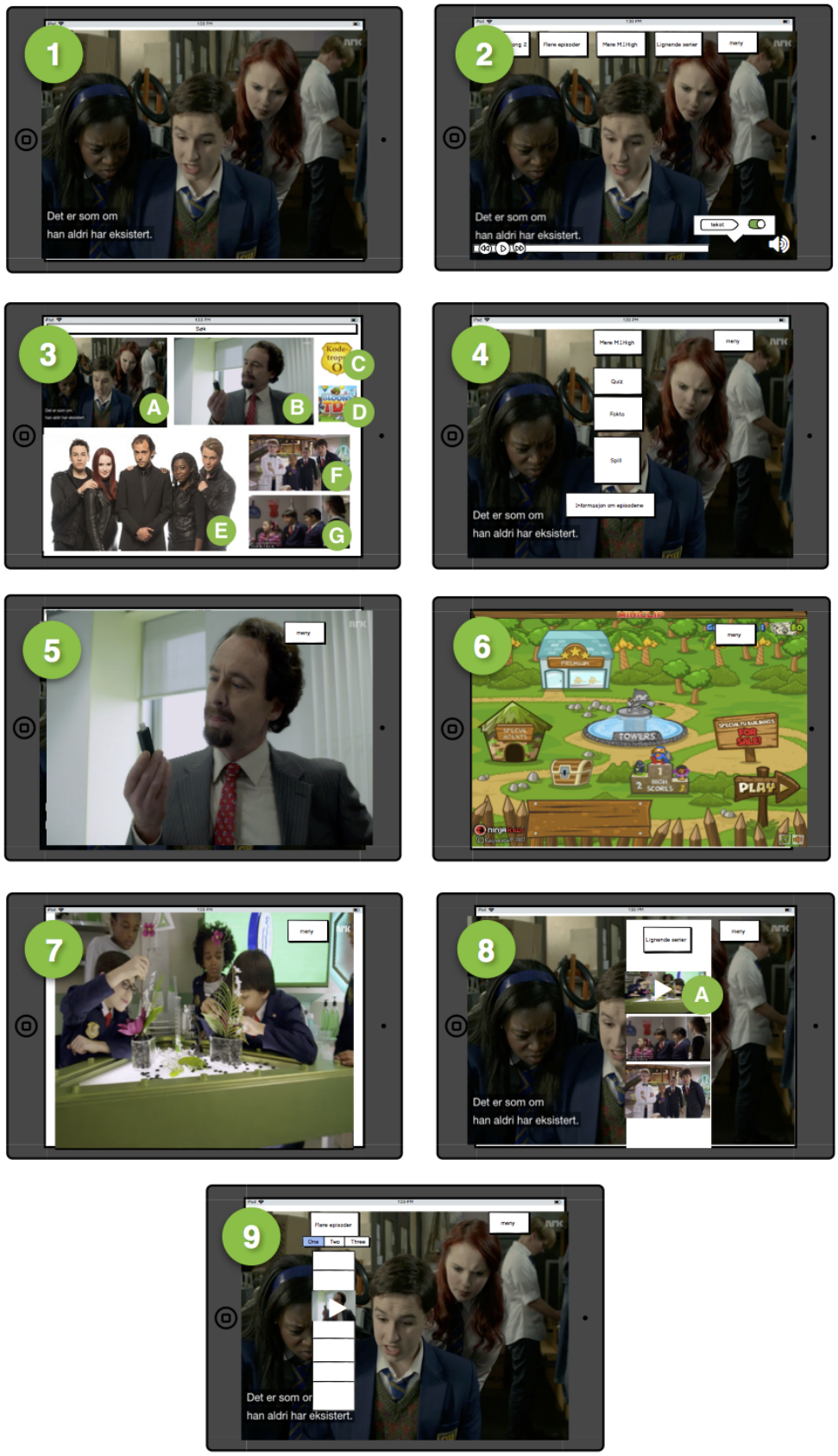


Figure 12.20: Group A's wireframe

	From	To	From	To
Navigation within **Group A**'s Wireframe	Screen 1	Screen 2	Screen 4, "Spill" (*Game*)	Screen 6
	Screen 2, "Flere episoder" *(More episodes)*	Screen 8	Screen 4, "Meny" (*Menu*)	Screen 2
	Screen 2, "Mere M.I. High" *(More M.I. High)*	Screen 4	Screen 5, "Meny" (*Menu*)	Screen 2
	Screen 2, "Lignende serier" (*Similar shows*)	Screen 8	Screen 6, "Meny" (*Menu*)	Screen 2
	Screen 2, "Meny" (*Menu*)	Screen 3	Screen 7, "Meny" (*Menu*)	Screen 2
	Screen 3, images A, E	Screen 1	Screen 8, image A	Screen 7
	Screen 3, images B, C, F, G	Screen 8	Screen 8, "Meny" (*Menu*)	Screen 2
	Screen 3, image D	Screen 6		

	From	To	From	To
Navigation within **Group B**'s Wireframe	Screen 1, "NRKSuper"	Screen 2	Screen 11	Screen 10
	Screen 2, images A	Screen 12	Screen 12, "Tilbake" (*Back*)	Screen 2
	Screen 2, play button and image B	Screen 3	Screen 12, left arrow	Screen 14
	Screen 2, image C	Screen 8	Screen 12, right arrow	Screen 13
	Screen 2, image D	Screen 10	Screen 12, play button	Screen 3
	Screen 2, image E	Screen 5	Screen 13, "Tilbake" (*Back*)	Screen 2
	Screen 3, "Tilbake" (*Back*)	Screen 12	Screen 13, left arrow	Screen 12
	Screen 3, everywhere else	Screen 4	Screen 13, right arrow	Screen 14
	Screen 4, everywhere	Screen 3	Screen 13, play button	Screen 8
	Screen 5, first and third ⊕	Screen 6	Screen 14, "Tilbake" (*Back*)	Screen 2
	Screen 5, second ⊕	Screen 7	Screen 14, left arrow	Screen 13
	Screen 5, "Tilbake" (*Back*)	Screen 2	Screen 14, right arrow	Screen 15
	Screen 5, everywhere else	Screen 3	Screen 14, play button	Screen 10
	Screen 6, button	Screen 5	Screen 15, "Tilbake" (*Back*)	Screen 2
	Screen 7, button	Screen 2	Screen 15, left arrow	Screen 14
	Screen 8, "Tilbake" (*Back*)	Screnn 13	Screen 15, right arrow	Screen 16
	Screen 8, everywhere else	Screen 9	Screen 16, "Tilbake" (*Back*)	Screen 2
	Screen 9	Screen 8	Screen 16, left arrow	Screen 15
	Screen 10, "Tilbake" (*Back*)	Screen 14	Screen 16, right arrow	Screen 12
	Screen 10, everywhere else	Screen 11	⊕ on all screens	Screen 1

The navigation in **Group C**'s wireframe is simple enough to be depicted along with the wireframe itself.

Figure 12.21: Navigation within wireframes

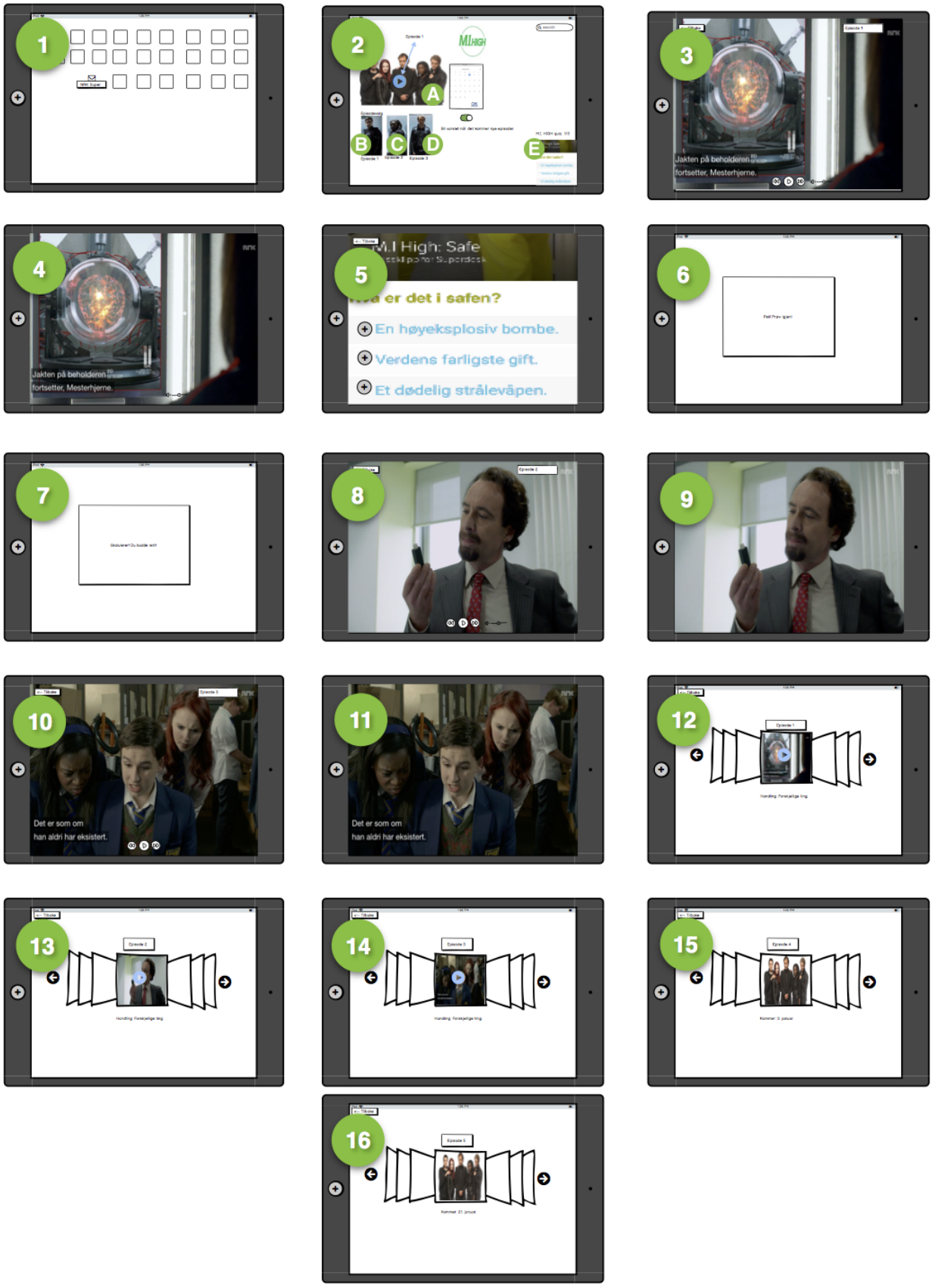


Figure 12.22: Group B's wireframe

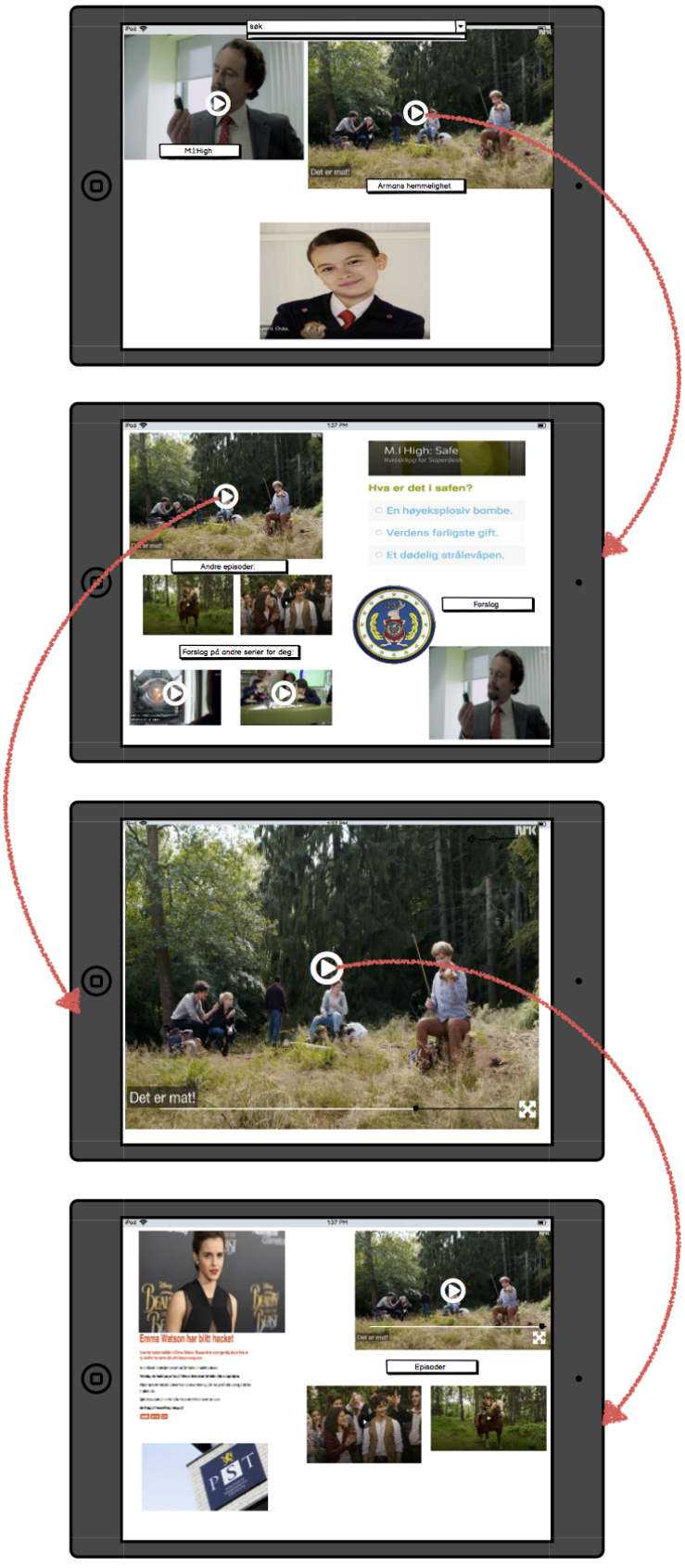


Figure 12.23: Group C's wireframe

Dialogue with NRK Super

The notes from the dialogue with one of NRK Super's interactions designers can be found in Section B.6 in the appendix. As these results are only relevant for answering RQ4, the relevant content will be presented and discussed directly in Section 13.3, and not split up into Chapters 12 and 13 as the rest of the data, only to be repeated in the *Discussion*.

12.5 Who are the Participants?

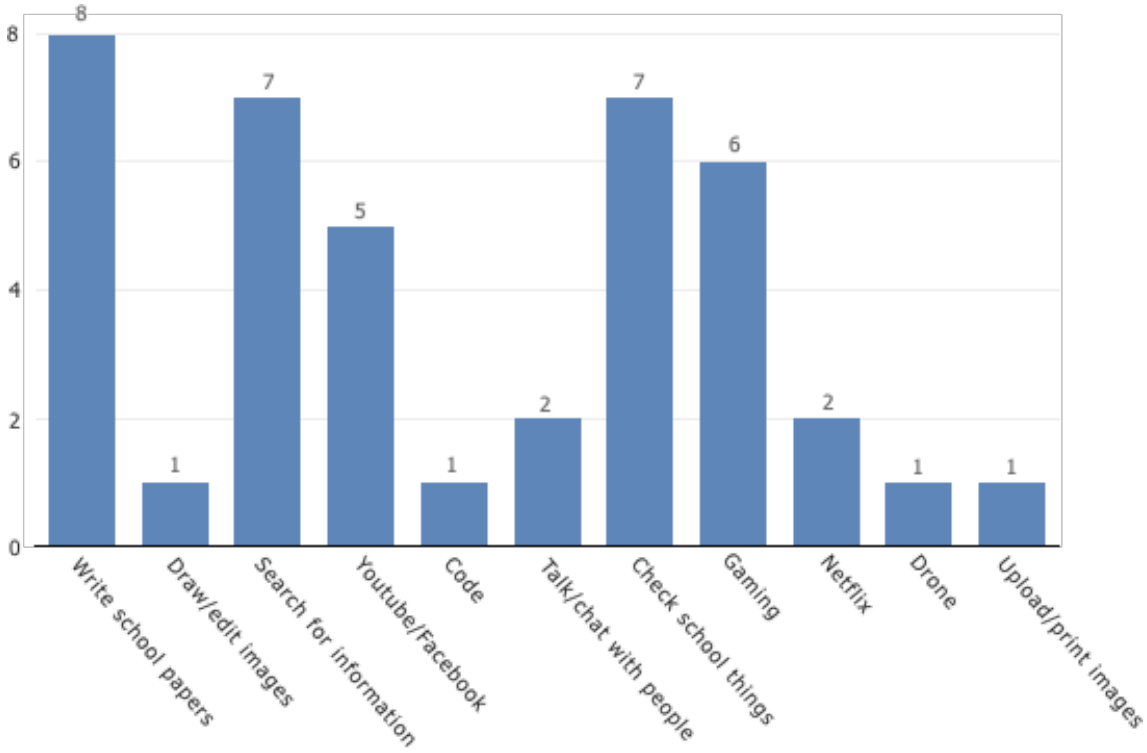


Figure 12.24: What the participants use their computers for normally

When trying to determine the participant's previous knowledge of computers, the questionnaire focused on which different activities the participants use the computer for, see Figure 12.24. However, through the thematic analysis it became clear that the participants also use their smartphones extensively, in addition to computers. For some activities, the smartphone has replaced the computer. Examples of such are identified by the thematic analysis below.

Participant Background: PC versus Smartphone Usage

This theme deals with how the participants use their phones in addition to, or instead of, computers. The participants typically use their phone for streaming content and communication. Following are four excerpts from the group interview where the interviewer asks what the participants use computers for:

> **Participant:** "And I don't use it very often to search for information"
> **Interviewer:** "No?"
> **Participant:** "...I'd rather use the phone"
> **Interviewer:** "You'd rather use the phone, yes. OK. Why would you rather use the phone?"
> **Participant:** "Mye kjappere og hendiere." (*Translation: Much quicker and more practical*) (GI, lines 87-92)

> **Interviewer:** "How many of you are using Netflix and watch TV and, or music? Like Spotify or Wimp or other things?"
> **Participant:** "I use spotify on the phone."
> **Participant:** "Yes, me too."
> **Participant:** "I use spotify on the phone, but not on the computer" (GI, lines 127-130)

> **Participant:** "I watch TV and such, or things on my phone and the iPad, and spotify on the phone and youtube on the phone."
> **Interviewer:** "Youtube also on the phone?"
> **Participant:** "Yes, and the iPad"
> **Participant:** "Mmm, mostly on the phone because it is so much faster..."
> **Participant:** "And snapchat of course."
> **Interviewer:** "On the phone...?"
> **Participant:** "Yes" (GI, lines 135-143)

> **Interviewer:** "Question. How many of you are using Skype or Messenger or Discord or similar things? On the computer?"
> **Participant:** "And we also use Messenger on the phone." (GI, lines 144-145)

The thematic analysis also highlighted some aspects of how the participants relate to the Internet.

Participant Background: Netiquette

Regarding their use of the Internet, varieties existed among the participants of how free they are to use the Internet on their own (GI, 27-43):

> **Interviewer:** "Do you also use the internet freely a home?"
> **Multiple participants:** "Yes, we have our own iPads etc."
> **Interviewer:** "Is there someone at home who decides which pages you are allowed to visit?"
> **Multiple participants:** "YES"
> **Interviewer:** "So you're not allowed to do whatever you want?"
> **Participant:** "No"
> **Participant:** "Yes"
> **Participant:** "Most of the time"
> **Participant:** "Æ får jo ikke gå på hva som helst, men dem har ikke sagt noe spesielt. Men æ skjønner at det er en grense." (*Translation: I can't visit just anything, but they haven't sad anything special. But, of course I get that there are limits.*)

The school has also focused on netiquette (GI, lines 48-52):

> **Participant:** "We had a whole week dedicated to netiquette at school."
> **Participant:** "It might even have been a whole month of netiquette at school."
> **Participant:** "It was a week."

In addition to their background knowledge with computers and the Internet, other aspects define who the participants are. Certain personal attributes which are beneficial to the workshop have been identified in the above sections. Moreover, several reasons exist why children should be included in design processes. However, the children also have their own thoughts on how they can contribute to the design process. They emphasize several advantages of being children, and several disadvantages of being an adult in the design process, especially related to digital wireframing. These opinions are further described in the thematic analysis below.

Participant Attributes: Self Reported - Children as Assets

Relating to children as assets, the participants stated that they, children, are more creative, and get ideas faster. One participant said, "Det har jeg hørt av mamma at 'Åh, du er så heldig siden du får alltid idéene så fort.'" (*Translation: I've heard it from my mom that 'Oh, you are so lucky because you are always so quick to get ideas.'*) (GI, line 455)

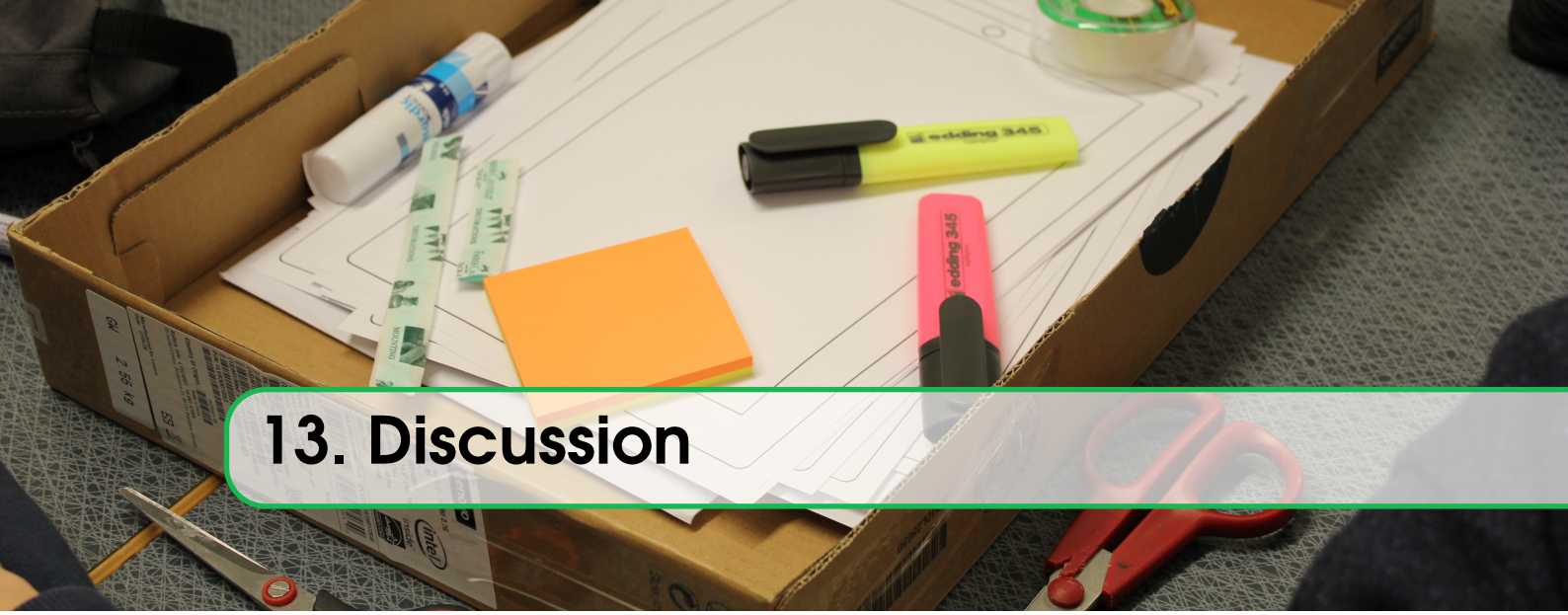
Another participant followed up on these arguments, adding that children have also grown up with technology, "Eh, we are more creative and we get ideas faster...And we have grown up with technology and, and it is easier for us to learn, that program because we understand technology" (GI, line 463).

Participant Attributes: Self reported - Adult Difficulties

Regarding adults, the participants felt that adults would take longer to master the digital wireframing tool since they have not grown up with technology in the same way as the children themselves. They also focused on the fact that adults' general ability to learn declines as they get older,

> "Just like with languages, it is difficult to learn a language as an adult. But it is easier to learn a language as a child. You might have a better memory when you are younger, or that you have a better, or remember... Ehm, that older people forget more. Or that it is a bit more difficult to learn things." (GI, line 467)

Lastly, when the participants stated that they understand technology, they agreed with the interviewer that they are not afraid of technology, whereas adults can be: "Nei, for dem voksne bare 'Åh nei, æh...!'" (*Translation: No, because grown ups are just like 'Oh no, ah...!'*). One participant also observed that, "it can also be that parents...that they must always be right. They can never do anything wrong" (GI, line 469).



13. Discussion

The discussion is divided into two parts. The first four sections address the overall research aim, with separate sections answering one of the three research questions RQ2-4. Findings which are relevant to the overall research aim, but which do not directly address one of the research questions, are discussed in Section 13.4. Section 13.5 discusses the validity of the research.

13.1 Workshop Process (RQ2)

This section aims to answer research question RQ2:

How can wireframing be included in co-design workshops with children?

When it comes to including wireframing into a co-design workshop with children, including it after a paper prototyping activity proved successful. Having prepared a schedule with paper prototyping activities, the wireframing activity can 'simply' be added as a new activity following the prototyping. The wireframing can then serve as another iteration of their concept, and provides the participants with a new medium through which to express their ideas.

In terms of how to structure the schedule prior to the wireframing activity, the theory chapter outlines various ways of including children into prototyping activities. In this particular project, the original schedule was successful with only minor alterations. The findings here coincide with many of the lessons learned by Pillai et al. [55], who also studied participatory design with children including activities on paper prototyping and wireframing. However, where Pillai et al. describe *what* was done with a purpose of developing a co-design method for educational technology for its end users (while at the same time provide a learning experience for its designers), the aim of this thesis is to focus on *one* particular activity within co-design (wireframing) and discuss *how* it can be included, and the effects of doing so. Which factors led to the success of the workshop are discussed below.

Wireframing Specific

Progression: Including Wireframing After Paper Prototyping

Although wireframing was the preferred activity of the day, most participants acknowledged benefits of including paper prototyping prior to wireframing. Some participants viewed the paper prototyping activity as practice for the wireframing, as was also intended by the workshop organizers. When prototyping, the participants did not have to know how the UI elements of a particular tool were organized in order to use them. They could simply pick the desired element from the table.

Moreover, partaking in a co-design workshop was new to all participants, as was the wireframing tool Balsamiq. Even if the participants were able to use the tool after a quick introduction, it might have been too much to begin the workshop by working with Balsamiq straight away. This, however, cannot be known with certainty and would need further investigation. By beginning the workshop with paper prototyping, the children were introduced to the concept of expressing and merging ideas with familiar tools such as pen, paper, glue etc. Thus, when wireframing was later introduced, they were already acquainted with the iterative process of expressing and sharing ideas. Now, the only new element was to express these ideas through a new medium.

Instruction: A Short Introduction to Wireframing is Sufficient

When beginning the wireframing activity, a ten minute introduction was given, five minutes for introducing wireframing and five minutes for demonstrating Balsamiq. After this, the participants began working on their wireframes.

At he end of the workshop, six participants reported that it was very easy to *learn* Balsamiq, and seven found it very easy to *use* Balsamiq, see Figure 12.11. After a quick introduction, the participants displayed no difficulties working with the wireframing tool. The only questions asked were where they could find the different UI elements, as they were unfamiliar with how the elements were organized.

Thus, a short introduction to wireframing and the specific tool is sufficient for including wireframing in a co-design process.

Time Allocation: Allow Sufficient Time for Wireframing

As the workshop team had not included digital wireframing in a co-design workshop before, they did not know how much time to allow for this activity. This lack of experience, and prior evidence, contributed to the second change of the workshop schedule. In all honesty, the workshop facilitator (also the author) believed 55 minutes to be plenty of time. However, the participants clearly wanted more time for this activity. Even after being allowed to work during their lunch break, "more time for wireframing" was one of the trending feedback responses by the participants to how the schedule could have been different. Thus, this alteration was made due to the lack of experience of the workshop organizer.

On the other hand, it is fair to discuss how allowing more time for this activity benefits the workshop as a whole. Adding more time clearly pleases the participants, and if ensuring a 'fun' workshop is the aim, more time for wireframing could be considered. However, this is an activity that can go on for ever, and just as with paper

prototyping, it has to end at some point. This is one of the reasons for introducing timeboxing in the first place. Thus, 55 minutes might have perhaps been sufficient after all. It is difficult to say if the produced wireframes would have been much different if more time was allotted.

Also, as discussed further in Section 13.3, if the products themselves are not important for the further design process, allowing more time for this activity might not benefit the design process as a whole. For example, if wireframing is included in the early stages of the design process to provide insights about the user group, or express initial concepts, detailed wireframes might not be necessary.

On the other hand, if refined and detailed wireframes are the aim, then adding enough time for the participants to feel able to complete their designs would be more important.

Clearly, when deciding how much time to spend on the wireframing activity, careful consideration needs to be given to the purpose of including wireframing in the first place before a decision can be reached.

Workshop in General

Team building: Importance of Icebreaker

The participants worked well together, both within and between the groups, throughout the whole workshop. The workshop began with an icebreaker, which could have contributed to this successful collaboration. This finding coincides with the literature which extensively documents the importance of icebreakers [45, 47, 55].

As experienced in intergenerational design teams [45], beginning the session with a team-building exercise was beneficial for the children. Although the participants all knew each other to some extent, the one-handed paper plane activity threw the teams into a collaborative experience while, at the same time, exposing them to the medium (paper) they would work with afterwards. The competition element added a clear purpose to the exercise and all seemed to enjoy the short flying competition at the end. No problems with group dynamics were experienced for the rest of the workshop, and all participants were ready to get started with prototyping immediately afterwards.

Warm-up: A Paper Prototype Warm-up Exercise Prevents Waste of Time Later

In order for the time dedicated to the main prototyping task to be used the most effectively, the paper prototyping warm up exercise was beneficial. Even though the participants reported that they understood what to do when paper prototyping, some guidance was needed in the beginning in addition to the live demonstration. Moreover, all the physical material of different images created a chaotic working environment when emptied out onto the desks. Having a warm-up exercise, mimicking what was to be done in the main prototyping exercise later, provided the participants with a learning experience. When delving into the main exercise, the participants were already more familiar with what they had to do and how to organize their material. This allowed more effort to be spent on the creative process.

Timeboxing: The Children were Able to Keep Up with a Tight Schedule of Unfamiliar Activities

Moving on from concrete activities, discussion now turns to more organizational features of the workshop applicable to more than one single activity.

Timeboxing is one such element key to the first part of the workshop. The participants displayed no problems working within these constraints. Rather, they exhibited effectiveness and were able to get things done within the time they had. No teams fell behind schedule, and all groups were able to keep up with the pace of the workshop.

The tight time limits of the workshop might have been unfamiliar to the participants as schools normally allow longer time for activities to be completed. The added factor of a delayed start made the initial activities a bit rushed. However, the participants were always ready to start the next activity. Even if they, occasionally, expressed a want for longer time to complete activities, they never displayed any signs to suppose they were not keeping up. Despite the rapid shifts between activities, the participants still expressed eagerness and no one became passive. However, even though the participants in this workshop all met the precondition of active participation, it is fair to question whether this high pace is suitable for all pupils. This is further discussed below under *Participant Attributes*.

In schools, longer time is often allocated to activities to ensure that most pupils will be able to complete them. In this workshop, however, the opposite was the case: The participants are largely not expected to complete the task at hand. Timeboxing is more about forcing the participants to quickly jot down ideas, and limit time for feeling self-conscious. This is possible as there are no right or wrong answers in these early stages of the design process. In ordinary school activities, however, finding the correct answer and being right is often important. This, in turn, nourishes self-consciousness. The participants were surprisingly able to overcome this way of thinking during the workshop.

Flexibility: Allow Alterations

Relating to the alterations of the schedule, some were caused by unforeseen circumstances, others by lack of experience on behalf of the workshop team.

The late arrival of the participants was outside the control of the workshop team, and the schedule had to be altered as a consequence. This underlines the importance of planning a schedule which can be altered at a moment's notice. In order to not let the participants of the workshop suffer, such changes should be possible to be made seamlessly without troubling the participants. One of the lessons learned was the importance of 'it's not the plan, it's the planning'. The workshop organizers should know the workshop structure, and the workshop objectives, so well that changes can be made without compromising the participants' experience of the workshop or preventing the workshop objectives from being achieved. Thus, detailed planning is necessary. However, once the workshop has begun, rigorous adherence to the plan should be dropped if necessary.

While planning for change is one thing, coping with sudden change is another. Even though this workshop schedule was devised to allow alterations, the workshop facilitator was not completely prepared for having to make the changes. Cutting

activities, and rushing those that could be rushed was accomplished, but resulted in the workshop facilitator (also the author) becoming stressed. She rushed to finish her own introductions and presentations in order to save time, at the cost of failing to notice the participants raising their hands to answer questions. The workshop facilitator did not realise she was asking rhetorical questions to which the participants raised their hands. The observers of the workshop made her aware of this fact. After a few episodes of this behaviour, some participants even stopped putting up their hands. This was very unfortunate, and a clear result of the workshop facilitator being affected by the stress of having to cope with spontaneous change to the schedule.

Thus, planning for change is one thing, but equally important is the ability to be prepared for, and cope with, the change when it has to be made. It should be noted, however, that this behaviour on part of the facilitator only lasted until she was made aware of it early on in the paper prototyping warm up exercise. For the rest of the workshop, she was again attentive to the participants.

With several short activities, some should be possible to cut. Alternatively, including fewer, but longer, activities might allow some time to be cut from the activities without the pupils feeling negatively affected. This, however, would compromise the desired effect of including timeboxing in the first place. In any case, which activities to cut, or where to save time, should be planned beforehand so the facilitator's attention is not disturbed.

Participant Attributes

The success of a particular schedule will depend on the participants. There is rarely 'one size fits all'. The success of the schedule used in this project can largely be attributed to the participants themselves, and certain attributes they possessed and exhibited throughout the workshop.

The workshop was characterized by strict time limits, and in order to ensure progress of the schedule, the participants would have to be motivated and willing to do as told. There was not time for the participants to misbehave by refusing to partake in certain activities etc. Thus, voluntary participation was important.

Moreover, the many activities and short time spans led to a high tempo in the workshop, and being able to keep up with the schedule required certain characteristics. First, the participants sought to understand the tasks. They paid attention to explanations, and when unsure about something, they asked questions. This ensured that time was not wasted when performing the different tasks.

Second, working with the paper prototypes, chaotic working conditions quickly arose as a results of all the material handed out. Being able to organize the material, and keep a tidy workspace throughout was important. Figures 12.7 and 12.8 exemplify this. The groups with the most chaotic working conditions created less elaborate prototypes than the group which maintained order in the workspace. Perhaps, the ability to keep order influenced how elaborate their prototypes became.

Third, cooperation skills were important as most activities were conducted in groups. In the few activities where participants worked individually, they were required to present their work to others. Thus, the ability to cooperate, present, and give and receive feedback were skills exhibited by the participants which contributed to the successful progression of the workshop. One participant even named this as

one of the most enjoyable aspect of the whole workshop, "I thought it was quite fun when we were, like, going to tell the others what we were thinking, and, like, how we wanted it to look. And when we were going to insert, and how we wanted it to look."

When wireframing, the participants divided responsibilities among themselves, ensuring that everyone was able to contribute to the product and, more importantly, feel ownership over what they created. This sense of ownership and participation became clear when they had to present their work to the other groups. All team members participated even if they had had little time to prepare.

Fourth, as the schedule differed greatly from what they are used to in school, being able to adapt and endure the high tempo was necessary in order to enjoy the workshop.

This requirement to always be active and participate in all the different activities, clearly required certain skills and characteristics, and it is fair to question whether this high pace would be suitable for all pupils.

However, the teachers in charge of selecting the pupils, commented on the selection of the participants, saying that among the almost 100 seventh graders, almost all volunteered to partake in the workshop. From these volunteers, nine were drawn at random. The selection was comprised of participants of various ability levels. Thus, the participants were not deliberately selected based on their abilities.

Summary

Based on the experiences of this project, wireframing can successfully be included in co-design workshops with children. For successful inclusion several different factors are observed.

First, relating to the wireframing activity specifically, it can be added into an already existing schedule with paper prototyping, and serve as another iteration of the participants' designs. Including wireframing after paper prototyping means that once the participants are required to learn and use a particular wireframing tool, they are already familiar with the process of expressing and sharing ideas.

Second, the time devoted to wireframing will depend on whether the purpose for including wireframing is for the produced wireframes themselves, or as an arena to converse with the children about their design choices. Moreover, a short introduction to wireframing and demonstration of the relevant wireframing tool is sufficient for the participants to be able to utilize the tool.

Third, relating to the workshop in general, an icebreaker at the beginning of the workshop strengthens teamwork throughout the day.

Forth, in order for time not to be wasted during the main prototyping task, a paper prototyping warm-up exercise is beneficial.

Fifth, timeboxing is important for two reasons: ensuring progress in the workshop, and preventing the participants from dwelling on self-consciousness. This is especially important during the wireframing activities. Surprisingly, the participants were fully able to keep up with the tight schedule based on timeboxing and worked efficiently with the time they had.

Sixth, the agenda should be flexible enough to allow for spontaneous alterations if necessary. And the workshop facilitators need to be prepared for such change.

Lastly, certain attributes exhibited by the participants ensured the success of

the schedule followed in this project. Participants exhibiting different characteristics might yield a different result if following the same schedule, as is the case with all experiments involving people.

13.2 Feasibility and Motivation (RQ3)

This section aims to answer research question RQ3:

> *How does creating digital wireframes affect the children's motivation for participating in co-design workshops?*

Motivation: Intrinsic Motivation to Partake in Co-Design Workshop, Especially Wireframing

It is clear from the results presented above that the children were highly motivated to partake in the workshop as a whole with all its activities.

For example, there was initial confusion about how long the workshop was going to last, but when one pupil asked "Are we going to do this the whole day?", receiving a positive answer, clear excitement was observed among the participants stating, "so we're not going to have ordinary school? YES, because this is so cool!" The participants had been told, at the beginning of the day, that they would be working with computers, but if this comment referred to wireframing specifically or the workshop as a whole is not certain. Nonetheless, it is a clear expression of motivation to be present in the workshop.

As the workshop replaced their ordinary school activities for a whole day, one could assume that it was simply motivating because it let them "get out of" ordinary classes. However, several examples illustrate that this was not their only motivation. First, they were scheduled to have 'Arts&Crafts' that day, and not 'normal' classes. Second, the most clear example is the time they wanted for wireframing. All except one participant chose to keep working on their wireframes during lunch, and some even asked if they could keep working during the rest of the break. Giving up their only free time during the day to keep working on their wireframes, is a sign of intrinsic motivation.

Moreover, the participants never indicated boredom by asking for breaks or how much time was left. Whenever the participants were informed of the remaining time for activities, the participants were always surprised of how little time was left and expressed a want for more time.

It is clear from these examples, and Section 13.1 above, that the icebreaker, paper prototyping, and wireframing were all activities they enjoyed. However, the aim of this project is to investigate to which extent the wireframing activity in particular influenced their motivation. This is discussed further below.

Preference: Participants would Choose Wireframing for Visualizing Ideas

All participants enjoyed both prototyping and wireframing, awarding both activities high scores in the questionnaire, see Figure 12.12. The participants actively participated in all the different activities in the first part of the day, and one might have expected the participants to be tired, or even lose interest in the next activity

(wireframing) which would last for an hour. Experiences from this workshop, however, suggest the opposite: The participants were motivated to continue working when they were allowed to change mediums. Not one of the participants expressed any sign of wanting to end the workshop after the paper prototyping activities, before the wireframing. Rather, six participants thought Balsamiq was the most fun part of the day, see Figure 12.13, and wireframing was the activity the participants explicitly wanted to have more time devoted to.

Moreover, most participants would choose the wireframes to present their ideas. When asked if they would use the paper prototype or their wireframes to present their design ideas to peers, only two would have chosen the paper prototypes. The seven others, would have either *definitely* or *maybe* have chosen the wireframes, see Figure 12.14.

Some gave this answer as they thought wireframing was the most fun activity, "It was the most fun activity, so I would rather spend a bit more time on something I think is fun." (GI, line 398)

This result is in slight contrast to Heintz et al. [38], who in a comparison of paper- and software-based prototyping activities, did not find a marked preference for either activity. However, where [38] aims to compare the two approaches to prototyping, this thesis has no intention of arguing for the replacement of paper prototyping with digital wireframing, or vice versa. While paper prototyping and digital wireframing share several characteristics, the digital wireframing activity is meant to add to the paper prototyping activity, and not necessarily replace it. Moreover, this thesis is not simply about about which medium (paper or PC) produces the most useful (however one chooses to define this) output, but it also investigates how the participants' motivation is affected by the different activities, and it is clear that the participants in this study were highly motivated by the wireframing activity. It should be noted that the participants in Heintz' study were university students and, thus, much older.

Aesthetics: Wireframes are More Real-Looking than Paper Prototypes

The answers to why the participants enjoyed wireframing fell into one of two categories: real-looking or faster to make. The participants repeatedly emphasised that the real-looking aspect of the wireframes was one of the reasons they enjoyed working with them. Children are exposed to professionally designed graphical user interfaces on a daily basis, and when being asked to design such an interface themselves, it is natural that they envision interfaces of a similar standard. Without any tools at hand, very few are able to express such interfaces in a realistic way. Thus, what they produce will necessarily be different from what they envision, and everyone can relate to, and experience frustration, when not being able to express their ideas.

When using a tool like Balsamiq, however, which allows users to drag and drop previously designed UI elements, the children are able to create interfaces which look similar to those created by adults (who drag and drop the same elements), and more clearly depicts what they envision. Some were even surprised at how "real" it looked.

Thus, using digital wireframing tools allows children to focus on the creative process and not being worn down by not being able to express the ideas they have. By feeling a sense of success, from creating more realistic interfaces, their efforts are directed towards further creativity.

This aspect of narrowing the gap between envisioned and produced was also acknowledged by one of the interaction designers at NRK Super, who has observed that:

> Children often like to sing and dance, however, some dislike watching recordings of themselves singing and dancing.

She believes this is because, in their minds, children are rock stars and prima ballerinas, but in reality they are not able to express this in the way they envision it in their minds, and watching recordings of themselves, thus, points out that the reality is not as they envision it.

This can be transferred to designing graphical user interfaces as well. The narrower the gap between the envisioned and produced, the more motivated the participants are.

This ties in to the experiences of the developers of DisCo [75]. In creating a digital version of layered elaboration, they found that "children had higher expectations of their own ability to draw with a computer-based design tool than of paper-based techniques...and did not want to draw with the computer" [75]. One could even argue that drawing on the computer produced even less real-looking prototypes than drawing on paper due to limitations in the particular drawing programs themselves. This shows that including digital tools in co-design with children is not simply a matter of replacing a paper-based method with a digital one. The purpose of including a new tool should be greater than simply digitalizing an already successful process. With DisCo, the added purpose was to enable cooperation within asynchronous distributed teams. However, as the children felt more limited by their drawing skills with a digital drawing tool, perhaps the distributed collaboration could have benefited from utilizing a digital wireframing tool instead of a digital drawing tool. By using drag-and-drop elements, the whole problem of digital drawing is circumvented, and might have supported the participants to focus on the creative process instead of the drawing itself.

Efficiency: Faster to Make

Another reason for preferring wireframing, according to the participants, is that they were faster to make. Several participants argued that it was easier to find the desired elements on the computer than amongst all the cut-outs on the table (when working with paper). For the more disorganized groups, this was perhaps a real time saver.

In reality, however, the participants spent more time wireframing, than prototyping, so "faster to make" is an interesting remark. A single participant even voiced this concern, wireframing "might take some time". However, when wireframing, the participants also implemented the navigation between pages. As such, one could say that more was done during the wireframing activity. For one of the groups, their paper prototype and wireframe was the same, meaning they spent more time creating the wireframe than the paper prototype. For another group, small additions were made to the wireframe. For the last group, however, their wireframe was extended to 16 screens from 3 in the paper prototype. Perhaps this was because the wireframes were so much faster to make. Or perhaps, they were simply more motivated to work on the computer than on paper.

Regardless, the participants themselves experienced that the wireframes were faster to make. This could indicate more motivation for the task, as time seems to pass more quickly when enjoying an activity.

Ownership: Completely Immersed in Wireframing and Proud of Their Results

The participants were clearly immersed in the wireframing activity. They were always surprised at how little time they had left, when being notified. When time was up, they still waned to continue, and were given an extra 20 minutes. And when this time was up, they still wanted to continue. And the only feedback to the workshop schedule was that they wanted more time for wireframing.

Moreover, the participants seemed proud of what they produced. When peers came into the classroom, one participant exclaimed "Check out what we've made!" The real-looking aspect of the wireframes made them proud to present what they had achieved. This sense of pride was not observed when creating the paper prototypes.

Furthermore, when presenting their wireframes to the other groups, they had had little time to prepare the presentations as they had rather chosen to continue work on the wireframes themselves. Thus, the presentations were mostly improvised. In an ordinary group of people, some will be shy and some will be quick to speak up. However, in this case, all team members were active during the presentations, even the shy ones. The fact that they had all been so immersed in the activity, and felt proud of the result, can have contributed to everyone feeling ownership over the product. Moreover, all the groups had collaborated successfully by dividing responsibilities, so that all team members had been active in the creation of the product. Under these circumstances, even the quietest participants had something to say in the presentations, and were able to do so.

Summary

The participants were clearly motivated to partake in the co-design workshop, and the wireframing activity played an especially important role in this motivation.

First, wireframing was the activity most participants enjoyed the most, wanted the most time for, and was the medium they would have chosen if they were to present their design ideas to peers.

Second, the fact that the wireframes were so real-looking was one of the biggest motivating factors for this activity. An effect of using a digital wireframing tool was that what the children produced did not differ greatly in appearance from what an adult could produce. By dragging and dropping pre-designed elements, the children were not limited by their artistic skills in expressing their ideas. Moreover, they were proud of what they produced.

Third, the participants were completely immersed in the activity. They felt the wireframes were faster to make than the paper prototypes, yet they spent more time wireframing and still wanted more time when time was up. They traded their only free time during the day to keep on wireframing. If the goal of the workshop was to keep the motivation high, wireframing would be the perfect activity.

13.3 Value of Design Artefacts (RQ4)

This section aims to answer research question RQ4:

> *What is the value of the produced design artefacts for the design process as a whole?*

In order to determine the value of the produced design artefacts, this section discusses both how the wireframes differed from the paper prototypes, to which extent the wireframes answered their respective case, and what the value of the artefacts is to the design process as a whole.

The Wireframes were More Elaborate than the Paper Prototypes

Two groups extended their paper prototypes when creating the wireframes. The wireframes of these two groups contained more screens and more interactive options than the prototypes. The wireframes also incorporated changes based on the feedback from peers. Thus, the output of the wireframing session was more than simply a digital reproduction of the paper prototypes.

As the creative processes continued when creating digital wireframes, most wireframes were more elaborate than the paper prototypes. However, it cannot be known with certainty whether the wireframes were more elaborate because of the change of medium, or simply because they were given more time to improve their initial idea, serving as a second iteration of the prototype based on feedback from peers.

An interesting result is that one group clearly stood out when extending their wireframe. This was group B, and consisted of only boys. Their paper prototype was fairly simple, consisting of 3 screens, whereas their wireframe contained 16 screens and complex navigation to all. The other two groups consisted of only girls. Group A made minor additions to their wireframe compared to the paper prototype, whereas groups C's wireframe was a strict reproduction of the paper prototype.

It would be interesting to investigate further if there is a difference between boys and girls when it comes to expressing creativity, and if the medium plays a role in this, see Chapter 16 *Future Work*. In this project, the boys had the simplest prototype, but the most complex wireframe. Had the workshop ended after completing the prototypes, the resulting artefacts would have been completely different for the boys' part. The reasons for this are unclear, but there was a marked shift. The boys' group was also one of the more persisting groups when it came to asking for more time for wireframing.

Value in Different Ways

Heintz et al. [37] studied the different extent to which paper prototypes versus digital wireframes (created with Balsamiq) elicit feedback from evaluators as a means of comparing "systematically a paper-based and tool-based approach to determine to what extent software tools can be used to support or even replace paper-based PD activities." [37, p. 503]. Given that the tool-based approach (using Balsamiq) neither yielded more nor better comments, they concluded that Balsamiq "cannot be used to replace the paper-based method." [37, p. 515]. However, they did not find any

significant difference between the quality of the comments elicited by the paper and tool-based approaches, which also means that paper is not necessarily better than digital wireframes, and other factors should be compared to determine the value of adding wireframing to the design process.

The research presented in this thesis also aims to investigate how software tools can be used in participatory design, however, with the view of adding to existing activities rather than replacing them, as seems to be the focus of several studies [37, 38]. As opposed to Heintz et al. [37] who dismiss Balsamiq because it does not provide more feedback comments, or comments of significantly better quality, this thesis argues for other reasons for including wireframing into co-design, such as the participants' motivation. Moreover, the reasons why digital wireframes did not elicit more comments could be many. Perhaps fewer comments were simply the result of more refined wireframes which better conveyed the intended ideas of the creator. If so, this is a concrete value of producing wireframes in themselves.

Moreover, in another study, Heintz et al. [38] compared paper- and software-based prototypes and found that the only distinction between the two was that digital prototypes outperformed the paper prototypes in relation to how 'pleasant' they appeared. This ties to the participants' own opinions (in this study) about the real-looking aspect of the wireframes.

Few Prototypes/Wireframes Answered the Cases

Another aspect worthy of evaluation is the extent to which the wireframes answer their respective case. Two of the groups did not answer their cases through their prototypes and wireframes. The last group went beyond answering its case, with the result that all cases were answered in total, but not by the assigned groups.

It is important to note that, apart from gentle prodding, the workshop organizers did not provide any additional reminders to strictly stick to the cases. The cases were worded similarly and it is not clear if the participants consciously disregarded their cases, or simply forgot the variations of the cases.

Whether more attention should be placed on ensuring the participants stick to their cases depends, again, on the aim of the workshop. The answer would, likely coincide with how much time should be spent on this activity. If the purpose is for the designers to gain concrete design suggestions from the participants, answering the case would be more important than if the purpose of the activity is to engage the participants in a design discussion and draw inspiration from the workshop as a whole.

Lastly, in order for the case to be answered, the case needs to be clearly communicated and on an appropriate abstraction level for the participants to understand. It might well be that the case presented to the participants in this workshop was too vague, and that the subtle variations of the task were not clear. Thus, all participants might have believed they were all answering the same case. In order to check this assumption, the participants could have been asked to repeat their case back to the workshop facilitators during, or after, the workshop, to verify if they were aware of their particular case formulation. This, unfortunately, was not done, and thus, we cannot know why the participants did not answer their cases.

As Stand-Alone Products, the Produced Artefacts did Not Contribute to the Greater Design Process

Even though NRK Super was involved in planning the workshop schedule, they were not present during the workshop itself. Thus, when presented with the produced paper prototypes and wireframes, the design artefacts provided little value to the interaction designers as they did not have the context of the workshop to place them in.

However, they could see from the artefacts that it would have been interesting to be present while the wireframes were being created to ask questions and engage in dialog with the participants about their choices.

Thus, NRK Super agrees that for the artefacts to be of any considerable value, the designers who will use them should be present in the workshop. This was especially important in this workshop were the artefacts did not even answer their cases. For those present, the artefacts can function as a summary of the day. However, even if present, designers might still not find much value in the artefacts after the workshop has ended, but rather take away the insights they have gained by conversing with the participants while designing. This aspect is further discussed in Section 13.4, under *Wireframing as Arena for Dialogue*.

Summary

Evaluating the value of the produced design artefacts will differ depending on the purpose for creating them in the first place.

First, if compared to the paper prototypes, the wireframes were more elaborate. This could either be because they had worked longer with their ideas by the time wireframing began, or because of the change of medium. Thus, the wireframes were a more complete representation of the groups' ideas than the paper prototypes. Moreover, in digital wireframes, navigation is built in, whereas with the paper prototypes this navigation would have to be documented elsewhere (something only one group did).

Second, if evaluated according to their respective cases, few of the wireframes answered their case. However, this might have been ensured if the workshop facilitators had been more active in reminding the participants about their case.

Third, as stand-alone products, the designed artefacts were not valuable to interaction designers who had not been present during the workshop. At best, the artefacts could serve as a reminder of what had happened in the workshop and trigger experiences from the workshop for those who had been present.

13.4 Other Aspects

As mentioned in the previous section, the design artefacts have little value for interaction designers who have not attended the workshop themselves. Another very interesting point, however, surfaced through the discussion with interaction designers at NRK Super.

Wireframing as Arena for Dialogue

Even though the interaction designers found little value in the artefacts themselves, they saw the expected value of having been present during their creation. One of the designers stated that there are many decisions going into designing a product which are not visible in a finished product, and these decisions would have been interesting to discuss with the participants while they were immersed in the design process.

She acknowledged that, for NRK Super, it is the process which is of value rather than the produced artefacts. When conducting usability tests, for instance, the team is rarely concerned with *which* buttons the users push, but rather *why* they press certain buttons. It is the dialog with the participants, and the opportunity to 'pick their brains' which yield the most insightful information. Understanding the thought process of users is what the designers aim to achieve.

NRK Super often conduct interviews to gain insight into particular user groups. Thus, if the purpose of holding a design workshop is to engage in conversation with representatives of a particular user group, including activities which motivate participants and stimulate discussion would be preferred. It is all about creating a space in which the participants can open up and discuss relevant topics.

By letting the participants create artefacts they are proud of, they are motivated to continue creating, and by being a design partner, new topics will arise which the participants will have to contemplate. This stimulates further interesting discussions which might not have been possible in a pure interview setting, where they have nothing concrete to work with.

Because of the clear motivation for wireframing, this activity might be used to engage participants longer in the design discussion. One might say that the wireframing activity, instead of resulting in concrete artefacts, rather sets the stage for discussion between designers and users (which can last longer than a traditional interview). Because the participants are so motivated to keep wireframing, this is a way to extend the discussion and bring to the surface other topics of interest.

NRK Super as Collaborator

Another aspect motivating the children to take part in design workshops is the particular collaborator and the case they will be working with. NRK Super is one of the most popular TV channels for children in Norway and everyone is familiar with it. Content from this channel is also used in schools.

The participants in this workshop were strongly motivated by working with NRK Super, and questions relating to how their ideas would be used were repeated throughout the day. They repeatedly asked if NRK Super would see what they made, and even asked hopefully, when being recorded, "Will NRK Super hear our voices?"

Importance of the Case

The specific case can also influence the participants' level of motivation. In this project, they were asked to design new features for the already familiar media player on NRK Super's website. Thus, even if the media player will not be changed any time soon, this seemed like a 'real' case to the participants.

As the children are so motivated by the 'real' aspect of both the collaborator and

the case, researchers need to be careful not to undermine the importance of putting efforts into creating an inspiring case for the participants, as they will take the case very seriously. If possible, the case should bear meaning to the participants, and be given serious thought in order to attract and maintain motivated volunteers.

Moreover, careful wording of the case is important, and it should be communicated at an abstraction level appropriate to the target age group. Few groups actually answered their case, in this study, which might have been a result of the slight variations of the cases being to vague for the groups to pick up on: All groups seemed to be working on answering the same case.

Children as Assets

Another finding worth mentioning, although slightly outside the scope of the overall research question, is the children's own opinion of how they can contribute to the design process. This research assumes, from the outset, that the design process will benefit from involving children in the design of digital products for children, as they possess valuable insight into their own user group.

The participants themselves, however, came up with further reasons for including them in design processes. First, the children are often praised for their creativity, with one participant stating that her mother says, "Oh, you are so lucky because you are always so quick to get ideas.' (GI, line 455).

Second, in relation to wireframing, the participants claimed that as they have grown up with technology, they are able to learn the tool faster. One participant said, "Eh, we are more creative and we get ideas faster...And we have grown up with technology and, and it is easier for us to learn, that program because we understand technology." (GI, line 463). They are not afraid to use new tools, whereas adults are afraid of technology, they claimed. The most interesting comment, was that, "they [adults] always need to be right. They can never be wrong." (GI, line 469).

Be it wireframing, or something else, not feeling free to express one's ideas out of a fear of being wrong (or not good enough) will prevent the outlet and sharing of ideas which is key to design. Where children might be limited by their abilities to draw, or otherwise, express their ideas, adults might be limited by the fear of being wrong. The fact that children are not as afraid to be wrong as adults is an example of why they are an asset to the design process.

Summary

Two additional factors are important for motivating participants to volunteer for co-design workshops: An interesting collaborator, and an interesting case. In this workshop, the participants were highly motivated by collaborating with one of the most popular TV channels for children in Norway, and by producing design solutions relating to a real media player on their website.

Another important result contributing to the overall research aim, but not directly relevant to any of the research questions, is the idea that wireframing can serve to create a space of motivated participants where they can engage in design discussions with designers. The particular nature of digital wireframing tools, which allow children to express their ideas unlimited by their abilities, and create real-looking designs stimulates their concentration and maintains their motivation.

13.5 Discussion on Research Validity

13.5.1 Overall Validity of Research

Below follows a discussion of the validity of the research based on the validity requirements presented in Section 10.5: trustworthiness, confirmability, dependability, credibility, and transferability.

Trustworthiness

How much trust can be placed in this research will naturally be a matter for the reader to decide, and will likely be affected by the aspects discussed below: confirmability, dependability, credibility, and transferability. If satisfactory answers are given to these aspects, the research might earn high marks in trustworthiness. The aim of interpretivist research, compared to positivist research, is *plausibility* rather than *proof* in the scientific method. Thus, trustworthiness is tied to how plausible the research appears.

Confirmability

In order to be able to confirm the results and findings of this study, and allow for external researchers to decide for themselves whether the data actually supports the findings, most raw data is included in the appendix. The main data collection methods used were observation, questionnaire, group interview, and produced design artefacts. Below follows a discussion of which data is, and is not included, and an explanation for these choices.

First, the only data which is not directly available to the reader is the observations made by the workshop facilitator (also author), and technical observer. The workshop facilitator did not have the capacity to write notes as she was conducting the workshop itself. Her observations have been incorporated into the research from memory.

The observations made by the technical observer were also debriefed orally within the observation team, and are therefore not available to the reader in their raw format.

The observation notes included in the appendix are those of the 4th year psychology student. Her sole responsibility on the day was to document her observations. It is these observations, together with the group interview transcript which form the basis for the thematic analysis. The thematic analysis was performed by the workshop facilitator and the technical observer to ensure that they could relate to the emerging themes.

Another method of documenting what happened during the workshop was by photography. Images are included in the thesis to support what is stated in the text. Many of the observations made by the workshop facilitator and technical observer are presented in Section 12.2.2 under *What Happened* even if they are not recorded in their raw format. Thus, images are meant to support these results and findings.

Second, the group interview is transcribed and the transcript is included in the appendix. Thus, all answers by participants and discussion between interviewers and participants are available to the reader. Interesting excerpts are included in the main text to support various themes identified by the thematic analysis.

Third, the questionnaire is presented in the thesis, and as the group interview

was based on the questionnaire many of the answers are transcribed as part of the group interview. However, not all questions were treated in the group interview, due to lack of time. As most answers could be summarised in the form of charts, these summaries are included in Section 12.3, and the individual answer sheets are not appended to the thesis. Thus, only summaries of the questionnaire are presented to the reader. Answers to open questions are included in the main text to support or further explain the quantitative results.

Lastly, the paper prototypes and digital wireframes are not included as they are, of course, of a different medium and cannot be presented in a thesis in their originality. However, photographs and screenshots of these design artefacts are provided with detailed navigation. This is the best representation of the design artefacts which can be offered in a written thesis.

Moreover, the artefacts produced in the early stages of the day (paper prototyping warm up exercise and the drawn sketches) are neither appended in their originality, nor as images. These activities were mostly included to support the main paper prototyping activity, and were not the object of interest when answering RQ4 dealing with design artefacts. Thus, they were not deemed relevant for inclusion in the thesis.

Dependability

The research process is documented in detail in this study. As investigation into RQ1 was of a very different nature to RQ2-4, RQ1 is treated entirely separately and documented in *Part 1*, with a separate section discussing lessons and limitations to the study, see Section 7.4.

Regarding RQ2-4, the chapter on Research Design presents the overall research plan. The chapter *Method and Materials* describes in detail how the research design was carried out in reality, with further explanations on why certain methods were chosen, and how they were applied in the workshop.

In relation to the schedule itself, reasons for the inclusion of all the activities, and detailed description of what they entailed are provided in Section 11.2 to allow re-creation of the schedule. Moreover, the necessary alterations to the schedule are presented in Section 12.2 so that other researchers can take these into consideration if wishing to replicate the workshop.

The case given to the participants is described in detail in the text, and the material from the main prototyping activity is included in the appendix. The material from the warm-up exercise, however, is not included as it is similar to what was handed out in the main activity, but with different shows and less variation.

Lastly, the questionnaire and group interview transcript are included in the appendix, so all questions formally posed to the participants are available to the reader.

In relation to data analyses, the thematic analysis is perhaps the part of the research which could yield different results based on who performs the analysis. In order for all researchers to have the same outset, (1) all raw data used in the thematic analysis is appended to the thesis, and (2) the process of developing themes is closely described in Section 9.2 and 12.1. However, determining and naming the actual codes is a subjective process and different researchers might end up with different themes, even when presented with the same material. Researchers will always be

influenced by what they know from before, and it is impossible to leave this bias completely out.

However, the information given above should be sufficient to trace, and replicate, the entire research process, although the exact same outcome cannot be guaranteed.

Credibility

The main step to ensure credible results has been triangulation. As most results in the study are based on subjective interpretations, the study has sought to rely on multiple sources for corroborating its claims. Observation is used to report observed behaviour, both *what the participants say* and *what the participants do*. The questionnaire is further used to identify *what the participants say they do (and feel)*, and the group interview is included to further explore answers from the questionnaire. Thus, the participants' answers are collected both individually and in a group to check for discrepancies.

Moreover, verbatim quotations are used to enhance the credibility of the presentation of the results. All quotations taken from the group interview or observation notes are accompanied by line numbers in the main text to allow the reader to identify the quote in the appendix which provides context for the quote.

While, some results are presented based on a single data source, the main findings of the thesis are supported by multiple data sources.

Transferability

Although this same workshop would most likely not yield the exact same results if replicated by another research team, parts of the study or its findings might still be transferable to other situations.

Aspects which would likely influence the results are related to the participants. As emphasized by [50], children are not a homogeneous user group, and targeting different age groups will very likely yield different results for most aspects of the workshop. In the design workshop, the participants were all 7th graders (11-12 year olds) and this needs to be taken into consideration when evaluating whether the findings of this study are relevant for another study.

Moreover, all participants were volunteers. It is often argued that recruiting volunteers will result in biased results, as the sample is not representative of the entire population. However, this is a research project and, in adhering to ethical guidelines, participation must be voluntary. There is no way of investigating motivation and feasibility, for instance, with involuntary participants.

Moreover, the workshop took place in a school setting and the school context might vary widely between nations. In Norway, power structures are fairly relaxed, perhaps making it easier for the participants to create freely and not be too concerned with "getting it right".

Above are examples of necessary factors to consider before transferring lessons from this study to another. However, once aware of these issues, the research process should be described sufficiently for external researchers to determine for themselves which parts of this study are relevant to other studies.

13.5.2 Validity of Individual Data Collection Methods

Observation

Data validity is briefly touched upon in Section 11.3 when describing how observation was applied in the workshop. This description largely addresses the measures taken to avoid disrupting the naturalness for the participants by having the observers present and interacting with the participants from the beginning of the workshop to create an atmosphere in which the participants need not feel intimidated by the observers. This was accomplished in the workshop and, apart from one participant who always struck a pose when his picture was taken, the participants did not display any signs of being shy or altering their behaviour for the sake of the observers. One reason for this, might be the fast pace of the workshop, where they probably forgot about the observers because of their sole focus on performing the task at hand. This is, however, speculation.

Other aspects affecting validity of data collected through observation is the researcher's reliance on the 'self'. In order to overcome this, three observers were present during the workshop to limit selective recall on behalf of the workshop facilitator (the author of the thesis). By consolidating three persons' observations, the aim is to enhance validity of the observations.

Observation is deemed a necessary data collection method in this research as video recording was not possible. The same results could not have been obtained without observation. Interesting results were gained from the questionnaire, group interview, and design artefacts, but observation provided the context for this other data to be understood. For example, the differences between the produced design artefacts could be better understood by having observed how the different groups worked together when creating them.

Moreover, observation makes triangulation of results possible, by not only relying on *what participants say*, but also observing *what participants do*. As discussed above, verbatim quotations are also used to enhance the validity of the observations.

A disadvantage of participant observation is that it is often difficult to "generalize from observations in one setting to others" [54, p. 215]. This is the same argument as the one presented above relating to *Transferability*. The findings may, of course, be unique to this particular situation. Even if the results presented here are ever so credible and valid, there is no guarantee that the same results would present themselves if the research was replicated in another setting. However, the thesis should contain enough detail for external researchers to understand the context of the observation and decide for him/herself if the lessons can be applied elsewhere.

Questionnaire

Section 11.3 discusses, in detail, how questionnaires with children are applied in the workshop. Issues relating to ensuring validity of the data collected are also addressed there, along with descriptions of how these issues have been handled (both in the preparation of the questionnaire and in the workshop itself). Thus, these data validity issues are not repeated here.

Group Interview

How the group interview is applied in the workshop is described in Section 11.3, along with how to support the participants to speak their mind and other issues related to ensuring data validity in group interviews. This discussion will not be repeated here.

13.5.3 Validity of Thematic Analysis

Figure B.1 in the appendix contains criteria for evaluating thematic analysis, and the thematic analysis performed in this study will be evaluated accordingly.

First, the data has been transcribed as close to the tapes as possible (some content was inaudible), and checked against the tapes for accuracy.

Second, all items (entries in the observation notes and utterances in the interview transcript), were treated equally when assigning initial codes. All entries with similar codes were then grouped together, and assigned a preliminary theme. These groups were further grouped together with other groups if the preliminary themes were related, and assigned a broader theme. The emerging themes were then checked against each other and rearranged if necessary. The result was five distinct, internally coherent themes. If anything, the themes 'wireframing preference' and 'observed motivation' could be difficult to separate at times, as so much of the participants' motivation was tied to their preference for wireframing. However, these themes were so big that merging them into one big theme 'wireframing' would have been of little use as it would have encapsulated most of the workshop in a single theme.

Third, the data has been analysed and extracts from the data are used to support the claims. However, as the themes are split up and included at various places throughout the *Results* section, each theme is not described by a long narrative. Rather, the main text of the *Results* section drives the presentation of the results, with examples from the various data sources, including examples from the thematic analysis, used to support the main text. A full length narrative of the thematic analysis is included in the appendix. The result section, as a whole, aims to achieve a good balance between analytic narrative and examples from the data.

Fourth, much time was spent understanding the steps of thematic analysis and reading about the method in general. Once the approach was decided on, sufficient time was spent on each step.

Fifth, the last area relates to presenting the analysis as a written report. It is the aim of this thesis to have clearly presented how thematic analysis has been understood (Section 9.2), and how it has been applied (Sections 9.2 and 12.1, and here). Further, a good match between what is *said to be done*, and what *has been done* is striven for.

13.6 Ethical Research with Children

As stated in Section 9.2.4, Alderson argues that, in relation to research and children, "[r]esearch means collecting, analysing and reporting data and this cannot directly benefit the children who take part." [3, p. 3]. Moreover, as stated in the introduction, this research project involves children for the purpose of improving product design,

not with the aim of teaching the children about design processes. Thus, it would be easy for the children to become mere guinea pigs in the research, but this is sought to be avoided.

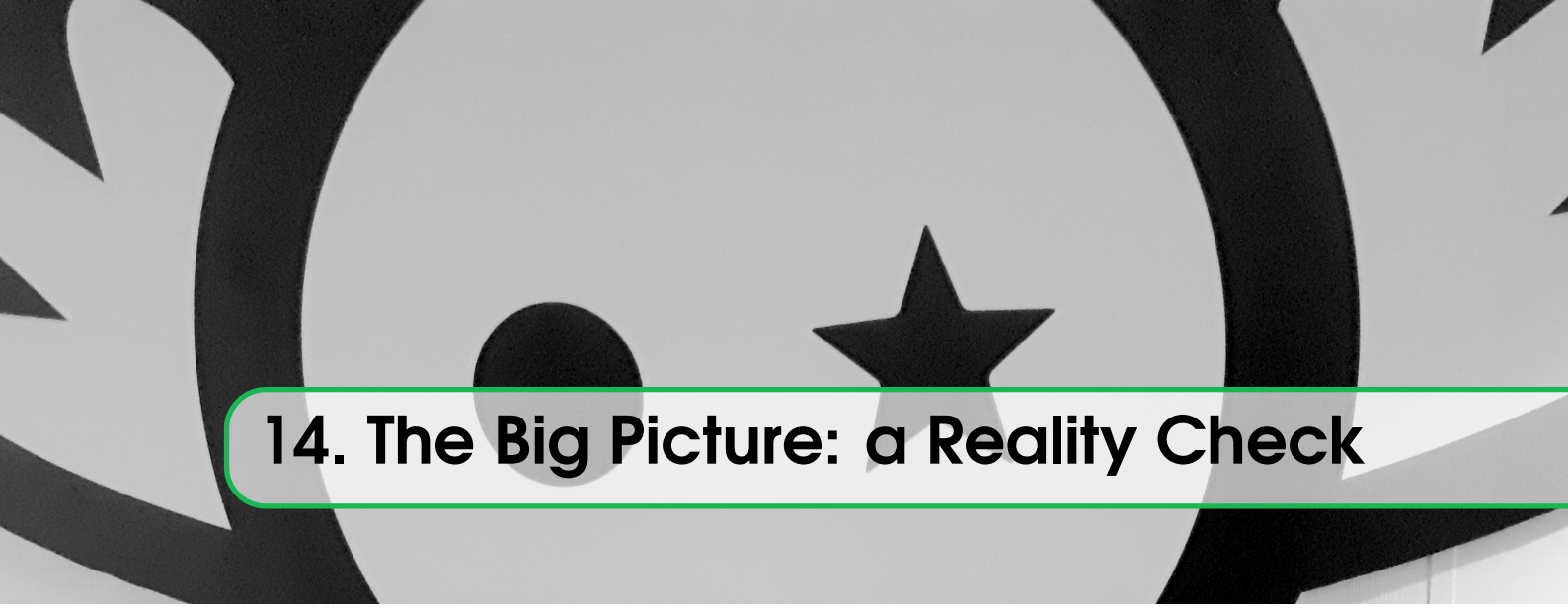
Taking part in research should be a positive experience for the children, if possible, and measures have been taken to plan for this in this study. In the feasibility study, a tour of the UX lab, and opportunity to use professional design tools were stated as incentives when recruiting participants. As the recruitment flyers were first circulated to the local coding club, these incentives were considered motivational for the children. Moreover, after the usability tests, the participants were rewarded with gift certificates as a token of appreciation. However, all participants expressed gratitude for having been able to partake in the usability tests prior to being presented with the reward.

The use of incentives in research is discussed briefly in Section 9.2.4. As seen above, monetary incentives were not used in this study, and the gift card was only used as a reward, and not as an up front incentive. This was because we wanted to recruit users based on their interest in the topic, to ensure a positive experience.

In the design workshop, recruitment happened through the school, and the main incentive for the children, when asked to volunteer, was perhaps the collaboration with NRK Super. The workshop team further wanted to award the participants with a reward, but this was discouraged by the school. The school said that so many pupils were interested in taking part in the workshop, that it was a reward in itself to have been selected to take part. This was also made clear by the participants themselves, who repeatedly thanked us for the opportunity to take part in the workshop, stating how much fun it had been. The only actual reward allowed in the end was refreshments in the form of grapes and biscuits during the group interview.

Another important aspect related to recruitment is informed consent. For the feasibility study, the recruitment flyer was written with language suitable for the target audience, whereas the consent form presented to the parents gave a more detailed description of the study with more formal language, in order for both parties to understand what the research is about. Moreover, the purpose of the research and the opportunity for participants to withdraw, was reiterated orally during the test itself.

Regarding the design workshop, individual consent from parents was not sought as the workshop took place during school hours, and is therefore not required by the school. One could potentially argue that parental consent should have also been sought. When presenting the project at the school, the pupils could volunteer for participation, and thus, individual consent was ensured. The purpose of the workshop, however was only presented orally, and the extent to which this can ensure informed consent can be debated, as they had no written material documenting the purpose of the workshop. In hindsight, this should have been provided.



14. The Big Picture: a Reality Check

This chapter is included to provide a reality check for the findings of this research project. Although the research found wireframing to be successful for motivating participants and providing an arena for discussion between designers and users, these results might not be automatically transferred to a real-life setting.

Thus, in order to investigate how wireframing could be included into a real organization, interviews with NRK Super were conducted. Through 4 interviews: 2 structured interviews with written responses, 1 semi-structured interview, and 1 conversation, the potential for including wireframing in their organization is discussed, along with benefits of, and obstacles to, including it in their current situation. The written answers, notes and transcript from the interviews are contained in Section B.6 in the appendix. See footnote[1] for the citation key of the interviews.

User centred design is a good example in itself of how results from research are not always carried out in practise. Although there is general agreement around the benefits of involving users in the design of new technology, this often does not happen in practise. The question why this is not done in reality was asked by Svanæs and Gulliksen [69] who, in their article, coin the term 'Context of Design'. They argue that, although there is agreement around involving users, all businesses operate within different constraints which can prevent this inclusion. Understanding this 'context of design' is key for planning successful user involvement.

This chapter, thus, begins by presenting NRK Super's 'Context of Design' in order to understand under which constraints they operate, and how this might affect the inclusion of wireframing as an activity. More specifically, it is Superteam's 'context of design' which will be presented, where Superteam is the development team at NRK Super. Next, the following sections discuss benefits of including wireframing, obstacles related to including it, and finally, how it could potentially be included. The chapter ends with a conclusion of how wireframing could be used in NRK Super's

[1] Quotes from the interviews and dialogue are referenced as follows:

W-ST = Structured interview with **w**ritten responses by **S**uper**t**eam
W-ID = Structured interview with **w**ritten responses by individual **i**nteraction **d**esigner
[mm:ss] = Timestamp for quotes from semi-structured interview with Superteam, eg: [30:10] for 30 minutes and 10 seconds.
D-ID = **D**ialogue with individual **i**nteraction **d**esigner

design processes.

In the first section, quotes by NRK Super are stated in English as they provide additional information to the rest of the text. However, in the three subsequent sections, Section 14.2-14.4, quotes by NRK Super are included in Norwegian, as the surrounding text contains the same information as presented in the quote. The quote does not provide any new information: it is simply a substantiation of what is presented in the text, in the words of NRK Super's employees themselves.

14.1 Context of Design

Inspired by the list of factors describing 'context of design' by Svanæs and Gulliksen, NRK Super's context of design will be described by their roles, development methodology, handover issues, who decides what is made, and their experiences of involving children.

The team: Superteam

Internal

1 product development manager (PDM)

1 team leader

1-2 concept developers

1 digital designer

3-4 full stack web-developers

1 system administrator

1 Android developer (full stack mobile)

Hired consultants (in-house)

1 Android developer (full stack mobile)

2 iOS developers (full stack mobile)

Roles

PDM decides direction and strategy for the services of NRK Super referred to as 'focus areas'. PDM has overall responsibility for user experience.

Team leader organizes the team, decides on methods and structuring of tasks. The team leader is further responsible for the agile process, and communication with other teams and divisions at NRK.

Concept developer cooperates closely with PDM to be able to offer opinions on direction and strategy relating to user experience. The concept developer is responsible for concretizing strategic goals for user experience and carrying them out in practise, and further responsible for conceptualizing and carrying out necessary

tasks related to a particular focus area (e.g. insight work, input to strategy, move a button, etc.)

Digital designer supports concept developer and is responsible for specifying graphical details. The digital designer also works continuously on updating the graphical profile and look.

Development Methodology

NRK Super follows a customized agile methodology with focus on continuous improvement. They plan 4 months ahead, and set new weekly goals every Friday based on what is in the backlog. These Friday meetings include a quick evaluation of the past week: what worked and what could be improved next week. More regular retrospectives are also held at regular intervals. They often work with multiple projects at the same time with both long- and short-term goals, in addition to keeping up with existing products on a daily basis.

Handover Issues

The designers work very closely with the developers. They prefer to work interdisciplinary and involve the developers as early as possible, but this collaboration is sometimes limited to checkups regarding insight and specifications. It is very important to transfer to the developers what the designers have learnt, and the reasons for the choices they make.

Developers can sometimes be very involved in strategy and brainstorming, and designers and developers work closely together when specifying details.

In the finishing phases, testing is often performed in parallel: designers are heavily involved in internal tests, and developers take turns being part of usability testing.

Who decides what is made?

The PDM, together with NRK Super executives and NRK media development, decides what is made, but Superteam can contribute with what they find important based on their own areas of expertise: Concept developers might have ideas based on user insights, or market research. Developers can have ideas based on updates relating to technology.

Involvement of Children

Time in Project Lifecycle

NRK Super involve children at both the early and later stages in the lifecycle. In the early stages, children are involved in activities providing insights to the design team. Such activities include interviews and Hot or Not (an activity where certain items are grouped according to whether they are desirable or not). It is important to note that these are only examples of activities, and NRK Super strive to vary the activities they use with children, aiming to always use the most relevant one. Children can also be involved in such activities prior to concept development. NRK Super also involve children at later stages of development with the primary aim of

evaluating finished products. Such evaluation is often carried out in the form of usability testing at schools.

Experiences

NRK Super emphasize the importance of always involving users, whether adults or children. If not, one can end up making something which is completely wrong, does not work, is not understood by the users, or solves the wrong problem (W-ID, question 11). Their experience with children is that they are very fun to work with. One interaction design er said, "I love how their heads work!" (W-ID, question 11).

NRK Super's access to children is primarily through reaching out to local schools. They have no problems recruiting representatives of particular age groups who are more than happy to help them, and they have no problems maintaining motivated participants. However, the children can sometimes be too nice and eager to be of help in that they simply praise the products rather than critique them, "the children want to be nice and please us" (W-ST, question 11).

NRK Super has experienced that children need concrete activities to keep them busy. If not, the children can easily become distracted, especially the younger ones, and start "consuming content" (W-ST, question 11).

Moreover, NRK Super has experienced that it works well to involve developers, in addition to designers, in the work with children. Then, "we do our work based on the same foundation" (W-ST, question 11).

How Could Work with Children be Improved

"Have more time" (W-ID, question 12, [26:16]). This utterance was repeated several times when asking what more NRK Super would need for involving users in different ways. Most of their work with involving children is limited by their own time, as well as the children's time [26:28]. As NRK and NRK Super are undergoing large changes, and much effort is devoted to building a strong team and organization, they operate under tight deadlines nowadays. Moreover, significant technical debt has led to much maintenance, slowing down the tempo.

In terms of the children, NRK Super would like the children to have stronger opinions. They would also like to do more observations in the children's natural setting. This, again, requires time and access to a representative sample.

One interaction designer, who no longer works there, said that she has "always been curious of co-creation, but this has not been possible while I have been working there" (W-ID, question 12).

Reasons for Involving Children

When determining why, and how, to include children, NRK Super ask themselves, "Ok, what is it that we really need answers to, and which method do we need to use in order to get those answers" [10:54]. They always strive to identify the most relevant method for particular challenges.

In addition to ensuring better quality products, their work with children is also important for the reputation of the channel, among schools and the children themselves.

14.2 Benefits of Including Wireframing

Maintain Focus

One of the experiences of NRK Super is that children need concrete tasks in order to not lose focus. Experiences from the workshop in this study are that children are completely immersed in the task when creating wireframes. Thus, the creative nature of the activity focuses the children's attention on one task, and this attention can be maintained for a long time.

The NRK Super team referred to using children as informants (one of the roles specified by Druin [22]), through giving the children concrete tasks to work with, "bruke barn som informanter...gjennom konkrete oppgaver og gjennomtenkte oppgaver hvor de gjør noen ting og du hører hva de tenker mens de gjør det...er det jeg mener at vi har fått størst utbytte av" [11:47 - 12.12]. Letting children design a product themselves gives rise to several issues the children will have to discuss, and designers can gain a lot from be included in these conversations. Wireframing is one activity which can be used to enable children to design user interfaces.

Moreover, in the case of wireframing, NRK Super feel that the children might be able to express more by using design tools developed for adults, "de [barna] får på en måte formidlet mer ved å bruke voksnes verktøy" [19.55], as opposed to with pure paper prototyping.

Include Children even Earlier

As stated above, NRK Super already involve children in the early design phases. However, at these points, NRK Super reach out to children to gain specific information deemed necessary in a project. When engaging with children, NRK Super have carefully prepared tasks aimed at eliciting the desired information. When usability testing is performed, hypotheses are already developed, "hvis du starter med brukertestingen så har du på en måte allerede gått inn i en hypotese" [16:35].

However, by including wireframing during the phase prior to concept development, the whole starting point for the product, or feature, might be different, "startpunktet vårt hadde blitt påvirket" [16:28]. By including children at this point, they might have a different focus from the designers, "hvis du starter opp mer med et innsiktsarbeid sammen med barna så kanskje de rett og slett har et annet fokus" [16:41], resulting in perhaps different solutions.

Honesty

NRK Super often experience that the children are too nice, and want to please NRK Super, whereas NRK Super are more interested in the children's honest opinions, "jobber jo litt med å få barna til å faktisk være ærlige" [16:07], rather than receiving compliments to their solutions. However, when presenting a finished solution to children and asking for their opinions it is natural to want to compliment the designers.

Therefore, by including children in the ideation phase, there will be no finished product to praise or critique. By letting the children explore different solutions for themselves, a discussion surrounding positive and negative aspects of potential solutions can be stimulated, where the children do not have to feel that they are

offending anyone. Thus, more honest opinions can be elicited by having the children coming up with the ideas themselves, and not simply evaluating already finished products.

Versatile Method

As NRK Super involve children at various stages of the product lifecycle, they always use the method they believe to be most relevant, "vi velger jo alltid den brukertestmetoden som vi mener at er hensiktsmessig" [06:23]. By being aware of wireframing as a technique for co-design, they now have another method they can consider when determining the most useful method for a given problem. Wireframing can also be used for different purposes: It can be used to create concrete artefacts which will be taken further in the design process, or as a technique to gain insight from the desired user group, "se på det som et verktøy for innsikt mer enn et verktøy for å komme opp med..." [16:55].

Target Upper Range of User Group

The findings from this study show that children aged 12 are highly motivated by creating digital wireframes as part of a design process. NRK Super's target audience is 2-12 year olds, and thus, the findings are only directly applicable to the very oldest users. However, NRK Super is very concerned with always finding the best method for engaging users in interaction, and perhaps, wireframing can be one such activity especially relevant for these older users, "selvfølgelig er det jo mye mer interessant for den eldste målgruppen" [25.11].

A final remark from one of the interaction designers no longer working at NRK Super says that the oldest users are the hardest to reach, and it would be very valuable to be able to engage them in a way that makes them feel ownership. This, in turn, could support work on reaching out to other user groups which are difficult to target, "Det er den mest relevante brukergruppen, mtp aktiv cocreation. Og den vanskeligste å nå. Hvis vi kan gjøre oss relevante for dem og de får eierskap er det gull. Knekker man koden her, kan den kanskje også brukes for andre brukergrupper vi sliter med å nå i NRK."

14.3 Obstacles to Including Wireframing

Targeted Age Group is too Narrow

The biggest concern for NRK Super with including wireframing in design activities is the uncertainty of whether young children can use the tools effectively, "vi vet ikke om barna er i stand til å faktisk ta det i bruk så langt ned i alder som det er behov for" [10:08]. The age group in this study constitutes only the very top of NRK Super's target age group, and the method might not be applicable to the overall user group, "i utgangspunktet så er kanskje ikke metodikken så egnet for målgruppa vår. Vi kan bare bruke den på den aller aller øverste delen av målgruppa" [09:52].

Despite potentially being used successfully with the oldest children, NRK Super have few products developed *strictly* for this age group. Thus, the method is less relevant than if it could also be used with the youngest children, "akkurat nå så

skal vi holde på med de yngste så, vi må jo bruke den når den er relevant...Den er ikke avvist som irrelevant. Det er bare det at den sjeldnere vil være egnet for oss..." [25.25-25:49].

Finding Right Project or Project Phase

Although NRK Super acknowledge the potential benefits of including wireframing in its design activities, any new method must be appropriate for the task it is used for. NRK Super manage several projects which are different in nature, and finding the right project would be the first step in experimenting with children and wireframing.

Including wireframing for the benefits mentioned above (honesty and early involvement) would require wireframing to be included in the very early phases of design. However, finding a project in its early phase, but which has been able to define a clear goal is difficult, "en sånn type involvering må være ganske tidlig i et prosjekt. Men tidlig i et prosjekt med et klart mål" [03:43].

Moreover, NRK Super maintains a portfolio of several products, and the current team at NRK Super has yet to develop a product from scratch, "så langt har vi jo ikke laget noen ting helt fra scratch" [21:06]. The most common phase for including children into co-design is in the very early phases of concept development, and finding the right project, or project phase, might be difficult if products are rarely developed from scratch.

Time and Resources

Preparing, partaking in, and evaluating co-design workshops, with or without wireframing, is resource-intensive in terms of time and effort. Although NRK Super acknowledge that there could be great value in working so closely with children as co-design with wireframing could allow, "kan gi veldig mye hvis vi liksom har tid og ressurser til å forberede godt" [06:59], they are concerned about the cost benefit analysis: Does the output from the workshop justify the time spent (D-ID).

Moreover, NRK Super has a very broad portfolio, as stated above, and they are rarely able to focus on one project for a long time. Often, they have to skip between projects, "vi har en veldig bred porteføljе. Og det innebærer at det er veldig sjelden at vi kan jobbe med...Vi har vært nødt til å skifte fokus på ulike deler av portføljen frem til nå. Jeg antar at det kommer til å bli stadig bedre og at får lov til å jobbe mer konsentrert over tid, men vi har ikke hatt anledning til å skulle jobbe med for eksempel videreseeing over en veldig lang periode." [05:33-06:04]. The high demand for resources is an obstacle for including wireframing in such a context.

Previous Experience

Moreover, NRK Super has no previous experience with co-design or co-creation, and including wireframing in such activities will be almost taking two steps forward at once. Thus, there are many factors which would need to be considered before even planning how wireframing specifically could be incorporated.

The product development manager has some experience with co-design from a previous position, but experienced that children rarely provide new information in such contexts. When children are co-creators, they are quick to refer to their favourite games, and struggle with making something which they have not seen

before. Her feeling is that the children mostly repeat the things they like, and these are facts the designers largely knew from before [10:28]. Her experience is that it is difficult to get *new* information from the children through co-creation, "når man ber dem[barna] om å være medskapere så kommer de veldig fort opp med referanser til favorittspillene sine...de har vondt for å lage noe som ikke allerede finnes fra før av i komersielle spill for eksempel. De sier egentlig bare 'dette liker jeg veldig godt' er det du får ut av dem. Og det visste du egentlig på en måte fra før av" [10.28].

14.4 How Wireframing Could be Included

Factors for Choosing Wireframing

Summarizing the responses from above, NRK Super think wireframing could be beneficial to certain projects with certain users, but that the activity (as part of co-design) is resource-intensive. Thus, opting to choose wireframing as an activity would be a decision based on several factors.

First, as wireframing tools have only been tested with the oldest target users, these users would have to be the object of study for wireframing to be chosen, "hvis vi får i oppdrag å skulle jobbe spesielt med den eldste målgruppen for å sikre oss at vi klarer å nå dem, så tenker jeg jo at da er det interesant." [25.49].

Second, as stated above, NRK Super always aim to use the most suitable technique for solving a problem, and thus, would only opt for using wireframing if they believe it to be the most useful approach for a certain task, "vi må jo bruke det når det er relevant for oss...vi velger jo alltid den brukertestmetoden som vi mener at er hensiktsmessig" [6.23].

Third, by having been made aware of the activity, NRK Super would now consider it if an appropriate project should come up, "idét det dukker opp et relevant case, så vet vi om det og ville brukt det" [11.27].

Type of Project

Far from all projects would be suitable for incorporating wireframing into, and the most crucial factor is that wireframing would have to be used in a project with enough time (D-ID).

Nowadays, the team jumps from project to project, and they would have had more opportunities for experimenting with wireframing if they had a larger project going on, "hadde hatt bedre overskudd til det hvis vi hadde hatt et sånt stor-prosjekt" [06:45]. One example is the 'Fantorangen' application: an application "breath[ing] life into the universe of Norway's favourite cuddly elephant" [2]. This was a big project developed from scratch, and if a similar project was undertaken, including children in co-design with wireframing could be natural, "...utviklet Fantorangen-appen...og hvis man utvikler sånne typer produkter så er det jo naturlig." [21.24].

One of the team members at NRK Super drew attention to the fact that, in the co-design workshop in this study, the paper prototyping warm up was an exercise in replicating and evaluating existing solutions, solving a similar problem to the one defined in the case. She wondered whether suitable projects for wireframing would require the existence of similar products for the participants to draw inspiration from,

"vi har jobbet med redaksjonelle prosjekter med eksperimenter hvor du kanskje ikke har helt liknende, helt sammenlignbare tilbud på markedet rett og slett" [06:04], but was later challenged by her colleagues asking how children might cope with having to design for a case with no existing similar solutions, "Altså sånn i dette tilfellet så du jo på netflix og youtube og sånne ting og fikk inspirasjon derfra. Men kunne man mer sånn gitt dem en problemstilling 'dette vet vi ikke hvordan best løses'. Hvordan hadde de taklet det?" [07:22-07:40].

Focus on Case

As stated in 14.2, wireframing is a successful activity for retaining the participants' concentration and motivation. One drawback, however, is that the participants did not answer the cases they were handed out. NRK Super do not have problems keeping the participants motivated, but their challenge lies in keeping them focused on the task at hand. As stated above, the children can easily become distracted, and start "consuming content" (W-ST, question 11). In the workshop, the participants were not significantly reminded on their tasks, and this might be reason why the groups drifted from answering their specific task. Thus, if using wireframing in an actual project, care needs to be taken to ensure that the participants (1) understand their task, and (2) that they are reminded of their task should they drift away.

Relevant Project Phase

Having defined a suitable project, finding the right phase for wireframing is also important. Co-design, as included in research, begins at the very early stages of the design process, and this was also echoed by the NRK Super team, "kanskje akkurat i innsiktsarbeidfasen at det kunne vært. Det kjentes ut som det kanskje kunne vært det mest verdifulle stedet i prosessen å gjøre det" [16.55].

In Practise

Co-design activities can be organized in various different ways, and wireframing can be included in just as many different ways. Apart from a narrow target age range, a big limitation to including co-design and wireframing is the demand on time and resources compared to the output of a workshop. Through dialog with one of the interaction designers, a solution could be to hold multiple workshops instead of only one, as done in this study (D-ID). Holding, for instance, two workshops with three groups each would have several advantages, "om det hadde vært interessant å kjøre over to dager...Og det tenker jeg kan være fint" [13:41-13:57]:

- double the output with only a minimum extra input
- can often see trend after 6 groups
- identify surprises after one day, and can adapt test accordingly for the second day
- inspire unique ideas by avoiding all groups influencing each other

Thus, by holding several workshops based around the same material, the cost-benefit ratio might appear more favourable, or at least acceptable.

Another idea, however, could be to hold the *same* workshop over several days with the *same* participants. This would give the participants more time to evaluate and iterate on their work, perhaps yielding artefacts with more internal value in themselves. These are examples of how wireframing could be used by NRK Super depending on the purpose for including wireframing.

Moreover, although wireframing was studied in the context of co-design, wireframing could perhaps be included in different ways. As stated above, the product development manager had previously experienced co-design with children to yield little value, and had more positive experiences with involving children as informants. During the semi-structured interview, the team questioned whether perhaps wireframing could be used in a different way: perhaps as including children in a hybrid role between informant and design partner, "co-creation på andre måter kan jo også være interessant å...ja, som en slags sånn hybrid da mellom informant og deltaker" [14.15].

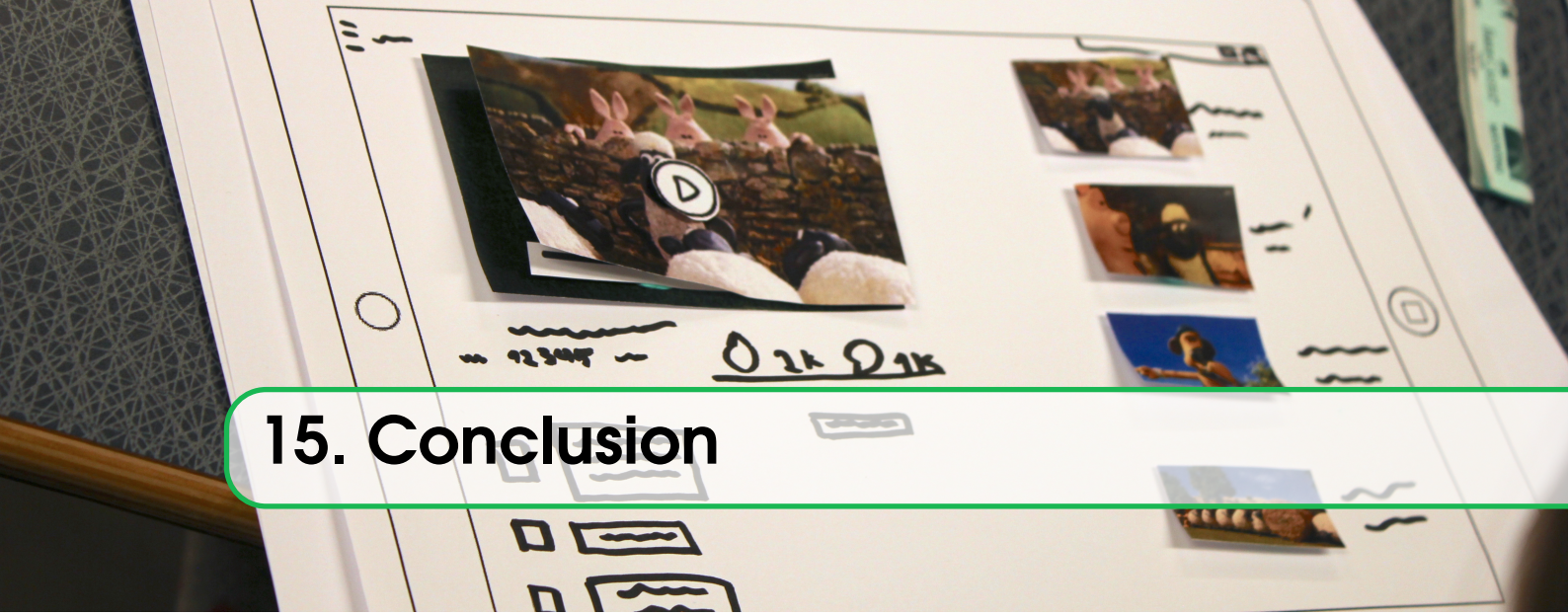
14.5 Summary

NRK Super identified several benefits of, and obstacles to, including wireframing in their design activities. To summarize, it all boils down to finding the right project which justifies spending the required resources. Moreover, without further research on using wireframing with younger children, NRK Super feel that wireframing can only be used in a project with the oldest end users.

In their work with children, they always strive to use the most effective and appropriate method for solving the task at hand, and would never use the same method for all tasks. Thus, having been made aware of wireframing as an activity, and seen how it can be used in a workshop, has provided them with yet another option to choose from, should a suitable project arise.

III

Conclusion and Future Work



15. Conclusion

The study presented here set out to investigate how wireframing, as an activity in co-design with children, can benefit the design process, and four research questions were formulated for this investigation.

After establishing, through the feasibility study, that children master existing wireframing tools (RQ1), a co-design workshop was conducted to collect data for answering the three remaining research questions.

Relating to how wireframing can be *included* in co-design activities with children (RQ2), the research found that it can be successfully included after traditional paper-prototyping activities, and a short introduction to the particular tool and concept is sufficient for children to be able to use the tool successfully. The time allocated for wireframing will depend on whether the purpose for including the activity is for the production of concrete artefacts or to engage in a design discussion with users.

The investigation of how children were *motivated* by wireframing was of particular interest to this study (RQ3). Results show that wireframnig was the preferred activity of the day, both in terms of engaging in the activity itself, but also as the preferred medium for sharing design ideas with peers. The most motivating aspect of creating digital wireframes was the fact that they were so 'real-looking' and the children were able to design interfaces which looked similar to what adults would create. Thus, the participants were not limited by their artisitc abilities when expressing their design ideas.

Most of the literature covering digital tools in co-design focuses on creating a digital version of paper-prototyping, and compare the value of one to the other [37, 38, 75]. The research presented here differs from existing literature in two important ways. First, digital wireframing is not treated as a digital version of paper prototyping. Rather, wireframing is acknowledged for its distinct feature of dragging and dropping existing elements, and specifying navigation, as markedly different from paper prototyping where the participants have to draw the elements themselves.

Second, digital wireframing is not studied with a view of replacing paper prototyping, but rather as an additional co-design activity allowing paper prototypes to be elevated to a new level where navigation can come to life.

In their study, Heintz et al [37] stated that they knew of no study which had been "conducted to compare systematically a paper-based and tool-based approach to determine to what extent software tools can be used to support or even replace

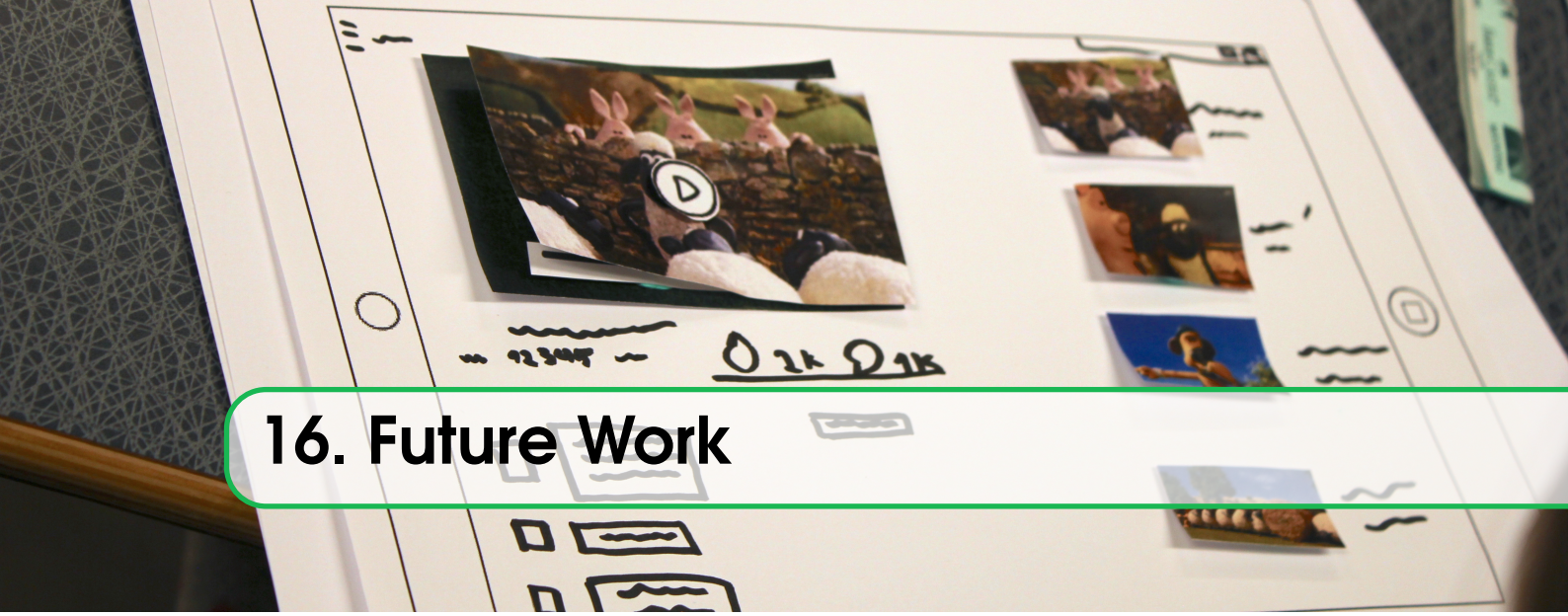
paper-based PD activities" [37, p. 503] and went on to compare the two. The research presented here, has aimed at investigating precisely how software tools can be used to support paper-based participatory design activities, however, not with a view of replacing them.

The last research question addressed the *value* of the produced design artefacts (RQ4). Although the wireframes were more elaborate than the paper-prototypes, they did not answer their respective cases. Interaction designers at NRK Super state that, as stand-alone products, the artefacts have no significant value to designers who have not been present in the workshop themselves.

This result, however, sheds new light on the overall research aim, not addressed in any of the research questions. In its inception, this study aimed to evaluate the wireframing activity in terms of the value of the produced artefacts and how it motivates participants. However, is is clear that the produced artefacts are of secondary importance. Designers are much more concerned with understanding their users, than seeing what they produce, and an established way of gaining such insight is by engaging users in interviews. However, by letting the users create themselves, new topics for discussion can arise which would not have been available to discuss otherwise.

Thus, one could say that that this research has been asking the wrong questions by focusing on the produced artefacts, when it is in fact the dialogue with the users which is of primary interest to designers. Rather, the focus should be on how designers can better understand their users by being present when they (the users) are designing. Wireframing, instead of yielding value through producing concrete artefacts, can serve as an arena for raising and discussing design choices with users. By providing the users with a tool which allows them to create professional-looking interfaces, and focus on the creative processes (because they are not limited by their artistic skills), they become motivated to produce designs they are proud of, and this sets the stage for designers to discuss the participants' choices with them.

In a way, this insight is already integrated in the term 'co-design' itself. The activity should be a 'cooperation' between the designers which will take the designs further, and the users who will use them. The activity cannot be outsourced to external actors who take children through a co-design workshop and present back to the design team a set of produced design artefacts, when it is the insight gleamed from the 'creation', and not the 'created' which is of importance to the overall design.



16. Future Work

In search of answering the research questions, new questions have arisen, and they fall into one of two categories. First, questions have arisen relating to wireframing in itself with children and its inclusion into a bigger schedule. Second, as the main result of the study is not tied to any of the research questions, a whole new set of questions opens up relating to how the designers themselves should be part of the co-design workshops.

16.1 Specific to Wireframing Activity in Itself

PP + WF versus PP + PP

In terms of evaluating the concrete value of the produced wireframes compared to the produced paper-prototypes, a new workshop would have to be conducted where the wireframing activity was replaced by another paper-prototyping iteration. In this way, one could discern whether the more elaborate wireframes were a result of the change of medium, or simply a result of more time for working on the same design idea.

Gender

For the two girls groups, the paper prototypes and digital wireframes were not markedly different. One group's digital wireframe was a complete reproduction of their paper prototype, while the other group added two screens to their wireframe. For the boys group, however, their wireframe contained 16 screens, compared to 3 screen in their paper prototype. They had the least complex paper prototype, but the most elaborate wireframe. This group had also, throughout the whole workshop, expressed eagerness to work with the computers. Thus, it would be interesting to investigate further if girls and boys are motivated differently by the use of different mediums, or if this was simply a coincidence. It would be interesting to know if they boys' prototype would have been equally extended in a second iteration (if the workshop had continued the activity of paper prototyping).

Age

Third, the co-design workshop was performed with 7th graders (11-12 year olds). They had no problems creating digital wireframes, and were clearly motivated by doing so. Future work could benefit from investigating how young children can be to make successful use of wireframing activities in co-design workshops. One of the main concerns of NRK Super with using wireframing in their ordinary design activities, is that 12 year olds constitute only the upper range of their user group. If wireframing could be used successfully with younger children as well, they would have more projects where the technique would be relevant.

16.2 Value of Wireframing to Overall Design Process

The main finding in this study is that wireframing is most valuable to the overall design process if designers are present during the co-design workshops and discuss the participants' choices with them. Thus, in order to further investigate this, future work would need to include wireframing in an actual design setting where researchers team up with a real-life design project. In this context, they can pose new research questions and investigate how the designers can actually benefit from observing users creating artefacts, and engaging in discussion with them.

IV Appendix

A. Appendix - Feasibility Study

A.1 Evaluation Summaries of Individual Tools

Wireframe cc has a minimal interface and a limited colour palette. The user interface is context sensitive, meaning the options available for each element depends on which element is selected. Users click and drag to draw elements on the wireframe, but there is a very limited number of GUI elements to chose from. Users can select which device they want to design for (phone, tablet or desktop) and the canvas will automatically resize and provide a template. On the negative side, it is easy to forget to save your work, and no auto-save functionality is available. Positively, the wireframe can be shared online via a link and frames can be downloaded as PDF. The tool is intuitive to use and documentation is easily available.

Moqups provides many existing GUI elements and content can be both internal or external to the system, meaning the wireframe can be built entirely from the tool, or existing frames and images can be imported. The wireframe can be shared by a link to an interactive version of the wireframe or frames can be downloaded as PDF. Moreover, collaboration on wireframes is supported my this tool.

HotGloo provides 'Getting started' instructions when using the tool the first time. Content can be built internally through the system, but personal image galleries can also be accessed. The wireframe can be shared via a link online, or sent directly to a mobile phone. The frames can also be downloaded as PNG or HTML. Negatively, it is difficult to group elements.

Balsamiq comes both as a web application and as a desktop app. It provides several existing GUI elements to choose from by dragging and dropping them into the wireframe. The phone, tablet and browser templates ease wireframing for different devices. The GUI elements are minimalistic and generic. They are not meant to mimic specific brands, and this aids the minimalistic feel of the tool, and emhasizes to the user/tester that this is a wireframe and not a finished product. Wireframes can be exported as clickable PDFs.

Framebox provides some GUI elements, but structuring pages and subpages is difficult, if at all possible. The evaluator of the tools was not able to set up navigation between pages, rendering the tool unsuitable for this project.

Axure is one of the most advanced tools on the list. In addition to supporting both internal and external content, pages, subpages and navigation it also contains simple programming functionality supporting dynamic content, conditionals and math functions to name a few. Despite providing the most freedom of the tools tested, this functionality is considered too advanced to be used by most children. Some background knowledge would be needed to use this functionality successfully. The finished wireframe can be shared online, or downloaded as PDFs or HTML.

Origami is based on importing frames created in external design tools. It has a minimalist initial view, and although the interface has a logical layout and easily legible text, and a tutorial is available on the download page, Origami is unsuitable for this project as content cannot be created internally in the tool itself.

UXPin has a good initial tutorial to get started. Content is created internally in the tool, and the user interface contains an appropriate amount of easily legible text and all actions provide useful feedback to the user. Several tutorials exist and the tool is actively maintained. Moreover, the tool allows for real-time collaboration. Wireframes can be exported as PNG files or as an HTML webpage.

InvisionApp is also not suitable for this project, as no actions can be performed without first importing existing designs. This tool works by marking certain spots on existing designs as interactive and then assigning interactivity to these spots.

Wire Flow is a mobile application for creating wireframes. A quick introduction is available when first opening the application. The interface contains barely any text, and the layout is logical and easy to understand. Frames can, and must, be created internally in the tool, but the choice of different elements is limited. Navigation between frames is possible, either by linking interactive elements to other frames, or by swiping to reach next and previous frames. A useful preview function is also available. As it is a mobile application, input is based on touch. The evaluator found it easier to create wireframes using mouse/keyboard than with touch input. Lastly, the wireframe can be shared via a link which is sent from the phone via SMS, email or any other option for sharing content the user has on his/her phone.

Pencil Project is unique in that it is an open source project prototyping, and wireframing, tool. It is a desktop application with several options when it comes to creating frames. It contains numerous categories of element to choose from. As opposed to many of the other tools, Pencil Project contains several device- and OS- specific elements. Pages can be linked together, but the tool

lacks a preview functionality, making testing cumbersome as the whole project needs to be downloaded to check if the navigation is set up properly.

Atomic allows content to be imported from external design tools or created in the tool itself. Atomic also allows collaboration and functionality for adding comments. The user interface is similar to most of the tools above, with easily legible text, a logical layout and useful feedback for different actions. Several tutorials are also available. Wireframes can be shared via URL, or individual pages can be downloaded as PNG files.

A.2 Recruitment

A.2.1 Flyer for Volunteers

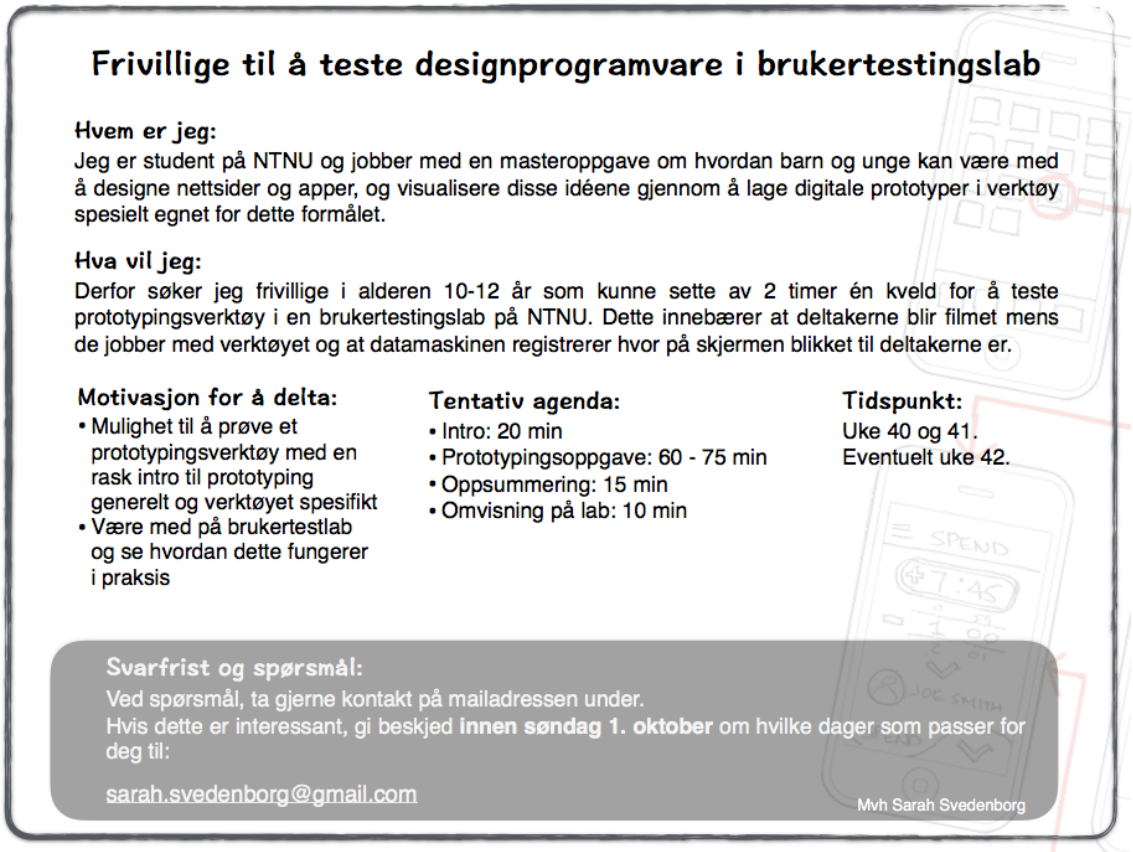


Figure A.1: Flyer for recruiting volunteers

A.2.2 Consent Form

Forespørsel om deltakelse i forskningsprosjektet: *"Wireframing med barn"*

Bakgrunn og formål
Barn kan spille en viktig rolle i designprosessen av digitale produkter. I dette prosjektet skal vi tilpasse et designverktøy til barn, og trenger derfor deres aktive deltakelse for å vite hva som fungerer og ikke.

Forskningsprosjektet er en masteroppgave ved Institutt for Datateknikk og Informatikk ved NTNU, i samarbeid med NRKSuper, innenfor fagfeltet Interaksjonsdesign.

Formålet med dette konkrete prosjektet er å se på hvordan 10-13 åringer kan visualisere app- og nettside-idéer gjennom digitale prototyper og wireframes og hva som kreves av slike designverktøy for at de skal appellere til barn. Deltakerne er valgt ut kun basert på alder.

Hva innebærer deltakelse i studien?
Data samles gjennom brukertester hvor deltakerne bruker verktøyene i en brukbarhetslab på NTNU. Det vil bli tatt video- og lydopptak. Dette gjøres for at vi skal kunne analysere opptakene i etterkant og sikre at vi har forstått deltakernes utsagn og handlinger riktig. I tillegg vil en eyetracker ta opp film av deltakerens blikk på skjermen. Deltakerne blir observert under testen og stilt noen spørsmål mot slutten om hvordan de opplevde å bruke verktøyet. Observatørene fokuserer på hvordan deltakerne behersker programvaren, hvordan de løser oppgavene og hvor lang tid de bruker.

Som forelder til deltakerne er det mulig å få se intervjuguide, utstyr og oppgave om ønskelig.

Hva skjer med informasjonen om deg?
Alle personopplysninger vil bli behandlet konfidensielt. Vi vil sørge for at materiale vil bli anonymisert slik at det ikke vil være mulig å føre opplysningene tilbake til enkeltpersonene som deltar i prosjektet. Dette innebærer at informasjon som blir formidlet til offentligheten ikke vil kunne settes i sammenheng med den enkelte. Enkeltpersoner vil ikke kunne gjenkjennes i de endelige publikasjoner. Det er kun de involverte i prosjektet som vil kunne se opptakene i ettertid.

Prosjektet skal etter planen avsluttes 1. juni 2018, og alt datamateriale vil da bli anonymisert.

Frivillig deltakelse
Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du har spørsmål til studien, ta kontakt med Sarah Svedenborg (masterstudent) på sarah.svedenborg@gmail.com, eller veileder Dag Svanæs på dags@idi.ntnu.no.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å la barnet mitt delta.

Navn på deltaker (barn)

(Signert av prosjektdeltakers forelder/foresatte, dato)

Figure A.2: Consent form

A.3 Usability Tests

A.3.1 Test Plan

Gjennomføring av forstudie (usability test med 10 - 13 åringer)

Hva	**Innhold**	**Tid**	**Klokkeslett**
Velkommen	Introdusere meg selv, uformell prat og forfriskninger Husk å motta samtykkeerklæring	15 - 20 min	14.00 - 14.20
Intro til oppgave	Se **hensikt** under		
Intro til wireframing	Powerpoint		
Intro til spesifikt verktøy	Demonstrasjon (basert på ToolTutorial)		
Beskrive hensikten med testen og Introdusere oppgaven	Tester ikke personen, men produktet, kan avbryte når de vil, kort beskrivelse av utstyret i rommet og begrensningene til verktøyet. Bekrefte at de har forstått oppgaven, spør om det er noe de lurer på.	60 - 70 min Ta tiden	14.20 - 15.30
Løse oppgaven (i par)	Barna løser oppgaven parvis uten innspill fra meg. De kan spørre om hjelp hvis de står fast.		
Semi-strukturert intervju	Se intervjuguide	20 min	15.30 - 15.50
Omvisning	Runde på labben, forklare hva man kan gjøre, utstyr	5 min	15.50 - 15-55
Avslutning	Takk for deltakelsen	5 min	15.55 - 16.00
Totalt		**1t 45min - 2t**	

Hensikt:
Voksne som designer nettsider/apper til voksne, eldre, barn. Men de vet ikke selv alltid hva de andre vil ha. Derfor viktig å ta med brukerne i designprosessen. Vanlig: gå på sykehuset -> spør sykepleier, lege. Alt i fra spørre om meninger, til at de er med å lager skisser, design idéer. Designprosess: observere/snakke -> idéer/papirprototyper -> wireframes -> teste -> utvikle. Gjøres også med barn, men stopper ofte på enkle papirprototyper. De som jobber med det lager så digitale wireframes for å kunne teste på andre. Mitt spørsmål: Kan barn være med på dette og lage dem selv? Derfor har jeg invitert dere hit i dag for å jobbe med noen sånne verktøy og se hvor lett/vanskelig det er for dere å bruke det.

Figure A.3: Test plan

A.3.2 Tasks for Usability Testing

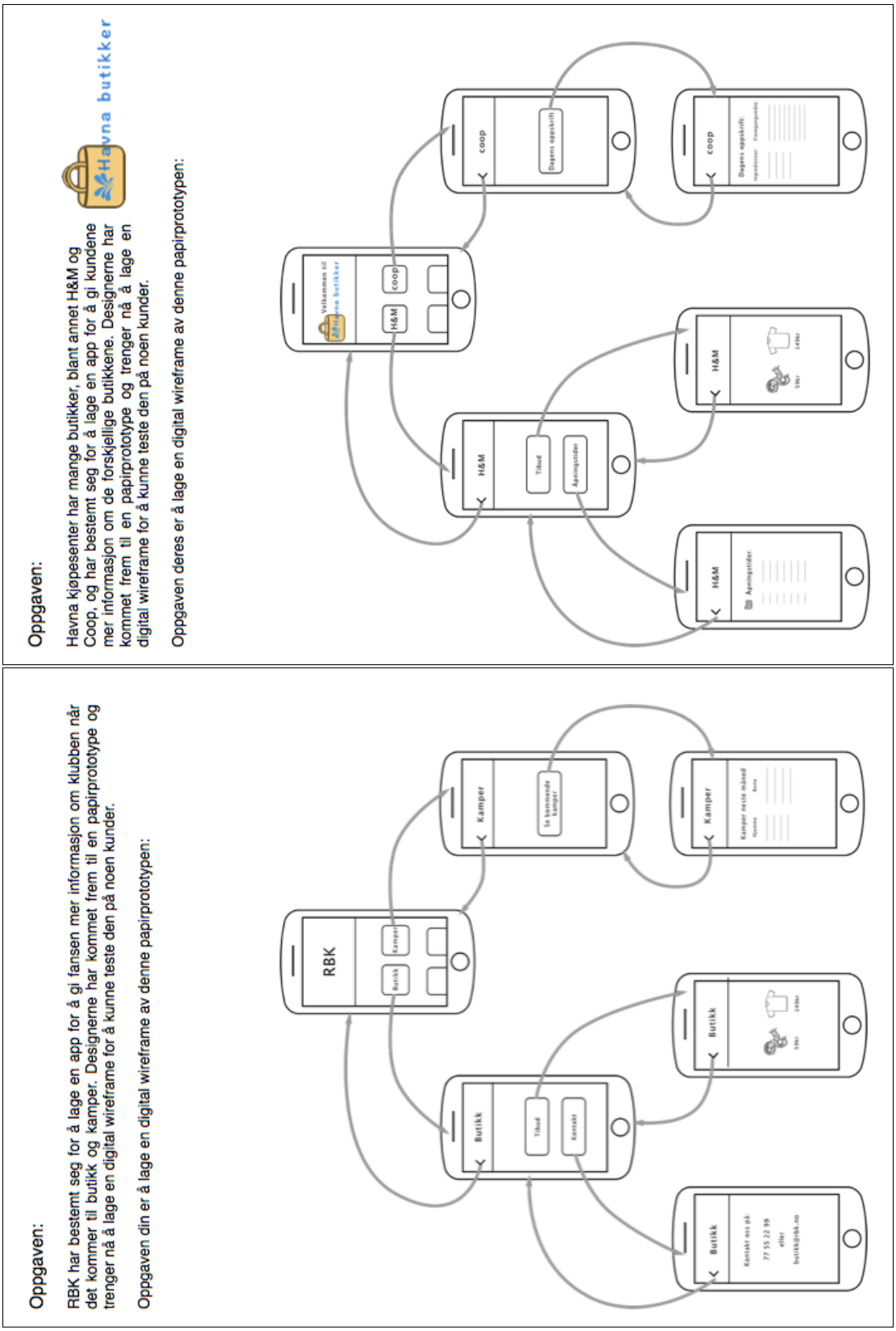


Figure A.4: Tasks for usability tests

A.3.3 Interview Guide

<table>
<tr><th>Steg</th><th colspan="2">Innhold</th></tr>
<tr><td>Rammesetting</td><td colspan="2">Avslutte oppgaven, flytte til intervju-setting</td></tr>
<tr><td>2 min</td><td colspan="2">Skal stille noen spørsmål om hvordan det var å bruke verktøyet og PC-vaner ellers for å lære mer om hvordan verktøyet kan forbedres.
Svarene skal brukes til å ende designet til verktøyet slik at det blir lettere/morsommere å bruke for aldersgruppen, så alle innspill er viktige. Ikke noe rett og galt. Kan være kritiske.</td></tr>
<tr><td>Fokusering
15min</td><td>Kvalitetskriterier:
1. Var verktøyet lett å bruke? (usability)
a. Hva var lett?
b. Hva var vanskelig?
c. Hvorfor?
2. Var det artig? (fun/motivating)
a. Hva var artig?
b. Hva var ikke så artig?
c. Hvorfor?
3. Var det lett å lære? (learnability)
a. Hva var lett å lære?
b. Hva var vanskelig å lære?
c. Hvorfor
4. Har du lyst til å lære mer? (fun/motivating/nysgjerrighet)
a. Hva har du lyst til å lære mer om?
b. Hva har du ikke lyst til å lære mer om?
c. Hvorfor?
5. Har du lyst til å bruke det igjen senere? (“replayability”)
a. Hvorfor/hvorfor ikke?

Hva har de lært
6. Skjønner du vitsen med det?
7. Hvem tror du bruker sånne verktøy til vanlig?</td><td>Bakgrunn:
PC
1. Hvor ofte bruker du PC?
a. Eller bare tablet/smartphone?
2. Hva bruker du PC-en til?
a. Skrive skoleoppgaver, word, ppt?, tegne/photoshop
b. Søke info
c. youtube/facebook
d. programmere/kode
e. Spille
f. Sjekke skoleting
g. Snakke med folk? Skype/chat?
~~3. Når begynte du å bruke PC?~~
4. Kodeklubben?
a. Hvilke kurs har du tatt/tar?
5. Har du egen PC hjemme?

Design
1. Har du brukt et sånt verktøy før?
~~2. Skala 1-5: Hvor mye liker du å tegne?~~</td></tr>
<tr><td>Tilbakeblikk
3 min</td><td>• Spørre hvis noe er uklart.
• Har jeg forstått deg riktig?
• Er det noe du vil legge til?</td><td>• Utdeling av gavekort</td></tr>
</table>

Figure A.5: Interview guide

A.4 Interaction Tables for DEVAN Analysis

1a: First mockup, INTERACTION TABLE

Time code	Action	Product status after action	Interaction segments	Task context	Breakdown indication code
3:40	Click IOS		Place iPhone templace on screen	**Create first mockup**	
3:41-3:43	Drag iPhone	iPhone on screen			
3:46	Click Buttons		Explore categories		
3:48	Click Big				
3:49	Click All				
3:59-4:02	Scroll vertically in menu		Explore categories		
4:02	Click Text				
4:09-4:11	Drag Icon		Add label to mockup		
4:12-4:15	Drag Label	Label on screen			
4:15-4:24	Chage label	Label changed			
4:29	Click State (in properties)		Explore properties		
4:46	Click Size (in properties)		Change size of label		
4:48-4:50	Change size				
4:53	Click Size (in properties)		Change size of label		REP
4:55-4:57	Change size				
5:01-5:06	Drag side of label	Label is longer	Attempt to change font size. "Du, hvordan får man den der teksten større?"		PUZZ
5:15-5:17	Move label		"Du, hvordan får man den der teksten større?"		PUZZ
5:20	Selects label		Select label		
5:33	Click Size (in properties)		Attempt to change font size, changes size of label		
5:35-5:40	Change size	Label is longer			REP
5:44-5:48	Drag size of label	Label resized	Move label back into place and correct size		
5:48-5:50	Center align label	Label aligned			
5:53	Right click on label		Copy label		
5:58	Copy label	Two labels on screen	Duplicate label		
6:03-6:07	Cut out second label	Second label gone, only one left	Replace label with subtitle		CORR
6:08-6:10	Delete first label	No labels left			CORR
6:10-6:15	Drag in Subtitle	Subtitle added to page			
6:15-6:19	Change subtitle	Subtitle changed			
6:20-6:23	Center align subtitle	Subtitle aligned			
6:33	Click Buttons				
6:38-6:43	Drag button	Button added to screen	Add two buttons to mockup		
6:43-6:48	Change name of button	Button name changed			
6:50-6:54	Drag in second button	Two buttons on screen			
6:54-6:58	Change name of second button	Name changed			
7:20	Click Save	Save mockup	Save mockup		
7:30	Click Close		Close mockup		

Figure A.6: Interaction table for group A creating the first frame.

1a: Insert image, INTERACTION TABLE

Time code	Action	Product status after action	Interaction segments	Task context	Breakdown indication code
24:32	Click Big		Explore categories	**Insert image**	
24:38	Click All		Explore categories		
24:43-24:47	Drag in image element		Add image elements and browse images		
24:48-24:52	Drag in second imge element				
24:53	Double click on image element				
24:57	Click Browse in pop up				
24:59			"Jeg fant det ut. Jeg fant det ut!"		
25:12	Select image from folder		Select image		
25:46	Click Attach	Image displayed in popup	Attach image		
25:54	Close popup		Add image to mockup		DISC
25.58	Double click image element	Popup displayed			REP
25:58	Select previous image in popup				
25:59	Click Load	image added to screen			
26:02-26:11	Move and resize image		Move image element		ACT
26:13	Move image element over image				ACT
26:20	Move image element outside iPhone template		Remove image element from iPhone		ACT

Figure A.7: Interaction table for group A inserting the first image.

1b: First mockup, INTERACTION TABLE

Time code	Action	Product status after action	Interaction segments	Task context	Breakdown indication code
3:25	Click IOS		Find iPhone template	**Create first mockup**	
3:32-3:34	Drag in iPhone	iPhone on screen	Place iPhone template on screen		
3:46 - 3:50	Drag Pointy Button	Pointy button on screen	Add button to mockup		
3:50-4:08	Change name of buttton	Name changed			
4:09			"Men det blir jo tilbake"		
4:17	Click button		"Hvordan tar vi den bort?"		PUZZ
4:21-4:24	Delete button	Button gone	Delete button		CORR
4:32	Click Buttons		Add new buttons		
4:42-4:45	Drag in button	Button on screen	Add new button and position it		
4:46-4:52	Change name on button	Name changed			
4:54-4:56	Drag button	New position of button			
4:58-5:20	Drag and resize button	Button bigger			
5:36-5:39	Move and resize button		Add and position second button		
5:39-5:42	Drag in second button	Two button on screen			
5:42-6:01	Change name of second button		"Hvordan får man til det 'og' tegnet?"'		SEARCH
6:01-06:06	Move and resize second button		Trying to make the two buttons have same size		
6:17	Resize first button		Resize button		
6:30-6:47	Save and name mockup		"Skulle vi save først?" Mockup saved		

Figure A.8: Interaction table for group B creating the first frame.

1b: Insert image, INTERACTION TABLE

Time code	Action	Product status after action	Interaction segments	Task context	Breakdown indication code
19:16-19:24	Drag image to web application	Opens in new tab		**Insert image**	ACT
19:25			"Hmm"		
19:34	Right click image > copy				ACT
19:58	Look for paste in mockup				
20:14-20:31	Search for images of scarf online				
20:31-20:36	Select image online and drag to application tab		"Nei, den vil ikke."		ACT
21:02-21:08	Drag image from folder to web application	Image opens in new tab	"Prøv å sett det utenfor telefonen"		REP
21:15-21:17	Right click image > open	Image opens in new window			ACT
21:27-21:40	Right click image > copy				REP
21:44	Right click mokup				
21:49			"Har du adda noen bilder ennå?"		PUZZ
22:06-22:14			"Ok, kanskje det er på layout. Nei sånn der edit."		
22:14-22:16	Click Edit > copy				ACT
22:17			"Nei, men nå kopierer du hele greia."		
23:16			"Vet du hvordan man gjør det?"		PUZZ
	Receive instructions from observer				
24:04	Click All		"Ta på All først"		
24:09-24:20	Scroll vertically in All				
24:21-24:23	Drag image element to screen	Image element added			
24:38	Click Links				
24:43-24:47	Copy url from image search online		"Å! Jeg tror jeg vet hvordan."		
24:53-25:03	Add url to Links of image element				
25:11			"Nei! Hvordan klarte du det?"		
	Receive instructions from fellow participant				
25:18	Double click on image element	Popup appears			
25:21	Click Browse				
25:25-25:33	Add image to popup				
25:39	Close popup				
25:45	Click Image in properties of image element	Drop down appears contining scarf image			
25:45-25:47	Double click image of scarf	Scarf appears on screen			
25:48-26:03	Move and resize image	Image is smaller and moved			

Figure A.9: Interaction table for group B creating the first frame.

2: First mockup

Time code	Action	Product status after action	Interaction segments	Task context	Breakdown indication code
0:52	Click Mobile		Select correct category	**Create first wireframe**	
0:56-0:57	Drag iPhone template	iPhone on screen	Place template on screen and resize		
0:58-1:02	Resize canvas > Fit screen				ACT
1:04-1:06	Resize canvas > Fit content	Canvas resized			CORR
1:15	Click Desktop		Select correct category		
1:20-1:22	Drag label	Label on screen	Place label		
1:28	Select label		Select label		
1:38-1:44	Change name of label	Name changed	Change label name		
1:45-1:48	Select label		"Kan du gjøre den litt stor så den dekker hele øverste delen av skjermen?"		
1:50-1:51	Rotate label and rotate back				ACT/CORR
1:52	Right click				ACT
1:55	Move position of label and move back		Attempt to increase font size		
1:57	Right click iPhone				ACT
2:01-2:02	Move label and move back		Attempt to increase font size		ACT/CORR
2:03	Right click label				ACT
2:13-2:18	Change size	Nothing happens	Attempt to increase font size		ACT
2:19	Click properties		"Ja, her var det."		
2:22-2:26	Change font size	Label font increased.	"Eh, font size." "Der ja."		
2:27-2:29	Move label	Label moved	Change font size and center align label		
2:29-2:33	Change font size	Font decreased			
2:33-2:34	Move label	Label moved	"Nice"		
			Insert image		
2:34-2:37			"Ok, må ha to buttons da med HM og COOP."		
2:39-2:40			"Nei, men skal vi ikke ha det ikonet der?"		
2:41	Minimize application window				
2:43	Open image folder on desktop				
2:47-2:48			"Å ja, det er logo her. I så fall."		
2:49			"Ja, da slipper vi hele Havna butikker."		
2:54	Selct label		Select label		
2:57	Delete label	Label gone	Delete label and search for new element		CORR
2:59-3:01	Search "image"				
3:04-3:06	Drag image element to screen	Image element on screen	"Jeg tror vi må importere den til programmet."		ACT
3:07-3:08			"Eller kan jeg bare dra den inn?"		
3:09-3:10	Drag logo from folder to screen	Logo appears on screen	Insert image on screen		
3:15	Delete image element	Image element gone	Delete image element		CORR
3:18	Maximize application window		Maximize window		
3:21-3:23	Move logo to center top	Logo moved	Move logo		
3:29-3:34	Search for buttons		Search for element		
3:37-3:38	Drag in button	Button on screen	Add two buttons		
3:38-3:40	Duplicate button	Two buttons on screen			
3:43-3:49	Move and resize first button	Button moved and resized	Move and resize button		
3:56	Delete second button	One button left	Make two buttons equal in size and align them.		CORR
3:57-3:59	Copy first button	Two buttons			
3:59-4:01	Align second button with first button	Buttons aligned			
4:04-4:09	Select both buttons and center align them	Center aligned	Align both buttons to center		
4:15-4:25	Change name of first button	Name changed	Apply desired name and font size to buttons		
4:26-4:31	Change font size of first button	Font size changed			
4:31-4:36	Change name of second button	Name changed			
4:38-4:42	Increase font size of second button	Font size changed			
4:44-4:45			"Så da er det her hoved pagen da."		
4:57-5:07	Rename first mockup/page to "Home"	Renamed	Rename first page		

Figure A.10: Interaction table from usability test 2.

	Pilot: 2nd wireframe of U1a, 07:45-10:32				
Time between activities	Time code	Action	Product status after action	Interaction segments	Task context
	7:48	Click Containers			
	7:49	Click Forms			
	7:50	Click IOS			
	7:51-7:56	Drag iPhone	iPhone on screen		
8 sec	8:02	Click All			
9 sec	8:11	Click Text			
	8:12-8:15	Drag Subtitle	Subtitle on screen		
	8:15-8:20	Change subtitle text	Subtitle changed		
	8:21-8:24	Center align subtitle	Subtitle aligned		
3 sec	8:27	Click Icon			
	8:29	Click iPhone	iPhone moves		
3 sec	8:32-8:34	Drag Icon	Icon on screen		
	8:35-8:42	Change label on Icon	Label changed		
	8:42-8:45	Align Icon	Icon aligned		
	8:46	Doubble click on Icon			
	8:47-8:49	Deletes Icon	Icon deleted		
3 sec	8:52	Clicks Buttons			
	8:54-8:57	Drags button	Button on screen		
	8:57-9:03	Change label on button	Label changed		
6 sec	9:03-9:07	Aligns button	Button aligned		
6 sec	9:13	Select button			
12 sec	9:19	Click Links			
	9:31-9-35	Drag second button			
	9:35-9:54	Change name on second button			
	9:54-9:58	Align second button	Button aligned		
4 sec	10:02	Click Links	Link to		
4 sec	10:06	Click Links			
10 sec	10:16	Select first mockup			
	10:18	Select button			
	10:19-10:21	Set Link			
7 sec	10:22	Select same button			
3 sec	10:29	Click All			
	10:32	Click Preview			
	Threshold pause time: 5 sec				
	Intermediate value: 3 sec				

Figure A.11: Interaction table of pilot study.

B. Appendix - Design Workshop

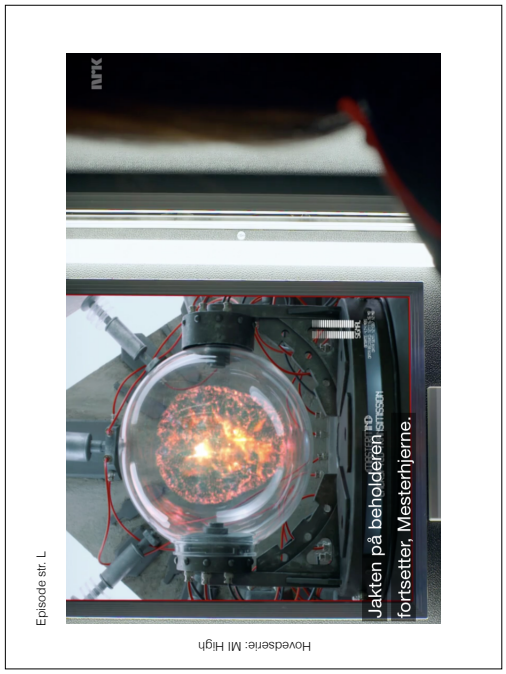
B.1 Criteria for Evaluating Thematic Analysis

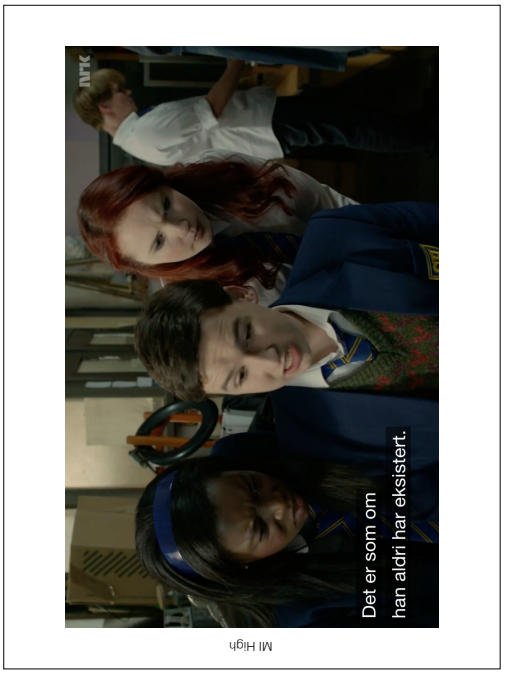
Process	No.	Criteria
Transcription	1	The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'.
Coding	2	Each data item has been given equal attention in the coding process.
	3	Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive.
	4	All relevant extracts for all each theme have been collated.
	5	Themes have been checked against each other and back to the original data set.
	6	Themes are internally coherent, consistent, and distinctive.
Analysis	7	Data have been analysed - interpreted, made sense of - rather than just paraphrased or described.
	8	Analysis and data match each other - the extracts illustrate the analytic claims.
	9	Analysis tells a convincing and well-organised story about the data and topic.
	10	A good balance between analytic narrative and illustrative extracts is provided.
Overall	11	Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly.
Written report	12	The assumptions about, and specific approach to, thematic analysis are clearly explicated.
	13	There is a good fit between what you claim you do, and what you show you have done - i.e., described method and reported analysis are consistent.
	14	The language and concepts used in the report are consistent with the epistemological position of the analysis.
	15	The researcher is positioned as *active* in the research process; themes do not just 'emerge'.

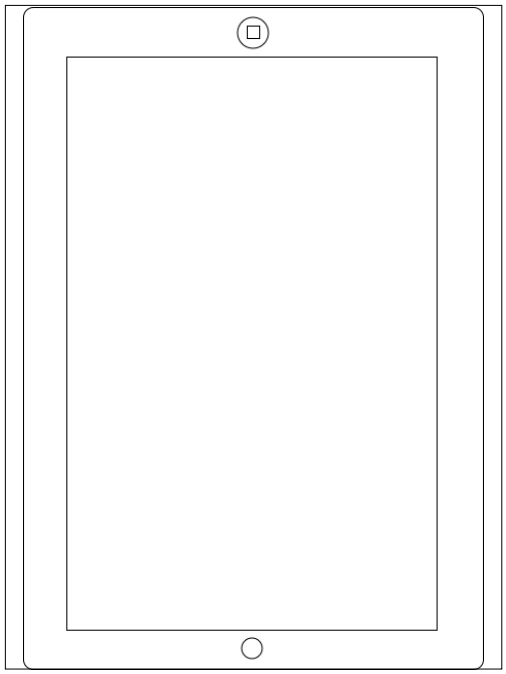
Figure B.1: 15-Point Checklist of Criteria for Good Thematic Analysis [9, p. 36]

B.2 Workshop Material

The following 6 figures contain all the material contained in the envelopes handed out to the participant in the main prototyping task. The scale is 1:2.







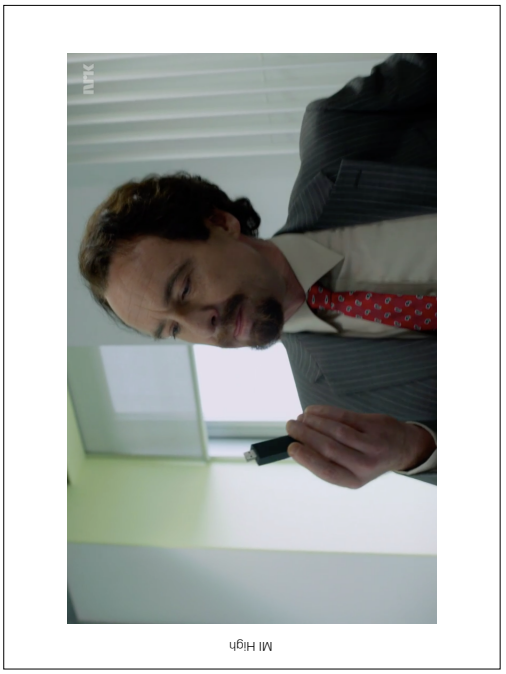
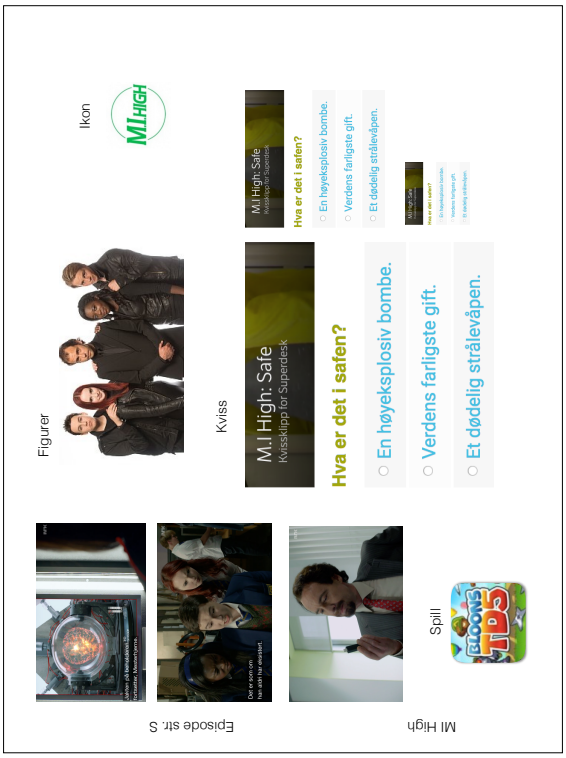
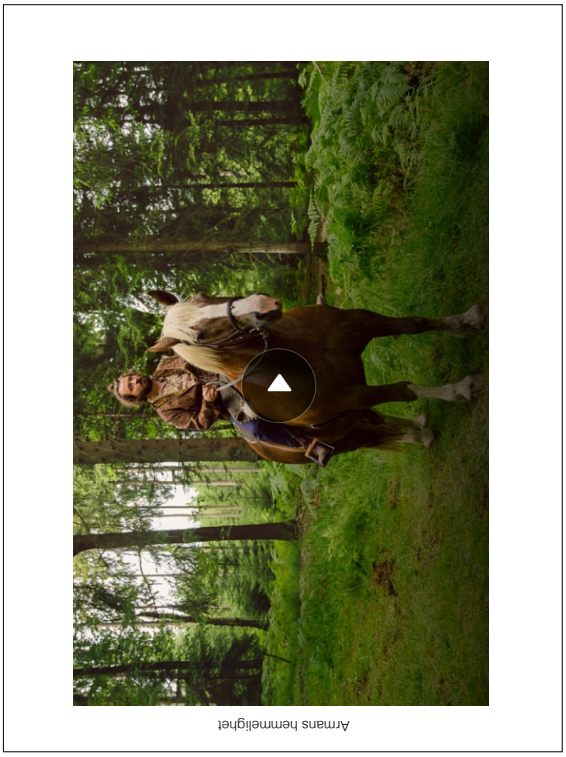


Figure B.2: Material for paper prototyping, 1/6





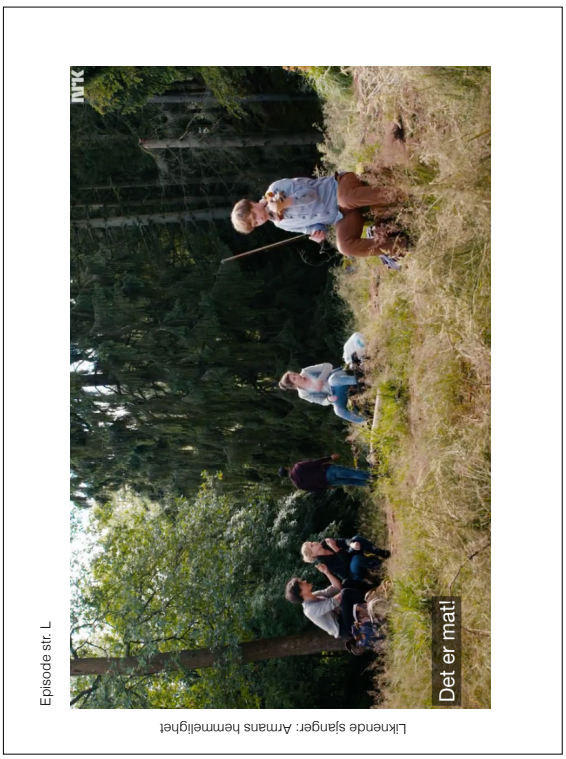


Figure B.3: Material for paper prototyping, 2/6

Figure B.4: Material for paper prototyping, 3/6

Figure B.5: Material for paper prototyping, 4/6

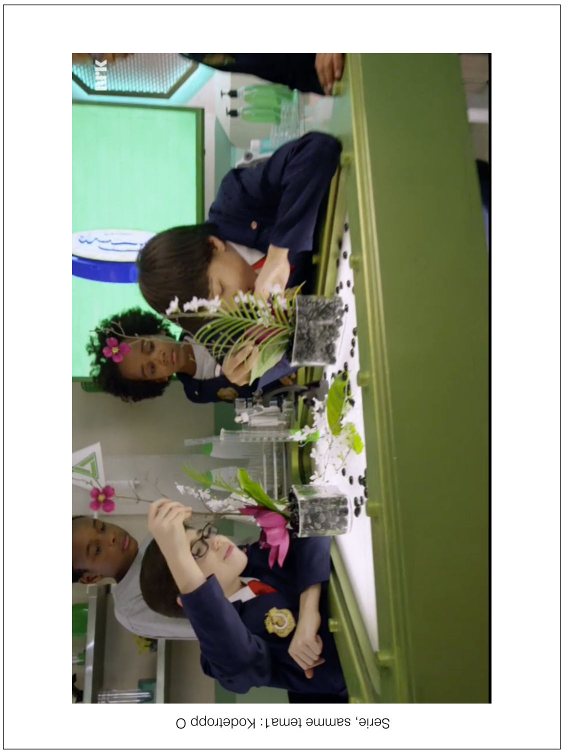


Figure B.6: Material for paper prototyping, 5/6

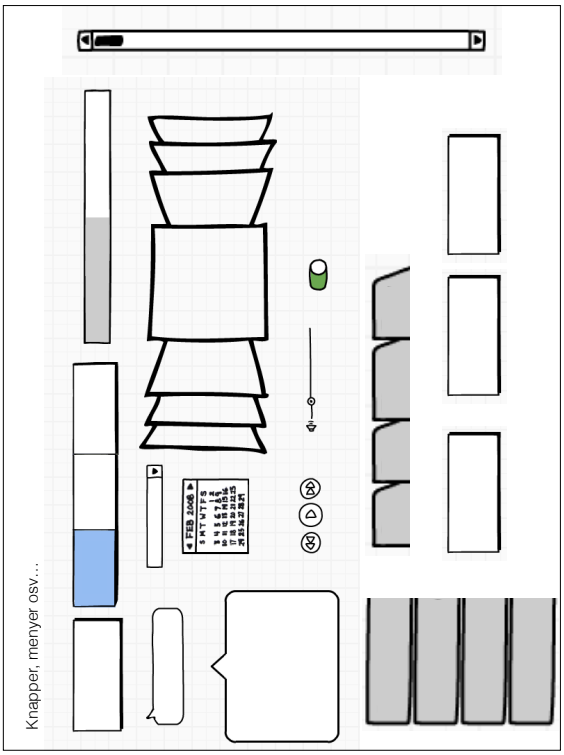


Figure B.7: Material for paper prototyping, 6/6

B.3 Questionnaire

DESIGN WORKSHOP MED 7. KLASSINGER

SPØRRESKJEMA

BAKGRUNN

Alder:		
Kjønn (sett ring rundt):	Gutt	Jente
Hvor ofte bruker du PC(ikke smartphone og tablet) utenom skolen?	Flere ganger om dagen / Én gang om dagen / Noen ganger i uka / Sjeldnere	
Hva bruker du PCen til? (sett gjerne flere kryss)	☐ Skrive skoleoppgaver	☐ Programmere
	☐ Tegne/redigere bilder	☐ Snakke/chatte med folk
	☐ Søke etter info	☐ Sjekke skoleting
	☐ Youtube/facebook	☐ Spille
	☐ Annet:	
Hvor mye erfaring har du med å lage websider?	Ingenting 1 2 3 4 5 Veldig mye	

PAPIR OG BALSAMIQ

Var det lett å forstå hva du skulle gjøre når du lagde papirprototypene?	Nei, veldig vanskelig 1 2 3 4 5 Ja, veldig lett
Hva var eventuelt vanskelig?	
Var det lett å lære Balsamiq?	Nei, veldig vanskelig 1 2 3 4 5 Ja, veldig lett
Var det lett å bruke Balsamiq?	Nei, veldig vanskelig 1 2 3 4 5 Ja, veldig lett
Hva var eventuelt vanskelig med Balsamiq?	

Figure B.8: Questionnaire page 1/2

MOTIVASJON

Hva var det morsomste i dag?

Likte du å holde på med papirprototyping?	Nei, veldig lite 1 2 3 4 5 Ja, veldig mye
Hva likte du med papirprototyping?	
Hva likte du ikke med papirprototyping?	
Likte du å holde på med wireframing?	Nei, veldig lite 1 2 3 4 5 Ja, veldig mye
Hva likte du med wireframing?	
Hva likte du ikke med wireframing?	

NYTTEVERDI

Dersom du skulle forklare designidéen din til en medelev, ville du ha brukt papirprototypen eller den digitale wireframen?

O Helt klart papir	O Kanskje papir	O Samme det	O Kanskje wireframe	O Helt klart wireframe

Hvorfor?

DAGENS OPPLEGG

Hva ville du endret med opplegget i dag?

Andre kommentarer:

Figure B.9: Questionnaire page 2/2

B.4 Results from the Workshop

B.4.1 Paper Prototypes and Wireframes

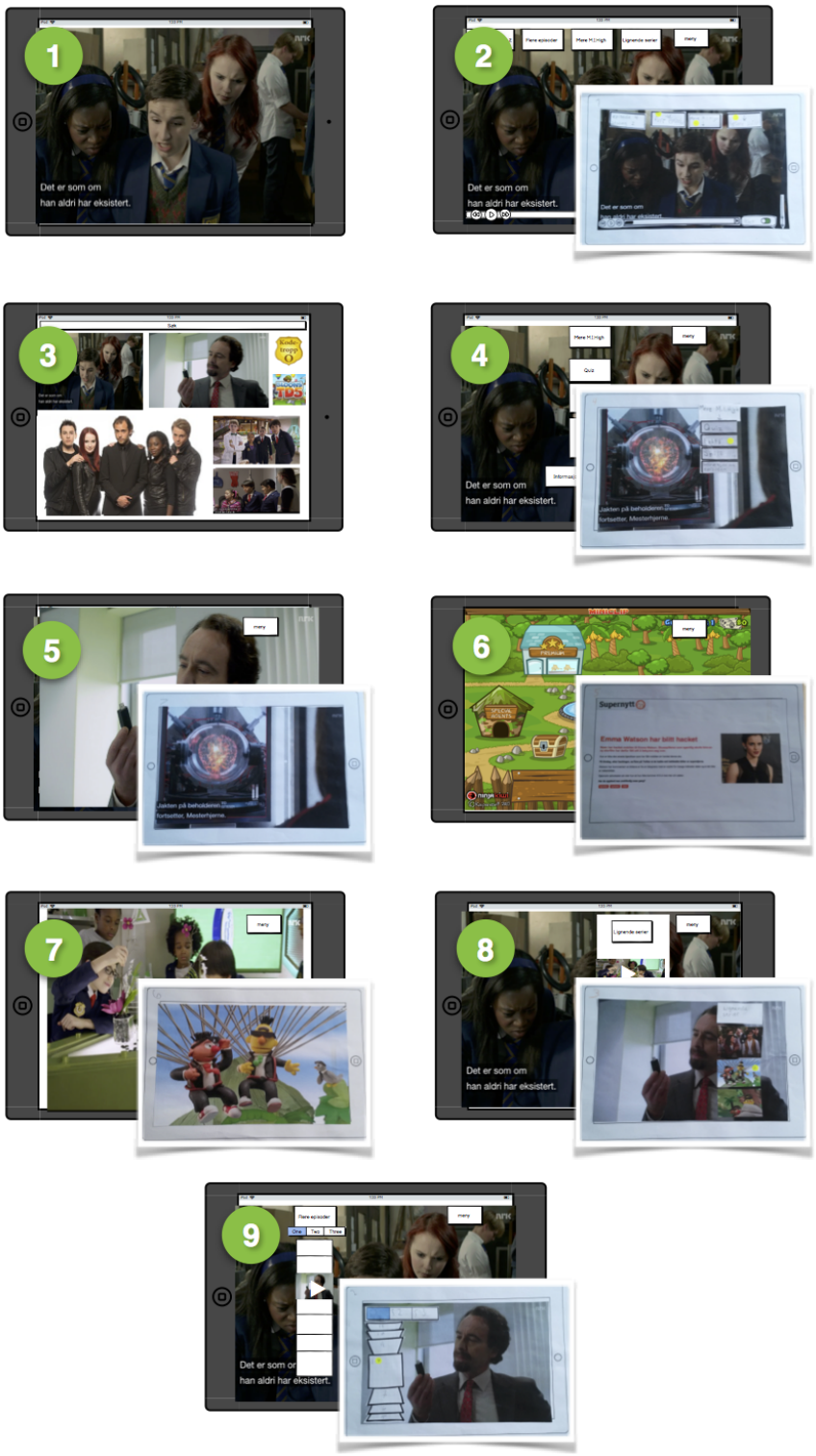


Figure B.10: Comparison of group A's paper prototype and wireframe

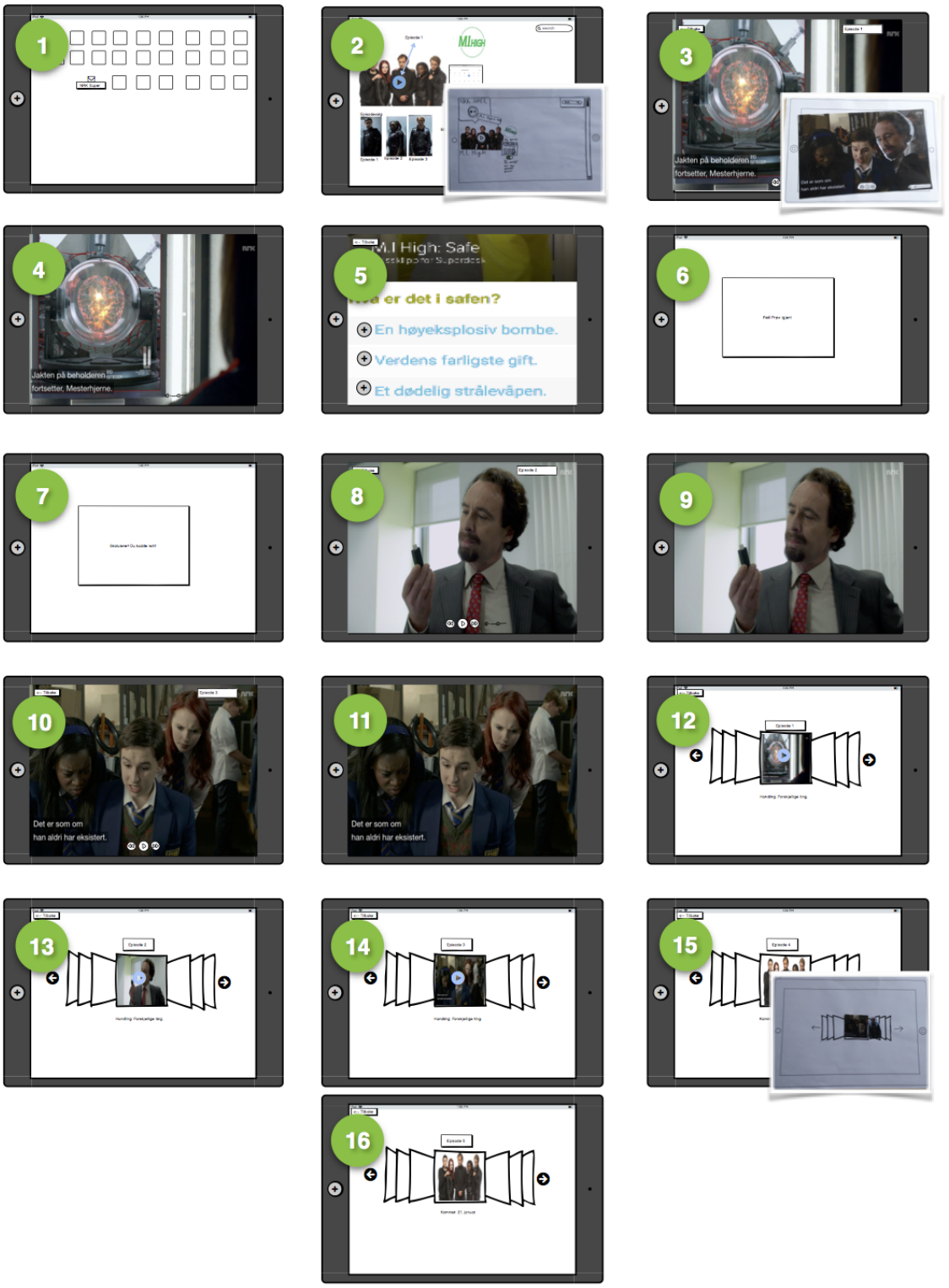


Figure B.11: Comparison of group B's paper prototype and wireframe

Figure B.12: Comparison of group C's paper prototype and wireframe

B.4.2 Group Interview Transcript

Transcript of group interview

Duration: 32 minutes and 26 seconds

Date: December 12th, 2017

1	**Interviewer 1**	Så det første er jo ganske greit det med alder da, for dere går jo i samme klasse. Så dere er vel nesten blitt 12 alle sammen.
2	Participant	Ja
3	**Interviewer 1**	Bortsett fra noen jeg snakka med som har bursdag litt senere. Ehm og på hvor ofte dere bruker PC, hva er det de fleste har svart da? Trenger ikke rekke opp hånda, kan bare si et egentlig.
4	Participant	Noen ganger i uka
5	**Interviewer 1**	Ja
6	Multiple participants simultaneously	Flere ganger i uka
7		Noen ganger i uka
8		En gang om dagen
9		Varierer litt
10		Flere ganger om
11		En gang om dagen
12	**Interviewer 1**	Og da tenker dere utenom skolen, ikke sant?
13	Participant	Ja
14	**Interviewer 1**	Har dere egne PC-er hjemme?
15	Multiple participants simultaneously	Ja
16		Nei
17	Participant	Æ bruker mamma sin fordi vi har ikke vi har ikke TV så vi bruker den te å se på TV og Netflix og sånn. Så vi bruker den når vi ser på TV.
18	**Interviewer 1**	Ja, smart. Kan dere rekke opp hånda på hvor mange som har egen PC hjemme? 5 det er jo nesten halvparten da. Og dere andre? Har dere PC hjemme som dere låner noen ganger eller bruker
19	Participant	Ja
20	**Interviewer 1**	Eller bruker dere ikke PC hjemme?
21	Participant	Æ bruker den samme som mamma
22	**Interviewer 1**	Ja, rekk opp hånda de som har hjemme så man kan bruke PC hjemme.
23		Ja, ok, så da blir det jo. Alle har tilgang på PC hjemme i hvert fall.
24		Ehm, ja,
25	**Interviewer 2**	Eh
26	**Interviewer 1**	og hva, eh ja
27	**Interviewer 2**	Bruker dere da også internett helt fritt når dere er hjemme?
28	Multiple participants simultaneously	Ja, vi har egen iPad og sånn
29		Ja
30	**Interviewer 2**	Ja
31	Participant	Æ bruke telefonen min og iPad

Figure B.13: Group Interview Transcription, p. 1

32	**Interviewer 2**	Ja
33	**Interviewer 1**	Ja
34	Participants	Ka m.....
35	**Interviewer 1**	Hva sa du?
36	Participant	Ka mene du med det?
37	**Interviewer 1**	Er det noen som bestemmer hjemme hva dere får lov å gå på på internett?
38	Multiple participants	JA
39	**Interviewer 1**	Så dere kan ikke gå på hva dere vil selv?
40	Multiple participants simultaneously	Nei
41		Jo
42		For det meste
43	Participant	Æ får jo ikke gå på hva som helst, men dem har ikke sagt noe spesielt. Men æ skjønner at det er en grense.
44	**Interviewer 1**	Du skjønner litt. Ja, ja. Dere har lært liksom litt om hva som er greit og ikke greit på nettet
45	Participants	People talking simultaneously. Inaudiable
46	**Interviewer 2**	Det er fint
47	**Interviewer 1**	Ja, kjempefint
48	Participant	Vi har hadd en hel uke om nettvett på skolen.
49	**Interviewer 1**	Hva sa du?
50	Participant	Vi hadd sånn kanskje en måned til og med med nettvett på skolen
51	**Interviewer 1**	Åja! Her?
52	Participant	Det var en uke.
53	**Interivewer 1**	Her? ja! I klasserommet?
54		[Inaudiable]
55	**Interviewer 1**	Ja, skjønner
56		Hva er det dere bruker PC til da? Vi kan jo egentlig bare ta en rask runde.
57	Participant	Æ bruker til å søke, eller mest til å se på ting.... Også kan jeg bruke den til skoleoppgaver
58	**Interviewer 1**	Når du er hjemme?
59	Participant	Ja, til lekser og sånn, på google classroom og sånn.
60	**Interviewer 1**	For de der ChromeBookene får dere ikke lov å ta hjem ikke sant?
61	Participants	Nei
62	Next participant	Æ bruker den til lekser og skoleoppgaver. Også bruker jeg den til å laste opp bilder fra kamera og titte på bilder og sånn.
63	**Interviewer 1**	Ah, ja. Har du skrevet det her?
64	Participant	Ja
65	**Interviewer 1**	Har du noe annet du vil si som du også bruker den til ellers?
66	Participant	Ja, det er skoleoppgaver.
67	**Interviewer 1**	Ja, mhm, og lekser og sånt. Ja, og Oskar

Figure B.14: Group Interview Transcription, p. 2

68	Participant (Oskar)	Læksa, spill og photoshop.
69	**Interviewer 1**	Ja, kult!
70		[Inaudiable]
71	**Interviewer 1**	Nei, Mona sa.
72	**Interviewer 2**	...Jeg ser ikke hvem som prater.
73	**Interviewer 1**	Nei, John?
74	Participant (John)	Jeg bruker min til skoleoppgaver, spilling, også har æ en drone som æ bruker dataen te.
75	**Interviewer 1**	Kult da! Har du skrevet opp det på arket ditt? På annet.
76	Participant (John)	Nei, ska æ gjør det?
77	**Interviewer 1**	Ja, skriv det. Det er veldig spennende med det som ikke er alternativene for meg også. å se hva annet dere gjør.
78		Og Alexander
79	Participant (Alexander)	Æ spille, og så bruker æ å snakke og chat med folk.
80	**Interviewer 1**	Ja, hva er det du bruker for å snakke og chatte med folk?
81	Participant (Alexander)	Skype og Discord
82	**Interviewer 1**	Discord?
83	Participant (Alexander)	Ja
84	**Interviewer 1**	Ja
85		[Inaudiable]
86	Participant (Alexander)	Æ gjør ikke skoleoppgaver på den. Det bruker æ en anna PC til.
87		Også bruker jeg den ikke særlig ofte til å søke etter info.
88	**Interviewer 1**	Ikke?
89	Participant (Alexander)	særlig ofte
90		Jeg bruker heller telefon.
91	**Interviewer 1**	Da bruker du telefonen ja. OK. Hvorfor bruker du telefonen til det i steden for?
92	Participant (Alexander)	Mye kjappere og hendiere.
93	**Interviewer 1**	Jaa...
94	Next participant	Æ bruker den til Google classroom. Så bruker jeg den til å søke opp ting sånn på Så bruker jeg den til netflix. Og så ser jeg på TV på den. Og så spiller jeg noen ganger. Jeg spiller ikke så mye nå lenger da.
95	**Interviewer 1**	Mer før?
96	Participant	Ja
97	**Interviewer 1**	Mhm
98	Participant	Æ bruker den ikke så ofte da.
99	**Interviewer 1**	Er det mer telefon og sånn du bruker eller? Ja. Hanna?
100	Participant (Hanna)	Æ gjør egentlig det meste på den. Æ tegner ikke eller redigerer bilder.
101	**Interviewer 1**	Nei, er det noe annet du gjør som ikke står her da? Har du skrevet noe på annet?

Figure B.15: Group Interview Transcription, p. 3

102	Participant (Hanna)	Netflix
103	**Interviewer 1**	Ja, mhm. Se på. Anne?
104	Participant (Anne)	Æ skriv skoleoppgava, søk etter info, og litt youtube og netflix og sånn. Og så sjekke skoleting, og så spille æ av og te. Og så pleie æ å shoppe.
105		[Inaudiable]
106	**Interviewer 1**	Ja, for det er jo ikke noe alternativ i det hele tatt, så det var bra. Får du lov til å gjøre det helt selv?
107	Participant (Anne)	Nei
108	**Interviewer 1**	...eller er det sånn at du finner også sier du at kan jeg kjøpe den tingen?
109	Participant (Anne)	Æ finn ting også tenker æ på å kjøp det sjøl eller ønsk mæ det i julegave. Også tar jeg det til foreldrene mine og så betaler dem fordi jeg har ikke kort
110	**Interviewer 1**	Ja, ikke sant. Men for å søke opp ting du ønsker deg og. Går du på nettbutikker og sånn da? Ja
111	**Interviewer 1**	Kjempebra. Er det noe mer dere kommer på da, som dere bruker det til, som dere vil si?
112	Participant	Mhm, æ har gjort det noen få ganger. Kjøpt ting på nett.
113	**Interviewer 1**	Ja, ok, men du har vært litt inne på det og sett på nettbutikker
114		[Inaudiable]
115	**Interviewer 1**	Ja, John?
116	Participant (John)	Æ bruker det til å søk på dealextreme.
117	**Interviewer 1**	ÅJA
118	Participant	Ække det en sang?
119	Participant (John)	Nei det er ei nettside
120	**Interviewer 1**	For å få billige ting?
121	Participant (John)	Ja
122	**Interviewer 1**	Ja
123	Participant (John)	Det er en billig nettside der du får masse sånn ting te data og...
124	**Interviewer 1**	Du kan kjøpe ting?
125	Participant (John)	Ja, masse sånn tekniske ting.
126	**Interviewer 1**	Jaaa, tekniske ja
127		Hvor mange av dere er det som bruker sånn derre Netflix og ser på TV og, eller musikk? Som spotify eller wimp og sånn?
128	Multiple participants	Æ bruker spotify på telefonen
129		Ja det gjør jeg og
130		Æ bruker spotify på telefonen, men ikke på PC.
131	**Interviewer 1**	Ikke på data
132	Participant	Nei
133	Participant	Eller nån ganger gjør æ det på data.
134		[Inaudiable]
135	Participant	Æ ser på TV og sånn, eller på ting på mobilen og iPaden, også spotify på telefonen og youtube på telefonen
136	**Interviewer 1**	Youtube også på telefonen?

Figure B.16: Group Interview Transcription, p. 4

137	Participant	Ja, og iPaden
138	**Interviewer 1**	Ja
139	Participant	Mmm, mest på mobilen for at det er så mye fortere å gå inn på...[inadudiable]...
140	**Interviewer 1**	Ja, ikke sant. Ja, men det er jo akkurat det der er.
141	Participant	Og snapchat selvfølgelig.
142	Interviewer 1	På mobilen...?
143	Participant and Interviewer	Ja
144	**Interviewer 2**	Spørsmål. Hvor mange er det som bruker skype eller messenger eller discord eller sånne ting? På PC?
145	Participant	Og messenger bruker vi på telefonen.
146	**Interviewer 2**	På mobilen da? Ok, ja.
147	Participant	Æ har skype både på data og telefon.
148	**Interviewer 1**	Ehm, ja. Hvor mye erfaring har dere med å lage nettsider? Er det noen som har gjort det før?
149	Participant	En gang.
150	**Interviewer 1**	En gang ja. Hvordan gjorde du det?
151	Participant	Det var bare sånn gratis greie som varte i en uke.
152	**Interviewer 1**	Ja, så du var på et opplegg. Du satt ikke hjemme og gjorde det alene eller?
153	Participant	Jo
154	**Interviewer 1**	Åja
155	Participant	Eller jeg gjorde det med pappa tror jeg.
156	**Interviewer 1**	Åja. Fikk du til å lage noe?
157	Participant	Ja, men etter en uke, eller en måned tror jeg, så kosta det penger
158	**Interviewer 1**	Ja.
159	**Interviewer 2**	Kan jeg spørre hvordan du gjorde det da? Måtte du skrive noe sånn HTML kode eller kunne du bilder inn og sette opp ting litt sånn som vi gjorde i dag?
160	Participant	Eh, det var en sånn ferdig en liksom.
161	**Interviewer 1**	Ehh, var det en til som hadde gjort det?
162		Nei. Dere har ikke holdt på så mye med nettsider og sånn?
163	Participant	Det går an på data så kan du trykke på en knapp så kan du gjøre om på nettsidene.
164	**Interviewer 1**	Ja, så det har du gjort litt?
165	Participant	Ja, jeg har skifta ut for eksempel Google logoen med en bil.
166	**Interviewer 1**	ÅJA!
167	Participant	Det har jeg gjort.
168	**Interviewer 1**	Det har du gjort.
169	Participant	Ja. Det har han og.
170	Other participant	Nei, æ har tatt kaniner. De er veldig kule.
171		Også har jeg prøvd å gått inn i koden på Google og så har jeg tatt og visket ut. Hvit side. Inspisere siden vet du.

Figure B.17: Group Interview Transcription, p. 5

172	**Interviewer 1**	Ja, jeg skjønner. Morsomt da.
173	Participant	For da kan du trykk på sånn rediger HTML. Da kan du ta bort Google logoen og sett inn ditt eget bilde.
174	Another participant	Det er veldig gøy å gjøre.
175	**Interviewer 1**	Ja, du anbefaler det.
176	Other participant	Eller ikke å ta bort ting. Tvert i mot å se profilbildet mitt/bakgrunnen min i seg selv istedenfor å ha sånn dritt foran.
177	**Interviewer 1**	Så gøy.
178	**Interviewer 3**	Det var sånn. Det var noen som kunne det på ungdomsskolen der hvor jeg jobba. Så pleide de å endre overskriften til en lærers overskrift sånn på VG nyhetene.
179	**Interviewer 1**	Det er alltid litt kult.
180	**Interviewer 2**	Jeg vil bare skyte inn det at Sarah gjorde dette her da vi skulle kjøpe bil. Så tok hun og fjernet prisen på alle annonsene. Så måtte jeg titte på alle bilene uten å da bli påvirket av prisen.
181	**Interviewer 1**	Det funka bra.
182	**Interviewer 2**	Funka veldig bra.
183	**Interviewer 1**	Eh ja. Og så er jeg jo da veldig nysgjerrig på det vi har gjort i dag med papir og data. Med papir prototypene, hvordan var det å lage de?
184	Participant	Det var veldig gøy fordi at man kunne liksom, det var enkelt. Og så kunne man gjøre hva enn man ville. Man kunne sette opp hvordan man ville. Man kunne tegne, man kunne sette inn bilder og det var veldig gøy.
185	**Interviewer 1**	Du synes det var mange muligheter liksom.
186	Participant	Ja.
187	Participant	Æ synes det var litt enklere og for at på den PCen så må man drive å redigere og slette. Mens der er det bare å tegne et bilde av en veg og...Det går fortere.
188	**Interviewer 1**	På papir?
189	Participant	Ja.
190	**Interviewer 1**	Var det noen fler som hadde rekt opp hånda her?
191		[Inaudiable]
192	**Interviewer 1**	Hvordan var det å gjøre det? Var det gøy å gjøre det?
193		Dere skjønte hva dere skulle gjør? Dere skjønte oppgavene ikke sant?
194		Gutta? Dere gjorde det?
195	Boy participants	Ja
196	**Interviewer 2**	Var det noe som var mer vankelig enn noe annet i forhold til oppgavene?
197	**Interviewer 1**	Hva var vanskeligst med å lage papirprototypene?
198	Participant	Kanskje at noen ganger så var det ikke plass. Det var egentlig det eneste.
199	**Interviewer 2**	På bordet eller på arket?
200	Participant	På arket.
201	Participant	Også at... Ikke så mye.
202	**Interviewer 1**	Nei, men det med plass tenkte du på?
203	Participant	Ja, fordi at det var liksom ikke så man kunne slett. Eller det var jo sånn. Det er litt vanskeig å forklare. Det var ikke så veldig mye vanskelig men...
204	**Interviewer 1**	Kunne ikke justere størrelsen på bildet, eller skriftstørrelsen.

Figure B.18: Group Interview Transcription, p. 6

205	Participant	Ja, det var litt sånn. Alle bildene var så veldig store så da fikk du ikke plass til det bildet du ville ha der
206	**Interviewer 1**	Ja, kjempefint. Ja.
207	Participant	Også vanskelig for der kunne man ikke trykke på play og så kom det...
208		[Inaudiable]
209	**Interviewer 1**	På papir?
210	Participant	Ja, og så må man bytte
211	**Interviewer 1**	Bytte selv liksom? En person må gjøre det?
212		Var det noe mer eller sitter du bare med hånda di oppe?
213		Var det noe mer dere synes var vanskelig på papir?
214	**Interviewer 2**	Noen av guttene. Har dere noe input?
215	Boy participants	Nei
216	**Interviewer 1**	Nei, men det er greit. Så gikk vi over på data da. Hvordan var det å lage det på data istedenfor?
217		Kan vi begynne med John da.
218	Participant	Det var mye lettere og så gikk det mye fortere.
219	**Interviewer 1**	Var det lettere på data?
220	Participant	Ja.
221	**Interviewer 1**	Hvorfor det?
222	Participant	Alt var sortert mye bedre.
223	**Interviewer 1**	Okei. Hva da mener du? Av bildene og sånn eller?
224	Participant	Nei, det var sånn at hvis du skulle ha en tekstboks så trykt du på den, men hvis du skulle ha en tekstboks måtte du begynne å lete på bordet og sånn.
225	**Interviewer 1**	Ja, at du fant det du trengte?
226	Participant	Ja, mye fortere. Og at man kunne justere størrelsen på det.
227	**Interviewer 1**	Ja.
228	Participant	Det gikk ganske mye kjappere.
229	**Interviewer 1**	Du synes det gikk kjappere du og?
230	Participant	Ja, det var liksom bare å dra inn ting også enda en ting, og så tok en til....og et bilde..og det var det.
231	**Interviewer 1**	Ja, så gøy. Ja?
232	Participant	Det var litt rart. For det vart så ekte.
233	Participant	Ja
234	Participant	Også kan du trykk på ting og så kjem det liksom noe nytt uten at du må liksom skifte alt og så...
235	**Interviewer 1**	Hva mener du med ekte da? Hva tenker du på?
236	Participant	Det så liksom mer ut som om det var en ekte nettside
237	Participant	Ja
238	Participant	På den andre så så det bare ut som en tegneserie eller noe.
239	**Interviewer 1**	Ja ja ja ja, riktig. Ja?

Figure B.19: Group Interview Transcription, p. 7

240	Participant	Det synes æ og.
241	**Interviewer 1**	Det synes du og.
242	Participant	Det virka mye mer ekte når det var på en data så var det som om æ liksom var innpå en nettside. Også trykke æ på der og så kom æ dit æ ville, og sånn.
243	**Interviewer 1**	Ja, ja. Kjempemorsomt! Ja?
244	Participant	Bildene ble bedre også synes æ. Så faktisk litt ekte ut da.
245	**Interviewer 1**	Ja. Du synes det så mer ekte ut på PCen enn på papir. Bildene?
246	Participant	Ja
247	**Interviewer 1**	Eh ja. Når dere skulle lære. Altså jeg hadde jo en rask demonstrasjon her. Var det nok for at dere klarte å bruke det? Hvordan var det å lære å bruke det? For dere hadde ikke brukt det før, ikke sant?
248	Participants	Nei.
249	**Interviewer 1**	Ja, hvordan var det å lære å bruke det?
250	Participant	Det var veldig enkelt. Det var bare hvis du leita etter noe også visste du ikke helt hva det het og sånn. Bare å finne noen ting.
251	**Interviewer 1**	Det var egentlig hvor du skulle lete?
252	Participant	Ja, det var bare så mye.
253	**Interviewer 1**	Ja.
254	Participant	Men det var ganske enkelt.
255	**Interviewer 1**	Men når du først hadde funnet det. Da klarte du å bruke det? Og dere klarte å bytte farger en del av dere på ting.
256	Participant	Eh, jo.
257	**Interviewer 1**	Og fant litt ut av et?
258	Participant	Det var ganske mye detaljer og sånn. Og vanskelig å huske på...
259	**Interviewer 1**	Ja, det var en del detaljer å huske på?
260	Participant	Ja
261	**Interviewer 1**	Ja. Nå står det stille for meg. Er det Tina?
262	Participant (Tina)	Ja. Eh, de første par minuttene så var det litt vanskelig å finne det vi skulle ha, men så fant vi alt sammen.
263	**Interviewer 1**	Ja, ikke sant. For dere spurte jo lite om hjelp på slutten. Da hadde jo liksom alle skjønt hvor de skulle finne tingene de lette etter og sånn.
264		Gutta da? Hvordan var det å lære og bruke det her? John?
265	Participant (John)	Nei, jeg skjønte det nesten med en gang.
266	**Interviewer 1**	Du skjønte det nesten med en gang ja.
267	Participant (John)	Ja. Det var veldig lett å forstå seg på.
268	**Interviewer 1**	Jamen så bra. For det er jo litt viktig at man bruker noe som man ikke må bruke en halvtime på å lære seg liksom. Når man har en så kort da så har vi ikke tid til det da. For det er absolutt programmer som man må bruke lang tid på å forstå.
269	**Interviewer 2**	Kan jeg spørre. Har noen brukt noen lignende programmer, og da mener jeg for eksempel AndroidStudio og lekt seg rundt der, eller Delfi eller sånne ting?
270	Participant	Jeg vet ikke om det er det samme men. Nei det er kanskje ikke det samme nei.
271	**Interviewer 1**	Jo, bare si det. Hva tenkte du på da?
272	Participant	Eh, sånn redigere musikk og sånn.

Figure B.20: Group Interview Transcription, p. 8

273	**Interviewer 2**	Ja, litt.
274	**Interviewer 1**	Ja, sånn ja.
275	**Interviewer 2**	Ja, det ligner litt på det samme for du drar ting inn der også.
276		[Inaudiable]
277	Participant	Jeg har holdt på med programmering av legoroboter.
278	**Interviewer 2**	Ja, det er også litt sånn samme. Drar inn og setter ting sammen for å få.. mhm..
279	**Interviewer 1**	...i lego. Ja?
280	Participant	Jeg hjalp mamma en gang fordi at hu jobbe med sånn interiør og sånn.
281	**Interviewer 1**	Ja
282	Participant	Og da kutter dem sånn filt of da måtte dem liksom ha det på sånn adobe. Noe sånn tegneprogram.
283	**Interviewer 1**	Ja.
284	Participant	Så liksom satt vi inn og så hvordan vi skulle ha det, og så sendte dem det til dem som kutta det da.
285	**Interviewer 1**	Ja... drar inn og plasserte? Ja?
286	Participant	Vi hadde sånne stasjoner i musikken, og da var den ene stasjonen at vi skulle lage en sang og det var nesten det samme for da fant vi liksom hvilken sang vi skulle ha og så tok vi den type musikk og trykka på når de skulle komme.
287	**Interviewer 1**	Ja, kult! Mhm, John?
288	Participant (John)	Jeg vet ikke om det er helt det samme, men 3D-printing. Er kanskje ikke det samme.
289	**Interviewer 1**	Har du holdt på med det?
290	Participant (John)	Ja.
291	**Interviewer 1**	Har du det?
292	Participant (John)	Ja, ikke mye, men jeg kjenner noen som har 3D-printer.
293	**Interviewer 1**	Jaaa.. Kult da! Nei, men vi synes det er veldig spennende å høre om det dere har gjort også så det er helt fint at du sier det. Ja, Hanna?
294	Participant (Hanna)	Ehm, det er en sånn nettside som heter Scratch der man kunne lage spill og sånn.
295	**Interivewer 1**	Ja. Har du holdt på litt med det?
296	Participant (Hanna)	Ja.
297	Other participant	Det har æ også.
298	**Interviewer 1**	Hvem er det som har holdt på med Scratch her? To.
299	Participant	Æ har holdt på med. Eh, kanskje ikke... Er det sånn firkante man trykker
300	**Interviewer 2**	Det er firkanter man drar inn i hverandre ja og så kan man for eksempel få katten til å gå på skjermen.
301	Participant	Eh, nei. Det er ikke det. Det er en annen sånn...man kunne få sin egen verden.
302	**Interviewer 1**	Ja.
303	Participant	Minecraft er jo også noe da.
304		Minecraft ja. Er det mange som har holdt på med det?
305		Alle.. utenom Jane?
306	Participant (Jane)	Joa
307	**Interviewer 1**	Du har egentlig det?

Figure B.21: Group Interview Transcription, p. 9

308		Kjempebra! Eh... Så det var lett å lære seg. Det var lett å bruke når dere kom i gang har jeg skjønt. Ja, Stian?
309	**Interviewer 2**	Jeg har et spørsmål før vi går vekk fra den sammenlikningen. Og det er: hvordan synes dere det var å vise frem prototypene deres på papir i forhold til...
310	**Interviewer 1**	Det kommer vi til etterpå.
311	**Interviewer 2**	Det kommer vi til etterpå? Det kommer vi til etterpå. Unnskyld.
312	**Interviewer 1**	Vi må bare gå litt videre her nå. På tiden og skjønner du. Men hva var det som, var det noe som var vanskelig? Med det dataprogrammet? Alexander?
313	Participant (Alexander)	Tiden. Litt for lite tid.
314	**Interviewer 1**	At dere hadde for lite tid til å lage det ferdig?
315	Multiple participants	Ja
316	Participant	Ingen tvil.
317		For det var jo det dere hadde nesten mest tid på i dag.
318		[Talking simultaneously]
319	**Interviewer 1**	Neimen jeg er jo helt enig i at man kan bruke masse tid altså. Men så gøy at du sier det da, egentlig. For at er det jo tydelig at du hadde lyst til å lage mye. Ja, Hanna?
320	Participant (Hanna)	At av og til var det litt vanskelig å finne de tingene man skulle bruke.
321	**Interviewer 1**	Ja, å finne frem ja.
322	Participant (Hanna)	For vi visste ikke helt hva det het på engelsk.
323	**Interviewer 1**	For det sa du.
324	**Interviewer 1**	Ja, ikke sant, det er det. Tror du det hadde vært lettere på norsk?
325	Participant (Hanna)	Litt
326	Other participant	Kanskje. det er jo ganske kompliserte ord så jeg tror ikke det hadde hjulpet å...
327	**Interviewer 1**	Nei det er det, ikke sant. Det er litt komplisert på nesten hvilket som helst språk og så i norge så bruker du jo de engelske ordene ikke sant, på det.
328		Ehm, da snur jeg arket. Hva var det morsomste i dag? Alexander?
329	Participant (Alexander)	Balsamiq
330	**Interviewer 1**	Balsamiq var det morsomste?
331	Participant (Alexander)	Ja
332	**Interviewer 1**	Rekk opp hånda de som synes det var det morsomste.
333		Okei. Er det noen andre som synes at det var en annen ting som også var veldig gøy? Sånn nesten like gøy?
334		Hva da?
335	Participant	Papirfly.
336	**Interviewer 1**	Synes du papirflyene var morsomme?
337	Participant	Ja
338	**Interviewer 1**	Hvem var det som synes papirfly var gøy?
339	Participant	De som vant.
340	**Interviewer 1**	Nesten alle.
341		Ehm, hvem var det som synes papirprototyping var gøy? Ikke at det var morsommere enn Balsamiq, men... Papirprototyping, det vi lagde.

Figure B.22: Group Interview Transcription, p. 10

342	Participant	Det var ikke sånn spesielt gøy, men det var gøy.
343	**Interviewer 1**	Det var greit ja. Men data var morsommere?
344		Ja, men det er veldig fint å vite, hva som passer best.
345	Participant	Æ synes det var ganke gøy med papir og da.
346	**Interviewer 1**	Du synes det ja. Men synes du det var morsommere enn data?
347	Participant	Det var egentlig helt likt.
348	**Interviewer 1**	Det var like morsomt?
349	Participant	Ja
350	Participant	Æ synes at det var ganske gøy når vi skulle liksom fortelle de andre hva vi tenkte, og liksom hvordan vi ville at det skulle se ut. Og når vi skulle sette inn og hvordan vi ville at det skulle se ut.
351	**Interviewer 1**	Var det når dere hadde de post-itene? Når de kom fra de andre gruppene?
352	Participant	...idéene til stedet der vi liksom ordnet alt, for det var veldig gøy. Uansett om det var på papir eller PC men liksom... idéene.
353	**Interviewer 1**	Når man samarbeidet?
354	Participant	Ja
355	**Interviewer 1**	Jaaaa
356		Det med å få tilbakemeldinger da. Synes du det også var en gøy del av det?
357	Participant	Eh, ja.
358	**Interviewer 1**	Å høre hva andre sa, eller?
359	Participant	Ja. Fordi at hvertfall når dem sa hyggelige ting.
360		[Laughter]
361	**Interviewer 1**	Det er jo fint det. Hanna?
362	Participant (Hanna)	Æ synes det var gøy å se hva de andre hadde laget.
363	**Interviewer 1**	Ja, og ikke bare holde på med sitt eget hele tiden?
364	**Interviewer 2**	Kan jeg spørre: Opplevde dere at når dere fikk feedback eller så de andres idéer at da fikk dere flere nye idéer som endret det dere hadde laget selv?
365	Participant	Ja
366		[Inaudiable]
367	**Interviewer 1**	Skal vi se. Skal vi se nå løper tiden vår.... Eh... Jeg tror jeg bare hopper helt ned, jeg, så vi får tatt det her først i hvert fall.
368		Eh, nå er jeg på det blå spørsmålet.
369	Participant	Er dem til nå?
370	**Interviewer 1**	Ja, nå kan dere spise kjeksen ja! JA!
371		[Laughter]
372	**Interviewer 1**	Ja nå er jo dagen snart ferdig, Ja spis kjeks!
373	**Interviewer 2**	Unnskyld, det glemte vi.
374	**Interviewer 1**	Du kan ta med deg en ja.
375	**Interviewer 1**	Nei, men det blå spørsmålet. For nå har dere jo hatt en idé. Dere har vist den på papir, dere har vist den på PC. Og hvis dere skulle gått tilbake til klassen og vist den til noen andre der, ville dere brukt papirprototypen eller wireframen? Alexander?

Figure B.23: Group Interview Transcription, p. 11

376	Participant (Alexander)	Helt klart wireframen
377	**Interviewer 1**	Helt klart wireframe. Jane?
378	Participant (Jane)	Æ tror kanskje papir.
379	**Interviewer 1**	Ja?
380	Participant	Nei, sånn det samme for jeg synes begge var veldig sånn likt, men jeg ville kanskje fortsatt tatt PCen
381		[Inaudiable]
382	**Interviewer 1**	Eh, ja?
383	Participant	Wireframe.
384	**Interviewer 1**	Wireframe. Hanna?
385	Participant (Hanna)	Eh, wireframe. Det hadde liksom gått greit å gjøre det på papir og.
386	**Interviewer 1**	Men du likte wireframen bedre?
387	Participant (Hanna)	Ja
388	**Interviewer 1**	Ja, Tina?
389	Participant (Tina)	Wireframe
390	**Interviewer 1**	Ja. Og dere som ville valgt wireframen. Hvorfor det?
391	Participant	Hvorfor ikke?
392		[Laughter]
393	**Interviewer 1**	Ja, det må jo de andre svare på da. Ja, Tina?
394	Participant (Tina)	Mmm, det var... Det blir lettere å liksom se det for seg som om det skulle vært en nettside når det er på nett. Når det liksom er digitalt.
395	**Interviewer 1**	Så det med at det var mer ekte?
396	Participant	Ja, det blir lettere å liksom forklare hvordan du vil at det skal se ut, og liksom få deg til det stedet på den måten du vil.
397	**Interviewer 1**	Ja. Eh, Anne?
398	Participant	Fordi det er mye mer ekte og fordi det var morsomt. Det var det som var mest gøy, så da vil jeg heller bruke litt lengre tid på noe jeg synes er gøy.
399	**Interviewer 1**	Åja, så det var morsommere å lage det. Så da ville du heller brukt tid på å lage det, og dele med noen andre. Enn masse tid på papir?
400		Er det noen flere tanker på hvorfor man ville valgt wireframe? med Balsamiq? Ja?
401	Participant	Eh, æ synes det var... jo at det føltes mer ekte fordi at man måtte liksom tenke gjennom litt ekstra. På PCen gikk det liksom litt fortere. Æ fikk kanskje litt flere idéer på hvordan det kan være fordi da ser man for seg en PC eller en iPad
402	**Interviewer 1**	... Ja, Hanna?
403	Participant (Hanna)	Det kan jo hende at de andre skjønner litt bedre hvis du liksom klikker der og så kommer man dit.
404	**Interviewer 1**	Ja, absolutt.
405		Eh, er det noen her som ville valgt papir? I steden for wireframe?
406	Participant	Æ kunne gjort det.
407	**Interviewer 1**	Du kunne gjort det? Ja, hvorfor kunne du gjort det?
408	Participant	Fordi at æ er veldig glad i å gjøre ting på papir da. Sånn i steden for PC.
409	**Interviewer 1**	Ja.

Figure B.24: Group Interview Transcription, p. 12

410	Participant	Ehm, så det kan være derfor at jeg vil, men også at jeg synes at da kan man få...Eller æ synes det var litt lettere for du hadde liksom alt da innpå dataen da sånn at innpå forskjellige filer og det var litt mye detaljer å huske på..huska ikke alt, men det var litt lettere å finne ting når du holdt på med papir for da hadde du alt fremme og så var det kanskje litt lettere å forklare egentlig.
411	**Interviewer 1**	Lettere å forklare til noen andre når du hadde papiret?
412	Participant	Eller det er egenltig det samme tror jeg.
413	**Interviewer 1**	Ja
414	**Interviewer 2**	Jeg har et spørsmål. Eh, hvis dere skulle vist det til lillebror eller lillesøster, hva ville dere valgt da? Ville dere fremdeles valgt Balsamiq eller valgt noe annet?
415	Multiple participants	Ja
416	**Interviewer 2**	Fremdeles på PC?
417	Participant	Ja
418	Participant	Men ikke til lillebroren min.
419	**Interviewer 2**	Da ville du valgt?
420	Participant	Ingenting. For han forstår det ikke. Han er bare to år.
421	**Interviewer 2**	Åh...ganske overrasket.
422	**Interviewer 1**	Ja
423		Jeg må nesten gå videre på neste spørsmålet mitt.
424	**Interviewer 2**	Okei
425	**Interviewer 1**	For vi har bare to minutter igjen før vi slutter. Eh, jeg lurer på det siste spørsmålet, med opplegget idag: har dere noen tanker på hva dere ville ha endret? Altså med alt vi har gjort i dag, er det noe dere synes vi kunne ha gjort annerledes? Vi altså som lagde oppgavene og? Jane?
426	Participant (Jane)	Alt var kjempebra, bare at, kanskje det der med, få bedre tid på wireframen.
427	**Interviewer 1**	Bedre tid på PCen?
428	Participant (Jane)	Ja
429	**Interviewer 1**	Ja, er det noen, John?
430	Participant (John)	Ehm, bare brukt data egentlig.
431	**Interviewer 1**	Bare data?
432	Participant (John)	Ja
433	**Interivewer 1**	Fordi det var?
434	Participant (John)	Mye morsommere.
435	Participant	Begge to synes det.
436	**Interviewer 1**	Er det noen flere tanker om det da?
437	**Interivewer 2**	Jeg har et siste spørsmål, bare så du vet det.
438	**Interviewer 1**	Ja. Ja, kan Stian ta spørsmålet sitt?
439	**Interviewer 2**	Eh, jeg lurer på: synes dere at dere fikk noe ut av å ha gjort papirprototypen først? Tror dere det ville vært like lett å gå rett på PCen? Og ville dere fått det like fint da som å først gjøre det på papir?
440	Participant	Æ hadde ikke lært noe om det her. Æ føler det hadde vært LITT vanskeligere på PCen for æ hadde ikke skjønt hvor alt hadde vært og hva jeg skulle gjøre. Og alt var liksom på en måte en metode for å gjøre det lettere på dataen.

Figure B.25: Group Interview Transcription, p. 13

441	**Interviewer 1**	Ja, ikke sant. Ja, helt riktig. Ja, Jane?
442	Participant (Jane)	Vi fikk liksom øving først.
443	**Interviewer 1**	Ja, at det funka som det. Ja, mhm. Alexander?
444	Participant (Alexander)	Nei
445	**Interviewer 1**	Nei? Du får ta det hvis du kommer på det. Tina?
446	Participant (Tina)	Det var, da kunne vi liksom ta å sette inn alt akkurat som det var på papiret. Sånn oppå dataen. Sånn at det, vi visste hvilke tegn vi skulle ha, vi visste liksom hvilke bilder vi skulle ha
447	**Interviewer 1**	Ja, for da hadde dere liksom gjort tankene på forhånd på papir, og så gjorde dere det på PCen.
448		Da er vi så ferdige som vi kan få blitt nesten, tror jeg. Har Marte noen flere spørsmål?
449	**Interviewer 3**	Jeg lurte på, tror dere at dere unger klarer å gjøre det her bedre enn voksne på et vis?
450	Multiple participants	Ja
451	**Interviewer 3**	Ja, hvorfor det?
452		[Laughter]
453	**Interviewer 3**	Se for dere liksom bestemora deres. Hva er det dere er flinkere på en bestemor?
454	Participant	Kreativt
455	Participant	Vi får fortere idéer. Det har jeg hørt av mamma at "Åh, du er så heldig siden du får alltid idéene så fort."
456	**Interivewer 3**	Ja, kjempekult.
457	Participant	Bestemødre har kommet til å brukt sånn tre år...
458	Participant	Et år!
459	Particiapant	...på å lær seg det programmet.
460	**Interviewer 3**	Ja, hvorfor tror du det?
461	Participant	Fordi dem har bare ikke vokst opp med det. Data og sånt.
462	**Interviewer 3**	Mhm, Tina?
463	Participant	Ehm, vi e mer kreativ og vi får lettere idéer som Tina sa. Og vi har vokst opp med teknologi og, og vi lærer det lettere, det programmet fordi at, vi forstår oss på teknologi.
464	**Interviewer 3**	.. og dere er ikke redd for det på en måte?
465	Particiapant	Nei, for dem voksne bare "Å nei, æh..!"
466	**Interivewer 3**	Ja, de er redd for å gjøre feil.
467	Participant	Akkurat som med språk, det er vanskelig å lære seg et språk som voksen. Men det er lettere å lære språk som barn. Det kan hende at du kanskje har bedre hukommelse når du er mindre, eller at du har bedre, eller husker... Ehm at dem eldre blir litt mer glemsk. Eller at det er litt vanskeligere å lære seg ting.
468	**Interviewer 1+3**	Ja
469	Participant	Det kan også bli sånn at foreldre... at de må alltid ha rett. Dem kan ikke ha noe feil.
470	**Interviewer 1**	Mhm. Ja, det var veldig bra.
471		Da..
472	Teacher has walked in:	Jeg har noen ting som jeg trur er bedre med unga. Fordi at der er dokker som skal være brukeran, ungan som skal bruke det. Så derfor tenker jeg at det kanskje er okei at det er unga som ska bruk, som lager det dem sjøl ska bruk. At for når voksne lager til unga, så er det ikke sikkert det blir like bra for ungan. Sånn tenkte æ kanskje.

Figure B.26: Group Interview Transcription, p. 14

473	**Interivewer 1**	Og det er jo akkurat en av grunnene til at vi er her, og gjerne vil høre hva dere tenker. Fordi som du sier, voksne er jo ikke barn. Selv om man har barn og kjenner barn så er man ikke barn. Nei, men...
474	Teaher	..føler meg om et barn noen ganger...
475	**Interviewer 1**	Ja, ikke sant. Men da kan vi bare, skal vi avslutte?
476		Da er jo tiden slagen og så vil vi si, før der går, jeg tar den etterpå, jeg. Tusen takk for hjelpen i dag, for dere har virkelig hjulpet oss, og dere har vært helt supre med det dere har gjort. Det har væt masse oppgaver på kort tid. Dere har klart det minst like bra som voksne jeg har møtt, og hvis dere er litt slitne nå så er det helt lov, for det har vært intensivt og så kan jo vi ønske dere god jul når det kommer snart. Det er jo snart ferie. Og så håper jeg dere for en hyggelig ferie. For det her har vært kjempefint for oss. Så tusen takk er alt...
477	**Interivewer 2**	Har vi sagt at vi sender dem..
478	**Interviewer 1**	Ja, også skal vi sende til læreren deres de wireframene dere lagde som pdf man kan klikke på. Sånn at dere kan ta det med og vise det til noen andre osv. Det får dere jo snakke med læreren om.
479		Okei, så jeg tror, vi må bare klappe for dere.
480	**Interivewer 2**	Ja
481		[Applause]

Figure B.27: Group Interview Transcription, p. 15

B.4.3 Observation Notes

Observasjonsnotater - 12. desember 2017

1 Elevene svarer på spørsmål: rekker opp hånda slik det burde være

2 Sara forklarer

3 Setting:

4 Prototype oppvarming:

5 Fordeler ulike grupper:

6 Forklarer oppgaven:

7 S- Hvordan se en episode, hva skjer når en episode er ferdig, hva skjer like før rulleteksten. Her er de stille, de observerer og lytter (er helt stille) nikker, "Skjønner dere oppgaven". Bekreftende spørsmål igjen. Dette med gruppene.

8 Elevene har ingen problemer med å forstå hva som skal gjøres. Problemet er å optimalisere tidsbruken. Med skoler så tar ting tid. Limingen kan ta litt tid.

9 De stiller spørsmål.

10 Det er lurt å ha elever med god fungering som kan være effektive.

11 De lager riktige.

12 Går det an å komprimere noe?

13 Noen blir helt ferdige, noen har spilt av litt filmen .

14 De interagerer veldig med materialet både i den originale og den

15 Sticky note session. Det kan vise litt mindre inngående hvordan ting skal gjøres (Dette kan forklares). Det kan være viktig. Det er ingen personlige tilbakemeldinger. Evaluering: (Oransj genser - har mange skjermbilder foran seg. "Det kan hende de kan legge ut skjermbildene på gulvet - begrensningen i pulten). Hvor fruktbare er de faktiske tilbakemeldingene? Hvor mye tilfører barna, tilfører barna noe nytt? De er jo oppdratt i youtube/netflix. Er det reelle ting - hadde barnehagebarn tilført noe helt nytt?

16 Hovedoppgaven

17 NRK super skjer ingen ting. Noen av elevene kjenner seg igjen i det de jobber med.

18 Utfordringen blir kommunikasjon med lærere og å ha to dager vil kanskje være mer ideelt. Eller at lærere kan klare å gjøre dette selv.

19 Opplegget krever utholdenhet og tilpasningsdyktighet. Opplegget krever: noen som har evner til å innhente informasjon og bearbeide informasjon. Personlighet, evner, intellekt, fokus og konsentrasjon, hvis opplegget er kjedelig). Opplegget i dag krever dette. I en normal læringssituasjon ville det være naturlig med oppgaver over lengre tid.

20 TID SOM BEGRENSNING:

21 Ubegrenset tid (normal)

22 Hvor mye primes eleven av å ha jobbet med eksisterende materiale? Begrensning: Muligheter:

Figure B.28: Observation notes, p. 1

Observasjonsnotater - 12. desember 2017

23 Elever som er gode muntlige, som klarer å abstrahere og presentere sine tanker. De følger med på hverandre når hver og en De lever seg inn i hverandre.

24 Noen rakk å begynne på en iterasjon til under presentasjon og feedback fra andre. Sticky notes ble også brukt (stian sin oppgave).

25 Så vi får ikke vanlig skole. "JA! Det her e jo kjæmpeartig"

26 De har fått ting gjort når de vet at de har dårlig tid. De jobber effektivt (både tid og motivasjon spiller nok en viktig rolle der, det er veldig kjent og praktisk) - noe som de bruker i hverdagen hver dag.

27 For en slik workshop vil det være viktig å:

28 Ha en plan, it's not the plan it's the planning".

29 Det å kunne rydde opp underveis og ha det oversiktlig

30 Da Sarah forklarte hva de skulle på dataen, og viste linkingen sammen og at dette kunne testes i presentasjon. Da smilte flere elever til hverandre og begynte å trippe med føttene.

31 "Sjekk hva vi har laget" Høy stemmebruk.

32 Samarbeider godt innad i gruppene, en styrer datamusa, en styrer skriving. Alle fokuseer på skjermene sine og følger med.

33 Når den ene gruppa ble ferdig:

34 "Ferdig!" med tommel opp.

35 Stian prøver:

36 Stian skal se på episode to:

37 De vil jobbe mer i spisepausen det er ikke spørsmål om pause.

38 mens hun hentet maten kikket utover og smilte anerkjendende og sa "Alle er her" som om det var en selvfølge.

39 Return etter friminutt:

40 De gikk rett på dataene, kjeksene som lå rett ved siden av den ene arbeidsstasjonen ble helt oversett.

41 Presentasjon:

42 De holdt presentasjon, de staget det bra fordi de alle hadde bidratt. de klarte å delegere videre.

43 12 år

44 3 gutter, 6 jenter

Figure B.29: Observation notes, p. 2

Observasjonsnotater - 12. desember 2017

45 Flere ganger i uka, noen har egen: 5 har egen PC, de andre bruke. Bruker internett fritt: de har lært flere ting om hva som er greit. De har hatt om nettvett på skolen.

46 Se på ting på, skoleoppgaver, lekser, laste opp bilder og printe bilder, spill, photoshop, drone, chatte med folk /skype og discord, telefonen brukes til info, google classroom, google google google. Shoppe. Musikk, tv

47 En person - lagde det hjemme fikk til å lage noe, etter en måned kostet

48 Noen ganger kan du endre HTML - koden

49 Papir og Balsamiq

50 Det var gøy, enkelt og man kunne gjøre hva en man ville, tegne, mange muligheter. Det var litt enklere på papir det var enklere på papir.

51 Hva var vanskeligst med å lage prototypene, det var ikke plass på arket, Du kunne ikke juster Du kunne ikke interagere enkelt med siden. En person

52 Hvordan var det på data: Det var enklere, og sortert. Du fant det du trengte mye fortere og kunne justere, det gikk kjappere. Det var ekte, Det ser ut som noe som er en nettside, det virket litt som om man var på en data.

53 Du må lete for å finne, men det var lett å lære seg å lete. Man lærer det seg mens man jobber. Det er en del detaljer å huske på, men det gikk bra.

54 De første fem minuttene var det vanskelig, men så lærte de seg navigasjonen. Noen skjønte seg nesten med en gang.

55 Vanskelig: Det var for lite tid (Det var) Det var litt vanskelig å finne frem til hvor man skulle, det hadde kanskje vært enklere på norsk, det er allikevel ganske vanskelige ord.

56 Morsomste:

57 1. Balsamiq, papirfly var morsomt, Data var morsomere enn papir. Noen synes det var likt, det var morsom å fortelle, når man hadde ideene, det å presentere ideene og høre hva de andre sa. I hvertfall når de sa snille ting.

58 2. Hvorfor wireframe? Det var

59 På papir måtte man tenke mer enn på data,

60 Brukeren skjønner det bedre.

61 Litt vanskeligere å rett på,

62 En papirmetode, du fikk en øving først.

63 Vi får fortere ideer,

64 Bestemødre på å lære seg programmet, de har ikke vokst opp med dette.

65 Vi er mer kreativ og får lettere ideer.

Figure B.30: Observation notes, p. 3

Observasjonsnotater - 12. desember 2017

66 AKkurat som språk er det vanskeligere å lære,

67 De er så redd for å

68 Brukere: Lettere om det er unger, at unger lager det de selv skal bruke.

69 Wireframing

70 Presentasjon av prosessen:

71 De sitter helt stille og lytter, alle følger med i blikket.

72 Når oppgaven ble presentert var det noen som stilte spørsmål som var oppklarende. De kikket også på hverandre da sarah viste at det gikk an å lage faktiske knapper og linker, de smilte og etter det begynte de å riste i bena etc (tegn på aktivering/økt spenningsnivå).

Figure B.31: Observation notes, p. 4

B.5 Full Narrative of Thematic Analysis

Workshop Process: Full narrative

Relating to the workshop process, two sub-themes were identified: workshop success factors, and time for wireframing. When asked how the schedule could have been different, the participants reported that they liked the whole process. Four participants would not have changed anything about the day, two would have wanted more time for wireframing, "Everything was really good, only that, maybe, have better time for wireframing" (I, line 426).

When asked what was difficult with using Balsamiq, one participant answered, "The time. Too little time." (I, line313) followed by another participant saying, "No doubt" (I, line 316).

The thematic analysis also brought attention to several aspects of the workshop which contributed to its success. Timeboxing was an intentional part of the workshop schedule, and it was observed that "the [participants] have been able to perform when they know that they have little time. They work efficiently." (ON, line 26). Moreover, "some managed to start another iteration during the presentation..." (ON, line 24).

However, "the problem is optimizing how the time is spent. Things take time in schools. The gluing can take some time." (ON, line 8). "Being able to tidy up as you go, and have a clear overview." (ON, line 29) becomes very important.

Lastly, the icebreaker also proved fun for the participants (GI, lines 335-340):

Participant: Paper airplanes
Interviewer: Did you find the paper airplanes fun?
Participant: Yes
Interviewer: Who found the paper airplanes fun?
Participant: Those who won
Interviewer (counting show of hands)**:** Almost everyone.

Wireframing Preference: Full narrative

The thematic analysis identified two reasons why participants preferred wireframing to paper prototyping. The first reason is how 'real-looking' the wireframes appeared, "It looked more like it was a real web page" (GI, line 236), as opposed to the paper prototype which "just looked like a cartoon or something" (GI, line 238). Some participants were almost surprised at how realistic the wireframes appeared saying, "It is a bit strange, because it looked so real" (GI, line 232) and "It is easier to, like, envision that it should be web page when it is on the web. When it is, like, digital" (GI, line 394).

More specifically, the participants felt the navigation and appearance of the wireframes made them appear more realistic, "The images also turned out better, I think. They actually looked a bit real" (GI, line 244). Another participant described the navigation in this way: "And then you can press things, and then something new will come without you having to, like, change everything and then..." (GI, line 234).

While real-looking says something about how the participants perceived the outcome of wireframing, and why they enjoyed this activity, the other motivating factor, relates to the wireframing tool itself. This aspect is named 'Faster to make' in the thematic map, and several participants reported that they felt the wireframes were faster to make than the paper prototypes saying, "Det var mye lettere og så gikk det mye fortere" (*Translation: It was much easier, and it went much faster.*) (GI, line 218) and "Det gikk ganske mye kjappere" (*Translation: It went quite much faster*) (GI, line 228).

Contrary to the situation with paper prototyping where all the elements were scattered all over the desks, the elements is Balsamiq were organized into categories, "it was like if you wanted a text box, you clicked it [in Balsamiq], but if you wanted a text box [on paper] you had to start looking for it on the table etc..." (GI, line224). The participants felt that "Everything was much better sorted" (GI, line 222) in Balsamiq, and this easy access to elements led to the participants feeling that wireframes were faster to make, "Yes, it was just like dragging things in and then another, and then another...and a picture...and that was it" (GI, line 230).

Another reason for preferring digital wireframing was the ability to resize elements digitally. When creating paper prototypes, the participants were limited by the printed material, and some experienced that "All the images were so big that you couldn't fit the image you wanted" (GI, line 205), and "sometimes, there wasn't enough room" (GI, line 198). On the other hand, if they had first glued an image to the paper, the medium did not allow them to change their minds, "Yes, because it wasn't like you could delete" (GI, line 203).

Observed Motivation: Full narrative

Through the questionnaire and group interview, the children reported that they enjoyed all the activities throughout the day. Together with the observation notes, the thematic analysis identified 'motivation' as an important theme, supported with observations of both both physical and vocal cues.

Some time into the workshop, it became clear to the participants that the workshop would last the whole day, and one of the participants exclaimed, "So we won't have regular school? YES! Because this is so much fun" (ON, line 25).

When the wireframing activity was introduced and Balsamiq was demonstrated, the participants sat in complete silence listening, and paying close attention. When the navigation between pages was demonstrated with buttons etc, the participants looked at each other and smiled, and their legs started trembling.

The participants were allowed to keep working on their wireframes during their lunch break, and when one participants returned from getting her lunch from another classroom, she looked around the room and smiled with acknowledgement, saying, "Everyone is here" (ON, line 38), taking it for granted that everyone was. Moreover, when the participants returned from the break, they returned straight to their computers and continued their work, ignoring completely the biscuits laying right next to one of the work stations.

While wireframing, loud voices were heard with outbursts of, "Check out what we've made" (ON, line 31). When one of the groups had completed their task, they exclaimed "Done!" (ON, line 34), accompanied by thumbs up.

One participant was motivated by the ideas themselves, "whether on paper or computer, it was like... the ideas..." (GI, line 352), and another liked the sharing of ideas, "I liked seeing what the others had made" (GI, line 362).

Participant Background: Full narrative

When trying to determine the participant's previous knowledge of computers, the questionnaire focused on which different activities the participants use the computer for. However, through the thematic analysis it became clear that the participants also use their smartphones extensively, in addition to computers. This theme deals with how the participants use their phones in addition to, or instead of, computers. The participants typically use their phones for streaming content, and communication. Following are four excerpts from the group interview where the interviewer asks what the participants use computers for:

> **Participant:** "And I don't use it very often to search for information"
> **Interviewer:** "No?"
> **Participant:** "...I'd rather use the phone"
> **Interviewer:** "You'd rather use the phone, yes. OK. Why would you rather use the phone?"
> **Participant:** "Mye kjappere og hendiere." (*Translation: Much quicker and more practical*) (GI, lines 87-92)

> **Interviewer:** "How many of you are using Netflix and watch TV and, or music? Like Spotify or Wimp or other things?"
> **Participant:** "I use spotify on the phone."
> **Participant:** "Yes, me too."
> **Participant:** "I use spotify on the phone, but not on the computer" (GI, lines 127-130)

> **Participant:** "I watch TV and such, or things on my phone and the iPad, and spotify on the phone and youtube on the phone."
> **Interviewer:** "Youtube also on the phone?"
> **Participant:** "Yes, and the iPad"
> **Participant:** "Mmm, mostly on the phone because it is so much faster..."
> **Participant:** "And snapchat of course."
> **Interviewer:** "On the phone...?"
> **Participant:** "Yes" (GI, lines 135-143)

> **Interviewer:** "Question. How many of you are using Skype or Messenger or Discord or similar things? On the computer?"
> **Participant:** "And we also use Messenger on the phone." (GI, lines 144-145)

Full narrative continues on the next page...

Participant Background: Full narrative continued

Another sub-theme related to computer usage, was the how the participants relate to the Internet. Regarding their use of the Internet, varieties existed among the participants of how free they are to use the Internet on their own (GI, 27-43):

> **Interviewer:** "Do you also use the internet freely a home?"
> **Multiple participants:** "Yes, we have our own iPads etc."
> **Interviewer:** "Is there someone at home who decides which pages you are allowed to visit?"
> **Multiple participants:** "YES"
> **Interviewer:** "So you're not allowed to do whatever you want?"
> **Participant:** "No"
> **Participant:** "Yes"
> **Participant:** "Most of the time"
> **Participant:** "Æ får jo ikke gå på hva som helst, men dem har ikke sagt noe spesielt. Men æ skjønner at det er en grense." (*Translation: I can't visit just anything, but they haven't sad anything special. But, of course I get that there are limits.*)

The school has also focused on netiquette (GI, lines 48-52):

> **Participant:** "We had a whole week dedicated to netiquette at school."
> **Participant:** "It might even have been a whole month of netiquette at school."
> **Participant:** "It was a week."

Participant Attributes: Full narrative

The purpose of involving children in the design process, and further letting them create wireframes, is discussed in previous chapters. Towards the end of the workshop, however, the discussion moved to having the children themselves explain the benefits of involving children in the design process. Their arguments can be categorised into those that (1) argue why children are an asset to the design process, and (2) the limitations of being an adult in the design process. The answers are largely focused around the use of digital wireframing tools.

Relating to children as assets, the participants stated that they, children, are more creative, and get ideas faster. One participant said, "Det har jeg hørt av mamma at 'Åh, du er så heldig siden du får alltid idéene så fort.'" (*Translation: I've heard it from my mom that 'Oh, you are so lucky because you are always so quick to get ideas.'*) (GI, line 455)

Another participant followed up on these arguments, adding that children have also grown up with technology, "Eh, we are more creative and we get ideas faster...And we have grown up with technology and, and it is easier for us to learn, that program because we understand technology" (GI, line 463).

Regarding adults, the participants felt that adults would take longer to master the digital wireframing tool since they have not grown up with technology in the same way as the children themselves. They also focused on the fact that adults' general ability to learn declines as they get older,

> "Just like with languages, it is difficult to learn a language as an adult. But it is easier to learn a language as a child. You might have a better memory when you are younger, or that you have a better, or remember... Ehm, that older people forget more. Or that it is a bit more difficult to learn things." (GI, line 467)

Lastly, when the participants stated that they understand technology, they agreed with the interviewer that they are not afraid of technology, whereas adults can be: "Nei, for dem voksne bare 'Åh nei, æh...!'" (*Translation: No, because grown ups are just like 'Oh no, ah...!'*). One participant also observed that, "it can also be that parents...that they must always be right. They can never do anything wrong" (GI, line 469).

Full narrative continues on the next page...

Participant Attributes: Full narrative continued

In addition to the children themselves describing what they bring to the design process, the observers noted several specific attributes exhibited by the participants which played a role in the success of the workshop. Some of the required attributes were determined prior to the workshop, and participants were recruited accordingly, such as recruiting volunteers to ensure motivation.

On the other hand, certain attributes were observed on the day which, most likely, impacted the success of the workshop schedule.

First, when explaining the different activities, the participants listened attentively, and nodded when asked "Do you understand the task?". They answered questions when asked, and asked questions themselves. One observer noted that the participants had no problems understanding what to do.

Second, when creating paper prototypes, the participants actively used the material, as well as sticky notes in the sticky note session. Given the short time limits during the prototyping activities, participants who worked well together and who could be effective, would be beneficial in order for the schedule to stay on track and let the participants get the most out of each activity.

Third, the feedback sessions also benefited from participants who were comfortable with speaking in groups, and who were able to present their thoughts, in addition to paying attentions to others.

Fourth, when building the wireframes, teamwork within the groups was successful. In several groups, one controlled the PC mouse, and one controlled the keyboard. All team members had their eyes fixed to the screen and paid close attention to what the others were doing.

Based on the participants' collaboration and paying close attention, all participants were able to contribute when presenting their wireframes to the other groups even if they had not received much time to prepare and rehearse the presentation beforehand.

The observer with a psychology background made the following comment about the required attributes of the participants for this particular schedule with strict time limits:

> "Today's schedule requires endurance and the ability to adjust. The schedule demands: Someone with the ability to collect and process information. Personality, skills, intellect, focus and concentration (if the activities are boring). Today's schedule requires this. One would expect longer time limits for activities in a normal learning situation." (ON, line 19)

The ability to cooperate was important, and when asked what they liked about the day, one participant mentioned cooperation explicitly (I, lines 350-354),

> **Participant:** "I found it quite fun when we were, like, going to tell the others what we were thinking, and, like, how we wanted it to look. And when we were going to put something in, and how we wanted it to look.
> ...
> **Interviewer:** When you were cooperating?
> **Participant:** Yes

B.6 Interviews with NRK Super

NRK Super was interviewed on four occasions after the workshop: 2 structured interviews with written responses, 1 semi-structured interview, and 1 conversation.

B.6.1 Dialog with NRK Super after Workshop (D-ID)

After the workshop, the results and findings were sent to the main contact at NRK Super, and a Skype meeting was set up to discuss the results. The meeting was more a conversation than an interview and the notes from the conversation are included below.

Skypemøte med Nina fra NRKSuper, 07.05.2018

Besvare case?

- resultat ikke så viktig
- gir lite
- rotert bildekarusell: morsomt!
- ikke verdi i seg selv: tenkt på mye før, bekreftelse på ting vi har tenkt før
- mer interessert i timing på når ting skal skje, blir de forstyrret/distrahert av det: ting man må snakke med dem om når man er der, mens de holder på, ting som ikke vises i et ferdig produkt, men i prosessen når produktet utvikles.
- Utviklingsprosessen er mest interessant
- artefactene gir ikke mye verdi ut av kontekst
- dialogen/diskusjonen mens de holder på er det som er interessant: da kan man stille spørsmål, pick their brains, følge opp det de holder på med. Hvorfor-spørsmål.
- Har ikke kvalitetskrav de ser etter
- har ikke jobbet mye med papirprototyping med barn før
- ingen fasit på hvordan det evalueres. Er som sagt, dialogen som er interessant

Jobbe med barn generelt:

- ikke det de gjør/lager som er så viktig, men samtalen vi har med dem
- delta i tankene deres
- brukertesting: ikke nødvendigvis hva de trykker på, men hvorfor/hvorfor ikke?
- var på tur en gang. ikke noe mål, bare bli kjent med brukergruppen. Hadde masse givende samtaler som er veldig verdifullt.
- Dagsbesøk på skole: 2-3 barn per gruppe, intervjuer hele dagen, 1-3 voksne, 1 holder intervjuet, 1-2 tar notater, ofte i samme rom har prøvd å ha ekstern observatør med webcam, men dette er ofte mer distraherende, merker ikke at barn er mer sjenert fordi man er fler voksne i samme rom
- Typiske aktiviteter: evaluere brukerløsninger, brukertester, Hot or Not
- Utrolig viktig at oppgavene er konkrete: regelsett, for mye frihet da løper de bare rundt
- Handler mye om å skape konteksten for at barna åpner seg rundt det man vil ha fokus på, og holder konsentrasjonen oppe lenge nok til at man får noe ut av det: case/papir/wireframing = kontekst for å lage/prate, wireframing: såpass spennende at man kan tyne dem lenger og holde motivasjonen opp. Da kan man få mulighet til flere spennende/innsiktsfulle samtaler

- Google Design Sprint (hva er det?)

Hva er nyttig med papirprototyping/wireframing?

- at de holder seg motivert lengre
- har ofte brukerintervjuer, ca 20 min
- dette er aktiviteter som gjør at barna kan konsentrere seg lenger: og da kan man snakke med dem underveis, kan ha egne hypoteser i forkant som man kan se etter/probe etter/skape dialog rundt/få barna til å tenke på.

Wireframing positivt?

- så mer ekte ut
- Nina erfaring: barn liker ikke å se seg selv danse/synge
- har et annet bilde av seg selv i hodet enn det som kommer til uttrykk
- wireframing gjør at det ser mer ekte ut, resultatet de produserer ligner mer på idéen de har i hodet, får til det de vil (eks: snømann innsending)
- barn kan ha en idé, men blir ikke fornøyd med det de lager
- verktøyet gir en stolthet
- føler seg mer som voksne/designere
- fantasi vs virkelighet -> klarer ikke få til det samme
- wirefamingverktøy, gjør at deres design ikke skiller seg så veldig fra voksnes design
- føler kanskje at de får til mer? (fordi det ser bedre ut?)
- blir ikke begrenset av egne ferdigheter?

Papirprototyping, positivt:

- klipp og lim, kommer på samme nivå
- ikke en voksen som intervjuer barn

Bekymring

- tid brukt vs resultat
- mye tid på forberedelse, etterarbeid
- input fra få brukere, 9 stk (3 grupper)
- noen ganger har de knapt tid til brukertesting
- må brukes i en prosess der man har god tid
- tenk på
  - hvordan effektivisere forarbeid? (etterarbeid?)
  - tidsbesparelse?
  - bedre med 5-6 grupper
  - får mer innsikt
  - ser ofte mønster etter 5-6 grupper. Litt vanskelig med 3 grupper
  - kjøre over 2 dager á 3 grupper
  - unngå smitteeffekt
  - dobbelt så mye utbytte for bare en ekstra dag, større sample
  - tester ofte på feil ting: eksempel innsending til Super, ingen klarte det, tilbake til tegnebrettet
  - er ofte overraskelsene som er interessate
  - da er det fint å kunne teste på dem også, når man oppdager dem

  - teste på 3 grupper først, få input, redefinere hva vi vil se på, teste på nye grupper
  - frivillige: ikke representativt utvalg for hele målgruppen. NRKSuper gjør også dette, men husk å snakke om det som en limitation/lesson

- svarte ikke på caset
- vi pushet dem ikke til å svare på caset,
- men lot dem holde på
- metoder for å hanke dem inn igjen?
- er dette ønskelig? er det bedre å bare la dem holde på? og fokusere på dialogen/diskusjonen?

Nina tanker:

- ville prøvd å få det til i en prosess med god tid
- interessant som workshop teknikk
- ta imot resultatet(?)
- morsomt at barna var motivert av å ha NRKSuper som (kunde?)
- finne tallverdier. Soft idéer trenger tallverdier for å kunne overbevise andre (argumentere). -> noe som kan måles
- måle antall klikk

B.6.2 Structured Interview with NRK Super (W-ST and W-ID)

Another interaction with NRK Super was in the form of a structured interview with written responses. The main contact for the project at NRK Super had, by this point, moved on to other projects, so the questions were sent to both her and the remaining development team at NRK Super.

Below follows the interview guide with the responses from both. The first answers are by the individual interaction designer (ID) (the main contact person for the project). The second set of answers are by the development team at NRK Super, Superteam (ST).

Systemutvikling

1: Hvordan er dere organisert når det gjelder systemutvikling? Hvilke roller har dere? (UX designere, frontend utviklere etc)

ID: Teamet (Superteam) består av rollene 1 produktutviklingssjef (intern), 1 teamleder (intern), 1-2 konseptutviklere (intern), 1 digital designer (intern), 3-4 nettutviklere (inkl 1 DevOps - alle interne), 1 drifter (intern, deles med flere team), 2 utviklere for Android (1 konsulent, 1 intern), 2 utviklere for iOS (2 konsulenter). En av utviklerne, pr dags dato en nettutvikler, har også tittelen Tech Lead og har ansvar for samarbeid rundt tekniske løsninger på tvers i NRK. Alle teams har en tech lead, som har egne møter. Produktutviklingssjef (PUS) bestemmer retning og strategi, ofte kalt fokusområder. Teamleder har ansvar for å organisere teamet, jobbe med metode og strukturering av oppgaver. Tar også mye av kommunikasjonen med andre team og avdelinger i NRK. Konseptutvikler samarbeider tett med PUS for å mene noe om retning og strategi med fokus på brukeropplevelsei, og har ansvar for å konseptualisere og gjennomføre det et fokusområde består av - kan være alt fra

innsiktsarbeid, input til strategi, flytte/endre på en knapp (og tilhørende beslutningsgrunnlag), nye redaksjonelle konsepter, videreutvikle publisering av tv-programmer osv. Som regel etter klassisk designprosess, hvor man velger antall faser litt ut fra hva man har tid til. Si fra hvis jeg skal skrive mer om det. Konseptutvikler har ansvar for brukeropplevelse, og å konkretisere strategiske mål og sette dem ut i livet. Digital designer bistår Konseptutvikler, og har ansvar for å detaljere og spesifisere grafiske detaljer. Også ansvar for å følge og videreutvikle grafisk profil, og det grafiske uttrykket. Konseptutvikler og digital designer jobber svært tett sammen, og er litt personavhengig hvordan man fordeler arbeidsoppgaver. Samarbeidet med utviklerne har vært veldig tett, med lav terskel for å spørre hverandre hvis det er noe man lurer på, noe som er uklart, eller noe som man ser kunne vært løst på en bedre måte basert på ens egen fagkunnskap. Det har vært litt ulikt hvor langt de ulike plattformene er kommet i utvikling (nett, iOS og Android), hvor appene har vært video-avspiller (internt utviklet, originalt av konsulenter) og separate spill (eksternt utviklet - av Agens). Det gjør at det ofte har vært ulike utviklingsprosjekter på de ulike plattformene.

ST: 1. Vi har en produktutviklingssjef som har overordnet ansvar for brukeropplevelse, fremtidsrettet konseptutvikling og strategisk retning for NRK Supers tjenester. Vi har en teamleder som har ansvar for å kjøre smidig prosess. Vi har to konseptutviklere som har ansvar brukeropplevelsen i samarbeid med produktutviklingssjef. Vi har en digitaldesigner. Vi har en teachlead som har ansvar for teamets komponenter og kvaliteten på disse. Vi har to (kanskje 3) frontendutviklere, 1 backendutvikler, 1 devops, 2 android-utviklere og 2 IOS-utviklere.

2: Er det kun intern utvikling? Leier dere inn konsulenter?

ID: Se parantes bak hver rolle i 1).
ST: 3 av mobilutviklerne er innleide konsulenter og resten er fast ansatte.

3: Hvilken utviklingsmetodikk bruker dere? Smigid? SCRUM?

ID: Jeg er litt usikker.... Når jeg startet kjørte vi en slags egentilpasset metodikk. Det er litt komplisert fordi vi som regel jobbet med flere løp samtidig, både langsiktige utviklingsløp og kortsiktige. Og det vi kalte daglig drift som var daglig oppfølging av de som publiserte innhold. Vi har jobbet med veldig overordnede brukerhistorier, som ikke følger noe satt format. Det er mer "huskelister" som er satt opp i det jeg tror er et KANBAN board. Det er ofte et samarbeid mellom å sette opp oppgaver. Husker ikke helt hva kolonnene heter, eller hva slags "regler" det er for når man flytter mellom dem.

ST: 3. Vi kjører smidig metodikk med fokus på kontinuerlig forbedring. Vi planlegger 4 måneder av gangen, og hver fredag setter vi oss mål for neste uke basert på hva vi allerede har i backloggen. Når vi setter oss ukesmål kjører vi også en kjapp evaluering av uka som gikk og hva vi kan gjøre bedre neste uke. Vi har mer grundige retroer med jevnt mellomrom.

4: Når involveres utviklerne i designprosessen?

ID: Jeg foretrekker å samarbeide med utviklerne så tidlig som mulig, og ha så tett kontakt at det blir tverrfaglig samarbeid hele veien. Men det er jo ofte mest avsjekker med utviklerne når det handler om innsikt og spesifisering (obs! Overføring av det man har lært og årsaken til de valgene man har tatt må overleveres), noen ganger er de veldig delaktige når det kommer til strategi- og idemyldring. Når det handler om spesifisering og detaljering, jobber man som regel veldig tett sammen - det utvikles som regel samtidig. Når ting ferdigstilles jobber man parallelt med testing, hvor designere er tungt inne (intern testing). Brukertesting etc rullerer man ofte hvem av utviklerne som er med.

ST: 4. Utviklerne involveres helt fra start som sparringspartnere for konsept/design rundt hva som er mulig å få til.

Prosjektleder

5: Hvem er prosjektleder

ID: Det er ikke ett svar på det, det avhenger av prosjektet. Teamleder er ofte prosjektleder, men veldig ofte drives et prosjekt framover av teamet. Min opplevelse er ofte at konseptutvikler har mye ansvar for framdrift og planlegging, mens hele teamet tar felles ansvar for å komme i havn til deadlines.

ST: vi har ikke prosjektleder, men i noen redaksjonelle prosjekt har vi behov for dette. Da kjører konsept ledelsen fram til utvikling starter og da tar jeg over arbeidsledelsen.

6: Hvem bestemmer hva som skal lages?

ID: Produktutviklingssjefen i samarbeid med ledelsen i NRK Super + Medieutvikling, men teamet kommer med innspill til hva man synes er viktig basert på sitt eget fagområde. (feks kan en konseptutvikler komme med forslag basert på brukerinnsikt/markedsundersøkelser, en utvikler kan komme med forslag basert på endringer i teknologi) Innholds- og publiseringsmiljøet kan også komme med forslag til hva de synes er riktig å gjøre framover.

ST: PUS/konsept/ledelsen i Super

7: Hvem bestiller software/betaler internt?

ID: Hmm. Skjønner ikke helt hva du mener, men teamet finansieres hovedsaklig av NRK Super - tror noen stillinger muligens er finansiert av Medieutvikling.

ST: Super betaler for endel av teamet

8: Når er et produkt ferdig/Hva er bra nok/Hva er kvalitet?

ID: Det blir aldri ferdig - eller aldri bra nok :) Det er alltid potensiale for videreutvikling, når marked og teknologi beveger seg og endres. Kvalitet/mål baseres på strategien til NRK Super, NRK og NRK Medieutvikling.Kvalitet kan feks være brukeropplevelse,

nedetid eller hurtighet. Det kommer veldig an på hva slags delprosjekt det er snakk om.SI fra hvis det er noe jeg skal spesfisere nærmere.

ST:

9: Hvilken rolle spiller wireframes/prototyper/skisser i designprosessen?

ID: STOR! Jeg liker best å skisse på papir først, før jeg går over til typisk Sketch og jobber med "bokser"/wireframes. Ofte tar jeg et screenshot i bunnen for å gjøre det raskere å jobbe, også jobber man gradvis mer og mer detaljert oppå til screenshoten er helt borte. Ferdigstilling skjer i en slags kombinasjon av Adobe og Sketch, litt avhengig av hva slags grafiske filer som er nødvendig å lage. (Illustrator blir en del brukt)

ST:

Barn

10: Hvordan inkluderer dere barn i designprosessene i dag?

ID: Hovedsaklig som innsikt/brukerundersøkelser/intervjuer i forkant/tidlig stadie. Og så til evaluering/brukertesting for å kvalitetssikre et konsept, eller evaluere en ferdig løsning. Jeg har alltid vært veldig nysgjerrig på mer co-creation, men det har ikke vært mulig å gjennomføre i tiden jeg har vært der.

ST: Vi har brukerteseter, gjerne på skoler. Vi har forberedt oppgaver slik at vi kan observere i stedet for å ha intervju. Tre og tre inne sammen så de kan snakke seg imellom. De gjør oppgaver, og snakker litt rundt det. Lite sprøsmål av typen «hva synes du?» Da vi jobbet med søk, ga vi dem i oppgave å finne et konkret program. Så får de tilleggsoppgaver basert på hva de gjør. Det siste prosjektet vi har er for jenter, 12 år. Der har vi hatt både brukertest og intervju med spørsmål som «hva synes du?» siden vi tenker at barn i den aldersgruppen kan bidra litt mer på det punktet.

11: Hvilke erfaringer har dere med det?

ID: Det er utrolig viktig å snakke med brukerne! Barn eller voksne. Samarbeider man ikke med brukerne, kan man ende opp med å gjøre ting som bare blir helt feil ("cringe"), ikke fungerer, brukerne ikke skjønner - eller man løser feil problem. Barn er veldig gøye og jobbe med! Elsker hvordan hodene deres fungerer.

ST: Det har fungert godt å jobbe slik vi har gjort. Det fungerer godt å ha med utviklere i tillegg til designere, slik at vi har samme utgangspunkt for å jobbe. Små barn kan miste konsentrasjonen fort, og begynner å konsumere innhold. Mange barn vil være snille, ønsker å please oss.

12: Hva savner dere? Hva skulle dere ønske dere kunne gjøre mer av?

ID: Alt! Skulle ønske man hadde bedre tid underveis. Det blir mye hurtig arbeid, fordi NRK og NRK Super er i en periode med store endringer, og det skjer store endringer i produktene. Det har også vært veldig stor teknisk gjeld, som gjorde

at det har vært mye vedlikehold/etterslep, som har senket tempoet underveis. Det har også vært mye fokus på å bygge opp teamet og organisasjonen, og få til et bra samarbeidsmiljø i organisasjonen.

ST: 14. Vi savner kanskje at barna skal kunne mene mer. Å gjøre mer av observasjoner i naturlig setting. Dette er tidkrevende og det krever mye å få tilgang til et representativt utvalg av barn. Hva skulle dere dere ønske dere kunne gjøre mer av?

13: Har det å involvere barn noen annen verdi utover det å lage gode produkter? Image? reklame?

ID: I kontakt med brukerne er man jo en forlengelse av merkevaren, og det er jo utrolig viktig at de vi er i kontakt med sitter igjen med et positivt inntrykk av oss. Det handler kanskje ikke så mye om image og reklame (vi kan jo ikke reklamere), men at vi tenker at når vi er "ute" så er vi representanter for NRK Super, og da er det viktig at de tenker at det var en god opplevelse, og at vi var fine folk.

ST: Det kan ha noe å si for omdømmet til NRK Super, både i skolen og blant barna.

B.6.3 Semi-Structured Interview with NRK Super ((mm:ss))

After having discussed the findings with the main contact person for the project and received written responses to questions relating to NRK Super's 'context of design', a semi-structured interview took place through Skype. First, a presentation of the thesis and workshop was presented, and then the interview was used as an opportunity to further discuss the results and NRK Super's answers to the written questions. The interview guide for the semi-structured interview is presented below.

Interview Guide for Semi-Structured Interview with NRK Super

Oppfølging: involvere barn

1: Hva begrenser dere når det kommer til å involvere barn i designprosessene?
2: Hvordan bruker dere resultatene fra involvering av barn i det videre arbeidet?
3: Har dere selv frihet/ressurses til å trekke inn barn underveis?

Barn og Wireframing

4. Hvordan kan wireframing inngå i utviklingen av web/app-løsninger (hos dere)? - Kan det i det hel tatt inngå?
5. Hvilken nytte kunne det eventuelt ha for dere?

Spørsmål basert på observasjoner med annen interaksjonsdesigner fra NRK Super?

Påstand: Ikke det de lager, men samtalen er viktig.
Spørsmål: Hvordan kunne denne diskusjonen blitt annerledes dersom barna selv designet?

Påstand: Med wireframing kan barna holde konsentrajsonen oppe mye lenger enn i et vanlig intervju.

Spørsmål: Ser dere en nytteverdi i det?
Spørsmål: Hvordan er barna med på å definere hvilke *nye* produkter som skla skapes?

Påstand: Barna designer/skaper selv.
Spørsmål: I hvilken grad kan case/papir/wireframing fungere som kontekst for å prate?

Påstand: Verktøy gir stolthet.
Spørsmål: Klipp og lim er ofte brukt for å få voksne ned på samme nivå som barn for å samarbeide på lik linje? Wireframing kan løfte barna opp på samme nivå som voksne. **Pros and cons?**

Transcript of Semi-Structured Interview with NRK Super ((mm:ss))

Following is the transcript of the semi-structured interview carried out with Superteam after presenting the findings of the workshop. The beginning, and concluding, remarks of the interview are not transcribed.

Transcript of Semi-Structured Interview with Superteam

Duration: 37:21

Date: June 7th, 2018

(I = Interviewer, ST = Superteam)

Timestamp		
03:01	**I:**	Basert på det dere har hørt nå da. Dere har jo allerede sagt litt om det. Kunne wireframing som aktivitet inngått i noe av deres måte å involvere barn på? Altså kunne det i det hele tatt vært interessant? Nå snakker jeg veldig tenkt. Ikke at dere skulle gjort det i morgen liksom.
03:19	**ST:**	Hvordan besvarer vi dette...vi er tre stykker med litt forskjellige roller så det er litt sånn. Hvem av oss kan svare på dette egentlig. Kanskje Berit, at du vil begynne eller?
03:32	**ST:**	Ja, jeg bare vet ikke helt hva jeg skal svare. Fordi at jeg synes det...
03:43	**ST:**	Jeg tror at litt av utfordringene våre er at en sånn type innvolvering må være ganske tidlig i et prosjekt. Men tidlig i et prosjekt med et klart mål på en måte.
04:03	**ST:**	Og sånn som vi har gjort det nå så er det bare innsikt, også....noe greier, og så har vi testa det, også har vi gjort...basert på innsikten...
		...
05:28	**ST:**	Du merker at vi er litt sånn ute etter hvilken oppgave er det som ville vært bra.
05:33	**ST:**	Hvis jeg skal si noe ut fra min vinkel så er det jo sånn at vi har en veldig bred porteføljе. Og det innebærer at det er veldig sjelden at vi kan jobbe med...Vi har vært nødt til å skifte fokus på ulike deler av portføljen frem til nå.
05:53	**ST:**	Jeg antar at det kommer til å bli stadig bedre og at får lov til å jobbe mer konsentrert over tid, men vi har ikke hatt anledning til å skulle jobbe med for eksempel videreseeing over en veldig lang periode.
06:04	**ST:**	Eh, også har vi også at kompleksiteten at vi har jobbet med redaksjonelle prosjekter med eksperimenter hvor du kanskje ikke har helt liknende, helt sammenlignbare tilbud på markedet rett og slett da på en måte...Eh akkurat sånn som det vi skal løse det. Så det er noe med...
06:23	**ST:**	Vi må jo bruke det når det er relevant for oss. Jeg ville jo aldri valgt det hvis, vi velger jo alltid den brukertestmetoden som vi mener at er hensiktsmessig.
06:34	**ST:**	Og vi driver jo med en...noen ganger med evolusjon og noen ganger med litt sånn brudd, eller hva skal jeg si, hvor vi gjør større hopp.
06:45	**ST:**	Så på en måte så kjennes det kanskje ut som vi hadde hatt bedre overskudd til det hvis vi hadde hatt et sånt stor-prosjekt.
06:54	**ST:**	...Enn det at vi holder på med alt vi må bale med nå da.
06:59	**ST:**	Jeg tenker jo også at det er ressurskrevende og det kan gi veldig mye hvis vi liksom har tid og ressurser til å forberede godt og...sett av tid da.
07:09	**ST:**	Det er kanskje mest det med tid og ressurser...
07:15	**ST:**	Det jeg også lurer på er kanskje det kunne fungert i prosjekter hvor det ikke finnes sammenlignbare løsninger.
07:22	**ST:**	Altså sånn i dette tilfellet så du jo på netflix og youtube og sånne ting og fikk inspirasjon derfra.
07:31	**ST:**	Kunne man mer sånn gitt dem en problemstilling 'dette vet vi ikke hvordan best løses'. Hvordan hadde de taklet det?
		...

Figure B.32: Transcript of semi-structured interview with Superteam, p. 1

09:52	**ST:**	Min umiddelbare mageføelse er at det er så mange spørsmål knyttet til wireframing for oss for at i utgangspunktet så er kanskje ikke metodikken så egnet for målgruppa vår. Vi kan bare bruke den på den aller aller øverste delen av målgruppa.
10:08		Så det er på en måte det første som avgjør om vi kan eller ikke for vi vet ikke om barna er i stand til å faktisk ta det i bruk så langt ned i alder som det er behov for.
10:17	**I:**	Mhm
10:18	**ST:**	Ehm,
10:20	**ST:**	Så er tidliger erfaring fra før jeg begynte hos NRK Super så jobbet vi litt med co-creation helt i starten
10:27	**I:**	Ja
10:28	**ST:**	Og erfaringen min med barna da var det at når man ber dem om å være medskapere så kommer de veldig fort opp med referanser til favorittspillene sine eller til... de har vondt for å lage noe som ikke allerede finnes fra før av i komersielle spill for eksempel. De sier egentlig bare 'dette liker jeg veldig godt' er det du får ut av dem. Og det visste du egentlig på en måte fra før av.
10:53	**I:**	Ja
10:54	**ST:**	Så det vi hele tiden etterstreber når vi lager oppleggene våre er jo på en måte 'OK hva er det vi virkelig har behov for å få svar på' og hva slags type metode er vi nødt til å bruke for å få svar på det
11:05	**ST:**	Og så velger vi metode ut fra det igjen
11:08	**ST:**	Sånn at for meg så ville det vært veldig unaturlig å velge samme metode hele tiden og det største spørsmålet rundt akkurat wireframing som er ditt ...er jo at det sannsynligvis ikke er et veldig egnet verktøy for oss på grunn av at det blir for snevert
11:26	**I:**	Ja ja ja
11:27	**ST:**	Men at det kunne vært interessant å prøve, altså jeg tenker at idét det dukker opp et relevant case, så vet vi om det og ville brukt det.
11:36	**ST:**	Men inntil det så vil det ikke bli tatt i bruk da på en måte. Men fordi at du har gjort denne oppgaven så har du jo bevisstgjort oss rundt muligheten
11:46	**I:**	Ja
11:47	**ST:**	Men erfaringen min til nå utfra hun forskeren som du snakket om med de sirklene er det at det å bruke barn som informanter
11:56	**I:**	mhm
11:57	**ST:**	gjennom at du gir dem veldig konkrete oppgaver og gjennomtenkte oppgaver hvor de gjør noen ting og du hører hva de tenker mens de gjør det og hva de lurer på og hva som er uklart og hvorfor de havnet om de gjorde er det jeg mener at vi har fått størst utbytte av
12:12	**ST:**	eh, mens design-partner har jeg til nå ikke egen erfaring med at jeg har fått stort utbytte av
		...
13:41	**ST:**	Du lurte jo også på hvis vi først skulle hatt en sånn session med wireframing om det hadde vært interessant å kjøre over to dager da da...
13:51	**ST:**	Og det tenker jeg kan være fint siden du hadde...[inaudiable]...tid på forberedelse og sånn.
13:57	**ST:**	ja, også til det du sa også med at hvis du skulle fått et godt resultat så...[inaudiable]...mer tid til diskusjon...[inaudiable]...tid med gruppa.
14:05	**ST:**	...enten man da har samme gruppa over to dager sånn at den...eller om man har to foskjellige grupper...begge deler kan jo gi verdi
14:15	**ST:**	Og så tenker jeg også wireframing eller co-creation på andre måter kan jo også være interessant å...ja, som en slags sånn hybrid da mellom informant og deltaker

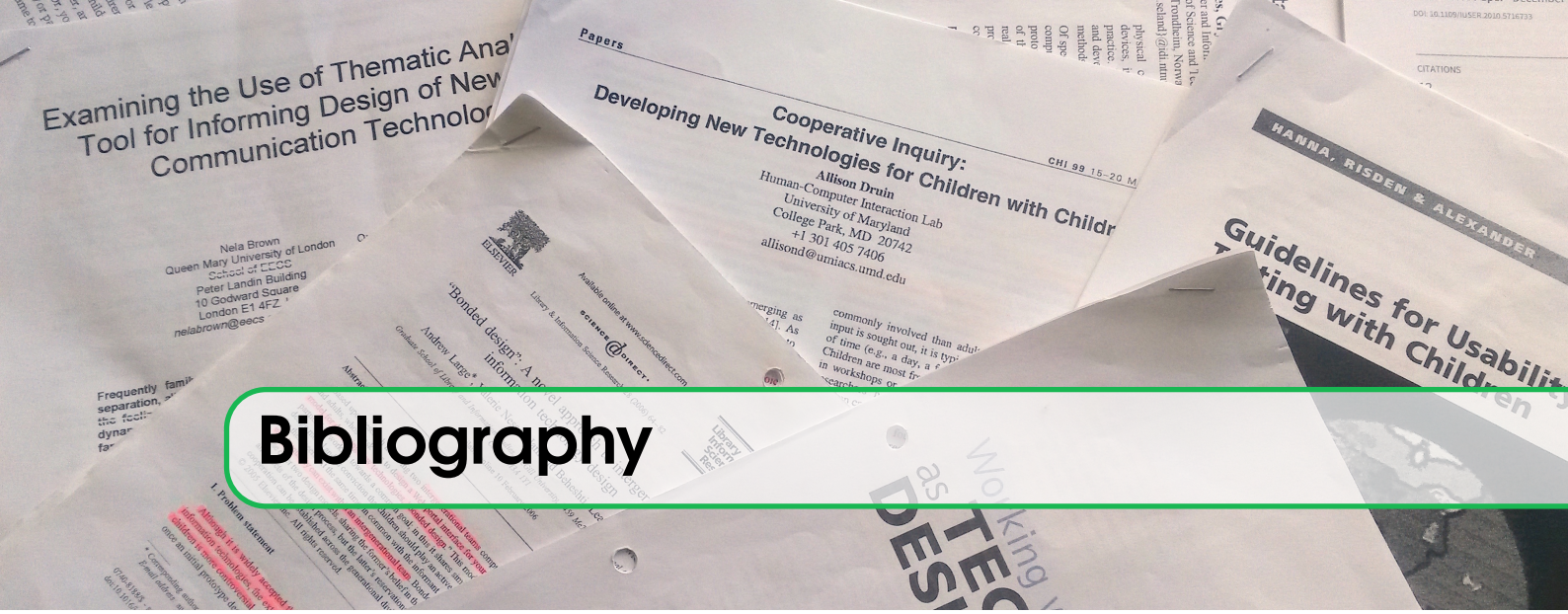
Figure B.33: Transcript of semi-structured interview with Superteam, p. 2

14:30	**ST**	Du skal ikke nødvendigvis sette opp din egen nettside, men du kan for eksempel...Det er jo litt det vi gjør med brukertester også 'Hva ville du valgt av sånn og sånn'...
		...
15:45	**I:**	Hvordan tror dere at diskusjonen hvis du ser på verdien som diskusjonen og ikke produktet, tror dere den diskusjonen kunne blitt annerledes, kunne dere fått andre ting ut av en sånn diskusjon enn et vanlig innsiktsintervju eller en vanlig prat under brukertest? Skjønner dere hva jeg mener? Ville det laget grobunn for andre typer problemstillinger torr dere?
16:07	**ST:**	Det ene er jo at vi jobber jo litt med å få barna til å faktisk være ærlige og oppriktige.
16:12	**ST:**	Og det er vanskelig å vise sånn 'her er noe jeg har laget, vær så snill si at det er dårlig'
16:16	**I:**	Ikke sant
16:19	**ST:**	...Sånn man kankje kunne ha unngått da med å ha en annen approach.
16:25	**I:**	Mhm
16:28	**ST:**	Det kan jo være at man hadde fått tak i en annen, altså at startpunktet vårt hadde blitt påvirket. Det er et godt poeng i det.
16:35	**ST:**	Og fordi at hvis du starter med brukertestingen så har du på en måte allerede gått inn i en hypotese...
16:41	**ST:**	Så hvis du starter opp mer med et innsiktsarbeid sammen med barna så kanskje de rett og slett har et annet fokus enn hva...
16:55	**ST:**	Så kanskje akkurat i innsiktsarbeidfasen at det kunne vært. Det kjentes ut som det kanskje kunne vært det mest verdifulle stedet i prosessen å gjøre det. Og se på det som et verktøy for innsikt mer enn et verktøy for å komme opp med...co-innsikts...
		...
19:18	**I:**	Mens at wireframing kanskje er en måte å få barna opp på voksnes nivå. Skjønner hva jeg mener?
19:25	**I:**	For jeg tenkte liksom på ja men hvis begge klarer og de er på lik linje hva er vitsen med wireframing da. Det fungerer jo helt fint med papirprototyping, men at det kan være en slags forskjell.
19:33	**I:**	Tror dere det kan ha noe å si da? Er det noen forskjell på om du tar de voksne ned 'nå er de voksne nede på vårt nivå' eller om 'nå er vi kommet opp på de voksnes nivå'. Skjønner du hva jeg mener?
19:43	**ST:**	mhm
19:47	**ST:**	Det er jo en måte for dem å kunne utrykke seg mer da som også du var inne på.
19:54	**I:**	Ja
19:55	**ST:**	De får på en måte formidlet mer ved å bruke voksnes verktøy
19:59	**I:**	Ja
		[inaudiable]
20:05	**ST:**	...Kan komme opp i andre diskusjoner...
20:42	**I:**	Er det på noe tidspunkt at barna er med på å definere...altså 'nå skal vi lage et nytt produkt, hva skal vi lage? Jeg vet ikke', og så ta med barna allerede der da? Har dere noen gang gjort noe sånt eller er det alltid at de voksne/det derre desing teamet har idéer, og så trekker man inn barna. Eller kan barna være med helt fra start? Har dere noen tanker, eller har dere prøvd det noen gang i det hele tatt?
21:06	**ST:**	Så langt så har vi jo ikke laget noen ting helt fra scratch da på en måte.
21:10	**ST:**	Deler av de eksisterende produktene som vi...
21:16	**ST:**	Så det å starte helt på scratch er det jo ikke så ofte man egentlig gjør...
21:20	**I:**	Nei, det er sant.
21:24	**ST:**	Før vi begynte så ble det utviklet en Fantorangen-appen...og hvis man utvikler sånne typer produkter så er det jo naturlig.

Figure B.34: Transcript of semi-structured interview with Superteam, p. 3

21:38	**ST:**	Men det er veldig ofte at vi... For oss så er det naturlig i prosessen at det dukker opp en problemstilling som vi er nødt til å ta tak i.
21:45	**I:**	Ja
21:45	**ST:**	Så det er ikke sånn at du starter på bar bakke. Det er jo at du skal prøve å lykkes i markedet
		...
24:13	**I:**	Helt i starten før oppgaven var satt og jeg snakket med Nina, så sa hun at det var spennende at jeg ville target de eldste fordi hun synes at det var en målgruppe som var vanskelig å nå. Det var en av tingene hun sa. Og det å se på teknikker for å nå dem kunne være spennende. Og når du også sier at wireframing kanskje ikke er direkte relevant fordi det er så snevert på de eldste, altså kunne det da allikevel vært interessant fordi det da nettopp blir noe for de eldste som kanskje ellers synes at mye av spekteret som NRK Super står for blir jo for mange små barn fordi NRK Super skal jo target alle de små. Skjønner du hva jeg mener? At det blir noe annet for dem da? At kanskje de kna være med på co-design og co-creation på en annen måte enn de minste kan?
25:11	**ST:**	...så sier du at om wireframing kan være særlig interessant for den eldste målgruppen? Svaret på det er jo ja, så selvfølgelig er det jo mye mer interessant for den eldste målgruppen enn den yngste.
25:25	**ST:**	Så svaret mitt i sted dreide seg jo egentlig om at fordi at, for eksempel akkurat nå så skal vi holde på med de yngste så, vi må jo bruke den når den er relevant
25:37	**ST:**	Ikke sant. Den er ikke avvist som irrelevant. Det er bare det at den sjeldnere vil være egnet for oss enn hvis vi bare hadde hatt...
25:49	**ST:**	Hvis vi får i oppdrag å skulle jobbe spesielt med den eldste målgruppen for å sikre oss at vi klarer å nå dem, så tenker jeg jo at da er det interessant å plukk opp konseptet.
26:00	**I:**	Så jeg bare lurer sånn veldig generelt på når dere involverer barn, hvilke begrensninger har dere på å involvere barn? Jeg tenker på tid, penger, ressurser altså eller får dere gjort det dere vil på en måte?
26:16	**ST:**	Tid!
26:17	**I:**	Tid ja
26:19	**ST:**	Tid, sånn at vi prioriterer det da.
		[Inaudiable]
26:28	**ST:**	Og så er det jo deres tid og på en måte...De er på skolen i vår arbeidstid. så hvis vi skal ta det i vår arbeidstid så er det jo gjerne mot skolene. Hvilket gjør at de er allerde i skolesetting...[inaudiable]
26:48	**I:**	Ja, er det mest i skolesetting at dere har, jobber med brukere? Eller når er det vanligst for dere å innvolvere bruker? Altså nå snakke jeg om tid på døgnet liksom.

Figure B.35: Transcript of semi-structured interview with Superteam, p. 4



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