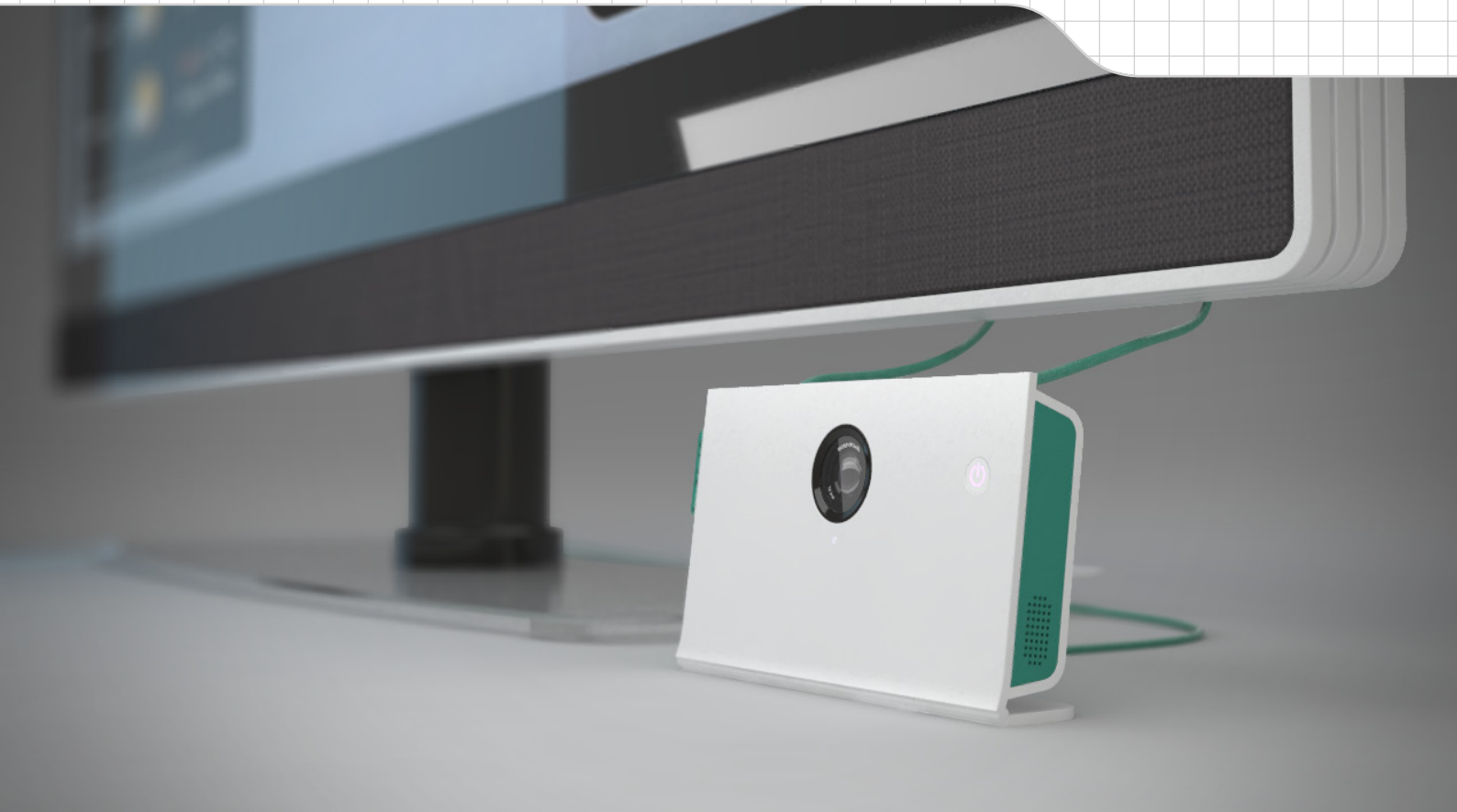# CHALMERS

LAVA A.I.
Design of an Interactive Online Device

MASTER THESIS IN THE INDUSTRIAL DESIGN ENGINEERING PROGRAM

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ABSTRACT

Swedish manufacturer of TV sets People of Lava is a small company with a history of creating innovative products. In 2010 the company introduced the world's first TV set equipped with Google's Android operating system. This TV set, called Scandinavia, enables a user to browse the Internet, send e-mails and use applications from the comfort of their living room.

People of Lava has identified a possibility to take the interactive functions of the Android system to a higher level in an entirely new product. By incorporating audio and video communication functions in an Android-powered standalone device, any modern TV set can become a central device in the communication users have with the world. The focus of this master thesis project has been to design the visual form and user interaction of such a product.

The project has included research on current trends in control and input methods to find a suitable form of interaction with the product. The attitudes and demands of potential users have been investigated. An extensive form study has been performed to find an aesthetically pleasing expression in the product. Furthermore, the People of Lava brand has been analysed to find a way to strengthen the brand identity through the use of a well defined form language.

The final result is the Lava A.I., a unique product in both appearance and functionality. It can be hung from a wall mounted TV set from its power cord, utilising a form element that is usually undesired as a prominent design feature. An Android circuit board and a digital video camera has been enclosed in a small device that features simple yet expressive aesthetics. The concept incorporates a remote control with both a trackpad and a full QWERTY keyboard for easy interaction reminiscent of a laptop. Thus, the concept fulfills user demands on fast, easy and familiar interaction. The function of the Lava A.I. can compete with products like smartphones, tablets, laptops and set-top boxes. It brings together Internet connectivity and video communication in a device designed to be enjoyed from the comfort of your living room.

Keywords: Product development, Design, Interaction, Aesthetics, Internet, Television, Visual Brand Identity

ACKNOWLEDGEMENTS

Contents

1. INTRODUCTION

This chapter describes the framework of the report, why the project has been carried out and what is hoped to be achieved.

1.1 BACKGROUND

People of Lava is a producer of exclusive TV sets and TV accessories. The company is located in Sweden with its head office in Stora Höga. People of Lava strives to be unique by focusing on quality and innovation. The company delivers hand built products with state of the art performance for a high-end niche market where design and product experience are high priorities. The Scandinavian heritage is evident in both the design and naming of their products. In the spring of 2010 People of Lava presented a new TV, named Scandinavia, that incorporates a version of Google's operating system Android. The use of Android allows users to surf the web and download applications to their TV. This implementation brings new types of interaction and possibilities to everyday TV use.

1.2 PURPOSE

People of Lava operates in a niche market, thus needing to continuously create buzz around it products and brand to stay competitive. Cutting edge products are a key factor in this strategy. People of Lava have found a new business possibility with a product that connects TV to mobile communication. This possibility requires a new type of product to be designed, continuing on the path that was started with the Scandinavia TV set. As the product will be highly visible it requires well thought through interaction and design.

The purpose of this project is therefore to design a product that will create new types of interaction and communication possibilities using TVs. The purpse is also to design the product so that it fits well together with the People of Lava brand and products.

The project will be carried out in collaboration People of Lava with mentoring from Zenit design consultancy and tutors from Chalmers University of Technology.

1.3 AIM

The main aim of the project is to design an interactive online device that allows communication between different users and between users and devices via a TV set. The device should use People of Lava's technique of implementing mobile technology in everyday TV interaction. Another big priority is to design a product that communicates its use and functionality in an easily comprehensible way. The product is intended to be used with TV sets, not only from People of Lava but also from competing manufacturers. Therefore, adaptability, integration and brand recognition are highly prioritised in the project. The nature of the product means that user interaction and overall functionality will have a large part in the design of the product.

The aim is also to answer the following questions:

- How can the interaction be designed to make the user feel more emotionally connected to the product itself and the People of Lava brand?

- How should the product be designed to allow seamless integration with the entertainment systems of a modern home?

- What are People of Lava's brand values and how can they be reflected in a new product design?

- Will this product allow new types of social behaviours to be formed and in that case how can it do this?

1.4 DELIMITATIONS

This project will focus on developing the form aesthetics of the casing and the user interaction of an online device. The design of possible control devices are of secondary importance. Design and development of software and graphical user interfaces are not included in the scope of the project. Cost will be considered in the choice of materials and manufacturing processes but no economical calculations or estimations will be included in the scope of the project.

1.5 REPORT STRUCTURE

This thesis project of creating an interactive online device has been focused on two main areas. The first is the development of form and expression connected to the People of Lava brand. The second is the development of interactive functions involving web browsing, applications and audio/video communication in relation to a TV set. These two areas require knowledge about the habits and demands of the intended target group and the possibilities and limitations of the applicable technology. Finally, knowledge about visual aesthetics, branding, ergonomics and form semantics finish off the scope of the project. As far as possible, the report presents the working process in chronological order.

2. PEOPLE OF LAVA

This chapter consists of a description of the history of People of Lava and their products. It contains descriptions of competing brands and potential rivaling products to the concept developed in the project. A brief description of the intended final product is also given.

2.1 INTRODUCTION

People of Lava is a company manufacturing and marketing premium TV sets and accessories for the TV market. The company was founded in 2001, by Christian and Lars Svantesson and has since then been creating TV sets and TV accessories with a clear focus on design and quality (People of Lava, 2011a). Today, People of Lava has around 20 employees in Sweden but also have several sales offices around the world.

People of Lava has since the beginning tried to combine quality components from different suppliers with design to create TV sets and accessories for a premium market. The design has been a strong selling point for People of Lava and they have marketed the products to hotels and boutiques across Scandinavia.

People of Lava also has a habit of creating products that are a world's first and was the first company to release a motorised mount enabling the users to move, slide and tilt their TVs with the push of a button. The company are now the world leaders within this segment of TV accessories. People of Lava was also the first in the world to introduce TV sets with exchangeable colour frames and in 2010 they showed their Scandinavia TV set with a built in Android system.

The Scandinavia TV set allows users to surf the web and download applications, making the tv experience more interactive. With the release of the Scandinavia, People of Lava started to refer to the TV as a "Window to the World", implying that it is so much more than just a TV set (People of Lava, 2011a). In the People of Lava product catalogue the Window to the World is explained as follows: "We envision a seamlessly connected world where people socialise and interact beyond physical boundaries. A world where we see, show and share. We are People of Lava, a Window to the World." (People of Lava, 2011b). In this report the Android system will be called the 'Window to the World' software.

2.2 PEOPLE OF LAVA PRODUCTS

People of Lava currently sell four different TV sets: Royal Sweden, Scandinavia, Granite and Flex. Royal Sweden is People of Lava's most exclusive TV set, with a brushed aluminium frame and thin LED backlit screen. Granite is People of Lava's mid sized TV set ranging from 19 to 32 inch in size. The Flex TV sets are smaller than the other TVs and allow the user to exchange the frame for other colours. Scandinavia is People of Lava's interactive television set. The different products are shown in figures 2.1-2.4.

People of Lava also produce several different mounts, stands and lifts that enable mounting in several different ways. People of Lava was the first to company to introduce motor controlled mounts to the market.

Figure 2.1 The Scandinavia TV

Figure 2.2 The Roytal Sweden TV

Figure 2.3 The Granite TV

Figure 2.4 The Flex TV

2.3 ANDROID IN PEOPLE OF LAVA'S PRODUCTS

People of Lava's Scandinavia TV set incorporates an Android software to allow the user to surf the web and download applications, see figure 2.5. With the built in web browser and applications such as Youtube, mail and Facebook users can access information all around the web. Users can also download other applications through the use of People of Lava's application market.

The Android system is controlled by a remote control with a keyboard. As most other Android applications are made for smartphones and tablets, applications must be re-coded to fit the interaction with the Scandinvia TV set. To cope with this, People of Lava has created their own market for applications, where applications are made to work with the TV set.

In the Scandinivia, the Android system is separated from the TV system. This results in that a user can only use one system at a time. The switch between the modes, TV and Android, can be done through the push of a button on the remote. When starting the Window to the World mode, users are greeted with a home screen displaying widgets, like a weather and a clock widget, see figure 2.6. In the software the user can check their e-mail, browse the web and download and use applications.

As each Scandinavia has a unique MAC adress, an identifier on the network circuit board, the system can be updated with the latest software update. The mac adress allows updates to be configured to fit specific languages and devices.

2.3.1 Web browsing

Web browsing is one of the main features of the software, allowing the users to access most of the web pages available online. Some web pages, containing Adobe Flash and Microsoft Silverlight plug-ins, cannot be viewed on the device. In future software updates this functionality can be added to allow for more functionality.

The user can navigate around a web page by pressing the different arrow buttons on the remote, and can also increase the text and image size by pressing the zoom buttons, seen in figure 2.7. As the user normally views the pages from a distance, the zoom buttons allows the user to more easily read long texts in a bigger size. To press links and images the user must skip through each of the links on the visible page to get to the one he or she wants to continue to. In larger pages, with a lot of links, the user must press the arrow keys many times to reach the desired link.

To get more functionality the user can press the menu button. When doing this a menu pops up allowing the user to enter web URLs or use bookmarks. The menu is visable in the bottom of the TV in figure 2.5.

2.3.2 Applications

Youtube, Facebook and email applications are included in the system by default, allowing the user to easily access these from the home screen. Several other applications can also be downloaded from People of Lava's Android market. All of the applications available have been created to function with the Window to the World software and Scandinavia remote.

In the future, applications for viewing online content from television networks can be made available. With this functionality users can be able to browse content from for example SVT Play, TV4 Play and services from several other television networks. To do this, each network would have to create applications that fit and function with the Window to the World.

Figure 2.7 - The Scandinavia remote

Figure 2.5 The Scandinavia web browser

Figure 2.6 The Scandinavia with Window to the World software

2.4 COMPETITION

To get a better understanding of the products currently on the market a small analysis was made on the products and companies competing with People of Lava.

2.4.1 Bang & Olufsen
Bang & Olufsen is a Danish manufacturer of exclusive hi-fi equipment. The company focuses on distinctive aesthetics and high quality customer experiences, see figure 2.8. Bang & Olufsen's vision is to have the courage to constantly question the ordinary in search of surprising, long lasting experiences (Bang & Olufsen, 2011).

People of Lava is a close competitor to Bang & Olufsen on the premium TV market. Bang & Olufsen's TV sets do not have any web functionality, instead the company focuses on high quality video and audio paired with slim designs, see figure 2.8.

2.4.2 Loewe

Loewe is a close competitor to People of Lava. Both companies state innovation and design as core values. Loewe strives to have a clearly identifiable brand recognition, vision and experience, relying heavily on its long heritage and knowledge within the home entertainment market. Customers should experience the premiumness of the Loewe brand whenever they come into contact with it (Loewe, 2011a). The distinct Loewe design cues are apparent in all product categories, thus creating a unified look when displayed together, either in a shop or at home, see figure 2.9.

The Connect range provides the user with Internet access through the TV set via a software feature called MediaNet (Loewe, 2011b). It allows the user to connect to several Internet based applications and also surf the web freely using an Opera browser (Loewe, 2011b).

2.4.3 Samsung

Samsung is at the forefront of developing and adopting new technology and is in that aspect a competitor to People of Lava. Samsung rarely mention aesthetics as a unique selling point. This is one of the factors where Samsung differs from premium manufacturers like People of Lava.

High specification TV sets from Samsung incorporate 3D-viewing, Internet, and wireless connectivity all in one device. Internet@TV is the name of Samsung's Internet function. It is a collection of widgets for displaying Internet-based content like video, news, weather and social networks. The widgets can be displayed at the same time as you are watching TV (Samsung, 2011).

The remote control of the 9-series TVs can show a different channel on its 3 inch display than the one you are watching on the TV set, see figure 2.10. It is also a multi-device remote that can control other audio and video devices. A computer can be wirelessly connected to a network via Samsung's feature Allshare (DLNA) and a user can browse the media content of that computer on the remote.

Figure 2.8 Bang & Olufsen Beosound 5

Figure 2.9 Leowe TV with Napster app

Figure 2.10 Samsung remote with tv functionality

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2.4.4 Google TV

In may 2010 Google announced a new TV platform developed together with Intel, Sony and Logitech based on the Android operating system (The Official Google Blog, 2010). The main function of the Google TV platform is to allow users to access web content on their TV sets and bring more interactivity to the everyday TV use (The Official Google Blog, 2010). This function makes Google TV a competitor to People of Lava's Scandinavia TV sets.

Searching for a TV show in the Google TV web browser will provide results from both web based content and also the time it is going to be aired on a specific network (Google, 2011). The service allows users to watch TV while browsing the web at the same time (The Official Google Blog, 2010). All Google TV platforms support remote controlling of the interface with Android and iPhone mobile phones (Google, 2011).

Google does not market Google TV themselves but provide it through manufacturers of TV sets. In 2011 only a few manufacturers sell TV sets, Blu-ray players and companion boxes with the Google TV platform, one of them is Sony, see figure 2.11 The remote controls provided with the Sony TV sets have a small QWERTY keyboard for text input and a keypad for a mouse like control (Ny Teknik, 2010). The TV allows downloading of applications to easier access social networks and movies. Sony also sell a Blu-ray player with Google TV, allowing users to connect it to any TV set (Ny Teknik, 2010).

Logitech has released a box type solution containing Google TV called the Logitech Revue. It is controlled by a keyboard and a trackpad and has accessories like a camera for the TV set. The Logitech TV cam thus provides high-definition video calling for TVs (Logitech, 2011).

2.4.5 Boxee

Boxee is a software platform which allows access to locally stored media and web content from a single interface (Boxee, 2011a). People of Lava competes with Boxee on the possibility of having web applications on TV sets. The Boxee software is aimed at different Home Theater PC (HTPC) systems focusing on TV and movie viewing. The system also has social network features connecting it to Facebook and Twitter (Boxee, 2011b). The software platform can also be distributed to many different devices such as Macs, PC's and devices designed specifically for the Boxee platform (Boxee, 2011c). The Boxee does not allow web browsing but allows for downloading of movies and shows through bittorrent and Boxee applications.

The first system delivered with the Boxee platform pre-installed was the Boxee box by D-link (Boxee, 2011a). This device is a HTPC with the Linux operating system running the Boxee software platform (Boxee, 2011a). A remote with a QWERTY keyboard in the back is delivered with the device (Boxee, 2011a).

2.4.6 Peel

Peel is a product that turns an iPhone, iPad or iPod Touch into a remote. It was introduced in late 2010 and consists of an app, a cable for Wi-Fi access and an infrared (IR) transmitter dubbed 'The Fruit', see figure 2.12. The app is free to download from Apple's App Store and the the Fruit and cable are sold in Apple Stores (Peel, 2011a).

The app contains an interface displaying TV content as a graphic programme guide. Content is shown as a mosaic of thumbnail images and categorised by type and genre (Peel, 2011b). Programmes are started by clicking a thumbnail image on the screen of the Apple device used. The app gradually learns the user's preferences in programming and streamlines the content shown in the interface to fit those preferences (Peel, 2011b).

The so called Fruit can control several common home entertainment devices like TVs, cable or satellite boxes, Blu-ray players, AV receivers and Apple TV (Peel, 2011c). Nothing needs to be plugged into the iPhone and the Fruit can be placed almost anywhere in the room (Peel, 2011c). A cable needs to be plugged into a wireless router to access the Wi-Fi network (Peel, 2011c, d).

Figure 2.11 Sony TV with Google TV

Figure 2.12 The Peel fruit and Iphone remote

2.5 DESCRIPTION OF NEW PRODUCT

The product to be designed is meant to use the Window to the World interface together with new communicative functions like a camera. The product should function together with any television set, from any manufacturer, to add a level of interactivity to everyday TV use.

The communicative function is meant to create a new way of socialing with a users friends and family, bringing them together even if they are far away from each other. In reality this means using video and audio communication, and finding a way to make it comfortable and seamless for different users.

Incorporating the Window to the World software in the device is done by using an Android circuit board, see figures 2.13 and 2.14. The existing circuit board is aproxamately 100 mm by 65 mm and 15 mm thick and has one ethernet port, one HDMI output cable, a power cord and one USB port.
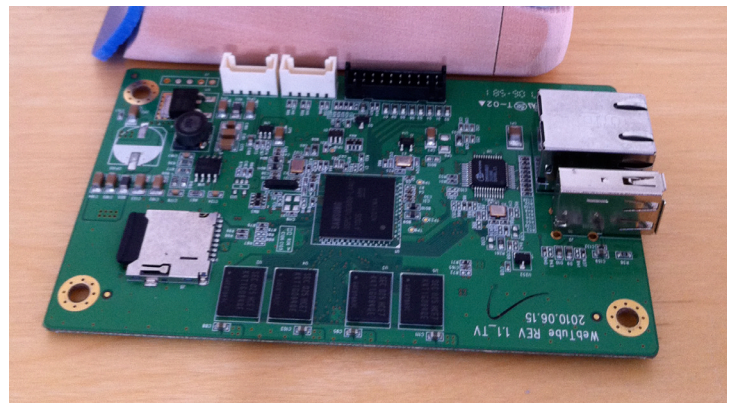

Figure 2.13 The Android circuit board

Figure 2.14 The Window to the World home screen

3. KNOWLEDGE BASE

This chapter contains factual information gathered prior to the creative development phase of the project. The contents focuses on theories on visual aesthetics, ergonomics, applicable technology, input methods and trends.

3.1 FORM AND FUNCTIONALITY

This part contains theory related to the aesthetics, innovation and ergonomics needed for the development of the new product.

3.1.1 Visual Brand Identity

In a world where millions of brands are competing for the attention of the customers, being recognised and remembered becomes very important. Recognising a brand and its products can make the difference between a customer buying a product or just looking at it in a store. If a customer has used a product from the brand before, and liked it, the positive feeling of that product can be transferred to other products from the same brand. Therefore, it is important to know how customers perceive a specific brand and to consider this in the design of new products.

Brand recognition can be achieved in many ways: by graphic coherence, logotypes and architecture to give a few examples. Product design also has a large part in customer recognition of a brand and its products (Karjalainen and Snelders 2009).

There are many ways a product can express brand identity through product design. It can be form features that are used often, product lines that are similar in several products and the use of specific materials. Using specific features consistently throughout a product portfolio can both help customers to recognise the brand and to differentiate the brand from the competition (Karjalainen, 2007). According to Karjalainen (2007) there are two aspects to take into consideration when regarding customer brand recognition in relation to design: attractiveness and meaning creation.

Product attractiveness is of importance both in selling the products and in strengthening a brand. Furthermore, products can be designed to express positive meaning to the customers in relation to the brand (Karjalainen, 2007). In the design of products it is possible to create meaning through form elements. Closely connecting the meaning of the form to the brand's core values makes it possible to create a strong

Figure 3.1 The Volvo catwalk expressing safety

recogniton factor in the products. An example of this is the catwalk in volvo cars, see figure 3.1 . The protruding shoulder on the sides of the car express that the car is safe and robust. This expression is quite subjective but is still strongly connected to Volvo cars' core value of safety.

Repetition of specific form features can also be used to help a customer recognise a brand, even if they are not closely related to the core values. Used consistently in a brand's products, these features would be recognised by customers but they are not as powerful as the features that also carry a meaning connected to the brand. Karjalainen (2007) differentiates these two types of features by calling the form containing meaning value-based design cues and the repeated features without meaning artifical design cues.

Design cues in a product can also be either explicit or implicit. Explicit design cues are instantly recognised by a customer as belonging to a specific brand, a unique form feature. Implicit design cues are not as obvious and refer to characteristics and impressions of the brand. Examples of implicit design cues could be Scandinavian or architectural for example. Explicit design cues can be both of a value based and an artificial nature while implicit cues must be value based in order to create a level of recognition (Karjalainen, 2007).

By using a combination of artficial and value based together with implicit and explicit design cues in a brand's product portfolio it is possible to increase the level of recognition and visual value of the brand (Karjalainen, 2007).

3.1.2 Differentiation

Market positioning is a way of finding where to place a product in relation to its competition. Most companies try to find a unique position where their products stand out from those of other companies, thus gaining a competitive advantage. One way of achieving this is to look at aspects that can help a company differentiate its products through unique properties.

Axelsson and Agndal (2005) list 9 possibilities to differentiate a product:

1. *Become the first*. By being the first company releasing a product or service it is possible to gain large advantages such as setting the standards in the category and becoming the synonym for the product.

2. *Be known for a specific property*. Having a unique or special property makes it possible for the product to stand out from the competition. The product can become known for this specific property, which in turn might make the brand synonymous with the property in the minds of customers.

3. *Be the market leader*. Being the leading brand gains trust from consumers.

4. *Use History*. A brand that can rely on a history of producing good products can make the consumers believe in the brand even more.

5. *Become the specialist*. If a brand focuses on one product it can be known as an expert and specialist in a specific field, making the consumers believe more in the company.

6. *Call on*. If a consumer lacks knowledge in a product field they often rely on others knowledge to make decisions when buying products. If experts speak well of a product, consumers will often follow.

7. *Use technology*. Unique features and new technologies makes it is possible to gain an advantage on the market.

8. *The latest*. By using technology and methods that are trendy and in the forefront of the market, it is possible to gain advantages by standing out compared to the competing products.

9. *Brag*. Consumers want to hear that the brand producing a product is doing well. It makes them trust the brand even more.

3.1.3 Novelty and Aesthetics in Design

In virtually every consumer market it is important to look at how to design products that appeal to the selected target group. Both novelty and aesthetics has been shown to be a large part in catching the attention of consumers and making them interested in a product. Hekkert (2006) lists four principles that make us experience products in a positive manner: Most advanced yet acceptable, unity in variety, maximum effect for minimum means and optimal match. Novelty and aesthetics of products are apparent in each one of these principles.

The term 'most advanced, yet acceptable', or MAYA, is directly connected to the novelty of products. There is always a conflict in whether a customer wants a product that is familiar or a product that is new and original. Customers often chose familiar products because it is the safe choice, they know how things function and work. At the same time customers want something new in a hope to overcome boredom (Hekkert, 2006). To overcome this conflict Hekkert (2006) discusses the principle of MAYA. The principle describes that a product should have the optimal combination of typicality and originality for a customer to prefer it over other similar products (Desmet, 2006; Creusen, 2001).

The importance of novelty in appearance of products can also be connected to the attention-drawing aspect of products that in the end can affect the point of sale and product choice by customers (Creusen, 2001). If a product stands out from other similar products in a store, a customer is more likely to notice it (Creusen, 2001; Schoormans, Snelders and Lagers-Dresselhuys, 2007). It has also been shown that a product's appearance is not only connected to the aesthetic part of the product but also to the perception of quality, price and ease of use (Creusen, 2001).

The gestalt laws have an important part of a product experience and are part of the second principle, unity in variety. Hekkert (2006) connects this to the fact that we have a perceptual tendency to group and to discover relations between objects, helping us create meaning. Grouping things together, seeing symmetry and continuity helps us understand products and can therefore be connected to the experience of products. Symmetry and continuity can be seen as aesthetically pleasing, but it can also be connected to experience of meaning.

Regarding 'optimal match', Hekkert (2006) discusses the importance of consistency in the aesthetic part of product experience. The visual expression, the audial experience and the tactile experience should all match for a user to perceive them as desirable.

The 'maximum effect for minimum means' principle says that we prefer things that take less effort over more demanding items. If we can hear, smell and see things faster and with less effort we appreciate them more (Hekkert, 2006). A product that expresses it's purpose, meaning or aesthetics in a clear way therefore has an advantage over other products.

3.1.4 Diffusion of Innovations

When innovations enter the consumer market the rate at which they are adopted by customers, which is called diffusion, varies greatly. In 1962 Everett M. Rogers defined a model for explaining how this phenomenon occurs called the 'Diffusion of Innovation' (Proven Models, 2011). The model is based on the theory that people adopt innovations at different times of the product's life cycle and at different rates (Proven Models, 2011). The diffusion of innovations model suggests that the rate of adoption follows an S-shaped curve over time, starting with a slow change followed by rapid change and ending with slow change as the product matures or as new technologies emerge (Proven Models, 2011). The S-curve corresponds well to the rate of adoption during a product's life cycle. The number of 'new' adopters at any given time in the product life cycle follows a bell-shaped Gaussian curve. This curve indicates a low number of new adopters at the start and the end of the product life cycle, and a large mass of adopters at about halfway of the S-curve, see figure 2 (Proven Models, 2011).

The model divides adopters into five categories according to their willingness and ability to adopt innovations. Proven Models (2011) provides the following definition of the five categories:
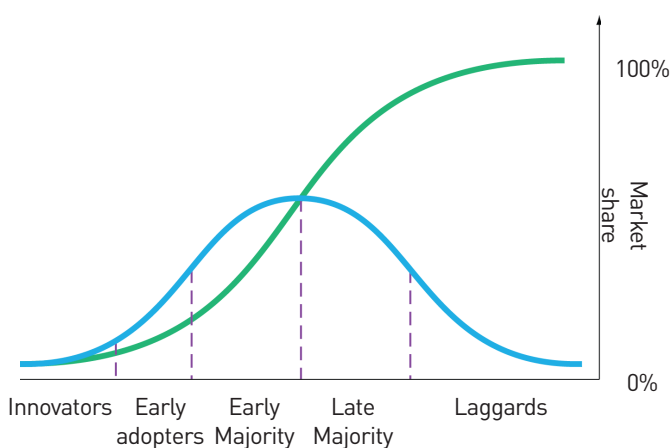

Figure 3.2 The Diffusion curve

Innovators are exploring and educated, they have multiple sources of information and are more willing to take risks. They are motivated by being the person who initiates changes within a social group. Innovators can tolerate initial problems that might occur in new products and are willing to propose solutions to them.

Early adopters are social leaders, popular and educated. They are willing to adopt new technology to achieve competitive advantages and price is not a big issue because they believe in great gains from this adoption. Early adopters take high risks but demand personalised solutions and highly qualified support.

Early majority adopters are deliberate and have many informal contacts. They look for evolutionary changes rather than revolutionary products. This is a large category of adopters due to the fact that they tend to wait for others willing to make the same change. They look for producers and vendors that are popular and they want the change to be as fast and free of problems as possible.

Late majority adopters are skeptical, traditional and of lower sociological and economical status than previous categories. They are very price sensitive and demand products to be fully developed and free of problems. Late majority adopters are only motivated to change as not to fall behind their peers and often rely on only one trusted advisor to help them make the right choice.

Laggards are skeptical to change, do not believe that innovations will make their lives better and are therefore likely to resist adopting innovations.

It is important to remember that these categories are a way of facilitating the explanation of a certain phenomenon and not generally applicable in user or customer categorisations.

3.1.6 Multimodality and Sensory Processes

The way humans perceive the world is largely decided by the information that is received by the five major senses: vision, audition, touch, taste and smell (Robinson-Riegler, G. and Robinson-Riegler, B., 2003). When several senses process information at the same time the process is called multimodality. Each sense has its own strengths and weaknesses but during multimodality the weaknesses can often be compensated for by other senses (Bohgard et al., 2009).

The process of perception can be divided in two different sub-processes depending on how the stimulus is perceived, either bottom-up precessing or top-down-processing. Bottom-up processing occurs when no other information than that of the stimulus itself is needed to form a perception (Bohgard et al., 2009). The opposite, top-down processing, occurs when context, expectations and previous knowledge is used to determine what is being sensed and thereby perceived (Bohgard et al., 2009). According to Bohgard et al. (2009) top-down processing is an active and highly conscious process, becoming less and less conscious as the task is familiarised, while a bottom-up process is always automatic and unconscious.

Factors like ageing and colour blindness can impair the ability to sense visual stimuli. This means that persons affected by factors like these have to rely on top-down processing in many situations (Bohgard et al., 2009). An example is that people who cannot distinguish between red and green have to rely on their knowledge that the green light is at the bottom and the red at the top when interpreting traffic lights.

Audible stimuli are interpreted using a combination of both top-down and bottom-up processing. Individual words and warnings are single stimuli that often do not require consideration of the context to be interpreted correctly. In such situations less attention is needed for interpreting sounds, something that can be very useful in multimodal situations. However, a person with impaired hearing has to use top-down processing to understand speech by consciously trying to fill in the missing words based on the context (Bohgard et al., 2009).

Processing sensory information that is induced by touch and the position of the hand is called haptics. It can be recognising edges, curvature and textures or the sensation of weight. Haptics can be helpful in situations where other senses are not sufficient in interpreting a stimulus. When experiencing a product for the first time haptics is often used to assess its features and properties, in other words top-down processing. If primary senses like vision and audition are used to their ultimate capacity, haptics can be used to give additional cues in an interface or a product. Haptics has a big advantage in that a stimulus can be transferred to the body by several means like vibration, friction, weight, temperature, size and rotation for example (Bohgard et al., 2009). Another advantage haptics has is that it can be used when environmental factors like darkness or loud noise limit other senses (Bohgard et al., 2009).

3.1.7 Mental Models

A mental model is a representation that an individual has created to mentally picture itself, others and the things that it interacts with (Liu, 2009). When presented with a task a person unconsciously tries to apply a mental model, based on previous knowledge and experience, to the task to assess how it should be performed (Liu, 2009). One mental model represents one possible solution to the task. According to Liu (2009), too many applicable mental models or the choice of a highly complex mental model will affect the performance of the task negatively. Mental models can be formed on either a deeper understanding of how a system works, mechanically or structurally for example, or at a functional level with a knowledge of the necessary steps needed to perform a task (Liu, 2009).

It is important for a designer to be aware of the intended user's mental model of a product or service. A designer who has this knowledge can design a system that corresponds to the user's expectations of the interaction with the system. This will improve the usability and user experience. For example, if users of a certain system do not have any knowledge about the internal mechanics of the system, and do not need it, the designer can hide these parts to avoid confusion and focus on making a highly functional user interface.

3.1.8 Gestalt Laws

Industrial designer and author Rune Monö (1997, p.33) describes the word gestalt as 'an arrangement of parts which appears and functions as a whole that is more than the sum of its parts'. What this means is that the way an object is perceived by an observer is dependent on the colour, orientation and materials of its parts (Monö, 1997). If one of these things should change, for example colour, the object will most likely appear different to the observer.

There are several factors that lets the observer interpret visual impressions as gestalts. Monö (1997, p.35) states that the most frequently used factors are: proximity, similarity, area, symmetry, enclosedness, 'the good curve', common movement and experience. The following is a description of these eight factors by Monö (1997): see figures 3.3-3.5

The proximity factor: Form entities that are grouped closely together will appear as gestalts. The closer the forms are, the clearer the gestalt is.

The similarity factor: Objects with similar properties in a group of several different objects will appear as gestalts to the observer.

The area factor: A form within an enclosed area will appear more clearly as a gestalt the smaller the enclosed area is. For example, this is why the Swedish flag is seen as a yellow cross on a blue background and not as four blue rectangles on a yellow background.

The symmetry factor: Form entities that appear to be mirrored from a centre line are symmetrical and will be seen as a gestalt by the observer.

The inclusion factor: Gestalts can be created by simple lines that enclose an area. For example, four lines that connect in four corners will appear as a square.

The good curve: Separate objects that are oriented in a curve will stand out as gestalt in a group of otherwise seemingly unoriented objects.

The common movement: Different elements that are moving in the same direction will appear as gestalts to an observer. An example is that the movement of cars in two directions on a multi-lane freeway will appear as two gestalts.
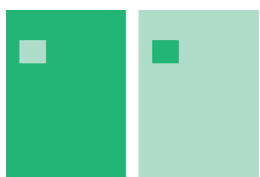
The experience factor: Some gestalts can only be perceived correctly if we recognise them from experience. An example is a technical drawing of a machine. The forms on the drawing can only be correctly interpreted by an observer who recognises them as that specific machine.

3.1.9 Semantic Functions

In industrial design it is crucial to know and understand how different sensory impressions are understood by a user of an object. One important theory that facilitates this process is called semantics, which Monö (1997, p.167) describes as 'the study of the messages of signs'. Here, signs are sensory impressions, such as products, images or sounds, that we interpret as having been made for a specific purpose (Monö, 1997). It can be understood that somebody has had an intention even if we do not know that it was (Monö, 1997).

A product sign can be said to have functions that inform an observer or user what it is, how it works and how it will feel to use it. Monö (1997) defines four semantic functions that applies to the product sign:

To describe the purpose of an object and how it should be operated

To express properties of an object through form

To exhort reactions by sensory impressions like form, sound and scent

To identify a product and who made it, what model it is, where it is from, what category it belongs to and so on. This can be done with the use of logotypes, emblems, text, typography, colour and patterns.

Similarity

Common movement

Proximity

Symmetry

Area - the smaller area is seen more clearly irrespective of the of the colour of the surrounding area
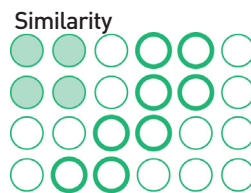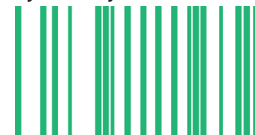
Inclusion - the vertical lines in the two rows are identical the horizontal lines are placed differently and create gestalts

Experience - the figure to the left could be a stylised drawing of a workshop machine but to the right experience tells us that this is the letter 'r' against a coloured background

Good curve - some of the seemingly unorganised lines in the picture are follow a continous curve, creating a gestalt

Figures 3.3 - 3.10 Gestalt laws

3.2 TECHNOLOGY

This part contains short explanations of the basic technology and terminology needed to understand the contents of the report.

3.2.1 Terminology

Ethernet
Ethernet is a term for the technology of transferring data between computers connected to networks via cable (Cisco, 2011). Ethernet is the dominating technology for fast data transfer in the world (Cisco, 2011).

Wi-Fi
Wi-Fi is essentially wireless communication between devices such as computers, mobile phones and printers. Wireless communication between multiple devices, a so called Wi-Fi network, requires an access point to be set up. Using radio waves the access point transmits data between the devices connected to it or between an ethernet connection and a device (Wi-Fi Alliance, 2011).

High-Definition Multimedia Interface (HDMI)
High-Definition Multimedia Interface (HDMI) is a standard for sending uncompressed all-digital audio and video data between any audio/video device (HDMI, 2011). It has a standardised interface that transmits data via a single cable between devices such as TV sets, monitors, computers, audio/video receivers, DVD players and set-top boxes (HDMI, 2011). The uncompressed digital data transmission allows sending high-definition video and multi-channel audio free of any loss in quality (HDMI, 2011).

Universal Serial Bus (USB)
A Universal Serial Bus (USB) is a standardised interface for transmitting data between computers and peripheral devices (USB, 2011). It is a cable transmission with a standardised plug that connects to a corresponding port (USB, 2011). The USB is widely used in computers to connect peripheral devices like printers, external hard drives, computer mice and keyboards.

Digital Living Network Alliance (DLNA)
The Digital Living Network Alliance (DLNA) is a union of companies that have agreed that their products will be better if they are compatible. More than 245 companies are affiliated to DLNA today, most of them producing consumer electronics, mobile and computer devices, components and software (DLNA, 2011). DLNA strives to achieve compatibility between products by using open standards and widely available industry specifications (DLNA, 2011).

Infrared Remote Control
An infrared remote control is the most common device used to control TV sets (HowStuffWorks, 2011). This handheld device has a Light Emitting Diode (LED) that transmits codes through infrared (IR) light to the TV set (HowStuffWorks, 2011). The TV set has a IR receiver that decodes the light signal from the remote and translates into a command in the TV set's microprocessor (HowStuffWorks, 2011). IR remotes require a direct line of sight and a maximum distance of 10 meters to be able to transfer a signal (HowStuffWorks, 2011).

Infrared Blaster
An infrared blaster is a device that emulates an IR remote control (Tech-FAQ, 2011). Normal remote controls that accompany consumer products like TV sets send codes that are compatible only with that specific device. An IR blaster can send IR signals to virtually any device with an IR receiver if configured with the right set of codes (Tech-FAQ, 2011). Thus, a device with an IR blaster connected to it can control several other devices (Tech-FAQ, 2011).

Google Android Operating System
In November 2007 Google showed a new mobile phone operating system competing with, Apple, Microsoft and Nokia in the smart phone market. The main driver behind realising the Android system was to make it simpler for both users and developers to create applications for mobiles. Developers would be able to easily create applications that use the different functions of the mobile phone (Techradar, 2008).

The Android system was first developed for mobile phones but soon spread to both tablets, e-readers and TV sets. One of the main features of the Android system is the downloadable applications, allowing the users to enhance the functionality of their devices, (Tablet world, 2011). The applications can mainly be downloaded from the Android market application store, currently housing over 200 000 applications.

Set-top box
A set-top box is a device that is connected to a TV set and an external source of audio and video signals. The set-top box decodes the incoming source signal and converts it into content that is displayed on the TV set.

Streaming media
Streaming media is multimedia that is constantly received and presented to an end-user from a streaming provider, meaning that the multimedia is readily available at the users convenience at any time.

3.2.2 Input methods

Several methods of input were found and evaluated prior to the design of the device. The aim was to find one or more input metho ds that fit the desired interaction with the device. The methods should be easy to use in a living room context and feel natural to the user, requiring little effort to use.

Touch Controls
During recent years there has been a great increase in the use of touch controlled interfaces on several different devices. Laptops commonly use touchpads or trackpads for controlling the cursor in the operating system. Smartphones and tablets most often use touchscreens.

Trackpads
As mentioned, touchpads or trackpads are used in laptops to control the cursor in the operating system, see figure 3.12. By sliding a finger over a designated surface the movement is replicated on the screen with a corresponding movement of the cursor. Pressing down hard, or lifting and tapping the finger, on the touchpad creates a selecting operation on the screen, a so called 'click'. A hard press of the finger results in a tactile and audial feedback given to the user, offering an easier comprehension that a click has been made (Mackenzie and Oniszczak, 1997).

Touchscreens
Touchscreens allow the user to control a graphical user interface by touching, with a finger or a stylus, directly on a screen, see figure 3.11. With a graphical interface designed for use with touchscreens it is possible to interact directly with the displayed items. This eliminates the need for an extra device to control a cursor, or even the use of a cursor. Touchscreens are commonly used in tablets, home appliances, mobile phones and tablet-PCs.

There are several different technologies used in trackpads and touchscreens but the most common are resistive and capacitive matrices. Resistive technology is when a top flexible layer touches a voltage gradient in a bottom layer to record x and y coordinates for control of the cursor. A capacitive matrix uses a patterned sensor placed under a touch surface. When a finger touches the surface a change in current is detected in the pattern resulting in a touch event (Touch Topics, 2009).
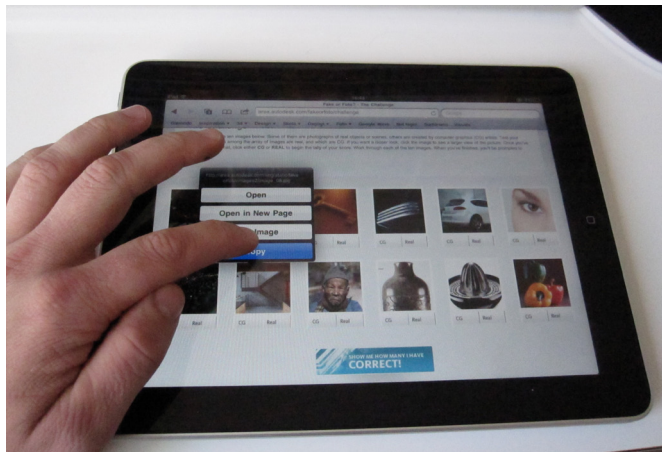
Multitouch and Gestures
With multitouch it is possible to detect several different touch events at the same time. By being able to differentiate separate touch events (or fingers) it is possible to allow for more natural interaction with for example touch screens (TED, 2006).

There are possibilities of creating applications that require no intermediate interfaces, like buttons or menus (TED, 2006). Instead, the user interacts directly with the content using movements created by sliding fingers over a touch surface. This type of interaction is quite common in smart phones. An example is the photos application in the Apple iPhone where a user can pinch his or her fingers on the screen to enlarge an image. By swiping the fingers over the surface a user can also flip between images.

These types of movements, pinching and swiping or similar, are called gestures. These gestures control different events that happen onscreen. An example of this is the two finger scroll on web pages. Swiping to fingers down on a trackpad causes the web page to scroll down, enabling the user to access more information. This is a direct analogue of the physical world where a paper is moved upward as a text read from top to bottom.

Mouse and Keyboard
The use of a mouse and keyboard is the most common way to interact with a computer. There are also combined keyboard mouse sets specifically designed for use with TV sets in a living room environment. A problem with using a keyboard and mouse in a living room is that a mouse often require some kind of flat surface to work properly. Furthermore, using a mouse and keyboard on a low living room table might affect a users body posture negatively.

Eye Tracking and Eye Control
Onscreen objects can be controlled by tracking the movement of a user's eyes. A cursor or similar can be moved around the screen by looking at specific objects. Eye tracking and eye control works by capturing video of the user's eyes. The information about where the user is looking is then converted into data controlling corresponding onscreen cursor movements. To be accurate eye tracking requires the user to sit somewhat close to the screen, between 50 and 80 cm, where the interaction is carried out (TobiiEyetracking, 2011).

Figure 3.11 Ipad with touchscreen

Figure 3.12 - A laptop with trackpad

Eye tracking has been used in both psychology and usability experiments for a long time, but there are several other applications. One of these is helping paralyzed individuals to communicate by controlling a voice interface on a screen (Gazegroup, 2011). By looking at different keys on a virtual keyboard the user can write words that can be read out loud. Lately, eye tracking has become more common in consumer products. Swedish company Tobii showed the world's first laptop with built in eye tracking and eye control at the 2011 CeBit exhibition (TobiiEyetracking, 2011).

Voice Control
Speech recognition has been available in computers and cellphones for many years. By speaking into a microphone and using a speech recognition software a user can tell a computer commands. This way of input requires the user to learn the desired commands.

Mind Control
Neuroengineering company Emotive has developed a device that can convert a person's thoughts to computer commands. This is a very new technology which requires the user to learn to think all the commands beforehand. By placing a device, similar to a head band, on the user's head it is possible to measure electric changes connected to the users mind, see figure 3.13. The electric changes are then converted to signals that control computer commands (ForaTv, 2008). When a user then thinks the same command the computer performs it. (ForaTV, 2008).

Motion control
A possible way for a user to interact with an interface on a TV could be by recording physical gestures and connecting these to commands. This has been done in the gaming industry for some time with the Nintedo Wii, Playstation Move and the Microsoft Kinect. There are different techniques to capture the user's movements. The Wii uses gyros and infrared light to capture movements and the Playstation Move works in a similar way. The Xbox Kinect works by capturing video and depth information of the user's movementes and then converts the movement into virtual positions, see figure 3.14. These positions are given joints and by connecting specific movements to commands the user can control an onscreen interface.

Natural and Multimodal User Interfaces
The term Natural User Interfaces (NUI) refers to interfaces that are invisible, or become invisible, to a user when it interacts with a system (Nuigroup, 2011). A natural user interface relies on the fact that the user by carrying out natural motions or movements can discover how to control a system or manipulate the content of a system (Nuigroup, 2009). Natural user interfaces often focus on basic human movements and motions as an input method to a graphical user interface. Touch, body gestures, vision and speech are typically used as input methods in the user interfaces. Another aspect of natural user interfaces is that users have an increased possibility of quickly advancing from being novices to experts at controlling the system (Nuigroup, 2009).

In likeness to natural user interfaces there are multimodal interfaces. An interface is multimodal when several different input modalities are combined. An example of this is can be to combine speech recognition with touch as input methods in an interface (Raisamo, 1999). By combining different input methods the user's level of freedom within the interface is increased. An increased level of freedom in a system is often followed by an increase in productivity and can facilitate the user's understanding of an interface (Raisamo, 1999).

Raisamo (1999) describes that by using multimodal interaction within a system it is possible to make the interface both more natural and effective to the user. There are many examples where use of multimodal input results in a natural user interface. Microsoft Kinect, Nintendo Wii and several touch tablets are good examples of multimodal and natural interfaces, see figure 3.11.
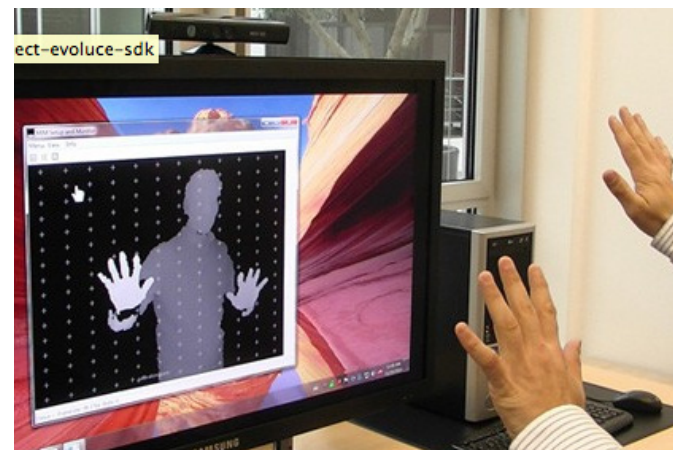

Figure 3.13 Mindcontroll functions through the use of a headband recognising electrical signals

Figure 3.14 The Xbox kinect regestring movements

3.2.3 Guidelines for Video Communication on TV

Skype is a company that develops a text, voice and video communication application with the same name for computers, TV, smartphones and tablets. The application is free to use to on the mentioned devices and for an additional small charge users can also make calls to landline phones (Skype, 2011a). In the fourth quarter of 2010 Skype had an average of 145 million connected users per month (Skype, 2011a).

TV sets with Internet connectivity are becoming increasingly common. Skype has adapted to this trend by making their application available to TV sets as well. A possibility with this type of application is to have a small picture of a TV show within the picture showing an incoming video call. Another possibility is for a user to have only audio communication with one or several people while for example watching sports. As text, voice and video communication on TV differs a lot from computers, Skype has developed design principles specific to the development of applications using Skype on TV sets or set-top boxes.

Design Principles
The following text reflects Skype's view on how applications using their technology should work. A focus is put on user environment aspects, and how audio and video calls should be managed.

The first thing stated by Skype (2011b) is that consumer electronics must be simple to be successful. When watching TV, users are accustomed to operating the TV set with a remote using only a few buttons, like those for changing channel and adjusting the volume (Skype, 2011b). According to Skype (2011b) these controls are optimised for touch interaction because of the fact that users usually watch TV in dimly lit environments and that their attention is directed towards the TV set, not the remote. It is also suggested that if the TV set does not have an easy way to input text, texting or chat functionality should be eliminated from the interface (Skype, 2011b).

An application like Skype should ideally be running in the background on the TV set processor while the user watches TV or surfs the Internet (Skype, 2011b). This will make receiving calls fast and easy. Skype (2011b) assumes that neither the caller or receiver will want to wait for the application to load and initialise when a call is made. Applications could even take this one step further and run in the background even when the TV set is in stand-by mode (Skype, 2011b). In this case, Skype (2011b) suggests that the TV set is automatically turned on when a call comes in to allow the receiver to answer. If the call is not answered the TV set goes back into stand-by mode within a reasonable amount of time.

Skype (2011b) states that users are concerned about being disturbed by incoming calls on the Skype application while watching TV. Therefore, users should always know whether they are using the Skype application or not and have the possibility to set their online status to Online, Away or Do Not Disturb according to their liking (Skype, 2011b). Notifications of incoming calls need to be unobtrusive or at least very subtle, as not to disturb the user while watching TV (Skype, 2011b). Of course, the user must be able to decline incoming calls, preferably without leaving the TV show that is being watched (Skype, 2011b). Furthermore, Skype (2011b) suggests that users should also be able to put calls on hold and mute calls.

Another important feature stated by Skype (2011b) is to provide feedback to the user who it is communicating with and what information that is being sent. Users want the possibility to hide what is shown in the background of a video call if for example the house is a mess (Skype, 2011b). In a video call use situation in a home, it is likely that more than one person will be in front of the TV and people might be coming in and out of the room. Skype (2011b) suggests that the application's audio and video settings should be adaptable to different amount of users. An important aspect of the audio experience mentioned by Skype (2011b) is to offer separate volume controls for the TV and the active call.

Microphone Placement Recommendations
Devices equipped with microphones to allow audio transmission during an audio or video call face several engineering challenges. The first is that the distance between the near-end talker (the person sending the audio) and the microphone in the device is usually greater than 150 cm (Skype, 2010a). The farther the near-end talker is from the microphone, the weaker the outgoing speech signal becomes. The room echoes caused by the near-end speaker and the TV set also increase proportionally to the distance to the TV set (Skype, 2010a). The echoes or reverberations due to the room can be cut to a minimum with acoustic echo cancellation (AEC) algorithms (Skype, 2010a). However, Skype (2010a) states that with greater distance the AEC has to cope with increasingly louder echoes which may exceed their maximum performance. Skype (2010a) concludes that the issues mentioned above will diminish as the distance between the near-end talker and the microphones decreases. Omni-directional microphones can be used for distances less than 150 cm but for greater distances only highly directional microphones will be sufficient (Skype, 2010a). Several directional microphones can be used to create a wider area for audio receiving (Skype, 2010a).

If the device enclosing the microphones is placed in close proximity to the TV speakers, either on top, below or to either side of the TV, the microphones will have to cope with strong playback signals (Skype, 2010a). Again, this effect can also be reduced by AEC, but there is a limit to its possible performance (Skype, 2010a). If the device is designed to be integrated with the TV's hardware components, like the speakers, its software can be designed to limit the volume from the TV speakers to stay below the critical level of the AEC (Skype, 2010a). However, Skype (2010a) claims that if the device is not designed to be integrated with the TV's hardware components it is not possible to predict and thus design for the playback signals from the TV speakers. Another difficulty arises if a user has connected the TV to external speakers. According to Skype (2010a) these are likely to produce a higher playback signal than the TV resulting in insufficient acoustic echo cancellation.

The issues described above have led Skype to require clear and detailed instructions on how and where to place audio and video devices for Skype in relation to the TV (Skype, 2010a).

Recommendations for Good Video Quality
An audio and video communications device connected to a TV set poses certain demands on the camera connected to it. According to consumer studies cited by Skype (2010b) TV viewers typically sit between 2 m and 4 m from the TV set. As not to make the persons captured by the camera appear too small on the receiving screen, Skype (2010b) requires the camera to have a 30° diagonal field of view (FOV) downwards from the horizontal plane, see figure 3.15. This will result in upper body coverage at 2 m and full body coverage at 4 m, thus satisfying a majority of the use cases (Skype, 2010b). If a full body view is desired at a distance of 2 m the horizontal FOV should be 57° while only upper body view at 4 m requires a FOV of 14° (Skype, 2010b). These use cases can be satisfied with the use of a zooming lens, either optical or digital zoom (Skype, 2010b). Skype (2010b) states that this provides the user with a flexibility to adjust the capture as desired and that digital zoom also adds the possibility of panning or tilting the capture.

Skype requires the camera to support resolutions of 640x480, 320x240 and 160x120 pixels at bit-rates from 25 Kbps to 800 Kbps (Skype, 2010b). Support for High Definition resolution is optional and will require support for bit-rates of 1.2 Mbps or more (Skype, 2010b).
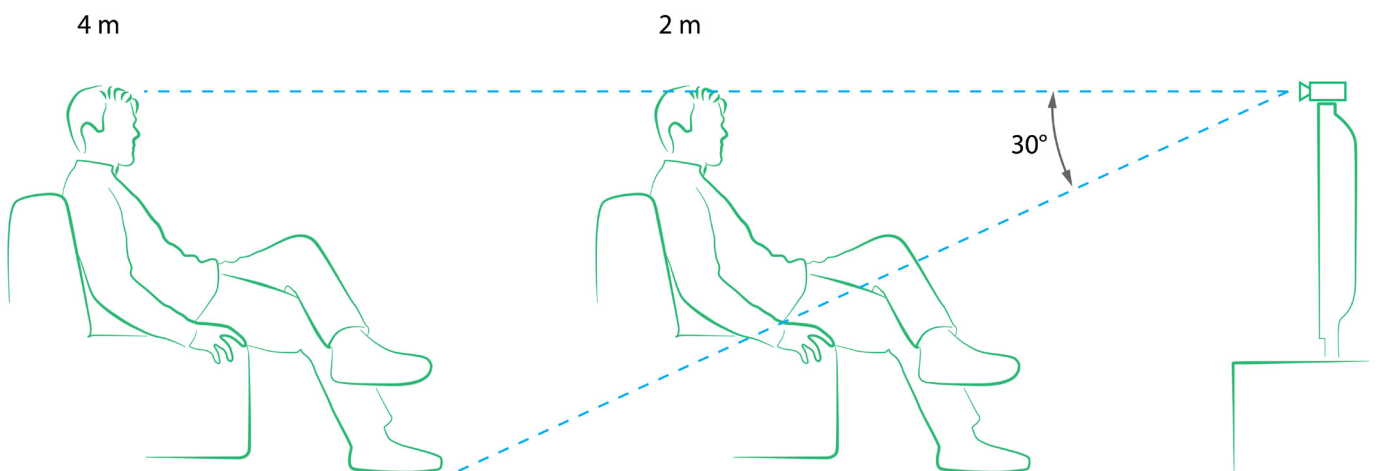

Figure 3.15 - Field of view from the camera

3.3 INTERNET AND TV

Several ways of combining the online experience users get from a computer and tablet devices with the TV experience have become available on the TV market. With added functionality in the TV sets the users are enabled to gain access to much more information from their living room sofa than ever before. With new functionality comes new ways of interacting with devices and content.

3.3.1 Internet of Things

The use of the Internet in computers, both at home and at work, is a natural part of everyday life for many people today. The same can be said about Internet use in smartphones. Currently, a similar revolution is happening that could potentially make almost any product connected to the Internet or local networks. The goal is to create features and products that simplify tasks through the use of connectivity.

Some industries have already incorporated connectivity into their businesses, like the transport industry for example. Containers, vehicles and train cars are equipped with transmitters so that information about them, like their position, can be monitored (Stiernstedt, 2011). Leading providers of communication systems predict that the Internet will continue to grow rapidly and that a increasing number of connected devices and products will be a part of this growth (Stiernstedt, 2011).

3.3.3 Internet on the TV

Internet TVs or interactive TVs refers to TV sets that in some way are connected to the Internet. Many of the tasks that are usually performed on a computer can now also be done on a TV set, such as listening to music, streaming video and browsing the web.

The interactivity of Internet TVs today is quite varied. Simple versions of Internet TVs can only recieve small amounts of extra information included in the regular broadcast, such as show information, without connecting them to an Internet source. The more complex Internet TV sets offer more interactivity and the possibility to use them more freely by accessing more content, (Eli, Groabel and Gerbarg, 2004). Some TV networks make their broadcast content available online allowing the user to watch it at any time, not having to wait for it to air on the network. With a high-end Internet TV a user can access this type of content.

The use of applications, or apps, have increased in popularity in the so called smartphones. Applications have also spread to interactive TV sets allowing users to download and use them at their convenience. As most TV manufacturers have their own software platform for their TV sets, the apps have to be made to fit each specific manufacturer's interface.

There is also a possibility to bring interactivity to any TV set by using a set-top box with a user interface. This has been available for quite some time, offering users services like video on demand and information about running shows. In the last couple of years more advanced set-top boxes have emerged like the Logitech Revue which uses Google TV and Boxee Box which has it's own interface. These boxes allow users to access streaming content online on any TV set with a HDMI connection (Logitech, 2011a).

3.3.2 TV on the Internet

TV networks are often making their content, shows and bonus takes available online for customers to view at their convenience. As TV content historically always has been broadcast on a tight schedule it has been a time-dependant media. With the possibility of accessing video content online at any time, the way we watch TV is changing.

Watching TV has always been considered a way to relax, pass time, and to socialise with friends and companions (Steincamp, 2010). Convenience, on the other hand, has been shown to be one of the main reasons why users chose to view streaming content online instead of regular broadcast. Being able to choose what, when and how to watch TV content are also reasons why more and more people start to use streaming services (Steincamp, 2010).

With set-top boxes being able to receive both normal broadcasted TV and access streaming online content, the old fashioned TV is converging with the online TV, but it is not problem free. When Google TV released set-top boxes and Internet TV sets in collaboration with Logitech and Sony, some of the larger TV networks blocked the software from accessing their online content (Boulton, 2010). This was claimed to be because of the networks' fear of piracy but was also because the networks wanted clear way of charging customers for their content (Boulton, 2010). Another issue was the loss of ad revenue in Internet based content compared to broadcast content.

On the Swedish market many networks have their own streaming services, using their own software. Accessing this content on a computer is easy, but when it comes to mobile phones, set-top boxes and tablets this becomes a problem. Software plug-ins such as Adobe Flash or Microsoft Silverlight are often needed to play the streaming content. However, mobile devices and set-top boxes does not always support the plug-ins needed. As a result, users often cannot watch the streaming services on devices like these without using specific apps.

4. METHODS

This chapter contains descriptions of the generative methods that were used to gather requirements and to facilitate the design process.

4.1 REQUIREMT GATHERING METHODS

Below is a description of the methods used for gathering and managing information about potential users.

4.1.1 Interviews

Interviews can be performed in several different ways, individually or in groups, and structured or unstructured. A structured interview is when the interviewer strictly follows a set of predefined questions and never deviates from it (Karlsson, 2007). This type of interview is most often used to gather quantitative, that is to say simple and measurable, information (Karlsson, 2007).

Karlsson (2007) states that in the opposite, an unstructured interview, the interviewer discusses a certain subject with the interviewee rather than just posing questions. The unstructured interview is supported by a list of questions that should be posed in such a way that the interviewee is encouraged to speak more freely and hopefully give exhaustive answers. Here, the interviewer is encouraged to deviate from the predefined list of questions if the interviewee should touch on any interesting or unforeseen aspects. The unstructured interview will thus provide more qualitative information that gives a deeper understanding of the interviewee's views and opinions (Karlsson, 2007). Karlsson (2007) recommends that the list of questions is structured in a way so that the interview starts with questions that are more general (how?) and proceeds towards more specific questions on attitudes or problems (why?).

Regardless of which interview technique is used, the list of questions that is to be used should be tested in a least one pilot interview. The pilot interview will give an indication of how the questions are interpreted by an interviewee and if their internal order gives a natural flow (Karlsson, 2007).

4.1.2 Focus Group

A focus group is a form of interview where a group of people are gathered to discuss a certain topic (Karlsson, 2007). According to Karlsson (2007), the focus group is used to find out how potential customers and users perceive a product, the attitudes they have towards it and what their requirements are. A moderator leads the discussion to make sure that it stays focused on the intended topic (Karlsson, 2007). One of the strengths with this method is that the participants trigger new associations in each other during their conversation (Karlsson, 2007). Of course, there is also a risk that this could lead individuals to express things that are based on what others say, rather than their own thoughts and opinions.

In preparation for the focus group the goal and target group have to be defined. A list of questions and an interview guide also needs to be prepared. The next step is to contact the participants and to send them invitations. It can be helpful to send the participants some form of assignment in their invitation, such as a workbook or similar. This can help them to start thinking about the topic of the focus group in advance and make them better prepared and more vocal during the discussion. The focus group is then carried out in accordance with the prepared interview guide. It is recommended that an audio or video recording is made of the focus group for later reference. Afterwards the interview should be transcribed and analysed. The results are gathered and presented in a comprehensive way.

4.1.3 KJ-analysis

A KJ-analysis is used to manage large amounts of verbal data that has been gathered through interviews or similar (Karlsson, 2007). It is a method to visualise the data in order to make it more comprehensible and manageable. The result shows a graphical representation of relations which facilitate the understanding of a problem or requirements (Karlsson, 2007). The method is based on a bottom-up strategy that starts by focusing on the details and then moving upwards to overlying levels (Karlsson, 2007). The participants of the KJ-analysis should preferably have different competencies to make the result as objective as possible (Karlsson, 2007).

The process of conducting a KJ-analysis starts by writing down facts, or statements, on post-it notes, one fact per note. When all facts have been written down the notes are placed in a corner of a flat and empty surface, like a paper for instance. The notes are then placed one by one on the designated area. If a note is related to the contents of another note they should be placed together. Eventually groups of notes will form. Notes can be rearranged if they are found to fit better into another group. After all of the notes have been placed, each group should be given a name that represent the content of the notes. Finally the result is documented for further use.

4.1.4 Functional analysis

A functional analysis collects all the data from research and user tests during the product development process A functional analysis is conducted by stating a main function for a product and then breaking the function down to several sub functions. Functions are often stated by a verb followed by a noun, such as for example: allow interaction. All of the functions are also rated after level of importance. The levels main function (MF), necessary function (N), desirable function (D) and unnecessary function (U) are used to rate the functions. The functional analysis can be used in the product development process as a tool for brainstorming ideas and to evaluate concepts. (Johannesson, Persson, Pettersson. 2004. s.93)

4.2 DEVELOPMENT METHODS

Below is a description of the methods used for generating and communicating concept ideas during the design phase.

4.2.1 Brainstorming

Brainstorming is a method used to quickly stimulate and inspire ideas in a group of people (Karlsson, 2007). Karlsson (2007) states that the participants of a brainstorming session should preferably have different competencies and that one of them should act as a facilitator of the process (Karlsson, 2007). It is important that the atmosphere is informal and

that negative criticism is avoided (Karlsson, 2007).
A brainstorming session is started by specifying the problem (Karlsson, 2007). When the participants start formulating solutions they should be written down or illustrated on paper or on a Wyte-board. The important thing is that everyone can see all ideas that have come up. The participants are then encouraged to develop or draw inspiration from the ideas that the other group members have had (Karlsson, 2007). According to Karlsson (2007) a session should last about 20 to 30 minutes or until there are no more new ideas. All ideas should be saved as their potential might not be realised until later. If the brainstorming session results in one or more solutions, or new ideas, it has been successful (Karlsson, 2007).

4.2.2 Personas

In order to portray the thoughts and actions of a potential user it can be helpful to create a so called persona. The persona is a fictive character that possesses the most common characteristics that a user group has (Karlsson, 2007). The persona can be used as a way of communicating user needs and requirements to those involved with the development of a product or service (Karlsson, 2007). It is helpful to use the persona both in innovation and evaluation.

In most cases it is preferable to create several personas with different characteristics, as there often are many different types of users within a target group, sometimes with contradictory needs (Karlsson, 2007). According to Karlsson (2007) the persona should consist of a name, gender, age, interests, hobbies, profession, how this person perceives the product or service and what it means to the persona. Karlsson (2007) goes on to say that it is important not to create the 'average' user but rather the 'extreme' user, the one with the most demanding needs.

4.2.3 Scenarios

In product development a scenario is a fabricated use situation of a product or service that describes the intended goal (Karlsson, 2007). A scenario describes and illustrates how a user interacts with a product or service, who buys it, which features it has, how the features are used and so on (Karlsson, 2007). The scenario relies heavily on knowledge about the user and coming trends. Therefore, the scenario should be based upon information from the data collection and the conclusions drawn from it (Karlsson, 2007). It can be beneficial to construct several scenarios to illustrate different kinds of user needs or use situations. Scenarios can also be useful during interviews with users and customers to elicit latent information without having the interviewee perform an action (Karlsson, 2007).

4.2.4 Sketching, Models, Mock-ups and Prototypes

During the development process of a product it is useful to be able to quickly test and communicate ideas. It is often easier to comprehend an idea if you can see it or even touch it instead of reading a description of it (Karlsson, 2007). The different stages of the development process require different techniques to be used. The fastest and most straightforward technique is sketching. Sketching allows for fast illustrations of ideas, all

that is needed is a pen and a paper. This is often how ideas are first communicated to others. Despite its relative simplicity, compared to models for example, a sketch is a good way of describing aesthetics, form, structure or interaction (Karlsson, 2007). Sketches can be used throughout the development process as new ideas or solutions appear. The refinement of the sketches can also vary, for example simpler pencil sketches for fast communication or coloured renderings for presentations.

When 2-dimensional sketches are not enough to illustrate an idea 3-dimensional models are a good substitute. Models can be built in many types of materials, like wood, clay or plastic foam, and they can be in actual scale or scaled down. A model is just a static form without any moving parts. It is suitable for experiencing what the actual product could look like in real life and how it could be to interact with physically (Karlsson, 2007). Like sketches, models can be used continuously in the design process to test and communicate ideas.

To test specific features or functions of a product the model has to be taken one step further. Karlsson (2007) describes a mock-up as a model with some degree of functionality. It could be a latch that can be opened or buttons with a haptic response. Mock-ups are most often used after some progress has been made in the development of a product as they illustrate specific details.

In the final stages of a product development phase the product needs to be tested in a fully functional state. This is when a prototype comes into use. A prototype is the first fully functional version of a product which is used in tests to verify its functionality (Karlsson, 2007).

4.2.5 Structural Models

Structural models is a way to develop structural variants of a product by different ordering of its components (Muller, 2001). In most cases, many of a product's components are known prior to its design. For example, a vacuum cleaner can be said to consist of a motor, a dust bag, a suction hose and a suction nozzle. Muller (2001) presents a generative technique to create a multitude of models by placing physical representations of the components in space in a large variety of ways. These models can act as a starting point to find new ways to design a product by considering the distribution of its components rather than just encapsulating a pre-constructed core. Physical representations of the components can be made of simple materials like plastic foam, paper or wood. To allow a distribution of the components in all axes steel wire can be used for vertical variations (Muller, 2001).

The method is intended to be implemented as a pre-study to the concept generation phase of a design project. Placement of the components should be made freely without any consideration of feasibility (Muller, 2001). When the possibilities of distributing the components have been exhausted it can be useful to evaluate and categorise the result. Examples of categories are direction, symmetry, regular, irregular or balance (Muller, 2001). Each category of structural models with similar distribution will then show possible structural concepts or forms that the product could assume (Muller, 2001).

4.2.6 Computer Aided Design

Computer Aided Design (CAD) is a generic term for computer software used for designing 2-dimensional and 3-dimensional objects (Jarfors, et al., 2006). Objects are created by placing points and curves in a virtual space and using these to form shapes and surfaces. Anything from simple forms to highly advanced machines can be created in CAD software. The benefits of CAD include time saving construction, virtual testing of tolerances and functions, quick technical drafting, simulation of and preparation for manufacturing, etc. CAD software is widely used in a variety of modern manufacturing industries like automotive, aviation, ship building, but also the film and gaming industry.

CAD software can produce files with embedded control information for numerically controlled (NC) machines (Jarfors, et al., 2006). These so called Computer Aided Manufacturing (CAM) systems can manufacture products in a large variety of materials and forms (Jarfors, et al., 2006).

4.2.7 Design Format Analysis

Design Format Analysis (DFA) is a method for identifying and communicating how form elements are used to signify products from a specific brand. A design format is described by Warell (2001, p.107) as the container of the factors that goes into the form design of a product. The design format is influenced both by factors that are internal and external to a company. Company internal factors are for instance styling influences from previous generations of products (Warell, 2001). Factors that are external to a company can according to Warell (2001) be trends, contemporary styles, changing values in society and the design of products from competitors. These factors are external in the sense that they are available to use by all companies in the product design (Warell, 2001). The design format is simultaneously evolving with the design of a product as new variations and form ideas are developed during the design process (Warell, 2001). This leads to the fact that the final product form also contributes to the content of the design format (Warell, 2001).

In cases where a company designs and produces a range of products, a so called product family, it is important to use the same design format for all products in the product family (Warell, 2001). By doing so, the products will give visual references to each other, which in turn provides a clear brand identity and facilitates brand recognition (Warell, 2001). In a Design Format Analysis (DFA) a number of products from a brand's product family are compared. Each product can be said to have its own design format, because the visual form is unique for each product (Warell, 2001). However, Warell (2001) also states that the products share the same format as they are part of the same product family.

The process of conducting a DFA starts by choosing 5-15 products from a brand's product range. Specific design elements in each product are then singled out, some will occur in several products and some might only be represented in one product. The next step is to construct a grid with the design elements organised into rows and the products into columns. It is now possible to check the occurrence of each design element in each product. If a product has a strong visual occurrence of a design element it is awarded 2 points, represented by a filled circle in the grid. If the occurrence of a design element is present but weak it is awarded 1 point, represented by an unfilled circle. If there is no occurrence of a design element in a product it is awarded no points and no marking is made in the grid. The procedure is repeated for all design elements and all products.

When the DFA has been completed, the points are added vertically for each product and horizontally for each design element. The result provides both a numerical and visual indication of how strong or weak each product denotes its design format. The DFA also indicates which design features are the most typical to the brand and which are not.

4.2.8 Moodboards

A moodboard can be used to describe different aspects around a product, company, service or brand (Furendal, Björnsköld, 2007). The moodboard can consist of a collection of images, colours or text that describe an emotion of the company, service or brand. The moodboards can help the development team in getting a common design goal and to make sure that group is on the same path. The moodboard can be used both in a creative sense, helping and inspiring in the creative process, and in an evaluative sense, facilitating the decision making process.

A moodboard is created by collecting images, text and colours that describe the objective and then put out on a board. Having a moodboard close by and visible can work as a reminder of the goals during the entire product development process (Furendal, Björnsköld, 2007).

5. PROCESS DESCRIPTION

This chapter provides a rough overview of how the project was carried out from start to finish.

5.1 INTRODUCTION

The work conducted in this project can be divided in three phases: Technology and user research, concept creation and concept refinement, see figure 5.1. These phases will be described in more detail in the following chapters.

5.2 INFORMATION GATHERING

The project started by gathering information about trends and technology in related products and markets. As more knowledge in this field was gained it was time to bring in the users to get their opinions and perceptions on it. Two focus groups were carried out and complemented by interviewing sales personnel in home entertainment stores. The accumulated information from this phase resulted in a functional analysis that laid the foundation for the creative process.

5.3 CONCEPT CREATION

When sufficient background knowledge had been gathered on users and technology the concept creation phase started. People of Lava does not have a predefined form language so the first task in this phase was to create one. With a desired form language defined the idea generation could begin. The process went from vague visions to increasingly detailed concepts as more functions were added and user needs fulfilled. The process involved continuous evaluation of the created concepts against the functional analysis. Input from People of Lava, the project supervisor at Chalmers and mentors at Zenit further spurred iteration and evaluation of the concepts. Finally, one final concept was chosen out of four promising alternatives.

5.4 CONCEPT REFINEMENT

The final phase of the project consisted of refinement of the final concept. The work included solving some of the physical functions and improving the visual form and expression. The goal of this phase was to make the concept as realisable as possible.

Looking at the project as a whole it is realised that the three main phases were not as isolated as described above. All three phases have been overlapping as new information has been found continuously and affected the developing process. For example, several new products have been released on the market during the development process that are very close to the desired result from this project. This has resulted in subsequent efforts in trying to find really unique solutions. Users, fellow students and people involved with the project have also provided additional insights that have resulted in continuous refinement of concepts and sparked new ideas. Furthermore, as the concepts have gotten increasingly detailed, new issues have been found and solved.
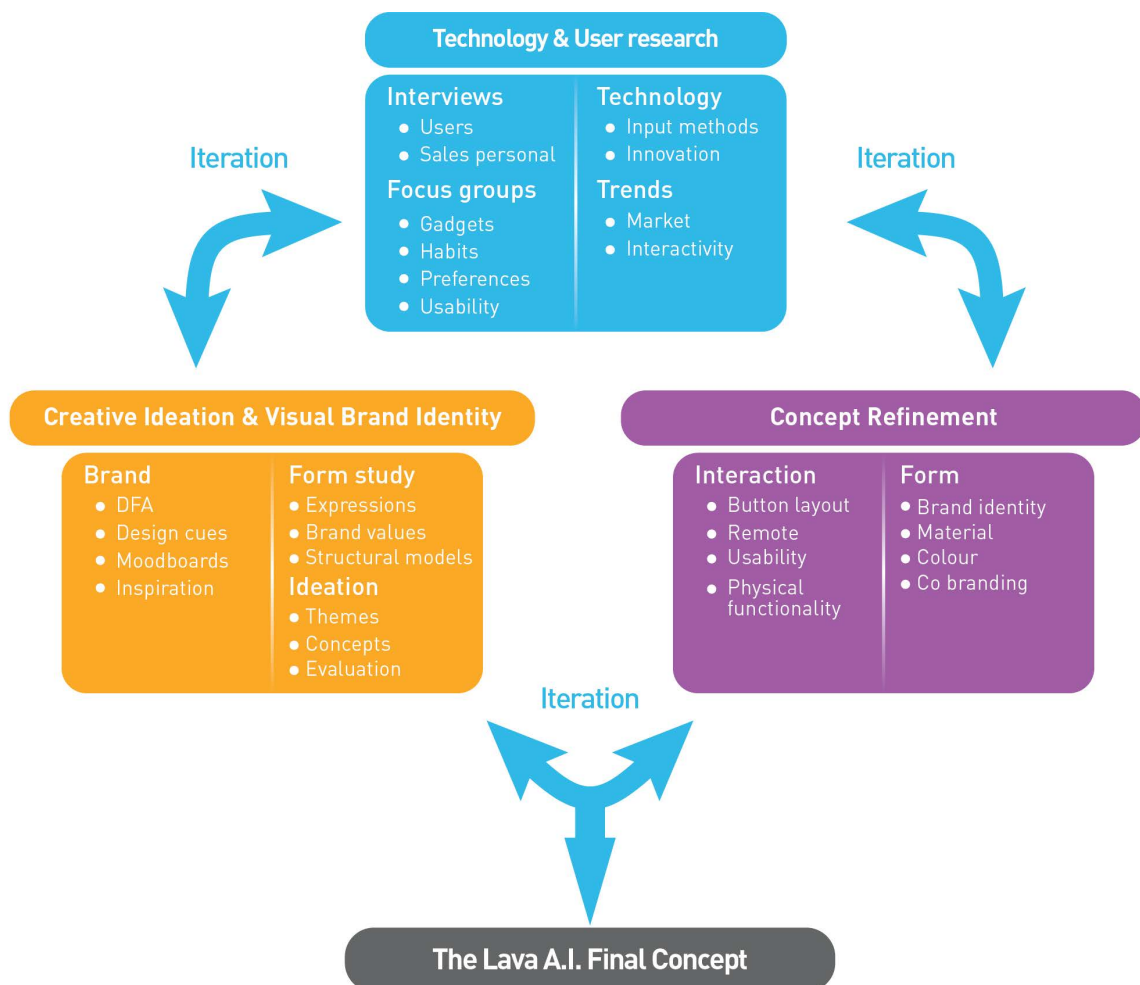

Figure 5.1 - The iterative process of this project.

6. USER BEHAVIOUR AND BRAND IDENTITY

This chapter summarises the results from the generative methods that provided information about the intended users and People of Lava's visual brand identity. The chapter is concluded by a summary of the functional requirements on the concept.

6.1 INTRODUCTION

During the first phase of the development process information related to the project was collected and studied. This information was later used as a platform to base decisions on in the development phase and as a starting point in the creative work. Much of the information gathered in this phase is presented in chapter 3. Some of the functions described here are outside of the delimitations of the project and have therefore not been considered.

6.2 TECHNOLOGY AND TRENDS

In the project brief People of Lava expressed a wish that the device should incorporate an innovative interaction with the Window to the World software. Therefore, the research phase started by studying available input methods. The scope of this research was made wide to allow for as many possibilities as possible.

Much of the information on cutting edge input methods was found in video presentations by researchers from universities and companies provided by websites like TED.com and YouTube.com. Blog articles and technology reviews were also included in the research. Many of these technologies were so new at the time that this was the only type of available information. The information on input methods is described in detail in chapter 3.2.2.

A study of recent research showed a strong development towards natural user interfaces, as they are becoming increasingly present in everyday technology. With tablets, smartphones and game consoles like the Microsoft Xbox Kinect and Nintendo Wii, users are already getting used to innovative yet intuitive ways of controlling software.

Most of the input methods that were found could be interesting to use in new products. The negative aspect is that many of them are at an early stage of development and not yet ready for widespread use in consumer electronics. In this project it is important to find an input method that gives the user a suitable and comfortable way of controlling the system. Another important aspect is to find a method of input which most of the users are familiar with, thus maximising the target audience.

The number of interactive TV sets have also increased during the last couple of years. With the release of the People of Lava Scandinavia TV set in spring 2010, mobile software had made its way to the TV market. Soon to follow was Google, Sony and Logitech with their Google-TV devices. Several new products that increase the interactivity in TV sets were released in the duration of this project. This shows that the market for applications, social media and communication in a living room environment is increasing and that customers are getting comfortable with the technology being used.

6.3 USER BEHAVIOUR

The focus groups were held at two different occasions with 4-5 participants at each time, see figure 6.1. The participants

Fig 6.1 Focus group users creating their perfect living room

were chosen to represent early adopters and early majority users according the diffusion of innovation theory. It is believed that members of these groups are around 20 to 30 years of age and that they have a great interest in technology and gadgets. Members of these groups, both men and women, where chosen to participate in the focus groups in order to get valid input.

The participants were divided into two different groups, one group of early adopters with great interest in technology, and one group of early majority users with some knowledge of technology and a moderate interest in new products. The reason for this grouping was to be able to control the level of technological knowledge in the discussion. The intention with the focus groups was to obtain a broad overview of how gadgets are used within a home environment. A secondary objective was to find out how users want to interact with future products and to use this knowledge in the design of the new product.

Workbooks were sent by mail to the participants of the focus group prior to the group meeting. The workbook consisted of five small assignments that would trigger the user to think about their situation and how they use their personal products, figure 6.2. The workbooks were used as stimuli for the discussion during the focus groups together with film clips and picture collage assignment. The entire workbook can be seen in appendix 1.

Figure 6.2 Users presented their gadgets in a workbook before the focus group meeting.

The focus group resulted in valuable data regarding user habits and views on technology and innovation. The differences in habits and gadget use between the two groups were almost non-existing and similar ideas and concepts were discussed during the meetings.

All of the users commented on their own gadgets and their functionality. Most of the positive comments hinted that usability and functionality had a large part in making the users feel comfortable with the products. Versatility and portability were also mentioned by many users in relation quality and ease of use.

The users talked much about how tablet devices were better suited for comfortably consuming media than productivity. The device being designed will probably be used mostly for consuming media, something that would have to be taken into consideration.

A conclusion that could be made was that the way you control a device affects how and what you use it for. Tasks are performed on the device that is most comfortable and easy to use, alternatively on the device that is closest the user. This shows that finding an input method that is both familiar, easy to use and comfortable is of high importance. It also shows that the interaction with the product has to be designed to be both quick and comfortable. Remote controls were discussed and users expressed their dislike of having too many remotes, not knowing which one controlled which device.

Communication during TV viewing was discussed in both groups without being addressed by the moderator. The participants expressed that the social part of TV viewing had decreased in their lives, compared to when they were younger watching TV together with their family and friends. It was also stated that watching TV shows and communicating via text or voice chat was something that happened from time to time. However, online chats and video calls were mostly performed on their computers. When users decide to relax, TV viewing is often the choice but they keep phones and tablets in close proximity. This discussion shows that there is a possible market for a device that can make watching TV more social.

People of Lava's concept of Window to the World was also expressed by one of the participants without any mentioning by the moderator. The participant spoke of a portal to other worlds. This shows that by finding a way of bringing communication and social aspects to a TV set could allow for interesting products that appeal to customers.

The user-oriented results from the focus groups were complemented by spontaneous interviews with sales personnel in home entertainment stores. The interviews helped in gaining information about current technology and TV sales. It was stated that the thickness of TV frames had gone from being around 100-150 mm thick a couple of years ago, to being
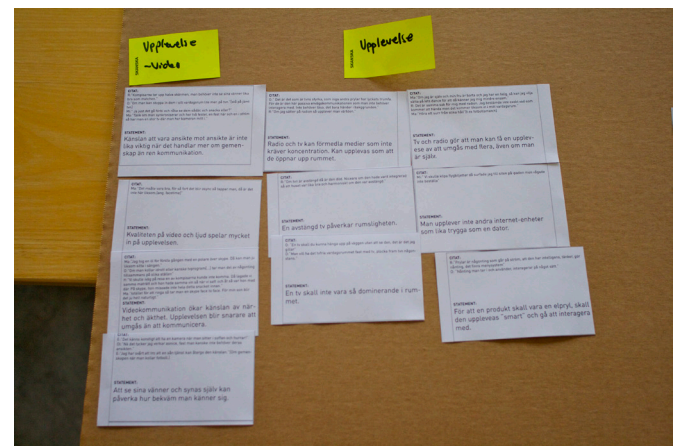

Figure 6.4 Structuring statements in a kj analysis

between 70 - 10 mm thick in recent models. Most of the TV-sets being sold today are thinner than 100 mm, see figure 6.3. One sales person estimated that around 20 percent of people buy a wall mount with their TV set. He had not seen much increase in sales of the interactive TV sets but acknowledged that the products with interactivity were increasing in number.

The discussions from the focus groups were transcribed and analysed in order to find specific user requirements and preferences. Quotes that were considered valuable were singled out and turned into statements. These statements were then written down on post-it notes and organised into groups using a KJ-analysis, see figure 6.4. The groups of statements were later used to create functions in the functional analysis and also as a starting point when brainstorming ideas.

57 statement cards were created, the most important ones are presented below:

- TV content is consumed on other devices than TV's at an increasing rate.
- Tasks are performed on the device which will reach the goal with the least amount of effort.
- Physical interaction comes natural, you want to hold things in your hands.
- The perceived comfort of an input method affects how the product is used.
- Users do not necessarily want a remote, but they want the functionality.
- Video communication increases the felling of closeness and genuineness. The feeling is togetherness rather than communication.

Figure 6.3 Sideview of a typical Tv, thinner than 100mm

6.4 VISUAL BRAND IDENTITY

This part describes the People of Lava visual brand strategy and how it can be altred to better express the brand's core values and vision.

6.4.1 Design format analysis

A Design Format Analysis (DFA) was conducted on five of People of Lava's products. These products were the Scandinavia, Royal, Granite and Flex TV sets and the Scandinavia remote control. The products were chosen as they are the most visible products within the Lava Brand. Seventeen form features were found within the chosen products and used for the DFA.

The DFA showed that the Scandinavia TV set was the product that incorporated the most of the chosen form features. It is our belief that the Scandinavia was designed to stand out from TV sets from competing manufacturers. The other TV sets in the People of Lava product range do not have the same strong visual expression as the Scandinavia. This makes it difficult to single out features that are typical to the brand. It also means that the product form features have little in common with each other. This is clearly visible in the DFA as it shows that there are only a few features that are present in all of the products see figure 6.6.

The feature that was awarded the most points and therefore the strongest feature was the Lava logo tab, figure 6.5. Needless to be said, a visible logo is also very common in all types of products and can hardly be seen as a unique feature.

However, using a tab to display and highlight the Lava logo is very unique in the form language of TV sets. It is a very strong form feature and design cue that has great potential in becoming an iconic People of Lava trademark, comparable to the Levi Strauss red tab and the Mercedes Benz star.

Figure 6.5 The Lava tab and grooves

There are two other features that are reoccurring in some of the products: the contrast between light and dark materials and the rectangular stand. The form of these rectangular stands is probably not strong enough to be considered a unique People of Lava feature. The combination of the form and the use of glass material in the stands can be connected to the Scandinavian heritage. However, when considering all of the features of the TV sets as a whole, it is not considered to be a prominent feature.

Feature	Scandinavia	Royal	Granite	Flex	Scandinavia remote	
Art frame diagonal edge		●				2
Visible logo front	○	●	●	●	●	9
Black frame around screen	●					2
Light and dark contrast	●	○	●	○	○	7
Flat glass front	●	○				3
Straight and round edges	●			●		4
Outer Shell	●		●	●		6
Touch buttons	●		●			4
Polished metal texture		●	●		○	5
Chamfer on frame		●	●	●		6
Bottom front speaker	●			●		4
Mesh grid	●			●		4
Ear logo	●					2
Visible IR reciever			●	●	●	6
Convex bottom edge			●		●	4
Side and bottom outer frame				●		2
Thin rectangular stand	●	●	●	○		7
	21	12	18	18	8	

Fig 6.6 Design format analysis of People of Lavas Products

With the exception of the logo tab, we believe that the contrast between light and dark materials is the most unique feature in the DFA. People of Lava draws design cues from their Scandinavian heritage and this can be connected to light and dark contrasting materials. The Scandinavia TV set is the product that most clearly uses this feature and it works well as a design cue. In combination with other features, the light and dark contrasting materials make the Scandinavia appear as an aesthetically unique TV set.

Figure 6.7 The Scandinavia outline

Figure 6.8 The Scandinavia remote

There are a few other features that are aesthetically unique but only used in the design of the Scandinavia. The frame creates an interesting outline of the screen. The white Corian material frames the TV set with a combination of straight and rounded edges, see figure 6.5 . When viewed from the front the top corners of the frame are angular while the lower corners are rounded. This feature is quite subtle on it's own but together with the white material, the Lava logo tab and the grooves on the sides, the entire frame creates a strong visual design cue, see figure 6.7. The other TV sets from People of Lava cannot be compared to the visual strength of the Scandinavia and it's way of expressing the People of Lava brand.

The remote control of the Scandinavia has not inherited any of the visual features of the TV set, figure 6.8. The only similarity is the visible log and as mentioned before, this is not a feature that adds to the aesthetic experience of the product. This has a lot to do with the fact that the remote is a People of Lava branded OEM product.

4.4.2 Visual Brand Strategy

People of Lava views Bang & Olufsen and Loewe as the company's closest rivals. Both of these companies have larger sales and stronger brand recognition among customers on most markets compared to People of Lava.

Looking at the products and brand communication of Loewe and Bang & Olufsen it becomes very clear that they have a well executed brand strategy. Form language, typefaces, colours, images and so on are used consistently in all types of communication, be it products, webpages, stores or commercials. This portrays a unified image to customers and strengthens brand recognition. A strong brand recognition is very valuable in consumer goods, especially in premium products. In a comparison between People of Lava on one hand, and Loewe and Bang & Olufsen on the other, the branding of the companies is very dissimilar. People of Lava does not have the unified brand communication as its competitors.

As noted in the DFA performed on a number of People of Lava products there are virtually no visual connections in form between the product lines. Bang & Olufsen and Loewe products have many similarities, not only between product lines, but also between product categories. Customers of these brands often buy several products from the same brand to get the unified look in their own home. Of course, they also know that they are buying quality products and maximising compatibility.

Although People of Lava only have two product categories, TV sets and mounts, their strive to be a premium brand would greatly benefit from a strong visual brand identity. In the DFA a few strong visual features were found in the design of the Scandinavia TV set: the Lava logo tab, light and dark contrasting materials and the outer shape of the frame. These features are strong enough to use as a basis for creating a unique design language for People of Lava. They should be implemented not only in products, but also in webpages, commercials and packaging. More features and cues, like typeface, colour and imagery, should be added and improved over time. The importance is that these features and cues are used consistently in all visual aspects of the brand.

6.5 FUNCTIONAL REQUIREMENTS

Information gathered from the focus groups and interviews, paired with trend and technology research, laid the foundation for a functional analysis. A long list of functions was created and divided into categories to create a better overview. The categories and a summary of their content are explained below and the full functional analysis can be found in appendix 2. The functional analysis and the statement cards were used as a starting point for the creative work.

Main function
The main function of the product should be to provide interactivity to TV sets. The solution was predetermined by the use of the Android operating system developed further by People of Lava. In turn this added a technological requirement that connecting TV sets are equipped with a HDMI socket.

Communication

The device should allow the user to both communicate through audio and video. It was recognised that the user must be able to choose if and when he or she wants to be contacted by others. To allow privacy the user should be able to physically turn the camera off. Other functions in this category cover how communication can be made easy and intuitive.

Handling

This category comprises the physical interaction that a user has with the product. The device must be able to function and fit with most HDMI equipped TV sets. It should at the same time allow an easy setup and connection. The device should preferably allow for one-handed use.

Software

The scope of the project did not focus on the software functionality of the new product. However, some necessary functions connected to the software were found during the analysis phase. The software must allow remote interaction, preferably using several input methods. A quick startup of the software, regardless of which mode the device or TV set is in, is also desired.

Input

Navigation of the interface and input of text is necessary and should provide comfortable handling. Several ways of input might be possible and switching between these modes must be seamless. The chosen input method should allow for familiar and intuitive controlling of the graphical user interface. The possibility for one handed input is desired but not necessary.

Expression

The device must express it's main function and how it should be handled. It should also express the People of Lava brand values and fit into their product lines.

Environment

This category gathers functions related to the context, usually a living room, where the product is to be used. Important functions here is a desired power saving mode and demand for possible use in low light and noisy environment.

Usability

Different types of feedback to the user are required in a device with the specified properties and features.
The device must be able to provide visual, audial and haptic feedback at the correct time. Examples are feedback of incoming calls and if the camera is turned on or off. It is important that feedback is provided at the correct time and in a manner that suits the context.

Connectivity

The device should be able to connect to the Internet through the use of wireless connections. It should also allow for wireless connection to other devices.

Experience

The user should be provided with a positive experience when using the device. This can be done by providing a flow to the input methods, minimising input error and easy correction of input errors.

Placement

The device must offer possibilities to be placed on or in close vicinity of the TV set. Once in place the device must be stable in relation to its contact surfaces. The placement should allow easy connection to the TV set and power supply. Furthermore, the vertical alignment of the camera should be within comfortable distance of the user's line of sight.

Security

Personal integrity is a high priority in this type of device. In reality this means that the user should feel comfortable around the product, knowing that information is only transmitted at his of her will. By allowing a user to physically turn the camera off the feeling of security might increase.

7. CONCEPT CREATION

This chapter describes the early creative process of creating form and interaction. The chapter starts by describing the iterative design process and is concluded with a detailed presentation of four final concepts.

7.1 INTRODUCTION

The creative ideation started with a form study using sketches, modelling and form expressions. This was followed by several iterations of brainstorming, sketching and conceptualisations.

7.2 FORM STUDY

A form study was conducted alongside the research process and product development from the very beginning of the project. This form study allowed form to be created disconnected from function in order to get a broad view on possible product forms to use. The form study did not have a specific structure to allow the form to be created using different levels of freedom. In the end three different approaches to form development were taken, resulting in a wide array of form being created.

7.2.1 Free Sketching and Sketching From Expressions

The first approach in the form development process was free sketching. When an idea came to mind it was sketched down using pen and paper to keep it for later evaluation, see figure 7.2. Sessions with free sketching were also conducted but was shown to produce little results. In another attempt to create more results expressions were used as a starting point in the sketching sessions. Three words were decided on as a starting point: change interaction and mobile. The meaning of these three words were then broken down into several more words. Sketches were then created using these words as inspiration resulting in a variety of forms. Over time this method proved to give little result.

7.2.2 Structural models

The second approach was to create models of probable components that the product will consist of. Two speakers, one circuit board, one microphone, one camera and sockets for peripheral connections were built in foam and paper. By combining these components in different orientations it was possible to create new product forms, see figure 7.1.

The forms created were later divided into ten groups. The groups where then used as a starting point of new sketching sessions to create encapsulating forms for the distributions of components, see figure 7.2. This form development resulted in a large amount of different forms that were evaluated. It also allowed for looking at form without any direct technical limitations.
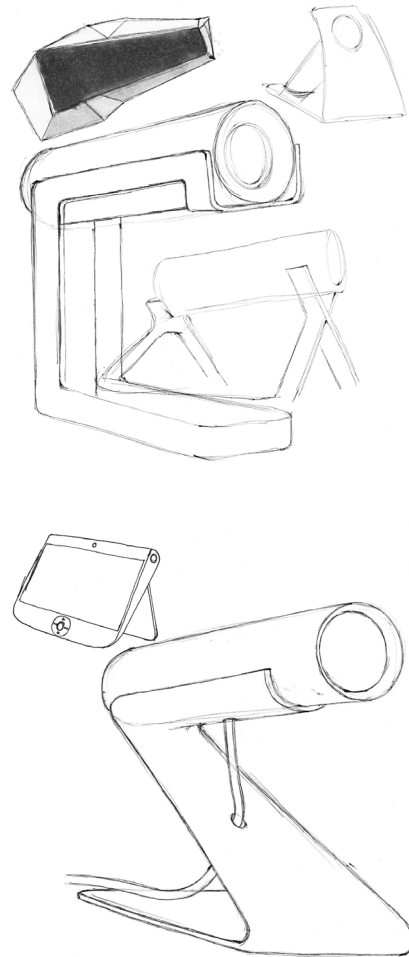

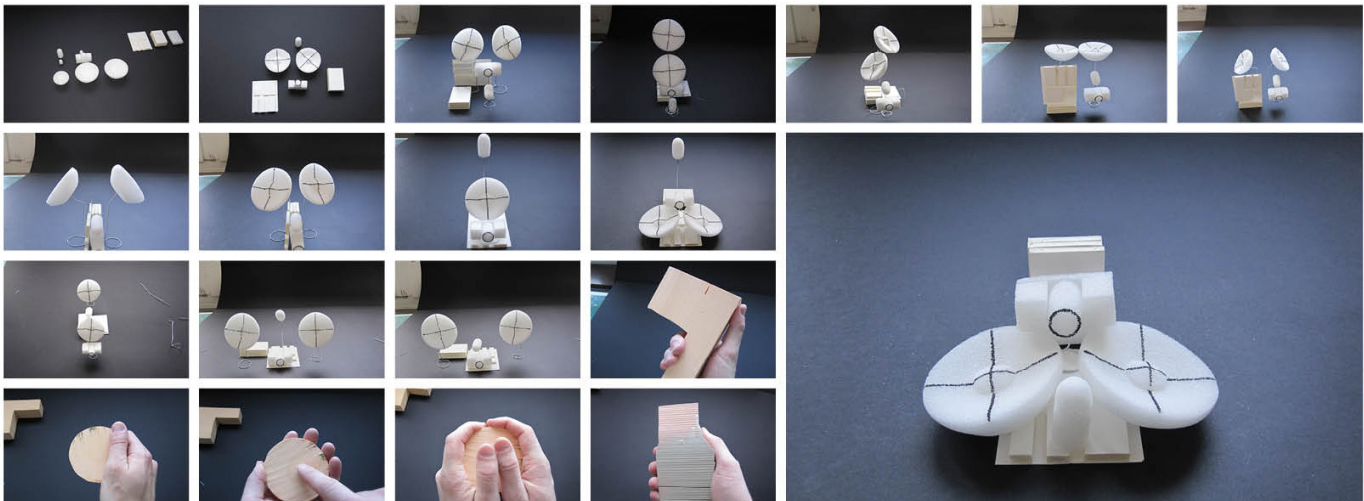Fig7.2 Sketches done with the categorisation of form as a starting point

Figure 7.1 - Foam models and variation of component positioning

Figure 7.3 The People of Lava moodboard

7.2.3 The Lava Brand as Form Driver

In a third approach the visual brand identity research was used to create a moodboard that represented the People of Lava brand. The words Scandinavian, stringent, architectural and contrasting were selected as being the essence of the People of Lava form language. Images supporting these expressions were gathered for the moodboard, see figure 7.3. The moodboard was used as a tool for both creating and evaluating form. The expressions and values of the moodboard were also taken into account when creating concepts and detailed solutions.

The brand moodboard concept was expanded in a second moodboard. This time, images of products incorporating the same expressions as in the brand moodboard were collected. Several hundreds of images were collected and evaluated. The result was a large moodboard with products that could inspire new forms and functions, see figure 7.4. Both moodboards where used during the entire concept creation phase as inspiration and to evaluate specific solutions.
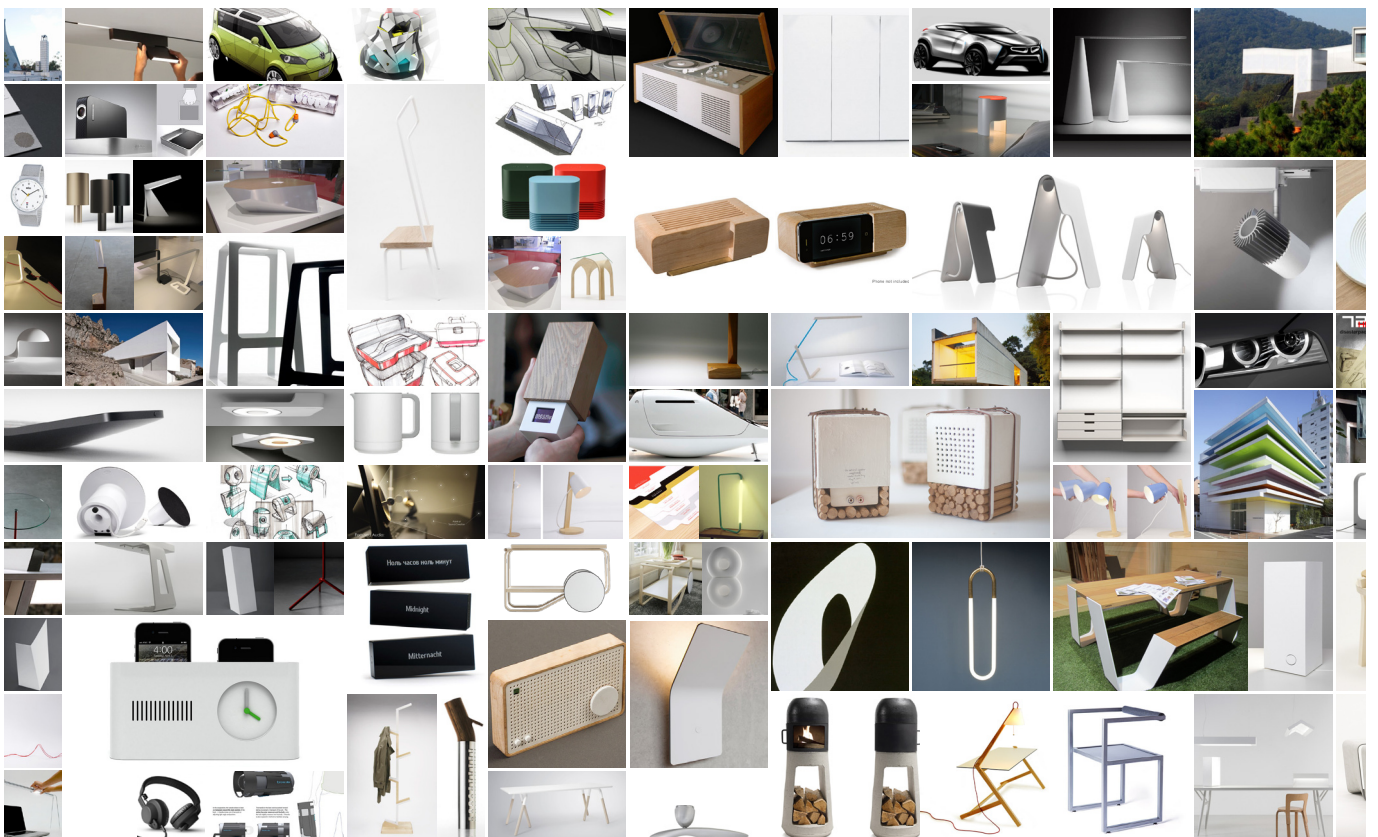

Figure 7.4 Product moodboard used as inspiration in the development process

7.2 CONCEPTUALISATION 1

With a large amount of information gathered from users, trend and technology research, competition and brand research it was possible to start creating product concepts. By going through the statement cards one by one, discussing each statement and quote, various ideas started to form. When discussing the ideas it was possible to find themes and main functions that could be turned into product concepts.

In the first brainstorming session around 20 rough themes were created. The themes were described by simple sketches and keywords see figure 7.5. Combining the research about input methods and the form study made it possible to take the themes and turn them into 12 different concepts, see figure 7.6. All of the concepts had a main theme where communication and control of the Window to the World software were in focus.

To create a wide variation among the concepts several sessions of sketching part solutions were conducted. By having a several variations of solutions, such as mounting or controlling the graphical user interface, it was possible to pick the most suitable combinations of functions for the concepts.

The concepts were then sketched with pen and markers to add form to the functionality. These sketches also served as a means of communication and evaluation. Each concept had a unique way to input commands to the software. All of the concepts were described by putting the product into context in a scenario and by making drawings of its function, see examples in figure 7.7. All of the concepts can be seen in appendix 3.
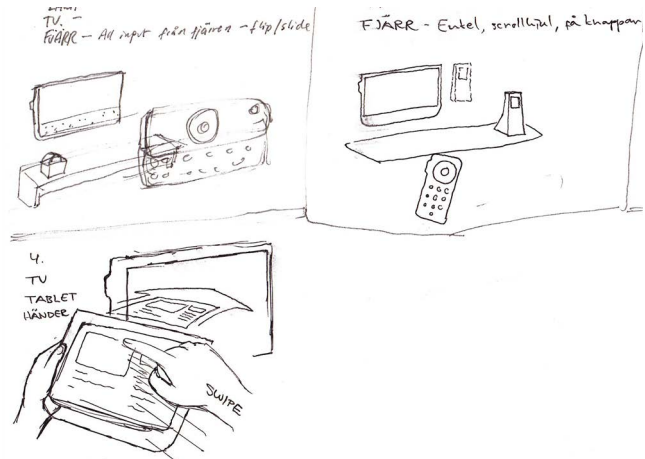

Fig 7.5 - Simple sketches explained each theme created

Separate Something

Social part separated from television, so that a user can watch Tv and videochat together with friends anywhere.

Multitouch remote. Control a virtual keyboard by sliding your thumbs on the touch surface.

Camera and microphone in the remote

Module based device. Personalise with what you want, speakers, dvd/blurayplayer, amplifier etc.
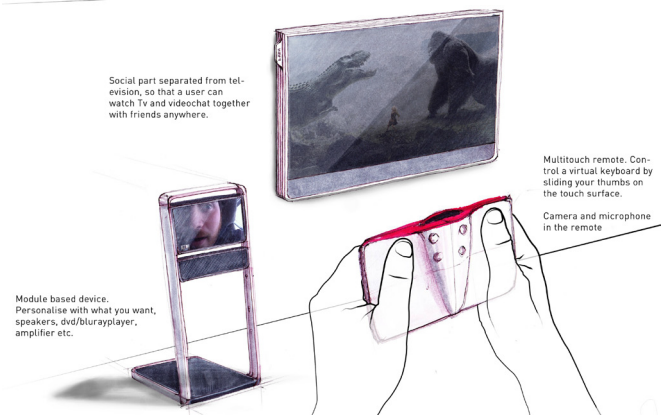
Fig 7.7 Each concept was sketched with markers explaining functions and use.

Figure 7.6 12 concepts were created that had different ways of input and different main functions

40

7.3 CONCEPTUALISATION 2

When evaluating the 12 concepts many similarities could be found. Through combination and alteration of the 12 concepts they could be turned into four new and more individual concepts. A few of the 12 concepts were directly discarded when compared to the functional analysis and the brand and product moodboards as they did not fulfil some of the basic demands on functionality or form.

At the same time the different input methods were evaluated against the user demands found in the focus groups and knowledge about mental models, semantics and perception. This made it possible to discard all but two of the alternatives, touchscreen and trackpad, as a main input method.

7.3.1 The Four Concepts

The four concepts where then iterated once more to add more detailed functionality. To get a higher level of detail in their expression they were sketched in Adobe Photoshop. A concept of a remote control was also designed which incorporated the use of a trackpad and physical keyboard. The remote control has been designed to be a part of the first three out of four concepts described in the following pages. Each concept was explained further by creating a scenario, containing simple personas to exemplify a typical user.

7.3.2 The Trackpad Remote Control Concept

The remote control is intended to give the user a comfortable way of controlling the user interface shown on the TV set. The concept works as a two sided remote. One side of the remote is equipped with a trackpad where the user controls a cursor on the screen by sliding a finger over the surface. The cursor then mimics the finger movement over the surface and translates this to the screen. Buttons and indicators controlling incoming and outgoing calls are placed on the trackpad side of the remote to allow for easy access and fast answering of calls, see figure 7.8.

The trackpad also allows for simple interaction with the applications within the software. For example, in the web browser the user can scroll up and down and go back and forward by swiping the fingers up or down or from side to side, see figure 7.10. This is similar to most trackpads on computers, thus making the users feel familiar with the interaction. Clicking links is done either by tapping or clicking the surface.

A full QWERTY-keyboard is placed on the other side of the remote. With this keyboard the user can input text on the web and in the graphical interface. To allow for a comfortable input of text the buttons are of a harder material and stand out one or two millimetres of the surface, see figure 7.9.

The remote can also be used as a universal remote control for most TV sets. By downloading specific software within the Window to the World interface the remote can be programmed to allow the user to control his or her TV set by using the trackpad. Through the use of gestures the user can change channels and sound volume. The suggested use is changing to the previous or next channel by swiping left or right, with two fingers, respectively. Sliding two fingers towards the top or bottom results in a respective increase or decrease of the volume.

The main reason for deciding on the use of a trackpad as a main input method is familiarity. Many users are used to laptops controlled by a trackpad, making it possible to use previous experience in the interaction with this remote. Another important reason to choose the trackpad over any other input method is that it allows for a comfortable use in a living room environment. Controlling a pointer from a larger distance also requires some accuracy, which a trackpad will provide.
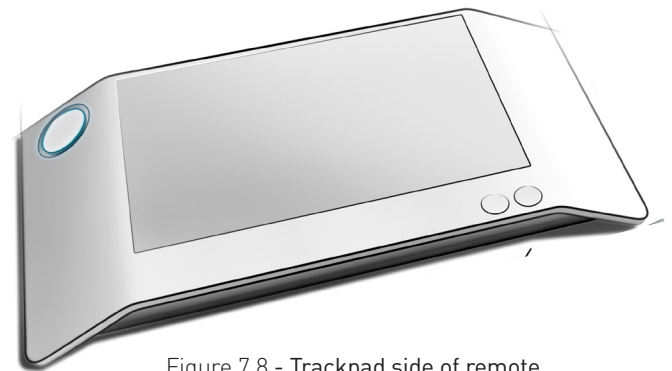

Figure 7.8 - Trackpad side of remote
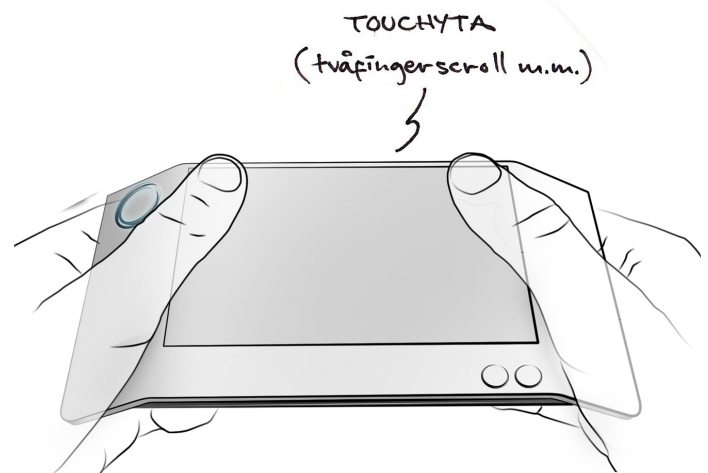

Figure 7.9 - Keyboard side of remote

Figure 7.10 - User interaction with remote

7.3.3 Concept 1 - Camdroid

The idea behind the Camdroid concept was to create a simple concept with focus on communication. The concept should clearly communicate its function and provide the user with an easy way communicate with their peers.

User Scenario
In a typical living room a mother, teenage daughter and a 7 month old baby is relaxing, see figure 7.11. They have just started a conversation with their relatives, grandma and grandpa, who is in their home in Västerås. The grandparents are curious about how their youngest grandchild is doing and started a conversation with the Camdroid unit that they got from their daughter last Christmas. The camera is easy to use with a familiar interface and simple form, making the grandparents feel confident in using it. Having the camera makes it effortless to spontaneously check in on their daughter and grandchildren from time to time.

Functionality and Form
The Camdroid concept has a shape similar to a camera to communicate its main function to the user, see figure 7.12. When placed in close vicinity to a TV set, the context and the Camdroid shape will let the user understand what it is and how to use it.

The unit is placed on top of the TV by rotating the latch and clamping it to the TV set. With the help of a hinge with built in friction, a rubber surface on the latch and a small flange at the front, the unit will stay in place on top of the TV set, see figure 7.14. If a user does not want to mount the unit on the TV set the latch can also function as a stand on a flat surface, see figure 7.13.

The unit is powered on by twisting the small Lava tab clockwise. This will cause a lid, similar to a camera shutter, to open allowing the camera to be used, see figure x. This functions solves the issue of user privacy as the camera unit can be shut physically.

The cylinder is made of brushed aluminium and the tab is made of Corian to match the materials used in other People of Lava products. The tab resembles the tab used in the Scandinavia TV to increase the brand recognition in the product.

The cylinder radius is around 40mm and the depth of the unit is 70mm, see figure 7.15. This is the maximum size that was considered acceptable for this type of top mounted concept. A larger unit would make it look extremely clumsy and big. A negative aspect to this is that the current circuit board is 100x65 mm and would therefore need to be redesigned and made smaller to fit in this concept.
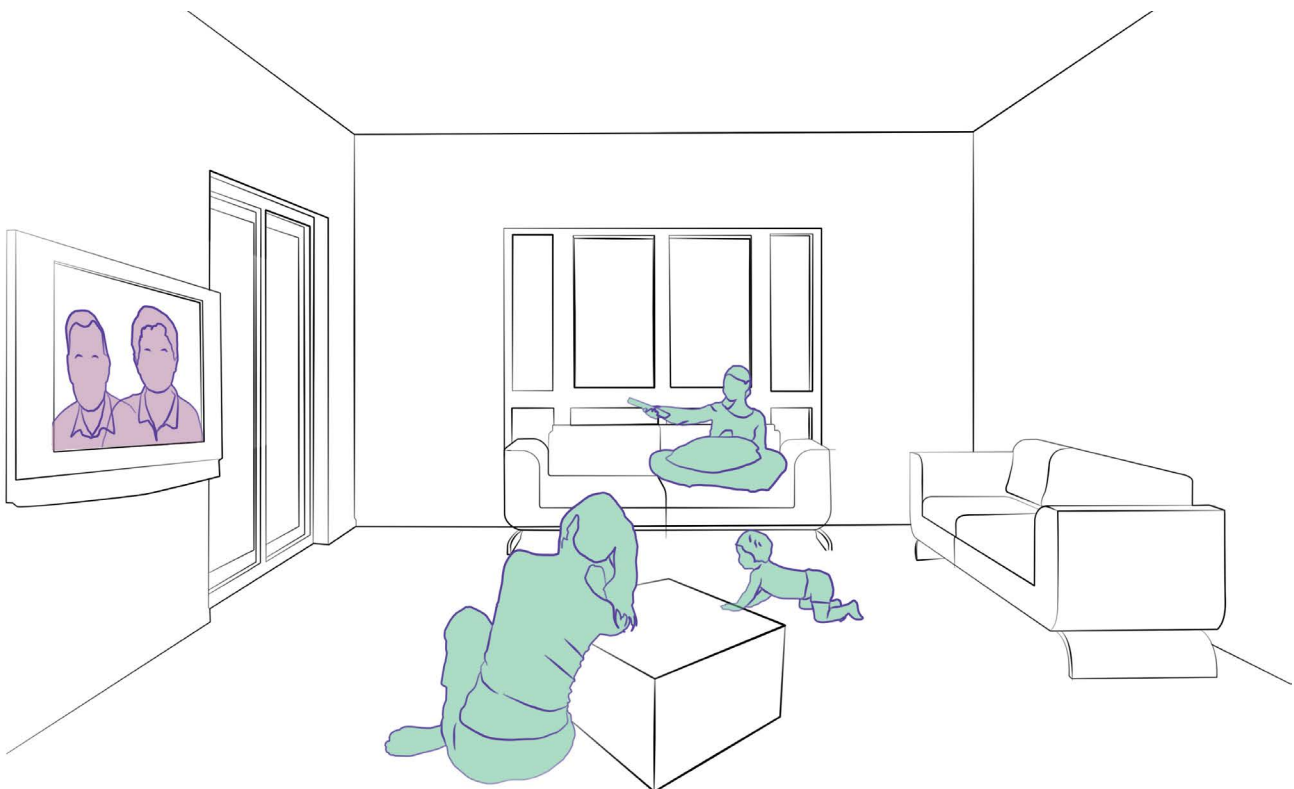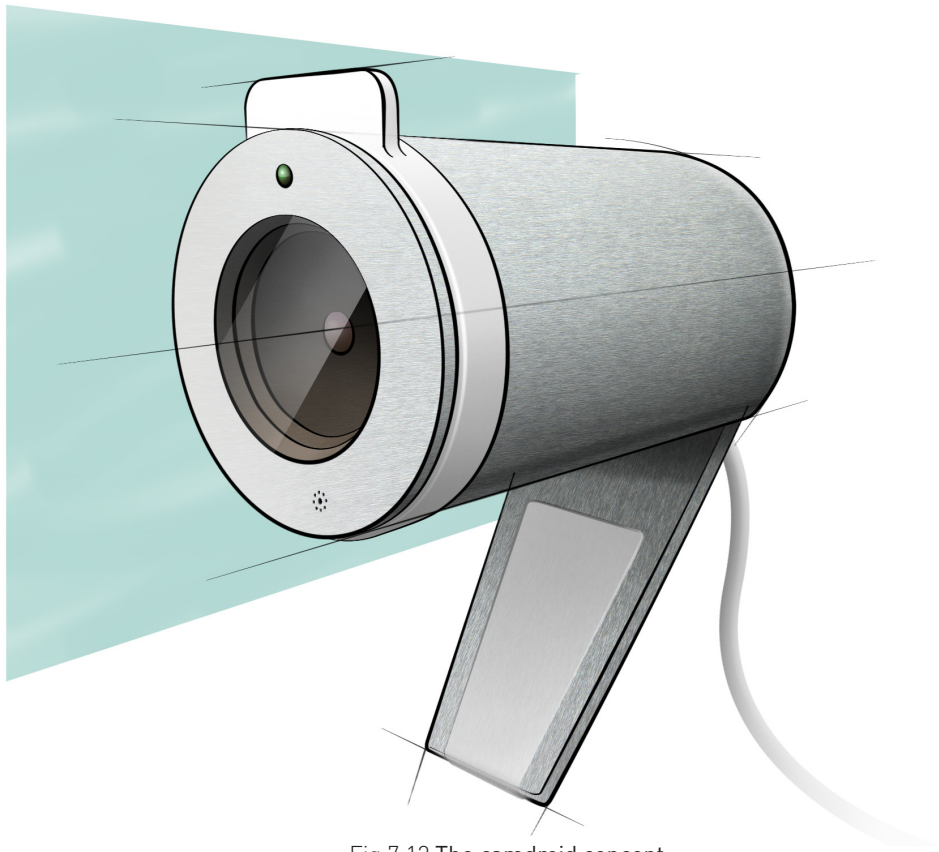

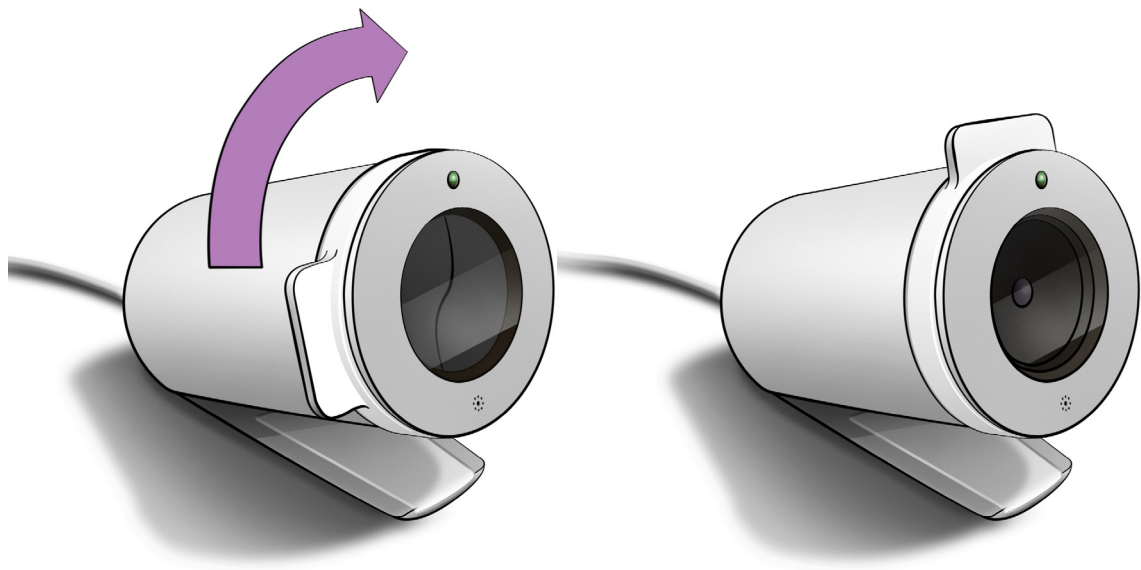Fig 7.11 - Camdroid Scenario

Fig 7.12 The camdroid concept

Figure 7.13 Device could also be positoned on a flat surface

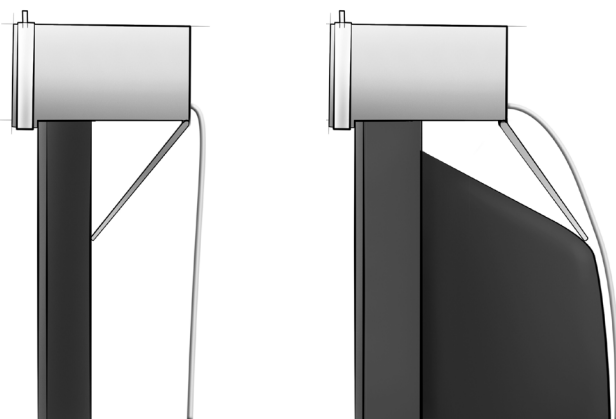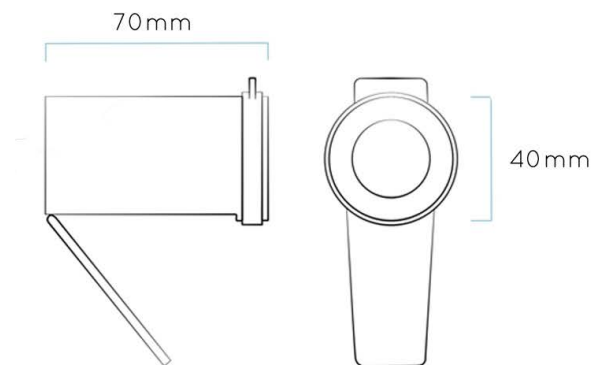Figure 7.14 The device mounted on different TV sets

70mm

40mm

Figure 7.15 Size of Device

43

7.3.4 Concept 2 - Social+

The Social+ concept focuses on the social part of TV viewing. The concept incorporates functions that provides more social interaction.

User Scenario
Anton has just come home from work, had his dinner and is preparing for tonight's football game. Anton's friend Mikael has told him that he will also be watching the game, so Anton calls him on his Social+ unit. A video capture of Mikael shows up in a small square on Anton's TV and they start talking about everyday things before the match starts. Anton remembers that he wants some crisps and beer for the match. He picks up the camera unit, walks into the kitchen and continues the conversation with Mikael. Anton opens the fridge and takes a bottle of beer. 'Have you tasted this one before?' he asks Mikael and holds the camera unit towards the bottle. When the game starts, Anton closes the frame showing Mikael to get a full focus on the game, but he does not end the conversation. With the camera unit in front of him, Anton still hears Mikael. When Mikael shouts and screams at the game, it almost feels like they are in the same room. They are socialising on distance.

Functionality and Form
The Social+ concept consists of three parts: the aforementioned remote, a camera unit and a base unit containing the Android circuit board, see figure 7.17. The camera unit is made separate from the base unit to put the social part of the interaction in focus, see figure 7.18. The user can bring the camera unit with him or her to show something to the person he or she is speaking to. The small size and the low weight makes it easy to move around the apartment.

The camera unit can easily be mounted on top of a TV set, see figure 7.20. The mounting is similar to the Camdroid concept and the camera unit is clamped onto the top of a flat screen TV frame.

The base unit functions as a wireless charger for the camera unit and the remote control. The Lava tab on the camera snaps to the slot with the same inverted shape on the base unit to charge the camera's built in battery, see figure 7.18. Charging of the remote is done by placing it on top of the base unit see figure 7.19.

The base unit is designed so that the camera could stay connected at all times, if the user wants it to.

Separating the camera from the Android circuit board makes it possible to reduce the size of the camera unit. This reduction in size also makes it possible to create a device looking less clumsy on top of the TV set, see figure 7.21. With the base unit having a charging function, it will not as easily be seen as another undesired set-top box.
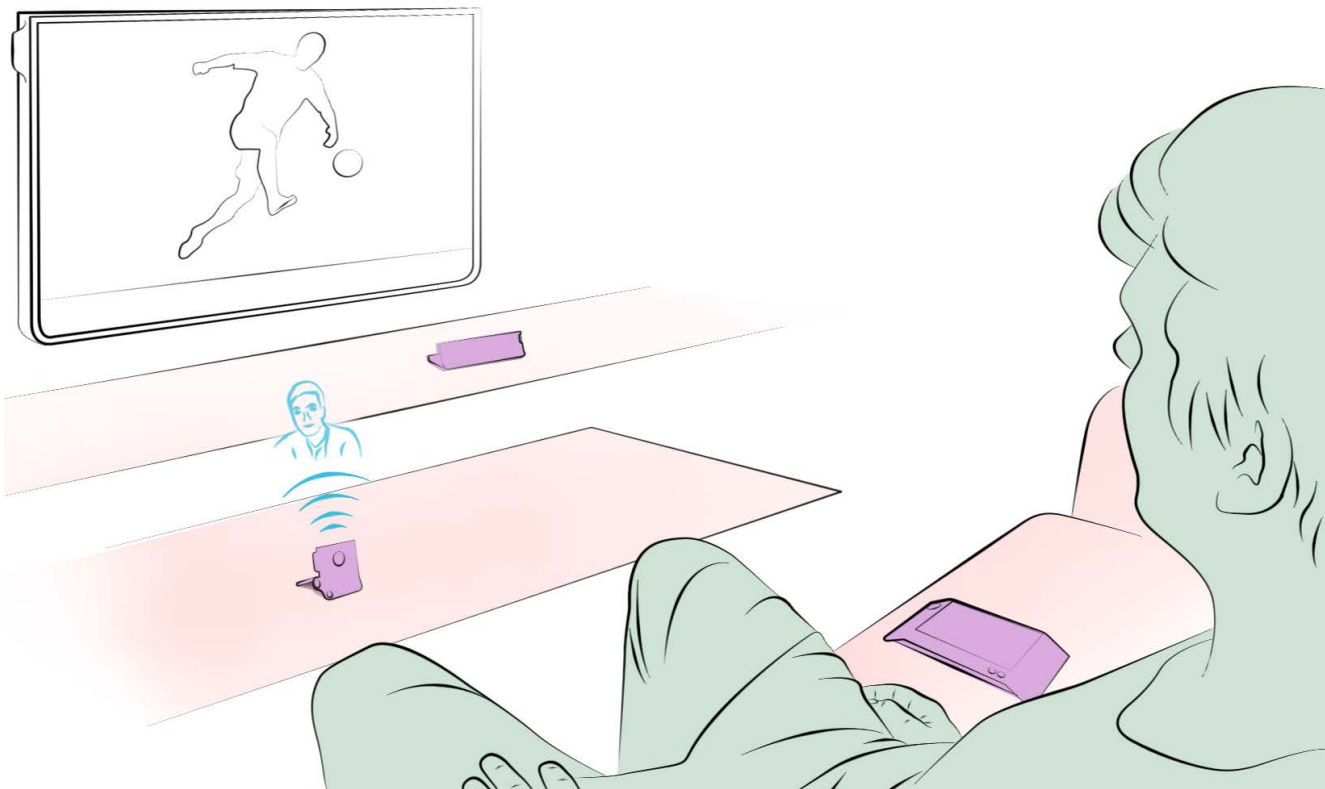

Figure 7.16 User watching fotball and chatting at the same time

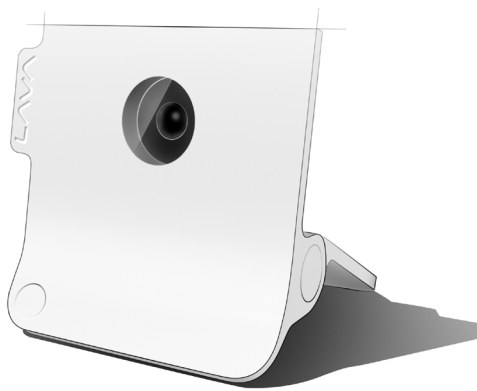Fig 7.17 The base unit, remote and camera unit
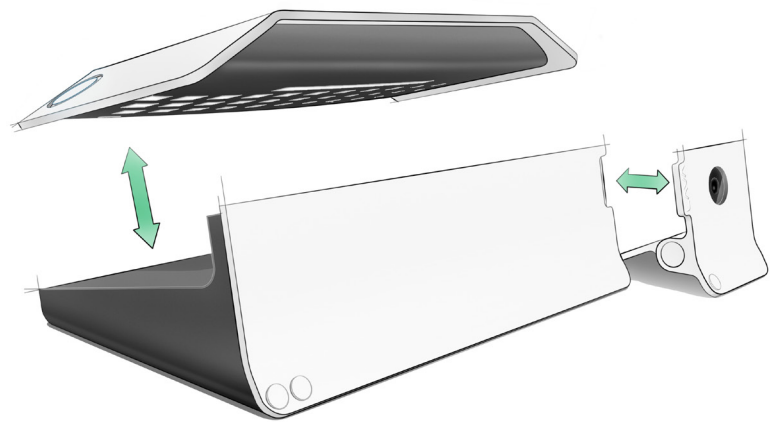

Figure 7.18 The camera unit standing on flat surface

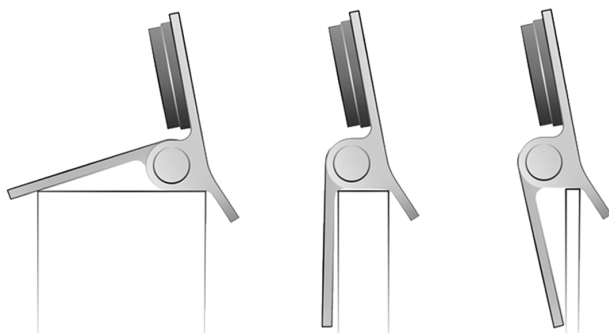Figure 7.19 The base unit can charge the camera and remote

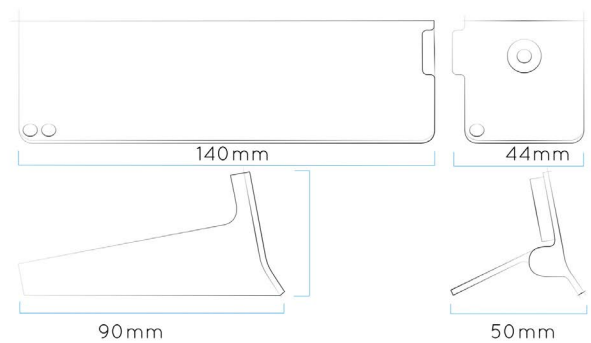Figure 7.20 Mounting of camera unit on TV

140mm

44mm

90mm

50mm

Figure 7.21 Size of devices

7.3.5 Concept 3 - Björk

The focus of the Björk concept was to create an eye catching device that encourages more physical interaction with the unit. The concept should at the same time strongly express the People of Lava brand values.

User scenario
Maria is having her friend John over and is preparing coffee in the kitchen. Meanwhile, John is checking out her apartment. A white unit next to the TV catches his attention. He walks up to it and notices that there are small white boxes that can be rotated. He rotates some of them and feels the weight of the of them. As he rotates a box a sound is played and the unit lights up. Maria comes into the room saying: 'That is my new gadget, isn't it cool?' See figure 7.22.

Functionality and form
The Björk concept consists of a single unit constructed of five different sized boxes. The first box from the left encapsulates a camera, the second and fifth boxes hold speakers, the remaining two contain connections and power supply, see figure 7.24.

Rotating a box backwards turns off the specific function of that box, see figure 7.23. This allows the user to physically turn the camera off by tilting it backwards. The purpose of the rotating function is to make the user interact with the device often. The function in itself will also be an eye catcher making the user curious about what the unit can do.

The size of the unit (see figure 7.25) also allows for the use of larger components, such as speakers that could complement the sound of the TV.

The form of the concept is inspired by simple architectural shapes that bring a structure to the unit. The cut off corner on one of the boxes containing a speaker further helps to make the form unique and eye catching. The shape of the device will continously change as different boxes are tilted up and down to turn on and off functions. The shape of the device will continously change as different boxes are tilted up and down to turn on and off functions. Using Scandiavian wood gives the unit even more connection to the brand values. The name Björk, Swedish for birch, comes from the feeling of the unit being reminiscent to a birch forest during the Scandinavian winters.

The Björk concept is meant to be positioned in close vicinity to the TV set, instead of on top of the TV. This does make it somewhat similar to a set-top box but the added physical interaction makes it stand out in this category.
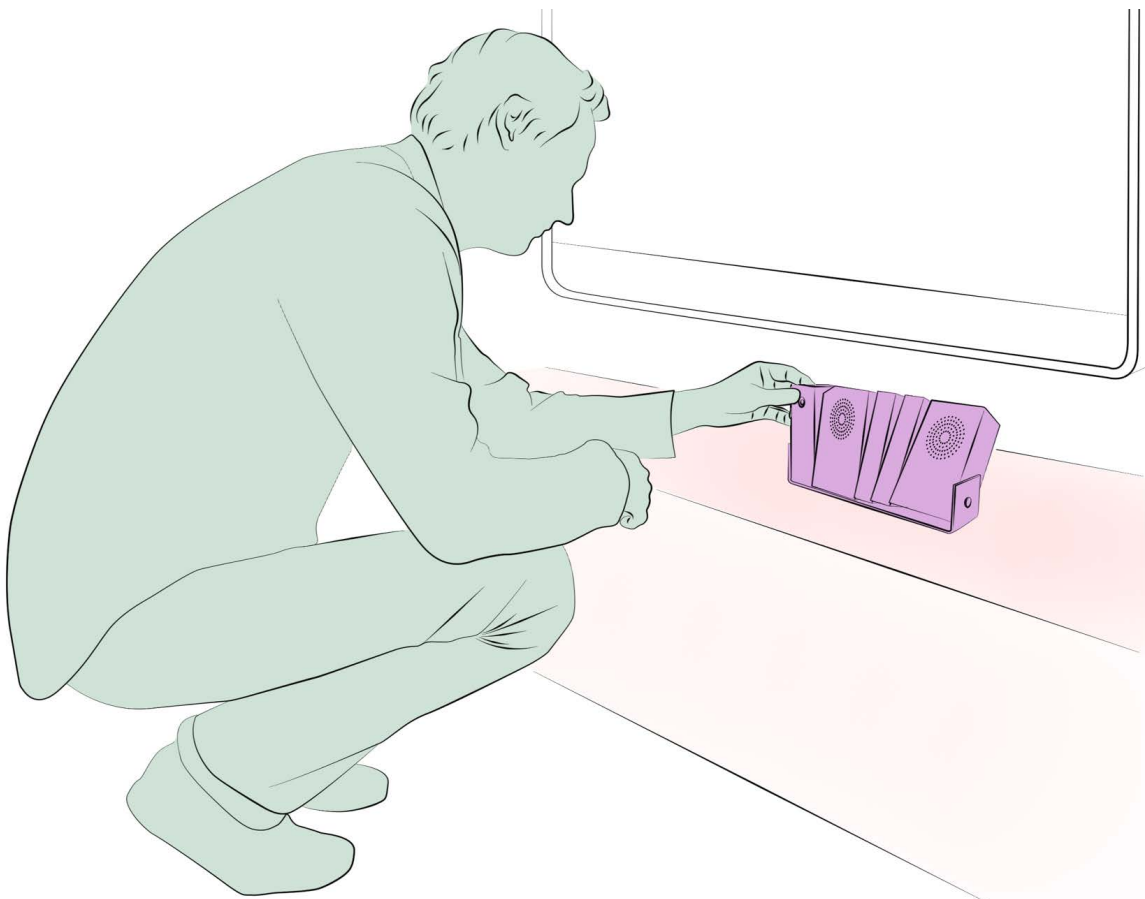

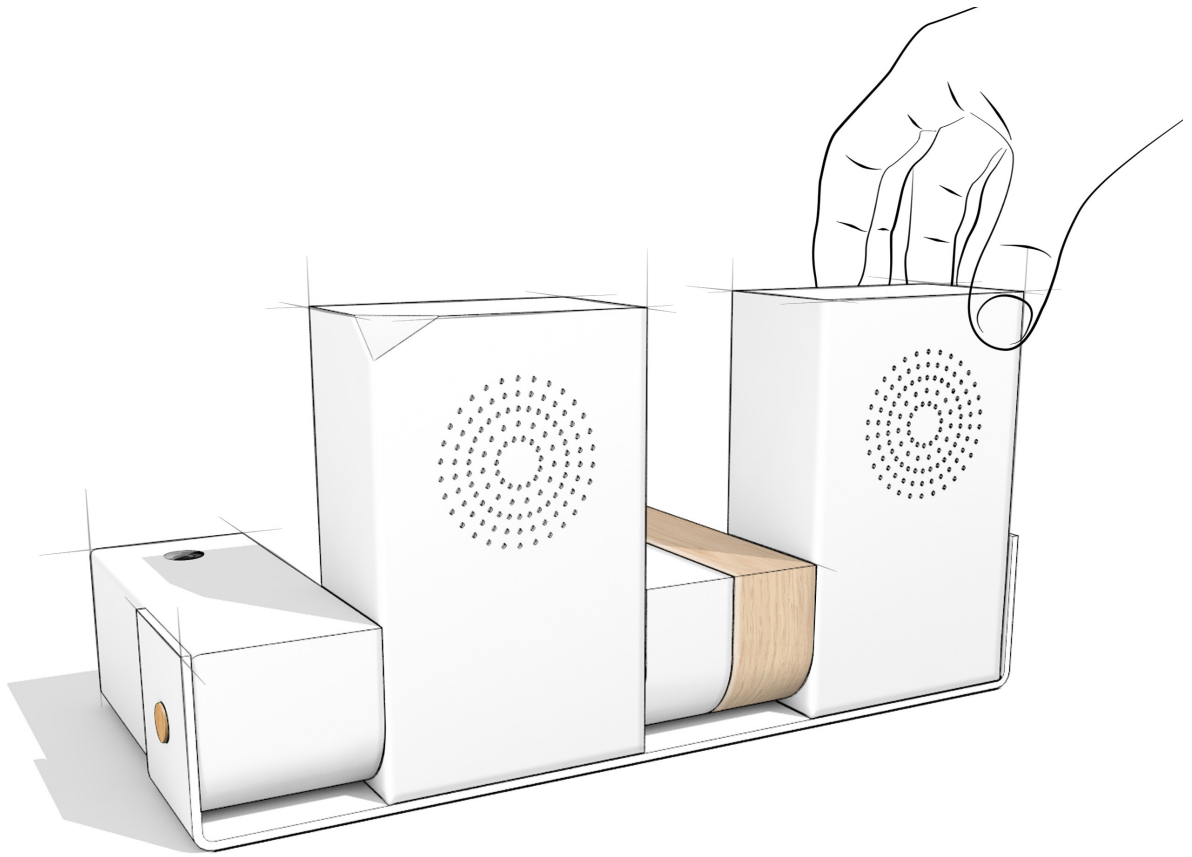Figure 7.22 User trying out folding function of Björk
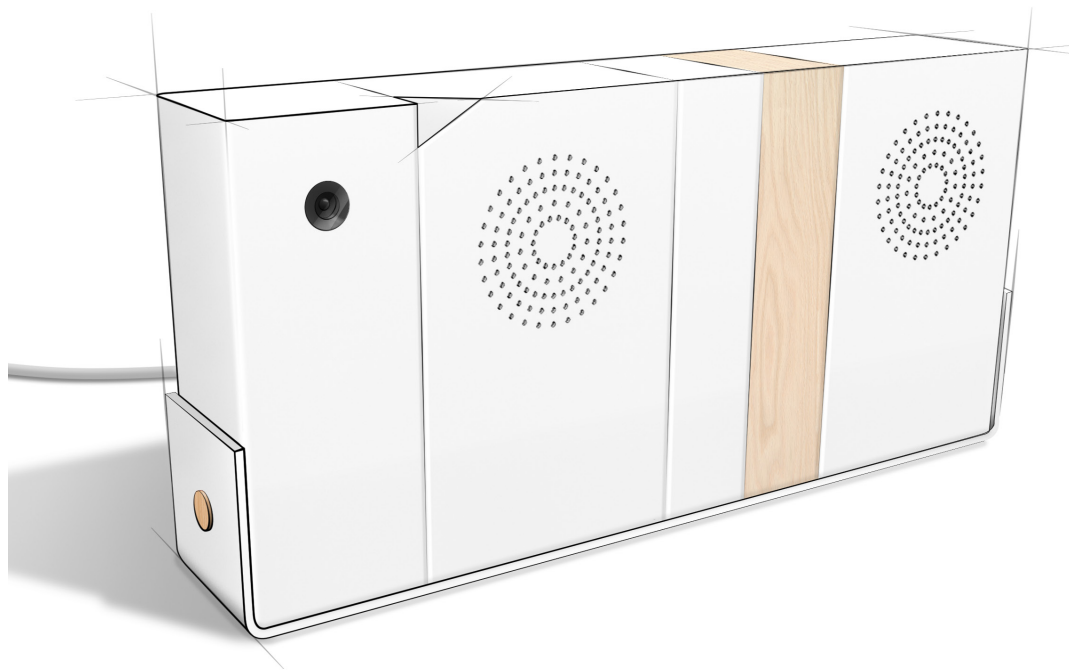
Figure 7.23 Folding of the Björk units
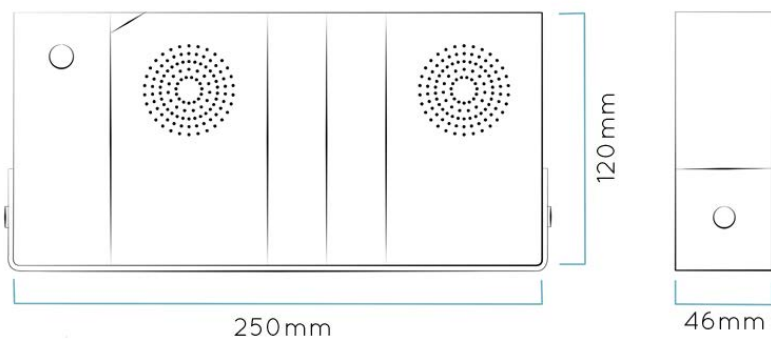

Figure 7.24 Björk concept with all functions active

Figure 7.25 Size of Björk concept

120mm

250mm

46mm

7.3.6 Concept 4 - Android Remote

The aim of the Android remote was to create a concept that would allow the user to use the Android system to its fullest potential. The Android remote is an all-in-one concept based on a remote with a graphical user interface similar to a smartphone.

User scenario

Three friends are watching TV when one of them asks if they have seen the YouTube clip with a talking dog. Fredrik takes the remote and searches for it in the YouTube app. He finds the clip and it starts playing directly on the remote. Fredrik swipes his finger towards the TV, over the remote control screen. The YouTube clip now starts playing on the TV set and they can all watch it together. See figure 7.26.

Functionality and Form

Android is created as a software platform for mobile devices such as smartphones and tablets. In this concept the software is used in a remote control. To allow the software to be sent to the TV a wireless dongle has to be connected to the TV's HDMI port. The remote provides the TV set with internet connectivity and sends content wirelessly to the TV set. The user can thus utilise the possibilities Android provides both in the remote control interface and on the TV screen. This enables the user to watch a TV show and use the remote for other tasks at the same time, see figure 7.28

Having the Android system in a separate device, like a remote, will allow for interesting interactions. A user could for example browse the web and get more information about the show he or she is watching at the same time. The remote can also control the TV set and content could be shown on both the remote and the TV set.

Communication has also a large part in the concept. By including a camera and speakers in the remote, the user can video chat while he or she is watching TV. The user can have the video chat either on the TV or in the remote. With this functionality comes the possibility of both watching TV and video chatting at the same time.

To avoid mistaking the remote for a mobile phone the size of the remote is made larger and more elongated compared to a smartphone. The elongated form makes it resemble a classic remote, which helps explain the purpose of the device, see figure 7.29. The remote has a slightly angled bottom surface to be able to stand upright, see figure 7.27. The upright position can be helpful when for example conducting video chat.

Figure 7.26 Users showing each other content

Figure 7.27 The Android remote standing up

Figure 7.28 Sending content to TV

Figure 7.29 Size of the Android remote

8. CONCEPT REFINEMENT

This chapter describes the process of evaluating and refining the four final concepts. It also presents the reasons behind the choice of the final concept.

8.1 INTRODUCTION

With four concepts created it was possible to start an evaluation against the functional analysis. After deciding on which concepts to continue developing, work proceeded with refining them.

8.2 EVALUATION 1

To help decide on which of the four concepts to develop further they were presented to People of Lava. The concepts were discussed and the feedback was written down for later use. Further evaluation of each individual concept was made against the functional analysis following the meeting with People of Lava. The concepts where also evaluated based on their level of social interaction, level of technology and form language, see figure 8.1. Finally, two of the concepts where chosen for further development before choosing a final concept. These concepts were Camdroid and Social+.

The Björk concept was discarded because the tilt functionality was questioned both by People of Lava and the development team. The purpose of the tilt functionality was to add more physical interaction with the product and to create an interest. The questions was if the tilt functionality would be be used at all and that this resulted in the negative aspect that the user to would have to get up from the couch to power it on. An alternative would have been to put electrical motors in the boxes, so that it could be turned on from a distance. However, this would have been too expensive. The likeness to a static and unwanted set-top box was also considered to be a problem and therefore another reason for discarding the concept.

The Android remote was considered by People of Lava as requiring a lot of new technology to work properly. The development of this type of technology would be expensive and require much time to finish. People of Lava wanted a design that would allow for quick market introduction and the Android remote was considered to be too difficult to produce within a short time frame. Another reason for discarding the Android remote was that similar products exist, both as remotes and as applications for smartphones. Finding a market niche for this type of device would be difficult because of the similarity to smartphones and tablets.

The Camdroid concept was considered to be close to People of Lava's initial idea of the product. The design was considered to be clear and self explanatory. The clarity of the product form would help explain the function to future customers and users. A problem with the design was that it required a redesign of the existing Android circuit board. The next step in the continued development would be to change the design to make room for the existing circuit board.

The Social+ had many qualities that users would hopefully find interesting. The social functions accompanying the separate camera unit was considered to be unique and interesting. The interaction aspects were also interesting enough to give it another iteration of development. Problems that had to be solved were related to semantic functions and how to explain the functionality to new users in a simple manner.

The trackpad remote control concept was considered to work quite well with both of the concepts chosen for further development. Therefore, it was also subject to more refinement in the next phase of the development process.

Figure 8.1 - Comparison of the different concepts

8.3 REFINEMENT OF THE CONCEPTS

Both the Social+ and the Camdroid went through a new iteration of development. In the Social+ concept the development focused more on details. The Camdroid concept, on the other hand, went through more functional changes like finding an acceptable way to mount it on a TV set. The two concepts were refined in parallel.

8.3.1 Refinement of Social +

Focus in refining the Social+ was put on finding a way to give the correct feedback, like how to notify a user of an incoming call. As the concept consisted of three separate devices, the charger, the camera unit and the base unit, the user has to know what to react to. Several ideas on how to place buttons and indicators were quickly created and compared in Adobe Illustrator, see figure 8.2.
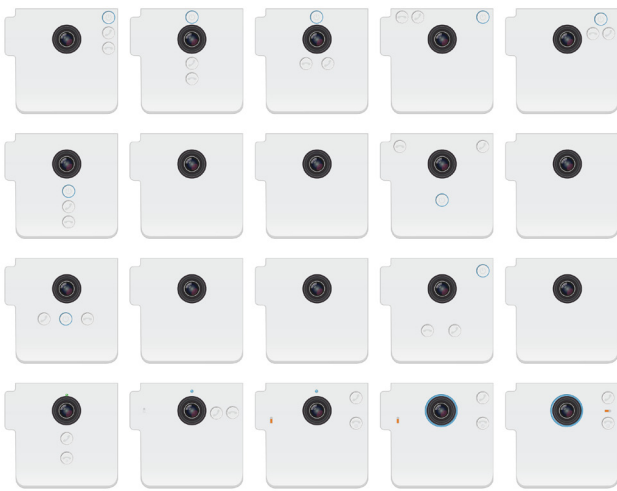

Figure 8.2 Positioning and design of buttons

A mock-up of the Social+ was built from Plexiglas and plastic foam to get a better perception of its actual size, see figure 8.3. When printing a full size blueprint of the camera unit it was realised that it was too small to contain the necessary technology. It was realised that the concept needed an increase in size of 150 percent . With a larger volume the concept felt more producible.
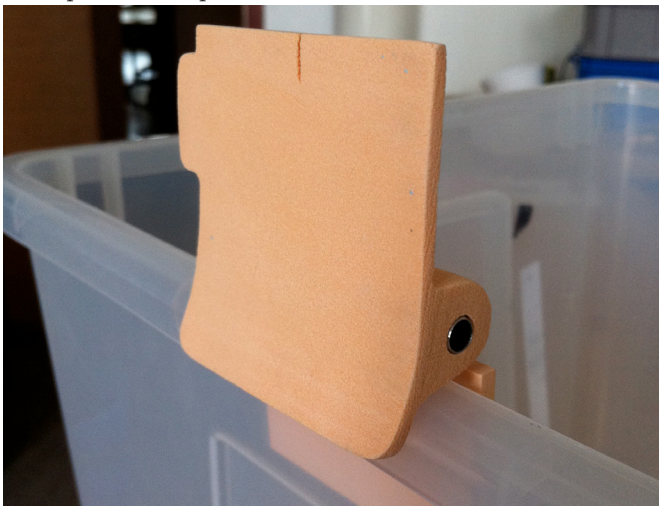

Figure 8.3 Test of mounting function with mock up

The way of how to mount the camera unit on a TV set was further evaluated. Questions regarding the force needed to make it stay firmly in place on a TV had been brought up, would a single clamp be enough? The mock-up made it possible to evaluate the functionality and it was decided that a single clamp would provide an easy and stable way of mounting it on most TV sets, see figure 8.3.

The form of the Social+ was not a big focus in the refinement process. The form was considered to have strong connections to the brand and clearly describing its functionality. No big changes were made to the form during this phase of the development.

8.2.2 Refinement of Camdroid

The most important issue with the Camdroid concept was that it needed to fit the existing circuit board inside of it. The main negative aspect to overcome was that the device would be quite large and risk looking out of place on top of a TV set. To start the development four different distributions of the circuit board were examined, see figure 8.4.
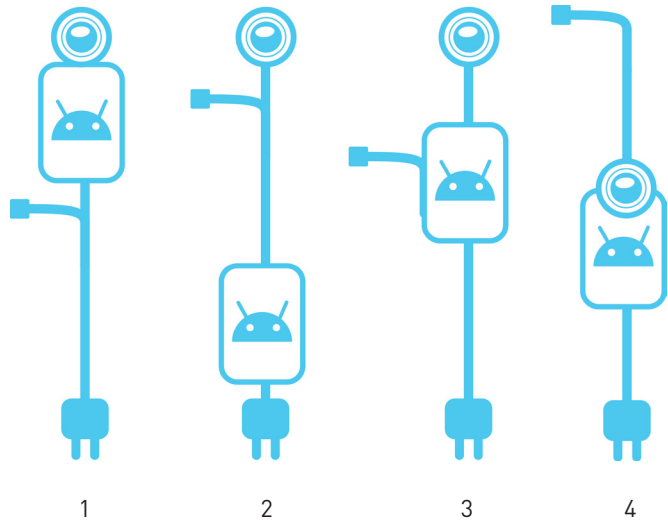
Fig 8.4 -Different distributions of components

The first distribution option is the initial Camdroid concept where everything is put in one static unit. It has one HDMI cable and one power cord attached to the back. As mentioned, this distribution requires a larger shell to fit the circuit board.

The second distribution option is has small camera unit mounted on top of the TV, a unit containing the circuit board placed close to a electrical outlet and long cord between them. This would allow for a slim camera unit but large base unit.

The third distribution option resembles the second option but has the base unit suspended from a cord from the camera, behind the TV set. A second cord runs from the base unit to the electrical outlet. This requires a reliable solution for hanging the circuit board from the camera.

The fourth distribution consists of one single unit hanging by the HDMI cable from the TV mount. A second cable goes from the unit to the electrical outlet.

Several mock-ups were built to to try out these solutions. The mock-ups made it possible to evaluate the strengths and weaknesses of the solutions. It was found that the first and the fourth distribution options were the only ones that allowed a fully functioning mounting. The fourth distribution was considered to be especially interesting since it allowed for a unique mounting on a TV set using the cords as a specific design element.

Concept sketches were made to find variations of aesthetic expression of the two distribution options. With the original distribution it was proven hard to find a form that allowed the product to express the People of Lava values. Most of the ideas where discarded since the circuit board required to much space. Many of the designed units appeared clumsy even when trying to hide most of the circuit board behind the TV set. Several outline shapes where tried in order to find a form that was both interesting and easy to manufacture. In the end, a very simple form was decided on and created in a 3D modelling software, see figure 8.5.

It was easier to find an attractive form that incorporated the People of Lava values for the suspended unit concept. Using the cord as a suspension function and design element made it possible to create a concept that felt unique and new, see figure 8.6 . Because it is estimated that only around 20 percent of all TV sets are wall mounted, the concept was designed to be able to stand next to or below a TV as well.

A choice had to be made between the two alternatives, thus requiring another evaluation. The suspended unit concept was considered to be the only concept that would result in a desired solution. It was also the only concept that could incorporate the People of Lava brand values in an aesthetically pleasing manner. Thus, the choice was easy.
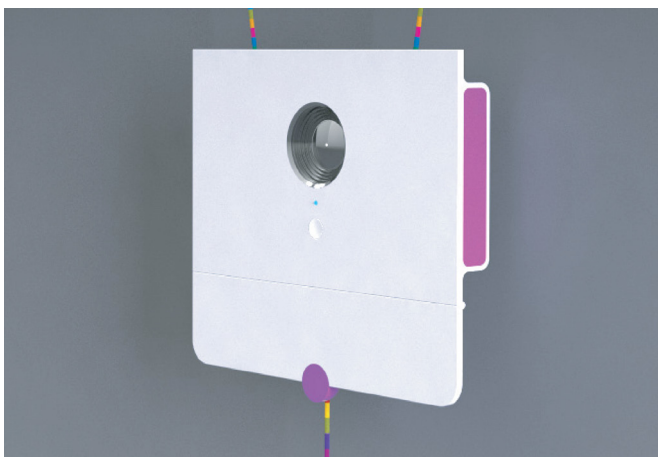

Figure 8.5 TV mounted Concept

Figure 8.6 The Suspended concept

8.2.3 Refinement of the remote

The trackpad remote control concept also went through another iteration with the button layout from Social+ as inspiration. By looking at the Scandinavia remote control and testing it together with the Android software it was possible to get an overview over the functionality of the existing buttons.

Several design issues were found in the trial of the Scandinavia remote control:.

- There are far too many buttons, some with the same functions. The result is that it can be hard to tell which button that controls a certain function.

- The remote was sensitive to transmitter alignment towards the TV set, resulting in occasional unregistered key strokes.

- The rubber surface of the buttons gave little haptic feedback to tell the user whether or not a button had been pressed.

A quick survey was made by testing a few applications to find which buttons were used the most. The survey resulted in the realisation that some changes had to be made to the inter-
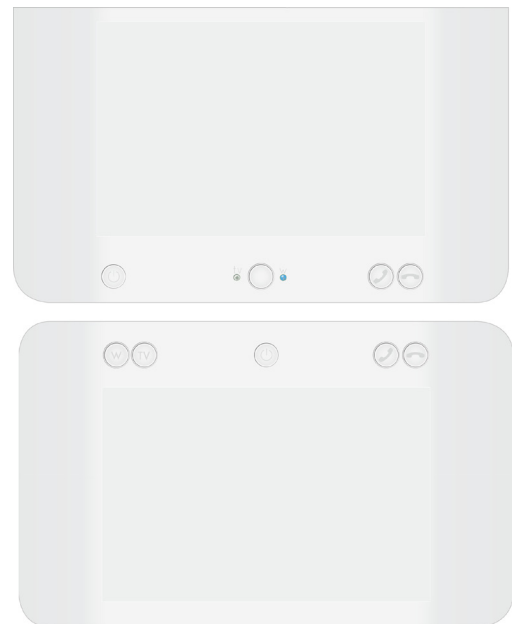
Figure 8.7 - Changing button layout and overall form

face in order to fully allow for a seamless use of the trackpad. More of these thoughts are presented in the final concept.

The form of the remote was also revised. In the original concept the remote had sharp upper corners and rounded lower corners, similar to the shape of the Scandinavia frame, see figure 8.7. This shape was revised by making all four corners rounded to achieve a comfortable feel regradless of which side of the remote that was being used, see figure 8.7. After a few tests it was also decided that the remote was to be flipped along its long side because this was claimed to feel more natural.

8.3 EVALUATION 2

To add a level of objectivity in the choice of final concept, possible users were involved in the decision making process. The users' concerns and the initial research served as the basis for choosing the final concept.

8.3.1 User evaluation

Four users with a design background were presented with the two concepts to start the discussion. They were then encouraged to share their opinions and to ask questions. Because of confidentiality agreements the future product had never been discussed with possible users before this meeting. Thus, their input was considered very valuable.

The users' comments mostly concerned the Social+ device. The users felt that the base unit did not have enough functionality and that the charging of the units was not enough to justify its existence. Why would a user have this unit visible next to a TV? There is no reason if it is not used often. How often would you need to charge the remote and the camera? Probably not often enough to have the base unit visible all of the time.

At the same time the users described that the idea of having a camera unit to bring with you, showing your environment to your friends, was interesting. However, there was yet again doubts about how often they would use this functionality. It was argued that the camera unit itself might be interesting at first, but most likely it is the Android software that would be used. Another concern was that the level of technology in the Social+ concept might be two high to comprehend by some target groups. This could result in that they would be discouraged to use the product.

The users felt more positive towards the Cordroid concept. It was stated that this concept took a greater leap away from ordinary set-top boxes, compared to the Social+ concept. There was one major concern about the Cordroid concept, namely its aesthetics. The Cordroid device was not considered as beautiful as the Social+. The users experienced a higher aesthetic level in the design of the Social+ compared to the Cordroid device. Furthermore, there was also a concern regarding placing a camera beneath the TV set, something that might make a user feel watched.

8.4 CHOICE OF FINAL CONCEPT

The user evaluation gave quite obvious hints about which concept to chose. The choice fell upon the Cordroid concept, knowing that improvements had to be made in the aesthetic expression and some of its functions. The final concept, called the Lava A.I. is presented in the next chapter.

9. FINAL CONCEPT

This chapter is an in-depth description of the final concept. The description includes aspects such as functionality, aesthetics, brand identity, interaction and marketing possibilities.

9.1 INTRODUCTION

The final concept 'Lava A.I.' is a device that adds interactivity, applications and social interaction to TV sets, see figure 9.3. A.I. is an abbreviation of several things like Android Interface, Android Interaction and also a flirt with Artificial Intelligence, as the device can be seen as making your TV smarter. With the Lava A.I connected to a TV set, users get the possibility to socially interact with their friends and family through video and audio chat. A new remote control has been designed to allow for easier interaction with the Window to the World software, see figure 9.2. The entire concept follows what is considered to be People of Lava's form language: innovative but simple, stringent and architectural, see figure 9.1.

9.2 FUNCTIONALITY

The Lava A.I. is a simple device that allows users to quickly connect to the Internet and use Android applications on their TV set. Users can easily switch between regular TV viewing and the Window to the World interface by a simple click of a button. The users can interact socially with their friends by using the device's built in camera together with applications in the software.

The remote control is optimized to support users when browsing the web, writing text and chatting. This is achieved by having two input modes in the form of a trackpad and a keyboard, see figure 9.4. This new remote adds possible

Figure 9.1 The Lava A.I. hanging under a TV set

Figure 9.2 The Lava A.I. remote and device

Figure 9.3 - The Lava A.I. in action - videochat on a TV set

ways of interacting with the Window to the World software, compared to the remote accompanying the Scandinavia TV set. The trackpad can be used both as a gamepad and as a way to control the TV's functions. Using a trackpad as a main input method is motivated by the fact that it is often used for controlling laptops and personal computers, thus resulting in an interaction familiar to most users.

The speed of the interaction provided by the trackpad enables the device to compete with state of the art products such as tablets, smartphones and laptops. Because of this, a user might end up spending even more time in front of the TV, using it in for two way communication in a more intuitive manner. The Lava A.I. makes TV watching more social, both with people physically close to you and people far away. With the Lava A.I. users can bring their friends into their living room.

9.2.1 Main Functions

The unit's main function can be divided in two sub functions: social video communication and the use of applications and Internet browsing.

The video communication allows users to stay in touch with their friends and family. The communication is acheived through several apps within the Window to the World software, like Skype for example, see figure 9.1. Using apps, users can easily be contacted and contact their friends on a platform that they are used to. Video communication can either be done in fullscreen mode or by using the TV's picture in picture function, see figure 9.6. The device has a microphone for picking up speech and two loudspeakers to deliver sound from the other caller, even when the TV set is turned off. The TV could be used as a means of communication, on its own or together with TV content.

Subfunction two is the use of the Window to the World software to browse the internet or download and use applications, see figure 9.5. This also includes the use of apps like e-mail, Facebook, YouTube and Twitter. As the Window to the World software is based on Android, a software common in tablets and smartphones, the functionality of this device is similar to that of a smartphone. However, in this device the software has been redesigned to better function on a TV set. A user can download apps from People of Lava's own application market. Switching to the Window to the World mode is made by a simple press of a button on the remote. The similarities with the smartphone system allows the user to use the same type of mental model, allowing rapid learning.

Figure 9.4 Device with Window to the World software

Figure 9.5 Device with Window to the World software

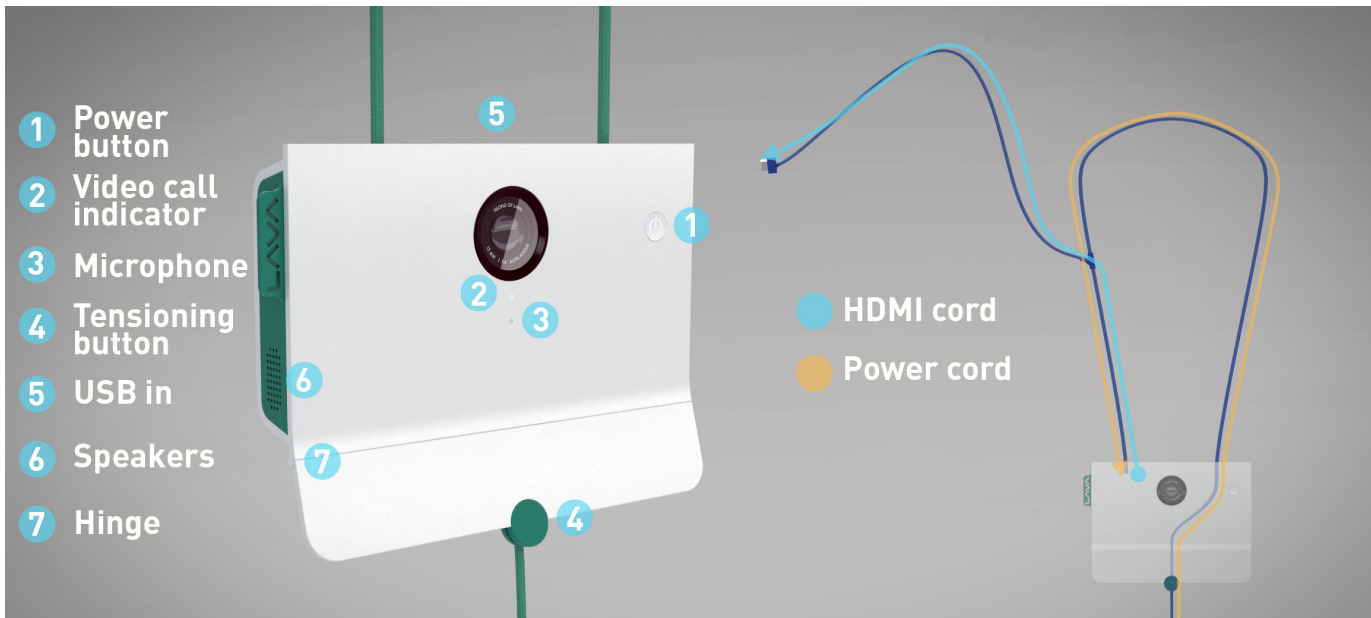Figure 9.6 Chat With picutre in picture.

Power button 1
Video call indicator 2
Microphone 3
Tensioning button 4
USB in 5
Speakers 6
Hinge 7

HDMI cord
Power cord

Fig 9.7 Parts and cord layout of the Lava A.I

9.2.2 Physical Functionality

The Lava A.I. consists of a base unit equipped with an Android circuit board and a camera. The base unit is 160 mm wide, 120 mm high and just 30 mm deep.

The base unit is connected to the TV by a HDMI cable and power is collected from a regular electrical outlet, see figure 9.7. A short part of the looped cord houses both the power and HDMI cables, see figure 9.7. To meet legislation requirements the power must be below 42 volts to run next to the HDMI cable. The top side of the base unit has USB socket to allow the user to connect other devices, such as 3G dongles and flash memory sticks. The placement of the USB input ensures that the user can easily connect their USB devices. In order to provide Internet access the device needs to be fitted with a Wi-Fi or 3G card to the Android circuit board inside the device.

The base unit can be placed in three different ways: hanging it below a wall mounted TV set, hanging it from a wall mount, or placing it on its stand next to or in front of a standing TV set.

The Lava A.I. has an innovative way of attaching it to a wall mounted TV set. A long cord goes out from the top left side of the base unit and into the top right side, creating a loop above the unit. The cord continues through the base unit and exits in the center of the bottom side, see figure 9.7. By putting the loop around the TV set the device can be hung from TV's wall mount, see figure 9.9. The loop can be adjusted by pressing the tensioning button and pulling the cord up or down to tighten or enlarge the loop. This is similar to tightening a neck tie or a drawcord in a sport garment. The solution makes placing the device on a wall mounted TV set simple and easy to understand. In some cases the device can be mounted in similar fashion on a standing TV set, depending on the distance between the TV set and the flat surface it stands on.

To ensure that users can connect the device to the TV set, the extension of the HDMI cable from the looped cord is long, close to 750 mm. The end of the bottom cord has a power plug. If the
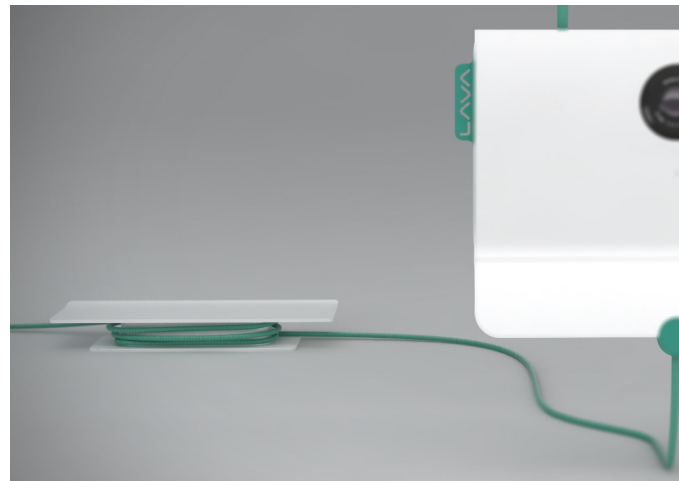

Figure 9.8 The Lava A.I also comes with a cord holder accessory that also works as a wall mount.

user feels that the cord is too long, he or she can wrap it around the cord holder accessory delivered with the device, see figure 9.8. If a user does not want to, or can not, mount the device on a wall mounted TV it can use the cord holder accessory as a wall hanger, see figure 9.10. The cord holder is easily attached to the wall by two screws.

The last alternative for positioning the device is to place it next to or below the TV on a flat surface. This is preferable if the TV is placed on a stand, as the distance between the flat surface and bottom of the TV screen often is not large enough to allow hanging the Lava A.I. from the TV stand. A stand can be created by folding the lower part of the base unit backward, see figure 9.11. The hinge has a built in resistance allowing the user to adjust the angle of the unit. The built in resistance is similar to laptop screens where users can rotate the screen for a comfortable viewing angle.

With these three different methods of positioning the product, the Lava A.I. will fit all types of TV sets.

Figure 9.9 The Lava A.I. hanging from a wall mounted TV

Figure 9.10 The Lava A.I. mounted ona wall with the cord holder

Figure 9.11 The Lava A.I. standing in front of TV set

9.3 THE LAVA A.I. REMOTE

It is believed that this type of device needs to have a well functioning remote to provide a comfortable, fast and easy experience of the whole system. This is a necessity if the user should favour the Lava A.I. instead of reaching for their smartphone or tablet. The existing remote for the Scandinavia TV does not support this need. A remote has been designed to support the fast and comfortable experience provided by the Lava A.I. The remote has two different input modes: a trackpad and a keyboard, see figure 9.12. The trackpad enables the user to easily browse web pages and use apps. This is similar to a laptop and allows for quick and simple input commands.

In most cases when surfing the Internet a user clicks on bookmarks, links and scroll up and down on web pages instead of writing the entire URL, regardless of which product is used. Text input is therefore a secondary, but necessary, function resulting in the combination of both a trackpad and a keyboard. On the opposite side of the trackpad is a QWERTY-keyboard, see figure 9.13. Shifting between these two methods of input is done by flipping the remote along its long side. When flipping the remote a gyro registers the change and turns off the input mode that is facing down. This eliminates the risk of entering commands on the opposite side of the remote.

A large reason for using the trackpad is the ability to implement the use of gestures in the interaction with the system. With simple movements and gestures with one or more fingers on the trackpad the user can input commands, see figure 9.14. This is common in both computers and tablets and will therefore feel natural in this type of product as well. Browsing the web with the trackpad could work like this: Scrolling up and down a web page is done by swiping two fingers up or down on the trackpad, while swiping two fingers left or right corresponds to back and forward in the web browser, see figure 9.15. The trackpad could also be used even more extensively in specific apps, like games, where it can be turned into a gamepad.

When using the remote, commands are transmitted to the base unit by a radio transmitter. This results in a well functioning and safe transmission speed, even when the remote is not aimed at the device. The remote is also equipped with a IR transmitter to enable the user to control any TV set as well, similar to a universal remote. This function works by downloading settings for specific TV remotes and TV sets in the Window to the World system. It is also possible to copy the signals from a remote if the software is not available in the Window to the World system. In TV mode the buttons on the keyboard works as a regular remote, while the trackpad functions in another way. Using gestures similar to those used in the Window to the World mode, channels could be changed by swiping two fingers to the right or left. Swiping two fingers up or down results in an increase of decrease of the volume level, see figure 9.15.

The trackpad side of the remote has five buttons, see figure 9.13 Two buttons to the left enables the user to switch between controlling the Window to the World mode or the TV mode. To clearly show the users which mode is active, the button of the active mode lights up when pressed. The button in the middle functions as a power button for both the TV set and Lava A.I. depending on which mode is active. The two buttons to the right are used to answer and end or deny calls. The buttons are placed above the trackpad to minimise the risk of pressing them by mistake and to avoid the user from concealing them with the hands when using the trackpad.

On the keyboard side of the remote there are three extra buttons at the top for functions that are used often, see figure 9.13. To the left is a home button which takes the user to the home screen of the Window to the World interface. The middle button takes the user to the applications menu and the right button toggles the menu in all apps and on the TV. These functions can also be toggled by specific gestures on the trackpad side.

Figure 9.12 The Lava A.I. remote

Figure 9.13 Keyboard (top) and trackpad (bottom) side of the remote

Figure 9.14 The user controls the Window to the World software by moving an onscreen cursor with the trackpad

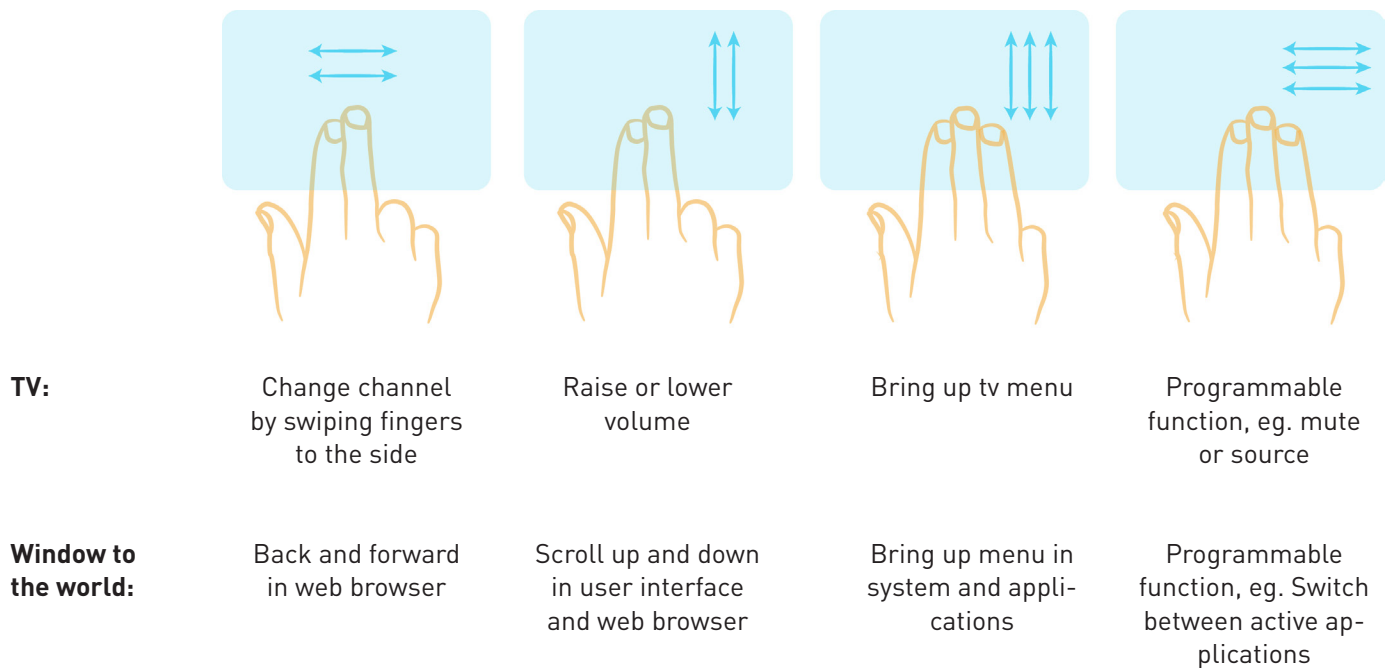| **TV:**	Change channel by swiping fingers to the side	Raise or lower volume	Bring up tv menu	Programmable function, eg. mute or source
Window to the world:	Back and forward in web browser	Scroll up and down in user interface and web browser	Bring up menu in system and applications	Programmable function, eg. Switch between active applications

Figure 9.15 The gestures give the user the possibility to easily control and navigate the user interface and TV

Figure 9.16   Design cues in the Lava A.I
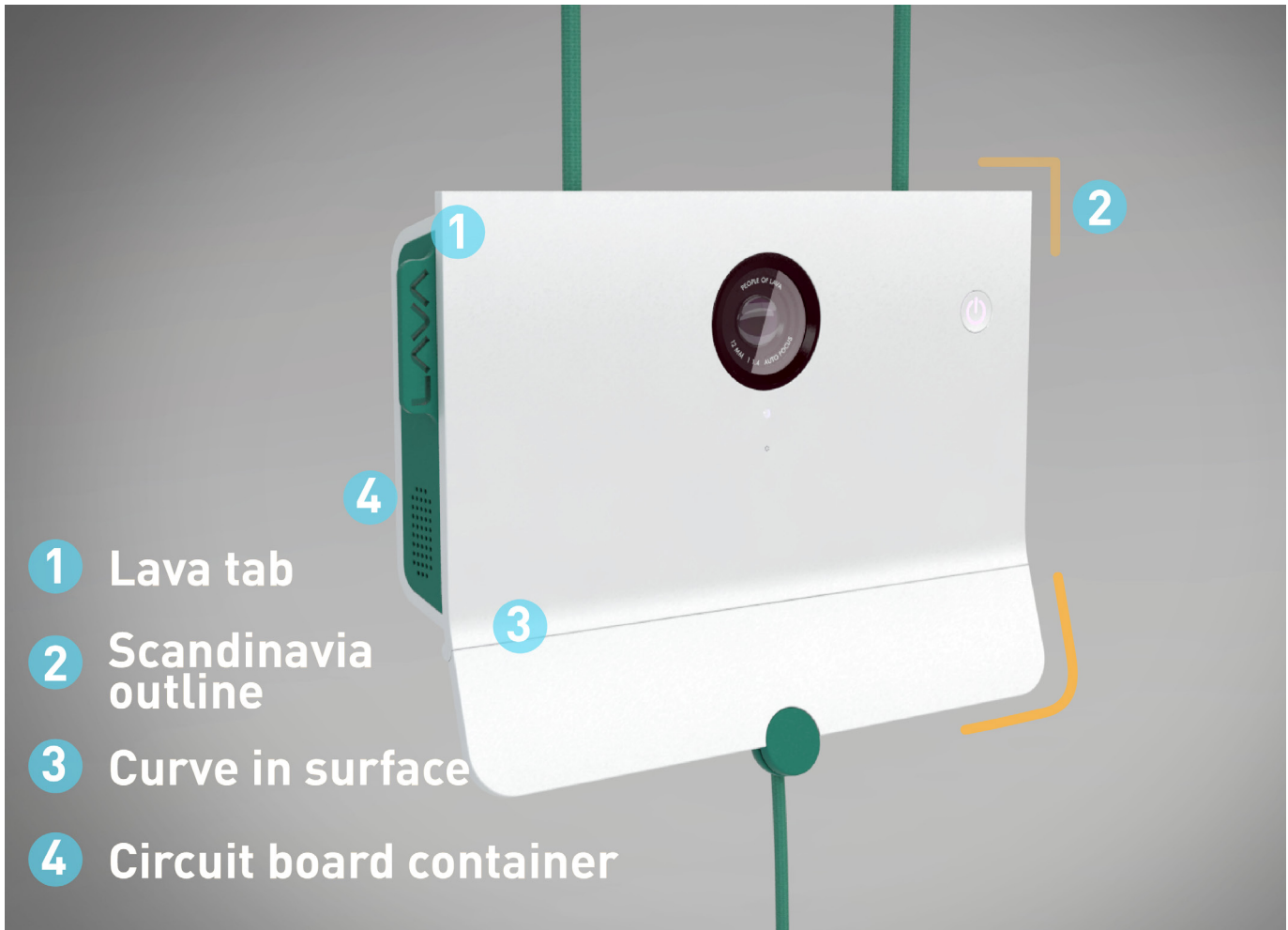
1 **Lava tab**

2 **Scandinavia outline**

3 **Curve in surface**

4 **Circuit board container**

9.4 FORM AND BRAND IDENTITY

The overall form was inspired by the design of the Scandinavia TV set. It was agreed that the Social+ concept had an attractive form and this could be transferred to the Lava A.I. concept. Another big inspiration for the form in this device comes from other products where the cord has a prominent role in both function and form, such as lamps and headphones.

The overall form is based on demands of functionality. It satisfies both the basic function of enclosing circuit board and at the same time clearly descibes that the product has a camera. By placing the circuit board container at the back of the unit (see nr 4 in figure 9.16) the front surface unobtrusively highlights the camera. This is done similarly with the hinge for the stand, where the function exists but almost blends in with the angled bottom, not disturbing the impression of the overall shape. The outward angled bottom part of the front surface (see nr 3 in figure 9.16) helps to create a dynamic and interesting form. The angled surface creates reflections and also adds contrast to the device. This radius going into the curved surface is not a part of the stand and remains visible when the device is placed on a flat surface, see figure 9. 17. This way the dynamic look is retained even when the device is not hung from a TV set.

The camera is placed in the unit's horizontal centre. The on/off button and the Lava tab is placed far out on each side of the camera to create balance. Balance is also the reason why the camera/call indicator and microphone are placed below the camera. The rest of the front surface is free from other forms, creating a clean and minimalistic expression in line with the perceived People of Lava form language. At the same time the camera has been made large to clearly communicate the products function.

An outline similar to the Scandinavia TV set has been used as another visual cue to the brand, but also has a function in describing direction, see nr 2 in figure 9.16. The sharp top corners connect to the TV frame when the unit hangs below a TV set. The rounded corners in the bottom creates a soft expression and helps to describe an end of the unit. When the unit is placed on a surface the rounded corners are not visible, but here the previously mentioned expressions and relations are not as evident. Another reference to the Scandinavia TV is the use of the Lava tab. It is considered that the form of the tab and the logo are the most important cues of this element. Playing with the colour of the tab still keeps the brand recognition cues intact.

Reference is given to the angled surface at the bottom of the device in other parts of the design. The form that encapsulates the circuit board on the back has angles and radii that create a connection to the form of the front surface. The
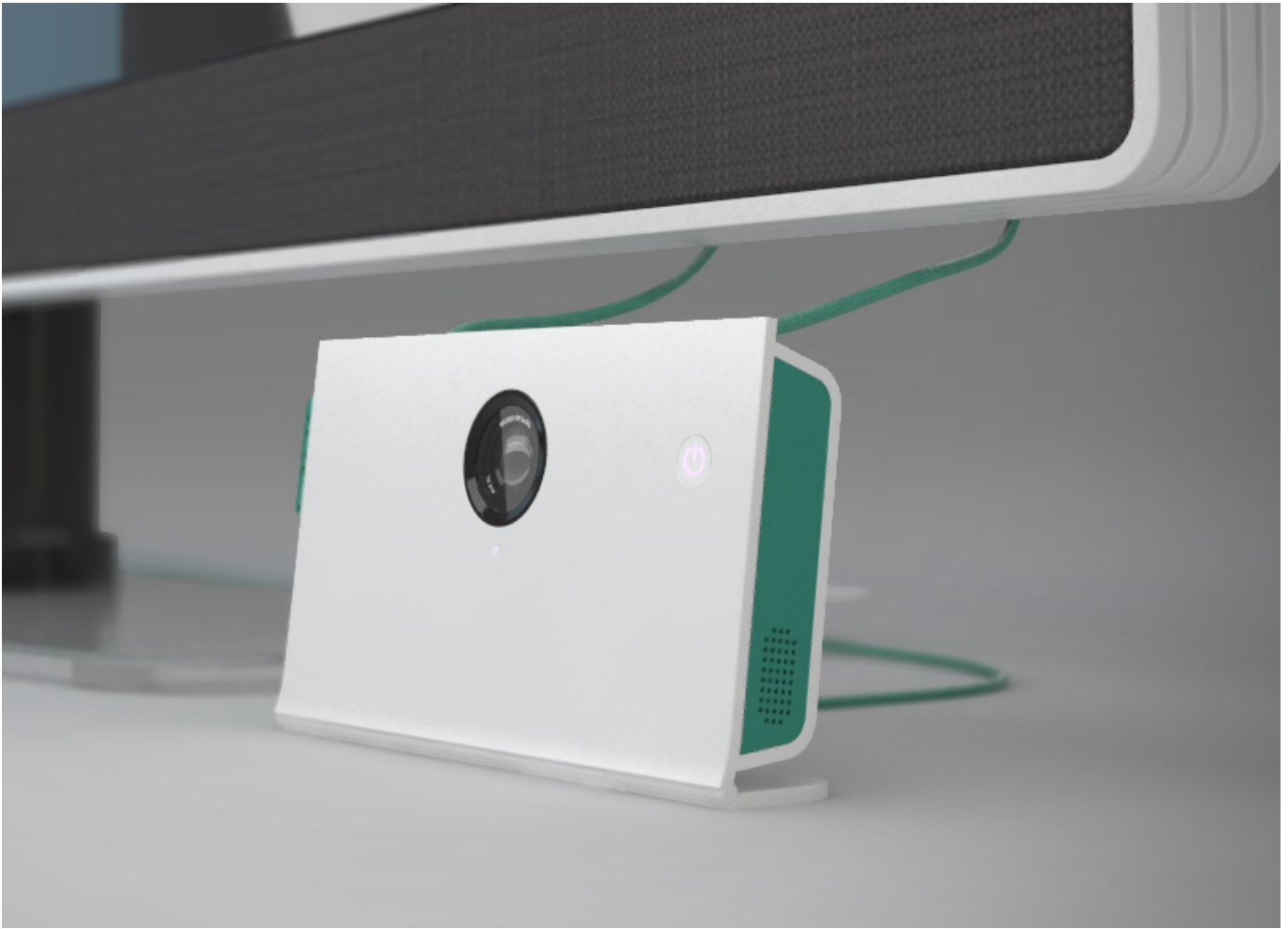
Figure 9.17   Unit standing below a Scandinavia TV set

remote has a similar angled top surface that also creates a comfortable grip, see figure 9.18. The rounded corners in all of the parts of the concept are also consciously designed to create unity in the overall design.

One of the most prominent design features of the product is the use of the textile cord. The cord is a very important aspect of the functionality of the concept, making it possible to mount the device in several different ways. Furthermore, the cord strengthens the unique expression of the device and makes it stand out from competing products. The cord also helps in explaining how the device should be used and describing what it is. Using a textile cord of high quality creates a feature that is prominent instead of being something that would otherwise be hidden, see figure 9.19.

Suspending a device like this functions as an attention grabbing feature. The suspension function is something that has never been seen in this type of product before. It could therefore connect to the potential customers' desire of having something novel yet understandable. Because of this feature the unit will get a highly visible centered position in a living room. This is in line with People of Lava's strive to deliver innovative solutions.
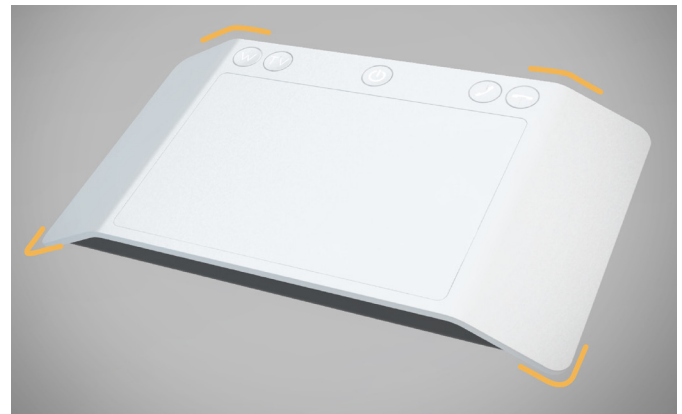

Fig 9.18 Design cues on remote

Figure 9.19   Textile cord of high quality

9.5 COLOUR AND COBRANDING

Colour has had a large part in the concept. Using different colours on the side surfaces and the cord creates contrast in the device, which also connects the device to the brand form language. The contrast in itself creates an attraction and the colour makes the device stand out. The colours have been chosen to stand out in a modest way (see figure 9.20) and help to create interest in the product. Electrolux chief designer Henrik Otto once said: 'By offering several different colourways in a product the question the customer will ask itself is not whether or not to by the product, but which colour it should choose'.

More sober colourways must also be available to customers who want alternatives to the more loud colours. To connect to the colours in People of Lava's TV sets, gray and white should also be offered as alternatives. The more loud colourways will function as an attention grabber in stores.

The colours also have a main function in the case of cobranding, a possibility that has been discussed throughout the project. An option would be to use the coloured surfaces as a way of identifying specific brands, see figure 9.21. An example of this could be the Telia brand, where the purple colour of their graphical identity is used and where the logo is displayed on the tensioning button.
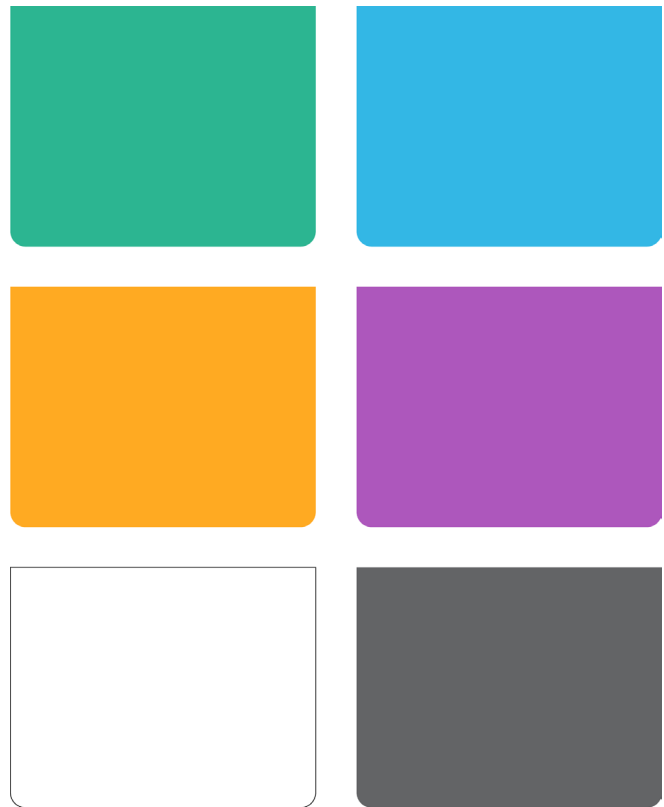

Figure 9.20 The Different colours of the Lava A.I.

Figure 9.21 Cobranding with Telia, using the cord and the side colors to represent the brand

9.6 INTERACTION

The Lava A.I. is turned on by pressing the power button on either the remote or the base unit. When it is turned on a sound is played and the power button lights up, giving the user clear multimodal feedback. The power button on the unit is placed to the right to make it possible for the user to easily turn it on with one hand, see figure 9.23.

When a call comes in, the light below the camera starts to blink and a ringtone is played through the loudspeakers. By involving several senses in the feedback, the chances of a user understanding and noticing the incoming call are increased. The user answers the call by pressing the button on the remote and the TV set automatically switches to the Window to the World mode. If a user ignores or declines a call the light stops blinking and the TV stays in the mode it is currently in.

The light below the camera is turned on as long as the camera is sending information, giving the user a clear feedback that the camera is being used. To make a call the user uses applications within the Window to the World software. In the applications the user can find contacts and change call settings.

When a video call is active, sound comes from the loudspeakers of the TV set. If a user instead wants to watch TV but still continue having a voice chat, the sound comes from loudspeakers of the Lava A.I. This function could also be used if the TV supports picture in picture, so that the user could continue having video chat and watching TV shows. This functionality adds a social level to normal TV viewing.

Sound is another important aspect in the design of the device, especially in the software. Sounds informs the user about events that are taking place in the interaction with the interface together with visual notifications. This multimodal feedback allows the user to easily comprehend and use the product more effectively. Sound can be used to direct attention to the device or the TV screen.

Sound is also important when physically interacting with the product by affecting the overall feeling of quality and the quality of feedback. An example of this can be the sound that is created when the touch pad of the remote control is clicked, see figure 9.22. This sound should give an impression of robustness and quality by giving hints about how the remote is constructed. This sound should be constantly equal in volume and character to provide the user with the desired impressions. The same is true in all haptic feedback of the device. The buttons on the device and the remote are designed to allow the user to feel their position and at the same time provice a clear feedback of when pressed. Ensuring that all sensory impressions of this multimodal product are equal and coherent increases the perception of overall quality according to the optimal match theory.

Figure 9.22   Interaction with the Lava A.I.

9.8 SUSTAINABILITY

The sustainability aspects that were considered in this project are mainly manufacturing processes, the number of components in the design and the use of materials for the casing of the device.

Aluminium is used as the main material for the casing of the Lava A.I. About 8 percent of the earth crust consists of aluminium in different minerals (Sapa, 2009). According to Sapa (2009), a well renowned maker of aluminum profiles, practically all aluminum can be recycled and reused in new products in an endless cycle. This can be done with no loss in quality and only a few percent is lost in the process of recycling.

Recycling aluminium requires only 5 percent of the energy consumption that is needed for making new aluminium from minerals (Sapa, 2009). About 25 percent of the consumption of aluminium in the world today consists of recycled aluminium (Sapa, 2009). Sapa (2009) adds that the known aluminium deposits will be sufficient for several centuries ahead at the current rate of production. The recyclable and durable properties of aluminium makes it a good choice of material for this type of product.

The casing of the Lava A.I. is made from extruded aluminium. This provides a sturdy design and a low number of parts due to the possibility to incorporate several components in the same section. In this case, the front and back parts are extruded from the same piece of aluminium. The stand and its hinge is extruded from another part, again keeping the number of parts low. A low number of parts allows easy assembly and disassembly, resulting in low energy consumption in production and recycling. An easyily disassembled product increases the chances of recycling its materials separately and correctly.

The device will not be subjected to high wear and tear during it's life cycle, thus not requiring to be manufactured from high grade aluminium. Production costs and environmental effects can be kept at a minimum by using recycled aluminium. More of the components in the device could be manufactured from recycled materials which would allow promoting the device as a truly environmentally friendly product. From a brand perspective this could also be connected to People of Lava's Scandinavian heritage, increasing the premium feel of the product. This image would also fit the intended target group of young environmentally conscious consumers.

A large part of the energy used by the product during its life cycle will be consumed during active use or in standby mode. The Lava A.I. should therefore be programmed to enter standby mode whenever it is not in use to reduce energy consumption. The device should be ready to instantly start up when it is needed, but the electrical components and software settings should be used in a way that keeps energy consumption low at all times. Another important energy aspect is the batteries used in the remote control. By using rechargeable batteries the energy consumption will be lowered. The user can be motivated to use rechargeable batteries by allowing them to charge the remote from the same power source as the Lava A.I. main device.
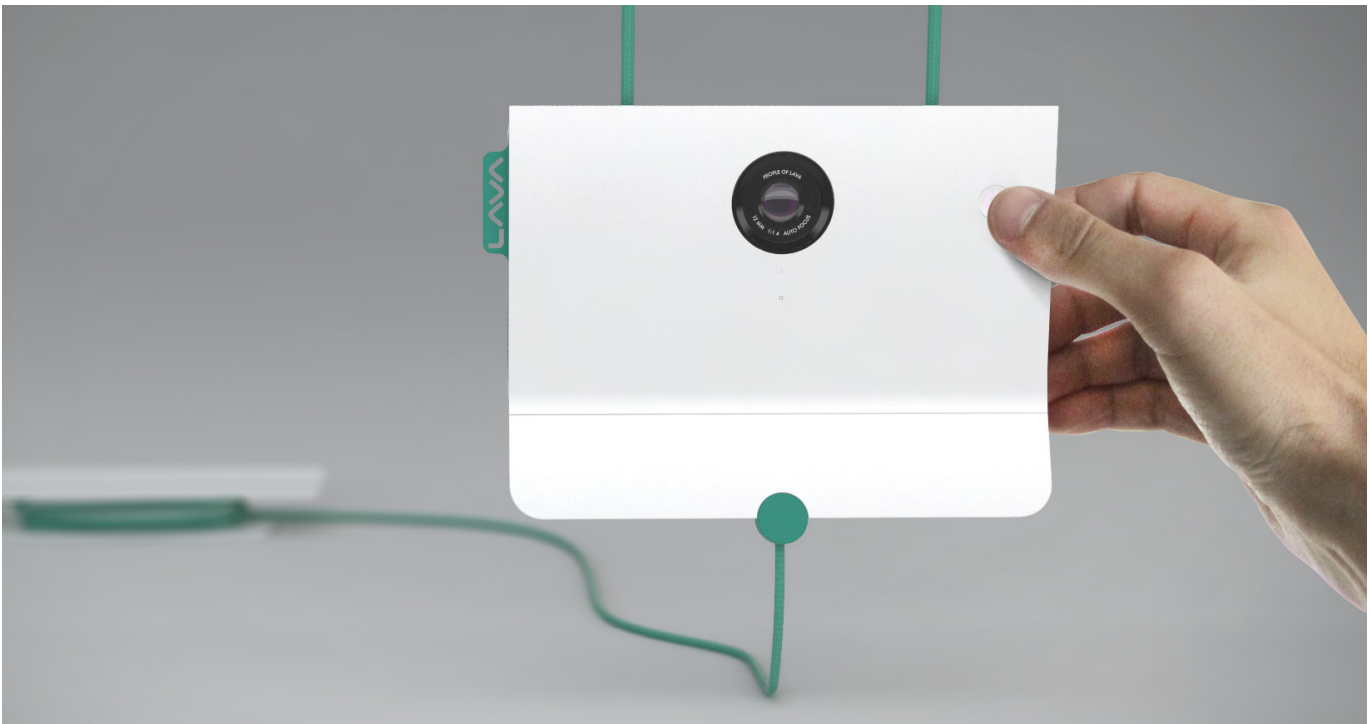

Figure 9.23 **Powering on the Lava A.I.**

9.7 MATERIALS AND MANUFACTURING

The Lava A.I. was designed to be manufactured in extruded aluminium, following a suggestion from People of Lava. Therefore, the profile only has straight lines and a simple form, see figure 9.24. Extruded aluminium would keep manufacturing costs low while still providing an exclusive and rigid impression of the finished product.

Two parts of extruded aluminium, one being the casing that encapsulates the camera and circuit board and the other is the stand. The hinge is designed to be an integrated part of the two extruded parts. By integrating the hinge it becomes less visible from the side of the device, but also from the front when the stand has been folded backwards. This also eliminates the need to fit a separate hinge to the two aluminium parts during manufacturing. However, the two aluminium parts require that pockets are milled in the hinge before they can be fitted together, see figure 9.25.

The extruded aluminium part containing the circuit board leaves two open ends that are covered with lids in injection moulded plastic, see figure 9.23. The advantage of injection moulding these parts is that the holes for the loudspeakers and the Lava tab can be part of the same mold, requiring no additional processing. Any colour of choice can be added to the plastic before it is moulded.

Using textile for the cover of the power and HDMI cables adds to the exclusive impression of the device. The textile stands out from most other cords that usually have plastic covers. It also adds a nice texture to the cord which attracts attention to the product.
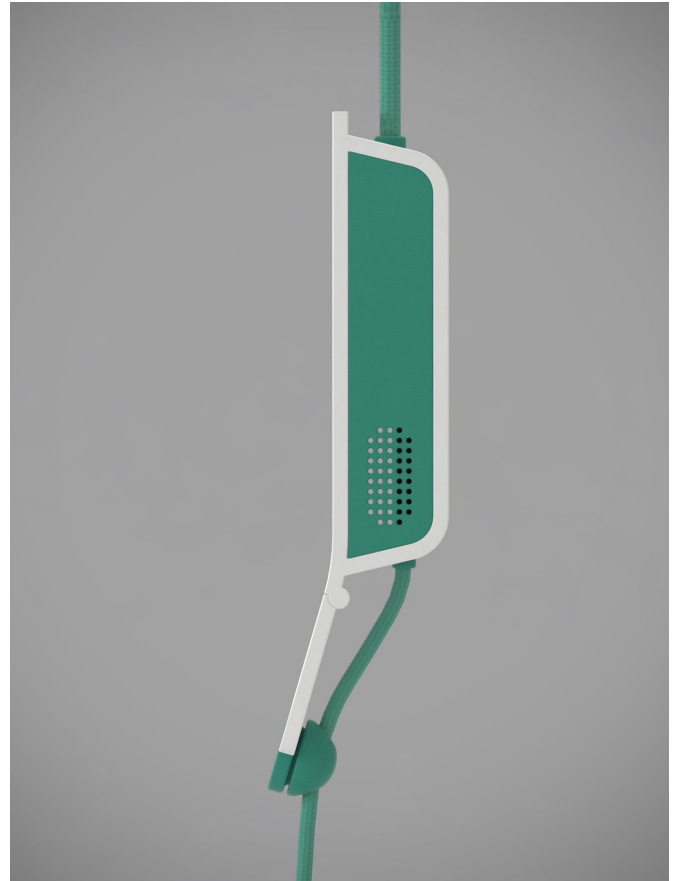

Figure 9.24 Sideview of the device

Figure 9.25 Exploded view of the device

9.9 MARKET POSSIBILITIES

The Lava A.I. has been designed to fit a very large target group and at the same time fit most living room settings. This is accomplished by the sober look of the unit and the use of familiar interaction methods. Although, the focus has been to design the device for use in living rooms, other user environments have also been taken into consideration. For example, the device could be used by companies as a videoconferencing solution in conference rooms where a TV or projector is available.

Another market segment that is already being exploited People of Lava's is hotels. The unit could be sold to hotels, where the Window to the World interface and applications can be customised to suit a specific hotel's needs. The hotel can then create even more interaction possibilities for their customers, for example by using customised applications. Hotels could easily add the Lava A.I. to their current solutions, not having to exchange their existing TV sets.

A third possible market for this product could as an aid to hearing impaired persons. Video calls are already common in this user group and this device could make them easier by having them from the comfort of the living room. A positive aspect is that this product is a big step away in both form and function from the hearing aid products. Hearing impaired users would not regard this product as an aid but as an everyday product, thus not being reminded of their condition.

Figure 9.26 The Lava A.I in its natural habitat

10. DISCUSSION

This chapter contains the authors' reflections on the final result and the development process.

10.1 INTRODUCTION

During this project several factors have been taken into account when designing the new product for People of Lava. User studies, technology research, visual brand identity and a large amount of creative ideation have all contributed to the final design of the Lava A.I. concept. As this type of product is completely new with no other products to directly compare it to, juggling all aspects of user interaction and product design has been challenging.

The project has had an open goal and a wide scope to leave room for unique and creative solutions. This has made it challenging to find where to look for information. The need for secrecy has made it difficult to speak to outsiders about what was being developed and made it hard to gather user input. In the end we believe that the product design will meet most of the demands that users will have on this type of product.

10.2 THE LAVA A.I.

People of Lava has a history of creating innovative and unique products and we felt that it was of high importance to find a design that both stood out from competing products but still fits the brand. One of the things that make the Lava A.I. stand out from the competition is they way it is positioned in relation to a TV set. We believe that this function enhances both the interaction and visual appearance of the concept. Cords are something that most people try to hide and get rid of, but by creating something that 'pops out' and is beautiful at the same time, users will want to do the opposite here.

10.2.1 Functionality

The communicative aspect of the concept is something that has been widely discussed throughout the project. In the beginning of the development process the focus was put on trying to find a main function for the product. Having the interaction possibilities of the Window to the World software is one thing, but another important function was required to not just design another set-top box. At first we did not think that adding a camera to a TV would make the users interested in the product but the focus group generated several positive comments and interesting discussions that made us change our minds. Instead we saw a wide array of possibilities in creating a more social living room.

The degree to which communicative functions were added to the product had a strong impact on the different concepts that were created. Therefore, several different concepts were created where different ways of interacting with the device and different ways of communicating through the device were varied. By doing so we tried to challenge People of Lava's, and our own, way of looking at the product to be. In the end we believe that we have created a product that is novel yet familiar.

During the project the question of what function is of most importance, the communicative function or the interaction with the Window to the World software, was a reoccurring

subject. We believe that the functionality of the Window to the World software is what people will use the most, being able to quickly switch between watching TV and browsing the Internet. However, the communicative functions are also of great importance. The social functionality and the simple fact that the device has a clearly visible camera makes users notice it. It also makes the device differentiate itself further from a simple set-top box. The device can also help in creating a more social living room environment, making people more social in their own home even if they are far away from friends and relatives.

10.2.2 Interaction

A critical aspect to both the communicative and the interactive functionality of the device is the trackpad remote. When trying out the Scandinavia TV we realised that using the existing remote in the new product would exclude a very large user group that is used to fast and intuitive interaction. The input of commands, the speed of text input and the navigation when surfing the Internet were not functioning very well. Furthermore, the remote had to be pointed directly towards the television to be able to transmit any key strokes. By instead using a trackpad for most functions, primarily the navigation in the user interface and when browsing a web page, the interaction speed would increase greatly. Because this way of navigatiing is common in laptops and computers the interaction feels familiar and comfortable. With this functionality power users (users with a high level of experience in similar gadgets) might use this device instead of for example smartphones and tablets.

Another aspect that has been widely discussed throughout the project is the possibility of routing the TV signal through the Android system before it enters the TV processor. This would make it possible to increase the experience of the TV medium. Information about current TV shows, interactive TV schedules and connectivity to streaming services would allow the user to gain many advantages compared to having the systems separate. Interaction aspects such as onscreen notifications of incoming calls would also help in creating a more streamlined experience. This functionality has been discarded in this project due to technical difficulties and the need for large changes of the software, but would be a welcome addition in future People of Lava products.

We also feel that by updating the software, by adding plugins for Adobe Flash and Microsoft Silverlight to allow the use of streaming services, would make more users interested in this type of product and create an even larger market.

10.2.3 Form

When comparing People of Lava's current products it has been shown that they have few similarities in form. We are confident that form is of the outermost importance to a premium brand in order to create a visual identity expressing the brand values. In this project we have tried to create a possible route for continuing and expanding on the form created in the design of the Scandinavia. We consider the Scandinavia TV set to be a product that is unique on the TV market and

that it has several design cues that could identify the brand. These design cues have been used in the Lava A.I., such as the Scandinavia outline shape, the Lava tab and the overall sober and minimalistic Scandinavian feel. We believe that the Lava A.I. also shows how People of Lava could continue towards strengthened form expressions and brand values in future products.

10.3 PROCESS

The design process has been divided into four parts: Technology and market research, user studies, form development and creative ideation. The structure of the work was mapped out in the beginning but several shortcuts and detours has been taken along the way.

In the research for the project it was hard to find relevant information in literature and articles. As the technology is new and fairly unexplored by competitors we had to look elsewhere for information. Videos of several technology and product presentations were viewed and blogs about gadgets and new technology read. Consequently, watching TED talks and Youtube clips did not feel like real research in the beginning. However, paired with knowledge from our education the information gathered turned out to be a good source for the future development process.

The user studies had a large part in the result of the project and we learnt a lot from them about user habits and preferences when it comes to interactive products. The data collected during the focus groups could be used in the entire project to create and evaluate new concepts.

The form development started early in the project when trying to find interesting form unrelated to the technical aspects. This process turned out to be harder than expected as trying to create form without any boundaries was challenging. We found that the best way of creating form is by looking at other products, creating moodboards and product boards for inspiration during the form development. It is always hard to evaluate form but by using our common sense and knowledge from our education we believe we have made the right decisions.

Economy and costs have been considered throughout the process but not in great detail. Cost has been weighed against function and form alternatives in every decision. In the end we believe that the product will be both producable and economically feasible.

11. RECOMMENDATIONS

This chapter provides recommendations for further development and market introduction of the final concept.

11.1 RECOMMENDATIONS

A small evaluation has been done on the Lava A.I. concept resulting in positive feedback from possible users. Further verification of the final concept is necessary to gain more knowledge about user preferences and thoughts on the functionality. This data could become very important in a future realisation of the concept. Economic factors must also be considered when evaluating the concept further.

The Lava A.I. has been designed to function well together with the already existing Android circuit board. During the process it has been realised that creating a solution that positions the camera on top of a television is hard due to the size of the circuit board. In the future, refinement of the circuit board to make it much smaller could result in solutions that allow for mounting on top of a TV set.

Speed, comfort and simple interaction is of great importance in creating this type of product. We believe that this could only be done through the use of a well designed remote. The remote designed in this project is one alternative, but it must be evaluated thoroughly and fitted with good components and materials.

With the release of the Scandinavia, People of Lava started using a unique form language that really stands out on the premium TV market. We believe that it is of the essence that form continues to play a large role in future People of Lava products to compete with products from Bang & Olufsen and Loewe.

We believe that developing the Android circuit board and the camera, and maybe adding a TV decoder functionality, would create an even better product. If users could control their entire TV experience through a well functioning Window to the World software, great interaction and services could be created. Google TV has tried to do this, though not very successfully, but we think that People of Lava could have more success and might be able to beat Google at their own game.

12. CONCLUSION

This chapter gives a brief description of the achievements and accomplishments that have been made in this thesis project.

12.1 CONCLUSION

The purpose of this project has been to design a new product for People of Lava that creates new possibilities for user interaction and communication through a TV set.

The main aim has been to implement People of Lava's Android based system in everyday TV interaction. The product must be compatible will all TV sets equipped with an HDMI socket, regardless of manufacturer. It is important that the product communicates its use and functionality in a comprehensible way.

The final concept, called the Lava A.I., is a small device equipped with a camera and an Android circuit board which is controlled by a specially designed trackpad remote control. It incorporates visual design cues to People of Lava's TV sets, especially the Android equipped Scandinavia.

The Lava A.I. is a unique product in the way that it offers social communication, applications and Internet access all in one product. It is first and foremost designed to be used in a living room context but will also function well as a videoconferencing unit at companies or as an aid for hearing impaired persons. All of these possible use cases imply a large target group. To accommodate a large target group, the Lava A.I. has been purposely designed to be easily comprehensible with simple interfaces and familiar interaction. The base unit only has one button and an easily adjustable stand. The remote has a trackpad and a keyboard, both familar to users from laptop computers. These controls match the intended use of Internet browsing and applications, plus providing new and interesting ways to interact with a TV set.

Probably the most eye catching feature of the Lava A.I. is the way in which it can be mounted on a TV set. Instead of hiding the almost unavoidable cables in a device like this, they have been used as a prominent design feature. The cord that connect the device to the electrical outlet creates a loop from which the device can be hung from the wall mount of a wall mounted TV set. A part of this cord contains the HDMI cable, thus reducing the amount of cords running to and from the device. The power cord is very long to ensure that the loop fits around larger TV sets. The length is adjusted by pressing a tensioning button at the bottom of the device and at the same time pulling the power cord up or down to decrease or increase the size of the loop respectively.

The overall simplicity of the concept, in design, interaction and functionality, will make users feel confident in using the device right from the beginning. The unique placement, attractive design and choice of colourways provides a personal connection between the user and the Lava A.I. This will also create an emotional connection to the People of Lava brand and strengthen brand recognition.

New social behaviours can hopefully be created by the use of this product. By providing a camera in the device users can stay in contact with friends and family from the comfort of their living room. Video chats can be had with one or more people on the TV set, potentially even while watching a TV show. Audio chats can be had while watching TV, for example talking to your friends while watching a soccer game.

Using the open source Android operating system together with Wi-Fi and 3G connectivity ensures that the device can be connected to peripheral devices like smartphones and tablets that also run Android. More examples of devices are loudspeakers, laptops, printers, wireless storage devices and Ethernet routers. All of these possibilities can make the Lava A.I. have a central role in connecting the TV to other devices in the modern home.

An analysis has shown that People of Lava products currently have a diffuse form language. Therefore, a new design language has been developed to support the design work. The words Scandinavian, stringent, architectural and contrasting have been chosen to define People of Lava's form language. Visual design cues have been taken mainly from the Scandinavia TV. This is due to the fact that it is considered to be the most aesthetically attractive product in the portfolio and that it fits well with the framework of words.

Figure 12.1 - The Lava A.I. and remote allows users to interact with their TV in new ways

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14. APPENDICES

HEJ!

Tack för att du kan medverka i vår fokusgrupp! Denna bok skall hjälpa dig att börja fundera på saker och ting som har med dina elprylar att göra. Med elprylar menar vi allt från din tv och mobiltelefon till din elektriska tandborste och spelkonsoll.

I denna bok finns det små uppgifter som du skall utöra under en vecka. De flesta uppgifter går snabbt att göra men det är bra om du funderar på uppgiften under dagen och fyller i boken innan du går och lägger dig. Försök att göra denna bok till din egen!

Ta med dig denna bok när du kommer till fokusgruppen!

Uppgift 1 - Mina prylar

Lista några av dina elprylar här bredvid. Välj dem som du tycker är intressanta, unika eller de du använder mest. Fundera lite på varför du valde dessa och kanske varför du köpte dem?

På nästa sida skall du välja tre prylar som du beskriver lite mer. Vad är bra med dessa produkter och finns det någonting som du stör dig på eller tycker illa om? I den första rutan skall du rita, klistra in bilder eller beskriva prylen i ord. I den andra rutan kan du lista de positiva (+) och negativa (-) aspekter du ser hos produkten.

Mina prylar

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Pryl 1	+	−

Pryl 2	+	−

Pryl 3	+	−

Uppgift 2 - Mitt pryldygn

I den här uppgiften ska du lista de prylar du använder under en dag. Markera när under dagen du använder en pryl genom att sätta ut klisterlappar på tidslinjen. Beskriv sedan hur du använde prylen och vad du använde den till. Fundera på hur din dag brukar se ut, skiljde sig denna dagen något från andra dagar?

🕐

| 00.00 | 01.00 | 02.00 | 03.00 | 04.00 | 05.00 | 06.00 | 07.00 | 08.00 | 09.00 | 10.00 | 11.00 | 12.0 |

Pryl:

Vad jag gjorde:
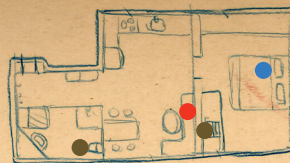
| 00 | 13.00 | 14.00 | 15.00 | 16.00 | 17.00 | 18.00 | 19.00 | 20.00 | 21.00 | 22.00 | 23.00 | 24.00 |

Uppgift 3 - Min pryllägenhet

Hur ser det ut hemma hos dig? Var i lägenheten använder du dina prylar? Rita en enkel planlösning över din bostad och sätt klisterlappar där du främst använder dina prylar. Vad gör du främst vid de olika områdena? Kommentera de olika platserna som du använder till dessa aktiviteter.

Exempel

Planlösning:

Kommentarer:

● Surfar   ○ Pratar i telefon
● Spelar spel   ● Chattar/skype
● Lyssnar på musik ● Gör annat:
● Kollar tv/film

Uppgift 6 - Min framtidspryl

Under en vanlig dag i framtiden kommer du att komma i kontakt med väldigt många produkter som kan kommunicera med varandra. Vad skulle du vilja att tekniken gjorde för dig då? Använd din vildaste fantasi och rita eller beskriv i ord hur en framtidsprodukt skulle kunna fungera och hur du skulle använda den.

Framtidsprylen

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Uppgift 4 - Min gravitationspunkt

Det är vanligt att man har en plats i sin lägenhet där man lägger ifrån sig sina prylar, en plats dit prylarna graviterar. Detta är ofta platsen du kollar på först om du letar efter en pryl. Beskriv var din punkt är och svara på frågorna.

Min personliga gravitationspunkt är:

Saker jag brukar lägga där:

Därför är platsen där den är:

Här lägger jag andra saker:

Saker jag har nära mig när jag slappar:

Uppgift 5 - Mina onlineprylar

Mer och mer prylar blir uppkopplade, inte bara mot internet utan även mot varandra. Hur använder du dina prylar som är sam- och uppkopplade? Rita, klistra in en bild eller beskriv några produkter som du använder ofta i ord. Beskriv även vad du främst använder dem till.

Onlinepryl 1	Detta använder jag den till:

Onlinepryl 4	Detta använder jag den till:

Onlinepryl 2	Detta använder jag den till:

Onlinepryl 3	Detta använder jag den till:

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APPENDIX 2. FUNCTIONAL ANALYSIS

| Function	Description	Importance
Main function		
Allow for use with different input methods	Through the use of the Android operating system	MF
Communication		
Offer visual communication		N
Offer audio communication		N
Allow to Physically turn of camera and microphone		D
Allow for wide viewing angle		D
Allow user zooming	Digital or analog zoom	D
Allow user to change focus		D
Support external microphone		D
Support external camera	Babymonitor	D
Support use of headphones		D
Support no handed communication	Camera and microphone	D
Handling		
Allow for multiple users	at the same time	D
Provide correct information at the right time		N
Fit different television sets		N
Easy to hold		D
Provide sturdiness	Not break if dropped	N
Provide one-handed use		N
Provide power on/off		N
Minimize use of wired connections		D
Easy switching between modes		N
Be used by visually impaired users	Hearing impaired and functionaly impaired users.	D
Provide easy installation		N
Allow answering with tv turned off		D
Allow answering of incoming call on all devices	Devices connected to the product. close proximity to user´	N
Provide compact storage	When on the move	D
Provice easy storage of accessories	Cables etc.	D
Allow use without television turned on		D
Allow for mobile use	In close proximity to television	D
Software		
Allow quick startup		N
Offer remote access	Allow to view camera and sound from other location.	D
Allow for use with different input methods		D

Function	Description	Importance
Input		
Provide possibility to input text		N
Provide possibility to navigate Gui		N
Allow multiple ways of data input		D
Easy access to all inputs	No awkward movements during use	N
Allow for one handed input		N
Seamless switching between input modes	if several	N
Expression		
Visually communicate main function		N
Visually communicate way of handling		N
Aestheticly fit into different types of livingrooms		N
Aestheticly fit the lava brand		N
Express premiumness		D
Environment		
Allow power-saving		N
Allow for use low light conditions		D
Allow for use in noisy environments		D
Usability		
Provide visual feedback		N
Provide haptic feedback		N
Provide correct feedback at the right time		N
Provide audial and visual feedback of incoming call		N
Indicate incoming call	caller id	N
Indicate when camera is on		N
Indicate when microphone is on		D
Show missed calls		D
Show call connection failures	Receiver has no internet connection etc.	D
Connectivity		
Provide easy connectivity with other devices		D
Offer wireless online connectivty	Wifi or 3g	N
Connections should be standardised		D
Experience		
Provide flow to input		N
Provide error free input	minimize error	N
Provide easy correction of errors		N
Allow for pleseant use		N

Function	Description	Importance
Placement		
Offer stable fastening		N
Provide stable storing		N
Allow for different ways of mounting on television sets		D
Provide one handed placement		D
Minimize distance to line of sight		D
Security		
Secure personal integrity		N
Turn of microphone and camera manually		D

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Android remote

Camera in dongle, put directly into hdmi or use a dock to connect it.
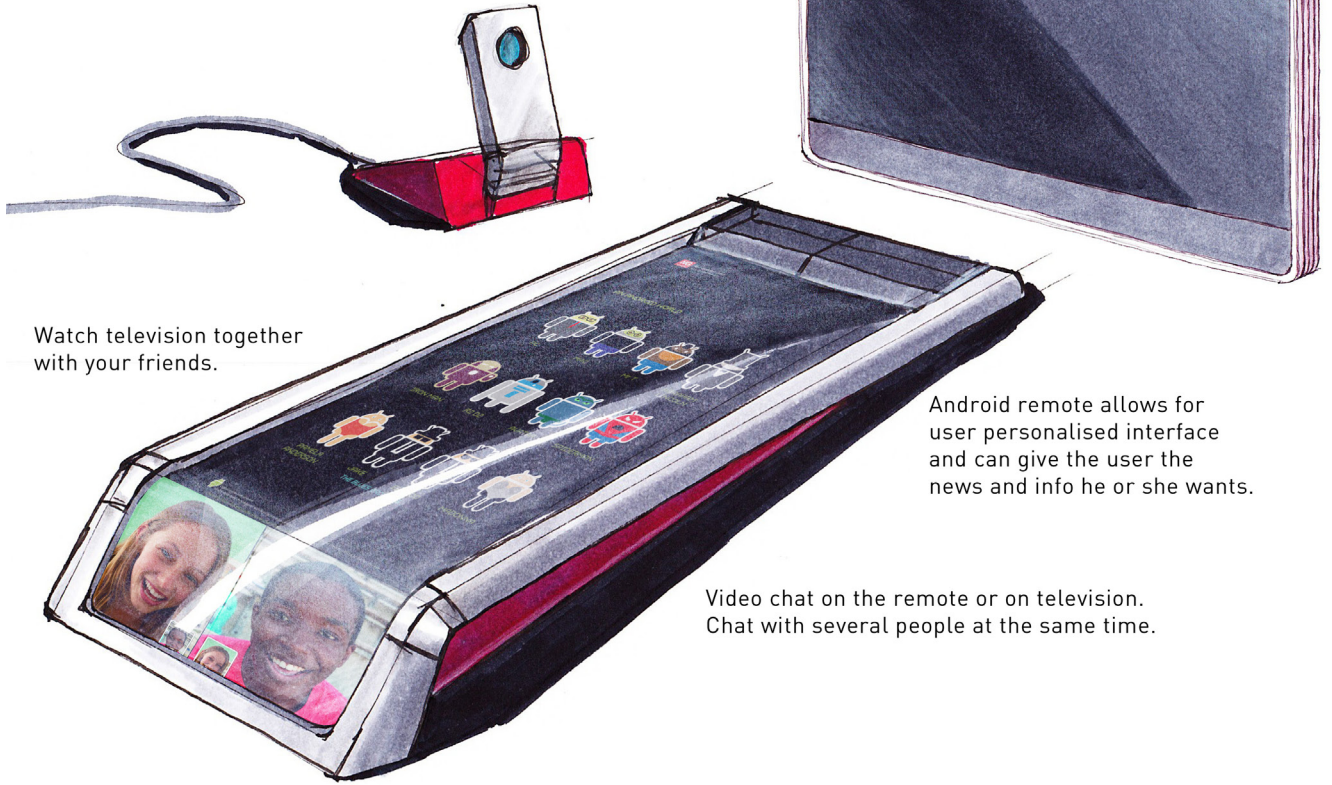
Watch television together with your friends.

Android remote allows for user personalised interface and can give the user the news and info he or she wants.

Video chat on the remote or on television. Chat with several people at the same time.
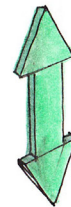
Gesture remote

Rotate light to turn socialmode on and off.

Click light to turn device on/off (Also possible from remote)

Virtual keyboard

Light
Ir sensor
Camera

Gesture remote,
Rotate to increase volume
Flick to change channel etc.
Back and forward in browser

Social tv - android tablet

Android tablet with same userface as
the scandinavia television. Send the
data to the television to watch it there.

Watch television and hang out with your
friends at other places at the same
time. Watch television shows together
and compete in game shows.
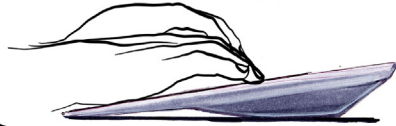
Write comfortably by folding
down the tablet stand.
Raise it up to chat more face
to face.

FLIPPER

Flip and fold the
device as you like it.

Dock the device to
charge it and connect
it to the television

Camera
Microphone
Speakers
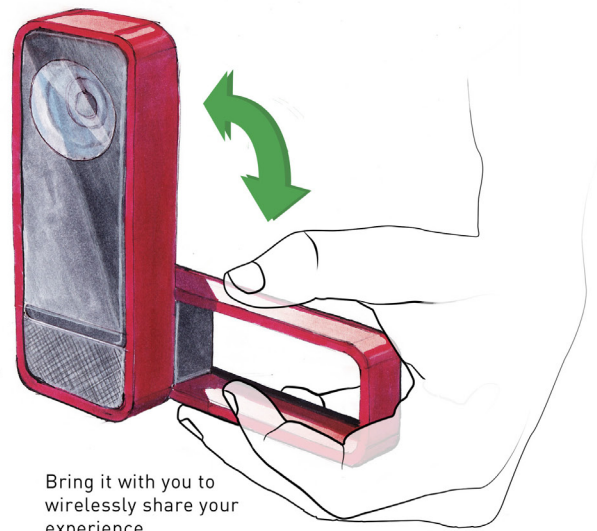
Bring it with you to
wirelessly share your
experience

The fold out part
works makes the
device stable

Separete Something

Social part separated from tel-
evision, so that a user can
watch Tv and videochat together
with friends anywhere.

Multitouch remote. Con-
trol a virtual keyboard by
sliding your thumbs on
the touch surface.

Camera and microphone
in the remote

Module based device.
Personalise with what you want,
speakers, dvd/blurayplayer,
amplifier etc.
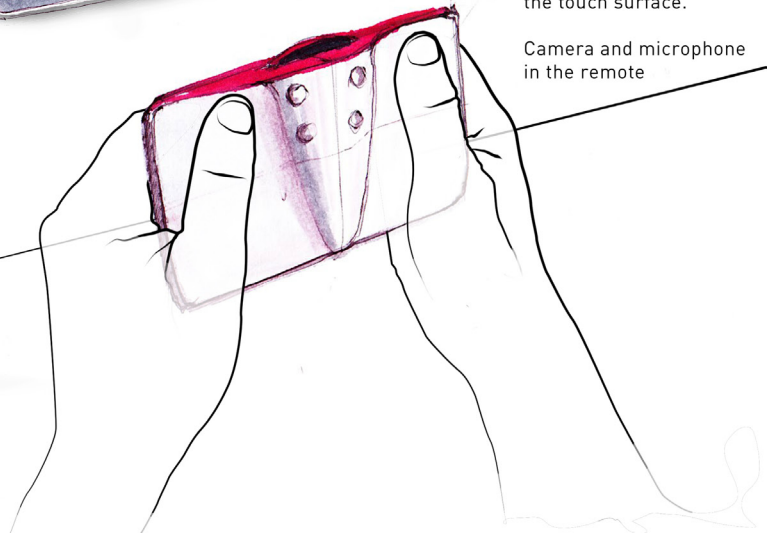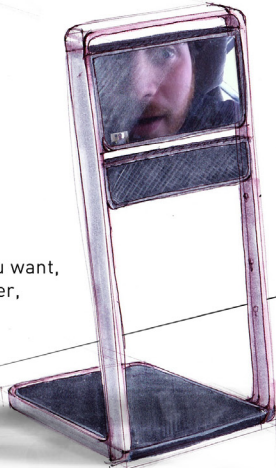
Social tv – touch remote
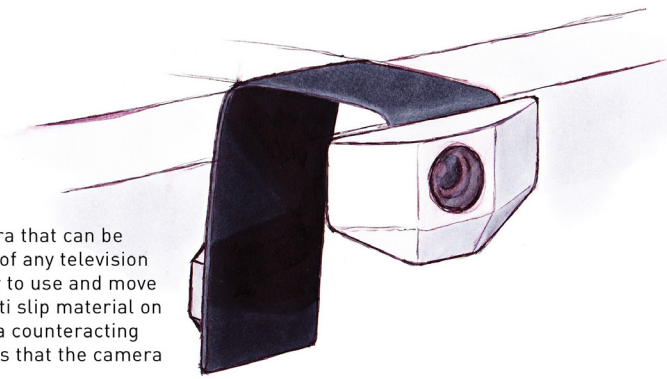
Camera and android device

Slide out
qwerty key-
board

Control mouse on screen
Swipe to go back and forward.
Two finger scroll
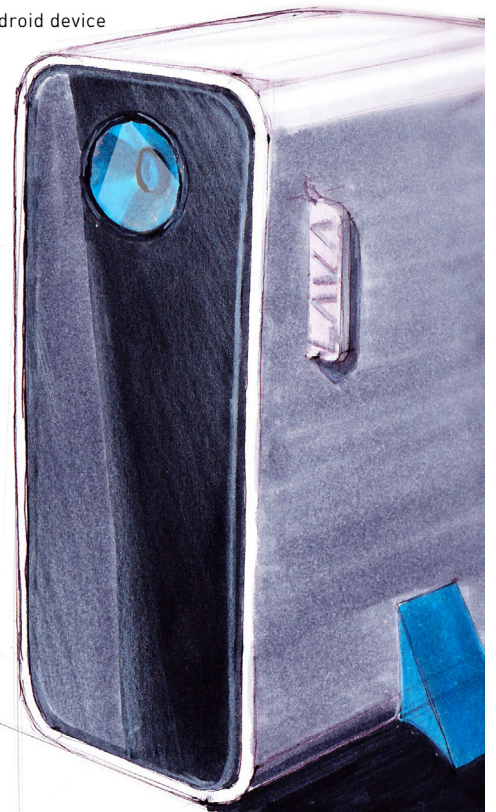
Easy Surf

A small camera that can be placed on top of any television screen is easy to use and move around. An anti slip material on the band and a counteracting weight assures that the camera stays in place.


Easy surfing means an effortless combination of pin-point accuracy and fast text input. This remote combines a touchpad with a slide out keyboard.


ANTI-SLIP COATED BAND

CAMERA

COUNTERACTING WEIGHT
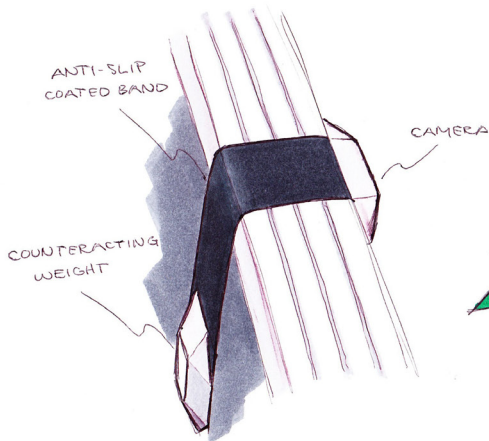
Media Furniture
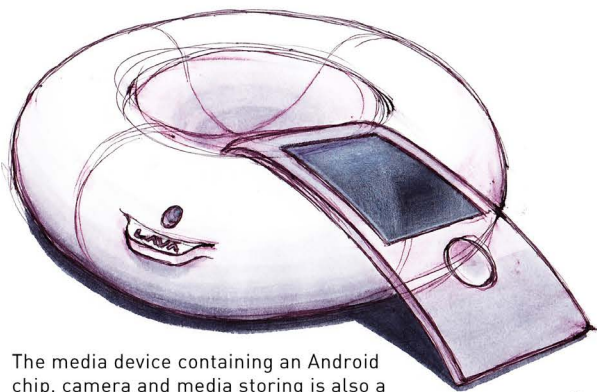
The media device containing an Android chip, camera and media storing is also a bowl to but fruit or snacks in. The remote is designed to rest over the curve of the bowl.
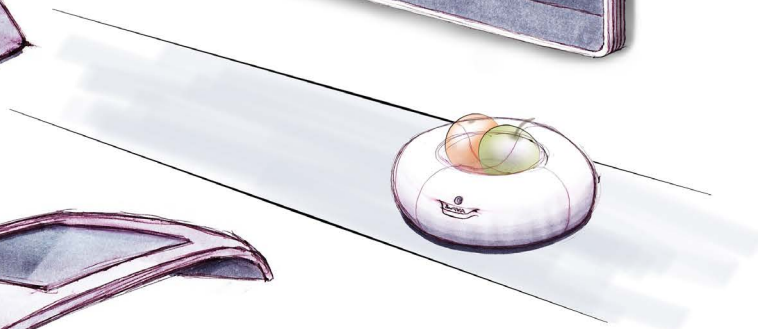
The design of the media device should inspire the user to put it on display, rather than hiding it in a cupboard or shelf.

Maximised Ergonomics

The remote control is an object that we often hold in our hands. Easy access to buttons, tactile and visual feedback are essential to a postive experience of the remote.

CAMERA

CONTROL BUTTON

MICROPHONE

LOUDSPEAKER
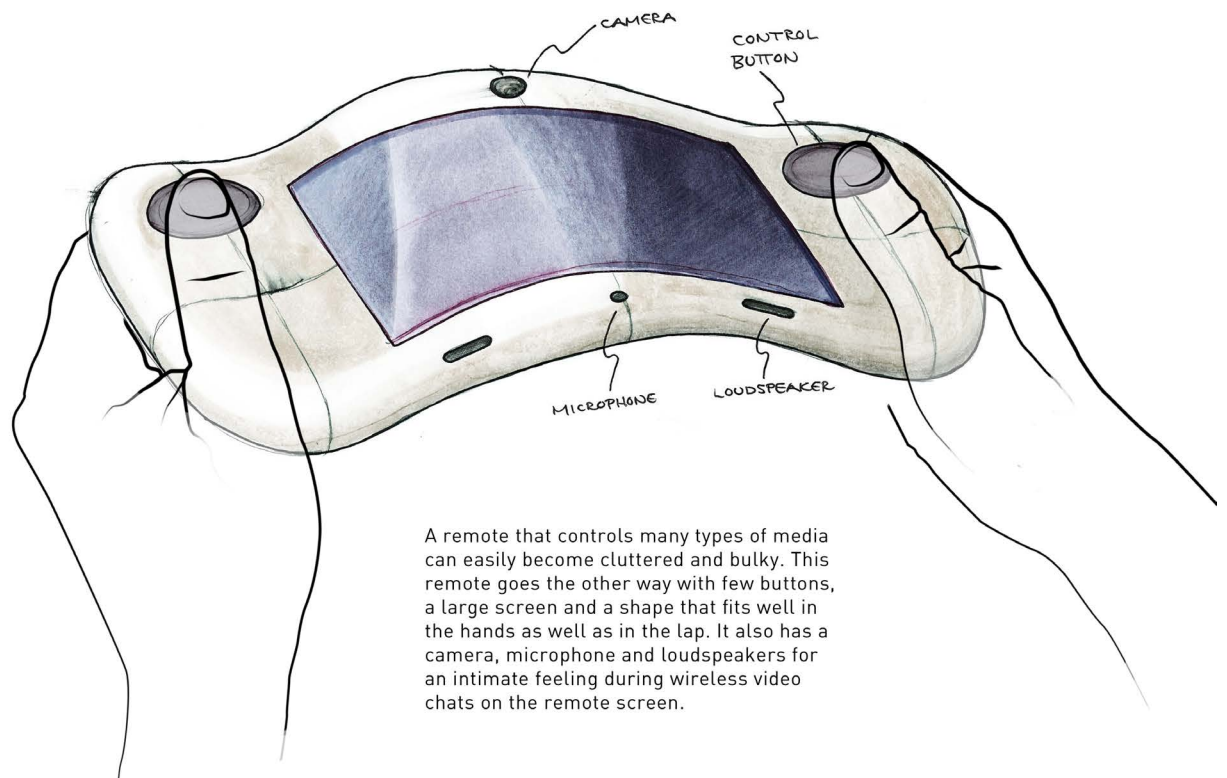
A remote that controls many types of media can easily become cluttered and bulky. This remote goes the other way with few buttons, a large screen and a shape that fits well in the hands as well as in the lap. It also has a camera, microphone and loudspeakers for an intimate feeling during wireless video chats on the remote screen.

Recognizer

Welcome home John!

The system utilises the TV screen as far as possible to show visual media. This allows for a minimized design ofboth the camera and the remote control.

A small camera with face recognition capabilities identifies the user as it enters the area in front of the TV. When the user has been identified the system streamlines the media content towards the profile of that particular person.
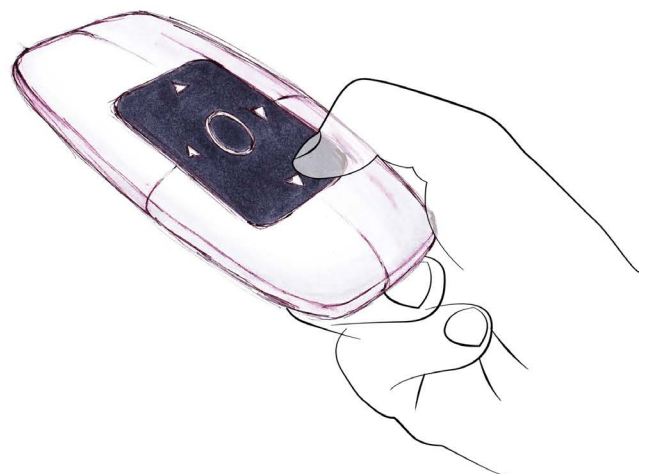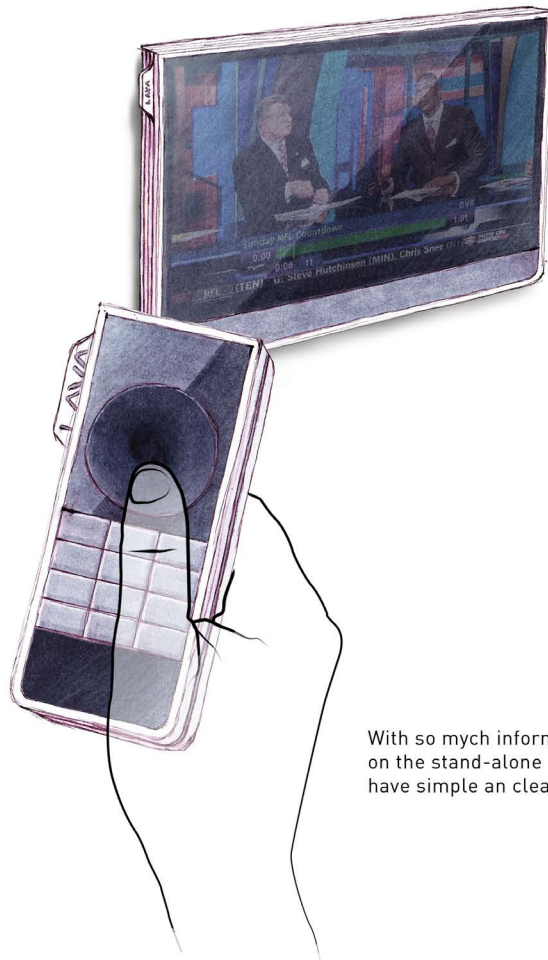
Social TV - Mini Screen

The stand-alone unit can also be mounted on the wall.

A stand-alone unit shows video chats, social media updates and playlists to let the user enjoy fullscreen media on the TV. It has a camera and can be connected to external speakers for separate use, even without the TV being turned on.
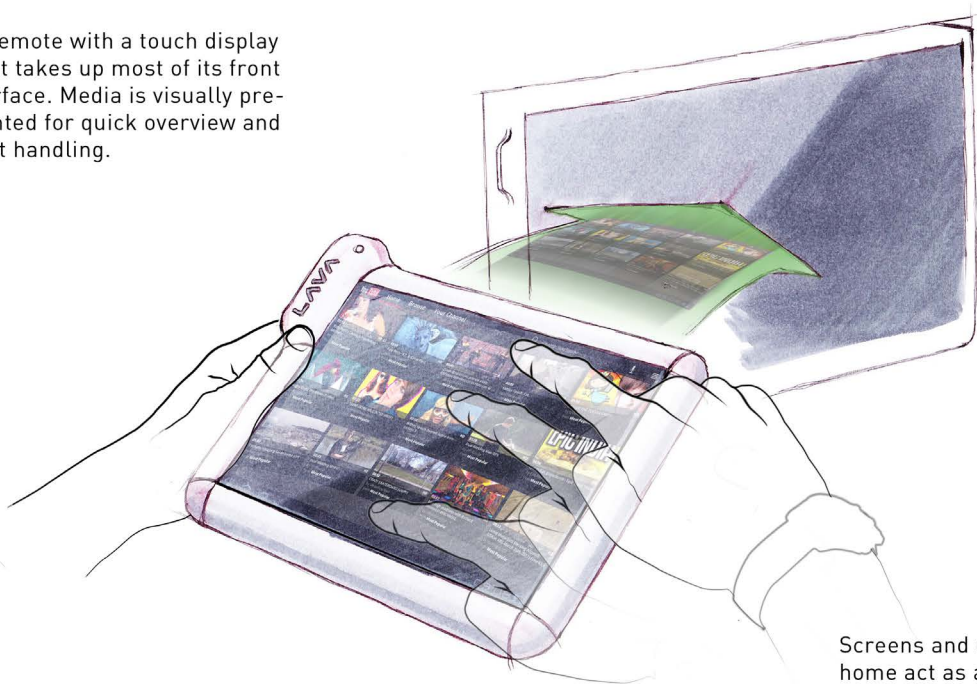
With so mych information being displayed on the stand-alone unit the remote can have simple an clean design.

Media Absorbent

A remote with a touch display that takes up most of its front surface. Media is visually presented for quick overview and fast handling.

Screens and other devices in the home act as absorbents as the user points and drags media on the screen of the remote towards the desired media device.