Materializing social presence: Exploring the Internet of Things using a Research through Design approach

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Abstract

This thesis examines the role connected devices in the home could play for maintaining and taking care of close relationships of people living apart. Communication tools nowadays offer many different ways of communicating and they are mostly focused on mobile devices. Social presence describes the feeling that humans have when communicating with each other and can be mediated through communication tools in different strengths. The Internet of Things is one rapidly developing branch of contemporary technology and estimates say by 2020 about 200 billion devices will be connected. This research focuses on the possibilities the Internet of Things offers to the notion of social presence in the domestic setting by exploring how we feel interrupted by current devices: Through a Research through Design approach, alternative concepts will be developed to materialize the feeling of social presence.

Keywords

Social presence, closeness, tangible interaction, IoT, research through design, domestic setting, interaction design
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1. **INTRODUCTION**

1.1. **Motivation**

One rapidly developing branch of contemporary technology is the Internet of Things. Knutsen et al. (2011) describe IoT as “a near-future scenario in which physical structures and objects communicate through and with the internet” (Knutsen, Martinussuen, Arnall, & Morrison, 2011, p. 196). Although there is no common definition of IoT, the terminology describing IoT mostly involves technical terms, as in a network, services, infrastructure, protocol etc. Approaching IoT from this technical point of view, there are issues around the infrastructure of systems, architecture, networks, privacy, data protection and so on that are and have been investigated and explored by researchers. But even in research groups that investigate IoT from a more human-related point of view, technical definitions prevail (Koreshoff, Robertson, & Leong, 2013, p. 335). Koreshoff et al. (2013) examined and reviewed HCI-related literature and commercial products dealing with IoT. One of their findings was that “much of the literature […] was technologically-focused explorations of how new technical systems can support particular domains and activities.” (Ibid, p. 341) From an interaction design point of view, there also arise questions about the physicality and materiality of IoT and the influence those qualities have on humans. “Commercial products did not include any unique forms of interaction when compared to the HCI-related literature we reviewed. However, some forms of interaction were much more common in commercial efforts. These include direct interaction with the object, environmental alteration and mobile app notification.” (Koreshoff et al, 2013, p. 342) Direct interaction with the object opens up to the field of tangible interaction. Tangible interaction defined by Ishii et al (2012) “expands the affordances of physical objects so they can support direct engagement with the digital world” (Ishii, Lakatos, Bonanni, Labrune, 2012, p. 38-40). In their paper, they describe a future scenario in which “materials […] can change form and appearance dynamically, so they are as reconfigurable as pixels on a screen.” (Ibid, p. 38) Even though technology is not able to realize Ishii’s scenario yet, there are many different ways to interact with IoT products. With these products aiming to support, help, enrich, accelerate and simplify the life of humans in every aspect of the day, there arises the question of when we want to manipulate objects manually and when we want systems to take over.

In research and on the market, there is a lack of focus on the human in IoT. Even in so called social IoT, research tends to look into the technical direction, namely what objects can learn from humans. Aztori et al approach “social objects” from this point of view. They suggest to give “social like capabilities to the objects in the internet of Things” (Atzori, Iera,
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Morabito, 2014, p. 97) while accentuating that their suggested social network is established between the objects “owned by humans who may have no connection with each other.” (Ibid, p. 100) The focus lies on the networks of objects and the interaction between device and human. But how about using the IoT to strengthen human-to-human interaction?

According to Intel, there were 2 billion connected devices in 2006. But numbers are expected to increase drastically. Intel projects the existence of over 200 billion connected devices by 2020 (Intel, n.d.). Intelligent products will be all around us and yet, there is not much research about how significant they are to human beings.

Aside from our work/school/university, we spent a big amount of our time at home. Home IoT nowadays is mostly specialized in securing the house and improving energy consumption. There are also endeavors in other fields, for example entertainment, but security and energy prevail until now. But a home has an intimate setting. It is the place for people to withdraw from the outside world and where specific people have access to. It is an area where we can and should explore our relationships with connected devices, the data they transmit and human interaction from a human-centered point of view. Through research in this direction we can identify what data and in which scope it might be of meaningful value for different kinds of social interactions.

1.2. Research Questions

In order to do so, I want to explore how we communicate and maintain relationships with people we are close to emotionally but far away physically in the present. To develop products and services that are meaningful for people, we have to understand what role objects play in forming and maintaining relationships of humans living apart.

In general, this thesis will be considered with the following questions:

- How can social presence be materialized to convey the feeling of being close?
- How can we design for/against interruptions?

1.3. Proceeding

This thesis explores close relationships: close relationships we have with people and close relationships we have with objects. The knowledge contribution will be to explore how the feeling of social presence can be conveyed through IoT.

The aim is to create concepts of how these objects could play a meaningful role in the life of human beings.
This thesis is mainly structured in five parts. To form the basis of the thesis, the first part examines the theoretical grounding of the related topics. These topics are concerned with IoT, tangible interaction, emotional design, distant relationships, social presence etc. In the second part, the methodology will be elaborated on. The third part describes the design process and the outcome of the project. The last two chapters summarize this thesis and discuss it critically.
2. THEORETICAL FRAMEWORK

This section describes the research background of this thesis. First, the Internet of Things will be looked at from a research angle. It will be elaborated how Hybrid Products are related with IoT and how IoT opens up to the concept of tangible interaction. Concluding with the definition of Social IoT, it will then be explicated how relationships are described through the terms closeness and social presence. Communication technologies will be looked at from a critical standpoint. This section completes with the description of commercial and research projects related to the topic.

2.1. IoT & Research

As mentioned in the introduction, the Internet of things is a big technical, commercial and present topic in the HCI community. As Koreshoff et al (2013) examined and reviewed literature in the field of HCI and commercial products, they found out that most explorations were technologically driven. (Koreshoff et al, 2013, p. 341). Since no mutual definition of the term IoT exists, there is also no technological standard. This means, there is a lot to be explored technologically. Jenson et al propose for example the Physical Web to solve infrastructural problems with today’s IoT (Jenson, Want, Schilit, Kravets, 2015). There are also efforts on making people trust in the IoT. Pignottis et al (2014) investigated “how Semantic Web technologies can be used to manage information about IoT devices so that their capabilities are transparent to users.” (Pignotti, Beran, Edwards, 2014, p. 61).

Aside from the technical point of view, there is also a shift on the purpose of technology. “For a long time we’ve been buying technology because of the utility it provides, but increasingly connected technology will enable the products in our homes and living spaces to deliver better experiences.” (Knapman, 2016) In order to deliver better experiences, there is a need to study the experience people have with products. Humans engage in activities to satisfy psychological needs. An experience is the outcome if that action is successful. (Hassenzahl, Klapperich, 2012, p. 22) Hassenzahl and Klapperich explored how people experience the activity of brewing coffee. They let testers use a manual coffee machine and an automated one. The outcome of the study was that the focus of the testers changed with the machines: while people enjoyed the process of making a coffee with the manual material, they focused more on the outcome with the automated machine. Hassenzahl and Klapperich conclude: “Rather than ‘designing away’ everyday chores to have more ‘free time,’ we believe design should find ways to mediate everyday activity through technology to make it experientially richer.” (Ibid, p. 29)
In order to design for experience, we have to look at explorations that have been done in interaction design that investigate the experience of humans with objects.

### 2.2. Tangible interaction and Hybrid Products

Through the work of Hornecker, materiality and physicality of objects were recognized as key aspects for shaping the experience of technology and tangible interaction. (Petrelli Soranzo, Ciolfi, Reidy, 2016)

Tangible interaction is a subfield of interaction design which is strongly coined by Ullmer and Ishii's description of tangible interfaces as “giving physical form to digital information” (Hornecker, Buur, 2006, p. 438). However, Hornecker and Buur define tangible interaction with a broader scope. For them, central to the concept are “tangibility and materiality, physical embodiment of data, embodied interaction and bodily movement as an essential part of interaction, and embeddedness in real space” (Ibid.). They call for focusing on the interaction rather than the interface.

Knutsen et al (2011) coined the term “Internet of Hybrid Products” in order to create a term that focuses on the “conceptualization of the Internet of Things at the level of products, communication, and culture” (Knutsen et al, 2011, p. 196) instead of solely technological possibilities of IoT. They argue that “physical, networked, and interactive products are intertwined with digital services” (Ibid.) and therefore different domains of design need to merge to create Hybrid Products. Physicality in Hybrid Products was further investigated by Bjertnæs in 2013. He defines physicality as the representation of "the located body, tangibility and materiality of hybrid products" (Bjertnæs, 2013, p. 2). He argues that the physical representation of the product deserves more attention in the design since it needs to “communicate the intangible and invisible services and networks” (Ibid. p. 4).

Recent research in tangible interaction has been done on different aspects of tangible interaction. Petrelli at al (2016) explored “the Aesthetics of Tangible Interaction” by systematically investigating user’s perception of hybrid objects that differ in shape, size, material and behaviors. This research solely explores aesthetics, so the objects do not have any purpose or utility. The findings of Petrelli et al suggest that form, material and behavior affect the human’s perception of an artefact and they identify seven psychological key dimensions. For example, participants named more positive terms for vibrating behavior than for sound, spheres were rated more positively than cubes and the choice of the material has impact on playfulness. They conclude that interaction design needs to “open[…] up to creative ways of combining material and digital” (Petrelli et al, 2016, p. 106). Schmid et al (2013) investigated how a specific material can “inspire the implementation of tangible..."
interactions” (Schmid, Rümelin, Richter, 2013 p. 91). Their research focused on using glass as material to create more meaningful and richer interactions. They encourage designers to explore other rich materials like wood, plastic or metal. A very interesting exploration in materials is “Understanding and Designing with (and for) Material Traces” by Robbins et al (2007). In four studies, the product designers explore how material traces can serve as “texture for communication and interaction.” (Robbins Giaccardi, Karana, D’Olivo, 2007, p. 1) They investigated relationships between people and objects and developed a conceptual connected object based on their findings. Other explorations in this subfield include for example focusing on “the Behavior of Interactive Objects” (Spadafora, Chahuneau, Martelaro, Sirkin, Ju, 2016) and “Prototyping Speculative Objects for the Internet of Things” (Jenkins, 2014). However, one of the most influential papers is “Radical Atoms, Beyond Tangible Bits, Toward Transformable Materials”. Ishii et al (2012) describe a future material which goes beyond tangible interaction by giving “all digital information […] physical manifestation so that we can interact directly with it” (Ishii et al, 2012, p. 38).

Relating this research to the Internet of things opens up an interesting design space to explore relationships between humans, objects and data.

2.3. Social IoT
Humans are social beings. We need human contact to survive and we depend on each other. The Social Internet of Things describes the objective of the Social IoT paradigm to give objects the chance to build their own social networks in order to separate the levels of people and things. (Social Internet of Things, n.d.) Atzori et al (2014) elaborate on this paradigm in their paper. According to Atzori et al, objects should be able to interact with each other autonomously but with respect to the owners, discover services and information and be able to announce their presence in the network in order to provide services (Atzori et al, 2014). Guo et al propose to explore the “harmonious’ interaction between human and IoT” they named “social side of IoT” (Guo, Yu, Zhou, & Zhang, 2012, p. 925). Their project, Opportunistic IoT, describes a connection of devices based on “the movement and opportunistic contact nature of human.” (Ibid.) They describe a scenario in which IoT is “the primary media to sense and monitor human behaviours” (Ibid.) and at the same time is affected by the human behavior. Jara et al (2014) highlight the possibilities that the big data offers to describe human behaviors and activities in real-time. They see a big potential of “new applications, patterns and understanding” (Jara, Bocchi, & Genoud, 2014, p. 584) that can be reached in order to improve human behavior. (Ibid) Even though researchers call this
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area “social”, which one might think is concerned with humans, it is again considered with the technical side of IoT and how to improve the infrastructural organization and sense-making of data in order to develop IoT products and services. What is missing in this research area is the kind of Social IoT which explores and inspires the social interaction between humans.

2.4. Human Relationships, Interaction and Communication

Our physical and mental well-being is strongly connected to our social interactions and belong to our very basic needs. (Maslow, 1943) In social studies, there are several phenomenological concepts describing interpersonal relationships. Closeness, empathy, emotional awareness or intimacy are common concepts that are concerned with the human experience of relationships. Gooch and Watts (2014) explicate that participants in several studies have issues understanding or distinguishing these concepts clearly. They propose closeness as a familiar, informal concept that “reflects a more enduring understanding of how an individual thinks about their personal relationship with another”. (Gooch, & Watts, 2014, p. 662)

Technology is ever evolving and has changed during the last one hundred years significantly, but Norman highlights how communications persists to be one of the essentials in human life. (Norman, 2004, p. 148) Kirkpatrick et al (2006) identify distance as one of the most problematic topics to overcome in any relationship. Distance is considered an obstacle because it makes it more difficult to fulfill the “physical, psychological, [and] emotional” needs. (Kirkpatrick, Duck, & Foley, 2006, p. 119) Communication technologies play a significant role in maintaining the relationship. Nowadays we have an abundance of choices between calling, texting, video calling, leaving messages through different services and on several devices. Those communication tools “can support personal relationships by facilitating a welcome and timely presence of an absent person in the mind of the other.” (Gooch, & Watts, 2014, p. 661)

2.5. Social presence and interaction design

Gooch and Watts (2014) studied how social presence impacts the feeling of closeness in personal relationships. Social presence is a concept in communicative research that describes a “short term feeling which is only experienced during an act of communication” (Gooch, & Watts, 2014, p. 663). “SP functions by highlighting the relationship with the other person in the mind of each interlocutor through the acts of communication they share.” (Ibid.)
“By relating the two concepts to each other, we can demonstrate that by creating technologies that help to create emotionally significant experiences during acts of communication, designers have the potential to help support personal relationships in a more meaningful, long-term fashion.” (Gooch, & Watts, 2014, p. 664) One of the most notable findings of their research was that “the instantaneous impact of Social Presence during a communication act impacts upon the longer-term feeling of Closeness between the people in the relationship.” (Ibid, p. 670) Further findings suggest that the feeling of closeness can be felt and maintained regardless of the communication technology being used. Gooch and Watts suggest designers to focus on maximizing the experience of social presence in the development of technology. Social presence is rated the highest in face-to-face communication. Relating the feeling of social presence to technology, the ones which are rated with high social presence contain elements of people’s person-hood. That means, those technologies involve elements of people’s uniqueness, as in their voice, or face. In addition, those technologies are using fleeting communication, so the communication is happening in real-time and there is no permanent trace after it ended. Examples are telephones or using Skype. Technology low in social presence ratings do not contain personal elements and the majority is asynchronous. The messages are of a more permanent nature, like SMS, Email or Facebook. (Goosh, & Watts, p. 667ff)

“Of most interest is the fact that distant partners are predicted to have a significantly higher SP score than co-located partners. This is perhaps unsurprising; in distant relationships communication technologies are the primary means of communication. This is likely to increase the emotional meaning of these technologies compared with co-located relationships. Similarly, the limited opportunities for face-to-face communication in distant relationships is likely to increase its meaning when it does occur.” (Goosh, & Watts, p. 668)

2.6. Communication tools & interruptions

In the present time, we have many different opportunities to stay in contact. There are classical landlines with telephones, we have mobile phones, tablets and laptops. Basically, we can connect everywhere. As mentioned before, there are synchronous tools to communicate like a phone or a video call. And there are asynchronous tools to send text messages, pictures, emoticons, video or audio messages. All these possibilities are offered by different services, like Whatsapp, Facebook or Skype. They combine different types of media and can be used on different devices. Everything is connected and users get notifications on a regular basis everywhere.
Rushkoff (2013) wrote a social and cultural critique in his work “Present Shock” where he describes the effects on living in the digital age. With the technology of today, we broadened our scale of effect to a global reach. We can contact somebody on the other side of the world and have an effect there. He describes how we have virtual personas and they can be reached no matter where our “real bodies” (Rushkoff, 2013, p. 72) are. He elaborates on how this effects our perception of time. Whereas in former times, time was defined by natural causes, like light, weather or seasons, nowadays we are attuned to the chronological time which has a dividing character. Time has changed to be only another “form of information” to us. With our digital devices, we cannot feel like we are in the now due to their reflection of “things that happened moments ago.” (Ibid. p. 74) That is why we are trying to catch up with this wave of information. Rushkoff calls it “digital bombardment” and explicates how there emerges a gap between it and “the true now of a coherently living human” (Ibid. p. 75). As an example or practical representation of this phenomenon, he describes the alert-list on our phones: how the single notifications content for attention and leave a scrollable list with the latest on top. Leaving us with the feeling that “[a]nything we do may be preempted by something else. And, usually, we simply add the interruption onto the list of other things we’re attempting to do at the same time. All these interruptions, more than simply depleting our cognitive abilities, create the sense that we need to keep up with their impossible pace lest we lose touch with the present.” (Ibid. p.74) Norman (2004) identifies a problem with these interruptions in social interactions: there exists an asymmetry in the perception of an interruption when looking at all the participants of that situation. For the person sending the notification, it is a positive act of transmitting a message, feeling or emotion to somebody who is not present. The person receiving the notification is interrupted in the social interaction with the people she/he is surrounded with. But still, for the recipient, it might be a positive interruption. For the people surrounding, the interruption is perceived as disturbing since their interaction is paused. (Norman, 2004) Therefore, he argues for technologies that give back control without interruptions: a mixture of synchronous and asynchronous communication. In view of the fact that Norman’s argument was written 2004, we nowadays have exactly these mixtures of communication methods. But almost ten years later, according to Rushkoff (2013), this does not leave us uninterrupted, but the devices have outpaced us. He argues that we are trying to adapt to our technologies rather than letting them adapt to us. (Rushkoff, 2013)
2.7. Home

The home as a setting for exploration of what “dwelling” means in the present was explored by Michael and Gaver in 2009. Through threshold devices, they probed the connection of the home to the world beyond the home. They draw on Heidegger’s view of the relation between humanity and the world and how dwelling can be achieved through recovering the home through sparing and preserving. In relation to Latour’s explication of how humans have always lived in a mixture of nature and culture, he calls them “naturecultures and technocultures” (Michael, & Gaver, 2009, p. 360). Michael and Gaver conclude that dwelling is complex and in a modern world to dwell, preserve and spare is "to be open to the unpredictable, the ambiguous, the ironic, the multiple, and the variegated that characterizes technonatures." (Ibid. p. 360) The threshold devices were designed to mediate these values within the home.

The home as a place for studies has often been looked at from the angle of science and technology studies. Michael and Gaver elaborate that analysis were often concerned with how technological artifacts shaped the home. The TV as an example is a media through which the world and other meanings enter into the home. Michael and Gaver critique how the TV and all the other technological devices have a clear function. On the contrary, Michael and Gaver designed objects for poetry that are ambiguous and uncertain in order to let people reflect, muse and “to explore what it means to dwell in the context of such complex connectivity.” (Ibid. p. 362) Crabtree and Tolmie (2016) conducted an observational study in the home to uncover potential things humans interact and to explore the home as a resource for design. They identify routines as main influence on the assemblage of things in domestic life. (Crabtree, & Tolmie, 2016)

Apart from dwelling in the home with connected devices, it is important who connected homes are built for. Commercial IoT works with the picture of a stable family living in one home together for several years. But in our globalized world where it is normal to live temporally in one place, is it contemporary to design for only these setups?

Communication tools in the complex and individual context of home open up many questions that are interesting for interaction design. Is there a different usage of our connected devices between home and being “outside”? Relating this to social presence, do we feel social presence at home differently than outside? And relating to letting the outside world inside: How do we let people that we love inside the home? Especially those, who live far away?
2.8. Emotional Design

We react to immediate events with emotions. These emotions can change our behavior over a short period of time (Norman, 2004). In his book, Norman argues that there is more to the design of everyday things than just usability. “Beyond the design of an object, there is a personal component as well, one that no designer or manufacturer can provide. The objects in our lives are more than mere material possessions.” (Norman, 2004, p. 6) Norman argues that human attributes arise from different layers in our brain. There are three layers: the visceral level, the behavioral level and the reflective level. These three levels of processing are inseparable from each other and influenced by each other. Figure one illustrates these connections.

The visceral level is “prewired” (Ibid. p. 67) and automatic. It responds to the signals from the environment and physical features are dominating. We interpret the signals immediately and can make rapid judgements. The behavioral level responds to everyday human behavior and is not conscious. Performance of the product is central and influenced by the function, understandability, usability and physical feel. The reflective level responds to “the contemplative part of our brain” (Ibid. p.21) and through reflection we can determine the overall impression of a product. It is about what message the object exudes to ourselves and to others and results in the meaning of a product and its cultural connection.

![Figure 1: Three levels of processing after Norman. (Norman, 2004, p.22) Diagram by author.](image-url)
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Norman describes the core aspects designers should consider when designing for the levels of processing. Visceral design is mostly about the physical feel and texture and “immediate emotional impact” (Ibid. p. 69). Behavioral design focuses on “understanding and satisfying the needs of people who actually use the product.” (Ibid. p.81) and reflective design is concerned with what impact the design has on its owner.

2.9. Examples

The following section describes examples of research and products that relate to the described concepts.

Figure 2: The Good Night Lamp, LumiTouch and Sincerely

2.9.1. The Good Night Lamp

The Good Night Lamp is a set of connected lamps, commercially available since 2012. Alexandra Deschamps-Sonsino, a product and interaction designer, came up with the concept in 2005. It responded to a brief during her studies of designing something for people who live alone. The functionality of the lamps is simple: once the big lamp is switched on, the other lamps light up as well, no matter of how much distance is between the lamps. Deschamps-Sonsino designed an object around the everyday-ritual to tell somebody goodnight. It gives the users an easy, ambient way of telling the other persons that one is at a certain place. It can convey the feeling of social presence just by sending light. The user has to switch it on manually which leaves him the control of sending the signal or not. This subtle way of communicating one’s presence lets people have their own freedom in interpreting and communicating the purpose of this ambient light. With its plain design and its immaterial way of communicating, it adds an unobtrusive connection to the other person(s) in a specific place of the homes. (Good night lamp, n.d.)
2.9.2. LumiTouch

*LumiTouch* is a project presented at CHI in 2001 and aims at enhancing communication between loved people. It consists of two via the internet connected picture frames that are touch sensitive. It aims at exploring emotional communication through tangible interaction. Touched by one person in one space, the other frame lights up. The interaction with the device enables the users to develop an own language by transferring different colors of light. The color of the light is connected to the way the user is squeezing the frame. This device does not send a part of one’s personhood, but still it transmits more information about the person than the Good Night Lamp. The recipient can choose to answer to the conveyed message by touching her/his own frame, or just leave it and watch it. (Chang, Resner, Koerner, Wang, & Ishii, 2001)

2.9.3. Sincerely

Studio 360 and IDEO design a row of products that are supposed to make Monday mornings more joyful. One of these products is called *Sincerely* and consists of an app and a device. The focus lies on conveying the feeling of you to somebody else. The app asks the user on Sundays if they want to send an audio message to another person. If they do, the connected device is activated on Mondays and the receiving person can listen to it. The physical design of the device is inspired by a tin can telephone and the wiggling tails of dogs if they are happy. If there is a message on the device, the “tail” of the can will wiggle to let the user know. This product is stationed at home and builds space for special messages. The sender is interrupted by his/her phone on Sunday and the recipient on Monday with a visual clue. It contains voice and the physical representation is supposed to convey joy. (IDEO, n.d.)
2.9.4. Touch Room
Touch Room is an iOS App designed by Goodby Silverstein & Partners that enables the users to communicate via touch. On the screen, there is a real-time connection between the screens that are being used. Whenever the screen is touched, the other person can see where and interact with that person. It is a very plain and simple way of communicating without speaking in real time. (Goodby Silverstein & Partners, 2013)

2.9.5. Bear-With-Me
Bear-With-Me is a prototype exploring emotional, embodied communication through tangible interaction. The design consists of two teddy bears equipped with sensors that can detect squeezing, touching and motion. They are connected through Twitter and Twitter transmits the information from one place to another. Two LEDs indicate if information is or has been sent and received. On each foot, the bears have a pair of LEDs, as well as a tri-color LED that is sewed to the position of the bear’s heart. The LEDs indicate if the bear is being hugged, patted or moved. In their study with 10 participants, the researchers found that the design was overall perceived as positive, but the design was a little too bulky and not meant for carrying the bears around. (Fong, Ashktorab, & Froehlich, 2013)

2.9.6. Ambi-Presence
Ambi-Presence is a project which specifically designs a tool for couples in long distance relationships. It consists of surround sound speaker, 3D cameras and a light and with these tools tries to simulate the sensory experience of the significant other. The corresponding rooms are mapped into each other’s homes so that the couple’s telepresence is present.
This project works with a very literal translation of social presence in trying to fill a room with the other person’s presence, even though they are in another place.

2.10. Synthesis of concepts

Present technology offers opportunities that are not considered in the study of Goosh and Watts. Besides the synchronous communication tools with elements of person’s hood, there are also tools today to leave messages, e.g. video or audio messages. Omitted in their study was the quality of an interaction. Whereas social presence only describes the feeling somebody has during an interaction, it does not include the positive or negative feeling an interaction can result in. Social presence is described as a construct in the head of the interacting people. The power of thinking about a person and be thought of at the same time could be central for the design case.

The existence of communication tools nowadays is nearly endless. We are always connected to a cell-service or the internet which enables us to keep in touch all the time with everyone around the world. Norman elaborates on how this connectedness results in being “in touch” from the sender of the communication, but might be an interruption for the recipient. (Norman, 2004, p. 153) This imbalance leads to disruptions in everyday social life. (Ibid, p. 158) Research on the effect of interruptions in Interaction Design is mostly concerned with its effect in the work environment. Grandhi (2008), however, explains how efforts in HCI research have focused on trying to design systems that spare users the experience with unwanted interruptions. She proposes a framework for interruptibility and researched the effect of the relational context of the interruption. (Grandhi, 2008)

When looking at the smart home, where everything will be connected to each other, are there ways of communicating with our closest family and friends without interruption? Are interruptions in the home perceived differently as somewhere else? And can we design for positively perceived interruptions?

Relating the concepts described in this section to each other opens up for exploring the meaning of our communication tools and how and when we feel interrupted by them. Can we use IoT and tangible interaction to design for social presence? The following section describes how the use of methodology is used in this thesis to formulate an answer to the question.
3. METHODOLOGY

This section describes methodological approaches used in the design process. Research through Design will be briefly introduced and elaborated how it has been used in this work.

3.1. Research through Design

Zimmerman et al investigated design theory in 2007 and identified three roles of design in research by interviewing HCI researchers: there are “(i) design researcher[s] in service of a research community—working to help researchers ground and frame problems and communicate the impact; (ii) design researcher as critic of the HCI community—making artifacts that stimulate discussion of critical issues; and (iii) design researcher as pattern finder, finding patterns that lead to pattern languages.” (Zimmerman, Forlizzi, Evenson, 2007, p. 497) Zimmerman et al developed a model for interaction design research within HCI to solve wicked problems through making artifacts. Löwgren (2007) discussed the generation of scientific knowledge through interaction design. He names “novelty, relevance, groundedness and criticizablility” (Löwgren, 2007, p. 4) as scientific norms and argues that with their basis, Research through Design is relevant to other designers in the future. We understand Research through Design as “the process of iteratively designing artifacts as a creative way of investigating what a potential future might be” (Zimmerman, Stolterman, Forlizzi, 2010, p. 313). By engaging with materialized artifacts and constantly reframing the problem, Research through Design is the used method in this thesis.

3.2. Desktop research

In the early stages of a design process, the designer needs to get an overview of existing and previously done work. Desktop research is a fast and resourceful method to access this material. Projects, products, literature and related information can be found and used immediately. For projects with limited time frames, this method poses a promising start. In order to define the field of IoT this thesis is concerned with, desktop research was used to explore different topics. In combination with reading relevant literature, the focus on Social IoT was found. The results from the desktop researched were organized in annotated portfolios which are described in the next section.

3.3. Annotated portfolios

In 2012, Gaver and Bowers introduced “Annotated Portfolios” to the design community a way to seek guidance for work and discussion in a design process. As an alternative to turn
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to theory, they propose to put together work in an annotated portfolio and look at specific examples of practice. The annotated portfolio consists of designed artifacts which are then annotated with text in order to highlight specific qualities of the designs. As a collection of artifacts which represent a “systematic body of work” the portfolio is then used to compare design, design spaces and their occupation more easily. “If a single design occupies a point in design space, a collection of designs by the same or related designers establishes an area in that space.” (p. 44) Since products and concepts can reflect insights and innovations, annotated portfolios open up a design space by bridging the gap between artifact and issue of concern. (Gaver; Bowers, 2012). Gaver highlights that annotated portfolios are informal and their strengths lie in their adaptability to audience and purpose. Important is not the material in which the portfolio is presented, “but that a balance is achieved between descriptions of specific, detailed examples of design practice” as well as the “values, issues and themes which characterise the relations among the collection, and to which the examples suggest answers.” (Gaver, 2012, p. 944)

In this research, annotated portfolios were used to analyze designs and products from different designers. In order to define the design space, the annotated portfolios give an overview about products and research of previously done work. They offered the opportunity to compare designs regarding the topics explicates in the theoretical part of the thesis. The portfolios were constantly revisited during the whole process of the thesis and offered guidance during stuck phases. Even though Bowers and Gaver proposed to use annotated portfolios with own work pieces, they proved to be a helpful tool for other design spaces as well.

3.4. Surveys

Quantitative research is a classical research method and aims at reaching as many people at once. Nowadays, the online-survey is a commonly used tool to reach a broad group of people. It is fairly easy and quick in the making and can run besides other work. The posed questions are usually very specific and often the participants have limited options to answer them. The answers can then be depicted statistically and be compared.

The aim of using a survey in this project was not to get statistically valid answers, it was to find out what people think about certain topics. Questions were posed in a prompting structure, so that the participants had to finish the sentences. The structure of this survey aimed at gaining open, diverse answers that lead to form the project.
3.5. Interviews

To comprehend the perspective of the target group in a design project, interviews are an often used and valuable tool. Interviews can be divided up into three categories: unstructured, semi-structured and structured interviews. These terms refer to how specific the questions are when being posed to interviewees. In unstructured interviews, topics to be explored are known by the researcher, but he has a lose protocol to go about the interview. That leaves room for uncovering novel and surprising insights within the topic. In semi structured interviews, the line of questioning narrows and questions become more focused. Structured interviews then can build up on the findings and be more specific. (Blomberg, Burrell, & Guest, 2003) The structure of the interviews is also determined by the stage of the process. In this thesis, interviews were used when the topic of interest was found. Therefore, semi-structured interviews were conducted.

3.6. Sketching

Sketching as a method is one of the fastest methods to communicate an idea. Buxton describes sketching as a vehicle for designers to explore and communicate ideas. “Sketching as an aid to thought” (Buxton, 2007, p. 105) and, according to Buxton, the activity is more relevant than the actual sketch. Sketches convey that they were produced effortless and quickly, so they invite for suggestions and changes and to be criticized. They are an inexpensive method to use primarily in the early stages of the design process. Sketches tend to exist in collections and in comparison depict the development of an idea. (Ibid.) Because of their nature, sketches are disposable and they invite for discussion and iteration. (Salmond, 2013)

3.7. Brain- and bodystorming

Brainstorming is a commonly used method to generate ideas. The participants or the participant writes down everything which is related to a topic or theme. Crucial is that in the first place, no idea or association will be discarded. Only the next step is to assess, sort and discard ideas. (Salmond, 2013) According to Schleicher, Jones and Kachur, bodystorming as a method in design has mainly been used in three ways. The first focus lies in working regularly in the environment where the product will be put to use. The second aims at replicating the place which the design is made for and then test the design in that environment. In the third methodology, actors and probs are used to prototype the space and this methodology focuses on simulating the experience of the product. (Schleicher, Jones,
& Kachur, 2010) Bodystorming is a relevant technique to change perspective on the project and discover unnoticed issues and opportunities.

3.8. Prototyping

Prototyping objects of the internet of things involves skills of different designers. Since there is no unambiguous idea of what a prototype is in interdisciplinary teams, Houde and Hill introduced a model of “What prototypes prototype”. Depicted in figure four, the model has three dimensions: the role, look and feel and implementation. The role of a prototype describes the functionality and the usefulness of the object in the life of the user. Look and feel refers to the sensory experience with the object. The implementation is concerned with the technical realization of the prototype. Separating design issues into these three dimensions can help to decide what kind of prototypes have to be build and the focus can be set on the exploration. (Houde & Hill, 1997, p. 3)

![Figure 4: Model of what prototypes prototype. (Houde, & Hill, 1997, p. 3)](image)

Buchenau and Suri (2000) introduced experience prototyping to the research community. In comparison to Houde and Hill, Buchenau and Suri explicate how a more holistic view on the prototype, including to consider look & feel, role but also for example contextual factors in the prototype. “[A]n Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing.” (Buchenau, Suri, 2000, p. 425) They highlight how commonly used design prototyping methods like the use of scenarios, storyboards or video are included in experience design, but its main aim lies in the “subjective experience”
of participants. (Ibid.) For prototyping the internet of things, this thinking is crucial since it “asks for a blending of the multiple design disciplines and beyond.” (Ibid, p. 431)

Video as a design tool can and is being used in different stages of a design process, from capturing observations, to ideation, prototyping and evaluation. Mackay, Ratzer and Janecek (2000) describe how they used video artifacts throughout a participatory design process. Video prototypes are distinguished from video brainstorming by the aim of negotiating one single design. Video brainstorming is supposed to generate several ideas. Mackay et al consider video artifacts to be “the output of one design activity and the input to the next.” (Mackay, Ratzer, & Janecek, 2000, p. 72) Reusing these artifacts institutes to what Zimmerman et al (2007) describe as the “attempt to make the right thing” by reframing the problem through a constant process of “ideating, iterating, and critiquing potential solutions” (Zimmerman et al, 2007, p. 497). Video prototyping offers a holistic and quick way to prototype ideas.
4. DESIGN PROCESS

This section describes the design process, the setup of different stages and findings of the used methods during the project. Figure five shows an overview of the process and the researched topics in this thesis.

**Figure 5: Diagram of the design process. By author.**

4.1. Desktop research and annotated portfolios

The first stage of the project consisted of a literature review of the topics IoT, tangible interaction and social interaction. I analyzed projects and products and, as Gaver and Bowers suggested, I put them together in form of annotated portfolios in order to see and compare the key qualities of the projects. The portfolios can be found in the appendix of this thesis. They were used during the whole design process as guidance and reflection on the own design work.

In the beginning of the process, the research about plants opened up to the idea of Social IoT. The ICT project and the selfie plant, both, used plants as a facilitator between humans. This finding lead to projects that focused on relationships of long distance and the feeling of connectedness, especially in the home. It emerged that research, for example with the Bear-With-Me project, often examined the topic in a literal way: in this specific case it was that the hug of a teddy-bear was transmitted to another teddy-bear. The Sincerely project or
the Good Night Lamp, they tried to convey the feeling in a different, not so literal way. Especially the Good Night Lamp with its simplicity and deepness materializing a ritual, were crucial in guiding the proceeding in this thesis.

4.2. Surveys

Besides the literature review and the annotated portfolios in the early stages of the project, I conducted a short survey. The aim of the survey was to get a feeling of what the term home means to participants and how they communicate with people they love but are far away. To gather first insights and have room to improve the survey, I conducted a test run with the fellow students attending the interaction design program. Since most of them come from different countries, they know what it means to have family and friends in different countries. They all have to take care of these relationships and that made them part of the target group.

The questions were formulated in a prompting structure in order to give the participants room for interpretation and to find out their own associations related to the topics. In this stage of the project, I was not interested in gender or age of the participants. After that, the questions were iterated and send out to my own social network in order to see if there were more diverse answers.

The questions and answers of the survey can be found in the appendix.

4.2.1. Survey aims

I wanted to find out what the term home means for people. What is their first association with the term? Is it one or more places, is it a feeling or does it relate to people? I was interested in how people express it when they miss somebody. I aimed at finding out if they think of communication with their loved ones in terms of frequency or if they thought about how they communicate with them. Finding out when or how they would find out how their close ones feel, was another prompting sentence. I also asked for the nicest way somebody ever told them that they were thought about was and how they express this feeling to others. In addition, I tried to find out where and why people like to communicate when they are at home. I left a free space for saying anything they wanted about their loved ones, emotions and communication.
4.2.2. Findings of first round

In the first iteration, 9 people answered the survey. The structure of the questions being more prompting sentences to be finished by the participant, influenced the answers in being very diverse in type and scope. Some participants only finished a sentence, some explained what they meant more detailed.

Home means very different things to people and is mostly connected to places, people, feelings but also to oneself. The majority of my fellow students thinks more about the frequency of contact they have with close people than about what channel they communicate with. The answers to when or how they want to find out how their loved ones feel was diverse. There are people who want to know primarily about the big feelings of the significant others and there are people who want to find out how they feel in everyday life. There was the wish to find out without texting or calling them. The nicest way somebody ever told them they were thought about was mostly related to personal content. In addition, it appeared to be crucial how much time the sending person spent to prepare something, for example, a handwritten letter. Bed, kitchen and sofa prevailed to be the preferred places to talk at home because of the comfortable, private and intimate atmosphere. Insights from the open space field were that being away from your loved ones has also to do with negative feelings, like guilt. Participants find it “hard to keep in touch. It takes a lot of time, and sometimes it becomes a stressful thing, rather than a pleasant.” There also is a need of people to know that their close ones are safe. One person wrote the following: “the importance of not hearing someone everyday but still knowing the love that there is between you”.

These findings provide a first insight in the communication with close people who live and are far away.

4.2.3. Iteration on the survey

After the first round of the survey, I changed a few questions. I added the question what people usually do when they come home. Also, I was interested in which object or thing makes them happy at home and why.

4.2.4. Findings of second round

The second round of the survey was answered by 24 people from my own private network. Since I have friends from different countries, it was convenient and quick to include them in this survey. The answers of the second iteration were a lot shorter than the ones answered by fellow students. Despite the scope of the answers, their content was as ambivalent to the
ones of the first round. One quote that was really interesting said the following: “There is always less communication than thinking about loved ones”.

4.2.5. Insights of Survey
Although this survey was more a starting point for the practical part of this thesis, it provided me with important insights that are valuable for the whole process.

As every person is different, every person expresses feeling and things in different ways. The communication tools are nearly endless and everyone has their own opinion about it. But the feeling of not keeping up with the incoming messages creates guilt. Guilt as a part of being always connected was an interesting topic.

4.3. Scenarios
Out of the findings of the survey and the theoretical part, I will describe “problem” scenarios in the following section. They are related to the topics of guilt, time, effort and try to exemplify when technology fails to communicate what the person want to express. They were used as a way to summing up the findings until this point and presenting them in an approachable, narrative way.

4.3.1. Scenario 1
Maria is a Business Relations student at Malmö University. She left her place of birth, North Carolina, and family behind several years ago and moved to Sweden. Even though she loves where she is in her life, she always feels sad about leaving her loved ones. She is very driven and dedicated to her studies, so she has a very busy schedule. That leaves her often with the feeling of not communicating enough with her family and close friends. Even though she tries to keep in touch with her family and friends as much as she can, she misses the skype calls sometimes and she can’t make the effort of responding to a very long and emotional text she has gotten from a friend. The time difference between the countries increases the problem. She wishes she had something to say that she is alive and thinking about them, without having to spend too much effort every time.

4.3.2. Scenario 2
Veronika’s son moved out a few weeks earlier to begin his studies. He lives 200 km away and he does not like to call his mother regularly. Veronika tried to stay in contact with him some times a week by texting, but he is not very keen on answering. That leaves Veronika with the
unpleasant feeling of not knowing if her son is okay. Sometimes she checks on Whatsapp when he was online for the last time, just to check up on him without annoying him.

4.3.3. Scenario 3
Joane and Lotta are very close friends. They have met during their studies and lived together in a shared flat for a few years. During their time together, they got to know each other very well and were a mental support to each other. They have a very strong connection, but ever since Lotta moved away, their keeping in touch is very rare. They think about each other a lot, but communicating through text and voice messages is not really their way of communicating. Synchronizing Skype-calls is also very hard and they often don’t happen because of their different schedules and living situations.

4.4. Interviews
Interruptions and the feeling of not being able to keep up with incoming messages were topics described in the theoretical part of this thesis and also present in the survey. In order to explore these topics more detailed, I conducted 5 interviews. These interviews were semi-structured and three of them were conducted in person, while two were conducted over Skype. The participants were five women in different living situations. This gender imbalance arose from the availability of interviewees.

The questions were concerned with their close relationships over distance, what kind of communication tools they use and how and when the participants feel interrupted by technology at home.

The structure and questions of the interviews can be found in the appendix.

4.4.1. Insights
From the interviews, the following insights were crucial for the development of the project. Mainly, the usage of technological devices for communication at home are the smartphone, tablet and laptop/pc, only one participant has a landline telephone. The smartphone represents the most important communication tool when on the move, but it is significant at home as well for some people. Here, the participants divided into two groups: one group does not make a difference in the usage of the phone being outside or at home. This group carries the phone with themselves the whole time. The other group either willingly puts the phone away at home or a shift of attention (e.g. for the partner who is living with the person) results in forgetting about it. All participants said they have their phone muted or on vibrate
at home, unless they expect a special email, call etc. They said that sound is a very disturbing form of catching their attention.

The phone represents the medium of connection, but at home, other tools are used for conversations. One of the participants told me that she has a ritual of skyping with her family every Sunday on the computer. She feels this is constraining her a little in her freedom, but she also needs it. Especially when friends and family live far away, the participants told me that there arise inner conflicts. On the one hand, they perceive it to be nice to always have the chance to contact somebody, but on the other hand they don’t want to be reached sometimes. The notifications on the phone which indicate that their attention is wanted somewhere makes them feel guilty.

Even though the participants described that communication with loved ones is never a bad thing, messages and notifications can be. The participants described how there is a hierarchy in differentiating the notifications. First of all, there is a difference through which channels the messages are coming. With four participants, Whatsapp messages were more important than Facebook-messages. But more importantly, it was crucial if the received messages were for the receiver only or if they were group-messages.

All participants talked about that they have an ambivalent relationship with their phone. On one hand, it represents all communication and connectedness they have with people, and on the other hand there is a certain force which makes them use it all the time. One participant said the following about her relationship with her phone: “Forgetting my phone makes me feel like I’ve lost an arm.” That is why some participants restrict the usage of the phone. Be it while sleeping or while working from home. So there is self-restriction happening, but deliberately.

Interesting was also the fact that a lot of interruptions are self-directed. The participants told me that quite often, they check their devices themselves. Without having any notifications, especially the phone is checked very often.

**4.5. Autoethnographic research**

The fact that we check our phones and devices often without having any notifications was a finding in the interviews which I decided to pursue further. With an autoethnographic experiment over the duration of one day, I aimed to find out how big the share of self-directed interruptions compared to the ones by notifications are. Since the device usage is very personal, hard to track and it takes a lot of effort to capture, it was appropriate to conduct the experiment myself. I counted how many times I was interrupted by different
services and devices and how many times those interruptions were self-directed. Since I am not a heavy social media user, I counted my Facebook-visits on the computer and the ones on the phone. Since I don't have a Facebook-app, those visits are all self-directed. I also counted how many times I checked Whatsapp. I distinguished between opening it because I have gotten a message and writing one myself. Checking Instagram and Snapchat-visits were counted. Lastly, I also counted how many times I checked just the display of my phone to see whether I have gotten anything.

Interesting was that even though I wasn’t aware of it in every moment, the fact that I was counting ultimately made me use the tools less.

For this research, the most surprising finding of this exploration was how often I checked the phone without having any notifications. Over seventy times I pressed the button to see the screen. It is impressive how much this specific gesture is embedded into my everyday life and how little attention I pay to it.

4.6. Ideation

Figure 6: Example sketch of the ideation phase. By author.
In the ideating phase, I developed ideas on the insights that I have gotten from the different research phases. They were mostly kept in sketches and short written text. Crucial ones can be found in the appendix of this thesis.

I took the core findings of my previous research, so from the annotated portfolios, the surveys and the interviews and started ideating. Mostly, I brainstormed around the topic alone, by drawing diagrams, which depicted the core insights or things that the design should convey and sketches. In order to get different perspectives, I also ideated together with classmates. We would sketch together or brainstorm on the whiteboard. As shown in figure six, I annotated the sketches most of the times in order to expand the drawn image and clarify the idea behind.

4.7. **Video prototyping**

After the interviews and the ideation, I decided to prototype three ideas with videos.

Since the ideas differ in form, shape and also utility, all video prototypes have different qualities. They were made in two days and can be reached by clicking on the pictures in the following section.

4.7.1. **Shared plant**

Plant friend is a simple idea to let two people take care of a plant together. The plant is living in a connected pot, which can store some water. Since the pots are connected, every time one of the friends waters her/his plant, the other plant is watered automatically. That way, the friends can take turns. It evokes a kind of ownership and lets the friends share a practice together over distance. Watering plants is an activity sewed in everyday life. Usually, it does not interrupt any other kinds of interactions since it is a self-directed activity. Taking care of the plant together can express great care between the two people. The thought behind was also to evoke further interaction through other channels.
Figure 7: Video prototype of shared plant idea. Produced by author.

4.7.2. Hedgetalk

Hedgetalk is a communication device to put in the home with animal-like resemblance. It is designed to do two things: transmit messages that can be kept by the receiver and a way to communicate emotions/moods without words but with tangible interaction. The idea was to create a device that conveys joy through a message, and that this message can be kept by the receiver.

Figure 8: Videoprototype of hedgetalk idea. Produced by author.
4.7.3. Tumbled
Tumbled is a spherical shaped device for the home which transmits if it is being touched or not. It is activated by picking it up and conveys to the sister device via pulsating light that it is being held. The device has a temperature sensor and heating to communicate the warmth or coldness of the fingers of the device.

Figure 9: Videoprototype of the tumbled idea. Produced by author.
4.8. Bodystorming

In order to develop the concepts further, I used a bodystorm technique invented by one of my classmates. She is aiming to implement a new methodology for interaction designers by thinking about how deaf people perceive the world. For her understanding, I explained the core elements of my project so far. Then the goal was to look at the insights I had from a different angle. She guided me through a few exercises where closing the eyes, re-acting specific situations and imagining certain people were the core elements. She made me think about what the uniqueness of one’s person hood means and how we, as humans, embody it.

- We perceive one’s person hood also by gestures and the very determining way people move. And how fast or slow we perform those gestures. What’s also defining is the relation the movement or gesture has to the height and the space a person is in.

- Since I found out in my interviews that sound is a very interrupting and obtrusive form of interaction, we thought about how to visualize sound. There emerged an idea about how to visualize notifications and make them more displayable to persons.

4.9. Iteration of Concepts

In a second iteration, the ideas of the video prototypes and bodystorm were further refined, evaluated and two of them eventually discarded. In this stage, the video prototypes were shown to three classmates.
**Hedgetalk**

The resemblance of Hedgetalk with a hedgehog made it a playful concept, but also excluded a wide range of potential users. At the same time, it made it rather appropriate for kids. For the age group of 4 to 9, it could have been a nice concept to connect with friends without using the parent’s smartphone. Because of shortness of the project and no access the user group aged 4-9, this concept was not further explored.

**Tumbled**

After a reflection, tumbled was discarded as well. The concept was too narrowed down as an artefact. Since there are a lot of communication tools already, this idea did not have the potential to be explored further.

4.9.1. **Plant Concept**

When being introduced to plant concept, participants of the reflection found it to be an idea that could be explored further.

*Figure 11: Plant concept. By author.*

The concept responds to the need of persons to share an activity over distance with one special person. Since there are a lot of things you cannot do when you live apart or not in close proximity to each other, this concept is an attempt to establish a practice between two persons over distance. People express care not only through words and gestures, shared activities are a central part of caring. From making the other person coffee to look after their pet when the owner is away, activities mediate trust and closeness. In long distant relationships, these little activities cannot be carried out any more, which can leave a gap in
a relationship. If that person then is not very good at staying in touch with current technological devices, there can arise some issues. Here, the possibilities of IoT open up to challenge this problem. IoT has the power to connect many different devices, but interaction design needs to find out what could be meaningful for people.

The plant concept is meant to establish a connection through a mundane, everyday action and adding an extra layer of connectedness on that object. Figure twelve shows which sensors were thought of to be integrated in the first, basic concept and how they could add value to the life of the owners.

**Features:**

- **Watertank**
  - Every time, plant A is watered, plant B will be watered as well
  - Creating a shared experience over distance

- **Moisture sensor**
  - Daylight from Plant A is mirrored in plant B
  - Additional information about timezone of the other

*Figure 12: The basic concept is to have two living plants in connected flowerpots. By author.*

By putting the plant into two separate homes and connecting them, the two people living in those homes have a different connection than other ones. The basic idea is to take care of the plant together, meaning if one of the persons waters her/his plant, the other plant is watered as well. This mechanism can be seen as a balance humans have to find in relationships. During some periods of time, one person puts more effort and power into the relationship. In other times, that person is more reserved. There is a constant giving and taking which is often imbalanced. With this connected flowerpot however, the negotiation of giving and taking would result in the upbringing or keeping alive of the plant. So the plant would function as a representation of the relationship. It is a shared effort to keep it alive. There is also an extra layer of inviting for more communication in general between the two plant owners. So it is not just a reminder on the significant other, but also a spark for further interactions.
The basic concept is depicted in the following figure and shows where interactions arise in this concept.

![Figure 13: Outline of the basic plant concept and interactions. By author.]

With this basic concept, the focus lies on the shared practice of having and taking care of a plant. The light adds an extra layer of information to the surroundings of the other person. Since there is no interaction from person to person in this concept, I decided to iterate on the concept further. Based on short interviews I conducted with classmates about what kind of rituals and duties they share with the people they live with, and an experiment that will be described in the next section, there emerged three concepts which add up to the basic concept and try to let the plant become more alive.

### 4.9.2. Plant experiment

In this experiment, I asked one of the participants of the interviews who owns a lot of plants, to take one of her existing plants and imagine that this plant is connected to one of her
closest friends. In order to make this connection more visible, I asked her to give the plant the name of that person. For the experiment, she was supposed to write down what she thinks every time she waters that plant and if there is something she would like to tell that person. After five days, I interviewed her about her experience with that prototype.

The participant lives with her fiancé in an apartment together. She chose a zucchini plant as an experiment plant and the plant was located with other plants on the balcony. After five days, I asked her to tell me about her experience with that experiment and what she thinks about it.

During the five days, she watered the plant every day mainly in the mornings and evenings due to her work schedule, but checked on it more often (two to three times a day). The participant said that when she was in front of the plant, she would have liked to know if the significant other would be in close proximity with her plant as well. She said she liked the thought of the plant telling her this somehow. When being asked why, she answered that the plant would be the connecting object between her and her friend. It is a reminder and at the same time could tell something more about that person. She described a feeling of tension and excitement about the moment when she is in front of her plant and wonders if and when the other person would be in front of her plant as well. When being asked what she would have liked to communicate to that person in that moment, she said she didn’t exactly have something concrete to say. There was not a clear message she would like to send. The participant remembered one evening when she came home very exhausted after work. She said that she would have liked to communicate that feeling to the plant friend, but without words and she did not have an idea how. In this short period of time, the participant also explained how she liked to look at the plant and think about the other person.
4.9.3. Concept 2

Concept two relates back to creating the feeling of social presence and reacts on when both people are in close proximity to the pots. A subtle movement, a wiggle of the plant in the flowerpot, lets the plant “come to life” and signal to the other person that they are in the same “position” at the same moment. It is supposed to create a moment of surprise and coincidence in everyday life. The fact that the flowerpot can be put by the persons wherever they want in their home, lets them control the frequency and invasiveness of the plant in their life. To have a layer to react on that situation, this flowerpot has a colorful light output. It can be controlled by both users, but the output is on the other plant. Only while adjusting it, the active person sees the color on her/his own plant. After being finished, the color turns back to the adjusted color of the other person. With this color feature, the two people can create their own language.

Additional features:

- **Motor**
- **Proximity sensor**
- **Color control**

When both are in front of the plant, it starts to wiggle

Creating a feeling of presence, surprise and coincidence

Color wheel appear

Communicate moods/emotions-own language play

*Figure 14: Concept 2. By author.*

*Figure 15: Additional features of concept 2. By author.*
### 4.9.4. Concept 3

Additional features:

- **Connected to GPS of the other’s phone**
  - When approached, shows the location of other person
- **Extra layer of information**
  - Flowerpot shows, if it has been checked on

*Figure 16: Outline of concept 2. By author.*

*Figure 17: Additional features of concept 3. By author.*
With concept three, the two persons need to be willing to give more information to each other. The flowerpot would be connected to the smartphone of the other person. Therefore, it can always display where the other person is. When the plant is being approached, it shows the place to the flowerpot owner. With this feature, the plant owners always have an extra layer of information about each other. In comparison to the concept 2, this concept shows more detailed and concrete information, rather than creating a feeling.

Figure 18: Outline of concept 3. By author.
4.9.5. Concept 4

Additional features:

Connected to emotion tracker

\{ Fl...flowerpot shows, if it has been checked on \}

Concept number four relates to the fact that when you live together or see each other, you always get a sense of the emotions and moods the other person is in. During the research, I found out that people are more willing to share what occupies their mind when they talk to somebody face to face. When there is a long distance relationship, these sensitive feelings of recognizing and reacting can only be conveyed through mediated communication technology. But through technology, significant qualities can be lost. This concept would use an upcoming technology, an emotion tracker, to convey the mood or emotions to the other plant owner.

Figure 19: Additional features of concept 4. By author.
Figure 20: Outline of concept 4. By author.
4.9.6. Physical and digital prototyping

During the concept development, I engaged in building physical representation of how the plant concept could look like. I bought two plants and several flowerpots in order to experiment with them. Figure 21 shows these prototypes and how they were built.

![Figure 21: Pictures of prototypes. By author.](image)

These prototypes influenced the phase of concept development. In a following step, depicted in figure 22, a picture of the prototype served as base for a phase of digital prototyping in Photoshop. To depict some of the interactions, there also emerged a clickable prototype. It can be found here: [Digital prototype](image)

![Figure 22: Digital Prototypes. By author.](image)
4.10. Reflection

The outcome of this eight-week design process is a line of conceptual explorations how close people could be connected through a shared plant. A video prototype shows the explored concepts here: Plant concept

Research through Design was the chosen method to design for this thesis. After the desktop research and collecting selected examples in annotated portfolios, the examples were analyzed. For the design process, the annotated portfolios were very crucial because of their easily accessible nature and their flexibility. During the design process, they were changed and expanded constantly. In retrospective, it would be interesting to see which comments were inserted in which stage of the design process. In order to start the practical process, a survey was initiated that was send out to the author’s private social network. The survey was concerned with the topics home, close relationships and communication places/media and what these topics mean to participants. Looking at it critically, this survey did offer some first insight to the topic. Quantitative research methods are not that frequently used in interaction design, but for this early stage of the process it was a satisfying method. With the interviews and the question of how we are interrupted by current technology, the research finally found a concrete direction. What was not surprising was the fact, that the phone was found to be the most present communication technology of the interviewees. The described love/hate relationship with the notifications/messages made the design space more ambivalent. With the participants of the interviews being only women, the research could have gone into a feminist direction. But with a lack of time, it was not possible to explore that topic in this research. In addition, the research as well as the design process might have taken a different direction, if there had been a balanced gender representation in the interviews.

The resulting concepts of this research should not be seen as final concepts. They are a starting point to explore this area of research. Their design raises questions that need to be examined further.

First of all, there is the problem or question how much the users of the connected flowerpot want to share with each other. In order to elaborate on this part, different concepts were developed, but the question could not be answered. There is the question if the basic concept of just evoking the thought of the other and a shared practice is considered to be enough connectedness and interaction. Relating to the other concepts, with them and in combination with the plant experiment, the grand question of what do we want to share or communicate
when interacting with a plant? Is it just about the negotiation who is watering the plant next or is it, as suggested by the concepts of this thesis, about something more? And if yes, what is it? These questions should be addressed in a further step. Another question that has not been asked is how to design this plant, if it is for example for separated family members. Especially, when some of them still live together, while others live alone or with other people. What role could the plant play then and how would it restrict or expand the interactions with it?

When comparing this project with one of the examples, the Good Night Lamp, there is a crucial difference in the approach of the project. The Good Night Lamp is built around a ritual that close persons might share and that ritual is translated into an object. Plant friend takes a practice that a certain group of people do anyway in their everyday life and transforms it into a shared responsibility. It would be interesting to see if a ritual could be developed around this object.

In general, the process was very concept orientated. The field of IoT offered so many directions to explore that it was difficult to pinpoint the research questions. The many directions explored in the beginning of the process influenced the ideation phase more than intended. The limited time of the whole project was an issue, too. For the physical prototyping phase, it probably would have been fruitful to do a workshop. With more time at hand, it would have been very interesting to build (semi-)working prototypes and deploy some of the concepts in real environments to find out how people perceive this kind of connectedness. One unknown variable is how an object like this influences the live of the owners over time. Would the plant friend get boring? And if yes, how could the design prevent it from getting boring? In addition, it would be interesting to see how a person who does not have a preference for plants would react to a concept like this.
CONCLUSION

5. CONCLUSION

Research in HCI about the Internet of Things is mostly focused on technical terms. However, this thesis focuses on the human perspective of the paradigm. The research was concerned with how we perceive the connectedness with devices in the presence in order to find possible ways to materialize the feeling of social presence through IoT. The home as a design space for connected devices was identified as promising in the theoretical part. Connecting with people we are emotionally close with but who live far away are poses a design space in this field.

In combination of theory and practical design work, the aim of this thesis was to answer the research questions how social presence can be materialized in order to convey the feeling of being close to certain people. The second addressed question was how we can design for or against interruptions by technology. The questions could not be answered fully in this thesis, but they were explored through a Research through Design method. The result of this process are four concepts of a connected object that question how much we want to share with a significant other. On a conceptual level, this project explored how the shared practice of taking care of a plant can be a way to feel connected to one significant other person.

The Internet of Things is a vast field that offers many different ways to interact with objects, services and products. Interaction design has a responsibility to challenge and critique the developments in this field, but it has also the power to create things that might mean more to people on a personal level. In order to develop these things, interaction design needs to explore the possibilities IoT offers. Research through Design as a methodology for this investigation is crucial since it produces knowledge through the combination of theory and design work. In the vast field of IoT, it can shift the perspective from a technical view to a more human centered one. The orientation on previously done work as guidance offers a more practical, exemplary access to design work than theory. Experimenting with different methods in this process and by this, constantly shifting perspectives, resulted in reframing the research questions during the process. This project explicates how such a design process can look in a small scale and how it opens up to exploring concepts more deeply.
6. DISCUSSION

This project identified that there are people who are not satisfied with current communication technology for different reasons: there are issues with the quality of communication, the effort that has to be put in, the self-directed and also the technology mediated interruptions, the time perception and guilt. These issues might not be perceived equally strong by every individual, but their existence cannot be denied. Where commercial companies focus on creating tools that work for a broad group of people, interaction design has the chance to concentrate on individually perceived phenomena and explore their potential meaning for a broader group of people.

By designing a connected flowerpot which turns the activity of taking care of a plant into a shared experience over distance, this project tried to develop an alternative form of building a connection to somebody. The author of the thesis is aware that this connected flowerpot would only be adapted by a specific group of people, namely people who have plants and like to take care of them. But it should be highlighted that it also opens up to exploring this kind of connectedness through different artifacts. In this short amount of time and limited resources, one aspect could be focused on only. A next step would be to identify more activities that could be shared over distance and elaborate on how they could convey a feeling of social presence.

This project also uncovers a design space in interaction design and IoT that is concerned with subjectivities. Home, in the classical and conservative view, produces the image of a family, consisting of two heterosexual parents and three kids, living in a house together. But that image mirrors only a fraction of how people live together nowadays and misses the diversity of what people consider to be a home. Living in shared flats, with friends, mixed generation or alone, those are all living-forms that deserve to be seen in this field. So not only has interaction design the responsibility to look at the person, but also how that person chooses to live her/his life and respect and design for those choices. Whereas this thesis only focuses on how this living situations influence the use of communication technology at home by women, there is a vast field to explore and to challenge by interaction designers.
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Bill Gaver and John Bowers (2012) introduced „Annotated Portfolios“ to the design research community as an alternative to turning to theory in a design process. They suggest to seek guidance in „looking at specific examples of practice“ (Gaver, & Bowers, 2012, p.40) since products and concepts „can reflect insights and innovations“ (Ibid. p.42). In this research context, annotated portfolios will be used to assess previous work that has been done in the field of IoT in order to indicate core values, inspiration and guidance for the further design process.

Firstly, the projects are introduced with a short description, mostly written by the creators of the project. Afterwards, the annotated portfolio was created, focusing on the following terms:

- action, use scenario
- control: automatisation vs. tangible interaction
- input/output modalities
- virtual process and physical representation
- impact and (social) value for the user
- affordances and aesthetics
- emotional aspects
- social presence
- communication properties
- remarkable qualities

The first annotated portfolio is mainly concerned with the role of plants in IoT and interaction design.

The second annotated portfolio looks at tools for communication over distance.
1. ANNOTATED PORTFOLIO: 1

The Botanicalls project is fundamentally about communication between plants and people. We are empowering both by inventing new avenues of interaction. Plants that might otherwise be neglected are given the ability to call and text message people to request assistance. People who are unsure of their ability to effectively care for growing things are given visual and aural clues using common human methods of communication.

Source: https://www.botanicalls.com/about/

The Selfie Plant is an attempt to provoke some thoughts in the above genre of expression. The Selfie Plant expresses itself in the form of a nice-looking selfies, which it clicks according to its mood, weather or occasion. It mimics human behaviour, by living its best pose and adjusting the camera angle to take the perfect selfie. Undoubtedly, the plant posts these photos on social network via its Facebook profile.


With our concept Plant Friend we seek to help children discover and learn how to care for and grow plants, while tightening and developing the emotional bond between them. Based on sensory inputs Plant Friend expresses the plant’s needs through emotional and communicative movement, thereby facilitating engagement and interest in the plant’s well being.


The presented application encompasses the use of a large video display, users’ mobile devices, a projector and a micro controller for a water pump connected to a small real garden in a box. Using their smartphones collaboratively, people can fill out a virtual water container and, once the container is full, they can release the water from it, watering the real garden as a consequence.

Resource: http://doi.acm.org/10.1145/2598784.2602801

The ambient plant is intended to connect family members living in separate homes by sensing local plant moisture levels and displaying this information through a series of colors produced by LEDs on a plant pot-based display. An additional display conveys the condition of the separated household plant, allowing members to keep track of each others’ respective plants. Additionally, when a family member is in close proximity to their plant, the pot in the distant household begins to glow brightly to convey a loved one’s temporary presence.


At the MIT Media Lab Open Agriculture (“OpenAG”) Initiative we are on a mission to bring out the farmer in everyone by creating healthier, more engaging, and more inventive food systems. OpenAG is building collaborative tools and platforms to develop an open-source ecosystem of food technologies that enables and promotes transparency, networked experimentation, education, and local production. By making the science behind modern agriculture more accessible, we hope to break down the barrier of entry and put the power of food production back in the hands of the people.

Resource: http://openag.media.mit.edu/about/

This paper presents a project that tries to teach children how to grow their own food indoors and outdoors, mixing real and virtual reality, connecting something natural like a plant to the Internet of Things (...). The use of sensors related to an app makes this process more fun and useful for educational purposes. The aim of the project is to change children’s attitude towards food, increasing their knowledge about production and consumption, in order to reduce waste on a long term basis.

Resource: http://www.mdpi.com/1424-8220/16/2/231
interaction between plant and human
giving plants a human voice

- interaction through existing objects
- reminder & praiser
- visual & aural clues
- surprise
- humour
- artsy

humanizing plants

virtual output
mimics human behaviour
critical design
plant as attentionseeker
plant as social point/
as invitation for participation

emotional & communicative
movement of flowerpot

domestic setting
visual and delayed physical output

teach kids

mix of physical and
digital in- and output

gamification
„personal”
„tamagochi”

increase interaction between strangers
gardening as design metaphor

physical input (movement/soil)
domestic setting
elderly people as target group
connection of households
visual output
no interaction - just display

whole system
change agriculture
DIY
food as output
collaboration on plant recipes

community

public setting
virtual & physical elements
1. ANNOTATED PORTFOLIO

**Good night lamp**

Turn your Big Lamp on and Little Lamps which you’ve given away turn on too. Use the Good Night Lamp to tell a loved one ‘now’s a good time for a chat’, ‘I’m thinking of you’ or ‘call me when you get home’. You decide. As your family grows or moves away, you can add as many Little Lamps as you want.

Resource: http://goodnightlamp.com/

**Grandma’s Pill box**

This cloud module gadget is set to remind Grandma to take her pills at four specific times a day and emails another person as a backup reminder. If she presses the button within 4-5 minutes of hearing the buzzer, nothing needs to be done. If she doesn’t take her pills and press the button within 4-5 minutes, then the „Call Me” sign will light up and the cloud module will send the person an email, so she can call the Grandmother and ask what is going on.


**Make a group**

“Make A Group” is a project that helps people to achieve their wish through tasks on daily basis. It is worth planning whether there is a friend, family who could join you in achieving your willpower goals? This project builds communication to support and encourage between companion and yourselves.

Resource: http://blogs.arts.ac.uk/london-college-of-communication/2015/05/12/lcc-students-exhibit-social-objects-at-thingscon-conference-berlin/

**Bear-with-me**

While previous work has explored sending tangible forms of emotion like hugging, this work has been limited by not supporting or encouraging users to reciprocate emotional pings or „hugs.” In this paper, we introduce Bear-With-Me, a prototype system that allows users to exchange tangible expressions of emotions, such as hugs, in real-time. In contrast to previous work, Bear-With-Me is mobile, tangible, bi-directional, and real-time allowing for new types of exchanges of emotional, embodied communication.

Resource: http://dl.acm.org.proxy.mah.se/citation.cf-m/id=2468537

**Sincerely**

Sincerely is a new ritual of gratitude designed to chase away any end-of-the-weekend gloom. On Sunday nights, the Sincerely app will prompt you to record a simple “thank you” message to someone you care about. If you’re having trouble getting started, the app can help you keep it short and sweet. Then, on Monday, you get some love back when your friend responds.

Resource: http://bringjoy.ideo.com/

**Olo**

Olo is a 3D Printer in a very small scale. It is connected to an app of a smartphone and therefore easily accessible. It makes it possible to create physical things in different locations and can be used, for example, to send gifts. It is affordable and might be the future of creating things at home.


**Lumitouch**

The Lumitouch system consists of a pair of interactive picture frames. When one user touches her picture frame, the other picture frame lights up. This touch is translated to light over an Internet connection. We introduce a semi-ambient display that can transition seamlessly from periphery to foreground in addition to communicating emotional content. In addition to enhancing the communication between loved ones, people can use Lumitouch to develop a personal emotional language. Based upon prior work on telepresence and tangible interfaces, Lumitouch explores emotional communication in tangible form.

Resource: http://tangible.media.mit.edu/project/lumitouch/

To start, enter your name and create a Touch Room. Invite others to join. Watch their touch points move about on-screen in real time. When your fingertips touch, your phone vibrates, and you feel the connection.

Resource: http://touchroomapp.com/
1. ANNOTATED PORTFOLIO: 2

- communication through light
- big lamp as control
- ambient output
- build around a ritual
- designed for several people

- assist someone far away
- control system
- inspires/prevents other communication

- takes an existing gesture
- and expands the scope
- option for developing own language
- synchronous and asynchronous

- touch sensitive: light color is connected to the squeezing

- very literal
- detects squeezing, touching, motion

- “bulky” design

- simulates the presence of a partner with light, audio and motion
- maps to apartments onto each other
- telepresence

- light as main output

- „help“ to achieve goal
- communication through light
- two persons involved
- playful design
- buttons as input

- focuses on bringing joy
- scenario driven
- uses familiar metaphors: wiggling tail, can-telephone
- asynchronous communication
- physical object, app
- app as reminder, audio
- input, audio output
- several people can be involved

- digital input, physical output
- the future of sending gifts?
- app and device
- not necessarily a collaborative tool

- app
- uses available technology
- maps fingers onto each other
digital
- interacting through „touching“
2. SURVEY QUESTIONS

2.1. Survey questions – first iteration
   a) Home is…
   b) When I miss someone, I…
   c) I check on my loved ones…
   d) I wish I could find out how my loved ones feel…
   e) The nicest way somebody ever told me that she/he was thinking about me was…
   f) When I want to tell somebody “I am thinking about you”, I…
   g) I signalize “now is a good moment to talk” via…
   h) I am coming home after a long day. The first thing I see is…
   i) And the first thing I do is…
   j) My favorite place at home to talk is…
   k) Anything else you want to say about loved ones, emotions and communication…?

2.2. Survey questions – second iteration
   a) Home is…
   b) When I miss someone, I…
   c) I check on my loved ones…
   d) I wish I could find out how my loved ones feel…
   e) The nicest way somebody ever told me that she/he was thinking about me was…
   f) When I want to tell somebody “I am thinking about you”, I…
   g) When I get home after a long day of work, I usually…
   h) I signalize “now is a good moment to talk” via…
   i) My favorite place at home to talk is…
   j) is my favorite place because…
   k) Which object/thing makes you happy at home?
   l) Why? What meaning does it have?
   m) Anything else you want to say about loved ones, emotions and communication? Here is some space for other thoughts.
### 3. SURVEY ANSWERS: FIRST ITERATION

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Participant's Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you often feel lonely?</td>
<td>Yes, I feel lonely most of the time.</td>
</tr>
<tr>
<td>2</td>
<td>Do you feel like you have a support network?</td>
<td>No, I feel isolated.</td>
</tr>
<tr>
<td>3</td>
<td>Do you feel safe in your environment?</td>
<td>Yes, I feel safe.</td>
</tr>
<tr>
<td>4</td>
<td>Do you feel satisfied with your life?</td>
<td>No, I feel unsatisfied.</td>
</tr>
<tr>
<td>5</td>
<td>Do you feel like you are making progress?</td>
<td>Yes, I feel I am making progress.</td>
</tr>
<tr>
<td>6</td>
<td>Do you feel like you are happy overall?</td>
<td>No, I feel unhappy.</td>
</tr>
</tbody>
</table>

*Note: The table above is a simplified representation of the survey answers.*
### 3. Survey Answers: Second Iteration

**When you think about the time...**

- **During my personal time**
- **During my work time**
- **During my leisure time**

<table>
<thead>
<tr>
<th>When you think about the time...</th>
<th>During my personal time</th>
<th>During my work time</th>
<th>During my leisure time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When you think about the time...</strong></td>
<td><strong>During my personal time</strong></td>
<td><strong>During my work time</strong></td>
<td><strong>During my leisure time</strong></td>
</tr>
<tr>
<td><strong>During my personal time</strong></td>
<td><strong>During my work time</strong></td>
<td><strong>During my leisure time</strong></td>
<td></td>
</tr>
<tr>
<td><strong>During my work time</strong></td>
<td><strong>During my personal time</strong></td>
<td><strong>During my leisure time</strong></td>
<td></td>
</tr>
<tr>
<td><strong>During my leisure time</strong></td>
<td><strong>During my personal time</strong></td>
<td><strong>During my work time</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Types of activities**

- **Work activities**
- **Leisure activities**
- **Personal activities**

<table>
<thead>
<tr>
<th>Types of activities</th>
<th>Work activities</th>
<th>Leisure activities</th>
<th>Personal activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work activities</strong></td>
<td><strong>Leisure activities</strong></td>
<td><strong>Personal activities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Leisure activities</strong></td>
<td><strong>Work activities</strong></td>
<td><strong>Personal activities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Personal activities</strong></td>
<td><strong>Work activities</strong></td>
<td><strong>Leisure activities</strong></td>
<td></td>
</tr>
</tbody>
</table>

**How often do you...?**

- **Think about the time...**
- **Work activities**
- **Leisure activities**
- **Personal activities**

<table>
<thead>
<tr>
<th>How often do you...?</th>
<th>Think about the time...</th>
<th>Work activities</th>
<th>Leisure activities</th>
<th>Personal activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Think about the time...</strong></td>
<td><strong>Work activities</strong></td>
<td><strong>Leisure activities</strong></td>
<td><strong>Personal activities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Work activities</strong></td>
<td><strong>Think about the time...</strong></td>
<td><strong>Leisure activities</strong></td>
<td><strong>Personal activities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Leisure activities</strong></td>
<td><strong>Think about the time...</strong></td>
<td><strong>Work activities</strong></td>
<td><strong>Personal activities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Personal activities</strong></td>
<td><strong>Think about the time...</strong></td>
<td><strong>Work activities</strong></td>
<td><strong>Leisure activities</strong></td>
<td></td>
</tr>
</tbody>
</table>

**What are your thoughts about...?**

- **Work activities**
- **Leisure activities**
- **Personal activities**

<table>
<thead>
<tr>
<th>What are your thoughts about...?</th>
<th>Work activities</th>
<th>Leisure activities</th>
<th>Personal activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work activities</strong></td>
<td><strong>Leisure activities</strong></td>
<td><strong>Personal activities</strong></td>
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**What do you think about...?**

- **Work activities**
- **Leisure activities**
- **Personal activities**

<table>
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The interviews were initiated by an introduction to my research area, the topics of the questions and general information about the material and the usage of the answers.

a) Personal details: Age, gender, living situation and happy or unhappy with it, location of family and friends.

b) Closeness:
   a. How many people would you consider to be very close to you? Could you map them on the IOS Closeness Measure after Gooch and Watts (explained the concept of this mapping)
   b. With which medium do you communicate most with the close people who are far away? Why do you choose this and how often?
   c. Do you make a difference between people who interrupt you?

c) Technology
   a. Can you think of any rituals you have with technology? (for example a certain time when you mute your phone… etc)
   b. Is there a difference in usage of your technology when you are outside or at home?
   c. Do you feel the need to disconnect completely sometimes?

d) Interruptions
   a. What do you understand under the term interruption?
   b. When do you feel like technology interrupts you?
   c. Do you feel like you interrupt yourself sometimes with technology?
   d. How do you differentiate the technologies that interrupt you?

e) Notifications
   a. Which mode is your phone usually in?
   b. How do notifications catch your attention?
   c. Can you describe the feeling when there is a long list of notifications on your phone and what you do with them?
   d. Have you turned off notifications for specific services? Or persons? Why?

f) Content
   a. Do you answer phone calls immediately? Is it person dependent?
   b. Do you feel more interrupted by a phone call or notification?
   c. What kind of interruptions make you feel happy
5. IDEATION, SKETCHES

**Design for Coming Home**

- **Phone Prison**: Prevents work-related notifications social media apps at home.
  - Only personal messages get through.

- **Human Capital**
  - Notification: Work by a person.

- **More Dice**: Helps people connect through a shared experience.

- **Trade-off**: Interruption vs. value of receiving a notification.

- **Critical**
  - Do you push something before being interrupted?
  - Home makes you not contact people.

- **Suprise Think Machine**
  - What do you think about someone when they leave the machine?
  - If alerted, you don’t follow it.
5. IDEATION, SKETCHES

CONNECTED DEVICES
- curl up into a ball

- sets out only (approx. 2 years)
- guess if it?

- ION GUESS. UNDOE BLEND.
- DRAW WIND AND GLOWDEN.

mood: katus vs. tease.
- temperature
5. IDEATION, SKETCHES

[HEDGE TALK]

- Kids interrupt parents
- Expressing emotions through touch, playful, without words
- LANDLINES
  DIE
  Too EASILY
  For PHONE

KIDS
4 - 9 years old
basically no research about that age group
5. IDEATION, SKETCHES

HOME CONCEPT: Social presence without interruptions

- Two people do the same thing with the same device, the behaviour of the device changes the behaviour.

Creating moments of synchronicity

MODES OF SYNCHRONICITY

- Social presence without interruptions
- Surprise when people use the device at the same time
- Control?

Invasive contact. Abrasion. Theft.

Accessories for
- Self-directed

- Something common
- Privacy concerns

Invasive?

Translate self-directed interruptions to other devices
Tumbled.

> handheld device for nervous, lonely moments.
> temperature sensitive: pace/intensity changes?
> catches attention through light (when held by the other person)
> can be hold during another (relaxing) activity (like watching TV, book...)
> spheric forms are perceived to be playful...

--

**Prototype 2**

- self-directed interruptions - alternative to the phone
- self- / non-self directed interruption & more urgent?
- subtle expression: light
- social presence through "holding" the same device
- "forced" just another new device
5. IDEATION, SKETCHES

PLANT-FRIEND

Turning a practice into a connected, shared experience.

Sensors feel if plant is watered

Every time one plant is watered, the other one is watered too.

Optional:
APP: Notifications every time plant is watered
What if one plant is sickly? Is it possible to turn it off?