



STAY SAFE IN THE SUN

Development of a UV indicator patch for children

Master of Science Thesis in the Master Degree Program, Industrial Design Engineering

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GÖRAN SMITH**

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ABSTRACT

Skin cancer is on a rapid increase in Sweden due to increased sun exposure to the population. 40,000 Swedes are struck annually and more than one percent of the cases are lethal. Pre-mature sunburns are identified as extra hazardous and children should therefore be very cautious when spending time in direct sunlight.

The visionary aim of this master project was to enhance social and economic sustainability by reducing sunburn among children. The goal was therefore to develop a device which indicates when children have been exposed to a recommended maximum daily amount of UV radiation and hence should avoid additional exposure. An industrial partner and their disposable UV indicator wristband served as starting point for the project which focused on user experiences and usability.

Characteristics of intended users and use contexts were investigated through surveys, contextual studies, interviews and observations. A user test with a prototype of the wristband was furthermore performed in order to explore usability and user experiences. The collected data was analyzed whereafter a product concept was developed according to insights and accommodated to the industrial partner's market position and strategy.

The end result of the project was Solplåster, a UV indicator patch which incorporates the industrial partner's patented ink technology. It targets Swedish families on holidays abroad and should be used by children below 12 years old. A final user test implied that Solplåster has better usability qualities and is more agile and flexible than the existing wristband. A final conclusion is thus that Solplåster stands a chance of reaching out to users and fulfilling its aim, if the industrial partner chose to commercialize it.

Keywords: *UV indicator, sun habits, children's products, sun care, product development,*

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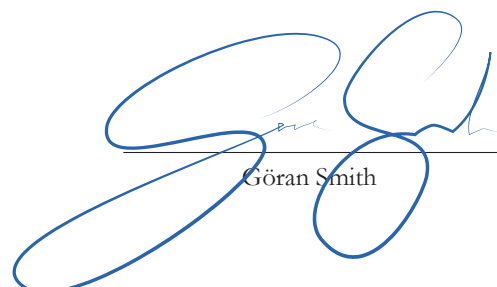
Claes Lindahl, CEO for the industrial partner and Maria Gunnarsson, head of material development for the industrial partner, initiated this project and have been devoted and truly inspirational along the way. We thank them for the opportunity and the support they have given.

Last but not least we would like to show our thankfulness to our supervisor Viktor Hjort af Ornäs, our examiner Pontus Wallgren and all our friends and classmates at the fourth floor of the Architectural building. They have been with us from the start to the end and have helped us whenever help has been needed.

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Daniel Falk



Göran Smith

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01

INTRODUCTION

This chapter describes the project's starting point and explains the background, aim and goals that were set at the beginning of the project.

1.1 BACKGROUND

There is a rapid increase of skin cancer cases in Sweden, which can be related to increased sun exposure to the population (Brännström et al., 2005, Måhnson-Brahme, 2005, Wålin, 2012). 40,000 Swedes are struck annually and more than one percent of the cases are lethal (Cancerfonden, 2012).

Children have more sensitive skin than adults and should therefore be extra cautious when spending time in direct sunlight (Eriksson, 2011). Since many factors influence how long children can stay in the sun without getting sunburned, it is difficult for parents to protect them properly. There is therefore a need for products that help parents monitoring the UV status of their children.

A company* (referred to as “the company” or “the industrial partner”) has developed a patented ink that changes color when exposed to sunlight. By calibrating the ink, it can change color when exposed to the amount of sunlight human skin can be exposed to without risk of sunburns. The company's first product, a disposable UV-indicator wristband, was released in the end of march, 2013. They want to review it in terms of user experience and usability and investigate possibilities to extend their product portfolio by developing other products with similar functionality.

1.2 PROJECT

This master thesis at Chalmers University of Technology has been performed in cooperation with the company. It used a prototype of the their existing product as starting point and investigated how their ink technology could be used for UV indicators for children. The project investigated the Swedish market and targeted children aged 2-12 years and their parents, since they are the company's primary focus.

Important focal points were to explore how a UV-indicator should be designed to fit in with the target group's needs and requirements and to propose how such a UV-indicator could be manufactured and sold. Consumer behavior, user experience and target group characteristics were therefore essential cornerstones.

1.2.1 Purpose and goal

The visionary aim of this project was to enhance social and economic sustainability by reducing sunburn among children and thereby cutting back related diseases such as skin cancer and the costs for treatment of these conditions. A project goal was therefore to enhance the likelihood of adoption of the industrial partner's wristband through investigating it from a user experience and usability perspective and presenting findings in a way that can be used as basis for refinement. The main goal was however to develop a highly realizable concept, based on research insights and accustomed to the company's market strategies, brand and economical possibilities.

1.2.2 Deliverables

The main deliverable was an academic report that describes the project and highlights research findings. A holistic concept at prototype stage was also delivered. It consisted of both a product and a packaging design as well as a description of the product journey, from cradle to grave and the intended customer journey. The concept was presented through system charts, drawings and renderings.

1.2.3 Delimitations

Development of the patented ink technology was not considered during the project. The final concept was therefore bound to become a disposable product and some refinement of the ink might be needed in order to make the final concept completely production ready. Optimization of production cost and margin, through finding the best suppliers and retailers was furthermore not performed, and potential profitability is thus not maximized. More limitations emerged during the project process. These are described in the different concluding chapters throughout the report.

1.2.4 Report outline

Process and results are separated in the report. The project process and its methodology is described in chapter 4 while the results are presented in chapter 5 to 10.

*Out of respect for the industrial partner; their company-, brand- and product name will be disclosed in the report

02

PROBLEM DEFINITION

This chapter elaborates on the problem the project aimed to solve and provides background information that affected the project.

2.1 SUN PROTECTION

2.1.1 UV radiation

Ultraviolet light (UV) is a type of electromagnetic radiation which has shorter wavelengths than visual light. UV is primarily emitted by the sun and contributes with 10% of the sun's total energy (Nylén et al., 2002). It has several acute and chronic hazardous effects on human skin. The most common immediate effect is sunburn and the most publicly discussed chronic effect is skin cancer.

Long term and continuous UV exposure make the skin dry, rugged, wrinkled and uneven. Pigment cells get damaged why the pigmentation becomes uneven and freckles, brown spots and age warts emerge. UV radiation additionally affects immune system and eyes negatively but is vital for human skin since it triggers development of vitamin D (Nylén et al., 2002).

The most commonly known effect of sun exposure is nevertheless suntan. It occurs through two different mechanisms; one immediate and passing which does not imply any extra protection towards UV radiation and one delayed, more lasting, which starts about three days after exposure. The delayed suntan and thickening of the epidermis imply some extra protection towards UV radiation. This is commonly known as "natural protection" (Nylén et al., 2002).

2.1.2 Skin cancer

There are three different types of skin cancer; basal cell carcinoma, squamous cell carcinoma and malignant melanoma. The world health organization states that between 50% and 90% of the 13 million skin cancer cases worldwide are caused by UV exposure (WHO, 2009). Even though sun exposure is known as the biggest risk factor for the development of skin cancer, the incidences of skin cancer continue to increase (Brännström et al., 2005). The two less lethal (non melanoma related) types of cancer had 2 762 cases in Sweden 1999 and increase yearly with about 4% while 2 333 cases of malignant melanoma was reported in 2007 (Rodvall et al., 2009). The number of malignant melanoma cases in Sweden has doubled every decade since 1950 (Nylén et al., 2002). They are often localized to trunk, legs and arms and a quarter of the cases lead to death.

Research indicates that malignant melanoma can emerge as an effect of single extreme UV exposures and there is a commonly accepted theory that UV exposure before puberty increases the risk to develop malignant melanoma

vastly (Nylén et al., 2002, WHO, 2013). The reason for this is undisclosed, but it is probable that the skin is more susceptible to the effects of UV radiation during childhood (WHO, 2013).

2.1.3 Skin types

To calculate the time a particular person can be exposed to sunlight at a particular place at a particular day without risk of sunburn, one need to know two vital factors; the strength of the ultraviolet radiation from the sun (the UV index) and the particular person's sun sensitivity (skin type). Fitzpatrick has developed a widespread classification system for skin types regarding sun sensitivity and sun tanning ability. This classification is presented in figure 2.A. Photosensitive skin types is a main reason for getting sunburned why light skinned people have a higher risk of developing skin cancer (Rodvall et al., 2009). The cumulatively amount of UV radiation absorbed by the skin during a day is called erythemal dose. The minimum erythemal dose (MED) is the minimum amount of radiation which is required to cause reddening of the skin. A MED has been determined for each skin type.

	COLOR	SKIN TYPE	BURNS IN THE SUN	TANS IN THE SUN	MED (JOULES)
MELANO COMPROMISED		1	ALWAYS	SELDOM	200
		2	USUALLY	SOMETIMES	250
MELANO COMPETENT		3	SOMETIMES	USUALLY	300
		4	SELDOM	ALWAYS	450
MELANO PROTECTED		5	NATURAL BROWN	SELDOM	600
		6	NATURAL BLACK	ALWAYS	1000

Figure 2.A. The different types of skin, how often they burn in the sun, how often they tan in the sun and the associated MED (Ravnbak, 2010).

SUNCARE MARKET

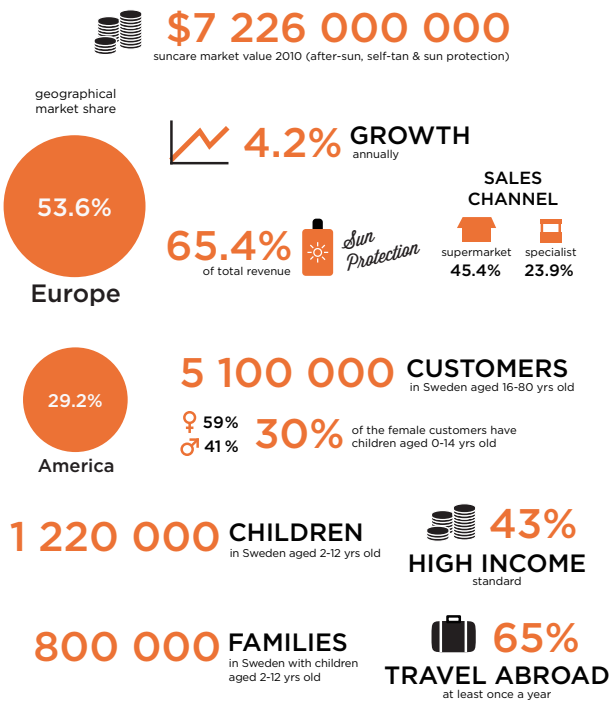


Figure 2.B. Sun care market infographic.

2.3.1 Sun care market

The awareness of the effects of unprotected sun exposure has risen and more and more people use thought through methods to protect themselves and their children from the sun. Hence, there is a growing market for sun care products.

The total market value for sun care products (after-sun, self-tan and sun protection products) was 7,226 million dollars in 2010 (Marketline, 2011). This figure has been growing annually with 4,2% (Marketline, 2008) and is estimated to continue to grow due to the increasing awareness (Mintel Oxygen, 2012). Europe is the main geographical market, responsible for 53,6% of the market value while the American region accounts for 29,2%. Sun care products are normally distributed through either supermarkets or specialist retailers and sun protection is the primary product segment, responsible for 65,4% of the total revenues (Marketline, 2008). In Sweden, suncare products are mainly sold at pharmacies and at supermarkets. 5.1 million Swedes between 16 and 80 years use sun care products. 59% of these are women and 30% have children below 14 years old (Strand, 2012). The statistics are displayed in figure 2.B.

There are currently about 1 220 000 children, living in 800 000 families, within 2 and 12 years old in Sweden (SCB, 2013-1). This figure is estimated to grow with 14% until 2025 (SCB, 2013-2). About 65% of these families travel abroad at least one week per year and many of the trips are beach holidays (SCB, 2013-3). 43% of the households are classified by SCB as having a high income standard and the overall household income is 45% higher than their need for providing basic needs (SCB, 2013-3). As an effect their vacation budgets continue to increase (TT Spektra, 2013)

2.2 INDUSTRIAL PARTNER

The industrial partner is a small innovation company founded 2011 in Gothenburg, Sweden. Their aim is to provide products that help people see how much UV radiation they have been exposed to in order to decrease unhealthy sun exposure and thereby risk of skin cancer development. Their vision is according to the business plan *to be a profitable company on an international market whose products are the obvious products for every person purchasing sun care products and their mission is to develop the most reliable and easy to use UV indicator technologies.*

2.2.1 Reference product

The company has created a brand (referred to as “the brand”) and developed their first product, a disposable UV indicator wristband (referred to as “the reference product”). The wristband (figure 2.F.) was released on the Swedish market in the end of march 2013 (half way through this project). It utilizes a patented ink which gradually changes color, from yellow to pink, when exposed to a certain amount of UV radiation. The ink, which respond to both UVA and UVB, has been calibrated to change color when it has been exposed to the MED for skin type one. Color change can therefore be used as an indication for when it is appropriate for the wristband user to avoid the sun. The entire wristband changes color, apart from three reference points (as can be seen in figure 2.C.). These indicate the color at the starting point, the color midway through the process and the color when the maximum level is reached. Chlorinated or salt water do not imply any usage problems and sun screen can be used with the wristband by applying the same amount of sunscreen on it as on your body. The wristband will then receive the same protection as the skin and the color change will be slower.

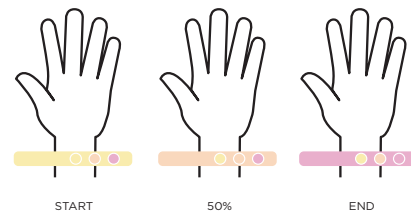


Figure 2.C. A pictorial overview of the use of the reference product.

Consumers interactions with the wristband can roughly be divided in four phases, pre-purchase, purchase, use and after use. These all contribute to the user experience and need to be taken into account for a successful product development. What these phases imply are described in figure 2.D.

The value the wristband provides for end consumer can according to the company’s business plan be summarized as follows; Prevents skin cancer, sunburn and aging of the skin. It also helps people to relax and not worry about the sun and when to re-apply sunscreen.

Children are more sensitive to sun exposure and experience the most hazardous effects why the wristband mainly aims for children 2 to 12 years old. The company has also identified promising consumer habits among parents. The length of the wristband makes it nevertheless possible for adults to use and it is not clearly stated who the wristband is for.

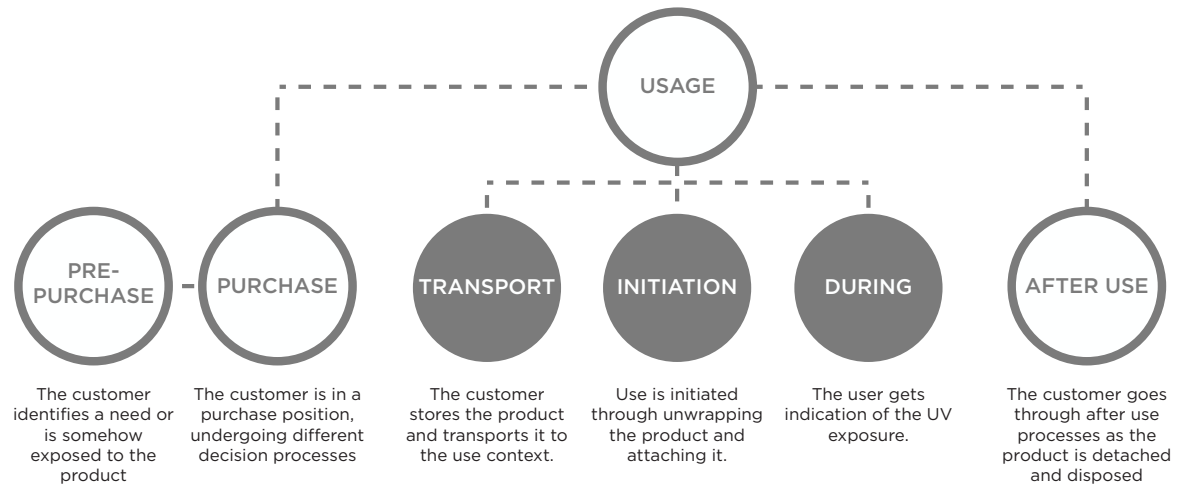


Figure 2.D. The customer journey displays the different phases the customer goes through during the experience of the product.

The wristbands are sold in sets of seven. These are packaged in a printed, glossy cardboard package (figure 2.F). The front cover of the package, which should be hung in the shelf, states essential information such as product type, skin type and brand while the back cover has a detailed description of how to use the wristband and reasons why to use it etc.

The polymer based ink is produced by company representatives at Chalmers University of Technology and then screen printed on PVC sheets in Stockholm. The printinghouse die cut the PVC sheets to create the wristbands while an organization is responsible for packaging of the product. Distribution rights belong to a distribution firm which primarily deliver to Swedish pharmacies where the wristbands are sold to end customers. Wristbands are finally used and disposed by users. The product journey is displayed in figure 2.E.

The industrial partner has until now focused on market studies, manufacturability and technical development and there is no design competence within the company. Development of brand, packaging and web design was therefore outsourced to an advertising agency. What the intended customers actually desire and how the wristband and its marketing is perceived by customers is more or less unknown. The company therefore saw a great need to develop the wristband and upcoming products, from a design perspective, which was their reason behind initiating this project.

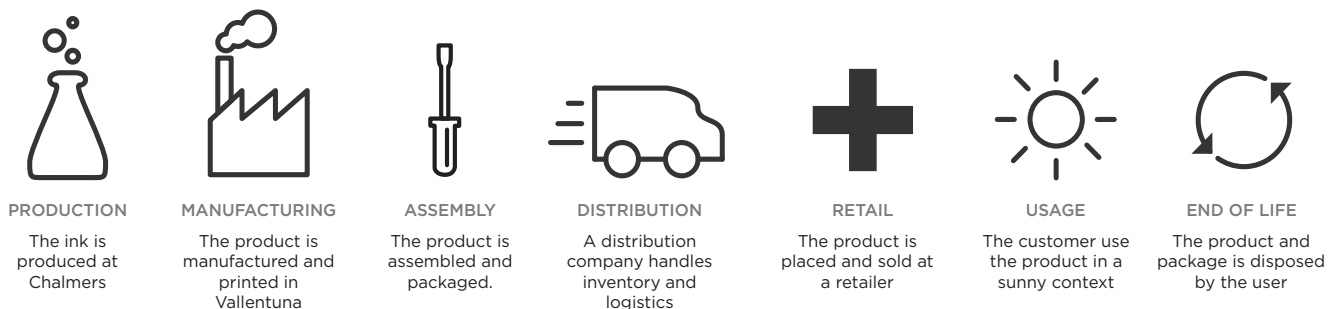


Figure 2.E. The product journey displays the different phases the product goes through from cradle to grave.

2.3 CONCLUSION

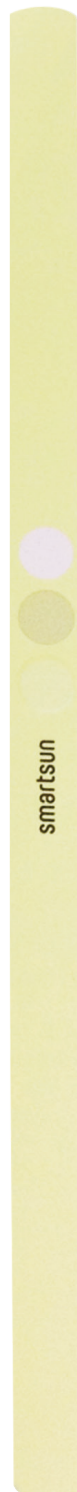
Unhealthy UV exposure is the main reason behind the growing number of skin cancer cases worldwide. Children with photosensitive skin types are extra vulnerable and premature sun burns have hazardous effects. Better sun care products for light skinned children are therefore desired.

UV indicator devices fit within the category and have potential to decrease skin cancer and pain by facilitating monitor of children's UV exposure. The industrial partner has developed a wristband which has unique properties and possibilities due to the ink technology. User experience and usability qualities are however essential for adoption of new products and are in this case uninvestigated. The project therefore aimed to answer the following questions;

- Should the industrial partner's wristband be refined in terms of user experience and usability qualities to facilitate adoption?
- How could a highly realizable concept, accommodated according to generated insights and accustomed to the company's market strategies, brand and economical possibilities, be like?



Package front



Wristband



Package back

Figure 2.F. The reference product and its package.

03

THEORETICAL APPROACH

This chapter describes the chosen design theories that formed the theoretical basis for the project.

3.1 APPROACH

All interactions with the product, its brand and its marketing give rise to user experiences. A holistic approach was therefore needed in order to examine the appropriateness of the current product and to refine it. This implied not only focusing on aligning ideas with the customer journey but also with the company's strategy and financial possibilities. Considering the novelty of the product category, the consumer behavior of the intended user group would also be of great importance. The project needed therefore to take the adoption process into account and facilitate diffusion. It was furthermore important to make the innovation understandable and usable, in order to pave the way for a successful market introduction. As a result, the following theoretical approach was chosen for the project.

3.2 USER EXPERIENCE

A user experience is the user's affective response to interaction or anticipated interaction with a product or the surrounding services. The affective responses that can be experienced through human-product interaction are described in an established theoretical framework proposed by Desmet and Hekkert (2007). Their framework (figure 5.A) includes three fundamental components; the degree to which all our senses are stimulated (aesthetic experience), the meanings and values we attach to products (meaningful experience), and the feelings and emotions that are elicited (emotional experience) (Schiffstein & Hekkert, 2007). The three components in the model have their own underlying processes but are intertwined. The experience is the combined effect of them.

Users' affective responses to products are highly contextual and individual since they originate in the users' appraisals of the significance of the product interaction for their personal well-being. It is furthermore the appraisal of the product interaction rather than the actual interaction that determine the affective response. Nevertheless, it is important for designers to create favorable conditions that enhance possibilities for desired experiences.

Since user experiences not only include actual use of the product but all interactions which can be associated with the product, it is important to consider the full customer journey. "The customer journey encompasses every moment from the second when someone has a need for a certain product or service through the purchase and even onto aftercare or repurchase" (Ruth, 2011). Moments when user and product or associated services interact are often referred to as touch points.

3.3 USABILITY

Usability, which is a quality experienced by the user during use, is determined by the interplay between user, context, product and task (Jordan, 1998). Usability is thus an important part of the user experience which is directly connected to actual use. Nielsen (1993) advocates a view upon usability in which the combination of usability and utility determines a product's usefulness. The ISO-definition (which is used in this report) includes utility in the term and states that usability is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO 9241-11, 1998).

Jordan (1998) has complemented the ISO-definition with five additional measurable aspects of usability:

- Guessability - Usability for first-time users.
- Learnability - Usability when the user already has used the product.
- Experienced User Performance - Usability for experienced users.
- System Potential - The optimal level of usability that the system possesses.
- Re-usability - Usability of a user who had a long break from using the product.

3.4 BRAND IDENTITY

The brand, which is an important part of the user experience, is a major influence for perception, evaluation and choice of products (Veryzer, 1998 in Karjalainen, 2007). Both functional and symbolic properties are consciously and unconsciously attached to product by the brand, creating a perceived understanding and expectations of the product. Products therefore need to not only appear attractive, but also relate to the characteristics of the brand to help position and categorize it (Karjalainen, 2007).

A visual brand identity is all the visual aspects of design that helps the consumer to identify the brand and understand its core values. These values can be manifested and expressed through a combination of features such as shapes, forms, colors, materials, surfaces, textures, graphical elements and logotypes (Karjalainen, 2007). In order to create a strong brand, the product portfolio must have a consistency that makes all these elements come together and create design cues that are in-line with the intended core values. Repeating a trademarked design feature is one way to gain recognition. Karjalainen (2007) however suggest the use of "value based" design cues, i.e. cues that help the consumer understand the cues instantly by alluding the desired core values.

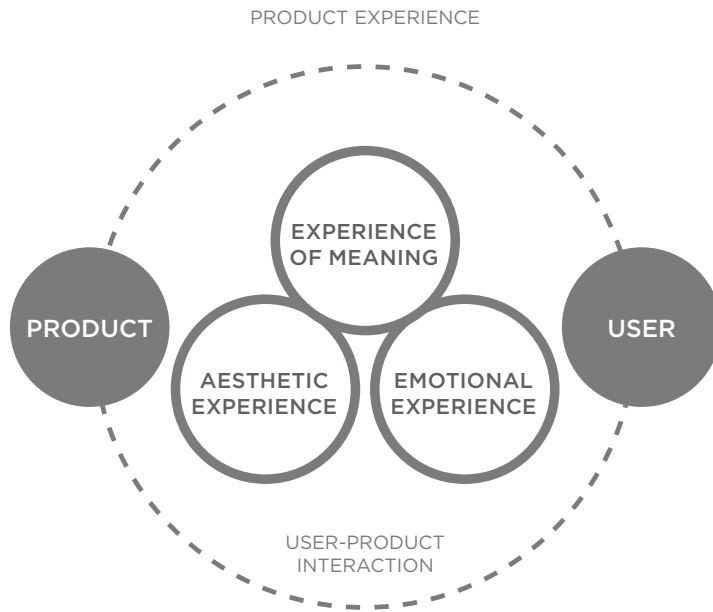


Figure 3.A. An interpretation of Demset & Hekker's (2007) product experience model.

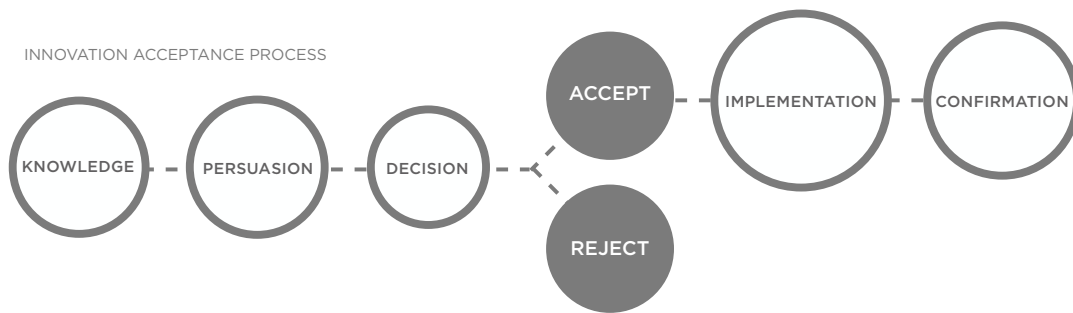


Figure 3.B. An interpretation of Roger's (2003) innovation acceptance process.

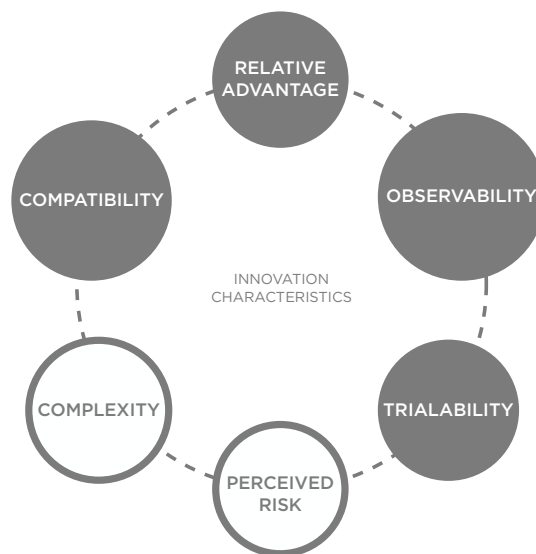


Figure 3.C. The innovation characteristics as suggested by Rogers (2003) and complemented by Gatignon and Robertson (1985). Out of these 6, Complexity and Perceived Risk are negative influencers on adoption

The brand identity needs to be consistent not only for the product, but for all touch points of the brand throughout the customer journey (Roscam, 2010). Hence the visual brand identity should be applicable for communication, marketing, package, retail environment etc. Thus, everything that shape the customer's perception of the product and the brand need to be considered. A packaging for instance is not just a communicating part of the brand, but the brand itself and influence the total experience (Rapheal & Olsson, 1978 in Underwood, 2003).

3.5 CONSUMER BEHAVIOR

Consumer behavior is the processes carried out by groups or individuals as consumers and influences the adoption and acceptance of an innovation. The theoretical framework can be used in order to understand how consumers will react and respond to purchase situations, what experiences they desire and what will influence their decisions (Evans et al., 2009).

3.5.1 Diffusion of innovations

In order for an innovation to become a successful product it must be adopted by the user. The innovation diffusion is defined as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003). The five step innovation acceptance process by Rogers (2003) (displayed in figure 3.B) shows how an innovation is being received, evaluated and accepted. The knowledge of the innovation and the following persuasion lead to a decision of either acceptance or rejection. If accepted, the innovation is then implemented into the acceptors context who then confirm the decision through evaluation.

3.5.2 Innovation characteristics

Rogers (2003) lists five characteristics that affects the speed and likelihood of adoption of innovations (figure 3.C);

- Relative advantage compared to competitive products earlier generations
- Compatibility with the context and user
- Complexity, the perceived level of difficult to use and understand
- Trialability, meaning the ability for the user to test and try out the innovation
- Observability of the innovation affects how visible it is to others, which speeds up the spreading and acceptance.

Gatignon and Robertson (1985) suggest to add perceived risk; how much negative influence the user believe that adopting the innovation will bring. In order for an innovation to become successful, all of these characteristics need to be optimized and presented in a way that fits with the users' perception.

3.5.3 Categorization

Categorization is a way to order objects into groups. It can be done by looking at specific attributes or functions in order to identify alternatives, reduce complexity and understand the product (Rosch & Mervis, 1975). A product can be placed within an existing category (assimilation) or create a new category based on the consumers perception of its uniqueness (accommodation) (Solomon, 2006). When assimilating a product, a lot of knowledge can be transferred from earlier experience, which makes the transition faster and more convenient. At the same time it might be harder to identify the differences between the products. Accommodating a product requires more time and is more difficult, but can at the same time make the unique aspects more clear (Solomon, 2006).

3.5.4 Decision making

A decision strategy is a consumer's approach to finding a product that suits their need and goal (Bettman et al, 1998). Decision strategies can either be compensatory or non compensatory; compensatory strategies are rational and well thought through, taking in a large number of attributes. Non compensatory strategies are faster and simplifies the process by only taking in a smaller number of attributes (Bettman et al, 1998). The different strategies depend on the reason for desire; Hedonic motivation is more highly influenced by emotions while utilitarian goods are more focused on the function and performance (Dhar & Wertenbroch, 2000). If a customer have little knowledge, the information in the purchase environment highly influence their decision and preferences (Bettman et al., 1998).

3.6 CONCLUSION

Understanding users' needs and examining all touch points that form basis for the user experience must be the major focus of the project. In order to do so, interaction with users and contextual observations is essential. A deeper understanding is able to gain by combining information and inspiration from various sources. For instance interviews, surveys and observations with parents and children, visits to use contexts, retail environments and kindergartens and schools.

Insights about usability and user experiences should furthermore be possible to obtain from user test of the current product and contextual studies. The theoretical basis of consumer behaviour could be used both for understanding and analysing as well as for starting point in the ideation. The framework it provided could also be used for guidance in evaluation and decision making as it would help understand the impact.

04

PROCESS

This chapter outlines the project's process and describes its methodology.

4.1 PROCESS OUTLINE

The project had five major phases; *initiation*, *research*, *ideation*, *concept development* and *final concept*. The process was however highly iterative, meaning that phases were performed concurrently and often repeated, why they often interlaced.

The scope of the project, a problem definition and the theoretical approach were set in the *initiation phase*. A user-centric *research phase* followed in which use context, user characteristics and use experiences were investigated. Market studies and interviews with stakeholders were also performed to gain a complete picture of requirements. Concepts were subsequently developed according to insights and analysed in the *ideation phase*. A final concept was selected for further development and refined through input from expertise and user tests in the *concept development phase*. The concept was finally evaluated and presented in the *final concept phase*.

4.2 INITIATION

This section describes how project scope and approach were established.

4.2.1 Company interviews

Interviews were held with key persons within the company in order to understand the company's strategy and their patented technology and to set the scope of the project. The interviews were unstructured and had a broad approach in order to open up for unexpected topics and opportunities. Complementary interviews and evaluations with the company were held frequently during the project and they were used as a sounding board throughout the project.

4.2.2 Literature review

A literature review was carried out in the beginning of the project in order to get a theoretical basis (and to avoid reinvention of the wheel). Topics dealt with included among other things; design and marketing theories, UV radiation and sun habits, the sunscreen market and parenthood in general. Literature examined has mainly been specialist books, market reports and academic documents such as theses and research reports.

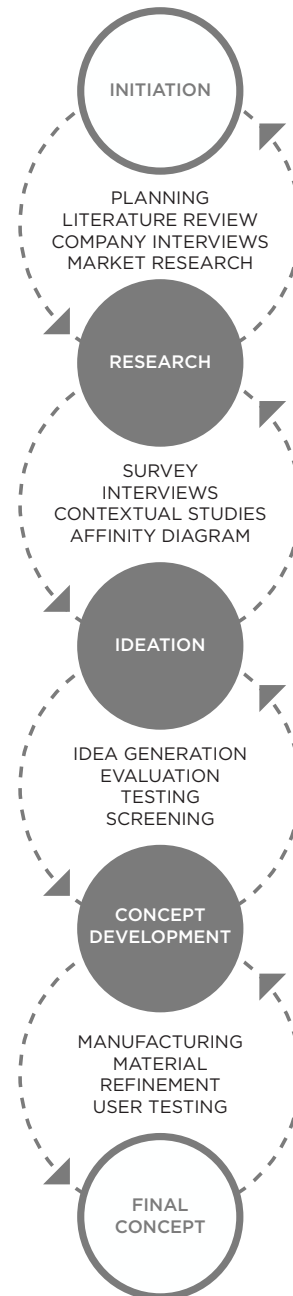


Figure 4.A. Flowchart of project process

4.3 RESEARCH

This section describes how research insights were gathered.

4.3.1 Initial survey

In order to understand the user group, a questionnaire targeting parents with kids in the intended age span was performed. Questionnaire is a cost- and time-efficient indirect query method which is good for collecting large numbers of data (Kinnear & Taylor, 1991). This questionnaire primarily concerned parenthood and sunbathing habits but also investigated the respondents view on children products and whether an actual need for UV indicators existed. The questionnaire was spread through different internet forums and received 81 responses from Swedish parents of various demographics.

4.3.2 Study visit to school

A study visit to a school was performed in order to gain deeper knowledge about the primary users. Participatory observations and interviews were carried out during the visit, concerning children's general behavior and taste. Observation is another key method for identifying of needs and requirements. The method involves actual behavior and actual use of products or prototypes which is observed in either a lab environment or the actual use context (Ulrich & Eppinger, 1994). It is especially good for completely new products, since the user might have trouble to verbally translate their requirements and their behavior is somewhat unknown (Leonard & Rayport, 1997).

Opinions about sunbathing were additionally collected through a focus group in which the children painted "a day in the sun" and talked about their lives in general. A focus group is a way to generate qualitative information by letting a number of people discuss a subject given by a moderator, which stimulates the discussion and the creativity (Jordan, 1998). Ten children between seven and ten years old participated in these sessions. Three childminders were also interviewed to get a complementary perspective.

4.3.3 Competitor analysis

An analysis of competitive products was performed in order to understand the competition and the product segment in which the final concept most likely would be present. The analysis explored products ranging from direct competitors (UV indicators) to related products (e.g. protective products for children), which were found via websites and subsequently reviewed with respect to unique features and advantages. Direct competitors' functionality were further explored in order to inspire future solutions and to identify unique competitive qualities with using the patented ink technology.

4.3.4 Product mapping

To get a grip of what characterize children's products and how they differ from products targeting adults, a mapping of children's products was made. Products were gathered from various online stores and then mapped out and sorted based upon prominent aesthetic characteristics. This was repeated for sun care products, followed by a review of the current product's and brand's characteristics. This led to an understanding of the visual cues the product had to relate to.

4.3.5 Interviews with parents

Based upon the results and answers from the questionnaire, a series in depth interviews with parents were carried out with the aim of gaining a profound understanding of what characterise parents as a group. The gained knowledge served as basis for the contextual studies in Egypt. The interviews focused on parenthood, children, children's products and sunbathing habits. The interviews were semi-structured and conducted with four parents gathered from a childrens' swim school.

4.3.6 Contextual studies

A main conclusion from initial survey, interviews with parents and the company's previous market studies was that vacations abroad was the most probable use context. In order to get closer to the user and use context, a week was therefore spent at a family resort in Egypt. The main aim of the trip was to get to know users better; both to see if what was said during previous interviews and in the survey was in line with the reality and if there were any latent needs that could not be expressed before. It was also an opportunity to get a collective picture of the use situation that could serve as inspiration for the upcoming ideation. Almost all of the about 30 Swedish families at the hotel participated in one way or another. Hence, the week became more or less like a long participatory observation with countless conversations and user interactions.

Structured observations were performed during the week and focused on how the users actually act in the use environment (pool area, beach and at field trips). Parents' and childrens' behavior were studied and documented. Eleven parents were furthermore interviewed in a semi-structural manner. An interview guide was utilized but probing and flexibility were practised in order to adapt to interviewees' sentiments. Subjects discussed concerned the parents views on vacation, sun behavior, parenthood etc. These parents were mainly approached when sun tanning next to the pool or at the beach and interviews were held on spot.

A prototype of the reference product was tested by families. They were given products together with the accompanying packaging and were asked to use it during the next day. The test thus included transporting and storing the product, understanding the information on the package and using the product.

The test was followed up with a short interview and a user experience oriented questionnaire concerning perceptions of the prototype. Hesselgren's emotional scale, which includes humans' eight fundamental emotions (Hesselgren, 1985), was used for detecting elicited emotions. Bipolar adjective pairs were furthermore used to investigate elicited meaningful and aesthetic experiences. The choice of adjective pairs was based on Desmet and Hekkert's (2007) definition of meaning and aesthetic and encompassed the adjectives thought to be relevant for this product. To gather qualitative data regarding the product experience, the questionnaire also contained a few open interview questions and questions of more practical nature. A pilot study was performed before the study to ensure understability.



Figure 4.B. Mapping products, testing the reference product and interviewing parents and children

25 children between 4 and 13 years old and 14 parents took part in in the user tests. Some of them participated in the previous interviews as well. Two parents and four children were additionally asked to use the reference product a second time in order to investigate learnability and get some indications on experienced user performance. The products were furthermore tested by the authors themselves to generate a better understanding of user experiences.

As a final event, a focus group was held with four previously uninvolved parents in order to generate ideas for new products and refinement of the current. The focus group incorporated discussions regarding how problems, detected during the contextual studies, could be solved.

4.3.7 Visits to pharmacies

As pharmacies were identified as the most probable and desired retail environment, visits were made to three different pharmacies in Gothenburg. General characteristics of the context, the sorting of products and behavior of visitors were studied. Interviews were furthermore held with shop owners and personnel in order to gain insights regarding how it is decided which products that end up on their shelves. Additional telephone interviews were subsequently held with purchasing managers at two bigger pharmacy chains to further research underlying reasons.

4.3.8 Affinity diagram

Especially the initial survey and the contextual studies in Egypt resulted in huge amounts of data. A review was needed in order to gain a thorough understanding of what the data implied. The data was therefore organized and analysed together with the rest of the results from the research phase by using an affinity diagram (figure 4.C). Affinity diagram is a common method for organizing and analysing data where the data is clustered based on relations in order to identify important and recurrent themes (Courage & Baxter, 2005). All data was read through and concluding quotes were picked out and written on post-its. The post-its were then put on a wall and sorted into groups, based on their natural relationships and similarities. Every group was named and typical quotes were picked out, creating a framework for the upcoming development. This result served as the main basis for the research results chapter in this report.

4.3.9 User test analysis

The user test of the prototype during the contextual studies resulted in 13 questionnaires to analyse. The quantitative part of the results was processed in excel to retrieve numbers on i.e. evoked emotions and perceived meaning and aesthetics of the products. The analysis showed what aesthetic, meaning and emotional experiences the reference product provoked, which could be further used for identifying positive as well as negative aspects. These then helped shaping the guidelines for the concept development and guidelines for the design.

4.3.10 Implications of results

How the result of the analysis influenced the concept to be developed was summarized in a few different ways. At first, a list of quite general guidelines was written. These guidelines dealt with appropriate target group, use context and use experience among other things. Five core values which described the desired user experience of the product was then developed from comparing the company's brand identity with the desires expressed by parents and children during the research phase. A customer journey with associated experiences was also created based upon the insights, to be used for facilitating the ideation and create a coherent understanding of the usage.

To describe which contexts the product needed to fit into, image boards over intended use and sale context were developed. These served later as inspiration and guides during the concept development. Personas, which are fictional characters meant to create a joint understanding of a target users and to aid the evaluation process (Courage & Baxter, 2005), described users. Main aims with the personas in this project were to communicate user characteristics and subgroups to the company and to enhance a user perspective throughout the project. Finally a product specification was created, which is a list of all the needs and demands that the product should meet and to be used in order to enable reliable and thorough evaluation of future concepts.



Figure 4.C. Affinity diagram

4.4 IDEATION

This section describes how ideas were developed and evaluated.

4.4.1 Idea generation

Brainstorming is the most commonly used ideation method. It aims at generating large quantities of ideas through gathering people and letting them ideate on particular topics or problems in a non-judgmental environment (Wilson, 2013). Initial brainstorm sessions (figure 4.D) aimed at capturing a broad spectrum of ideas by focusing on open questions such as “what could the ink be used for?” and “what information could be shown?”. The first sessions took place before the research phase and was iterated during the contextual studies and then after the analysis of the research results. Sessions were carried out both by the project group and in collaboration with potential users and company representatives.

As further insights were gained, brainstorm sessions became more and more focused on solving specific problems. Many different ideation techniques were complementary used during the brainstorming sessions in order to spur ideas. Mediating cards, 6-3-5, exchange of ideas, random input and scamper are some examples.

4.4.2 Morphological chart and screening

Morphological charts were used in order to develop holistic concepts from the vast number of ideas generated during the idea generation. The aim of using a morphological matrix is to identify new possible concepts by identifying core functionalities of existing concepts and rearranging them (Michalko, 2006). Insufficient ideas were disregarded through iterative screenings throughout the development. Seven final concepts were picked out, further refined and summarized with drawings in order to enable easy presentation and evaluation during subsequent interviews and meetings.

4.4.3 User evaluation

Group interviews with in total eight parents were held in order to gather user experts’ insights. The parents, which were found at Chalmers and at a local daycare center, were presented each concept and told to evaluate the potential based on their own thoughts. A few key concerns brought up by the project group regarding each concept were thereafter discussed. As a final exercise, the parents ranked the concepts upon potential and described their reasoning behind decisions.

4.4.4 Theoretical evaluation

The main aim of the theoretical analysis was not to identify the theoretically best concept but rather to go through all the concepts thoroughly. SWOT-analysis is a common analysis tool for identifying strength, weaknesses, obstacles and threats (Kotler, 2010). This technique was used to evaluate these aspects of each concept. A weighted matrix was furthermore developed in which the seven concepts were evaluated upon fulfillment of identified key demands in the product specification. The selection was based on what was thought to be essential for realizability, market potential and ecological sustainability as well as for to facilitate for desired user experiences.

4.4.5 Company feedback

The concepts were finally presented for and discussed with company representatives in order to ensure that they wouldn’t be unreasonable and detect eventual flaws from their viewpoint. Matters such as realizability, ink development needed and possible production techniques were discussed. It was furthermore discussed how well the different concepts fitted with the company’s strategies and expansion plans.



Figure 4.D. Brainstorming

4.5 CONCEPT DEVELOPMENT

This section describes how the chosen concept was refined.

4.5.1 Manufacturing

Moving forward with a patch UV indicator, the concept development phase was initiated by an investigation of how patches normally are manufactured and how these techniques can be related to how the reference product is manufactured. This knowledge was achieved through telephone interviews with branch experts. A desired product journey was developed to describe the manufacturing techniques and stakeholders involved.

4.5.2 Patch design

The first move for developing the patch design was to set up some basic principles for the upcoming development. In order to do so, a large variety of different sizes and shapes were created and evaluated based upon how they were in line with the core values, overall experience and usability. This was done in an iterative manner, approaching the final size and shape by testing and refining ideas. Shapes were investigated through producing all considerable shapes that could be consistent with the sought expression. Size was subsequently investigated through creating paper prototypes in sizes ranging from 1 to 64 cm² and comparing it with the target group's anthropometrics by trying them out on children's arms and necks.

After a number of steps, the refining process shifted to be more focused on the UV exposure indication and what should be printed on the patch. The interplay between readability, usability and the overall appearance together with the patch's dimensions lead after three iterations of ideation and screening to three final design suggestions.

4.5.3 User test of patch designs

The three patch design suggestions were evaluated by 15 industrial design engineering students with respect to the five core values. Respondents were given a brief introduction to the product whereafter they ranked the expressions of the three designs regarding core values, and discussed their decisions. A weighted, final result was achieved through grading the importance of the core values from

one to five. An evaluation of the weighted result and the comments led to dismissing one of the suggestions and to development of a refined final concept, based upon the two suggestions that passed the test. This design was achieved through use of a morphological technique, identifying the different sub-choices that existed and then subsequently making decisions based upon the vast knowledge from previous research, testing and evaluation.

4.5.4 Patch material

Identifying suitable materials was a task carried out concurrently with the refinement of the chosen patch idea. A number of producers of band-aid, paper and medical aids were contacted. Out of these, one responded eagerly to help out and offered their support of knowledge within the subject. Three materials were chosen based on the criterias in the product specification and samples were tested, by attaching them to the body, before swimming. Based on this evaluation two additional materials were selected. These five were subsequently tested more thoroughly in a constructed real life use situation. They were cut in the intended size and shape (which was developed simultaneously), attached to probable attachment spots on the body and then tested in both chlorinated water and heat. Three materials managed the test well. The printability of these materials was subsequently tested by the industrial partner's printing house. Based upon that result, one material was chosen for the application.

4.5.5 Package design

The development of the packaging started broad to find different solutions but was quickly limited, in order to enhance realizability, to cheaper solutions. These solutions solely used cardboard as base material and a manufacturing process which included printing, die cutting, folding and gluing. This is the material and manufacturing techniques that the current package utilizes and the currently used printing house can manage. It made the solution space much narrower but enabled rapid prototyping and testing.

During the initial ideation, the main focus was on enabling the user to be able to physically use the product and to make it stand out from other products in the pharmacy. Inspiration



Figure 4.E. Patch design

was found through examining innovative package designs in general and pharmacy packaging in particular. The initial ideation furthermore took in different aspects from users, context, product, company and manufacturing techniques. Approximately 20 cardboard package prototypes were created. Four of these were selected for further testing based on manufacturability and expression.

Graphical prints for the four cardboard packages were developed in an highly iterative manner. The visual identity of the current package and brand, together with the identified characteristics of sun care products and children's products were used as starting points for the graphical profile. Insights from the contextual studies, regarding which information the users needed and wanted was furthermore used as guidelines.

4.5.6 User test of package designs

A contradiction between child friendliness and reliability was found and ten design students were involved in order to identify what characterise these expressions. They were told to place nine sun care products and the current package on a two dimensional scale and discuss their reasoning. The results lead to improvements and changes regarding the appearance in order to better match the perception on what is both reliable and child friendly.

Four functional prototypes were then constructed. These were evaluated by ten parents with young children to test their understanding, experience, associations, excitement and ultimately favourite concept. The participating parents, found at a local daycare center, were presented with one package prototype and asked to read the front. They then answered questions regarding their understanding and uncertainties before they were asked to scan the back cover as well. As a final exercise, the participants were told to look at all the prototypes and discuss the differences between them.

4.5.7 Package refinement

The package that managed the user test best was chosen. It was then refined by taking insights from the user test and evaluation in consideration and further develop the print upon understanding of the product and how to use it. This was conducted in a highly iterative manner in which solutions were tested within the project team and by fellow students who had an understanding of the project. The package was also further refined regarding size, construction and opening mechanism to optimize it for production and use. In order to improve usability, create a higher value of the plaster and a more premium experience, an envelope was finally added to the equation.

The manufacturer of the reference product's package was also contacted. Their expertise was used in order to evaluate the manufacturability of the package and to make economical improvements. By suggestion, changes were made to improve the opening mechanism.



Figure 4.F. Package design

4.6 FINAL CONCEPT

This section describes how the final concept was finalized and visualized.

4.6.1 User experiences

A suggested customer journey was created to make desired user experiences of the final concept comprehensible and communicable. The customer journey also made it possible to compare the final concept, with research implications and findings regarding the performance of the reference product. By combining customer journey and personas, a consumer scenario was created to further explain the concept and show its properties through a concrete example. The scenario goes through all the touchpoints in the consumer journey and describes them from a typical user's perspective.

4.6.2 Prototype

The final concept was prototyped using adhesive paper with a liner for the plaster, a thick and glossy paper for the package and a thin, semi-transparent paper for the envelope. The materials were printed on by a local printing house. This prototype was used for presenting the final concept and in the final user evaluation.

4.6.3 Final user evaluation

As a final evaluation 12 parents, with children within the targeted age span, tested and discussed the final concept. Half of these tried the final concept first and then had the chance to compare it to the reference product, while the other six did the opposite. The test staged an imagined user scenario and featured both the purchase situation as well as usage. They were first exposed to the front cover of the package, then the back cover and finally were allowed to open the package and interact with the product. During each of these stages they were asked questions regarding their understanding and experience. Their behavior and way to interact were also observed in order to detect subliminal experiences and unexpected things. The results were used in order to compare the final concept with the reference product and the project aim.



Figure 4.G. Final user evaluation

05

RESEARCH FINDINGS

This chapter summarizes insights regarding users, use context and experience of use, that were generated during the pre-study and research phase.

5.1 USE CONTEXT

This section deals with probable use contexts.

All use contexts for UV indicator devices, which were suggested by intended users in the initial survey, were closely related to when children are exposed to sun. Other characteristics were that the *parent has to be aware of and consider the sun exposure* and that *the situation must not happen too often since that would be too expensive and unpractical. At the beach or during early summer excursions* were therefore the most frequently mentioned contexts. Other examples included *playground, park, schoolyard, boat, ski slope and garden*. It was however clear that most parents only want to use the utensil when at holidays in the sun since the sun is *stronger* there and that the most applicable situation would be when bathing since that is when the children use least clothing and therefore face an increased risk of sunburn. As an effect of this, it was decided to focus the subsequent contextual studies on a sunny vacation context.

Commonly observed activities during the contextual studies included sun bathing, bathing (in pool and in the sea), excursions, shopping, sightseeing and eating and drinking. Many families focused entirely on relaxing and getting away from everyday life but some also wanted adventures and new experiences. It was not uncommon however that the families at the resort stayed around the pool area pretty much the entire vacation.

5.2 USER GROUP

This section describes characteristics of the intended target group.

5.2.1 Parents

Parents' attitude to parenthood differs extensively although most parents seem to be very protective over younger children. This could both be observed during the contextual studies and was frequently mentioned in surveys and during interviews. Interviewed parents generally wanted to be caretaking and responsible, but at the same time not overprotective or nervous. Most were moreover ensured that parents are important role models for their children and believed that their children would mirror them. Many interviewees mentioned a clear difference between two kinds of parents; the first are insecure, easily influenced parents in need of guidelines of exactly what to do, and the second kind are more self secure parents who trust themselves. First time parents normally belong to the first group since they are inexperienced and therefore more insecure in their role.

Two personas (figure 5.A and 5.B) were developed to represent the parent user group and describes therefore the most important characteristics found during the research phase.

5.2.2 Children

There are definitely many commonalities among children, but also a large variety and diversity. Comparing a 2 year old with a 12 year old shows the contradictions that could occur in matters of taste and opinion. This was also found to be apparent to the children themselves. Older children want to feel older and will not play with the same toys as their younger siblings. The reverse is also true. It is however common that siblings get the same things as it otherwise could lead to fussing and fighting.

The differences among children are not only in their personal development, some physical differences also affect the choice of product. Small children for instance have more sensitive skin, play in smaller areas and are not as physically active in their play. Children seek attention and recognition, both from parents and others. They are also inquisitive, asking a lot of questions, as they want to understand the world and the things in it. They therefore find interest in the smallest things, using all their senses to get to know it.

Gender stereotypes were identified as quite distinct during the school visit. Boys tended to be more loud and intense, playing war at the schoolyard, while many girls wore pink tinsel shirts and pretend to have tea parties. Parents mentioned this as a negative aspect of children products, but something they sometimes fall under.

Two personas (figure 5.C and 5.D) were developed to represent the children user group and describes therefore the most important characteristics found during the research phase.

ANNETTE 42

*Secure, suburban mom
who wants to relax*

Annette lives in Täby, outside of Stockholm, with her husband and their two boys, Charlie, 5 and John, 10. She works at Deloitte within accounting, starting her 15th year this summer. She likes to feel in control and understanding all the numbers uplifts her. She is furthermore very fond of her colleagues.

Annette's life is focused on her family. She is not only deeply engaged in building up a positive home environment but is also involved in the children's after school activities and discusses parenthood constantly with her husband and friends. She feels secure in her role as parent and is less worried now compared to when John was born. Apart from that, she recently began taking Zumba classes with some childhood friends who lives nearby.

Annette is aware of the dangers related to sun exposure since the women magazines she occasionally reads for leisure, sometimes write about it. It is more important to get a sun tan though. She thinks it makes her look healthy and vivid and she highly enjoys comments from colleagues and friends. She is however very protective regarding her children and apply large amounts of sunscreen on them.



Figure 5.A. Parent persona Annette.

FREDRIK 28

First time father

Fredrik lives in Falun with his wife Sandra and their daughter Leia, soon to become three years old. He works as a paramedic and plays bass in a local jazz band, but is currently taking out his last days of parental leave.

Fredrik is really concerned about Leia and thus reads parenting magazines and uses as many aids as possible to feel more secure. He is actively looking for recommendations and product reviews in order to make the best decisions. Technique is furthermore one of his bigger interest and he is quick to adopt new trends.

Fredrik and his wife are experiencing many things for the first time and are for example on their first vacation abroad with Leia. They did not really know what to expect. Before the vacation they have been preparing by reading some articles on what to think about and browsed the online community familjeliv.se for practical tips.

Fredrik is very aware of the dangers related to sun exposure and feels that it is a primary priority to not letting Leia get sun burned. He therefore bought UV clothing and a hat but feels worried anyway. Children's skin is more sensitive to sun but how sensitive is Leia?



Figure 5.B. Parent persona Fredrik.



CHARLIE 4

Energetic and determined

Charlie is an energetic kid who spends more or less the entire vacation jumping in and out of the pool and playing with his bathing toys. He loves the warm weather and the water and is completely unaware of the dangers related to sun exposure.

Charlie is very fond of his mum, although she sometimes is a bit stubborn; forcing him to do things he does not want to do. She decides everything for him, such as what to wear, what to eat and when to go to sleep. But Charlie knows what he likes and dislikes and is not afraid of showing it. Some things he does not like he will not even try, like broccoli. Unlike broccoli, Charlie likes Bamse a lot. He is strong and nice at the same time. Charlie's dad reads it to him before going to bed sometimes, but he can just look at the pictures and make up his own stories.

Charlie's older brother John is the person Charlie admires the most even though he never would admit it. John is a great footballer, can read and has plenty of cool toys and friends.

Figure 5.C. Child persona Charlie.



JOHN 10

Neither a kid nor an adult

John just turned ten years old and feels a lot older than his younger brother Charlie. He practices football a lot and is convinced that he one day will become a professional footballer.

John loves all-inclusive resort since he can eat as much as he likes and there are plenty of sport activities he can participate in. He also wants to meet new friends so he finds it somewhat boring to hang out with his embarrassing parents and his childish brother. John wants to feel like a teenager and wants to be treated as one and hates when people see him as a child. He is nevertheless fond of his parents and very happy when they take care about everything.

John is aware of the dangers related to sun exposure and has experience from getting sun burned. He is therefore careful when it comes to sun screen and hassles his parents to not sun tan as much.

Figure 5.D. Child persona John.

5.3 SUN HABITS

Sun habits were observed during the contextual studies and dealt with in the initial questionnaire. This section summarizes the findings.

5.3.1 Children's attitude

Children associates the sun with playing and fun. Sun protection is the parents' concern and responsibility, and not something the children themselves worry about. The risk of cancer is not generally understood, but the instant pain is well known and feared. This was also evident during the contextual observations. As they are very young they are more looked after, while older children are more independent and harder to control. Sun tanning is not practised until they reach an age of around 10 to 12. Before that it is not a common goal to get a tan, but rather to just enjoy the warmth. Sun habits and attitudes are however in many cases undoubtedly inherited from parents. Observations showed a clear link between sunburned parents and sunburned children.

Children in Sweden get exposed to extensive sun early in life. Many of the families at the observed resort had very young children and Bränström et al. (2005) have concluded that 36% of Swedish one year olds have been abroad on vacations at sunny resorts. 12% of all children furthermore get sunburned during their first two year of life. The corresponding numbers for four years and seven years are 44% and 67% (Rodvall et al., 2009). Rodvall et al. (2009) have identified three major causes of why children get sunburned; if they use sunscreen, if the children have light skin and if the parents appreciate if the children look brown and healthy.

5.3.2 Parents' attitude

Most interviewed parents made a clear distinction between their own sun habits and the children's habits. As an adult it is important to get sun tanned while the children only should "achieve some color" (Rodvall et al., 2009, Brunnberg & Rodvall, 2009). Friends and coworkers expect a sun tan when you return from vacation and you risk missing out on quite a few compliments if you are not. It can even feel inconvenient if you do not have any color and some interviewees mentioned a pressure to get sun tanned. Getting a suntan is also one of the main reasons for trips to sunny destinations, showing the contradictory attitude towards the sun.

A general attitude is that children preferably only should achieve enough color to look healthy and vivid and parents are therefore much more careful and strict regarding the children's protection than their own. Some observed parents even used their own bodies as warning bells for when they have to be attentive to the children. The common attitude is however that the sun is good for the children and reduces the risks of health issues, as long as they do not get sunburned.

Interviewed parents worry more about their small children. Partly because they are unfamiliar and inexperienced with the small children's skin type but also since they are aware of that small children have more sensitive skin and that the causes of getting sunburned are more hazardous when

very young. The risk of instantaneous pain is however a more obvious threat than the enhanced risk of skin cancer. Itching and burning is something interviewees do not want to provide their children with. Attitudes differed nevertheless a great deal among the interviewed parents. Some parents are very relaxed regarding the issue, especially if they have applied sunscreen. Others use all kinds of protective methods and worry anyway. Sun protection is in general a women's issue. Mothers worry more and are often "in charge" of the sun protection of the children.

5.3.3 Sun protection strategies

Many parents have deliberate strategies, habits or patterns for how to protect their children from getting sunburned (Brunnberg & Rodvall, 2009). What the strategies includes and when they are utilized differs however widely. Some respondents in the initial survey only consider the risks while *at the beach during the summer*. Others protect their children *as soon as they are outdoors all year round*. Rodvall et al. (2009) have however found that it is closely related to when it is sunny and risks are considered much more when close to the sea or abroad. Many of the children to the survey respondents have experience of getting sunburned. The most frequently mentioned places where this has happened are; *in Sweden during the spring* (often at kindergarten or at school) or *during vacations abroad* (often at the beach or during excursions). *Misjudging the sun's strength, forgetting to apply or re-apply sunscreen* and *being in the sun longer than planned* are mentioned in the survey as reasons.

T-shirts, UV clothing, special caps, hats and sunglasses were apart from sunscreen some of the most commonly observed products that parents use in order to protect the children from the sun. Especially younger children wear these gadgets and are in general protected much more carefully than older children. The smallest children at the resort never even experienced direct sunlight while older children took more responsibility themselves. To avoid the sun during midday or being in the shadow are other commonly used strategies even though many mentioned that they do not want to avoid the sun if they have travelled far to enjoy it. Rodvall et al. (2009) collected the statistics seen in figure 5.F regarding protection of 7-year-olds.

Parents are aware that the skin generate a natural protection when exposed to sunlight and are therefore more careful when the children have not been exposed to sunlight for a while. This could for example be during spring or in the beginning of the vacation.

The observation showed that there is a big difference between how parents think they act and their actual behaviour. They might for example plan to re-apply sunscreen after every bath but it seldom happen in reality. Most parents and many children get sunburned at least once during the vacation. Tanning, sunbathing and sunburns are furthermore common conversation subjects during the vacation.

5.3.4 Difficulties related to sun exposure

Many difficulties regarding sun habits were mentioned during interviews and in the survey by the parents. A major issue is to *evaluate the sun's effect, to remember how much the children can handle and to thereby realize how long the children can stay in the sun*. This should be matched with protective methods and activities. The sun is for example most hazardous during midday when it is most enjoyable and sometimes difficult to find shadow or convince the children to stay inside. It was furthermore mentioned that is sometimes *difficult to communicate with, understand and motivate the children*. They often refuse to sit still, do not realize the danger and are in general difficult to control. It is for instance difficult to convince smaller children to wear warm uncomfortable UV clothes and older children to wear something *childish or geeky*.

To *apply sunscreen correctly* and to *know when to re-apply* it were the most frequently mentioned problems in the survey. It is apparently very difficult to find a trustworthy sunscreen and to know how it should be used, how much it protects and how much of it that is left after bathing. Rodvall et al. (2009) found in a study that most parents to 4-year-old children find it difficult to apply sunscreen and to know if it is correct. Another problem the parents mentioned during interviews was that they *are not always present when the children are exposed to sunlight*. It can be difficult to trust and cooperate with e.g. caretakers, teachers and grandparents.

The parents feel that they have all the information they need regarding sun exposure but want short, direct sun bathing tips if something. Guidelines should be effective and realizable rather than too complex and perfect.



Figure 5.E. Children using different protection strategies

PROTECTION METHOD	SKIN TYPE 1 & 2	SKIN TYPE 3 & 4	TOTAL
Sun screen	67%	54%	56%
Clothes	65%	50%	52%
Shadow	11%	7%	8%
Stay inside	8%	5%	6%

Figure 5.F. Table describing the use of different sun protection strategies for 7 year olds (Rodvall et al., 2009)

5.4 USER EXPERIENCES

This section describes user experiences expressed in the initial survey and elicited during the user test of a prototype of the wristband.

5.4.1 First reaction to prototype

The prototype of the reference wristband elicited strong but conflicting emotions in the initial survey. Parents first reaction when presented with a picture of the wristband and the idea behind it was always either *smart idea* or *unnecessary*. Some did not see any need of assistance and thus not the wristband's utility. Others knew about the growing skin cancer concern and thought that this is a product *perfectly in tune with the times* that could enhance their control. It was however common to state that the product is *ideal for others but maybe not for me*.

It was common, among participants in the user test, to follow up with questions regarding how the wristbands work and how it can be adjusted for different types of sun and skin. When provided with that type of information, the attitude was far more positive. In order to test the product, they also wanted to be sure that it is safe and reliable (tested) and that it functions in the specific use context. How it should be used was another key concern; both how to understand the information and how to use it accordingly.

5.4.2 Packaging information

The information on the packaging was generally rated as appropriate in the questionnaire that followed up the user test, even though many misunderstood how to use the wristband. Guessability was found to be rather low while learnability seemed quite high. Common problems included understanding;

- the description of the color change
- that the the entire wristband change color
- what the different colors imply
- for how long it is meant to be used
- whether it was water resistant or not
- that you should apply sunscreen on it
- if it was meant for children or for adults

It was mentioned that a description of the technique would have increased trust. Parents were also interested in knowing how it account for the natural protection you develop as you are exposed for the sun.

Parents were in general sure that they used the wristband in a correct manner and said that it was very easy to understand how to use it. They therefore rated satisfaction of use and guessability as high. This was falsely since several used it incorrectly and asked many questions that were supposed to be explained on the package. The parents agreed however on that easy usage was one of the most important aspects.

5.4.3 Use of prototype

It was in general very easy for the parents to convince the children to wear the wristband during the user test and it elicited positive emotions both before and during use. All but two smaller children wanted to use the wristband and most expressed interest and curiosity. Siblings that were not given wristbands became jealous.

To attach the wristband to the children's arms was rated as *very easy* by the parents even though problems such as *manage to get it straight and fasten it tight enough to not fall off but loose enough to not hurt* was mentioned during the concluding interviews. A need of a possibility to redo the fastening was expressed.

Approximately 90% of all the children that used the wristband dropped it why the actual effectiveness of using the wristband was almost absent. Many did not notice exactly when it happened but it usually occurred when they were in the pool. Most small children did not notice that they wore a wristband at all while the older children followed its progress with some curiosity.

The wristbands changed color, according to the parents, after one to three hours. They noticed that it changed color but thought it was *close to impossible to tell whether it had reached the same color as the reference points or not*. This was especially difficult to tell while in direct sunlight. It was thereby very difficult to make decisions based on the color change* and the efficiency of use was low. Most parents chose to re-apply sunscreen when the wristband got a pink color. The color change was noticed by both parents and children.

The effects of using the wristband were thoroughly discussed during the interviews. Parents mentioned that it *should not require intelligence, make you feel like a bad parent or increase your feeling of guilt*. The link between cancer and death should furthermore not be obvious for the children since they should be *allowed be children and focus on enjoying the sun*. It should in other words not elicit negative emotions from either parents or children. *To show other parents that you are a good parent that protects your children* was another meaningful experience that some parents would have appreciated. They agreed furthermore that it would be difficult to tell your child that *your wristband is pink, you need to stay in the shadow and can not play with your friends*.

5.4.4 Elicited experiences

The worry over if the children would get sunburned did not change through use of the wristband. They did however say that the wristband made them *increasingly aware of the sun's strength*. The project group also realized, through self studies, that the product provides a comforting feeling when you use it yourself. If you trust the wristband, you do not have to worry until it becomes pink. A few users mentioned that this trust could be difficult to build. *I would not put the well being of my child in the hands of a technical product. What if he gets sunburned because it forgot to alert for danger* was for example expressed by one of the interviewed parents.

The wristband evoked furthermore quite a bit of interest and liking among the users but almost no other emotions, according to the questionnaire. Both parents and children rated their use experience as very positive in general.

The wristband was, according to the questionnaire, seen as an effective product for special occasions. It was also perceived as pretty modern and useful and on top of that

*Since research was conducted, ink development has lead to an improved color change. Hence difficulties experienced at this point are believed to be less important, although the overall concern for how to make the indication visible and easily detected remains.



Figure 5.G. User experiences

very innovative and smart. The meaningful experience was furthermore closely linked to sunscreen and sun care products. No clear patterns emerged when the parents were supposed to rate the products aesthetics. They thought however that it rather could be described as discrete, soft and stripped than vulgar, hard and cluttered. During interviews, some respondents described it as *a bit dull and boring* while others thought it was *cleanly designed and blended in well with the skin*.

5.4.5 Storing and transport

Interviewed parents associated the wristband with the same situations as they use sunscreen in. As an effect, they want to buy, store and use it at the same places as the sunscreen. This implies that the major touch points for storing and transport are; buying it at the pharmacy, storing it in a not central part of the bathroom cabinet, transporting it to the holiday destination in a vanity cases and to the beach in a beach bag. It have furthermore been found that 99% of the Swedish sunscreen users visit a pharmacy yearly and 50% even monthly (Strand, 2012).

5.5 CONSUMER BEHAVIOR OF PARENTS

This section describes the consumer behavior of the user group, which was researched in the initial questionnaire, during interviews and during the contextual studies.

Since the market of UV indicators is small and untested, no specific consumer behavior is established for the specific product segment. Some characteristics are however shared for the target group as a whole and some can also be translated from other fields. The data collected through contextual studies was analysed by using an affinity diagram, leading to the following insights and predictions of the consumer behavior.

5.5.1 General attributes

Parents are generally more aware and active in their decision making process when it comes to products for their children. The children impact product decisions both direct and indirect. Parents bear a mental image of their children's preferences and consider their opinion in order to minimize negative effects such as the child refusing to use a product. Children's opinions are highly regarded when it comes to products concerning enjoyment and taste, but for safety, health and responsibility their opinions are not as important. Children's preferences moreover shift quickly and are highly affected by especially their parents and friends. Interviewed parents talked about how children sometimes have a distinct opinion, seemingly for no reason, which some parents explain as *a way to test their own will and influence*. As they get older, they are allowed to make more decisions on their own, leading to increased awareness of their own and others' appearance and opinions.

The target group can as mentioned earlier roughly be divided into two categories; first-time parents and experienced parents. First-time parents have limited knowledge and experience. They therefore need to make decisions for the first time and create new behaviors. This group of parents are usually more actively seeking information, are more concerned as well as anxious and rather play it safe than

take any risk. Enhancing observability could therefore be a good way to spread the knowledge, letting the product also be an more influential information barrier. The experienced group have already developed a lot of habits and ideas of parenting and products. They are thus not actively seeking new products and are instead more provoked to change if the current state changes.

A commonly expressed opinion during interviews was that *traditional ways of parenting children, using common sense and experience, are good enough*. Technical gadgets aimed at enhancing or simplifying the monitoring of the children can as an effect therefore be seen as unnecessary. It was moreover frequently mentioned during interviews that *aiding products in general are appreciated and parents often try new things*. This seems to be more typical for the men in the families while women prefer to at least have some kind of recommendation or positive information before considering new gadgets. A good trialability could enhance this aspect and lower the threshold for adoption.

5.5.2 Decision making

There are a number of important drivers that affect the consumer in the decision making process. Parents are quite proactive when buying products, reading tests and reviews, getting recommendations from friends and magazines and going through the Swedish pharmacy Apoteket's homepage. Even though the pharmacy monopoly in Sweden is dissolved since 2009, their position as trustworthy and a quality seal for products remains almost untouched. Parents usually buy their health products in the store where they feel secure and are able to ask for advice, but an increase of online shopping is also seen. Most have a clear idea of what they are looking for before getting in the store, using a non compensatory decision strategy. Brands and products that are in their assortment are more trusted and believed to be safer to use.

In the evaluation of alternatives, function, quality and price are the top characteristics that are considered at a conscious level. Buying children branded products is common since they are believed to be extra tested, reliable, and not containing hazardous substances. There is furthermore a general understanding that kids are more sensitive and that children's products are milder and more adapted to their preconditions. The product therefore need to be compatible with other children products in order to be adopted.

Brands were rated in the initial questionnaire to play a minor role, but labeling and marking products with well-known symbols (CE, Fairtrade) or recommendations (Naturvårdsverket, Barncancerfonden) that indicate quality or safety, are seen as a major benefit and lowers the perceived risk. The functionality is of course one of the first attributes that is evaluated in the process of decision making and parents have a weak spot for well functioning products that are easy to use and to understand. This is something that goes hand in hand with the quality attribute. The decision making process is also heavily influenced by recommendations from other parents. This is especially true for products to avoid, and similar effects can be seen for product experiences.



Figure 5.H. User experiences

Parents are furthermore very habitual in their consumption; if they find a good product, they will stick to it and become quite closed for new ideas or alternatives. If a new alternative appears, the perceived risk is quite high since the current state is close to the desired.

5.6 CATEGORIZATION

This section deals with how the expression affects the categorization of the product and what benefits and disadvantages that could imply.

5.6.1 Categorization of UV indicator

The categorization of a UV indicator will either follow an assimilation or accommodation process. Since the product will have a new function and different usage compared to the existing market, the possibility is quite high that it will be accommodated (put into a new category). As an effect the product can be seen as unique, interesting and without competitors, but at the same time harder to understand.

Many parents have however, during interviews, related the product to sunscreen. There is thus a possibility that it will be partly assimilated into a sun care category. Since it aim at children, it is furthermore likely that it will be associated with such products. If sold at the pharmacy, it will be sorted as either sun care or as children's product. In that case it might be harder to detect the product's relative advantage and instead compare it to products that have other functions. It is therefore suitable to make it closely linked to sunscreen and brand it as a children's product but at the same time push on its unique features and market it as a supplementary sun care aid. The assimilation might also help it to be easier understood, e.g. that it is against sunburn, for kids and trustworthy. It is furthermore vital to relate the product to the company's other product and the established brand identity.

5.6.2 Categorization of children's products

Assimilation of products for children comes from a number of traits that helps consumers understand who the product is for. Appearance is one of the major factors and there are a number of characteristics that are typical. The study of children products identified the following characteristics;

- Soft product shapes
- A small set of saturated colors
- Element that express childishness, e.g. a picture of a child or text in different colors, written in a childish way.
- Harmlessness highlighted
- References to "real" products.

5.6.3 Categorization of sun care products

Assimilation of sun care products is, just as children products, affected by a number of visual characteristics. The study of sun care products identified the following characteristics;

- Brands located highly on the front cover
- Blank plastic materials
- Large white, yellow, orange and blue color blocks
- References to the sun in form of text and illustrations
- A lot of text in various sizes on both front and back cover with a clear division on what to read first and what can be read if interested
- One unison font with different thicknesses and whether upper or lower case letters is used
- Technical Information with positively associated words such as UVA and UVB

5.7 BRAND IDENTITY

This section deals with the brand identity which was expressed during the initial interviews and which can be seen through the current product, package and website.

The industrial partner expressed a brand strategy of becoming a natural part of sunbathing during initial interviews. They aim at being perceived as serious, technical and smart, almost on the edge of a medical device. At the same time they also want to be seen as something positive, understandable and friendly. Since their visual identity is well defined, both for website and on current package (figure 5.I), and they do not want to completely re-brand the company or have differently branded products, the new product needs to be coherent with the existing brand. Only minor changes of the identity should thus be considered in the development of the new concept.

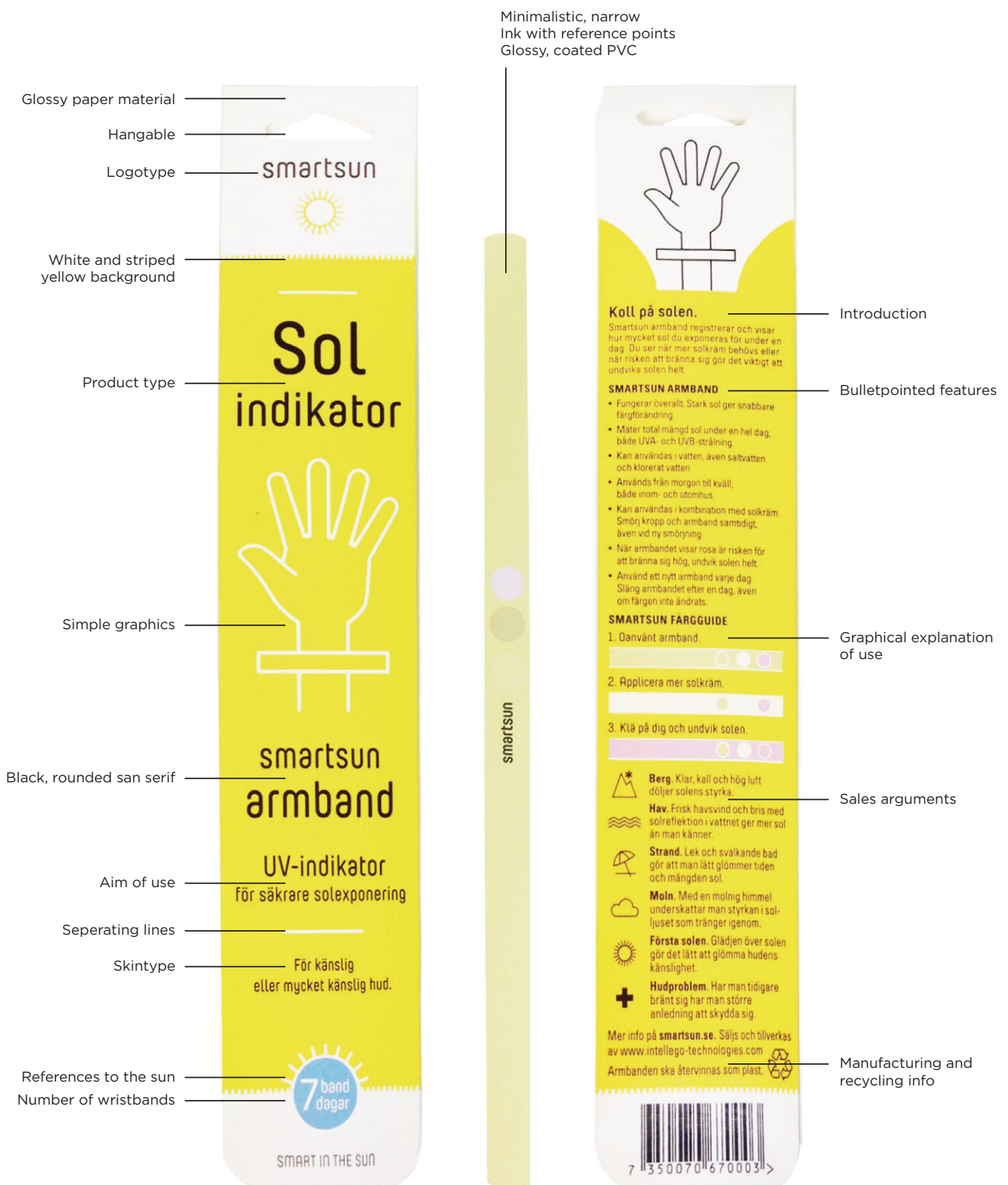


Figure 5.1. The reference product and its visual identity

5.8 RETAIL ENVIRONMENT

This section describes the characteristics of the retail environment, which were identified during the visits to drug stores and how products are chosen.

The visits to different pharmacies showed that the products on display are divided according to what part of the body the products aim at. There is also sometimes a specific area for children's products in which all products that specifically aims at children are placed. Almost all products have a healthy, clean and pharmaceutical appearance and are displayed in racks of either hanging or standing packages. If a certain brand have a variety of products within a category they are usually placed together, making them easier to identify and more visible.

The interior uses very small means of marketing and instead rely on the products to communicate and be sold more based upon function. Interviewed personnel agree furthermore that *most customers have a quite clear goal with their shopping, not allowing much space for discovering new products.*

Swedish pharmacies most often belong to or cooperates with one of the bigger pharmacy chains in Sweden such as Apoteksgruppen and Kronans droghandel. Which products to sell and to what price is mainly decided at the chains' head offices even though the shop owners have some influence. Camilla Ryman, purchasing manager at Apoteksgruppen claimed that *about 80% of the items at their pharmacies are decided centrally.* The head office furthermore organizes monthly marketing campaigns which includes marketing posters, products to display and special deals.

All pharmacy purchasing departments cooperate with pharmaceutical distributors. It is the pharmaceutical distributors who test and insure the quality of the products, and recommend volume and end price to the pharmacy chains. It is however common that the introduction of new products originates in an expressed which from pharmacy companies. Sales persons therefore often contact the pharmacies directly. Normally, only products from big and established pharmaceutical brands are considered. If other products should be taken in and tested, they should according to Camila Ryman be *demonstrated to have unique qualities and meet proved needs that other products do not.*

5.9 COMPETITORS

This section deals with the most relevant competitors, examined during the competitor analysis.

As mentioned in previous sections, the current product will belong to a more or less unknown product category; products that aid monitoring of children's UV exposure. This product category is highly related to sun care products. These are not seen as competitors, since the product is a complement to sunscreen and not a substitute. There are however quite a few existing competitors. The table in appendix III gives an overview of the most prominent.

As of now, the competitor Swimpy's wristband is the only product available on the Nordic market which has similar functionality as the reference product. The reference



Figure 5.J. The retail environment in Swedish pharmacies

product utilizes a different ink technology compared to the swimpy wristband, which is more accurate, adjustable and gives a clearer indication. The swimpy wristband has furthermore not spread in the Nordic countries, is branded more as fast moving consumer goods and is not sold at a "reliable" store. There is therefore an opportunity to become the first accepted product within the category and thereby a market leader.

The greatest threat from competitors is that a big, trustworthy company in the sunscreen industry that currently sells sunscreen decides to expand its product line and start selling UV indicators. Established companies have resources, contacts and trust among customers that the industrial partner can't compete with. The competition intensity on sunscreen market can however be seen as quite low since the market growth is high.

5.10 IMPLICATIONS OF RESEARCH FINDINGS

The major implications of the research findings on the product are presented below. The product specification list in appendix V are based upon these.

5.10.1 User group

- It is relevant to address children with skin type 1-4 since these children in a greater extent should be protected from the sun. Children with skin type 1 and 2 are however protected more carefully and sun burned more often and should therefore be prioritized.

- The younger the children are, the more carefully parents protect them against the sun. Very small children are rarely even exposed to direct sunlight. The proposed target group, children between 2 and 12 is therefore appropriate but the emphasis should be on younger children.

- Attitudes towards tanning and sun protection differ markedly between families. In order to reach a large group of customers, the product should work both for those who protect their children zealously, and those with a more casual attitude.

5.10.2 Use context

- Children get sun burned both in Sweden and abroad. The sun and protection from it is however mostly considered when abroad. 65% of Swedish families go abroad every year and a large part of the trips are to sunny destinations. It is therefore appropriate to primarily focus on children on holiday in the sun.

- Vacations are about having fun and relaxing. The product should therefore not enhance the parents' guilt or limit the children's possibility to have fun.

5.10.3 Retail context

- Pharmacies are usually visited before departure by most parents. It is also a common place for purchase of sunscreen and is considered as a reliable source for products and advice. The product should therefore be saleable at pharmacies in order to gain trust and recognition.

- Parents are very protective regarding their children. The product must therefore be proved to be safe for children, i.e. labeled and recommended by well-known organizations or with familiar safety signs.

5.10.4 Expression

- It is not necessary that the kids want the product, but they should not dislike it. Parents consider nevertheless their children's taste when purchasing products. A children product branding may therefore be necessary.

- The product will probably be sorted with sun care products in the pharmacy and should therefore relate to these kind of products. Since the concept will be new and different compared to other products, it should stand out and unique features should be displayed.

- Stereotypical gender differences exist, hence the product should remain neutral to get accepted by both sexes.

- To differentiate from the Swimpy wristband, unique feature should be highlighted and the product should be branded and sold differently

- The product must relate to the industrial partner's current product and brand.

- The product should comply with the feeling of the use context which is described in the mood board which is displayed in figure 5.I.

5.10.5 Aim of use

- Parents find it difficult to know; when the children's sun exposure limit is reached, which sunscreen to use, how well the sunscreen protect, when to reapply sunscreen, how much sunscreen is left after swimming and how to evaluate the sun's effect. The ink technology makes it most feasible to address when the sun exposure limit is reached.

5.10.6 Use

- The product must be compatible with existing protection methods. These include use of sunscreen, t-shirts, UV clothing, special caps, hats and sunglasses as well as to avoid the sun during midday or being in the shadow.

- Clear instructions on how to use the product are necessary since it is essential that the product is easily used. Parents furthermore want to understand the technique behind the product and what it accounts for (natural protection, sun strength, skin type etc.).

- Sunscreen is almost always used when tanning. It would therefore be appropriate to integrate the product with sunscreen use.

- It would be beneficial if the product also can be used by the parents themselves since they are interested in their own UV status as well. Their goal is rather to get a perfect tan though.

5.10.7 Core values

The implications led to a list of core values which are presented in figure 5.K. The final use experience and the product's expression should conform with these values.

- Reliable - To trust technology, functionality, durability, preciseness and that it's safe to use

- Child friendly - Desirable for kids, safe, thoughtful, protective and fun

- Logical - Clear, simple, easy to use, easy to understand, guessable and effective

- Smart - Exciting, interesting, problem solving, astonishing and designed for efficient use

- Encouraging - Positive, not limiting, enhancing, helpful, kind and educating



Figure 5.K. Mood board

Child Friendly
Reliable Smart
 Encouraging **Logical**

Figure 5.L. Core values

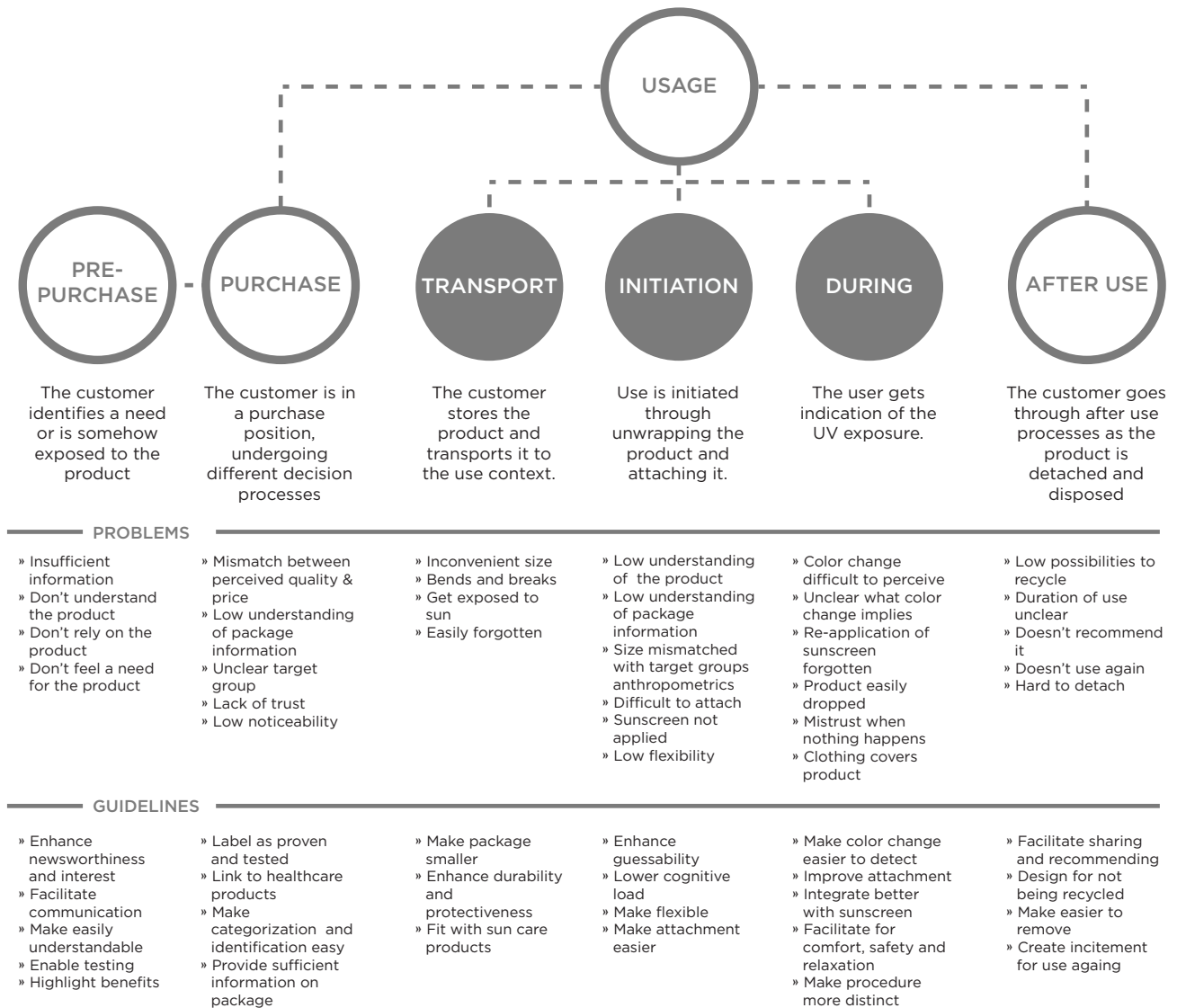


Figure 5.M. The customer journey with related problems and guidelines

5.10.8 Customer journey

The research findings led to a rough draft of the customer journey with identified problems attached to each touch point as well as guidelines on how to solve these issues. The overall goal of the guidelines is to enhance parent's and children's positive experiences of sun exposure through introducing a positive, easily used product that decreases parent's worry and increases children's possibilities to enjoy the sun.

Pre-purchase it is vital to maximize observability and facilitate for spreading the word about the product in order to reach as many as possible. During purchase, in the retail environment, it is important that the product elicit meaningful experiences that associate it with trustworthy and positive products. It is furthermore important that its aesthetics are appropriate for the environment but simultaneously makes it stand out.

In general, good usability qualities are important in order to facilitate adoption and enhance positive emotional experiences among parents. The package should provide all information needed in order for the parent to understand what it is, who it is for and when and how it should be used.

During usage, children's experiences should be enhanced through associations to, nurturance, gifts and fun. They should also appreciate the aesthetics of the product. Guessability should be high in order for first time users to manage the procedure and avoid basic errors and related negative experiences. The same goes for re-usability since the product will be used during vacation, which is periodically once or twice a year. The product should furthermore be able to be used quickly and with high efficiency to facilitate for expert users.

06

IDEATION

This chapter describes the path from the research results to ending up with one concept to be further developed.

6.1 IDEAS

This section gives an overview of initial concept ideas.

Initially, a great number of ideas were generated through different kinds of ideation techniques. As can be seen in figure 6.A, the starting point consisted of three main areas that lead to different tracks and ideas. These areas were; the ink, the target group and the product. The figure is meant to give insight into what has been in focus and the text below furthermore describes a few of the ideas that came up briefly.

6.1.1 Finding use of the ink

Early thoughts regarded how the ink could be used differently from how it is used in the reference product. This led among other things to ideas where the ink was not a part of a physical product but instead the product itself e.g. as pen ink, as bodypaint or as nail varnish. The ink could also be integrated with other materials and thereby enable for example UV-indicating sunscreen or clothing.

Investigations were also performed in order to find out the span of what could be indicated and how it could be done with the ink. The ink could for example indicate when the maximum limit for sun exposure or the D-vitamin level is reached, which SPF to choose or when to re-apply sunscreen. It could also increasingly focus on the positive side of sun exposure or be branded as more of a guideline product than an accurate measuring tool.

Since one of the biggest concerns was to make the indication clear, different methods for how to enhance the indication were suggested. These included contrasting colors, tactile changes, pattern differences, urging messages and figures among other things.

6.1.2 New product categories

Plenty of ideas for both disposable and non-disposable new products were created. By looking at the reference product and its current problems, a vast number of different ways to develop it further were detected. These ways spread from discrete nasal strips and flexible key rings to stylish ear studs. Integrating the technique into existing and present products such as sunscreen bottles and sunglasses was also a theme that many ideas revolved around.

Since the package is an essential part of the experience and thereby the commercial success, ideas about how the package could be used in a smart way were thought of. How to make it an integrated part of the sunbathing process, how to differentiate in the retail environment and how to make the use smoother were some of the problems that solutions were provided for.

6.1.3 Target group ideas

Even though children are not buying the product, they are the main users and therefore an important part of the equation for a successful product. Ideas on how to make them not only accepting the product, but actually love it, were looked at. Ideas springing from this track included trying to make it child friendly with characters and comic figures as well as make it to a game or something they can tweak themselves. It could also be an educative tool that helps them learn about the sun.

The parents are maybe even more important than children since they will purchase it and monitor the use. An aim was therefore to make their understanding, use and consumption as smooth as possible. Ideas on how to increase trust through storytelling, marking and information, decrease the number of steps in the process were thought of.

Another theme was how to add value to the product by e.g. collaboration with other companies and products, provide more than just a UV indicator or add after use value. A used, disposable product could for example be part of a puzzle or give a collectable value. The indicator could also create something exciting when reaching the maximum level or be part of a vacation/sun package for children.

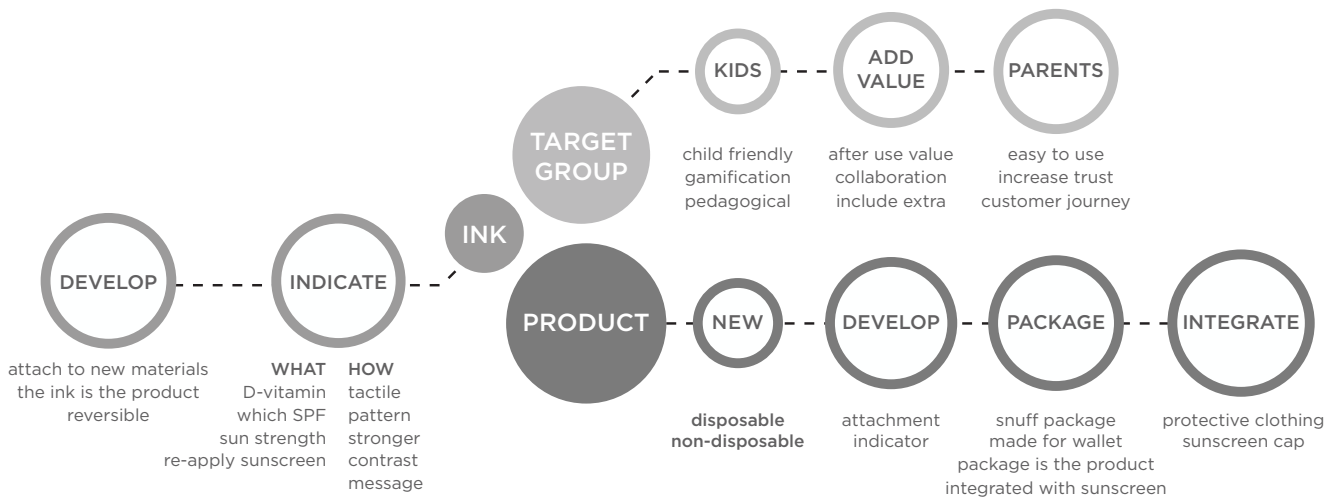


Figure 6.A. Map of ideation tracks that were covered



Figure 6.B. Ideation

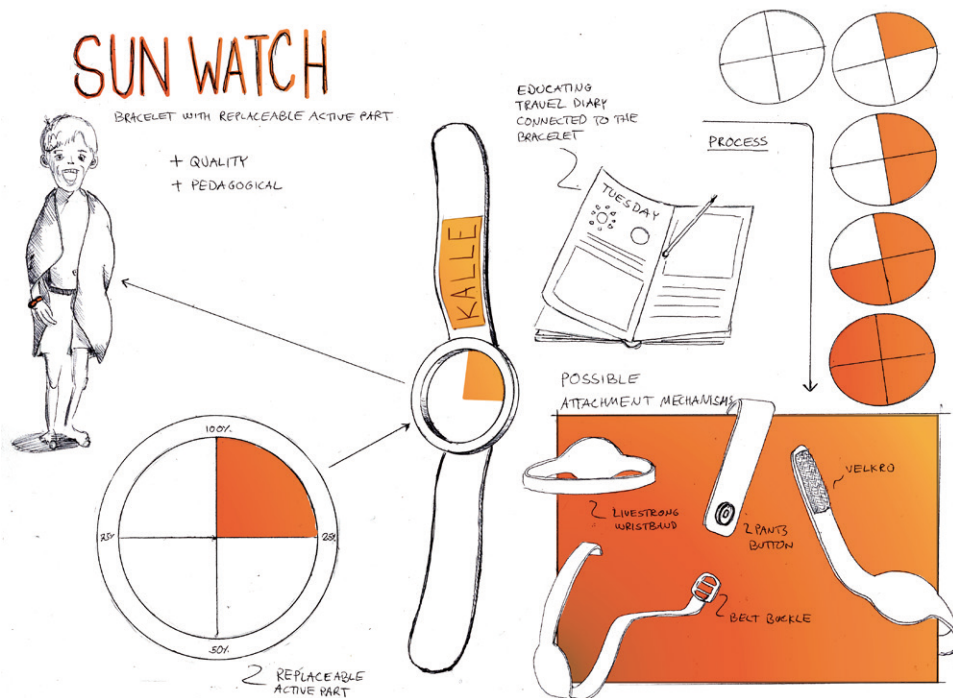


Figure 6.C. Sun Watch

6.2 CONCEPTS

The seven concepts described in this section were developed from the span of ideas in order to gather different tracks and make them more grasp- and presentable.

6.2.1 Sun watch

Sun watch (figure 6.C) is based on the idea of creating a high quality product with longer lifespan and higher value. It is also pedagogical way for children to learn about the sun and keep track of time. The quality wristband, which can be used unlimited times, will probably be perceived as more valuable than the reference product. The attachment of the wristband can be opened and closed an unlimited numbers of times using either a quality clasp, velcro or by making the entire wristband in flexible rubber. Patches, with the reactable ink are attached to the center of the wristband by the parent and can afterwards be placed in a vacation diary that is both fun and educational. for the children. The patch changes color in four steps in order to provide a better understanding of how much time is remaining. The system potential of the concept is thus higher than the reference product's.

UV TAPE

A UV-INDICATING TAPE THAT CAN BE USED BY ALL THE SENSITIVE SKIN TYPES

+ UNIVERSAL

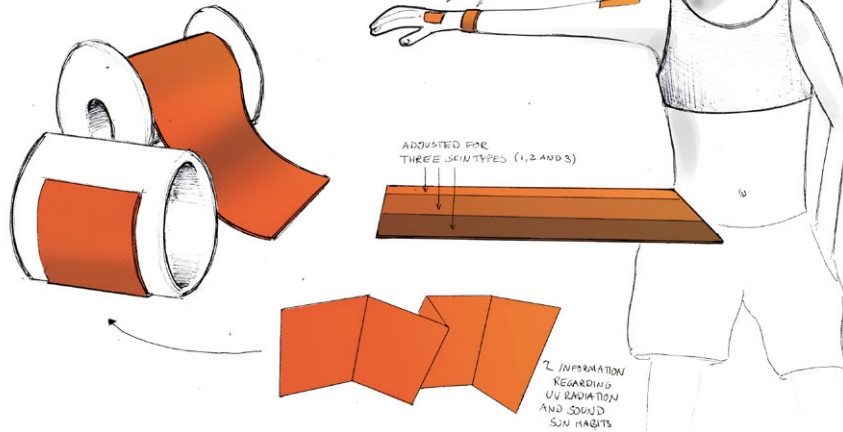


Figure 6.D. UV Tape

SUN TATT

TEMPORARY TATTOOS WITH POPULAR CARTOONS OR FUNNY PICTURES

+ CHILD-FRIENDLY

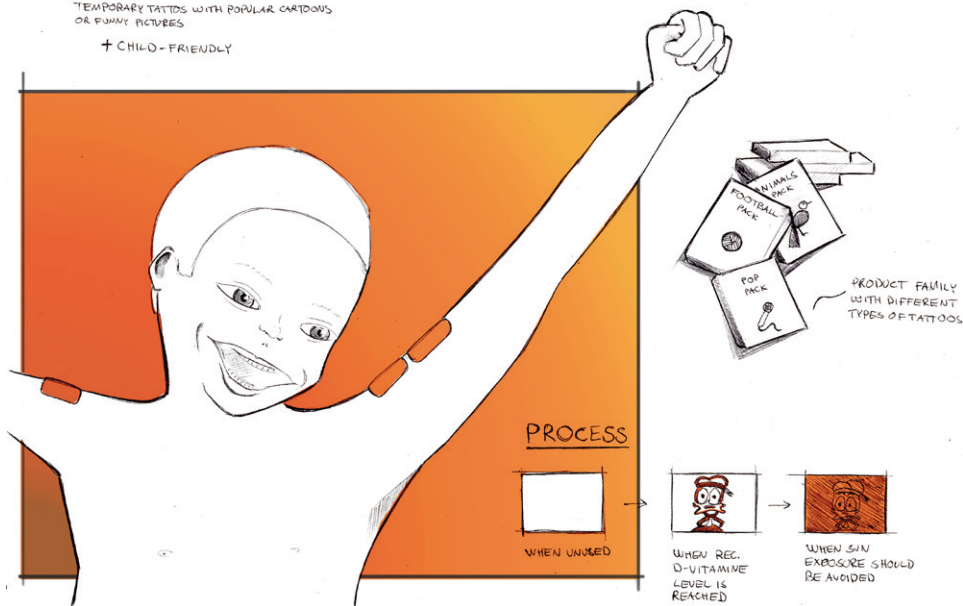


Figure 6.E. Sun Tatt

6.2.2 UV tape

UV tape (figure 6.D) was a concept developed in order to be as versatile as possible. Users can choose tape size upon preferences and the tape can be put anywhere on the body, i.e. closer to specific parts that are more easily burned or so the parent can easily overlook the color change. The tape could also be placed on something else than the body, e.g. clothes, sunhats or strollers. By letting the surface have three demarcated areas with differently calibrated ink, the UV tape suits everyone in the family, independent of skin type. The concept is therefore highly flexible and has high system potential and experienced user performance.

6.2.3 Sun tatt

The Sun Tatt concept (figure 6.E) reminds of temporary children's tattoos (known in Sweden as "gnuggisar"). By mixing the ink in the tattoo it becomes a fun and child-friendly way of showing sun exposure that can be put anywhere on the body. As it becomes a part of the skin almost, it is easier to apply sunscreen on it. Instead of just changing color to indicate UV exposure, the Sun Tatt has a character that only becomes visible when reaching the recommended d-vitamine limit and then disappears as you stay in the sun, creating a will to not "loose" the tattoo. The Sun Tatt can be produced in different appearance and customized for companies or different markets and target groups. The concept has therefore a high potential of eliciting positive emotional experiences and satisfactory use.

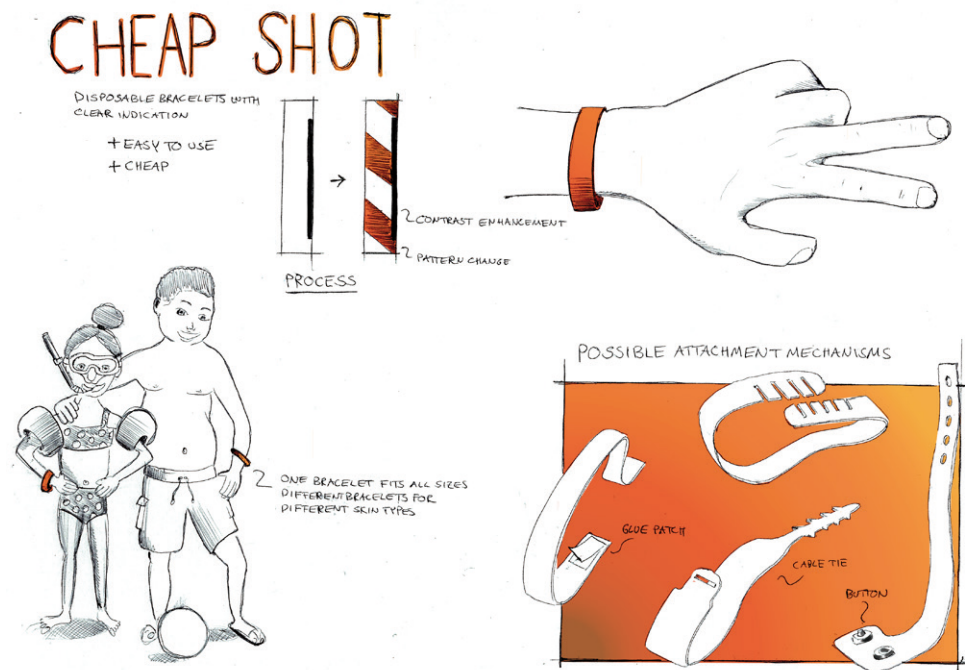


Figure 6.F. Cheap Shot

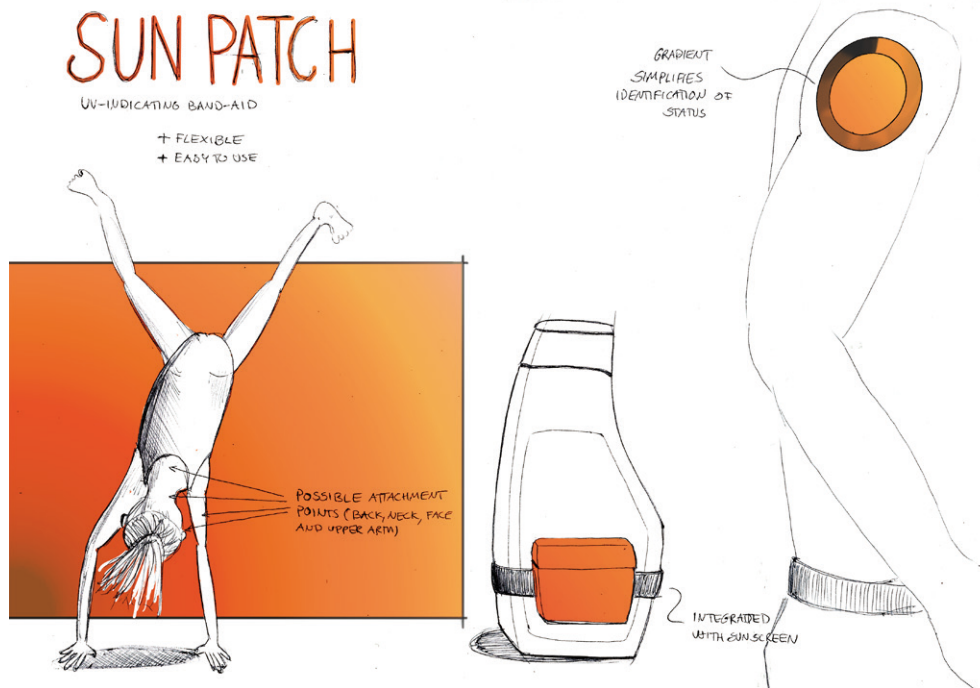


Figure 6.G. Sun Patch

6.2.4 Cheap shot

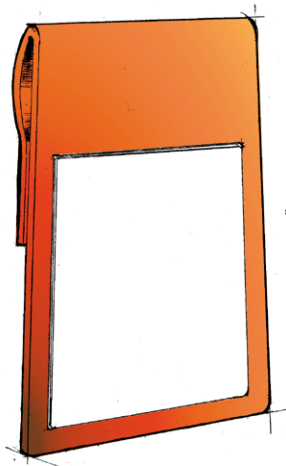
Cheap shot (figure 6.F) is the concept that resembles the existing prototype the most, with only incremental differences. A thin wristband for the arm wrist, with new features that enhance usability. Since one of the biggest concerns identified during the field study, was to perceive the color change, cheap shot uses patterns and a clearer reference area to make it color change easier to detect. Different solutions on how to attach the wristband in order to prevent the user from dropping it were also presented. These included among other things mechanical solutions by which the two different end parts are connected by its own shape.

6.2.5 Sun patch

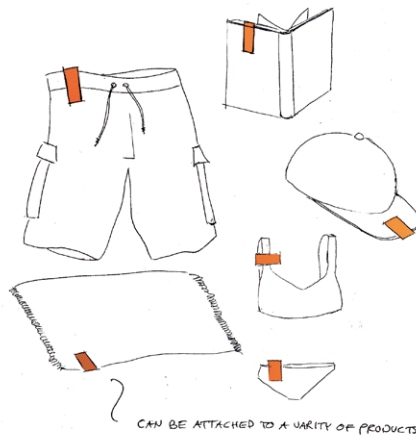
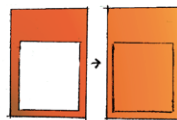
Sun patch (figure 6.G) is similar to a band-aid, an aid that can be put where it is needed in order to prevent harm. Sun patch uses a gradient, why it is possible to follow the steps of the process and understand how far the level of sun exposure has reached. This makes it easier to see and understand what the color indicates and the system potential is increased. The package can be attached to any sunscreen bottle in order to become a natural part of being in the sun and make it easier to not forget putting on/re-applying sunscreen on the product as well and to put the product on in the beginning of the day. The patch can also be put anywhere on the body.

FAMILY CLIP

A FLEXIBLE CLIP-ON WITH A CLEAR INDICATION
+ FLEXIBLE



LOADED WITH 7 PATCHES



CAN BE ATTACHED TO A VARIETY OF PRODUCTS



ONE CLIP-ON PER FAMILY

Figure 6.H. Family Clip

SUN PEN

A PEN WITH UV-INDICATING INK

+ FLEXIBLE
+ UNIQUE

DRAW
WHATEVER YOU LIKE

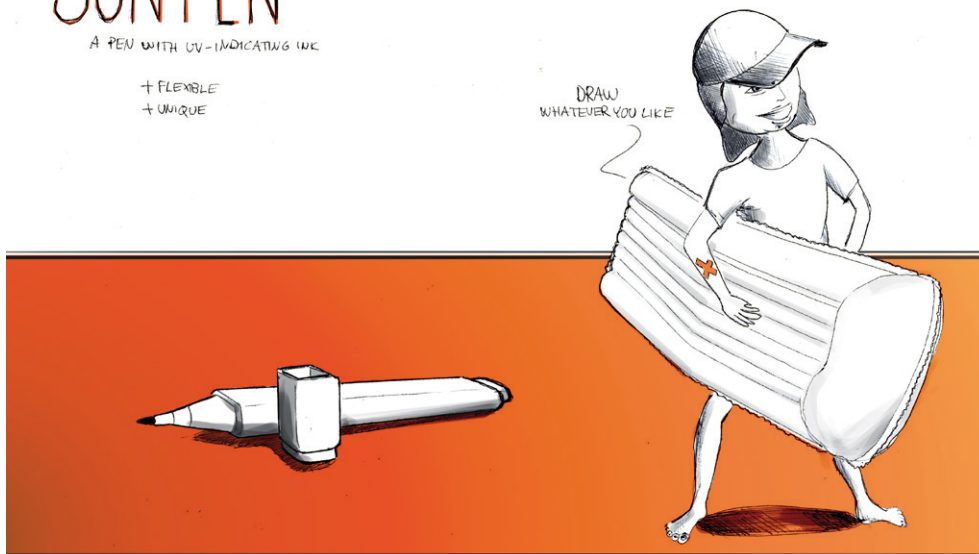


Figure 6.I. Sun Pen

6.2.6 Family clip

The family clip concept (figure 6.H) features a re-usable clip on that is loaded with a seven days use of patches from which one is removed after each day. Prior to vacation, the user reload the clip on with a new set of patches. The indication of when the exposure limit is reached is detected when the patch reaches the same color as the base product. One family clip can be used for monitoring the entire family which makes it easier to control even when the children are not nearby or when the family are in contexts such as cities. Use efficiency is thus enhanced.

6.2.7 Sun pen

Sun pen (figure 6.I) is a more futuristic concept that is exciting and easy to use. The ink is integrated into a pen and the child or the parent can draw directly on the skin. That makes it very flexible and the amount of ink can be used anywhere on the body and at a chosen size. The ink is either removed with soap or disappears by itself within a few days. It does not leave any white marks, is at the same time easy to apply on the skin and to remember to apply sunscreen to. When the ink is applied it has similar color as the skin, and becomes more prominent first when the level of sun exposure has reached its limit, making the indication simple and obvious. Usability is therefore enhanced and positive emotional experiences facilitated for.

6.3 EVALUATION

In order to find a concept to move forward with, a number of evaluation methods and tools were used. This section highlights the results.

6.3.1 SWOT

The SWOT matrix (appendix VIII) showed some clear benefits and disadvantages between the different concepts. A greater part of them could however be transferred from one concept to another. The flexibility for some of the concepts in terms of placement and size is however a key feature for adapting to different types of usage, that is not transferable. Some concepts are also more realizable since they do not require ink development and others are easier to use and suitable for more than just one person or skin type. The SWOT also helped detecting some uncertainties, e.g. how to remove sun tatt and how to use sun pen.

6.3.2 Weighted matrix

The weighted matrix (appendix VII), which was developed from the requirements list, took the core values into account together with a few market and time factors. The evaluation pointed out sun tatt as the least good alternative, mainly because its limitations regarding market potential and its relatively low realizability. Three alternatives (sun patch, cheap shot and sun watch) stood out. These were probably the most realizable and simplest concepts. Sun pen for instance got high scores on most parts and would have placed in comparison to the top three if not for the bigger development cost and the lower reliability score.

6.3.3 Evaluation by users

The user evaluation showed no clear direction or distinct, mutual opinion about which of the concepts that should be taken further. Some joint concerns and opinions for each concept could however be seen.

The sun pen came out on top by many users as it was seen as exciting, flexible and easy to use. It was also seen as fun and child friendly. Concern was expressed considering the amount of ink to use, what substances the ink contains, how the body would respond to it and what happens to it after use.

Similar concerns were expressed for Sun tatt, which also was seen as more unserious and unreliable than the other concepts due to its childish product category and appearance. There were additionally some doubts regarding the attachment process, which was seen as unrealistic and complex. Positive properties were that Sun tatt would be very appreciated by young children, possibly to a degree at which they would ask for it themselves, since temporary tattoos are much appreciated by them. This would facilitate use and be a great incitement for buying.

A joint opinion, expressed by parents with very small children, was that the solution needs to be “childproof” in a way so that children cannot remove the product themselves, as they sometimes do this with Band-Aids. This might cause problems if sun patch or UV tape are placed within the small children’s reach. A positive property of these concepts were however their flexibility; a parent could put it onto himself or on something that the child cannot reach.

They would moreover probably be appreciated by most children since many like Band-Aids and almost see them as toys or gifts.

The idea of having a product with a disposable part, as in Family clip and Sun watch, was seen as positive by some for environmental reasons, and negative by others since it would mean extra work. Many had an impression that it would be fiddly and did not like having to buy “a bag of disposable parts”. Writing the child’s name on the product, as on Sun watch, and the idea of being able to follow the process more easily was however seen as very positive aspects.

One measuring device for the entire family, as Family clip, did not feel reliable for some. There were many small uncertainties on the accuracy and use that just did not add up. At the same time it would be feasible for bigger families, but if it gets too general interviewee’s said that they might just use their own instincts, i.e. sun tan in the traditional way. The price was also a concern. The respondents wanted the product to be cheap enough, to not worry about losing it.

Cheap shot was considered as one of the top concepts, seeming like a logical product. The biggest concerns were that it did not feel environmental friendly, that clothes might interfere with the measuring process and that it would not be attached to the part of the body which is exposed to the highest amount of UV radiation.

6.3.4 Company evaluation

Discussions with the company lead to insights about the long process of getting from concept to market, and that therefore the final result should be close to implementation and without much uncertainties or development attached to it. The sun pen seemed most interesting to the company based upon the market potential, but at the same time quite technically difficult to implement.

The most promising concept that fulfilled easy implementation, big market potential and being in line with the company’s product portfolio was thereafter the sun patch. On the grounds of being flexible, well adjusted to the target group and easily implemented Sun patch was therefore seen as the number one choice.

6.4 CONCLUSION

Based upon the collective results, with the company evaluation as the final brick, it was decided to go further with the sun patch concept. A few of the other concepts might be very good alternatives for other companies or for this company further into the future. But at this stage and during these circumstances, sun patch is believed to have the highest potential of being implemented by the company and reaching end customers since it relates to their current product but has clear advantages and seems fairly realizable. It is therefore the best shot at fulfilling the visionary aim of the project; enhancing social and economic sustainability through decreasing sunburns among children.

07

CONCEPT DEVELOPMENT

The refinement of the concept focused on developing a production ready packaging and patch that fitted with the requirements stated in the requirements list.

7.1 PRODUCT JOURNEY

Band-aids are normally produced in custom build machines which manage the entire process, from raw material to ready-to-be-sold band-aid. This includes printing, die cutting and optionally printing envelopes and placing the band-aids in these. Packaging is sometime produced in the same machine through similar techniques. Machines are customized according to what the end-product should look like, which includes choice of printing technique. Common techniques are offset, screenprint, rotogravure and flexography. There are prominent advantages and disadvantages with the different techniques but most bigger printing houses have access to all and will chose the most feasible for the application. To be able to produce band-aids, collaboration with a medium sized or large printing house and investments in a production line is thus required. Many printing houses in Sweden have experience from producing band-aids and are able to design the most cost efficient production line according to Bue Anderssen, business development manager at 3M.

Leading suppliers of medical materials offer everything from raw material to fully processed products. It seems most reasonable to at an initial stage buy roll goods of tape material (with prepared liner) from a supplier and then use the industrial partners existing printing house to print, die cut and assemble the patch. This might not be the most cost efficient product journey in the long run but will shorten the time to market since the product will be refined by people who are familiar with the UV-ink and cooperate with the industrial partner. It is furthermore appropriate to initially print the patch through screen printing, since the industrial partner and their collaborative printing house are familiar with the technique and since the technique requires low investment cost and is relatively fast and easy to setup and adjust. Screen printing is a method in which ink is applied to the substrate (surface to be printed) through a fine fabric stencil screen which blocks non-printing areas (NE, 2013). Ink is wiped across the screen and passes through the unblocked parts. Every color requires an individual screen why the process is repeated as many times as there are colors. When production is scaled up and the design will not be altered anymore, it could be beneficial to investigate flexography which is a faster printing technique which requires a bigger investment due to the higher plate cost (Bryant, 2010).

Any surrounding products such as envelope and packaging should preferably be printed, die cut and creased at the

collaborative printing house to minimize the number of suppliers in the product journey. Digital or offset printing will be most feasible depending on production size and need of flexibility (e.g. for languages and skin types). The more automated the production process can be, the better in terms of efficiency and for economical reasons. It seems however realistic to initially utilize a semi-automated process where patches are put in packages and quality insured manually before shipping to pharmacies.

Since the main use context will be abroad, in countries where recycling systems are undeveloped, there will be limited possibilities to recycle the product. The product will therefore probably be burned. A feasible strategy for decreasing environmental impact is thus to reduce the amount of material as much as possible and not use hazardous materials.

7.2 PATCH DESIGN

7.2.1 Patch material

Five patch materials were chosen according to listed requirements and subsequently tested in a simulated use context. All of them are role goods, previously used by the leading producer 3M in wet medical applications. They include a backing (base material), a liner and a hypoallergenic pressure sensitive acrylic, medical grade adhesive. The full results from tests regarding the materials' printability and feasibility for use context are presented in appendix IX and a summary in figure 7.A. The combined results of the tests, backed up by recommendations from branch experts, led to choosing white polyurethane as base material for the patch.

Polyurethane coatings are frequently used within the textile industry since it can give textiles a wide range of qualities. 3M primarily uses polyurethane for wound care dressings and the nonwoven material is porous, breathable and elastic.

MATERIAL	PRICE (SEK/M ²)	ADHESION	PRINTABILITY
White Polyurethane	99,5	Good	Good
Polyester nonwoven	40,5	Ok	Bad
Rayon nonwoven	41,5	Ok	Good
Transparent Polyurethane	48,5	Good	Unknown
Transparent Polyethylen	39,1	Ok	Ok

Figure 7.A. The different materials' properties

7.2.2 Size and shape

After investigating possible shapes, a circular shape was chosen due to a safe, harmless and natural expression. It might furthermore imply lower investment cost, compared to more complex shapes, since standard circular die cuts must exist. The diameter was determined to be 3 cm. This decision was due to that the patch should be proportional to body dimensions of all children within the targeted age span, and not cover a too big part of their bodies, but simultaneously big enough to be manageable and visible from a distance. It was also important to not decrease the size too much since that could make it difficult to print and since it could interfere with customers' expectations of what they should get for their money.

7.2.3 Print

The printable area became quite small due to the chosen size, which limited the solution space. It was therefore decided to primarily focus on usability. Hence, most suggestions had a big, central reactable area and supporting reference point areas located around it. This is also sufficient since yellow and pink are complementary colors. They will therefore, according to the basic rules for contrasting colors, affect each other to become as different as possible, both in terms of hue and brightness. This will make the color change more apparent. The effect is even stronger if one color block is a lot bigger than the other. It could moreover be beneficial to have a small part line between the colors since the border between two colors which contrast strongly in terms of chroma can vibrate, which is displeasing to look at (Nilson, 2004). This part line should however not be too thin since the base material moves during screen printing and some geometric tolerance thus is needed. The level of movement is however material dependant and needs to be tested.

Embellishments and graphical elements, unnecessary for the functionality of the patch, were disregarded due to the limited size. Illustrations that helped branding the product as a sun care-, brand- or children's product were however thought to be beneficial and therefore investigated. Excessive use of colors was furthermore avoided since that implies extra cost and time when using screen printing. In the end, suggested illustrations and details were either black or white. Black was the most readable color while the white interfered the least with the colors of the UV-ink.

The number of reference points was one of the more frequently discussed issues during the development. More reference points imply more information, more complex use and higher production cost. The company's current product incorporates three reference points; a starting point, a midway point and a maximum limit point. A starting point is beneficial since it makes it easier for the user to see that the process is initiated. A midway point helps the user realizing how fast the process is going and it is thereby easier to predict when the maximum limit will be reached. A maximum point makes it easier to know how pink the reactable part should get and therefore when to avoid the sun. In the end, it was decided to promote extremely simple use and low production cost. Hence, it was suggested to skip the midway reference point and either use a starting and a maximum reference point or only the maximum point.

Three print design suggestions were picked out for evaluation (figure 7.C.). Suggestion one had a quadratic reactable part surrounded by a circular area with the maximum reference color. It incorporated a big sun illustration to relate to use context and brand. The aim was to develop a clean, child-friendly and simple design. Suggestion two had a circular reactable area surrounded by maximum and starting reference areas. It incorporated descriptions of the colors meaning, a white logotype and thin white lines between the three color blocks. The aim was to create a reliable and explanatory design. Suggestion three was similar to suggestion two but did not have any description of what the reference colors mean or any thin lines between the color blocks. The aim was to make the color change clearer through making the color blocks alter shape, and to exploit the brand as much as possible.

7.2.4 User test

The three suggestions were evaluated with respect to if their expressions were in line with core values. Test participants found suggestion one most child-friendly and encouraging due to the simple and playful design with large and rounded illustrations and color blocks. It was frequently mentioned to be cute and most fun. Suggestion two was rated as most reliable, logical and smart mainly due to the technical and structured engineering-like design with a lot of instructive black text and clear deviations between different parts. The results from the test can be seen in figure 7.B.

7.2.5 Final print design

It was decided to combine the benefits from suggestions one and two to create a child-friendly but reliable design. The final print suggestion thus had a big, quadratic and central reactable part with a sun illustration in it as suggestion one, but two surrounding reference areas with black, explanatory text, as suggestion two. The final design might therefore be more complex and expensive to manufacture but is more pedagogical, trustworthy and functional compared to suggestion one. It was moreover decided to make the patch design as language independent as possible to facilitate geographical market growth. The final design will be further described in chapter 7.

7.2.6 Release liner

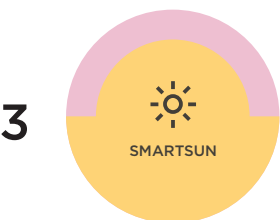
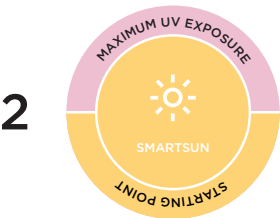
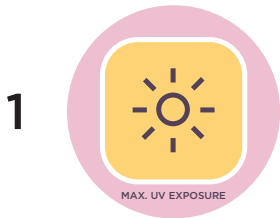
3M offers customized release liners of different material that uses one or several of the following release principles; unprocessed liners, split liners divided in two parts by die cuts, extended liners which provides a dry edge on each side of the tape for easy liner removal and folded liners which provide a flap for easy gripping.

It was assumed that most medical tape supplier can offer similar liners. The different release techniques imply different costs but the choice has a minor effect in relation to the total production cost according to Bue Anderssen at 3M. It was decided to utilize a design which incorporated a folded liner and a unprocessed liner. This will add additional cost but enhance usability and the experience of quality. It was furthermore decided to not print on the liner and not specify the liner material since it has no important functionality. The cheapest accessible liner material should be utilized.



CONCEPTS

MANUFACTURING



- COATING —
- TEXT PRINT —
- COLOR PRINT —
- UV INK —
- MATERIAL —



EVALUATION

Concept	Reliable (5)	Child-friendly (4)	Logical (3)	Smart (2)	Encouraging (1)	W.Result
1	3	13	4	2	9	92
2	12	0	10	9	3	111
3	0	2	1	4	3	22

Figure 7.B. The three patch design concepts, their layer structure and the results from the user evaluation.

7.3 PACKAGE DESIGN

7.3.1 Shape

Approximately 20 different package prototypes were created during initial ideation (figure 7.C). Some of the ideas took inspiration from origami, with complex foldings in order to generate durable, solid constructions. A number of other ideas were created based upon existing solutions such as pharmaceutical, cigarette and candy packages. Packages from similar products such as nicotine patches and bubble gum were also investigated in order to find inspiration.

From the initial ideation phase, four packaging concepts were chosen based upon their simplicity and diversity (figure 7.C). The first was a traditional pharmaceutical package that would be easy to manufacture and to print on. The second was a wallet-sized, travel-friendly and agile solution. This package size reflected the actual size of the patches and did not use unnecessary material. It might however give a cheaper impression and do not act as protective as the others. The third solution was a hangable, thin container that would be both lissome to use and have somewhat of a volume. This concept fitted well with the retail context but implied simultaneously a possibility to stand out from other products. It might not be as good for transporting and handling though. The last concept was a more unusual, small shape that was attached to a background plate in order to be more prominent. The thought was to make the product noticeable in the retail environment and simultaneously easy and practical to bring. This shape could be more difficult to produce but is more impressive than the other, boxy shapes.

7.3.2 Print

The graphical, informative part of the package design relied on graphics and text (figure 7.F). The current visual identity was used as framework, and improvements were primarily based on enhancing understanding and excitement. Important informative focal points were to provide better information regarding; product category, aim of using the product, target group, how the product is supposed to be used and the technique behind the product. The expression aimed for is described by the core values and the mood board. Language of choice was Swedish, considering Sweden was the intended first market and that it would be beneficial for understanding. It was also the language in use on the current package within the product portfolio.

A prominent issue throughout the concept development, which was extra visible when developing the print, was whether to accustom the product for first time users or experienced users. Since the product belongs to a new and unknown category and since the company is small with limited marketing resources, most pharmacy visitors will have no idea of the product's existence or what it is when visiting the pharmacy. It is thereby initially extremely important to have a high noticeability and simultaneously clearly state what it is and who it is for on the front cover. This is however hopefully a passing state and it is important to facilitate for expert users who might appreciate a minimalistic design more. The middle path was chosen here, by making it easy to identify the product category but keeping a lot of the necessary information on the back cover.

7.3.3 Packaging concepts

A print suggestion was eventually decided for each of the four packaging packaging concepts whereafter these were prototyped and evaluated by intended users.

The first concept (figure 7.D) had, as previously mentioned, two parts. One bigger, noticeable background plate to which a smaller unusual shape was attached. It seemed probable that the background plate would not be brought to the use context. It was therefore feasible to put all the information needed in order to adapt and buy the product on the background plate but have all the information needed in order to use it, on the smaller shape. The front cover of the background plate thus highlighted product name, brand, aim of product and a recommendation from barncancerfonden while the back cover had extensive information regarding the product. The small shape had a short description of how to use the patch accompanied by illustration of how the color will change. The concept was therefore thought to be trustworthy and noticeable but simultaneously agile and easy to use.

A big line art illustration of the patch was located centrally on the flat, wallet-sized concept's front cover (figure 7.D) in order to enhance understanding of what the package contains. This strategy can be seen on many pharmaceutical products which often visualizes the product. The expression of the front cover resembled the reference product's package a lot, using similar illustrations and the same organization of information. The back cover had a step-by-step description of how to use the patch with associated illustrations and an extensive list of facts regarding the product. This was meant to provide simple and quick instructions on how to use the product but simultaneously answer the most frequently asked questions. The concept was therefore thought to be agile to bring and easy to use, and thus facilitate positive use experiences. The question was if the concept seemed valuable and trustworthy enough.

The traditional pill package concept (figure 7.D) had a stripped front cover design which highlighted brand, product name, tagline and target group. Information on the back cover was divided upon technique and use. Illustration accompanied the texts to enhance simple understanding. The concept was thought to have a positive but serious expression and thus diminish the thought of the product as something limiting.

The hangable, pharmaceutical concept (figure 7.D) incorporated an illustration of children on the front cover in order to make the target group clear. This is a common technique among children's products which was frequently mentioned in a positive manner during the contextual studies. The front cover furthermore included brand, skin type, product name, product category and number of patches. The back cover was kept white and withheld only text and two symbols; a recommendation from barncancerfonden and a recycling label. This was thought to give a clean and pharmaceutical expression. The concept was therefore thought to have a trustworthy but innovative expression.

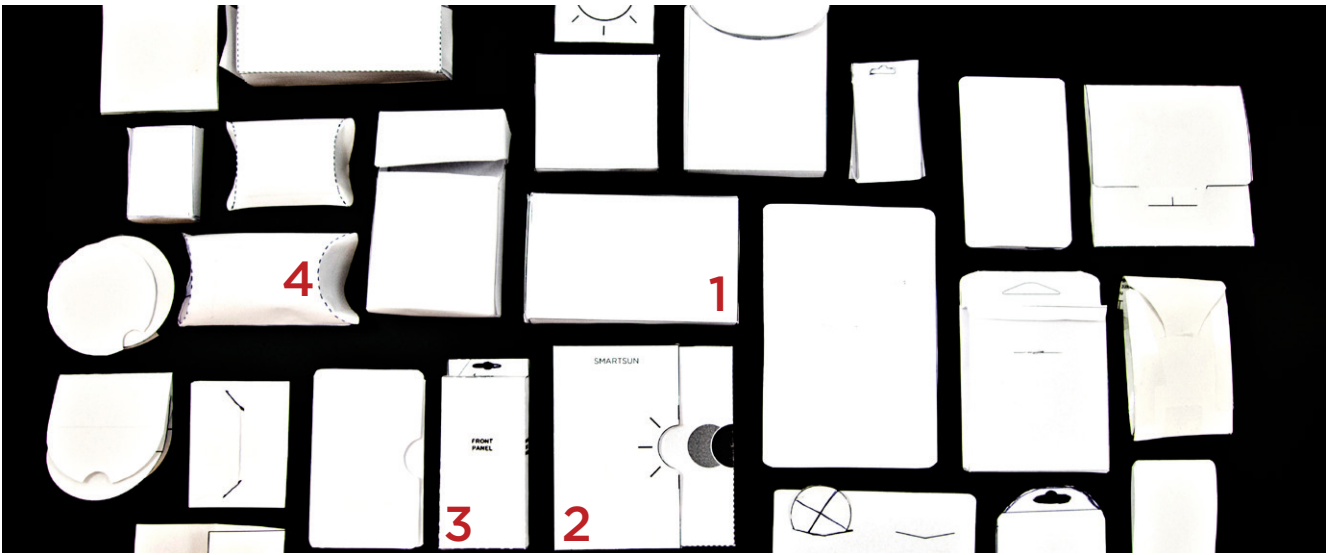


Figure 7.C. Exploring shape



Figure 7.D. Front cover of the four concepts



Figure 7.E. Back cover of the four concepts



Figure 7.F. Exploring prints

7.3.4 Envelope

How to store the patches in the package was frequently discussed during the concept development. Ideas ranged from storing them as they are to constructing advanced storage compartments. Storing them as they are implies no extra material but might be perceived as *cheap* and *shabby*. Complex solution might increase the production cost due to material, manufacturing and assembly.

To increase the value of each patch without increasing the production cost significantly it was decided to use a non-sterile envelope. The solution is relatively cheap since it can be integrated in the production line and thus not require extra assembly. It was furthermore decided to print a monochrome logo, the skin type and a reminder of applying sunscreen to the patch as well since this will connect the envelope to the package and these aspects were identified during the contextual study as prominent issues. An initiation of where to rip the envelope apart was furthermore marked with ink and die cut.

7.3.5 User test

One of the biggest insights during the user test of the packages, in which ten users evaluated the four concepts, was that it still was hard to understand what the package would contain or exactly what the functionality of the product was. The concept's name had however a positive effect on the understanding, linking the product to the sun and a protective product category.

It was furthermore hard to identify who the intended user was for all the packages except the one with the children illustration. Guesses varied between young adults, children, persons with sensitive skin and just people in general.

When the test participants only focused on the front, which is common during the initial retail environment interaction with the package, the packages provided little support for understanding the product category. When the participants were told to turn and read the back cover, it was quite an eye opener for many and the function and how to use it was considered as quite clear. Some questions however still remained unanswered (depending on package); the size of the patch, whether to apply sunscreen on the patch and if the ink was completely harmless. It was also still hard to understand the categorization of skin types and the incorporated ink technology.

The respondents expressed many positive experiences when testing the packages. Especially the hangable, pharmaceutical container was said to be smart, pleasant to look at and trustworthy. Respondents pointed out the overall shape, the children illustration and the discrete use of colors as main reasons.

7.3.6 Final design

The hangable, pharmaceutical container was chosen for further refinement based on being most appreciated by test participants and since it was thought to have the greatest potential of fitting in but still standing out, at Swedish pharmacies. Refinement of the package according to insights made during the user test and an expert review by a package design firm led to a rearrangement of prints and highlighting of important information such as product type and tag line. It furthermore led to a slightly improved opening mechanism and an increased volume in order to better accustom the package for production and use. The final design will be further described in chapter 7.

7.4 CONCLUSION

The concept development phase resulted in a holistic final concept which included patch and packaging. This concept, which is one of the main deliverables of the project, was developed according to the product specification and in close collaboration with intended users, the industrial partner and their suppliers. The concept will be described in detail in the following chapter.

08

FINAL CONCEPT

In the following chapter the final concept is presented and explained.



Figure 8.A. Solplåster.



Figure 8.B. Solplåster is easily attached to the skin.



Figure 8.C. The patch's different layers

8.1 SOLPLÅSTER

Solplåster is an easy-to-use UV indicator patch that helps parents keeping track of their children's sun exposure (figure 8.B.). By utilizing the industrial partner's UV sensitive ink, which change color upon UV exposure, Solplåster gives parents direct and clear feedback on when to shield their children from additional sun. Solplåster thereby reduces sunburns among children and decreases the risk of developing skin cancer. Solplåster furthermore lowers the level of worry among parents and creates a more relaxed sun experience for the entire family.

Solplåster is supposed to be a part of the industrial partner's product portfolio and will be sold at Swedish pharmacies. It is designed for families on sunny vacation and is therefore waterproof, easy to travel with and comes in sets of seven. There is two versions of Solplåster; one for children with normal sun sensitivity (skin type 3 and 4) and one for children who are extra sensitive to sun (skin type 1 and 2). Solplåster furthermore accounts for protection from sunscreen if the parent apply it on both the child and the patch.

The patch can be placed anywhere on the child's body, which makes usage flexible and the measuring procedure reliable. By placing the patch directly on the skin it becomes natural and easy to apply sunscreen to both the skin and the patch. Two big reference points, surrounding the reactable part which will change color, facilitate perception of the color change. The reference points also make understanding

easy and the risk of errors minimal. Maximum UV, which is written on the upper part of the patch is language neutral, meaning it is understandable in Swedish as well as in English and therefore can be sold without production adjustments to many markets. The sun in the middle and the logo on the bottom are graphical embellishments that facilitate for a meaningful experience which connects usage to the brand, the packaging and the use context.

The patch attaches to the body with an adhesive which is protected by a plastic liner (figure 8.C). In order to make attachment easy and efficient and avoid negative emotional experiences, the liner is split into two pieces with grippable ends. The overlying part is removed first when attaching the patch, leaving half of the patch ready. The patch is then placed on the body, before the second piece of the liner is removed. This way, the adhesive is not touched and thus has its properties undegraded.

Solplåster's main material is a water resistant and breathable white non-woven polyurethane tape. The material is heat and water resistant, which is essential due to the conditions of the use contexts. It also gives a high quality feeling, is certified to be used on human skin and enhances reliability and positive emotional experiences and therefore the value of the product.



Figure 8.D. Solplåster's package; the back and the two different versions' front.

8.2 SOLPLÅSTER'S PACKAGE

Solplåster comes in a small package that easily can be carried during traveling (figure 8.D). The package contain seven patches in order to last for a weekly vacation, which is the most probable usage scenario. The appearance is designed to lower adoption barriers and to create a reliable, child-friendly and positive expression that fits with sun care and children's products. By reusing form elements from the industrial partners existing product, a consistency is created that makes them obviously linked together. The package is designed in order to be hung in the shelf at the pharmacy, but can also be laid on a flat surface or put in baskets.

On the front cover is information placed that evoke interest and facilitate fast understanding of the product. On the top is the brand logotype which connects Solplåster with the brand and marketing campaigns. The name Solplåster derives from the Swedish word for sun and patch, enabling associations to positive sun experiences and aiding products. The name thus facilitates for meaningful experiences which link the product to usage.

Beneath the name is the industrial partner's tagline placed, which gives a short explanation on what the product do and why to use it. The central illustration of two kids helps the customer identify the product as a children's product which according to research findings is essential for building trust. Additional explanatory text further enhances understanding of the product's functionality and the aim of using it. At the bottom of the front are information informing the user

of the number of patches in the package, what skin type the patches are calibrated for and that the product take both UVA and UVB radiation into account, which are key concerns for sun care product users.

The back of the package is mainly white to create a reliable, pharmaceutical expression and to highlight the importance of the information. A brief text that explains the technique behind the products, the benefits of using it and how to use it. An illustration of how the patch will change color is also provided in order to explain what the different stages mean. An illustration of the product also helps to further increase the understanding of the product and lowers the perceived complexity. Beneath the patch illustration is text that bullet points some of the most important features. There is also a recommendation from a collaborative organization that enhance reliability, information regarding the manufacturer and an invitation to the homepage. The yellow striped background creates a design cue to the front as well as to the reference product.

Solplåster is packed individually in envelopes that increases the perceived value of each patch. Information on the envelope also help the user remember the most frequently identified use problem - applying sunscreen to the patch. If the product is used without the package it also clearly states brand, product name and what skin type it is calibrated for. The envelope thereby allows flexible marketing campaigns which could speed up the adoption process.

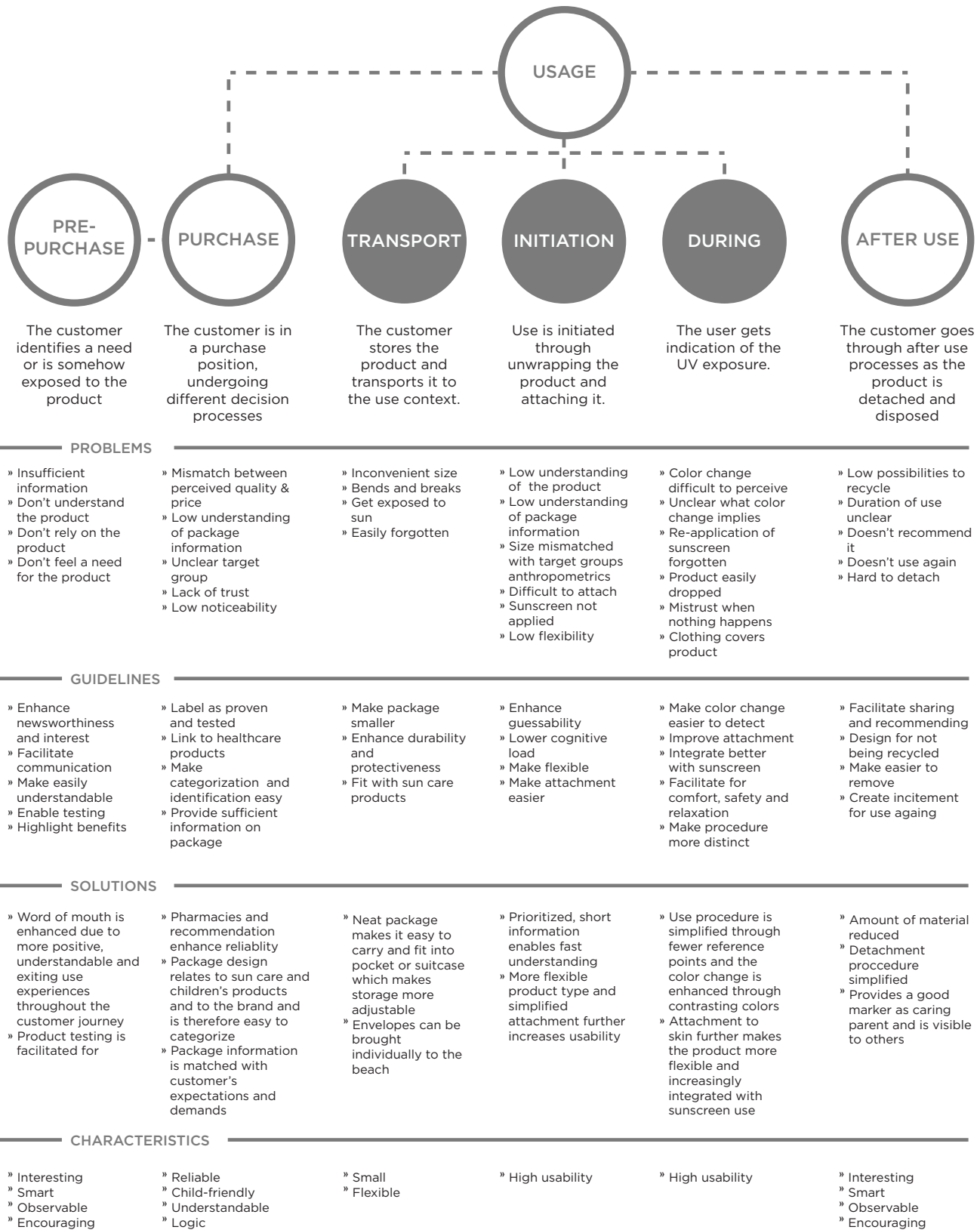


Figure 8.E. Desired customer journey

8.3 USER EXPERIENCES

Solplåster is developed from a user experience perspective. This primarily means that Solplåster is designed to create meaningful, aesthetic and emotional experiences at every touchpoint where consumers interact physically or mentally with the product. The intended experience is described in the following customer journey and exemplified by the customer scenario.

8.6.1 Customer journey

The final concept address the problems that were detected for the reference product and the guidelines that consequently followed as can be seen in figure 8.E. The desired customer journey is exemplified by the customer scenario in the following section.

8.3.1 Customer scenario

Annette's sister is back from a vacation at Crete. She is excitedly telling Annette about a new product she saw children using at the beach. A band-aid which indicates when to avoid sun in order to avoid getting sunburned. Annette, who soon will travel to Gran Canaria with her family, is concerned over her children getting exposed to strong sun. Her interest is piqued.

Annette is at the pharmacy to purchase sunscreen for the Gran Canaria trip. Two new products hang above the sunscreen shelf: Solplåster and the reference product. Solplåster got to be the product her sister told her about. Annette picks it up and scans the front cover. It sounds promising and she turns it around to learn more. The information is reliable and the product seems smart, child friendly and useful. Seven patches are furthermore perfect for the trip. She decides to try it out and purchases a "sensitive" package for her four year old son Charlie and a "normal" package for her ten year old son John. She finds the price reasonable for such an agile, quality product.

Annette packs the package in her toiletry bag. At the resort, she stacks them next to the sunscreen and tells her husband about the new product she bought. He gets interested and studies the package. After reading the back cover, he reminds Annette that the patches should be attached directly in the morning, before they put on sunscreen.

The morning after, Annette and her husband perform the morning routine. It now includes getting the children dressed, attaching the patches and applying sunscreen. Annette attaches Charlie's patch to his sun cap since she does not want to attach anything directly to his sensitive skin. John, who is happy about getting a cool patch, wants to have it on his upper arm where he can see it. It is easy to differentiate between the patches since there is a clear connection between envelopes and packages. The patches furthermore looks positive but trustworthy.

The family spends the entire day around the pool area. Charlie and John play in the children's pool while the parents tan in the sun and read books. Sunscreen is re-applied frequently and Annette and her husband check the patches for color change every now and then. They find it very simple to monitor the process since they can compare the color change with the end color.

Charlie's patch reaches the final color and Annette applies 50+ SPF sunscreen and puts on a long sleeved shirt on him. John's patch never reaches the final color. Annette finds it very comforting to know that the children were not exposed to more sunlight than recommended and was able to relax better during the day. Patches are taken off and put in the common trash bin since the hotel does not recycle.

Annette and her family are flying home. She is happy that her children did not get sunburned during the entire week. Her husband got sunburned though and she considers complementing the children's solplåster with a sun bracelet for herself and him next time.



Figure 8.F. Customer scenario

8.4 SOLPLÅSTER'S JOURNEY

The base material is bought as rolegoods with prepared liners whereafter Solplåster is printed, die cut and put into envelopes in a customized production line at the industrial partners collaborative printing house. The UV-ink, which is produced at Chalmers, embellishments and the reference points are printed on the patch through screen printing and a protective coating is lastly added in order to protect the patch and to make it possible to use together with sunscreen. The cardboard package is also printed through digital printing, die cut and creased at the printing house. An outside organization is thereafter in charge of packaging and quality control before the finalized product is shipped to Swedish pharmacies to be sold to end consumers.

8.5 ECONOMICAL FACTORS

When calculating the industrial partner's margin, it is important to consider all the cost drivers within the product journey. The industrial partner will only receive an 18 to 25% share of the end price to customers since the sales tax is 20%, the pharmacies' margins are about 50%, the wholesalers margin about 10% and the distributors margin is somewhere between 20 and 50%. It is this income that must be related to production costs, investments and market size.

Solplåster utilizes the same printing technique as the reference product but is 70% smaller and uses 82% less UV-ink. Hence, ink costs are lowered and the production process should be possible to speed up since the used ink will dry faster. This is a major benefit which could lower the production cost significantly and which is essential if the production should be scaled up. Solplåster furthermore only uses two reference points and thus requires one less round of printing. The medical tape, which is used as base material, is however slightly more expensive than PVC, which is used as base material for the reference product. This cost increase is negligible though since the base material cost is a minor part of the total production cost, contributing with about 5-10%.

Solplåster's package is produced in a similar manner as the reference product's package and requires slightly less material. The assembly is a bit more difficult though since it requires two additional foldings and the package take up more volume when stacked. The cost for assembly and shipping could thus be higher.

The package furthermore includes a recommendation from Barncancerfonden, which is essential for convincing doubtful parents. To enable this, the industrial partner must make a deal with the organization which usually includes giving money to their fund.

An implementation of Solplåster requires investment in a customized printing line and some fine tuning of the ink to match its properties with the new base material. The size of the investment needed is dependent on factors which were not investigated during the project, such as comparison of suppliers, the level of automatization in the production process and a general optimization of the product journey, and needs to be investigated before any definite conclusions

regarding the economic benefits of implementing Solplåster could be drawn. There are nevertheless many cues which indicate that Solplåster could create a better margin than the reference product for the industrial partner.

8.6 FINAL EVALUATION

A final evaluation of Solplåster was performed by comparing it with the reference product in a user test with 14 participating parents. The results (appendix X) imply foremost that Solplåster's package is much more understandable and readable than the reference product's package. Test participants found it easier to understand who the product is for, what the main functionality is and how it should be used. The information is furthermore easier to overlook, pinpoints important use aspects better and is faster to scan through. Consequently, participants had a much better understanding of the product, both after skimming the front cover and after reading the information on the back. The willingness to buy the product was nonetheless significantly higher for the reference package. This was primarily due to that most participants falsely thought that it contained one wristband which lasts for a week, and thus did not seem as complex to use as Solplåster. The reference package was nevertheless also said to be more noticeable due to its unusual shape.

Solplåster was rated as significantly easier to attach to the child than the reference product which, similarly as during previous user tests, was difficult to put on without errors. Solplåster was furthermore seen as more lissome and practical to use since it blends in better with the child's body and thus is easier to integrate with existing sun habits and activities.

Both products fulfilled the core values in a good way, according to the test participants although Solplåster was rated as somewhat more logic and smart. It was also said to be more trustworthy and technical, partly due to its references to Strålskyddsinstitutet and Barncancerfonden but also since participants thought it would handle the use context better and produce more accurate measurements. Proof of being allergy tested and a list of including substances were suggested as beneficial additions for facilitating trust and adoption of both products.

The collective experience of the reference product elicited more joy and less rumination than Solplåster, according to the participants' ratings. This was however contrarious with their comments which implied that Solplåster would be easier and more pleasurable to use.

75% of the participants preferred Solplåster over the reference product when comparing them. Main reasons were that both Solplåster and its packaging were flexible, child-friendly and understandable. The smaller size and the ease of integrating it with existing habits were also mentioned as motives.

09 DISCUSSION

The following chapter elaborates on the project; both the overall process as well as the result and how the project could further be improved.

9.1 PROCESS

This paragraph discusses how the process affected the project and the final concept.

9.1.1 Starting point

The industrial partner, their ink technology and a prototype of their current wristband were used as starting points for the project. The project was therefore limited to investigate questions that had relevance for the company and to the solution space they envisioned. An approach without the goal of generating profit opportunities for the company or the delimitation to use their ink technology might have led to completely different, more futuristic suggestions. It is for example uncertain if an additional product is what the situation really needs. Education and information might be better alternatives in order to change sun habits. Other alternatives could be to aim to discard the ideal of being sun tanned or to develop fun activities to perform in the shade. A broader approach including other application areas and other user groups could also have led to differing solutions and possibly more radical innovations.

9.1.2 Theoretical approach

A user-centric design approach, focused on user experience, usability and customer behavior was utilized. Hence, the project was outlined thereafter and the research identified above all challenges connected to these areas. This is reflected in the end result which is based on intended users' needs but might deviate from what is most effective for gaining profit for the industrial partner or from what is most effective in order to achieve behavior change. An increased focus on market and trends or on how to design for behavior change could for example have identified opportunities that were undetected during this project.

The user-centric approach might furthermore have ruled out technology push solutions and limited the solution space to incremental changes since the project focused entirely on current situation and current desires. An increasingly design driven or more visionary based approach could have implied a different conclusion. This type of approach is supported by the fact that awareness of the sun's effects and thereby sun habits change rapidly. Studies of the current context might thus not generate a good picture of what future needs will be like. Quick realizability and profitability was however important for the industrial partner which was the reason behind focusing on the current situation.

It was very difficult for test participants and interviewees to understand, evaluate and communicate their user experiences. Few parents (or children) were aware of that interactions with products elicit emotions or that they can have meaningful qualities. The theoretical framework of user experiences was therefore out of line with the mindset of respondents. The project group tried to overbridge the gap by modifying tools, translating the associated terminology and analyzing comments and behavior. Excessive training of participants in methods and tools, development of an appropriate language and building of trust would have been needed to make results more reliable. This was however unfeasible due to the time scope. A major conclusion is that development of new, tangible explorative and evaluative tools is needed to enable cost and time efficient user-centric design for experiences.

9.1.3 Research context

Research was primarily conducted through an initial survey and contextual studies at an all-inclusive resort with user tests, observations and semi-structured interviews. The research context implied certain activities and thereby problems associated to these. Other problem areas might remain unidentified since all intended use contexts were not studied. The studied context was however found to be the most likely and lack of funding, time and access to sun in Sweden made it impossible to perform further contextual studies. The focus on reviewing the current wristband during the research furthermore narrowed the solution space to products that are used in a similar manner as the current, since much of the retrieved information regarded such use.

9.1.4 Selection of respondents

All-inclusive trips attract a certain crowd that is unrepresentative for the full target group. It is for instance likely that these peoples' attitudes towards sunbathing and what characterizes a good vacation differs from the general attitude. Hence it is likely that the respondents aired different arguments and experienced different problems than the average intended user would. They were nevertheless treated as typical users and the end result might therefore be too accommodated for sun worshipers. The initial survey was however spread via parenting forums and received thus responses from extra ordinary aware and interested parents. This is thought to reflect the first adopters within the target group quite well since they are thought to actively search for new information and products.

Interview sessions and follow-ups were performed with parents at swimming schools and daycare centers during the concept development. Most of them had very young children and represented therefore the *uncertain, first time parents* part of the target group. Parents with older children were more difficult to access since they do not gather at activities as frequently. The final concept might therefore reflect the uncertain first time parents too much. It was moreover meant to follow up decisions with children. Enough children to represent the wide target span was however time consuming and difficult to access and it was difficult to get useful information from them. Better knowledge on how to incorporate children in the product development process or how to design for children would have benefitted the project.

9.1.5 Concept development

The ideation phase focused on envisioning products in line with the company's strategies and economical possibilities. Ideas were thus strictly screened based upon perceived realizability. There is a risk that these screenings were performed too early and based on inaccurate facts, why good and realizable ideas might have been disregarded. It could have been beneficial to get feedback for all ideas by company representatives but due to the time limitation there was not enough space for evaluation. Performing a more exhaustive screening could also implied that the final concept would not been taken as far as it was.

The concept choice was based on theoretical analyses, user evaluation and company feedback. It was however difficult to pinpoint the differences between the different concepts and thereby their individual potential. It would have been interesting to develop a few concepts further in order to examine their possibilities prior to making a definite concept choice. Requirements, selected to the weighted matrix were moreover quite vague and the trustworthiness of the outcome is questionable since it is highly dependent on personal opinions. It did however give a clear indication on which concepts that were more likely to work.

9.2 FINAL CONCEPT

This paragraph discusses how well the final concept matched the expectations.

9.2.1 Product specification

Guidelines and requirements listed in the product specification were not quantified and it is thus difficult to distinguish if the final concept meets all requirements. To do so, proper measurements need to be established and expert reviews and tests performed. Key aspects and indications are however discussed in the following sections.

9.2.2 User experiences

The final evaluation indicated that it has superior understandability than the reference product, and is better appreciated due to flexibility and agility. The test included only examination of package and attachment of the product and was not conducted in actual use environment or by actual users. The concept is nevertheless, contrary to the reference product, developed from a user experience perspective and is designed to elicit appropriate experiences at all touch points within the customer journey. To verify the outcome, further testing needs to be performed. Especially regarding user experience and user reactions to the final concept, which demands a more contextual study with a functional prototype in order to make results comparable.

9.2.3 Usability

Time constraints made it unfeasible to perform a holistic usability evaluation of the final concept but the initial understandability was tested and found to be sufficient. It is however difficult to cover all problems and questions that might occur on such a small package, since the product category is completely unknown and since UV is quite fuzzy and unclear to many. Educating the personnel at the pharmacy and developing a pedagogical website or app with supplementary information would be highly beneficial. It is furthermore important to not only adjust the concept for first time users but also have expert users in mind. Their perception of the concept is unknown, since they do not exist yet, but needs to be investigated.

One of the major usability issues found during the user test of the prototype wristband was to perceive and understand the color change. The industrial partner managed to develop their ink technology during the project and the color change is now clearer and more uniform. The final concept additionally, only uses two, bigger reference point, instead of three small, which simplifies the perception. User tests of the final concept should however be performed to verify this.

A new usability issue that comes with the final concept is to choose the correct version when purchasing it.. The additional version was introduced to cover a bigger target group and to address parents that have children with different sun sensitivity. Most intended users have little knowledge of the skin type categorization or which they belong to. The utilized description is not accommodated for all users and it is easy to confuse sensitivity towards sun with general skin sensitivity. It is probable that the description needs fine-tuning in order to avoid wrong choices and miss-use of the product. The different versions might also need to be adapted

to different markets depending on the skin type ratio of the demographic.

Another possible usability problem with the final concept is the opening mechanism of the package. The small package volume makes the opening mechanism tight and it might be difficult for users with reduced hand function to open the package and pick up patches. This issue needs to be further investigated and the mechanism altered according to findings.

Solplåster's package incorporates different fonts and illustrations than the reference product and the information is rearranged and prioritized differently. The reference product's package needs to be fine tuned in relation to Solplåster's package, or vice versa, to create a unison product portfolio.

9.2.4 Realizability

The final concept is designed to be highly realizable for the industrial partner. Manufacturers and material suppliers have been contacted to ensure that the design is producible, without unfeasible investment costs. The production cost is however not optimized and branch experts should review the concept and refine it upon DFMA aspects. A review of available suppliers and production methods should also be performed to identify the most cost efficient product journey.

9.2.5 Market potential

Comparison of the final concept with the reference product clearly shows that the concept is more distinctly aimed at certain users (children) and thus aim at a much smaller target group. The economical potential of the concept is therefore smaller but the decision is supported by findings from previous market studies and the initial survey of this project. They imply that the chosen target group includes the most probable first adopters. The concept might therefore be faster adopted by enough users for the company to achieve a stable position at the market. Since the reference product and the final concept will form a product family, the reference product can aim at capturing users that do not fit within the final concept's target group. For this scenario to work out, it is essential that the final concept is introduced as soon as possible. It would be beneficial if the reference product is increasingly branded as a flexible product for adults.

If the industrial partner's products succeed on the market, it is probable that new competitors emerge or that sunscreen producers start selling similar products. What strategy the company should utilize in such scenario or how the final concept should stand out is uninvestigated in this project but should be considered in order to create a stronger market position.

Solplåster is primarily developed for the Swedish market, although consideration has been taken in order to make it easy adjustable for new markets. If the end result is accommodated for users from other cultures is however uninvestigated. Differing level of awareness of the sun's effects and general circumstances of life affect sun habits

and thereby needs and demands. Retail environments, customer behavior and market climates differ extensively between different cultures. In order to introduce the concept to other markets, these contexts might need to be investigated and the concept adjusted thereafter.

9.2.6 Sustainability

The final concept has the three legs of sustainability in mind. Social sustainability is enhanced since the product facilitates sound behavior and thereby decreases sunburns and related diseases. Global and personal economical sustainability is gained since fewer cancer treatments will be needed and sick leaves will decrease. Ecological sustainability will be improved since the concept uses less material compared to competitors and since unnecessary use of sunscreen can be decreased. Ecological sustainability has however not been the most prominent focus of the project and the concept will for example probably not be recycled since most tourist locations do not facilitate pre-separation at source. Development of a reversible ink could therefore be of interest in order to be able to create non-disposable products. It is furthermore uninvestigated whether the sustainability benefits that come with the concept justifies introducing it to the market.

9.3 RECOMMENDATIONS

Prior to commercializing Solplåster it is essential to validate its properties and refine it upon manufacturability. Involvement of potential users and branch experts is thus needed. The four following points are recommendations on key focus areas.

- Refinement of printability and manufacturability through tests and expert reviews
- Maximization of margin through optimization of product journey and examination of feasible suppliers
- Holistic evaluation of functional prototype by potential users to verify user experiences and usability
- Development of a market strategy and a product portfolio that includes Solplåster and the reference product

CONCLUSION

The research phase showed that the industrial partner's product has a distinct primary target group and a related use context; sun bathing families with young, light skinned children on vacation abroad. It was furthermore obvious that many of these customers have a positive attitude towards the aim and functionality of the product. To facilitate adoption though, the current product needs to be refined upon use experience properties since it was quite difficult for intended users to understand what the product was, how to use it and to use it without errors. This refinement should follow the requirements stated in the requirements list and an example of how it could be made is displayed with the developed concept, Solplåster.

Solplåster, is a highly realizable UV indicator device accommodated according to generated insights and accustomed to the company's market strategies, brand and economical possibilities. It has distinct and non-transferable advantages compared to the industrial partner's current product such as higher flexibility, agility and chance to be a natural part of existing sun habits. It is also probable that it is cheaper to manufacture and can thus generate a better margin. User tests furthermore implied that the package is more understandable and that the concept is more efficient to use than the reference product. Hence, it stands a chance to enhance social and economical sustainability through decreasing sunburn among children and thereby related diseases such as skin cancer, if the industrial partner chose to adopt it. Manufacturing tests, more user tests and optimization of the product journey are however needed to commercializing the concept.

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APPENDIX I: INITIAL SURVEY

The initial survey was distributed online at Swedish parenting forums and received 81 responses from parents with children between 2 and 12 years old. The survey included the following questions and received both quantitative and qualitative information.

1. Age
2. Sex
3. How many children do you have?
4. How old are they?
5. Imagine that you are at the pharmacy to buy sunscreen that your children will be using. What weight do you think the following product characteristics have for your decision?
 - a. Quality
 - b. Price
 - c. Brand
 - d. Appearance
 - e. Harmlessness
 - f. Child friendliness
 - g. Reliability
 - h. Labeling
 - i. Recognition
 - j. Lifetime
 - k. Environmentally friendly
 - l. Modern
 - m. Easy to understand
 - n. Ease of use
6. What do you think distinguishes a children's product from a product for adults (try to describe appearance, usage and perceptions from other senses)?
7. How would you describe a typical children's product?
8. For children aged 2 to 12 years, how much does the age of the children affect what products to buy for them at the pharmacy?
9. How do the children's ages affect decisions?
10. Up to what age do you buy child-specific products? (ex. Bamse Toothpaste)
11. Have your children ever been sunburned?
12. If yes, please specify at what sites (eg, playground, soccer practice) and what it was due to (eg, forgot the sunscreen at home, misjudged the sun intensity etc).
13. At what part of the body have your children been sunburned?
14. How do you protect your children from the sun?
15. Do you protect your children differently depending on their age?
16. Do you feel that you have enough information and knowledge to protect your children in the best way?
17. If no, what are you unsure about?
18. What do you perceive as the biggest difficulty when it comes to children and the sun?
19. How worried are you that your children can get sunburned?
20. On what occasions do you protect your children from the sun (Is it both in Sweden and abroad, is it both at the beach and during visits to the playground, etc.)?
21. If you use sunscreen, what strength of sunscreen do you use for the kids and how do you decide which one to use?
22. Do you re-apply sunscreen during the day and how do you decide when it is time to do it?
23. What are your spontaneous reactions to the reference product?
24. Do any immediate questions come up due to the description of the product?

APPENDIX II: USER TEST

This table visualizes the quantitative results from the user test of a prototype of the current wristband, which 14 parents and 12 children participated in during the contextual studies.

	Average Median	
Age of parents.		
No. of children.		
Age of children.		
Duration of use.		
Activities during use.		
How difficult was it to understand how to use it? (1-5) (1= very easy, 5 = very difficult)	2	1,9
Comments regarding the instructions on the package.		
How sure are you that you used is the right way? (1-5) (1 = totally uncertain, 5 = very confident)	4	4,3
Did the wristband change color?		
How difficult was it to perceive the color change? (1-5) (1= very easy, 5 = very difficult)	2	2,5
Who noticed the color change?		
What did you do when the color changed?		
How easy was it to attach the wristband?(1-5) (1= very easy, 5 = very difficult)	1	1,8
Did your worry change by using the wristband?	3	2,6
How appropriate was the wristband for your child's skin type? (1-5) (1= very bad, 5 = very good)	4	3,8
Was it difficult to convince the children to use it?		
Comments on other problems or difficulties		
Emotional experience (1-5) (1 = not at all, 5 = very strong emotion)		
Annoyance	1	1,2
Surprise	1	1,8
Reluctance	1	1,1
Joy	2	2,4
Fear	1	1,4
Interest	4	4,0
Liking	4	3,6
Rumination	1	1,8
Aesthetic experience (1-5) (1= left adjective, 5 = right adjective)		
Beautiful - ugly	3	2,9
Pleasant - Unpleasant (touching)	3	2,8
Vulgar - Discrete	4	4,2
Stripped - Cluttered	2	2,1
Soft - Hard	4	3,5
Colorful - Grayish	3	3,3
Meningful experience (1-5) (1= left adjective, 5 = right adjective)		
Modern - Dated	2	2,2
Useful - Useless	2	2,4
Durable - Delicate	3	3,3
Cheap - Expensive	3	2,5
Innovative - Traditional	2	1,8
Smart - Idiotic	1	1,7
Everyday product - Special occasions	4	3,5
Playful - Boring	3	3,0
Juvenile - Adult	3	3,3
Clear - Unclear	3	3,1
Reliable - Unreliable	3	3,0
Effective - Ineffective	2	2,6
Experience (1-5) (1 = very negative, 5 = very positive)		
Parent's user experience	4	3,9
Child's user experience	4	3,7
Comments		

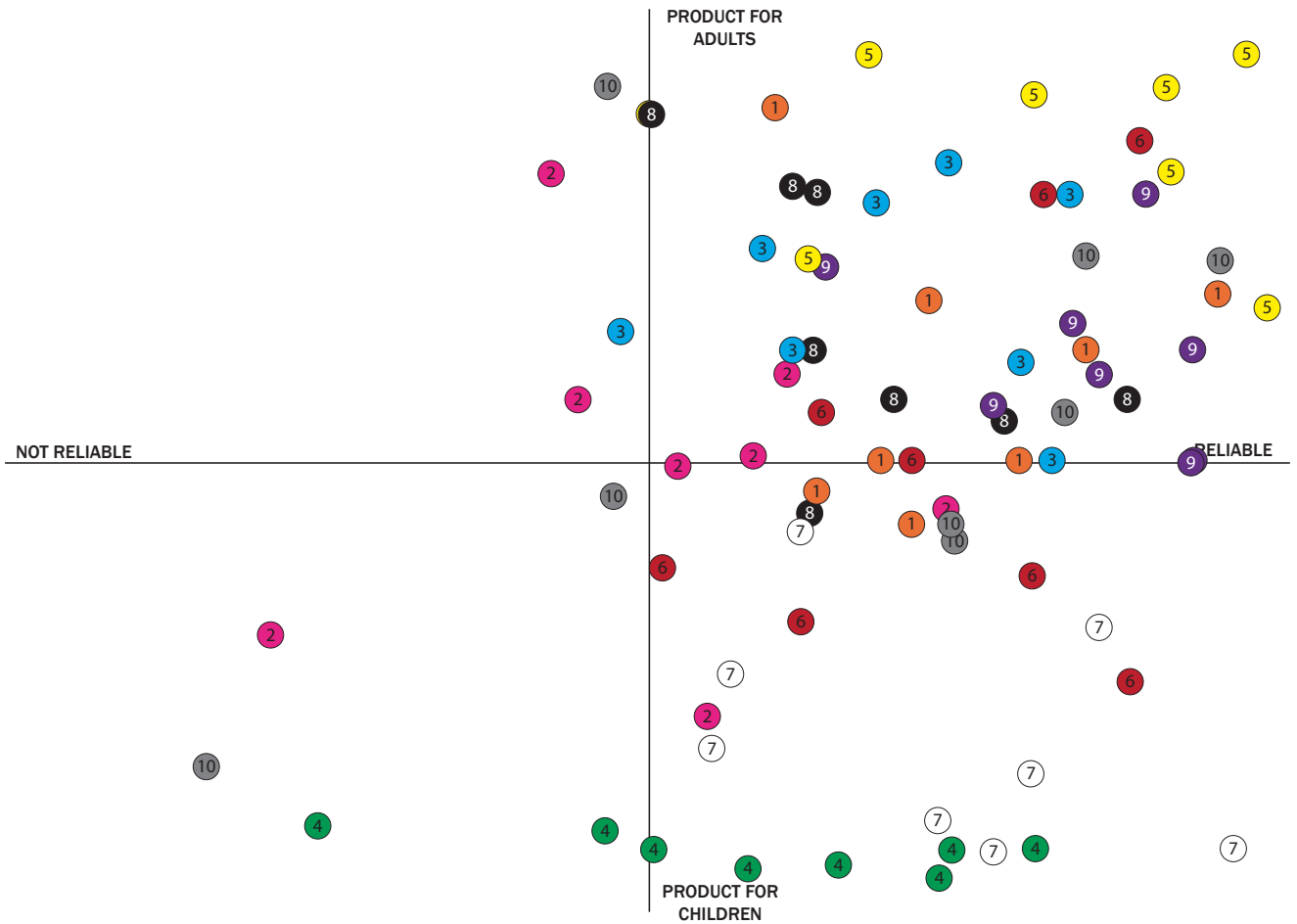
APPENDIX III: COMPETITORS

This chart describes the industrial partner's most relevant competitors, their attributes and some important advantages and disadvantages.

Product	Description	Producer	Nordic market	Sales channel	End price	Benefits	Disadvantages	Comments
Swimpy UV-wristband	Measures accumulated UV dose and indicates when to re-apply sunscreen and avoid sun	Sun Sense	Yes	Through Claes Ohlsson and through websites such as Sun Sense	Ca 11,50 SEK per wristband	Use with sunscreen, Indicates clearly that the process has started, Widespread, 100% recyclable	Works only with SPF 15 or higher, Not appropriate for other skin types than 1, Technology hasn't been updated in 12 years due to complicated ownership structure, Indicates too late	Wristbands made for skin types 2 & 3 and for skin types 4 & 5 under development
UV-Watch	Measures UV intensity and thereby the sun strength	Browin Promotions and Shenzhen Ever King Photoelectronics	Yes	B2B as give away items, e.g. through Parnass	Ca 10.00 SEK per watch (300 minimum order size)		Indicates sun strength and not accumulated exposure	Similar products available as jewelry, cards etc.
Solar Safe Wristband	Measures accumulated UV exposure and indicates when to re-apply sunscreen and avoid sun	PHB Healthcare	No	Website	Ca 5,50 SEK per wristband + shipping		Affected by heat, Unclear color change, Doesn't account for sunscreen, Unclear which skin type adjusted for	
SunCheck Patches	Patch which measures accumulated UV exposure and indicates when to avoid sun	Sun Check Monitors but the company has ceased	No	Website	Ca 4,80 SEK per patch + shipping	Adjustable for normal, sensitive and super sensitive skin	Adjusted to be use with sunscreen but unclear which SPF	
SunSignals Films	Patch which measures accumulated UV exposure and indicates when to re-apply sunscreen	Sun Signals	No	Website	Ca 2,00 SEK per film + shipping	Child-friendly	Several patches needed per day, Doesn't tell when to avoid sun	
Precision UV meter	Electronic device which measures UV intensity and estimates when it is time to avoid sun	Oregon	Yes	Claes Ohlson + website	299 SEK	Use with sunscreen, Adaptable for skin types	Does not measure accumulated UV	Many similar devices available
Min soldid	App which recommends exposure time based on UV-index, time of the day and skin type	Strålsäkerhetsmyndigheten	Yes	Website	Free	Helps calculating estimated solar time, gives sun advice and facts about the particular sun and vitamin D, UV radiation and UV index	Doesn't calculate actual exposure	Similar App available from ACO

APPENDIX IV: SUN CARE PRODUCT GRADING

This chart is the quantitative result from the user test in which ten industrial design engineering students rated the child friendliness and reliability of nine common sun care product packages and the reference product's package. The different numbers in the chart represent different packages.



- ① Apoteket sollotion
- ② Reference product
- ③ Nivea standard
- ④ Bamsesolkräm
- ⑤ Clinderm
- ⑥ Vichy
- ⑦ ACO Kids
- ⑧ Nivea modern
- ⑨ Eucerin
- ⑩ ACO Sunlotion

APPENDIX V: PRODUCT SPECIFICATION

The product specification was developed as a guideline for how to develop products accommodated to the research insights made during the project. It was used as guideline for the development of Solplåster but measurements for demands were not specified why it should not be used as a validating tool. Some information is furthermore disclosed upon request from the industrial partner.

Group	Demand	Type	Explanation	Validation
1. CORE VALUES				
1.1	Reliable	Guideline	Reliable technique, functionality, durability, precision and use	User test
1.2	Logical	Guideline	Clear, simple, easy to use, easy to understand, guessable and effective	User test
1.3	Smart	Guideline	Exiting, interesting, problem solving, astonishing and accustomed for use	User test
1.4	Child friendly	Guideline	Desirable for kids, safe, clear target group, thoughtful, protective and fun to use	User test
1.5	Encouraging	Guideline	Positive, not limiting, enhancing, helpful, kind and educating	User test
2. TARGET GROUP				
2.1	Target light skinned children	Guideline	Light skinned children between 2 and 12 years old is the primary target group	2.1.1 - 2.1.4
2.1.1	Acceptable	Demand	Children will not be in charge of whether they will use it but must not refuse to use it. They should preferably also want it.	User test
2.1.2	Adapted to body size	Demand	The device should be adapted to the anthropometrics of children between 2 and 12 years old	Comparison with anthropometrics
2.1.3	Account for skintypes 1-4	Demand	Alternatives for skintype 1-4 should be available since they risk to get sunburned and children with these skintypes are frequently protected actively by parents. Skintype 1-2 are more protected and get sun burned easier.	Y/N
2.1.4	Gender independent	Demand	Should not To aim for both girls and boys	User test
2.2	Target the parents of the children	Guideline	Parents are the secondary users who are in charge of purchasing it and will monitor usage. In order to reach a large group of customers, the product should work both for those who protect their children zealously, and those with a more casual attitude.	-
3. AIM OF USE				
3.1	Decrease risk for sun burns and skin cancer	Guideline	Overall aim of the project	3.1.1 - 3.1.2
3.1.1	Simplify monitoring of children in the sun	Demand	By providing information of when the maximum UV radiation level is reached	Y/N
3.1.2	Encourage sound sun habits	Guideline	By enhancing awareness of the sun's effects on human skin	User test
3.2	Decrease parents' worry	Guideline	By giving comfort	User test
4. EXPERIENCE OF USE				
4.1	Should elicit positive experiences	Guideline	Through emotional, meaningful and aesthetic experiences	User test
5. INK TECHNOLOGY				
5.1	Utilize smartsun's ink technology	Demand	Delimitation of the project	Y/N
5.2	Not require extensive refinement of the ink	Demand	Some ink refinement will however be need if materials and manufacturing techniques differ from the reference product	Expert review
6. SAFENESS				
6.1	Safe for children	Demand		6.1.1 - 6.1.5
6.1.1	No toxic substances	Demand		Y/N
6.1.2	Not harmful for sensitive skin	Demand		Allergy test
6.1.3	Safe to have in mouth	Demand		Expert review
6.1.4	Not have sharp edges	Demand	Minimum radii	Y/N

6.1.5	Not contain small pieces	Demand	Minimum size	Y/N
7. DURABILITY				
7.1	Should be able to withstand use and play	Demand	Should withstand activities that the children probably will perform during use	7.1.1 - 7.1.3
7.1.1	Tough	Demand		Material choice
7.1.2	Water resistant	Demand	Fresh water and salt water	16.4
7.1.3	Chlorine resistant	Demand	Pool water	16.5
7.2	Manage high temperatures	Demand	Should not melt, etc.	16.3
7.3	Manage direct sun light	Demand	Should not get bleached (fade), etc.	Material choice
7.4	Should withstand for 2 years	Guideline	The life span of the reference product	-
8. MARKET				
8.1	Aim for a Nordic market	Guideline		8.1.1-8.1.2
8.1.1	Nordic languages	Demand	Utilize one or several Nordic languages on package and product	Y/N
8.1.2	Sellable at Swedish drug stores	Demand	Should fulfill requirements stated in Oriolas product template since it will be sold at Swedish drug stores	Oriola template
8.2	Sellable at grocery stores, hotels etc.	Guideline	May also be sold at other venues	-
9. USABILITY				
9.1	Easy to use	Guideline	A decisive quality according to interviewed parents	User test
9.2	High guessability	Guideline	Few intended users are familiar with the product or the product type	User test
9.3	High experienced user performance	Guideline	In order to be accustomed for expert users	User test
9.4	Easy to understand how to use it	Guideline	the package should provide all the information needed (see packaging information)	User test
9.5	Easy to see/notify color changes	Guideline	Key aspect, often in direct sunlight	User test
9.6	Easy to understand color changes	Guideline	To know what to do when color change is perceived	User test
9.7	Not require extensive forces	Guideline	Maximum force needed to use the device should be feasible for all intended users	User test
9.8	Not require high dexterity	Guideline	Should not require extreme dexterity, ie. not too small functional areas	User test
9.9	Easily bought	Guideline	Should be easy to decide which subproduct to buy, if many subproducts	User test
9.10	Easy to know if the product fits your child	Guideline	Should be able to choose correct product when buying	User test
10. REALIZABILITY				
10.1	Maximum final price to the customer 14 SEK per product	Demand	Identified as limit in the company's market studies	Y/N
10.2	Feasible within two years	Guideline	Not require ink development, not require many new suppliers etc.	Expert review
10.3	Maximum production cost, XX kr	Demand		Y/N
10.4	Maximum investment cost, XX kr	Demand		Y/N
10.5	Minimum market potential XX people	Demand		Y/N
11. EXPRESSION				
11.1	Match with expression board	Guideline	Expression board is developed to match key values	Expert review
11.2	High observability	Guideline	Attract attention in retail and use environment	Expert review
11.3	Target group aimed for should be obvious (children)	Guideline	To simplify for customers	User test

11.4	Fit with the company's brand	Guideline	Will be a part of a product family	Expert review
12. STORING AND TRANSPORT				
12.1	Should be storable in a bathroom cabinet	Demand	Maximum size: XXdm3	Y/N
12.2	Transportable in a beach bag	Demand	Maximum size: XXdm3	Y/N
12.3	Should not be exposed to direct sunlight	Demand	During storage and transport	Y/N
12.4	Should not be damaged during transportation	Demand		Test
12.5	Should fit in hand luggage	Demand	Maximum size: XXdm3	Y/N
13. LABELING				
13.1	ISO 1401	Demand	Environmental management standard	Y/N
13.2	Possess a recommendation labeling	Guideline		Y/N
13.3	Recycling Label	Guideline		Y/N
13.4	Allergy Labelling	Guideline		Y/N
14. USE CONTEXT				
14.1	Primarily aim for sunny vacation holidays abroad	Guideline	Implies pool, pool area, beach, excursions	-
14.2	Should also be usable in Sweden	Guideline		-
14.3	Should be useable along with standard safety practices	Demand	Primarily use of sunscreen, t-shirts, UV clothing, special caps, hats and sunglasses as well as to avoid the sun during midday or being in the shadow.	Expert review
15. ECOLOGY				
15.1	Recycleable	Guideline		Y/N
15.2	Ecological footprint	Guideline	Smaller ecological footprint compared to reference product	Expert review
16. MATERIAL				
16.1	Printable	Demand	Should be possible to print the polymer ink	Printability test
16.1.1	Alcohol resistant	Demand	The ink is alcohol based	Y/N
16.1.2	High surface tension	Demand	Must be higher than the ink's surface tension	Y/N
16.1.3	Porous	Demand	Good for printability, minimum porosity XX%	Y/N
16.2	Sunscreen compatible	Demand	Should be possible to apply sunscreen	Y/N
16.3	Heat resistant	Demand	Should be used in strong sunlight (80C)	Y/N
16.4	Water resistant	Demand	Salt and sweet water	Y/N
16.5	Chlorine resistant	Demand	Poolwater	Y/N
17. PACKAGING				
17.1	Noticeable	Guideline	Stand out in retail environment	User test
17.2	In line with current product portfolio	Guideline	Will be part of a product family	Expert review
17.3	In line with core values	Guideline	See demand 1.1 - 1.5	1.1 - 1.5
17.4	Easy to travel with	Guideline	See demand 12.1 - 12.5	12.1 - 12.5
17.5	Easy to handle	Guideline	See demand 9.1 - 9.10	9.1 - 9.10
17.6	Protect product against sun	Demand		Y/N
17.7	Inexpensive to manufacture	Demand	See demand 10.3	10.3
17.9	Could be placed in pharmacies racks	Demand	See demand 8.2, implies that it should be hangable or standable	8.2
17.10	Easily identified as sun care product	Guideline		User test

17.11	Easy to identify as children's product	Guideline		User test
17.12	Based on paper material	Demand	Current package material	Y/N
17.13	Manufactured through printing, die cutting, folding and glueing	Demand	Current manufacturing techniques	Y/N
18. PACKAGING INFORMATION				
18.1	Product name	Demand		Y/N
18.2	Company logotype	Demand	Preferably at a high position on front cover	Y/N
18.3	Tagline	Guideline	För säkrare solning or similar	Y/N
18.4	Product type	Guideline	UV-indicator	Y/N
18.5	Aim of using product	Demand	Monitor Uv-exposure	Y/N
18.6	How to use product	Demand	Step-by-step	Y/N
18.7	What reference points imply	Demand	What users are supposed to do when reference points are reached	Y/N
18.8	Can be used in water (pool and sea)	Demand		Y/N
18.9	Can be used with sunscreen	Demand		Y/N
18.1	Use for a day and do not reuse	Demand		Y/N
18.11	Where it will be located	Demand		Y/N
18.12	Apply to dry and clean skin	Demand		Y/N
18.13	How the product works	Guideline	Utilises a patented ink technology that changes color due to UV radiation	Y/N
18.14	What it account for	Guideline	Skin type, sun strength, not natural protection	Y/N
18.5	Skin type meant for	Demand	sensitive skin or "normal skin", or preferably more specific	Y/N
18.6	Recommendation from barn-cancerfonden	Guideline	If feasible	Y/N
18.7	Barcode	Demand		Y/N
18.8	Number of devices in the package	Demand		Y/N
18.9	Target group	Guideline	Children with ligh skin (2-12 years old)	Y/N
18.2	Harmless	Guideline	For children	Y/N
18.21	Manufacturer	Demand		Y/N
18.22	Recycling Symbol	Demand		Y/N
18.23	Allergy Symbol	Guideline		Y/N

APPENDIX VI: MORPHOLOGICAL MATRIX

The aim of the morphological matrix was to identify new possible concepts by identifying core functionalities, of the seven concepts during the ideation phase, and rearranging them. This chart visualizes sub-functionalities among the concepts. Choices made are visualized through coloring. Green means yes, yellow maybe, red no and blue that further investigation is needed.

<i>Basis</i>				
What to indicate		D-vitamine level	Maximum UV dose	Sun strength/SPF
	<i>Positive</i>	Technically easy to implement	Crucial info for avoiding sun	To choose SPF is a major issue
	<i>Negative</i>	Users not very interested	Too strict for the use situation	Require a different ink
How to indicate		Color change	Pattern	Tactile
	<i>Positive</i>	No ink development, cheap and easy	Easier to recognize	clearer indication, easier in the sun
	<i>Negative</i>	Hard to detect in sun light	Might require advanced printing	Need development, not visible by
How to use the product		Flexible	Specific	
	<i>Positive</i>	Big target group	Adapted for the exact use, higher	
	<i>Negative</i>	Less clear how to use it, not as good	Smaller target group	
Use situation		Abroad	Sweden	Day care
	<i>Positive</i>	Big awareness, easier to create more	Many children get sunburned	Many children get sunburned here,
	<i>Negative</i>	limited target group	Small awareness, happens too	Not clear who will pay, many
Personal or group measure		Personal	Family	
	<i>Positive</i>	Exact measuring	Easier for parents to monitor	
	<i>Negative</i>	More products needed	Not individual measuring	
Duration of use		Disposable	Vacation	Long-time use
	<i>Positive</i>	The ink is disposable, the easiest, most	Feeling of quality, attachment,	Feeling of quality, attachment,
	<i>Negative</i>	People dislike disposable products in	More complex, more robust	Refill needed, more robust product
Communication		Inform	Guide	Urge
	<i>Positive</i>	Doesn't intrude with personal attitudes,	Doesn't intrude too much with	Good for uncertain parents
	<i>Negative</i>	Might not have an impact, require	Might not have enough impact	Some might feel controlled
<i>Product type</i>				
Integrate or not		Stand-alone product	Pure ink	Integrated in other products
	<i>Positive</i>	Can probably use current ink-	Enable a big solution space,	Can easier become natural part of
	<i>Negative</i>	A new product has to be accepted by	Require vast ink development	Require ink development and an
Attachment		Around the body	On the body	On clothes
	<i>Positive</i>	Close to the skin without interrupting	Close to the skin	Close to the skin without
	<i>Negative</i>	Difficult to achieve a flexible solution	Might leave a mark, might be	Require that the user uses clothes,
Placement		Face/nose	Arm	Neck
	<i>Positive</i>	Spot that easily burn	Natural placement, visible	Spot that easily burn
	<i>Negative</i>	Not visible for primary user	Not easily burned	Not visible for primary user
Product type		Band-Aid	Pen	Bracelet
	<i>Positive</i>	Fun to use, flexible, natural, easy to	Unique	Existing product
	<i>Negative</i>	Attach to skin	Require ink development	Unflexible
Removal of product		Manual	Wash off	Disappear by itself
	<i>Positive</i>	Normal	Might be difficult,	Easy to use
	<i>Negative</i>			Environmentally confusing
Product family		Size	Skin type	One for all
	<i>Positive</i>	Fit for all ages	Fit for all skin types	One good product
	<i>Negative</i>	Many products to produce, choose	Many products to produce,	Might not fit for the user
Packaging		Hard	Soft	Small
	<i>Positive</i>	Manages harsh handling		
	<i>Negative</i>		Does not manages harsh	Not visible
Information on packaging		About the sun	About the technique	About use
	<i>Positive</i>	Needed in order to improve sun habits,	Needed in order to trust the result	Needed in order to use the product
	<i>Negative</i>	Might be too much information	Might be too much information	Might be too much information
<i>Assorted</i>				
Appearance		Discret	Sensational	Childish
	<i>Positive</i>	Not interfering with environment	Innovative, new and therefore	Fun, clear target group
	<i>Negative</i>	Not visible	Not efficient, trustworthy	Not trustworthy
Who should discover indication?		Children	Parents	Both
	<i>Positive</i>	Involved in use and therefore	The parents can monitor the	Flexible
	<i>Negative</i>	Children have to be trusted and are of	Parents can't relax, children not	Require information that both
Number of steps in the measurement		One	A few	Complete scale
	<i>Positive</i>	Simple, Clear	Indications along the way	Indications along the way
	<i>Negative</i>	Doesn't give any indications along the	Require ink development and	Require probably ink development
Natural part of sun bathing		Attach to sun screen products	Gamification	Educational
	<i>Positive</i>	Sunscreen is almost always used in	Fun and a bigger service than	A bigger meaning, engaging
	<i>Negative</i>	Doesn't stand out as much	Might be complex, unpractical	Might be complex, unpractical
Sale point		Pharmacy	Online	Supermarket
	<i>Positive</i>	Trustworthy, many buy sunscreen here	Flexible, doesnt require	Many sale points, many buy
	<i>Negative</i>	Difficult to get in, pharmacies take big	Not trustworthy	Not trustworthy

How much sunscreen is left	Time estimation (of when to				
A major worry among parents	Parents want to plan their day				
Difficult/impossible to implement	Dependent on how the user act in				
Text message	Figurine	Numerical	Gradual "Movement"	Reference Point	Disappearing figure
Fun, flexible, cool, educational, Language barriers, hard to	Fun for kids, flexible Might be hard to see, unreliable	Follow the whole process, Requires development of	Easy to keep time and Require several printing	How it's done on the Might be confusing	More visible, more not as trustworthy, sun
Vacation	Boat	Sports	Events		
Big awareness, much time in the Few times a year	Premium segment, used to aids Very small target group, trendy	Difficult to avoid the sun Difficult to avoid the sun	Easy to integrate with Few children		
Force					
Will avoid sunburn Hard to implement, negative UX					
On other products					
Can be natural part of sun habits Require ink development, complex					
On other products	Stand alone				
Close to the skin without Difficult to achieve a flexible	New prudct, noticeable Not close to skin -> inaccurate				
Hand	Back	Flexible			
Natural placement, visible Not easily burned	Spot that easily burn Not visible for primary user	Enables customization Require decisions,			
Tape	Tattoo				
Flexible Attach to skin, difficult to package	Fun to use Attatch to skin, not reliable				
Different target groups	Collector items				
Fit for different target groups Many products to produce, choose	Fun, might trigger children to want Many products to produce, choose				
Integrated	All in one	No package			
Easier become natural part of sun Doesn't stand out as much		Fett			
Medical	High tech	Cheap			
Trustworthy Boring	Seen as cool, innovative, smart and Might look difficult to understand	Trigger people to buy it Not trustworthy			
From a distance					
Parents can monitor from a Might require big and unefficient					
Package with sunscreen etc.	After use value				
Sunscreen is almost always used in require partnership with sunscreen	Might trigger children to want it Might be complex, unpractical				
Close to use					
Where people realise the need Unpractical, who should					

APPENDIX VII: WEIGHTED MATRIX

The weighted matrix was a part of the theoretical evaluation of the seven concepts during the ideation phase. The concepts were evaluated upon fulfillment of identified key demands in the product specification. The selection of key demands was based on what was thought to be essential for realizability, market potential and ecological sustainability as well as for to facilitate for desired user experiences. Demands were furthermore weighted upon perceived importance by the project group.

Evaluation	Weight	Sun tatt	Sun patch	UV tape	Sun pen	Cheap shot	Sun watch	Family clip	Sum
Reliable		15	24	24	15	28	28	26	
Accurate (technically)	2	3	3	3	3	2	2	1	17
Trustworthy	3	1	2	2	1	3	3	2	14
Safe for children (experience)	3	1	2	2	1	3	3	3	15
Durable (experience)	3	1	2	2	1	2	2	3	13
Logical		9	18	6	15	18	6	12	
Easy to understand (how to use, simple)	3	2	3	1	3	3	1	2	15
Easy to use	3	1	3	1	2	3	1	2	13
Smart		7	6	4	9	3	7	5	
Innovative	1	1	2	2	3	1	3	3	15
Exciting	2	3	2	1	3	1	2	1	13
Child friendly		12	7	5	8	8	12	4	
Desirable for kids	2	3	2	1	2	2	3	1	14
Fun to use	1	3	1	1	2	2	3	1	13
Child involvement	1	3	2	2	2	2	3	1	15
Encouraging		5	3	4	4	3	5	2	
Positive	1	3	1	1	2	1	2	1	11
Educating	1	2	2	3	2	2	3	1	15
Market		12	17	18	15	13	14	16	
Size of target group (the more the better)	2	1	3	3	2	2	1	1	13
Number of variations needed (less is good)	3	1	2	3	2	2	1	2	13
Obvious target group (children)	1	3	1	1	1	1	3	2	12
Possible end price	2	2	2	1	2	1	3	3	14
Realizability		11	16	14	11	19	12	12	
Time to market (not require refinement of ink etc.)	3	1	2	2	1	3	2	2	13
Low manufacturing cost	2	2	3	2	2	3	1	1	14
Ecology		2	2	2	3	1	3	2	
Ecological footprint	1	2	2	2	3	1	3	2	15
Unweighted sum		39	42	36	40	40	45	35	277
Weighted sum		73	89	75	79	87	87	79	544

APPENDIX VIII: CONCEPT SWOT

The SWOT-chart was a part of the theoretical evaluation of the seven concepts in the ideation phase. It is meant to create deeper understanding of the concepts through identifying their strengths, weaknesses, obstacles and threats.

Cheap Shot	UV Tape	Sun Tatt	Sun Patch	Family Clip	Sun Watch	Sun Pen
STRENGTHS / OPPORTUNITIES						
Resemblance to event bracelet	Can be placed on other things	Easy to remember when reapplying sunscreen	Packaging integrated with sunscreen	Lasts a complete vacation without recharge	Educational and easy to understand	No white mark
Adjustable size	Adjustable size	Child Friendly	Easier to remember	Can be taken of and on	Higher value	No removal?
Small development costs	All skintypes/family members	Understandable / easy to use	Easier to see differences with gradient	Can be taken of and on	Can be taken on and off	Can write name or draw figure
High trialbility	All parts of the body	No removing needed	All parts of the body	One indicator for everyone	Nametag makes it more personal	Can be used all over the body
Cheap to sample	High observability	All parts of the body	Create kit with sunscreen brand	Environmental friendly	Environmental friendly	Long lasting
Could be used by more than children		Easy to understand		Can be put on more than one thing	Could be branded by companies	easy when re-applying sunscreen
		Create temporary collaborations		Freebie marketing		Easy to understand Unique High observability Gender and age neutral
WEAKNESSES / THREATS						
Can be dropped and lost	Traces of glue	Figurine disappears	Put directly on the skin	Not as exact measuring	Refilling everyday	Put directly on skin
Non-environmentally friendly	Hurts when taken off	Not suitable for older kids and parents	Demands development of the ink	Easier to forget reapplying sunscreen	Have to buy and keep track of refills	Development of the ink
Different bracelets for different skin types	Might leave white marks	Low trust / could be seen as non-serious	Limits the target group to smaller kids	More costly?	More costly?	Removal with soap?
White marks	Higher cost with different layers	Water resistant?	Traces of glue	Keep track of a device	Keep track of a device	Implementation time
Competition within product portfolio	Determine size	Existing competitors	Might leave white marks	Low tech compared to digital UV indicators	Limited to the arm wrist	High perceived risk
Only placed at wrist		Low observability				Harder to get accepted
Not unique						

APPENDIX IX: PATCH MATERIALS

This appendix lists important properties of the five materials that were selected for testing during the concept development phase.

Material one: White Polyurethane (9907HT W)

Type:	White elastic nonwoven tape
Backing:	Polyurethane fibers
Thickness:	0,28 mm
Adhesive:	Hyperallergenic pressure sensitive Acrylic Medical Grade adhesive/tape
Liner:	60# buff kraft paper, two sided silicone (0,11 mm)
Water properties:	Water resistant
Breathable:	Yes – MVTR 500gr/m2/24hours
Color:	White
Surface structure:	A bit rough and fatty
Surface tension:	
Adhesion:	12,2N/25 mm width
Price:	MOQ 321m2 . Price per m2 at MOQ level: 99,50 SEK excl. VAT
Printability:	Good (3/3) Some smearing
Adhesion in water:	Good (3/3)
Experience in water:	Ok (2/3)
Comments:	Waterresistant. Gets a little wet but dries up. Stays clean. Seems appropriate for the application.

Material two: Polyester nonwoven (1776)

Type:	White spunlace polyester nonwoven
Backing:	Polyester
Thickness:	0,30 mm
Adhesive:	Hyperallergenic pressure sensitive Acrylic Medical Grade adhesive/tape
Liner:	83# Poly-coated kraft paper, silicone on one side (0,15 mm)
Water properties:	Water resistant
Breathable:	Yes. MVTR 1300gr/m2/24hours
Color:	White
Surface structure:	Very rough textile
Surface tension:	
Adhesion:	6,9N/25 mm
Price:	MOQ 321m2. Price at MOQ level 40,50SEK/m2 excl. VAT
Printability:	Bad (1/3) The ink dries out
Adhesion in water:	Ok (2/3)
Experience in water:	Bad (1/3)
Comments:	Became very wet, scruffy and dirty. Thick. Looks like a disgusting old patch. Not preferable. Probably difficult to print details on.

Material three: Rayon nonwoven (1529)

Type:	White printable nonwoven rayon tape
Backing:	Rayon
Thickness:	0,14mm
Adhesive:	Hyperallergenic pressure sensitive Acrylic Medical Grade adhesive/tape
Liner:	83# Poly-coated kraft paper, silicone on one side (0,15 mm)
Water properties:	Water resistant
Breathable:	YES. MVTR 4200Gr/m2/24hours
Color:	Vanilla
Surface structure:	Like paper
Surface tension:	
Adhesion:	4,7N/25 mm
Price:	OQ 321m2. Price at MOQ level 41,90SEK/m2 excl. VAT
Printability:	Good (3/3) Some smearing
Adhesion in water:	Ok (2/3)
Experience in water:	Ok (2/3)
Comments:	Became a little translucent and wet in the water. Feels like construction tape (paper tape) and thus not as a quality plaster.

Material four: Polyurethane transparent (9834)

Type:	Translucent polyurethane film with carrier.
Backing:	Polyurethane
Thickness:	0,05mm
Adhesive:	Hyperallergenic pressure sensitive Acrylic Medical Grade adhesive/tape
Tape and carrier:	Tape caliper (polyurethane tape 0,05mm) + carrier (white poly-coated paper, silicone on one side 0,12mm)
Water properties:	Waterproof
Breathable:	Yes. MVTR 600gr/m2/24hours
Color:	Transparent
Surface structure:	Smooth plastic
Surface tension:	
Adhesion:	15oz/inch
Price:	MOQ 321m2. Price at MOQ level 48,50SEK/m2 excl. VAT
Printability:	Unknown (Due to mistake during printability test)
Adhesion in water:	Good (3/3)
Experience in water:	Bad (1/3)
Comments:	Shrinks and becomes wrinkled. The skin looks red and damaged through it. Probably difficult to print on. Difficult to handle due to carrier and caliper.

Material five: Polyethylen (1525L)

Type:	Translucent polyethylene film
Backing:	Polyethylene
Thickness:	0,11mm
Adhesive:	Hyperallergenic pressure sensitive Acrylic Medical Grade adhesive/tape
Liner:	63# Poly-coated kraft paper, silicone on one side (0,12mm)
Water properties:	Water proof
Breathable:	No
Color:	Transparent
Surface structure:	Smooth
Surface tension:	
Adhesion:	5,0N/25 mm width
Price:	MOQ 321m2. Price at MOQ level 39,10SEK/m2 excl. VAT
Printability:	Ok (2/3) A lot of smearing
Adhesion in water:	Ok (2/3)
Experience in water:	Ok (2/3)
Comments:	Small air bubbles appeared. Does not really look like it fitted with the usage but feels most water resistant. Probably difficult to print on.

APPENDIX X: FINAL EVALUATION

As a final evaluation 12 parents, with children within the targeted age span, tested and discussed the final concept. Half of these tried the final concept first and then had the chance to compare it to the reference product, while the other six did the opposite. The test staged an imagined user scenario (described in the final concept chapter) and featured both the purchase situation as well as usage. They were first exposed to the front cover of the package, then the back cover and finally were allowed to open the package and interact with the product. This appendix visualizes the questions posed in the associated questionnaire and the quantitative part of the results.

1. Background info

- a Name and age
- b No. of kids and their ages

2. Front cover

- a What does the package contain? (+ certainty)
- b Who is it for? (+ certainty)
- c How interested are you of the product? (1-5)

3. Back cover

- a What does the package contain? (+ certainty)
- b Who is it for? (+ certainty)
- c How interested are you of the product? (1-5)
- d If your interest changed when scamming the back cover, why?
- e Does the package evoke questions that are not answered?
- f If the package costs 100kr, how big is the probability that you will buy it? (1-5)
- g Comments

4. Use

- a To whom should the precut be attached? (+ certainty)
- b When should use be initiated and for how long should the product be used? (+ certainty)
- c What do you do if you use sunscreen along with the product? (+ certainty)
- d How does the product indicate that you are supposed to avoid sun? (+ certainty)
- e How difficult was it to attach the product? (1-5)
- f Comments

5. Core values

- a How well did your experience of the product match the following core values? (1-5)
 - 1 Reliable
 - 2 Child friendly
 - 3 Logic
 - 4 Smart
 - 5 Encouraging
- b Did the product elicit any of the following emotions? (1-5)
 - 1 Annoyance
 - 2 Surprise
 - 3 Reluctance
 - 4 Joy
 - 5 Fear
 - 6 Interest
 - 7 Liking
 - 8 Rumination

6. Comparison

- a What difference do you see between the products?
- b Which would you prefer?

QUANTITATIVE RESULTS	Solplåster	Solarmband	Difference
FRONT COVER			
Certainty of what the product contains (1-3)	3	3	0
Certainty of target group (1-3)	3	3	0
Interest (1-5)	3	4	-1
Product function much clearer for solplåster than for the wristband Target group is crystal clear for Solplåster and very unclear for the wristband The wristband's packing is more startling and raises more interest			
BACK COVER			
Certainty of what the product contains (1-3)	3	3	0
Certainty of target group (1-3)	3	3	0
Interest (1-5)	4	4	0
Probability of buying the product (1-5)	2	4	-2
Cumulative dosage clears for solplåster users and understanding of the functionality is very high Exact functioning is still very unclear for wristband users Target group still undersstood for Solplåster but not for the wristband Most people think that the wristband will last for seven days, which makes it feel easier to use and more as a quality product Generally, people think it's too expensive, especially the patch			
USE			
Certainty of where to attach product (1-3)	3	3	0
Certainty of duration of use (1-3)	3	3	0
Certainty of how to use sunscreen (1-3)	3	2	-1
Certainty of how it will indicate (1-3)	3	3	0
Perceived Difficulty to attach (1-5)	1	3	-1
Duration of use crystal clear for Solplåster and very unclear for the wristband Solplåster users understand that they should apply sunscreen on the patch. Wristband users are still unaware of the wristband's functionality Much easier to attach Solplåster			
CORE VALUES			
Reliable (1-5)	3	3	0
Child Friendly (1-5)	4	4	0
Logic (1-5)	4	3	1
Smart (1-5)	5	4	1
Encouraging (1-5)	4	4	0
Both products fulfill the core valuse in a good manner			
EMOTIONS			
Annoyance (1-5)	1	1	0
Joy (1-5)	1,5	3,5	-2
Liking (1-5)	3,5	4	-0,5
Surprise (1-5)	3	3	0
Fear (1-5)	1	1	0
Rumination (1-5)	3	2	1
Reluctance (1-5)	1	1	0
Interest (1-5)	4	4,5	-0,5
The wristband elicited more joy and less rumination			
COMPARISON			
75% prefer Solplåster over the wristband Solplåster: smaller, more agile, flexible, child friendly, understandable and easier to integrate Wristband: It does not leave a mark and is safe for sensitive skin			

APPENDIX XI: SOLPLÅSTER DRAWINGS

Drawings of the three parts of the final concept Solplåster; package, envelope and patch. The concept is described in detail in the final concept chapter.

