Increasing awareness of mobile phone usage by peripheral interaction

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ABSTRACT

UPDATED—15 June 2017. The past century digital technology has seen a major up rise. Especially smartphones are used on a daily basis. This has a big impact on the way we interact with each other. Although it has a negative effect on face-to-face interaction there are too many benefits to just ban this technology. This research focuses on a way to make people more aware of their mobile phone habits rather than discouraging it. Using the theory of peripheral interaction a lamp was created called Litt. It was designed to make people aware of their mobile phone usage in an unobtrusive manner. Litt was tested for two weeks in 5 family homes. Quantitative data was collected about the time and frequency of the mobile phone usage for each participant. Qualitative data was gathered about the experience of the participants with Litt and their thoughts on the use of mobile phones in social context through group interviews. The quotes were analysed and lead to opportunities for further research as well as the conclusion that the information was not specific enough and Litt was not noticeable anymore after a few days.

Author Keywords

Peripheral interaction; mobile phone; mindfulness; awareness; ambient

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

INTRODUCTION

In 2015 more than 7 billion mobile phones were in use by the total world population and this number keeps increasing. [12] One can say that almost everyone on earth owns a mobile phone, a lot being smartphones. This increase of mobile phone usage has a big impact on the way people interact with each other. On the one hand there is a rise of spontaneous communication but on the other hand this rise has a negative influence on the quality of face-to-face interaction. As L. Srivastava states: "Interaction with those that are present can be interrupted at any moment by interaction with a remote other, leading to a scenario of 'always-on, always there' but 'never here'". [23]

Although these new technologies have a lot of negative effects on face-to-face interaction, they bring a lot of positive effects too. It is now possible to communicate with almost anyone anywhere just by the pressing a few buttons. This interconnectivity has created a more connected world and helped people to find similar minded. Therefore there is no need for an invention that bans the mobile phone completely. It is rather important to come up with something that regulates the usage.

Most research done on this topic and its influences on social interaction do not provide possible solutions nor do they look into the attitude of mobile phone users about their awareness of use. This research focuses on whether, how and why peripheral interaction creates awareness of mobile phone usage. Peripheral interaction is explored for this study as it is able to inform the user rather than overburden him or her with information. [24] This is done by doing a field study with Litt, a design that aims to create awareness of mobile phone usage.

THEORETICAL BACKGROUND

Mobile phone usage and its effects

In the past a lot of studies looked at the effect of the integration of the mobile phone in everyday life. The presence of the mobile phone influences face-to-face interaction in multiple ways. [13] The unpredictability of calls makes it hard for them to be anticipated and integrated into the everyday social life. It is also an unwritten rule to answer incoming calls or messages as soon as possible regardless of the current social environment. This also means that the presence of mobile phones makes the carrier less focused on the social interaction since every moment a message or call can come in, this in return causes irritation to the other parties present.

Since the smartphone has been widely introduced and social media has taken a flight, not only the possibility of a call or SMS, but all sorts of notifications are able to interrupt face-to-face interaction. For these notification the same effects as calls and SMS are present, although the frequency of these messages is higher. In a recent study it is concluded that people are depending more on their communication by mobile devices than before. [11] They also found that people experience conversations of a lesser quality when these devices are present, many are bothered when relatives or friends use technology when they are spending time together. This illustrates the importance for solutions regarding mobile phone usage in a social environment.

Periphery of Attention

In the paper Acting by hand: Informing interaction design for the periphery of people's attention [2] an interpretation on the theories of attention has been written. Our study bases its theory of peripheral interaction on this interpretation. The understanding of theory described in the paper follows on research based on these theories. Several interesting conclusions are drawn; There are four different clusters of peripheral activity. These clusters are fitting within the theory that suggests automated activity usually needs less cognitive action. It was also found that activities which were relevant on a personal scale were more often performed in the periphery.

The Coming Age of Calm Technology [24] describes the periphery of attention and the switch between periphery and center and its effects. They call the technology that is based on this switch a "calm technology" since it has a calming effect on its user. "Things in the periphery are attuned to by the large portion of our brains devoted to peripheral (sensory) processing. Thus the periphery is informing without overburdening" this quote presents the functioning of peripheral attention. When a person focuses his/her attention on the periphery he/she centres it and takes control. With this switch the periphery becomes: "... a fundamental enabler of calm through increased awareness and power". In other words, the knowledge that the information is available by switching focus provides the feeling of control which in return provides calmness. [16] This confirms the need of peripheral interaction in our design research, as we would like to increase awareness without creating information overload.

The feeling of being in control which provides calmness is also confirmed by mindfulness theories. Mindfulness is an attribute of consciousness. [22] Mindfulness-based cognitive therapy is used to help people suffering from a depression overcome their illness. However, aspects of it are now used in courses and books for everyone who wants to enjoy life more and live more in peace. [21] Its effects on mental health and well-being are positive. Awareness plays an important role in being mindful. Awareness is a constant feature of normal functioning, while mindfulness is an enhanced version of attention and awareness of the current reality. [14] Awareness is a first step in making mindful decisions. This illustrates the importance of awareness.

RELATED WORK

Ways to increase awareness

The most obvious way to bring mobile phone usage to the awareness is by using an application. These applications monitor and show how much time one has spent using the mobile phone. Examples of these apps are Checky and Breakfree. This however makes all things one does on one's mobile phone seem bad, while this is not always the case. Another way to become more aware of the use of one's mobile phone is mindfulness. This makes it possible that one is in control and makes a mindful choice whether or not to use the mobile phone. [1, 6] The importance of attention, an aspect of mindfulness, to gathering factual information on behaviour or subjective experience as a first step in making health-enhancing behaviour changes was discussed by theorists in the cognitive tradition. [22] ShutEye illustrates that using a peripheral display showing sleep hygiene recommendations makes people aware and thus more mindful of good sleep hygiene practises. It also illustrates that the awareness provided by ShutEye was most successful when participants looked at the recommendations as suggestions rather than rules. [5]

Next to this, a study was conducted on cell phone awareness using calendar information. The phone used the information from the calendar on the mobile phone to determine whether the phone has a loud ring, quiet ring, vibrate and whether it is switched on or off. Even though it was not always accurate, participants said they were willing to adopt it in real life. [16] There are several ways to increase awareness of mobile phone usage and also for other areas. Stimulating to make a mindful choice whether to use the mobile phone or not, rather than banning it altogether or making a decision for the user is the approach that we think is interesting to pursue in this research. According to us, this should not be done in an obtrusive manner. Therefore we look into how peripheral interaction can create awareness.

Designing for peripheral interaction

In the field of peripheral interaction several design related papers have been written as well as products developed. ShutEye shows that awareness can be created with a peripheral display on the mobile phone. [5] Sideshow is another onscreen awareness interface with the goal of helping people stay aware of large amounts of dynamic information without overloading or distracting them. Participants liked that they were able to see information in just a quick glance. [8] Next to displays on an already existing device like a computer or a mobile phone, research has been done on providing awareness information by means of tangible, aesthetic displays. We can learn from their research that this tangible approach is good, however the design should not stand out too much. Therefore making the design an everyday object is recommended. [10]

They state that it is important for these displays in order to be successful to require low cognitive effort. This knowledge is relevant for the design used in this study since it has the same function: providing information in an unobtrusive manner. [5] Mankoff et al. have presented a set of heuristics applicable to ambient displays, which can also be used to design for peripheral interaction. They also state that one of the heuristics is that the display should be unobtrusive and remain so unless it requires the user's attention. The user should also be able to easily monitor the display. The other heuristics are: useful and relevant information, match between design of ambient display and environments, sufficient information design, consistent and intuitive mapping, easy transition to more in-depth information,

visibility of state, aesthetics and pleasing design. [19] These were taken into consideration when designing Litt.

Evaluating

Whether people accept these kind of technologies in their environment is important in the process of finding out whether peripheral interaction can increase awareness of mobile phone usage. Acceptance of people towards a technology can be measured using the Technology Acceptance Model. This model uses the Perceived Ease of Use and the Perceived Usefulness as factors that determine the actual system use. [18] In a study about providing peripheral awareness of important information, the system was evaluated by means of quantitative and qualitative questions about the usefulness of the system. Another way of predicting whether people are going to use the technology is using the Theory of Planned Behaviour. Here, behaviour is determined by the intention, which is predicted by Attitude, Subjective Norms and Perceived Behavioural Control. This theory takes into account social factors as well. [20] In a study about predicting user acceptance of collaborative technologies a combination of the Technology Acceptance Model and the Theory of Planned Behaviour is used. It shows that the models should be enhanced to get valuable insights. [9]

However, just like Bauer [5] evaluating ShutEye, the goal of this paper is not to investigate whether we can cause behaviour change. Rather we would like to investigate whether we can increase awareness so people consciously choose themselves to use their mobile phone. Klasnja et al. have studied how to evaluate technologies in human-computer interaction research and suggested that the primary goal is not to measure efficiency. Behaviour change is very complex and long-term, so especially in this early phase of development, we should focus on how and why the system is used. [17] ShutEye [5], Calendar Information [16] and Sideshow [8] all confirm that gathering qualitative data by means of interviews, sometimes combined with a survey, is very valuable in understanding how and why people use a certain technology. Therefore a qualitative approach was taken in doing this research.

A study about evaluation methods for Ambient Information Systems states that the way to understand how people will make use of AIS is by conducting long-term in-situ studies, 'where the participant is allowed to own the technology and even forget about it'. [14] This is also done in ShutEye [3], Calendar Information [16] and Sideshow. Deployment 'in the wild' for a longer time is also recommended in literature on interaction design, specifically for designs that require peripheral interaction. [3] A study about Technology Probes found that probes can be successful in several ways. They help reveal practical needs and playful desires within families and provide real-life use scenarios to motivate discussion in interviews. [15] Klasnja et al. also address the importance of in situ or field evaluations in the early stages of development and the ability of this to discover unintended consequences of the design. [10] This caused us to make an actual design that could be deployed for a longer time.

THE DESIGN

For this research we designed a lamp, called Litt, that can change colour and can be connected to all phones through the home Wi-Fi connection and an application that we designed. It is powered by a 5V DC adapter and currently only Android phones are supported. The lamp is very compact and can be placed anywhere in the house near a socket. When none of the connected phones have its screen on, the lamp will emit a warm candle-like light. When at least one phone screen, that is connected to the home Wi-Fi network, is switched on, Litt will receive a command and starts to change its colour to a more bright and cold one. Litt therefore does not require a lot of cognitive effort (works in the periphery of attention) and is integrated in an everyday object. [10, 19] All commands received by the lamp are forwarded to and saved in a database, giving us next to the qualitative data also a set of quantitative data.

Figure 1. Mobile phone is not used, therefore Litt is orange

Figure 2. Mobile phone is used, therefore Litt is white

A pilot study was conducted with this design to evaluate whether the colours of the light suited the purpose and whether the light was noticeable in the periphery of attention. This was done by interviewing 5 students from the department of Industrial Design. The participants were asked questions about mobile phone usage at home and at the same time, the lamp changed colour. Afterwards they were asked whether they noticed the change of light, whether the speed was okay, and what they thought of the colours. All participants noticed the lamp changing colour in their periphery of attention. The lights contributed to a pleasant or less pleasant atmosphere depending on the colour, but the contrast could even be stronger. Therefore the colour of the light was adjusted.

2-WEEK FIELD STUDY

In this section the 2-week field study is described in which 5 families used Litt and evaluated their experiences with it. The goal was to find out whether peripheral interaction could increase the awareness of mobile phone usage. In doing this, we followed the recommendations of Klasnja et al. [17] and thus focused on how and why this technology might be effective in promoting behaviour change. This caused the study to be qualitative. Litt was deployed 'in the wild' for 2 weeks as this is recommended in literature. [3] [10] It is also the way that allows us to understand how people will make use of the design. [15]

Participants

The participants were recruited through word-of-mouth. They were recruited on several criteria: All the people who own a phone should own a mobile phone on which Android runs to be able to run the application. The family should preferably be a nuclear family (2 parents and their children) as it would represent different generations, so also a high chance of difference in mobile phone usage. The participant demographics are shown in Figure 3.

Study method

The study consisted out of three stages: placement of the prototype, using Litt for two weeks in the field and finally the group interview including a questionnaire.

Placement of prototype and field study

At least one of the researchers visited the family to explain the goal of the study, as well as how the prototype works and how the study will be performed. All participants had to sign a form of consent. The prototypes were placed in the homes of the families. Additionally, a booklet was given with the explanation of the research and the possibility to write noticeable things down. It was explained that they could choose to do anything with the lamp: place it somewhere else, switch it on and off at their own preferred times, etc.

Interview

At the end of the two weeks a 1-hour group interview took place within the family. This interview was recorded with the consent of all family members. Each member of the family was asked to fill in a questionnaire about demographics and their mobile phone usage. The data was made anonymous by giving every participant a number. This is all shown in figure 3. At least one of the researchers was there to ask questions about their experiences with Litt and whether it influenced the awareness of mobile phone usage. One of the interviews was done via Skype due to travel issues. At a given moment during the interview the data from the last two weeks was shown to them to possibly evoke interesting insights. This interview was in Dutch, as all participants were Dutch. A guideline for the interview can be found in Appendix I.

FINDINGS & DISCUSSION

Participant number (family number.idnumber)	Sex	Age	Occupation	Average time spent per day on mobile phone at home according to themselves	Average time spent per day on mobile phone at home according to measurements
1.1	M	19-30	Student (living at home)	>120 min	1 min
1.2	F	19-30	Fulltime job	>120 min	10 min
1.3	F	51-64	Parttime job	45-60 min	20 min
1.4	M	51-64	Fulltime job	60-120 min	-
2.1	M	51-64	Fulltime job	15-30 min	-
2.2	F	51-64	Parttime job	60-120 min	-
2.3	M	19-30	Student (not living at home)	15-30 min	62 min
2.4	M	13-18	Highschool	>120 min	7 min
3.1	F	19-30	Student (not living at home)	>120 min	3 min
3.2	F	41-50	Parttime job	60-120 min	75 min
3.3	M	51-64	Fulltime job	15-30 min	5 min
3.4	F	13-18	High school student	>120 min	83 min
3.5	F	19-30	Student (living at home)	>120 min	1 min
4.1	M	19-30	Student (living at home)	60-120 min	2 min
4.2	F	41-50	Parttime job	45-60 min	28 min
4.3	M	41-50	Fulltime job	30-45 min	1 min
4.4	M	13-18	High school student	>120 min	36 min
5.1	F	41-50	Parttime job	45-60 min	6 min
5.2	F	13-18	High school student	>120 min	61 min
5.3	M	41-50	Fulltime job	No mobile phone	
5.4	F	0-12	Primary school student	No mobile phone	

Figure 3. Participant demographics and time spent on mobile phone at home

For the qualitative data we first got familiar with the data and transcribed all the interviews. We generated initial codes and after that searched for themes. The data is clustered without a predefined coding scheme. The clusters were formed during the analysis. These themes have been reviewed several times. [3, 7] To avoid bias, another researcher without a lot of prior knowledge about the study clustered the quotes. After this process the quotes were translated from Dutch to English. The quantitative data showed to be very unreliable because of malfunctioning of Litt and was therefore not taken into consideration. This was not a big issue as the focus of this research was on the qualitative data.

Awareness

There were some participants that felt they became more aware of their phone usage:

"You do think about it more often, since you spent a lot of time on the thing." - 3.3

"At the start I became more aware of my phone usage, especially when I switched it on." - 2.3

"The first couple of times I actively thought about the usefulness of my phone usage." - 2.3

"Yes, especially in the beginning it was like oh *4* is using her mobile phone again." - 3.4

"We talked a little bit about it sometimes." - 3.3

More participants however thought Litt did not have influence on them and did not increase their awareness of mobile phone usage.

"But I did not get a specific influence from the lamp." - 1.1

"Yes, me neither, but at the start I looked at it." - 1.4

"It did not really have an effect on me." - 5.1

It is interesting to see that there are really two different experiences. The period of two weeks did weaken the influence Litt had for the people that felt an increase of awareness. It can be said that Litt has influence on certain people but only for a limited amount of time.

Habituation

Most participants thought they were not aware because they got used to Litt very quickly.

"Yes I guess only the first weekend we became more aware." - 3.4

"Yes you get used to it rather quickly." - 3.5

"There sort of was habituation" - 4.2

"Yes after the first day already actually." - 4.1

"At the beginning of the test we were busy with it, but after a while we were not really paying attention to it anymore. Our mobile phone usage did not become less." - 5.1 (from the booklet)

As stated in the awareness section, Litt only had an impact on the participants for a short period of time. The habituation was mostly to blame for this. Litt became a normal thing and the unobtrusiveness of the design had little impact after the novelty faded away. The design was maybe too much of an everyday object.

Noticeability

Many participants stated that Litt was not very noticeable. Habituation, the location and possible other variables could have caused this. It was for example summer, so it is possible that the light was not intense enough.

"Especially at the start it was noticeable when you turned on your phone and the lamp changed in the

corner of my eye. But soon enough I was too focused on my telephone and did not watch it anymore. Therefore it mainly showed the telephone usage of others." - 2.3

This participant also said that the colour of light was not really striking, it was rather the change of light. As soon as it changed, he noticed it, and after that if blurred into the background again while using his phone.

"At the start we looked at it a lot and at the end well you don't really look at it anymore. You just stop noticing." - 1.4

Klasnja states that certain things only become visible after a certain time using the system in the field instead of relatively short traditional lab-based usability evaluations. [17] The two week period of the experiment showed us the lack of noticeability and the role of habituation.

The location of Litt in the environment could have influenced the noticeability. As participants placed the device on the location of their own preference. Some examples:

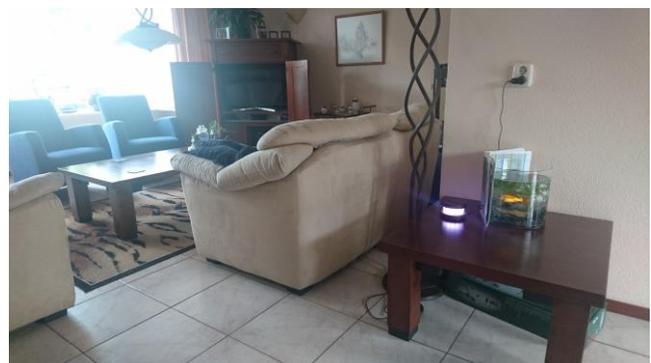**Figure 4. Litt placed behind the couch (family 1)**

Figure 5. Litt placed in the center of the living and dining room (family 3)

Figure 6. Litt placed on top of a cabinet located in the living room (family 4)

Figure 7. Litt placed in the center of the living and dining room (family 5)

From these examples you can see that the participants tried to integrate Litt in their home environment. In some cases this lead to a low noticeability location.

Litt as a monitoring tool

Finding unintended consequences during a field study is stated as a useful insight when doing field study by Klasnja et al. [17] Many parents shared their concerns regarding their kids mobile phone usage or their gaming habits and stressed this during the interview. The use of Litt in one case was very interesting as derived from the following quote.

> *"It did have influence on "person 4".*
> *We told her that the red colour of the*
> *lamp indicated when she used the*
> *iPad for too long. So as soon as she*
> *noticed the lamp being red she asked*
> *'daddy can we go outside now?'" -*
> *5.1*

The iPad did not function with Litt and to tell person 4 that the colour red, which indicated no usage of mobile phones, meant she spent too much time on the iPad was an interesting form of unintended use. Other families also indicated that

monitoring their kid was something they found useful or interesting.

> *"We struggled a bit with the fact that*
> *4 games a lot and uses his mobile*
> *phone quite often. We would actually*
> *like to keep an eye on that and the*
> *lamp is good for that." - 2.1*

This unintended case of use could be explained because the lamp did not only change when someone in the same room switched on his or her screen. Instead, all the phones in the entire home were connected. We were not able to program the device in such a way that the lamp would only change if a mobile phone screen in the same room was switched on. This probably caused some parents to think of the design as a monitoring tool to check up on their children. The purpose of the research was initially directed at increasing awareness of mobile phone usage at times when social interaction was possible.

Data

During the interview the participants were asked if they would like to see the data of their registered use. All reacted positively to this question and were confronted with the data.

> *"Well I do think it will confront you*
> *when your usage is higher than*
> *expected."- 3.5*

> *"If you could see this data on an app*
> *then I would regularly check it." - 1.1*

> *"If you could see at the end of the*
> *week per person the difference in*
> *duration online, it could maybe lead*
> *to more awareness." - 2.2*

Although the data was not very accurate, their experiences from showing this mostly resulted in reactions similar to the ones above. The participants shared their need for more accurate data to feel more confronted with their and each other's use.

No need to change behaviour

Many participants were not feeling like their behaviour had an impact on their life or on the ones around them. This led to them having no intention to change their behaviour. In some cases the use was so minimal that indeed it did not impact their surroundings.

> *"We had no intention to use our*
> *phones less. I can image it having an*
> *effect when you do have the*
> *intention." - 4.2*

The fact that there were guidelines on mobile phone use in some households also made the placement of Litt unnecessary in certain situations. The fact that there were rules in some families, implied already a sense of awareness.

*"For example, when there is a party
or during dinner I don't allow them to
use their phones." - 1.3*

Or they were simply not home together a lot and when they were the phones would not be used.

*"We were not together at home a lot."
- 1.1*

This overall lack of need to change behaviour was remarkable in some cases since they are often irritated by the use of others but do not feel like their own use is bothering other people. Participants were mainly blaming each other of abusive mobile phone usage during the interviews, but thought their own mobile phone use was useful and not too frequently.

*"I don't think she is bothered by my
phone use." - 5.1*

*"My opinion about using your mobile
phone all the time is that you do less
together (...) You communicate less
with each other." – 5.3 (parent
without mobile phone)*

*"We (2 and 1) are not really busy
with our mobile phones and if we use
it, we mostly use it for a reason, but it
seemed interesting to keep an eye on 4
a bit better." - 2.1*

Looking at this we maybe should have recruited other families that were willing to change their behaviour regarding mobile phone usage. However this research was not about changing behaviour, but rather about increasing awareness.

Limitations
Every experiment has its limitations and side effects. Our participants probably became more aware of their use already by participating in the study, this indirectly influenced the effect of Litt on their awareness.

The participants were free to use Litt in every way possible. Unfortunately from the interviews it became clear that they felt obligated to leave it as placed and turn it on as much as possible so the researchers would get good results.

On the downside Litt did not work how it should have worked all the time, this had an influence on the participants as well and it made them frustrated with Litt. This made them focus more on 'is it working?' then on 'am I using my phone too much?'.

*"Mom becomes hysterical when she
thinks the lamp does not function
anymore." - 1.1*

*"When you look at the lamp and
think: 'hey this isn't correct'. When it
is white while it should be red and red
when it should be white." - 4.3*

The quantitative data also showed to not be reliable when analysed with common sense and compared to the averages the participants indicated themselves. Therefore it was not used to draw conclusions from.

Opportunities for Future Research
For the future it could be interesting to look whether sound as a peripheral interaction has more effect. This is researched successfully in a paper on peripheral interaction in primary schools for teachers. [4] It was also suggested by some of the participants as a better way to become aware of their mobile phone usage.

With a design like Litt, a different location or context of use could be researched. Places where it is almost always undesirable to use a mobile phone, like a restaurant, could be studied as well. An example of a different use case is to target it at parents to monitor children. As it could be seen in family 5 that the youngest daughter really wanted to go outside when the light turned orange for a longer time, because her family told her that orange meant that she was on her tablet for too long.

It could also be interesting to show more than just the colour of the lamp, so people could extract more detailed or specific information from it when they want to. It is also stated in the heuristics for evaluating ambient displays that the system should provide enough relevant information with an easy transition to more in-depth information. [19]

When it appears that peripheral interaction can actually increase awareness of mobile phone usage, a next step could be to do research about how awareness of mobile phone usage created by peripheral interaction influences social interaction.

CONCLUSION
This research focused on finding out whether peripheral interaction could increase awareness of mobile phone usage. This can be done to a certain extent. However a design to increase the awareness should be more noticeable and the information it displays should be more specific to be interesting for more than a few days. Apart from this, the question also arises whether one wants to be aware of mobile phone usage. It became clear that the participants mainly thought the behaviour of others should be changed, and not necessarily their own behaviour.

ACKNOWLEDGMENTS

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APPENDIX I – INTERVIEW GUIDELINES

How did you experience the use of the lamp?

Would you use this again? Why (not)?

How was it used? When was it on/off? Where was it located?

Did it bring changes?

Do you think you are more aware of your mobile phone usage?

What was most striking? The white or orange light?

Was the lamp used as an argument to put away the phone?

Did the lamp have influence during these two weeks as far as you know?

Did you talk about it?

Did you notice it?

What would you want differently?

Did you discuss it with people outside your family?

Was there a difference between the first and the second week?

What happened when you saw the lamp changing? What did you think? Could you give an example.

Do you want to see the data? Why?

APPENDIX II – REFLECTIONS

Daan van Driel

Introduction
Past semester I have been working on a research project within the Seamless Interaction design squad. Together with two fellow students I developed a prototype and have set up a user study to test a research question. The research question was as follows; "Can peripheral interaction increase the awareness of mobile phone usage?" The goal of our research was to find out if we could make use of peripheral interaction to raise someone's awareness about his or her phone use. Roughly the project was divided into two parts; firstly setting up the research and building the prototypes, secondly conducting the research and analyzing the findings. I liked the structure of this division so I adopted it in my reflection.

To start off I want to mention that I had a great team. We all had different strong points which complemented each other real nicely. My role within the team concerned making the prototypes and gathering the qualitative data. Besides those tasks I helped the rest with conducting the research and analyzing the data.

Conception and realization phase
As I really like to invent and build things this part of the project was most fun and close to me. The main difference opposed to design projects that I had done before was that the prototype now served to find an answer to the research question. I was used to expect building the prototype entirely by ourselves anyway, but this time I took more time exploring the different possibilities to test our research question. Our goal was to make people aware of their phone usage with the least possible obtrusion, so the prototype had to be unobtrusive. Therefore I looked into using Philips hue lamps to use in the research. This would have been perfect since the participants would already have been accustomed to having the lamps in their home. Unfortunately we were not able to find enough families meeting our requirements while also having a hue system at home. Eventually this resulted in building our own lamps anyway.

Building the actual lamp I learned some new skills; a better understanding on using databases and php, more in debt knowledge on programming ESP microcontrollers and how to make simple android applications.

Setting up and conducting research
The second part of the semester was less close to me and I did more things that were new to me. First of we had to deploy the prototypes in people's homes. One thing that really stuck to me is that you can never perfectly predict the user. One example had to do with the android application I made. This simple application was purely meant to detect whether the screen was on or off and I made it with zero attention to the UI as it only had to be opened once. It gave some serious troubles however during the deployment. I had spent quite some time developing the app and little things like getting no feedback from the input had become normal to me, but for some users this was very confusing. This made me realize that I should never forget to take a step back and evaluate the project from the user perspective as well. Something simple as walking through the app with a few random people would already have given me enough feedback to prevent this from happening.

Gathering data was new to me as well. Especially conducting the interviews and collecting qualitative data. For the first time I transcribed an interview and experienced how hard it is to get meaningful data out of it. After eventually having gathered all the data we had to analyze it. I had never analyzed data from interviews before and therefore had no idea how to do it. Luckily Saskia taught us a good method to do so. I now know how to analyze qualitative data by searching for quotes and ordering them into themes.

Sam van der Horst
In this reflection I look back at the Design Research Project I did the past semester in the Seamless Interaction for Everyday Life squad. During this project we researched how we can increase the awareness of mobile phone usage by peripheral interaction. In order to do this a design was made and developed 5 times in order to test our research question. This testing was done with five families over a period of two weeks and afterwards group interviews with each family were held. The results were analyzed and a paper was written.

Over the course of this project I experienced the perks of having a really tight and effective team. We all had our separate skills and knowledge which complemented each other perfectly. My role in the team would be the connector. Helping Julie mostly with the research related part and Daan with the technical tasks. But they also helped me with my tasks. This team really taught me the value of good teamwork. This experience contributes greatly to my *Teamwork & Communication* competency.

This project forced us to make fast design decisions. I learned a lot from the pressure of making a working design and repeating it 5 times in the first half of the semester. This made me think about ease of production but also cost and materials.

The designs had to function for a long period so the robustness was a very important factor as well. Also designing something that would fit in many people's home environments was a very useful experience. This whole process contributed greatly to my *Creativity & Aesthetics* and *Technology & Realization* competencies. Basing the design on previous research done by others was important to be able to justify our design decisions since we were unable to evaluate them all.

As it being a research project the research would of course be the essential part of the project. This was nothing compared to previously done research and user tests in electives and projects. Doing extensive and well planned research with multiple participant groups turned out to be very complicated. The recruitment of participants taught me that planning is essential as well as being very clear in you communication to the participants.

The Android compatibility of our device made the test group smaller than expected, which led to a participants coming from all over the country. Having to make a planning for installing the research device and after the research period arranging group interviews was very complicated. With the installment the whole group was present to meet the participants and help each other with the briefing and technical issues. Teamwork in this case again proved to be essential.

Transcribing and analyzing the interviews was new for me since I had never done this kind of research before. It was a very time consuming task to transcribe part of the interviews. Helping Julie with the final categorizing of the quotes really showed me the process of grouping and analyzing and the importance of doing this together.

The overall approach of this project was largely new for me and I can safely say that compared with previous project this one taught me the most. I will use a more design process version of the used approach in my future projects. Doing research with people outside the department brings the most interesting results and they generally represent a better sample of your projected user.

This project mostly contributed to my *Design & Research Processes* competency. But also to *User & Society* and *Teamwork & Communication.* When doing my final bachelor project I will definitely use the knowledge and skills I have gained over this past semester.

Julie Moens
This semester I did a design research project in the Seamless Interaction Design for Everyday Life squad. I wanted to apply the knowledge I gathered during Design<>Research in my project as that course did not provide me enough time to do everything well. I also wanted to learn how to work with quantitative as well as qualitative data and I wanted to get more experience with rapid prototyping. Furthermore this squad was on my list for a long time already, so I also wanted confirmation on whether I like working on this design topic.

I was able to apply the Design<>Research knowledge and skills to the fullest as I took the responsibility of the research paper. I saw that this was my chance to discover whether I liked doing research as I did not really like it during Design<>Research due to the chaos and incredible time pressure. This project I took the responsibility of research instead of communication and project management for once. This means I played a big role in defining a research question, as well as looking for theoretical background and related work. This project allowed us to go through different iterations and reflect on this work several times. The practise together with the lectures made me feel that I get what writing a research paper is about and that I discovered that I actually really like the whole process.

It did not really work out to work with quantitative data as the reliability of it was too low. Also the importance was not that high for our research. It provides me with a future learning opportunity. The qualitative data however was very interesting; from recruiting participants, to interviews, to processing and analysing, to finally presenting. All the practicalities that come with arranging families and interviews were quite hard to deal with. However it went quite smooth at the end. Although transcribing the interviews was not my favourite task, I did learn a lot from it. I learned that next time I could even dig deeper to find answers and I sometimes tend to ask leading questions and not finish sentences. Analysing the data was one of the things that I found really satisfying. I also discovered by doing the Strengthsfinder test that one of my strengths is 'Analytical'. This really was confirmed during the analysis of the results in which we clustered the quotes. With more time, we could have done this more elaborately and ended up with a better findings & discussion section. However I think that it is very valuable that I discovered that I apparently find looking for relations very interesting. I can use this knowledge in my upcoming study and career decisions.

Regarding rapid prototyping I have not really fulfilled my goal. As I focused on the research a lot, I was involved less in the actual making of the prototype. I tried to do some electronics and formgiving, but I realised that this was the ideal opportunity to learn more about research. There are a lot of other opportunities to learn about rapid prototyping in the future that I already planned. That is why I decided to focus more on research.

It was confirmed that I really like the topic we are working on in this squad. I think I like it because the subjects we focus on are subjects we deal with every day and taking into account a large audience. In this project there were a lot of other things

that were confirmed as well. What I learned from previous projects and courses is that documentation and argumentation is very important. I tried to keep that insight in mind throughout the whole process. It was again confirmed that it is indeed very important. Next to that, peer reviewing also confirmed some things I had already learned before. My critical attitude improved, as well as dealing with feedback. In the past I had a really hard time with receiving feedback as I always took it personally, and I can now see a lot of improvement in that area. I even asked feedback from people I know that were not familiar with the research. Regarding team work, it was confirmed that I like to work with people who take initiative. Working together went really smooth because everyone was motivated. We did a lot together and helped and supported each other constantly. We even took part in a design case as a team for Breman about future homes, which also improved the team spirit. I still took care of planning and organisation mostly, this seems to be something I cannot help not to do. This is not a problem, however it is very useful to know about myself to improve teamwork in new groups.

Although I did not reach all my learning goals fully, I got to know myself, my skills and my interests better. This project helped me to develop myself towards an academic industrial designer and contributed mostly to the expertise areas of *Math, Data and Computing* and *User and Society*. I want to find out what I would like to do with my analytical skills and whether writing papers is something I would like to pursue. In short, this is a project that has a large impact on my identity and vision as a designer. Together with my internship it will help me choose what I would like to do in the future.