Social discovery and information sharing in sport climbing

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0 ABSTRACT

In this report I examine current practices of knowledge sharing in the climbing community. Through the use of co-design methods ideas are developed and brought out by the community. The role of the interaction designer becomes the enabler for the community to create a participatory design of a system supporting information creation and knowledge sharing in the context of exploration. The aim is to use established interaction design research methods to examine the activity and with the practitioners from the community explore what role technology can play in enhancing the experience for information sharing between individuals and groups.

In order to find an answer to the thesis central research about the role co-design can play in engaging a non-designers in this diverse community to design of an interactive service, practitioners from the community is engaged through a co-design workshops and discussions. This collaborative methodology is applied and used from the initial ideation phase all the way to the exploration phase and into the last design formation stage. By using the creativity of the community through the entire process, the result is not only grounded in theory but also in the expectations and specific activities of its intended users. Another reason for engaging the community when researching is attempting to involve and build on the individual's unique perspectives that comes from each participant's specific experiences.

The information is explored in relation to current technologies and practice and how it can be applied to the main activity to better achieve the community's or participants goals. Using methods of research through design to perform technological exploration ideas are evaluated by constructing prototypes that can be used to introduce technology to the participants and test concepts. Outcome and documentation is evaluated to examine the overall experience and identify desired results. The final result is a prototype of an interactive system called The Circuit Tool that supports the exploration of a new form of curated information produced by individuals or groups of climbers to share within the community.
0.1 ACKNOWLEDGEMENTS
I would like to thank my supervisor Kristina Lindström for valuable support and critique during the research. I also want to give out big thank you to all my fantastic classmates who offered their help and skills along the way. Most of all i would like to thank the participants from the climbing community who helped make the co-design workshops, discussions, testing and evaluation possible.

0.2 THESIS STRUCTURE
The research is structured by dividing the thesis into five main chapters. Following this introduction **Chapter 1** describes the background and motivation for the research focus. A theoretical framework is established. This framework is outlined to create a theoretical grounding for the research. It also serves as a guide to using appropriate methods while exploring the research domain. **Chapter 2** describes the relevant methods chosen for the research process. In **Chapter 3** the result from applying these methods are presented. **Chapter 4** examines work related to the result from the previous chapter, details the design of a final prototype, the steps involved in getting to a testable design and the testing with users. The last **Chapter 5** presents the analysis of the results and a reflection of the work. This is then followed by code appendix, references and the list of figures that has been presented throughout the thesis.
1.1 INTRODUCTION

Co-design and participatory creation is used in the area of interaction design when designing for collaboration. It is used for improving the functionality of services from a user perspective or for making systems more customer centered and making sure they solve the right problems. This research projects aim to explore the theory of co-design in the outdoor context of sport climbing. The main focus is on how knowledge is created and shared among practitioners and to examine how a collaborative and participatory approach to forming information creation and sharing systems for climbing can be implemented.

For a person engaging in outdoors sport climbing there exist a number of different challenges while preparing for or performing of the activity. Depending on the individual's level of engagement, previous experience and current knowledge about climbing what form this information takes and what it contains varies.

For the new practitioner who has little previous history in the field, the necessary information could range from finding out what equipment is needed, where to go or how to get there in order to successfully engage with the activity. While an intermediate or professional practitioner might be looking to to find out about specific sets of routes or to get estimates on how many specific grades of a certain difficulty exist in a area. The more experience the practitioner has, the less the basic informational need is and the more likely it is the individual have thought through specific goals while performing. The level of experience also influence the engagement and contributions in the form of establishing new problems and accessing grade and difficulty of the existing.

In this research i have chosen to concentrate the efforts and focus on these groups of new and intermediate practitioners. The reason for this simplified categorization and imposed limitation is that even though I think that a finished service or system support all stakeholders in the domain the fact that there is interest overlap between all groups the outcome give something back to the entire community, but it will mainly be researched in collaboration with these specific groups of practitioners. This limitation is not necessarily a negative one since it gives the me as researcher possibility to go deeper within the specific groups instead of trying to target everything in all aspects and areas. Access to participants is also more focused when involving actors from these two groups of practitioners and I want to clearly establish this as intentional from my perspective as researcher.
1.2 BACKGROUND

1.2.1 MOTIVATION FOR DESIGN FOCUS
I have been climbing for a few years. Being a practitioner in the sport is the main reasons and motivations behind the choice of research research domain. As a practitioner i have insight into the researched activity that would take a lot of time to gather if I was starting from no prior knowledge or without any earlier involvement. It also gives me the position of being a part of the community that i am engaging with for the design research. Because of the relatively short time period for this research project⁷ it makes sense to use this previous knowledge in the area of research to be able to use the time to dig into details about the subject. Not starting in a completely new field also gives me the ability to further my understanding in the motivations and goals that is the foundation for this research.

I believe that when doing design research in a specific context with a specialised use there is much to be gained by including the users of the system in the early stage of shaping the system. To test this i have set out to design a service for the climbing community. The research question and focus area came out of the initial workshop where users were included as participants in the ideation phase. The motivation for choosing this specific area of research is also part of the fundamental design process. By focusing on the climbing community the research leaves room for ideation, experimentation and flexibility while keeping the field narrow enough to be able to focus in on details in this particular area.

1.3 THEORETICAL FRAMEWORK
In order to design with a community, not only for, it is required of the researcher to make the effort to understand the communities practices and it is also important to incorporate the practitioners goals. There exist a lot of interaction design theory and methods for doing user-centered design and for including individuals in the design process. This chapter looks into established co-design methods and theories that are suitable to the research project and how to integrate them into the design process. They act as theoretical grounding for the research and the following chapters discuss the effects of this theory has in relation to the researched community and the project. The design of an interactive systems, supporting climbing related activity will be based on co-design and activity theory.

¹ From ideation to finished project the thesis research was lasted 9 weeks
1.3.1 ACTIVITY THEORY

Kaptelinin et.al (2009) argues that activity theory assumes goals and motivations reflected in the activity individuals perform can only be understood in relation to the context. The authors stress the importance of understanding context in computer-supported activities because this understanding has a great impact on the design results. The theory of object-orientedness (Kaptelinin, 2014) state that the subjects actions is directed towards an object (which can be a object, a purpose or other individuals). Looking at the activity of climbing in context, the communication between practitioners involved in the activity shows that climbing is performed not only directed at the the specific route being climbed, the the rock or cliff but it is also directed at other practitioners as a social action. While using tools and technology for these actions, the technology used serves the activity, but do not have a value in themselves as specific actions, they are only useful to reaching the goals in the context of the activity:

“.../ while the ‘user-system’ interaction can be considered a component part of activity, the purposeful interaction with the world cannot be limited to interaction with the user interface of an interactive system /.../ using a system does not normally have its own purpose; its meaning is determined by a larger context of human activity carried out to accomplish things that are important regardless of the technology itself.”

By focusing on this larger context of human activity the designer can try to design for the user’s goal and create a better experience. Kuutti (1996) points to the limits in traditional cognitivist HCI theory, where research is oriented at actions, for successfully describing and translating human activity into methodology for interaction design research. He states that actions always are situated in context, and that analysing them without this context in a lab context is misleading. Instead he proposes that context must be included in the research and that this is performed by looking at the individual actions as part of a larger activity. The activity is often supported by an instrument and the limitations of this instrument affects the ability of the subject to act towards the object (Kuutti, K, 1996). Kaptelinin (2009) suggest that activity theory can work as a framework for interaction design when researching human use of technology.
1.3.2 CO-DESIGN

Herbert Simon writes in Sciences of the Artificial (1966) that:

“Engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones. The intellectual activity that produces material artifacts is no different fundamentally from the one that prescribes remedies for a sick patient or the one that devises a new sales plan for a company or a social welfare policy for a state. Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design.”

Extended to the multidisciplinary nature of the interaction design field, the design process or the design result from the process have a lot to gain by inviting individuals from different areas in to participate in the work of exploration and research.

By doing this the creative influence is widened and by working with the theory of co-design the aim is to bring users into the creative process. The theory and methodology definition of co-designing that this research is taking inspiration and guidance from is the method described by Simonsen et al. (2014) that is structured around the main activities of analysing an existing situation, the technological possibilities then synthesizing the output through the design process into a preferred situation.

Löwgren and Stolterman (2004) reminds us that when introducing a digital artifact into a situation the designer directly affects the degree that people are connected and the way that they communicate with each other. Kaptelinin (2009) also emphasises that while performing an activity the mediation that tools enable play a central role. The mediation shape how humans interact with reality. This aspect is important to take into consideration during the design process and to aim for intentional effects rather than unintentional side effects.
The existing situation is the research area that is to ultimately be transformed into the new situation. By breaking it down into tasks and activities and looking at how and why they are performed to make decisions on what is to be changed and why. The analysis of the existing situation is performed by looking at how the community performs in the present.

1.3.3 COMMUNITY OF PRACTICE

When designing for the community it is important to include the community in the design process. It is also necessary to look at why the community is formed and what specific practice and/or knowledge characterizes it. Schatzki et. al. (2001) states that knowledge is mediated between people through interactions and that it is not the property of the individual mind but that is consist as a feature of groups:

“This prioritization of practices over mind brings with it a transformed conception of knowledge. As indicated, knowledge (and truth) are no longer automatically self-transparent possessions of minds. Rather, knowledge and truth, including the scientific versions, are mediated both by interactions between people and by arrangements in the world. Often, consequently, knowledge is no longer even the property of individuals, but instead a feature of groups, together with their material setups.”
Co-design together with the community serves as a good method for analysing the practices and activity from the practitioner’s perspective. By letting practitioners describe the important actions involved in the main activity and using the activity theories focus on activity to understand the actions in context and by letting the co-designer try out current technologies the material informs both the creative process of the individuals and the research process.

1.4 RESEARCH QUESTIONS

The question this research will set out to find the answer to is:

**How can co-design help in the design of an interactive service that support creation, sharing and exploration of community generated content in sport climbing?**

Obrenovic (2011) emphasises the importance of design-based research in order to help create insights and and to construct a framework from the results that emerge in process of design research. He also proposes that a problem understanding continues to grow during the whole process while the designer is working on solutions and that the “problem understanding evolves in parallel with the problem solution” making the problem more clear as some attempts have been made at solving the issues that arise during the research process.

The feedback during the entire process of ideation through research phases is iteratively applied to to construct and inform the research direction. Since the participants are involved in formulating the problem setting, they are also inflicting changes on the formulation of the research. When doing research through design the questions and process is in flux with a more definitive formulation of the problem and its context growing from the process. It is restructured and recreated from the interaction with the participants and by the outcome of this interaction.

Arriving at a research question was therefore an iterative process. By applying co-design from the beginning the specified research question continued evolving during the fieldwork and workshops. The first co-design discussion (see chapter 2 section 2.1 Analysis of existing situation) established specific areas of interest while this was later narrowed down in relation to the research developing boundaries and finding its starting point for discussions. This led to identification of design areas and later a clearer direction.
The research question acts as guide through the design phase of the thesis. The following sub-questions act as further direction and by seeking answers to them the aim is to present a coherent result:

- What is the current practice?
- What technology is suitable for this activity?
- What kind of information does this system need to support?
- How can this collaboration be made engaging and available to the community?

1.5 RELATED WORK

For the possibility of evaluation of results and for putting the research work in relation with other works, this chapter is an examination of current services and technologies that exist in the same domain as the area of research. This work deals with the information sharing and creation around the same context and participatory creation of information in the context of climbing.

There exist a lot of general purpose information systems that work in a collaborative context. The Wikimedia Foundation published the MediaWiki platform\(^2\) that support the Wikipedia website. It is one of the most popular platforms for information sharing where participants edit and make updates in a collaborative way. These systems do a fantastic job in structuring data and turning it into usable findable information. But they are general purpose and broadly useful to many situations in the sense that they are not specific to a certain context and or a certain usage scenario. Similar technology and systems are explored and many of the existing systems that are used to support activities around climbing have much to gain from a greater focus on the user experience and the motivations behind users actions in relation to the services.

\(^2\) [https://www.mediawiki.org/wiki/MediaWiki](https://www.mediawiki.org/wiki/MediaWiki)

*Image 1b left: 8a.nu, the world’s biggest climbing database. Image 1c right: world map with areas registered on 8a.nu.*
8a is is one of the world’s most popular online climbing forum for route related climbing information. It supports registering areas and routes. It has functions for storing personal information regarding progress such as what routes have been climbed and support a profile information page with file area for photographs and videos. Besides from the massive amount of information about routes, the site supports registering a user profile and checking off the climbs performed. The users can then get a local ranking based on a specific area, or see how they perform in relation to other climbers in an area. Because of its size, the site is seen as a benchmark for climbers. The professional community members are present and it is possible to follow the world’s best climbers in their progression. Another effect of the high usage and activity is that the site can analyse the seasonal popularity of an area or the grade distribution in and around it (see example in image 4c).
Kjugebeta.blogspot.se was started by the former owner/administrator of the kjuge.nu forum (currently inactive) that contained information about the climbing in Kjugekull. Kjugebeta.blogspot.se uses the blog format for sharing information about current climbing in the area. The creation and discovery works by people submitting their videos or route information and the moderators of the blog validate and post this to the blog. It relies on moderation and the skill of the contributor to do editing, sending in the material for review. It works as a central point for climbers in the region to send in videos but also information about new areas and routes. The site has a form for sharing new established routes and also information about the updates to the guidebook of routes that changed or new routes. There is only one guidebook\(^3\) for the area which was published in 2005 and the authors are working on a updated version that will be published late 2015 or in beginning of 2016.

\(^3\) [http://libris.kb.se/bib/9860875](http://libris.kb.se/bib/9860875)
Sverigeföraren is one of the biggest climbing databases in Sweden. Before a recent re-design it used the Wikimedia Foundation's tool MediaWiki the software that powers Wikipedia.org. But has recently re-built the site with a wordpress frontend, connected to a database backend. It supports searching and displaying results on a map. When displaying information about specific areas there are route information, access information (parking, roads, etc) and information about accommodation nearby. Sverigeföraren covers all types of climbing ranging from bouldering to ice climbing. But is mainly focused on sport climbing and traditional climbing.

27crags.com is the newest of the services explored in this chapter. It is based in Finland but covers climbing routes worldwide. They have route information, ability to register and add routes, personal profile and a tick-list used to mark routes as “to-do” or “done”. This adds the route to your personal profiles record and you comment on the routes or give them ratings. When you have marked a route as climbed, you are also given the option to rate the grading. By doing this the grade is regulated to fit the community's opinion of the grade rather than the first ascent. Just like 8a.nu the climber gets a personal record of progress by using the date and rating data from marking the route as climbed.
1.5.1 SUMMARY

As a summary and method for evaluation of the related examples described above in relation to the research this chapter analyses the strengths and weaknesses of each system relating back to the research aim of how they support the main activity.

8a has the most complete amount of data related to climbing. From routes to information about climbers and their progression this service is the biggest. The format is not well adjusted for the experience of newcomers. The site is for the knowledgeable practitioner and experts. The site is badly structured and you need to know where to look not just what you’re looking for. Its current status as the most established database for climbing data is what makes users return.

Kjugebeta.blogspot.se serves as a visual information contribution to the area of Kjugekull and its community. The routes discussed and presented are all part of the guidebook which is also being reworked for a new print and publishing release. Though the data could be presented to stand on its own (it has the data structured but only accessible if you know what you are looking for) it is intentionally left the way it is for complementing the guidebook. Guidebooks are still a dominant format for information regarding all the areas worldwide. They are very specialised for local geographical areas and work well for remotely visiting climbers. The authors have collected and structured the information for you, and for the bigger climbing areas like for example Fontainbleau in the country of France you can purchase guidebooks for a specific range of grades, Ex: 7-8 routes or 5 - 6 routes or for what are called circuits: routes specifically assembled together to form a circuit for the climber. Since these are books that are authored, published and printed, they have the associated costs related to them. The cost is between 200 - 400 SEK (20 - 40 €) per book.
Guidebooks do support a good selection of routes, composed by the respective authors. Care is put into structuring information and the authors spend a lot of time gathering information for the books. Guidebooks have their special quality. Everyone who enjoys the experience offered by a book knows they are not going to go away anytime soon, but there exist an inherent limitation in printed material in that information that somehow gets changed can not be updated unless it is reprinted. The physical precondition of the environment that supports the activity does change. Rocks crack and alter the conditions for routes which changes the grade or makes it unsafe to climb. Access restrictions can occur such as when the site is in a sensitive wildlife area or the land is private property and the access permission has been revoked by the land owner. Without knowing this it can be illegal to enter an area previously accessible for climbing. If trying to get all the routes and climbing information from buying printed books the cost can get quite high. A search on Amazon for ‘Bouldering Fontainebleau’ returns 49 results. It can also be hard to find guides that go out of print.

Sverigeforaren.se is an established tool in the swedish climbing community. But even though their description contains ‘find the best ranked climbing sites in the country’ a search for Kjugekull, which is considered southern Sweden’s (and probably one of Scandinavia’s) best bouldering areas return only one result that contains no information about the available routes or information about the climbing in the area except for where to stay when going there. The fact that Sverigeföraren is a wiki-style service seems to indicate that the climbers around the southern bouldering community go elsewhere for information.

http://www.amazon.co.uk/s/ref=nb_sb_noss?url=search-alias%3Daps&field-keywords=bouldering+fontainebleu Visited 2015-08-12
During the fieldwork with practitioners I asked about this and the participants said that the site used to contain more information before the migration away from the MediaWiki platform and that information is also harder to locate on the site now. Though it contains a lot of information, the sites design was not impressing the practitioners. There are updates listed on the front page of the webservice, but as the design of the service is considered there does not seem to be any improvements being made or planned in the near future.

Although all of these services have their special place as a tool for the active climber, except for the kjugebeta.blogspot.se that has a responsive design (and blogger is available as an app for many\textsuperscript{56} platforms) none of them seem to take into account that the activity is performed in the field. None of the sites perform well on mobile. They are all structured for a desktop experience. To navigate with pinch zoom and trying to tap links on a small device is rough for a site like 8a.nu that use small font-sizes and limiting visual hierarchy. The fact that the user basically needs to do editing at the desktop and prepare material before submitting takes the moment out of the activity right there in the field.

\textsuperscript{5} https://itunes.apple.com/us/app/blogger/id459407288?mt=8
\textsuperscript{6} https://play.google.com/store/apps/details?id=com.google.android.apps.blogger
2.1 METHOD

The direction of research is to diverge by widening the area of focus together with the participating individuals to later converge and narrow down into a specific research area.

Image 2a: Research plan to approach the research and design phase.
Derived from Simonsens et.al (2014) methodology the process this research project follows is constructed by the following phases:

- **Analyse the current situation.** Analysing the current practice in the field. The existing situation is researched with the method of fieldwork and by engaging the community practitioners.
- **Analysis of available technology.** Demonstrations and explorations together with the community.
- **Co-design through discussion and paper sketching as an initial prototyping.**
- **Envisioning a new situation, possibilities and improvements based on the outcome of the former phases.**
- **Design of final prototype of the concept.**

The literary study of interaction design theory described in the first chapters in this research is intended as a theoretical framework that act as a base for this continued analysis. It is also the point for where the experimentation with prototypes should start off. In the activity of the community.

By engaging the community and keeping focus on co-design methods by applying a research through design process (Gaver, 2012) the progress of research is executed in collaboration with practitioners. The users that participate bring their individual creative input and ideation into the process and as the co-design workshops serve as entry point into the research. Co-design, or the results from the co-design sessions, is also a method for creating and selecting a ideas to build on. The research is structured around this selection, and this defines what the main activity for prototyping and further iterations will be based on. The main activity of climbing is broken down into categories and sub activities (Simonsen et.al 2014). The intended outcome of this interaction design research project is a conceptual prototype that can be used by the climbing community, either individually or collectively. The outcome is validated by keeping the focus on the user's goals (Cooper, 2007) and the activity at the center of interaction (Kaptelinin, et. al 2014).

An analysis of the current situation is performed to identify design openings and to gain a greater understanding of current practices. The analysis is further outlined in user scenarios that create narrative around the use situations that arise. This serves to examine the current situation, using a situated design method and analysing existing situations, exploration of technical possibilities, organising a design process and envisioning the new situation.
2.2 ANALYSIS OF EXISTING SITUATION

The first as a fieldwork study including practitioners that gave me their view and analysis of what they see as areas related to the main activity and possible fields for design openings. A quick introduction to the activity is given, because this is the base of that the research is trying to understand and design support around. This research is aimed at the form of climbing that is called bouldering. In bouldering the climber does not use harness or rope, and the climbs are at lower heights where the climber falls on a mat. In this practice, the route that is ascended is called a problem. This problem have a set starting point, and sometimes a set ending point, but in most cases you have the freedom to go whatever path you can to the top of the boulder from a fixed starting point. There sometimes are specific points that the climber is expected use along that path. A climber solves the problem by finding a way to the top. To people unfamiliar with climbing this may sound a lot easier than it actually is. When you are challenging yourself by climbing grades on the upper edge of your capability, moving one finger a few millimeters or twisting your foot stance the other way makes all the difference and figuring out how to solve a specific problem can take minutes or years. The most common ways a climber come by routes are through word of mouth, researching online through the use of a climbing database or through guidebooks (described in detail later in chapter 1 section 1.5 related work).

The process of establishing a route, or problem, is as follows: the route is invented, or designed, and documented by the person who performs the climb. This first ascent traditionally gives the climber the right to choose a name for it. The information then spread through different channels in the community and is updated in the different registers that exist. The information is public and as the route is ascended by more climbers its grade is discussed and adjusted to fit the community. This is done by the community in the physical world and on various forums either global or more local (or regional groups on facebook).

2.2.1 FIELDWORK

The first collaborative session took the form of a discussion between me in the role as researcher and two other climbers. The role of researcher was to keep discussion flowing but also taking an active part in the discussion. This was performed during a climbing trip to the area of Kjugekull and Valje Stenbrott. Being a practitioner myself I will intentionally bring in my own experiences into the development process including this discussion. But the goal for the fieldwork and discussion is to break down the activity into smaller parts of and form categories for further examination (Simonsen et. al, 2014). The different main categories identified during this discussion are based on the area of activity, purposes, sub-activities. Mapped out in a mind map structure four main categories under the activity of climbing were identified:
The main activity of sport climbing broken down into sub areas

<table>
<thead>
<tr>
<th>Climbing</th>
<th>The main activity of climbing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>The individual tracking of progress or specific goals. Performed indoors or outdoors by measuring the progression.</td>
</tr>
<tr>
<td>Exploring</td>
<td>Individually or in group, in the field or online. Finding new routes to climb, new areas or communicating with a group about exploration. Also includes tracking other people’s progress and activity.</td>
</tr>
<tr>
<td>Creating Routes</td>
<td>Establishing new areas, new routes or new variations of routes. Sharing information about this through current channels.</td>
</tr>
<tr>
<td>Developing new areas</td>
<td>Finding completely new regions or areas to develop. Sharing this info and its related route information with community.</td>
</tr>
</tbody>
</table>
This research focus is in the area of exploration, creation and sharing of information. During the following chapters, to better understand the researched community and its activity, the research will try to answer the following questions (Simonsen et. al 2014):

- Who are the stakeholders?
- What are they doing?
- Why are they doing it?
- How are they doing it?

2.3 CO-DESIGN WORKSHOP

The purpose of the workshop is including actors in the design phase, to let them help in describe the ideas and expand on the way they act (Schön, 1983). The co-design workshop is set up to ideate around the subject categories that was the previous fieldwork session (creation, sharing, exploring). Because of practical issues (other engagements and lack of time) the participants from the fieldwork could not participate in this workshop. Instead it was performed together with two new participants, both beginner climbers who are less experienced in the sport. Because of time restraints and to have a more clear target for the research the decision was made to structure the workshop focused on the three areas previously identified combined to two: Exploration and creation/sharing. Ideation around them served as intended outcome of the workshop.

To get initiate discussion and the start the though process the workshop was introduced with two inspirational questions that participants kept in mind during technological demonstration:

- **What if the system was place specific?**
  - What would the effects be on each area of activity.

- **What if the system could supported augmented or virtual reality?**
  - to inquire into what prefered technologies are in use or would be desireable.
2.3.1 TECHNOLOGICAL POSSIBILITIES
The co-design workshop started with an exploration in technology. It is important to let the participant try out and use material in order to effectively investigate the possibilities (Sanders & Stappers, 2012) to encourage talk back from material (Schön, 1983). The reasons for looking at the specific technologies is their relation to the smartphone technology. The participants in the previous workshop explained that the use of technology is limited by the amount of equipment brought into the field. The smartphone is a device already present and used for other purposes than the one explored so the technological possibilities is centered around this.

I explained how augmented reality (AR) works, with the overlay of printed markers and described how virtual reality (VR) functions with current technologies and how geofencing and triggering is made possible using GPS-devices. This research deals with the activity of storing information for display and exploration, and in the workshops the functions of AR and VR had been discussed. As opposed to GPS-technology, AR and VR are relatively new technologies and it made sense to show demonstrations to inform the participants how it can work. In order to show examples of this technology two prototypes were constructed beforehand using the available software developer kits from Vuforia and Unity.

The Google Cardboard virtual reality SDK (Google, 2015) uses a smartphone as a three dimensional viewer, an immersive virtual reality display, which can programmed using a plugin to the cross platform Unity3D game engine (Unity, 2015). The process is straightforward. By downloading the SDK for each software it is possible to construct a scene in which 3D models can be displayed.

By constructing three models of rocks in Blender 3D (Blender Foundation, 2015) and exporting these to the Wavefront OBJ format the models were loaded into Unity3D

Image 2c: Simple VR prototype of rock landscape using Google Cardboard and Unity.

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7 https://en.wikipedia.org/wiki/Wavefront_.obj_file
and placed behind triggers that alter the texture of the model. When the user looks at a place in the virtual reality, the trigger is activated and a texture is switched.

The virtual reality demo existed of a simple scene where the user is able to tilt and rotate around a set point in 3D space (not spatially, limitation of sensors in smartphone). By pointing at certain spaces in the scene additional information was displayed. In this case the triggering of pointing to a specific model of a rock would display information about the route attached in the format of a texture switching.

![Image 2d: Unity3D viewer running on Android with AR and the Google Cardboard viewer headset capability from the Vuforia SDK. The markers give the viewer additional information. The route information is attached to a rock paper model.](image)

The AR experiment enabled the user of the headset to move around. By cloning the AR camera and displacing it by 0.5 the same stereo effect is achieved as in VR. By allowing the user to see through the camera and wearing the headset from Google Cardboard, the experience becomes less immersive but open the possibility of augmenting real world objects.
For the geofencing demonstration Mapbox and a HTML5 prototype was displayed, but very limited. By moving around an area the system can detect the user position on a map using the coordinate system (Geolocation API works with phone gps, ip-address origin and wifi). Unfortunately the geofencing feature did not work at the moment and parts of the demonstration was explained and how it was intended to work had to be imagined instead. Since GPS technology is not new, this was not an unfamiliar concept to act out and explain.
3.1 RESULTS

FIELDWORK AND ANALYSIS

Coming back and answering the questions posed earlier in relation to analysis of the situation:

Who are the stakeholders?
The stakeholder are members of the climbing community. For this research the specific part of the community that exist in the region of Skåne around the area of Kjøgekull.

What are they doing?
Training - Recording progress to measure the results. Sharing this progress and keeping track of others for motivation.

Exploring - Finding new routes that others have developed and establish. Rating and sharing information back to the community about routes and areas.

Creating - Some of the practitioners are establishing routes by themselves (or with others) and sharing this information back to other practitioners in the community.

Why are they doing it?
The participants in this research climb for different reasons. They do it for leading a healthy lifestyle, making progress in the sport and because it is fun, to name a few reasons. Engaging in the sport create a sense of purpose. The exploration of areas are to find new information and to get inspired by trying new routes and areas. The motivations for sharing routes are that it is a creative act. Creating something and sharing this with the greater community is rewarding in itself. It also gives a sense of accomplishment to be able to complete a route and then for someone else to figure out how this is done.

How are they doing it?
The current involved technology include forums, specific databases with information, community websites and facebook groups. Sharing information in the form of media is done using popular video sharing services such as youtube, vimeo or for photographics content flickr, facebook or similar.
**CO-DESIGN WORKSHOP**

During the co-design discussion workshop the following information was presented by the participants. The starting questions:

**What if the system was place specific?**
What effect would place requirement have on the system? One collaborator found it interesting to limit some of the functionality to being on site. The current practice is that a problem is graded by people who have climbed it. The discussion of what difficulty grade a problem holds is discussed on forums, or on sites like 27craggs (see *chapter 1 - section 1.5 Related Work*). What if you could only do grading if you were in the radius of the rock? Would that motivate people to go out and revisit old sites to give their opinion on the grade? The other participant noted that the system should support some remote editing to, for correction and moderation of mistakes or wrongfully added information.

**What if the system supported augmented or virtual reality?**
The VR technology was demonstrated with Google Cardboard (*Chapter 2.1.1. technological possibilities*) and a Android smartphone and a discussion about what is possible with the hardware. They found the concept fascinating. Using the smartphone as a way into virtual representation of the data connected to the problem hold interesting potential. But they felt it did not support the activity of climbing. That it was too immersing and takes away from it and they could not see themselves using this kind of equipment in the field. They also noted that the real setting might have to changing conditions. in order to use this in a real setting the markers would have to be huge to be captured by the camera from a distance. In the test the markers were 4 by 4 cm in dimension and placed under good light conditions (the AR is triggered by the contrasting pattern on the marker and requires that it is visible). They also pointed out that there is the problem of bringing equipment into the field. Sensitive things break easily while dragging it around the forests and mountains. The current practice is to travel as light as possible because of the distance to many destinations from the nearest parking spot.
3.1.1 SUMMARY

During analysis of the existing situation it became apparent that the current tools used for specific information searching are useful and accurate, but that they lack the mobile features and this make them less usable in the field. Based on these results it would make sense to explore the creation of a system that could complement the current tools in the field for an enhance user experience.

The workshop participants also started discussing the how a tool that supported creation and sharing of routes in the field could look and function. During this exploration and sketching it became clear that it we were re-inventing the wheel. The design may create a system that function better in the activity context as a tool in the field, but it would be creating another island in the sea of current climbing route information systems that already exist. Instead of building yet another separate system that does the same thing.
A decision was made to instead focus on the exploration aspect. Because it would make more sense to focus the design effort into something new that can enhance the experience such as constructing a tool that function as front-end to access existing information in a new way. Something that was mentioned during the research was the use of circuits in Fontainebleau (See image 3c below). The guidebooks often have circuits like these made described by the authors. A specific set of routes combined to provide a tailored experience. It works by the practitioner completing each route in a specific order that is described.
As this is strongly related to creation, sharing and exploration the prototype was focused on examine how user authored circuits, such as the ones found in guidebooks or in place on climbing areas, could be supported. The testing ground and main focus of this research project is the area of Kjugekull which is a protected nature reserve, so doing something similar to the example from Fontainebleau by trying to paint on the stones is not legal here. In this case the technology can act as an augmentation on top of the physical world by making something like the previous discussed technology (AR, VR or GPS) the tool could function in the same way as a physically marked circuit. All the user need is access to a smartphone.
CHAPTER 4

4.1 DESIGN

In order to bring the concept discussed from the previous chapter, the *interactive climbing circuit tool*, to life the design phase starts with the creation of prototypes that act as discussion artifacts. This chapter outlines the creation of a blueprint to act as base for the final design of the prototype. The prototype supports the creation, sharing and exploration of climbing circuits. The next chapter describes scenarios in which the tools are used in relation to the activity of climbing.

4.1.1 ENVISIONING A NEW SITUATION

Introduction of design artifacts for evaluation and study of use is a critical part of design. Prototypes are used to help users understand the concept. By creating prototypes the design proposals are abstracted to communicate the ideas to the users. This prototype needs to be detailed enough so that users can get an understanding of the intended functionality. It is therefore important that they get first hand experience to make decisions of what is usable and what needs to be improved or removed (Simonsen et.al 2014). Gaver (2012) emphasizes the importance of generating new realities by doing research through design. That the fundamental achievement of research through design is the prototypes or artifacts produced and that the prototype is the functional implementation of the design choices that have been made. The evaluation of the prototype is an evaluation of the judgment imposed by the designer, and by trying it out the practice informs the design.

Using fast simple sketches, where the user has the ability describe and point to changes in the flow of actions, is a suitable first material towards a concrete design. The research is done together with individuals who are not designers and should not be required to learn programming or graphic design applications. Paper and documents is a quick step to letting the users communicate ideas back to the process. By incorporating the outcome described in the previous chapters the research result is used as foundation for constructing a prototype of ideas. Research through design (Zimmermann, Forlizzi & Evenson 2007) is used as a method to evaluate different ideas and to contribute knowledge to the interaction design field. The prototype is a tool to evaluate the possible new situation (Simonsen et. al 2014) and used as an instrument for transforming the activity in context into a new preferred state. Moving through the process the paper designs are transformed into interactive mockups of the interface using online mockup tools as the new situation gradually realised.
4.1.2 PROTOTYPING THE CLIMBING CIRCUIT TOOL

The systems features and the graphical prototype was developed in two stages. First a discussion over video link, with a digital whiteboard and a shared document was used to brainstorm together with another climbing practitioner about the possible features such a system should support, what different scenarios it would be used in and what the motivations behind using such a tool would be. The result from this session is summarized in the diagram below:

Image 4a: Summary of co-design discussion around the circuit tool prototype
The second step is the sketching out and design of a user interface based on result from the discussion. First conceptualization of the imagined interface.
Scenarios were constructed to support the creation of the interface. The scenarios are presented later in this chapter and are also used as part of the narrative to explain the functionality of the prototype. These scenarios were produced with an intentional high level description of application use with little detail, to leave room for innovation (Cooper, 2007). The sketches are validated with the participants and the prototype is tested for improvements on the design before the detailed design of a hi-fi prototype is designed. This is to insure the interface and the functionality is evaluated and errors can be corrected before proceeding to a hi-fi prototype.

To support the narrative of intended use of the prototype, the design process includes the following personas to act out the scenarios. The activity can then be acted out in a story format. This is a step in designing the interactivity of the prototype and it keeps the focus on the main activities for the final design.

### 4.1.3 PROVISIONAL PERSONAS

There was not enough time to perform a user study and collect supporting data wide enough to construct rigorous personas. Instead provisional personas as described by Cooper(2007) are used through the design phase. These are based on the data made available during the co-design phase and the researcher previous experiences in the field. Where gaps in this data exist best guesses are made about the personas. Research shows that using provisional personas yields better results than not using personas and they are an effective tool for avoiding flexible user (Cooper, 2007) where the imagined user is constantly changed over the process to match the designer's current idea or vision. While the risks of using provisional personas are that the focus lands on the wrong target group. In this case the risk is low because the target group has been previously formulated and previous domain knowledge from the researcher supplements domain.

The following provisional personas are used to represent different types of user groups in the scenarios and storyboards. The goal column represents a goal that is used to support the persona and narrative. In reality there is overlap and a multitude of goals and degrees of skill. But for this research the use of provisional personas is sufficient for narrative:

<table>
<thead>
<tr>
<th>Main persona type</th>
<th>Motivations for using circuit tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginner</td>
<td><em>Find information about routes that are in the range of individual capability</em></td>
</tr>
<tr>
<td>Intermediate</td>
<td><em>Enter and edit new circuits to create the best circuits and improve reputation by sharing this with the community.</em></td>
</tr>
</tbody>
</table>

*Table 4a: personas types and goals*
Persona One
Name: Lily Smith
Age: 35
Climbing experience: Intermediate
Motivations in climbing: Climbing for the workout, like climbing with friends and exploring new areas. Has established a few new routes and variations of existing routes.
Climbing goals: Getting better than her climber friends. Keeping track of individual progression going forward. Engages with the community by entering and editing new and existing routes. Shares this information with friends and through forum. Climbing is a big part of her lifestyle.
Motivation for using circuit tool: Enter and edit new circuits to create the best circuits and improve reputation by sharing this with the community.

Persona Two
Name: Herbert Palmer
Age: 25
Climbing experience: Beginner
Motivations in climbing: Staying healthy. Climbs a form of exercise.
Goals: Trying to get out at least once every other week, but takes a trip to the gym in between the fieldtrips aiming to get up to the 7-grades but is currently stuck around the ~6 range.
Motivation for using circuit tool: Find information about routes that are in the range of individual capability
4.1.4 SCENARIOS
The scenarios are created around the actions involved when using the tool. Structured around Bailey's performance model (Rubin, J., & Chisnell, D. 2008) they follow the format of *somebody, doing something in some place*. Linked to Kaptelinins (2014) description of activity theory the circuit tool becomes the tool used for subject to object or community mediation. The use of scenarios also lets the design reflect priority of functionality and define the behaviour of the systems in use (Cooper, 2007):

The first scenario is from the beginner personas perspective while exploring on site the circuits that other users created. The second scenario is the intermediate user who is remotely adding together a circuit based information previously stored in the system by the community. The scenarios have a temporal mode and focus on the user's activity as opposed to use cases which are more detailed analysis of tasks, the reason for choosing the former is that the focus from a research view is on activities which looks on the holistic experience for the user. Theses scenarios work also functioned as a base for the design of user interface sketches in the previous chapter.
Scenario 1:
*Category: Intermediate / Creating / Remote*

Image 4e: Interactive prototype for scenario 1

A click through of the functionality of the prototype is available at atomic.io: https://beta.atomic.io/d/OCk6N0K0InDA

1. Lily has just finished her evening training at the local gym. She checks the weather on her phone and sees that the weekend look very promising. Around 10°C and light winds.

2. She arrives home and after having dinner she decides to create a warm up circuit for herself and her climber friends for the coming weekend. She logs on to her computer and heads to the site of Circuit Tool. Proceeding to the map-view she filters the available routes based on grade and selects a starting point for the circuit.

3. She continues to select the nodes in her circuit based on her previous experience of the routes in the area. Carefully putting together a warm-up selection.

4a. When she feels that enough routes are included, she continues to add a name “warmup routine”, adding a description to the circuit reading “nice selection of routes...”
in the 6a-b range with flat landings”. She then chooses a few contacts who she wants to send the circuit information to.

4b. She decides to publish the route in the public register. That way other people can use the route and she gets recognition for the contribution.

5. She published the route. Shuts the lid on her laptop. A minute later she receives a text message. Picking up and unlocking her phone she sees that her friend Alex sent her a message: “Nice selection! Super excited about heading out this weekend!”

6. Starting the Circuit Tool application on the phone she can see the new route on the front page. She locks the phone and puts it back in the pocket.
Scenario 2:
Category: Beginner / Exploring / On site

1. Herbert just pulled up to the parking lot of the natures reserve. He is feeling excited about finally getting out into the field for some climbing. Feeling a bit rusty, it was a long time ago he was out, but now he have a few hours to get climbing. He straps on his crash-pad and picks up the backpack with equipment.

2. Before leaving the parking he picks up his phone and checks in with the Circuit Tool. Not sure about what to climb, he checks for nearby circuits on the map using the apps GPS capability. He sets the filter to a range from 5-6c and and notices the newest route added, only 5min walk to starting node.

3a. Reading the description of the circuit “nice selection of routes in the 6a-b range with flat landings” he thinks it sounds like a good match for his skill level.

A click through of the functionality of the prototype is available at atomic.io: https://beta.atomic.io/d/aGh09XxsMb9A
3b. By selecting the circuit he gets directions on where to find the starting node and sets out towards the direction.

4a. Arriving at the first node he gets a notification that first route is in the area. He can see from the description that it is the traverse starting from the right. He unpacks his things, sets down the crash-pad and straps on shoes.

4b. After finishing the route he opens the application and marks the node as complete. A new direction is shown on the screen and he pick up the equipment to continue.

5. On completion of the last node in the circuit the application displays a “congratulation” message and the time from start to finish. He marks the route as finished and at the same time rating the circuit with five stars. Picking up his stuff he starts to head back to the car.

4.1.5 INTERACTIVE PROTOTYPE

Image 4g: Still images from the final interactive prototype.

An archived animated recording of the interaction:
http://sipinen.se/thesis/circuit-tool.gif
5.1 REFLECTION & ANALYSIS

Coming back to the thesis initial research question:

*How can co-design help in the design of an interactive service that support creation, sharing and exploration of community generated content in sport climbing?*

By using co-design theory and methods the research arrived at the final design which is a tool for the creation and sharing of virtual climbing circuits. The intention is that the tool can act as inspiration and motivation for the climber in the field. Instead of creating another system for storing the data that already exist in so many places, this tool extends these existing systems by creating a front-end for using this information to create tailored circuits for the practitioner or community. Even though it is a simple concept it serves a function in the current landscape of information services around sport climbing that does not exist.

The intention was to apply co-design methods for inquiry into actions and motivations and analyse the activity using the framework of activity theory to bring these into the design process from the start. This was not without difficulties. While including actors in the early stages of the process, where the research question was still not fully formed, there was some confusion among the participants and me as to the purpose of the activity. Even though I had the co-design methods clear in my head and the reasons for approaching the participants with the design work in this stage with this in mind, I failed to properly communicate the reasons or importance to the project.

I used multiple forms of working with participant: face to face discussions, material workshops and online discussions. They all had different outcomes and different preconditions because they were used during different stages of the process. Because of this making a straight comparison between the methods and outcomes is not really possible. Being in the field and doing discussions had the benefit of not being an artificial environment as the workshop. The participants were more relaxed, compared to the workshop setting where expectations were not clearly communicated from my side as well as the participants not sure what they were supposed to do. As for the online discussion performed over google hangouts the expectations was very clear from the beginning and with the agenda set (requirements for a specific system) the outcome was quickly realised.

The process will hopefully get easier for me as a designer or enabler of design work for the participating individuals. I feel I could have prepared a lot more for the sessions.
The expected outcome needs to be formulated and I as researched needs to present this at the start of every session with participants. Though the sessions could be better prepared, they still revealed and gave back a lot of information to be used in the research. The final design is based on the input from the sessions, which would not exist if it had not been formed from this cooperation. Some of the participants had a hard time understanding why I as an interaction design researcher would need their help in the design. I believe the reason for this is I failed in communicating why their involvement was important for the final design and I was not clear about what I expected to take with me from the sessions.

I underestimated the time it takes to get people together, and the time these people actually had to spend. Going back in iterations also made this hard. During the last phase I used phone calls and video meeting technology to get participants feedback. After participants cancelled, there was not enough time to set up a meeting in person. This worked out well in the end, and the participants were able to express their thoughts, but access to physical prototypes may have given better or more elaborate results.

I find the co-design process to be both very hard (as discussed previously) but also very rewarding. Co-design is not a magic bullet, the designer still needs to direct the design and make decisions on what to take forward and where to focus the discussion. The co-designers cannot be expected to move the project in a fruitful direction. The role of the researcher/designer is to take executive decisions on which of multiple possible ideas that are introduced by the co-designers to follow. It takes effort to stay on top of the design and to keep all the information in perspective. As a design participant, taking part in a single workshop session will not give the same overview as working with the project from start to finish line. Here a systematic approach to design research helps. By breaking down the process into phases and analysing these, while continuously reflecting on the results, it is possible to keep a holistic perspective. Being the first encounter for me using co-design as a method my understanding of co-design is not comprehensive. Though now I know a lot more. Co-design is effective in doing activity analysis, and for getting the details right. But for a successful project there needs to be decisions made by the designer that forwards the project research in a fruitful direction. Participation from the early stage of ideation and problem formulation into finalising phases of design and testing resulted in a service grounded not only in theory but in actual values and goals from the community.

5.1.1 FUTURE RESEARCH

My initial idea was to use WEBGL or some similar technology based on the web but I did not have access to devices that it would run on. Using native Unityplayer and Vuforia SDK for constructing the prototypes was a compromise, but it turned out a lot better than expected. It would be interesting to pursue the augmented reality aspect, either as pure web technology as a frontend to existing sources of data (such as the climbing sites databases), or to build dedicated technology using the SDKs. I did test out a simple preview of what the experience could be like. With that in mind it served
its purpose during the workshop - but there is much more ground for tests and research in the area.

As for the exploration and choice of technological implementation, the use of theory as grounding for the design decisions makes it possible to adapt the result to a new technology. Technology is of less importance when designing around the activity. The core of the system should be aimed at supporting the activity because what technology is currently in use in the field may change. By starting from the point of research and answering the questions of who, what, and why the system could be re-implemented on top of another stack.

Future research could approach the domain by looking specifically at how a certain technology such as augmented reality, or virtual reality, could act as a frontend to the information retrieval such as looking up route information, or area information. To see what this technology could do for the practitioners in the activity. I believe there is great potential in these new areas of interactive technology. Development of the technology moves quickly and the performance of the hardware in our smartphones are only getting better. The designs tested on my five year old phone ran quite well. I can imagine that the experience would be vastly improved just by upgraded hardware. From a research perspective other technologies, not limited to by the use of smartphone, could also be examined. But for the scope of this research imposing this limit created a helpful frame to center the technology around.
5.2 BIBLIOGRAPHY


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