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Carrying Solutions for Mobile Devices

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Tämän opinnäytetyön tavoitteena oli ideoida älykkäisiin materiaaleihin perustuvia kantoratkaisuja mobiililaitteille, erityisesti matkapuhelimille. Toimeksiantajana oli Golla Oy. Ns. älykkäitä materiaaleja käytetään jo menestyksekkäästi monissa arkipäivän sovelluksissa. Kännykkälaukkujen ja –kuorien valmistajat eivät ole niitä vielä löytäneet, ja tuotteet ovatkin teknisesti kaukana itse mobiililaitteista.

Tiedonkeruun pohjaksi tutustuttiin Gollan nimeämien kilpailijoiden mallistoihin. Tarkoituksena oli erityisesti selvittää, ovatko kilpailijat hyödyntäneet mallistossaan tai markkinoinnissaan älykkäitä materiaaleja. Kirjallisuuslähteiden avulla kerättiin yhteenveto em. materiaaleista. Niiden toiminnallisten ominaisuuksien pohjalta ideoitiin tuoteratkaisuja mobiililaitteiden kantamiseen. Lupaavimmat ideat visualisoitiin ja esiteltiin asiakkaalle. Koska toimeksiannossa sovittiin konseptitason toteutuksesta, ei pidemmälle vietyä tuotemuotoilua tehty.

Luodut konseptit auttavat Gollaa ennakoimaan ja ideoimaan mahdollisia tulevaisuuden tuoteskenaarioita ja käyttäjätarpeita. Materiaalien yhteenveto toimii arvokkaana tietopankkina ja helpottaa arvioimaan älykkäiden materiaalien potentiaalia Gollan tuotestrategiassa. Yhdessä konseptien kanssa materiaaliyhteenveto toivottavasti herättää myös edelleen uusia ideoita toiminnallisuutta lisäävistä tuoteratkaisuista.

Osa esitellyistä materiaaleista ja konsepteista on vielä tulevaisuuden teknologiaa. Osa taas on melko helpostikin toteutettavissa. Kehittämällä markkinointitarpeisiin toimivia prototyyppejä Golla voisi lisätä kiinnostavuuttaan messuilla ja mediassa. Näin se voisi toiminnallisempien tuotteiden kehittäjänä erottua kilpailijoistaan, profiloitua edelläkävijänä ja kasvattaa brändiarvoaan.

Avainsanat	älykkäät materiaalit, mobiililaitteiden kantoratkaisut, ideointi, konseptisuunnittelu

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With Golla Oy Ltd. as a client, the aim of this work was to create design concepts based on intelligent materials with respect to creating solutions for mobile devices, especially phones. Intelligent or smart materials have found their way to several areas of life, but not yet to bags and covers that protect portable electronics. The technological gap between the devices and their carrying solutions is vast. New ideas are needed to bring them closer together and somehow make them interact.

A competitor review was made in order to find out to what extent Golla´s competitors are using smart materials and technologies today. Literary research and summary on smart materials were conducted, and the materials found acted as an inspiration for creating concept ideas, in other words the essence of this thesis. The most prominent ideas are presented in this work. 3D modeling was used to visualize two concept ideas. No further product design was made as the work was agreed to be made on concept level only.

About a dozen concept ideas were visualized and presented to the client. The concepts will help Golla in evaluating their product strategy and creating alternative development scenarios for the future. The competitor and material review will help Golla in positioning itself in the market. Furthermore, it will further provide information and ideas on intelligent materials that could have a potential to increase Golla´s competitiveness.

With a relatively small investment, some working prototypes could be developed for demonstrating intelligent materials´ potential for the customers during marketing events. This could help Golla add its brand value and profile itself as a pioneer of functional mobile bags and a visionaire of future products.

Keywords	smart materials, carrying solutions for mobile devices, ideation, concept design

Contents

1 Introduction

Materials get smarter every day. Despite that, very conventional solutions are being used in the mobile bags business. Mobile devices on the other hand have evolved a lot. The technological gap between portable electronics and the bags and covers designed for carrying them is enormous. I wanted to explore the potential of using smart or intelligent materials and technologies in these product applications. Maybe there´s a way to bring the bags closer to the devices they´re holding inside?

Together with Golla Oy Ltd. as a client, the goal was set on creating a collection of ideas or concepts of carrying solutions for mobile devices. The focus was set on mobile phones, which were defined as the client´s main interest. The ideas would be inspired by smart materials and technologies. According to Golla, smart materials are not commonly used within the business so far. Nor has their potential widely been explored within this context. This impression was confirmed after a competitor and material review.

Smart materials are presented in this thesis with the focus on their basic functionality. Scientific and thorough theory on their properties and mechanisms has been cropped out. The material review laid a base and acted as inspiration for the ideation and concept design process, which was the actual essence of this work.

The concept ideas presented in this work could improve the user experience of mobile devices by creating deeper integration between the devices and their carrying solutions. New materials have inspired designers throughout times and by introducing those materials the designers have been able to offer new solutions for improving everyday life. In the best case this work could bring new ideas of smart materials´ potential also more widely to the field of design.

1.1 Aim of the work

The aim of this work was to create and visualize ideas, based on intelligent materials and technologies, of carrying solutions for mobile devices. The aim was set together with mobile bags company Golla Oy Ltd. as the client.

1.2 Task setting and context

The purpose was to explore the potential of so called smart / intelligent materials in new product applications, in this case carrying solutions for portable electronics. The focus was set on mobile phones.

The task was to first make a material review on smart materials. The review would inspire the ideation process. The deliverables would include visual or written presentations of these ideas on concept level only. Further product design would not be done.

The theoretical context is formed by intelligent materials, carrying solutions for mobile devices, ideation and concept design.

2 Introduction of Golla

Golla is a design driven, globally operating Finnish company that designs, manufactures and markets carrying solutions for mobile devices.

The Golla story started in the early 90's from designing and crafting furniture out of metal and later small functional items from rubber and plastic, which were sold around the world and even appeared in the MoMa gift shop in New York. By the turn of the millennium Golla saw a market in fashionable accessories for portable electronic devices, just as the mobile revolution emerged. Throughout the years, the collection of bags has grown and been introduced to new markets all around the globe for more than 40 million users worldwide (Image 1). (Golla.)

Image 1. Golla products (Images: Golla)

Golla has a turnover of about 26 million Euros (2011), with some 8 million articles sold annually. Net profit was 1.6 million Euros (2011). In spite of the decrease in net profit from previous year´s 2.0 million Euros (2010), the company´s profitability was good in terms of ROI, return on investment (Yrityshaku).

The collection is comprised of 130-150 articles for carrying mobile phones, laptops, tablets, cameras etc. Golla employs about 55 people including 6 designers. The company has its HQ in Helsinki and offices in Chicago, Essen, Lille, Shanghai and Tokyo. Products are stocked in warehouses in Finland and China and sold through the same channels as mobile phones, e.g. operators and consumer electronic shop chains. The manufacturing is trusted to 3-4 partners, usually starting with a new collection every autumn. (Haapalainen, Pia. Interview 30.8.2012.)

As the sales channels are filled with electronic devices, Golla products need to compete for the consumer´s attention. Golla does not have stores of its own. Thereby it might be a good idea to bring the mobile bags and covers technologically closer to the actual devices. By introducing smart materials it would be easier for Golla to stand out from its competitors and boost its visibility in its sales channels.

2.1 Vision, mission and brand heritage

Golla´s vision is to be the leading consumer brand of fashionable carrying solutions for portable electronics around the world. They continuously set new trends with products that are unique, useful and universally appealing. (Golla.)

Golla´s mission is to make technology part of people´s lifestyle and to provide the most stylish accessories to fit it. The market of electronics is developing fast and new technology shapes the customers' needs and preferences. By staying innovative, Golla will help shape the products and trends of the future. (ibid.)

According to Golla´s brand heritage definition Golla is the original brand that brought colors and prints to portable electronics. Designing fashion bags for portable electronics is their specialty. Golla bags are known worldwide for their array of colours, stylish prints and good quality. (ibid.)

Image 2 presents the way Golla wants to be seen, i.e. what kind of impression the brand wants to create on its customers. In Golla´s case the products are the most important way of communicating brand identity.

Image 2. Golla´s brand identity (Image: Golla)

3 Competitor review

A very simple review was made by exploring the websites of the companies that Golla identified as competitors (Image 3). The main focus was set on products, especially on whether the companies have used intelligent materials in their product range or not. Based on this review, no sign of such materials or technologies could be found. The solutions are quite conventional and usability is mainly based on structural properties.

Materials used are in most cases different plastics and genuine or synthetic leather. The limited use of textile fabrics result from their tendency to seam slippage and it´s more difficult to control the size in the manufacturing process in order to produce precisely fitting bags for mobile devices. (Haapalainen, Pia. Interview 18.10.2012.)

The typically low sales prices of carrying bags are probably one constraint for wider use of smart materials. As the consumers switch their devices to new ones at a constantly accelerating pace, the carrying case is most likely to be replaced as well. That´s why the customers tend to favor rather inexpensive solutions. Especially the phone specific bags rarely fit new devices.

Some mobile phone manufacturers offer their own carrying solutions for the market. As their unit prices tend to be low, for a phone manufacturer the mobile bags business is lucrative primarily from the volume and growth potential´s point of view. The business area also differs greatly from the core business of making phones by its working methods and materials. For a phone manufacturer it´s easier to concentrate on phone specific carrying solutions fitting their own models rather than so called multicompatible carrying cases that should be able to accommodate several alternative devices. With those products they are also more likely to face heavier competition from companies like Golla. (Raatikka, Hanna. Interview 16.11.2012.)

Image 3. Golla´s competitors identified by Golla

3.1 Market potential

Golla could benefit from the current situation on the market by introducing future solutions based on intelligent materials and profiling itself as a pioneer. Creating new type of user value, based on functional materials, would enable reaching new customers and a bigger market share.

On the other hand, Golla´s brand value and people´s interest towards the company could be boosted by presenting innovative products in e.g. exhibitions and marketing in general. Functional prototypes and samples could be used for creating “wow” effects, showing people visions of the future, thereby increasing potential customer´s interest towards the company. This kind of development should be constantly and continuously made alongside with the volume business, and the highlights should be brought public frequently. This would also result to more valuable millimeters on the media for Golla. Standing out (from both the competitors and the actual electronic devices) in the distribution chain would be easier. At the moment Golla does not have shops of its own. The products are being sold through the same channels as the mobile phones and other devices, e.g. consumer electronic market chains, mobile operators etc. Improving the company´s conspicuousness by presenting revolutionary products could enable a different sales channel strategy, e.g. launching Golla stores.

3.2 The mobile future

New materials like graphene, which is at the moments the hottest hot in nanotechnology, can revolutionize the design possibilities of portable electronics as well as improve their everyday usability via e.g. self cleaning screens. Its elasticity, transparency and flexibility make it suitable for ultrathin foldable touch screens. It can also be used for producing foldable, rolling light sources that can even be applied to a wall like wallpaper. We´re not far away from bracelet computers that can be rolled around ones wrist (Wadendal 2011).

Companies like Google are developing head-up displays also known as a HUD (any transparent display that presents data without requiring users to look away from their usual viewpoints) for the consumer market. (Jablonski 2012.)

“A breakthrough in foldable OLED screen technology means a display can be folded in half like a sheet of paper without creasing. It's no exaggeration to say this could change every mobile device's design.” (Eaton 2011.)

Sci-fi has long played with the idea of gesture-based interfaces. “A new concept for an 'imaginary' interface takes even the screen out of the equation, allowing the user to simply imagine the interface, manipulating it through hand motions” (Dillow 2010). A gesture-based mobile device with no screen, no keyboard, and no other peripheral inputs or outputs, is a mobile device that's not really a device at all (ibid.).

According to the researches at the University of Tampere, embodied user interfaces will become a part of everyday life. E.g. televisions, computers and screens can be controlled by hand gestures. The first televisions and computers with an embodied user interface have become available in Finland this year. (Laurinolli)

Whether the future brings mobile devices based on advanced technology or material innovations, Golla should be able to react, as the carrying solutions need to evolve together with the devices.

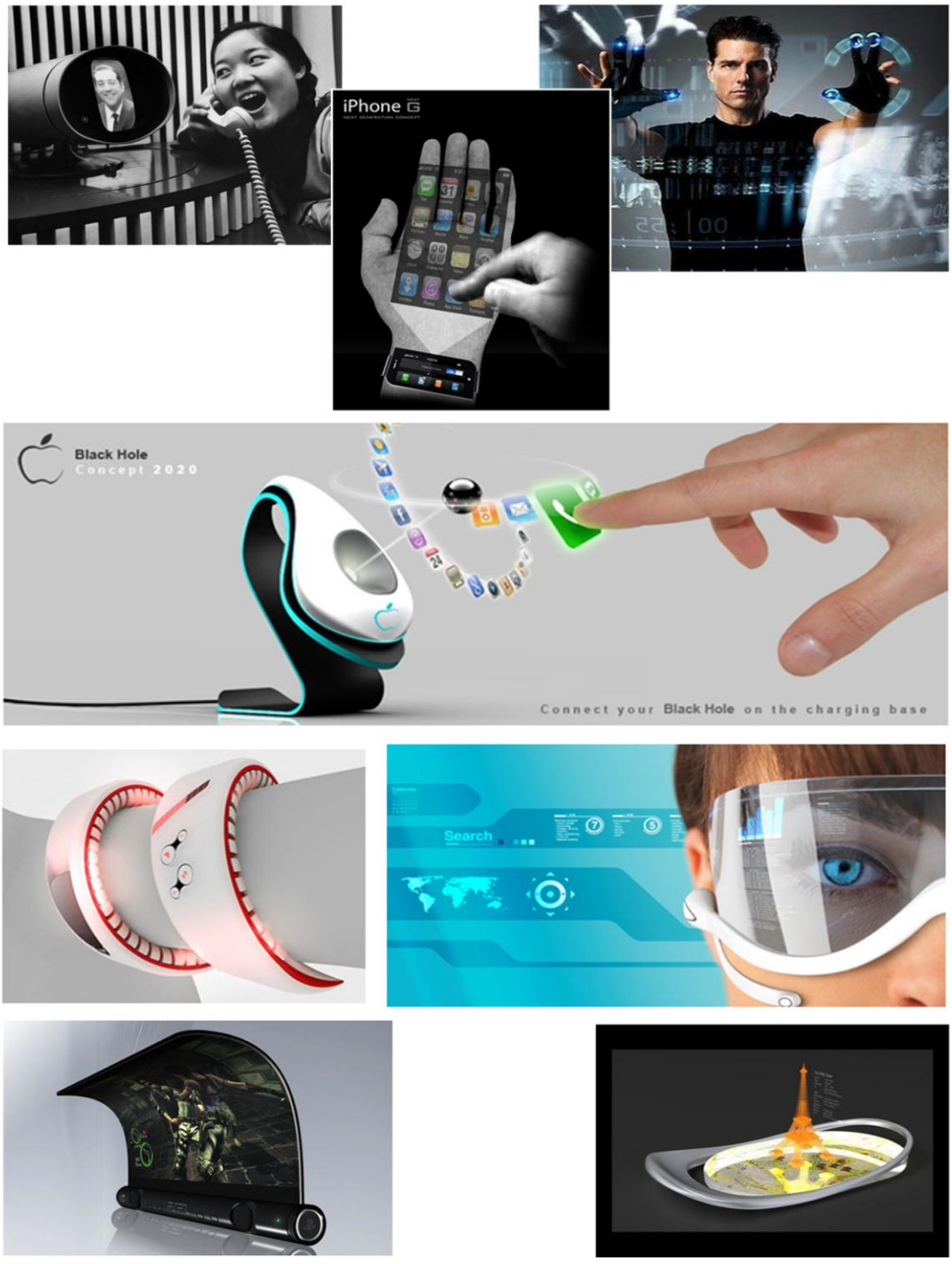

Image 4. Visions of the mobile future

4 Smart / intelligent materials

The concept of smart / intelligent materials comprises substances which are able to respond to changes in their environment by changing their structure and functions. (Van Schoor 2011.)

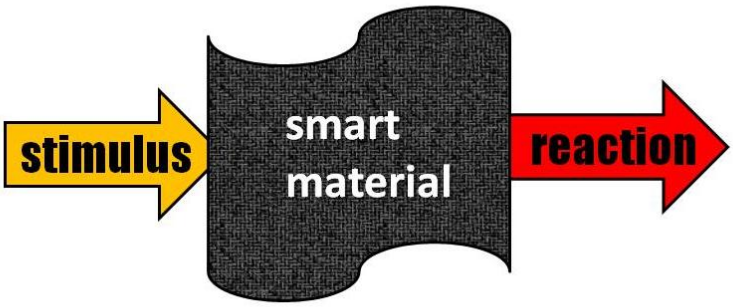

Image 5. Definition of smart material (Image: Juha Ilén)

4.1 Phase change materials

"Phase change technology originates from NASA (National Aeronautics and Space Administration) research program of the 1970´s. The aim of this program was to provide astronauts and instruments with better protection against extreme fluctuations of temperature in space." (Mattila 2006, 34.) More than 500 different PCMs are described in Phase Change Materials Handbook published in 1971 by NASA (Smith 2010, 144).

> *Phase change is a process of going from one physical state to another. […] Substances that undergo the process of phase change are known as phase change materials (PCMs). By definition PCMs are materials that can absorb, store and release large amounts of energy, in the form of latent heat, over a narrowly defined temperature range, also known as the phase change range, while the material changes phase or state (from solid to liquid or liquid to solid).* (Mattila 2006, 34-35.) (Image 6)

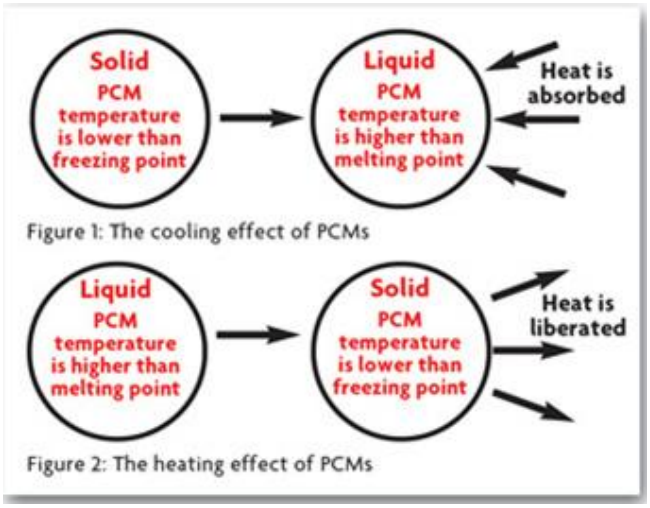

Image 6. Thermo-regulating effect of PCMs (Image: textileworld.com)

"PCMs have been applied in many fields, including heat management of electronics, telecommunications and microprocessor equipment, solar heat storage systems for buildings, microclimate environmental control for vegetation in agriculture, biological and biomedical carrying systems etc." (Mattila 2006, 34).

4.1.1 PCMs in textiles

> *Intelligent textiles are able to sense stimuli from the environment, to react to them and adapt to them by integration of functionalities in textile structure. According to this definition textiles containing PCM´s are intelligent, as they react immediately to changes in environmental temperature and adapt to the prevailing hot or cold conditions.* (ibid., 39.)

Paraffin-waxes are the most common PCMs in textiles. They are available in various phase change temperatures. These waxes are enclosed in microcapsules 1-30 µm in diameter, which is about half the diameter of human hair. Commercialized PCM products like Outlast®, Comfortemp® and Thermasorb® are based on paraffin-waxes and microcapsule technology. Typically the microcapsules are mixed in a coating compound and applied to the textile surface, fabric or foam by coating technology. PCM microcapsules can also be added into acrylic fibre in a wet spinning process. (ibid., 23-24.)

4.2 Shape memory materials

Shape memory materials (SMMs) have the ability to remember their original shape, i.e. they can change their shape from some temporary deformed shape to a previously programmed shape (Image 7). An external stimulus activates the shape change. Usually it´s a change in the surrounding temperature, but it can also be stress, magnetic field, electric field, pH-value, UV light and with some materials even water. (Mattila 2006, 85.)

Image 7. The shape memory effect (Image: everythang.wordpress.com)

Most of the commercially available shape memory products are based on metallic shape memory alloys (SMAs). Gels and polymers (SMPs) with shape memory properties are developing fast. Shape memory ceramic (SMC) materials are still mainly at the research stage. (ibid., 85.) Materials with shape memory include synthetic rubbers (Thompson 2007, 445).

The most commercially successful applications can be found in bioengineering and biomedical applications, but shape memory materials are increasing their importance in aircraft and automotive components industry, space applications, vibration and seismic applications, telecommunication and many others, including textile and clothing sector. (Mattila 2006, 86.)

Image 8. Veritex™ is a shape memory composite with memory intelligence. “When exposed to thermal stimuli, it can progress from a rigid to highly elastic shape, and back to a rigid state” (Riddle 2009). (Image: specialtyfabricsreview.com)

4.3 Auxetic materials

Auxetic materials absorb energy. They have better impact resistance compared to conventional materials. They can be composed of metals, ceramics, polymers, or a combination of several materials. (Muovit vaatetustekniikassa 2010.)

According to the definition of auxetic behavior (Image 9) “while most materials get thinner when stretched and fatter when compressed, auxetic materials do just the opposite – they get fatter when stretched, and thinner when compressed.” (Auxetix expanding technology.)

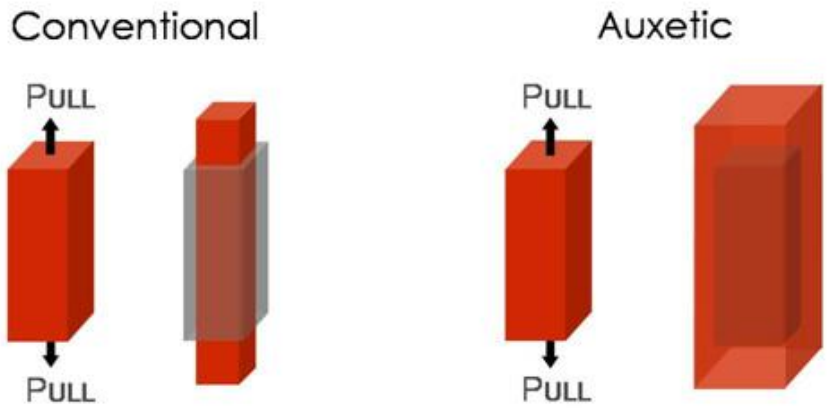

Image 9. Conventional vs. auxetic material behavior (Image: home.um.edu.mt)

Auxetic foams, such as the one developed by the University of Malta, have various superior properties compared to ordinary foams. For example, they provide extra support during sudden collisions. This makes them especially suitable for protective equipment such as knee and elbow pads, crash helmets etc. as well as for packaging purposes. (Auxetic polymers 2006.)

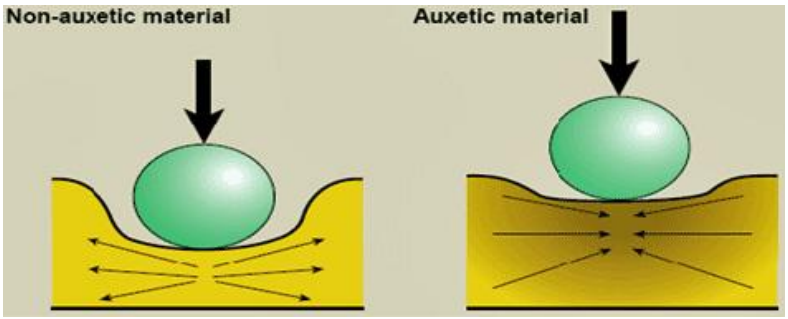

Image 10. Improved impact resistance based on auxetic material (Image: auxetic.com)

D3O is a flexible and soft gel, which locks its molecules from impact energy, but reverts to its original flexible state instantly after the shock (Tech 21).

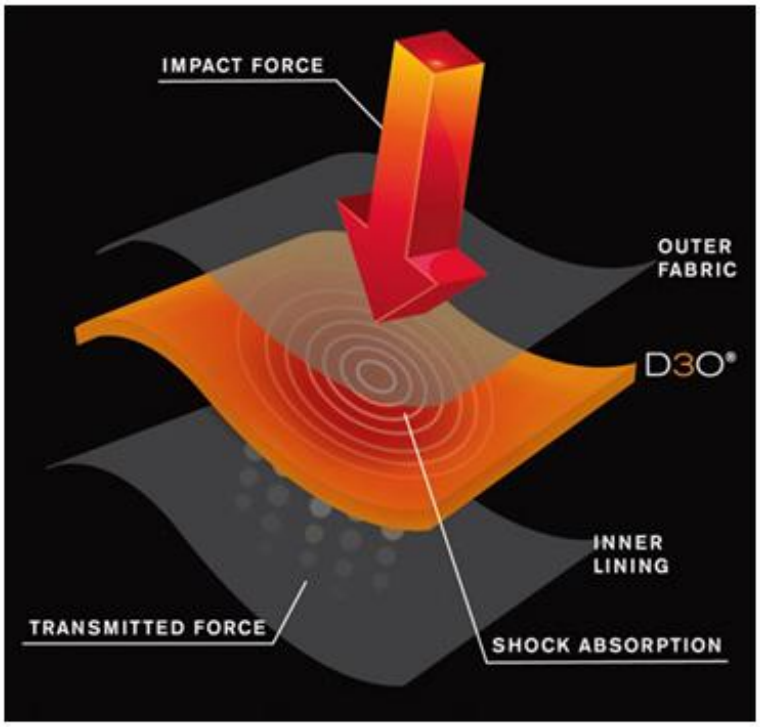

Image 11. D3O “smart gel” (Image: D3O.com)

D3O has also been applied to mobile phone cases and brought to market by Tech 21 in the UK.

Image 12. D3O bumper around a mobile phone (Image: Tech 21)

Auxetic materials can be further processed into fibers and yarns. This might open up possibilities for making soft, more textile-like impact protection bags for mobile devices.

Table 1. Some unique characteristics predicted for materials fabricated from auxetic fibers (Image: Auxetic polymers 2006)

	Pull-out Resistance	Fracture Toughness	Energy Absorption	Indent Resistance	Impact Resistance	Breathable Fabrics
Composites	▪	▪	▪	▪	▪	
Clothing			▪	▪	▪	▪
Cord & Net	▪	▪				
Upholstery			▪	▪		
Seals			▪	▪	▪	

4.4 Colour changing materials

Chromic is a general term for materials which change, radiate or erase colour. Due to their colour changing ability, they are also called chameleon materials. The colour changing phenomenon is caused by external stimulus, depending on which the chromic materials can be classified as follows:

photochromic	stimulus is light
thermochromic	stimulus is heat
electrochromic	stimulus is electricity
piezochromic	stimulus is pressure
solvatechromic	stimulus is liquid
carsolchromic	stimulus is an electron beam

The main applications for chromic materials include paints, inks, tiles, eyeglasses, windows and many optical applications. (Mattila 2006, 193.)

4.5 Conductive materials

An electrical circuit interconnects electrical elements to form a functional system. Electrically conductive fibers often lack typical textile properties, such as comfort, wear resistance and dyeability. The lack of these properties can anyhow be solved by finishing technologies or by modifying the fibre structure. Electrotextiles have great possibilities for creating a new generation of flexible and multifunctional textile structures for various electronic systems. (ibid., 236, 239.) An outstanding advantage of textile circuits over traditional circuit boards is their flexibility (Smith 2010, 180).

Methods of making fabric based electric circuits include embroidery, braiding, weaving and knitting of conductive threads on fabric structures, printing and chemical patterning of conductive elements on textile substrates (Mattila 2006, 240.) “Printable electronics are based on conductive polymers. Printing is made on smooth substrates, typically plastic films. Application to textiles is most suitable using lamination technology.” (ibid., 236.)

4.5.1 Acoustic optical fibres

MIT researchers are developing functional fibers able to detect and produce sound. These acoustic fibers are based on plastic that is commonly used in microphones. By adjusting the plastic's fluorine content and the asymmetry of the molecules, the plastic can be made piezoelectric; it changes its shape when electric field is applied to it. Applications of the technology could result in clothes that act as sensitive microphones for e.g. capturing speech or monitoring bodily functions. (Quick 2010.)

4.6 Light emitting materials

“The source of the excitation to produce light emission can come from a variety of sources” (An overview of light emission).

4.6.1 Electroluminescent materials

Electroluminescent materials produce a brilliant light in different colours when stimulated electronically (e.g. by electric current). When emitting light, the materials do not produce heat. They can be used as light stripes for decorating buildings, or for safety precautions in industrial and public vehicles. (Responsive (smart) materials.)

Similar to a capacitor, the material consists of an insulating substance with electrodes on both sides. One of the electrodes is transparent allowing the light to pass. The light is emitted by the insulating substance, which can be made of e.g. zinc sulphide. (ibid.)

4.6.2 Fluorescent materials

“Fluorescent materials produce visible or invisible light as a result of incident light of a shorter wavelength (X-rays, UV-rays, etc.). The effect ceases as soon as the source of excitement is removed.” (Responsive (smart) materials.)

“Fluorescent pigments in daylight have a white or light colour, whereas under excitation by UV radiation they irradiate an intensive fluorescent colour. They can be used for paints, inks, or mixed to molding or casting materials for different applications.” (ibid.)

4.6.3 Phosphorescent materials

“Phosphorescent or afterglow materials produce visible or invisible light as a result of incident light of a shorter wavelength (X-rays, UV-rays, etc.), detectable only after the source of the excitement has been removed.” (Responsive (smart) materials.)

“Afterglow effect pigments are polycrystalline inorganic zinc sulphide (green afterglow) or alkaline earth sulphides (red or blue afterglow), and can be used in paints, inks or mixed to moulding or casting materials for different applications.” (ibid.)

5 Ideation process

Concept design is not a straightforward term (Image 13). This thesis work can be regarded as *visioning* concept design, in which the goal is not a commercialized product, but rather long term potential and future product possibilities. These possibilities can be used as a tool in strategic planning. The focus is usually at least ten years ahead in the future. (Kokkonen et al. 2005. 25, 93.)

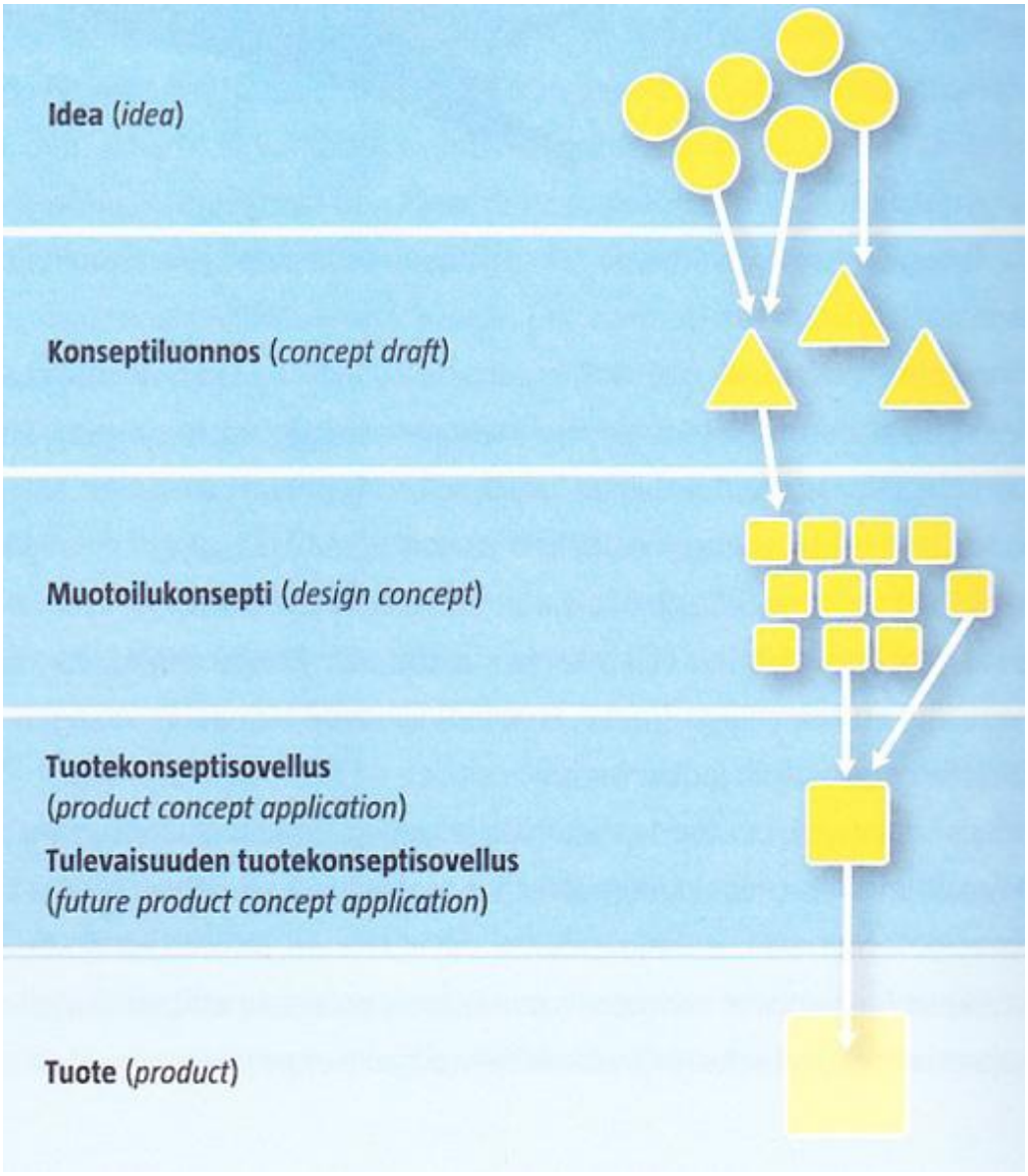

Image 13. From idea to concept (Image: Kokkonen et al. 2005)

If reflected to generic product development process presented by Ulrich and Eppinger, the work done in this thesis is concentrated on phases 0. and 1. (Image 14)

Image 14. Product development process according to Ulrich & Eppinger (Image: Maass)

Phase 0. includes identification of opportunities guided by corporate strategy as well as assessment of technology developments and market objectives. In this case the stress was on assessing technology developments, which was then used for generating concept ideas. The concept ideas can be seen as Gollas opportunities. “An opportunity is a product description in embryonic form, a newly sensed need, a newly discovered technology, or a rough match between a need and a possible solution”. (Maass 2011.)

On Terwiesch & Ulrich´s opportunity horizon most of the concept ideas presented in this work can be positioned on the green or red fields of Image 15.

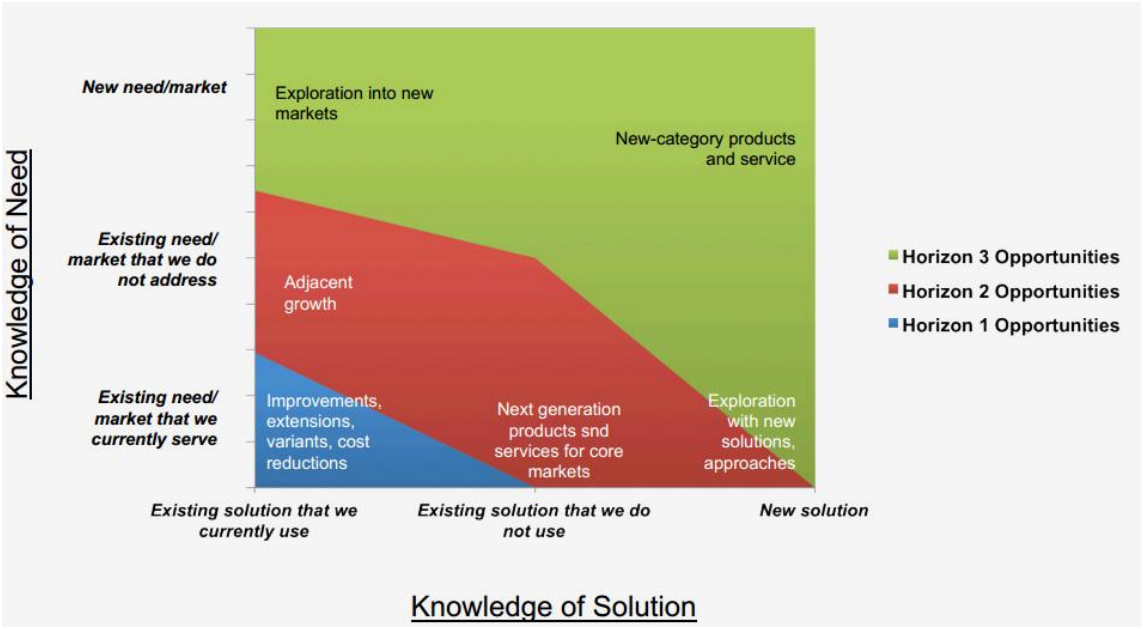

Image 15. Types of opportunities according to Terwiesch & Ulrich (Image: Maass)

The core functions of mobile bags are protection for the device, improved portability and self expression. Using smart materials these functions could be enhanced and new functions brought up so that the bag could fulfill more needs than just these core functions.

With this on my mind I started the process of generating ideas. That process was very intuitive and informal. I used the intelligent / smart materials and their properties as inspiration for new solutions in mobile bags (Image 16).

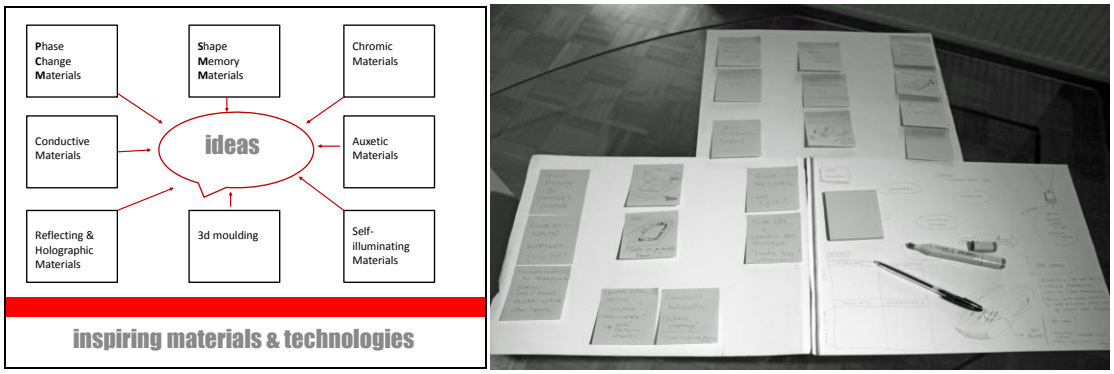

Image 16. The ideas were inspired by smart materials and technologies (Images: Juha Ilén)

The actual work was done by free association (“one man´s brain storming”) and ideating by drawing. I tried to avoid holding back any ideas. It had already become clear to me during my past projects that, as professor Rehn puts it, “when it comes to creativity, quantity equals to quality” (Rehn 2010, 145).

Also Terwiesch & Ulrich emphasize that often hundreds or thousands of raw opportunities must be considered for one commercial success (Image 17). In order to be effective you should generate a large number of opportunities, high quality of opportunities and high variance in the quality of opportunities. (Maass 2011.)

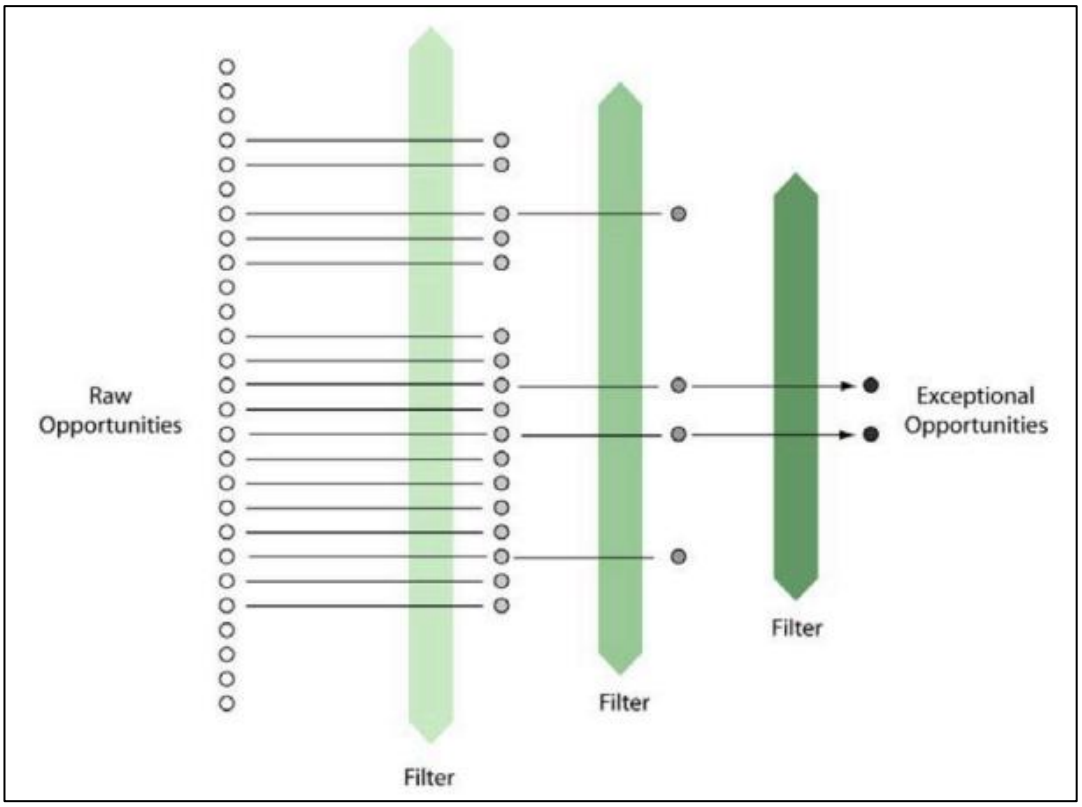

Image 17. How to identify opportunities by Terwiesch & Ulrich (Image: Maass)

After several rounds of brainstorming I grouped all the ideas around those smart material types that they related to. Some of the ideas utilize combinations of more than one smart materials.

I filtered the idea mass and visualized the prominent ideas to concept drafts (Image 13) which I then presented to the client. Those concept drafts are presented in the following chapter “Concepts”. Two chosen concept drafts were taken a bit further to 3D design concepts. Each of the concepts together with the user needs and scenarios behind them shall be presented in the following. It´s obvious that some of the concept ideas could be integrated or combined in order to produce multifunctional products. Those possibilities have been mostly left open and the ideas are presented as individual concepts.

6 Concepts

Mobile bags and covers are typically partly or fully closed structures. As long as the cover is not opened, the device itself cannot be used. Neither can it communicate with the user through the cover.

Many people have replaced their wrist watches by the watches on their mobile phones. By integrating the cover to the device and adding a time display on the cover, the user wouldn´t need to open the cover to see what time it is (Image 18). This feature could be realized on textile structure by using optical fibers and conductive materials. Alternatively it could be embedded on a hard plastic cover for more technical appearance.

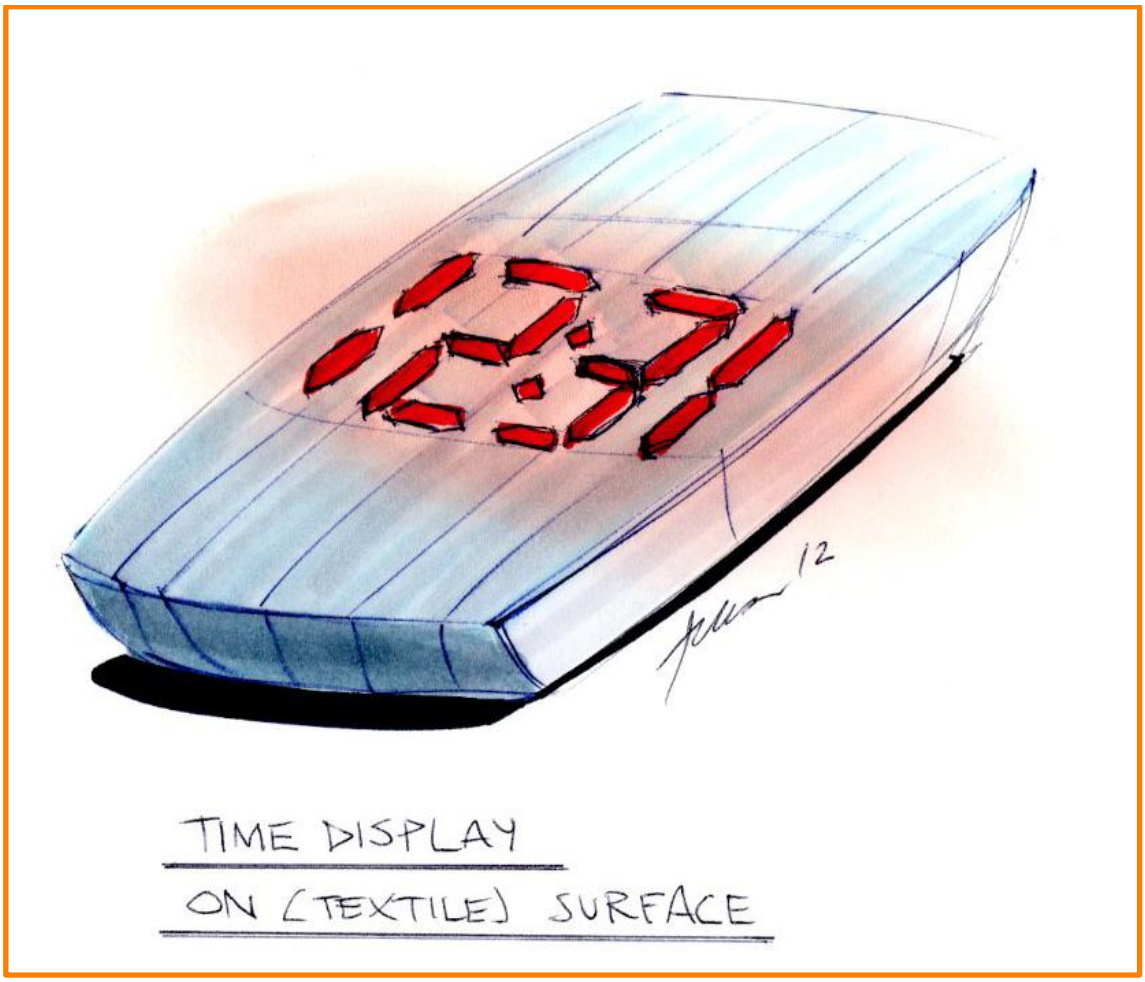

Image 18. Watch it! time display on mobile bag (Image: Juha Ilén)

The same idea and technology could be expanded to inform about major events that can easily be unnoticed if the cover is closed: incoming calls, emails, SMSs, low battery etc. The signal colours or simple symbols (or combinations of both) could be integrated on the cover using e.g. textile technology (Image 20).

Image 19. Events are easily missed inside a cover (Image: dilkibaatblogkesaath.blogspot.fi)

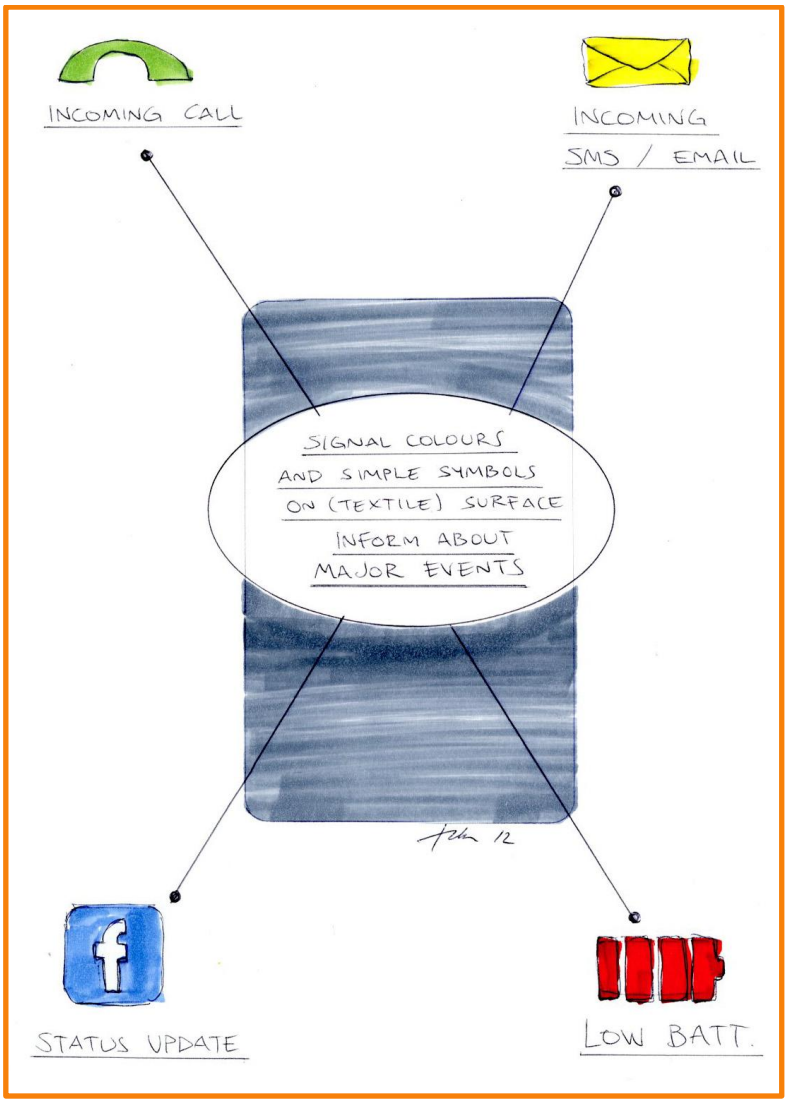

Image 20. What´s up? Information at a glance - without opening the cover (Image: Juha Ilén)

Charging mobile devices requires a battery charger. Practically you should have the charger with you all the time to be able to use it whenever needed. Usually the charger is difficult to move around and easy to forget. And the battery runs out.

Image 21. Remember the charger! (Image: technocel-europe.com)

If the mobile cover would contain an integrated charger, it would always be with you as long as the cover is with you. Charging could take place using induction charging on specific spots equipped with transmitters acting as wire-free charging platforms. This kind of platforms can already be found in many offices, airports, cafés etc. The system is based on electromagnetic induction and the phone cover would act as the receiver of the wire-free charging energy transferred through the charging platform´s transmitter (Images 23, 24). This way there would not be need for an external receiver (Image 22).

Image 22. An external receiver for induction charging (Image: trendwatching.com)

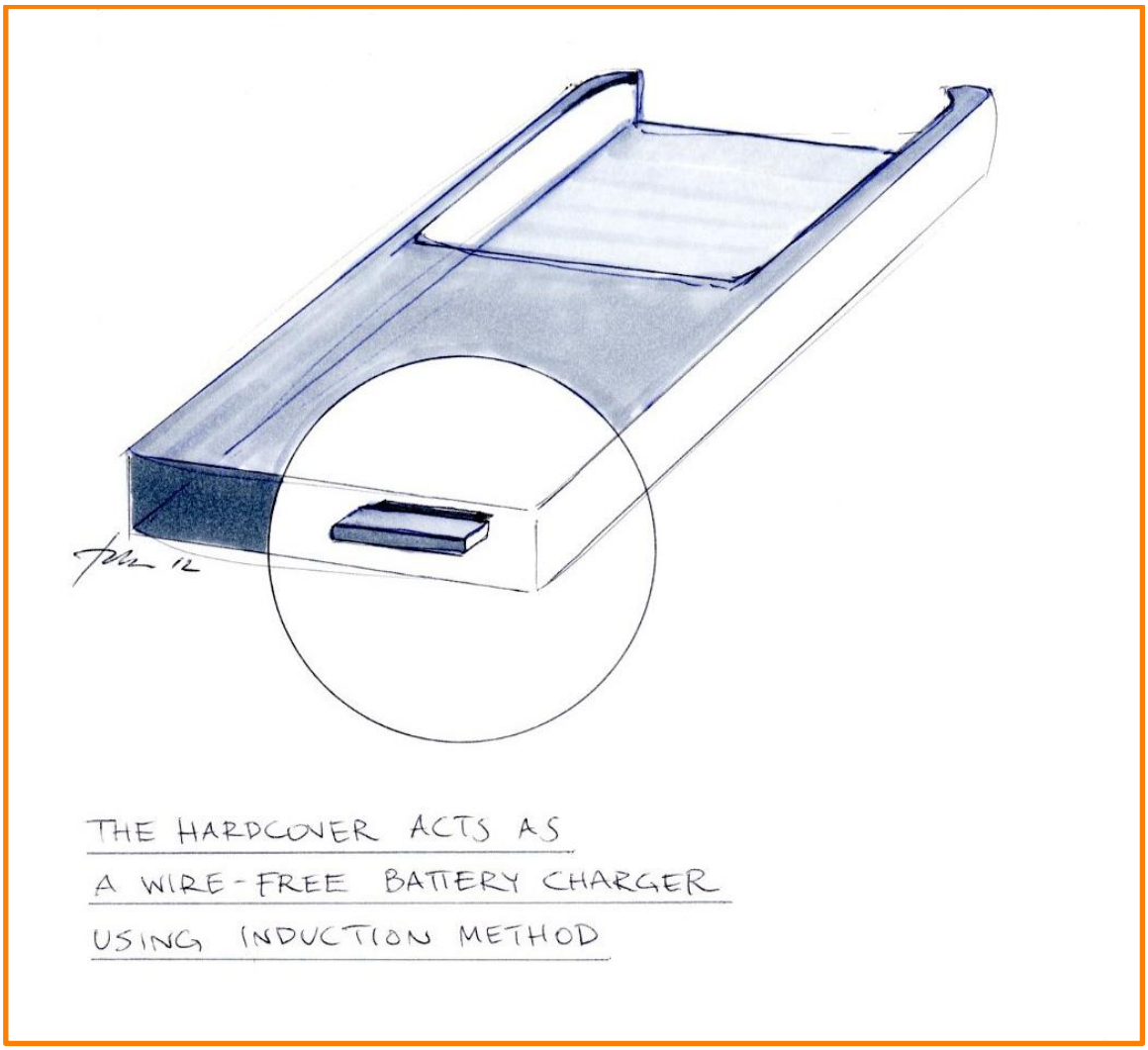

Image 23. Power within, the mobile cover for induction charging (Image: Juha Ilén)

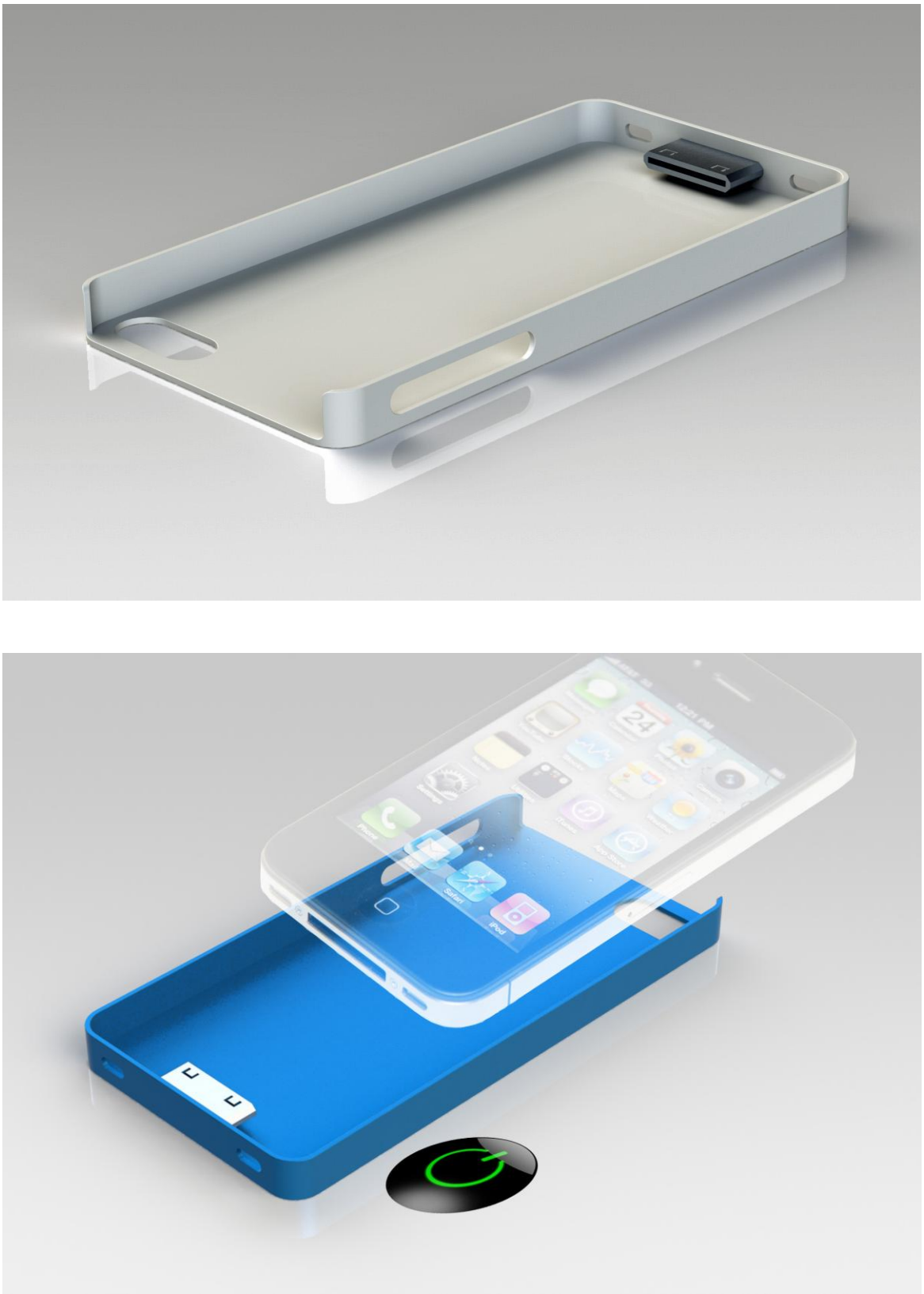

Image 24. Power within, the mobile cover for induction charging (Images: Juha Ilén)

Another solution for wireless charging without the need to carry around big chargers could be solar cells on the cover. The limitations are primarily aesthetic as the solar cell determines the appearance quite strongly (Image 25). Maybe in the future a wider range of different surfaces can be modified to harvest solar energy by e.g. using nanotechnology.

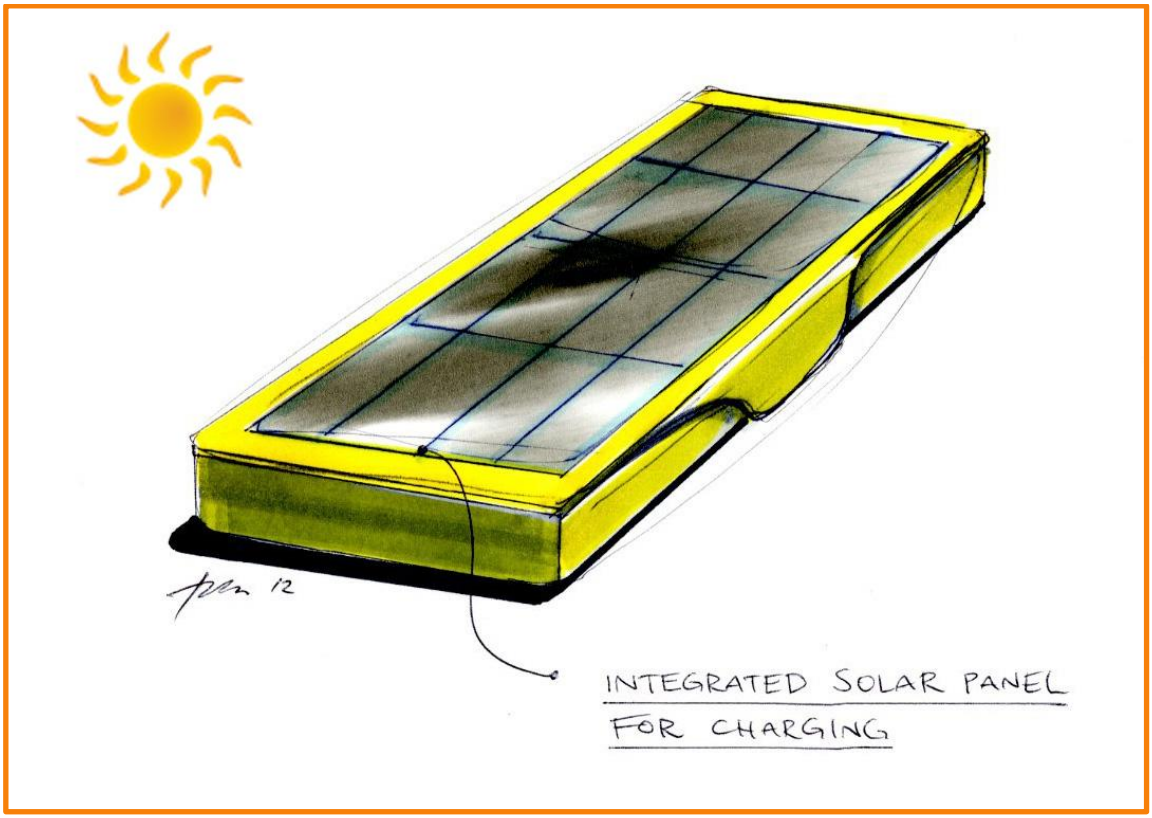

Image 25. Beam me up! Mobile cover with solar cell battery charger (Image: Juha Ilén)

Another challenge with portability are the loudspeakers (Image 26). As mobile phones and other devices are increasingly used for listening and sharing music, it should be as easy as possible to set up the speakers for playing music aloud.

Image 26. Sharing music is not always easy (Images: made-in-china.com; gigaom.com)

By using soft panel speakers or acoustic optical fibers, speakers could be integrated into the mobile bag or cover. They would be available all the time and would not require extra space or even add to the weight.

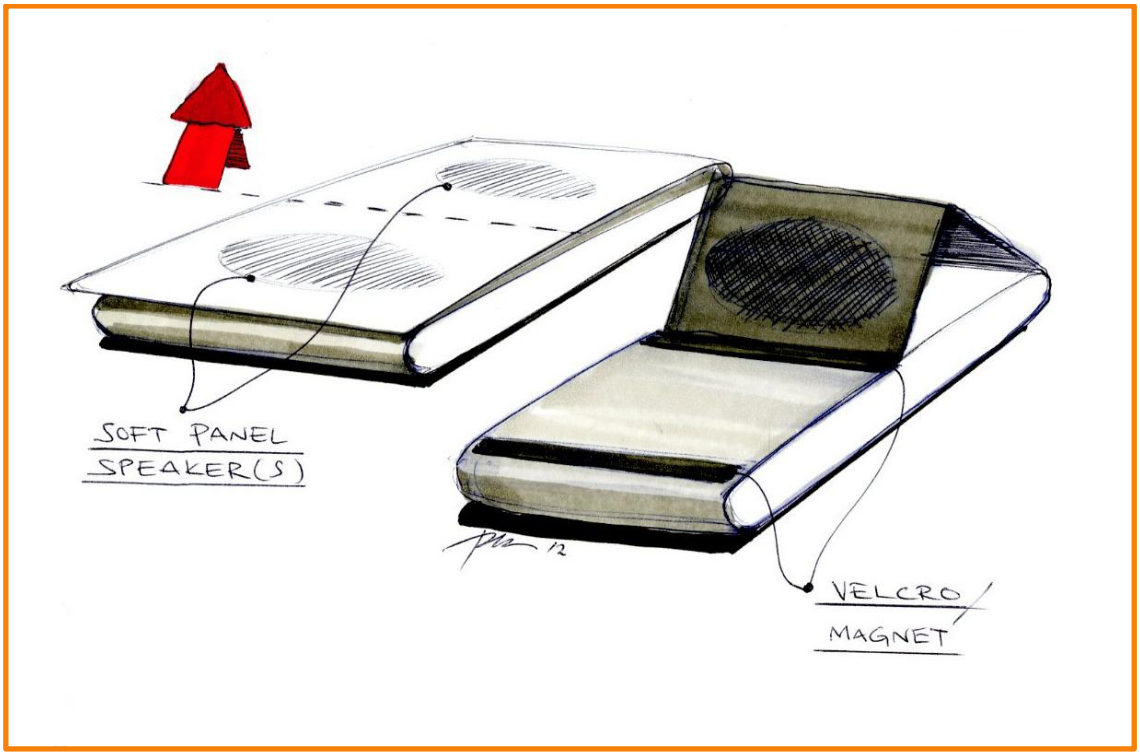

Image 27. Fold-a-blaster, mobile cover with integrated speakers (Image: Juha Ilén)

Most phones today have a touch screen. It means the cover should allow easy access to the entire face of the phone, or alternatively a music player, for navigating, creating playlists etc. On the other hand the speakers should rather be in vertical than horizontal position for better listening experience. As the client found this concept interesting, some further sketching and 3D modeling was carried out (Images 28-30).

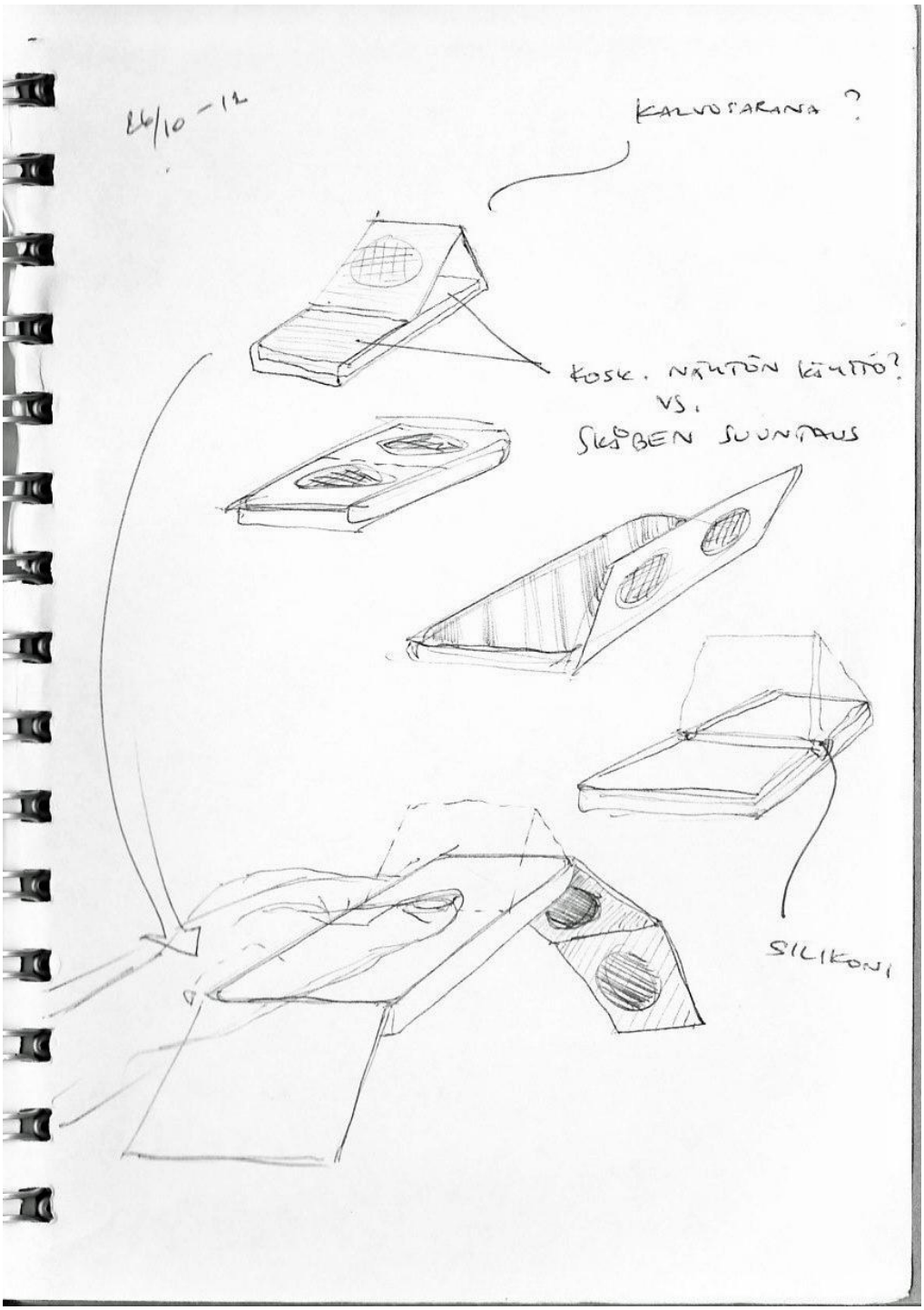

Image 28. Sketching for the usability; touch-screen vs. loudspeakers (Image: Juha Ilén)

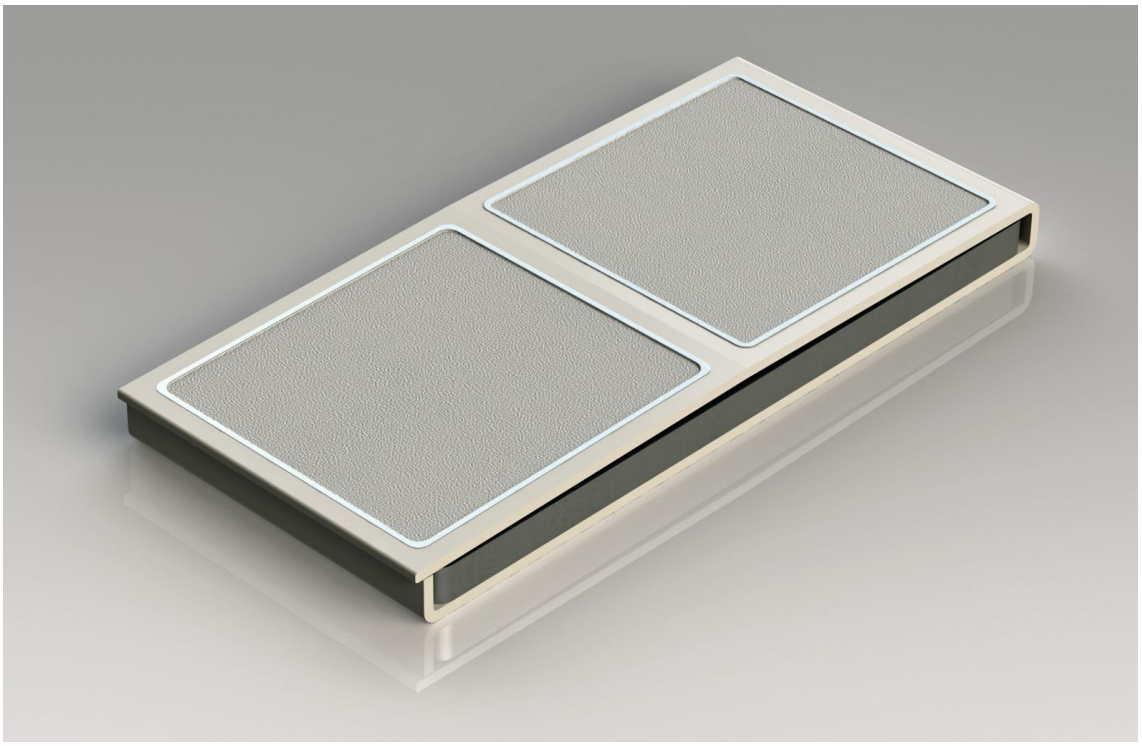

Image 29. Fold-a-blaster closed (Images: Juha Ilén)

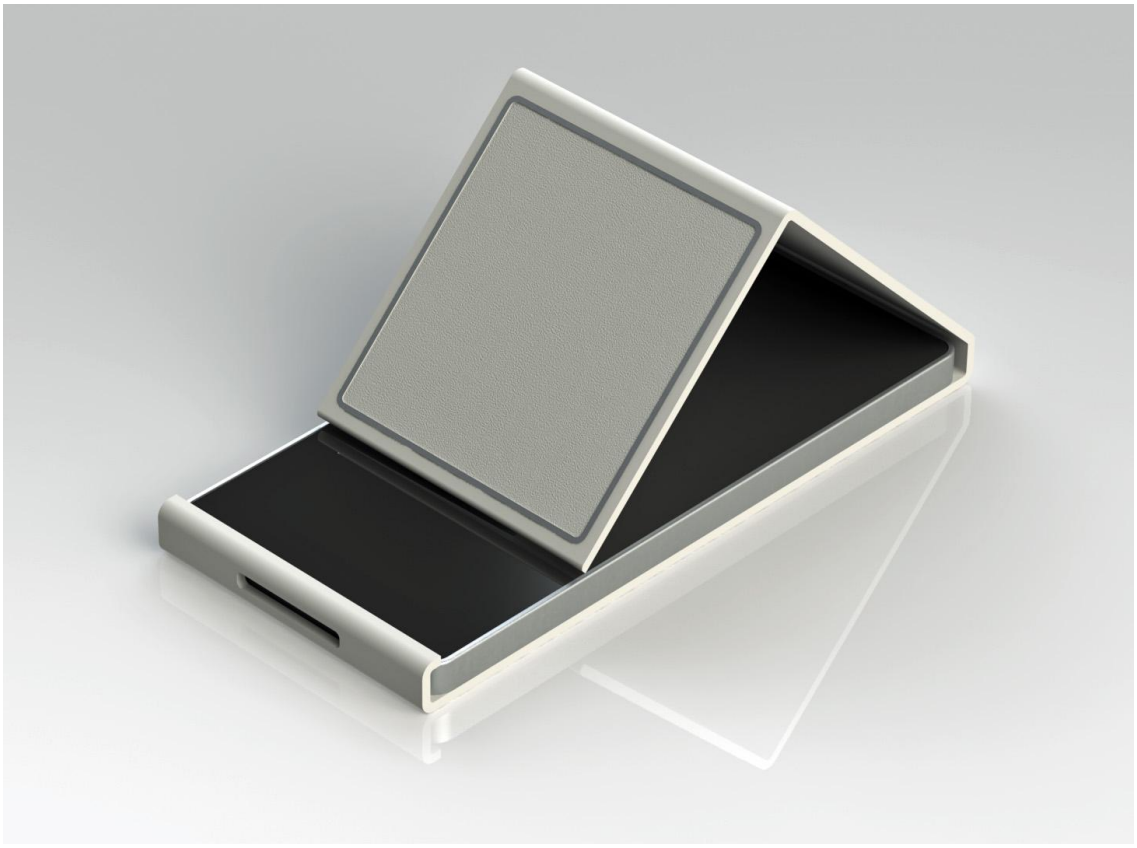

Image 30. Fold-a-blaster playing music and the phone / player can be easily accessed

By integrating textile electronic touchpad on a soft mobile bag surface, the simplest operations on the phone could be made without opening the cover. At least answering and disconnecting a call could be such functions.

Image 31. Answering is not always easy (Image: aliexpress.com)

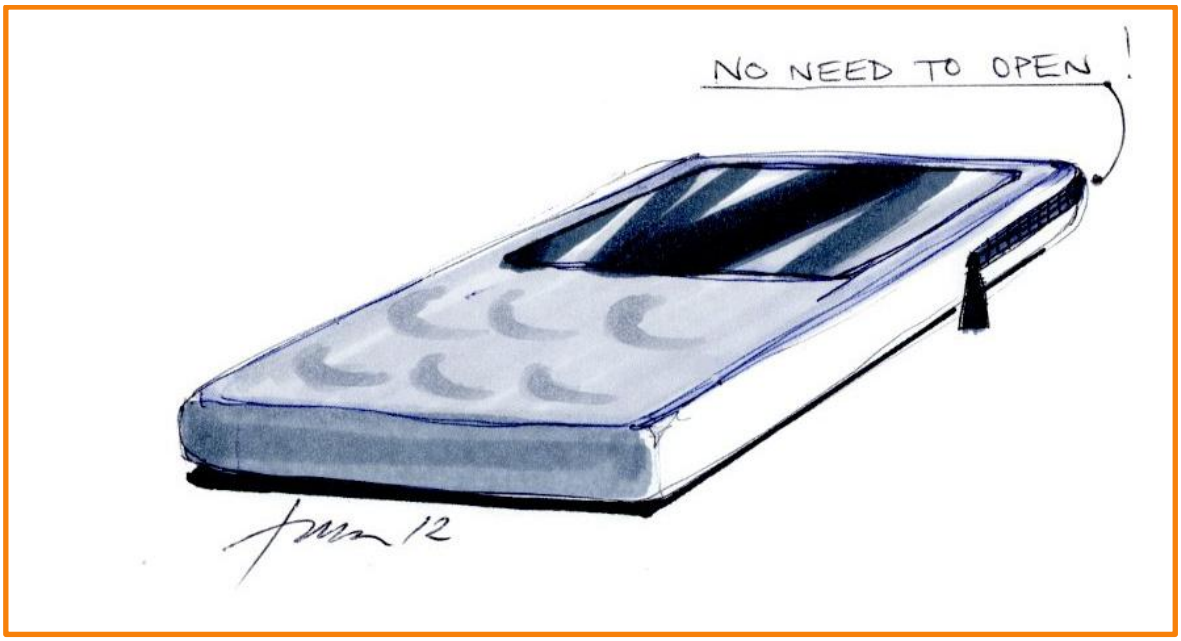

Image 32. Prextile, a soft simplified keypad for quick answering without removing the case (Image: Juha Ilén)

By adding more functions, e.g. numbers for dialing, the construction gets more complicated and possibly clumsy. In this case the application should be kept as simple as possible.

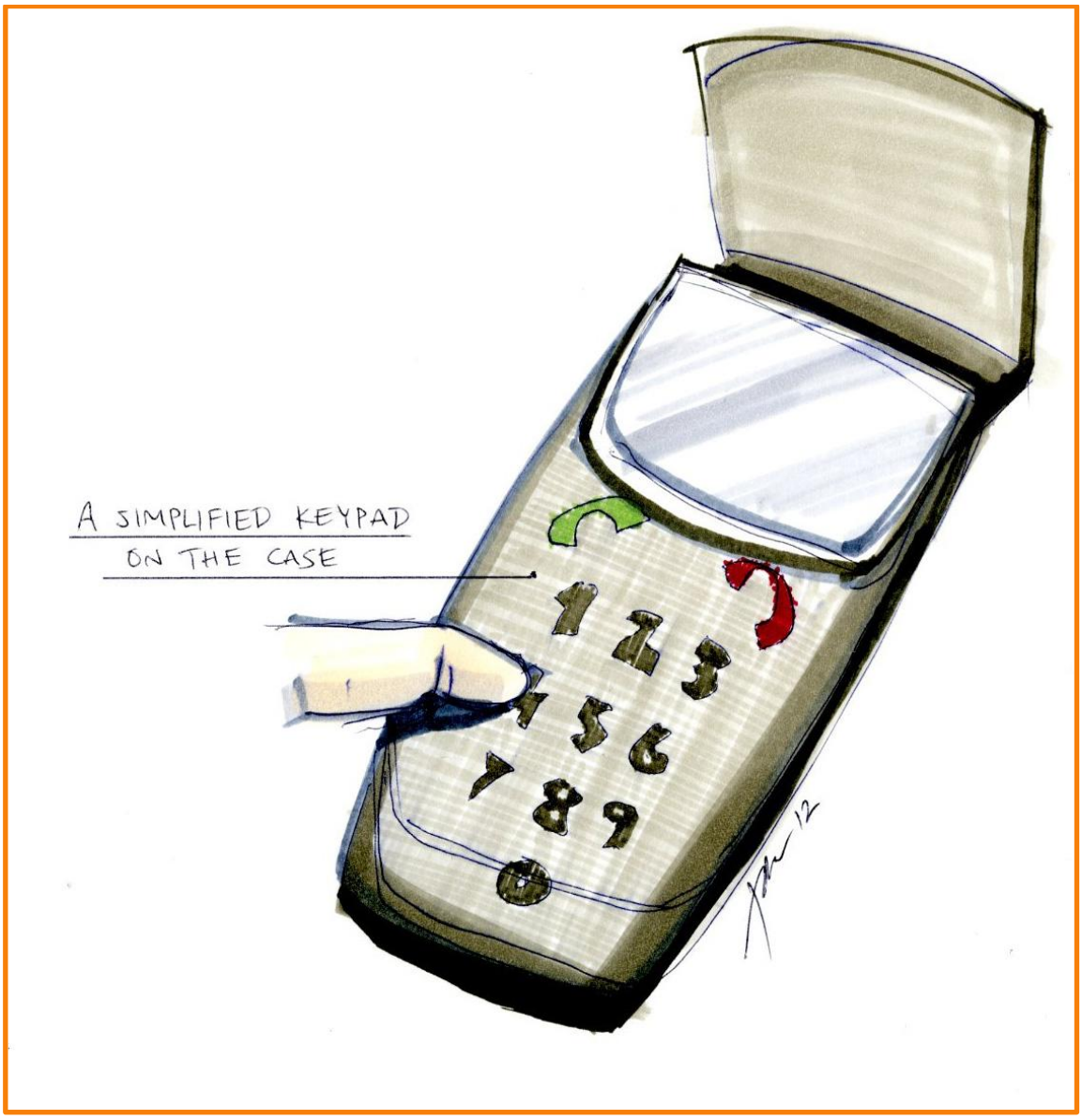

Image 33. Prextile for quick answering and dialing without removing the case (Image: Juha Ilén)

Finding your phone may sometimes be difficult in the dark. By adding self illuminating material on the cover its visibility can be improved. By using phosphorescent inks Golla could make their prints visible also in the dark. Alternatively for obtaining a more powerful lighting effect, optical and conductive fibers could be used.

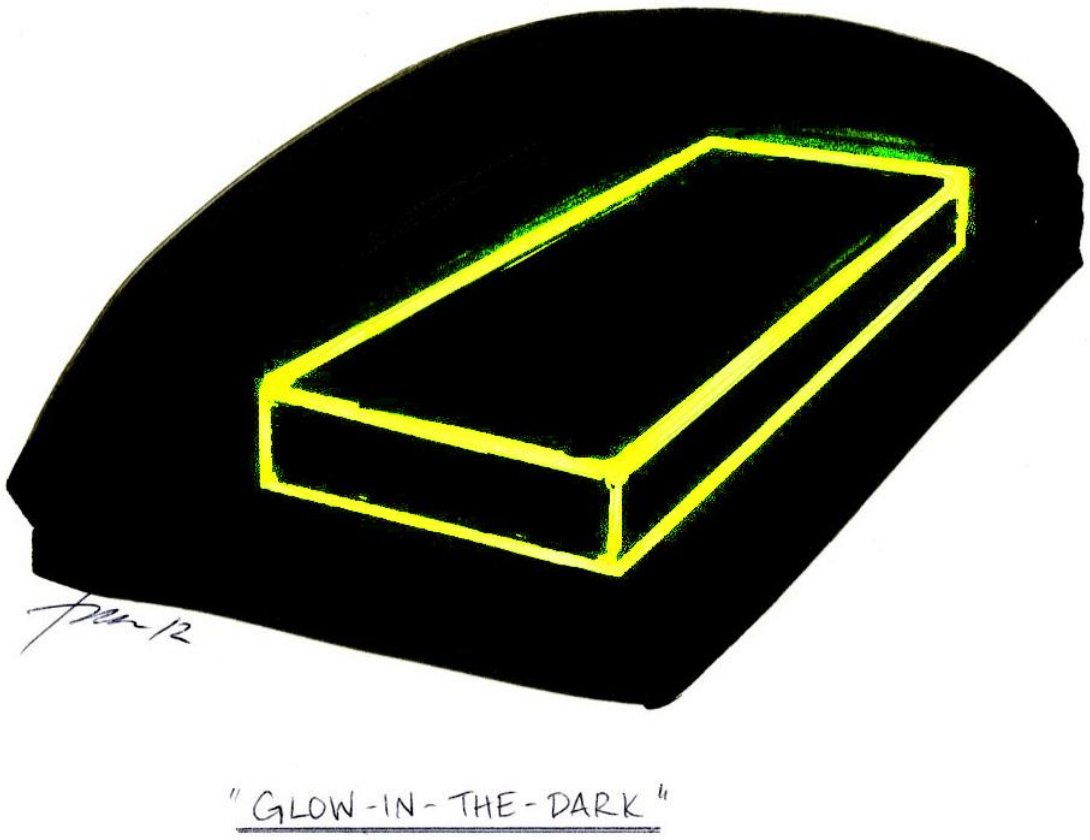

Image 34. Glowing to be found, light emitting mobile case (Image: Juha Ilén)

One of the most important functions of a mobile case is to protect the device. By using auxetic materials or smart gels, better protection with less material can be achieved. The case can be soft and elastic, but hardens at the moment of a sudden impact. After that it immediately returns to its original state. Golla could use its own visual language in the design to strengthen the brand. Co-branding with smart material manufacturers could also be an alternative.

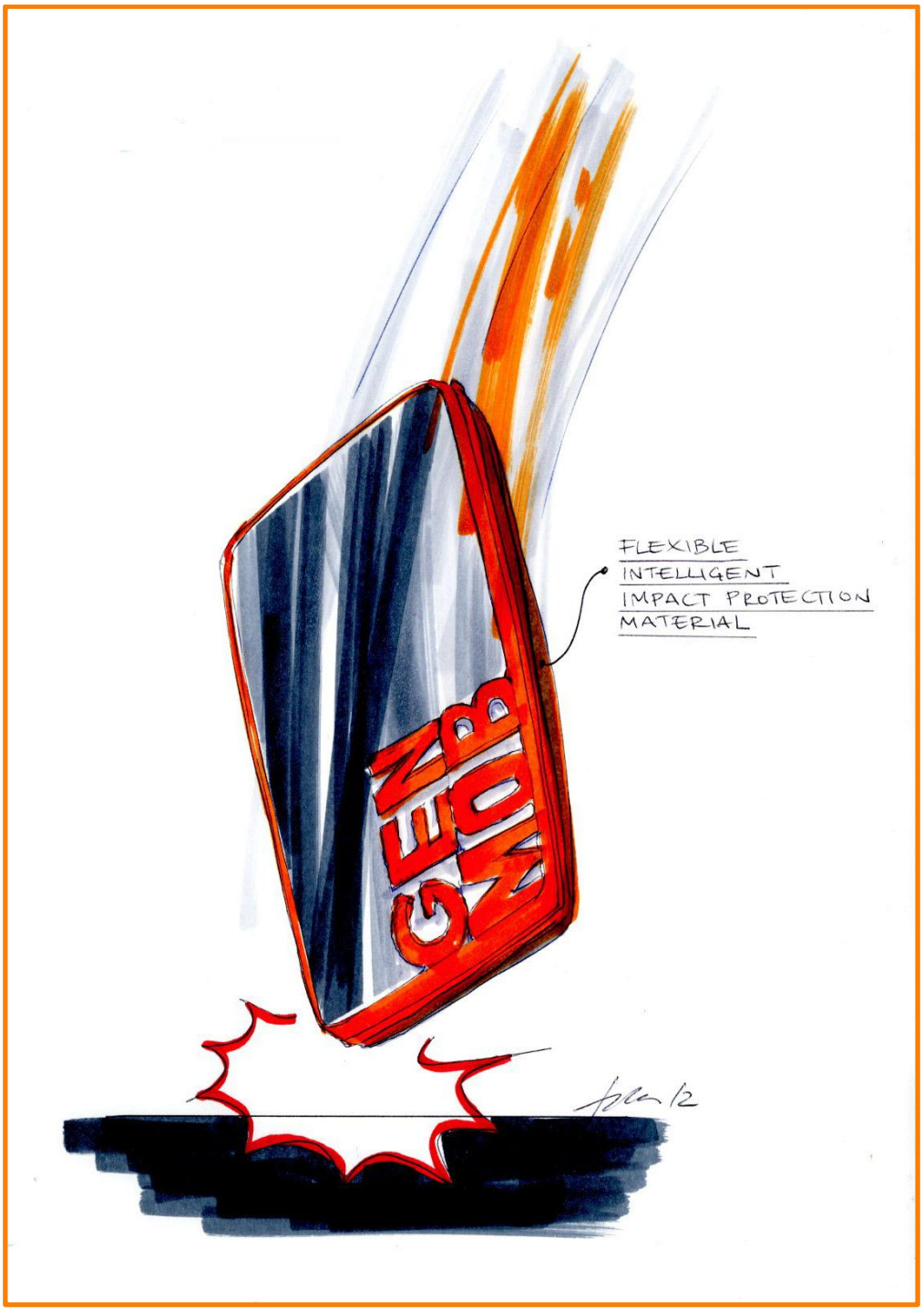

Image 35. Hitme, mobile case with intelligent impact protection (Image: Juha Ilén)

A shape memory polymer band could be sold in a simple and, no doubt, mysterious flat package. Packing and logistics would be easy. After buying the product, the customer would trigger the pre-programmed memory effect by e.g. water, and release the form of a protective mobile case. This way the customer could take part in “making” the product.

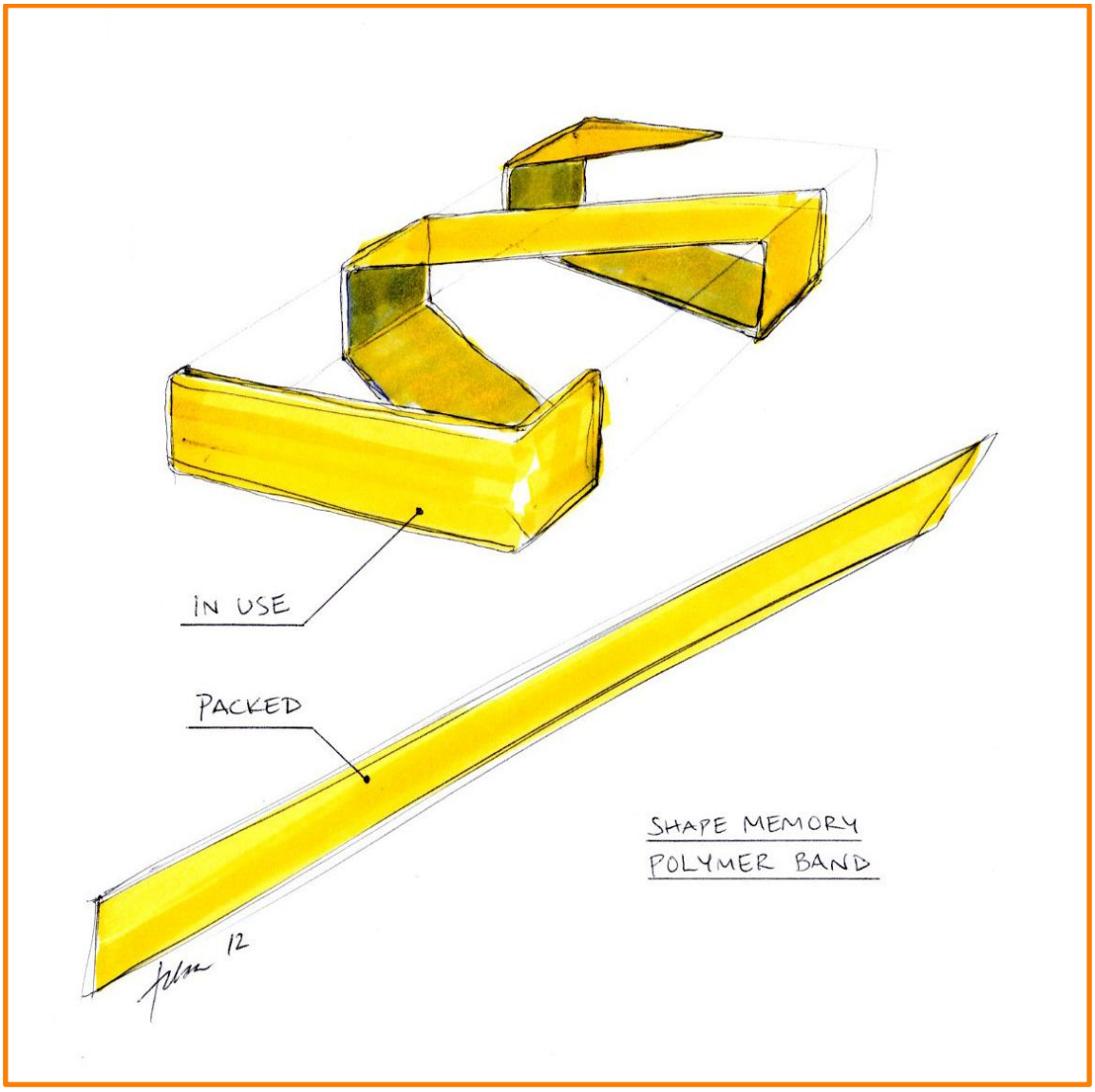

Image 36. Boa, shape memory protective wrap (Image: Juha Ilén)

Many people have more than one mobile phone. If shape memory materials were used to produce a case with two programmed size options, the same case could be switched from one phone to another. This would of course need a reversible mechanism. In logistics point of view it would be great if one package could hold a case for either iPhone 7 or 8, depending on which size you happen to need.

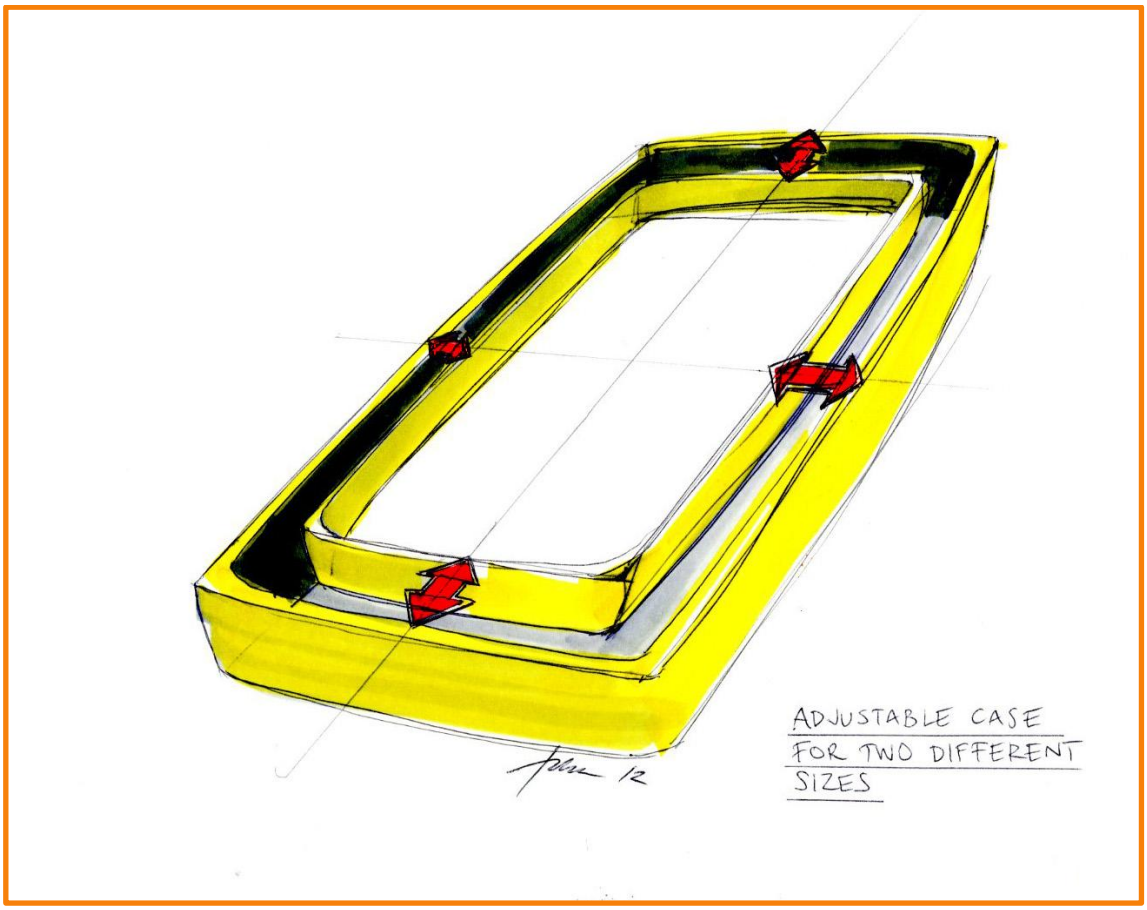

Image 37. Adjust-a-case for smaller and bigger devices (Image: Juha Ilén)

Touch screens are known to have usability problems in low temperatures. Some phones refuse from functioning as soon as there are some minus degrees. By integrating phase change materials in a (soft) mobile bag, a warming effect could be created. When the device gets into a cold atmosphere, the case starts heating by releasing PCM´s thermal energy, warming up both the device and the user´s hands. By using thermochromic material in addition, the case could indicate temperature switch from e.g. above to below zero by changing its colour (Images 38 and 39).

Image 38. Touch screen is freezing (Image: thinkjetstationeryanditsupplies.co.uk)

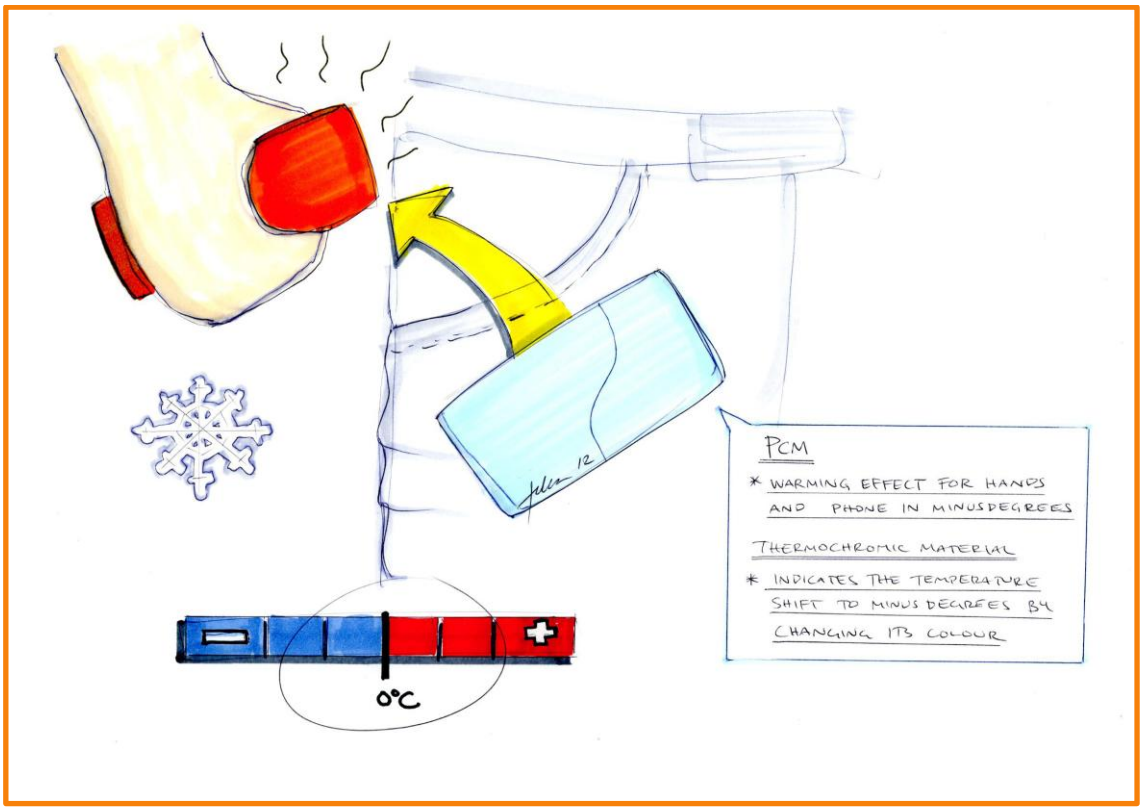

Image 39. Chameleon, a colour changing mobile case with heating effect (Image: Juha Ilén)

6.1 Analysis of material potential

User value can basicly be added by “funny” or useful functional features. Conductive materials offer the most versatile possibilities for creating such features. The investments needed for product development are dependent on the complexity of the design. Shape memory materials would most likely require the biggest investments on the development process. On the other hand, their originality and distinctiveness on the market could be taken into a very high level.

Regarding the time to market and the versatility and flexibility of the materials and technologies presented in this work, it would be advisable for Golla to look deeper into conductive materials. They offer the widest possibilities for differentiating Golla products. By adding a bit of technology they would also form a natural link between the mobile devices and their carrying solutions.

Table 2. Analysis of material potential (Image: Juha Ilén)

	added user value	investments required	originality
conductive materials			
phase change materials			
chromic materials			
light emitting materials			
shape memory materials			
auxetic materials			

7 Conclusions

Smart materials are not commonly used in carrying solutions for mobile devices. The products are very modest and conventional. Their personality is based on colours or prints, and their functionality is based on structure rather than material intelligence. Any features that could add the user value, preferably by bringing the mobile bags or covers technologically closer to the actual devices they´re holding inside, would increase interest towards Golla.

The extent of the material review was fit for this thesis work´s purpose. Basic information on smart materials worked well as inspiration for generating ideas of using them in a new way. In this case it was better not to know all the material properties and limitations they would cause. The review will also serve Golla as a material databank for generating new concept ideas and conducting possible further research on intelligent materials.

The essence of this work, the concepts, will help Golla estimate the potential of different product strategies and envision alternative scenarios for the future. Some of the ideas could be realized quite easily, others require long term commitment. An advisable way of introducing smart materials could be not mass production but making working prototypes for demonstration. They could be used as showstoppers in exhibitions to boost the Golla brand. With a relatively small investment Golla could differentiate from its current competitors and profile itself as a pioneer and a future visionaire. In any case it´s important to follow the development of new materials and weigh their possible effects on Golla´s future.

When it comes to presenting smart products to the market, packaging design and the way of communicating the advanced functional properties comprehensibly and appealingly to the customers become an interesting challenge and possibility. It would be a subject for another thesis.

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Thanks
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Concept ideas grouped by the smart materials they´re based on