

FMP report

To re-humanize our living room that is increasingly – and unavoidably - filled with smart technology using smart furniture that allows for quality time with family members

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ABSTRACT

The prototype that is eventually created is basically a table that allows you to put your smartphone on it after which it extracts and shows the video and photo content you shared and created that day. It aims to combine the qualities of social networks, a sharing platform, and the obvious qualities of being together in the living room and having a good conversation with your family members. The photos and videos that are shown are used to support and enrich a conversation with your home family members through moments of communal reflection - having quality time with your family. Effectively fusing the digital (social) world with the physical social world.

Smart technology nowadays tends to dehumanize our homes and living rooms through both design intent and use. Most smart technology in home such as Internet Of Things appliances are aimed at efficiency and take away some of our control. The nature of personal smart technology with small screens leads to situations we sadly are all familiar with: sitting on the couch next to each other with a smartphone or tablet in hand "being social" whilst completely neglecting each other socially.

Therefore is aimed to propose a prototype that re-humanizes our living room that is increasingly – and unavoidably - filled with smart technology. Note, unavoidably. the intent is not to be overly nostalgic and to ban smart technology from our living room. Instead a piece of smart furniture is proposed that is not aimed at efficiency but rather on play, and that is not a personal device but rather a shared experience.

The biggest challenge in making a product like this 'work', is keeping users interested over a longer period of time. To keep people interested in the table I deployed and played with different modes of awareness and unawareness and a mode in between that I studied shortly using my first probe prototype. I then learned that when the table was aware - reacts on the user through movement, sound and light - people were very interested in the table and tried to figure out how it worked through playful interaction. Though when they figured it all out, they quickly lost interest. The table could no longer surprise them - a vital element of fun and play - it no longer held any secrets to them. When the table was in its unaware mode - it randomly moved, made sounds, and emitted light - people were intrigued for a while. They very quickly lost interest as they figured out they could not influence the actions of the table and started to find its behaviour annoying. Some however were sure to see some pattern and tried to figure that out still. A combination of the aware and unaware modes seemed to be 'magic'. People quickly recognized a pattern through the aware behaviour but sometimes this pattern got interrupted by unaware, seemingly spontaneous, actions. These spontaneous actions intrigued people, and triggered them to find out why actions occur through playful interaction.

The final prototype has been user tested for two weeks in the context it was designed for to be able to find out to what extent design goals are met. This showed that the prototype allowed this family to have more quality time with each other and get more involved in each others' activities. It did not necessarily re-humanize the living room.

A photograph of a wooden table with a perforated top, overlaid with a large red geometric shape. The background is a blurred pattern.

Introduction

In this document I will discuss the process to, and the results of, my Final Master's Project.

In the end of this project I want to provide an initiation for smart furniture that supports and enriches family quality time in the living room. The goal of this is to push back the dehumanization of our home that is increasingly – and unavoidably - filled with smart technology. Not by banning smart technology but by using it.

Because of this, I looked into the relationship we have with our furniture and how this can be enhanced in such a way that it brings the residents of a home together around this piece of furniture. As an example one could think of the early days of television and radio in which family gathered around to enjoy the same show together, which gave a sense of connectedness.

The result of my previous M21 semester - through research and a number of design iterations - paved the way to do this by combining the qualities of social networks and the obvious qualities of having quality time with your family. With this concept, in a way, I try to fuse the digital (social) world with the physical social world.

The content we create using smartphones and social networks will be used to enrich and support quality time conversations with family at home. In the end I will discuss a short diary study (2 weeks) that I performed to measure to what extent the design goals are met.

Design Opportunity

Our home is increasingly – and unavoidably - filled with smart technology. I believe that the current design of many smart technology appliances, leads to dehumanization of our home. To prove that this does not mean that smart technology is a bad thing in itself, I want to propose a Smart home product as a new entity in the living room that supports social cohesion amongst its residents.

Context of the project: The home of a family

Our homes and interiors are being shaped through our furniture. The past century has been characterized by rapid and extensive change of how we use our homes. Both through cultural change and functional change. Technological advancement has been a catalyst for both of these.

History

What we now perceive as the typical family home in our western culture is something that evolved after the industrial revolution.

Our homes now typically host a single generation of a family - parents with children. Less than a century ago often also grandparents and other family lived in the same house.

This is still the case in many non-western cultures. This can be due to the way people value their value, but mostly because family has to take care of each other. In non-western cultures the 'living room' is often a space where an even a broader diverse collection of family and friends are gathering together. This is a concept that already existed 790.000 years ago when people started gathering around campfires in villages or camps. (Alperson-Afil, 2008; Langard, 2014)

Before the industrial revolution and the social safety nets we know now, lower class people did not have a number of rooms in their homes like we have now. Often the whole house existed out of one space where families were together, where they cooked and ate and where they even slept. The living room in its current form has emerged in city buildings in the 20th century. As the houses of the common people got larger, the combined living / bedroom was separated into separate living and sleeping areas. However this physical growth of our houses is a positive development, it also has the counteraction that family members can retreat to their own corners of the house, so there's less chance that family members will see each other. (Taylor, 2013)

Interior Design

Decorating our environments is something the human species has always been doing; from cave drawings to our current eclectic homes.

For many people their home is the only place where they can truly be themselves. Through globalization, information technology and television shows people have become much more aware of interior design. Many interiors nowadays are very eclectic and reflect the history and personality of the inhabitants. It is part of their identity. ("Vitra," n.d.)

Home interior decoration has always been something fairly standard within a certain culture. Interior styling was very period determined, based on convention. The ever growing globalization of the last centuries has changed this into trends that are less culture sensitive but also a more mixed and considerate. Profound knowledge in interior design history is currently needed to properly recognize the latest trends in the market. (Crawford, 2002)

The various interior (makeover) magazine features and television shows has had a great impact on the idea of a home and how we perceive our interiors. (Naratzky, 2011) Moreover it has made us more aware of our interior design. Over the years The design of the interior has been conceptualised as a domestic and amateur phenomenon. (Lees-Maffei, 2008) The experts in magazines and television shows though, actually act and function as 'tastemakers' in this regard. (Philips, 2005)

The profound awareness of interior design amongst people has transformed them from imposed trend followers to designers. Instead of different style trends following up, we now see them being next to each other. Our homes have become our own choice of interior style mixed with personal items, old and new, classical and modern. Our interiors evolve over the years and are often made even more personal through DIY items.

Furniture and technology

The first technology for our homes was designed as furniture, as an addition to your interior. Current design of technology is way more generic. Personally I want to aim for synergy between interior design and technology: "Technologies must be designed to accommodate the rich and diverse ways in which people organize their homes, by providing resources to artfully construct their own systems from their own experience." (Taylor & Swan, 2005)

Cultural probe: The Dutch living room

I personally think the living room is a pre-eminent space in our homes when it comes to social gathering and domestic comfort and qualities. Therefore I conducted a small cultural probe in six households to get more insight in how this space is being used and what qualities it possesses. (Bernhaupt, Obrist, Weiss, Beck, & Tscheligi, 2008) This probe learned the following things about the (Dutch) living room:

All living rooms included a sofa; most had other seats or sofa's in front or next to this sofa. (83%)

All households without children had a coffee table close to this sofa. (50%)

The households with children had small side-tables or no tables at all.

All of the living rooms included a dining area. Though only 50% actually used it as such on a daily basis. All of the living rooms consisted out of furniture that was collected over the years - not bought at once.

All participants put value in the things they use as decoration. Most valuable to them where the photos they had all spread through the room. One of the living rooms actually featured a table that only had family photos on top of it. 83% agreed that their living room projects their identity. Also books - which 83% of the living rooms had - are perceived as being important to this regard.

In 50% of the households the decoration and interior style is mainly determined by one person of the family. In all cases this is a woman. The other half determines this together or even with people that don't live in the same house.

67% of the participants works in the living room on

a regular basis. For none of them this was the only working space.

All of the participants value their living room most as a place to be together. Though all of them also spend at least 8 hours a week alone in the living room. They would then either be working or entertained by reading a book, watching television or listening music. The latter entertainment activities are greater valued when being together. Other important activities in being together are, playing and socializing/communicating.

To the question what makes a living room into a living room participants answered very differently. Some argued that this is where they meet family, others identified a living room by its facilities to 'chill', which is close to another that recognizes a living room by the availability of lazy chair and/or comfy couch.

All of the participants frequently use technology in the living room. This is mostly for entertainment. Televisions and stereo sets often have a central place (67%) in the living room and are greatly valued for the pleasure they provide and their clear and confined functionality. Most women don't like the looks of devices in the living room. At one household the television was in a cabinet. 67% has their music installation in a cabinet.

100% of the participants frequently use personal technology in the living room, regardless of others being present. This is done mostly for social media and entertainment but is sometimes work related.

Only two of the households had 'smart house' technology in the living room. One of them experiments with domotica so has several items, the other only had a smart thermostat.

Most importantly and concluding I learned that truly being together in the living room mainly involves:

- Being entertained together;
- Playing together;
- Communicating with one another.

This is pretty much in line with the findings of Bernhaupt et. al. (2007) It names five most appreciated activities in the living room, namely: socializing, watching TV, listening music/radio, reading and playing.

Identified issues

I believe that the current design of many smart technology appliances, leads to dehumanization of our home and living room.

I identified five main issues regarding the current technology that enters our homes, adding up to this dehumanization in some extent:

- Efficiency driven design
- Loss of control
- Technology is getting decreasingly comprehensible and graspable
- Caring for each other is decreasingly necessary
- Personalization/individualization of technology

I will shortly elaborate on each of these issues.

Efficiency driven design

Innovation has always been driven by a desire to decrease efforts and to increase efficiency of the things we do on a regular basis. Innovation has become so fast in this era though, that we are hardly able to develop and maintain our own rituals over the years. Some new technology that will dramatically increase efficiency of the process is always around the corner. Rituals are personal and developed from intrinsic motifs based on endogenous values. They are in this way very valuable. Rituals in the home may be inefficient, but they should not be optimized away. (Bell, Blythe, & Sengers, 2005) Many researchers have concluded that people are willing to overlook a lower efficiency because the alternative has more endogenous value, is more enjoyable and is more stimulating. (Zuckerman & Gal-Oz, 2013) Lots of research is done to new design and interaction methods such as rich interaction, that provides more meaning to interaction with technology, and pays more attention to interaction affordances. (Frens, 2006) This is not yet translated to the market though that evidently is now dominated by (very efficient) touch screens.

When we design for a home environment we should not just deploy tools and work methods for certain specific tasks. But in a more general sense also consider the design of an environment in which these tasks occur: Design structures within which we express presence through interaction with the environment. This implies technology that aims for reflection and moments of mental rest rather than efficiency. (Hallnäs & Redström, 2001) (Odom et al., 2014)

Loss of control

The rapid and consecutive introduction of labor saving appliances changed our lives for the better. Tedious tasks require less effort, leaving energy and time for more enjoyable things. Though with technology becoming more intelligent the question of who's in charge arises. (Bell et al., 2005) (ALM & ARNOTT, 2015)

It seems that people gradually lose control over details of their everyday lives. Smart technology takes decisions for you and could even take over whole processes or correct your wrongs. (Tovala, 2016) (Bell et al., 2005)

For people to feel comfortable in their house this house must also be a home to them. This implies a degree of control over your domestic environment and supplies refuge from the world outside (Rybczynski, 1987) that does not provide this degree

of control. (ALM & ARNOTT, 2015)

Computers have long been dependent on the user input only. Advanced context-aware systems can break this interaction model and thus make us question or even invert the sense of who is in control. (Bellotti & Edwards, 2001)

When designing for the home environment, one must design for families rather than for defined users. The activities and routines of families do not map well to predefined tasks. When providing control to users it is about control of devices. Families want more control of their lives. (Davidoff, Lee, Yiu, Zimmerman, & Dey, 2006)

Technology is getting decreasingly comprehensible and graspable.

This data driven information era, with its increasingly complex devices has disabled people to fully comprehend the technology that surrounds us. (Arbesman, 2014) This lack of full comprehension also leads to less trust in the technology because we cannot fully anticipate its behaviour. (Howah & Cowling, 2015) Healy (2005) argues that this lack of comprehension is due to complexity of a system, its dynamics, its intransparency and our own ignorance and mistaken hypotheses.

With many of our personal data and information in the cloud and many products wirelessly connected, we can no longer even truly touch it. Hence the vague name: 'the cloud'.

This is not necessarily a problem in itself, though it could add up to a sense of loss of control as discussed earlier. Also I learned from the first cultural probe that touchable and clearly confined devices such as stereo sets are greatly appreciated and valued. People value their clear boundaries in functionality and spatial placement. Still though, especially women tend to put devices out of sight because they are perceived as being ugly; highlighting the importance of visual aesthetics in the living room.

Caring for each other is decreasingly necessary.

Caring for each other potentially endorses and strengthens relationships. Technology is taking away the extrinsic need to care for each other bit by bit. In elderly homes and nursery this has already grown into an important ethical issue. They are watched over and sometimes cared for by technology but lack the human contact that would otherwise come with this care. (Chung, Demiris, & Thompson, 2016)

There is value in honouring food that someone else has cooked with love and care. If we don't communicate at the dining table because we are too busy with our personal technology or if the food is prepared by smart technology, this value is lost. (Mitra, 2015) (Tovala, 2016)

Personalization/individualization of technology and 'social' networking

The most apparent dehumanizing smart technology is without a doubt the Personalization and individualization of technology. In just a decade a majority of western people have obtained the opportunity to access the internet by using a mobile device from virtually any place, including their homes. This allows us to actively use social networks throughout the day, or get solitudinal digital entertainment at any time.

Mature markets such as the USA, Western-Europe, Japan and Asian markets such as South-Korea, have a smartphone penetration of about 90 percent. (Gartner, 2016) In the Netherlands 86% of the people between 12 and 80 years old own a smartphone. In the range of 12 to 50 years old, 95% of the people own a smartphone. ("TP:Basics," 2016) Communication on social media (70%), WhatsApp (74%), sms (71%) and e-mail (74%) are the most important uses of a smartphone in the Netherlands. (Marketingfacts, 2015) Smartphones and digital social networks have become so important to us that we check our devices about 50 times a day and many check their phones within five minutes of waking up. (Woollaston, 2015)

Most people will recognize the scenario where family members are sitting together in the living room, all staring at their smartphone. Being with others in the living room seems to become a side issue. While one is physically present in the room one could actually be at an entirely different place. (Price, 2011) One could just sit on the couch next to another, completely ignoring each other. Personal technologies, like smartphones, tablets and laptops allow us to keep in touch with the whole world. Though it also potentially isolates members of the same family under one roof or even in the same room. (Lickerman M.D., 2008) Obviously this has a negative effect on our relationship with the family and even our social well-being. (Catherine Steiner-Adair EdD., Teresa H. Barker, 2013)

"Human beings are losing their ability to communicate in person. To smile at each other. To converse. To enjoy a meal together without looking at their smartphones. To look into each other's eyes. To touch. To be present in the moment without interruption. This is a tremendous loss that cannot be quantified." (Mitra, 2015)

Many families increasingly get into – what I like to call – a 'Live Together Apart' relationship.

"It has gotten to the point where it seems like parents and children are emailing and texting each other more than they're talking — even when they're at home together!" (Taylor, 2013)

Some literature though quotes that smartphones and social networks are a social improvement for families (Moscaritolo, 2012):



Picture 1: Infographic on how "mobile technology unites the American family". Image source: CTIA/Qualtrics

According to CTIA (an international industry trade group representing all wireless communication sectors), wireless devices don't dehumanize families, they merely change the way we live and work. According to a survey CTIA did, mobile technology improves the quality of time families are spending with each other. Their actual survey numbers only mention informing family, staying in contact when being apart, and planning activities though. (Picture 1) The actual quality of the time spend together is not mentioned. An article by Charlie Osborne (2012), a medical anthropologist, indeed argues that this survey missed the fact that there is a difference between having information about the activities and status of a relative, and having quality communication with them.

"Mobile devices simply add yet another distraction that takes away interaction in the present with those around you. Is it quality time when you are pulled away from a game with your child to take a work call, or spend time checking Facebook instead of communicating with your partner?" (Osborne, 2012)

Knowing things about people around you through digital social networks may make you feel more connected with them, but if the trade-off is a distracting environment and less quality time spent with them physically present, this is a deprivation of human relationships.

Initial Design goals

One solution to all of these issues would be to ban smart technology - and mainly personal technology - from our homes. I don't intend to be overly nostalgic about smart technology in a way that I wish to ban it from our living room. I believe banning technology or switching it off this is not a marketable solution since we have become dependant on it and because it also brings a lot of good things. Switching off technology to allow family quality time has been proposed by others however. (Like for instance the Dolmio Pepper Hacker does: *Dolmio Australia, 2015*) Instead I would like to embrace it. I believe that there is room to use smart technology to enrich this quality time. Effectively fusing the qualities and possibilities of the digital world with the qualities of the physical social world. Unlike many other Internet Of Things Appliances and smart technology today this should not be aimed at efficiency but rather on play, and it should not be a personal device but rather a shared experience. To push back the dehumanization of our living room through smart technology, this technology must be designed in such a way that the control and interaction mechanisms reflect the complex and emotional relationship between the person and the domestic environment they live in. (Rybczynski, 1987, p244) As Rybczynski states it:

"... the evolution of comfort will continue. For the moment, this evolution is dominated by technology ... This need not dehumanize the home, any more than effective fireplaces or electricity did in the past. Can we really have coziness and robots? That will depend on how successful we are in turning away from modernism's shallow enthusiasms, and developing a deeper and more genuine understanding of domestic comfort."

Therefore I will wield from the many decades of findings and experience in this regard from fields such as interior design, architecture and ethnography.

The television was once introduced as a piece of furniture that members of the same family could gather around to. (Picture 2) However the television - back then - could hardly be called smart technology, it still is a piece of 'living room invading high tech' that brought valuable means of being together. Much like a camp-fire has done many centuries ago: People did not necessarily gather to meet each other, they gathered around this source of warmth and with that came together. (Langard, 2014)

To bring people together they apparently need what is called a visual focal point. (Canter, Gilchrist, Miller, & Roberts, 1974) For many decades this has been a fire. However the primary intention of a fire was of course to give warmth and light, other sources of light and heat have been developed, moving the primary intention of a fireplace into a completely different physical dimension, a visual one. (Panofsky, 1970) (Canter, Gilchrist, Miller, & Roberts, 1974) (Franz & Smulyan, 2011, 360-361) The television from its introduction became the new visual focal point in the living room; uniting families around it to watch the same show. Television is more and more loosing this important place in our living rooms though. On demand entertainment on personal screens takes away the need to enjoy things together.



Picture 2: Illustration of a family from the 1950s, gathering around a television that was designed as a piece of furniture back then.

I want to propose a Smart piece of furniture as a new entity in the living room that enriches supports social cohesion amongst its residents.

The goal of this is to push back the dehumanization of our home that is increasingly - and unavoidably - filled with smart technology. Because of this I am interested in the relationship we have with our furniture and how this can be enhanced in such a way that it brings the residents of a home together around this piece of furniture.

Design iterations



First prototype: Aware/Unaware table

The first prototype I developed can be considered to be a second probe that is aimed to find out more about the relationship we have with this furniture and how this can be influenced by smart technology in a way that is not dehumanizing.

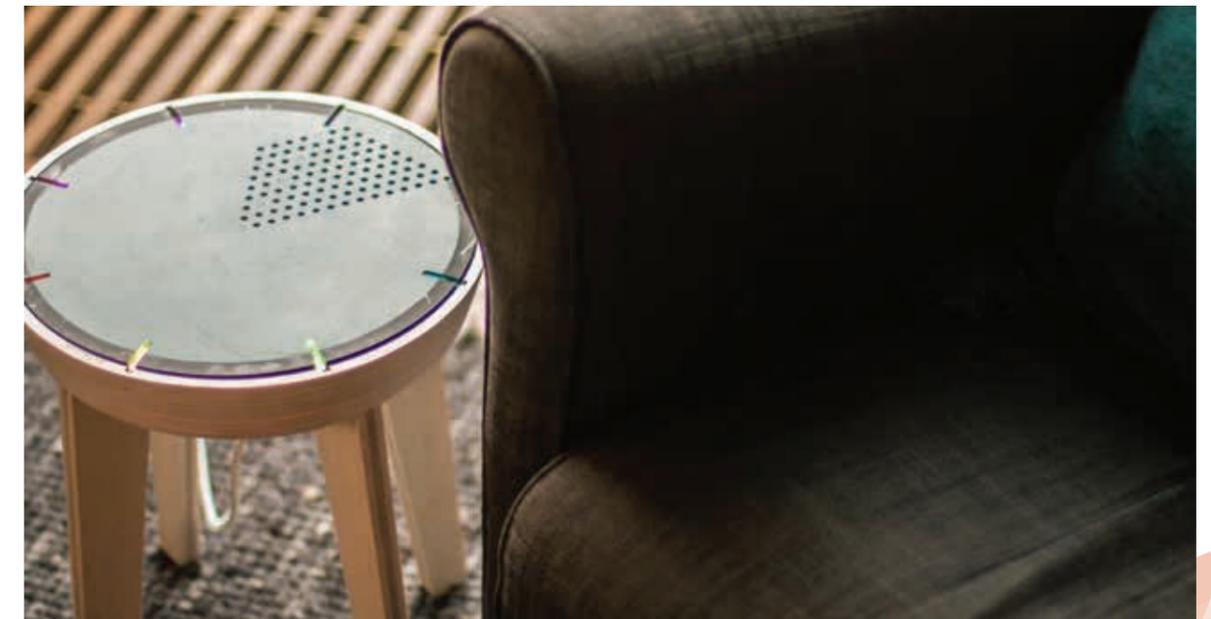
Background

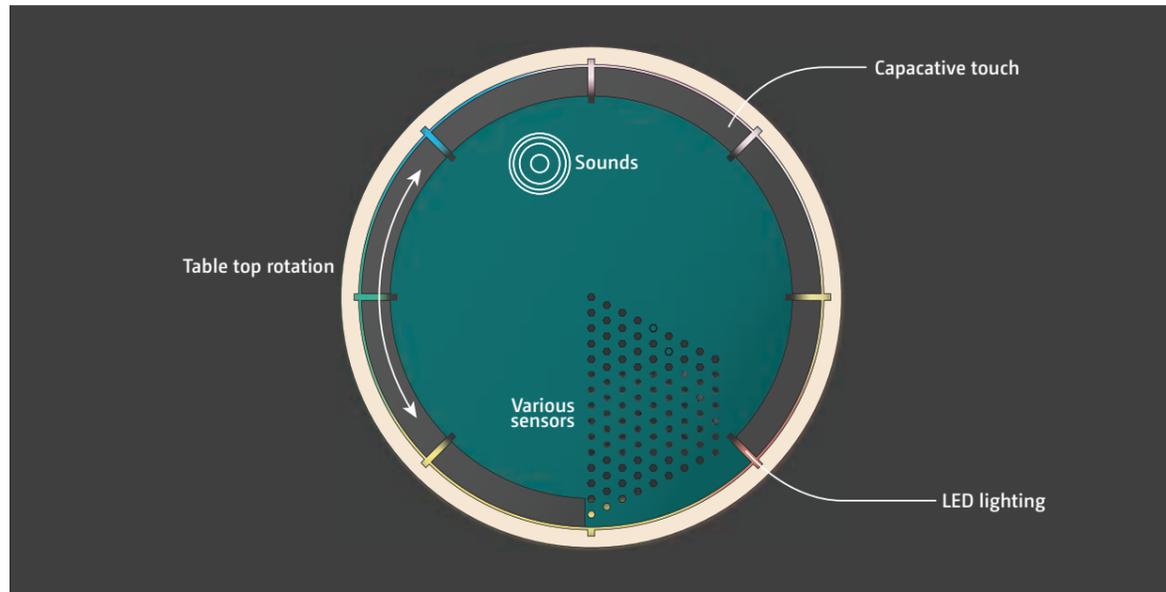
In many ways our relationship with other humans and pet animals feels richer than the relationship we have with furniture. I hypothesize that this is because humans and some animals react on interactions in a meaningful way but also spontaneously undertake actions. The mentioned action and reaction can be considered the base of communication. This is how most current smart home appliances work. If this would be all in human communication, it would feel very artificial though. It's the spontaneous action that makes human communication feel alive. Spontaneity is a vessel for surprise, fun and curiosity. Because for instance dogs both react and undertake spontaneous action, we perceive it as being an intelligent entity with a personality that is taken into account when being in the same room. Robot vacuum cleaners such as the Roomba also inhibit this seemingly spontaneous behaviour next to reaction through the embedded sensors. Because of this people tend to project human characteristics and emotional relationship to this little device. This results in higher endogenous value which is evident by the fact that people even took some effort to fit Roomba into their homes, and shared that with others. It also helped them to forgive shortcomings and unreliability of the technology. (Sung et al., 2007) If products are a new entity with its own personality in the living room, 'users' are enticed to project

human emotional values and relation to the product. With that people are more likely to grant endogenous value to the product. Surprise, curiosity, action and reaction are tools to achieve this. To give the product a personality means it has to have a believable balance of action-reaction (Environment aware) and spontaneity (Environment Unaware/ignoring); (Odom & Wakkary, 2015) The work of Odom and Wakkary on Unaware objects is very interesting in this regard. This work highlights the notion of intersections (post- functional engagement) and ensembles (relation to, and combination with, other artifacts) through fully Unaware Objects that blend in our interior as furniture. These interaction design artifacts emphasizes actuality over functionality, and neither has an explicit interface nor computational awareness of its owners presence or actions.

Description

The first project iteration that I created therefore is an interactive table that varies in this balance between awareness and unawareness. It is tested in three households for about one week to see what intersections and ensembles arise and to learn what the perceived intelligence and personality is in its different aware/unaware balance varieties. The design of the table is kept small and simple because it has to fit in different interiors. The table has three different modes Aware, Unaware, and a mode in between. In aware mode, the table only reacts on its environment, in unaware mode it only undertakes spontaneous action. Every household got to test another mode. The technology to enable the interactions is elaborated in table 1 and picture 3.





Picture 3: Render of the table top including sensing and actuation capabilities

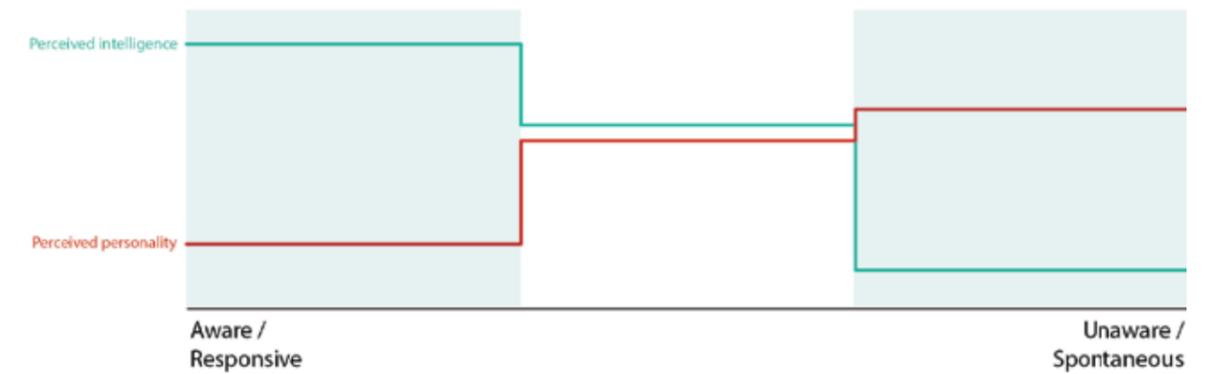
	Aware	Combined	Unaware
Sensors			
Microphone	sound pressure translated to the intensity of sound and movement the table made.	sound pressure translated to the intensity of sound and movement the table made.	Inactive
Proximity sensor	table reacts on people approaching from the top by sound and light.	table reacts on people approaching from the top by sound and light.	Inactive
IR light sensor	Amount of ir light gets translated to the amount of light the table emits	Amount of ir light gets translated to the amount of light the table emits	Inactive
Capacitive sensors	enact sounds when touched and also stop the table top from moving whilst being touched	enact sounds when touched and also stop the table top from moving whilst being touched	Inactive
Pressure sensors	stop the table top from moving whilst being touched and translate the pressure to the the amount of light the table emits	stop the table top from moving whilst being touched and translate the pressure to the the amount of light the table emits	Inactive
Actuators			
Servo motor (with position readout hack)	makes the table top move slowly. (By hacking the servo I could also readout its current position which enabled me to rotate back when the user rotated the table top.) Movement is based on sound pressure and touch and pressure on the table top.	makes the table top move slowly. (By hacking the servo I could also readout its current position which enabled me to rotate back when the user rotated the table top.) Movement is in 50% of the cases based on sound pressure and touch and pressure on the table top. It also moves at random moments.	makes the table top move slowly. Moves at random moments in random directions.
Soundshield and two speakers	Uses sounds on an sd card. Always the same sound with a certain sensor input.	Uses sounds on an sd card. Sound intensity is based on environment sound pressure and input from proximity sensor. Plays random sounds at random moments.	Plays sounds at random times.
Led lighting strip	Emits RGB-colored light based on sensor inputs.	Emits RGB-colored light based on sensor inputs. Without high inputs it emits light at random times, in random, patterns, colors and intensities.	Emits light at random times, in random, patterns, colors and intensities.

Table 1

Gained insights

Based on the work of Hingston, using four human sociality traits: grouping (personality and endogenous value), attachment (personality and endogenous value), reciprocity (intelligence and awareness), reflexivity (intelligence and awareness), a number of

questions is compiled into a survey. (Hingston, 2012) Next to this the participants where asked to rate human emotional traits that are discussed earlier: surprise and curiosity. The results of these surveys are summarized in the graph below: (Graph 1)



Graph 1: Showing how the balance between awareness and unawareness is perceived on intelligence and personality

Some survey questions on interactions and ensembles with the table learned me that people interacted mostly with the moving of the tabletop because they wanted to align it. The fully environment aware table was interacted with most at the beginning. The users tried to figure out how it worked through playful interaction. Though when then they figured it all out, they quickly lost interest. The table could no longer surprise them - a vital element of fun and play - it no longer held any secrets to them. After all was explored the table was more or less forgotten. The unaware mode of the table intrigued its users, but they very quickly lost interest as they figured out they could not influence

the actions of the table and started. The tables behaviour then quickly started to annoy them. Some however where sure to see some pattern and tried to figure that out still. A combination of the aware and unaware modes seemed to be 'magic'. People quickly recognized a pattern through the aware behaviour but sometimes this pattern got interrupted by unaware, seemingly spontaneous, actions. These spontaneous actions intrigued people, and triggered them to find out why actions occur through playful interaction. It was especially interesting to see how the combined and unaware mode tables where often referred to as 'he' whilst the environment aware mode table was consistently referred to as 'it'.

Construction process

The bowl in which all technology is stored, simply consists of number of stacked lasercut circles that where sanded to create a smooth outer surface. (Picture 5) This is fully made out of birch plywood. The table legs are also made out of sanded lasercut layers.

Though the middle layer is made of MDF opposed to birch plywood to make sure they won't bend. The tabletop is lasercut and engraved out of MDF to ensure it will not bend. Also MDF provides a better ground for applying the graphite conductive paint that functioned as capacitive sensor.



Picture 4: Integrating electronics



Picture 5: Sanding the lasercut table bowl

iRobot iCreate

From the field of smart technology with a personality, one quickly gets into the realm of robotics. As the Roomba and television discussed earlier, I want the product I design to be a new entity with personality in the living room, in order to bring people together around this product. For the product to have personality it must have human like qualities as explored with the first table prototype but it should not visually be a 'fake human'. Research has shown that lifelike forms are inappropriate for domestic technologies. (Sung et al., 2007) A mentioned example is that one of the participants wanted to buy a Sony AIBO, though his wife refused to have a 'fake dog' in their home. One of the participants in

my own first probe in several households did greatly value the friendly creature like shape of their stereo speakers (Scandyna BigPod).^(Picture 6) As a platform to explore different designs I therefore wanted to buy a iRobot iCreate.^(Picture 7) The iCreate is a developers version of the iRobot Roomba vacuum cleaner excluding the actual vacuum cleaning capability but including all sensors and actuators and an open SDK. Actually getting one in Europe proved to be quite hard. This was a good thing though because it allowed me to reflect on where I was going with this project. I then realized I was astray on a path that was more one creating a digital pet, rather than supporting and enriching social cohesion at home to push back its dehumanization.



Picture 6: A photo of the 'creature-like' Scandyna BigPod speaker.



Picture 7: iRobot iCreate 2. Image source: irobot.com

Second prototype: projection of smartphone social content

By stepping back and taking the design-goals into re-consideration, I decided to start from the most apparent issue in the dehumanization of our family lives at home: smartphones.

Basic concept

As discussed extensively, smartphones use deprives true human connection at home. (Taylor, 2013) Smartphones allow us -through social networks - to share moments in our lives and to inform others about our current affairs. This stays within the digital realm though. Why don't we just use this content to enrich and support quality time with our family at home? This content then has to be provided through a piece of furniture that a

family could gather around - much like the earlier mentioned television in its early years. When the family members gather around, their smartphones could be collected in order to extract content such as photos made that day and things shared on social networks. This could then be shown within this small gathering to provoke, support and enrich quality time conversations.

The relationship we have with this piece of furniture could then be enhanced through means that are explored in earlier iterations. i.e. giving it a personality through the right balance of awareness and unawareness. This is useful in getting people willing to 'be with it' and gather around.



Picture 8: From left to right: A photo of the original lamp prototype, A render of the projecting and phone holding lamp, A rough alteration of the lamp prototype to test phone collection in a lamp.

Lamp explorational prototype

Taking into account this unaware behaviour, I thought back of an earlier developed prototype of a lamp for the 'Unaware Objects' course by Ron Wakkary. Considering this is already a piece of furniture I altered it in such a way that it can hold several smartphones.^(Picture 8) Putting the smartphones in a lamp has been tested. Most people actually found it to be a weird place to store a smartphone. It 'did not feel right'.

This lamp first functioned as a light spot to bring forward specific places in the room. Therefore

I thought on converting this to a projection of the smartphone contents.

This was mimicked using a beamer and the manual collection of content from social networks. This content was shown using a simple slideshow. To most people this lacked the intimacy of a table to gather around. Also some found the projection to big - considering some things shown feel personal. One argued that the connection between the smartphones, the people gathering and the projection was vague due to the relatively large physical distance.



Picture 9: A down projecting lamp to bring the projection to the intimate setting of a table

Picture 10: I made some sketches and renders of a down projecting lamp that could be taken of the ceiling to lay on the table in order to function as projector from there. I quickly decided though that the various ways to in which the device would be rotated could give problems with storing the smartphones. Also it does not take away some of the earlier mentioned problems.

Back to the table

Back to the drawing table at this point literally meant, 'drawing a table' as I realized a table that is projected on will take away the problems of intimacy, distance and sensible phone storing. A table has the intimacy that is needed for some good family quality time.

The projection is now done using a lamp on top. Several sketches and renders were made. These drawings are used to construct the second - aesthetic - prototype. This prototype is mainly aimed at trying out materials and finishing and to check if the aesthetics fit the context and goal.



Picture 11: A down projecting projection lamp above a table with clear and save slots for the user phones. The design feels closed off though, and also separates the users around in three areas.



Picture 12: A down projecting projection lamp above a table with a separate layer to easily lay down smartphones.



Picture 13: Mostly the same as previous, but with a more flexible lamp holder. This allows the user to project on a wall - for instance for watching movies on a larger format.



Picture 14: Constructing the table prototype



Picture 15: Photos of the finished aesthetic prototype of the table.



Picture 16: Detail photos of the finished aesthetic prototype of the table.



Picture 17: A mockup of smartphone content projection on the table

Early insights and conclusions from the aesthetic prototype

By reflecting on the prototype and taking into account comments I got during the M21 demo day, there are already some insights and conclusions contributing to further development.

The size of the table is good for the intended use. It might be a little lower for use with a sofa and couch. Truly gathering around is not possible since one side is 'closed off' by the lamp holder. Also for people sitting at the back the image would be upside down. Personally I think the chosen materials provide a fresh and modern look without diminishing a natural feeling.

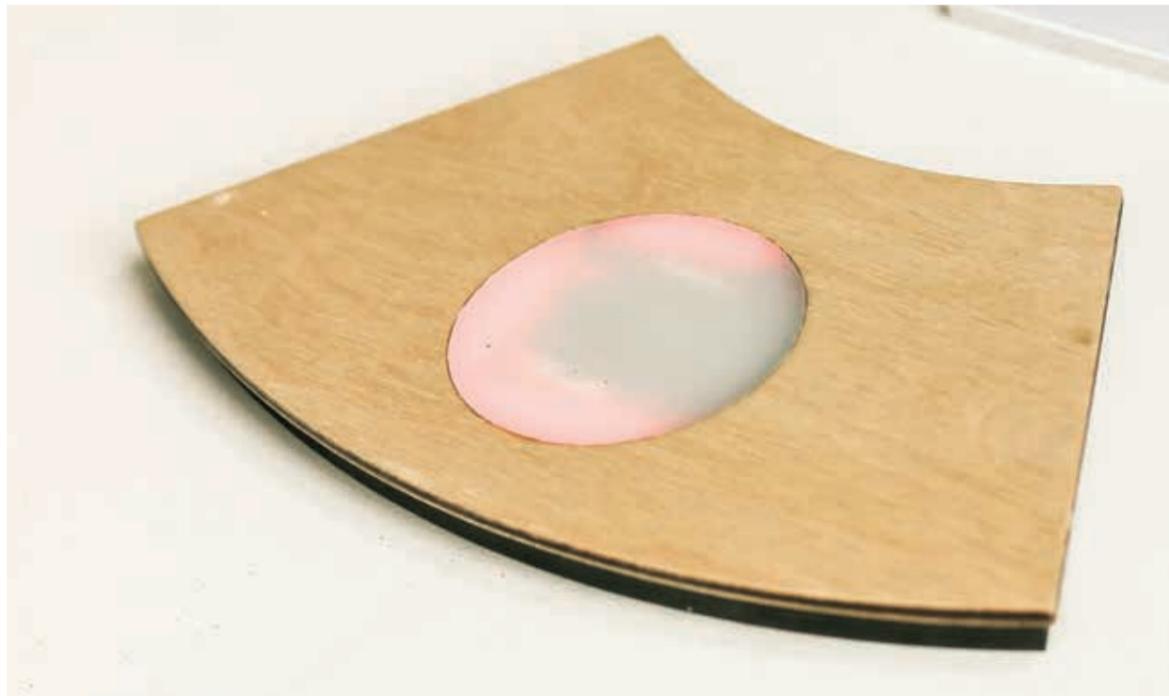
An important downside of the used birch plywood is that it bends heavily. In next iterations I may need to use other wood or combine it with MDF layers like I did with the first prototype table.

At this point the power cable just bluntly comes out

of the bottom of the table bowl. In next iterations I need to do some routing for the cables - both power and a cable to the lamp on top- and incorporate this in the design. The unfinished MDF toplayer disturbed some people. In the end though this should have some finishing. It will probably also provide capacitive touch control to the device.

I need to do some research to the willingness of -especially- teenagers, to share with their parents. It might help to give some degree of control over what is shared.

It is also interesting to investigate the fact that teenagers are reluctant to have quality time conversations with their parents is a consequence of this era or whether this is a phenomena of all times. The most interesting thing would be to just test and see how they cope and react.



Picture 16: NFC - Smartphone connection exploration



Literature

Next to what has been established in the 'Research opportunity' chapter and various design iterations, some other interests arose in the process towards the final prototype. Literature that is relevant to these subjects will shortly be discussed in this chapter. Subjects include our privacy versus our wish to share, social media use and the concept of quality time with family.

Quality time

The goal of my final prototype is to supporting and enriching quality time with family at home in the living room. To be able to measure success in this regard in a user test, it first needs to be established what 'quality time with family' entails. Quality time according to the Cambridge dictionary is "the time that you spend with someone, giving them your full attention because you value the relationship".

Time for quality

With quality time the actual amount of time spent together is not as important as the amount of personal attention focused on loved ones. When families do not have a lot of time to spend together, the quality of time and the activities become important. (Christensen, 2002; Daly, 2001) However quality time is not about amount of time, one does

need a fair amount of time to be able to spend some quality time.

A little boys' description of quality time with family; "sit down, we have a little laughs, we eat a little, and we just be, we talk, we do homework." (Polatnick, 2002) Whether or not those activities fit most people's definitions of quality time, this boy is describing a leisurely "hanging out" together that requires a fair amount of time. (Polatnick, 2002)

Quality of time

One of the most commonly appreciated forms of quality time is that of quality conversation. Quality conversation is sympathetic and empathic: people share their experiences, their thoughts, their feelings, and their desires in a friendly, uninterrupted context. (Chapman, 1995).

Quality communication with your family members is more important than the quantity of communication with them, when it comes to relational quality, satisfaction and intimacy. Quality communication means communication without distraction. A quality conversation is merely impossible without undivided attention for each other. (Przybylski & Weinstein, 2013)

The presence of smartphones or other communication devices can have negative effects on closeness, connection, and conversation quality.

Having conversations is the key to strong family relations. (Bowen, 2013, Offer, 2013) In terms of family live, quality time is a period of time dedicated to family members doing activities without distractions. (Bowen, 2013, Christensen, 2002; Daly, 2001)

Dedicating time to loved ones or even yourself is considered to be one of the best expressions of "love languages," those gestures and expressions which help strengthen the bonds between loved ones, according to relationship counselor Gary Chapman. (Chapman, 1995).

Togetherness

Some argue that "a sense of togetherness" is one of the key-elements of quality time. (Chapman, 1995, Holloway & Valentine, 2004)

Togetherness is about simply belonging together in some space, often a home. The accompanying routines and rituals give a sense of security and comfort. Togetherness in this sense is more about doing things with family than it is about doing things as a family. The first referring to being together, the latter to a more self-conscious enactment of the idea of a family.

Social media, privacy and our desire to self-present

We massively share our information on the internet using social networks. We worry about what governments know about us and how websites track our websurfing behaviour but we voluntarily share a lot of information - that is often of personal and sensitive nature - on social networks. (Utz & Kramer, 2009) This information includes basic information, relationship information, information on private and work-life development and even personal photos and videos. Research to this self-disclosure on the internet suggests that self-presentation (Boyd, 2007) and the ability to maintain social ties (Ellison et al., 2007) contributes to participation on social networks online.

We have a deeply embedded desire to share in order to present ourselves to the world as we want them to see us. (Boyd, 2007) Digital self-presentation gives users the opportunity to present only desirable information about themselves - a control possibility they may not possess in real-world, face-to-face encounters. This is not a new phenomena though:

"A Social Network profile can be seen as a form of digital body where individuals must write themselves into being. In everyday interactions, the

body serves as a critical site of identity performance. In conveying who we are to other people, we use our bodies to project information about ourselves. This is done through movement, clothes, speech and facial expressions. What we put forward is our best effort at what we want to say about who we are." (Boyd, 2007)

Also the decoration of our homes and living room (objects) also mirror our (designed) identity. Many peoples' living rooms are stuffed with so called dis-identifying objects. (Riggins, 1994, p. 113) This concept refers to objects representing false claims, for instance a higher social economic status or intellectuality. Examples include fake antiques or books that are never read.

This self-presentation and trying to "look better" isn't just plain vanity - it's about being noticed and accepted in society. (Sanghani, 2014)

Creativity

One of the upsides of this pursuit of being liked on social network, is that more and more effort is put in producing likable content; which is beneficial to our creativity. (ten Brink, Nack, & Schouten, 2016)



The final prototype

The final prototype is an evolution and further elaboration of the aesthetic prototype shown at the M21 demoday. It is a functional and high quality prototype suitable for testing in context.

The prototype I eventually created is basically a table that allows you to put your smartphone on it, after which it extracts and shows the video and photo content you shared and created that day. It aims to combine the qualities of social networks, a sharing platform, and the obvious qualities of being together in the living room and having a good conversation with your family members. The photos and videos that are shown are used to support and enrich a conversation with your home family members through moments of communal reflection - having quality time with your family. Effectively fusing the digital (social) world with the physical social world.

▶ Table functioning

Modes

The biggest challenge in making a product like this 'work', is keeping users interested over a longer period of time. In the end the goal is after all to make room for quality time and have family members put away their phone on the table. The likelihood of the users doing so should be increased as much as possible. Sound light an movement is used to attract the attention of potential users. If a user is present it also sometimes shows an older photo already. This is all aimed at triggering and motivating users to actually use the table and put their phone on it. This is in line with the factors in the model for persuasive design by B.J. Fogg (2009) The ability factor is very high because it is a very simple action to put a phone on the table. Also interacting with the interface is very simple (just back and forward). To keep people interested in the table I deployed and played with different modes of awareness and unawareness and a mode in between that I studied shortly using my first probe prototype. A combination of the aware and unaware modes seemed to be 'magic'. People quickly recognized a pattern through the aware behaviour, but sometimes this pattern got interrupted by unaware, seemingly spontaneous, actions. These spontaneous actions intrigued people, and triggered them to find out why actions occur through playful interaction.

Image carousel

A set of images and videos derived from present smartphones. These images and videos are projected on the table platform one by one. The user can scroll through the media using back and forward controls by holding their hands over respectively the left

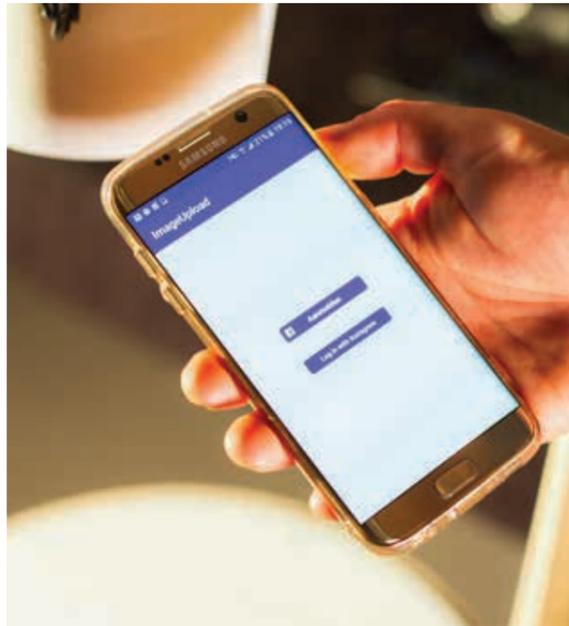


Picture 17: Image carousel interface on the final table prototype.

and right ultrasonic sensor. Images and videos are rounded borders to match the shape of the table. The image carousel holds images that the user made and shared the last 24 hours. For means of surprise and moments of reflection, sometimes an older photo is shown as well. Older photos are also sometimes shown when no smartphone is available to trigger users to put their phones on the table in order to view more photos.

App

Users of the table prototype have to install an app on their (Android) smartphone. This app uploads photos and videos as soon as they are made (camera action) or that are shared via Facebook or Instagram. Once the app is installed users need to start it one time to allow it the necessary access to the phone media and camera and to (optionally) login on Facebook and Instagram. Once this is done the app runs on background.



Picture 18: File upload app

Photos and videos are uploaded to a webserver. This way photos and videos can be uploaded even when the table is offline for some reason.

NFC

Scans for 'known' phone (a phone that has the image and video upload app installed). It flashes a red light if something is detected but not recognized. It lights up green when a known phone is detected. Once the known phone is detected its photos and videos are retrieved via a database. While the phone remains on the NFC scanner the photos and videos from this smartphone are included in the projected image and video carousel.



Picture 19: Smartphone NFC scanning

Table illumination

The table illuminates based on the presence of potential users; ultrasonic detection, sound level detection and light detection. This means if user is physically close (ultrasonic sensor triggered), there is a lot of noise and all lights are on or the sun lights up the room, the illumination is at its brightest.



Picture 20: Table illumination

Table sounds

When the table is not being used but the environment is light and some sound is detected the table makes sounds to attract attention of potential users. It does this using a 20W amplifier and speaker and a vibration motor. It mimics smartphone sounds like ringtones and vibration. The amplifier and speaker are also used to emit the sound of videos.

Table movement

Other means to attract attention of potential users is movement of the table. The table itself does not move, only part of the tabletop rotates. Since this is a round part, change through movement is very subtle. A small stripe indent indicates movement relative to a static stripe indent. The tabletop rotates randomly, effectively dis-aligning the stripe indents. The table top also most of the times reacts if the user rotates the table top; effectively representing a table with a mind of its own.



Picture 21: Table top rotation movement

Technical functionality and specifications

App

The file upload app was, to me, the hardest thing to realize. The Java software has been developed in Android Studio and uses the Facebook and Instagram SDK's. I only developed an Android app due to time restraints.

NFC Detecting a smartphone on the table

This could be done using a simple proximity sensor. This will however not give any information on which smartphone is close-by. Therefore Bluetooth or NFC would be logical ways to detect a phone. Since this is about nearby devices, NFC makes most sense. This can't be used very well to send rich media though. Therefore NFC should only be used to detect which smartphone is on the table after which content can be downloaded via WIFI. Some exploration with different NFC scanners has been done. *(Picture 18)*

In the end the an NFC RFID module built around NXP PN532 is used. The NXP PN532 is very popular in NFC area, meaning there is good documentation a wide community and existing libraries to depend upon.

Projection lamp

The projection lamp holds a pico laser projector. The benefit of a laser projector is that it is always in focus.

This allows users to quickly switch from the intimate setting of projecting on the table to projecting on for instance a wall.

The only good option pico laser projector currently is Microvision PicoP. *(Picture 19)* Therefore Microvision has been contacted with a request for a developers kit. Unfortunately they could not help me on a small scale project like this. Therefore the Sony MP-CL1 projector is used. This projector houses the Microvision PicoP engine. The downside of this is that it is all somewhat bigger.

The projector is cooled actively which is why the projector lamp has a number of cooling slots on the top and bottom. The side of the lamp is intentionally left open for quick access while testing.



Pictures 22: Projection lamp

Raspberry Pi 3

A Raspberry Pi handles the software side of the table prototype. This means it downloads files from the webserver once a known device is present and shows them in a simple GUI. All interface inputs are via serial from an Arduino.

Arduino Mega 2560

An Arduino is used to sense and control objects in the physical world.

The actual behaviour of the prototype depends on the mode(s) that are set to true in the Arduino code; Aware, unaware or both.

Other components

Other components include embedded AC-DC 12V and 5V adapters, voltage regulators and voltage step up converters.

I actually wanted to include induction charge pad. This would have given a nice additional trigger for people to put their phone on the table. Though a quick trial learned me that this somehow conflicts with the NFC scanners.

Sensor and actuator overview

	Aware	Combined	Unaware
Sensors			
Microphone	sound pressure translated to the intensity of sound, light and movement the table made.	sound pressure translated to the intensity of sound, light and movement the table made.	Inactive
Ultrasonic Proximity sensor	table reacts on people approaching from the top by sound and light.	table reacts on people approaching from the top by sound and light.	Only used to scroll through the photo/video carousel
light sensor	Amount of light gets translated to the amount of light the table emits	Amount of light gets translated to the amount of light the table emits	Inactive
NFC scanners	enact sounds when touched and also stop the table top from moving whilst being touched	enact sounds when touched and also stop the table top from moving whilst being touched	Inactive
Potmeter (Servo with position readout hack)	stop the table top from rotating whilst being moved by a user. Compare user enacted rotation states and self-enacted rotation states.	stop the table top from rotating whilst being moved by a user. Compare user enacted rotation states and self-enacted rotation states.	stop the table top from rotating whilst being moved by a user.
Actuators			
Servo motor (with position readout hack)	Makes the table top rotate slowly. Movement is based on user presence (sound, light and proximity). It also reacts on movement actions by the user.	Makes the table top rotate slowly. Movement is based on user presence (sound, light and proximity). It also reacts on movement actions by the user. This reaction is completely random and will not always occur. It also moves at random moments.	makes the table top rotate slowly. Moves at random moments in random directions.
20W amp and a speaker	Uses sounds from Raspberry Pi. Sounds are based on user presence (sound, light and proximity). Sound level is based on measured sound pressure.	Uses sounds from Raspberry Pi. Sounds are based on user presence (sound, light and proximity). Sound level is based on measured sound pressure. Plays random sounds at random moments.	Plays sounds at random times.
Vibration motor	Activity is based on user presence (sound, light and proximity). It also reacts on users actions (interacting with GUI through proximity sensors and rotating the table top)	Activity is based on user presence (sound, light and proximity). It also reacts on users actions (interacting with GUI through proximity sensors and rotating the table top) Gets active at random moments for random length.	Gets active at random moments for random length.
Led lighting strip	Emits RGB-colored light based on sensor inputs.	Emits RGB-colored light based on sensor inputs. Without high inputs it emits light at random times, in random, patterns, colors and intensities.	Emits light at random times, in random, patterns, colors and intensities.

Table 2



▶ Table aesthetics design

This table attempts to fuse the modern futuristic digital world into the physical social world. This is how the table is designed and made: a fuse of seemingly contradicting worlds. It should be contemporary without being overly futuristic, because it is also a piece of furniture in the familiar surroundings of our living room. Therefore I used natural materials to give it a homely furniture feeling without being nostalgic. The chosen materials provide a fresh and modern look without diminishing a natural feeling. The table is packed with electronics and made using some modern Computer aided production tools but also with a lot of wood craftsmanship.

From M21 aesthetic prototype to final prototype By reflecting on the prototype and taking into account comments I got during the M21 demo day, there are already some insights and conclusions contributing to further development. The size of the table is good for the intended use. It might be a little lower for use with a sofa and couch. This has been incorporated in the final prototype. An important downside of the used birch plywood is that it bends heavily. Therefore it is combined with some other materials in the final prototype. Still however some parts are bend a little. The M21 prototype had no projector yet and thus no cables to the projector lamp. Also the power cable just bluntly comes out of the bottom of the table bowl. For the final prototype I tried to invest some time into cable routing and incorporated this in the design. The unfinished MDF toplayer on the M21 prototype disturbed some people. All parts on the final prototype are now finished and look either natural (wood pattern) or are painted.



Picture 23: Cable routing

In total three main colours/materials can be found on the table: white painted, black painted or black cables, satin finished birch-wood. All thumbscrews, nuts and bolts are stainless steel.

Considering total (box) size of the table, it is fairly big to put in the middle of a living room seating area. For this reason a sense of lightness is pursued without making it look fragile. Therefore I applied A 'V' shape to the main table bowl. Having a smaller bottom then top makes an object appear lighter. Also the table top projection surface has been kept as thin as possible and seems to be floating on top of another, much smaller 'V' shaped foot.

A lot of iterations in proportion and size of the projection lamp and arm have been made to make the overall result as balanced as possible.



Picture 24: Different iterations depicting the search for the 'right' proportions



▶ User test design

Method

Changing behaviour in ones private space and routines takes some time. Because of this, and to take away novelty bias as much as possible, a longitudinal user test was desirable.

Considering time available, the aim was to test for 4-6 weeks.

This way the test could be performed in combined (default) mode for at least two weeks and the aware and unaware mode could both be tested for a week.

Different testing methods have been considered. In the end a diary study arose as a most suitable method because it allows to get a contextual understanding of users' real-life behaviours and experiences over time. *(Flaherty, 2016)*

To have a reference point, first a one week control test will be done to be able to some extent to compare behaviour with and without the table prototype.

During the test itself the users are asked to try-out the table prototype the first day after which things are left open. At the end of each day, the participants are asked to fill out a small online survey. 10 - 15 questions with mainly likert scale answers. *(McLeod, 2008)*

A likert scale is convenient and quick to fill out and have the advantage that they do not expect a simple yes / no answer from the respondent but rather allow for degrees of opinion, and even no opinion at all. This makes it very suitable to collect quantitative data on qualitative matters.

The questions participant get each day vary, but always cover the same subjects.

The participants are also asked to select keyphrases from a list to characterize the table prototype. This is added to gain some additional insight in how the participants perceive the prototype itself and not necessarily its implications.

In the end this survey is completed with an open interview.

Participants

Due to time constraints the user test can only be conducted in one family. So it is important that this family fits the problem space.

I need a family with preferably four persons; parents and two children that live at home. All participants have to own a personal Android smartphone that they use frequently and actively.

Goal

The final goal of the user test in the end of course has to be to provide means of measure to establish in what extent the project goal has been met.

The project goal is to support and enrich quality time with family at home in the living room, using smart furniture to effectively fuse the digital world with the physical social world.

The two worlds to bring together seem to be each others opposites.

Quality time being very much about trust, sympathy and empathy in a moment of undivided attention for each other.

The digital world and social media being very much about privacy concerns and self-presentation.

To be able to measure success on these matters, the diary study will contain daily varying questions on the following main subjects:

- Our desire to share and self-present (p. 27)
- Consequences in security and comfort (p. 27)
- Persuasive capabilities (p. 29)
- Quality time (p. 26)
 - Undivided attention
 - Trust
 - Empathy and sympathy
 - Emotional connection
- Additionally I'm interested to see whether the direct sharing on the table evokes creativity in creating content. (p. 27)

User test results overview

Due to hardware and software trouble and the overall time restraint the test could not be performed for the envisaged amount of time. In the end the prototype could only be tested in context for two weeks. This test period was even broken due to the demo day and holidays.

Participants where a family consisting of parents, male and female and children male and female, respectively being 51, 47, 18 and 14 years old.

The provided survey was filled out every day by each of the participants. The open interview at the end of the testing period could unfortunately not be held with all participants. The 'father' could not be present.

Usage

The first week the table prototpe is used (actually put phone on it and interact) 15 minutes per person per day averagely. The second week this has already dropped to about half that; 8 minutes.

Our desire to share and self-present

The participants found it moderately valuable and desirable to share media content with their family like they did. It is also notable that they would have probably not shared most of the content with their family members otherwise.

Consequences in security and comfort

Participants experience no significant changes in their sense of security and comfort in the living room whilst the table is present.

Persuasive capabilities

Participants find the table prototype to be somewhat persuasive. Participants do not really find that the table attracts attention. They do however find it to be fairly surprising.

Quality time

Combining several factors scores very variable, Looking at for instance the factor of undivided attention; participants find that the table prototype helps to achieve this.

On the other hand it scores very low to the tables capability to help family members to bond emotionally.

Undivided attention

Trust
Empathy and sympathy
Emotional connection

Creativity in making photo and video content

Participants don't think that using the table prototype increases their creativity when it comes to creating media content with their smartphone.

Keyphrases describing the prototype

The four keywords that are selected most are; fun, fun to play with, well functioning, looking good, addition to the living room.

Keyphrases that are never selected include; annoying, boring, needs finishing, fragile, does random things, unnecessary/please get rid of it, needs substantial improvements, not trustworthy.

Control test results and comparison

The children share about twice as much photos and videos than their parents do. Sharing behaviour of the children is more than their parents aimed at self-presenting.

The family does react on each others social media activities but mainly online and not through 'real life conversation'.

Especially the children are not very keen to have their smartphone content available to their family members.

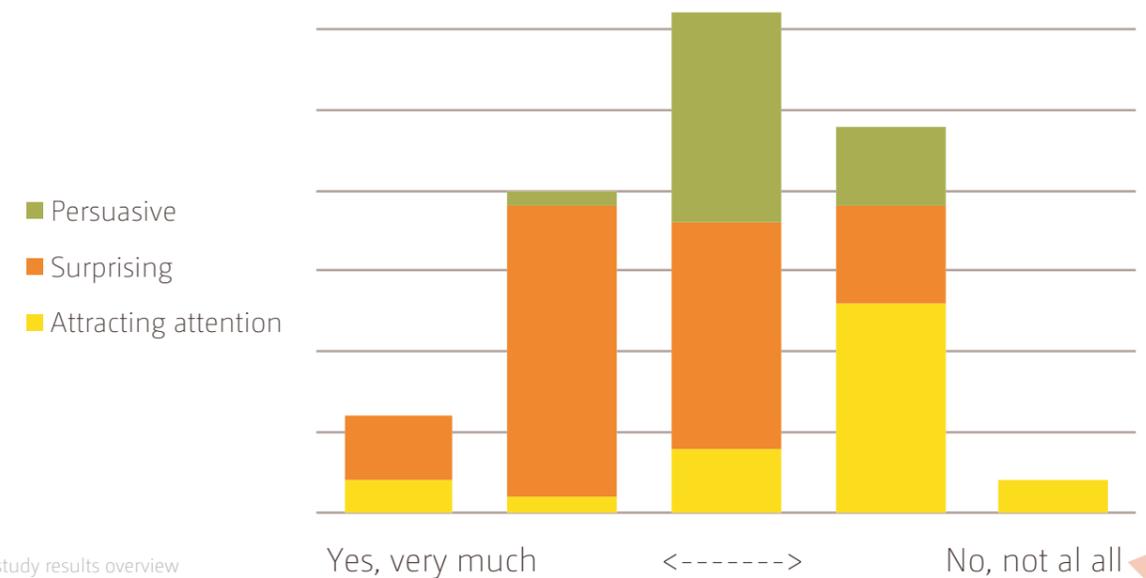
More general all family members value their privacy a lot.

All of them think their family is not very involved with their daily activities which is much better in the diary study when the table is used.

Results of both the diary study and the open interview showed that the participant became more involved with each others activities compared to the control situation.



Graph 2: Diary study results overview



Graph 3: Diary study results overview

Discussion

As noted there is a decay of usage in the second week. Inquiry on this subject during the open interview yielded the suggestion that the concept might not be suitable for daily use. (Which was not imposed by the way) Participants argue that the concept is more suitable for occasional use or when all family members have some peace and time in weekends or holidays.

The two women participants, mother and daughter, are more enthusiastic on the potential implication of the table concept. Both men are in a way more phlegmatic on the subject of quality time. Adding practical functionality like the earlier considered wireless charging might result in more support from the men.

The daughter mentioned that she did not really feel a real desire to share her photos with her family. This is much stronger on for instance Instagram. This might have something to do with the fact that one does not really need to 'self-present' within the family at home.

When using it however she actually really liked it and found it less stressful than posting a photo on social networks.

This might also explain the fact that the participant did not really feel they got more creative in creating content to be shown on the table. This was a surprising notion because halfway the participants

mentioned they had so much fun preparing photos and videos specially to show on the table. This prepared media led to hilarity, and was counteracted on, by the other family members by yet other specially prepared media. Examples include dog poo close-ups, photos of weird photos from long ago and edited photos.

Looking at the results, the participants liked to share media with their family members. Specifically because these often were media files that would otherwise not have been shared probably. One of the participants mentioned that it sometimes felt like their family group whatsapp, without the ability to select.

Participants limped on two minds however; if this is a good thing or not. Showing all photos and videos also mean showing garbage media, like double photos or blurry media. But more importantly, showing all photos and videos means also showing media that is sensitive, shameful or shocking. In practice - mentioned the son - this meant "that I just did not participate"

However this is a downside, this is also a fairly drastic measure that will likely only be applied when something is really not suitable for showing. Especially since family members will get curious if one necessarily does not want to participate. After inquiring, they however also recognize the value in not having to select the media you want to show and to give and receive a real glimpse in each others

lives outside the homely dwellings.

Since putting the phone on the table is a voluntary action and since the content is only shown in a trusted environment, it does not feel like a real privacy breach to the participants. Getting a look at all the content one created on a day, helps to get more awareness of each other, but considering the results not really more emotional involvement. This could well be caused by the fact that the nature of the media varies a lot. From funny to sad, from beautiful to ugly, and from something to keep to junk-files.

Looking at the results it is clear that the table helps to spend more time together without distractions. It also allows for conversation very well. Inquiry on this subject during the open interview learned me that these conversations were necessarily a richer or deeper conversation. This is in line with the diary study results where emotional connectedness score was low. Especially male participants do not feel more emotional connectedness. Spending more time, being together and having a light conversation and a laugh, is in itself considered very valuable though. Because of this, after some days using the table became more arranged. A drink and snack was brought along before sitting down and putting the phone on the table. This action of putting the phones away helps spending time together and having undivided attention. But only shortly, since the phones are not turned off, they have been interrupted a few times which is also evident in the diary study results.

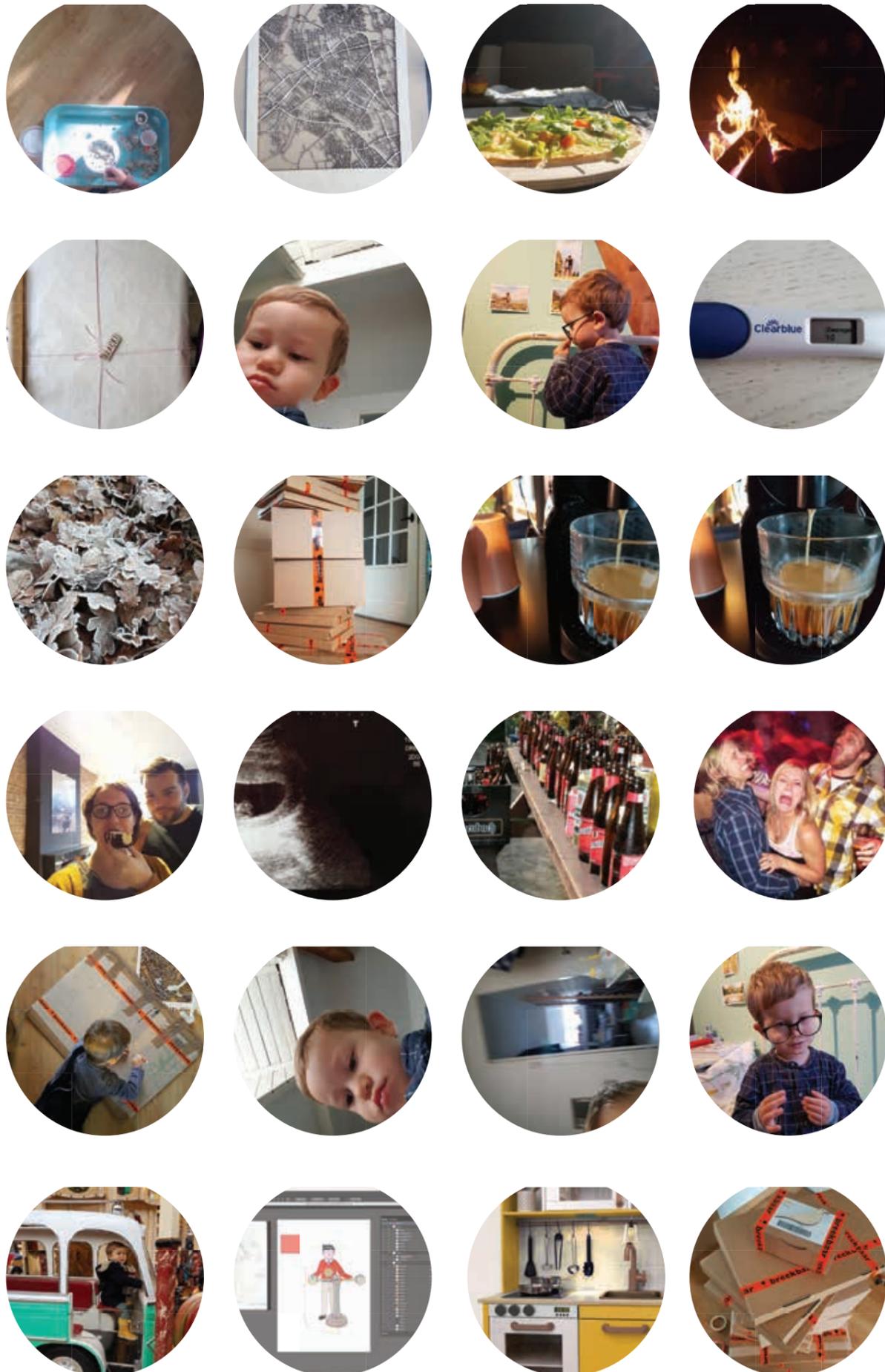
After inquiry about the fact that the table was used a lot less in the second week, the participants mentioned that being away a lot during holidays may have caused this. It might have had some influence of course, but it is arguable that 'sessions' become shorter because of being away. Being away means that sessions do not exist. A possible explanation could be that they got used to using the table and got quicker with it - putting phones on the table without playing around and trying things.

Attracting attention worked a lot worse than expected and its effectiveness decayed very fast. It is not sure however whether attracting attention just did not work well enough once they got used to the tables' actions and behaviour or that it quickly no longer triggered them to do anything with it. Still though, according to the diary study, participants felt persuaded by the table sometimes to come and use it. This might however be a novelty biased notion because the table is an object that - according to the participants - "stands out in the interior". This probably becomes less apparent after some time. A thing that did strongly persuade them to start using the table was seeing older photos displayed on it at random moments. The surprise and moment of reflection with others is a strong trigger to start using the table.

As already mentioned for one aspect, also generally the test results may be novelty biased to some extent because it was not tested for the intended 4-6 weeks. Because of this also the variance between the different modes of awareness could not be tested.



Picture 25: Media carousel interface being used.



Picture 26: Day photo ensemble. Due to privacy considerations no photos of actual test are stored longer than needed. (automatically erased) Therefore I show an ensemble of what my families personal photo and video carousel could look like.

► Conclusion

Looking back at the initial goal of this project - 're-humanizing the living room through a piece of smart furniture that allows for quality time with family members.' - it can be concluded that the final prototype partially fulfilled this goal during the user test.

On the one hand the user test showed that the table helped to have some valuable conversation/ quality time with family. On the other hand it is easy to note that once the table has been used, one quickly falls back into using smartphones in a less social manner. During the user test, I understood, this literally happened. One of the family members received a text message. Since they already went through all content she grabbed her phone after which others did as well. Within seconds everyone converted from family conversation to being sunken in their personal screens. This does however not take away the valuable family time they had before that also helped them to get more involved with each others' daily activities. Therefore, it is safe to say that a piece of smart furniture/smart technology that is not dehumanizing is successfully created. 'Re-humanizing the living room' might have been a bit overly ambitious. It is clear however that the living room, whilst people use the table, is re-humanized.

The table successfully combines the qualities of social networks, a sharing platform, and the obvious qualities of being together in the living room and having a good conversation with family members. Which is among other things evidenced that it was compared to a family Whatsapp group and the fact that the conversations around the table where greatly appreciated. It really got to be a piece of furniture that fuses the digital (social) world with the physical social world.

Considering feedback, the table looks good and attractive and is well finished, which is important to me as a designer.

Considering the surprising lack of success of drawing potential users attention through table actions, this 'attracting attention' might not even be a necessary part of the concept. The participants did however mention the enjoyed playing around with these functions and that it might be more to the frequency of attention seeking that this is not successful. As discussed the concept might be more suitable for occasional use, or when all family members have some peace and time in weekends or holidays.

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SOCIAL EMOTIONAL control test - SURVEY

Estimated average amount of photos and videos shared a week

M (51)	4
F (47)	6
M (18)	7
F (14)	15

Wish to share (presenting 'me'?)

Why do you share on social media

M (51)	Zakelijk netwerk onderhouden, familie
F (47)	Om kinenen, familie en vrienden te zien
M (18)	Geen idee. Om te lsten zien waar ik voor sta misschien
F (14)	Om gewaardeerd te worden door vrienden

What kind of things do you share on social media

M (51)	projects I work on, appointments, photos on whatsapp
F (47)	family photos mainly
M (18)	foto of filmpje als ik iets moois heb gedaan
F (14)	Mijn status, foto's van mij, foto's van vriendinnen, foto's van leuke dingen doen

Does your social media activity reflect 'you'? Why / to what extent?

M (51)	nee, het is incidenteel dus laat niet echt zien wie ik ben.
F (47)	Laat dingen zien die ik belangrijk vind maar zijn vooral leuke en opvallende dingen
M (18)	Nee, het is maar een greep
F (14)	Ja, maar niet precies.

Does not reflect me – completely reflects me

M (51)	1
F (47)	3
M (18)	2
F (14)	3

Are there things you (deliberatly) share at social media and not at home?

M (51)	no
F (47)	no
M (18)	yes
F (14)	yes

Does your home family like/react on your social media posts

never - always

M (51)	1
F (47)	2
M (18)	4
F (14)	2

Do they (also) refer to these posts in 'real life conversation'?

mever - slwsys

M (51)	1
F (47)	2
M (18)	2
F (14)	2

Vertrouwen (vs privacy)

To what extent would you trust your family members at home with your smartphone? (Would you share all photos and videos on it with them?)

Not at all – Completely

M (51)	4
F (47)	4
M (18)	1
F (14)	2

Would you leave you smartphone in the livingroom unattended? (without a lockscreen)

No, never - Yes, no problem at all

M (51)	2
F (47)	3
M (18)	1
F (14)	3

How import is your privacy at home?

Not important – Very important

M (51)	3
F (47)	4
M (18)	4
F (14)	3

How would you rate your home family members current relationship on trust vs privacy?

Trust – Privacy

M (51)	4
F (47)	3
M (18)	4
F (14)	4

Sociale ruimte

To what extent do you feel at ease in your living room with your home family members present?

Not at all – Completely

M (51)	4
F (47)	4
M (18)	2
F (14)	5

To what extent do you feel comfortable showing your emotions whilst being in the living room with your home family members

Not at all – Completely

M (51)	1
F (47)	3
M (18)	2
F (14)	3

Could you rate the routine and ordinaers at home / in the living room?

Not at all routinely – Completely routinely

M (51)	4
F (47)	4
M (18)	3
F (14)	4

Inzicht in elkaar

How well do you think your home family members know you?

Not at all – Completely

M (51)	4
F (47)	4
M (18)	1
F (14)	2

To what extent are your family home members knowledgeable reagarding your daily activities?

Not at all – Completely

M (51)	2
F (47)	4
M (18)	1
F (14)	3

empathie

To what extent do you think your home family members are involved with your daily activities?

Not at all – Very strongly

M (51)	2
F (47)	3
M (18)	1
F (14)	2

Hoe goed kan terecht met je emoties bij je huisgezin?

Not at all – Completely

M (51)	3
F (47)	4
M (18)	2
F (14)	2

Controle over tijd en aandacht

How often are your home family members available when you need them for some time together.

Never– Always

M (51)	3
F (47)	3
M (18)	2
F (14)	2

How often are your home family members available for you when you need some attention from them

Never– Always

M (51)	4
F (47)	3
M (18)	2
F (14)	2

Creativity (Research on liking and creativity)

How much do you appreciate a like on social networks from one of your family members?

Don't care – Very important

M (51)	3
F (47)	5
M (18)	2
F (14)	3

How do you rate the social quality of a 'like'?

No social quality – Rich social quality

M (51)	1
F (47)	2
M (18)	1
F (14)	2

How much do you appreciate a reaction on social networks from one of your family members?

Don't care – Very important

M (51)	4
F (47)	5
M (18)	2
F (14)	4

How do you rate the social quality of a digital reaction?

No social quality – Rich social quality

M (51)	3
F (47)	4
M (18)	3
F (14)	3

How much do you appreciate a conversational reference to your activity on social networks from one of your family members?

Don't appreciate it – Very important

M (51)	3
F (47)	5
M (18)	2
F (14)	3

How do you rate the social quality of a conversational reaction?

No social quality – Rich social quality

M (51)	4
F (47)	5
M (18)	4
F (14)	4

When showing and positing photos and video how important is its 'likeability'? (ie. Is the goal to get as much likes as possible?)

Not important– Very important

M (51)	2
F (47)	5
M (18)	3
F (14)	5

SOCIAL EMOTIONAL control test - Diary study

Real amount of photos and videos shared a day this week

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	0	0	1	0	0	1	1
F (47)	1	2	0	1	1	3	1
M (18)	0	0	0	3	1	2	2
F (14)	1	1	2	2	2	5	2

Quality time

Have you spend quality time with your family at home today?

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	yes	no	no	yes	yes	yes	yes
F (47)	yes	yes	no	yes	yes	yes	yes
M (18)	No	No	No	No	yes	No	yes
F (14)	No	No	No	Yes	Yes	Yes	yes

During this time; did one of you use a smartphone tablet or computer?

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	no	-	-	yes	yes	yes	no
F (47)	no	yes	-	no	yes	yes	no
M (18)	-	-	-	-	No	-	yes
F (14)	-	-	-	Yes	no	Yes	yes

If yes, How did this influence the time of being together?

Distracting – Enriching

M (51)				1	1	1	
F (47)		3			3	3	
M (18)							1
F (14)				1		1	1

How much undivided attention have you given to one or more of your family members at home today? (min)

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	none	none	none	45	10	10	60
F (47)	15	5	15	45	30	20	60
M (18)	none	none	none	none	none	none	30
F (14)	none	10	none	60	30	15	15

How much undivided attention did you get from one or more of your family members at home today?

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	5	none	none	45	10	15	60
F (47)	none	10	10	45	15	none	60
M (18)	none	none	none	none	30	none	15
F (14)	none	10	none	60	15	10	15

During this time; did one of you use a smartphone tablet or computer?

	Ma	Di	Wo	Do	Vr	Za	Zo
M (51)	no	-	-	yes	yes	yes	no
F (47)	no	yes	-	no	yes	yes	no
M (18)	-	-	-	-	No	-	yes
F (14)	-	-	-	Yes	no	Yes	yes

//// ARDUINO CODE

```
//Compiles in ARDUINO 1.1.13

// FMP MAIN

// HARDWARE PINS ////
static int servopin = 5; //digital servo control pin // PWM
static int sensorPin = A5; //Analog servo potmeter read
static int vibemotorpin = 11; //digital vibration motor pin // PWM // https://www.precisionmicrodrives.com/tech-
blog/2016/05/16/how-drive-vibration-motor-arduino-and-genuino http://learningaboutelectronics.com/Articles/Vibration-mo-
tor-circuit.php
static int micpin = A6;
static int lightpin = A7;

#define SS_PIN1 25 //NFC1 // non PWM //
#define SS_PIN2 27 //NFC2 // non PWM //
#define SS_PIN3 24 //NFC 3 // non PWM //
#define SS_PIN4 26 //NFC 4 // non PWM //
#define RST_PIN1 9
#define RST_PIN2 9
#define RST_PIN3 9
#define RST_PIN4 9 // ACTIVATION PINS // PWM

static int mainLEDpin = 7; // PWM
static int nfcLEDpin = 6; // PWM

const int leftTRIG_PIN = 28; // non PWM // ultrasonic proximity
const int leftECHO_PIN = 29; //non PWM // ultrasonic proximity
const int rightTRIG_PIN = 30; //non PWM // ultrasonic proximity
const int rightECHO_PIN = 31; //non PWM // ultrasonic proximity

// Serial comm
//1,2,3,4, A,D,U

// MAIN SETTINGS : //////////////////////////////////

boolean randomized;
boolean aware;

float brightness;
int ultrson;
int ultrsonleft;
int ultrsonright;
boolean useractive;

////-----
////////////////////////////////////

////////////////////////////////////SERVO DEFINITIONS //////////////////////////////////
//-----

#include <Servo.h>
Servo myservo; // create servo object
int servoValue; // variable to store the value coming from the sensor
int servopos;
int randombool;

boolean gotorandom;
unsigned long servotime;
//_____end of servo definitions_____
////////////////////////////////////

////////////////////////////////////VIBE MOTOR DEFINITIONS //////////////////////////////////
//-----
unsigned long vibemtime;
//_____end of vibe motor definitions_____
////////////////////////////////////

////////////////////////////////////NFC reader DEFINITIONS //////////////////////////////////
//-----

#include <SPI.h>
#include <PN532.h>

PN532 pn532_1(SS_PIN1, RST_PIN1); // Create First reader instance.
PN532 pn53_2(SS_PIN2, RST_PIN2); // Create Second reader instance.
PN532 pn53_3(SS_PIN3, RST_PIN3); // Create 3rd reader instance.
PN532 pn53_0(SS_PIN4, RST_PIN4); // Create 4th reader instance.

PN532::M_Key key;

unsigned int hex_numONE;
unsigned int hex_numTWO;
unsigned int hex_numTHREE;
unsigned int hex_numFOUR;

boolean deviceONE;
boolean deviceTWO;
boolean deviceTHREE;
boolean deviceFOUR;

unsigned int readercurrent[4];
int readeractive[4];

//_____end of NFC reader definitions_____
////////////////////////////////////

////////////////////////////////////LEDSTRIP DEFINITIONS //////////////////////////////////
//-----
#include <Adafruit_NeoPixel.h>
Adafruit_NeoPixel strip = Adafruit_NeoPixel(16, nfcLEDpin, NEO_GRB + NEO_KHZ800);
Adafruit_NeoPixel strip2 = Adafruit_NeoPixel(34, mainLEDpin, NEO_GRB + NEO_KHZ800);

int waiting;
long prevLEDmillis;
int color;
int BRIGHTNESS;

//_____end of LEDSTRIP definitions_____
////////////////////////////////////

////////////////////////////////////ULTRASONIC DEFINITIONS //////////////////////////////////
//-----

// Anything over 400 cm (23200 us pulse) is "out of range"
const unsigned int MAX_DIST = 23200;
int lastleft;
int lastright;

//_____end of ULTRASONIC definitions_____
////////////////////////////////////

////

int lightlevel; //the variable that will hold the light level reading
int miclevel; //the variable that will hold the sound level reading

//////////////////////////////////// SETUP SETUP SETUP //////////////////////////////////
//////////////////////////////////// SETUP
void setup() {
  //////////////////////////////////MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS////////////////////////////////////
  aware = true; // change by user
  randomized = false; // change by user
  //////////////////////////////////MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS//////////////////////////////////// MAIN PARAMETERS////////////////////////////////////
  gotorandom = false;

  useractive = false;
}
```

```

/// RECOGNIZED DEVICES //////////////////////////////////
hex_numONE = 59040;
hex_numTWO = 58450;
hex_numTHREE = 57504;
hex_numFOUR = 30757;
////////////////////////////////////

//// DEVICE (NFC) RECOGNITION //////////////////////////////////
deviceONE = false;
deviceTWO = false;
deviceTHREE = false;
deviceFOUR = false;
///-----

//ULTRASONIC activate //////////////////////////////////
//The Trigger pin will tell the sensor to range find
pinMode(leftTRIG_PIN, OUTPUT);
digitalWrite(leftTRIG_PIN, LOW);
pinMode(rightTRIG_PIN, OUTPUT);
digitalWrite(rightTRIG_PIN, LOW);

  lastleft = 4000;
  lastright = 4000;
  ///-----

////// NFC SCANNERS ACTIVATE //////////////////////////////////
SPI.begin(); // Init SPI bus
PN532.PCD_Init(); // Init First PN532 card
PN532_2.PCD_Init(); // Init Second PN532 card
PN532_3.PCD_Init(); // Init 3rd PN532 card
PN532_0.PCD_Init(); // Init 4th PN532 card

for (int i = 0; i < 4; i++) {
  readeractive[i] = 51;
}
//
// //set Antenna Gain to Max to increase reading distance
//   PN532_1.PCD_SetAntennaGain(PN532_1.RxGain_max);
//   PN532_2.PCD_SetAntennaGain(PN532_2.RxGain_max);
//   PN532_3.PCD_SetAntennaGain(PN532_3.RxGain_max);
//   PN532_0.PCD_SetAntennaGain(PN532_0.RxGain_max);
//-----

////// SET LEDSTRIPS //////////////////////////////////

prevLEDmillis = 0;
color = 0;
waiting = 1;
brightness= 1,00;
BRIGHTNESS = 255;
strip.setBrightness(BRIGHTNESS);
strip.begin();
strip.show(); // Initialize all pixels to 'off'
strip2.begin();
strip2.show();
///-----

//////SERVO PARAMETERS//////
int servopos = 90;
myservo.attach(servopin); // attach servo to pin
servopos = 90;
myservo.write(servopos);
delay(1000);
myservo.detach();
///-----

////// ACTIVATE VIBEMOTOR ///
pinMode(vibemotorpin, OUTPUT); // vibemotor
digitalWrite(vibemotorpin, HIGH);
delay(500);
digitalWrite(vibemotorpin, LOW);

```

```

///-----

//microphone and lightsensor activate //////////////////////////////////
pinMode(lightpin, INPUT); //sets the digital pin as input
pinMode(micpin, INPUT); //sets the digital pin as input

///-----

brightness = 255;

/// BEGIN SERIAL COMMUNICATION //////////////////////////////////
Serial.begin(9600); // Initialize serial communications with the PC
while (!Serial); // Do nothing if no serial port is opened (added for Arduinos based on ATMEGA32U4)

delay(1000);
Serial.println("GO");
}

//////////////////////////////////// L00P L00P L00P L00P //////////////////////////////////
//////////////////////////////////// LOOP
void loop() {
  ultrasonic(leftTRIG_PIN, leftECHO_PIN, "left");
  lightCheck();
  servohandling();
  vibrationhandling();

  micCheck();

  // Ultrasound proximity check
  ultrasonic(leftTRIG_PIN, leftECHO_PIN, "left");
  ultrasonic(rightTRIG_PIN, rightECHO_PIN, "right");
  //-----

  // CHECK NFC RAEDERS ONE BY ONE
  check_reader(PN532_1, 1);
  check_reader(PN532_2, 2);
  check_reader(PN532_3, 3);
  check_reader(PN532_0, 0);
  //-----

  // MAINLEDSTRIP
  rainbowCycle();
  // Serial.println(millis());

  // rainbow(); // all same color rainbow fading to colors
  //-----
  ultrasonic(rightTRIG_PIN, rightECHO_PIN, "right");
  Reaction();
  ultrson = 23200;
  ultrsonleft = 23200;
  ultrsonright = 23200;
}

void ultrasonic(int TRIG_PIN, int ECHO_PIN, String side) {
  //Serial.println();
  // Serial.print(side); Serial.println("<->measuring");

  unsigned long t1;
  unsigned long t2;

  unsigned long pulse_width;

  // Hold the trigger pin high for at least 10 us
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);

  // Wait for pulse on echo pin
  while ( digitalRead(ECHO_PIN) == 0 );
  // Measure how long the echo pin was held high (pulse width)
  // Note: the micros() counter will overflow after ~70 min
  t1 = micros();
  while ( digitalRead(ECHO_PIN) == 1);
  t2 = micros();
  pulse_width = t2 - t1;
}

```

```

if (side.equals("left")) {
  if (pulse_width < (lastleft + 300) || pulse_width > (lastleft - 300)) {
    ultrsonleft = pulse_width;
    if ( pulse_width > MAX_DIST ) {
      //Serial.print(pulse_width); Serial.println("->Out of range");
    }
    else if ((pulse_width < 2300) && (pulse_width > 500)) {
      // Serial.print(side);
      // Serial.print(pulse_width);
      // Serial.println(" USER PRESENT!");
    }
    else if ( pulse_width < 500) {
      //Serial.print(side);
      //Serial.print(pulse_width);
      //Serial.println(" TRIGGER");
      Serial.println("A");

      digitalWrite(vibemotorpin, HIGH);
      delay(1000);
      digitalWrite(vibemotorpin, LOW);

    }
  }
  lastleft = pulse_width;
}
else if (side.equals("right")) {
  if (pulse_width < (lastright + 300) && pulse_width > (lastright - 300)) {
    ultrsonright = pulse_width;
    if ( pulse_width > MAX_DIST ) {
      // Serial.print(pulse_width); Serial.println("->Out of range");
    }
    else if ((pulse_width < 2300) && (pulse_width > 500)) {
      // Serial.print(side);
      // Serial.print(pulse_width);
      // Serial.println(" USER PRESENT!");
    }
    else if ( pulse_width < 500) {
      //Serial.print(side);
      //Serial.print(pulse_width);
      //Serial.println(" TRIGGER");
      Serial.println("D");
      digitalWrite(vibemotorpin, HIGH);
      delay(1000);
      digitalWrite(vibemotorpin, LOW);

    }
  }
  lastright = pulse_width;
}

//if (pulse_width < lowestpulse) {lowestpulse = pulse_width;}
// Wait at least 60ms before next measurement
delay(100);

if (ultrsonleft <= ultrsonright)
{
  ultrson = ultrsonleft;
}
else if (ultrsonright <= ultrsonleft){
  ultrson = ultrsonright;
}
}

void Reaction() {

  // higher is lower brightness 1 - 255

  if (ultrson > 2000){
    brightness = 240;}
  else if (ultrson < 250){
    brightness = 0;
  }
  else
  {

```

```

    int ultrmap = map(ultrson, 250, 2000, 0, 240);
    brightness = ultrmap;
    //Serial.println("ultrmap:");
    //Serial.println(ultrmap);

  }

  //Serial.println(miclevel);
  //min 330 - 690 max
  if (miclevel > 600){
    brightness = 0;
    useractive = true;}
  else if (miclevel< 330){
    brightness = 130;
  }
  else
  {
    int soundmap = map(miclevel, 330, 600, 65, 0);
    brightness = brightness-soundmap;
  }
}

```

```

if (lightlevel < 300){
  int lightmap = map(lightlevel, 0, 100, 255, 0);
  brightness = brightness+lightmap; // 100 - 2300 -> 1 - 23
}

```

```

//brightness = brightness - (lightlevel/4);

```

```

if (brightness < 1) brightness = 1;
else if (brightness > 255) brightness = 255;
//Serial.println("");Serial.println("color intensity:");
//
//Serial.println(255-brightness);

```

```

if (useractive){
  Serial.println("U");
  useractive =false;
}

```

```

}

```

```

//
//-----
//

```

```

void lightCheck() {

```

```

  lightlevel = analogRead(lightpin); //the sensor takes readings from analog pin -> dark 0 - 300 light - 900 direct light
  //Serial.println("lightlevel:");
  //Serial.println(lightlevel);

```

```

  //Serial.println(lightlevel);
  // if (lightlevel > 300) {
  //   //Serial.println(lightlevel);
  //   //delay(500);
  // }
}

```

```

void rainbowCycle() {

```

```

  if (millis() > (prevLEDMillis + waiting)) {
    //Serial.print("prevLEDMillis:");
    // Serial.println(prevLEDMillis);

```

```

    if (color < 255)
    {
      color = color + 1;
    }
    else
    {
      color = 1;
    }

```

```

    uint16_t i, j;

```

```

//for(j=0; j<256*5; j++) { // 5 cycles of all colors on wheel
Reaction();
int R = 255-brightness;
int G = 255-brightness;
int B = 100-brightness;
if (B<0) B=0;

for (i = 0; i < strip2.numPixels(); i++) {
//strip2.setPixelColor(i, Wheel(((i * 256 / strip2.numPixels()) + color) & 255));
strip2.setPixelColor(i, R,G,B);

}

//strip2.setBrightness(BRIGHTNESS);
strip2.show();
prevLEDMillis = millis();
}
}

// Input a value 0 to 255 to get a color value.
// The colours are a transition r - g - b - back to r.
uint32_t Wheel(byte WheelPos) {
WheelPos = 255 - WheelPos;
if (WheelPos < 85) {
return strip2.Color(((255 - WheelPos * 3)-brightness), 0, ((WheelPos * 3)-brightness));
}
if (WheelPos < 170) {
WheelPos -= 85;
return strip2.Color(0, ((WheelPos * 3)-brightness), ((255 - WheelPos * 3)-brightness));
}
WheelPos -= 170;
return strip2.Color(((WheelPos * 3)-brightness), ((255 - WheelPos * 3)-brightness), 0);
}

///
//-----
//
void micCheck() {

miclevel = analogRead(micpin); //the sensor takes readings from analog pin -> min 330 - 690 max

// if (miclevel > 350) { // min 330 - 690 max
// //Serial.println(miclevel);
// //delay(100);
// }
// }

void ledcontrolscanning(int id) {
if (id == 1) {
colorWipe1(strip.Color(55, 55, 55), 1);
}
else if (id == 2)
colorWipe2(strip.Color(55, 55, 55), 1);
else if (id == 3)
colorWipe3(strip.Color(55, 55, 55), 1);
else if (id == 0)
colorWipe4(strip.Color(55, 55, 55), 1);
}

void ledcontrolactive(int id) {
if (id == 1) {
colorWipe1(strip.Color(0, 255, 0), 1);
}
else if (id == 2)
colorWipe2(strip.Color(0, 255, 0), 1);
else if (id == 3)
colorWipe3(strip.Color(0, 255, 0), 1);
else if (id == 0)
colorWipe4(strip.Color(0, 255, 0), 1);

//fill ledstrip green and delay
}

void ledcontrolerror(int id) {

if (id == 1) {
colorWipe1(strip.Color(255, 0, 0), 1);
}
else if (id == 2)
colorWipe2(strip.Color(255, 0, 0), 1);
else if (id == 3)
colorWipe3(strip.Color(255, 0, 0), 1);
else if (id == 0)
colorWipe4(strip.Color(255, 0, 0), 1);
}

void ledcontroldefault(int id) {

```

```

if (id == 1) {
colorWipe1(strip.Color(55, 55, 55), 1);
}
else if (id == 2)
colorWipe2(strip.Color(55, 55, 55), 1);
else if (id == 3)
colorWipe3(strip.Color(55, 55, 55), 1);
else if (id == 0)
colorWipe4(strip.Color(55, 55, 55), 1);
}

// Fill the dots one after the other with a color
void colorWipe1(uint32_t c, uint8_t wait) {
for (uint16_t i = 0; i < 4; i++) {
strip.setPixelColor(i, c);
strip.show();
//delay(wait);
}
}
void colorWipe2(uint32_t c, uint8_t wait) {
for (uint16_t i = 4; i < 8; i++) {
strip.setPixelColor(i, c);
strip.show();
// delay(wait);
}
}
void colorWipe3(uint32_t c, uint8_t wait) {
for (uint16_t i = 8; i < 12; i++) {
strip.setPixelColor(i, c);
strip.show();
// delay(wait);
}
}
void colorWipe4(uint32_t c, uint8_t wait) {
for (uint16_t i = 12; i < 16; i++) {
strip.setPixelColor(i, c);
strip.show();
// delay(wait);
}
}

void check_reader(PN532 reader, int id) {
//
// for (int i = 0; i < 24; i++) {
if (readeractive[id] > 50) {
ledcontroldefault(id);
}
// }

readeractive[id] = readeractive[id] + 1;

// Look for cards
// Look for new cards
if ( ! reader.PICC_IsNewCardPresent() ) {
return;
}

// Verify if the NUID has been readed
if ( ! reader.PICC_ReadCardSerial() ) {
return;
}

unsigned int hex_num;
hex_num = reader.uid.uidByte[0] << 24;
hex_num += reader.uid.uidByte[1] << 16;
hex_num += reader.uid.uidByte[2] << 8;
hex_num += reader.uid.uidByte[3];

// if (hex_num != readercurrent[id])
// {
readercurrent[id] = hex_num;

//Serial.print(F("Card detected in reader: ")); Serial.println(id);
// A card has been detected

//Serial.print(F("Card UID hex:"));
Serial.println(hex_num);

if (hex_num == hex_numONE) {
Serial.println("1");
ledcontrolactive(id);
readeractive[id] = 0;
}
}

```


//// Raspberry Pi code

```
//TEST CODE - LAT WORKING FMP 9
```

```
import gohai.glvideo.*;
GLMovie video;
import serial.*; //import the Serial library
Serial myPort; //the Serial port object
String val;
```

```
ArrayList<File> files = new ArrayList<File>();
int outputlines;
int prevoutputlines;
int previd;
```

```
String devFOUR = "2099724edb4db7d7";
String devTWO = "51fc02027f4731f8";
String devTHREE = "A12345";
String devONE = "B0987";
int filecount;
```

```
static int filedeptimer = 10; // 30 seconds untill files of some device are no longer shown
static int synctime = 30; // 120 seconds untill syncing files with online files again
```

```
static int maxwidth = 500;
static int maxheight = 500;
```

```
Boolean one;
Boolean two;
Boolean three;
Boolean four;
```

```
Boolean sync;
```

```
long Synctimer;
long prevsync;
long prevtime1;
long prevtime2;
long prevtime3;
long prevtime4;
```

```
long timer1;
long timer2;
long timer3;
long timer4;
```

```
int currentpos;
```

```
PImage bg;
```

```
void setup ()
```

```
{
  size(1280, 720);
  bg = loadImage("hole3.png");
  myPort = new Serial(this, Serial.list()[0], 9600);
  myPort.bufferUntil('\n');
```

```
  one = false;
  two = false;
  three = false;
  four = false;
```

```
  sync=true;
```

```
  sync();
  filecount = files.size();
  println(filecount);
  currentpos=0;
  prevoutputlines = 0;
  previd=0;
```

```
  for (File file : files) {
    file.update();
  }
}
```

```
void draw ()
```

```
{
  background(0);
  imageMode(CORNER);

  if (sync) {
    text("SYNCING IN PROGRESS", 600, 200);
    println("SYNCINGMODE");
    sync();
    println(" ");

    println("Starting file update");
    for (File file : files) {
      file.update();
    }
    filecount = files.size();
    println(filecount);
    println("READY, done syncing!");
    sync = false;
  } else {
    updateTimers();

    if (currentpos >= 0) { //initiated
      File file = files.get(currentpos);
      if (file.check()) {
        file.display();
      }
    } else
    {
      if (one || two || three || four) {
        NEXT();
      }
    }
  }
  image(bg, 0, 0);
}
```

```
void sync() {
```

```
  //sync files with online files again using list of my online output.php file.
  if (loadStrings("http://www.jeroenalblas.nl/m22/outputproc.php") != null) {
    String lines[] = loadStrings("http://www.jeroenalblas.nl/m22/outputproc.php");
    //println("there are " + lines.length + " lines");
    outputlines = lines.length;
    print(outputlines);
    print("check outputlines");
    println(prevoutputlines);
```

```
    if (outputlines > 1) {
```

```
      String[] listtest = split(lines[0], ' ');
```

```
      print(Integer.parseInt(listtest[0]));
      print("eerste id check");
      println(previd);
      if (outputlines != prevoutputlines || Integer.parseInt(listtest[0])>previd) {
        sync = true;
        println("SYNCTURE!");
      } else {
        println("Nothing changed; so no need for file syncing");
      }
    }
```

```
    if (sync) {
      for (int i = files.size() - 1; i >= 0; i--) {
        files.remove(i);
      }
      for (int i = 0; i < outputlines; i++) {
        println(lines[i]);
        String[] list = split(lines[i], ' ');
        prevoutputlines = outputlines;
        print("new prevoutputlines:" + prevoutputlines);
        if (i==0) {
          previd = Integer.parseInt(list[0]);
          print("previd:" + previd);
        }
      }
    }
```

```
    files.add(new File(0, list[2], Integer.parseInt(list[0]), "http://www.jeroenalblas.nl/m22/" + list[1]));
  }
```

```

        //sync = false;
    }
} else {
    println("Connection error");
}
}

void keyReleased() {
    if (! sync) {
        if (key == '1') {
            prevsync = millis();
            println("1");
            prevtime1 = millis(); //reset timer 1
            one = true;
            File file = files.get(currentpos);
            boolean activecheck = file.check();
            //println(activecheck);
            if (! activecheck) {
                NEXT();
            }
        } else if (key == '2') {
            prevsync = millis();
            println("2");
            prevtime2 = millis(); //reset timer 2
            two = true;
            File file = files.get(currentpos);
            boolean activecheck = file.check();
            //println(activecheck);
            if (! activecheck) {
                NEXT();
            }
        } else if (key == '3') {
            prevsync = millis();
            println("3");
            prevtime3 = millis(); //reset timer 3
            three = true;
            File file = files.get(currentpos);
            boolean activecheck = file.check();
            //println(activecheck);
            if (! activecheck) {
                NEXT();
            }
        } else if (key == '4') {
            prevsync = millis();
            println("4");
            prevtime4 = millis(); //reset timer 4
            four = true;
            File file = files.get(currentpos);
            boolean activecheck = file.check();
            //println(activecheck);
            if (! activecheck) {
                NEXT();
            }
        } else if (key == 'a') {
            PREV();
        } else if (key == 'd') {

            NEXT();
        }
    } else {
        println("wait for syncing");
    }
}

void NEXT() {
    video.pause();
    prevsync = millis();
    System.gc();
    println("d");

    if (one || two || three || four) {
        // println("D");
        currentpos++;
        if ( currentpos >= filecount ) {
            currentpos = 0;
        }
        File file = files.get(currentpos);
        boolean activecheck = file.check();
        //println(activecheck);
        while (! activecheck) {
            currentpos++;
        }
    }
}

```

```

        if ( currentpos >= filecount ) currentpos = 0;

        file = files.get(currentpos);
        activecheck = file.check();
    }
    println(currentpos);
}

void PREV() {
    video.pause();
    prevsync = millis();
    System.gc();
    println("a");

    if (one || two || three || four) {
        // println("A");
        currentpos--;
        if ( currentpos < 0 ) {
            currentpos = filecount - 1;
        }
        File file = files.get(currentpos);
        boolean activecheck = file.check();
        while (! file.check()) {
            currentpos--;
        }

        if ( currentpos < 0 ) {
            currentpos = filecount - 1;
        }
        file = files.get(currentpos);
        activecheck = file.check();
    }
    println(currentpos);
}

///// TIMER FUNCTIONS ////
void updateTimers() {
    if (one) {
        timer1 = ((millis()-prevtime1)/1000);
        //println(timer1);
    }
    if (two) {
        timer2 = ((millis()-prevtime2)/1000);
        //println(timer2);
    }
    if (three) {
        timer3 = ((millis()-prevtime3)/1000);
        //println(timer3);
    }
    if (four) {
        timer4 = ((millis()-prevtime4)/1000);
        //println(timer4);
    }
    if (timer1 < filedeptime)
    {
        //println("key 1 files active"); //load corresponding files into carousel to scroll through them
    } else {
        one=false;
        //println("ONE now INactive");
    }
    if (timer2 < filedeptime)
    {
        //println("key 2 files active"); //load corresponding files into carousel to scroll through them
    } else {
        two=false;
        //println("TWO now INactive");
    }
    if (timer3 < filedeptime)
    {
        //println("key 3 files active"); //load corresponding files into carousel to scroll through them
    } else {
        three=false;
        //println("THREE now INactive");
    }
    if (timer4 < filedeptime)
    {
        //println("key 4 files active"); //load corresponding files into carousel to scroll through them
    } else {
        four=false;
        //println("FOUR now INactive");
    }
}

//println(Synctimer); //////////////////////////////////////
Synctimer = ((millis()-prevsync)/1000);

```

```

if (Synctimer > synctime) {
    prevsync = millis();
    println("Sync again");
    sync(); //sync files with online files again using list of my online output.php file
}
//println(Synctimer +"-"+ synctime);
}

void serialEvent( Serial myPort) {
    //put the incoming data into a String -
    //the '\n' is our end delimiter indicating the end of a complete packet
    val = myPort.readStringUntil('\n');
    //make sure our data isn't empty before continuing
    if (val != null) {
        //trim whitespace and formatting characters (like carriage return)
        val = trim(val);
        //println(val);

        if (! sync) {
            if (val.equals("U")) {
                println("User activity -> sync timer reset");
                prevsync = millis();
            }

            else if (val.equals("1")) {
                prevsync = millis();
                println("1");
                prevtime1 = millis(); //reset timer 1
                one = true;
                File file = files.get(currentpos);
                boolean activecheck = file.check();
                //println(activecheck);
                if (! activecheck) {
                    NEXT();
                }
            } else if (val.equals("2")) {
                prevsync = millis();
                println("2");
                prevtime2 = millis(); //reset timer 2
                two = true;
                File file = files.get(currentpos);
                boolean activecheck = file.check();
                //println(activecheck);
                if (! activecheck) {
                    NEXT();
                }
            } else if (val.equals("3")) {
                prevsync = millis();
                println("3");
                prevtime3 = millis(); //reset timer 3
                three = true;
                File file = files.get(currentpos);
                boolean activecheck = file.check();
                //println(activecheck);
                if (! activecheck) {
                    NEXT();
                }
            } else if (val.equals("4")) {
                prevsync = millis();
                println("4");
                prevtime4 = millis(); //reset timer 4
                four = true;
                File file = files.get(currentpos);
                boolean activecheck = file.check();
                //println(activecheck);
                if (! activecheck) {
                    NEXT();
                }
            } else if (val.equals("A")) {
                PREV();
            } else if (val.equals("D")) {
                NEXT();
            }
        } else {
            println("wait for syncing");
        }
    }
}

class File {
    int Group;
    String devID;
    int ID;
    String fileURL;
}

```

```

int xsize;
int ysize;
PImage image;
boolean active;
String localfile;

// Constructor
File(int group, String devid, int id, String url) {
    Group = group;
    devID = devid;
    ID = id;
    fileURL = url;
}

// Custom method for updating the variables
void update() {
    System.gc();
    //change image parameters --> image get and resize and change devid to groupnr

    // check if image or video
    //print(devID); print("="); println(devFOUR);
    if (devID.equals(devONE)) {
        Group = 1;
    } else if (devID.equals(devTWO)) {
        Group = 2;
    } else if (devID.equals(devTHREE)) {
        Group = 3;
        println("EEN DRIE!");
    } else if (devID.equals(devFOUR)) {
        Group = 4;
    }
}

if (Group != 0) {
    // println("getshere");
    if (loadImage("data/"+ ID + ".jpg") == null) { // has not been downloaded in earlier sync
        if (loadImage(fileURL)!= null) {
            image = loadImage(fileURL);

            float x=image.width;
            // print(x);
            float y=image.height;
            // print("x");
            // println(y);

            float proportion = x/y;

            //println(proportion);

            if (x > y)
            {
                xsize = (int)(maxwidth*proportion);
                ysize = (int)(maxwidth);
                // println(xsize);
                // println(ysize);
            } else if (y > x)
            {
                xsize = (int)(maxheight);
                ysize = (int)(maxheight/proportion);
                // println(xsize);
                // println(ysize);
            }
        }

        image.resize(xsize, ysize);
        image.save("data/"+ ID + ".jpg");
        image = null;
        localfile = ("data/"+ ID + ".jpg");
        System.gc();
        println("data/"+ ID + ".jpg");
    }
    } else {
        image = null;
        localfile = ("data/"+ ID + ".jpg");
        System.gc();
        println("EXISTING: ");
        println("data/"+ ID + ".jpg");
    }
}

// Custom method for drawing the object
boolean check() {

    if (Group != 0) {
        if (Group == 1) {
            if (one) {

```


//// ANDROID APP JAVA CODE

// MAIN ACTIVITY

```
package com.imageupload;

import android.Manifest;
import android.app.Activity;
import android.app.ActivityManager;
import android.content.DialogInterface;
import android.content.Intent;
import android.content.SharedPreferences;
import android.content.pm.PackageManager;
import android.support.annotation.NonNull;
import android.support.v4.app.ActivityCompat;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.Toast;

import com.facebook.AccessToken;
import com.facebook.CallbackManager;
import com.facebook.FacebookCallback;
import com.facebook.FacebookException;
import com.facebook.FacebookSdk;
import com.facebook.login.LoginResult;
import com.facebook.login.widget.LoginButton;
import com.imageupload.InstagramAPI.InstagramApp;
import com.imageupload.InstagramAPI.InstagramSession;
import com.imageupload.Util.Config;

public class MainActivity extends AppCompatActivity {
    private Button mBtnInstagramLogin;
    private LoginButton mBtnFBLogin;
    private CallbackManager mCallbackManager;
    private int PICK_IMAGE_REQUEST = 1;
    private InstagramApp mApp;
    private InstagramSession mSession;
    public SharedPreferences mPrefrencre;
    public SharedPreferences.Editor mEditor;
    private static String[] PERMISSIONS_STORAGE = {
        Manifest.permission.READ_EXTERNAL_STORAGE,
        Manifest.permission.WRITE_EXTERNAL_STORAGE
    };
    private static final int REQUEST_CODE_ASK_PERMISSIONS = 10;
    private InstagramApp.OAuthAuthenticationListener mInstagramLoginListener = new InstagramApp.OAuthAuthenticationListener() {

        @Override
        public void onSuccess() {
            mBtnInstagramLogin.setText(getString(R.string.instagram_disConnect));
            //UploadStartService();
        }

        @Override
        public void onFail(String error) {
            Toast.makeText(MainActivity.this, error, Toast.LENGTH_SHORT).show();
        }
    };
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        FacebookSdk.sdkInitialize(getApplicationContext());
        setContentView(R.layout.activity_main);
        mPrefrencre = getSharedPreferences(Config.PRE_KEY,MODE_PRIVATE);
        mEditor = mPrefrencre.edit();
        mApp = new InstagramApp(this, Config.CLIENT_ID,
            Config.CLIENT_SECRET, Config.CALLBACK_URL);
        mApp.setListener(mInstagramLoginListener);
        mSession = new InstagramSession(this);
        mBtnInstagramLogin = (Button)findViewById(R.id.btn_instagram_connect);
        mBtnFBLogin = (LoginButton) findViewById(R.id.facebook_Login);
        mCallbackManager = CallbackManager.Factory.create();
        mBtnFBLogin.registerCallback(mCallbackManager, new FacebookCallback<LoginResult>() {

            @Override
            public void onSuccess(LoginResult loginResult) {
                AccessToken token = loginResult.getAccessToken();
            }

            @Override
            public void onCancel() {
```

```
                String value = "cancel";
            }
        });

        @Override
        public void onError(FacebookException error) {
            String value = "success" + error.toString();
        }
    });

    mBtnInstagramLogin.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {
            if (mApp.hasAccessToken()) {
                final android.app.AlertDialog.Builder builder = new android.app.AlertDialog.Builder(
                    MainActivity.this);
                builder.setMessage("Disconnect from Instagram?")
                    .setCancelable(false)
                    .setPositiveButton("Yes",
                        new DialogInterface.OnClickListener() {
                            public void onClick(
                                DialogInterface dialog, int id) {
                                mApp.resetAccessToken();
                                mBtnInstagramLogin.setText(getString(R.string.instagram_connect));
                            }
                        })
                    .setNegativeButton("No",
                        new DialogInterface.OnClickListener() {
                            public void onClick(
                                DialogInterface dialog, int id) {
                                dialog.cancel();
                            }
                        });
                final android.app.AlertDialog alert = builder.create();
                alert.show();
            } else {
                mApp.authorize();
            }
        }
    });

    if (mApp.hasAccessToken()) {
        mBtnInstagramLogin.setText(getString(R.string.instagram_disConnect));
    }
    verifyStoragePermissions(MainActivity.this);
}

public void verifyStoragePermissions(Activity activity) {
    // Check if we have write permission
    int permission_read = ActivityCompat.checkSelfPermission(activity, Manifest.permission.READ_EXTERNAL_STORAGE);
    int permission_write = ActivityCompat.checkSelfPermission(activity, Manifest.permission.WRITE_EXTERNAL_STORAGE);
    if (permission_read != PackageManager.PERMISSION_GRANTED) {
        // We don't have permission so prompt the user
        ActivityCompat.requestPermissions(
            activity,
            PERMISSIONS_STORAGE,
            REQUEST_CODE_ASK_PERMISSIONS
        );
    } else if (permission_write != PackageManager.PERMISSION_GRANTED){
        ActivityCompat.requestPermissions(
            activity,
            PERMISSIONS_STORAGE,
            REQUEST_CODE_ASK_PERMISSIONS
        );
    } else {
        if(!isServiceRunningCheck()) {
            startService(new Intent(MainActivity.this, UploadService.class));
        }
    }
}

@Override
public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
    switch (requestCode) {
        case REQUEST_CODE_ASK_PERMISSIONS:
            if (grantResults[0] == PackageManager.PERMISSION_GRANTED) {
                if(!isServiceRunningCheck()) {
                    startService(new Intent(MainActivity.this, UploadService.class));
                }
            } else {
                finish();
            }
            break;
        default:
            super.onRequestPermissionsResult(requestCode, permissions, grantResults);
    }
}

@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
```

```

super.onActivityResult(requestCode, resultCode, data);

if (requestCode == PICK_IMAGE_REQUEST) {
    if( resultCode == RESULT_OK && data != null && data.getData() != null) {
    }
} else {
    mCallbackManager.onActivityResult(requestCode,resultCode,data);
}
}

public boolean isServiceRunningCheck() {
    ActivityManager manager = (ActivityManager) this.getSystemService(Activity.ACTIVITY_SERVICE);
    for (ActivityManager.RunningServiceInfo service : manager.getRunningServices(Integer.MAX_VALUE)) {
        if (UploadService.class.getName().equals(service.service.getClassName())) {
            return true;
        }
    }
    return false;
}
}
}

```

// RECEIVING

```

public class ReceiverBroadcast extends BroadcastReceiver {
    private Context mContext;
    public ReceiverBroadcast() {
    }

    @Override
    public void onReceive(Context context, Intent intent) {
        mContext = context;
        // TODO: This method is called when the BroadcastReceiver is receiving
        // an Intent broadcast.
        Toast.makeText(context,"BootingServiceOnReceive",Toast.LENGTH_LONG);
        if(Intent.ACTION_BOOT_COMPLETED.equals(intent.getAction())){
            Toast.makeText(context,"BootingServiceStartService",Toast.LENGTH_LONG);
            Intent serviceIntent = new Intent(context, UploadService.class);
            serviceIntent.setAction(Config.SERVICE_RESTART);
            if(!isServiceRunningCheck())
                context.startService(serviceIntent);
        }
    }

    public boolean isServiceRunningCheck() {
        ActivityManager manager = (ActivityManager) mContext.getSystemService(Activity.ACTIVITY_SERVICE);
        for (ActivityManager.RunningServiceInfo service : manager.getRunningServices(Integer.MAX_VALUE)) {
            if (UploadService.class.getName().equals(service.service.getClassName())) {
                return true;
            }
        }
        return false;
    }
}
}

```

// UPLOAD

```

package com.imageupload;

import android.app.PendingIntent;
import android.app.Service;
import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
import android.content.IntentFilter;
import android.content.SharedPreferences;
import android.database.Cursor;
import android.graphics.Bitmap;
import android.media.ThumbnailUtils;
import android.net.ConnectivityManager;
import android.net.NetworkInfo;
import android.net.Uri;
import android.os.AsyncTask;
import android.os.Bundle;
import android.os.Environment;
import android.os.Handler;
import android.os.Message;
import android.os.SystemClock;
import android.provider.MediaStore;
import android.provider.Settings;

```

```

import android.support.v7.app.AlertDialog;
import android.text.TextUtils;
import android.util.Log;

```

```

import com.facebook.AccessToken;
import com.facebook.FacebookSdk;
import com.facebook.GraphRequest;
import com.facebook.GraphResponse;
import com.facebook.HttpMethod;
import com.google.gson.Gson;
import com.imageupload.Adapter.MediaClass;
import com.imageupload.Adapter.MediaFileClass;
import com.imageupload.InstagramAPI.InstagramFileClass;
import com.imageupload.InstagramAPI.InstagramSession;
import com.imageupload.Util.Config;
import com.imageupload.Util.Download;
import com.imageupload.Util.RequestHandler;
import com.imageupload.Util.Upload;

```

```

import org.json.JSONArray;
import org.json.JSONException;
import org.json.JSONObject;
import org.json.JSONTokener;

```

```

import java.io.BufferedReader;
import java.io.File;
import java.io.IOException;
import java.io.InputStream;
import java.io.InputStreamReader;
import java.net.HttpURLConnection;
import java.net.URL;
import java.text.DateFormat;
import java.text.DecimalFormat;
import java.text.SimpleDateFormat;
import java.util.ArrayList;
import java.util.Calendar;
import java.util.Date;
import java.util.GregorianCalendar;
import java.util.concurrent.ExecutionException;

```

```

public class UploadService extends Service {
    private ArrayList<InstagramFileClass> mInstagramFileList = new ArrayList<>();
    private ArrayList<InstagramFileClass> mFBFileList = new ArrayList<>();
    private ArrayList<MediaFileClass> mMediaList = new ArrayList<>();
    private ArrayList<MediaFileClass> mTemplList = new ArrayList<>();
    public long mLastUpdateTime = 0;
    public long mFBLastUpdateTime = 0;
    public long mIGLastUpdateTime = 0;
    private boolean mMediaUploadState = false;
    private boolean mVideoUploadState = false;
    private boolean mFBImageDownloadState = false;
    private boolean mFBVideoDownloadState = false;
    private String mDeviceID;
    private long mCurrentDay;
    private SimpleDateFormat simpleDateFormat;
    public SharedPreferences mPrefrencre;
    public SharedPreferences.Editor mEditor;

```

```

    private String mAccessToken;
    private InstagramSession mSession;
    private AccessToken mFBAccessToken;
    public ReceiverBroadcast mReceiverBroadcast;
    private Intent mIntent = null;
    private boolean mServerSate = false;
    private long mFBCurrentDate;
    private long mIGCurrentDate;
    public UploadService() {
    }

```

```

    @Override
    public IBinder onBind(Intent intent) {
        mIntent = intent;
        // TODO: Return the communication channel to the service.
        return null;
    }

```

```

    @Override
    public void onCreate() {
        super.onCreate();
        mPrefrencre = getSharedPreferences(Config.PRE_KEY,MODE_PRIVATE);
        mEditor = mPrefrencre.edit();
        mServerSate = true;
        Config.DOWNLOAD_PATH = Environment.getExternalStorageDirectory() + "/FBDownload";
        mDeviceID = Settings.Secure.getString(getBaseContext().getContentResolver(),Settings.Secure.ANDROID_ID);
        mSession = new InstagramSession(getApplicationContext());
        mReceiverBroadcast = new ReceiverBroadcast();
        if(mIntent == null || !mIntent.getAction().equals(Config.SERVICE_RESTART)){

```

```

IntentFilter filter = new IntentFilter();
filter.addAction(Intent.ACTION_BOOT_COMPLETED);
try {
    registerReceiver(mReceiverBroadcast, filter);
} catch (Exception e){}
}
initLastTime();
new Thread() {

    @Override
    public void run() {
        while (mServerSate){
            new Thread(){
                @Override
                public void run() {
                    handler.sendMessage(0);
                }
            }.start();
            try {
                while (!mMediaUploadState) {
                    Log.i("---THREAD---", "TimeLine");
                    Thread.sleep(1000);
                }
                mMediaUploadState = false;
                Thread.sleep(10000);
            } catch (InterruptedException e) {
            }
        }
    }
}.start();

@Override
public void onDestroy() {
    super.onDestroy();
    mServerSate = false;
}

final Handler handler = new Handler() {
    public void handleMessage(Message msg) {
        if (msg.what == 0) {
            initialData();
        }
    }
};

public void initialData(){
    Date currentdate = new Date(System.currentTimeMillis());
    SimpleDateFormat = new SimpleDateFormat("yyyy-MM-dd");
    mCurrentDay = currentdate.getTime();
    mMediaList.clear();
    if(isNetworkAvalible()) {
        mMediaList.addAll(getPathOfAllMedias(MediaStore.Images.Media.EXTERNAL_CONTENT_URI));
        mMediaList.addAll(getPathOfAllMedias(MediaStore.Images.Media.INTERNAL_CONTENT_URI));
        mMediaList.addAll(getPathOfAllMedias(MediaStore.Video.Media.EXTERNAL_CONTENT_URI));
        mMediaList.addAll(getPathOfAllMedias(MediaStore.Video.Media.INTERNAL_CONTENT_URI));

        if (isIGLoggedIn()) {
            getInstagramMedia();
        } else if (isFBLoggedIn()) {
            getFBMedia();
        } else {
            uploadMedia();
        }
    } else {
        mMediaUploadState = true;
    }
}

private void uploadMedia(){
    class UploadMedia extends AsyncTask<Void,Void,Boolean> {

        @Override
        protected Boolean doInBackground(Void... params) {
            boolean flag = true;
            Upload u = new Upload();
            for(MediaFileClass mediaClass: mMediaList){
                u.uploadVideo(mediaClass.getFilePath(), mediaClass.getCreated_time(), mDeviceID);
            }
            return true;
        }
    }
    UploadMedia ui = new UploadMedia();
    if(isNetworkAvalible()) {
        try {
            if(ui.execute().get()) {
                updateLastTime();
                FBFileDelete();
            }
        }
    }
}

```

```

} catch (InterruptedException e) {
} catch (ExecutionException e) {
}
}
mMediaUploadState = true;
}

private MediaFileClass downloadMedia(String url, String create_time, boolean imageflag,String prefixName) {
    class DownMedia extends AsyncTask<String, Void, String> {
        @Override
        protected String doInBackground(String... params) {
            Download download = new Download();
            return download.ImageFileDownload(params[0],params[1]);
        }
    }
    DownMedia uv = new DownMedia();
    AsyncTask<String, Void, String> response = uv.execute(new String[]{url,prefixName});
    try {
        String filepath = response.get();
        MediaFileClass newMediaClass = new MediaFileClass(filepath,create_time);
        return newMediaClass;
    } catch (InterruptedException e) {
        return null;
    } catch (ExecutionException e) {
        return null;
    }
}

private ArrayList<MediaFileClass> getPathOfAllMedias(Uri uri)
{
    ArrayList<MediaFileClass> result = new ArrayList<MediaFileClass>();
    String[] projection = { MediaStore.MediaColumns.DATA, MediaStore.MediaColumns.DISPLAY_NAME };

    Cursor cursor = getContentResolver().query(uri, projection, null, null, MediaStore.MediaColumns.DATE_ADDED + "
desc");
    int columnIndex = cursor.getColumnIndexOrThrow(MediaStore.MediaColumns.DATA);
    int columnDisplayname = cursor.getColumnIndexOrThrow(MediaStore.MediaColumns.DISPLAY_NAME);

    int lastIndex;
    while (cursor.moveToNext())
    {
        String absolutePathOfImage = cursor.getString(columnIndex);
        String nameOfFile = cursor.getString(columnDisplayname);
        lastIndex = absolutePathOfImage.lastIndexOf(nameOfFile);
        lastIndex = lastIndex >= 0 ? lastIndex : nameOfFile.length() - 1;

        if (!TextUtils.isEmpty(absolutePathOfImage))
        {
            File file = new File(absolutePathOfImage);
            Date date = new Date(file.lastModified());
            String dateformat = SimpleDateFormat.format(date);
            if(mLastUpdateTime < date.getTime() && mCurrentDay > date.getTime()) {
                MediaFileClass newMediaClass = new MediaFileClass(absolutePathOfImage,dateformat);
                result.add(newMediaClass);
            }
        }
    }
    return result;
}

public void getFBMedia(){
    mFBFileList.clear();
    getFBOfAllImages();
    getFBOfAllVideos();
}

private void getFBOfAllImages(){
    Bundle parameters = new Bundle();
    parameters.putString("fields", "created_time,id,source");
    new GraphRequest(
        mFBAccessToken, //your fb AccessToken
        "/" + mFBAccessToken.getUserId() + "/photos/uploaded", //user id of login user
        parameters,
        HttpMethod.GET,
        new GraphRequest.Callback() {
            public void onCompleted(GraphResponse response) {
                Log.d("TAG", "Facebook Albums: " + response.toString());
                try {
                    if (response.getError() == null) {
                        JSONObject joMain = response.getJSONObject(); //convert GraphResponse response to
                        JSONObject
                        if (joMain.has("data")) {
                            JSONArray jaData = joMain.optJSONArray("data"); //find JSONArray from JSONObject
                            //aLFBAlbum = new ArrayList<>();
                            for (int i = 0; i < jaData.length(); i++) { //find no. of album using jaData.Length()
                                JSONObject joAlbum = jaData.getJSONObject(i); //convert particular album into
                                JSONObject
                                String time = joAlbum.getString("created_time");
                                String source = joAlbum.getString("source");
                            }
                        }
                    }
                } catch (JSONException e) {
                }
            }
        }
    );
}

```



```

mFBLastUpdateTime = mPrefrencre.getLong(Config.FBDATE_KEY, 0);
if(mFBLastUpdateTime == 0){
    Calendar cal = new GregorianCalendar();
    cal.add(Calendar.DATE, -1);
    Date date = cal.getTime();
    mFBLastUpdateTime = date.getTime();
    mEditor.putLong(Config.FBDATE_KEY, mFBLastUpdateTime).commit();
}
mIGLastUpdateTime = mPrefrencre.getLong(Config.IGDATE_KEY, 0);
if(mIGLastUpdateTime == 0){
    Calendar cal = new GregorianCalendar();
    cal.add(Calendar.DATE, -1);
    Date date = cal.getTime();
    mIGLastUpdateTime = date.getTime();
    mEditor.putLong(Config.IGDATE_KEY, mIGLastUpdateTime).commit();
}
mFBCurrentDate = mFBLastUpdateTime;
mIGCurrentDate = mIGLastUpdateTime;
}
public void updateLastTime(){
    mEditor.putLong(Config.PRE_KEY, mCurrentDay).commit();
    mLastUpdateTime = mCurrentDay;
}
private String streamToString(InputStream is) throws IOException {
    String str = "";

    if (is != null) {
        StringBuilder sb = new StringBuilder();
        String line;

        try {
            BufferedReader reader = new BufferedReader(
                new InputStreamReader(is));

            while ((line = reader.readLine()) != null) {
                sb.append(line);
            }

            reader.close();
        } finally {
            is.close();
        }

        str = sb.toString();
    }

    return str;
}
private boolean isNetworkAvailble(){
    boolean _isNetworkAvailble = false;
    ConnectivityManager connectivityManager = (ConnectivityManager) getSystemService(Context.CONNECTIVITY_SERVICE);
    NetworkInfo networkInfo = connectivityManager.getActiveNetworkInfo();
    if(networkInfo != null && networkInfo.isConnected()){
        _isNetworkAvailble = true;
    }
    return _isNetworkAvailble;
}
private void FBFileDelete(){
    File file = new File(Config.DOWNLOAD_PATH);
    File[] childFileList = file.listFiles();
    if(childFileList != null)
        for(File childFile:childFileList){
            childFile.delete();
        }
}
public boolean isFBLoggedIn() {
    AccessToken accessToken;
    try {
        accessToken = AccessToken.getCurrentAccessToken();
        setCurrentdFBAccessToken(accessToken);
    } catch (Exception ex){
        accessToken = getCurrentFBAccessToken();
    }
    mFBAccessToken = accessToken;
    if (accessToken == null)
        return false;
    else return true;
}
public AccessToken getCurrentFBAccessToken(){
    Gson gson = new Gson();
    String json = mPrefrencre.getString(Config.ACCESS_TOKEN, "");
    if(json.equals(""))
        return null;
    AccessToken obj = gson.fromJson(json, AccessToken.class);
    return obj;
}
public void setCurrentdFBAccessToken(AccessToken token){
    Gson gson = new Gson();
}

```

```

String json = "";
if(token != null)
    json = gson.toJson(token);
mEditor.putString(Config.ACCESS_TOKEN, json).commit();
}
public boolean isIGLoggedIn(){
    mAccessToken = mSession.getAccessToken();
    return (mAccessToken == null) ? false : true;
}
}

```

// MANIFEST.xml

```

<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.imageupload">

    <uses-permission android:name="android.permission.INTERNET" />
    <uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
    <uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.RECEIVE_BOOT_COMPLETED" />
    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:largeHeap="true"
        android:supportRtl="true"
        android:theme="@style/AppTheme">
        <meta-data
            android:name="com.facebook.sdk.ApplicationId"
            android:value="@string/facebook_app_id" />

        <activity android:name=".MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity
            android:name="com.facebook.FacebookActivity"
            android:configChanges="keyboard|keyboardHidden|screenLayout|screenSize|orientation" />
        <service
            android:name=".UploadService"
            android:enabled="true"
            android:exported="true" />

        <receiver
            android:name=".ReceiverBroadcast"
            android:enabled="true"
            android:exported="true">
            <intent-filter>
                <action android:name="android.intent.action.BOOT_COMPLETED"/>
            </intent-filter>
        </receiver>
    </application>
</manifest>

```

// Layout.xml

```

<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"

    xmlns:tools="http://schemas.android.com/tools"

    android:id="@+id/activity_main"

    android:layout_width="match_parent"

    android:layout_height="match_parent"

    android:paddingTop="@dimen/activity_vertical_margin"

    android:orientation="vertical"

    android:weightSum="20"

```

```

android:gravity="center"
tools:context="com.imageupload.MainActivity">

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="0dp"
    android:layout_weight="1"
    android:orientation="vertical"
    android:layout_marginLeft="@dimen/pad5"
    android:layout_marginRight="@dimen/pad5"
    android:weightSum="2"
    android:visibility="gone"
    android:layout_above="@+id/bottom_line">
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="0dp"
        android:layout_weight="1"
        android:orientation="vertical">
        <TextView
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:layout_marginLeft="@dimen/pad5"
            android:text="Images"
            android:id="@+id/txt_image"/>
        <GridView
            android:id="@+id/gridViewImages"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:numColumns="2"
            android:horizontalSpacing="@dimen/pad5"
            android:verticalSpacing="@dimen/pad5"
            android:paddingTop="@dimen/pad5"
            android:paddingBottom="@dimen/pad5"
            android:gravity="center">
        </GridView>
    </LinearLayout>
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="0dp"
    android:layout_weight="1"
    android:orientation="vertical">
    <TextView
        android:layout_width="match_parent"
        android:layout_height="wrap_content"

```

```

        android:layout_marginLeft="@dimen/pad5"
        android:text="Videos"
        android:id="@+id/txt_videw"/>
    <GridView
        android:id="@+id/gridViewVideos"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:numColumns="2"
        android:horizontalSpacing="@dimen/pad5"
        android:verticalSpacing="@dimen/pad5"
        android:paddingTop="@dimen/pad5"
        android:paddingBottom="@dimen/pad5"
        android:gravity="center"/>
</LinearLayout>
</LinearLayout>
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="0dp"
    android:layout_weight="5"
    android:orientation="vertical"
    android:gravity="center">
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:layout_weight="2"
        android:weightSum="20"
        android:gravity="center"
        android:orientation="horizontal">
        <LinearLayout
            android:layout_width="0dp"
            android:layout_weight="10"
            android:layout_height="match_parent">
            <com.facebook.login.widget.LoginButton
                android:layout_width="match_parent"
                android:layout_height="40dp"
                android:background="@drawable/btn_background"
                android:id="@+id/facebook_login"
            />
        </LinearLayout>
    </LinearLayout>
</LinearLayout>
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:layout_weight="2"

```

```

        android:weightSum="20"
        android:gravity="center"
        android:orientation="horizontal">
        <LinearLayout
            android:layout_width="0dp"
            android:layout_weight="10"
            android:layout_height="match_parent">
            <Button
                android:layout_width="match_parent"
                android:layout_height="@dimen/pad30"
                android:background="@drawable/btn_background"
                android:textColor="#FFFFFF"
                android:textAllCaps="false"
                android:id="@+id/btn_instagram_connect"
                android:text="@string/instagram_connect"/>
        </LinearLayout>
    </LinearLayout>

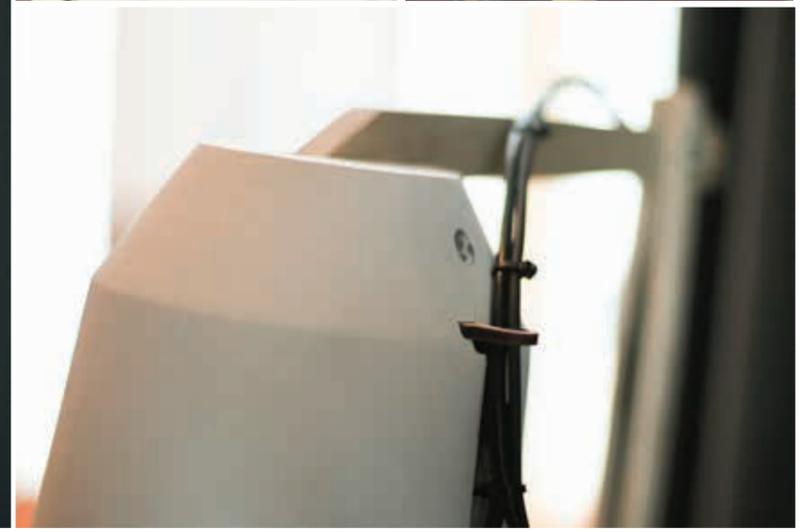
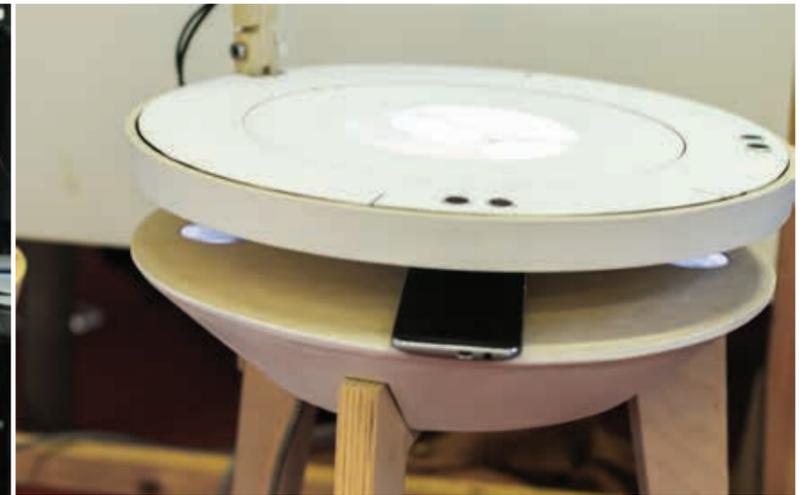
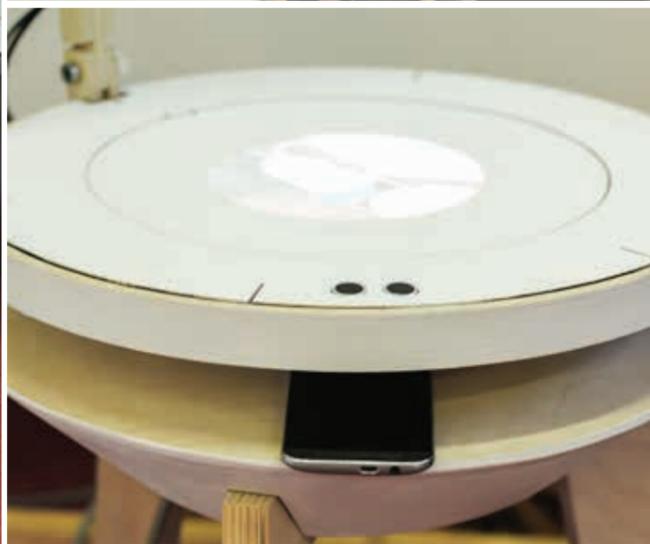
<LinearLayout>
<LinearLayout
    android:visibility="gone"
    android:layout_width="match_parent"
    android:layout_height="@dimen/pad50"
    android:id="@+id/bottom_line"
    android:layout_marginBottom="@dimen/pad5"
    android:layout_marginTop="@dimen/pad5"
    android:weightSum="20"
    android:gravity="center">
    <com.facebook.login.widget.LoginButton
        android:layout_width="0dp"
        android:layout_weight="9"
        android:layout_height="40dp"
        android:background="@drawable/btn_background"
        android:id="@+id/facebook_login1"
    />
    <Button
        android:layout_width="0dp"
        android:layout_weight="0.5"
        android:layout_height="match_parent"
        android:background="#00000000"/>
    <Button
        android:layout_width="0dp"
        android:layout_weight="9"
        android:layout_height="@dimen/pad30"

```

```

        android:background="@drawable/btn_background"
        android:textColor="#FFFFFF"
        android:textAllCaps="false"
        android:id="@+id/btn_instagram_connect1"
        android:text="@string/instagram_connect"/>
    <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:id="@+id/btn_select"
        android:text="@string/refresh"
        android:layout_marginRight="@dimen/pad16"
        android:visibility="gone"/>
    <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:id="@+id/btn_upload"
        android:visibility="gone"
        android:text="@string/upload"/>
</LinearLayout>
</LinearLayout>

```





Design opportunity

Personalization/individualization of technology trough smartphones and digital social networks.

95%
of 18 to 50 years old, owns a smartphone in the Netherlands
(Telecompaper, 2013)

50
Times we check are smartphones daily.
(Woolfaton, 2013)

5
Minutes after waking up until checking smartphone.
(Woolfaton, 2013)

Explorational prototype / probe

Second prototype

Using smartphone content to enrich and support quality time with our family members.

- Provide content through a piece of furniture that family can gather around
- Collect smartphones to extract content
- Enhance relationship with this piece of furniture

Design path

Re-humanizing the living room that is increasingly – and unavoidably - filled with smart technology.

Investigate the potential of smart furniture in supporting and enriching quality time.

Investigate the potential of smart furniture in supporting and enriching quality time.

Second prototype iterations

Second prototype iterations

Exploration and research

Cultural probe (our relation with our home and family)

First prototype (our relation with smart furniture)

Explorational prototype / probe

Environment aware action and spontaneous, unaware action

Personality

human emotional values and relation

endogenous value

Second prototype





Final prototype

Main goal: Using smartphone content to enrich and support quality time with our family members. **Research:** Using several changing parameters, test some weeks at a family to research:

- Users relation with smart furniture
I hypothesized that changing the table from being aware, unaware or both of them, has significant effects on usage frequency and engagement.
- Social/emotional effects
Effects on social space / Effects on quality time
- Effect on positive goals that are recognized in being at home and to some extent with using social media
 - wish to share (defining me)
 - Improve social space (make the living room your true home again)
 - Quality time (Undivided attention, Trust (privacy vs trust among loved ones), insight in each others life, empathy, having control over time and attention)

