D.I.T. CELL PHONE
A possible future for cell phone interactions

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Abstract

This thesis project identifies an issue of limited interaction options with cell phones and considers it to be a design opening and opportunity, rather than a problem. The design opportunity presented in this work is for shaping of future cell phone interactions by allowing users to design their own cell phones. To explore this provocative yet complex design opportunity a programmatic design research approach is used. The design program in this thesis is referred to as the ‘Design-It-Together cell phone’, or the DIT cell phone, design program and can be described as a design research effort into how users working together to design and make their own cell phones could offer a new set of perspectives and possibilities in shaping future interaction options with cell phones in contrast to an industry lead cell phone design and development process. Furthermore, the motivation for this thesis is not problem-based but rather exploratory, where the intention is not to build an ideal phone but rather to explore the opportunities and challenges faced by the design program, and what that can mean for shaping the future of cell phone interactions.

A comprehensive exploration of this design space was done in nine main explorations or nine main experiments. Each experiment was formulated to challenge a perspective of the design program. The results of the explorations generated a repertoire of examples relating to understanding the current situations and predictions for future possibilities for cell phone interactions. Interpretation of the design program was done by analyzing this repertoire of examples from the perspective of nine specified dimensions of the design program. The dimensions acted as a guide in thinking about possible futures of cell phone interactions within the design space of the program. Interpretation of the design program in this way allowed for comprehensive scenarios to be created of what the future of cell phone interactions could be like, as well as gaps and bigger picture impacts of the design program.

The overall results and contribution of this work adhered to what is expected from a programmatic design research approach and is stated here as knowledge generated from explorations and interpretation of the DIT cell phone design program, based on the generated repertoire of examples, which helps shape possible futures for cell phone interactions.

Keywords
Interaction Design, Design program, Programmatic design research, Cell phone, Future interactions, User centered design.
Dedicated to Frank Pahalad
My father and my number one fan
R.I.P.
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1. Introduction
The cell phone is now one of the world’s most ubiquitous devices exemplified by the fact that out of world’s 7 billion people, 5 billion have been recorded as owning a cell phone, and more than 1 billion of these being Smartphone (research, 2012). Smartphone devices themselves are increasingly sought after since in addition to basic communication options of text messaging and voice calls, they offer a number of integrated services including global positioning, internet and personal organizers to name a few. It is no surprise then that almost everywhere people can be seen engaging in interactions with cell phone devices by talking, tapping or pressing the interface.

1.1 Brief cell phone history
The cell phone as we know it today is the result of a long historical line of methods and inventions to communicate over distance. One of the first of such inventions is the house phone or landline. The original house phone focused only on verbal communication so its design catered for this simple interaction by use of a turn dial and a receiver to listen and to speak. Then house phones became more advanced to include text, other buttons and extended functions such as an answering machine and wireless receivers for short range mobility of use. As people became more mobile there arose a need for more mobile communication. This necessitated house phones to go beyond the home and into the world which lead to inventions such as the phone booth, car phones and in 1983 the first cell phone. An unrelated communication device in the 1950’s was the pager and was originally designed for one way transmission of numeric messages however, users found a way to exchange more meaningful messages by using numbers to represent text. This was later integrated with cell phone technology for text messaging or SMS and is considered one of the most unintentional yet widely successful means of communication in cell phone technology. Evidently, the phone has come a long way from simply sitting sat idly at home till there was a need to make or receive a call, and has adapted to needs for communication (verbal and textual), connectivity (internet and satellites) and mobility of users; however the basic design and interactions with it remain fundamentally the same. We still talk using receivers of some kind and tap the interface which has changed from a turn dial to the touch screen or keypad of most modern day cell phones. A central paradox then arises as user interaction needs and preferences of phones have diversified, but the fundamental interaction options for using them have not changed much. From an interaction design (IXD) perspective this can be interpreted as a gap in current interaction options with cell phone devices.

1.2 User involvement in cell phone history
Throughout cell phone history the cell phone industry and cell phone users have held distinct roles. The role of the cell phone industry has evolved to provide support and guide changes required in infrastructure, development and design as the phone evolved from landlines to mobile devices to smart phones. Cell phone users’ role in this evolution however has mostly been held constant and user involvement in the history of design and development of phones has not been as direct and obvious as that of the industry. Even with the entry of user centered design
perspectives and an increasing focus on design, especially in more developed countries, user involvement in cell phone design has been to provide ethnographic data and feedback in an industry lead design and development process. Some manufacturers in the cell phone industry consider user perspectives by funding usability, user experience and interaction design departments that usually take a laboratory experiment approach in getting feedback on designs, but the focus is usually on software applications. This work argues that user are still largely excluded from involvement in the holistic design of phones, both hardware and software aspects. To the end user then the cell phone is like a black box, since it can be bought off the shelf knowing neither how the inside work or is designed nor offer more than surface level flexibility for specific and contextual user interaction preferences. This can also be interpreted as a gap in current interaction options for end user with cell phone devices

1.3 Cell phone interactions
These two historical perspectives on design and development of cell phone devices raised the issue of limited interaction options today for the end users. Such interaction limitations are experienced for example when struggling to put your phone on silent when its notifications suddenly cuts into the silence in a meeting room and you cannot find quickly enough the hard control button or the user interface option; or when driving and you need to reply urgently to an important SMS; or when separated by geographical distance from a loved one and somehow text and verbal communication on the phone are not satisfying expressions. The range of limitations experienced in using cell phones is broad a subjective issue depending on factors including the user, time, environment and use context.

To get a deeper understanding of this issue, cell phone interactions can be broadly classified as hardware or software interactions. The advanced cell phones of today are typically thought of as software devices so interactions with them are synonymous with software applications on the screen display or user interface. Several research projects have been done already to understand software interactions including one study (Falaki, 2010) that found the mean number of smartphone application interactions per day for a user varies from 10 to 200 and the number of applications used varies from 10 to 90. Physical interactions with cell phones relate to physical use and manipulation of tangible parts. As much as the cell phone is a software device, some research has already been done recognizing the importance of the tangible aspects as well. There was one report on battery charging behaviors of smartphone users (Rahmati, 2007) and another on the tangible vibration alerts of smart phones (Shin, 2011). Cell phones however are dominantly viewed as software devices and not so much as having useful tangible interactions for input.

Another point of view is that there are some benefits of limited interaction options with cell phones today. Limited options to use the cell phone do not always allow users to choose how they want to use it, usually just talking or tapping, and these actions require focus temporarily and spatially which gives users the option to be immersed in using the cell phone device and
temporarily and spatially block out the world around. In some situations users may want this without seeming to be rude or wanting to feel isolated, such as in long lonesome public transport commutes. Additionally, by forcing users to devote most of their attention to this interaction they can seemingly press a pause button on what is happening around them and focus on a task with the cell phone that is important to them. This devotion of senses to do this important thing on the phone and not expected to share their attention, because there is no real way to do that with the talking or tapping, allows users to feel like they are keeping up with today’s fast paced world by multitasking the real world and the virtual phone behind the screen of the phone.

While acknowledging the situations where limited interaction options may not be considered such a bad thing, there exists a longer list of consequences and negative effects. Limited interaction options leads to immersion in its use which results in both personal and situated effects. Personal effects happen in interpersonal relationships and situated effect is on those in close proximity to situated use of the cell phone. Another view to cell phone interaction limitations is that people are inherently expressive beings but social norms call for more subtle public expressions. The central issue, using these examples however, is not in possessing a cell phone, but rather restricted options to interact with it, when and how we want to and despite the advancements made in cell phone designs, these devices are becoming slowly more and more closed to end user specific needs and preferences.

Previous works have been done on extending interactions with cell phones using light and visuals (Jusis, 2012), tangible alerts (Hemmert, 2012) and voice commands such as the iPhone’s Siri and use of Bluetooth headsets. Countless accessories and cell phone applications have been designed for more or different interactions however; everyday cell phones and accessories on the market today still offer the basic interaction options of talking or tapping. Furthermore most previous solutions however typically address one aspect of cell phone interaction at a time but considering that cell phone interaction varies with the user, time, and use context, what we end up with are ‘one size fits all’ solutions. Assuming then that no one interaction solution can apply to all users and use contexts then another approach to address the issue of limited interaction options is to open up the design process for cell phones interactions more to the users themselves.

### 1.4 User involvement for shaping future interactions with cell phones

The issue of limited interaction options with cell phones is considered in this work as a design opening and opportunity, rather than a problem. The design opportunity presented in this work is for shaping of future cell phone interactions by facilitating deeper user involvement in the cell phone design and development process. Deeper user involvement in these processes, which are traditionally reserved for the cell phone industry, aims to allow users to have more control and flexibility in how they interact with their cell phones in the future. Control and flexibility in customizing their cell phone interactions would mean that users be involved, to some extent, in designing their cell phone from the conceptual phase to making it into a functional device. In
effect then, the design opportunity presented here is the shaping of future cell phone interactions by allowing users to design their cell phones with their customized interaction preferences. To explore this provocative yet complex design opportunity a programmatic approach is used and this approach will be explained in depth in chapter 2. Essential to the understanding of the programmatic approach in design research is that it is different from a linear research process, which aims to answer a specific research question, but is instead based on a design program and several experiments that explore different aspects of the program.

1.5 Aim of thesis
The motivation for this thesis is not problem-based but rather exploratory, where the intention is not to build an ideal phone but rather to explore the opportunities and challenges faced by the design program, and what that can mean for shaping the future of cell phone interactions. Furthermore this work is not about eliminating the cell phone industry as we know it today, neither is it about empowering users to design their perfect phone without limitations, but rather it explores perspectives on the design program from both industry and users.

1.6 Preliminaries

1.6.1 Users
Previous works on cell phone interactions have focused on specific target user groups based on age (Ito, 2005) and culture (Jusis, 2012) for example, however this work explores fundamental perspectives on cell phone interactions rather than isolating a group of users based on their inherent traits. One reason for this was the highly explorative design research approach adapted allowed for the assumption that any need for narrowing down on a target user group will become evident in the series of experiments. Another reason was that from the onset no validation was found for focusing on a clearly defined group of persons. It can be said however that this work will speak more to persons who have an interest in design and technology and are avid cell phone users.

1.6.2 Places of exploration
The geographic place where most of the explorations in this work happened was in the city of Malmö, Sweden. With Sweden listed as one of the top 5 countries in the world in 2012 for smart phone penetration (Alexander, 2012), there was an initial personal interest and motivation to explore cell phone interactions in Sweden. To provide a different perspective on the design program however, one experiment was done in a place different in many ways from Sweden and this was a rural village in the developing country of Trinidad. The significance of these places in exploring the design program is explained more in chapter 10.

In the rest of this thesis first the design program is presented and explained in chapter 2, then other considerations for the design process and methods used are given in chapter 3. The nine experiments within the design program are described in chapters 4 to 12 and the main knowledge contribution is found in chapter 13 in overall reflections which is followed by the conclusion.
2. The Program
The programmatic approach has been recently promoted as a valid approach in design research (Brandt, et al., 2011) and an example of a previous design program is for Static! (Öhman, et al., 2010), which was described as “a research effort into how design research could offer a new set of perspectives and possibilities on energy consumption in everyday life in contrast to the prevalent strategies of changes to the current state of affairs either by improving the technology or informing the consumer”. In this chapter first the design program, which is the focus of this thesis, will be presented and then follows discussions and explanations of the program.

2.1. The DIT cell phone design program
The design program in this thesis is referred to as the ‘Design-It-Together cell phone’, or the DIT cell phone, design program and can be described as a design research effort into how users working together to design and make their own cell phones could offer a new set of perspectives and possibilities in shaping future interaction options with cell phones in contrast to an industry lead cell phone design and development process.

The DIT cell phone program wants to serve in the shaping of future interactions with cell phones from the simplest and traditional interaction options to advanced and futuristic designs. In the conviction that cell phone interactions and end user preferences should be more rationally related to each other, the DIT cell phone program is seeking – by practical and theoretical design experiments in the formal, informal, technical and social fields to derive a repertoire of artifacts and examples that describe future possibilities for shaping cell phone interactions in a more user lead process.

2.2. About the programmatic approach
The programmatic approach is relatively new to design research, at least in a formalized way, and calls for following a design program with design experiments at its core. To better understand the programmatic approach this section explains its key aspects. One key aspect is to understand the outcome and knowledge contribution of a programmatic approach, then explanation is given about the purpose and relationship between the design program and the experiments followed by stating the structure of the design experiments in this work. Another key aspect the difference between a programmatic approach and the traditional linear process and this is then explained followed by stating the motivations for adapting a programmatic approach in this work.

2.2.1. The program outcomes and knowledge contribution
Arguments have been made for different outcomes of the program in design research compared to the program in design work (Brandt, et al., 2011). This thesis is design research based and this research method will be further explained in chapter 3, however to give an all round contextualization within interaction design it is important to note the difference and set expectations of the intended outcomes here. This difference has been described as “In design work the intended outcome is the finished product (in a very wide sense including services and
all that modern stuff that counts as design today) that fulfils the brief. In design research, the intended outcome is (mainly) knowledge” (Brandt, et al., 2011) pp25. This thesis adapts a programmatic approach for design research so the main outcome of this work aims to be knowledge generated from provoking discourse and a repertoire of examples and artifacts rather than a single finished product. Furthermore, discourse is provoked by considering the relations that surround and bind together the program and the experiments. Even though minor insights and knowledge is gained from reflection and analysis upon each experiment, in a programmatic design research approach it is in the relation between program and experiments where the most important knowledge is gained. The main outcome and knowledge contribution of this work then is given in the overall reflections in chapter 13.

2.2.2. The program and the experiments

Key to the knowledge contribution of a programmatic design research approach is the relations between the program and the experiments. The program and the experiments have an interdependent relationship such that, the program sets limitations for the experiments and the experiments concretizes the program. It is usual for the initial program to seem abstract, as maybe the impression of the DIT cell phone program stated above however, it is in the process of experimentation done in the rest of this work that the program is made more structured. The initial program being abstract affords a range of possibilities which can be investigated and so offers a rich design space; however it is not meant to be random but rather framed by experiments that explore relevant and delimited directions within the range of possible perspectives. The design space is opened by the program and the experiments are used to explore this space, finally positioning this work somewhere within interaction design. The program maintains influence on the experiments by not only acting as a starting point but by being continuously present in the work. A deeper understanding of the program and how the experiments relate to it has been well explained as, “That the program is provisional means that it is not unquestionably presupposed, but rather that it functions as a sort of hypothetical worldview that makes the particular inquiry relevant. As the design research unfolds, it will either substantiate or challenge this view. The purpose of the experiment is thus not to “test” the program in the sense of proving or confirming it.” (Brandt, et al., 2011).

2.2.3. Structure of the experiments

In this work each experiment is associated with a titled exploration of the design program, such that, one exploration is done by one or more experiments. Except for the theoretical exploration, each exploration is structured in sections giving the actors, materials, description and outcomes of all the experiments within that exploration. The outcome of each exploration is minor insights and knowledge gained from reflection and analysis on the generated outcomes of the associated experiments and how it supports, challenges or present design opportunities for the DIT cell phone program.
2.2.4. Difference between a design program and a traditional linear process

A comprehensive explanation of how a design program differs from a more traditional design process was given in the XLAB project and publication (Brandt, et al., 2011), and drawing from this, some key differences are outlined to give a complete understanding of the programmatic approach here. The more common approach to design research work entails a linear approach where at the beginning a main research question is formulated, then coherent steps taken to find an answer to this question where the insights gained from one phase logically leads to the other phase, and at the end of the work a generated artifact is given as the ultimate solution to the research question. In the programmatic way of expressing the starting point for a research process however it is not by setting the frames using questions. Another difference is that in more traditional research, experiments are designed meant to address a hypothesis. The result of the experiment then either affirms, refute, or, more likely, rephrases the hypothesis and iterate the process. An important difference between the design program and this hypothesis based approach is that while the hypothesis ideally should be quite precise and “testable”, a design program needs to be suggestive and open for the unexpected. Furthermore the hypothesis ideally is addressed through one, or a series of linear coherent, experiment but the design program needs to open up a space where innovation and future development is possible, thus typically requiring a series of experiments to illustrate the diversity it affords.

2.2.5. Motivations for adapting a programmatic approach

The decision to adapt a programmatic approach for this work was not clear from the beginning however, for several reasons it became obviously necessary as this work progressed. One reason was that by approaching the issue of limited interaction options with cell phones by notioning that to shape future cell phone interactions users work together to design and make their own phones, presented a highly explorative and possibly provocative design opportunity with unclear effects and impact. Unclarity in this design opportunity allowed for opening up of a design space which can be explored and framed by considering different perspectives throughout the space rather than a linear progression of coherent ideas. In fact, attempts at a coherent approach may even neglect some important perspectives of the design space.

Another reason for adapting a programmatic approach was a more deliberate one where it was assumed like in previous works (Brandt, et al., 2011), that by doing it this way the exploration would have a greater impact on people’s lives than with a traditional linear approach. Greater impact could be to provoke shaping future interactions in other design fields and provoke wider discourse beyond IXD such in maker communities, engineering fields and among cell phone industries and users themselves.

The programmatic approach was also partly influenced by a personal decision as the leading interaction design researcher of this work. Going into this thesis work I wanted to focus on creating an experimental environment that urged people to think about doing things differently with their cell phones, and reflections on outcomes of some initial experiments lead to a decision
to work with a programmatic approach rather than a research question which should be answered in the end.

2.3. Overview of the DIT cell phone design program

Now that the design program in this work has been stated and the programmatic approach understood, the DIT cell phone design program which is the focus of this thesis can be further explained. One way of presenting a design program is in the form of a critical question about the present and a suggestion about an alternative way of doing things (Brandt, et al., 2011). This follows then that the DIT cell phone program critiques the present by questioning the effectiveness of the current industry lead design and development of cell phone interactions and suggests instead the shaping of future cell phone interactions by a more user lead process. This critique of the present and suggestion for an alternative way identifies a design opportunity which will be explored by nine main explorations, with each raising a main question that gives a different perspective to the DIT cell phone design program.

**Questions**

**Program**
- Design-It-Together Cell Phone

**Experiments**
- Theoretical explorations
- Current cell phone interactions
- Users views on new interactions
- Future IXDers views
- DIT cell phone approaches
- Industry views
- Different environment
- Social and technical feasibility
- DIT cell phone possibilities

Figure 1: Positioning of experiments and questions within the DIT cell phone design program.

Figure 1 is an adaptation of a picture found in (Brandt, et al., 2011) and states the nine explorations done, which will be referred to as the nine major experiments to be consistent with terminology used in previous programmatic works (Brandt, et al., 2011). Shown here are the experiments positioned within the program and the program within the question, but this does not mean a strict separation of these aspects but instead is meant to indicate a tight coupling and dependency on each other. This question is not defined since, as previously explained, in the programmatic approach the aim is not to answer a single research question but rather to explore
questions that challenge and concretize the design program. The question explored by each experiment and the purpose of each experiment is given in Table 1.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Purpose</th>
<th>Main question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theoretical exploration</td>
<td>Analysis of the design program by discussing previous works related to separate aspects of the program and how they are connected in this work.</td>
<td>What literature and existing works most relate to the DIT cell phone design program and what is the theoretical scope of this work?</td>
</tr>
<tr>
<td>2. Exploring current cell phone interaction</td>
<td>To gain insights into current cell phone interactions by provoking a sample of users to reflect on their own interactions, and that of others around them.</td>
<td>What are users’ main likes and dislikes of current cell phone interactions and what opportunities exists for shaping new interactions.</td>
</tr>
<tr>
<td>3. Exploring openness to new cell phone interactions</td>
<td>Provoke a sample of users to engage in non traditional interactions with cell phones to gage opportunities and understand limitations in shaping future interactions with the device.</td>
<td>What are opportunities and limitations for cell phone users to envision new forms of interaction with the device?</td>
</tr>
<tr>
<td>4. Exploring next generation IXDers’ views on the future of cell phone interactions</td>
<td>To explore how future interaction designers envision the future of cell phone interactions when presented with the idea of designing their own phone.</td>
<td>What opportunities and challenges are raised by current views of a future generation of designers when given the opportunity to design their own cell phone for shaping future interactions.</td>
</tr>
<tr>
<td>5. Exploring users’ visions for a D.I.T. cell phone future.</td>
<td>Gain insights on how different kinds of users could work together, or not, to design cell phones and how they think a DIT approach can work in the future.</td>
<td>What opportunities and challenges are raised in the social dynamics of designing cell phone interactions together?</td>
</tr>
<tr>
<td>6. Industry perspectives</td>
<td>Gain insights into how the cell phone industry currently works, including understanding industry roles in the design process, and generate discussions on how the DIT cell phone design program can be supported or challenged by the industry.</td>
<td>What opportunities and challenges to the DIT cell phone design program from existing cell phone industry structures?</td>
</tr>
<tr>
<td>7. A different environment</td>
<td>Generate discussions around the idea of designing and making your own phone in place different from Scandinavia in terms of making, designing and cell phone technologies.</td>
<td>What opportunities and challenges exists for a DIT cell phone approach in place with a different environment for making, design and cell phone technologies than in Scandinavia?</td>
</tr>
<tr>
<td>8. Exploring social and technical</td>
<td>Gain hands on insight on how socially and technically feasible it is for</td>
<td>What are current technical and social opportunities and</td>
</tr>
</tbody>
</table>

15
feasibility
different users to design and make your own phone today, based on the DIY cell phone prototype (Mellis, 2014).
challenges faced by people with different skills set in making together their DIY cell phones?

| 9. Exploring modifications and reactions to my DIT cell phone. | Take the DIY cell phone further with initial customizations and use it to generate discussions around the design program by provoking perspectives on shaping future interactions. | What are opportunites, challenges and reactions for shaping future cell phone interactions by customization of the DIT cell phone prototype? |

Table 1: Purpose and main question of each experiment.

The explorations will be presented in chapters 4 to 12 and then the collective insights gained and outcomes generated will be used to interpret the design program in chapter 13. Interpretation of the design program can be done by landscaping (Brandt, et al., 2011), which is the analysis of all exploration outcomes on various dimensions of the design program. The dimensions act as a guide in thinking about possible futures of cell phone interactions if users could design their own cell phone. Within the scope of this work the generated outcomes, or examples, are positioned on the following dimensions:

- Do more / Do different / Raise awareness, of use
- User / industry led design process
- Social / individual interaction experience
- Current / future interaction designs
- Inclusive / exclusive design process
- Reflective / passive use interactions
- Maker / industrial environment
- Maker / market value
- Contextualization within IXD

The dimensions stated above are really insights into what is to come later on in thesis since they were not prepurposed but arose during the 9 explorations. For this reason too these dimensions are vaguely stated here but will be better understood when reflecting on the whole of this exploration. The design program can be viewed from more dimensions than those listed above however these 9 provided a sufficient scope for this master’s thesis. The hope is that additional dimensions will be formulated in future discussions provoked by the repertoire of examples generated and knowledge contribution of this DIT cell phone design program.
3. The Design Process and Methods Used

A programmatic approach to the design process has been already explained however there are other perspectives to the design process and methodologies used in the experiments that are worth discussing.

3.1. Participatory design

Participatory Design (Schuler, 1993) is an approach to design attempting to actively involve all stakeholders in the design process in order to help ensure the product designed meets their needs and is usable. Participatory design draws on various research methods (such as ethnographic observations, interviews, generative prototyping and analysis of prototypes and artifacts), these methods are used to iteratively construct the emerging design, which itself simultaneously constitutes and elicits the research results as co-interpreted by the designer-researchers and the participants who will use the design.

In this work a participatory design approach was used by involving in the experiments cell phone users and other stakeholders, which were other designers, computer scientists and professionals working in the cell phone industry. Rather than attempting to extract knowledge from the stakeholders, I chose to continually involve people with difference expertise to ensure that important issues are considered.

While a user centered design perspective was constant in the design process there are some criticisms to democratizing design in this way. One critique is that basing design decisions on users can cater just for temporal situations and uses, and this can cause problems in generalizing insights for other situations. This is avoided here by the diverse repertoire of experiments which gains perspectives in different contexts and time. It was observed that when it came to cell phone use the use situations were highly temporal and dynamic depending on the user, time, place and situation and this relates to opening discussions in the introduction. There is also the issue that sometimes users do not really know what they want; even though they may think they do. I experienced this as some conflicting data was collected among some experiments, but the final interpretation was made by carefully considering which data to expand on and which to disregard for the purposes of this work.

3.2. Research through Design

Research through design (RtD) (Gaver, 2012) involves explorations to learn more about a topic, the process and possible solutions. These explorations traditionally involved a linear process however this work adapts a programmatic one. Adapting a programmatic RtD process was found useful in addressing issues of how to gage future interactions and what to design since initially there were no indications of what were the exact design openings.
3.3. Facilitating reflections

Reflections were a constant and important part of this programmatic design research process as it helped generate insights both by myself and those involved in the experiments. In each exploration there was a continual doing and reflecting and doing again. I experienced that one day of doing required a day to pause, reflect, gather my materials and thoughts and then do again. I also experienced that it helped to use different forms of media in reflections because each form offered a different way to demonstrate, analyze and generate insights for interpretations of the program. One way I facilitated reflections was construction of a ‘post-it wall’, see Figure 2, where I wrote main insights and interpretations on one post-it each and displayed the collection on a wall. On this wall I also placed pictures and photos related to different aspects of cell phone interactions. The exact location of this post-it wall was at the MEDEA which is a semi-public space shared by experienced interaction designers. By placing in this location it raised interests and initiated conversations around the design program. For further collaborative reflections I adopted the idea of extending encounters by blogging of the design process (). An online blog for this thesis work is found at this link http://wpmu.mah.se/m11p0636/. I connected my blog to popular social media such as Facebook and LinkedIn to raise interest in it. I experienced the usefulness of blogging in this way because it served as a ‘quick and dirty’ way to present my work with those interested in the design program and recruiting participants for experiments and in creating networks with others related to or interested in the outcomes and insights gained. This can be viewed also as the beginnings of an online community around the DIT cell phone idea. I also experienced that the blog was useful for extending participants’ reflections after in person contact was made as some used it to keep up to date with the project and give feedback occasionally. I valued personal reflections as well as so for my personal, frequent reflections and documentations I maintained a thesis journal by utilizing the Google Docs tool. By placing importance on facilitating reflections in these ways I was able to iteratively bring together insights and perspectives generated from each experiment, which helped concretize the program and the overall contributions of this work.
4. Theoretical Exploration

In the programmatic approach theories related to the program can be viewed as a way to explore challenges in the program, and not as a free standing chapter as it is in a traditional linear approach. This exploration differs in structure from the others by instead being presented as a dissection of the title of the design program to structure theories related to each aspect. Some kind of delimitation is needed for the numerous theories that exist which are in some way related to this work, so while other theories do exist, the ones presented in this work were chosen to be most relevant to and sufficient for interpreting the design program.

4.1. ‘Design It’

The ‘Design It’ refers to the design of cell phones and by extension interactions with it. The design of cell phones can be viewed in a number of ways. First it can be seen from the perspective of maker culture today, which has evolved from historical industrialization to user empowerment ambitions such as Do-It-Yourself (DIY) and Do-It-Together (DIT). In this perspective design here considers making as part of design work. Second, it can be examined from the perspective of the changing role of the cell phone user becoming a maker and third, design here can face challenges from changing use contexts.

4.1.1. Maker culture

Several works have been published about the change in industry production to the rise of the maker culture we are experiencing today. These works usually set the starting point as the historic bartering system where one person specialized in certain goods or services and traded this to others, who were not as good at it, in exchange for a subjectively equal valuable goods or service. This way of doing things was highly specialized and inherently fostered community relations. Specialization gave satisfaction to the individual as he/she could focus on doing or making things they can and community relations meant interdependence on each other. This system of bartering changed in the historical phase of the industrial evolution (Anderson, 2012). This phase gave rise to the industry way of making and providing to consumers. Specialization changed to a division of labour process and buying and selling with money rather than trading. Division of labour meant that now no one person was in charge of the whole design and making of a thing, rather each person was now just one of many workers in an assembly line with each focusing on one aspect. Buying and selling now meant that items and services were no longer traded for an item/service of subjective equal value, but instead printed paper and coins were now used. For several years this industrial way of making and selling prospered and gave rise to most of the world’s largest industry corporations today including the cell phone industry. In relatively recent years however there has been growing buzz about the industrial revolution and the rise of maker movements. There are different views on the impacts of this one being that now the industry line workers have a way to regain pride and personal satisfaction in making something from start to finish. Personal pride and satisfaction comes partly from the shortening of the path from idea to entrepreneurship (ibid), which means that any individual with an idea can now be a maker. Another impact is the move away from independence on industrial
structures and a bit of a step back to community support and reliance on others as several maker communities have already been formed for the making of almost anything. The advent of the internet and the WWW largely helped to promote the social interdependence among makers by instantly connecting people and even equipment over long distances. Another impact is that the owners of the means of production get to decide what to produce (ibid), rather than being dictated by the industry. The means of production today include modern fabrication tools such as 3D printers, CNC machines and laser cutters which are becoming more accessible for personal use and more affordable for individual purchase.

Maker terms have also been introduced or taken on new meaning in modern day maker movements. One such term is Do-It-Yourself, or commonly known as DIY, which is not a new idea (Spencer, 2008) however the range of possibilities for DIY has increased with modern day fabrication tools. DIY today involves activities from simple home repairs to robot building. Communities have also formed around DIY activities both in the physical and virtual world. These communities are a support to makers as they share their skills, knowledge and resources mainly for their shared enthusiasm for making and by sharing individual restrictions can be overcome. Focusing on a community practice, DIY has been extended to Do-It-Together, or simply DIT (Hagel, et al., 2010). The main distinction between DIY and DIT considered here is that DIY taken literally suggests making something yourself but DIT suggest that something is made in collaboration with others. DIY is the more common phrase of the two but as more and more communities form around DIY activities most of these activities really adapt a DIT approach. DIT here is not to be confused with the DIT acronym in the title of this thesis which instead stands for Design-It-Together, a phrase introduced in this work. By using ‘Design’ rather than ‘Do’, for the DIT design program acronym, the intention is to convey design thinking (Rowe, 1991) in doing. This draws from Rowe’s views that “Design appears to be a fundamental means of inquiry by which man realizes and gives shape to ideas... design is a practical form of inquiry insofar as it is concerned with making.” (ibid)

Reflecting on the developments from bartering to industrialization to maker movements it is evident that throughout history there has been back and forth tugging between individual and industry roles in design and making.

4.1.2. The cell phone user as maker
As mentioned previously in the introduction, the cell phone industry throughout history has led the design and development process for cell phone interactions, with cell phone users being confined to this role. There are some benefits of being just a cell phone user. For one it is easy to simply buy a phone off-the-shelf and with the rapid advancement of technology and market competitiveness today, even the most basic of cell phones offer advanced features. The market competitiveness also helps to keep the cost of phones with basic functionality relatively low. As just a user you don’t have to worry about what is going on inside your device, it is enough to know that it works the way you expect it to and the way it was advertised when you bought it.
This work however challenges opportunities for a provocative alternative that cell phone users can be cell phone makers.

One opportunity in cell phone users taking up a more maker role is personal benefits of making including taking a personal stance, pride and a sense of purpose and fulfillment (Gauntlett, 2011). From a social science perspective, another opportunity is for self reflection on personal cell phone use which can bring about a change in how users perceive and use the device. This opportunity is referred to as a point of inflection by Turkle (Turkle, 2012) who is concerned with the current path of technological advancement and urged users of technology to start to take action and “to embrace the complexity of our high tech and highly connected lives ... and reminding ourselves that we own technology.”(ibid). In another field, action is combined with reflection as a way to break up a problem (Schön, 1987). Schön urged us to reflect-in-action, which is, thinking what you are doing while you are doing it and reflection on action as thinking about what you did after you did it. Bringing all this together in the context of the design program; making involves design thinking and, this thinking while making provokes reflection on the intended actions or interactions with the cell phone device. Making in this way then shows potential for self reflection on cell phone interactions.

4.1.3. Challenge of changing use contexts
The value of users in defining their interactions with an artifact has previously been explored from different perspectives. From a technical perspective Sokoler states, “While digital technology may bring forward opportunities for action, actual decisions on the appropriate course of action are better left with humans and their earned ability to make sense of and act in complex social and physical settings.” (Sokoler, 2004). Another notable perspective is that of Lucy Suchman (Suchman, 1987) on situated actions where she argues that human action is not as rational, planned, and structured as most previous solutions conceptualize it to be, but rather improvised, as a moment-by-moment “situated” response to immediate needs that emerge out of the interaction with the setting. These perspectives present a challenge when designing cell phone interactions since the contexts of use in everyday situations are usually more complex than the range of interactions currently provided in only one cell phone device.

4.2. ‘Together’
The ‘together’ in this design program relates to the persons involved in the design process of cell phones and can be viewed in different ways. One way to look at it is to consider designing as an individual or as part of a community. Second, it can be viewed from the perspective of meaning persons derive in using and designing the device. Thirdly, it can be viewed in terms of how persons’ perspectives on the cell phone device changes having designed it.

4.2.1. Individuals and communities
Broadly speaking, designing and making can be done as an individual or together with others in a community. This work adapts a community approach to making and theories have formed to understand these communities as a whole and also to understand the individuals within it.
Theories to understand these communities draw from several social science perspectives. One such perspective is viewing making together as social capital (Gauntlett, 2011), where social capital is about the value of people doing things in communities. Gauntlett argues for high value in doing things in communities, but when people remain isolated by not working together the society goes downward. Further analysis relates social capital to human capital and an individual’s sense of self-identity, confidence in expressing one’s own opinions, and emotional intelligence (ibid). Robert Putnam (Putnam, 1995) takes this view of social capital further by explaining the inclusion and exclusion of people in the making together community. He uses two terms to explain this. The first term is bridging social capital, which he uses to refer to a community that draws people in, embraces diversity and so makes links between different people and groups. The second term is bonding social capital, which is more exclusive by tying people together who are already similar or have common interests. Putnam concludes however that in reality communities are not either bridging or bonding but have some degree of both.

There are also benefits to individuals involved in these communities. Richard Layard’s work on happiness presented ‘7 Big Seven Factors Affecting Happiness'(Layard, 2011) and stated “There is a creative spark in each of us, and if it finds no outlet, we feel half-dead”. Gauntlett interpreted Layard’s happiness factors to reveal that social relationships were linked to 5 of the 7 factors of happiness which he used to argue that making is related to self esteem, sense of purpose and social connections which all generate a feeling of happiness (Gauntlett, 2011).

### 4.2.2. Meaning in cell phone use and making

In day to day use meaning of cell phone interactions is lost or easily overlooked. Theories have been formed from different perspectives for an understanding of ‘meaning’. Heidegger understood meaning from a phenomenological philosophy perspective and argued that meaning relates to how an entity encounters the world by being involved with it (Heidegger, 1927). Dourish relates to this notion of meaning in phenomenology and applies it to embodied interaction (Dourish, 2004). He views meaning as being behind every action the user has with the artifact, artifact being the device or object that is being acted on, and a primary concern for ubiquitous technologies, such as cell phones. Another notion of meaning is from a semiotic perspective and this is the understanding Krippendorff relied on (Krippendorff, 2005) in his exploration of the meaning of interfaces. He contextualized interfaces not in the traditional sense of the word but as prolonged and ideally intrinsically motivating interactions between human actors and their artifacts. These theories view meaning as hidden and this further relates to theories on tacit knowledge (Layard, 2011) which is doing things under the surface which cannot be explicitly explained. Taking a phenomenological and semiotic perspective on meaning, with considerations for tacit knowledge, cell phone interactions can be understood as deriving from underlying meaning that makes this device an increasingly integral part of our everyday life. Furthermore, the traditional interface of the cell phone is the display screen and keypad however, the mobile phone itself can be thought of holistically as an interface between the world of human and the world of connectivity. Ito referred to meaning specific to mobile phone use (Ito, 2005) by
notioning that mobile phone use has not just tacit meaning but takes on new meanings. These new meanings according to Ito, is dynamic, subjective and continuously transforming depending on time, space and social relations. In this work some experiments seek to tap into hidden meaning of cell phone use based on the assumptions that it may be helpful to get a deeper understanding of user interactions with the cell phone, in order to shape the future of it.

Other than a hidden perspective to meaning, there is a constructivist perspective (Papert & Harel, 1991) and this is the understanding of meaning relied on in theories about making. Meaning has been connected to making (Gauntlett, 2011) with the view that making is a process of discovering deeper meaning by having ideas through the process of making. In particular, taking time to make something, using the hands, gives people the opportunity to clarify thoughts or feelings, and to see their interactions in a new light. Making your phone then has potential to provoke the individual to become more aware of interactions with the cell phone device, the subjective meaning of the device and the intentionality of interactions with it. In this way, by making people can actually become more aware of what interactions they want and are most meaningful to them in their everyday life. By provoking this introspection and reflection on doing, the user and maker themselves are set on a path for the shaping of future interactions.

4.2.3. Background in use, foreground in making
Dourish defined embodied interaction as the creation, manipulation and sharing of meaning through engaged interaction with artifacts (Dourish, 2004) and explained it as a coupling of tangible and social computing. Social computing is increasing attempts to incorporate understandings of the social world, which links back to the discussion on communities. Tangible interaction is focusing on how to remove focus from the device and provide people with a more direct interaction experience. This idea of removing a device from the focus dates back to notions of ‘the disappearing computer’ (Streitz, 2005) which provoked getting digital technology out of the way. This was later challenged as being perceived transparency (Sokoler, 2004), with the view that it is differentiated from ‘the disappearing interface’ as being true invisibility. While Dourish, Streitz and Sokoler promoted getting the device out of the way, in another view of affective computing there is some support for bringing the device more to the forefront. Affective computing (Picard, 1995) is the development of devices and systems that can recognize, interpret, process and stimulate human affects. With this intention, use of the device deliberately influences human affects and so makes the user more aware of its presence. To bridge these contradicting views consideration is given to the work by Morris (Morris, 1970) that a hands-on engagement with a craft was the only way to truly understand it. Building on this then it can be deducted that it is the use of cell phones that is desired to be in the background which is helped by opening up the making of the cell phone to the user and so bringing it temporarily to the foreground.
4.3. ‘Cell phone’
The ‘cell phone’ part of the design program focuses specifically on cell phone technologies and this is discussed here by first considering informal rules for cell phone interactions and then current cell phone technologies.

4.3.1. Rules of cell phone interactions
There are informal rules about cell phone use which are not always explicitly stated. The explicit rules include things like public signs which prompt us to turn off or put our phone on silent, while other rules completely prohibit cell phone use such as ‘no phone’ zones. Some rules were made to guide acceptable ways of using mobile phones when around others and these are informally known as rules of cell phone etiquette (Krotz, 2003). Examples of etiquette rules include, not talking too loudly when speaking on the phone in public and not talking on the phone when in enclosed spaces with others. Some projects have been done to emphasize the importance of these etiquette rules and annoyances when they are not followed and one example is a project for the design of colourful cards which are downloadable so that they can be handed out when cell phone etiquette is breached (Shearman, 2012).

4.3.2. Cell phone technologies

![Image](image_url)

(a) Sixth Sense technology  (b) Feel Me phone  (c) Mono phone covers

Figure 3: Existing cell phone interaction technologies.

Today there is an overwhelming collection of work already done on cell phone interactions. One way for meaningful interpretation is by considering three broad categories of (1) facilitating interactions so that users can do more with their cell phones, usually involving an added accessory or integrating the phone into a larger device (2) do different what we already use the cell phone for or (3) cell phones designed to raise awareness of use rather than a focus on functionality. There are some overlaps with the technologies in these three categories. From another perspective relevant to this design program are works done on user made cell phone technologies.

**Do more**
These technologies focus on using cell phones to help us do more things than we already use them for. The focus can be on how to process more cell phone output while multi-tasking the world around us (Jusis, 2012) or how to provide input in a more seamless way so that we get more done (Rao, 2010), see Figure 3(a). The cell phone has also begun to take on different forms
so that it integrates more into our everyday objects which was interpreted as being ‘ready at hand’ (Worstall, 2013).

**Do different**

These technologies provide alternative ways to use cell phones, to do the things we already do with them. This includes making output more meaningful for non verbal communication (Triverio, 2012), see Figure 3(b), and alternative ways for input interactions rather than tapping on the screen and voice control (Hemmert, 2012) (Santos, 2012).

**Designs to raise awareness**

Some cell phones were designed to raise awareness of use rather than having functional benefits. These include projects like Social mobiles by IDEO which is a set of phones that in different ways modify their users’ behavior to make it less disruptive. The intent was to provoke discussion about the social and public impact of mobile phones. To raise awareness of our fast paced lifestyle the Mono task phone project uses covers for mono tasking, rather than multitasking (Cardini, 2012), see Figure 3(c). His mono-phone provokes us to focus on doing one thing at a time, in effect allowing us to focus on the world around, and make a stance against the ‘do more’ designs.

**User made cell phones**

Discussions about people wanting to create their own phone can be found on blogs that date back 9 years to 2005. Here is an excerpt from one such online blog,

“We spent 10 to 20 hours a week studying, building and testing the subsystems. At the end of the 10 weeks, we used our subsystem as the transmitter and a similar one as the receiver (so 4 people * 15 hours/wk * 10 weeks) and we managed to send morse code because we were too exhausted build a circuit to do the voice modulation. In total there were 12 of us trying to do this and only 8 finally got it working.” (Borland, 2005)

There have also been informal talks about the desire by users to make their own phone. The idea itself therefore is not new, however it is the technology, skills, and maker community today that has recently made it possible to some extent.

![Figure 4: MIT's DIY cell phone by David Mellis](image-url)
The DIY cell phone was designed and developed by David Mellis, a PhD student at MIT and a cofounder of Arduino, with basic functionality using open source software and hardware and with support from DIY communities (Mellis, 2014). The process and steps to making this phone has been well documented and the files for both hardware and software have been made available online. This DIY cell phone prototype was completed after this thesis work was already started and became invaluable to this work since it formed the basis for the technical aspect of this design program.

4.4. Program perspective
In this theoretical exploration several perspectives of the design program were raised that helped to formulate dimensions from which this work can be viewed. Program dimensions identified include; (1) user/industry led design process, in considerations of maker culture, (2) designs for reflective/passive interactions, revealed in considerations for reflections on technology use and a call for a point of inflection, (3) Social/individual experience in making and using, brought up in thinking about individuals and communities involved in the design process, (4) inclusive/exclusive design process in reference to theories on bonding and bridging social capital (Putnam, 1995) and, (5) technologies that do more/do different/raise awareness. Furthermore, several important considerations were raised for the future of cell phone interactions and one main consideration is challenges in designing for changing use contexts (Suchman, 1987).

In the next chapters the more practical experiments within this DIT cell phone design program are presented.
5. Exploring Current Cell Phone Interactions

The topic of the day for these experiments is exploring what a small sample of people think about the current state of cell phone interactions, both their own interactions and those of others around them. The intention of this experiment was to gain insights into current cell phone interactions by bringing to the surface tacit meaning of the actors interaction with their mobile phones. This is based on the assumption of tacit meaning, as discussed in the theoretical exploration, that users’ interactions with their cell phones have deeper meaning, beyond their visible surface interactions, which cannot be easily explained. Setting up the experiment in this way presents a perspective of the program for a deeper understanding of user needs and wants from cell phone interactions, which can possibly be instrumental in designing for future interactions.

5.1. Actors

The people, or actors, for this experiment had characteristics of different international backgrounds, skills, ages and used different kinds of cell phones including basic and smart cell phones. The actual experiment activity was done in Malmö, Sweden, and social media was used to carry on a conversation around the experiment with one actor in Trinidad.

5.2. Materials

One material used here, and also in the next exploration, is what was label ‘the white box’, see Figure 5. This label was not intended to draw reference to any other field that may already use this term, such as in arts; rather this literal white box was used for representation of a cell phone, and a tool in the experimentation process. Materially, the white box itself measured 20cm x 6.5cm x 5.2cm and weighted approximately 90g. The box was chosen to be white because it was thought that white would be a neutral colour, free of subjective colour opinions and preferences. It was also plain white, without any patterns or markings, so that the participant would not be distracted and would not draw any deeper meaning in its style. The shape of a box was also chosen because of its familiarity to the early days of cell phones when some phones may have actually had these dimensions. The ways people engaged with this box then, was intended to be easier to translate to cell phone interactions than if any other shape was used.

![Figure 5: The white box](image)

5.3. Description

A series of short experiments were done within this exploration on current cell phone interactions, until the aim of tapping into tacit meaning was thought to be satisfied.
**Experiment 1: Observing cell phone use**

This experiment adapted a ‘fly on the wall approach’ for making observations in an environment such that neither the environment nor the persons being observed were interrupted. The environment observed was the city of Malmö, Sweden. Observations were made at everyday places including bus stops, in buses and streets around the city. Most observations were done by sitting or standing in the background, such as at the back seat inside buses, because this was found to be a comfortable observation point with a usually unobtrusive view. These observations were done spontaneously and randomly for about 1 hour at various times each day, from December to March, when the weather then ranged from cold winter to hints of spring.

**Outcomes**

This experiment was expected to gain some insights on mobile phones use situated in public spaces, however what actually happened was an overwhelming parallel occurrence of cell phone usage by most people in the environment. An on the spot decision was made then, that instead of considering the whole environment, to focus rather on a few instances of use, such as, by focusing on one person at a time for a certain length of time. This yielded some insights on individual behaviour; however it was felt that the environment influences on cell phone use was too strong to interpret individuals use behaviour. It was also experienced that documentation of observations in this way was restricted to note taking as taking a photo or video recording of a stranger on their phone in public was mostly uncomfortable both for the observer and the ones being observed. Note taking itself was not enough to keep up with the real time simultaneous interactions with cell phones and the complex surrounding environment. This limitation in detailed documentation of the experiment limited meaningful observations and interpretations; however surface level insights could be gained. One such insight was that observations are not sufficient for gaining deeper understanding of cell phone interactions. This experiment also aligned with assumptions that in Malmö there is a strong culture of cell phone, and even smartphone use, since most people were observed to be using iPhones and Androids. The main lesson here was that more staged experiments will be better suited for further exploration.

**Experiment 2: Informal talks**

To get a deeper understand of mobile phone use behaviours I observed Adriana and Magnus at their work place, an office space in Malmö, and then spoke informally with them. They together are the co-owners of a start-up interaction design company in Malmö with Adriana taking the lead in interaction design and Magnus the lead on technical implementations. We started our conversation about their mobile phone use during a casual car drive to their office. From Magnus I received very strong and valuable comments, mainly because I think he felt comfortable in this informal setting. He brought up the iPhone’s app called Siri and described it as, “...the most horrible way to interact with a smart phone. I will never talk with a machine, even in private.” He talked about problems he experienced with Siri understanding his ‘Swedish-sounding-English’ which makes him feel silly having to repeat himself and change his voice for the software to understand him. He also talked about Siri being a machine and not responsive, so it is
not like talking with a person. He did, however, like an Android phone’s feature, he could not recall which one, that if the phone is ringing and you place your hand over it, it automatically goes to quiet mode. In my observations of Magnus at work at his desk in the office later I noticed that he usually kept his phone on silent and positioned it in close proximity to him on his work desk. Sometimes he missed notifications on his phone because he deliberately kept it off to not be disturbed. He even was observed to turn the face of the phone over on the desk so that he could not see when a notification arrives. This was necessary to him since he did not want to break his concentration during intense times of focus, which indicates that even subtle notifications triggers use of the mobile phone. It is not enough then to just have no sound.

Adriana talked about difficulties in driving and using her iPhone. She knows it is a bad practice, but as long as she knows that there is some kind of notification on her phone she wants to check it as soon as possible. It is the knowing that there is some activity happening on her phone that triggers thought processes in her mind that require an action, and is only satisfied when she finally uses the device. At the same time I did not observe her to be very attached to her phone, except for work and family purposes. Most of her mobile phone interactions relate to communications for her work and family, so to her it is not that she cares for the phone itself but the convenience that it offers. She also spoke about being annoyed with rude cell phone users in public space who do not follow the rules of etiquette.

Around this time also a friend of mine in Trinidad, Andre, who is also a working parent, posted a picture on a social media platform that comically showed his solution to handling limited interaction options with his smart phone while driving. This picture is given in Figure 6(b) and shows his smart phone wedged tightly between the bars in his car’s steering wheel. This photo initiated a conversation with him about how he shared Adriana’s experience.

![Adriana](image1.png) ![Andre’s ad hoc solution](image2.png)

Figure 6: (a) Talking with Adriana at their office, (b) Hack for cell phone use while driving.

Another talk was done, with Salla, first about current cell phone use and then relating it to the idea of making your own phone. Salla is an international student from Finland now living in Malmö and she commented that she loves the idea of making her own phone. She herself has a hard time keeping a cell phone ‘alive’ so she does not want to invest in an expensive phone while being a student. Also, she travels to different countries fairly often so she does not want to commit to a price plan to buy a higher end phone such as an iPhone. She stated she would love to
have an iPhone however, because of the sleek look and user interface design, but now she is content with a simple Nokia phone because of her mobility and financial limitations.

**Outcomes**
These informal talks did go deeper than the first experiment in provoking people to reflect on their mobile phone use and provided some insights into the meaning of these participants’ use of cell phones however; they were not able to reflect on their behaviours easily because their moment of cell phone interaction already seemed mostly forgotten. I learnt here that a staged setting like this made the discussion more like work that people had to allocate time for and this perhaps can make the conversations a bit stiff and the need to keep pushing the conversation on rather than the participants becoming immersed in the topic. An experiment that provoked persons to reflect on their mobile phone use during the time of interaction was expected then to get closer to tapping into tacit meanings.

**Experiment 3: Role playing**
This experiment aimed to provoke participants to relive scenarios of cell phone interactions with the intention that by doing this they will easily reflect on and actively discuss phone interactions by them, and that of others around them. By observing and documenting their reflection and discussion the conversation was guided to bring to the surface tacit meanings in use. The white box was used here as a representation of a cell phone device. An informal setting was staged for a game adapted from charades, a well known game, where what was acted out focused on both subtleness in public and expressiveness in private of cell phone use.

![Role play game participants.](image)

Six participants were divided into two teams of three and each team was given a stack of six cards. Each card had a short description of a mobile phone use scenario in a public or private space and is provided in Appendix A. Each team took turns acting one scenario to the other team, who then had to guess what the scenario was within 90 seconds. After a right guess was made, or time was up, all participants discussed that use situation.

**Outcomes**
Conversations about different mobile phone use scenarios flowed freely with everyone actively participating. The paper scenarios and acting out in the present, having a white box (to simulate a cell phone) as a constant prop, made the use contexts alive to the participants who easily recalled
their own experiences and even brought forth confessions of cell phone use that may not be socially considerate.

5.4. Program perspective

Reflections on this exploration into current cell phone interactions gave insights from perspectives of the experiments methodology and importantly on the program. The progression of experiments from a fly on the wall approach to finally development of a role play game was deliberate so that the intention of this exploration was satisfied. Moving from one experiment to the next then was the result of lessons learnt from shortcomings of the previous experiment. It was highlighted that typically people do not reflect on their interactions with cell phones, so this attributed to some difficulties in provoking deeper introspection of their use. The role play game put the participants in a context where they had to make deliberate efforts to reenact theirs and others interactions with cell phones, and this was observed to make them more aware of their own use of phones, why they use it like that, how their interactions affect others around and ways they rather use the device in different contexts of use. This further relates to the program of DIT cell phone in a few ways. One is that the reflection and introspection brought up by the deliberate engagement with the white box in a scenario can set a frame for deliberate actions to make your own phone as setting a stage for reflection and introspection while you are in the making process on what you are making for and why. Another is that it was in the group activity of role playing that tacit meaning was most brought to the surface, through the social interactions and dialogues. This relates to the ‘together’ aspect of the DIT cell phone program as also fostering deeper meaning in the making can be transferred to more meaningful interactions. It was learnt too that people are already aware of the limitations of interaction options with mobile phones provided to them, despite the rules against its use in certain contexts. It is an innate nature then for ad hoc solutions to be created to overcome limitations, such as the irresistible need to check phone notifications, no matter how subtle, while driving. This innate nature of tinkering to make something work the way you want it to supports the potential of creation of new interactions specific to the user and user context by opening up the design of cell phones to the user at the deepest level. Overall, program dimensions derived and supported by this experiment are (1) user/industry led design process and (2) interactions that are reflective/passive in use.
6. Exploring User Perceptions of New Cell Phone Interactions

The topic of the day for this experiment was exploring people’s reaction to non conventional ways to interact with cell phones. The intention of this experiment was to gain insights into what limitations people have implicitly prepurposed on their interaction options with cell phones. This is based on the assumption that current interaction options with cell phones are limited, therefore it can follow that cell phone users have already limited themselves to what they can and cannot do with these devices. Setting up the experiment in this way presents a provocative perspective of this design program for creating your own phone as a way of opening up the interaction options for users to be the makers of their cell phone interactions.

6.1. Actors

The actors for this experiment also had different international backgrounds, skills, age and used different kinds of cell phones; however they all currently lived in Malmö, Sweden.

6.2. Materials

The white box used in the role play game was used again here, but in this exploration its role was as an object to be acted on for expressiveness, and its representation as a cell phone was kept hidden from the participants till the end.

6.3. Description: Cell phone prop experiment

In this experiment three participants were individually given the white box without being told what it represented, and asked to express different feelings but by only tangible interactions with the box. It was done at a private location where they could express themselves freely and without interruptions. To get a better feel for these two initial staged experiments the reader is encouraged to look at their edited video recordings before reading further, found here.

Outcomes

When asked to express happiness one reaction was to throw the box up, see Figure 8 (b), because “joy has a sense of lightness” while another participant expressed this by lifting the box high. Stress was commonly expressed by squeezing or shaking the box, see Figure 8 (c), because as one said, “I feel restless and can’t be still” and another “I rather shake it (than throw it away) for self gratification”. When asked to show that they were busy one notable expression was to
push the box to the side, see Figure 8 (a), because “I am busy doing my own thing...and I want to reject other (distractions) by pushing them away.” Overall, at first the participants found it strange to express emotions using only the white box. By the third task however, it was observed that they felt more comfortable engaging with the box in this way and their expressions became more creative and meaningful. At the end, when they were told that the white box really represented a cell phone, they were initially surprised but then discussions followed about the meaning of their expressions and how it can be applicable to future cell phone interactions.

At first some concerns raised for using a phone like they did with the box, including consequences to the device if expressing anger and some interactions being too revealing when you don’t want people to know how you feel. By the end of the reflective discussion the participants seemed to be slowly opening up to possible benefits of interacting with their cell phone in new ways, such as this. One such benefit was expression to send a message of feeling afraid and another stated, “Social networks already have the feature of expressing your feelings, such as I’m feeling sad today, so it makes sense to be able to express your feelings in other ways using your phone. That can be like an upgrading of social networks.” Overall however, the participants seemed to be set in their traditional ways of interacting with cell phones and not easily able to think beyond the interactions provided to them, but when provoked with the idea of a new way of interaction they showed potential for embracing the idea in the future if it can be possible.

6.4. Program perspective

In this exploration the idea of designing your own cell phone was not brought up to the participants, rather focus was on one new way of thinking of interacting with cell phones as a way to generate discussscion around how open minded they were to new interaction options with the device. This challenges the DIT program from the perspective of shaping new interaction options with phones. If people have the possibility to make their own cell phones, assuming no limitations, interactions can still be limited if their creativity is limited to what already exists and interacting in the ways they already do. In this perspective, a challenge can also be what comes first, making the phone and then designing new interactions with it, or already wanting new interactions which leads to one making their own phone. From this perspective it depends on the persons who are the ‘together’ in the DIT cell phone process as different people will have different motivations, however whether the making of the phone is the cause or the effect does not remove the significance of having the option to do so. This experiment also supports the DIT cell phone design program from the perspective of users accepting and wrapping their minds around the idea of designing their phone. Perhaps, given time and exposure to the approach, designing your phone can be accepted as well as new interactions with it. Overall, the main program dimensions derived and supported by this experiment is fostering interactions that are reflective/passive in use.
7. Exploring Future Interaction Designers’ Visions for Future Designs

The topic of the day for this experiment was exploring how those becoming interaction designers see the future of cell phone interactions when presented with the idea of designing your phone. The intention of this experiment was to gage the current views of a future generation on this design opportunity for shaping future interaction with cell phones. This is based on the assumption that the process of making phones is open for interjection by these designers in the future. Setting up the experiment in this way presents a futuristic perspective of the design program.

7.1. Actors

The actors in this exploration were student in the IDK program at Malmö University. They all spoke Swedish mainly but also English, and lived in Malmö for at least a substantial part of their lives. Their ages ranged from 19 to 25 and they all owned a smart phone.

7.2. Materials

The actors were allowed to use any materials they needed for conducting focus groups on the topic of ‘build your own cell phone’.

7.3. Description: Student Focus Groups

An Interaction Design bachelor class at Malmö University was given a one week assignment to organise focus groups based on the idea of creating your own cell phone. In all there were 8 focus groups, and each group took turns of being the participants or the organizers. These focus groups then were both organized by and participated by the actors. Before they were given the assignment they were briefed about the idea of creating your own phone and the already existing DIY cell phone made by MIT (Mellis, 2014). They were however encouraged to not restrict themselves to what already exists but rather think about designing for the future.

Outcomes

Each group gave physical outcomes from their focus group experiments including sketches, paper prototypes and other materials like videos. Their original reports containing the documentation and findings of their focus group experiments were done in Swedish and are given in Appendix G. Two groups also made video documentation of their focus group and these can be found here and here. Figure 9 shows some of the notable ideas generated.

A common trend in their views of the future cell phone is a quality of personalization and customization to their day-to-day needs, not only in terms of software but also in tangible interactions with the device. This is the idea behind Figure 9(a) that illustrates a partially biological, 3-dimensional monitor phone that is made from a malleable material so that it can be worn as jewelry on different parts of the body, and Figure 9(d) that shows an ergonomic phone with silicone case that would take the shape of the user’s hand. Personalization was also discussed for security reasons such that, nobody else can use the phone besides the owner, since the phone can distinguish the owner’s voice.
Another linking factor was that the participants showed that they have very high expectations for the future of cell phone interactions. This is illustrated in Figure 9(b) of a hologram phone that allows you to interact with it by moving around apps, features and send messages through the movement of your hands with inspirations from the iPhone, Star Wars, Iron Man and other Sci Fi movies. Another high expectation of the future is the projection phone shown in Figure 9(b), where the phone projects a keyboard on the table and a monitor on a wall in front of you. Besides the high future expectations and advanced personalization requirements, there were some considerations of making a phone that meet their anticipated future requirements. One view was that it is not considered to be likely that the larger companies would take the initiative with a DIY when they want to remain profitable, but this would initially be a minor player where designers have more power who dared to break new ground. Some perceived benefits of building your own phone were identified as being able to fix the exact part when your phone is broken, it can also provide greater scope for an individual to express commitment to the environment, political position (distance from large companies) or specific technology or design interest. Overall the actors in this exploration do not believe that future phones will look like they do today and furthermore they don’t see using a cell phone as a solution to future interactions but envision that there will be no limits to design of future devices that provide the functions of cell phone we have today.

7.4.  **Program perspective**

They associated the idea of making your own cell phone with the cell phone of the future. This is a challenge to the design program here since there is a perceived difference. When thinking about current cell phone technology it is obvious that in the future the cell phone is on the path of doing more, being faster, more connected, etc. When thinking about making your own phone it is
rather about doing it differently. This proves some thought around the program of creating your own phone to think about the potentials of a DIY cell phone to satisfy or meet the expectations of the future of cell phones. Yes, DIY cell phone is for personal fulfillment, but thought arise about how long with this personal fulfillment last, how strong is it, how valuable is it personally to make a phone yourself when technology is advancing and the DIYer seems to taking a major step backwards. Will the idea of making your own phone then fade away and die out before anyone has the necessary skills to make a phone themselves that gives a balance between the phone of the future, what people want and need, and what people can make themselves? Who can really make a phone this high tech anyways? Will the task of manufacturing go back to the big companies with the know-how and resources? It is true that the DIY phone is not intended for commercial and competitive markets, however, where does the current need really lay? While only time can tell, predictions on some possibilities of making your own phone and how would this align to the future of cell phones today. Their requirements also support the design program since the DIT phone intends for the user to have complete control to customize to their own needs, even the physical shape. Overall, the main program dimensions derived and supported by this experiment are (1) cell phone designs for current or future scenarios and (2) user/industry led design process.
8. Exploring Users’ Visions for a DIT Cell Phone Future

The topic of this experiment was exploring fundamental preferences if a mixed group of persons could together design their own cell phone. The intention of this experiment was to provoke discussions around the DIT cell phone program and generate tangible outcomes that represented different possibilities. This is based on the assumption that there exists a workspace or maker space where people with different skills and demographics can come together with a common purpose of designing their phone, therefore some kind of DIT cell phone community. Setting up the experiment in this way presents a social and community based perspective of the design program as opposed to individual tasks and individual perspectives which were explored in chapters 5 and 6. This experiment was done as a one day event called a Fieldshop (Halse, et al., 2010).

8.1. Actors

Participants were selected with varying characteristics such as age, nationality, profession, skills and expertise. Recruitment was done by word of mouth and through personal contacts, however the online thesis blog was found to be useful in recruiting suitable participants with whom there was no prior contact. There were 16 participants in total which included:

- 5 designers
- 2 of 65+ years old
- 1 teenager
- 5 technologically savvy
- 8 Swedes, 8 internationals
- 1 cell phone industry professional
- 9 students, 6 professionals

Additionally 2 IXD colleagues assisted with photo and video documentation of the event.

8.2. Materials

To get a better understanding of all the participants and to plan for the event efficiently, an online questionnaire was sent 3 days before the event and it is provided in Appendix C. It was completed by all 16 participants and Appendix D gives some visuals of their responses. Detailed information about the experiment/event and provoking questions to initiate reflections on their cell phone use, and ideas on designing their own, was sent in a preparatory document which is provided in Appendix B.

On the day of the Fieldshop event materials were used for documentations, guiding discussions and group prototyping, shown in Figure 10.
A feedback questionnaire was sent to participants 2 days after the event to get feedback on the
event itself and not on the topic. This was to aid my personal overall reflections on the event, for
learning and helping me to better interpret the findings from the event. This feedback form is
given in Appendix E and Appendix F shows some of their responses.

8.3. Description: Fieldshop
A fieldshop has been described as a combination of fieldwork and workshop (Halse, et al.,
2010). It was a method created to short-circuit the traditional phases of a design process by
enabling the designer to try out new interactions and social relations around a certain design
opportunity from the very outset. This can also be viewed as a co-design event as it focuses on
creating engagement, shared experiences and organized to produce tangible output. Before
reading further the reader is encouraged to look at a 5 minute video summary of the fieldshop
event found here.

Agenda

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Figure 10: Materials used at the Fieldshop.

(a) Documentation materials
(b) Cards for guiding discussions
(c) Materials for group prototyping

Figure 11: Tour of the fieldshop space. Figure 12: Reflective sketches on cell phone use.
There were three distinctive sessions, of 45 minutes each and with 15 minute fika breaks between. In session 1 participants made brief round table introductions and then were given a tour of the workspace, see Figure 11, MEDEA. In session 2 they first presented their reflections before the event in the form of a show and tell, see Figure 12, and then discussions were guided on the aim of the fieldshop, traditional crafting, history of phone designs and modern fabrication. The last 15 minutes of session 2 involved separating into 3 groups and having group discussions on how the idea of making your own phone could work. The group work continued in session 3 as each group took their ideas from session 2 and made sketches, scenarios and props to show how they envision it could work.

Outcomes
Basic prototypes were made by each group with a focus on interaction rather than functionality. The importance of this experiment however is not only on the tangible prototypes but the process of prototyping and making together.

![Sustainable Phone](image1.png)
(a) Sustainable Phone

![Build-A-Phone](image2.png)
(b) Build-A-Phone

![Smart social frog Phones](image3.png)
(c) Smart social frog Phones

Figure 13: Tangible outcomes of the Fieldshop.

One prototype presented was for a phone with considerations for sustainability; see Figure 13(a). The idea here was for a mobile phone with a customizable case, made of Lego, physical representations of software interactions, loading cards, and for public mobile phone chargers permanently installed around their fictional city, like public toilets they said. Issues important to this group were (1) the use of fair trade materials to make each individual part of the phone, (2) parents having control over how their children can interact with the phone, the reason for physical representation of software (3) easy customization of the look and feel of the phone case, reason for a Lego building block case design and (4) issues of low battery life.
Another group presented an idea based on personal customization called Build-A-Phone, see Figure 13(b). The main issue important to this group was customizing their mobile phone with specific features that they preferred including, having built in headset so they would not risk forgetting it at home, added camera functionalities and variations in the touch screens and keypads for input. They saw this approach working if some kind of business made the individual cell phone features and parts and the users can specify online what they want and get it shipped or picked up at a store or they go into a physical store and get it made on the spot. Inspirations for this idea were in the customization of a laptop purchased online and the Build-A-Bear stores.

A third idea presented is referred to as the Smart Social Frog Phone, see Figure 13(c), which is a mobile phone that learns about its owner and such phones can communicate with each other to initiate conversation between their owners based on similarities. Issues important to this group were (1) ways cell phone use in public can initiate social interactions rather than distract us from it (2) personal customization, designed for by adding or removing small balls from inside the frog where each ball represented a feature and (3) physical interaction with the device, designed for by making it ‘clam’ shaped so it felt good in their hand.

8.4. Program perspective

The intention here was to see how the different people can come together in the process of making or crafting own cell phone. By prototyping the participants were provoked to think and enacting new practices for cell phone interaction if they could make their own. Some support was given to the design program in the aspect of making together since it was observed that the topic of cell phone interaction was a unifying topic among the diverse participants. They talked in a common language about their mobile phone use and needs, despite their differences. They were informed before hand of their role in the event such as to represent perspectives from an elder, or a teenager, a designer, an international, a local swede, etc., however they all seemed to have similar stories of mobile phone interactions to share. Support was also given to the notion of a community of users as innovators and designing of cell phone interactions and issues in the future which was evident by some groups designing for issues in a bigger picture or phone design such as fair trade issues and parental controls. Support for the making as connecting views discussed in the theoretical exploration and the design process provoking introspection of personal interactions with their cell phones, which reflected in the friendly atmosphere and feedback about enjoying the social aspect of the event. Furthermore no group was observed to talk about doing more with their phone, rather each prototype talked about doing things differently, in ways that more suited them personally. This also follows on the intention of the design program to not just be another new advancement in cell phone interaction technology but rather to ‘do different’.

Challenges that did arise was not from their characteristic differences but rather from the differences in their taught skills and knowledge, which presented one challenge to the design program of who could be involved in the ‘together’ aspect of making the phone. This challenge
was discussed by prompting participants to think about who can be involved in a process to design their mobile phone. Some possible role players identified were (1) Groups like they were in at the event, such that each had one designer and one tech savvy participant (2) Businesses that can manufacture the separate parts instead of the whole phone or (3) The retailers who they could order a customized phone from.

Overall, the main program dimensions derived and supported by this experiment are (1) social/individual design and use experience and, (2) current/future interaction designs. Furthermore, from this experiment overall fundamental qualities important to some users if they could make their own cell phone is for it to be (1)simple, (2)customizable (3)flexible (4)controllable, and these form a perspective of use qualities for the DIT cell phone design program.
9. Exploring Industry Perspectives

The topic of this experiment was cell phone industry professionals’ perspective on the idea of users designing and making their own cell phone. The intention of this experiment was to gain insights into how the cell phone industry currently works, including understanding industry roles in the design process, and generate discussions on how the DIT cell phone design program can be supported or challenged by the industry. This is based on the assumption that there can be some kind of co-existence between industry and the possibility to make your own phone, even though futuristically thinking, industry and users may take on different role from what we know it as today. Setting up the experiment in this way presents a perspective of the design program from a current day realistic and practical viewpoint, rather than future minded like the previous experiments.

9.1. Actors

Four professionals with difference experiences and roles in the cell phone industry were interviewed and are described in Table 2, in no particular order.

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasi</td>
<td>Senior engineering manager with Nokia</td>
<td>Mobile phone production process and markets.</td>
</tr>
<tr>
<td>Livia</td>
<td>Interaction designer at Sony Ericsson, now independent interaction designer with Unsworn Industries</td>
<td>Cell phone customization and personalizations.</td>
</tr>
<tr>
<td>David</td>
<td>Arduino co-founder</td>
<td>Worked to design part of the DIY cell phone with David Mellis.</td>
</tr>
<tr>
<td>Gustaf</td>
<td>RF verification engineer at Ericsson</td>
<td>Telecommunications and mobile networking.</td>
</tr>
</tbody>
</table>

Table 2: Cell phone industry professionals interviewed.

9.2. Materials

A printed interview guide was used and is provided in Appendix H.

9.3. Description

Everyday cell phones used today are designed, engineered and marketed by the cell phone industry, which comprises of several entities that work together, to get the device into the hands of end users. Four individual talks were done to gain insights into how some of these entities work together and are presented here under topics relevant for interpretation of the DIT cell phone design program.

9.3.1. Understanding how cell phones are made in the industry

In exploring an approach for shaping future interactions with cell phones by designing these devices together, a useful perspective is to consider how cell phones are already made today. Pasi gave insights here by identifying four main areas of expertise and skills applied from the beginning to end of the process and they are mechanics, electrical mechanics, hardware and
software. He explained that the mechanics is done by mechanical engineers who at the beginning of the process design the cell phone covers labeled as the A, B and C covers. The A cover includes the keypad buttons or touch screen space, B cover includes cameras, screws for battery, the sim etc and the C covers are for the sides including USBs and other connectors. This area of expertise also includes designing how all the components fix together which involves considerations for placement of antennas and how the user will ultimately use the phone. Another aspect is the electrical mechanic and is done by electrical engineers. This deals with how the electronic components inside the phone will work together and includes considerations for proper functioning of the different antennas such as radio, GSM, WiFi, Bluetooth, etc. The hardware aspect involves considerations for memory, processors, and other hardware components, while the software aspect is added last and involves installing the operating system and applications.

9.3.2. Current role of design in the cell phone industry
Having a bigger picture understanding of how cell phones are made in the industry gave a useful perspective for contextualization of this work later, but the role of design in this making process was vital for this design research program. Pasi again was able to give insights on the place of design in the cell phone industry today, from an engineering perspective, as he identified the main areas as in the mechanical and software stages. He viewed design as important in the mechanics since this affects tangible and intangible qualities of the cell phone. Tangibly, the mechanics designs determines the shape, size and feel of the phone and relates also to some hardware design considerations for materials used for the covers. Intangibly, the mechanics designs determine the smooth functionality of phone by designing in such a way to efficiently bring together the components. The mechanical design is particularly important to companies because this aspect directly affects the price and therefore profit earned on the phone.

Pasi considered software designs as the most common aspect of design in the cell phone industry today. Livia later supported this view by talking about the importance placed on user experience and interaction design considerations when designing cell phone applications. This is demonstrated for example by some companies, including Sony mobile in Lund, having set up a usability lab for the main purpose of user testing of cell phone applications. Pasi took design of cell phone software a bit further by noting that most cell phone software was proprietary but now there are more open source options. When asked what makes a cell phone ‘open source’ he responded with “Android phones are commonly thought of as open source phones, but this is only from a software perspective, since you can build apps and games for the device yourself.” Thinking about design holistically however he stressed that it is not possible to look at only software because it is dead without the mechanics, rather the overall user experience when using a cell phone is dependent on both the mechanics and the software designs.

9.3.3. Designing for customization and personalization
Livia gave insights on the role of design in the cell phone industry, from a non engineering perspective, by focusing more on designing for end user customization and personalization of the
device. She held the view that people normally customize their cell phone in terms of software and hardware aesthetics. Software customizations include changing visual themes, background pictures, ringtones and the screen lock whereas hardware customizations include stickers and hanging things from the phone. In her views too, customizing phone covers are the biggest part of hardware aesthetic customizations, however it is the software content stored in a phone that makes it personal, not so much the physical phone itself. Discussion was provoked about customizing the cell phone device holistically by referring to possibilities for this with the DIY cell phone (Mellis, 2014). In response she gave examples of custom cell phone designs by the industry such as a phone designed with basic functionality yet attractive for use by the elderly called the Doro phone, and a luxury phone with a simple functionality but expensive design called the Purity phone. She explained also that design in the industry caters to mass production since design and production cost is fixed regardless if basic or more advanced features and functionality is provided on a particular phone. This means that less features and functionality does not mean spending less by the company, so even the basic phones today can be made with features considered to be advanced 5 years ago. The cell phone users benefit from this lack of customization as well since they can pay less (money) for more (features); however there is currently no option provided by the industry to pay less for less. Therefore, cell phone design and production by companies today is not scalable and provides for end user customization and personalization only in terms of some software and accessorizing the covers.

9.3.4. Requirements by cell phone networks and standards
Besides engineering and design aspects, cell phone networks and standards are important entities in the cell phone industry. Gustaf provided insights to the overall structure of cell phone networks by explaining briefly the history of cell phone networking, the actors involved in networking and then cell phone standards.

Considering the design program, Gustaf thinks that having a basic understanding of the evolution of cell phone networking gives a valuable perspective. He summarized it like this (1)1980, the first generation of cell phones that allowed for circuit switch calls (2)10 years later we had the GSM or 2nd generation phones which provided some support for data, (3)15 years ago was introduced 3G networks which provided more data and (4) now we have 4G networks which support mostly data and less of the initial phone functionalities. As the network evolved so has cell phone use, providing more capacity now for connectivity than ever before. As exciting as this has been for users to do more and be more connected, Gustaf expressed concern with increasing R&D cost to make more complex phones and possible long term stagnation in cell phone developments. For this reason Gustaf thought it difficult to predict the effect of an end user designed cell phone, such as the DIY cell phone, on cell phone networks today, however effects can better be understood by considering the different actors in cell phone networking.

One actor is cell phone manufacturers, such as Sony mobile, who in his view will not be affected because the DIY phone is not competitive on the market. Another actor is the cell phone operators, such as Vodafone, and he thinks these can be a bit worried because they cannot
control a DIY phone like other cell phones today. A third actor is the cell phone networks, such as Telia, and these will require each instance of a user made phone to successfully connect to the network by satisfying network standards. This connection is usually not a problem but in extreme circumstances problems can arise if the phone caused a lot of disturbance on the network. In such cases the network would place a ban on the phone, and so prevent it from being used on that network. Gustaf did not see this as a realistic issue however. The forth actor in cell phone networking is the International Telecommunication Union (ITU) which is an international body that meets annually to discuss design and development of cell phone technology by setting standards on how phones will work and what they are allowed to do. Last, but not the least, actors in cell phone networking is the users.

9.3.5. Suitability for different cell phone markets
Another important aspect of the cell phone industry is the cell phone market since it influences the design of phones for particular markets. Pasi gave insights on this aspect by discussing different designs of cell phones made for different markets. Phones for underdeveloped/less developed countries, such as India and Africa, are designed to not have as many features as those designed for developed countries. This is because the luxury in less developed countries is convenient communication, where as in more developed markets, such as Scandinavia, it is hard to tell what a phone is since it is common to own other mobile technologies as well. A phone in developed countries is like a computer so the demand here is for more advanced phones. Given this perspective it is evident that the market defines the design of the cell phone provided. Different markets also use different kinds of cell phone networks, so this brings in design considerations for network capabilities as well. Technically thinking, it is the cell phone software platform that enables different features. This follows then that cell phone companies chose to design phones based on different platforms for different markets. Pasi gave the example of the Nokia S30 and S40 which are the platforms for phones with basic functionality and provided to India and Africa, while the S60 and S90 are used for Europe and enable the advanced touch screen feature. The platform provided in a cell phone model affects the cost as well, which is a key factor when considering costs of living in different markets, for example the platform provided in European markets on average costs 700 EUR but in India the platform budgets for about 8 EUR. The cell phone industry then has to consider factors including costs, features, networks and platform when designing and providing a cell phone to different markets.

9.3.6. The maker industry perspective
All these talks gave a good understanding of various aspects of the cell phone industry including the making process, the role of design in this process, opportunities and limitations for customized interactions, cell phone networking and design requirements for different cell phone markets. Another kind of industry however has recently entered the scope of cell phone design and creation and this is the maker industry. Maker culture and movements were discussed in the theoretical exploration and in particular the DIY cell phone, which gives this new dimension for
consideration here. David provided valuable insights not only into the DIY industry but specifically about the DIY cell phone.

David described the DIY industry as the "first world dream kill" because 3rd world countries dream of having the technology that 1st world countries have. He argues that DIY therefore is not an argument for aiding 3rd world needs but rather it is for a personal statement. DIY also raises discussions about democracy in technology by opening up the design and development to the end users rather than reserved for the companies. Talking specifically about the DIY cell phone, David stated that the aim was to make it simple looking so people can make nicer ones. Considering the cell phone market, less/underdeveloped countries do not want a DIY phone because it is not an advancement in cell phone technology. The DIY phone also is more expensive than some commercially available cell phones that have the same basic features. The DIY phone may never be cheaper than the cheapest commercial phones, and it does not aim to be. Instead DIY aims for reappropriation of technology such that it has new meaning and gives new perspectives. From a design perspective, the DIY cell phone was made with interaction design considerations with special focus on how to enable people to make their own, without needing specialised skills. Whether or not this is the case however will be explored later in this design program.

9.4. Program perspective
This experiment gave insights to industry perspectives on cell phone making, designing, user customizations, networking, market value and DIY. When these insights are compared to a DIT approach to cell phone design this raises challenges, support and opportunities for the design program.

One supporting view for the design program was from Gustaf as he believed in the power of making together rather than making alone. He believed that the DIY cell phone alone is no competition for industry made phones, but rather the real power to effect change will be in a community that shares knowledge and skill in designing and making their own phone, that is, a DIT cell phone approach. Livia supported a DIT cell phone approach as a way to explore deeper customizations of cell phone and interactions with it, which can compensate for the limited personal customization options provided by the industry today. From a marketing perspective, Pasi supported a DIT cell phone approach with the views that it would benefit the cell phone markets of less and underdeveloped countries; however he saw a challenge for the DIT phone to survive in the markets of developed countries. David brought a new perspective to Pasi’s market views however by revealing that DIY does not aim to have marketable value in any case, but is more of a personal stance.

Critically thinking, some possible networking challenges were identified by Gustaf. These challenges are with meeting technical requirements of the network operator by satisfying some preset networking rules and having proper functioning components such as the antenna, calibration (set of data) and software of the phone. He however thought that there would be little
chance of this challenge being faced regularly since the DIY cell phone uses the Arduino GSM module which has been designed according to the networking rules and standards. Another challenge was raised by Livia with respect to personal customizations. While it has been identified that customization options are limited on cell phone devices, she sees a challenge in users not knowing what is best for them, even when given options. Some cell phone users want the best phone, maybe for status, and associate the best with the most expensive and do not think instead what is best in terms of functionality that is customized to their needs. A DIT phone can either make people aware of what is really best for them, or be a hindrance since people will design what they already know or not want to make it at all since they can buy more expensive, ‘flashy looking’ phones. Another challenge to giving the user options to customize their interactions is that there are some basic features that people expect their phone will have and they do not think about this on the onset, so by asking them to customize their phone they may overlook some of these basic things. Deeper customization by a DIT cell phone approach also poses ethical challenges since it is looked down upon to access the software memory storage of someone’s phone, how much more concerning would it be to be able to access more than just the software. Other concerns raised about customizations were limitations in time, effort, money and the custom of different countries to be open for customization and maker culture. These were addressed in explorations later on, however coming back to the maker industry perspective, it is assumed then that persons involved in a DIT cell phone community will be aware of and not hindered by these limitations but rather focused on the personal value derived from making their own.

Opportunities for a DIT cell phone approach to shape future interactions were also identified by these industry professionals. Gustaf sees uses for enthusiasts, small companies and in schools for teaching electronics, networking and programming. He further sees more opportunities in not just a DIY cell phone device but in using the GSM module, a DIY phone component, to control other devices by text messaging such as sending an SMS to a coffee machine to control it. With respect to cell phone markets, Pasi noted that the question faced by the industry when providing cell phones to a market is “what enables better communication?” and he argued for future opportunities of a DIT cell phone approach to have a big social impact in lesser developed countries since, in his views, it can make communication jump to another level. From a perspective of providing better or more mobile communication this may make sense, however he acknowledged that currently the cheapest phones on the market do a good job for these markets and are affordable. Livia viewed existing customizations and user interaction hacks, such as that shown previously in Figure 6(b), as a desperate need for deeper customization which a DIT cell phone approach has potential to offer. This opportunity is confirmed by the maker industry intention to design the DIY cell phone in a simple way that can be taken further by the maker community.

Overall, the main program dimensions derived and supported by this experiment are (1) user/industry led design process and, (2) maker/market value of designs.
10. Exploring a Different Environment
The topic of the day for this experiment was exploring perspectives on designing your phone based in an environment with a different design, maker and cell phone culture. The intention of this experiment was to generate discussions around the idea of designing your phone in a place that does not have, or has a different culture in these ways from Malmö, Sweden. This is based on the assumption that people who live here grasp the concept of making their own, after perhaps some initial explanations. Setting up the experiment in this way presents a provocative perspective of the design program from an environment different in several ways from the Scandinavian environment in which the other experiments were based in.

10.1. Actors
There were 8 participants in total which included:

- 1 65+ year old
- 3 teenagers
- 3 parents
- 2 tech savvy
- 1 professional (engineer)
- 3 students

10.2. Materials
The experiment was audio, video and photo documented.

10.3. Description: Trinidad workshop
This experiment was done in the form of a workshop. The place of exploration was Trinidad, a developing country which is strong in fields related to IT and engineering but has little exposure to interaction design topics.

![Participants during the workshop in Trinidad.](image)

Figure 14: Participants during the workshop in Trinidad.

10.3.1. Agenda
The workshop was planned to be one hour long with three distinctive parts. The first part was 15 minutes long and included an introduction about the overall thesis and the aim of this workshop.
Special mention was also made of the fieldshop experiment done in Malmö to give these participants a perspective of the ideas and topics raised in a similar but more elaborate workshop. Since interaction design is not a recognized area in Trinidad, I provided design directions. Then the participants were separated into 2 groups, trying to achieve as mixed demographics and perspectives as possible, and for 20 minutes had group discussions about how they envision the idea of designing and building your own phone can work, accompanied with sketching of their ideas. After the group work each group briefly presented their sketch and discussions around their ideas and some reflective questions were done.

10.3.2. Outcomes

![Figure 15: Ideation sketches done by the two groups.](image)

(a) All purpose glasses phone.  
(b) Foldable iPad phone

**All purpose glasses phone**
One group based the idea for their phone design on a pair of glasses, shown in Figure 15(a). This coincidentally reminded me of Google Glasses which was not yet popularized at the time, and the group claimed to not know about it. Some issues important to this group were connectivity, support for safety, device integration, high tech functionalities and reliability. The concept was full of features and the main ones were; (1) voice control for all interaction, (2) different forms of data connection including EDGE, 3G and wifi, (3) location tracking services such as satellite, compass and the ability to send an SOS signal if lost, (4) entertainment features including antennas for radio, basic TV and advanced features for 3D TV as well (5) solar panel rechargeable battery (6) a spotlight for navigating in dark spaces (7) various ports for external connections including USB, HDMI, and for TV and projector connections (8) a built in mini screw driver for on the spot repairs.

The other group raised several issues they saw as flaws in this idea of a phone such as dangers using this kind of phone while driving, not catering to users with simple needs such as the elderly...
and affordability of this kind of phone. When asked about who they think would be involved in designing this kind of phone one comical response was NASA, but more seriously, suggestions were made for a Sony designed phone.

**Foldable iPad phone**

The other group based their idea on a foldable iPad device, shown in Figure 15(b). The idea here was for a cell phone which is not really a phone but a thin, foldable iPad-like device that can fold into a phone or fold out to an iPad. Some issues important to this group were to cater to people of different ages such as the old and teens, marketable, attractive and use of advanced technologies. The features they came up with that addressed these issues were (1) solar panel charging (2) optional voice control (3) storage space for a Bluetooth headset (4) visual and audio notifications. Issues raised with this design by the other group was how easy was it really for the elderly to use and possible problems with voice control such as background noise. When asked about who they think would be involved in designing and making this kind of phone they referred to current cell phone manufacturing companies such as Nokia and Samsung.

Overall it was observed that (1) Their ideas were very high tech (2) Their opinion about who made the phone was influenced by their cell phone experience and novel ideas raised included designing a phone for people who cannot read by using symbols instead.

**10.4. Program perspectives**

Several challenges to the DIT cell phone design program were raised in this experiment. One main challenge was the view that designing and building your own phone is actually a step backward, at least in relation to the current DIY cell phone design. One participant stated "If we were to go back to a basic phone it would be a step backward and would negatively impact on our whole experience of technology." This view was based on the opinion that first world countries, like Sweden, have reached a point of technology saturation and to get new ideas there is a need to step back by being more hands on with technology. Third world countries, like Trinidad, have not yet reached a point of saturation with technology, so there is room and a need for growth. Anything that is not more advanced in technology then is a step backward. Another challenge to the program was that in the closing discussions the participants indicated having no desire to use a DIT phone, unless it was made in a way that allowed them to do more with technology. One participant stated,” It depends on the functionality. If it suits my needs then yes, if not then I have to go elsewhere.” This view can be understood by considering the statement that "in Trinidad there is still this growth path and once there is room to grow it does not make sense to look back. We will only look back when we tell ourselves we are saturated, and this is what they are doing in Sweden now.” Furthermore no one indicated any real desire to be involved in making a phone themselves, but were becoming enthusiastic to design requirements of a list of their ideal features and have it custom made at an affordable price. “No regular person can make it (our designs)”. 

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Some opportunities were also raised for this DIT cell phone design program, because of criticisms of use of cell phone technologies. One such criticism is a need for more control over their increasing use of technology. One participant stated “When I see the kind of things that messes up my daughter’s mind on the phones now I think its best we downsize all the phones otherwise we will lose a generation.” A counter argument for this can be however that is this a design issue or can it be addressed by educating young people about the proper use of cell phones? “It is messing up adults too, not only children. You have to protect the adults too, because when it messes up them it messes up the children in turn.” This hints an opportunity for designing your own phone such that even though they do not seem to want it and see value in it, it is in the making of the device that retrospection can be gained which can help to manage their use of the device. Technology itself was discussed as promoting misuse “a downsides to cell phones and technology today. Technology is designed today to make it so user friendly that anyone can use it, and making it so user friendly makes the younger people use it for the wrong reasons. This is where the problems evolve and escalate.” Overall then, in this context the DIT cell phone approach may not seem attractive but the criticisms expressed about existing technological trend is not new so exploring designing your own phone here can either short circuit the saturation point or have no impact at all.

Overall, the main program dimensions derived and supported by this experiment are (1) user/industry led design process, (2) current/future designs and importantly, (3) designs for a maker/industrialized environment.
11. Exploring Current Social and Technical Feasibility

The topic of this experiment was to explore current social technical possibilities and constraints for a DIT approach to design cell phones. The intention of this experiment was to gain insights in how socially and technically feasible it is to build your own phone today. This is based on the assumption that the DIT cell phone is not just a dream but given certain circumstances it is possible to an extent, based on MIT’s DIY cell phone prototype. Setting up the experiment in this way presents a technical and practical perspective of the design program. This experiment took the form of a DIT cell phone workshop.

11.1. Actors

Participation in this workshop was left open to anyone interested in creating their own cell phone. Diversity in participants was desired and encouraged, however participants for this event was not as selective as in the fieldshop event. This was partly because I thought it would be interesting to see who would be interested in making such a DIY cell phone when presented with the idea and opportunity, and partly because the cost of the materials to make this phone, 1150 Swedish kronars (equivalent to 114 Sterling pounds or 176 USD), inherently restricted who were financially able to participate. Given limitations in human resources to assist participants in the making of their own cell phone however, the intention was to have between 5 to 8 participants. 5 being the minimum we thought that would allow some diversity and social interaction in the group and 8 being the maximum expected to be able to give attention to on the day, such as assistance in soldering the parts to the circuit board, and the maximum able to share the limited resources available such as soldering equipment. Participants were found by posing the idea online to the hacker community in and around Malmö, through word of mouth and gaging interest through social media. There were 6 participants, besides myself and teacher, David Cuartielles. They included:

- 2 female, 6 male
- 4 with no soldering experience
- 1 non techy

Additionally one colleague assisted in photo and video documentation of the event.

11.2. Materials

To get a better understanding of all the participants they were sent an online questionnaire before the event and it is provided in Appendix J. It was filled out by all 6 participants and Appendix K show some visuals of their responses. Materials needed to make the DIY cell phones were obtained prior to the workshop and, due to limited time on the day of the workshop, the cell phone cases were laser cut for each participant before the event.
On the day of the DIT cell phone workshop materials were used for documentations, similar to those used in the Fieldshop.

After the workshop an online post survey was sent to participants and is provided in Appendix L. The purpose of this survey was to provoke participants to reflect on their experience at the DIT workshop while it was still fresh in their minds. Reflections at this point made sense in terms of working together in a social/community practice to build the cell phone, their role at the event, expectations, lesson learnt, and feedback on the workshop itself that could help in interpreting their experiences.

11.3. Description: DIT cell phone workshop
The DIT cell phone workshop intended for the participants to come together and build MIT’s DIY cell phone based on the technical and design files provided online. The creator of the DIY cell phone, David Mellis, was remotely involved in this experiment as well by giving support for practical design questions and discussions around the topic of making your own phone. It was thought an appropriate location for the workshop would be a well known maker space in the Malmö area called Fabriken.

11.3.1. Agenda
First the participants briefly introduced themselves and then a 15 minute talk about the idea of creating your own phone. The cards from the fieldshop were used to reflect on crafting traditionally and in modern times with laser cutters and 3D printers, as well as the history of cell phone design. Next an expert in DIY, and one of the few people in the world who already made a DIY cell phone, David Cuartielles, gave basic lessons about hand soldering.
The rest of the day the participants were left to work together on making their DIY cell phones using guidelines provided online by Mellis and figuring out the rest together.

Outcomes
The planned time frame for this workshop was from 12 noon to 5pm on a Saturday however, all but one participant was eager to finish the phone before leaving the company of the others so the last of us left at 9pm. After leaving the physical company of each other the participants continued working on their DIY cell phone at home or meeting in mini groups during the following weeks. No one continued making on their own however, but contact was maintained via emails, phone calls and meeting up until each phone was completed.
Socially this experiment also provided valuable insights. There was a communal feeling during the event and even after. One participant stated “feeling of being brave because others don’t know as well, we are all learning, each experienced in different fields of technology but not exactly in making this phone.” Even though most participants met for the first time at the workshop, and started off as strangers, during the process of making they were observed to take initiatives to ask for help and figure out problems when they got stuck. Even the most experienced participants in soldering and DIY experienced getting stuck sometimes and afterwards expressed having more fun and learning more during the workshop than they expected. Initial there were concerns and even reluctance to tackle the task but after giving it a try with the help of others more comfortable even the most amateur of participants seemed excited about the progress when they saw how it was working out. Detailed reflections of the event and the experiences by the participants are provided in Appendix M.

![Figure 19: Some participants completed DIY cell phones.](image)

Technically the outcomes can be said to be successful since there were 6 functional DIY cell phones at the end. Contributions were also made towards improving the DIY cell phone technical design. During the making together process some practical fixes and improvements were discovered to the DIY cell phone design including; mis-matches in the components list between the US and European sizes (the original DIY phone being made in the US), missing parts in the components list and misalignment of the holes for the circuit board and cases. This workshop also provided guidelines for others interested in making this phone in Europe.

### 11.4. Program perspective

Some challenges to the DIT design program were faced during the whole experience of planning, conducting and reflecting on the workshop. In preparing for the workshop one challenge realized was that participation in the workshop was perceived to be exclusive from the onset. During the experiment a more obvious challenge was in the expertise and skills need to make the DIY cell phone. A limitation with the DIY phone itself is that with the current phone, it is not so easy to customize the functionality. There's more flexibility in designing custom cases, although you're kind of stuck with the rectangular form factor, but it probably takes a decent amount of time and skill to make any software changes.
These challenges in practically making your own cell phone however gave insights to some opportunities. For those who did not previously consider themselves to be a maker or hacker soon found themselves making and even enjoying the experience and challenge of making their own. Insights were gained into DIY as a learning process, not structured with a set of instructions. Even those who were used to a more systematic, instruction following and manual reading approach warmed up to an adhoc way of doing and learning. Learning was also by observing the ease at which instructions were questioned and changed things and modified things to suit the purpose and modified based on the resources available. Personally also, my initial feeling and approach was to follow Mellis’ files and instructions completely, but I soon began to see Mellis’ work as a work in progress, one that I actually was not just copying but adding to and building on. This gave me insight to the feeling of hacking and DIY or DIT. This follows the possibility of a variety of users being involved in making their own phone, even though initially it may seem exclusive. Another thing experienced was that the real value of making the DIY cell phone is having made it. Even making with the support of others, still gave the feeling that ‘I made it myself’. Even with all the high tech cell phones popular in Sweden, the place of this experiment, participants readily relinquished temporally their regular cell phones to proudly use their DIY phone. “I can’t wait to pull that thing out of my pocket showing it off "Ohh, that’s just the new eco-friendly Nokia... Wood edition!" Aesthetics of the phone also had an appeal “That's so ugly that it's kindda cool!” , and even with basic phone features it raised positive nostalgic feelings “retro-chic in a wood kind of way ...” This shows then that, at least from these participants, they value making their own phone despite the time required and basic features. The design program also calls for a community approach to making rather than individual. Future possibility was seen in this experiment as a temporary, mini community was formed. One participant stated expecting a visual manual or instructions to mount or put together the phone, rather than building it with such small pieces. In this way however the process of making would be more of an individual thing, but the difficulty of it seems to what push people to work together, the need to ask for advice and talk about it to figure it out. I would say that making a cell phone in this way is an inherently social and communal practice. Furthermore, people initiated exchange of contact information to keep in touch for completion of the phone. Overall, the main program dimensions derived and supported by this experiment are (1) cell phone designs for current or future scenarios and (2) an inclusive/exclusive design process.
12. Exploring Modifications and Reactions to my DIT Cell Phone

The focus of this experiment was taking my DIT cell phone design further by exploring how people react to it, and trying initial customizations. The intention of this experiment was to generate discussion on the idea of making and designing your own phone based on the DIY cell phone and futuristic design opportunities. This is based on the assumption that the DIY cell phone can be customized. Setting up the experiment in this way presents a perspective of the design program to explore future opportunities based on current possibilities.

12.1. Actors

No event was staged for this exploration, rather discussions were done randomly with anyone who thought the DIY cell phone interesting and wanting to know more.

12.2. Materials

My DIT cell phone, made in the previous experiment, was the main material used here as a conversation starter. Talks were photo documented when possible.

12.3. Description

My DIT cell phone was shown to various people. They were allowed to use the phone to make and receive a call and an SMS. We had one on one or group discussions and questions around the prototype and the idea of designing your own cell phone.

Some comments were about the DIT phone in terms of aesthetics, feel, design, and possibilities for ways to modify it for custom future interactions. The use of wood was found to be appealing as one commented, “I love the smell of the wood. It makes it more obvious how far away from natural materials we have come in our everyday devices.” Salla from experiment 1 was contacted again for feedback on this prototype and stated, “I love the wood! This would be very popular in Finland! We love all things wooden.” Another commented that the buttons in the original design were difficult to press and also that they want to see what’s inside without having to take the covers off. Reactions to the possibility of making and designing a phone themselves were of enthusiasm as expressed by “It is awesome to know that you made this and that I can..."
“and “It's even fun to send text messages to you. It's awesome to think that I just sent a text to a phone which you made yourself. Technology to the people!”

Figure 21: DIT cell phone and wooden case compared to the iPhone 4S.

During these informal discussions sometimes the participants pulled out their own cell phone and placed it side by side to the DIT phone to emphasize the contrast. This in itself seemed to open up a space for discussion on the possibilities for new interactions based on designing it yourself, such as a stance against current designs.

12.3.1. Initial customizations

Initial hardware and software customizations were done for provoking discussions on new interaction possibilities based on the DIT cell phone.

Figure 22: Initial hardware customizations of the DIT cell phone.

Comments were made about these initial customizations in person or on social media. Reactions to the clear case design, see Figure 22(a), were provoking especially when compared to the black-box look of the iPhone popularly used. “It looks great, I love it, why haven’t the bigger companies made something like this already?” Mixed comments were made about a case designed so that it fits neatly into my hand and so affords for physically holding the device, see Figure 22(b). “It makes sense....that wud be oddly shaped but innovative” and also “It should be
made from a soft material which will take an appropriate shape every time you grab it, not from wood.”

Other comments on customizations related to aesthetic qualities included, “Design it leather”, and “Can you paint it? Or add some texture? I want one! So cool!” The creator of the DIY phone himself had some ideas for further customizations “I'm interested in making a modular version of the phone, so that people could swap out different options for the display and buttons, or reposition the components relative to each other. Haven't started designing the boards yet, though.”

One shortcoming of the current design of the DIY cell phone is that it is not so easy and simple to make software customizations, however given more time in the hands of interested communities it is possible. One software customization was explored by connecting an Arduino accelerometer to the DIY cell phone circuit board and using this to show different visuals on the phone display based on physical movements of the phone. One simple simulation was shaking the phone to show a sad face and when the phone is still a smiling face is shown. This has potential to link tangible interactions with cell phones for more meaningful expressions, similar to what was experimented with in Chapter 6.

![Sad face displayed](image1.png) ![Happy face displayed](image2.png)

(a)Sad face displayed (b)Happy face displayed

Figure 23: Initial software customizations.

12.4. **Program perspective**

The design program of the DIT cell phone gained a perspective here in terms of impact and people’s reactions to the possibility of designing their own phone. Overall, this generated feelings of enthusiasm, fascination and free flowing ideas of possibilities for the future. People much more easily accepted the possibility of making their own phone when presented with an artifact, than in the previous experiments, and they also suggested willingness to make their own phone given the support necessary, such as was done in the DIT cell phone workshop. Overall, the main program dimension derived and supported by this experiment is considerations to current/future interaction designs.
13. Overall Reflections and Knowledge Contribution

After these 9 main experiments it was determined that there were enough examples of what the design program affords and allowed for insightful interpretation. This realization was stated in previous programmatic work (Brandt, et al., 2011) as a reason for appropriate closure of a design program. Closure means that no new experiment will be done, in this work, but instead a distillation now of what has already been done. In this chapter the work presented in this thesis is reflected on to highlight the main knowledge contributions. Reflections are presented first at a surface, and somewhat shallow level, of interpretation by position the examples on program dimensions. Then, deeper reflections are presented in a description of a promising future scenario by grounding knowledge contributions in insights gained from the 9 experiments, and includes a critical layer of reflection on the overall societal impact of the results. Then follows possibilities for future work and a critical perspective to identify gaps in this design program.

13.1. Interpreting the design program

Collective insights gained and outcomes generated from the explorations are used to interpret the design program. Interpretation is facilitated by a landscaping approach which aims to help draw various issues together instead of addressing them separately and was stated as necessary for reflections to make sense to those who were not present during the experiments (Brandt, et al., 2011). Landscaping analyses all exploration outcomes, referred to simply as examples here, on various dimensions of the design program and within the scope of this work 9 dimensions have been formulated and was previously listed in the chapter describing the program, see section 2.3. For comprehensive interpretation this section first gives a summarization of all the experiments done then the repertoire of examples are positioned within the stated dimensions and discussed.

13.1.1. Summary of experiments done

A summarization is given in Table 3 of all the experiments done, highlighting the main insights of each and the generated outcomes which form the repertoire of examples considered in further analysis.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Main insights</th>
<th>Generated outcomes/examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theoretical exploration</td>
<td>Bringing together topics in interaction design, social sciences and technology that relate to cell phone interactions.</td>
<td>Theoretical framework formed that influenced the direction and interpretation of the design program.</td>
</tr>
<tr>
<td>2. Exploring current cell phone interaction</td>
<td>Cell phones currently provide one-size-fits-all interaction options but different people prefer to use their phones in different ways and this changes over time.</td>
<td>Method to provoke insights on current cell phone use.</td>
</tr>
<tr>
<td>Experiment</td>
<td>Main insights</td>
<td>Generated outcomes/examples</td>
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<tr>
<td>3. Exploring perceptions of new cell phone interactions</td>
<td>Acceptance and adaptation to current cell phone interaction options and some hesitence to think beyond the interactions options already provided even though common to experience limitations in interacting with the device.</td>
<td>Method to provoke reflections and ideas for new interactions with cell phones, and some associations for gesture based interactions.</td>
</tr>
<tr>
<td>4. Exploring next generation IXDers’ views on the future of cell phone interactions</td>
<td>These future IXDer’s see the opportunity to design their own cell phone as designing the phone of the future, based on current trends of advancement in cell phone technology and design that they are exposed to and emersed in.</td>
<td>Sketches, videos and reports explaining their process and cell phone designs for the future.</td>
</tr>
<tr>
<td>5. Exploring users’ visions for a D.I.T. cell phone future.</td>
<td>Despite their differences demographically, technically and in other characteristics, cell phone interactions was a unifiying topic that allowed each person to have some contribution in the design of their cell phones and work together.</td>
<td>Low-fi prototypes, sketches, video scenarios and other discussion material that demonstrated what qualities were important to them as a group in designing a cell phone and how it can work in the future.</td>
</tr>
<tr>
<td>6. Industry perspectives on a DIT cell phone future</td>
<td>Considering the design of the DIY cell phone, this was not expected to have a big impact on the cell phone industry in the near future since it (i) does not have a high market value (ii) not competitive with technologically advanced and cheaper phones on the market and (iii) takes more time and skills to make than buying a phone off the shelf. There were expressed some curiosity however about the future of the DIY phone design when a community forms around it, that is a DIT cell phone.</td>
<td>Talk and discussion materials that formed the framework for a professional and industry perspective on the DIT cell phone design program and which influenced the direction and interpretation of the design program.</td>
</tr>
</tbody>
</table>
7. A different environment

These sample participants expressed great interest in designing their cell phones to be highly technical and with functionality specific for their environment and culture however they were not interested in the building of the phone themselves and had overestimations of how the cell phone industry works and what they can do. Sketches, audio and video materials generated from discussions that provoked the idea of designing and building their own phone.

8. Exploring current social and technical feasibility

First hand experience, and sharing of this experience with others, for designing and making a functional cell phone including (i) practical insights on the skills required, limitations for the current DIY cell phone design and its possibilities for the future (ii) experiential insights on the dynamics for designing and making cell phones together.

Audio, video, photo and other discussion materials generated before, during and after the process of designing and making together 6 functional DIY cell phones, one for each participant.

9. Exploring modifications and reactions to my DIY cell phone.

The DIY cell phone modification was observed to open up the design space for current cell phone interaction options as general public reactions were of enthusiasm and interest to know more and make their own.

Generated discussion materials on the possibilities of a DIT cell phone, using 2 DIY cell phone modifications to show an opening up of the design space of cell phone interactions.

Table 3: Summary of explorations/experiments done within the DIT cell phone design program.

13.1.2. Repertoire of examples and program dimensions

The dimensions provoke thinking about possible futures of cell phone interactions, based on the design program. Further work could be done to add substance to the dimensions such as prioritizing them in relation to the program and identifying dimensions as either adding to insights or as tools for reflections. The dimensions here however will be used for providing initial and somewhat shallow reflections, on the 9 explorations. These initial reflections make possible deeper and more meaningful reflections after, so that closure to the design program is achieved and knowledge contributions are made. Next, each dimension is considered for positioning of the repertoire of examples based on some meaningful interpretation.
In the theoretical exploration a categorization was done on current cell phone technologies, see section 4.3.2, so following this, each example was interpreted and initial categorization done following insights from the theory about cell phone designs for doing more, doing different and raising awareness and is shown in Figure 24. The categorization shown is intended as more of a sketch to express one perspective of the designs and is mostly self explanatory, except here overlaps between categories are made more explicit and represented by intersections of the circles. The overall aims of this work focuses more on a perspective of doing different and raising awareness and in this overlap is loosely placed (1) the DIY cell phone, because making is a different way of doing and raises awareness by provoking reflection in/on our actions, related to arguments made by Schöll (Schön, 1987) (2) the modular phone, because it opens up different roles for cell phones users and industry and raises awareness of which entity controls design of cell phone interactions, related to maker culture theories (Hagel, et al., 2010)(Spencer, 2008) and (3) social frogs phone, because of its unique approach for awareness of the impact of cell phone use on social interactions and relates to theories on the need for reflections (Turkle, 2012).

The following graphs arrange the repertoire of examples in 3 groups which are either extreme on the horizontal dimension, extreme on the vertical dimension or somewhere between the two extremes and, the examples are loosely placed within the groups themselves.

Figure 24: Mapping of repertoire of examples by use/design purpose.
Figure 25: Examples positioned on the dimension of user or industry led design process.

Figure 25 illustrates a perspective of the design program in terms of which entity controls the design process for cell phone interactions, users or industry. This interpretation relates closely to the exploration on industry perspectives compared to users’ perspectives in the other explorations. The group interpreted to have most user involvement relates most to maker theories (Spencer, 2008)(Hagel, et al., 2010) and include the DIY phone with its modifications and also the method for insights on current cell phone interactions. These examples are also considered to have some, but relatively little, industry influence, since for example the parts to make the DIY phone is provided by the electronics industry. The group that allows for most industry control includes the examples from future IXDers and from the experiment in Trinidad. Interactions with these devices are in keeping with existing industry trends where the cell phone is like a black box offering limited holistic interaction options and user customizations. The group positioned between both extreme dimensions includes the examples made in the fieldshop experiment and two that challenge current phone designs to provide for different interaction options. These examples were interpreted as allowing some level of compromise between user and industry led designs relate more to theories which argued for designs that facilitated user customizations (Sokoler, 2004).
Figure 26: Examples positioned on the dimension of social or individual use/design experience.

Figure 26 illustrates a perspective of the design program as being a social or individual experience in the using or designing of the example. This perspective relates to explorations on visions for a DIT approach and social and technical feasibilities. The group interpreted as a more social use/design experience relates to theories on communities and connecting with others (Gauntlett, 2011) and includes the DIY, social frog, modular and sustainable phones. The social frog phone is social in terms of use while the others here are social in terms of making since it involves different people with skills and personal preferences to design these examples of interaction opportunities. The group interpreted as a more individual use/design experience relates to theories focusing on doing yourself (Spencer, 2008) and understands of meaning (Dourish, 2004) and includes the more high tech design examples. This group also represents current trends in cell phone interaction designs. The group positioned between both these extremes is interpreted as depending on the context and situation for its use/design and relates to theory on situated use (Suchman, 1987). Examples in this group are the DIY phone modifications, since it can be designed individually or socially depending on constraints in skills and resources and the white box methods since they provoke reflections by the individual but amplified in a social context such as in the role play game.
Figure 27: Examples positioned on the dimension of current or future interaction designs.

Figure 27 illustrates a perspective of the design program in terms of current or future cell phone interactions designs. This perspective relates to explorations on new and possible future interactions as well as current technical possibilities. The group that shows what is currently possible is the DIY cell phone and its modifications, and insights from reflections on current use. This was exemplified by the DIY phone and its modifications being the only functional example in this work. The group that shows futuristic interaction designs includes the examples that does not currently exist neither technically possible but considering current design trends they may be possible in the future. The group that is positioned between both extremes is already exists to some extent, however the concept may need more design thinking (Rowe, 1991) to be realized given the current state of technology. In this group is (1) the glasses phone, which is similar to Google Glasses, (2) the projection and wearable phone based on current tech talk rumours of such designs soon to be released by influential companies in the cell phone industry (3) gestures which relates to Feel Me (Triverio, 2012) and, (4) the modular phone since its basic concept is already supported by an increasing design focus for user customizations.
Figure 28: Examples positioned on the dimension of an inclusive or exclusive design process.

Figure 28 illustrates a perspective of the design program in terms of inclusion and exclusion from the ‘together’ aspect of the DIT cell phone approach for designing future interactions. This perspective mainly interprets the explorations done on how users think DIT could work, industry views and technical and social feasibilities, and relates to social views and theory on making (Putnam, 1995) (Hagel, et al., 2010). The group that shows most promise for inclusion of a wide range of people includes the hardware and software modifications of the DIY phone and the modular phone. Examples in this group were also interpreted on other dimensions as being user led designs, see Figure 25, and high in social use/design, see Figure 26. This reflection gives insight that there is less restriction of who can be involved in designing cell phone interactions when users they have more control over the design process and community support and relates to similar insights in theory (Gauntlett, 2011). The group exclusive in its design are the more high tech ideas, which is not surprising since this follows a more industrialized way of designing and making (Anderson, 2012). The examples positioned between both extreme perspectives were interpreted as inclusive and exclusive in different aspects of its designs and include most notably the DIY phone, since it can be made but not all participants were successful in the experiment, social frogs and sustainable phones because they allow basic inclusion by customizations.
Figure 29: Examples positioned on the dimension of provoking reflective or passive interactions.

Figure 29 illustrates a perspective of the design program in terms of provoking reflective or passive interactions with cell phones. Provoking reflections are supported by theories on reflections on use (Schön, 1987), a need for inflection (Turkle, 2012) and gaining understanding by hands-on making (Morris, 1970). Examples interpreted to provoke such reflection include (1) the white box methods which used a prop to provoke users to reflect deeply on their current cell phone use, (2) the DIY phone which is exemplified by the result that participants involved this workshop stated having a different perspective on their cell phone use after the experience of making (3) the sustainable phone since it was the outcome of users reflections on bigger picture issues related to cell phone design and (4) the phone hack was the result of reflection on limited interaction options while driving. Passive interactions is supported by theories on getting technology out of the way (Sokoler, 2004) and examples the exemplify this include the more high tech designs, which follows the current course of cell phone interaction designs. The examples interpreted as provoking both reflective and passive use depends on the individual and include the social frogs and modular phones as these make user reflection optional in the act of customizing their interaction options.
Figure 30: Examples positioned on the dimension of maker or industrial environment.

Figure 30 illustrates a perspective of the design program in terms of suitability for a maker or industrialized environment. Suitability for a maker environment draws from works on maker culture (Spencer, 2008) and assumes that these designs are possible given the current state of technology and skills. This group includes the DIY phone and its modifications, since these were the only functional artifacts made and the method for reflections on current use, since reflection and making complement each other (Papert & Harel, 1991). Suitability for an industrialized environment assumes that they may only be possible to design and create by industries given the current state of skills and technology and includes all the high tech ideas. This aligns with the exploration in a different maker environment where participants could only see cell phone companies making their high tech designs. The group positioned between both these extreme assumptions and perspectives includes the sustainable, modular and the hack phone because they may be possible to make, either in a community or an individual maker, but these ideas include some industry involvement in their designs for defining user customization interaction options.
Figure 31: Examples positioned on the dimension of having maker or market value.

Figure 31 illustrates a perspective of the design program in terms of having more maker or market value. Maker value means valuable at a personal level to those involved in its design and process and relates to theories on personal benefits of making, especially within communities, (Layard, 2011). Examples interpreted to have a high maker value includes (1) the DIY phone and its modifications which was experience as an outcome of the DIY workshop and (2) insights gained from reflection on current phone use is beneficial to the user at a psychological level. Market value means these examples can be attractive on the market given the current trends for more and better technology. These examples are not surprisingly the more high tech designs. Some examples were interpreted as having some measure of value for both the maker and on the market, which may be possible if it is held to market quality and standards but allows a lot of flexibility for user interventions and customizations in its design. This group includes the modular, social frogs and sustainable phones, as well as the idea for a more gestural way to interact with cell phones.
13.1.3. Contextualization within Interaction Design

There are many and varied understandings of what is interaction design but simply stated and most relevant to this work is the understanding that “Interaction design is about shaping digital things for people’s use” (Lowgren, 2013). Based on this understanding, the repertoire of examples was positioned within IXD and is shown in Figure 32. The circle here represents all things IXD with the center representing a strong focus on IXD, a weakening of this focus moving outwards, and outside of the circle representing not IXD. In this section each aspect of this contextualization will explained, grouped as within, border or outside IXD examples. This positioning is based on all the previous interpretations and minor insights gained throughout this exploration.

**Within IXD**

All the examples placed inside the circle are considered to be positioned within the field of interaction design however they are loosely placed to represent varying strengths of this positioning. Instead of arguing their varying strengths it is more worthwhile here to consider them collectively for the significance of being positioning within IXD. The examples placed inside the circle are the modular, social frogs, sustainable, malleable, hologram, projection, glasses, foldable and wearable phones, along with the DIY phone software modification.

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Figure 32: Positioning of examples within Interaction Design.
These examples were positioned within IXD for a few reasons. One key reason is that these examples were obviously exploring possible interactions with cell phones in the future. It is core in IXD to focus on what could exist, that is, futuristic thinking. This futuristic thinking evident in these examples helped to open up the design space for suggest ways of initiating and shaping change in the way people interact with their cell phones. Another main reason for positioning these examples within IXD is because they were the outcomes of some kind of design process respectively. Important in IXD is not just what is done but how it is done and this requires a process of design thinking (Rowe, 1991) for a ‘designerly’ approach and activity (Buxton, 2010). Albeit, the design processes that lead to the design of these examples were relatively short lived, the outcome of these processes was not just an artifact but insights on design decisions that led to the final example. A final reason for placing these examples inside the circle is because they each can be interpreted as a sketch or tangible representation to engage conversation about challenges and opportunities of the design program.

**Border IXD**

All the examples placed on the circumference of the circle are considered to be positioned on the edge of the IXD field. The examples placed here are the DIY cell phone and its hardware modification and the methods using the white box as a prop for reflection on current cell phone interactions. They are interpreted as edge cases in this work mainly because they fall short of one or more of the three reasons given above for positioning within IXD so in this work they are not exactly IXD examples themselves however they are used within the IXD processes. These examples were used within IXD processes by facilitating an analytical and critical understanding of what already exists. An understanding of what already exists was the intention of the explorations on current cell phone interactions, current perceptions of possible interactions, industry perspectives and current social and technical feasibility for users to shape their interactions with cell phones. These explorations used these examples, therefore making them valuable tools in the IXD process but not IXD examples themselves, within the context of this work.

**Outside IXD**

All the examples placed outside the circle are considered to be outside the field of interaction design, however reasons for positioning outside IXD also relate to the border IXD examples. The only example completely positioned outside IXD is the cell phone hack for using the phone while driving. The main reason for positioning outside IXD is a focus on instrumental and technical aspects and not so much on interaction qualities. The phone hack example can be interpreted as useful to demonstrate and raise an IXD issue of limited cell phone interaction options, but this example itself is not IXD. Similarly, the DIY cell phone and its hardware modification were used mostly to demonstrate technical aspects of building your own cell phone.

The previous reflections offered a surface level of reflections on the design program by initiating thoughts on how the generated repertoire of examples could compare and contrast in relation to
dimensions of the design program considered within the scope of this work; however the next section aims to provide a deeper level of reflection by describing a promising future scenario.

13.2. ‘User-Industry cooperation’ for future designs of cell phone interactions
In the introduction a brief history of the cell phone was given and considering where we came from and the rate of technological advancements and maker evolutions, it is not easy to predict the future for cell phone interactions. Furthermore, the idea of users designing cell phones as the future of cell phone interactions may not be so farfetched. This section presents a ‘What if’ scenario for describing a promising future of a user-industry cooperation in designing cell phone interactions, by grounding arguments for this future in knowledge contributions gained from insights throughout this work. To facilitate these in depth reflections the post-it wall method described in section 3.3, Figure 2, was returned to by noting, arranging and rearranging all the key points and insights in the 9 experiments, Figure 33, until coherency, connections and insights were revealed.

Figure 33: Arranging and rearranging of insights gained throughout this work.

In the following subsections first insights are given in relation to bridging the constituencies of cell phone user and industry, then deeper discussions are provided in understanding issues and topics relevant to each of these constituencies, followed by a layer of critical reflection on how the overall scenario could impact further on society, IXD and the future beyond this scenario.

13.2.1. Bridging the constituencies of cell phone user and industry
The overall result of this work can be summed up in a proposal for user-industry cooperation for designing future interactions with cell phones, or a Design-It-Together (DIT) cell phone future, where the together means users and industry involvement. The relationship between users and the cell phone industry, both current and futuristic, have been explored from different perspectives in this work, and in describing a DIT cell phone future their relation is still seen as complex but opportunities has been identified where they can benefit from each other. Here arguments and insights are given for user-industry cooperation for the future of designing cell phone interactions.
User-industry codependence for cooperation in the future

Initially the intention of this work was already stated as not aiming to eliminate cell phone industries completely, and throughout this work insights have been gained that support this intention. Instead however, several lessons were learnt through the explorations and reflections that highlighted opportunities for and benefits from industries cooperating with users for designing future cell phone interactions. The main opportunity is for allowing industry and users to dedicate themselves to what motivates them individually which is made possible by their codependence rather than interdependence.

Codependence means that both constituencies of cell phone user and industry mutually depend on each other to achieve optimal designs of cell phone interactions such that both constituencies benefit in ways that are most important to them. Reflecting on this work I hold the view that the cell phone industry, like most other industries, is profit driven and cell phone users are purpose driven. Profit and purpose are then most important to industry and users respectively and I find reasons to believe that codependence by cooperation can result in better satisfaction of the motivations of both constituencies by a change in their current roles and relationship.

Codependence necessitates a change in current user and industry roles

Cell phone industries have experience, resources and capabilities to make cell phones so elimination would be a removal of an important aspect and it seems also a silly notion to waste what society, including users, have worked to build up. Users know best what they want and need from everyday cell phone interactions and what they are willing to pay for. Codependence then could allow industry to do what they do best, technological advancements and functional innovation, while users could be given the opportunity to do what they do best, solutions for interactions that benefit them in their everyday use contexts.

Insights that lead to the identification of the opportunity in user-industry codependence and cooperation is that industries actually want users involved and users want the industries involved in the cell phone design process as well.

Support was indicated from industry perspectives in this work to want user involvement in the cell phone design process. One indication was from Gustaf who talked about the power in community and not being able to predict the possibilities in the future if the DIY cell phone is taken over by user communities. Another was from Livia talked about the need for deeper user customizations, Pasi about involving users in designing for different markets and also David on personal user value and motivation of a DIT cell phone future.

Support as also found from users for desiring industry involvement in the cell phone design process, albeit, in a different form. One such need is derived from the Trinidad workshop which gave insights in possible transition shock to this future, and other unique challenges faced by different environments, so their need calls for establishing user communities based on a DIT approach alongside the existence of cell phone industries. This way there is still the option to
purchase off-the-shelf phones but as these environments slowly progress in design and digital maker culture, then user involvement in the cell phone design process could be opened up gradually.

User-Industry codependence and cooperation however is best to not be strictly and clearly defined, but it is better to allow overlapping roles based on a negotiated common purpose of profitable and purposeful interactions.

**Cooperation as bartering of modern day skills**

Cooperation by codependence reminded me of communal bartering of goods and services, before the industrial evolution, and which allowed for specialization in areas of expertise. A future scenario of user-industry cooperation then is likened to bartering since in this future users and industries are allowed to focus on their areas of expertise, described above as a change in user and industry roles. Bartering can occur between users and the industry and also among user communities themselves.

**Bartering between user and industry based on changed roles**

Bartering of modern day skills could occur between user and industry based on the identified strengths of each constituency and their codependence. User abilities in designing cell phones are limited by components and tools available, which was observed in the DIT cell phone workshop and my DIT cell phone modifications being limited because of limited technical and non-technical components currently available for this purpose. In the future however, the industry can provide more innovative parts for cell phone designs and making by user communities. In addition, the industry can take further user community designs which aids in their motive for competitiveness by innovation and invention. In this way the industry responds to user needs and requests and could also provoke new interactions by creating and providing new components for user designs. This way of bartering between user communities and industry assumes that there is a change in roles and rules that facilitate bartering.

**Bartering among user communities**

Bartering of skills and resources for designing cell phones in user communities can be among these communities themselves, arising from the need of one community being satisfied by another. In relation to theory on bonding social capital by Putnam (Putnam, 1995), which talks about inclusion and exclusion in maker communities, bartering could occur between these bonded communities which make a modern day bartering design process for cell phone interactions. Such bonded communities could be formed to include other areas of specialization such as engineering, human factors and social science communities. Insights on how user community bartering could happen was gained mainly from the fieldshop and DIT cell phone workshop experiments which both simulated and constructed temporal user communities for designing cell phones. In the Fieldshop participants were concerned about the technical connotation of the topic, design your own phone, but they felt relaxed and creativity flowed
when they were given the task to focus on the design and not on how it would work exactly. This is opposed to observations in the DIT cell phone workshop where participants seemed to be motivated by the functional aspect of making their own phone. One group then was motivated more in design and another in making. I learnt then that it is naïve to think that everyone will want to design, proven in the DIT workshop. It is also naïve to think that everyone will want to make, proven in the fieldshop and even the Trinidad workshop where participants explicitly expressed no interesting in making themselves. This indicates then the possibility that some user communities could be formed based on an interest in conceptual and critical designs while others could be more functionally motivated.

**Cooperation depends on Modularity and Flexibility as major bridging qualities**

This call for cooperation between cell phone users and industries in the future is derived from an underlying assumption that in future designs cell phones will be modular and flexible to both users and the industry. Modularity and flexibility today is practiced in hardware aesthetics and software customizations both by users and industry. Modularity and flexibility are qualities important to users and incentives to industries. Due to the high importance of these qualities in different ways to both users and industries, development of this insight will be explained in more detail later in relation to each of these constituencies respectively.

**Modular and flexible future cell phone designs must be functional**

DIT cell phone enthusiasm will wear out if not practically useful was an insight from the fieldshop since the users were enthusiastic about designs that were made from their creativity, with the imagination that it could be functional. Functionality is needed to fully gage people’s reactions to new interaction options which would help explain the difficulties of participants in the white box prop experiment to imagine interacting with cell phones by gestures, but a free flow of ideas and visions for the future by participants who were presented with the final functional DIT cell phone prototype. To design for modularity and flexibility, and even conceptualize new interaction options then, users need to be able to engage in functional interactions.

**Modular and flexible designs should opt for data connectivity**

This was derived from reactions to the DIT cell phone modifications since it was nice to look at and ‘play with’ but not appealing for practical use. It was observed that initial reactions to the DIT cell phone was of contentment and being impressed that it provided the basic functionalities of text messaging and calls. Some even asked if it had the game known as *Snake* that was a common game in the early days of game designs for phones. The DIT cell phone workshop participants who have been using their DIT phone as their main phone I assume have been able to do so because their initial phones were not smartphones either, so they experienced little withdrawals from data connectivity. To make a bigger impact by being practically useful to suit today’s lifestyle and that of the future I am convinced that DIT phones in the future need to align...
with modern advancements in cell phone networking, as explained by Gustaf, and so allow data connections. There is hope for this being possible in the future however since a recent update on the DIY cell phone by Mellis has provided some WAP data connection.

**Cooperation calls for DIT and not DIY**

Another insight gained in support of user-industry, and even user-user, cooperation in the future was that designing cell phone interactions is best done as a shared practice and not individually. Individually here refers to not just individual users but from the perspective of the industry and user communities as being separate and individual constituencies in the cell phone design process, which is the case today. I learnt then, that my initial intention of DIT as Design-It-Together does not just indicate users designing together but also should be extended to consider users and industry designing together. DIT then can be viewed in terms of arguments for user communities versus individual users working independently, and also in terms of arguments for user-industry. Arguments for user-industry are made throughout this section, so here I will elaborate on arguments for user communities.

An individual will experience high costs, time consuming, steep learning curve as challenges in designing and making their own phone but these can be helped by adapting DIT since it is a shared practice and required learning being less demanding. DIT enables people to make their own without needing specialized skills. This was exemplified in DIT workshop with David being an expert in hand soldering and whose involvement in the event was invaluable who would not have been able to make the phone otherwise. This experiment then can be viewed as a glimpse of the future and an initiative for a mini and temporal community for designing and making cell phones and the observed social interactions showed that such communities quickly and easily become tightly knit and is a continual learning experience. Social feasibility observed to be stronger than making individually in the DIT cell phone workshop, since the social engagements were needed to successfully complete each phone, and those who did not seek such social engagement beyond the allotted time was not successful. Furthermore, from my experience in this work I hold the view that it is not possible to design and make a cell phone individually, at least not the first time. It was pointed out in the theoretical exploration however that already more and more communities are forming around DIY activities so in the future there could be a moving away from DIY in the strict sense to more share practices by DIT.

**DIT helps to bridge current possibilities and future visions**

*We are set on a path of technological advancement which does not allow us to go back*

Categorization of current cell phone technologies in the theoretical exploration created the ‘do more’ group to explain technologies focusing on using cell phones to help us do more things than we already use them for. Validation that society and technology is current on this ‘do more’ path was found mainly in the Trinidad workshop and future IXDers views with statements that they held little interest in a DIT future unless it followed this technological path. Furthermore indications that ‘do more’ is desired for the future was seen with most of the generated examples
throughout this work falling under this category as well, seen in Figure 24. In this work then I think it naïve to not acknowledge this path of technological advancement that has a grip on most of society, and despite efforts by some to raise awareness (Cardini, 2012), it does not seem that society will take major technological steps backward in the future.

**Need for technological advancements to overcome limitations in modularity and flexibility**

To bridge current possibilities and future visions, one main thing that needs to happen then is technological advancements and this would also greatly increase the technical feasibility for users to design and make their phones. The DIT cell phone workshop revealed some constraints on technical feasibilities such as the physical design being tied to a box shape, limited options for electronic parts to make the DIY phone, and difficulty to make software customizations. This can be viewed then as a possible limitation to modularity and flexibility in the future.

**Technological advancement as a major industry role**

I view this need for advancements in technology, specifically technologies for designing and making cell phones, as an opportunity to enhance user-industry cooperation by appealing to the industry again to take on technological advancement as their major role in this future. Industry involvement in the DIT future then plays a role in maintaining this technological advancement by providing more innovative and functional technologies for cell phone interactions. This will be elaborated on later in this discussion when focus on the industry constituency in the future. This is reasoned by the view that a high tech future, such as the high tech examples generated, makes a gap between what DIT cell phone currently offers and interactions envisioned that is so vast that it seems almost ridiculous to consider that this level of technology can be achievable by users alone. It is more realistically and practically achievable to delegate technological advancement to the industries and users allowed being creative with it, which is supported by the expectation for cell phone concept design made in the Trinidad workshop to be made by cell phone companies.

**Some overlap in industry and user roles**

To elaborate here on the cooperation between user and industry however, I argue further that while I see technological advancements as a key role for the industry in the future, this can also be addressed within the communities by considering involvement of users with advanced technical skills and expertise, such as engineers and computer scientists. Already today regular people with such specialised skills have been accredited for major technological advancements such as a high school student who recently created a new super capacitor that makes it possible for cell phone batteries to be fully charged in 30 seconds (CNN, 2013). I further realized then that the user-industry roles should not be strict and clearly defined but it is beneficial to allow for overlapping roles with the common purpose to improve designs and possibilities with cell phones in the future. However, this negotiation of new roles is still expecting a lot to change in
society to be made a reality, and for such change noble intentions are not enough but incentives must exists for changes such as industry restructuring and user initiatives.

Incentives needed for change in roles

It was stated in the Trinidad workshop that there was no desire to use MIT’s DIY cell phone or to design their own phone unless it allows the participant to do more with technology. From this I derive that society is on a path of technological advancement and for DIT to be attractive in the long run it should have benefits over what cell phones gives us today. In other words, designing and making a phone must have significant benefits to the user that warrant their investments in time, skills and money. This personal investment was also a concern of Livia, who questioned who will want to and be able to design and make their own phone when an easy option is to just buy one off-the-shelf. This user incentive needed can be viewed as a current limitation in social feasibility of DIT cell phones which was revealed in the fieldshop and DIT cell phone workshop. In these 2 experiments mini and temporal communities were observed to gain insight in social feasibility to design together and while the experience was overall rewarding for the participants, I observed some difficulties by a few participants in terms of design thinking and technical skills. However, despite their initial hesitance and limitations faced I further observed that by working together in a diverse group, incentives were inherent in the diversity and communal feelings of such a group, since the participants learnt from each other and slowed realized their own value and role with the group. To be more specific, I think about those over 65 years old who participated in the fieldshop and afterwards expressed satisfaction of the experience being more fun than they expected, learning more that they intended and being able to contribute to the designs in ways that they did not see before the event. Additionally, in the DIT cell phone workshop I think about Pernilla who was initially concerned about her lack of technical abilities but being involved in the staged mini community she found incentives to learn in the fact that in some ways everyone was learning and teaching each other on some aspect of making the phone.

Incentives for the industries are more business oriented, as opposed to the personal incentives for user communities. In this ideal future scenario, cell phone industry change would involve a total restructuring of the way they currently work to take on a new role in the cell phone design process in the future. This new role of industries has already been explained in this section, and will be further explained in a later section. Incentives in the corporate world are usually closely tied to profit gains and competitive advantage and in deeper reflections specifically on the industry constituency in this scenario, opportunities for this will be identified.

Now I will provide deeper insights into the possible roles of each of the constituencies of user and industry.
13.2.2. Deeper understanding of the user constituency in this future

Having considered the interplay between user and industries today and providing insights on how it could be in the future, I now focus more specifically on future roles and impacts on the user and user communities in this scenario.

Modularity and flexibility are solutions in designing for changing use contexts

Use context was identified as a limitation of current interaction options offered with cell phones, since previous solutions provide ‘one size fits all’ solutions which address one aspect of cell phone interaction at a time rather than catering for changes with the user, time, and use context. Theoretical insights relates this issue to situated actions by Suchman (Suchman, 1987) who argued for moment-by-moment “situated” response to immediate needs that emerge out of the interaction with the setting. Situated actions then explains a challenge in designing for changing, everyday use contexts.

Public and private use contexts

Different use context includes considerations to public and private cell phone use, which was explored by enactment in the role play game by provoking participants to reenact both public and private scenarios of cell phone use. One comment made during the role play game “When in public I look to find your own space for my cell phone conversation, but I want to answer my phone so I make my own space”, which relates to theory on the blurring of public and private behaviours in public space (Wei & Leung, 1999). In the theoretical exploration also, I identified a growing rule for cell phone interaction in public places as cell phone etiquette. I developed the view in reflection that such etiquette issues in public phone use is actually a result of limited interaction options that do not allow easily for changing use contexts by users. Growing concerns and annoyances make it obvious that at least most users do not want to be a nuisance, but because there is not interaction options provided that suit them to use their phone when others are around.

Current designs cater to either public or private but I argue from insights gained in this work that is not easy for one type of interaction to be efficient in both contexts. This means then that a better approach maybe to not expect that one design solution could satisfy both dimensions of this use context, but rather address the issue from a different design approach, one that makes it easier for users to easily and effectively adapt their cell phone interactions in everyday public and private environments, which calls for more modularity and flexibility in users everyday cell phone interaction designs.

Changing use contexts for place and space

In considering changing use contexts in IXD it is inevitable to bring up the topics of “place” and “space”. These simple, yet loaded words, were investigated by Dourish by drawing on the work of a range of architectural and urban theorists to give a summation that; ““space” describes geometrical arrangements that might structure, constrain, and enable certain forms of movement
and interaction, “place” denotes the ways in which settings acquire recognizable and persistent social meaning in the course of interaction. The catch-phrase was: “space is the opportunity; place is the (understood) reality.” (Dourish, 2006). A lot can be revealed about impacts on “space” and “place” in a future scenario for user-industry cooperation in designing cell phone interactions however I focus here on context of use more specifically to the concept of place. Focus on “place” in previous work coined the term Place Specific Computing which was explained by Messeter as “a genre of interaction design that categorizes a class of digital designs whose functions, as well as the information these functions provide, are inherently grounded in and emanating from the social and cultural practices of a particular place, accounting for the structuring conditions of this place – social and cultural as well as material” (Messeter, 2009). Considerations for “place” in this work initially took a literal geographic meaning by exploring perspectives in Trinidad as literally a different place, from Malmo, Sweden, but in reflection more social and cultural differences in this literal “place” accounted for examples generated and perspectives of the design program.

In the exploration into a different environment then the generated outcomes showed features for not just high tech desires but also specific designs for their unique everyday needs and experiences such as, wanting features for safety support, utilizing high exposures to solar energy, and navigation in unchartered terrain. This further exemplifies a current limitation of cell phone interaction options as not catering to and being flexible to all possible use contexts inherent in different places. I learnt in this experiment too that the users in these places best know what is important to them and this cannot be easily understood or conceptualized by industries or even IXDers partly because these places themselves are viewed from the outside by these entities. Furthermore, I was surprised that even for me with a background in this environment, but being trained in recent years in IXD in a more developed environment, it was at first not so obvious to me the use contexts raised by the participants in this workshop. I use this realization in place specific use contexts to argue further for more flexibility and modularity in cell phone designs by users so that designs can be created that are not just specific to everyday use context but influenced also by cultural and environmental factors as well.

**Changing use contexts over time**

Use contexts also change in relation to time. Some changes over time for an individual user include quantifiable changes in demographics and profession, and also subjective changes in needs and wants. These changes affect cell phone needs and wants exemplified in the exploration into current cell phone interactions with a student, Salla, and Adriana, a mom and professional. Salla and Adriana differed in financial abilities and social needs which resulted in a contrast in their cell phone interactions such that Salla does not want to invest in an expensive iPhone while being a student and Adriana being a mom and a business owner could not imagine surviving without the conveniences her iPhone provides. From this I learnt that as a person transitions to different life stages and lifestyles over time, such as from student to professional to being an elder in society, their needs for interaction changes. Currently we respond to this change by
purchasing a cell phone we can afford and that provides the conveniences we can settle for, however in a user-industry scenario I envision modularity in cell phone design that allows changing cell phone components and design so that as the user changes their phone can change with them. This insight was also supported in the modular phone example generated in the fieldshop experiment where users’ expressed visions for flexibility to change design and features that suited their individual desires.

**Designs across use contexts form attachments and another view to meaning and value**

Insights also indicate a new meaning to cell phone devices because of the possibility to form new attachment to phones for more sentimental value. Attachments because modularity allows maintaining the same phone through different phases of life that call for different interaction needs, and even to pass on the phone to others adds sentimental value like it does to other things today. Attachments form because of invested time and efforts which leads to more personal value of the phone.

**Designs for changing use contexts best done by users themselves**

The difficulties in providing design solutions that cater to all possible everyday use contexts, which spread across “places” and “spaces” and public and private use contexts, I hold the view that a key user role in this future scenario is designing for their changing use contexts themselves in such a way that modularity and flexibility of future cell phone designs allow this. This is supported by an insight gained from the white box prop experiment as participants reflected on gesture based interactions with cell phones with that statement that … (some quote). There is a need then for flexibility and modularity in cell phone designs that cater to both public and private interactions in different places and spaces. It is better left up to the user then to design for this based on their everyday use, or some modular way to switch between both contexts that is less invasive to others but satisfies their personal interactions and communications.

**Designing for everyday use contexts as a different approach for the disappearing computer**

I learnt also that the disappearing computer, by Streitz (Streitz, 2005) and Sokoler (Sokoler, 2004), has been driven by the industry but my argument is that the computer cannot really disappear is not customized to optimally suit the specific user and use context. Making observed to bring the interactions and the device to the foreground, as seen in the fieldshop and in the DIT cell phone workshop, since especially in both these experiments the participants gave feedback after the events about having a change in perspective on their cell phone devices and interactions with it that they did not think about before the event. Designing and making in these experiments was done by focusing on interaction qualities of modularity and flexibility and encouraging the participants to conceptualize designs suited to use context. Unfortunately no experiments were possible within the scope of this work and current technical feasibilities to gage if cell phones designed for changing everyday use contexts is a way to allowing the cell phone to be in the
background in use, however, based on insights gained both by me and the participants in designing their own, this could be possible in the future.

**Acknowledging users’ desperation for flexibility and wishes for modularity**

I learnt also that there is already an obvious need from users for modularity and flexibility in cell phone interactions, but it just has not been yet articulated as such. To bring closure to this identified need then, here I acknowledge it by highlight existing ways that users demonstrate desperation and wishes for more modularity and flexibility in cell phone designs, and how this can be appeased in the future.

**Flexibility in aesthetics and function**

Users currently personalize and customize their cell phones to adopt a generic industry made phone as their own. This is seen by changing aesthetics of designs which includes interface design and physical aesthetics. Interface personalizations include background, themes and screen lock, and were confirmed by Livia. Physical aesthetics relates to what is called “pimping your phone”, which is the basis of work done by a group of Nokia researchers who identified several cultural differences in physical personalization of cell phones ranging from cases, straps, and other physical phone modifications to personalize and protect the appearance of phones (Cui, 2007). Flexibility in aesthetics came up in case designs in the Fieldshop experiment (social frogs and sustainable phones examples), DIT workshop and the hardware modifications. Limitations were experienced to flexibility since more advanced knowledge and skills needed to make customizations, experienced with the shape of phones being tied to a box shape in the initial modifications of the DIT phone. Furthermore a need for more functional flexibility arose in discoveries of ad-hoc user solutions such as Andre’s solution to cell phone use while driving, seen in Figure 6(b).

**Modularity beyond software and entering mechanics design**

Modularity in cell phone interactions is currently restricted to allows for software changes in so called ‘open source’ phone that allow users to build and update their own applications. In a user-industry future I envision modularity at deeper levels, such that, it is possible to mix and match software and hardware features. This was seen in the fieldshop. Modularity, by designing physical representations for software interactions, was seen in the social frogs and sustainable phones examples. Modularity in terms of being able to put the parts together, practically exemplified in the DIT workshop. In the DIT cell phone workshop the user/participants role was to (1)design the circuit board in a way that all the necessary electronics could be soldered to it, (2)design and laser cut or 3D print the cell phone cases (3)hand solder the electronic parts to the board (4)assemble the soldered circuit board, sim card and case to give the completed cell phone in terms of hardware and finally (5)add the software. In this way what really happened in this experiment was that for maybe the first time such a community of users carried out the steps done in the cell phone industry in cell phone production, which was explained by Pasi in Section
9.3.1. At the time of talking with Pasi there was some speculation by us both that any user or community could take on these industrialized steps in the cell phone design process, but after the DIT workshop it was evident to both me, the participants and those who expressed reactions to my DIT phone, that users can carry out this process from start to finish.

Modularity for users to design cell phone interaction is currently limited because of parts available and design specifications of the DIY cell phone, however this possibility shows practically that users want, and are beginning to have, modularity in designing phones with already Mellis stating a desire to make his DIY phone design modular so that parts can be easily replaced and repositioned.

**Submitting to a call for inflection**

*Making inspires reflection, to a point of inflection*

So far several insights have been presented and arguments made for maintaining technological advancements in designing modular and flexible cell phone interactions in a future of user-industry cooperation. However, another perspective is that it is in technological advancements that has lead to issues such as technology fatigue and raised several concerns calling for a change. One such concern expressed includes Turkle’s call to take stock of our present use of technology and calling for a point of inflection (Turkle, 2012) before we advance further. Turkle’s concerns arise from the ‘do more’ technologies, and align with designs to raise awareness aims to make a stance against such negative effects. Others works against the ‘do more’ direction include the Mono phone design, Figure 3(c), Go Slow movements (Grönlund, 2012) and even an extreme stance by a journalist to disconnect her family from all digital devices for 6 months(Maushart, 2011).

‘Taking stock’ calls for a constructivist understanding of meaning such that making gives rise to meaning, which leads to new perspectives on IXD which aligns to Gauntlett’s (Gauntlett, 2011) theories previously discussed. Furthermore, the problem of limited interaction options with cell phones can be broken up by reflections in and on action supported by Schön’s notion (Schön, 1987), which causes a change in user perceptions. It is this reflection by Schön that provokes the inflection called for by Turkle.

Observed limitations by users to perceive new interactions with cell phones, from the white box experiment, exemplified to me an oversight by users today to think beyond interactions provided by industries and accept new interaction possibilities, which can be done by first taking stock of current use.

**Different view of inflection for a different environment**

Turkle based her research, which amounted to a call for inflection (Turkle, 2012), mainly on the technological advancements in robotics and communication technologies in the developed world including places such as Japan and the United States. In my work however I observed
frustrations with technology in another way from a different environment, which Turkle failed to consider. The frustration in these environments is not with technology fatigue that calls for a need for inflection (Turkle), which is experienced in more developed countries, rather there are frustrations of great desires for more technology that is better suited to their specific needs but being restricted in expressing it partly because they feel so far removed from the environments where cell phone are manufactured and designed and also because they environments have not been yet exposed to the design and innovation skills needed for this user involved scenario to work. I see the motivation of this possible future scenario to address a different kind of frustration felt in these environments, typical with lesser developed countries. Inflection in these environments then is needed in terms of design possibilities and actually empowering users to do more.

*Inflection inspired by modularity and flexibility enhance user empowerments*

Some user stances made possible by modularity and flexibility in interactions with cell phone have already been identified, but not explicitly so, and include stances against ‘do more’ technologies, technology fatigue and limited interaction options with cell phones that do not fit into everyday changing use contexts.

Making a stance against ‘do more’ is growing in importance as it has been the cause of issues including technology fatigue, digital overload, immersion which was described by John Thackara (Thackara, 2006) as “in the bubble” and antisocial behaviour in society. By opening up the design process of cell phone interactions to users, those affected and concerned about these issues are empowered to address them, at least in their own lives, by designing phones that do not follow doing more, but perhaps doing less. Practically then, users can design their own phones with minimal and basic functionalities or with just those that suit them. Stances have already been made against ‘do more’, and have previously being pointed out, but have failed to provide practical alternatives. This future scenario provides an alternative option in making a stance against technology by allowing the user to define a middle ground that makes them comfortable, as opposed to the extreme stance of giving up technology completely.

User empowerment to make a stance against personal and societal issues is also afforded in this future scenario. One such stance is against closed industry designs which have already been initiated in this work by revealing some aspects of designing cell phone interactions not commonly known. Another stance for promoting appropriate use of to guide better use such as, parents who are concerned by their children’s use of phones and exemplified with physical representations for software functionalities in the fieldshop examples, and raised in discussions in the Trinidad workshop. Societal stances include commitments to the environment which covers concerns for issues like sustainability, fair-trade, e-waste and for more ecologic solutions. Such issues were brought up in the fieldshop, by future IXDers and in reactions to the DIT cell phone.
Furthermore, this DIT future opens opportunities for concerned users to make a stance from inside the design process rather than being an outside activist. This was derived from insights and observations in the DIT cell phone workshop and reactions to the DIT phone.

13.2.3. Deeper understanding of the industry constituency in this future
In explaining the cooperation between users and industry in this future scenario mention was already made of a change in industry roles to one that facilitated modularity and flexibility for continued advanced functionalities and technologies for future cell phone interactions. Here aspects of this changed industry role are elaborated on.

**Facilitating modularity and flexibility as the key role of industries in this cooperation**

*Innovations in hardware components for future designs*

Industry role can be to provide the hardware components by focusing their resources for discovering and creating innovative components such as, memory, processors, and antennas. This was the role of the industry in the mini and temporary user community formed in the DIT cell phone workshop. Insights here showed that the industry role was to provide the technical and non technical parts and equipment including materials for aesthetic value such as the phone case, components for functionality such as the electronic components and custom circuit board, parts for networking such as the sim card and even the machines the make the phone such as soldering irons. One practical example was the experienced difficulties in hand soldering the components in making the DIT cell phone, and here the industry can possible provide some innovations that make it easier and possible for a wider range of users to be able to do it.

*Opening up mechanics designs*

Modularity and flexibility would require the industry to open up cell phone mechanics designs to users, based on insights from Pasi on the industry design process. There will be both opportunities and challenges faced by doing this. An opportunity for the users is that such mechanical engineers can be part of the user communities so the skills and knowledge then can be disseminated in these communities and not reserved for just the industry. An opportunity for the industry is that while the mechanics design is handed over to an extent to users, the mechanics possibilities was pointed out as a profitable aspect to the industry by Livia. Industries can channel their resources to constantly improve what is possible with the mechanics designs then. However I am aware that not being a mechanics engineer myself this maybe a naïve proposal, however this points out room for future advancement of this work in the engineering fields.

The industry cannot just facilitate modularity and flexibility but can negotiate delimitations on designs that are possible and feasible at any one point in time, bearing in mind that there is increased inventions and innovations over time.
Industry needed for functionality and technological advancements

There will be some limitations to what user communities can do that will have to be accepted but can be compensated for by industry expertise, resources and experience. This is based on the fact that cell phone industries have built up decades of experience, resources and skills in cell phone design and this is valuable for technological advancements and functional innovation. Talks with just 3 representatives from the industry made this evident to me as they had a wealth of knowledge and experiences to share in our short meetings.

One limitation the maybe faced by user communities is creating new functionalities easily and the way they want it to work. Functionality itself was pointed out previously as necessary for effective modular and flexible interactions with cell phones. Functionality has been a driving force of cell phone industries so in this future they can play a key role in creating and providing components and parts they provide the functionalities the users need but after some efforts, may not be able to make themselves.

In this way too, the industry can take design further in way the users alone cannot. This is further supported by Moore’s Law (Moore, 1965) with the observation that in history the capabilities of digital electronics double every 2 years, including processing speed, memory capacity and sensors. This law in computing hardware and the fact that not all existing computing components are applied to designing cell phone interactions validates a possibility for future cell phone interactions, which means then that functional cell phone interactions could possibly improve exponentially in the future. Furthermore, it has been the industry that has mainly propelled Moore’s Law into effect since 1965 to today, so industry involvement in the future for technological advancement is obviously necessary.

As previously stated as well, data connectivity is also important for modular and flexible interactions to be effective in this future, since there is a further need to keep up with advancements in communications technologies. This means in other words that some kind of smartphone functionalities should be maintained in this future, for those to want or need to keep up with today’s ‘do more’ lifestyle. The industry is instrumental in designing for this based on insights on networking from Gustaf on the evolution of networking and stated as necessary by IXDers and some DIT phone reactions.

Profit incentives necessary for industry cooperation

Profitability will always be a necessity for industries so they will not take initiative for opening up the design process to users unless the system changed in such a way where industries could take on new roles that showed potential for increased profitability. These are the main incentives for the industry in this scenario.

Opportunity to decrease costs

Gustaf expressed a concern for increasing research and development costs by industries, which is usually done to improve the phone design and functionality and so make it more competitive and
profitable. Improving phone design and functionality should be based on end user needs and wants. In this future, user communities are for conceptualizing and implementing together interactions that they need and want, so this can be an opportunity for industries to minimize expenses by allowing users to take a lead.

Another way to possibly decrease costs is to make it possible to ‘get less for less’ by modularity. This means scalable costs for industry and user. ‘Get less for less’ was stated as not currently possible with industry made phones by Livia because of fixed overhead costs, however with modularity and flexibility in cell phone designs costs can be associated with user specifications and so be scalable with the features provided. This can benefit the industry to cut back on costs and the user in paying for exactly what they want and get.

Furthermore one current challenge/limitation experience in the DIT cell phone workshop was the overall high cost of the parts needed to make the phone today. For the future scenario to be appealing the DIT phone needs to be cheaper than it is today and this can happen with industry support in technical innovation and scalable costs.

**Tackling long term stagnation**

Today the bigger cell phone companies are beginning to dominate the cell phone industry, partly because it is these profitable companies that have the resources to advertise and market their products so that it looks and sounds appealing, driving up sales based on their market advantage and not necessarily based on innovation and invention that satisfy the real needs of users. Cell phone industry and technologies then seem to be going in the direction of being monopolized by a few big companies and this does not give room for innovation by small companies or individuals, including users. From an economic view, monopolization is usually not desirable so a total restructuring or user empowerments then could be ways to address this in the future by promoting cooperation, in the ways noted above, rather than dominance.

**Industry stance against economic and market trends that threaten their survival**

Several factors today make it increasingly difficult for companies in almost all industries to remain in business. The cell phone manufacturing industry is no exception and treats to their survival include market saturation, supplier restrictions, pressures from networks and global market downturns.

Current saturation of technology on the market makes it harder for companies to be as competitive as before. Even the bigger companies face challenges in maintain profit margins as more and more people already own a phone, or two, and are opting to not buy new ones. I gained insight on this view from latest news at the time of this writing on the latest iPhone models, 5S and 5C about to be released but the usual hype received in past years for previous releases is gone. Furthermore a report on Fox News on this seeming lack of interest in the new iPhones stated that 50% of people survey stated that it is not that important to have the latest gadgets on
the market. Another difficulty faced by cell phone companies is that they no longer have a full say in the design of the phones they produced but the industry has evolved in such a way that it is more cost effective to get designs from supplier to the industries. These suppliers may set restrictions on what can be provided and so affect innovation possible by the manufacturers. Further cell phone manufacturer may experience pressures from networking companies whose market strategy to remain in business is to sell phones on contract at a cheaper price to users which takes away from the already marginal profit margin of the manufacturers. At a global economic level, recession and global down turns means users are saving more and spending less, including less new cell phone purchases being made today with the average person opting rather to hold on to their existing phones.

These challenges faced by cell phone manufacturing industries for their survival can be opportunistic for making a radical change in the direction of a user-industry cooperation future, as the alternative seems to be closure. These economic and market trends have been fought against in the same ways of trying to gain market shares by making ‘better’ phones, however this is obviously failing as these industries continue to fall. In this work however I have shown that user needs are still not fully satisfied and that there is room for industries to possibly better suit users. In this way I have provided insights on an existing demand and opportunity for supply, which is a promising opportunity for cell phone industries to take a stance.

13.2.4. Further critical reflection on the overall result

Impacts on personal happiness and social capital

The impacts of user-industry cooperation on personal and social capital can both counteract existing challenges and foster further positive impacts as well.

Counteracting existing challenges to personal happiness and social capital

The challenges faced by cell phone manufacturing industries set a stage for monopolization by bigger companies which is seen today with the closing down of cell phone companies who were once giants in the world market such as Nokia and Blackberry. This leads to unemployment and in effect negative impacts on social capital and individual fulfillment. Closing down of major companies like these leaves their ex-workers unemployed and redundant making it harder to find employment in other similar companies. The existing workers are increasing becoming insecure about their jobs. Overall then, cell phone industry workers are today experiencing negative effects on their personal happiness, and self fulfillment and according to Gauntlet (Gauntlett, 2011) impacts on a wider scale in social capital.

This is counteracted by allowing laid off cell phone industry workers to apply their knowledge and skills to user communities in this future scenario. This will benefit both the individual personally and the user communities collectively.

Fostering personal happiness and enhancing social capital
Personal happiness was stated to be derived from making by Gauntlet (Gauntlett, 2011) and this was exemplified in this work in the DIT cell phone workshop since the participant expressed happiness in having made the phone themselves and excited about ‘showing it off’. A sense of happiness was observed to not just manifest for those who made the DIT phones, but also those who I showed my DIT cell phone to gave reactions of being happy that this could be done and that they could do it too. Collective personal happiness is linked to social capital (Putnam, 1995).

Bridging social capital was described by Putnam as bringing together people with different skills sets and was observed mainly in the fieldshop where each group was purposely diverse. I was this diversity that actually brought the participants together as they depended on each other’s skills and experience to make their concepts complete. In the DIT cell phone workshop I also observed fostering of social capital among the participants however in this case I view the connections made as bonding social capital instead, since the participants were not as diverse in skills sets and it was their similar interest in physical prototyping and maker culture that brought them together.

Change in the role of IXDers to help transitions to this future

In this future where user communities are formed for the purpose of designing cell phone interactions, I envision that IXDers will be a vital asset to these communities. There will be a change therefore in IXD as strictly a job title, usually with one of the bigger companies in the industry, now more IXDers more engaged in participating and disseminating designing knowledge and thinking in user communities. I previously acknowledged that vast changes need to be made in society for user-industry cooperation in the shaping of future cell phone interactions, and I further explained some ways current possibilities and future visions for DIT can be bridged. Here I explain the role of future IXDers as also helping to bridge this gap in the user communities they are a part of.

IXDers could guide good and responsible designs in user communities

Opening up the design process of cell phones to users, while empowering, also places on user communities more responsibility for designs that benefit themselves and society as a whole. Allowing unconstrained freedom to design to diverse user communities runs a risk of irresponsibility as the typical user is not trained in design thinking and to reflect on possible effects design decisions. I see a role of IXDers in this future then to guide cell phone design decisions in user communities that will result in design of interactions that will have minimal negative impacts in society. This aspect came up in the fieldshop as the IXDers in each group were observed to guide group design decisions so that the generated examples were good and responsible, which is exemplified in the sustainable phone that was designed for good environmental impacts, and the social frogs example which was designed to foster good social interactions by taking responsibility against immersion in use. Another opportunity for responsible design is in parents concern for their children’s phone use which was brought up by parents in the fieldshop and in the Trinidad workshop.
**IXDers could support change in human skills and abilities**

In some environments there is high dependency on industry led processes in design of technologies it may not be so easy to grasp the concept of designing and making your own technologies, such as cell phones. This was experienced in the workshop in Trinidad as the participants needed to be briefed first on the basics of IXD and modern maker movements before they could imagine designing their own phone, and even then they could only see their designs being made by industries. In these environments then a sudden change in the cell phone user-industry structure could cause a kind of culture shock and even face resistance to change. Unique challenges then arise in these environments in the transitions required to make this user-industry cooperation a reality. Such challenges have already been experienced in this work and include introducing and establishing design in terms of enculturing designing thinking, implementing and enforcing design processes and promoting user empowerment to align with maker movement in other more modern environments.

Drawing on experiential knowledge, I now see my role in the Trinidad workshop as a probe for how it could be like in the future for IXDers to take on a role of easing the transition in environments with a different maker, design and cell phone structures. I can testify therefore that it is difficult and challenging, but the ability to derive some outcome and generate some discussion around the design program through this single experiment gives some validity that it is indeed a possible role for IXDers in the future.

**Change in responsibilities of IXD**

**IXD could provoke equality in cell phone ownership among individuals and across markets**

The current trends in cell phone designs is for more fancy, flashy and features which also means increasing costs. As prices increase certain groups are excluded from owning the latest designs which causes a widening gap between cell phone owners which can make more evident inequalities in wealth, knowledge or even status. Inequalities in society is an increasing concern for various reasons based in economics and other social sciences, however I view inequalities in cell phone ownership among users as also an IXD concern. I argue that by empowering user to design their phones such inequalities could be addressed in various ways. One main way is that since modularity and flexibility provokes users to focus on their specific needs and use contexts, rather than status associations with just owning a fancy phone.

Inequalities also exist across cell phone markets and could be addressed by IXD in this future. In industry talks, Pasi expressed some praise for the future of a DIT phone in improving communication technologies in 3rd world countries. He saw this as an opportunity to guide designs for different markets, e.g. in 3rd world countries, by making a move towards equality in communications and cell phone technologies across markets by user led designs in ways that the industry cannot achieve or not beneficial for them to do so. As stated by David and exemplified in the Trinidad workshop, less developed countries are motivated for more and better
technologies while developed countries are more motivated for less and to be more hands on, which was exemplified in the fieldshop generates outcomes. There may be a chance then for some kind of trade off in cell phone and other communication technologies to achieve a certain level of satisfaction in both kinds of markets. Surprisingly it is also a known stereotype that certain skills are associated with countries, such as India being associated with IT and engineering skills for customer service and telecommunication technologies, and these skills are needed by cell phone companies in more developed countries. By opening up the cell phone design process to users then, the cell phone technologies in less developed countries could be greatly developed since they have the skills and need.

**IXD could help disseminate design thinking**

There is an old saying, “Give a man a fish and feed him for a day, teach a man to fish and feed him for a lifetime” —Author unknown, which in my reflections helped in understanding a motivation for bringing a user-industry cooperation to less developed countries in the future, despite challenges identified in the Trinidad workshop for such environments not having an interesting in design and modern maker movements. I see ‘giving a man a cell phone’ in these different environments as going nowhere except along the path that led the more developed countries to technology fatigue. If instead there is some ‘teaching to think about and design cell phones’, over time this can enculture an alternative way of doing things in these environments as well leading to greater satisfaction and less frustrations in the long run, and even addressing the risk of technology fatigue before it materializes here as well.

User involvements in the design process in less developed countries could help bridge the gap between these environments and more developed countries in terms of design, modern maker culture and in relating to the cell phone industry. The gap in design is bridged by teaching design thinking so ideas can be conceptualized not only in terms of a long wish list, as was the case in the Trinidad workshop, but teach users here how to delimit expectations by reflecting to identify and design for real needs. This is a trait of good design and critical design that is covered by the IXD methodologies. The gap in modern maker culture is bridged by provoking these environments to apply existing maker skills to modern technologies. I hold the view, based on my experience in this work, that these environments possess dormant skills when it comes to technology design evident by the fact that there is already ingrained in these societies a high level of maker skills but stuck in more traditional crafts. Further there may not currently be available as much resources and opportunities that allow individuals to explore being makers and designers of their own technologies. Bringing IXD to these environments then, in both tangible ways by resources and intangible ways by skills and thinking, can have societal impacts across environments and markets.

**13.2.5. Beyond the future**

Future work here involves thinking about possibilities beyond the overall result of this work, which is a user-industry future scenario. Flexibility beyond this future could allow for integration
of cell phone functionalities in other everyday things thus shaping future phones to take on a new look and feel from how we know it today. Ideas and steps toward this are already being done and came up in this work by Gustaf who mentioned his vision for DIT cell phone as applying the GSM module to communicate with other electronic devices such as sending an SMS to a coffee machine and by Anders in the DIT cell phone workshop, who after having made his own phone, has been working on remote sensing units based on the Arduino GSM phone to act as a watch over newly planted trees in Malmö. This relates to theories and the drive for the disappearing computer and interface (Streitz, 2005). It opens the possibility then that this exploration to design cell phones in the future can be applied in shaping future interactions with other technologies that are based on current day cell phone framework. I acknowledge however that IXD cannot foresee consequences if users, industries and society adapt the overall result of this work for the shaping of future interactions with cell phones.

13.3. Gaps in the DIT cell phone design program

As comprehensive as the explorations done in this design program, there still exist some gaps in this work, partly due to time constraints and also because of a delimited focus on interaction design. One gap is a realization that DIT cell phone as much an engineering exploration as it is an IXD task. There are also close relations to other fields as well such as social sciences. Some important dimensions could exist then which directly affect the shaping of future interactions with cell phone but are outside the scope of this work. Another gap is in considering a future without cell phone devices as we know it today, which however has been stated as possible future work. This already seems to be the current path of cell phone technology advancement where focus is on moving away from the hand held cell phone device to designs that allow for more ubiquity and integration with everyday things such as glasses and watches. The effects of a DIT cell phone approach in such a present trend and future vision cannot be easily predicted.
14. Conclusion
The main motivation for this work was to explore shaping future interactions with cell phones, based on the premise that existing interaction options are limited and previous work have been confined to adding accessories and high tech software solutions. This thesis explored a Design-It-Together cell phone approach for shaping future interactions with cell phone devices. It adapted a programmatic design research approach by exploring various aspects of a DIT cell phone approach through practical experiments and theories.

The main insights gained in this work related to different dimensions of the DIT cell phone design program. Nine dimensions were defined and acted as a guide in thinking about possible futures of cell phone interactions and to interpret the IXD possibilities of the design program. At the end of the programmatic design work, distillation was done by reflecting on the generated repertoire of examples from the perspective of the dimension leading to predictions of possible future scenarios. From the scenarios it can be argued that while the idea of users designing their interactions sounds novel and exciting, the reality is that we are already set on a path of technological advancement that do not allow us to easily go backwards. There is a need however to open up the design process to users, in more than just a surface level activity involving lab and usability testing. Bringing together the repertoire of examples, insights gained on different dimensions of the design program and possible future scenarios, it seems most promising then to have a coexistence of user community involvement together with existing formalized industry processes in designing and creation of cell phone interactions for the future. The industry still needs to exists, albeit in a different form, with a focus on supporting user lead cell phone designs and interactions. It can be said then that it is good to have a community but the industry should exist for the value that it can provide such as to maintain technological progress.

It is not claimed here that an exact prediction is made for the future of cell phone interactions instead; this work helps shape possible futures by exploring design opportunities and generating knowledge around perspectives of designing cell phone interactions.
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## Appendix A – Role Play game scenario cards

<table>
<thead>
<tr>
<th>Waiting for a bus or train and you are bored. What do you do?</th>
<th>Sitting in a crowded bus or train, you have a while to arrive and you are bored. What do you do?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standing in a crowded bus and you answer a phone call</strong></td>
<td><strong>Driving and you answer a phone call</strong></td>
</tr>
<tr>
<td>Waiting for the bus, your phone rings but the bus pulls up.</td>
<td><strong>Driving and you try to check your latest cell phone message</strong></td>
</tr>
<tr>
<td>Talking with a group of friends and your phone rings (you take the call)</td>
<td>In the library and you want to answer your phone, but you don’t know where it is</td>
</tr>
<tr>
<td>Talking on the phone with someone in public and they make you very angry</td>
<td>Sitting on bus and the person next to you is speaking loudly on the phone about their personal life.</td>
</tr>
<tr>
<td>Walking on the street and you don’t know if the person next to you is speaking on their headset or to you.</td>
<td>Open to group</td>
</tr>
<tr>
<td>In class and you try to discretely answer a phone message.</td>
<td>Open to group</td>
</tr>
<tr>
<td>In a meeting and your phone keeps going off, it maybe something important.</td>
<td>Open to group</td>
</tr>
</tbody>
</table>
Appendix B– Fieldshop primer document

1. What you need to prepare for the fieldshop.

Preliminary online questionnaire
Please fill out this short questionnaire to give me more information about you and to help me plan efficient for the fieldshop. Questionnaire is found here.

Questions for your reflections before the fieldshop
Think freely and subjectively on these questions, there are no restrictions and no wrong answers.
A. Reflect on your current cell phone use behaviours (what, how, when, why)
B. What do you think can be the future of cell phone use based on current habits by you and in society?
C. What comes to mind if you think about the idea of crafting your own cell phone?
D. How would you imagine it could work?
E. How would you imagine you could go about making it? Bring some materials, actual or representations, of how you could possibly make it. Materials can be in the form of sketches, text, pictures, tangible and physical materials and things, etc.

2. What is the overall project about?
My main interest for my thesis project is exploring some aspect of smart phone technology, focusing on understanding use behaviours and exploring new ways of interacting with existing smart phones. I started off by doing some short experiments including observing people in public spaces, interviews and using role playing and design games all around topics of cell phone interactions. Initially I explored tangible ways to use cell phone, considering physical as well as software aspects. Then I decided to take a bigger perspective to issues behind cell phone use, which lead me to read social science and psychology works that investigated and gave reasons for the current state of cell phone use behaviours. This bigger picture thinking has currently led me in the direction of exploring the ideas around crafting and creating your own cell phone. In technical terms this is called Open Source or Do-It-Yourself and involves both software and hardware. The fieldshop on Saturday will be focused on exploring this direction of a possible future of cell phone interactions by crafting your own. More information about my overall thesis project is provided on a blog found here.

3. What is a fieldshop?
It is a combination of fieldwork and workshop. It was a method created to short-circuit the traditional phases of a design process by enabling us to try out new interactions and social relations around a certain design opportunity from the very outset.

4. Why have a fieldshop?
My thesis project has changed directions recently to open up to ideas of crafting your own and taking a more radical design approach to the topic of cell phone interactions. Given the relatively short time frame for my thesis works, and the time constraints of possible users of my cell phone idea, a fieldshop is a good method for me to use now to have fieldwork and generate outcomes.
that both involve users and is time efficient. The outcomes from the fieldshop will determine the future directions of my thesis project, and the final prototype.

5. **How will the fieldshop be done (Agenda)**

The fieldshop will be three distinct phases of 1 hour each. Each session will be photo, audio and video documented and these materials used only for the purposes of this thesis.

*Session 1: Ethnographic fieldworks*
- Get familiar with each other
- Get familiar with the location
- Open and curious questions
- Discussions about your reflections on specified questions (given in point 1)
- Discussions about any materials you brought (explained in point 1)

*Session 2: Collaborative analysis and ideation*
- Design team present sketches of possibilities and opportunities in this project
- Group discussions to select topics related to crafting your own cell phone
- Choosing materials that represent aspects you think important in crafting your own phone.

*Session 3: Experience prototyping*
All done in groups
- Each group develop scenarios around the chosen aspects
- Group discussions about how they lived experience of crafting your own phone can happen or play out.
- Creation of props using available materials to represent now possible artifacts of crafting a cell phone.
- Create narratives by improvised dialogue and actions to fill in gaps from the present condition of cell phone use to your imaginary attractive solution of how crafting your own phone can happen and work.

6. **Practical information for the fieldshop**

*Date:* Saturday March 2nd  
*Time:* 1pm to 4pm – kl13 to kl16  
*Location:* MEDEA (Östra Varvsgatan 11 205 06 Malmö)  
*How to get here:* Bus 8 at stop Ubåtshallen, look for signs for ‘MEDEA’

7. **Organisers and hosts of the event**

*Tricia*

Hi, I am a student in the Interaction Design Masters program at Malmö University, and this fieldshop is for my thesis. I am responsible for everything related to this fieldshop and I thank you again very much for agreeing to participate! Feel free to contact me with any questions or concerns you have.
Looking forward to meeting with you on Saturday! 😊
+46 727 31 44 74, Personal Website, LinkedIn

Simeon
Simeon is my classmate in the Interaction Design Masters program and he has kindly volunteered to assist me in documenting the fieldshop event, and assisting the group work on the day. His background is in graphic design and his thesis is about juicy feedback in game design.

Job
Job is also an Interaction Design Masters student at Malmö University, and he is in the first year of the program. He has also kindly volunteered to help in the documentation and monitoring of the fieldshop.
Appendix C – Fieldshop preliminary questionnaire

Cell Phone interactions workshop preliminary questionnaire

This short questionnaire is to give me information about your demographics, current communication needs and your cell phone behaviours and use.
This information is only for me and will be used to help me prepare efficiently for Saturday’s workshop.
* Required

Name *

Age *

Gender
☐ Male
☐ Female

Your contact phone number

Your contact email address *

Nationality *

How long have you been living in Malmö? *

How long have you been living in Sweden? *

Your current area of work / study *

Rate your technical expertise *

1 2 3 4 5
Very non techy ☐ ☐ ☐ ☐ ☐ Very techy
Technical skills/experience (if any)

Do you currently own a smartphone? *
If No, please give any reasons why.

What kind of cell phone do you currently own? *

Average amount of time you would say you spend using your cell phone each day? *
Please give an exact average number of hours if any of these choices do not suit you.

- 12 hours or more
- Between 6 to 12 hours
- 6 hours or less
- Other: ___________________________

Top three (3) things you do with your cell phone? *

- Messaging
- Voice calls
- Social Media
- Gaming
- Web browsing
- Other: Apps
- Other: Calendars and scheduling
- Other: ___________________________

Is the majority of your cell phone use for contacting those in your current home city (Malmö) or abroad (outside Malmö)? *

- Home (Malmö)
- Abroad (Outside Malmö)
- Other: ___________________________

Submit

Never submit passwords through Google Forms.
Appendix D – Fieldshop preliminary questionnaire results

Gender

- Male: 6 (38%)
- Female: 10 (63%)

Rate your technical expertise

- 1: 2 (13%)
- 2: 4 (25%)
- 3: 4 (25%)
- 4: 4 (25%)
- 5: 2 (13%)

Average amount of time you would say you spend using your cell phone each day?

- 12 hours or more: 0 (0%)
- Between 6 to 12 hours: 5 (31%)
- 6 hours or less: 8 (50%)
- Other: 3 (19%)

Top three (3) things you do with your cell phone?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messaging</td>
<td>15</td>
<td>25%</td>
</tr>
<tr>
<td>Voice calls</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>Social Media</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>Gaming</td>
<td>6</td>
<td>10%</td>
</tr>
<tr>
<td>Web browsing</td>
<td>5</td>
<td>8%</td>
</tr>
<tr>
<td>Other Apps</td>
<td>5</td>
<td>8%</td>
</tr>
<tr>
<td>Calender and scheduling</td>
<td>5</td>
<td>8%</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>8%</td>
</tr>
</tbody>
</table>
Is the majority of your cell phone use for contacting those in your current home city (Malmo) or abroad (outside Malmo)?

- Home (Malmo) 9, 56%
- Abroad (Outside Malmo) 6, 38%
- Other 1, 6%
Appendix E – Fieldshop feedback questionnaire

Fieldshop feedback form

Rate the following aspects of the organisation of the fieldshop.

<table>
<thead>
<tr>
<th></th>
<th>1 (low / very bad)</th>
<th>2 (bad)</th>
<th>3 (Neutral)</th>
<th>4 (good)</th>
<th>5 (high / very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity of purpose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation time given</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impression given</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rate the following aspects of the actual fieldshop event.

<table>
<thead>
<tr>
<th></th>
<th>1 (low / very bad)</th>
<th>2 (bad)</th>
<th>3 (Neutral)</th>
<th>4 (good)</th>
<th>5 (high / very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well organized</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to follow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insightful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What do you think could have been done better?

What do you think was missing in the organisation and content of the fieldshop?

What do you think was well done overall?

Any additional comments, ideas, or suggestions?

Thank you for participating! 😊
Appendix F – Fieldshop feedback questionnaire responses

Rate the following aspects of the organisation of the workshop (before the event). [Preparatory Information (Primer document)]

1 (high / very good) 6 (75%)
2 (good) 1 (13%)
3 (Neutral) 1 (13%)
4 (bad) 0 (0%)
5 (low / very bad) 0 (0%)

Rate the following aspects of the actual workshop event [what happened at the event]. [Enjoyable]

1 (high / very good) 7 (88%)
2 (good) 1 (13%)
3 (Neutral) 0 (0%)
4 (bad) 0 (0%)
5 (low / very bad) 0 (0%)

Rate the following aspects of the actual workshop event [what happened at the event]. [Well organized]

1 (high / very good) 8 (100%)
2 (good) 0 (0%)
3 (Neutral) 0 (0%)
4 (bad) 0 (0%)
5 (low / very bad) 0 (0%)

Rate the following aspects of the actual workshop event [what happened at the event]. [Insightful]

1 (high / very good) 6 (75%)
2 (good) 2 (25%)
3 (Neutral) 0 (0%)
4 (bad) 0 (0%)
5 (low / very bad) 0 (0%)

Rate the following aspects of the actual workshop event [what happened at the event]. [Easy to follow]

1 (high / very good) 6 (75%)
2 (good) 2 (25%)
3 (Neutral) 0 (0%)
4 (bad) 0 (0%)
5 (low / very bad) 0 (0%)

Overall, what did you like the most?
“The idea itself that we have to come up with mobile phone improvements”

“The mixture of people attending, this lead to very interesting discussions, and made me think of things I would not have usually thought off.”

**Overall, what do you think could have been done better?**

“Maybe more clearness on the purpose: was it about my own cellphone or about cellphones as a whole? But the openness and the positive attitude are mybe more valuable than beeing too distinct.”

“I was rather sceptical before and very positive afterwards - but it must be difficult for you to summarise the results! “
Appendix G: Interaction Design student focus group reports (Original)

Group 1

Mobil – Gränssnitt om åtta år

Johan Ståhl - Henrik Pedersen - Alexander Moe Ditlevsen

Syfte:

Frågeställning - Hur kommer de mobila gränssnitten att se ut om åtta år?

Hur kommer det se ut och fungera? Kommende är att gå i en rak linje från och med nu och behålla sitt format utökat med fler funktioner eller kommer dem helt att förändra form och få en ny innebörd i våra liv?

- Hur kommer det se ut? Exempelvis: kommer de existera i nuvarande format eller kommer de integreras med andra funktioner såsom armband, glasögon etc.
- Hur kommer vi interagera med dem?
- Vilka nya funktioner kommer de att fylla? Kommer touch skärmar att finnas kvar?
  Kommer de helt att ersätta våra bankkort eller kommer de simplifieras och exempelvis bara kunna användas till samtal?

Upplägg för undersökning

Första momentet - Intervju:

- Kommer mobilens bibehålla sin fysiska form?
- Hur tror du mobilens kommer att fungera i framtiden?
- Vad använder du mobilen mest till?

Material:
- Skisser och anteckningar

Andra momentet – Collage/Scenario:

Hur går det till när du utför dessa moment om åtta år?

- Du ska ringa en vän och möta hen på en viss plats.
- Du skall skicka ett sms
- Du ska ta en bild och dela den med andra.
Material:
- Saxar, limstift, A4-papper, post-its, tejp, färgpennor
- Tidsskrifter, utskrivna papper med bilder på möjliga inspirationskällor/arbetsmaterial

Resultat:
Att dömma ut av bakgrundshistoriken vi fick ut av våran fokusgrupp va många ut av deltagarna relativt flitiga användare av mobiltelefoner och hade i vissa fall använt mobil sedan 80-talet. Vi fick snabbt en inblick av att gruppen va ganska avancerade användare och ibland krävde avancerade och många funktioner av telefonerna.
Med våran fokusgrupp fick vi fram att deltagarna var väldigt posittivt inställda till en utveckling av delvis biologiska, 3-dimensionella skärmar, stryktåliga telefoner men även mer i formbart material som innebär att man kanske kunde personifiera sin mobil mer i framtiden så som att ha den som ett smycke mm.

Bilder för material:

Bilder för process:
Bilder för resultat:

Group 3

Fokusgrupp – Creating your own phone

Vi har satt ihop en fokusgrupp för att undersöka möjligheterna för att designa sin egen mobil. Deltagarna i fokusgruppen bestod av tre studenter från Malmö högskola, alla tre ägare till smartphones som de använder dagligen. Syftet med fokusgruppen var att få insikt om hur mobiler används i dagsläget, vilka funktioner som används mest och vilka funktioner som är viktigast. Vi ville även få reda på hur deltagarna ser på framtidens mobil. Vilka funktioner vill de se och hur telefonerna skall formges.

Upplägg
Till fokusgruppen införskaffade vi papper, pennor, färgpennor och post-it-lappar. Vi bjöd också på fikabröd för att lättuppa stämningen. Sessionen började med att Daniel bad var och en av deltagarna att plocka fram sin telefon och visa vad det är som göra den till deras egen. Sedan fick
deltagarna berätta om vilka funktioner de använder mest och vilka funktioner de tyckte var viktigast.

Deltagarna ombads att under cirka två minuter skriva ner tekniska sysslor de inte använder telefonen till, till exempel se på film eller ta foto för det fanns bättre alternativ. Efter det fick de redovisa vad de skrivit för varandra. Efter en diskussion kring vad de skrivit ombads de att skriva på nytt. Denna gång fick de tänka på hur sysslorna skulle kunna implementeras på ett bättre sätt än i dagens telefoner. Vad skulle behöva göras för att telefonen helt skulle konkurrera ut en systemkameras alla funktioner till exempel. Vi gjorde även klart för deltagarna tidigt att det inte skulle tänka på vad som vore möjligt rent tekniskt utan att tänka långt fram in i framtiden.


**RESULTAT**

**Saker ni inte använder telefonen till?**

Redigera bilder i Photoshop, systemkamera, (slutare/bländare), krävande spel, kolla TV (tycker det är jobbigt att kolla på den lilla skärmen), redigera film/bild, laga mat, köra bil, tända/släcka ljuset, motionera, städa och tvätta.

(Går in på komplikationerna med NFC, att det går att göra en del grejer men att det inte blivit någon standard och kräver mycket fokus för att implementeras).

*Simon berättar om sin kollega som automatiserat saker som start av sin bil, dimmande av ljus, start av radio, kokande av kaffe osv.*

**Alla funktioner ni gör, hur hade ni tänkt er att de fungerade via mobilen i ett drömscenario. [Skissa]**

"Behöver inte tvenget vara en telefonlösning., inga begränsningar”


Simons drömtelefon hade velat ha en mobiltelefon i linsformat.

Maja hade velat få doserat medicin via liknande koncept, en telefon i kroppen.

Majas andra koncept handlar om ett par skor som projicerar mobilskärmen framför sig.

Philip ville kunna projicera tangentbord på bordet och en skärm på väggen.

**Vad är det för appar ni använder oftast?**
Facebook, Instagram, väder, mail, Spotify, Youtube, runkeeper, schema, Skånetrafiken, Aftonbladet, kalender, mail, Facebook, internetbank, (hatar sms, tycker det är opersonligt).


**Group 4**
Uppgift: Vi har i uppgift att ha en fokusgrupp som behandlar området ”design your own smartphone”.

Medlemmar: Johan Tingbacke, Daniel Sofinet och Matilda Ståål
Fokusgrupp: Annebell Larsson, Max Moberg och Nasir Hussein

Syfte: Få fram vad användaren finner viktigt i en telefon och vad de vill se för funktioner.

Struktur: Vi valde att intervjua vår fokusgrupp samt att låta de sätta upp post-it lappar över vad de tyckte var viktigt och inte viktigt i en telefon.

Resultat: Vi tyckte att vi hade lite för få personer i vår fokusgrupp för att få fram ett ordentligt resultat. Hursomhelst så fick vi fram ett resultat till viss del.

Från post-it lapparna fick vi fram att de funktioner de tyckte var mest viktiga i en telefon var följande: sms, mail, snabbhet, surfa, ringa, täckning, batteri, design interface, schema, hörlurar, kalender.

de funktioner de tyckte var mindre viktiga var följande:

spel, pris, yttre design, hållbarhet, foto och video, skriva, läsa.

Vi hade även intervjuer där vi fick fram följande resultat:

**Vad använder du din mobil till i vardagen?**
Jag använder min mobil mestadels till att surfa och hålla kontakten med vänner och liknande. Jag tycker det är skönt att kunna vara uppkopplad hela tiden och närsomhelst kunna lägga upp bilder.
Vilka funktioner använder du dig mest av och varför?
Jag använder mig mest av appar så som twitter, facebook etc. Samt att kunna hålla kontakten med hjälp av att ringa samt och att skicka meddelanden.

Vilka funktioner vill du att en telefon ska innehålla?
Jag tycker att kameran är viktigast, att kunna ta en bild snabbt. Självklart även att man ska kunna ringa och smsa samt att vara uppkopplad till internet.

Vilka funktioner saknar du i dagens telefoner?
Jag hade velat att man kunde använda det mer som ett betalmedel, i större omfattning än vad man kan idag. Tex. Om man vill handla en kaffe i kafeteria på skolan men inte har kontanter. Möjligtvis att använda något slags system som interagerar mellan mobilen och kortterminalen.

Vad har du för åsikter om dagens design på mobiltelefoner?
Jag tycker att de har lagom storlek på skärmarna, jag vill inte ha en för stor. Hade velat se att mobiltelefonerna hade 3D-touch som känner av hur långt ifrån fingret är från skärmen. Det finns till viss del redan idag.

Tycker du att det finns några ergonomiska för- och nackdelar med dagens telefoner?
Det är bekvämt när man ringer. Kan bli lite svårt när man smsar då tangentbordet har ganska små knappar och själv har jag lite större fingrar.

Vad tycker du om kvalitén och hållbarheten på dagens telefoner?
Känns rejäl. Tycker inte om de som är lätt och plastiga, känns som att de har sämre kvalité.

Finns det något du känner att mobilen ska klara av rent fysiskt?
Hade velat att man skulle kunna ta bilder i regnet och vara överlag vattentät. Hade även velat ha en mobil som är robust och har bra kvalité som man kan tappa utan att den går sönder. Hade kunnat tänka mig att lägga lite mer pengar på en mobil som är mer hållbar.

Har du några ”crazy” idéer om vad du hade velat ha för funktion i en mobiltelefon?
Jag hade velat kunna ha hologram i mobilen.
Group 5
Metoder för interaktionsdesign 2

Kursansvarig: Amanda Bergknut, amanda.bergknut@mah.se

"Fokusgrupper"

Gruppmedlemmar: Nicklas Slagbrand, Dejan Milenkovich, Philip Jönsson.

Beskrivning av uppdraget:
Creating your own phone:
Exploring possibilities with designing your own phone – appearance, functionality

Uppgifts instruktioner:
• Planera ert upplägg - dela upp ansvar dvs. en moderator, en dokumenterar och en fotar
• Förbered er noga – material, eventuell teknik, underlag för frågor, uppgifter, övningar, bjuda på mat/dryck, möblering osv,
• Tydligt fokus och röd tråd - ha inte för många olika delar/uppgifter
• Skriv en guide för erta fokusgrupper – som stöd
• Var tydliga mot deltagare - vad de ska göra, syfte och mål med fokusgruppen
• Testa ert upplägg innan
Dokumentera noga (text, foto)

Inledning
Under en veckas tid skall vi i en grupp på 3 personer arbeta mot en fokusgrupp. Vi ska enligt briefen ta fram en ”ny” mobiltelefon. Vi har valt att lägga fokus på användarnas interaktion och användning av telefoner.

Förberedelser

Vårt huvudmål är att definera människors primära användningsområden samt vilka områden de anser vara viktiga för dem själva samt vad de tycker telefonen ”borde” användas till.

Frågor som ställdes:

* Vilka funktioner tycker du är viktigast i en telefon?*

* Vilka funktioner använder du mest?*

Vi vill även få fokusgruppen att tänka och diskutera kring fysisk design. Vi kommer därför först be personerna att skissa upp en egen design, sedan diskutera den i grupp.

Detta för att vi vill få en känsla kring former och storlek.

**Dagen för fokusgrupp!**

Vi samlades kl 10 och hade förberett en fika. Vi började eventet med en avslappnad morgonfika där vi satt och snackade lite allmänt. Detta gav alla medverkade en liten mer avslappnad känsla.

Diskussionen startades med att de medverkade fick under ca 5 min nämna de viktigaste funktionerna de själva använder och ville ha i en telefon.

Saker som nämndes var bland annat, Visuell påverkan på telefonens innehåll, bra kamera, batteritid, lätt att synka med dator osv.

Utifrån detta ville vi skapa en diskussion kring vilka av dessa som de känner att de lägger ner mest tid på samt hur pass mycket tid de lägger ner på dessa funktioner/appar.

Mycket av användandet är kopplat till internet/applikationsnätverket med allt ifrån sociala medier till chattprogram.

Diskussionen leddes sedan in på vad de själv tror kring framtidsutblickar och hur användandet samt utseendet kan se ut om ca 10 år. Där många av deltagarna enade om att vi just för tillfället är i en sorts övergängsperiod för marknaden. Där framtiden är väldigt svår att förutspå. Trots detta hade många av deltagarna intressanta ideer.
Exempelvis var de inne på att det kommer glida ifrån den klassiska abonnemangsdelen kommer att mer och mer utgå och att det istället kommer användas via internet. Detta i takt med att ”cloud” marknaden idag accelererar. Många av deltagarna pekar även på att marknaden kommer att utvecklas som mest när problema kring batteritider åtgärdas. De menar på att idag har telefonerna(smartphone) en kort batteritid vilket samtidigt förhindrar utveckling av funktioner. Då användaren inte vågar/vill ha allt för mycket funktioner som drar för mycket batteri. I och med att detta problem löses kan marknaden ta stora steg framåt och öppna upp för större funktionsutveckling.

Kring form och design har deltagarna haft en del idéer kopplat till en förutsedd utveckling kring batteri och laddning. Dessa förslag kan ni se i bilderna under.

Tankarna bakom bild 3 var att framtida koncept skulle kringgå telefon konceptet och kliva in mer mot ett multifunktionellt verktyg som skulle ha snarlika funktioner, fast telefoni som en av de valbara alternativen genom ex applikationer. Vi utforskade hur detta skulle kunna se ut.

**Gorup 6**
**Grupp**
Elisabeth
Erika
Petter Bjelm

**Introduktion**
Vi har utforskat möjligheterna med att designa en egen telefon med hjälp av fokusgrupp. I vår fokusgrupp har vi haft 3 deltagare. Inledningsvis fick de enskilt skriva ner svar på enkla frågor på post-it lappar, sedan diskutera kring sina svar. Därefter fick de ta del av en workshop där de fick instruktioner till att visualisera sin drömtelefon genom tillgång av olika material så som
post-it, tidningar och papper. Efteråt fick de diskutera och motivera till varför de valde de funktioner och utseende till sina mobiltelefoner.

**Fokusgrupper**
**Ansvarsuppdelning**
Elisabeth – Dokumentation
Erika – Moderator
Petter – Foto/Video

**Fokusgrupp**
Hampus Hammar 22 år – Studerar interaktionsdesign, musikintresserad
Pierre Cavalli 25 år – Studerar interaktionsdesign, Webb/spelutvecklare
Oscar Boman 24 år – Studerar interaktionsdesign, före detta kock

**Tid:** 24 April, 13.00
**Plats:** Mah, Kranen

**Material:** Papper, Pennor färg, Tejp, Lim, Bilder, Tidningar, Sax, Post-it lappar.

**Teknisk utrustning:** Digitalkamera, Videokamera, Laptop.

**Mat och Dryck:** Kaffe, Läsk, Kakor.

**Övningar**

**Inledande frågor**
Gruppen fick börja med att besvara några inledande frågor, där de enskilt fick tänka efter och skriva ner sina svar på post-it lappar. En övning tänkt till deltagarna att komma igång med tankar kring hur de känner för telefoner idag.

**Frågor**
Vad tänker du på när du hör mobiltelefon?
Vad tänker du på när du hör smartphone?
Vad tänker du på när du hör ringsignal?

Vilken app är din favoritapp?

Vad är din favoritfunktion?

När använder du telefonen mest, morgon, middag, kväll?

Vad använder mest telefonen till?

När de besvarat frågorna fick de dela med sig av sina svar, samt diskutera kring sina tankar runt respektive fråga.

Metoder för Aktivitet, D. Saffer s. 89.

Fokusgruppen fick använda sig av en kombination av att göra ett collage och att skissa sina tankar. Där de fick använda sig av tidigare nämnda material. Fokusgruppen fick utifrån tankar kring de inledande frågorna skissa ner vad de hade velat ha med i sin "drömtelefon". Genom att använda sig av kombinationen av collage och att skissa var de väldigt fria och hade inga större begränsningar i framställandet av sina visualiseringar. Där Tanken bakom var att använda sig av bilder, ord och skisser för att göra det visuellt för andra att förstå vad de menar med sin design.

För att lättare få dem att komma igång ställdes några ytterligare frågor för att komma igång.

- Hur kommer den se ut?
- Vilket material skall den vara gjord i? Plast, Trä, Glas, Metall, Gummi etc?
- Vilka funktioner bör den ha?
- Vem kommer använda den?
- Skall den ha enkel eller avancerad funktionalitet?
- Liten, lätt, stor skärm, robust?

De fick även blandade telefonrelaterade ord att titta på och bli inspirerade av utskrivna på lappar. Några exempel på ord: Taltid, Internet, Högtalare, Kamera, Appar, Ljud, Musik, Simkort, Minne / Lagring, Vibration mm.
När de kännt sig färdiga med sina visualliseringar fick de visa upp, samt motivera och berätta om vad de fått fram. Samt vidare diskussioner kring ytterligare idéer och tankar de fått från varandras kreationer.

**Resultat**

**Hampus**

**Pierre**
**Oscar**

Oscars drömtелефon kom i två delar. En som satt på tinningen, som visade hologram framför ögonen. Den andra satt på handleden och visade hologram på armen. På armen har man alla appar ”All skit man vill ha”, medan vid ögonen visas bara det man vill titta på, ex kartor via GPS, och filmer mm. Man kan skicka information från armen till ögonen med en svepande rörelse. Han har inspirerats mycket från olika SciFi-filmer, bland annat Ironman.

---

**Sammanfattning**

Undersökningen visade sig att deltagarna i fokusgruppen använde sig utav olika metoder i workshopen. Vilket var rätt intressant med tanke på att de fick samma material och inga begränsningar. I resultatet för varje deltagare visade sig att de har väldigt höga förväntningar för framtiden. Men även att de hade så pass lika resultat gjorde att det blev intressant hur mycket tekniken uppskattas i dagens samhälle.

Vi tog fram frågor och tankeord som deltagarna genom sin fantasi och drömmar använde för att ta fram sina persoliga drömmobiler med hjälp av papper. Detta gjorde det väldigt lätt att se vilka tankar de har för framtidens mobilteknik.

Mycket av det vi har studerat i fokusgruppen har varit både lärorik och inspererande, det har givit oss tankar kring vilka metoder som är bäst att använda sig av när man gör en sådan här undersökning.

**Referenser**

Saffer, Dan. (2010) Designing for interaction, New Riders. s. 89
Appendix H: Interview guide for industry talks

1. Talk about your area of specialization in the mobile phone industry
   1.1. What do you do? How long?
   1.2. How does it work? (t.ex. the networking of mobile phones)

2. Talks about how a Do-It-Yourself cell phone can possibly work in the mobile industry infrastructure you are familiar with.

3. What challenges can exist or how maybe it will not work?

4. What steps should be taken to make a DIY cell phone work here?

5. What are your views on the idea of people making their own phone?
   5.1. How could it affect the industry
   5.2. How could it affect the economy
   5.3. Good and bad sides of this idea.
## Appendix I: DIY cell phone workshop Bill of Materials (BOM)

<table>
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<th>Package</th>
<th>Original Supplier</th>
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<th>Local Supplier</th>
<th>Other Part Number</th>
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<td>BUTTON_6MM_JLE AD</td>
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<td>Gianluca</td>
<td></td>
<td></td>
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125
Appendix J: DIY cell phone workshop presurvey

DIY cell phone workshop presurvey

Thank you for taking this survey. It will take you about 15-20 minutes to complete. Your responses will be reported in group form only, with no personally identifying information. Please answer with your HONEST opinions.

Parts of this survey are taken from the work done by David Helie in his DIY cell phone workshop.

* Required

Your initials *

What do you think can be the future of cell phone use based on current habits by you and in society?

Generally, what comes to mind if you think about the idea of crafting/creating your own cell phone? *

Given no restrictions on the idea of creating your own phone, how would you like it to work? *
Thinking freely about hardware, software, mechanics, customizations, technologies, design, environmental and social factors, etc.

Do you imagine creating a cell phone(s) as a community practice/event or done individually? *
Comments on who (if anyone) do you imagine would be involved in creating a phone for/with you?
What do you imagine are possible benefits/possibilities/opportunities in creating your own phone?  
Personally and generally.

What would you imagine are disadvantages and limitations of creating your own phone?

1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert. *  
(Don't worry, no previous experience is required for the workshop)  

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<tr>
<th>Area</th>
<th>1 (no experience)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (expert)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art:</td>
<td>⭕</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craft:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer programming:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronics:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Briefly describe any experience you have had with art, craft, design, computer programming, and electronics. *
Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I plan to use the phone from this workshop in my daily life.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I understand how a cellphone works.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It's feasible for people to build their own cell phone.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I'm motivated to build my own cell phone.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cell phones would be more diverse if more people were able to design and build them.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It's valuable for companies to somehow open how cell phone creation/customization to individuals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I imagine it can be beneficial for a community to develop around the idea of creating your own cell phone.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I rather be involved in making my own phone in a community than individually.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

What kind of cell phone do you use? *

- ☐ Touch-screen smartphone (e.g. iPhone)
- ☐ Smart phone w/ full QWERTY keyboard
- ☐ Phone w/ traditional number pad
- ☐ More than one of the above types
- ☐ Other: ☐

Top three (3) things you do with your cell phone? *

- ☐ Messaging
- ☐ Voice calls
- ☐ Social Media
- ☐ Gaming
- ☐ Web browsing
- ☐ Other Apps
- ☐ Calendar and scheduling
- ☐ Other: ☐
Average amount of time you would say you spend using your cell phone each day? *
Please give an exact average number of hours if any of these choices do not suit you.
- 12 hours or more
- Between 6 to 12 hours
- 6 hours or less
- Other: [ ]

How do you feel about your cell phone(s)? *
- I hate it
- I dislike it
- Neutral
- I like it
- I love it
- N/A
- Other: [ ]

Age
[ ]

Gender
- Male
- Female

Your current field of work / study *

Nationality *

Where do you currently live? *
Appendix K: DIY cell phone workshop presurvey results

Art: [1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert.]

Craft: [1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert.]

Design: [1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert.]

Computer programming: [1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert.]

Electronics: [1. Please rate your previous experience in each of the following areas on a scale of 1 to 5, with 1 being No Experience and 5 being Expert.]

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I plan to use the phone from this workshop in my daily life. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 2 (33%)
Disagree: 0 (0%)
Neutral: 3 (50%)
Agree: 0 (0%)
Strongly agree: 1 (17%)

I understand how a cell phone works. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 1 (17%)
Disagree: 1 (17%)
Neutral: 3 (50%)
Agree: 0 (0%)
Strongly agree: 1 (17%)

It's feasible for people to build their own cell phone. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 0 (0%)
Disagree: 2 (33%)
Neutral: 1 (17%)
Agree: 2 (33%)
Strongly agree: 1 (17%)

I'm motivated to build my own cell phone. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 0 (0%)
Disagree: 1 (17%)
Neutral: 0 (0%)
Agree: 2 (33%)
Strongly agree: 3 (50%)

Cell phones would be more diverse if more people were able to design and build them. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 0 (0%)
Disagree: 2 (33%)
Neutral: 1 (17%)
Agree: 0 (0%)
Strongly agree: 3 (50%)

It's valuable for companies to somehow open how cell phone creation/customization to individuals. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

Strongly disagree: 0 (0%)
Disagree: 3 (50%)
Neutral: 1 (17%)
Agree: 1 (17%)
Strongly agree: 1 (17%)
I imagine it can be beneficial for a community to develop around the idea of creating your own cell phone. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

<table>
<thead>
<tr>
<th>Agreement Level</th>
<th>Count</th>
<th>Percentage</th>
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<tr>
<td>Disagree</td>
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</tr>
<tr>
<td>Neutral</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Agree</td>
<td>2</td>
<td>35%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>35%</td>
</tr>
</tbody>
</table>

I rather be involved in making my own phone in a community than individually. [Thinking about how you feel right now, please indicate how much you agree or disagree with the following statements.]

<table>
<thead>
<tr>
<th>Agreement Level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>Disagree</td>
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<td>0%</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
<td>35%</td>
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<tr>
<td>Agree</td>
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<td>0%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>60%</td>
</tr>
</tbody>
</table>

What kind of cell phone do you use?

- Touch-screen smart phone (e.g. iPhone) 5 83%
- Smart phone w/ full QWERTY keyboard 0 0%
- Phone w/ traditional number pad 1 17%
- More than one of the above types 0 0%
- Other 0 0%

Top three (3) things you do with your cell phone?

- Messaging 3 18%
- Voice calls 3 18%
- Social Media 4 24%
- Gaming 0 0%
- Web browsing 2 12%
- Other Apps 0 0%
- Calendar and scheduling 3 18%
- Other 2 12%
Average amount of time you would say you spend using your cell phone each day:

- 12 hours or more: 0 (0%)
- Between 6 to 12 hours: 0 (0%)
- 6 hours or less: 6 (100%)
- Other: 0 (0%)

How do you feel about your cell phone(s)?

- I love it: 1 (17%)
- I dislike it: 1 (17%)
- Neutral: 0 (0%)
- Other: 0 (0%)
- I hate it: 2 (33%)

Gender:

- Male: 5 (83%)
- Female: 1 (17%)
Appendix L: DIY cell phone workshop postsurvey

DIY cell phone workshop postsurvey

The workshop was fun, but the real value is in reflecting on the experience. In this survey I need your help to find hidden value in this workshop by asking you to personally and objectively reflect on the event. To guide you I have prepared these questions under broad categories of Interaction Design considerations, the DIY cell phone and the workshop itself.

Please answer as honestly and detailed as possible.

Interaction Design considerations.
These questions aim to relate this technical workshop to Interaction Design topics.

1. What do you think could be possibilities for new/improved/different interactions with cell phones if people could make their own? *
   Consider hardware and software interactions and etc.

2. Thinking in the future and based on your experience at the workshop, what alternative ways may be interesting to explore for making a cell phone? *
3. What are your reflections on the workshop being organised as a social/community event? Was it good/bad to be done in this way? How else do you think it could have been structured? *

4. As far as you got with making the cell phone, WHO do you feel made (or is making) your DIY cell phone? You / the other participants / some experts / some combinations? *

5. Reflect on your role in the workshop. What do you think your role was? What do you think your role was NOT? What did you want/expect your role to be? *

The DIY cell phone
These questions aim to get your personal and subjective views on the DIY cell phone device and approach.

6. Which do you prefer: making the cell phone on your own (Do-It-Yourself) or working with others (Do-It-Together)? *
   - DIY
   - DIT
   - Other: 

7. Comment on your response to the previous question. Why, etc.? *
8. What do you think are possibilities and meaning of DIY (Do It Yourself) and DIT (Do It Together) when applied to cell phone creation? *

9. Who else do you think could be useful to involve in making a DIY cell phone and why? *
Think about individuals with a certain skill or profession, companies and resources.

10. When finished, would you like to use this as your phone? Why and why not? *

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The workshop itself.

These questions aim to get feedback on the workshop event itself, and not on the topic, to help in planning future similar workshops.

11. Rate the following aspects of the actual workshop event (what happened at the event). *

<table>
<thead>
<tr>
<th>Aspect</th>
<th>1 (high / very good)</th>
<th>2 (good)</th>
<th>3 (Neutral)</th>
<th>4 (bad)</th>
<th>5 (low / very bad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well organized</td>
<td></td>
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<tr>
<td>Easy to follow</td>
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<tr>
<td>Inspiring</td>
<td></td>
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<td></td>
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<tr>
<td>Time frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of purpose/expectations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of event</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
12. Rate the following aspects of the organisation of the workshop (before the event). *

<table>
<thead>
<tr>
<th>Clarity of purpose</th>
<th>1 (high / very good)</th>
<th>2 (good)</th>
<th>3 (Neutral)</th>
<th>4 (bad)</th>
<th>5 (low / very bad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation time given</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Communication</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Impression of the workshop before the event</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

13. Overall, what did you like the most? *

14. Overall, what do you think could have been done better? *

15. Overall what do you think was missing (in the organisation, content, etc)? *

General Comment and reflections.

Any additional comments, ideas, suggestions, general feelings?
Appendix M: DIY cell phone workshop postsurvey reflective responses

Interaction Design considerations.

1. What do you think could be possibilities for new / improved / different interactions with cell phones if people could make their own?

Don't know. Lovely new things and applications. Twitter reader. Facebook reader. Next calender - just print a new one! Somhow I think some thing would becore more difficult. Bluetooth wouldn't have a standard nor would wifi or NFC. (If we went that far out) If making your own cell phone was a common thing, big companies like Nokia and HTC would probably not be so big again, and if the culture were that you build your own phone then maybe the big companies would be workshop places instead. Everyone could bold (or add if not available yet) the features they need more and omit or deactivate those they do not need or like. A large variety of cell phones could be found like: a cell phone working under water, one with professional camera, professional sound composing ability, one with very luxury case, one with infra red/dark vision, one with extremely low power consumption, flexible cell, transparent cell phone, and much more.

2. Thinking in the future and based on your experience at the workshop, what alternative ways maybe interesting to explore for making a cell phone?

Don't know. Connect it to cloud services. Like apps for the iphone, but simpler. How are my flowers doing? When is the next bus coming? I've actually after the workshop been looking at an arduino for some projects I'm not really sure about yet. And the GSM shell would make it possible to communicate in an easy way. In making a cellphone I don't really feel that there's much more to do than what Mellis have done. Maybe hacking around with the software a bit. A cell phone with glassily (transparent plastic) case would look cool. A smart phone with personalize (the creators own) apps.

3. What are your reflections on the workshop being organised as a social/community event? Was it good/bad to be done in this way? How else do you think it could have been structured?

I think it was structured fine. Good. Nice with different kind of background of people. The more obvious things like lack of good soldering irons could be improved. It was a great thing that there were other people around. Having multiple other people to ask for help was definately helpful. Maybe some more stuctured "program" could've been nice. So we could get started earlier. I was very good to be organised as social event.

4. As far as you got with making the cell phone, WHO do you feel made (or is making) your DIY cell phone? You / the other participants / some experts / some combinations?

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I feel that I made the phone with instructions from David. Combination. This is how actual phones are made as well, you get a chipset from a manufacturer. Make a pcb and some plastic designs. Program the stuff. Get it back from China. here we got to solder as well ;-) I did! Really! Okay, David helped with the micro controller, you ordered the parts and got the case cut but there was/is still sufficient stuff for me to do so that I feel that I made it. Me with help of many who have provided the basic blocks, technical information, organization of the event, and others in the group.

5. Reflect on your role in the workshop. What do you think your role was? What do you think your role was NOT? What did you want/expect your role to be?

I think my role was a participant and I expected that. I learnt some new soldering skills, and people learnt my soldering skills as well by looking at me. I had suspected I would have to solder other peoples boards, but luckily David did that so I was sort of allowed to speed ahead as fast as I could which was nice. Most unexpected thing was that Christoffer discovered some errors I had done when soldering the board, he wasn't sure on his mounting and looked at mine, but discovered errors I had made. Wrongly turned capacitors for the crystal etc. Would have taken me ages to discover. I was a participant, I was not in charge of the workshop. I expected to show up, instructed what to do and talk to the other participants. That was pretty much what was happening as well. I was expecting it would be like that some who aren't participants provide information, give instructions, supervise to help participants but it was like we a group with different levels of expertise who were making our own project while giving or receiving help to and from others. It was like being a member of a team that every body have their independent project. It was good. I would liked to be more involved in organization to make it better.

The DIY cell phone

6. Which do you prefer: making the cell phone on your own (Do-It-Yourself) or working with others (Do-It-Together)?

- DIY: 125%
- DIT: 250%
- Other: 125%

7. Comment on your response to the previous question. Why, etc?

I think it's good to get feedback from others and you can ask questions. I haven't really done this kind of things with others before. Need to try it out more. Usually when you work on projects with others professionally, you do your part and help out when someone is stuck. Solve a problem and then move on. But here everyone was doing the same thing so it was not a one-error-solved-move-on thing. Okay.. DIY sounds somewhat better but I was not at any time in
doubt that we were going to be running solo or not. Depending on the audience I would call it whatever fitted best. And for a bunch of young people like we (mostly) were, DIY is just much more attracting. And I don't think anyone at the workshop expected to actually do it on their own. In the first place its more fun to do it together. Its easier and more probable to succeed when sharing experiences.

8. What do you think are possibilities and meaning of DIY (Do It Yourself) and DIT (Do It Together) when applied to cell phone creation?

Don't know. Love to work the laser machine to do some new fronts and be inspired by others. In this case DIY and DIT is basically the same. As written above, no one expected this to be a solo performance, even though it was called DIY. DIY is simply a more broadly used term for home made stuff. DIY improves the ability for independent work and gives more feeling of I DID IT. But failure is more probable. DIT develops team work orientation and value of collaboration. The result would be better in term of success and learn others and learn from others.

9. Who else do you think could be useful to involve in making a DIY cell phone and why?

A person with a good soldering iron. There is a company in Helsingborg that does silicon vacuum molding (forgot their name, sorry). These molds last for about 10 pieces. Then from a 3d printed model, you could make 10 in real plastic... i.e real phones with curvy edges etc. A single or two more David type could be nice... If the audience is bigger. Else it was okay as it was. A combination of participants with different professions that is involved in the project such that even though each doesn't cover the whole know-how but the group together does. An expert for the package, one who can help with component organisation, etc.

10. When finished, would you like to use this as your phone? Why and why not?

Yes I would use my phone if it was finished but at the current state the phone is unusable. Case doesn't fit, screen broken etc. No, the cover seems to brittle. The phone is also to big to fit in a pocket. Yes. For some time.. with my smartphone in the other pocket. And probably for show-off! Yes, maybe some times but then prefer the normal phone I have because the phone I make is cool to have sometimes but it is not as efficient, convenient and capable in functionality as the normal phone is