Emotional Communication

products that connect friends and family

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ABSTRACT

This MA work concentrates on exploring the concept of emotional communication, through the design and prototyping of three communication "tools" for connecting friends and family. This concept was used as a guiding line for the design, and as means of illustration on how common objects and interests, along with subtle ways of communicating; can connect people to each other and even encourage their communication. The strategy used in each prototype is to implement some type of information design into a tangible object. As prototyping is considered a central activity in the development of the concepts, prototyping tools for designers are discussed and documented for the benefit of other interested.

The MA work consist of three parts: The present document, in which each tool is described from its concept development, scenario envisioning and prototyping to the first user trials; along with the framework used for their development. The second part is a DVD that contains documentation of the interaction design and functioning of the prototypes in the form of video clips. The third part consists of the prototypes themselves to be exhibited in the MOA exhibition.

KEYWORDS

Communication, Interaction Design, Ubiquitous Computing, Product Design, Ambient Intelligence

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INTRODUCTION

Information technology gives us many opportunities to communicate with other people and to share information. But our information society also faces problems, such as spam mails, noise of ringing phones in public spaces and so on. I suppose that the subject of communication is a good starting point in finding out how information technology can help us reach a more comfortable life, instead of focusing on implementing new technology into our communication tools. The individual user should be included in the context of the communication as well as the information. In the end, our communication tools need to satisfy the people using the information. Therefore I am interested in *how* information is exchanged between people when we call it communication.

Communication: "the exchange of meanings between individuals through a common system of symbols" (Encyclopedia Britannica Online Academic Edition). We talk with each other in cafés and chat to each other over the phone. However oral communication is not the only type of communication we experience everyday. Only 45% of messages are related to our verbal communication (Mehrabian 1981). It emerges everywhere in other forms. For example, you do not have to talk with your friends very much while you are playing catch with them because the thrown ball gives you lots of information. Your friend has thrown the ball seriously, easily or with other means. Communication is like this situation, it can be altered to any form if people recognize it correctly and sometimes it communicates something better than in an oral form.

I designed and developed a series of communication tools called Emotional Communication tools. These interactive tools are called Talking Glass, Sharing the Moment and Narrowcasting TV. In Talking Glass, I designed a cup in which

the users can enjoy the interaction while they toast their glasses. In Sharing the Moment, a couple with a long distance relationship can share the moment of brushing teeth together. Finally in the Narrowcasting TV, elderly can receive photos on their TV that are taken with a mobile phone by their children or grand children etc.
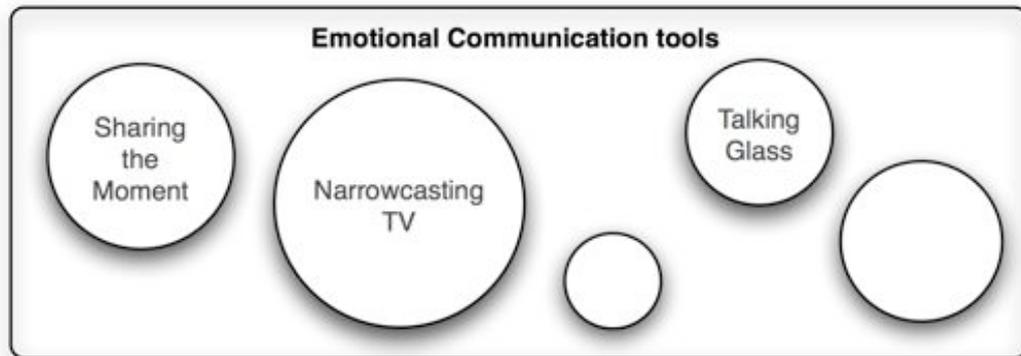
This thesis also includes an attached DVD. All the three tools that I have developed are documented in a video format on the DVD, in order to describe the interactivity and the functionality of each tool. The development of each tool is described in this paper in the following order: short description, scenario, concept development, prototyping with electronics, model making and user trial.

In this paper, I will describe my design process when developing a series of communication tools. I will first discuss some of the common communication tools of today, and present some problems occurring in our way of communication. I will then discuss the struggle we have when including interaction design into our communication tools. As an answer to the problems we have with our tools, I developed a concept called "Emotional Communication". The concept is based on the idea that a common interest connects people emotionally. I will then describe the communication tools I developed following this concept. Each tool is described from its concept development, scenario, and prototyping to the user trial. Through the process of prototyping the tools, I analyze the experience of both designing and developing the tools.

OUR LIFE INFLUENCED BY INFORMATION

The struggle of our information society

Information technology has been dramatically increasing and it surrounds us everywhere today. However, many people have become confused or irritated with it and they sometimes call it information divide, usability problem, barrier free issue and so on. Information cannot be called "information" if people are not able to understand what it tells them and if it only stays in storage as "data".

I was previously working in an architect's office for a couple of years, designing houses and public buildings. Architects need to be widely aware of many issues, from the clients' wishes to social issues, in order to propose solutions for both private and public spaces. However, the most crucial point is always the same and that is to improve our quality of life. Otherwise people will leave the space, and a space will not be recognized as architecture without people. Therefore I sometimes argue that too many of the information related products that are driven by technology are ignoring our way of life. "As computers pervade our built environments, it will become crucial to consider the *details* of interaction in order to make them a pleasing and useful improvement in our daily life" (Arroyo, Bonanni & Selker 2005). For example, I still wonder if the personal computer is the right means for home users to receive information. The personal computer brought us many things we can do at home but it also made many people bring their work home.

Communication with friends and family

Today kids are growing up with a lot of fascinating information and opportunities in many ways. Some students go abroad and keep relationships with boy/girlfriends at a long distance. Some kids are fascinated with video games, playing the whole day in his/her room and seldom talk with his/her family. Some people have not seen their grand parents for a few years. I sometimes feel that relationships between friends and family are becoming more distant emotionally.

However, information technology has brought us lots of other possibilities to fill these gaps. Some people use text messages more than they call each other, as it is both quick and cheap. Some people keep on the peer to peer voice service Skype all the time while they are at home, even while they are doing their own activities. People use this free phone not only to have a conversation but also to virtually connect their space with each other.

At the same time, our communication tools such as the phone and the email often become annoying when we receive a lot of spam mails and noise from ringing mobile phones. We "seem" to gain a lot of advantages when new technology is implemented into our communication tools, but shortly after we may be disturbed in our everyday life with these tools.

This is a very controversial situation. It seems that we have to live with both the positive and negative sides of what the information technology adds to our life. Donald A. Norman said in his latest book "Emotional Design" that 'the point of the frequent messages is not information sharing; it is emotional connecting. They are ways of saying to one another, "I'm here," "you are here," "we still like each other." People need to communicate continually, for comfort, for reassurance.' (Donald A. Norman 2004). For example, many people use an instant messenger everyday but there are few actual chats emerging. People still turn on the messenger everyday because they are looking for the connectedness to others. You might even feel more disconnected to others when you are in a place where you cannot have an Internet connection. The *presence* of others takes an important role even when we would be able to exchange lots of information.

The idea of 'Affordance' (Gibson) by James J Gibson gives an idea of how to create interfaces without an explanation, but that affords a specific action to the users. For example, HeatSink is a project that seeks to return a sense of value to water exiting the tap, and provides useful information about the temperature of the water without altering the function of the sink. Colored LEDs illuminate the stream of water red when it is hot and blue when it is cold (Arroyo, Bonanni & Selker 2005).
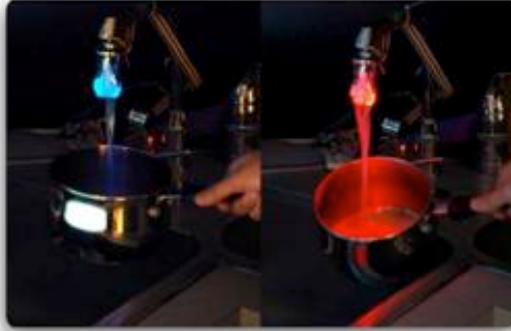
HeatSink

I think there are alternative ways of communication. Instead of our verbal communication, I would like to focus on designing and developing tools for more subtle ways of communicating. A verbal communication exchanges clear messages, but we are also able to read many different kinds of information unconsciously while we are talking with others. For example, we may read the feelings of the other person even if there is just a tiny movement in his/her eye. A simple piece of information and a function such as the LED light can be used as a non-verbal symbol in communication. People are likely to be able to read the pattern of a LED light and to receive a certain kind of meaning. I will highlight this type of subtle and nonverbal communication in the tools.

INTERACTION DESIGN FOR COMMUNICATION TOOLS

Designing a platform

Jesse James Garrett introduces a diagram about the elements of a user experience (Garrett 2002). It requires a different kind of process and builds up an information system from the base. If I expand these elements to a tangible interface development, it would mean that designers should become more concerned about how to make the information reach the users on different platforms.

Garrett, J.J. 2000,
P33, The Elements of User Experience: User-Centered Design for the Web, New Riders Press.
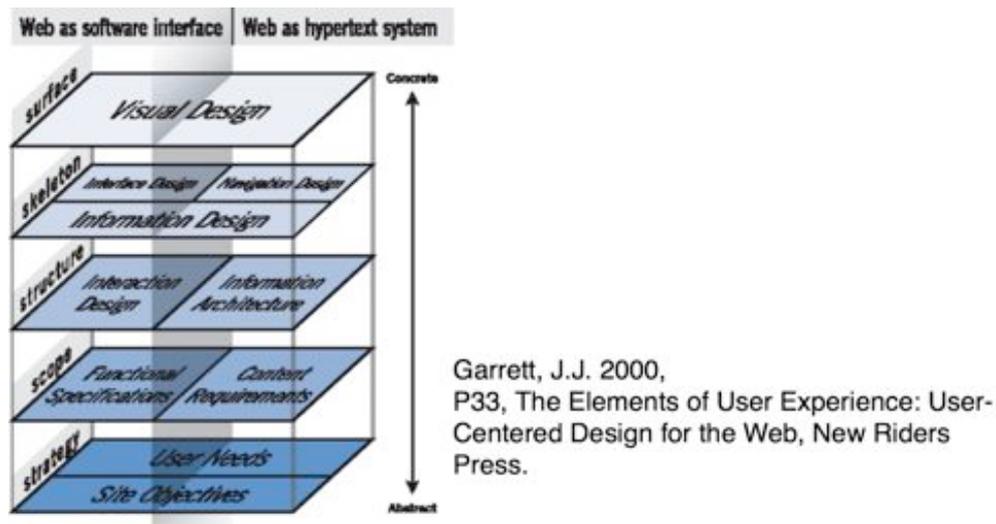
For example, a mobile phone seems to be very useful in dealing with multimedia information as well as telecommunication, but it is still a new and difficult device for many people. The designer should first make sure if the mobile phone is a better platform than any other to provide the information to the users. For example, providing news on a TV is a better means of communication than a webpage on the computer, in terms of our everyday life. Because even if the webpage can provide more information than the TV, it excludes some people who have difficulties using the computer.

Designing products including information technology

Many product designers have started to design information. The information is obviously invisible until someone has designed the interface for it. Designing objects including information technology also requires an understanding of communicating information. As you see in the following example, there might be different approaches between students in different disciplines when they design information.

Two students designed an animated person on the 8 x 8 pixels matrix LED. The limitation of 8 x 8 pixels brought a series of difficulties to the students when designing the "animation". Information design student exaggerated some parts of the body in his figure. The textile design student made her figure as close as possible to the scale of the actual body. When the figure made by the textile

design student was animated on the screen, it took a while for people to understand what was that is moving. On the other hand, the images of the information design student were recognized immediately. The image was also pleasing to look at while it was moving.

Animation made by a student studying information design
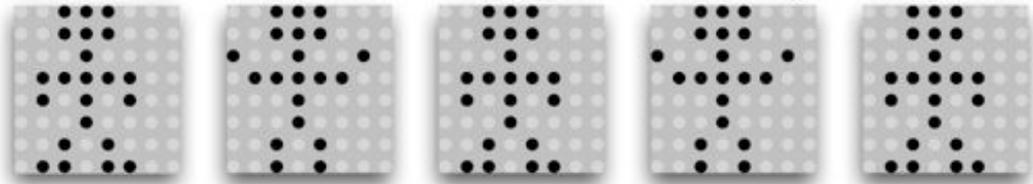
Animation made by a student studying textile design
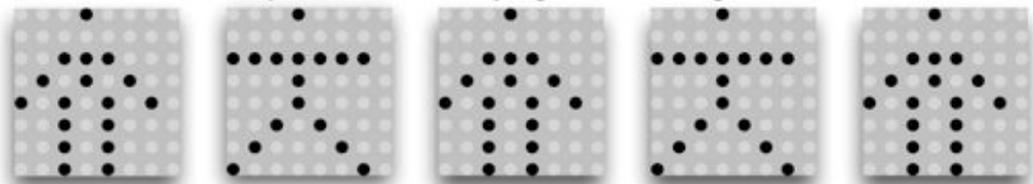
"co-design workshop" Media Lab, UIAH in Helsinki , March 2006

I do not think all students will make similar results like them. However it is clear from this example that the student studying information design was trying to show motion of what he wants to show. While, on the other hand, the textile design student was trying to represent the body as exact as possible. What I see from this exercise is that information design requires a different way of looking at our physical world. That is to say, designing information requires a different kind of set of skills than designing products.

EMOTIONAL COMMUNICATION

In this chapter, I am explaining my personal elaboration of the concept of Emotional communication, by introducing some examples from our everyday life. I will then present the qualities of such emotional communication and how they relate to the tools (design concepts) I designed

French bulldog theory

I was visiting my friend one day. She has a French bulldog, and I first thought that this dog does not look nice. He is not very big and he was always staying close to someone even sometimes barking against strangers as if he was protecting that person. After a while, I started to understand why she likes this French bulldog.

We went for a walk in a park because it was a nice sunny day. We found another French bulldog in the park and my friend started to talk to the owner of the dog. They only talked about the dogs but they looked like they had known each other for a long time. I asked her if she knew the owner but she said that she had not met her before.

Suppose that you have a French bulldog at home. He is really lovely but none of your friends understand that. One day while walking your dog in a park, you come across another French bulldog. You will excitedly start a conversation with its owner even if you have never met them before.

Common objects and interests can connect people to each other and they even encourage their communication. This is what I mean with Emotional Communication.

Other examples of Emotional Communication

During the development of my project, I collected examples of Emotional Communication in our everyday life to make the concept more clear to myself and to frame it. For example, I found that when people receive a text message they feel emotionally connected to the other even if only for a moment. I analyzed the different fieldwork - situations, defining *who* understands it and *how* that person feels about it.

Case study 1

Tarja Halonen's presidency campaign office in Kallio, Helsinki (2006/02/22)

- Description

Tarja Halonen was just elected for her second term as Finnish president when the photo was taken. This photo was taken in front of the campaign office in Kallio, Helsinki. The office was already emptied but there is still her image on the window. Besides her photo, there is also a printed text saying: "Kiitos!" (Thank you).

- Who would understand this?

People, who live in Finland and who recognize her on the picture, especially people who voted for her.

- Feeling?

People understand it as if Tarja Halonen says "Kiitos!" to them for their votes. Even if it was only a person who worked there probably who printed it out when he/she left the office last.

- Emotional Communication

The common interest is the person "Tarja Halonen". At the time, she was elected to be the Finnish President. "Kiitos" (Thank you) makes people feel connected to "Tarja Halonen" more personally.

Case study 2

Blinker on the car

- Description

When you are in a traffic jam, you might be irritated and stressed. Sometimes, when you give space in front of your car to another car, you give a flash of the blinkers as a signal and the another car also flashes blinkers back as if it says: "Thank you".

- Who would understand this?

The drivers of the cars.

- Feeling?

It is annoying when you are in the middle of a traffic jam. But a flash of the lamp makes you smile for a moment and you feel happy.

- Emotional Communication

The blinker is usually used to give a sign when people turn their car, but in this situation, people read this sign as "Thank you" and some flash back in the same way. This communication connects the drivers to each other more personally.

Qualities of Emotional Communication

Emotional Communication is not about just appearance where the user understands something at a glance. The users experience the Emotional Communication in the provided context and develop their experiences by them selves. Emotional Communication brings personal experiences with objects and motivates users to remember them. A certain time is required for the users to develop their personal experience.

Emotional Communication should provide implicit and subtle communication between people. To begin the development of the Emotional Communication tools, I targeted people who know each other. They already have some common interests and the Emotional Communication highlights their mutual interest consciously.

The goal of the Emotion Communication tools is to connect people especially friends and family, and to fill the gap of physical and mental distance between them.

Personal experience

M. Csikszentmihalyi describes the concept of "flow experience" in his book called "The Meaning of Things". It illustrates how psychic energy is directed through activities capable of being valued as intrinsically enjoyable (Csikszentmihalyi, Rochberg-Halton,Eugene 1981). In the flow experience, you feel more involved in an experience with an object. This creates a personal experience that you will remember. For example, the following toy gives a very good example of creating personal experience with objects (anchovy 2005). You can design your own so-called "Pontiki" using different kinds of parts. It is fun to make your own Pontiki but it also creates your personal experience with the toy, which make you remember it. It might also remind some people of the Japanese "Tamagotchi" toy
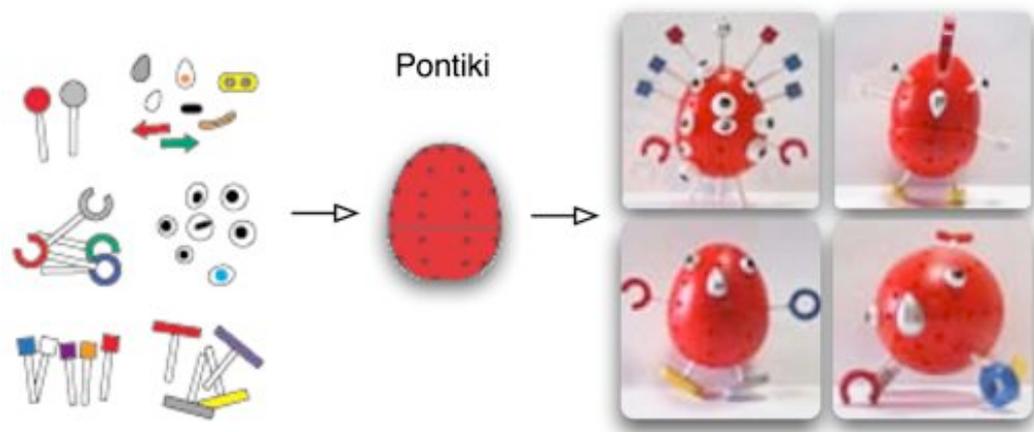
Donald A. Norman presented a similar idea that is more focused on recognition. He presents a so-called reflective level in a cognitive state. The reflective level extends much longer and through this reflection you remember the past and contemplate the future and this takes time to develop (Donald A. Norman 2004). He also discussed the appearance and the usability of objects. In the reflective level, people can even change the negative impression of an appearance and usability to a positive one. Sometimes people keep a clumsy object because they have a strong personal experience with it. It takes a while to create this strong experience.

Familiarity

The Japanese renowned product designer, Naoto Fukasawa designed a bag called "Sole Bag". He explains this bag like this, "We believe that a great many people are not happy with the idea of putting their bags on the ground. It stands to reason then that they'd go for a bag that they would not be too worried about placing on the ground. So we thought about shoe soles. More precisely, we thought about the rubber-soled shoes that are worn in schools throughout Japan. The color of the familiar rubber part of the shoe forms a focal point." (Naoto Fukasawa 2004) This bag has a very subtle expression, so that almost only the user appreciates having the bag, but the user understand it because he/she experienced it for a while. Naoto, in this design, works with recognition, so that people already have a familiar personal experience before the purchase.

Sole bag

Unobtrusive

The mobile phone does not always encourage the emotional connectedness between people. When a ringing phone disturbs someone during an important meeting, the connectedness will fail immediately. Emotional Communication tools will not disturb anyone. On the other hand, you will notice you are connected to someone close when the tools activate.

Connecting to one and other

People have some moments when they feel emotionally connected to others during the day. However, these moments are not always recognized consciously. The Emotional Communication tools try to highlight these

moments. Although these objects are used as communication tools, they do not mean to substitute the existing communication tools such as mobile phones, email etc. The Emotional Communication tools are subtle and quiet products. They are useless when you need to give a clear message to others. We can use mobile phones in that case but the Emotional Communication tools will help you *feel* others who you want to be connected to.

Related projects

There are similar projects to the Emotional Communication tools already existing. These related works are often connected to network systems such as the Internet, so that the communication can be established in different locations. Recently there is more interest in establishing the communication using wireless network and also in creating it with mobile phones.

RemoteHome

RemoteHome

The RemoteHome project developed some furniture that is located in London and in Berlin. The furniture is connected to Internet and reacts when someone uses them, for example sits. Both spaces are virtually connected (Tobi Schneidler 2003).

inTouch

inTouch

"inTouch is a project to explore new forms of interpersonal communication through touch. Force-feedback technology is employed to create the illusion that people, separated by distance, are interacting with a shared physical object. The "shared" object provides a haptic link between geographically distributed users, opening up a channel for physical expression over distance." (Brave, Ishii & Dahley 1998)

LumiTouch

LumiTouch

"The Lumitouch system consists of a pair of interactive picture frames. When one user touches her picture frame, the other picture frame lights up. This touch is translated to light over an Internet connection." (Chang et al. 2001)

Nokia Image Frame

Nokia Image Frame

The Nokia Image Frame looks like a photo frame but a function equivalent to a mobile phone is embedded in it. It only receives images via MMS. It meant to be used at home or in the office. This product is already on the market but unfortunately it is much more expensive than a normal mobile phone. (Nokia 2005)

Lover's cup

Lover's cup

"Lover's Cups explore the idea of sharing feelings of drinking between two people in different places by using cups as communication interfaces of drinking. Two cups are wirelessly connected to each other with sip sensors and LED illumination. The Lover's cups will glow when your lover is drinking. When both of you are drinking at the same time, both of the Lover's Cups glow and celebrate this virtual kiss. " (Hyemin Chung, Chia-Hsun Jackie Lee, Ted Selker 2006)

In my own work, I have developed a *series* of communication tools based on a specific concept. The concept of Emotional Communication works as a

guideline to develop details for each tool even if each tool is targeted at a different group of people and a different use of communication.

I have explored software development using existing hardware tools such as the mobile phone and the TV to make the Emotional Communication tools but also developed new hardware devices.

EXAMPLES OF THE EMOTIONAL COMMUNICATION TOOLS

Emotional Communication tool 1: Talking Glass

Short description

The Talking Glass was developed together with Ida Blekeli during the workshop called "Experimental Interaction" held in Media Lab, UIAH in October 2004. We developed the concept together and I developed the electronics.

A drinking glass is a very familiar everyday object. We use is to drink from, but it also has other functions. For example in parties a toast by the glass can work as an introduction between people that are new to each other.

The Talking Glass has electronics built into the base of the glass. When toasting, an arrow is illuminated by LED displays in both glasses. The arrow in the glass points to one direction, either at you or the other person.

when you toast the glass

an arrow point into either you or the other person
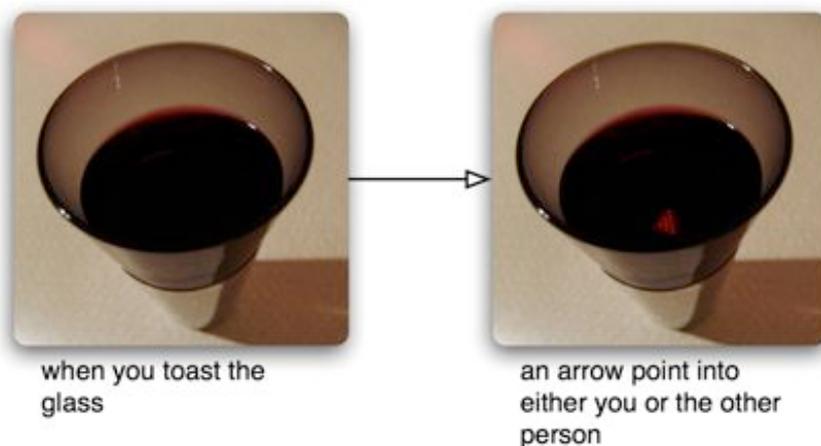
The intention of this work is to make people pay attention to each other and to encourage them to talk about what the arrows would mean. This can be the beginning of communication between people who are getting to know each other. For example, we envisioned that it might remind people of the social game called: "Spinning the bottle" in which the person that the bottle is pointed at has to tell a story. So people can create their own game or way of communication through this tool. Although the arrow itself is very simple information, it is more ambiguous than a text message. It shows only directions but lets people pay attention to each other rather than the object.

Scenario

Tapio is on the way to a party he is invited to. He is not a party guy; he rather prefers to sit in a café, reading a book for hours. But he is going there to see his old friend, Eki. Eki and Tapio studied together in a technical university. Eki was very social. He is now working in the marketing department of a telecommunication company. Tapio works as a system engineer in an IT company. They have not been in contact for a long time but Tapio got a phone call about a month ago from Eki saying he is going to China to open a new market for his company. Eki was very excited about this and wanted to meet Tapio at the party he was giving before his departure.

Tapio met a lot of new people at the party; he is usually shy when there are many people around, so he drank a glass of wine to encourage himself to talk to the others.

When Tapio was toasting his glass with a lady, he found a red light in the base of the glass. He had not noticed it until now because the wine was also red and he could not see the base of the glass. He thought, "Maybe this glass is a bit heavier than usual." The light was in the shape of an arrow and moving towards the lady so he looked at her. She was looking at the light too and said "do you also have a light in your glass?" and he said, "Yes and it is moving". She came close to him and looked at his glass. He also looked at her glass. The light in her glass was also moving but he found both lights were moving towards her. He started to wonder what they meant and he shook the glass a bit to see if something would happen. "Is this some kind of game?" she said to him.

Suddenly Eki came over to them and said; "Are you guys having a nice chat, Tapio and Liisa?" Tapio looked around and found that others at the party started toasting their glasses again and started playing.

Concept development

The idea of toasting glasses came up when we were discussing our actions in our everyday life at a student cafeteria. It is a fascinating idea to create an interaction when people toast their glasses with each other, because there is the action of the physical object and the situation of a multi-user experience. We focused on how the interaction could encourage the communication between people. It is technically possible to show an image or message in the base of the glass, but we found that an image or text takes too much attention from the users and rather disturbs the communication between them. We also looked for other interactions such as sound and motion. Sound also disturbs the conversation it played every time when a toast is made. In the end, we decided that an arrow as a good solution; it does not disturb but does encourage the communication. An arrow is a very familiar symbol, and the users can look at it at a glance to understand what the arrow tells them. The arrow gives a direction to the user and if the user follows the direction of the arrow he finds that the arrow points at another person or himself.

Prototyping with electronics

The Talking Glass is mainly implemented with a sensor, a microcontroller, a matrix LED display, a rechargeable battery and a solar panel.

In the prototyping process, the most crucial part was to make the glass recognize when it is being toasted with. Technically the glass needs to recognize two facts, one is when it is toasted and another is where it is touched. The arrow will react randomly either in the direction where its toasted or the opposite direction.

System diagram of Talking Glass

base of the glass

matrix LED display   sensor

microcontroller   rechargeable battery

solar panel
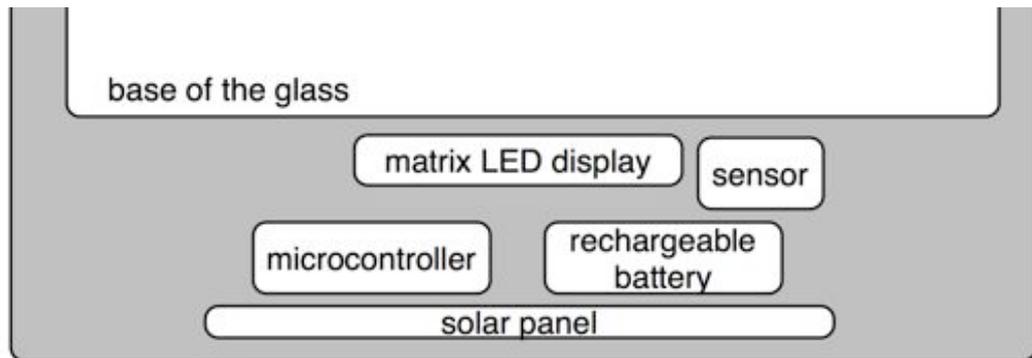
When I was making technical research, I found two possibilities, one was to use a slide sensor around the glass and the other was to use an accelerometer. The slide sensor looks like a ribbon and it gives a different value depending on which location is touched by an object.

Slide v2.1 Sensor from Infusion Systems Ltd.

slide sensor

value = 1

value = 5

value = 10
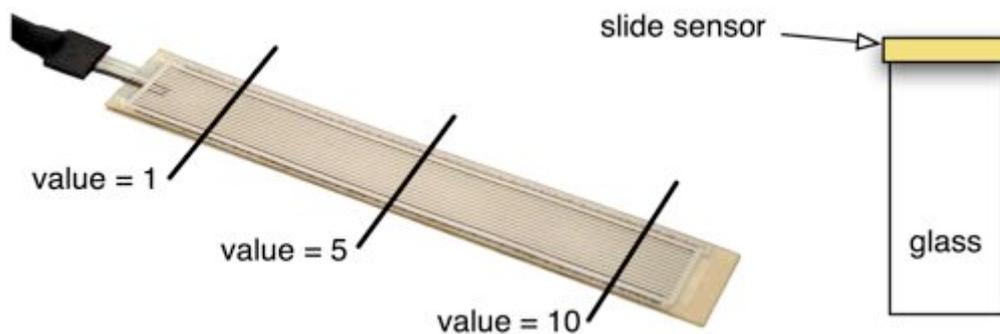
glass

Positive aspect

- Easy to install

Negative aspect

- The sensor is visible from the outside.

- The length and width of the slide sensor is fixed

- The sensor is flexible in only one direction so the glass needs to be of a cylinder shape.

The other solution was to use an accelerometer. The accelerometer is used to measure vibration, tilt and gravity. This sensor has two axes to measure with so it recognizes any vibration in any direction, in theory.

Memsic 2125 Dual-axis Accelerometer Sensor
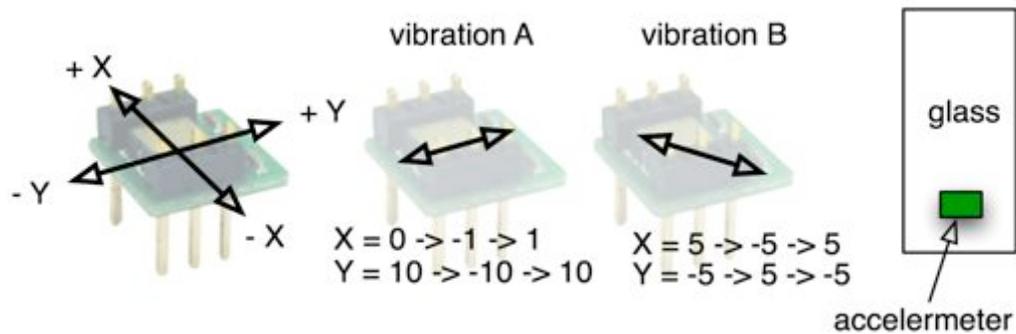
Positive aspect

- The sensor is invisible from the outside.
- It can also detect when the user is drinking something from the glass.

Negative aspect

- Software prototyping is needed to distinguish between vibration, tilt and gravity.

Software prototyping creates more flexibility than the hardware prototyping while adjusting the sensor of the glass. To make the sensors invisible from the outside was also a very important point in order to keep the traditional use and the concept of the product. Finally the accelerometer was chosen.

No component may be visible or exposed on the surface of the glass, because people will be washing the glass with water. A self-integrated electric system and portability are important aspects for the technical development in terms of use of the glass. A rechargeable battery can satisfy this need, but there are two technical issues considering rechargeable batteries.

Technical issue using a rechargeable battery

- How to recharge the battery
- When to recharge the battery

To respond to these issues, I found that there are two different kinds of technical solutions: creating an electric generator using an electromagnetic induction or a solar panel.

Technical solutions for recharging the battery

- An electric generator using electromagnetic induction
- A solar panel

The electric generator does not need to have a physical plug to supply power. It uses electromagnetic induction to transform electrical energy into mechanical energy. It is a very fascinating technology. However, it requires an external device to transfer the energy. This becomes unrealistic if there are many Talking Glasses that need to be charged.

On the other hand, a solar panel can easily be embedded in the glass. It will take a while to recharge the battery but the glass will then have a self-integrated energy system without external devices. The solar panel also brings with it one more interaction with the glass. When the user washes the glass, the glass is usually turned upside down to dry. This behavior can be used to recharge the battery, as seen in the following figure.
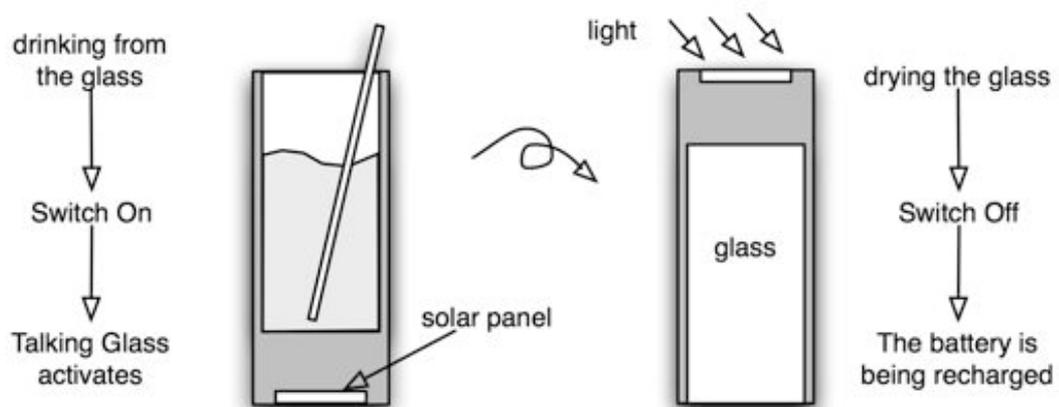
Model making

Through the process of the concept development, the prototyping and the user experience, I listed some issues concerning the design process:

Design Aspects

- The shape of a wine glass would be the best design solution for the concept, but it is technically hard to achieve.

- The cocktail glass is another solution but the shape of the cocktail glass already implies who might use it. For example, it is for a male or a female. Therefore the shape of the glass should be as uni-sex as possible.

A   B   C   D
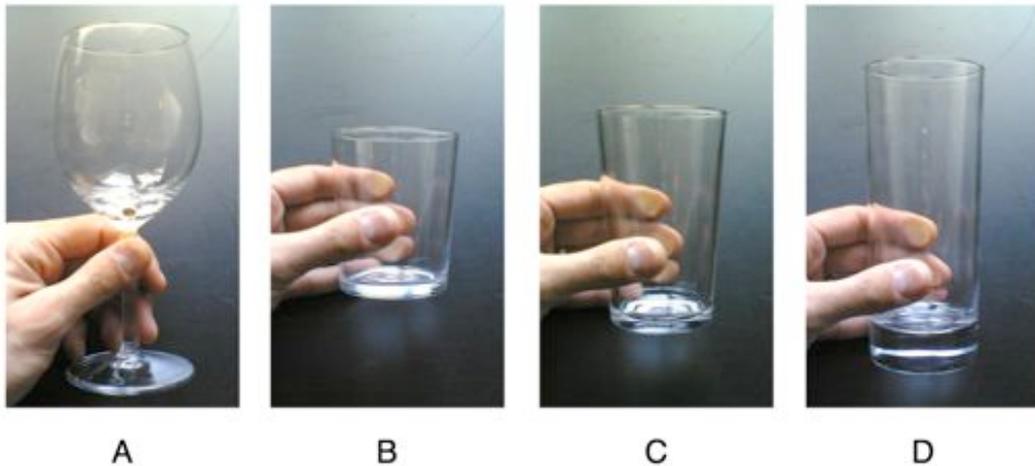
Designing the shape of the glass was also very important for the Talking Glass. Although there are lots of different kinds of possible shapes for the Talking Glass, people have a very strong feeling for which shape of glass is for which type of alcohol. For example, as you see in the following photo, Glass A is a wine glass; people rarely use it to drink any other type of alcohol than wine. Glass B is a scotch glass. Women usually feel uncomfortable to use the scotch glass because they think it is only for men. Glass C is for drinking water. Its very universal, but its shape will get less attention from the users. Glass D can be used for cocktails and soft drinks and so on. Women like to use this glass to drink cocktails but men can also use it.

Unfortunately making the actual Talking Glass using glass was not technically possible because the glass will be several hundreds degrees hot when it is blown into a mold. No electronics can take the temperature. We made a mold from an existing glass and made the same shape with epoxy resin. Some epoxy resin only goes 50 degrees hot, a temperature which the electronics can take.

User trial

The prototypes were brought to an ordinary party. There were about 20 people gathered in a flat. People poured wine in the glasses and used them as normal wine glasses.

The prototypes additionally had network ability, so that both arrows in the bases of the glasses pointed in the same direction. In the user experience test, I had a technical problem with the Bluetooth communication so I had to disable the Bluetooth, and the arrows then pointed in different random directions. People started to use the glass in a way that we did not expect at all. People created a game that reminded us of the "spinning bottle". When someone toasted the glass, it gave the person a direction in which to search for the next person to talk to. The arrows pointed in different directions randomly so that no one could expect which person you had to talk to next. I did not expect this situation of use, but this created an important aspect of the game in the party and people felt they were having fun. Through the user experience test we found that users can create their own way of use and sometimes pointing in one direction limits the

variety of use. We decided not to have the Bluetooth communication ability in the actual Talking Glass.

 Although our intention of this project was to encourage a dialog between two people, people created their own game together with others. Some people commented that the Talking Glass could be stunning if it is used in a party.

Finally, I left the function of the arrow pointing either in one direction or the other, but not in just any direction randomly. Because people can still toast with many others at the same time to make random directions of the arrow for a similar kind of game.

The prototype of Talking Glass is documented in the attached DVD. The video was taken in a party where we brought a pair of the Talking Glass.

Emotional Communication tool 2: Sharing the Moment

Short description

Sharing the Moment consist of a pair of toothbrush cups that communicate with each other through Internet.

Both cups detect whether a toothbrush is inside it or not and communicates this to the partner cup that is situated in another place. If the cup does not have a brush inside it, the other cup illuminates.

first prototype   second prototype

These cups meant to be used by a couple. When both cups illuminate, it means that, both boyfriend and girlfriend are brushing their teeth at the same time but

in different places. It will not show *how* they are brushing teeth, but it tells them *when* they are brushing teeth.

Brushing teeth is such a private act that people do not usually do it together with other people. However, if you are living with your girlfriend or boyfriend, you usually know when the other one is brushing his/her teeth. This project brings this type of the moments of living together even when you are apart.

Scenario

Aki has been studying Japanese tea ceremony in Kyoto for almost one year. He has a girlfriend in Helsinki, her name is Laura, and they have lived together for 5 years. It was really hard for Aki to tell her that he wanted to study in Japan, but she understood his ambitions and even encouraged him to go.

It is not always fun to be in a different culture. There are some misunderstandings sometimes. Aki was a bit disappointed with the discussion he had today when he was eating dinner with his friends. He got home very late and was thinking a lot about the discussion. When he was brushing his teeth before going to bed, he saw a red light fade in his toothbrush cup. Laura must just have had breakfast in Helsinki. She usually takes a quick breakfast eating cereals and then puts on her make up for a long time. He suddenly started missing her.

Laura actually overslept and had a very quick breakfast. When she entered her bathroom, there was a red light in her cup. She immediately thought about Aki. When they lived together, he usually cooked a nice English breakfast in the morning for her, but recently she had been eating only cereals. She will have her summer holiday soon; she might visit Aki in Japan. Aki and Laura had often brushed their teeth together in the morning so it might be nice to see his bathroom in Kyoto, too. Suddenly her phone is ringing and she knows it is him.

Concept development

I was looking for an intimate every day situation that a couple usually shares. A lot of social activities take place in the living room but the bathroom is often a place for individual privacy. There are also many *different* kinds of activities

going on in the living room, such as eating, watching TV and hosting friends, but the bathroom limits activities to a few. I found that the objects that are used in the bathroom already give a lot of information of what people are doing there.

It is challenging to bring the Emotional Communication tool into the bathroom because brushing teeth might be too intimate for the users. Intimacy between strangers causes uncomfortable feelings, but it emotionally connects people who love each other, especially people who live together and share most of their activities together.

Choosing the right color for the illumination was also important for this tool in order to give the users a feeling of connectedness. The red color is usually used as an alert and caution but psychologically red brings the meaning of passion and blue gives a cold feeling, so when the couple happens to be brushing their teeth at the same time, the light should be turning red.

Prototyping with electronics

It was necessary to make a P2P network between the two cups; in this way no external device was additionally needed to establish the communication. But the Sharing the Moment requires an IP based network ability in order to be able to plug the cup to an Internet connection anywhere.

the Sharing the Moment P2P networking process
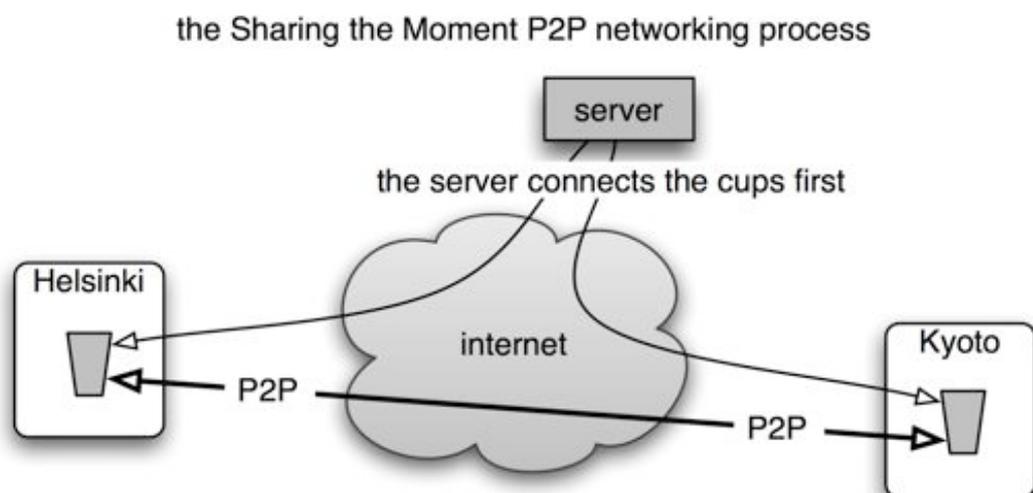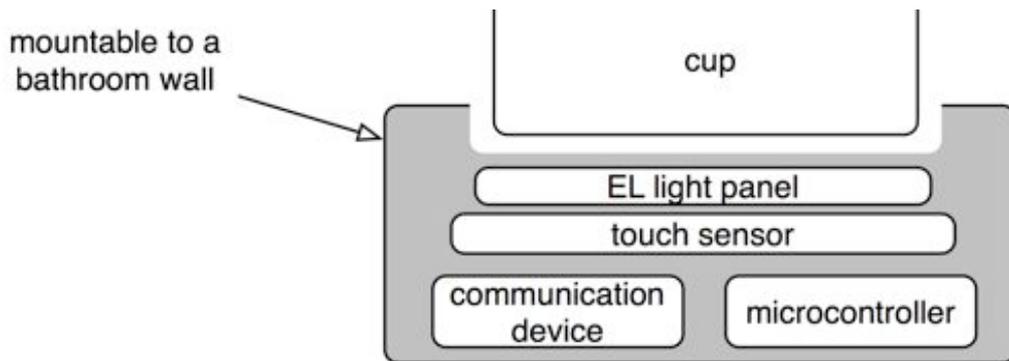
The Sharing the Moment is built using an EL light panel, a touch sensor, a microcontroller and a communication device. Developing communication was the most difficult in the prototyping process. After some technical research, I had two possible choices, Bluetooth module or Ethernet module.

Bluetooth module

Positive aspects

- It enables the tool to communicate with many existing communication products, such as mobile phones, PDA and laptops

- Many Bluetooth modules are available for prototyping.

- Compared to ordinary radio frequency communication, the data transfer is very stable and reliable.

Negative aspects

- It requires an external device such as a mobile phone or a laptop to connect to the Internet.

- The module for prototyping is larger than the Ethernet module.

Ethernet module

Positive aspects

- It connects to the Internet directly without any external communication devices.

- It can be wireless if it uses a Wi-Fi module.

Negative aspects

- There are not many Ethernet modules available.

Both communication modules are very compatible and reliable. The only question was if the Sharing the Moment needs a mobile phone or a laptop to communicate with others. Mobile phones have become personal belongings and many mobile phones have a Bluetooth embedded today. It would create an interesting interaction if the Sharing the Moment activates only when the user is at home. On the other hand, the Ethernet module communicates to the other Sharing the Moment cup directly without any other devices. I decided to use the Ethernet module this time but I can imagine that there will be more mobile phone embedded Bluetooth in the near future. Bluetooth modules may be more popular then.
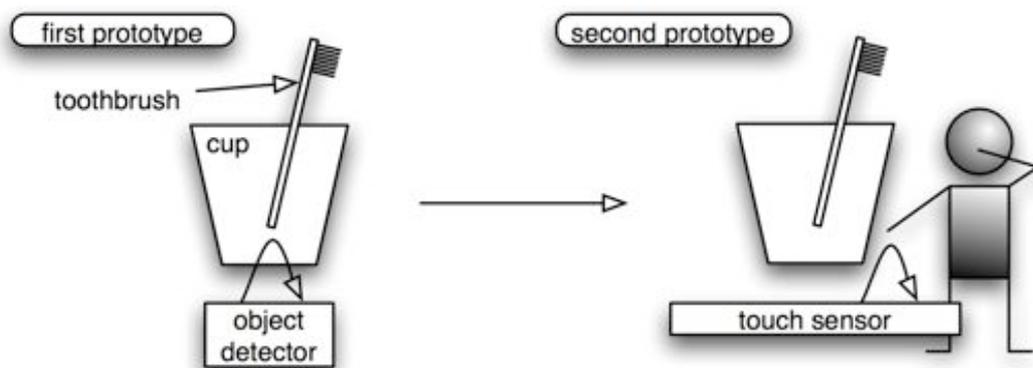

How to detect when the user is brushing his/her teeth was the most difficult part to figure out. In the prototyping process, it is necessary to make a plan of how to translate from human action to electronic signal. That means which sensors should be chosen to detect the action. First I was focusing on a detection of a brush in the cup. If I can embed a magnet or a piece of metal into the brush, it will make it much easier for the sensor to detect the brush, but it is not a very realistic solution as people buy new toothbrushes every few months. After the first user experience and some observations, I found that people don't use the cup at all except for the moment that they are actually brushing their teeth. In the second prototype I implemented a touch sensor instead of an object detector.

The touch sensor gives signals when the user puts his/her hand around the cup, and I can take for granted that the users wouldn't touch the cup unless they need to brush their teeth.

Model making

I have experienced a totally different approach in this project compared to the Talking Glass. In the Talking Glass, I was looking for a meaningful and luxurious glass but this time I was looking for a cup as ordinary as possible. In Sharing the Moment, people will not care much about which cup they are using when they are brushing their teeth.

Technically it is necessary to have two wires coming out from the base where the cup is placed; one power supply cable and one Ethernet cable: I designed a base that is mountable to a bathroom wall. I tried to design a base that is meaningful in other ways than just to be a base for the cup, so I design a tray in the base so that the boyfriend can keep his shaver and the girlfriend can keep her lipstick etc. To keep personal belonging with the Sharing the Moment will also enhance the concept of an intimate relationship.
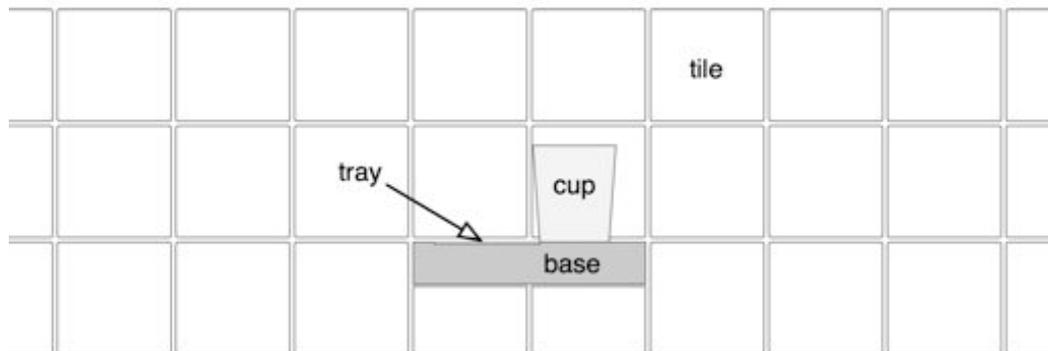
The cup is made of glass and it is sandblasted so that the red light coming from underneath illuminates the whole cup. The base itself is made out of wood.

User trial

I have tried a prototype of Sharing the Moment in "Demoday Spring" held by Media Lab, UIAH on May 13th 2005. The space where I ask users to try the Sharing the Moment was located in a hall divided with an exhibition space and a stage. More than hundred people visited there and many people experienced the tool. Several people among them kindly experienced the tool.

It is true that the experience of brushing teeth does not always remind people of sharing the time with their boy/girlfriend. Some people ask what happens if the boyfriend stayed over at someone else's house over night. I also thought some people would react that it is too intimate to brush their teeth even with their lovers, but on the other hand, people already create their own stories using the Sharing the Moment in their life even if it displays only a light.

It generally takes a while for people to find the meaning and use of the object. Especially with the Emotional Communication tool that causes implicit and subtle communication, it takes a while to find the importance of the communication; it might even take a few days. I realized that it is very challenging to reach the emotion of the users while I am presenting the tools to new people. Using a video documentation was a useful way to explain the purpose of the tool. A text also helped the users to understand the concept better and to connect to their own experiences in their life. For example, I put the texts "Tokyo" and "Helsinki" by each cup.

A video documentation on the DVD shows how Sharing the Moment works.

Emotional Communication tool 3: Narrowcasting TV

Short description

This is a product that connects the TV in your living room with your mobile phone. When your mobile receives a message or a photo, the mobile phone forwards the message to your TV. The TV has a certain channel that will then show the message or the photo. It also stores images and texts for a while and can show a slideshow of them. You may also send a message to your friends or families TVs directly, for example, you can show your grandmother what your baby looked like this morning. In this way you can connect to people who are not familiar with computers or mobile phones.

send message and
photo from your mobile

your messge will be
displayed on the TV
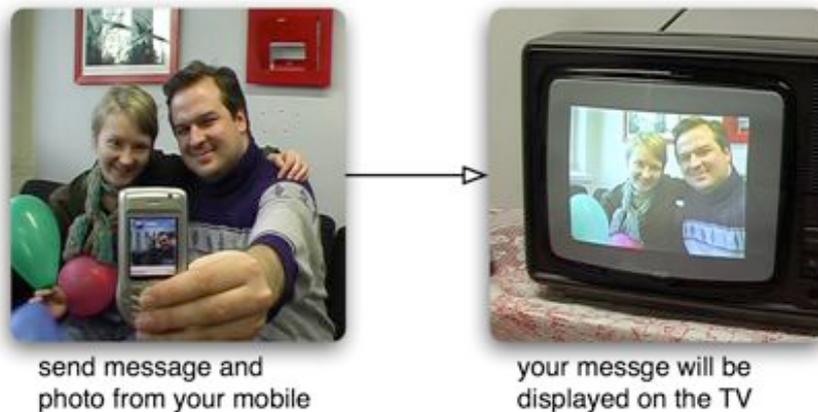
Scenario

Minna has two little kids, a husband called Mikki and a dog. Her 1 year old son is called Onni and her 4 year old daughter is called Aura. Onni just started walking last week. He is very curious about everything. Minna once left him on her double bed while she was washing dishes and cleaning their house after Mikki left home to bring Aura to her daycare center. After a while, she found him unusually quiet and she was wondered if something is going on. Babies are usually doing bad things when they are quiet. When she entered her bedroom, she saw him full of chocolate in his face and on her white linen. She started shouting at him but Onni looked so innocent and so cute. She just remembers her mother always telling her that she was messing around her bedroom herself when she was the same age as Onni. She picked up her mobile phone beside her bed and took some photos of him and sent them to her mother.

Minna's mother Ritva is living 10 hours away by car from her daughter's house. Her husband passed away more than 10 years ago so she is living by herself in her big house. Since the new grandchild, Onni was born; she has knitted some clothes for him. She sometimes knits a whole day in front of the TV. Today it is a very cold day. When she was knitting at home, her mobile phone rang once and received a message. Minna bought this phone for her as a birthday present. Ritva refused to have a mobile phone but Minna wanted her to keep it in case something happened to her. When Ritva got the message, she smiles. She changed the channel on her TV and there was Onni on the TV with his face full of brown chocolate. There is a text in the bottom of the TV saying, "Sorry mummy, I ate all the chocolate….". Ritva could not stop smiling at her little grandchild.

Concept development

The idea of this tool came from my relationship with my mother and grandmother. My granny is 75 years old and recently bought her first mobile phone, but her mobile phone is too complicated to use so she can only receive phone calls from me. It happened a few times that she pressed the wrong key and hung up the phone when she was trying to answer my call. It was very uncomfortable for both of us when this happened, annoying for her and I feel guilty to call her again, so I changed back to calling her land phone instead. On the other hand, my mother uses her mobile phone everyday. She can use all the functions on her mobile phone. I send pictures to her that I take with my mobile phone and she also replies with her pictures. She has not visited my place so the photos give a visual idea of what my life looks like. Unfortunately many useful communication tools exclude old people. But I can see that my grandmother also wants to share the same pictures that I sent to my mother. My motivation for the Narrowcasting TV is to share the same kind of contents with both my mother and grandmother.

Even if old people have strong motives to learn new tools, it is comparatively hard for them to learn. Therefore I was first looking for an equivalent device that would be able to show the pictures somewhere in her house, because it is technically possible to create a network system between different electronic

devices to send a picture to the existing device. I found she watches TV everyday and changes channels without any problem. The TV is a familiar object that she uses everyday.

First sketch
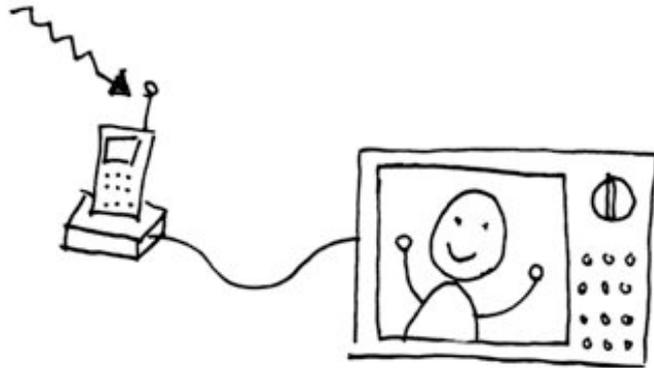
Prototyping with electronics

I first focused on searching for an electronic module that I could operate with a microcontroller, but I found there are two very difficult problems for its implementation.

Technical problems

- Transferring image data by serial communication
- Converting a digital image to an PAL format image for TV

Compared to other prototyping processes of the Emotional Communication tools, the Narrowcasting TV brings the operation of images that makes prototyping very difficult. I found that it takes a huge amount of work to make a device to receive an image from a mobile phone and convert it to an analog PAL format image, so I needed to look for alternative ways that would give the same result. I remember when we got our first TV game at home 20 years ago, my TV did not have a video input and I used a device called "RF modulator" to play the game. The RF modulator added the video image onto a specific channel so you could play the TV game on that channel. I created a prototype system to make a demonstration using the RF modulator and a laptop. When the mobile

phone receives a message, the python code I developed run automatically and transfers the attached picture to the laptop. When the laptop receives these pictures, it creates a slide show out of them and the RF modulator displays it on channel 2 on the TV. It would take a few months to make a prototype if I developed a device, but I developed this prototype in two weeks.
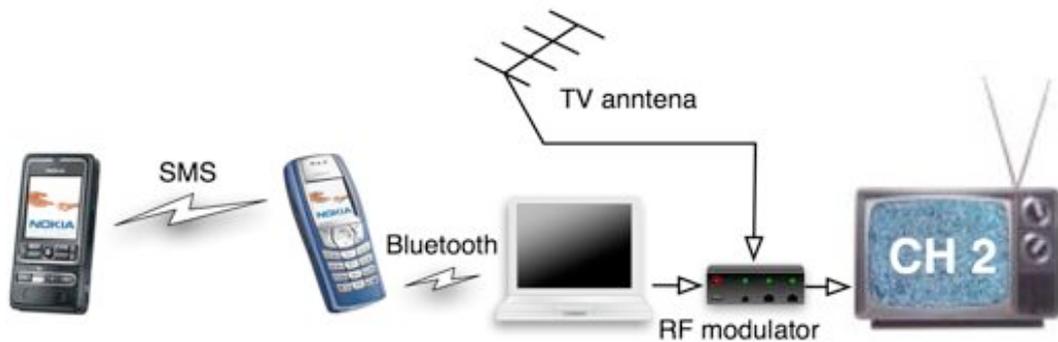
Model making

The Narrowcasting TV basically used existing infrastructure such as a mobile phone and a TV. Therefore no physical modeling process was needed for the prototype.

User trial

The prototype of Narrowcasting TV was shown in "Demoday Christmas" held by the Media Lab, UIAH on December 15th 2005. The tool was located in a small room.

Since I have experienced some user experiences with the other two Emotional Communication tools, I learned that the context of the situation affects how the

user understands the tools and create their own ways of use. If the users find the same context in their own life using the Emotional Communication tools, it is easy for them to realize how they can use the tool in their life. Therefore, I set up the atmosphere of a living room so that the test users would recognize that the TV is meant to be located in a living room. In addition to the atmosphere, I intentionally chose an old TV and left knitting tools on the sitting chair in front so that it would remind the users of their grand parents' house.

Many people asked technical questions during their experience. People are very familiar with mobile phones and they know the ability of their own mobile phone, so if there is a new way to use it, people seems to be interested in the technical aspects. I gave some users a mobile phone to take a picture and asked them to send it to the given number. Some people sent a picture they took before with their own mobile phone, such as a photo of his/her friends, or his/her daughter.

LESSONS LEARNED

Designing Emotional Communication tools

Information technology in products

It is important to include hardware product design development to make information tangible. Software development often lacks tangibility. The Emotional Communication project provides three working prototypes. In each prototype, I implemented information design into a tangible object. It took a while to decide which kind of information should be used in each project. To highlight the emotional communication in each prototype, it was necessary to use objects that people are already using everyday. These objects already have a very traditional way of use. On the other hand, "people have also developed personal feelings to these objects" (Donald A. Norman 2004), which is a very important fact when creating emotional communication. I tried to design the

prototypes to look as normal object as possible, so that each prototype is familiar and look like something people use everyday.

Throughout the process, I also developed a guideline for developing new communication tool in order to help me make more detail designs. The guideline consists of three ideas: concept of product, limitation by technology and understanding of use.
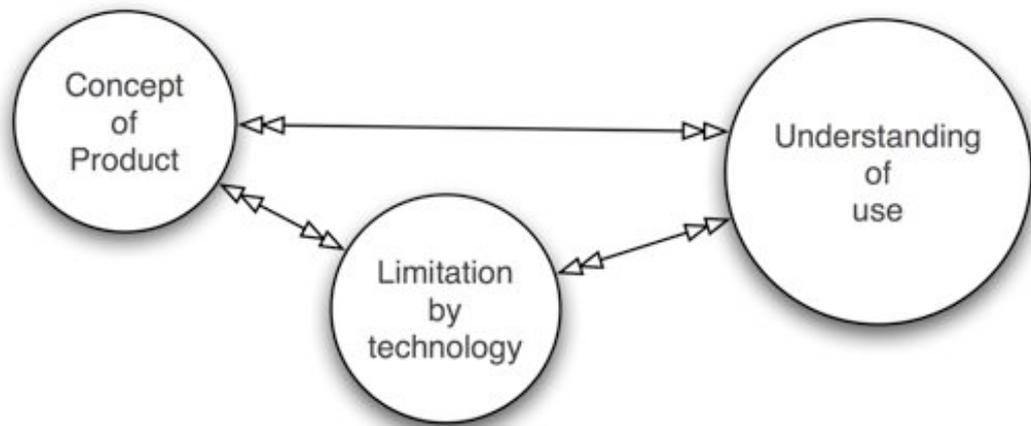
These three ideas were often fighting against each other during the designing of the Emotional Communication tools. For example, the electronics that makes the product interactive needs a power supply. But some of the products also require mobility. On the other hand, the concept of the design sometimes requires a different way of use of the product, that makes the user confused and the personal feeling about the product becomes very negative. For example, in the mobile game industry, the game design often confronts usability problems, because the games require a different use of the mobile phone than just calling. Technology also often limits the use of the product and therefore it may not respond very well to the user's expectation.

Since I was involved in the prototyping with electronic, model making and designing the concept, I often found new improvements while experiencing different phases of development. For example, I am sometimes blind to see another possibility of the tools during the concept development, but prototyping experience brings the possibility more clear. That helps the improvement of the tool.

Difficulties in designing new communication tools

Hardware oriented communication tools have two aspects that needs considering. One is the software designing based on its communication service and the other is the human-computer interaction included in the hardware. The communication tools operated by electronics have to encode information through a human-computer interaction. On the other hand, the encoded information also has to display something meaningful and informative to the users. Therefore, high fidelity of information transferred between two users is a very important aspect to be considered. This fidelity is affected by both the software based content and the hardware human-computer interaction. For example, when the infrastructure of international phone lines was not developed enough to transmit voices without delay, it was hard to make conversations over the phone. Because our voices were always delayed and often one person started speaking before the voice of the other person had toned out.

Another example is the instant messenger on the computer. The use of computer is not very easy for older people. Even if many people keep their computer on all the time to be connected to friends and family, many elderly have serious difficulties using a computer. Unfortunately this excludes them from the networking of the instant messenger, and other similar services that connects most of the rest of the population.

Important issues in developing Emotional Communication tools

As the goal of the Emotional Communication tool is to connect people emotionally. It brought different issues while developing the tools compared to the existing communication methods such as the mobile phone.

- Simplicity
- Pattern
- Everyday objects
- Common interests
- Shared spaces

Simplicity

Simplicity is not only about usability issues but also it is about helping the user to use their own imagination to feel connected to others. For example, in Sharing the Moment, If Sharing the Moment tool displayed image captured by a camera on the other side, it would rather disturb their own privacy in their bathroom than give a feeling of comfort. Although the user finds the boy/girlfriend brushing their teeth and uses his/her imagination as if he/she is brushing teeth next to each other, the actual information is only an illuminated light in the Sharing the Moment. Users are able to create their own way of communication. To leave this ability for the user is one way to encourage their Emotional Communication.

Pattern

Gregory Bateson defines information as "a difference that makes a difference" (Bateson 1972) and Paul Kahn in his information architecture workshop held by the Media Lab, UIAH in October 2004, said, "information is a pattern that provides a structure for understanding" (Paul Kahn 2004). Users are able to read patterns of information during their experience even if the information is very simple. For example, in Sharing the Moment, only a red light give the user information but the user can read patterns based on whether the light is on or off. This gives more accurate information about what the other person is doing.

Everyday objects

The use of everyday objects brings a lot of insights in developing the interaction design. For example, a glass is supposed to be used for drinking something but we use glasses to keep toothbrushes, toasting in a party, keeping a flower on the dining table and so on. These uses that people have created can be used to find an idea for interaction. However, I do not mean these uses could trigger another activity that is not related to the original meaning of the use at all.

Common interests

People will not generally communicate with each other if there is not any common interest. This is the most basic communication problem today. Narrowcasting TV is based on the scenario that a daughter wants to show her baby to her grand mother. The baby is now the common interest between them. The Narrowcasting TV basically encourages their interest providing the tool that enables the grand mother to reach the information she is interested in, easily.

Shared spaces

A shared space is similar to having a common interest when it comes to emotional connectedness. Many people have experienced receiving a phone call during their business meeting while the other person is calling them from home. They both feel uncomfortable to talk to each other and feel guilty about this. However the Emotional Communication tools specify the space where users can use them. That is to say, both users can see with who and where they are communicating. Sharing virtual space keep people connected even if they are in different locations.

Finally, communication is a very interesting part of interaction design. Communication obviously involves users and the designer cannot really avoid the subject. I suppose that designing communication tools is a very good exercise in terms of user centered design development.

## Prototyping Emotional Communication tools

Prototyping Possibilities for designers

There are increasing numbers of prototyping tools in electronics today. Some of them have already been taught in design schools for a decade. User centered design processes are now taking place in many practices, therefore testing prototypes on users is more needed in today's design development. According to one of the world leading design offices IDEO, they have both a traditional

model shop and an electrical engineering lab for their prototype development (Buchenau, Suri 2000). In the traditional model shops, they basically create objects made out of wood, metal and plastic. At the same time, in the electrical engineering lab, designers develop the interactivity that will be assembled into the objects later. The combination of these facilities gives designers an opportunity to make high fidelity prototypes to test on users.

The process of prototyping with technology has mainly two different phases. One is the hardware prototyping and the other is the software prototyping. In the hardware prototyping the designer can assemble ready-made input devices, and computers such as microcontrollers and displays as outputs.

Hardware Prototyping
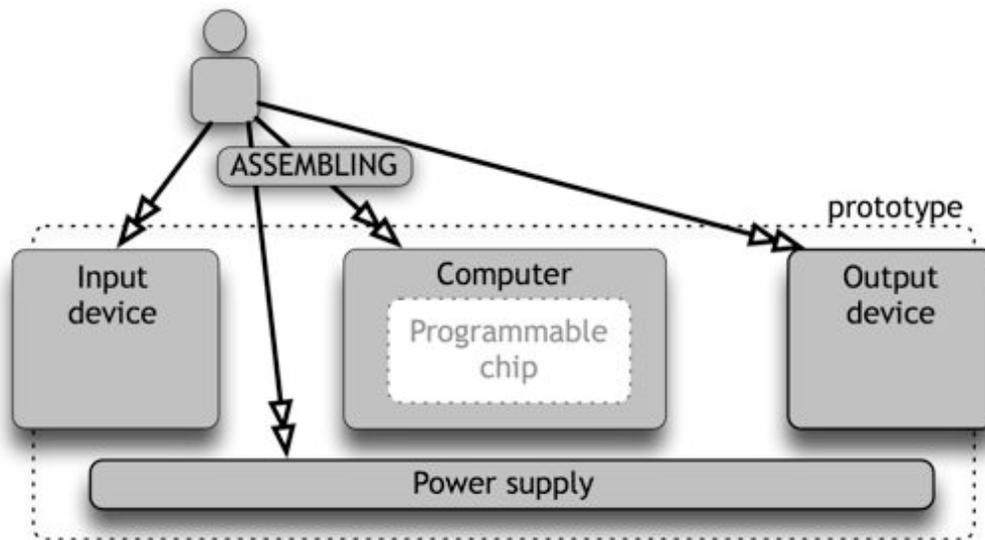
To make an electronic communication between these assembled components, the designer needs to program code into the programmable chip in the computer. Software prototyping is not always necessary but it enables the designer to test different kinds of human-computer interaction possibilities by changing only the code. It also keeps the hardware circuit simple.

Software Prototyping
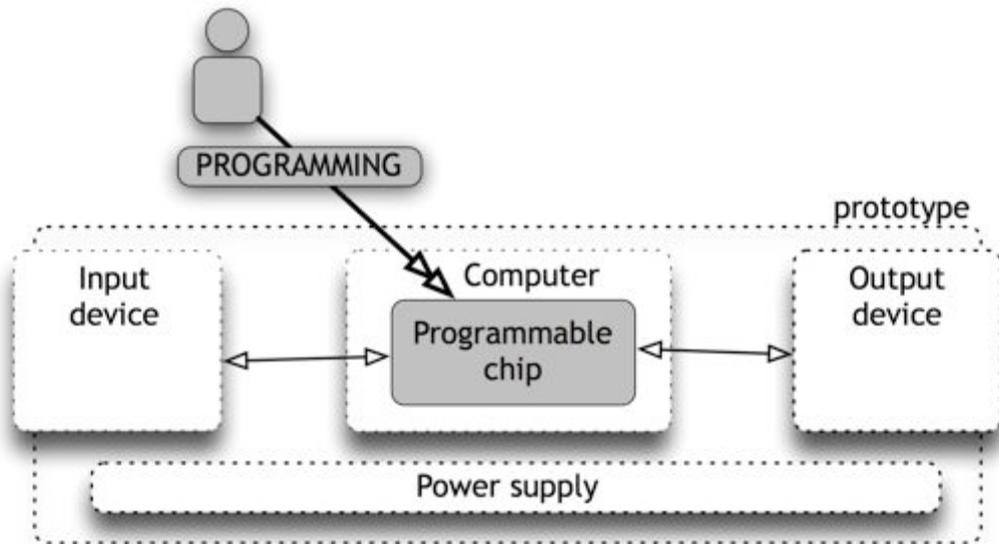
Choosing prototyping tools

As prototyping is only a part of the user centered design process, designers should not take too much time for the prototyping. Prototyping tools that are easy to control shorten the time of prototyping and gives more time for the user testing and the design process.

I researched both software and hardware prototyping tools before starting any of the projects. There are many different kinds of prototyping tools available, and it is very difficult to choose one. According to my experience, there are three important criteria in choosing and they are: portability, easy to control, and the amount of resources required.

Important criteria to choose a tool

- Portability

- Easy to control

- The amount of resources

Fortunately computer technology has been dramatically improved and many techniques have become controllable with software so that there are many

ready-made devices available. I mapped the prototype tools comparing with portable and easy tools in the following figure.

"Prototyping tools available for designers" by Michihito Mizutani
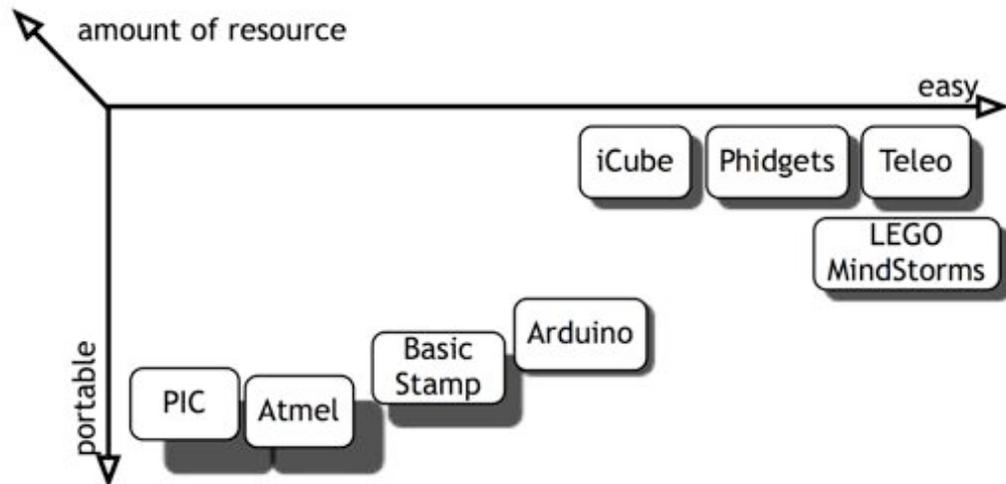
Portability

Portability means that the product can be small and wireless. Many products have become portable and wearable, so prototypes also need to be portable and wearable to keep their high fidelity.

Easy to control

If the prototyping tools are comparatively easy for designers to use, it will reduce a lot of time to develop the prototype, but tools, that are easy to control, are often not portable. For example, the iCube, Phidgets and Teleo have to be connected to a computer while being operated.

The amount of the resources

The amount of the resources also affects the process of prototyping. For example, if there are lots of resources available, the designer needs only to assemble the components according to instructions and can make their prototype quickly. Using ready-made hardware components and ready-made software code will also ease the work of the designer.

Difficulties in prototyping

Even though many prototyping tools became easy for designer to use, basic engineering knowledge is still required. If the designer lacks knowledge, it takes him/her more time to develop prototypes. A user-centered design process has become popular among product developers but the time for actual prototyping is often estimated very short. I have been looking for a way to shorten the time for prototyping but also to keep the same results in my prototype process. To manage prototyping in a short time, I have found five important things that I always keep in my mind:

- Understanding the concept
- Researching technologies
- Patience while prototyping
- Documentation of the results
- Organizing the prototyping process

Understanding the concept

Before starting anything to do with technology and development of a product, the designer should fully understand the concept behind the product. When we start to look for implementation technologies, we find lots of possibilities. It is easy for us to get lost in the forest of technology. It is often hard to decide which technology is the best to use. Especially new technology might look very fascinating, however mature technology is more reliable and easy to prototype. Understanding the concept guides us to find the right use and type of technology for each project.

Researching technologies

Only one choice of technology for a product is not always the only possible solution. There are usually many solutions. Through researching the given technology, we will find different properties for each technology even if they give similar results. These individual properties helps us to decide

which type of technology can be applied to the prototype, taking into account; the concept, implementation, function, cost, usability and so on.

Patience while prototyping

Electronics is invisible, so if a problem happens we cannot feel or see what is wrong. First I look for what causes the problem. Elimination is the most reliable and simple way to find the cause. The cause might take a few days to find, or only a few seconds. Patience is the best virtue for a designer. After finding the cause, I take a break to refresh my mind and think differently, in order to find another solution.

Documentation of the results

Once again electronics is invisible, so we cannot put any mark or note on it. It is very important that every solution is documented well. The documentation will be there for you to look back at later, when problems happen again. A schematic documentation using short notes is very helpful.

Organizing the prototyping process

As said, most of the time while we are prototyping, we are solving problems. So a good way to shorten the time is to avoid problems. Electronics is invisible, but you can change the colors of the electric wires, for example if it is for power supply or for signals. We can also work with each component separately first and make sure all of them are working and put them together in the end.

CONCLUSION

All examples tools brought different insights in terms of Emotional Communication. Each tool is strongly connected to the use of the traditional product and the situation where users use them.
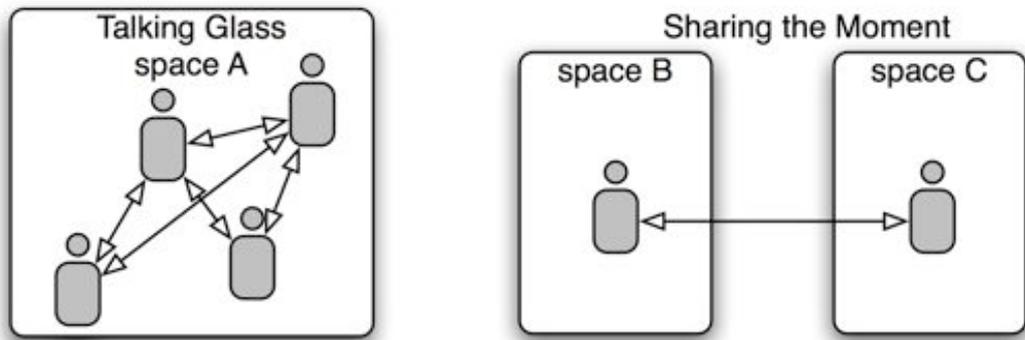
As many users use the Talking Glass especially in a party, it enhances communication with other people. On the other hand, the Sharing the Moment is used in private spaces at a long distance. These two different insights of communication flows bring new challenges to the Emotional Communication tools.
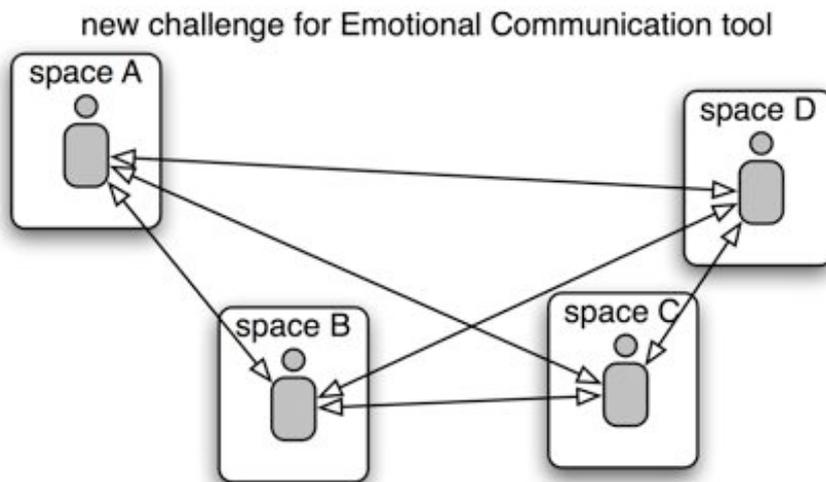
The challenge is to find a tool that evokes the connectedness between friends in different locations. This challenge also brings other challenges in multi-user content design. Personal relationships between friends are not as strong as family or lovers. The new tool has to be carefully designed not to disturb their privacy too much. The new tool should help users share their privacy in a comfortable way. Designing a small game between friends can also be considered.

Although I have been involved in all processes until the users experience the prototypes, the prototyping process took most of my time. In the end, the results of the user experience were left to too little consideration, and I would like to improve the analysis of the tests more in the future, so that I could consider a few more iterative processes.

ACHNOWLEDGMENT

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