PETAL TO THE METAL

'Designing multi functional lampshades for Kloosterman Verlichting'.

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Graduation Thesis MSc Integrated Product Design

Industrial Design Engineering | Delft University of Technology

TU Delft

Disclaimer

This thesis is written coherent to the master Integrated Product Design at the faculty of Industrial Design Engineering at the Delft University of Technology in The Netherlands.

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PREFACE

This graduation report marks the end of an 8 year journey at the industrial design engineering at the Delft University of Technology, with the final years finishing the master Integrated Product Design. The project has given me the freedom to design a luminaire from start to finish with the possibility of ending up in production at Kloosterman verlichting. This report guides you through the process of how I got to the final design proposal.

For me as a designer this was an amazing opportunity to showcase all that I have learned. The design freedom for me was both a gift as well as a struggle because the limits had to be personally defined. The absence of pressure often resulted in some delays. Even though there were some ups and downs I am glad this is how it ends.

Overall I think I can be happy with the end result in combination with the inspirational ideabook for future production (ADD TO Appendix) and I can be proud of the final result of this project. I hope others will enjoy my design as much as I do.

ACKNOWLEDGEMENTS

Graduation projects are known to be a one man job however this is a project which I could not have done without help and support from those around me. Therefore this thesis report will start off with thanking those who deserve to be thanked to there efforts.

Stephanie, my mentor, who has devoted time, effort and patience in guiding me through the entire process of the project. She had inspired me and at times brought me back to earth to send me on the right track to finish my project. Thank you for all the fun, and the good conversations. I have not only learned a lot, I have had a amazing time doing it.

Sylvia, my chair, who has dedicated time to sit with me, even though we saw each other few times I have valued the help and input greatly. I know I stormed into meetings with crazy idea and a lot of chaos, however you saw through the madness and focussed my thoughts

Rogier, my company, who has provided an amazing opportunity for me to create a fun design for my final graduation thesis. He supervised me and helped me in his own time. During the meetings he have me professional insights in material, design and production possibilities.

Edmee, my biggest fan, the person who always calls me amazing while she is the one that send me little cards during my project to get me motivated and let me know she will always be there by my side. You are amazing.

My parents and little sister, who have seen me grow up and raised me to become the person I am today. My family who devoted a lot of time to get me to where I am today. I could not have done this without them.

Elise, my sister, knight in shining armour and my tiny hero, the one person who has done more for me during this project then any other. You have sat with me through the struggles and frustration. You devoted time for me and have been a great help in getting all of my thoughts on paper. Thanks to you I was able to finally end the wonderful journey that has been my student years.

GLOSSARY AND ABBREVIATIONS

Bulb. A loose way of referring to a lamp. “Bulb” refers to the outer glass bulb containing the light source.

Colour Temperature. Describes the luminous colour of a light source. For thermal radiators the colour temperature is almost equivalent to the temperature of the filament. While discharge lamps, a correlated colour temperature is given.

Fixtures. Lighting fixture is part of a light that is attached to the wall or ceiling in which to insert the light bulb or other lighting element, and which cannot be easily removed

Fluorescent Lamp. Discharge lamp filled with mercury vapour. The ultraviolet radiation produced during the mercury discharge process is converted into visible light by the luminous substances on the inner wall of the discharge tube. (Ganslandt, 1992)

Halogen Lamp. Compact incandescent lamp with additional halides in the gas compound, which prevents deposits of the evaporated filament material forming on the outer envelope. In contrast to general service lamps, halogen lamps have increased luminous efficacy and a longer service life (Ganslandt, 1992)

Incandescent Lamp . Thermal radiator, where light is produced by the heating of a wire filament usually tungsten). The filament is contained in an outer envelope made of glass and filled with a special gas (nitrogen or inert gas) to prevent the filament from oxidizing and to slow down the vaporisation of the filament material. (Ganslandt, 1992)

Iterative design. A methodology based on a cyclic process of prototyping, testing, analysing, and refining a product or process. Based on the results of testing the most recent iteration of a design, changes are made

Light. Radiant energy that can be sensed or seen by the human eye. Visible light is measured in lumens.

Light-Emitting Diode (LED) A solid that directly converts electrical impulses into light. Some LEDs today incorporate fluorescent materials to change the colour characteristics of the emitted light.

Luminaires. The correct term for what is generally called a light fitting or light fixture. Strictly speaking, a luminaire is the apparatus containing the light source.

KV, Kloosterman Verlichting. The name of the Amsterdam based company which is the client and producer of this graduation project

SWOT. This analysis is a simple but useful framework for analyzing your organization’s strengths and weaknesses, and the opportunities and threats. It helps to focus the strengths, minimize threats, and find the greatest possible advantage of opportunities available.

USP. A unique selling proposition (aka unique selling point) is a factor that differentiates a product from it’s competitors.

READERS GUIDE

This readers guides has been created to understand the structure of this report and the meaning of some of the symbols and sections. The process is visualised in a overview (on the right) to aid in the understanding of the design process. The overview contains the main phases of the project including the inputs, outputs and deliverables.

DESIGN IMPLICATIONS

The iterative design process is subverted into several components, to grasp the meaning of each different phase and the purpose of it's content each section is introduced with a description and concluded with statements of the relevance of the content. This provides a generic guide throughout the proceedings of the assignment. These resulting 'design implications' are implemented into the list of requirements and the succeeding steps in the project.

CONCLUSIONS

These enlist the most important conclusion of the process, in the end this will form the main conclusion of the entire project and will aid in the future recommendations and discussion points.

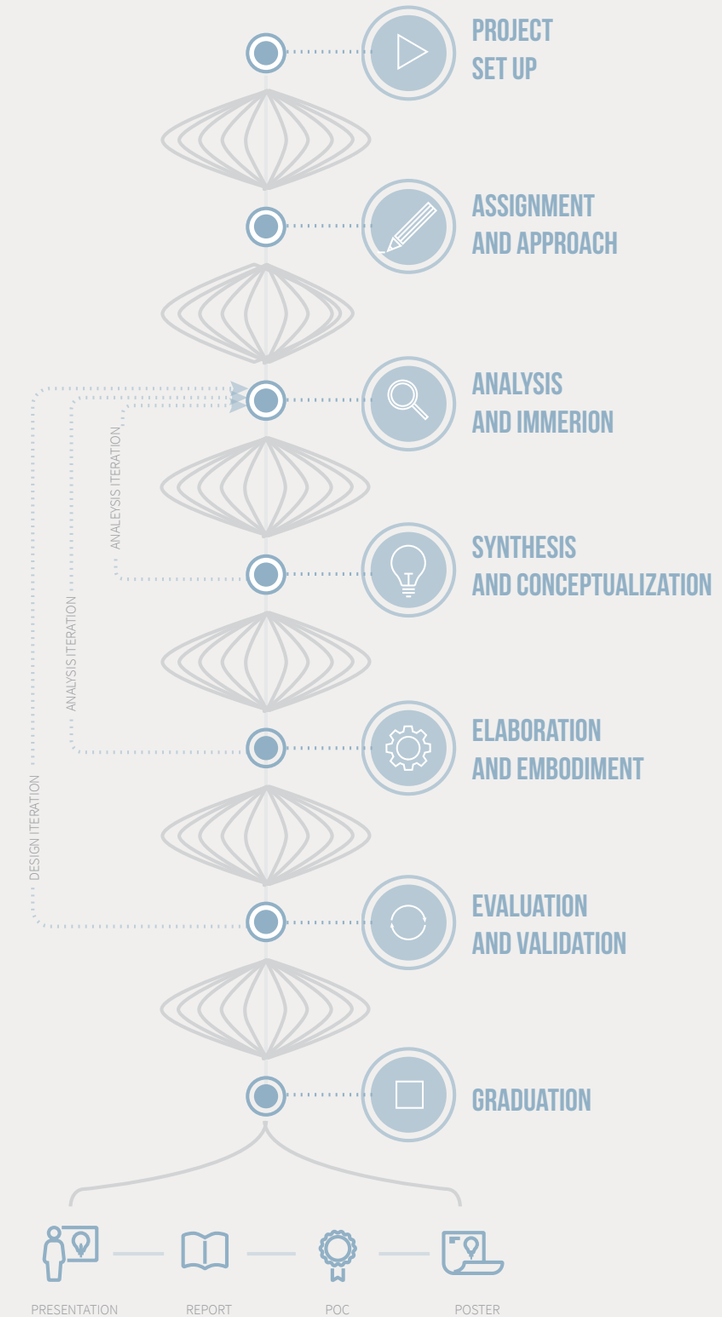
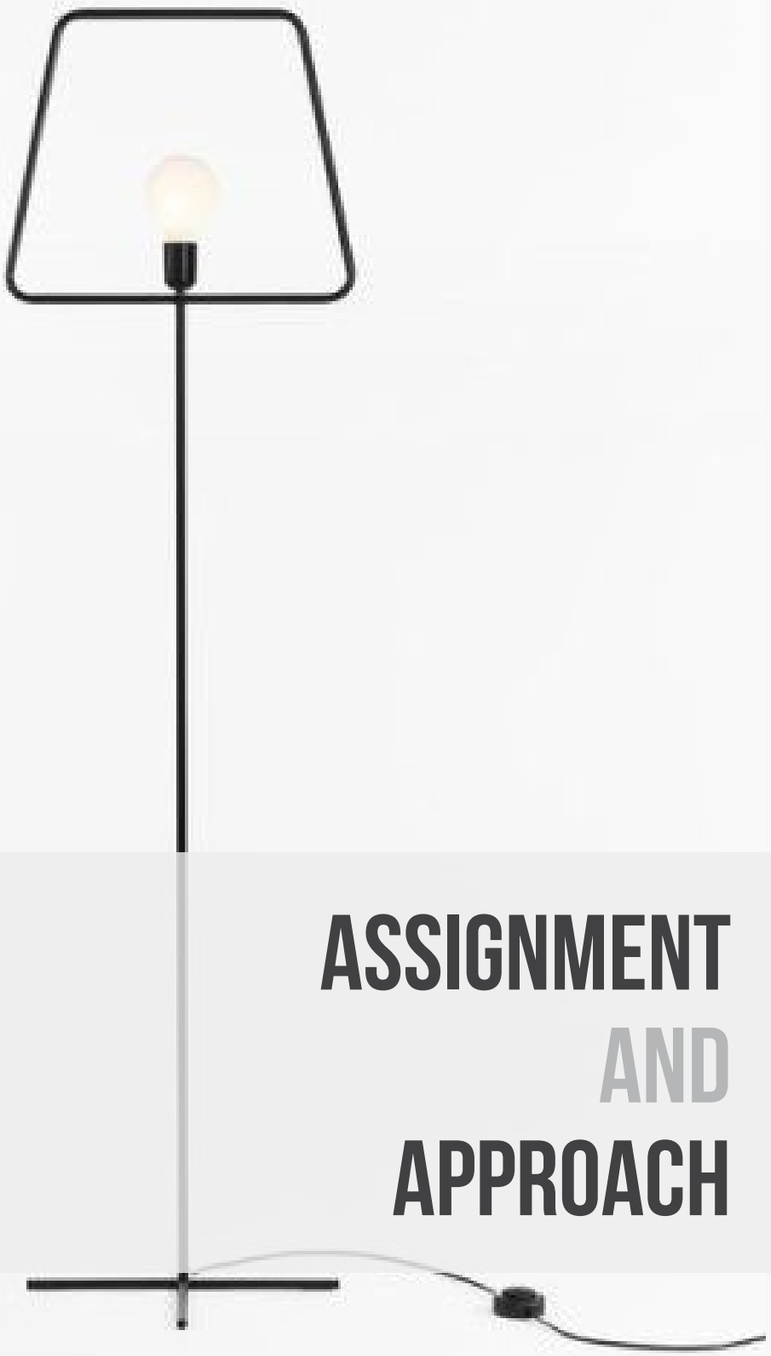


Figure 1.1 Readers guide through the report of this thesis

CONTENT

1 PART



ASSIGNMENT AND APPROACH

CONTENT PAGE

1 ASSIGNMENT AND APPROACH

This preliminary phase of the project precedes the start of the project, it defines the reasoning behind the assignment and the approach for this project. This phase is carried out to establish the process structure of the consecutive phases. The following phase describes the parties involved, the project goal, the preliminary boundaries and the overall proceedings during this entire process.

kloosterman
VERLICHTING

Kloosterman Verlichting

Kloosterman Verlichting (KV), founded in 1954, is a family business based in Amsterdam which specializes in the production of interior lighting products. Their current product line consists lighting design, lampshades, lamp stands in a variety of designs and sizes.

Project purpose

KV has contacted the TU Delft to engage in a graduation project, hereby entering the project as a client and therefore maintaining a significant influential role throughout the duration of the assignment. One of the responsibilities of KV is to give input in the project on a content level. Thus, meaning that the company has a large sphere of influence when it comes to the decisions in the project.

1.1 INVOLVED PARTIES IN THE PROJECT

This phase will further introduce the main partners of the project including their purpose and responsibilities during the course of this project.

TU Delft

The faculty of Industrial Design Engineering (IDE) is the facilitator of this thesis in coherence with the educational institute Delft University of technology. This assignment is the final obligatory course required to finish the master track Integrated Product Design.

Project purpose

TU Delft is the academic authority within this project. Their role is to guide the project from an academic educational perspective. They also ensure that the project is executed at a sufficient academic level. Another role, is to assess the project from the academic perspective of the faculty of IDE.

TUDelft

1.2 PROJECT BOUNDARIES

This section will discuss the context behind the graduation project, and the reasoning behind the assignment which is the fundamental base of this project.

KV is a well established lamp shade manufacturer who sells it's products through intermediate businesses. Current market trends have seen a decrease in lamp shade popularity, therefore the company is interested in seeking new angles to maintain a good position market. So in order to create new revenue streams, a new product line has to be developed that is specifically targeted at commercial direct sales.

One of the fundamental challenges is to develop a product that appeals to the contemporary needs of (private) end-consumers, in the design of the product it'self or in the service(s) supporting the product. One could for instance think of customizable products that the client can adjust and personalize while ordering online. Ideally, the product and accompanying service will provide an experience that does not exist yet. In other words, the needs of the market have to be identified as well.

The purpose for the design of a new product matched with the contemporary needs of the company and the customers. Arising from this need of renewal, KV contacted the TU Delft to collaborate on a graduation project. In the next section, the assignment that has been formulated is given and discussed.

The project was delimited by describing clear boundaries for development of the lamp shade. This section describes these boundaries to define the scope of the project. The boundaries are determined by the technical capabilities of the production facilities and the capacity of the team.

Scope

The scope of this project is to design a lampshade to adhere to current trends and create a new opportunity in an otherwise saturated market. Which means a new product will be implemented in the existing market. This market is currently being flood with high tech lamps such as LED lights and utilising various sensors. Furthermore multifunctional or highly adaptable designs are more favourable in the current market. This adaptability can mean variables in e.g. function, ambiance or overall shape of the design.

Contradictory to this, the company however specializes in low tech products to adhere to their current capabilities therefore it's most beneficial to design a product which is innovative without being too high tech. So the opportunity exists to create a lamp which is both low tech but multifunctional to fill the gap between the market and the company boundaries. The low tech design should facilitate the possibility of production within a year.

The majority of the available light sources concerns retrofit LEDs. The problem then is to design a lampshade in which retrofit LED systems with such functionality can be used in a way that the lampshade and/or stand add extra value to the light source properties. Variation in light diffuseness can not be done with existing retrofit LED sources while this property has a major impact on appearance, light atmosphere and experience. This could be added by a lamp shade and/or stand with which the resulting light's diffuseness could be adapted.

1.3 ASSIGNMENT AND GOAL

The establishment of the assignment stems from the previously described project context and boundaries. The development of this graduation assignment came forth from the cooperation of the project partners, mentioned in section 1.1.

The fundamental challenge is to develop a lighting design product (lamp shade or luminaire) that fills the gap between the current low tech product line of the company and increasingly high tech lighting market. Therefore the assignment is formulated as;

'Designing multi functional lampshades for Kloosterman Verlichting'.

The assignment as described above is based on preliminary research in consult with KV, and their experiences. This is used as the initial problem definition of the project assignment, but is not extensively substantiated. After conducting the analysis phase of this project, the assignment can be validated. The final step of the analysis phase will be to define the actual problem definition.

DECORATIVE

ON/ OFF FUNTION

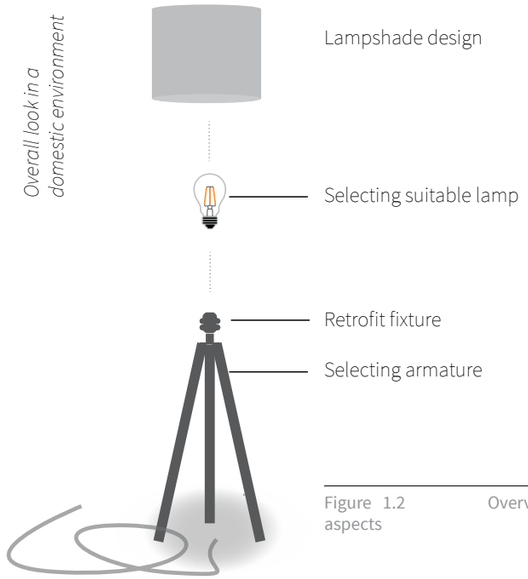


Figure 1.2 Overview of design proposal aspects

DESIGN PROPOSAL

The expected outcome of this graduation project is to have a lampshade design including a model and working prototype. The luminaire should suite the requirements set during the analyses and be implementable within 2 years.

1.4 PROJECT APPROACH

The approach is based on the iterative design cycle, which is described by Roozenburg et al. (Roozenburg et al., 1998) Due to the projects complexity this section is an elaboration on the structural overview given in the reader's guide, and gives insight on the overall content and different phase of the project. The project is distributed in four different phases, each with it's own methodologies.

Phase 1; Analysis and immersion

The first step is an external study of the market which needs to be done in order to find gaps in the otherwise dense market. Next, an assessment of the current competitors and partners could be profitable because these could hold possible benefit's for future designs. Furthermore an in depth research is required into the development of lighting design and other trends within this market that fit with the possibilities within the assignment. This initial analysis phase result in the establishment of the list of requirements, the problem definition, and the design direction and vision.

Phase 2; Synthesis and Conceptualization

The concept development phase has been limited by the design implications of phase one. It's starts of with an iterative process of ideation, after which concept directions are chosen and further detailed. These directions are assessed on concept viability and feasibility, using chosen criteria from the list of requirements.

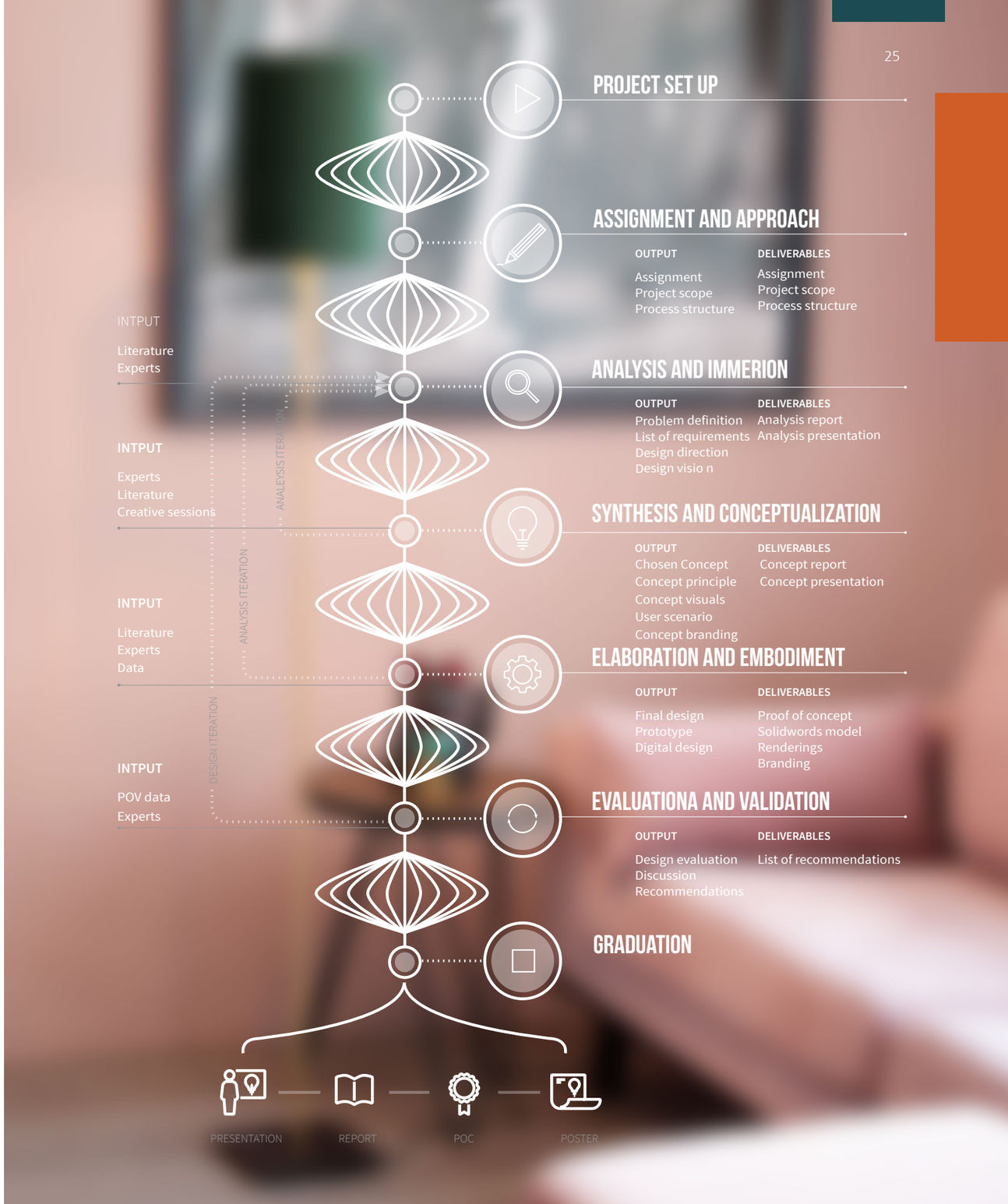
Phase 3; Elaboration and Embodiment

In this phase, the chosen concept of the previous phase will be elaborated to a point in which it's detailed enough to validate the feasibility. This validation will be done according to set demands and the list of requirements.

Phase 4; Evaluation and Validation

The final phase will be the building of the prototype and testing of this model. By doing this the design can be evaluated and validated for possible redesign steps before finalizing the embodiment of the product. When the design is finalized the manufacturing and embodiment will be detailed.

The input from analysis, client insights, coach feedback, and other experts throughout the project aids the iterative process. This feedback supports the important design decisions.



2
PART

ANALYSES AND IMMERSION

2 INTERNAL ANALYSIS

This phase has the main purpose of gaining understanding of the overall context of the company KV and current lighting market. The vast complexity of the analysis requires a clear process structure. Background and initial information is accumulated from internet and literature research. The final outcome of this analysis gives an overview of the entire project and results in the final problem definition, design vision, and further design implications.

During this project, KV is at the centre because they are the initiator of the assignment, the client, and the beneficiary of the final design proposal. Therefore, this analysis phase starts off with an internal analysis of the company to determine the strengths and weaknesses of the company. This analysis is then summarised and entered in a SWOT and search area matrix to further in the ideation phase. The full analysis can be found in Appendix B, the important findings that have been used for decision making are described in the following chapter.

The second part of this phase will be to develop a good understanding of KVs market environment and their current competitive advantage. Analysing the environment is important because of the continuously growing economic landscape of the lighting market. Understanding this external environment determines the external forces and the current position in this 'design space'.

2.1 KLOOSTERMAN VERLICHTING

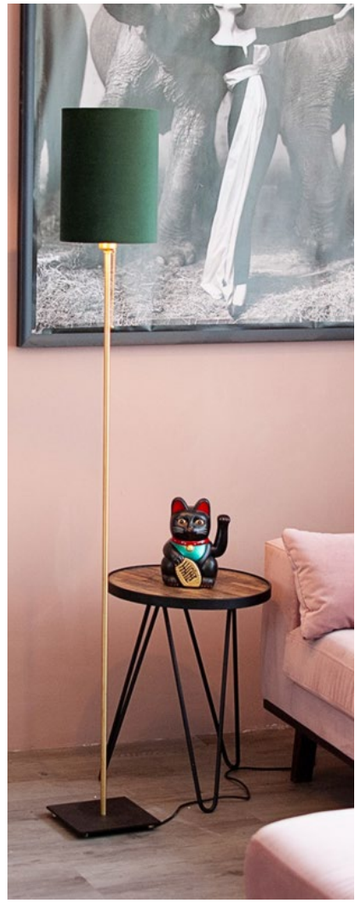
This phase strarts with further understanding the assignment and the reasoning behind it. Thus starting by gaining a better understanding of the company. Therefore this section looks into the company and it's assets.

KV is a small scale business which specializes in the production of interior lighting products. (Kloosterman, 2017) Their current product line consists of luminaires including lampshades, armatures in a variety of designs and sizes. All of which are sold in various designs and sizes.

Most of the lampshades can be implemented on armatures as well as used for ceiling luminaires,.

Figure 2.3 Kv sells a variety of amatures in multiple sizes (see Appendix Xxx)

Figure 2.4 Examples of two of KVs lampshades utilised as ceiling lamps



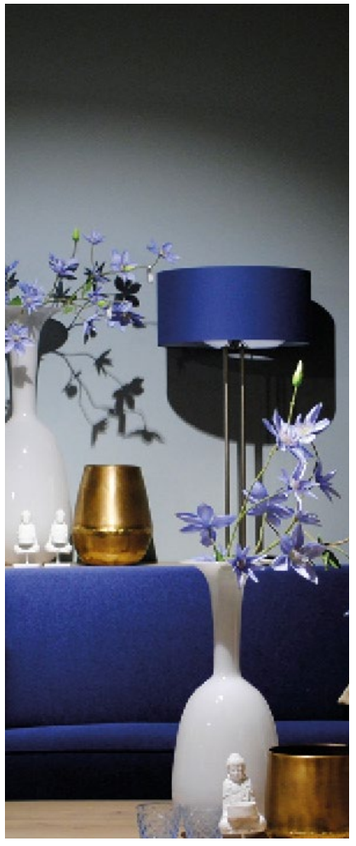
Design simplicity

One of the main features of the current design is it's simplicity which makes them implementable in a variety of interior decoration locations. The archetype of a luminaire is impeccably close to the current designs of KV. It adheres to the form follows function design principle when it comes to their product.

Furthermore, the customization of each luminaire, meaning the colour, material, shape and armature, means the product can be tailored and created to the specific needs of the individual customer. in the mass market, the combination of this kind of concept with customer co-creation, is of significant importance.

The current strategy of the company states: Handmade in Holland. The reason for this was that during the 80s several Amsterdam based lighting companies relocated their production overseas to the Far East. Kloosterman however retained their existing production facility. (Drinkenburg, 2017) Their slogan "Hand made in Holland" emerged to stand out from their competitors. In the past most lampshades had a label with this slogan stitched on the inside.

However this practice has faded over time but can be reimplemented in the new design proposal.



▲ ▶ Figure 2.5
The images depict the large variety in which KV luminaires are currently placed

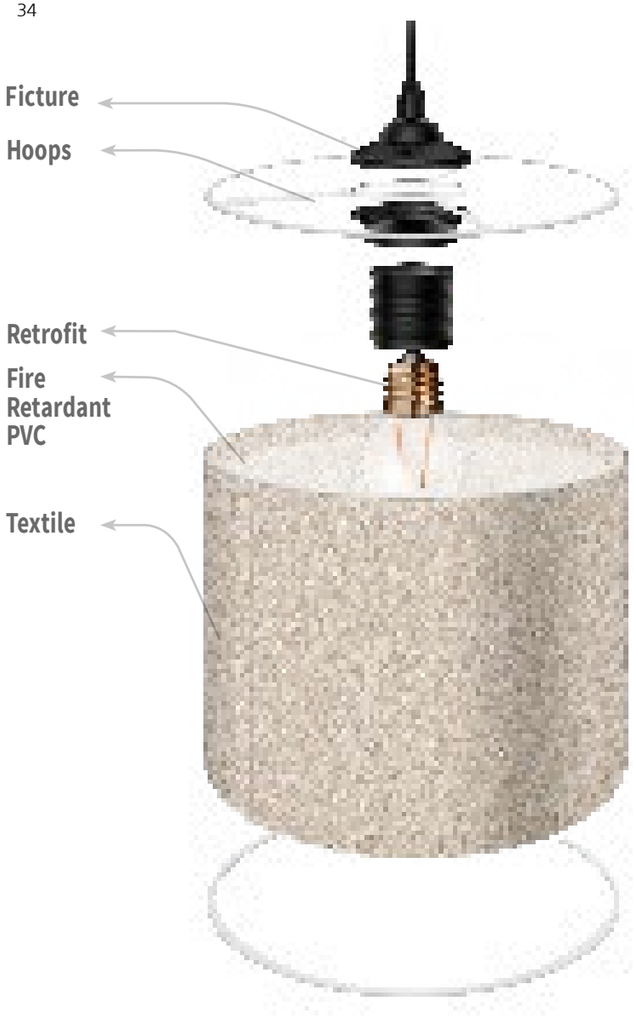
Manufacturing

One of the main resources of KV is their manufacturing facility, which includes production machines, transport vehicles and a distribution network. This facility also contains the R&D department and the assembly of the products before being distributed. This enterprise requires human resources, a particular prominent Figure is the owner himself, Rogier Drinkenburg. He is both head of the product development team as well as the main contact for both distributors, sales and customers.

The company has a product regularity of once per year, which includes the design and redesign of the current product line. This is mainly necessary to continuously update and renew their catalogue, in order to attract new customers and to keep up with current trends and competitors. New releases could include a new product such as a new armature or more minor deviations in lampshades such fabric or colour. The company currently produces products in small batches starting at 50 to 100, when a product is proven to be successful additional small batches will be produced. However, when a batch remains unsold in stock for a year or longer the product is discontinued and removed from the catalogue. The company tries to accommodate customers by adding colour and texture fabrics which adhere to trends in home decorating market. The key activities of KV start from the design of a product, through obtaining various parts from partners to assembly and distribution to the secondary sales partners.

The Appendix A` shows an schematic depiction of the production in the production facility in Amsterdam. As previously stated the company purchases various parts to assemble and distribute to the various retail location in the Netherlands

Figure 2.6
After assembly the lights are wrapped in plastic to prevent stains or damage in the facility.



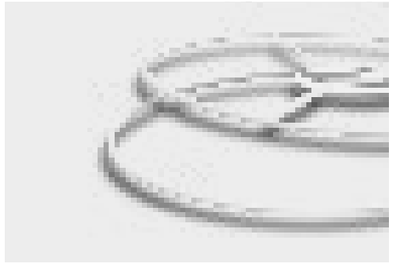


Figure 2.7Detailed depiction of the assembly process of a standard KV lampshade

Production

In the dust free area the lampshades are assembled. This images depicts the basic components. The textile is purchased with the PVC layer already glued on the back, the layers main intent is to function as a fire retardant layer.

Conclusions

KV is small scale business that produces, sells and distributes interior lighting products. Their preliminary focus is on the production and design of lampshades. Produced shades are places on various armatures and hanging fixtures, the variation of which is the companies inventory.

Design implications

Manufacturing. The in house production facilities of the company have to be utilised for the design proposal.

Style, The companies current design lies in simplicity. Important consideration should be made either to adhere to the current style or deviate.

Budget, The size of the company allows for small batches and low to mid entry manufacturing and prices in order to be profitable.

2.2 CUSTOMERS

Customers define the heart of the business, without them a company could not survive. Understanding the common needs, behaviour and attributes, could increase customer satisfaction. Therefore defining the customer segment could help designing around the understanding of specific customer needs.

Current customers

The focus for this project is the mass market for lighting products with customers with broadly similar needs and problems. Which are customers who purchase lighting products for home use and alternatively for interior decorating such as: illuminating and increasing cosy atmosphere to office settings. The current products of KV are situated in the lower price range of lamp shades.

KV has indicated that their main target group consists of home owners between the ages of 25 to 65, who purchase their lights online. The purchased lamp shades are designated many for the living rooms of the residential homes. KVs lamp shades are bought to increase homeliness and cosiness.

The main customer relationship is a self-service based system. The relationship between KV and it's customers needs to be understood to know how to maintain and improve this relationship. The overall company maintains no direct relationships with it's customer. It provides all necessary means for customers to help themselves.

Nevertheless, co-creation provides customers access to customized services. This customizing service recognizes the individual customer needs and also provides information on cost estimates.

Conclusions

The customer of KV can be considered to have basic lighting needs. The main objective is to illuminate and decorate a living area. Customers are in the heart of KV because they determine both income and the inventory.

Design implications

Service. The final design proposal does not require a customer service or special relationship, because that would require setting up a whole new department and company focus. Which would deviate from the purpose of the project.

Function. The basic lighting needs of the customer give a focus on the product requirements of the final design proposal.

Customer channels. The current customer channels can be utilised.

Online purchases. The product should be adhere to the wishes of the online decorative shopper.

2.3 CURRENT PARTNERS

This section describes the partners KV works with. The main focus is to establish current stakeholders and other partners involved with KV.

KVs products are currently indirectly sold to several secondary partners, such as furniture stores, web-sales, and property developers. Meaning, all sales go through intermediate businesses, a.k.a. business to business (B2b).

The overall sales partners contain wholesalers in lighting design and interior decorating. Furthermore, they also sell to online sites such as trendhopper, 4 u Design and 'M40 styling en wonen'. KV has a buyer supplier relationship with their sales partners to insure they are a reliable supplier of lighting products to their sales partners.

KV has been working predominantly with the same partners for several years, which includes partners for the manufacturing of parts and for inquiring electronic components. Throughout the years these partners sometimes alter, due to the different production method required for the designed components e.g. ranging from metal processing, woodworking and laser cutting.

Kvs current goal is mostly cost-driven with a focus minimizing costs wherever possible. This overall approach aims at creating and maintaining the leanest possible cost structure using low price value propositions and extensive outsourcing of overall activities. This is due to the relatively small size of the overall business and most inexpensive way of doing business for this company.

The costs maintain constant despite the volume of the goods and service products. However, the costs structure has an overall dependency on the global economy. When there is a declined in the global economy, the purchase trend of customers is to buy products which add a sense of homeliness and cosiness to their interior. However, due to their secondary sales, KV receives intermediate revenue from their secondary partners and not from the end-users. Which means an overall decrease in possible revenue when compared to direct sales.

Design implications

Preserve partners. The current sales channels such as Trendhopper can be utilised in the final design proposals

Online sales. Due to the small batches, one or perhaps two websites should be selected otherwise the lampshades will be out of stock fast and it will add to the exclusiveness of the new design.

2.4 COMPETITORS

The following section gives an overview of the competitors in the current market with their respective strategies. This is to determine the possible competitive advantage of KV currently hold and what position to take to increase their market position.

To simplify and compare this analysis of the current competitive market it's important to compare the various competitors on a number of criteria to determine possible design implication for the next phase.

By comparing the same variables on the competitive advantages or possible opportunities to be utilised for the final design proposal. A price/ USP comparison was done on the page to the left. This shows that KV is in the lower price section, it however does not have strong unique selling points compared to other competitors. The unique selling point is based on material, texture, overall look and feel, and distinction amongst competitors.

The next pages give brief explanations of the current competitors and their dis/advantages.

Figure 2.8
Comparison of the basic NOA luminaire of KV to similar ones provided by partners

Online design shops

Due to the increase in online purchases, online design shops have become a strong competitor for small scale companies such as KV. Despite the fact that KV sells products online on e.g. Trendhopper, there are an increasing number of webshops for lighting. The strength of these websites is the large variety of products, not only in the lighting sector but also retailing products for lifestyle and living. By displaying products in context with other products and suggesting matching items, allows people to select interior products together.

Advantage

Product inventory, Quality

Disadvantage

Customer relations, inventory, service, price

Luminaire Retailers

Retailers are often large scale organizations which produce and retail for secondary sales partners. While companies such as IKEA have the opportunity to significantly decrease their prices due to their global mass production. Other companies such as XXX sell high end designer luminaires which, as previously mentions are in a higher retail segment. Due to the low batch size and the midrange prices KV is in a less strong competitive position.

Hardware stores

The Netherlands has many available hardware store chains e.g. Praxis, Gamma and Karwei. These stores not only offer numerous lifestyle and living products, they also enabling customers to create their own products by supplying cheap material supplies, crafting tools and expert advice on DYI. Therefore these stores respond to the customer needs and the trend of DYI and homemade designs. This makes shops such as KV redundant because customers can buy and design on their own volition.

Second hand industry

Thrift shops or second hand stores compete in store sales as well as online retail (SOURCE XX). The online sector such as Marktplaats and tweedelands.nl whereby customers sell and buy to classified ads has become an important retail sector. Sites show daily new offers, with Marktplaats even supplying an average of 350.000 new advertisements a day. (Marktplaats, 2017) Furthermore local thrift shops sell products relatively cheap and supply a mishmash of products, therefore offering 'one of a kind' products.

Start ups.

Small companies such as start-ups offer customers unique designs and often locally produced products which are currently in demand by customers. Knowing the origin and improving local economy is popular amongst interior customers. These companies are comparable with KV, however they do often offer a more unique and innovative luminaire design. KV strength and at the same time weakness is their archetypical lampshade design which adheres the basic design trends but hinders the possibility for technically innovative designs such as lighting with motion sensors etc.

Conclusions

KV currently does not have a very strong competitive advantage, due to the relatively small variation in inventory, the service and overall unique selling point. The price however is a strong asset.

Design implications

USP. The final design proposal requires a unique selling point that increases the value.

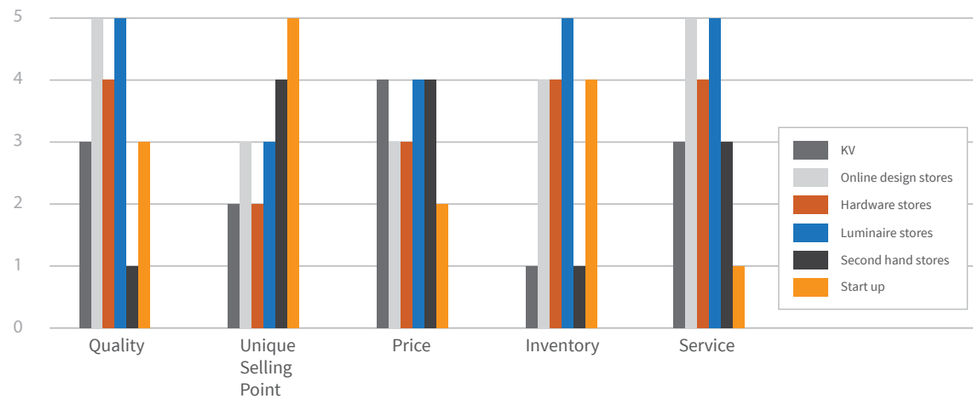
Price. To get a strong position in the market the design proposal should be comparable in price to the current products.

The reason for starting off with the comparison is to establish the position of KV in the market next to their competitors. (Figure 2.8)

Comparing the competitors themselves in table 2.1, is can be concluded that KV currently does not have a very strong position. This assessment was done based on criteria set and scoring them based on their assets.

The strength of the luminaire sales is in the USP, because of the moderate design of KV the company has a significant disadvantage over their competitors.

Table 2.1 Comparison competitive advantage criteria



2.5 GLOBAL LIGHTING MARKET EXTERNAL ANALYSIS

To gain insight in the current market climate and possible opportunities a external market analysis was executed. Establishing the current market position will determine possible threats and opportunities for KV as well as it's stakeholders.

Due to the overall size of the lighting market means that before this analysis can start, a subsection of this market needs to be selected. The current global lighting market, which is estimated to be around 112 billion dollars annually has been undergoing significant and rapid change due to two major trends in de market; the growing adaptation of LEDs and the increasing popularity of connected lighting systems, (BCT, 2015) Both trends are altering the underlying economics and dynamics of this global. In response to this, companies are emerging new strategies across the lighting value chain to increase their competitive advantage.

The secondary trend which is the connection of these LEDs in connected lighting systems or called smart systems is outside of the scope of this project so is less relevant for the overall analyses. However the main reason for the shift towards this connected lighting is the idea of a cost saving system to enhanced functionality with the possibility of altering the light to fit various situations.

Lamp selection

In the final design proposal the light source itself can significantly alter the appearance of the look and feel of the design. Light can be generated in many different ways. In it's natural form, it's present in nature provided by sun, lighting, stars, etc. When it comes to artificial lights, lamps are currently the biggest source. (See Figure 2.9)

So when thinking of light bulb, most people think about Thomas Edison. Despite that it's a misconception that he was the inventor of the bulb, he was one of the first to make a useful one. Of course there have been many modifications on Edison's original bulb, nevertheless the design has stood the test of time. Despite that the incandescent bulb, which is associated to that of Edison, is this available on today's market it has decreased in popularity.

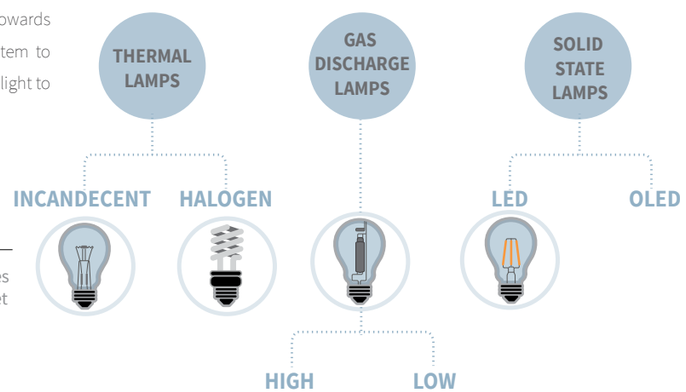


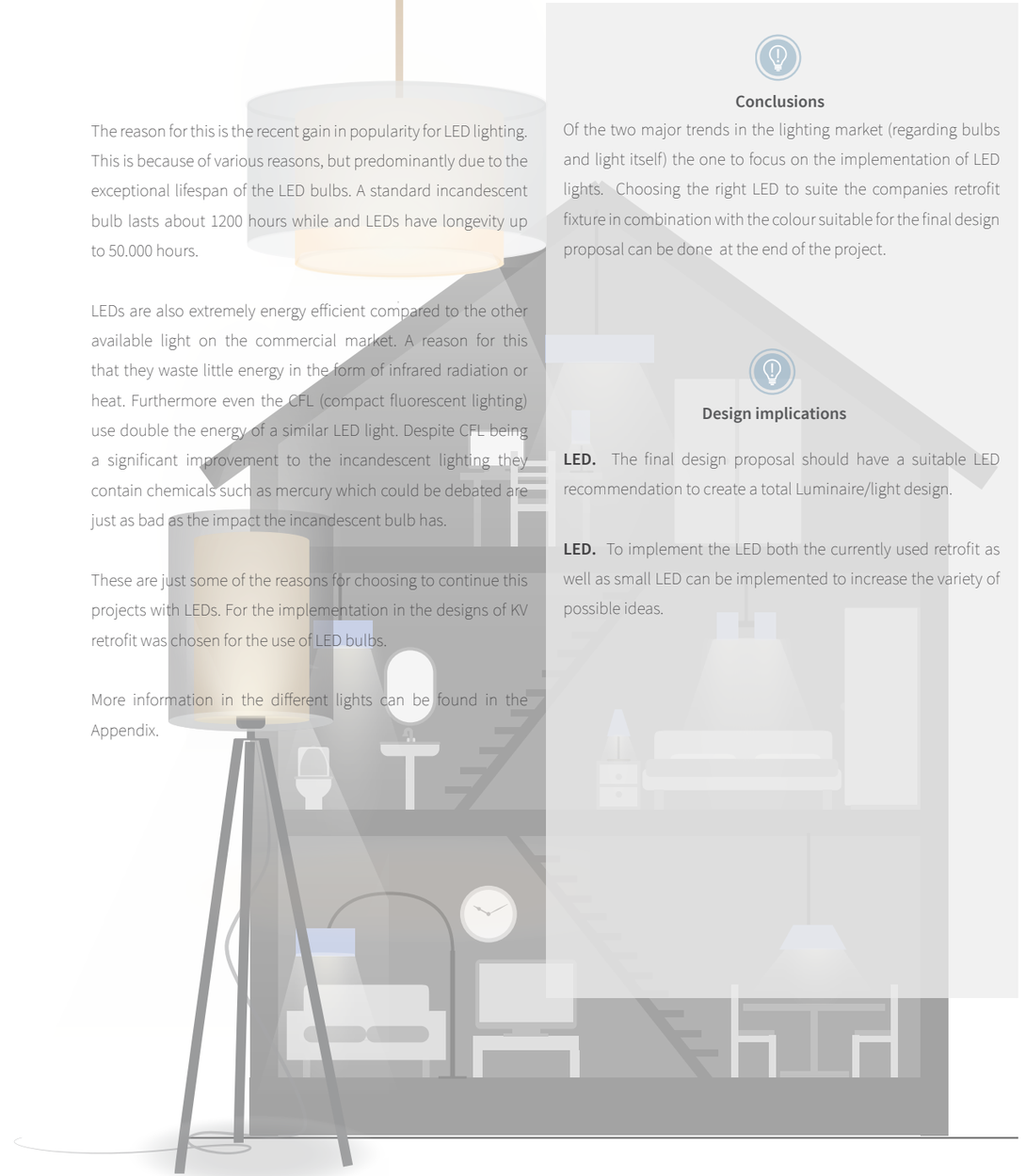
Figure 2.9 Different lamp types available on the European market

The reason for this is the recent gain in popularity for LED lighting. This is because of various reasons, but predominantly due to the exceptional lifespan of the LED bulbs. A standard incandescent bulb lasts about 1200 hours while and LEDs have longevity up to 50.000 hours.

LEDs are also extremely energy efficient compared to the other available light on the commercial market. A reason for this that they waste little energy in the form of infrared radiation or heat. Furthermore even the CFL (compact fluorescent lighting) use double the energy of a similar LED light. Despite CFL being a significant improvement to the incandescent lighting they contain chemicals such as mercury which could be debated are just as bad as the impact the incandescent bulb has.

These are just some of the reasons for choosing to continue this projects with LEDs. For the implementation in the designs of KV retrofit was chosen for the use of LED bulbs.

More information in the different lights can be found in the Appendix.



Conclusions

Of the two major trends in the lighting market (regarding bulbs and light itself) the one to focus on the implementation of LED lights. Choosing the right LED to suite the companies retrofit fixture in combination with the colour suitable for the final design proposal can be done at the end of the project.

Design implications

LED. The final design proposal should have a suitable LED recommendation to create a total Luminaire/light design.

LED. To implement the LED both the currently used retrofit as well as small LED can be implemented to increase the variety of possible ideas.

2.6 TRENDS

Despite the vast size of the aforementioned lighting market there are recognizable design directions which are currently dominating within luminaire designs. This section describes design trends which are currently prevailing.

For this project it's important to look at the trends currently being implemented. In the end it s important that the design proposal matches the current visual desires of the customers.

Additional findings and moodboards can be found in Appendix B which adhere to trends found at the global lighting expo and could be potential future trends

Abandoning the conventional shapes of luminaires has been is a succeeding trend in the current market. To create a distinction amongst pears, manufacturers are altering the expected shapes of luminaires and turning it into unique selling points. Namely arc luminaires have gained an prominent edge over other floor models. The prevalence of arc lamps in homes is in part due to the popularity of the mid-century modern interior styles, and partly due to the customers' leniency towards unique selling points.

Following the change is shape is the increase in sizes. Taller shades and squat bases can be found as the prevalent look in table luminaires. Contrary to the bedroom however, where preference goes to table lights which have a small bases and tall shades. For these lights there is emphasize on the shades and their substantial size.

The emphasis on shades and their larger relative size means that there is more eye for detail. Shades are becoming more complex, often almost sculptural, whilst remaining clean in appearance. The armatures can be mixed-material or novelty items such as figurines. Which leaves the overall look uncluttered despite various embellishments.

The main trend is revert from the use of plastics and other resinous materials. Various other materials such as metal, glass, and wood are used for both the armatures as well as shades. Within the rise of metal use, brass is one of the most popular materials, accompanied by accents of polished nickel and copper. Besides the material changes there is more attention for the finishing off the various materials to combine different textures (e.g. matt, distressed or coarse finishes)

In politics, economics and social areas there is a greater push towards sustainable and more energy conscious consumption. This also counts for lighting design and choices customers make towards energy reduced lighting and green living principles. Implementing green in urban living as well as awareness is more present in luminaire designs

Conclusions

The lighting market is vast market with a large variety of trends. Trends focus on mixing materials with different textures, and size differences to create luminaires where form follows function. Decorative focus rather then just bring a source of light.

Design implications

Simplicity. All trends, even when focussing on function or features should have an overall moderate and simple design.

Clean. The design proposal should be a clean design visually as much as durably clean.

Design. To have more chance of a successful product, the design should try to adhere to one or more of these trends.

2.7 ADDITIONAL CONSIDERATIONS

Alongside regulated proceedings of writing this design proposal there are additional considerations for this project.

Qualitative vs. Quantitative lighting design

Despite the importance of the primary objective, other aspects of lighting design are also important. The main design principles by e.g. Kelly or Vogels require the analysis of various aspects, which include the 'designated purpose of the light", 'the conditions of the surrounding environment' and 'the special rendering'.

For the design proposal it's important to look at the quantitative lighting design, which implements standards to fulfil set tasks, luminance levels and colour temperature. (Information also found in Appendix B

Next to that, the qualitative light design will gather additional details to improve the possible outcome of the design. Qualitative lighting design according to Gansland, who wrote The Lighting Design Handbook in 1992, is divided in; the utilisation of space, the psychological requirements, and the architecture and atmosphere of the environment.(Gansland, 1992). In which **utilisation of space** constitutes out of the activities, including their specificity and frequency. In this project that would mean indoor domestic activities most likely in the living room. Depending on the home and the intended user this could alter the purpose of the design.

The **psychological requirements** require knowledge of the emotional and biological needs of the user. The basic needs that the luminaire is set to fulfil will be determined in the beginning of the next phase in the functional analysis which will not only include the primary objectives.

The final principle of **architectural and atmosphere** will be, for the most part, excluded due to the lack of knowledge and large number of variables when it comes to the interior decorating and arrangement of the users home. However, basic atmosphere is considered at a later phase during elaborating and detailing of the final concept.

Customers

As previously described the market is extensively large and the specific customers are relatively unknown due to the indirect sales. The continuously adapting consumer market can mean that trends which are now significant and desired could become redundant in a matter of months. Therefore during the project there will be a continuous search for new inspiration, online and in magazines.

Other considerations

Financial constraints

The final goal of the project is producing a prototype or a look and feel mock up that will aid in the detailing of the embodiment of the design proposal. However the project comes with limited funds therefore cuts can be made when it comes to the amount of prototypes that can be produced, keeping in mind the possible failed trials can significantly add to the costs. Thus one should consider low budget solutions. Furthermore the final design should be assessed on the initial investment costs, to determine the cost- effectiveness of the design.

Adaptability and diffusion

From the start of this project the idea is to add a feature to the conventional luminaire (with LED) in order to increase the possibility of success of the design. As stated in the Appendix B the conventional luminaires have become less popular and are expected to even further decrease in popularity. However to remain with the core strength of the company (producing conventional lampshades) a feature can be added, such as diffusion or adaptability of the function of the luminaire.

Time constraints

The project has a limited amount of time this should therefore be held accountable during the proceedings of the project. Setting clean boundaries and limitation to the final outcomes. There is always more to be done and more complex details to be defined however those will be excluded from the project.

Overall the considerations are meant as a reminder that there are more aspects then have been mentioned in the initial analysis.

Facility

The company has a relatively new production facility (4 years old) and has various resources available. Due to the financial limitations, which disqualifies outsourcing, the new product had to be producible within the facility of KV.

2.8 CONCLUDING THE ANALYSIS

The conclusion of the initial analysis phase basically constitutes as a summary, based on the conclusions drawn from the subsection

Company

KV is small scale business that produces, sells and distributes interior lighting products. Their preliminary focus is on the production and design of lampshades. Produced shades are places on various armatures and hanging fixtures, the variation of which is the companies inventory. Resulting in a rather small deviation in inventory.

Customers

The customer of KV can be considered to have basic lighting needs. The main objective is to illuminate and decorate a living area. Customers are in the heart of KV because they determine both income and the inventory. The customers have become less interested in the archetype style luminaires.

Competitors

KV currently does not have a very strong competitive advantage, due to the relatively small variation in inventory, the service and overall unique selling point. The price however is a strong asset. The goal is to gain competitive advantage with the design proposal.

Global lighting market

Of the two major trends in the lighting market (regarding bulbs and light itself) the one to focus on is the implementation of LED lights. These will be implemented using retrofit fixtures.

Lighting design trends

The lighting market is vast market with a large variety of trends. Trends focus on mixing materials with different textures, and size differences to create luminaires where form follows function. Decorative focus rather then just bring a source of light.

Other Considerations.

The financials of the company require the new design to be cost effective and have a low investment threshold for the company. Otherwise engaging in a new product would not be feasible.

Nevertheless despite the funds the company is eager to find a new design proposal due to de reduction in current revenue. With the time constrains of the project it is a challenge to have a finished product which is ready for production.

Much like the current inventory and sales the new product needs to be produced in the manufacturing facility of KV. Thus one of the main requirements for the new design proposal is in house production.

Adaptability in design is currently a major trend in both the lighting market as well as other markets therefore the implementation of an additional feature to an otherwise conventional luminaire boasts for possibilities within the confides of both the project as well as the companies wishes,.

3 PHASE

SYNTHESIS AND CONCEPTUALIZATION

CONTENT

PAGE

3 PART 3 SYNTHESIS AND CONCEPTUALIZATION

The following phase describes the process of generating solutions for the problem which was determined by the outcome of the analysis phase.

The initial objective is to choose a design direction for the synthesis, which is the first necessary step in the framework to define the design context. The design direction is further defined by generating a functional analysis and setting up the list of requirements which will be the starting point of the solution process.

Sketching in combination with creative sessions and mock ups will be used to select and process the iterative ideation phase. By eliminating quick sketches which do not fit KVs objectives allows for significant exploration of the possible solutions.

In the end the most prominent solutions with the highest potential are substituted in concept directions, which will be further elaborated and developed to concepts. The phase will end with one chosen concept to further in the design process.

3.1 DESIGN DIRECTION

Prior to starting the ideation process it's important to set the list of requirements. These are based on the previous analysis and formulated using the checklist of Stuart Puch (Pugh; Pahl and Beitz (Roozenburg et al., 1998)). The list includes aspects of the product which have to be attended to after the design is finalized as well preceding the ideation process. Next to this extensive list which is applicable on the entire design proposal, several important requirements have been determined for the process of solution findings. These selected benchmark requirements are utilised in Chapter 3.4 to select the concept direction which to elaborate and evaluate on.

The page on the right (Figure 3.9) shows the four requirements which have been concluded from the previous analysis phase and will further determine the design space of the ideation phase .

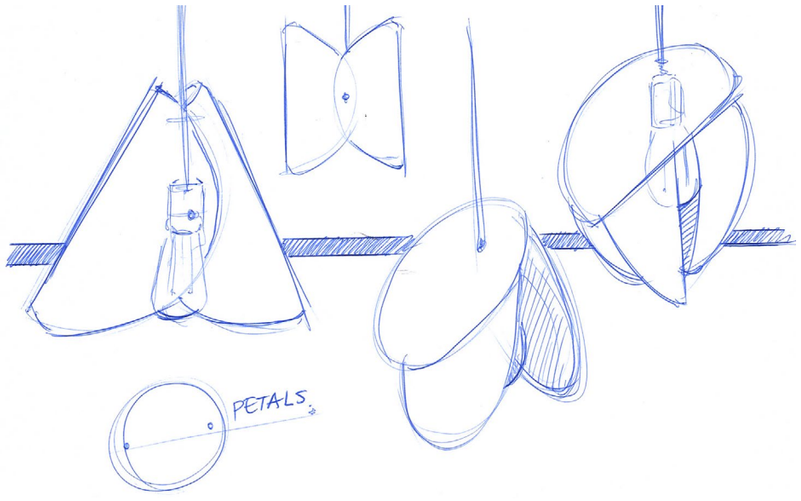
For the full list of requirements see Appendix C, which entails the full checklist some of which need to be determined after this project is finished. Some are outside of the scope of the project but are however required to be set before finalizing the product.

After the analyses of phase 2, the findings have been put in a SWOT matrix followed by a search area matrix to find possible solution spaces. (see Appendix B) Each of the found spaces have been utilised during the sketching phase to explore possible outcomes. For example combining the strength of the companies in-house production with low investment and simplistic design could result in refurbishing old material and Luminaires available on the premises of KV. Various of these solutions can be seen in the following sketches and visual though `

Figure 3.10
Four requirements that have been determined from the analyses in phase 2.

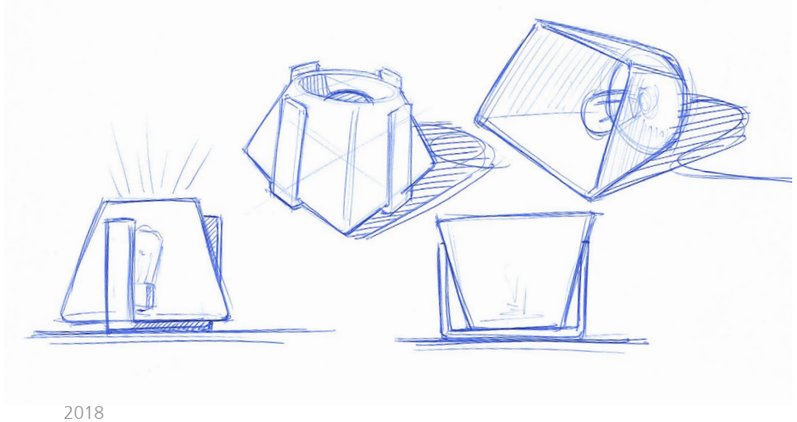
3.2 IDEATION

The following section describes the development of four different concept directions derived from the previous ideation phase. After which an assessment will determine the concept which is chosen for further development and elaboration.



Circles

Initial thoughts went to the idea of utilising the circular die cut. The basic shape sketches indicate the initial thoughts of the ideation.

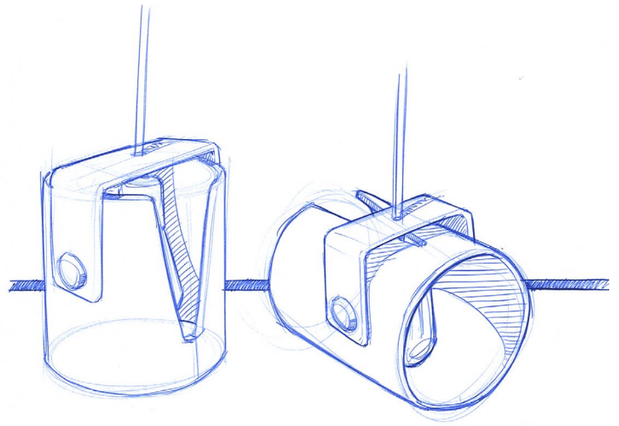


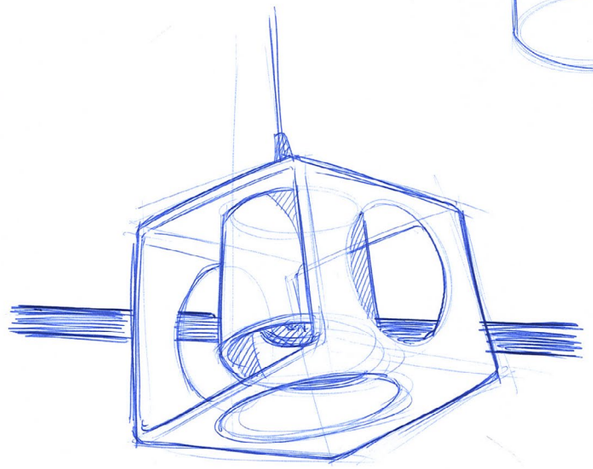
Stands

Continuing on the basic shaped lampshades but adding a stand to alters both the appearance as wel as the use of the light.

Direction changing light

Creating a shape that will allow the light direction to change. Much like a spot light but adhering more to the shade style of KV.



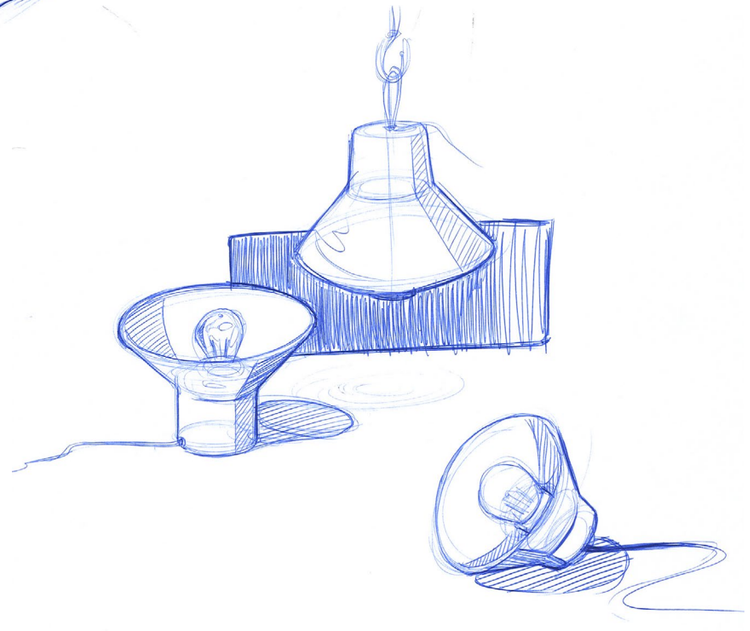


Adding to the shade

By boxing or adding a framework to the existing shade the light reflection will change as well as the overall appearance of the light. Perhaps also moving the shade in the framework.

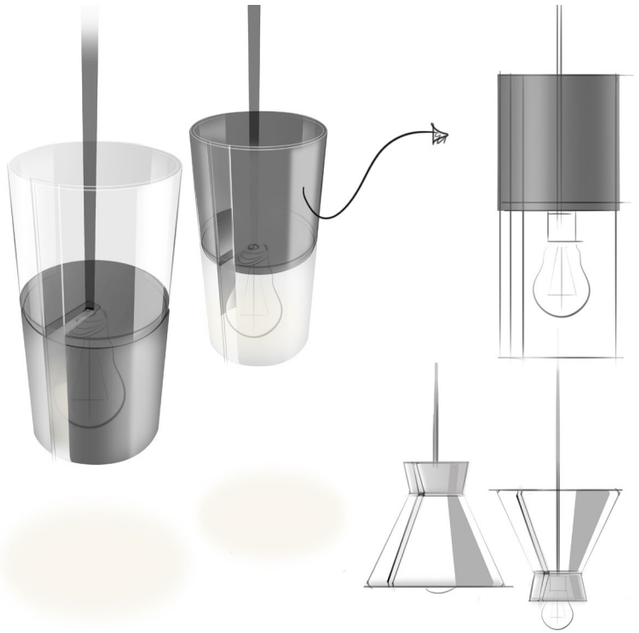
Multi purpose

This idea is based on the idea of designing a lampshade which could be placed, or hung in various placed to create a design which is flexible in the use situation.



Flip shade

Designing a shade which can change in diffusion by turning it upside down. The material difference in the two halves allows for a variety in diffusion

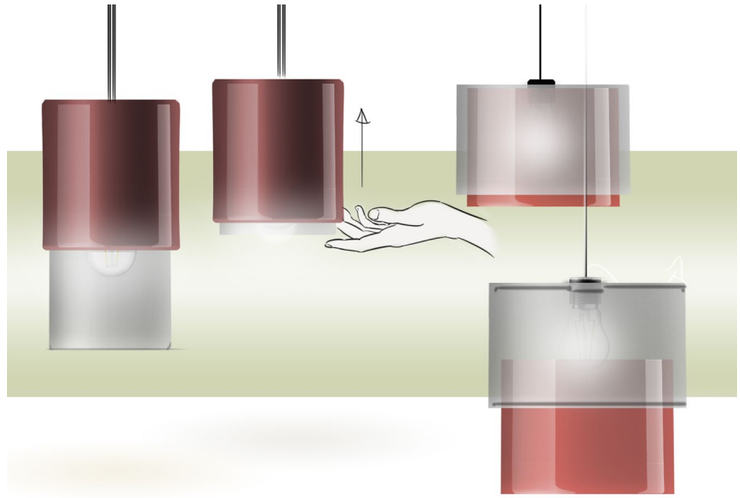


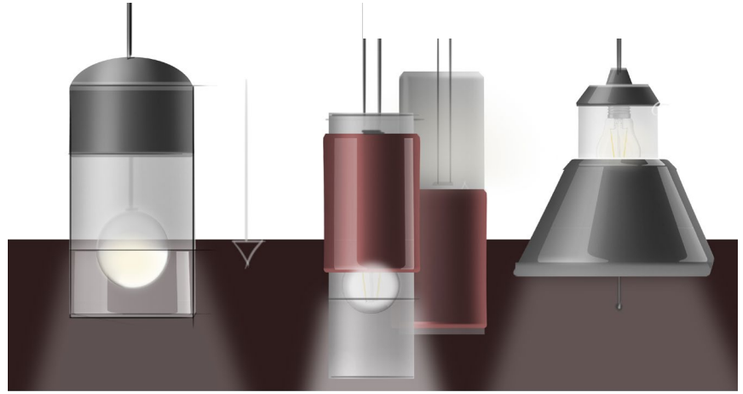
Pulley armature

Inserting the cord in the armature of the frame and using it as a pulley thus adding a fun feature to a lamp stand.

Sliding shades

Much like the ideation on the left the idea is the alter the diffusion of the light by using multiple materials. In this case the material side over each other.



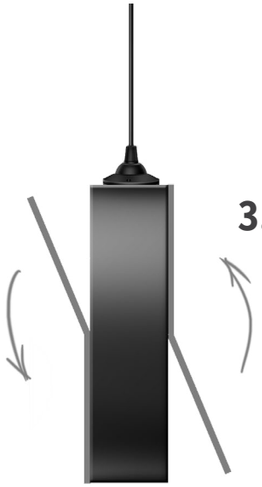


Bulb pulley

Designing shades with various outer materials. By changing the location of the bulb or light source in the shade will alter the overall reflection and diffusion

Conclusion

Many ideas have been clustered and simplified in the initial phase of the design process to create design directions and explore the various possibilities. Some of the brain farts have resulted in mere scribbles during meetings with the company others have been elaborated on more due to the increased interest by the company. Some of these ideas have been selected for concept development in the following sub chapter.



3.3 CONCEPT DEVELOPMENT

The following section describes the development of four different concept directions derived from the previous ideation phase. After which an assessment will determine the concept which is chosen for further development and elaboration.

The first concept direction shown on the right is described in the following section. This is means to give a brief understanding and know- how of the design in order to make an educated choice with which of the concepts to proceed to the final embodiment phase.

Explanation

This first concept is based on the simple principle of altering the orientation of the current lampshade design of KV to remain close to the current strengths of the company. Normally a lampshade is a vertically upright cylinder, by flipping the cylinder on it's side it changes the perspective of the light. Secondary, the front lid that can be flipped can alter the light source and thus the surrounding environment. With the possibility of either a diffused light or opening up the front lid to have a view of the lightbulb.

Why is this interesting

It allows the user to change the display of the light. The simplicity adheres to KV's need for a product which is close to home, but is nevertheless very dissimilar from their current designs. By making the front lid removable it can increase the visual varieties that are possible with the light even more.

Figure 3.11

Initial design direction of concept 1

Figure 3.12 Initial mock up of this concept

Production

The most promising feature of this luminaire concept is that the outer lampshade can be fully designed the existing lampshades. The mock – up below has utilised a KV lampshade lid, however by bending the steel rim of the frame the lid becomes angled and can be flipped on the side planes of the luminaire. Due to the current steel rim in the lampshades, magnets can be attached to it, thus making it possible to attach the new angled lid using magnets. Another option, as visualised in Figure 3.11, would be to apply a basic hinge and use that as a design feature of the lamp. Which is most likely more suitable, because the magnets would allow for the total removal of the lid. Then one has to wander where to place this luminaire part during the time it's not used.

Overall the despite having to experiment with the correctly determined magnet or hinge the production of such a design could be implemented relatively quickly by KV.

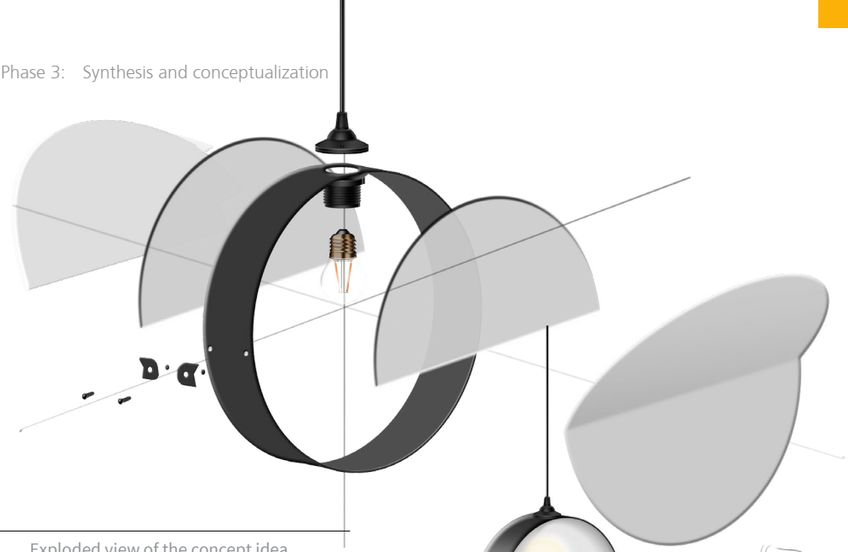


Figure 3.15 Exploded view of the concept idea

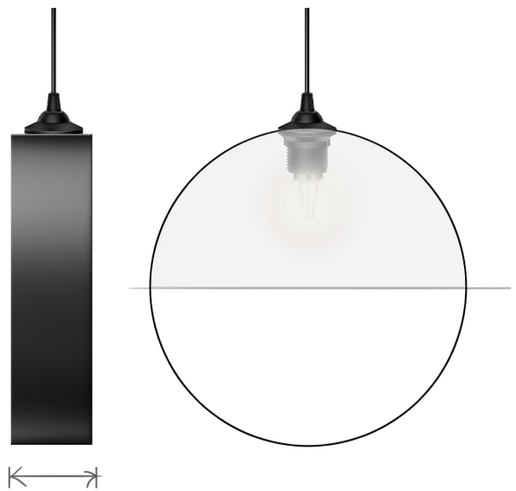


Figure 3.13 Side views of the concept idea

Figure 3.14 Depicted user indicates scale and usage

SLIDE LIGHT

The slide light is shown on the page on the right. The following section gives a brief explanation of the concept direction and the basic principle on which the design is based on.

Explanation

This concept comes from the search area containing, in house production and adaptability. The inner and outer shade of the luminaire have variable translucency. By sliding the two lampshades over each other the light of the bulb can be diffused. By making the outer shade opaque, thus not letting any light through and the inner semi-transparent the overall luminaire can alter it's appearance. When collapsed the opaque outer layer results in inner reflection in the shade and thus changing in light direction.

Why is this interesting

By simply pulling a cord the customer is able to smoothly play with the light source. Furthermore there are many possibilities when it comes to extending this idea. By implementing a variety of materials or perforating the inner shade for the luminaire to display light patterns. This basic concept idea allows for a significant variation of design direction within this concept. Therefore opening up the possibility of creating a new product line.

Figure 3.16 Sketches of the insides of the lampshade based on IKEA pendant

Production

The mock ups have currently been made using the internal sliding mechanism of the Pendant Light (IKEA, 2014)(also see 3.15 above). This light is based on exploding design rather than just sliding over a vertical axis. Nevertheless the basic principle of the design prevailed and the mock up proved the possibility of the basic design.

However for the actual production it's beneficial to recreate this sliding mechanism out of metal instead of the plastic utilised by IKEA. KV stated that their current metal processing partner is easily capable of producing the slider, making it suitable for the batch of 50 lamps.

Figure 3.17 Mock up of the Slide light

The user in Figure 3.18 depicts the customer using the design when the principle is implemented in a hanging light fixture.

Overall what can be concluded is that in it's current state the visual exterior of the luminaire is not appealing. The working principle however has the potential to be expanded on, and an iterative process over this design feature is profitable.

Figure 3.18 User depicted using the lampshade

CYLINDER SWAY

The following concept direction has also been briefly described and displayed in both sketches as well as mock up model of the idea.

Explanation

The main feature of this design idea was to create a smooth and clean design without much fuss that would suit the more minimalistic customer needs. A black cylinder which contain a subtle slider to alter the location of the spot light it provides.

Figure 3.19 Initial sketches of the cylinder sway lampshade. On the right a possible context is provided for the concept.

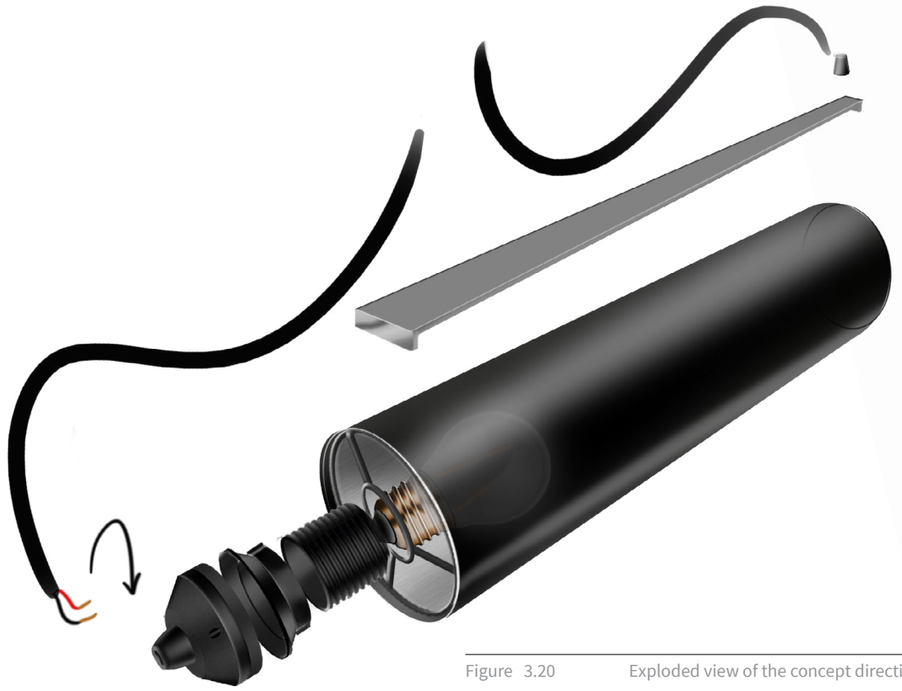


Figure 3.20 Exploded view of the concept direction

Why is this interesting

It started off as just a cylinder that contains a LED strip to suite in most interiors, and not be a statement piece but merely a beautiful luminaire design with a useful function. However when prototyping this particular idea it turned out that LED strips are merely used as backlighting not as a stand alone light source. Thus the design was altered to fit KV's regular retrofit fitting to contain a larger light source. Changing the internal light made it possible for the luminaire to function as a spotlight.

Production

It started off as another textile with PVC inlay design, however the direction changed into possibly using a PVC cylinder, and sandblasting and painting it to get an amazing surface finish and create a far different design from those prior to this one.

Both the electronic components as well as the fitting could still be purchased from the current partner.

To move the cylinder in another angle a clamcleat can be used to both move the luminaire as well anchor it in position and make sure it doesn't fall done when being used.

Figure 3.21 Mock up of the utilisation and size of the cylinder sway light

In earlier sketches there was a exploratory variation done to imagine what would be possible within this concept direction.

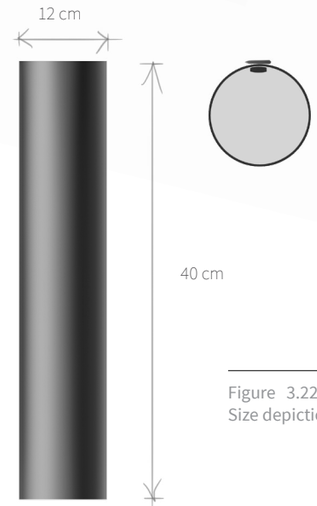


Figure 3.22
Size depiction of the concept

PETAL LIGHT

The following concept direction is not based on a sketch in the initial ideation phase it come forth however from cutting shapes into the material provided by KV.

Explanation

The basic design principle is the idea of creating a single entity which can be used in a variety of ways. By implementing either one or two of the petals the overall look and function of the design changes. Besides exterior changes to the design of the `moving petals have the option of forming a light beam in various directions. While the singular petal can create uplighting or downlighting, and therefore adhere to the needs customer.

Why is this interesting

If you break this concept down to the core it's just a singular petal with almost endless possibilities. The petal could be in a different material, size, colour, with print on pattern, texture, different armatures and even a third petal to create a more closed off diffused light.

Which means that the company can create a rather large new inventory solely based on a single design feature. Or it company could let the customer put together their personal configuration and send the product as a DIY (do it yourself) package.

Figure 3.23 Exploded view depiction of the Petal light design.

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An additional part for this design is a ring with an axis on either side constituting as the hinge on which the petals rotate. (see 3.17 exloded view) This axis ring can be produced by the same previously mentioned metal processing partner.

The material displayed in these basic sketches is the material the company already implements or their current shades. Thus meaning that it fulfils the requirements and regulations set for lampshades.

Production

The petals can be produced using the existing die cutting machine which is currently in the manufacturing facility. The ampshades that the company currently produces require to be cut using the machine. Which also means that KV already owns various sizes of circular die cut knives which can be used for the production of the petals.

In the picture to the right a user is depicted moving the rather large petal light, this is because this sketched is based on the 60 cm petal. A further possibilitiy for this design is a little pulling mechanism could be added to prohibit users from constantly touching the shades, thus preventing dirt or damage.

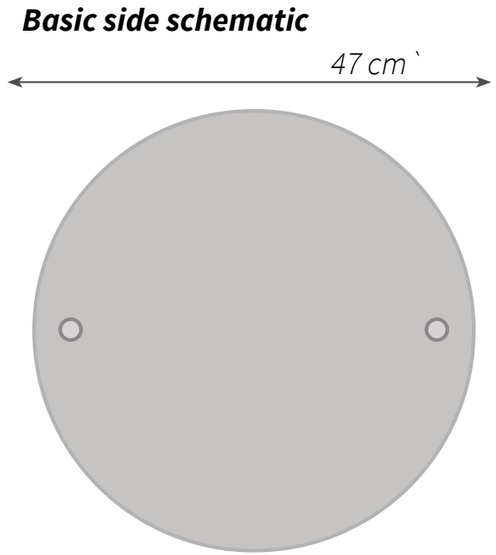


Figure 3.24 Basic size schematic of the petal design. The flat petal also depicts the holes for the axis.

Figure 3.25 Location of Kloosterman Verlichting in Amsterdam

3.4 CONCEPT CHOICE

The final stage of this phase is selecting a concept which to continue with to the next phase and start the embodiment portion of the project. Basic requirements are used to determine the most suitable concept.

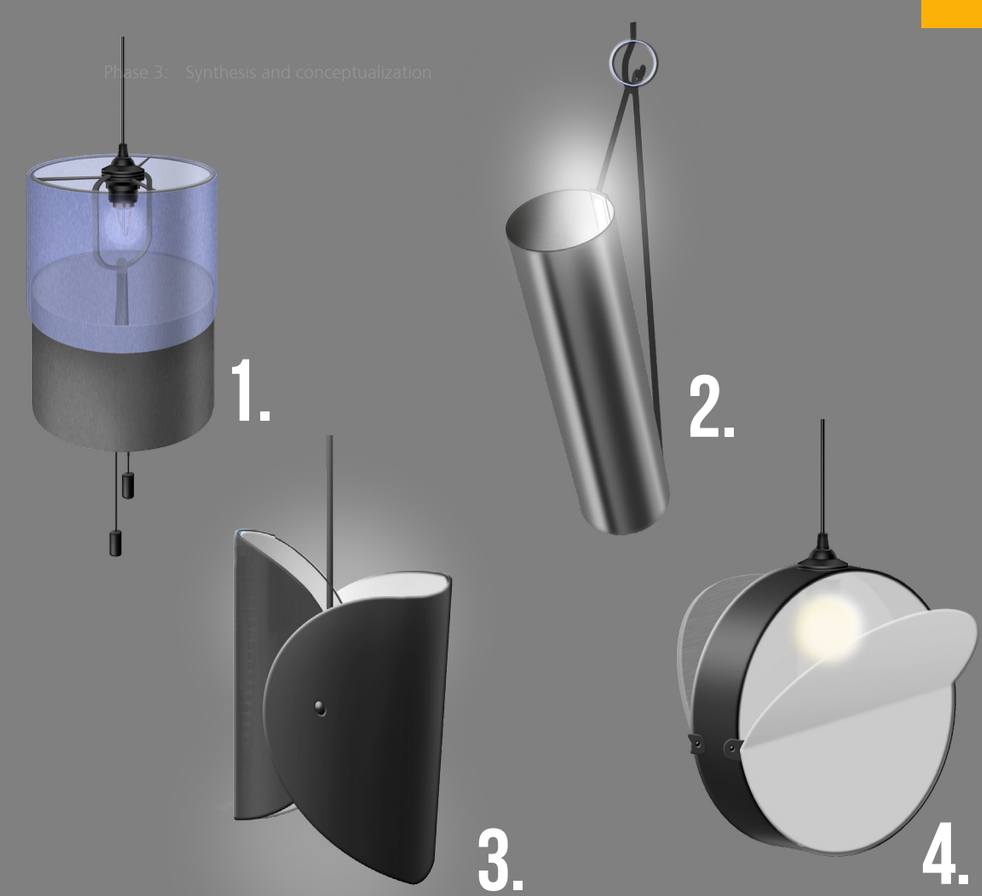
On the next page a brief overview is depicted of the four chosen concept direction. These four concept directions will be compared based on five basic requirements in a Harris Profile (SOURCE, 20XXX)

Before comparing it becomes clear that the four concept are not very 'out of the box' ideas. The reason for this is that in consultation with the desires of the company staying close to home and having a short implementation time was more preferable.

Nevertheless when comparing these concept directions, the third concept, namely Petal light was favourable both according to the requirements as well as the company. The company expressed it's preference which is an additional incentive to continue with this concept direction.

Conclusion

According to the Harris profile in combination with the companies deliberation on the subject the next phase will be conducted with the Petal light concept.



Harris profile	1	2	3	4
Adaptability	+	-	++	+
In house Production	-+	+	++	+
Trend adherence	-	+	-+	+
Cost estimation	-	--	+	+
USP	+	+	+	++

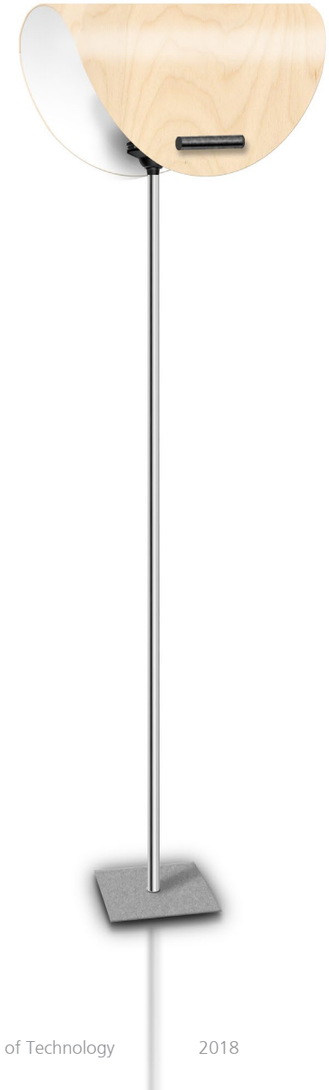
4

PHASE

ELABORATION AND EMBODIMENT

CONTENT

4 ELABORATION AND EMBODIMENT



The following phase gives a more in depth explanation on the specifics of the chosen PetalLight concept. The idea is to show how the product is made, what is it made of and how the product is ultimately used.

Initial depiction shown here are a visual representation of the PetalLight. Further in the chapter renders will show a more accurate depiction of the design.

So what makes the design so fun. Its the idea of a very minimalistic design with a little twist that allows the user to play with the light a little and possibly purchase multiple lamps due to the possible variation of both the singular and the double petal. Which allows the Petal light to be utilised in various scenarios as well and locations and positions.

4.1 TRIAL AND ERROR

To validate initial concept direction various trial and error based mock ups have been made. One of these rudimentary trials started the process which led to the final design proposal, therefore some of the interval trails have been summarized in this section.

The basic principle of this idea was the notion to utilising the manufacturing and/or production options already in the vicinity of KV, thus limiting the need for extensive production costs. As previously mentioned, KV works with a die cutting machines, of which KV holds a rather large inventory of cutting dies.

This meant engaging in the idea of implementing the die cut shapes which are in essence geometric shapes such as circles, squares, rectangles and arches. To improve the three-dimensional thinking of the possible shapes of the new lampshade, circles were cut using existing textiles currently used for lampshades.

Now the idea of the petal light has come in the trial and error or advanced prototyping stage of the design process. Much like Johnny Cash ones quotes; “You build on failure. You use it as a stepping stone. Close the door on the past. You don’t try to forget the mistakes, but you don’t dwell on it.”

Meaning that even though there have been many failed attempts some of them have had a significant impact on the design choices and further development of the overall design.

Initial testing

The important feature for this design is the utilisation of the current punch machine located in the KV facility. Depending on the desired size of the lampshade (40-47-60-80cm) the cutting die can be used.

The initial lampshades made with various circle diameters lacked a significant amount of strength. The petals collapsed and dented when hung on the ceiling. Furthermore the largest size of 80 cm was a good size for a floor model but was too heavy to hang and not fold downwards. (EXPLAIN) (PICTURE

The next batch of shades were produced using the rings normally implemented in the base or in the lid of the current lampshades. Despite adding the strength necessary the weld spot of the rings resulted several times in fracture as well as uneven bends even when utilizing a bending mould. A seen here on the right

▲ Figure 4.26
DIe cut machine in the KV facility.

▶ Figure 4.27
Cutting knifes in various sizes currently used for lampshade covers.

▼ Figure 4.28
Photograph of some of the initial models of the pe

The next batch of mock ups were no longer placed on a screw wire but on smooth axe with added rubber ring (3 x17 mm, washing machine rubbers) to increase the friction on the axe to prevent the petal from moving due to it's weight. The fixed axed on the existing fixture allowed for a trial and error approach to the mock up process of this design direction.

4.2 EXTERIOR VISUAL DESIGN

For the outer layer of the lampshade petal a layer of veneer wood was chosen. This was chosen because it suit's several of the requirements set in chapter 3. (Simplistic, clean, nature and unique selling point). To choose the most suitable and desirable layer of wood, mock ups were done to test the various wood species. As can be seen in Figure 4.29 and described in Appendix A translucency is determined by the material. The amount of translucency of the material determines the overall look of the design. Therefore some of them have been tried.

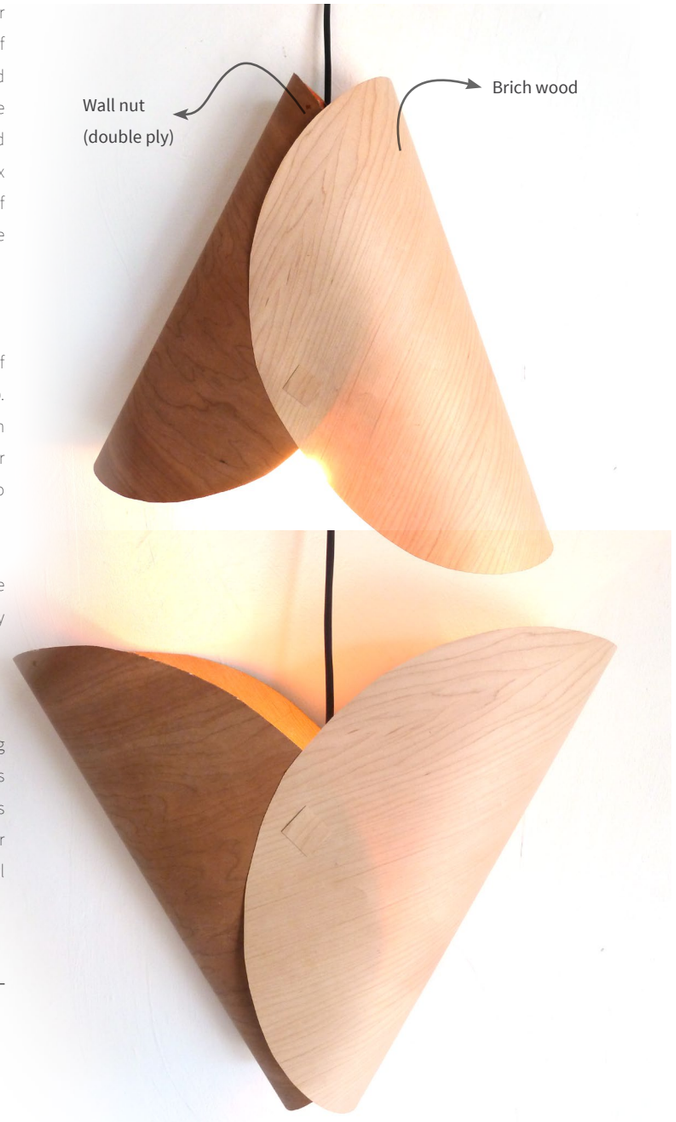
Veneer mock up

For the first wooden version of the lampshades a combination of two different types of veneer wood were applied to the mock up. (see Figure 4.29) The lighter veneer on the right is a flexible birch wood of 0.8 mm which still has some transparency. However the cider wood is of a double plied variety which meant no transparency.

The more flexible and more transparent birch wood was more favourable, due to the easier application and the transparency showed the natural wood grain.

Downsides

However the cut of the wood did result in some splintering along the edges of the circular petal. Furthermore the veneer does not allow for much light reflection on the inside of the shades therefore a lighter inner petal is more preferable for a brighter light source. This inner layer should not interfere with the natural transparency of the wood.



▶ Figure 4.29
Depicting translucency of the veneer wood

▲ Figure 4.30
Depicting the four kinds of veneer wood, birch, Oak, Cherry and wall nut (left to right)

▶ Figure 4.31
Chosen laminated Birch wood with a layer of PVC.

▼ Figure 4.32
Depicting how translucency of a material alters the design of the lampshade

Brich veneer with PVC layer

The secondary veneer lampshade had an inlay of white PVC (XXmm). The initial improvement of the addition of the layer is the fact that the punch press was more capable of cutting through the wood without needing additional cutting or leaving splinters. Furthermore the added layer makes the veneer stronger en more flexible before succumbing to fractures in the grains.

Due to the transparency of the PVC layer the outer birch veneer still contains it's initial transparency. The white colour creates inner reflextion of light which makes the overall light seem brighter and creates a better spot light when altering the position of the petals.

Further advantage of the PVC layer is that it adds a flame retardant layer which is necessary for safety standards.

Figure 4.34
The machine will cut the petals

The third lampshade seen here on the right has an alternative hinge location to hide the inner lamp when moving the direction of the petals . which gives the overall lamp a different overall look and feel. Both of these mock ups have circular petals of 47 cm

ADD PICTURES OF THE 60 cm light

Figure 4.33
The machine will cut the petals

Figure 4.35
The machine will cut the petals

Additional parts and materials

For the model an additional layer of adhesive was used, displayed in the image below. For the rubber friction rings over the axis of the product rubber gasket are used to make sure the petal don't drop due to gravity. The gaskets used in the model were purchased at the GAMMA which made them relatively expensive (0.50 Euro pp.). However they can be purchased in bulk from sites like Amazon.com and Aliexpress.com, (100-1000) for approximately 0.05 pp.

4.3 PRODUCTION

The main production will continue to be in the facility of KV. Utilising as much as the available tools and materials to reduce the initial investment cost and decrease the market implementation time.

Figure 4.36
Role of PVC, which is the inner white later of the Petal.

Combining layers

On the left a roll of 0.4 mm PVC can be seen which was used to be glued on the layer of veneer. The PVC sheet material in impregnated with layer of adhesive, so all that had to be done was remove the protective sheet. Following this the sheet was carefully pressed on the layer of veneer. All of which was done in the dust free room to prohibit dust to be collected in between the layers. However after some usage and flexing the layers start somewhat releasing therefore the PVC will be coated with an additional layer of adhesive to prevent separation.

Die press

Following this the selected size circle was cut by the die press and collected to further in the production

.

Figure 4.37
Die cut machine in the KV facility currently employed for lampshades.

Figure 4.38
The machine will cut the petals

4.4 PRODUCTION

The next step is to create a the necessary equipment and details for the manufacturing of the new design. This section describes the mould for the proper hole placement in the individual petals.

In the Figure below the measurements of a single petal have been displayed (side view shows layers already combined). The chosen distance of the two hinge holes from the sides is 5 cm.

The mould, created from MDF (Medium-density fibreboard) wood, of 60 y 60 cm has a circle laser cut out of it with a diameter of 47 cm. Which corresponds with the size of the petal.

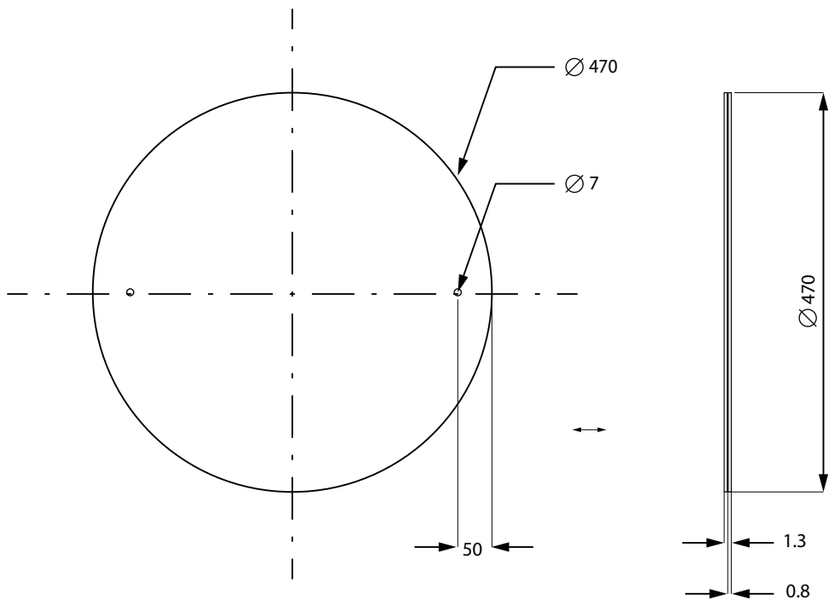
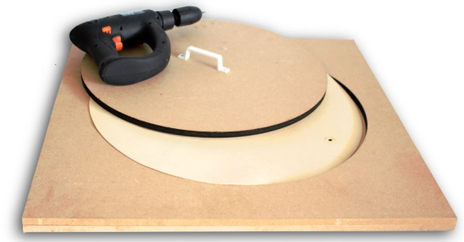


Figure 4.39
Technical drawing of the petal.

Figure 4.41
Build of the mould



The veneer with PVC layered circle is placed in the mould, covered with the lid, held in place and holes are drilled into it. To stop the lid from rotating in the mould its being stopped by two extended blocks that rest again two blocks on the bottom mould half.

When the petal is removed from the mould the edges of the holes need to be sanded own with a 80- to 120-grit sandpaper to remove and prevent splintering.

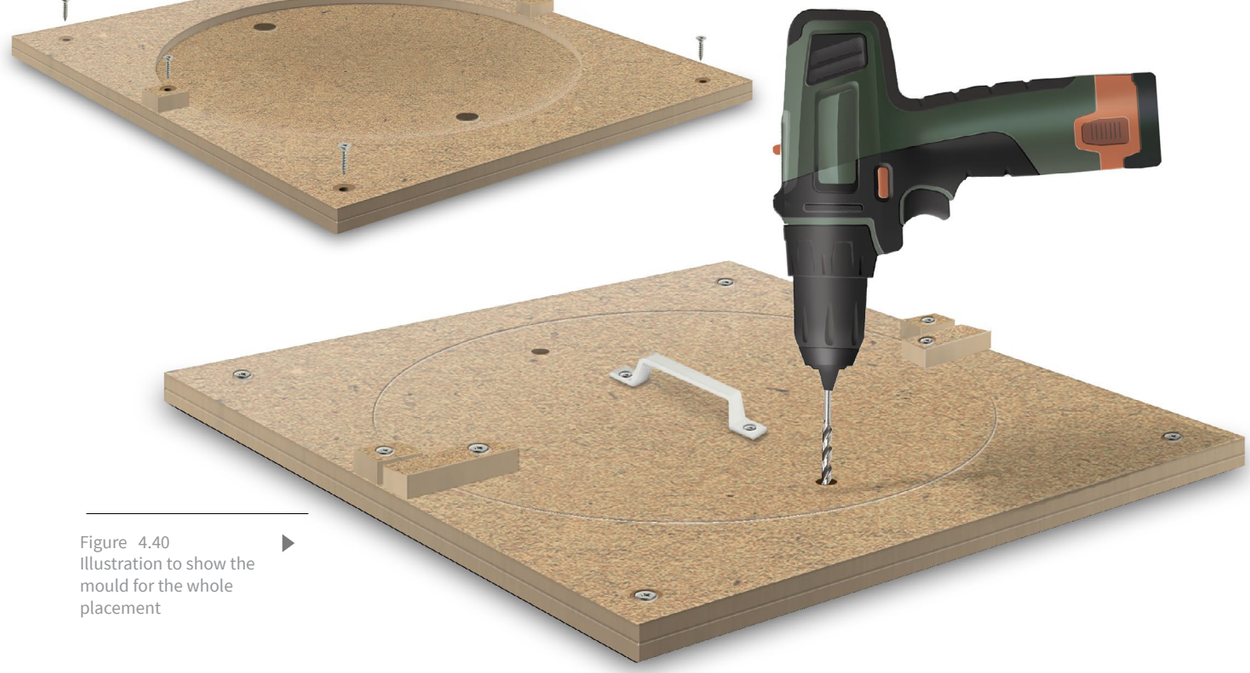
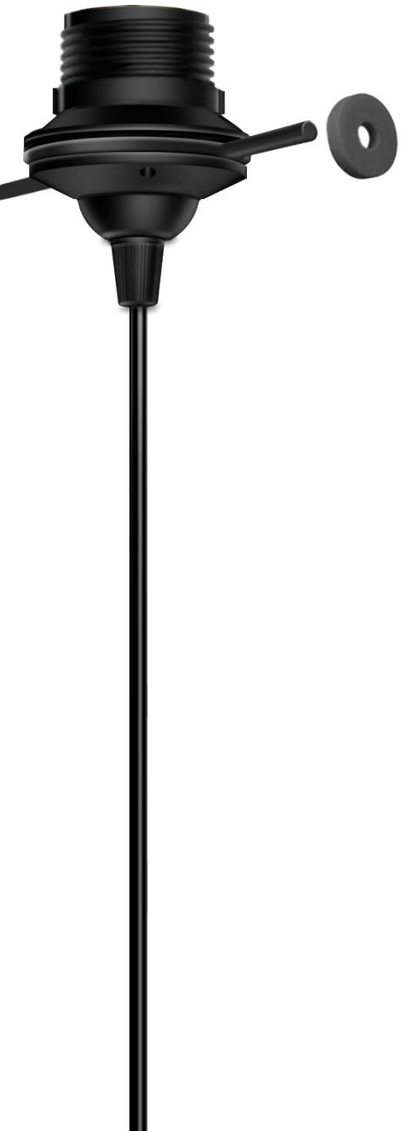


Figure 4.40
Illustration to show the mould for the whole placement

4.5 ROTATION AND HINGES

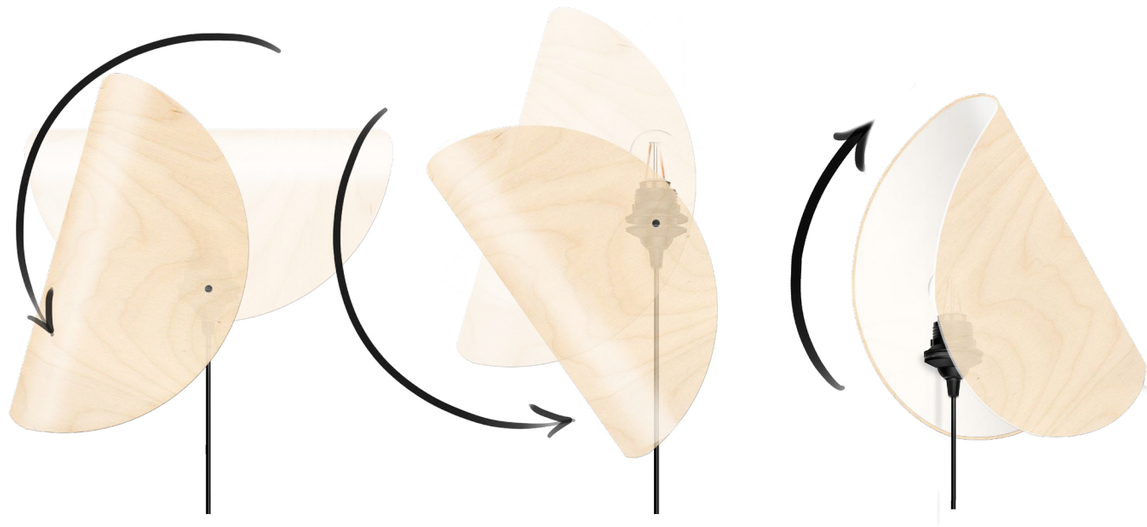


The ring which is visualized in Figure 4. XX depicts the part which gives the Petal Light its movement. The ring rotates around the fixtures vertical axis Figure 4.XX. The axis attached to the sides of the ring serve as horizontal axis for which the petals can rotate over.

Figure 4.42
Illustration to show the location of the rubber gasket over the axis

The ring which is visualized in Figure 4. 41 depicts the part which gives the Petal Light its movement. The ring rotates around the fixtures vertical axis Figure 4.42. The axis attached to the sides of the ring serve as horizontal axis for which the petals can rotate over.

Figure 4.43
Illustration shows the rotation without the hinge feature.



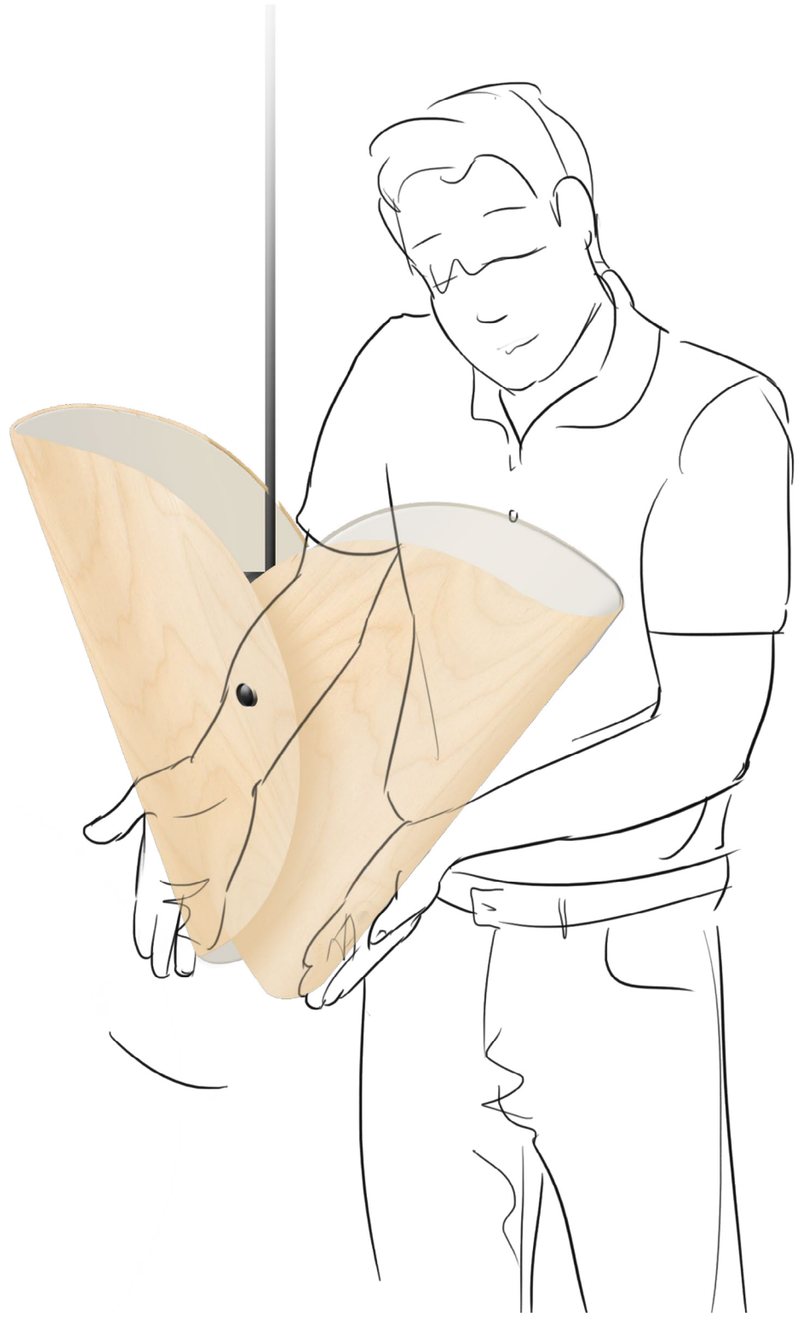
4.6 USER AND USE

The intended user of the final design proposal is a generic customer which means that although the use needs to be explained there are no special requirements attached to the design.

The use of the Petal light will be aided by a user manual, comparable to those visually similar to IKEA manuals. Thus making it easier for customers to install and utilise the product in optimum usage

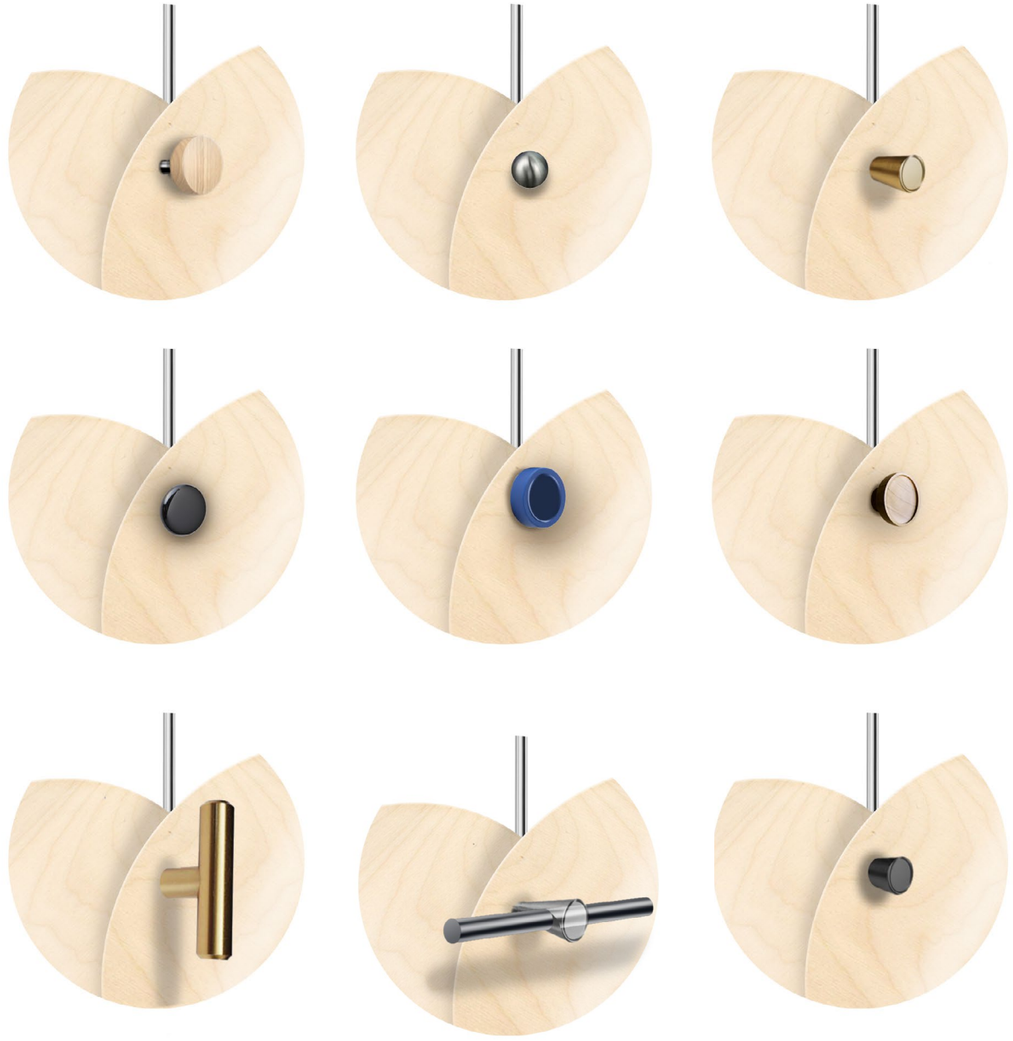
Furthermore the lacking customer service will be less of an issue when users are presented with a users manual. The manual should be available online to obtain when purchasing the product as well as a free download to allow users to get it even when the physical manual is lost.

The basic sketches in the manual shown in the page on the right (To DO) aid the user in both the installation as well as fun position and combinations of use. By adding visual inspiration to the product the user is more inclined to purchase more items.



4.7 HINGE FEATURE DESIGN

For the final feature of the design a knob is added over the axis by adding a screw thread on the end of the ring axis a knob or other rivet can be added.



4.8 DETAILS

These final renders display the assembly and parts for the final proposal. The hinge details are metal rods, painted black and are screwed onto the ends of the metal hinge ring. The other components are standard purchasing parts which are ordered in bulk.

The singular petal in the image below shows how the light is still somewhat covered so the design doesn't give too much glare when looking straight at it.

The design proposal overall is modular and lets KV choose the color of the petals, the size and amount of petal which allows the design to be very versatile as a new product in the inventory

4.9 COST

The final pricing of the design proposal depends on the costs of several aspects of the production and is described in the section below.

Most of the material and part costs can be determined by consulting the company and obtaining current financials for the purchase at current manufacturing partners.

As before mentioned the batch size will be approximately be 50 for the first batch. Which will also influence the initial production costs. Of course when purchasing the materials in bulk will significantly decrease the price.

The pricing system which is used by the company, predefined prices, is based on static variable. The overall prices depend on the number and quality of the value proposition features, meaning the extent of added customized features and the overall batch size of a certain design.

The company has a marginal profit margin of circa 20% because they are the intermediate company that is the distributor to other sales partners who then sell the for an additional margin. Due to the unique nature of the design proposal product and the initial investment cost the margin can be increased.

Costs	Euro/ €
Costs of the parts	
Electronic components	x
Cable	0.40
Stand	eg. 55
PVC	x
Adhesive	x
Rubber gasket (0.05 pp)	0.20
Veneer wood (Depending on species) (28 euro/ m2)	14
Hinge feature (TBD)	3.50
	X
Production costs	
Labour costs and production	X
Distribution	X
Total amount	X

5

PHASE

VALIDATION AND EVALUATION

	CONTENT	PAGE
x	Design proposal evaluation	x
x	Recommendations and discussion	x
x	Personal reflection	x

5 EVALUATION AND VALIDATION

The final section of this report is devoted to the evaluation of this design proposal. Including, what went well, what could have been done better and the possible next steps for the future

5.1 DESIGN PROPOSAL EVALUATION

After the initial analysis in phase 2 several criteria had been isolated and used to assess the ideation stage and the concept phase. These criteria are also the benchmarks for whether or not this design proposal is valid and is suitable for the assignment as well and the company.

Cost effective investment

The initial investment cost need to be cost effective. In phase 4 the retail price per luminaire had been assessed, however the total investment necessary for the initial batch of 50 need to be established. A calculation is required to determine the investment and the return of the first batch.

Adaptability/ diffusion

For this design proposal it was set that the luminaire could alter the diffusion in a living environment. The use of the luminaire and the effect is had on the surrounding environment can be documented and assessed. This can be done for both the singular as well as the double Petal light. By placing the finished prototype in several different positions and locations the effect can be visually observed and judged.

In house production

The product needs to be producible and assembled within the compound of KV. This means obtaining the necessary parts for a lamp and producing it. Whereby also establishing the total production time which can be taken into account into the retail price of the product.

These aspects of the design proposal will be assessed in the final stage of this project.


A

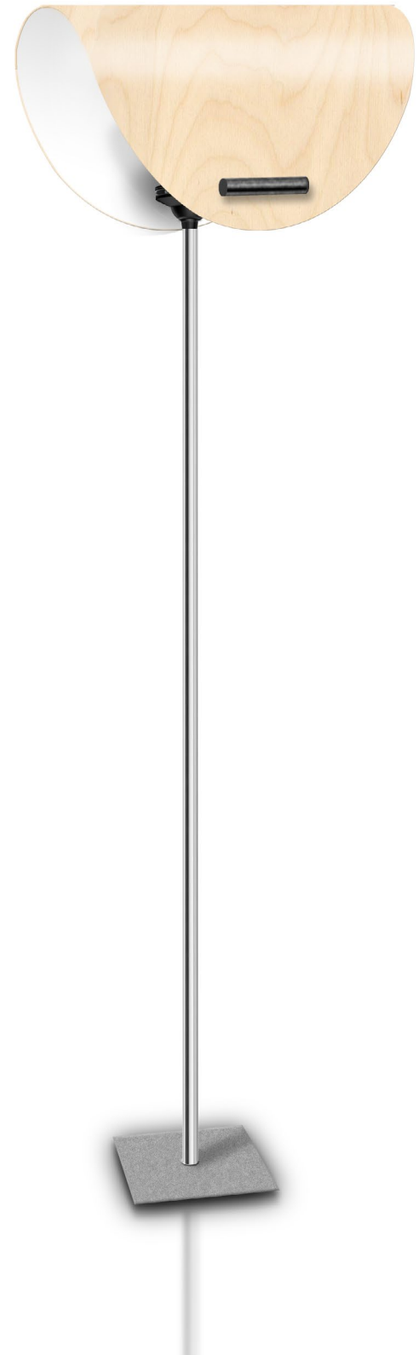
5.2 RECOMMENDATIONS

The end of this thesis project does not necessarily mean the end of this design proposal. If this idea does prevail and continue, what would be the logical next step. The following section described those aspects that haven't been assessed during the project or are interesting features to do in the future.

Of course the main next step will be to make to design proposal fully market and sales ready. This requires some testing. Overall the product can be produced because very few things need to be purchased or manufactured before it can be assembled in the facility of KV.

The design is currently been created to be implemented on the existing lamp armature already available in KV's inventory, however when the Petal light is successful a unique armature or fixture could be implemented to add to the uniqueness of the design.

Furthermore, a lot of experimenting can be done by utilising the laser cutter as a tool for adding patterns and texture to overall design of the lampshade .



Production

One of the things, as previously mention (in production Chapter 4.5), the adhesive currently provided by the purchased PVC is not strong enough in its properties to fulfil the needs required. Currently a clear spray on adhesive (GIVE GAMMA LINK) has been used to ensure a permanent bonding between the individual layers. However it is necessary to test a glue which may be less flammable or has more flexible properties to ensure the best outcome.

Currently the outer veneer layer is uncoated, however to improve the quality of life for the design it should be. The Petal light is a product which will be placed in a living room setting where people touch and use it. Therefore the possibility of damaging or staining the product would be prevented as much as possible by adding a protective layer which is cleaned easier. Which means that another important step will be to select the perfect matt coating.

Branding

To create brand awareness and customer interest a logo, slogan or graphics should be created. This will attract more people. Currently KV is already under going some branding changes. They have changed their name to 'lou lou lights' to appeal to a younger audience and get new cliental. However to keep the unique selling point my advice is to make this brand a standalone in order to not deduct from the uniqueness of the product. When it turn out that the initial batch is successful various of the other petal design implementation can be tested and iterated to create a Petal series. If it turns out multiple of the Petal light have success on the market it would be possible to establish a brand name and possibly start promoting the brand on platforms such as social media.

5.3 PERSONAL REFLECTION

The final section of this report is a personal refection by evaluating the whole project from my personal perspective. These insights reflect on the project and the overall process.

Project.

Initially the assignment started off with great dedication from my part due to a need to prove to myself and maybe also others of my own skills. The project was set up in such a manner that I personally felt I could put a lot of design freedom into it as well as an interesting spin. In the beginning, the company was very open to this. However, quick into the process it turnout out that the possible design space was narrower than initially anticipated. That in itself is of course not an issue but slowed my personal enthusiasm down. In every project as well as this one I start strong but slowly stagnate into the process. Luckily when the marketing analyses was over it allowed me to enter in a phase which I am more font off. Resulting in many fun sketches and multiple afternoons off arts and crafts.

Amsterdam

The location of the company and its facilities are very beautiful and has allowed me to do a lot of rapid prototyping due to the available machinery and materials. Nevertheless the unfortunate part was the distance between my home and the company which meant a lot of traveling. Furthermore the location of the company is mostly assessable by car, which meant having to borrow or rent one for most of the journeys. Despite the fact that I love driving, this became a bit of a hassle for me and resulted in a reluctance to go often. This is one of the main things I regret during the course of this project because the hours have spent discussing ideas and making things have been very enjoyable.

Learning experience

Much like everyone around me foretold is that graduation is a learning experience but is mostly getting to know yourself. Depending on the way you look at it, I have had the good (or maybe not) fortune of knowing myself a little too well and went into the project with the knowledge that my stagnating, my unwillingness to finish, my endless perfectionism and undermining my own skills would come knocking at the door as soon as the project started. Luckily, I had Stephanie by my side who, no matter how unwilling I was knew how to motivate me and get me through the difficult stages.

What I have always known is that I need strict deadline for any project. Give me a day and I will do it in one, give me a month and I procrastinate as long as possible until I can't anymore. This does give me an amazing deadline rush in wish I can achieve a significant amount of work in a very short amount of time. However this isn't feasible in the long run or in future job prospects.

Project management

As previously stated I started off well, got lost in the middle and I am going to cross the finish line with a solid project. Another one of my lacking skills is the ability of communication. Though if asked I will send my work, however seeing that this project is self-managing, I often forgot to keep my team and company posted on my progress. Nevertheless the end result is going to be a beautiful book that does represent some of the skills I have required over the past years during my student years in industrial design. Luckily my communication skills when it comes to drawing, designing and graphic are actually pretty decent.

Result

The project may not have been what it ought to be nor what I anticipated it would be, it does however put a bitter sweet cherry on top of the cake that is my student days.

6 REFERENCES

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7

EXTRA

APPENDIX

CONTENT

A APPENDIX
ANALYSES EXTENDED
INTERNAL

6.1 BUSINESS MODEL CANVAS BASIS

To make the internal analysis understandable while describing all of it's complexities, a business model canvas (BMC) analysis is conducted to create a clear picture. The business model is described through nine basic building blocks, which shows the underlying strategy of the company.

The BMC method has been used to do a internal analysis of the company.

Customer Segment; describing the customer focus and therefore the most important customers and whom the value is created for.

Value proposition; describing what value is delivered to the customer, what problems are solved and which needs are satisfied.

Channels; describing through which channels the customers should be reached and how to reach them.

Customer relationships; describing what type of customer relationship is established and how to maintain them.

Revenue streams; describing for what value is currently being paid and how each revenue stream contributes to the overall revenues.

Key resources; describing the various key resources of the company.

Key activities; describing the various key activities of the company.

Key partnerships; describing the key suppliers, which key resources are required from these partners and which key activities do they perform.

Cost structure; describing the most important costs inherent to the business model.

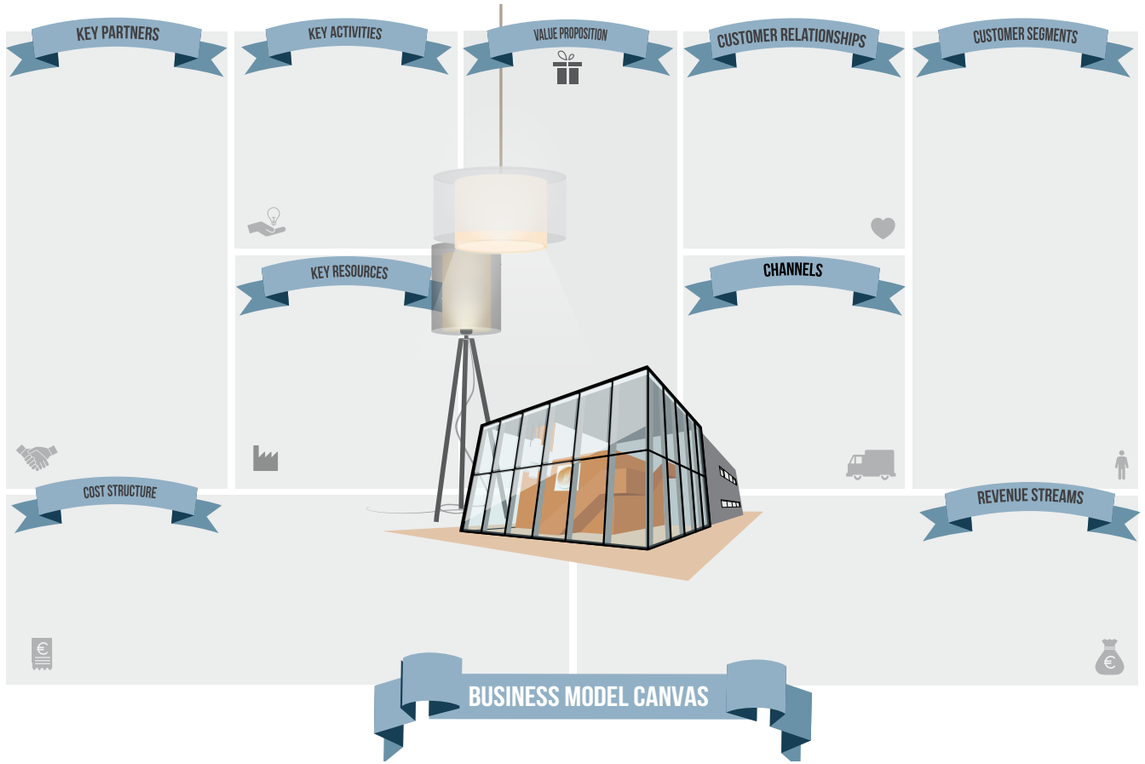


Figure 6.44 Empty business model canvas to be filled with the conclusions from the internal analysis

6.2 SUSTAINABLE SIDE

Current Value Proposition is based on what is previously written in the assessment of the sustainable business model in the previous sub chapter. The reason for establishing the destroyed value, missed value and value creation is to optimize the current SBM. The current SBM is an offer-driven innovation business model, which means that new value propositions affect the other business model blocks.

Destroyed value:
Current usage of PVC coating in the linen of the lamp shades which has a high environmental impact. Despite also advertising Eco- linen.
Low batch size means high costs and high depletion of renewable.
Significant environmental damage due to current excessive packaging material.

Missed value:
Underutilized assets such as the unexploited benefit of using the current slogan: 'Handmade in Holland'.
Underutilized assets of their partners and resources as being local which are not communicated to the end-users.
Waste streams due to non recyclable components and the impossibility of this assembly.
Failure to capture the value of the family business, which remains almost unmentioned despite being named once on the website.
The missing brand identity and strategy leads to no brand awareness and therefore no brand loyalty.

Opportunities for new value creation
Exploiting the handmade in Holland will significantly increase the value proposition of the overall model because it aids all three P's in the triple bottom line (people, planet, profit).

People
Exploiting loyalty between stakeholders (suppliers, manufacturers and sales partners) and extend this towards the value proposition of being a family business. Which refers to people in the 3-P bottom line, which is the main value of the value proposition.

Planet
Because the current production, distribution and sale is located within the Netherlands, the environmental damage of KV is relatively small compared to international production and sales. Radical transparency about environmental and social impact will improve the overall value proposition.

Another option would be to design for longevity, meaning to extend the current lifespan of the product by disconnecting it from styling trends or hypes in home interior design.

Decreasing the environmental impact of the material usage in the new design will aid in the negative impact of the wasteful use of current materials. (PVC + combination of several materials) Ultimately to maximize material use and energy efficiency by e.g. de materialization of packaging, low carbon solutions and lean manufacturing. Possibly creating a circular life cycle compared to the current linear life cycle could improve the environmental impact and satisfy overall customer needs for sustainable products. Which aids in closing the resource loop.

Profit
Exploiting the low batch size by creating a more premium branding and therefore limited availability. The scarceness of a product could increase the desire to purchase it. Due to this premiumization the product pricing of KV could make a shift from the low-middle segment to a more middle-high pricing segment.

Exploiting the sustainable aspect of the new product could open up a whole new customer segment in which customers are willing to spend more money on durable or sustainable product because of the eco-value.

Outsourcing the assembly by creating a DIY-product which a consumer can assemble after they purchase the product which adheres to the current trend of DIY.

KEY PARTNERS

Manufacturing partners

.metal processing
.woodworking
.laser cutting
.electronical components

Secondairy sales partners

KEY ACTIVITIES

Product regularity of six times per year, including updating of the current product line and renewing the catalogue.`

Entire product design cycle, design of a product, obtaining necessary parts from partners to assembly and distribution to the secondary sales partners.

Outsourcing manufacturig of parts and sales through secondairy partners

KEY RESOURCES

Small scale business of five employees with manufacturing facility, includes;

.R&D department
.Dustproof room
.Production machines
.Assembly station
.Packaging station
.Transport vehicles

VALUE PROPOSITION

Design simplicity allows for implemention in various interior decoration styles

Customization of products creates lights according to specific customer needs.

The **Slogan "Handmade in Holland"** refers to the Amsterdam based production

Eco designs add value by adhering to the customers desires for eco friendly products.

CUSTOMER RELATIONSHIPS

Self-service based system, the company maintains no direct relationships with its customer.

Co-creation provides customers access to **customized** services.

Personalization for individual customer needs including cost estimates.

CHANNELS

Indirect sale to several through **intermediate businesses**, e.g. furniture stores, websales, wholesalers and lichting exhibitions in the Netherlands.

Small batch sizes and relatively fast changing designs, indicate **cost efficient** model**.**

No direct sales, either through a website or instore.

CUSTOMER SEGMENTS

Mass market for lightning products with customers with broadly similar needs

The lighting products creates atmosphere and ambience in **home interiors** or the more casual offices

The rudimentary "form follows function" designs creates a **achetype- like** style of products

COST STRUCTURE

The pricing system are **predefined prices** based on static variables. Depending the extent of added customized features and overall batch size.

RESEARCH & DESIGN
MARKETING
PRODUCTION
DISTRIBUTION
MAINTENANCE

REVENUE STREAMS

BUSINESS MODEL CANVAS

kloosterman VERLICHTING

Figure 6.45 Business model canvas analysis summary overview

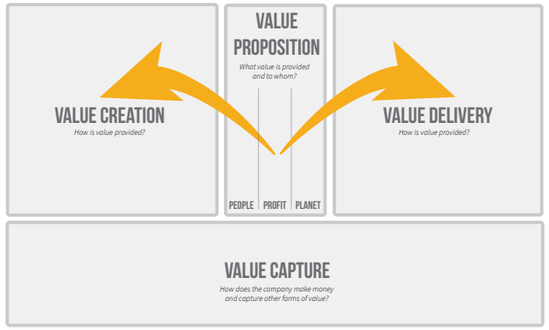


Figure 6.46 Business model is set up to add value to the cusstomers by means of value proposition

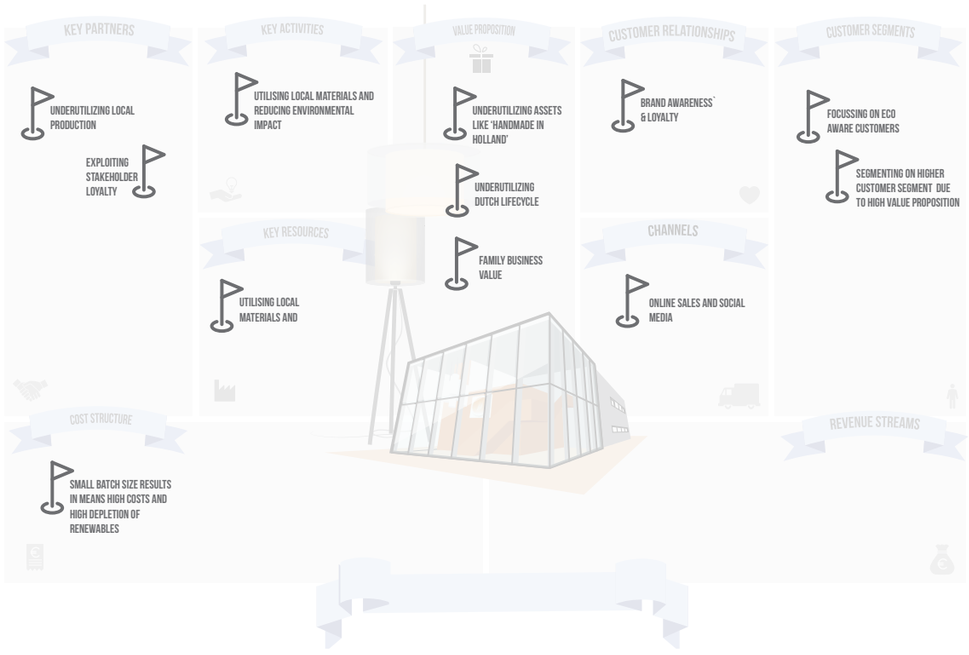


Figure 6.47 Possible design implications found through the BMC method

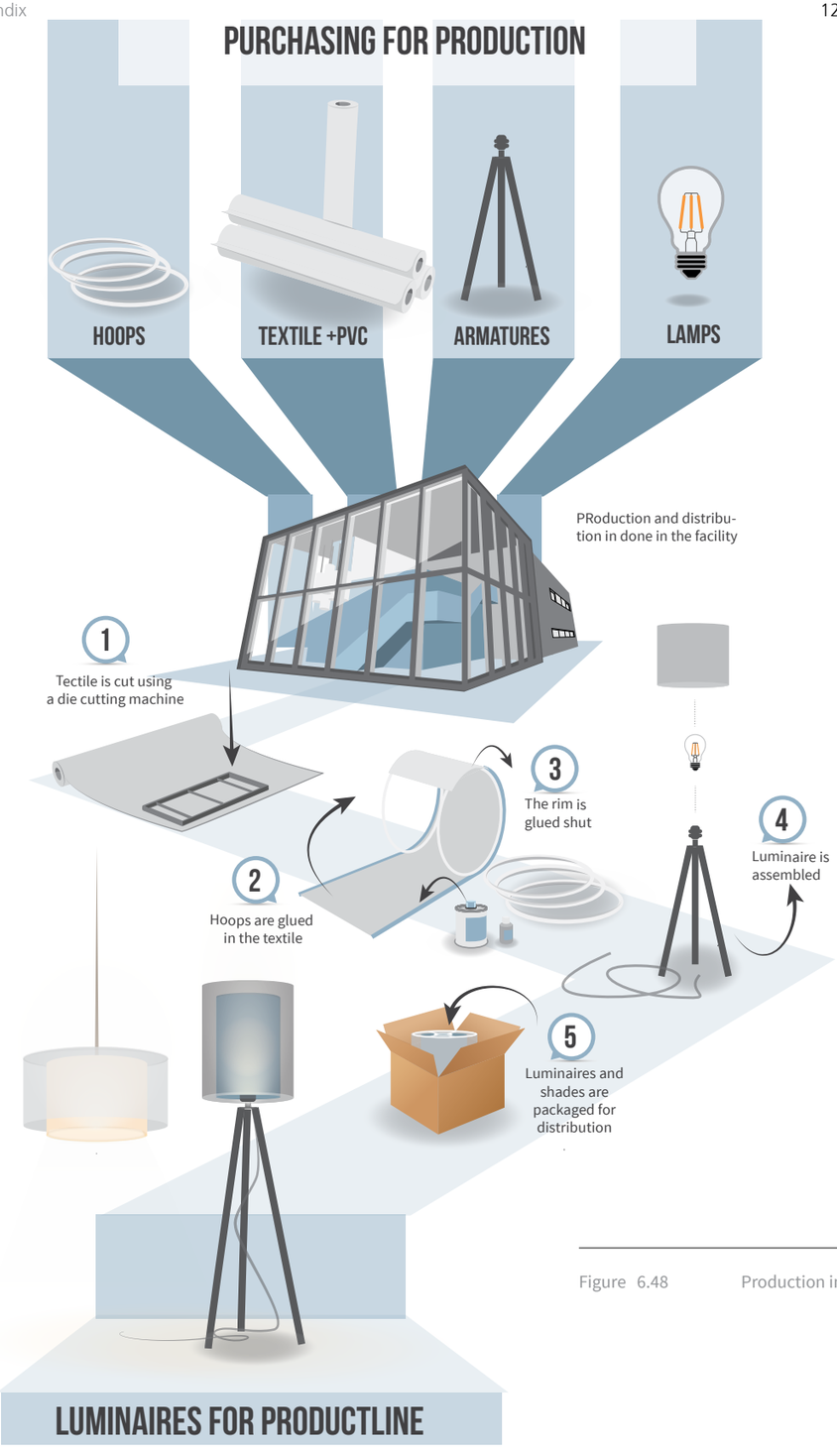


Figure 6.48 Production image

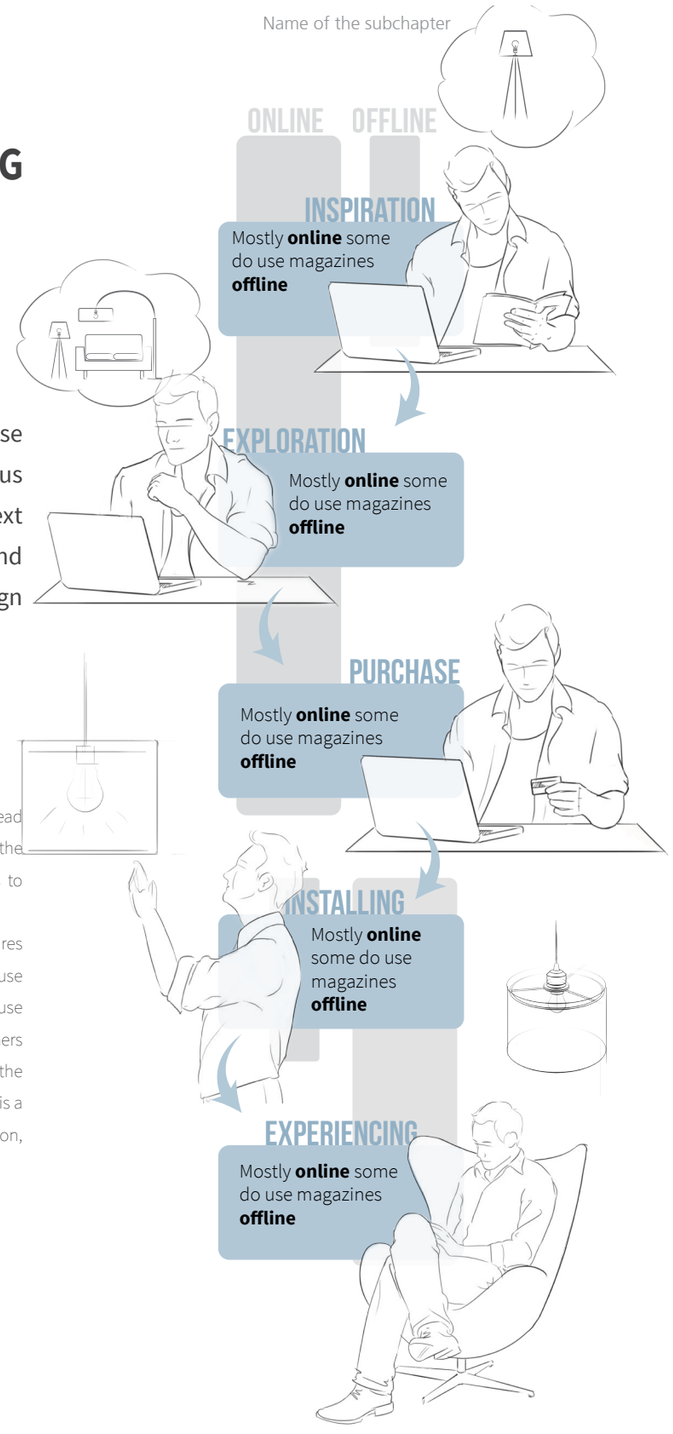
6.3 ONLINE BUYING BEHAVIOUR

Current and future customers of KV purchase their products online through various secondary sales partners. Therefore the next section explores their thought process and what could be useful for the final design proposal.

The online buying behaviour in lighting

A presentation given by Didier Zegers who is the Director, Head of Digital, Philips Benelux explained and explored the about the dynamics, trends and consumer behaviour when it comes to online buyer of lights and luminairs.

According to his research customers are purchasing luminaires they fit the styles of their fixtures to both the style of the house as well as the style of the people in the house. However, because most homes have multiple people residing in them, customers might have to deal with contradictorily opinions during the purchasing process. The overall online purchasing behaviour is a circular approach; inspiration, exploration, purchase, installation, and experience.



Inspiration

"Imaging the new home interior, and understanding the light options"

This stage is a subconscious process where customers collect impressions and thus inspiration consult various mediums such as magazines, the internet, and lifestyle TV-programs. Despite the fact that customers purchase their luminaire online, there is a significant importance of offline inspiration. In 2013, up to 53% of all customers start their buying process online.

Exploration

"Exploring relevant options in lighting solutions and where to buy them"

This stage is about narrowing down choices and selecting lighting options. There is a significant importance in assets such as imagery, videos, comparison tables, and product descriptions. All of which are tools to aid the decision process. During this stage the online customer will consult reviews and ratings of prior customers. Besides this, customers also gather information on the technical aspects their luminaires in products and manufacturing specifications.

Purchase

"Making the choice"

Pricing`

Online vs offline content consistency

◀ Figure 6.49
Summary and depiction of the online purchasing journey

Installing

"Fitting the lighting products in the new interior"

The installations stage is offline, nevertheless possibly supported by online tutorials and manuals. Here the customer installs their lighting and enters it in their current interior. Most people nowadays install their own lights, handyman or electricians have become redundant and are no longer necessary.

Experiencing

"Finalizing the new home interior and experiencing the lighting over time"

For the final stage off the luminaire purchase journey the customer will most likely refrain from using the internet unless it concerns e.g. warranty, maintenance and repair, personal reviews, and personal rating. In the end all that remains is enjoying the purchase.

Design implications

Inspiration. It's important for customers to see the product in possible interior setting therefore interior context needs to be provided.

Provide context. Displaying various utilisation options could persuade the customer towards purchasing the item.

Available resources. Current sales partners such as Trendhopper should provide the customer with links to possible videos of the lamp being installed.

6.4 LIGHT + BUILDING MESSE FRANKFURT EXHIBITION

The global lighting industry is a vast and growing industry which makes it hard to get a clear overview of the entire network of technologies, trends, and current solutions. Therefore, to get a first hand opportunity to increase the knowledge for this project, visiting the world trade fair for lighting and building services technologies was the best option. The Light + Building exhibition centre in Frankfurt houses the 2,700 exhibitioners. It's the worlds' leading trade fair for innovation, covering all electronically based building service systems. Furthermore, it's goal is to promote to show everything from LED and photovoltaic technology to electric vehicle, 'intelligent' ways of using electricity in smart systems. It's lighting product segment represents the total spectrum in it's exhibit's including; designer luminaires in various styles, technical luminaires and lamps in various forms and technical uses.

Lighting trends

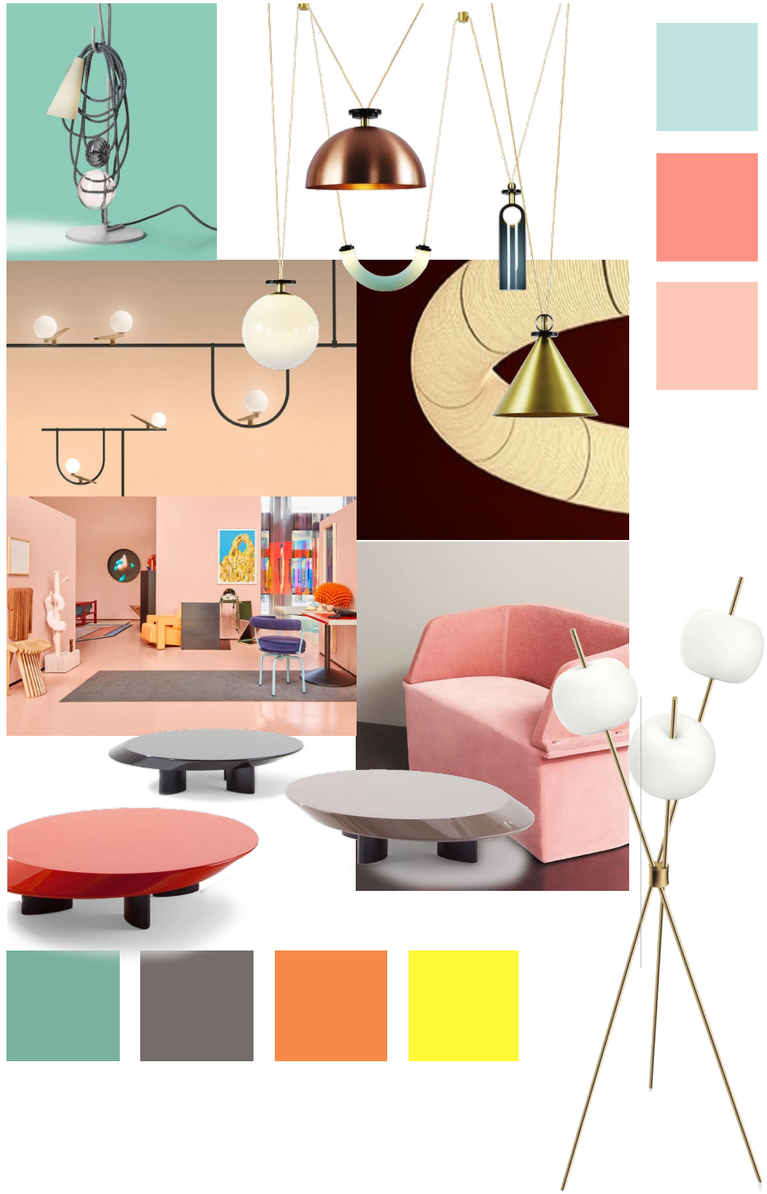
Visiting Light + Building resulted in a trend analysis of current developments in the area of decorative interior lighting in four themes, and provide manufactures, retailers and designers with a details overview of these trends. The continuous of LED technology has meant a significant increase in possibilities of luminaires. This area of decorative illumination with light as a material is increasingly becoming the core focus of lighting designers. Which means that 'form follows function' has become a strong recurring design theme.

The four themes are depicted on the followig spreadwith mood maps of each trend.

Evoke emotions

"The evocation of mood and sense of well-being"

This design trend originates from the angle of development process which investigates the utilization of experimental and innovative materials, and their resulting benefit's and effects. Recreating natural light, reflections, movements, and shadows in a room are meant to represent a combination of feeling and functionality. In this trend, emotional perception of light forms the fundamental idea of many designs. New experimental material developments allow for the production of materials witch calibrated optical effects using ultrathin films, iridescent, or metallised membranes and mirror effects. Furthermore, a deviation in transparency, diffusion and opalescence are very interesting for this project considering it's focus on light diffusion alteration.



Imagine mutations

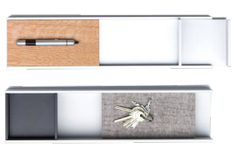
"The notion of divergence and modification"

Designers in this trend infuse their ideas with transformation, metamorphosis and change of shape within luminaire design. This alteration and modification gives designers the possibility of large variations in functions and interior of designs. As quoted, "Anomalies and peculiarities take centre stage", resulting in an expressive design language with a more conceptual design integration elements. Alteration between texture and patterns, and contrasting materials gives exaggerated effect on shape, colour and patterns. Intertwining these exterior details result in a distorted or deformed exterior.

Revive homeliness

"Breathing life into simplicity"

This trend resorts back to simplistic designs for creating innovative new concepts of smart living, whilst preserving traditional values. Overall the style radiates both modern as well as traditional features, creating a careful balance between two contradictive designs. Furthermore, this theme quotes "a contemporary flair as well as a sort of revival of tradition". The materials are simple, understated, but are a strong feature of each design.



Create history

"Stimulating a feeling of nostalgia"

Historical quotations and decorative aspects meet ultra-contemporary designs in this trend. Technical advanced luminaires are decorated with dramatic features borrowed from the classics. The main purpose is creating innovative and highly functional luminaires, and therefore creating ´history´ by utilizing design features of products that stood the test time.

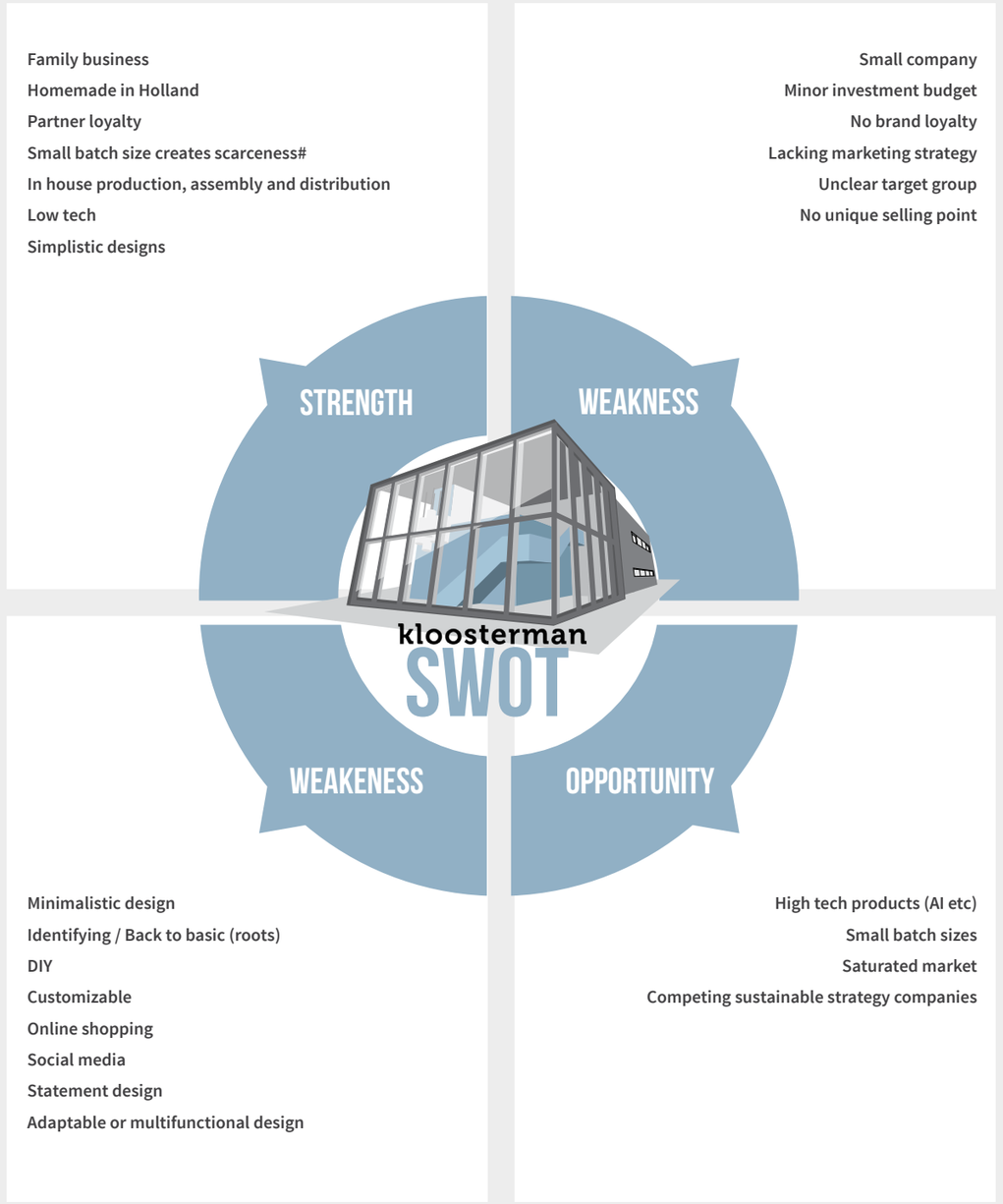
Design implications:

6.5 SWOT

After conducting a throughout internal and external analysis, the goal is to determine directions for new product developments. This systematic analysis of the company's current position in it's business context in the market will give a strategic focus for the upcoming steps in the ideation.

The SWOT is an inventory of the company's strengths and weaknesses, and valuates them by benchmarking them against competitors. The main focus here lies with it's strengths and main competences, and with a decreased focus on the weaknesses. Weaknesses however do need to be pinpointed in order to address possible setbacks.

The SWOT depicted in the Figure on the right, gives a summary of the overall findings to allow for clear communication of the possible new directions.



6.6 SEARCH AREA

The following section describes the search area method which aids in finding the new business opportunities for the development of new product ideas. The insides are based on the previous SWOT analysis which was derived from the prior analysis.

The search area matrix with it's relevant combinations can be seen depicted in Figure on the right In which, the strengths and opportunities are crossed to generate search areas. The areas most promising to this project are selected based on the promise of increased market size and growth of the current business. In the end resulting in a design brief based on these most promising search areas.

To determine which search areas lead to the best opportunities and greatest weaknesses, each of the SWOT factors is rated with the numbers 5, 3, or 1. Cross referencing these numbers will locate the highest and lowest rated search areas, and subsequently find the previously mentioned opportunity and weakness outliers.

SEARCH AREA MATRIX

OPPERTUNITIES		LR	VALUE	INTERNAL STRENGTH: Family business	Homemade in Holland	Partner loyalty	Small batch size	In house production	Low tech	Simplistic designs
				1	2	3	4	5	6	7
				1	3	1	3	5	5	5
Minimalistic design	A	5		6	8	6	8	10	10	10
Adaptable	B	5		6	8	6	8	10	10	10
Identifying / Back to basic (roots)	C	1		2	4	2	4	6	6	6
DIY	D	1		2	4	2	4	6	6	6
Statement design	E	3		4	6	4	6	8	8	8
Customizable	F	3		4	6	4	6	8	8	8
Online shopping	G	1		2	4	2	4	6	6	6
Social media	H	1		2	4	2	4	6	6	6
multifunctional design	I	5		6	8	6	8	10	10	10
Handmade design	J	3		4	6	4	6	8	8	8
Green living	K	1		2	4	2	4	6	6	6
Sustainable design	L	3		4	6	4	6	8	8	8
Interaction designs	M	1		2	4	2	4	6	6	6

A5	A6	A7
B5	B6	B7
I5	I6	I7

6.7 GLOBAL LIGHTING MARKET

To gain insight in the current market climate and possible opportunities a external market analysis was executed. Establishing the current market position will determine possible threats and opportunities for KV as well as it's stakeholders.

Several reports predict a continuous growth in revenue in the lighting industry with an estimated 3 percent annually and global revenues surpassing $130 billion in 2020. Nevertheless, despite overall growth the dynamics within the lighting market is shifting. For this project the focus will be on one of the three major categories within the industry; General lighting. The picture 6.49 will shows the other 2 categories and their comprising key segments. This market segment includes four segments lamps, electronics, service and professional, and consumer lights which includes household luminaires (the piece of equipment that combines the fixture and the electronics to create a singular usable end product.

ADD PICTURE

One of the main reasons for the fundamental shift towards LED is that it's considerably more energy efficient compared to previous technologies. LED is now four or five times more energy efficient than conventional technologies (e.g. Halogen and CFL). Which is fundamental because 50 percent of the total cost of lighting comes from energy consumption. Despite the fact that LED lighting is currently still more expensive than conventional lighting the prediction is that the price will continue to decrease in the coming years (€ 6 in 2014 to €3 in 2020).

Secondly the versatility of LED is incomparable with the other technologies. The large variety of colours in combination with the relatively smaller size of the LEDs allows then to be implemented in creative ways. Furthermore the LED lamps are expected to have a 15 year life span which is about four times more than the average CFL and ten times more than incandescent lighting.

The revenue distribution is shown in Picture 6.49 which shows that the largest section of the value chain is attributed to luminaires with a total of roughly 65 percent. For this project we are looking at the developed markets of Europe with approximately $5 billion a year in luminaires on the global lighting market.

Interestingly enough there is a predicted rise in LED luminaires for 2020. This means that in combination with current design trends there is a opportunity for KV to increase their current revenue by responding to this need. The trends analyses in combination with the companies strength could aid KV in finding there place in the market. However having previously enclosed that they are not interested in the connectivity could reduse their chances in the overal martker.

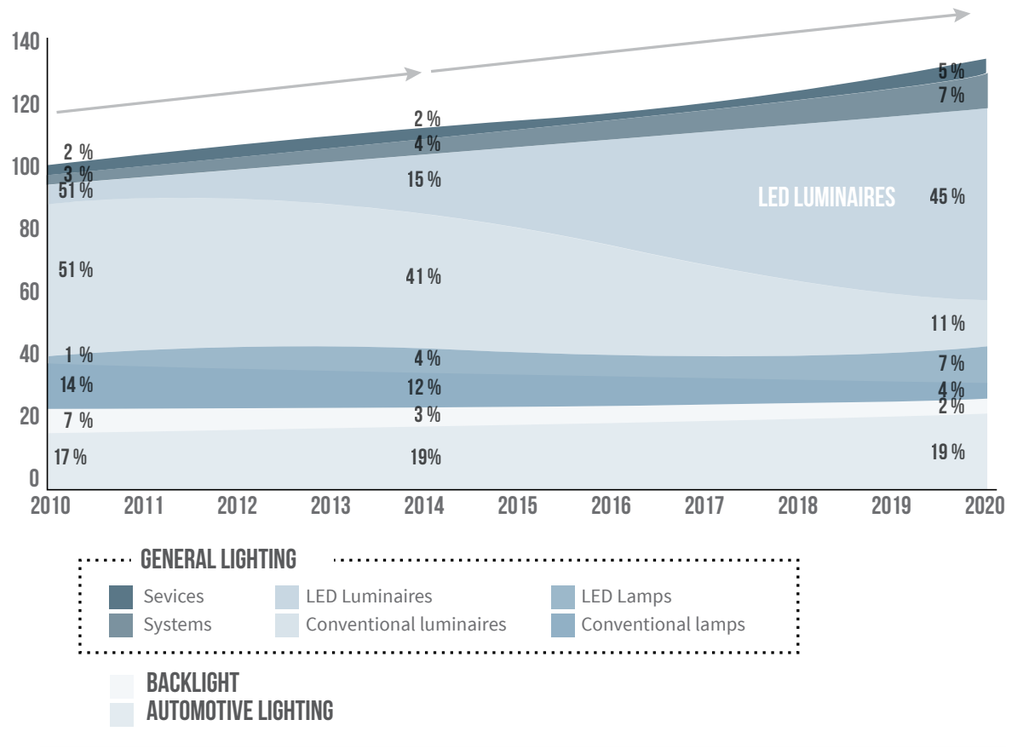


Figure 6.50 Global lighting market revenue distribution

6.8 LIGHTS

The project assignment is to create an overall design proposal for KV. However designing with light is not just the exterior but also the light it'self. Functionality of lighting with the possibility of altering the light source or it's diffusion. The overall design proposal is based out of three main features: The LED light, the fixture or retrofit, and the lamp shade.

In light science a distinction has been made between diffuse light, directional light and indirect light. As previously stated the focus of this design project lies with the diffusion of the light source. However it's important to understand the distinction. Light from a bare lamp needs to be directed efficiently to where it's needed and screened to prehibit possible glare.

Directional light

The light from directional lighting usually originates form a narrow beam an reaches an object directly. Important with this light is that it casts high contracts and bright highlights thus it has the possibility of enhancing the details of the surrounding objects. To reduce this intensity a secondary light source is used to balance the main beams intensity. Backlighting can be used to add light from different directions and reveal contours of close by objects.

Diffuse light.

This light constitutes light which reaches an object from several directions and therefore producing scarcely any shadow. Modeling effects (such as contouring and highlighting objects) is much less pronounced and with completely diffused light it's completely absent. The light creates a monotonous and duff effect in the surrounding area.

Indirect light

Indirect light can be achieved by utilizing surfaces to reflect light of off to reach the designated area. When these surfaces are not glossy or matt the light reflected is mostly diffused in nature.

When lighting interiors it's important to understand the possible light distribution and the effect it has on the surrounding objects. A combination of the light intensity, light direction and it's location determines the given light and the shadows it casts. Redirecting and screening light can be done while utilising materials which reflect, refract, absorb or transmit light.

Reflection

Normally only a part of the light is reflected on the surface it falls on. The type of surface has a significant impact in the amount of reflection and the angle. For dark surfaces the reflection like black velvet the reflection can be less than 1 percent, while silver, aluminum, and white surfaces the reflection can be as high as 90 percent. The ratio of reflection is called the reflectance of the surface and can range between 0 and 100 percent.
Light reflection is dependent on the smoothness of the surface it falls on. Reflection of light can be categorized in three groups; specular, diffuse and mixed reflection.

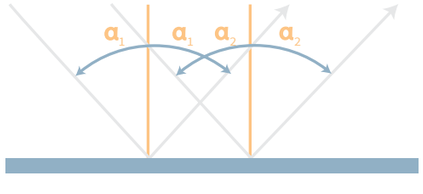


Figure 6.51 Specular reflection, angel of the light a is equal to the angle of reflection a

Specular reflection occurs on smooth surfaces such as glass or still water, whereby the angle of light incidence is equal to the angle of reflection also known as mirror reflection. Reflectors can be added to luminaires to create a precise light control such as spotslights. The shape of the mirroring surface and the location of the light source various light beams can be created (see image)

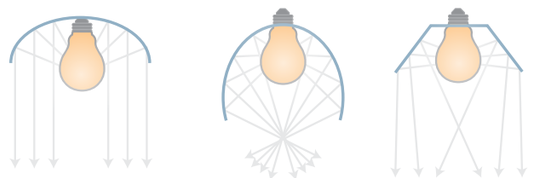


Figure 6.54 LIght beams vary depeding on the different mirror shapes.

Diffuse reflection

When a surface has a certain degree of irregularity it creates a different reflection called diffuse reflection. (See image) What occurs is that the incident light is reflected in various directions.

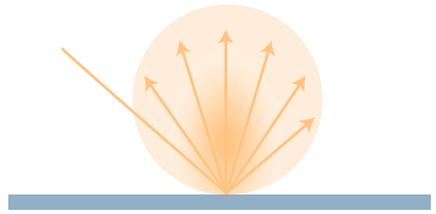


Figure 6.52 Diffuse reflection

Mixed reflection

An example of a mixed reflection is those from a wet road surface, called a spread reflection. A spreading beam reflection can also occur on a corrugated, hammered or etched surface. Another known mixed reflection is a compound reflection which is a diffuse reflection with a strong component in a certain direction.

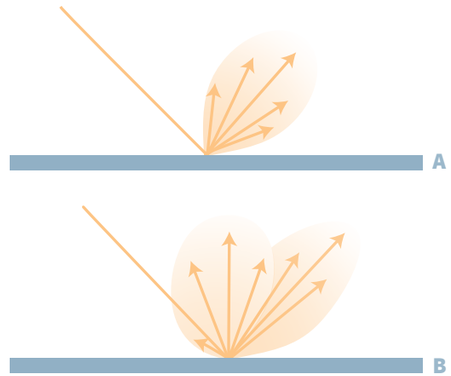


Figure 6.53 Top; Spread reflection
Below; Compound reflection

Light which falls on a surface that is not reflected it's either absorbed or transmitted. When a material is non-transparent and when the light falls on it disappears in the surface it's converted in another form of energy, ultimately heat. The amount of absorption is determined by the angle of the light incident and it's wavelength.

Transmission

Transmission is when the material it falls on has a certain degree of transparency and part of the light will pass through. Matt materials such as paper will transmit only a small percentage of light. The level of transparency in combination with the intensity and angle of the light set the transmittance of a material. Another way to diffuse light is through the refraction of a material. When a beam of light passes through a material in another direction of different density.

Design implication

All of these aspects are important for the design proposal. Whether the lampshades transmit's light and the amount of reflection in the lampshade it'self determines the overall appearance of the final design. All of these aspects can be combined in small morphological cart which can be used during the ideation process to investigate the possibilities within diffusion of light by selecting the right material and light source. This can enhance the ideation process and the overall appearance of the design.

Lamp selection

In the final design proposal the light source it'self can significantly alter the appearance of the look and feel of the design. Light can be generated in many different ways. In it's natural form, it's present in nature provided by sun, lighting, stars, etc. When it comes to artificial lights, lamps are currently the biggest source. These lamps can distributed in three fundamentally different types; Therminal radiators, Gas discharge radiators, and solid state radiators.

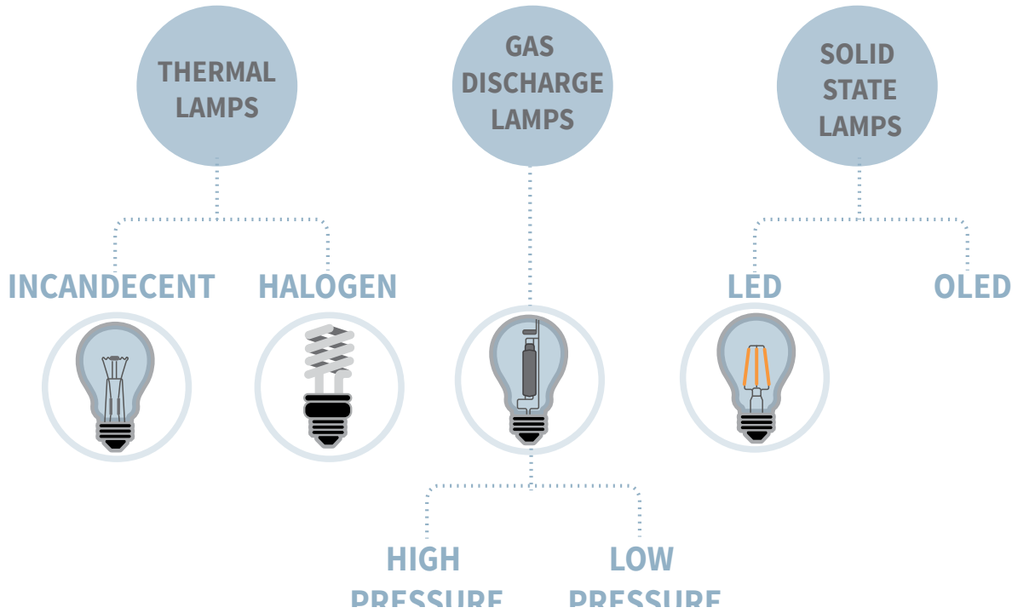
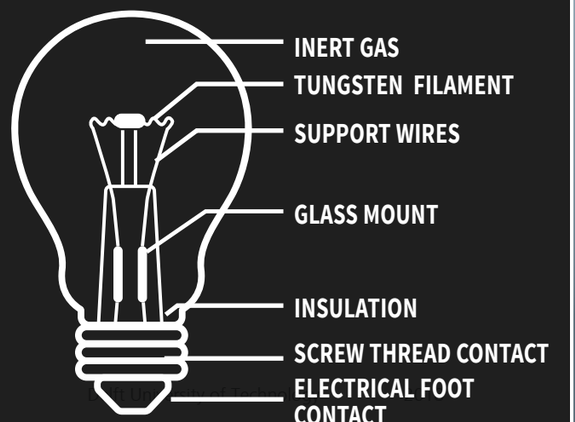


Figure 6.55 Different lamp types available on the European market

The following section describes basics of current lamps available on the market. It's important to understand the differences, and the reason why LEDs are currently on the rise. The main focus is to gain technical understanding of the specifications. With the reasoning towards the choice of designing with LED lamps.

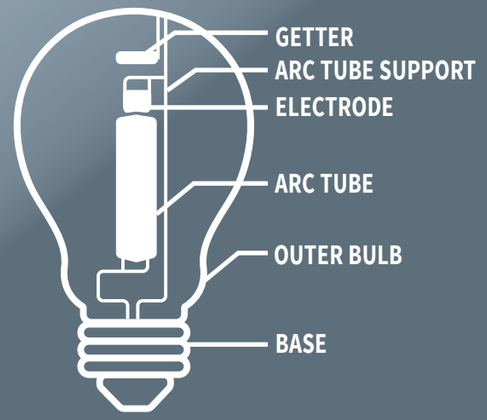
INCANDESCENT LAMPS

Thermal radiators emit a light source as a result of an increase in temperature, the main artificial example is an incandescent lamp. The incandescent lamps are the only light source which generate light as the result of the heating of the internal filament. Incandescent lamps are considered very inefficient in terms of light emitted, compared to energy consumption. A measly five percent of the total energy consumption of these lamps is converted into visible light. The colour temperature of incandescent lamps is between 2700 K to 2800 K. Due to filaments very high temperature when emitting light, it's material evaporates relatively quick. Which results in a relatively short lifetime of only a 1000 hours.



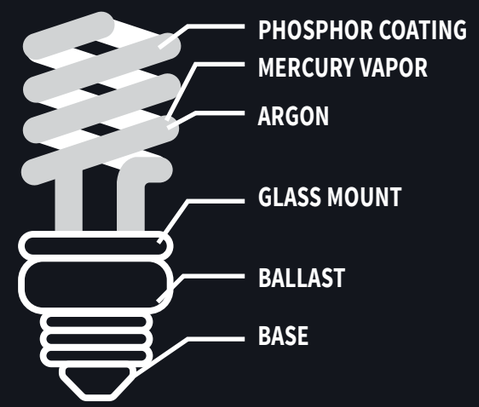
HALOGEN INCANDESCENT LAMPS

The main difference between regular and halogen incandescent lamps is the temperature of the filament, which increases for the halogen incandescent lamp to 3000 K. Therefore increasing the efficiency two to three times. The filament in the halogen lamps can be brought to a higher temperature without evaporating faster, because of internal halogen gas in the bulbs. Through this process, the lifetime becomes considerably longer from 1 000 to 6000 hours



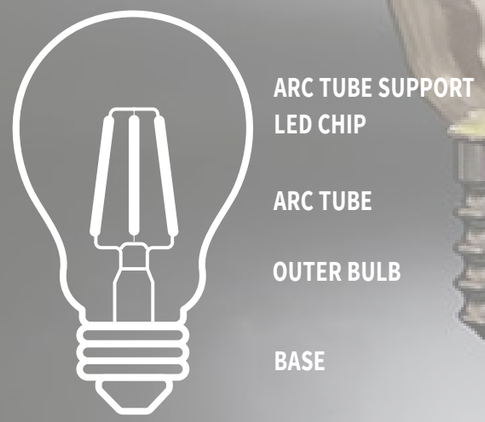
GAS DISCHARGE RADIATORS

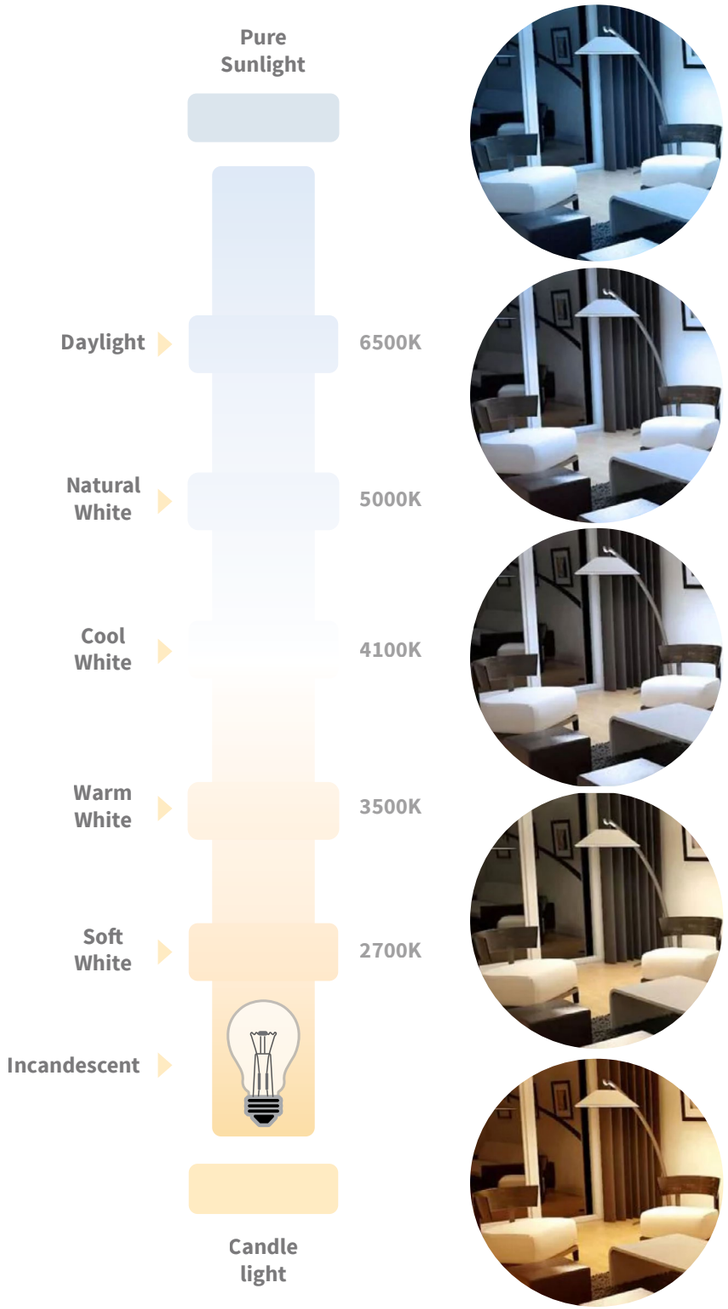
The principal of gas discharge is making gas emit light by sending a stream of electrons through it. Gases emit electromagnetic radiation in for example fluoresce`nt and other gas discharge lamps. In low pressure gas discharge lamps, the gas pressure insight is close to vacuum about 10^-5 Pa. These kind of lamps are at most 15 times more efficient, with an average lifetime between 10000 and 25000 thousand hours. Next to having a higher pressure, high gas discharge lamps are more compact compared with the low pressure lamps. In this project gas discharge radiators are not considered.



SOLID STATE RADIATORS

As the name suggested solid state radiators are light sources in which the light is created insight solid state materials. The principle of this was discovered in 1907, with a first product based on this phenomenon was developed in 1962. More commonly known as LED, Light Emitting Diode. Different materials produce light with different wavelengths and thus different colours. Since the late nineties, LEDs have improved on lumen output and efficiency, making them suitable for more applications and comparable to discharge lamps.`




Pure Sunlight
Daylight
6500K
Natural White
5000K
Cool White
4100K
Warm White
3500K
Soft White
2700K
Incandescent
Candle light

C APPENDIX
LIST OF REQUIREMENTS

Performance
The product should not break on impact
The product contains a LED bulb .

Environment
The materials will not give a reaction when in contact with skin or hair
The materials utilised must not get dirty from touch contact
The materials can be wiped down with a wet cloth; thus withstanding moisture.
The material should not get damaged by the heat of the light bulb

Life in service
The product must at least 10 years (excluding the light bulb)

Maintenance
Spare parts should be made available by KV

Target product cost
The new products should fit within the current product cost range of KVs products, namely xxx and xxx
Price is variable dependant on the variables in design.

Transport
The product should not get damaged during transport from production facility to end user.
The product must fit's in a standard shipping box
The product most be delivered pre assembled (excluding bulb)

Packaging
The product should be packaged to be protected from the elements of nature (e.g. rain, dirt, etc.)

Quantity
The amount of produced unit's is 50 per batch
The production will continue when previous batch is sold and still in demand

Production facility
The new product should be produced in the current facility of KV
Part xxx will be outsourced in xxx facility

Size and weight
Size range xxx depending on the model
Weight range xxx depending on the model
The product should fit the current distribution box (to be determined), to ensure production/transportation

Aesthetic, appearance and finish
TBD xxx

Materials
The luminaire should adhere to xxx safety regulations according EU standards
The material needs to be fitted with a flame retardant layer.

Product life span
The luminaire will be produced as long as the cost verses the demand is profitable

Standards, rules and regulations
The product should meet EU standards
The production should meet EU standards
KV should meet 'Arbo' laws for employees

Ergonomics
The product should be adjustable by the user
The cable must be long enough to facilitate practical use for the user

Reliability
Production failure is acceptable due to manual labour
Before shipping product should be inspected for failures
The product will only be sold when passed all inspections

Storage
The products can be stored in the KV facility
After shipment the products can be stored in retail storage

Testing
Heat from the LED lamp cannot damage or effect the luminaire
The products electrical components must be save for end user

Product liability
KV is responsible for replacing all products with production failures

Installation and initiation of use
The luminaire is fitted with a standard fixture so the user can screw in the LED bulb
Depending on the design the lamp can be hung or placed by the user

Reuse, recycling
The LED bulb can be unscrewed and be recycled
The product can be brought to a land fail after use

The END