COMMUNICATING TECHNICAL INFORMATION WITHIN COMMUNITIES OF PRACTICE

Stephan Fortelny

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Supervisor: Jonas Löwgren
Abstract

This thesis is an exploration of how the communication of technical information can be facilitated by practices of collaborative media. While focusing on the domain of bicycles and more specifically on hobbyists working on their bikes, the aim of this study has been to show possible directions for the design of collaborative media for hands-on kind of work environments in general. Two design experiments were carried out in the process. While the first one attempts to connect local work with global resources, the second experiment is more deeply connected to an existing local community of bike enthusiasts and their practices of learning and knowing. Through carrying out the two design experiments, an argument was made that involving existing social structures Wresources are deeply connected to practices of learning and knowing. However, more work needs to be done to generate more detailed solutions for different domains.
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1 Introduction

The domain of technical communication has undergone dramatic changes throughout the last two decades. At the beginning of this trend, technical writers were mostly concerned with the creation of printed manuals that were sold together with the product they were describing. Manuals acted as the main contact point for buyers to go to if they experienced any problems or wanted to know more about the newly purchased product or how to use it. Fast forward to today it is often the users of a service or buyers of a product who collaboratively create product information for each other. They do so through new infrastructures that facilitate user-engagement and enable them to produce and distribute their own content. Their incentives are diverse, but often related to making a contribution in the expectation of benefiting from the contributions of others.

Researchers have recognized this shift and the need for new roles for technical writers. They point towards promising directions of development for the field, among which social media and social and creative practices seem to be the most relevant areas. However, while researchers in technical communication seem to agree that there is a necessity of driving their orientation towards those research areas, there does not seem to exist a lot of practical advice for practitioners such as in the form as case studies.

Interaction design and more specifically the concept of collaborative media are arguably able to fill this gap. Collaborative media practices as introduced by Löwgren and Reimer (2013) are practices of design, production and consumption of and based on media services and tools. These practices are characterized by their intertwined and dynamic nature, meaning that they can be performed at the same time as well as by the same person. As a result, in collaborative media practices designers, producers and consumers are often the same people, switching between the three practices seamlessly.

1.1 Research question

Through this thesis, I aspire to explore how technical communication through practices of collaborative media could look like in domains, which still rely on models based on the strict separation of consumers and producers. Such environments are typically characterized by their more hands-on form of work and a local setting where the use of stationary computing devices is not feasible.
2 Theoretical framework

2.1 Collaborative media

The main underlying theoretical grounding of this thesis is the concept of collaborative media, coined by Löwgren and Reimer book with the same title (2013). For them, collaborative media is primarily a concept to capture the phenomenon under study. They build upon the concept of cultural forms established by Williams (1990) in order to overcome the fruitless discussion of technological versus social determinism. In the book they describe the cultural form of collaborative media by outlining “its specific properties without forgetting the contextual character of these properties. It is a way of treating the technological properties of the cultural form seriously, but neither treating these properties as essential or ‘natural,’ nor believing it possible to deduce simple ‘effects’ out of their properties” (Löwgren and Reimer, 2013, p.17). Collaborative media does not focus on technology, but on the action (or interaction) oriented component of media and the kind of practices that the cultural form makes possible. The “collaborative” aspect of collaborative media can furthermore be understood as a temporal quality, as “only at those occasions when they are put to use collaboratively they become collaborative media” (2013, p.19). Finally, the term media can understood very broadly "to include any channel that facilitates communication" (2013, p.19). In a nutshell, “collaborative media is a particular cultural form for collaborative, mediated practice“ (2013, p.19).

2.1.1 Characteristics of collaborative media

After having described collaborative media on a rather abstract level, it may be useful to delineate concrete common characteristics. Primarily, Löwgren and Reimer mention the following characteristics that collaborative media practices share:

“1) The practices are based on media services and tools that
   a) are easy to use;
   b) can be used creatively and pleasurably in many different ways.
2) The practices are to a great extent collaborative. People work together to create things that are not possible for the lone user to create. And this occurs not only face to face; to a great extent, the collaborations take place online on a potentially global scale.” (2013, p.17-18)

The term collaborative media is thus a combination of 1) media and 2) collaborative practice. Furthermore, highlighting the ease and creative use of media services and tools, hints at the presence of “new” media and technologies, that makes those kinds of practices possible. However, the authors very carefully distinguish the concept of collaborative media from other similar formulations such as “new”, “digital” or “social” media. They deem collaborative the most accurate adjective due to the focus on collaborative practice rather than technical attributes as outlined earlier.

2.1.2 Practices of collaborative media

In the field of media and communication studies, scholars primarily distinguish between production and consumption practices of traditional mass media such as TV or radio. Löwgren and Reimer argue that “the emergence of new media technologies led to new relationships between production and consumption, where the two processes became less distinct” (2013, p.20). This shift has been captured in academic literature such as the concepts of “Pro-Am” for Professional Amateur (Leadbeater and Miller 2004), “prosumption” (Tapscott and Williams 2000) and “produsage” (Bruns 2008). Löwgren and Reimer’s critique on these concepts is that production and consumption should
still be seen as very distinct practices, even though the same person may engage in both simultaneously. More importantly, they add the practice of design of infrastructures: “Not only can people produce media texts, they also can take part in the design of the infrastructure—the programs, software components, and web services that can be used for media production. People working within the media industries (broadly defined) as well as interested citizens can now participate in creating the tools that enable different kinds of media productions” (2013, p.22).

Thus, the three practices collaborative media make possible are design, production and consumption. Although each practice can be viewed separately, they are clearly not isolated from each other and a single person can engage in all three of them and even at the same time. As a result, at the moment of designing media infrastructure one may engage in so-called “production-in-design” or “consumption-in-design”. Similarly, “design-in-production” and “consumption-in-production” are possible at the moment of producing media texts and “design-in-consumption” and “production-in-consumption” at the moment of consuming media texts.

2.1.3 Action, interaction and actors

While in mass media infrastructure is generally considered as a given and unchangeable, the practice of designing infrastructure is one key characteristic of collaborative media. As the authors put it, “What interests us is not just how and why people consume media but also how they take part in the design of media infrastructure and in media production.” (2013, p.29). As a result, the inclusion of designing infrastructure leads away from traditional media studies and the notion of action. The authors continue, “We are interested not in action generally but in interaction—the interaction of people mediated by different types of collaborative media.” (2013, p.29). The authors turn instead to other conceptual approaches, such as the method of actor-network-theory (ANT), which has gained widespread recognition in design research. ANT’s “main tenet is that actors themselves make everything, including their own frames, their own theories, their own contexts, their own metaphysics, even their own ontologies.” (Latour, 2005, p.147). Löwgren and Beimer are especially inspired by the notion of inscription, a way artifacts are inscribed with meaning by designers. This notion is again similar to a model from media studies: the influential encoding/coding model of Stuart Hall (1980). However, while Hall’s model refers to media texts inscription refers to artifacts. More importantly, ANT treats non-human and human actors on the same level. It keeps the social “flat”, making it possible to analyze all powers including digital artifacts and systems.

2.1.4 Tribes

For this thesis, the notion of tribes and the focus on collaborative media in tribal settings is particularly valuable. The concept of tribes in academia is primarily associated with Michel Maffesoli and his book The Time of Tribes (1990/96). Löwgren and Reimer find the concept fit to describe the social structures that emerge from collaborative media practices. According to them, tribes are characterized by exhibiting a significant degree of cohesion such that members have something in common, altruism in that member contribute and benefit in an altruistic way and a sense of belonging.

In their book they describe three cases of tribes engaged in collaborative media practices. OurNewsOurWays is a tribal approach to social navigation. The case envisions tribe members relying on others to explore a massive amount of available audiovisual content and identify relevant media. The Arduino case reports of strong activist and tribal characteristics of a community of hackers and tinkerers, describing insights into tribal
process dynamics. The last case, Malmö City Symphony describes place-specific and cross-media collaborative media productions.

2.1.5 Collaborative media supported learning in communities of practice

The KLIV case run by Björgvinsson and Hillgren stands out as a particularly interesting collaborative media design intervention, as it connects learning, communities and collaborative media. Through their work, the researchers explored how medical staff at the intensive care unit of the Malmö University Hospital could develop a knowledge base on how to carry out various practical work tasks. Based on experiments using methods of participatory design, the case can be understood as a socio-technical intervention as opportunities and challenges in both digital media technology and work practices and procedures are considered. As a result, the resulting design was based on social as well as material practices. While staff was equipped with simple technological means to record and retrieve instructional videos, a vital part of the innovative design was the organization of a process of producing content which could be sustained by staff themselves.

Björgvinsson, one of the researchers, highlights the lack of research into possibilities of co-worker produced interactive or computer mediated learning content in his phd thesis (2007). Following Binder’s argumentation of the potential meaningfulness of structured computer-based learning processes (Binder, 1995), Björgvinsson raises the issue of how such learning and knowing can be structured in a meaningful way in relation to specific activities at work. He further points towards the necessity of considering the larger social context of work practices and how new social practices emerge as a result of new material practices.

Additionally to establishing a close connection to learning and knowing, Björgvinsson’s work further relates the notion of communities of practice, established by the anthropologist Lave and the organization studies researcher Wenger (1991), with collaborative media and in particular to the concept of tribes. Communities of practice are groups of people that organize themselves around a certain practice. Engaging in learning and knowing the practice is the key communality and connecting factor amongst members of such a community. This engagement is characterized through the inclusion of all available resources within the practice’s domain. Further, learning does not happen as a separate activity, but is deeply ingrained in any kind of activity that takes place. Through mutual engagement, relationship are built and a shared competence of the practice is developed. This competence is however dynamic in its nature and is continuously created and recreated, as engagement and relationships change. Newcomers get progressively involved by adopting and reshaping the shared competence of the community they are joining, a process Lave and Wenger called legitimate peripheral participation. Finally, a single person can and probably will be member of several communities of practice, taking in different roles and identities.

2.2. Technical Communication

The field of technical communication is concerned with the communication and documentation of information. The Society of Technical Communication defines technical communication as any form of communications that exhibits one of the following characteristics: communication about technical or specialized topics, communication by using technology and communication by providing instructions on how to do something (Society for Technical Communication, 2014).
2.2.1 Changes in production and consumption - From manuals to the web

As outlined in the introduction, technical communication has been evolving along with developments in technology. The changes follow and accompany very closely the changes the technologies themselves and the practices of both production and consumption of technology and media go through. For example, with advent of the digitization throughout the whole media spectrum, previously printed manuals were also digitized. In parallel with the broad adoption of the internet, technical communicators followed along and published their documents online. Initially, they “used the web as just another channel” (Abel, 2011). However, finally not only the medium and the distribution channel changed, but these transformations started to have an impact on the way of how technical information was produced. Leveraging the replicability of digital data to feed multiple distribution channels, technical writers moved away from creating separate independent documents to working on topics. “The era of topic based information development, commonly referred to as content management, has arrived in full force. And this era is all about integration—that is, integration of organizational and user generated content, disciplines and departments, expertise and roles, and business processes and tools. In a topic based approach to ID, organizational content, from technical to marketing to training content, is created in the form of stand alone topics rather than documents or books. These topics conform to predefined rules that ensure the topics are consistently structured and can be assembled into different information products (e.g., user guide or training module) rendered in different outputs (e.g., HTML or ePub) for different delivery channels (e.g., mobile phones or websites).”, Andersen (2014, p.10) describes the change.

2.2.2 Technical communication and interaction design

By emphasizing the necessity of integration and a more holistic and interdisciplinary approach, Andersen makes a connection to the field of interaction design. Exploring the communalities and differences between technical communication and human-computer interaction de Jong (2011) argues for usability as an obvious area of overlap. Further, he moves technical communication even closer to interaction design by saying, “Technical communication seems to focus less strongly on the frontiers of technological developments, and more on the effective use of technology” (2011, p.117-118). Spinuzzi (2002) reports of the recent interest of technical communicators in participatory design when arguing for considering it as a research methodology rather than a field. Technical communication is a design-oriented field and is especially connected to interaction design.

In an attempt to identify the major research problems within the design of communication, Albers (2013) identifies social media and social and creative practices as two of the most relevant research areas. As one of the researchers Albers points to, Jones reports of “communities who create their own ecosystems from similar tools for their own culturally significant purposes” (2013, p.23) and furthers calls for a more design oriented approach for researchers, requesting them to place themselves within “the social and technological ecosystems we are researching so that we have an impact on their development” (2013, p.24).

Rauch et al (2010) underlines more clearly the need for more research on social media’s impact on technical writing. According to the authors, this research is necessary to help writers adapt to changes in their field. One example they mention is Oracle’s support site “My Oracle Support”, which has been created to follow the trend of providing support and product information in one place. Another example they report is from the
American consumer electronics company Best Buy, which integrated their customer support into Twitter. Their argument is, that this shift in producing documentation has been necessary to keep up with faster product development cycles.

Although researchers in technical communication seem to agree on the need for more design-oriented research, there are surprisingly few documented examples. One such example in academia that connects interaction design with technical communication is “Answer Garden” by Ackerman and Malone (1990). They describe a system that allows organizations to structure their “organizational memory” by developing databases of commonly answered questions. Through their system, questioners are able to find already answered questions while experts can concentrate on more interesting problems.
3 Methodology

Following the research question, the goal of the design process was to establish a design that serves as an inspirational case study for practitioners and researchers in the field of technical communication. Therefore, the design process has been following an approach to explore designs on a broad conceptual level.

3.1 Domain and field sites

Most of the explorations and all design experiments were carried out at a local bicycle workshop called Cykelköket in Malmö. The work on bikes is typically hands-on and carried out in environments where stationary computing devices are not feasible. Therefore, it seemed to be a suitable domain for investigations. The workshop was chosen, since there was already an existing community with a functioning model of working collaboratively but hardly supported by modern technologies.

Further field sites for exploration were local bike shops in Malmö, a Swedish bike web forum and a question and answer web site. These additional sites served mostly as inspirational references.

3.2 Project outline

The project started out with some basic literature research, followed by explorations at Cykelköket, bicycle shops in Malmö, a Swedish bike web forum and a question and answer web site. As a second step, several conceptual directions were explored through both methods drawing on my own ideas as well as a workshop with people at Cykelköket. Finally, two design experiments were conducted at Cykelköket.

3.2.1 Explorations

As mentioned before, Cykelköket acted as the main site as it provided access to a community of bike enthusiasts. The explorations were carried out as contextual inquiries, as described by Beyer and Holtzblatt (1997), which results were highly inspirational and motivated the conceptual exploration and design experiments later on. In parallel, interviews with bike shop owners and mechanics were carried out to get a deeper understanding of the practices professionals within the domain of bike engage in. Following the recommendation of one of the bike enthusiasts at Cykelköket, activities at a Swedish bike web forum were analyzed in order to understand how existing collaborative media was used. Finally, inspired by my own experience as a software developer, the popular question and answer site “Stack Overflow” was studied as an example of functioning collaborative media practices in another domain.

3.2.2 Conceptual discovery

Starting out with generating ideas based on the previous phase of explorations, several directions were explored during the conceptual discovery. In order to further broaden the design space, the method of innovation through boundary shifting, originally proposed by Jones (1992), was carried out. Finally, a workshop with bike enthusiasts from Cykelköket was conducted to involve them in the ideation process. All of these activities contributed to the formulation of four desired design qualities that guided the design experiments.

3.2.3 Design experiments

Two design experiments at Cykelkök were carried out. The first design was grounded in the previous phases of conceptual discovery and explorations. A prototype was
developed and used as an artifact of probing bike enthusiasts for the potential role of the envisioned design. The second design can be seen as a response to the learnings from the first one. An animated storyboard was created to facilitate discussions with bike enthusiasts and validate and explore the concept.
4 Explorations

The goal of the exploratory phase was to get an understanding of present practices of repairing bikes. Fieldwork sites were both professional as well as hobbyist environments, with a stronger focus on the latter one. Additionally, online research was conducted investigating an online bike forum and a question and answer site for software developers.

4.1 Cykelkök

Cykelköket (Swedish: the bicycle kitchen) is a workshop, where anybody can go to work on bikes. Visitors can either bring their own bikes or take one of the bikes Cykelköket has gathered from the streets. The workshop provides tools and second-hand materials. Additionally, there is staff consisting of paid employed and volunteers that can help out. The focus is not on fixing bikes in general, but empowering and helping people to do it on their own.

4.1.1 Method

As my main research site, I spent altogether five days at Cykelköket observing people. Throughout my investigations, I tried to keep the following questions in mind:

- How do people fix bikes?
- How do they learn? How could they learn?
- How do they collaborate?
- What are their challenges?
- What do they not know?

In most cases, I did not ask any of these questions directly such as in a traditional interview, but rather in the course of a contextual inquiry, introduced by Beyer and Holtzblatt (1997). The core premise of contextual inquiry basically consists of observing and talking to people while they are at work. This approach helped me getting a better understanding of and developing empathy for “users” of the Cykelköket, i.e. visitors, volunteers and staff. I approached others as another interested hobbyist and when appropriate informed them about my research project. I started by asking what they were working on and then tried to stir the direction towards the questions listed above without asking them explicitly.

4.1.2 Staff

When starting my explorations at Cykelköket, at first I asked the project leader Katrina for permission and had a brief discussion with her. Katrina spends one or two days a week there, organizes the place and helps people out. Related, to the project, she told me about an idea of her and others at the workshop. As the main goal of the workshop is to empower people to repair their bikes, the idea aimed at bringing the knowledge of fixing bikes to people’s homes. The vague concept was to put an illustration of a bike on a bulletin board and QR codes attached to different parts. The QR codes would then link to different instructional videos and other learning materials. This way, existing online instructional media could be leveraged and made available for people. Further, Katrina would often delegate questions to regular visitors of the workshop. These visitors generally work on their own projects and have developed expertise in a particular area, e.g. gears. As so-called topic experts, they are often asked to help other less-experienced hobbyists. However, a lot of this knowledge of who topic experts are is unknown to others including volunteers at Cykelköket. On a more general note, Katrina mentioned that Cykelköket acted as a meeting space for people of different heritages, cultural
backgrounds and ages. As already mentioned and described more thoroughly below, this heterogenous group of bicycle enthusiasts help each other out and by doing so, they develop personal relationships. For Katarina, this works better than meetups that are only organized to bring people together, as there is a common practice people can center around and engage in.

Additionally, I had a brief conversation with Jesper, one of the volunteers at the workshop. From his experience, he mentioned one specific example where technology might help people. When fixing a puncture, one has to find it, roughen it up with a piece of emery paper, put some glue on and around the whole, let it dry and then put a patch on it and press it for one minute. According to Jesper, “one of the biggest problems when fixing punctures is that you have to press [the patch] a full minute. Something like a phone app that counts down from one minute could work”. One project called the “bakfiets” project, as they used cargo bikes or “bakfiets” in dutch, Jesper and others carried out during last summer was aimed at bringing the Cykelköket to areas in Malmö that were farther away. He told me about related workshops in Sweden and elsewhere that had similar ideas.

4.1.3 Hobbyists

When I moved on to users of the workshop, I met Erik who was fixing a puncture in the tube of his bike’s rear wheel (fig. 1). He had never fixed one before so I guided him through the process. That way, I ended up questioning him about his thoughts and process while he asked me how to fix things. One question that I couldn’t answer fully was, “The tube makes a bigger bulk here when I pump it up. Is this a problem?”. I told him that I did not think it was a problem since the bulk did not seem to be very big and probably unlikely to cause any additional punctures, but that was only my own humble guess.

Fascinated by the possibility of fixing his own bike, another visitor said, “It is so good how much we learn, and shops charge you 300 SEK (approximately 33€) for this”. For me this felt like an implication that it is really easy to fix things, once you know what you have to do.

While taking notes, I observed that a Spanish student who had just started repairing a bike herself ended up giving advice to somebody else. Even after a few visits only she was already able to help others out.

Assuming that I was a volunteer, another visitor asked me whether a chain he found at the spare parts was long enough to fit the bike. As the chain was loose with the ends not linked, we tried to estimate its fitness by attaching it to both front and back gears. Being satisfied with the length of the chain, he then asked me whether I knew how to put it together. I did not so he went requested the help of one of the volunteers.
When I met Halan, he was trying to fix the gears of his bike that weren't running smoothly. The cable that was leading from the derailleur to the shift levers was too short, but he was uncertain if he could change the cable. The problem was that he did not know how the inneries of the lever worked. “I don’t know if I can rebuild it,” he stated with an unsure look on his face. Not knowing if he could put the lever back together, he was reluctant to take it apart. With the help of one of the volunteers he finally managed to do so. However, changing the cable did not do the whole deal. His gears would still jump from one sprocket to another occasionally. Again guided by a volunteer, he took apart the sprockets and cleaned them to finally solve it (fig.2).

On another day, the first visitor I encountered wanted to spray paint his bike. He had talked to a friend working as a car mechanic, who advised him to use spackle to fix the spots where he had removed parts of the frame. When I met him, he was working on sanding the spackle and the rest of the frame in order to spray paint it later. As I had just spray painted my own bike frame, we started a conversation on which type of sandpaper would be suitable for sanding of the paint. He was working with a very fine grit size that made it difficult to sand off the paint or even roughen it up properly. Unfortunately, the workshop materials did not feature any other sandpaper. As a result, he just sanded the spackle with the available sandpaper and left then to continue another day.

Jon is a more regular visitor (fig.3). I approached him when we was just fixing his brakes. As both a bicycle and motorcycle enthusiast, he could transfer a lot of the knowledge and technical skills from working on his motorcycle to his bike. “It is always hard with spare parts that are not made for your frame”, he summarized his work on the bike he had entirely built from spare parts at Cykelköket. When I asked him whether he looked up instructional videos online, he replied enthusiastically, “Always, all the time to check out things. There are a lot of people that just like to hear themselves talk. 10 minutes for changing a seat, that’s really not necessary. But there is a lot of good stuff.” His primary source of online information is video where a lot of bike hobbyists post their instructional videos. Regarding Cykelköket he said, “I used to work from home, but I like the supportive character here.”

4.1.4 Insights

From the interviews with staff and contextual inquiries with hobbyists, there are several learnings to highlight. Firstly, the orientation of Cykelköket towards empowering people and teaching them rather than just “getting things done” as well as existing ideas of using technology to achieve this goal validate the site as a research site. Secondly, Cykelköket
can also be seen as a meet-up place for people from very different backgrounds and heritage. Their common interest in and work on bicycles unites these different people and gives them something to talk about. Thirdly, collaboration is crucial for the work there. Apart from staff, it is often topic experts who employ their expertise to help out others. Furthermore, even newcomers are able to learn quickly and are eager to contribute by helping others. However, it is often unclear who can and is willing to help. As a result, some of the potential gets lost.

4.2 Bicycle shops

Additionally to the fieldwork at Cykelköket, I went to different bicycle shops around Malmö. A few of the shops were repair-only shops, while most of them both sold and repaired bikes.

4.2.1 Method

Presuming that bike shops would mostly do routine tasks such as fixing punctures, adjusting brakes and gears and oiling chains, I deemed it more effective to ask them questions about their past experiences and general behaviour rather than observing them in their daily work. I based the interview I conducted on the following questions:

- What do you repair most often?
- How do you repair stuff you don’t know or have never repaired? Can you tell me about a specific experience?
- Do you collaborate with others? How?
- Are there others that want to learn from you or that depend on you? How do you teach them?

4.2.2 Interviews with bike shop owners

The first bike shop owner I talked to was Siran (fig.4). He is running a medium-sized shop in the southern center of Malmö. He confirmed my assumption of him working mostly on routine tasks. In the rare cases he encountered a problem he could not solve himself, he relied on different sources in learning to fix it. Primarily, along with the bikes he sells in his shop, he often gets manuals produced by bike manufacturers themselves. Additionally, he relies on a network of bike shop owners and mechanics in Malmö. Finally, he occasionally searches youtube for relevant instructional videos. In some cases, he refers to other more specialised bike shops. As he puts it, “Sometimes I don't do anything, because when I break something, I have to pay it out of my own bag.” As a result, he only sells bikes that he can repair as well. His shop is not specialized in anything in particular, he mostly sells street bikes and entry level mountain bikes. According to him, all mechanics in his shop are on the same skill level.

Alex is a mechanic in a bike shop close to Siran's. Like Siran, he works mostly on routine tasks and transfers other problems to more specialized bike shops. Alex has acquired all his knowledge about bikes at the very same shop he works in now, stating “It's easier to learn in a practical way” and when asked about online media “If I can learn it here, then I
don’t have to look online.”

Visiting a repair-only shop closer to the old center, the talk I had with mechanics working there was very much inline with my earlier interviews. They would work mostly on routine services and call friends if they were missing material. Again, they said that they had learnt everything they knew from working with other more experienced mechanics, following a conventional master - apprentice model.

Essi, a bike shop owner close to the shopping center Mobilia in Malmö, learned his abilities of fixing bikes from his father and grandfather. “I’m in the third generation”, he says and smiles. Having the experience and knowledge of three generations, he is confident with fixing any issue he might encounter. As a result, he does not use online media and only barely manuals produced by bike manufacturers to learn about innovations in bikes and how to maintain and repair newly developed components. As an immigrant from Iran, he has been living 20 years in Sweden. He owns two bike shops, one in Malmö and one in Iran.

Roberto is a young mechanic working at “Andersson Cyklefabrik”, a 56-year old bike shop south of Malmö’s center. As the others, he has learned his profession from his colleagues and boss starting as an apprentice and working his way up. Regarding innovations in bikes, he mentioned that in Sweden technicians are often invited to workshops of manufacturers to learn about them. An example he mentioned are batteries for e-bikes. In his shop, a more senior colleague normally goes and then teaches the more junior technicians.

Muhammad works at the “Stadion Cykelverkstad”. He states that he is very ambiguous about using online media such as youtube to learn about new technologies in bikes. He does so in his free time to keep up with innovation. Additionally, he mentioned that he used to go to eurobike-show in Friedrichshafen to inform himself about the latest trends. Regarding information about new bikes and other innovations in the industry, he said, “Information must be accessible and easy to understand. Just like the product itself, otherwise it doesn’t sell”. As an example, he told me about how he bought and repaired e-bikes of a certain model which featured a battery that was very hard to replace and repair. When new e-bikes came on the market that were easier to maintain, he stopped retailing the older ones. For him, “bikes must be easy to maintain”, and both the product itself and product information play a vital role in this.

Rikan from Cykelexperts close to the stadion repairs like the other mechanics mostly punctures and small things. Occasionally they get in newer bikes, race-bikes and e-bikes. He just repaired an e-bike which battery did not work well. Trained as an electrician, he replaced two wires and improved it this way. He was very open for the idea of using new technologies and media to help technicians and hobbyists as he was already using them himself.

4.2.3 Insights

The presumption of mechanics at bike shop mostly doing routine tasks has been validated by the conducted interviews. All interviewed mechanics expressed their confidence in their daily jobs regarding the match between required and actual skills and knowledge. In general, mechanics seem to follow a master-apprentice model of learning throughout their career. However, while some mechanics rely on the things they already know and stay within their expertise, others seem to make a higher effort in keeping up with innovations and acquiring new knowledge. For the latter, they often tend to use the same resources as hobbyists such as youtube video tutorials and other online media.
Finally, the interviews have shown that mechanics rely on existing networks to help out each other or refer customers to other bike shops that are more specialized in a specific area.

4.3 Online research

In parallel to fieldwork on site, an online bike forum and StackOverflow, a question and answer site for developers, have been analyzed as inspirational examples of existing media use.

4.3.1 Fixedgear - Online bike forum

Fixedgear was mentioned by one of the volunteers at Cykelköket as an active Swedish bike forum. As its name suggests, it is forum about fixed gear bikes. At the time of writing, the site has 4900 users, 203386 posts and 16306 topics (Fixedgear, 2014). It is structured into five different sub-forums: a form for general discussions that do not fit into any of the others forums, one forum to ask others for help for specific problems on your own bike, one forum for traveling and two forums for selling or buying parts or entire bikes.

For our discussion, the former two sub-forums are the most interesting ones. Topics here are typically started as an inquiry for help. These inquiries are mostly posed in text and sometimes supplemented with pictures and links to other websites. Other members answer likewise using text, images and links. Some of these questions then turn into discussions, with the asking person clarifying their initial inquiry and them and responders discussing different solutions. In the course of these discussions, the most valuable answers are often hidden between others and as result, for newcomers hard to find.

Apart from the use of the forum as a practical tool to get advice from other bike enthusiasts, it can be observed that great parts of it are about connecting with others. In the main sub-forum, one can find countless threads about showing off bikes, discussing different models and organizing offline events.

4.3.2 Stack Overflow - Question and Answer Site

The website Stack Overflow\(^1\) has taken the idea of Q&A forums a step further. The website allows its users to rate both answers and questions and view these ratings. Additionally, the user asking the question can accept an answer, which is likewise visible to outsiders. Through rating questions and answers and making these ratings visible, valuable contributions are highlighted and distinguishable from other less valuable ones. Especially for outsiders, who are not able to go through the entire discussion, the sum of these design improvements over a classical forum can provide a shortcut to find and identify correct and valuable answers.

Apart from its rating system of questions and answers, Stack Overflow features a system of assigning responsibilities and powers to its users. Through engagement with the platform such as asking questions, responding, rating or being rated, users earn reputation points. With an increasing amount of reputation, users are assigned privileges. For example, while a newcomer to the platform can only choose from available tags to tag his question, more privileged users with a higher amount of reputation points are able to create their own tags. With more privileges, users are more involved in the design of the infrastructure and community rules that frame the interactions.

\(^1\) http://stackoverflow.com
5 Conceptual discovery

The aim of the conceptual discovery phase was to explore as many directions as possible. This discovery was started by ideas based on the previous phase of explorations. In the following step, the generated ideas were grouped and detailed. In parallel, further background research on related examples was conducted. Subsequently, the method of innovation by boundary shifting was applied to generate a broader amount of ideas and concepts, adding to the existing ones. Finally, a workshop with volunteers, staff and visitors of Cykelköket was organized to include them in the idealization process.

5.1 Exploration-based ideas and concept

An initial ideation phase based on findings from earlier explorations, established four general themes as starting points for further conceptualization.

5.1.1 Show which videos are relevant

This theme drew on the insight that there were plenty of instructional videos available, but somehow not accessible enough for many bike enthusiasts. More detailed ideas are listed in the following:

- link answer videos and play them at the same time
- meta-information to retrieve videos, tags & keywords
- up and downvoting of videos
- mark videos as answered
- leverage already existing videos youtube, prefilled content by using existing videos
- video based Stack Overflow

5.1.2 Communicate what is wrong at the time it happens

Focusing on communication and communication channels, the underlying idea was to provide the right information at the right time. Again, more detailed ideas are listed in the following:

- instant messaging
- call helpers on the phone
- call helpers via a VoIP Service
- overlay comments
- commenting at seek time
- overlay drawing
- audio comments and automatic transcripts
- go there or invite them over

5.1.3 Find the right collaborators

This theme is similar to the last point, but with the focus shifted to the means of finding a collaborator instead of means of communication. The following ideas were grouped within this this theme:

- ask neighbors for help
- ask neighbors for tools
- social network integration (e.g. ask friends via Facebook)
- start a project over time with collaborators
- suggest others as collaborators
- possibility for manufacturers to show their skills and promote themselves
- possibility for shop owners and mechanics to show their skills and promote themselves
• identify topic experts of different categories (e.g. gears, brakes, …)
• check-in at Cykelkök so people know that certain topic experts are there and can reach out to them
• community currency, e.g. to ask for help (-10), help (10), comment (5), vote (1)

5.1.4 Show and teach mechanics and structure

This theme is characterized by the concept of teaching and learning underlying concepts of bicycles. By doing so, the aim is to establish a sufficient understanding so that hobbyists can solve problems themselves, opposed to following a detailed guide of how to solve things. The following ideas frame this theme:

• give hobbyists real bike parts to experiment with
• video of somebody taking apart a bike
• a 3D or 2D model of a bike taken apart
• create categories and tags for different models and parts of a bike
• 3D model can be projected on a bike
• overlay the model with comments, videos, picture, etc. similar to Google Maps
• model featuring multiple layers that reveal inner structure (e.g. shift levers)
• show inner structure of parts of an existing bike with augmented reality
• make parts of a model exchangeable to accommodate for different standards and bike models (e.g. different kinds of brakes or bike brands)
• visualizations collected in an app to show how certain mechanics work (e.g. interplay between lever and derailer)

5.2 Innovation by boundary shifting

Innovation by boundary shifting, originally proposed by Jones (1992), is an exploration technique that enables designers to expand their thinking of design solutions to include resources they have not thought of previously. The method is a procedure of four steps resulting in compatible sub-solutions to the original design problems.

5.2.1 Identify the essential functions of any device that could achieve the desired objective.

Here, it is already necessary to have a clear understanding of the desired objective (or design problem) to be able to identify the essential function. In order to formalize the design problem, two existing means that arguably work in general, but not in the design space at hand, were analyzed. Firstly, volunteers at Cykelköket can be seen as such a means. They can be asked and help out through their own expertise and experience, identify problems and show others how to accomplish repair tasks. Secondly, “Stack Overflow” and similar question and answer web sites similarly provide users with the options of asking questions and receiving answers as well as searching for existing questions and answers. Based on these two existing solutions, the essential function was described as enabling others to help somebody to fix their bike through either showing a solution to a problem or showing how things work so one can find a solution themselves.

5.2.2 Identify conflicts between existing means of achieving these functions within the assumed problem boundaries

The assumed problem boundaries are that the practice is carried out in a local, non-stationary context which could be at home, during a maintenance routine or practically anywhere on the go. Having the problem boundaries and the existing means - volunteers and Q&A sites - established, the conflicts that prevent these means from solving the problem were identified.
<table>
<thead>
<tr>
<th>show solution to problem</th>
<th>volunteer</th>
<th>stackoverflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>not present</td>
<td>hard to describe solutions to problems textually</td>
<td></td>
</tr>
</tbody>
</table>

| show how things work | not present, needs material | hard to describe concepts textually |

5.2.3 Identify resources outside the assumed problem boundaries that might be made available by transforming the problem

Additional resources that are available are manufacturers and their staff, web tools such as youtube, instant messengers, forums, manufacturers' web sites, skilled neighbors, close workshops, bicycle shops, friends and manuals.

5.2.4 Seek compatible sub-solutions to the problem that would provide channels for the use of some or all of the newly identified resources

One solution could be to take neighbors and friends into account by asking them for help. A concrete way of achieving this could be by using the web to create a service that connects the right people.

Another solution using existing web tools to connect volunteers and bike enthusiasts in order to bridge the geographical distance between them. Communication could be facilitated through a mix of text, audio or video or even more modern solution such as augmented reality or virtual reality solutions.

Another idea could be a support line for bike owners operated by bike manufacturers' staff. This support line could be based on conventional phone networks or using any more modern technologies as the ones listed above.

Manuals could be transformed through augmented reality tools, which enables readers to interact with manuals instead of just going through static instructions.

Communities could create an own designated public meeting space such as a public square or a community space, that brings more and less experienced bike enthusiasts together.

5.3 Future workshop

In order to draw ideas from others and not only myself, I conducted a workshop with people from Cykelköket. I (re-)adapted the concept of the future workshop, a method for participatory social and organizational development (Jungk and Müllert, 1987) that has been successfully adapted to work-oriented design of digital artifacts (Kensing and Madsen, 1991).

Future workshops consist of three phases: problem brainstorming to identify and communicate problems of the participants' current situation, a second brainstorming to create visions about the future, and finally a discussion about how these visions could be realized.

The main goal of the workshop was to hear of the experiences of participants to gain new insights and ideas as well as backup and validate existing concepts, opposed to probing how a collaborative platform could look like or how an app should work. As a result,
since I expected the implementation phase to be rather technical and too detailed for this discussion, I focused on the first two phases. Moreover, as the group of six people was already fairly small, I left out the division into small groups during the phases.

5.3.1 Participants
I invited bike enthusiasts, staff and volunteers of Cykelköket to join the workshop by personal invite and through a post on Cykelkök’s Facebook site. Six people joined the workshop, including the organizer of the municipality building Cykelköket is part of, the Cykelkök’s Project Manager, one staff member, two volunteers, and one visitor of Cykelköket. All but one of the participants I knew from earlier visits to Cykelköket.

5.3.2 Warm-up
For the warm-up game, participants were asked to line up according to the month they were born without any talking. The group managed to line-up fairly quickly (~2min) without a lot of interaction. For a group of this size, a slightly more complex and interactive game could have been chose to increase the “warm-up” effect.

5.3.3 Problem storming
Participants were asked to note down problems somebody could encounter when working on their bikes. They were free to come up with problems they experienced themselves, they observed or they imagined possible. Further, contributions could be of a more general nature or of a concrete example. They were asked to note down those problems on sticky notes. They were given one minute to prepare initial notes, that would then be posted to a wall. After this initial phase, they had three extra minutes of writing up additional notes and adding them to the others. Finally, participants and I started detailing and grouping the notes.

The group came up with about 20-25 notes during the brainstorming, which were roughly grouped into four groups. A group of notes was about practical issues. For example, one participant complained that it would be almost impossible to fully clean his hands of the grease after having worked on his bike, giving bad impressions on clients the next working day. Notes of the second group were about the availability and knowledge of tools that are necessary for repairs. Similarly, another concern for many participants was the question of how to obtain concrete knowledge of doing things. Most of them were aware of existing online tutorials and other support material. However, they agreed upon that it was difficult to find the right resources. Finally, many participants reported of experiences when they feared to fail fixing things. In such situations, they felt insecure of their ability to solve the problem at hand. As a result, they were afraid of making the problem worse. At the same time, the difficulty of estimating how much time a concrete repair task would take added to the insecurity.

5.3.4 Fantasy discussion
When detailing and grouping the notes, the workshop participants started already to engage in finding solutions for the problems they had listed earlier. As a result, I decided to follow their enthusiasm and change the fantasy phase to be a discussion instead of a second brainstorming.

There was a major agreement of recognizing Cykelköket as a solution for a majority of the problems discussed. Additionally, participants referred to applications in other domains, such as an app teaching people how to play the guitar. Here, the importance of solutions for beginners versus solutions for more experienced hobbyists was highlighted. For beginners, a participant brought up the idea of carrying out workshops or placing...
support material in a larger context in order to achieve a spillover effect. For example, one may attend a general DIY (do-it-yourself) event and in the course of it participate in a bike workshop. Another idea was to create professional tutorial videos to both help hobbyists as well as promote Cykelköket. This idea highlights the importance of approaching potential users both offline and online to reach a great level of engagement. A solution to the difficulty of finding the right tutorial was to use existing videos and make them searchable. In addition, a participant mentioned that it would be very helpful to have an estimation about the complexity of and the time needed for a particular repair task. Regarding the availability of tools, participants built on the idea of the already existing air pumps that are already distributed throughout the city of Malmö by adding tool kits to these outside stations. Similarly, tool kits could be borrowed from libraries and other public institutions that already lend out some tools such as drilling machines.

5.3.5 Conclusion
In general, insights from the workshop were generally very much inline with previous concepts and validated them. However, the most interesting insights were the importance of confidence and support for bicycle enthusiasts and the discussion of Cykelköket as a solution itself.

5.4 Synthesis
The most compelling direction to take seems to be the synthesis of several of the ideas that came up during the conceptual discovery.

5.4.1 Underlying ideas
More concretely, the envisioned concept takes parts from collaborative Q&A sites such as “Stack Overflow” and video tutorials such as found on youtube while not leaving out the human factor in the social and geographical context the practice takes place in. In the following the underlying ideas will be described in greater detail.

5.4.1.1 Community-driven Q&A sites and their shortcomings
The value of Q&A sites and similar systems for the domain of technical communication is hard to deny. For example, the popular website Stack Overflow has almost 40 million unique users per month globally (Quantcast, 2014). The main features contributing to its success are arguably the rating system allowing users to rate both questions and answers, the reputation system which assigns roles and responsibilities so that the community can organize itself and suggestions and search for existing questions and answers based on meta-information.

5.4.1.2 Video tutorials
Videos are already widely used by both professionals as well as hobbyists to acquire new knowledge. Mostly created by hobbyists, they are often of high enough quality to be useful to others. An effective tutorial uses the combination of video, audio and text to show how a concrete task can be performed. While video tutorials thus represent a great resource for anybody seeking to acquire new knowledge, the challenge comes in when trying to find the right video for the right task. As discussed earlier, one essential part of fixing a bike and of problem solving in general is assessing and finding the problem in the first place. Even when the problem is known, it is often hard to describe it in words and look for a video describing how to solve it via an interface based on textual search.

5.4.1.3 Personal relationships
The value of a real person helping out lies not only in their expertise in concrete repair
tasks. Of course, such a person helps by finding the problem, a solution and assessing its complexity. However, apart from representing a valuable local resource and contributing with their knowledge, helpers boost confidence and motivation of others through their sheer presence as the more experienced. At Cykelköket, the personal relationships between visitors, staff and volunteers have been crucial for the success of the project. This has been observed during the workshop as well as during earlier explorations. For this reason, one should not underestimate the value of local knowledge in a social context and take this resource into account.

5.4.1.4 Experts and knowledge gaps
When interviewing bike shop owners and mechanics, their first response to their limitations of fixing bikes was initially that they basically knew everything there is. However, asked directly about an occurrence of when their knowledge did not suffice to fulfill a customer's needs, most of them admitted occasionally having to send customers to other more specialised bike shops. This revealed an interesting phenomena regarding expert knowledge, namely the difficulty of delimiting such knowledge. One reason of their seemingly opposing responses could be that repairing a bike for them means actually doing conventional repair tasks or tasks they are used to perform on a bike. As a result, in their view their knowledge covers any tasks related to fixing bikes, making them experts in the matter.

5.4.2 Resulting design qualities and challenges
The following design qualities are derived from inspirational ideas in the previous section and guide the following design experiments.

5.4.2.1 Documentation for others
One compelling idea is to create documentation in the process of working on a task and being helped by others. For example at Stack Overflow, a programmer asking for advice usually needs to detail his inquiry in order to be understood by others. This inquiry itself often documents a certain task to some extent. Others then help refining, clarifying and detailing this documentation by asking for more details, proposing solutions as answers and voting already proposed answers. Additionally, they help assessing the relevance of the question itself by voting it up or down. Through my design experiments, I try to explore how bike enthusiasts could be provided with adequate means to create the same effect as observed on Stack Overflow.

5.4.2.2 Distributed communication
Aspiring to facilitate the practice of repairing bikes, one challenge will be to provide the means for bike enthusiasts to communicate effectively with others. Video tutorials have proven to be a vital resource for learning about concrete tasks. Hence, they seem to be a promising starting point to explore how effective communication could work in a mobile and place-specific but geographically distributed context.

5.4.2.3 Local and global resources
During the exploration phase, it has become clear that bike enthusiasts use both local as well as global resources to achieve their goals. So for example, somebody might go through a bike tutorial online, taking notes and when getting stuck ask their neighbors or friends for advice. In the design experiments to come, I aim to take this potential of leveraging both locally as well as globally available resources to the next level by integrating the two more closely and showing further opportunities.
5.4.2.4 Identify intermediate knowledge

As argued in the previous section, professionals are often unaware of their knowledge gaps within their domain. Hence, they do not see the need to learn about newer areas within their expertise. They rather stick to the known and are confident in keeping their expertise at a stable level. However, even if professionals are aware of their limitations it is in general hard to delimit knowledge, i.e. to distinguish between the known and the unknown. Through my design experiments, I pursue to explore how the boundaries of knowledge can be identified and communicated to domain professionals.
6 Design experiments

The following design experiments explore different directions following the established design qualities of the previous section. The experiments have been carried out in sequence. While the first experiment is based on the previous sections and follows closely the conceptual discoveries, the second experiment is mainly a response to some of the shortcomings of the first iteration.

6.1 First experiment

The first experiment focused on the question of how practices at Cykelkök could be transferred to a distributed community of bike enthusiasts. More specifically, my interest was in exploring how hobbyists could work on their bikes at home while still being connected to and benefit from a wider community, both locally and globally, of like-minded people.

The artifact is envisioned as an application for a smartphone. Conventional smartphones have sufficient capabilities for the desired functionalities, they provide communication facilities supporting connections to WiFi and mobile networks, cameras for image and video recording and screens of high-enough resolution to view videos.

6.1.1 Use cases

The first experiment was based on two potential use cases, illustrated by the following storyboards:

6.1.1.1 Basic problems solved through online communication

A bike enthusiast dealing with basic problems that could be solved with a little help from others (fig.5-11).

fig.5: Anna finds her bike with a flat tire  
fig.6: She takes a video of the bike and uploads it
6.1.1.2 Accessing local knowledge by asking people in her neighborhood

A bike enthusiast accessing local knowledge through asking people in her neighborhood for help (fig.12-17).
6.1.2 Prototyping and testing

Following the language proposal of Houde and Hill when describing prototypes (1997), the prototype was mostly focused on role rather than on look and feel or implementation, as the artifact was meant to introduce new functionality for its users, and thus play a new role in their lives. Through testing it I sought to get a sense of if people would generally accept the idea and how they would put it to use. A prototype for the operation system Android was created based on the Android SDK, since I did not consider prototyping platforms flexible enough to extend the interface in a more sophisticated manner.
The prototype features a login form, a simple camera application and an integrated chat client (fig.18). Additionally, a simple chat server and a command-line chat client were written in node.js. With this setup, I aspired to probe potential users on how the communication with others could work during the process of fixing a bike. This communication should enable users both getting immediate feedback while also reaching out to local more experienced bike enthusiasts.

During testing, I approached people at Cykelköket as during the exploration phase to involve them in a casual conversation and using the prototype as an artifact to explain and discuss my ideas.

### 6.1.3 Findings

Responses from the first round of testing with five hobbyists and two volunteers from Cykelköket range from general appreciation to objection. When I approached one of the visitors with the prototype and offered to videotape his bike to ask others for help, he replied that he would “prefer to try it myself and then ask the others around.” Of course, in the context of Cykelköket, he could ask others around, so I repeated my question asking him to imagine being at home. However, he did not deem it useful, but replied that it might be for others. Another visitor was equally sceptical, she said that “it would take a while to get a response probably”. Thus, she was not ready to make the effort to document her issue, as she needed help the same moment. Another volunteer acknowledged the idea’s value for people at home that needed advice. For himself, he could see a potential use when going on a trip with his race-bike. As some of his trips are up to 60 kilometers, the application could enable to get in touch with locals when having an issue with his bike. One of the volunteers, underlined the value of drawing on both local and global resources, calling it “the social versus the ‘social’”. While he himself would look for advice and documentation of specialized issues online, he compared the local aspect to a dating website for bike enthusiasts. For him, through this “dating app” enthusiasts could find like-minded others to meet at Cykelköket to repair their bikes. On the other hand, he could see the app as a means to find the right help guided by the community. Validating the idea of including locals, he stated that most helpers will probably prefer to help hands-on as opposed to communicating directions through technology. He questioned the usefulness of video as he could not imagine himself making a proper video to document a repair process. Having watched videos and textual tutorials, he however acknowledge the effectiveness of well-made videos.

### 6.2 Second experiment

As mentioned above, most of the visitors whom I approached with the first prototype had doubts about its usefulness due to the lack of activity on the platform. As a result, they assumed to not get a response at all or later when it was not needed anymore. Of course, this is an issue for many online (and arguably offline) communities. A critical mass of users needs to be reached so that interactions happen frequently enough ensuring that responses happen timely and new users perceive the community as alive and attractive.

One measure of approaching this problem is by creating the perception of an active
community to attract new users until a critical mass is reached. Preloading the platform with content, for the cast at hand with existing online tutorials on how to repair bikes, could help creating this perception. Moreover, a platform preloaded with tutorials would actually create real value to potential users by providing them relevant content.

Another approach would be to leverage the existing community of bicycle hobbyists at Cykelköket. The workshop is already a very busy place during some days and visitors notice the lively environment and the spirit of an existing collaborative community immediately when they enter. Thus, a compelling direction seems to be to draw on this spirit and incorporate it in the design concept. This results in a major change for the conceptual design. Building on the community of Cykelköket represents a shift to a much more place-specific design taking into account its sociocultural context and geographical location.

6.2.1 Cykelköket as a community of practice

By focusing on Cykelköket, it seems plausible to draw on the notion of communities of practice established by the anthropologist Lave and the organization studies researcher Wenger (1991) and introduced in the theoretical section of this thesis. At Cykelköket, staff, volunteers and regular visitors naturally stand close to the center of the shared competence in working on bikes. They and newer visitors consistently develop this competence further by engaging in activities of repairing and tuning bikes. When engaging in daily tasks they draw on their accumulated experiences and other resources such as shared stories, established help materials and known video tutorials. One example of a manifestation of this shared competence can be observed when looking at how Katarina, the project manager of Cykelköket, is able to refer for specific repair tasks to regular visitors she knows are experts in this area. This is not only possible, because regular visitors have developed this expertise, but also because Katarina knows through her personal connections with these visitors of their expertises and as the project manager can refer less experienced visitors to them. Additionally, bike enthusiasts at Cykelköket have created a social conduct of a collegial atmosphere based on personal relationships that is prevalent at the workshop. It includes for example showing patience when waiting for volunteers to help out, respect for the workspace and materials of others and a readiness to help others. Adopting these informal rules, newcomers quickly collaborate with others and contribute to the shared competence of the community.

6.2.2 Practical questions

Having described the community of Cykelkök as a community of practice, the major practical question lies in how a digital system with the desired design qualities could be incorporated in the practices of the existing community. Primarily, there are two major decisions to be made. First, there is a question of how documentation could be created while engaged in practices at Cykelköket. Second, how could the so-created documentation then be made available in a useful way?

For newcomers seeking to fix their bike, it is probably of less concern to document their process than actually getting the task done. While they may be interested in learning, they are probably not as closely connected to the community as it would be required for them to actively contribute to its shared competence. However, more regular visitors, volunteers and staff may have a greater interest in documenting their experiences and learnings. For them, this could represent another resource which will eventually turn out to be helpful in the future. As an investment in the future at times that allow it, such as at a calm day with relatively few visitors, recording repair tasks for documentation such as in the form of videos could be of great use when staff and volunteers are faced with
an overwhelming amount of visitors. Their incentive is the possibility of having some of their burden taken from their shoulders. Instead of having to explain routine tasks, such as fixing a puncture or showing somebody where the wrenches are, over and over again, they could refer newcomers to video-based tutorials and guides. As a result, they would be able to help more effectively and have time to engage when their help is really needed.

Thus in this second iteration of the design concept, Cykelkök volunteers and staff are put in charge of recording videos and guiding visitors to use this documentation. In this position, they will be mediators between past and future visitors, their problems and acquired knowledge, while deeply rooted in the place that is Cykelköket. As described in the previous chapter, they already fulfill this role to some extend by referring less experienced visitors to others. The envisioned concept takes this practice further by adding a digital knowledge base, which staff and volunteers have access to and can add to, ultimately contributing to the community’s resources. While doing so, they are still primarily engaged in personal interactions with visitors and others, but secondarily they may choose to document their activities.

Visitors engage in this manifesting of knowledge by bringing in new issues and questioning the established competence. By doing so, they will help exposing the unknown, delimit knowledge and ultimately expanding the community’s shared competence.

### 6.2.3 Scenario

In order to envision how this could work out in practice, let us consider a typical scenario. A less experienced visitor called Emil might try to ask Anna, one of the staff members, to help out with adjusting the gears of his bike. As Anna is currently busy, she promises to come as soon as she is done. Emil goes back to his workplace and tries to come up with a solution himself. He has a pretty good understanding how the gears work, but does not know how to start. While waiting for Anna, he starts to talk with his neighbor Muhammad. Muhammad is a much more experienced bike enthusiast, but he has never tried to adjust gears of the kind of model Emil has. Finally, Anna arrives and shows them how the gears could be adjusted. There was a key screw, which was responsible for the adjustment. Anna knew this special type of gears from having worked on another visitor’s bike just a couple of months ago.

Now, imagine Anna had taken a video of when she worked on this other bike. When being asked for help, she could have told Emil of her experience and the existing video documentation. In the best case, Emil and Muhammad would have been able to figure out how to adjust the bike based on this video and Muhammad’s expertise. Otherwise, they could have still learned something from the video and been able to deepen their expertise with the help of Anna later on. Moreover, imagine that there existed a larger collection of gear adjustment videos already. Ratings such as found on Stack Overflow and made by other earlier visitors and potentially outsiders could have helped Emil find an appropriate video.

### 6.2.4 Testing and findings

The concept was envisioned as an animated storyboard\(^2\). The animation was used to explain people at Cykelköket the concept briefly and start a discussion. My main interest was to get initial feedback on the general idea. Additionally, I probed how they could see themselves using such a system and how it could be implemented, such as whether they found video recording through smartphones feasible. In the course of the discussion, I

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\(^2\) the animated storyboard can be found here: [https://www.youtube.com/watch?v=k30rIfM7Iw](https://www.youtube.com/watch?v=k30rIfM7Iw)
elaborated on the concept when feasible.

One of the regular visitors found the concept mostly compelling. From his own experience, he recalled several situations when such a system could have been of great value for him. He told me about one particular moment, “I remember when there are ten people per volunteer, and I have to wait, but I really need him to help me, because I have to leave soon and I need to get it done.” He would probably use such a system to help him out in moments like this. Regarding the use of video, he mentioned, “It’s not hard to make a decent video, I have been to media school, but I think people could make a good video.” Having watched online tutorials himself, he deems the quality of a video taken with a modern camera good enough to be useful for others. While he prefers the personal contact with others when possible, he mentioned that he knows people, who he imagines to sometimes prefer viewing an introductory video, for example to get to know Cykelköket or prepare themselves before others get involved.

One of the newer volunteers seemed to be more opposed to the idea of introducing technology into Cykelköket in the described manner. For her, the interactions with visitors and the resulting personal relationships are a key motivator for her work. By making them watch a video instead, she is concerned that she would not be able to achieve the same kind of relationships. Similarly, she prefers hands-on learning experiences with others, whom she can ask for feedback in the course of working on a specific task. While she is convinced of preferring a person next to her helping her out, she admits having never tried to watch video tutorials on bike repairs.

After some time, a more experienced volunteer joined the discussion. Concerning the potential loss of personal interactions due to the use of videos, he mentioned that it should be both, meaning a working balance of enough personal contact between volunteers and visitors and the use of technology when volunteers were under too much pressure. He reported of one occurrence, where he had already helped out a visitor by referring them to an online video tutorial. In this case, the visitor came back the day later, having acquired enough knowledge through watching the video to solve his task. However, he also reaffirms the need for proper search tools and rating systems by stating that he finds that most tutorials are incomplete or of low quality. Additionally, the amount of different standards for bikes and the resulting variety or parts and combinations of bike parts make it especially difficult for him to find relevant tutorials online. Finally, as the others he found it feasible to record videos with conventional smartphone cameras and expected videos of high enough quality to be possible to record.

After a few discussions, I approached a few hobbyists and asked them to record some of their steps in order to test how a video could be recorded with a smartphone camera, in my case the camera of a Nexus 5, and how the video’s quality would turn out to be. The results are promising, myself far from being a professional cameraman, I have still been able to record meaningful videos that are potentially helpful for others. One main consideration is the quality of audio. While the video is easily of sufficient quality, so that its flow can be followed and main concepts understood, the audio signal gets sometimes distorted to a level where it is hard to be understood what the instructor of the video is saying.

Finally, when one of the visitors was trying to adjust his gears, I tried to help him by finding a relevant video on youtube using my smartphone. We located the name of the component’s model and searched for a solution by querying google for its name and the issue, i.e. adjusting the gears. We found a promising video, which after having
watched about half a minute turned out to be about a different model of the same group. Additionally, the audio was not clear enough to learn anything from watching it.

6.3 Discussion and future work
One of the conceptual questions that have been explored is how a working balance of personal interactions, hands-on work and showing, as well as support through technological means can be established. Through explorations and both design experiments, especially the second one, it has become clear that volunteers, staff and bike enthusiasts in general value the hands-on character of working with bikes. Additionally, for many the collaborative spirit of working embedded in a community is a vital part of the experience. As argued, Cykelköket understood as a community of practice requires a holistic approach and a deep understanding of the relationships that lead to and form its shared competence. The design experiments have further shown opportunities of how such a holistic approach may look like.

However, further work needs to be done to detail the design. For more detailed insights, it might be valuable to develop a working prototype that explores the before-mentioned balance between social and technological interaction to a greater extend. As the general framing is already established, such a prototype could probe different directions, for example whether new visitors should be able to access videos without the interaction of others or if they would require volunteers to guide them. Moreover, explicit roles may need to be assigned to ensure the sustained development of the design. For example, new volunteers will have to be introduced to the designed system and the community will probably have to review its development at times. These more detailed organizational processes will have to be designed to ensure that the design will last for longer than just the starting period and can evolve continuously with changing needs.

Additionally, there are open questions of how the video recording could work to ensure quality of video and sound and whether and to what extend post-editing should be allowed and facilitated. Another question is how and which features from a Q&A platform such as stackoverflow can get incorporated and how Cykelköket bike enthusiasts have access to these features. On the technological side, future work could explore how technologies such as wearable electronics, e.g. google glasses, combined with augmented reality could be employed to create a better experience.

On a rather conceptual level, it may be worthwhile to explore further how global knowledge could further be incorporated into the final design. Ideas from the first design experiment may be helpful, such as including already existing instructional videos. For more speculative approaches, one might try to involve others outside Cykelköket. Such potential human “resources” may be local bike shop owners or mechanics, bike manufacturers or other bike enthusiasts from a broader geographical area. They all have in common that they are likely to be able to contribute to the shared competence of the community of Cykelköket, while potentially also being able to benefit from it. Especially for professionals, their incentive may be to identify knowledge gaps and delimit intermediate knowledge.
7 Conclusion

How could the communication of technical information through practices of collaborative media look like in domains, which still rely on models based on the strict separation of consumers and producers and are typically characterized by their more hands-on form of work and a local setting where the use of stationary computing devices is not feasible?

The key finding of this thesis is that collaborative media as a form of practice to communicate technical information should not been seen as separated from already existing practices of learning and knowing, but rather carefully woven into these existing practices in order to be adopted and adapted.

One might ask if this answer is not the premise of user-centered design in general. My argument is that in many cases, people will already have developed a shared competence and practices to maintain and evolve it. These social structures represent viable resources when it comes to learning and knowing. Why should anybody abandon these existing resources and care to engage in new practices based on modern media and technologies? Leveraging and expanding on social structures already in place seems to be a more compelling direction.

Following this argument, further work will have to be done in more detailed explorations of how collaborative media can enrich existing practices. Additionally, more case studies of collaborative media in technical communication across different domains might help to establish common guidelines for practitioners.

Finally, I hope this thesis serves as an inspirational case study for designers and researchers within the domain of technical communication. As the design is grounded in practices of a hands-on form of work within an existing community, it may inspire ways of designing within different domains, but for similar environments.

7.1 Comparison with previous work

Björgvinsson (2007) comes to a similar conclusion in his dissertation, in which he first highlights the close relation between learning, knowing and working and further argues for seeing the socio-material infrastructure as new practices emerging from new and established spaces of action. Moreover, he describes the process of hardening socio-material infrastructure, a process of recursive translation through which the meaning of tools and aspects is changed. This process is opposed to simply inserting human or non-human actors inscribed with meaning into existing practices.

However, while Björgvinsson seems to have drawn similar conclusions, the design work has been carried out to greater detail allowing deeper reflection on specificities in the implementation. For example, workshops carried out at the end of the research project anchored the socio-material design in the organization and seemed to have played a crucial part in the success of the project. In contrast, this thesis’ focus has remained on a more conceptual level.

Comparing the proposed design with Ackerman and Malone's Answer Garden, one major similarity is that both designs are attempts to grow some kind of organizational memory, a term defined by Ackerman as “an organization's ability to benefit from its past experience in responding more effectively (e.g. faster or more accurately) in the present” (1990, p.1). However, the Answer Garden takes a very material approach - as Björgvinsson would probably say - when it comes to how specifically knowledge is captured and retrieved. Functional aspects are within a generic context in the focus
of the design and the outcome is a formal system to store information. The system is presented and conceived independently of an organization's processes and practices, since it is not anchored in any specific organization or domain.
8 References


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