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# Welcoming Light in Vehicles

Analysis of methods to increase vehicle quality perception by the use of light projections

Master's thesis in Product Development

EMMIE JOHANSSON

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MASTER'S THESIS 2017:1

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*Division of Design & Human Factors*  
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Gothenburg, Sweden 2017

Light Projections Development

Analysis of methods to increase vehicle quality perception by the use of light projections

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Master's Thesis 2017:1

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Cover:Light Projections Development

Typeset in L<sup>A</sup>T<sub>E</sub>X

Printed by [Chalmers University of Technology]

Gothenburg, Sweden 2017

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## Abstract

This project has investigated how to improve the welcomeness to a car using different colors, movement and pattern in a light projection, based on identified trends in the automotive industry. The investigation started with a theoretical research and was continued with a benchmark and user tests. As this was an unexplored topic, theories and methods were inspired by architectural lighting designs. The user test included two iterations with different approaches in order to evaluate methods and theories. For instance it included a comparison between the use of a focus group and individual interviews as well as a presentation of concepts using computer animations and a real life prototype.

The findings from the benchmark were mainly affected by the increasing numbers of autonomous cars. This is believed to change the behaviour and also put more demands on the communication between human and car. This is reflected as renewed customer requirements which will put more focus on lighting in cars, which motivated for the use of light projections.

The result from the user test included findings regarding e.g. the direction of the movement, matching design, user customization and cultural differences. This findings indicated that color, pattern and movement of a light projection will affect the perception in various ways. It also indicated on a possibility to improve the perception of the car and strengthen the brand identity. However, results also showed in a risk of low quality perception if used incorrectly.

Keywords: Light, projections, welcome, exterior lighting, vehicle, automotive.



## Acknowledgements

This thesis has been performed during the spring of 2017 at CEVT by two Product Development master students from Chalmers University of Technology. The completion of this thesis study could not have been possible without our supervisor and friend, Louise Solberg. Thanks for the guidance, support and knowledge you shared with us. We would also like to thank Pontus Wallgren, who has contributed with his time and valuable ideas to this project.

We would also like to thank the Perceived Quality team, and especially the Module Team Director Emelie Sundqvist, for facilitating the necessary tools to perform the project. Additionally, we would like to thank all the people that participated in our user tests by sharing their valuable thoughts.

Last but not the least, the authors would like to thank our dearest friends for the full support and encouragement during the project.

Without you none of this would be possible! ;)

Emmie Johansson & Ricardo Rivera, Gothenburg, June 2017





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# 1

## Introduction

This chapter explains the background to the project as well as its objectives and limitations. It also gives an outline of the methods used.

### 1.1 Background

CEVT is a subsidiary of Zhejiang Geely Holding Group and has since the start in 2013 developed a new brand car, Lynk & Co. Recently, they released a compact SUV named 01. CEVT, being a subsidiary of Geely, have been working with Volvo developing the new platform for the 40-series, the Compact Modular Architecture (CMA) platform (CEVT AB, 2017). Since Lynk & Co is a relatively new company in the car manufacturing business, it is vital that the company creates a recognition in their products. The company is targeting young urbanites - people living in cities, always connected and with a hunger of high technology. These social people prefer honest brands and are not afraid to challenge the conventions. With an adequate brand recognition in the early stages of design, the company will be able to draw the customers attention and more possible buyers. Possibly one of the best ways to engrave this brand recognition, is with unique lighting elements in the exterior of the car.

The department of Perceived Quality (PQ) is responsible to set requirements and secure fulfillment of the customer's expectations for complete vehicle appearance. PQ Illumination sets requirement on both interior and exterior lights with respect to sync, harmony, intensity and color. Illumination is dependent on electrical architecture of the vehicle, therefore it is equally important to be involved in early platform development as to be a part of top hat industrial phases. (CEVT AB, 2016)

The need of lighting development in the automotive industry has increased rapidly, the automotive industry has invested considerable amount of money in the lighting market over the last years. According to Yole Development (2016), in 2015 the investment was nearly \$22.4B usd, up to 5.4% more than 2014. Not much effort has been put on how illumination affects vehicle users and if it is possible to predict how they will perceive different aspects of light in terms of quality, function and attractiveness (Yole Development, 2016).

### 1.2 Objectives and Limitations

The project will include development of a new light concept that will enhance the entering of the car by creating an immediate attractive and satisfactory experience of the car. This requires an evaluation of how it is possible to affect the perception of a car by the use of different light designs and what methods could be used in order to evaluate a light concept. In order to succeed with this, it is necessary to gather knowledge about different properties of light and how humans are affected. According to Treisman and Souther (1985), a person's attention is attracted by visual items that stand out because of color, brightness and graphic design. To develop a fulfilling solution, a deeper understanding of what product quality linked to illumination is also required. In order to strengthen the brand identity, it is also important to identify which design aspects that is connected to this. The research will also include an investigation of future trends with focus mostly in automotive industry and how this could have an effect on future illumination.

- What are the different properties of light?
- How do different light properties affect the human perception?
- Is it possible to affect human emotions and perception by the use of different light designs - color, movement and pattern?
- Which light elements can help to strengthen the brand and the overall perception of the vehicle?
- How is the quality of the product affected by illumination?
- What are the future trends within the automotive industry and how could this affect the illumination in the vehicles?
- How can the brand identity of Lynk & Co be strengthened by the use of light designs?
- How can a user study be structured and conducted in order to capture the user perception of the light?

### 1.3 Outline

The project was initiated with a literature study of light, human perception of light and usage of light in architectural designs. This was followed by a market analysis including more information about illumination technology and its involved players. Market trends and pioneers within the automotive industry and illumination was also be identified. All findings above will be summarized and possible areas of opportunity will be identified.

The project continued with a development of a range of light design concepts. The concepts were verified in a user study, performed with questionnaires, informal interviews and observations while the users were interacting with the prototype. The results were analyzed in order to find the best possible outcome. The last weeks of the project is reserved for the creation of a written report and final presentation explaining the findings of the project.



# 2

## Theoretical Research

This chapter presents the approach to the theoretical research as well as the result. The findings covered areas like what is light, how do humans perceive the light and how is product quality related to illumination.

### 2.1 Research Approach

The research was initiated with a general insight about illumination and how it can differ, which led to a description about the different light properties. This was complemented with an investigation of existing research of how light is perceived by humans. It was also of essence to define what product quality is and how it is related to illumination. Many quality aspects are subjective which puts high demands and different opinions on how different aspects are defined.

In order to perform a correct verification and produce useable results from the user tests it was necessary to find information about how to structure a psychological evaluation of a subjective matter like this. Previously performed research about architectural and product design evaluations were analyzed and used in order to identify preferred methods. It was also important to set up hypotheses before the test was initiated.

### 2.2 Properties of Light

Different units are used in order to describe the look of the light and how it behaves. Light flux is a measurement of the total amount of light that a light source emits in all directions and the unit is called lumen (lm). The amount of light emitted in a certain angle is measured in Candela (cd) and is the SI-unit for light intensity. 1 cd is equal to 1 lm/sr, lumen per steradian, where one steradian is  $\frac{1}{4}$  of a sphere. Another way to measure light is to look at the illuminance which can be described as how much light that hits a certain area. The unit is called lux (lx) and is the same as lumen per square meters. However, the word illuminance can also be used as a synonym to light. One final way to measure light is to determine how much light a specific surface is emitting in a particular direction. This is called luminance and the unit is  $\text{cd/m}^2$ , candela per square meters. (Fuxén and Fagrell, 2015)

Light can also be evaluated in terms of color temperature which has the unit Kelvin (K). The higher the temperature is, the colder the light will be perceived as. Light with a light temperature lower than 3000 K is referred to as warm white light. A temperature between 3000-5300 K is called white while a temperature over 5300 K is considered as cold white light. (Fuxén and Fagrell, 2015)

Light is electromagnetic radiation which can be detected by the human eye. A human eye has about 126 million light sensitive cells divided into three different kinds, each of which can detect about 100 different colors. This leads scientists into believing humans can distinguish around a million colors. Of course there are people being able to distinguish more or less number of colors. Color blind people for instance only have two types of cones which enables them to distinguish around 10,000 colors. Another genetic mutation, which often affects women, provides the individual with an extra type of cone which gives these people the ability to distinguish around 100

million different colors (Hadhazy, 2015). How the color is perceived by humans is also dependent on the color elasticity which is a measure of how robust a color is. For instance, light surfaces with grayish colors are very sensitive to external influences and can easily be perceived with a tone of yellow, green or blue (Fridell et al., 2014).

### 2.3 Human Perception of Light Designs

Light has a large effect on human beings and how we perceive our surroundings. Light has been considered by many cultures and religions as a “synonym of safety, comfort and beauty” while “darkness is considered as synonym for danger, fear, and ugliness”. Specifically speaking from a car, in order to achieve this pleasant and safety feeling it is important to focus both in interior and exterior light. It is critical to take advantage of the vehicle elements to provide a feeling of safety and avoid darkness in the surroundings. In order to help to create this safety, comfort and beauty environment the exterior lights should be included to help the user. (Schreuder, 2008)

#### 2.3.1 Perception of Color

Color can evoke strong associations. However, it can mean different things in different cultures. For instance it can be associated with gender, social status and group identity. Examples of these three can be found in baby clothes, color of the cars of high-ranking city officials and soccer team shirts. (Hesslegren, 1967) (Sherin, 2011). Research has also indicated on red, yellow and orange colors having an awakening effect on humans while blue and green colors have a calming outcome. (Fridell et al., 2014)

How humans perceive light is not only affected by the different properties of light. It can, for instance, be affected by “visual” light differences. For instance, the same color can be perceived differently depending on which shade the background has (Fridell et al., 2014). In other words, this suggests that the perception of color may not only be affected by measurable aspects.

Contrast is defined in the visual arts, as “the juxtaposition of different forms, colours” (Speirs et al., 2005), where the highest contrast level will appear between achromatic colors, black, white and fully saturated gray. According to Johannes Itten, there are seven different levels of contrast: Contrast of hue, light-dark contrast, cold-warm contrast, complementary contrast, simultaneous contrast, contrast of saturation and contrast of extension (Sherin, 2011). By using these type of methodologies a good contrast can be achieved, gaining a good understanding of the desired message. By using different shapes, contrasting colors or images a different affect will be achieved where the spatial perception will create a difference, in the depth and distance, between the contrasting objects (Sherin, 2011). Another benefit of the use of contrasting colors is the possibility of give a lively impression. This can be achieved by using highly saturated colors or by pairing colors which are complementary or opposite from the color wheel. (Sherin, 2011)

#### 2.3.2 Light affecting mood

Humans collect most information via vision. Light is not only a prerequisite for vision, it also affects our sleep cycle, alertness, ability to relax and also our blood lipids. Melatonin is a hormone which controls our sleep cycle. In daylight, the melatonin production is low. Instead, the body is producing different hormones to keep us awake and alert, e.g. cortisol (Fuxén and Fagrell, 2015).

Throughout history, light designers have used different approaches in order to choose correct lighting in buildings. One of the methods is the Kruithof’s curve. In the 40’s the physicist Arie Andries Kruithof develop different studies based in different correlated color temperature (CCT) and visual conditions for interior lightning. Kruithof developed a graph based on his studies where a comparison between the CCT against the illuminance to define if a light is pleasing (Davis and Ginthner, 1990). Despite the popularity of the curve, the article lacks of details and discussions in the decisions to create the graph. Many studies have refuted the use of this curve due the lack of data points to graph the smooth curves. In the other hand, there are authors like Davis and

Ginthner's whom refer to this curve as "an effective method to define the comfort zone in terms of illuminance and CCT" (Davis and Ginthner, 1990). (Fotios, 2016)

It is also alleged that our mood is affected by which type of lighting we are exposed to. According to McCloughan et al. (1999), lighting has both long and short term effect on human beings. He also claims that females are affected more of the light compared to men and that the illuminance levels are highly correlated with how the light temperature is perceived. Knez (1995) claims that negative mood, in females, increased when changing from warm to cold light. However, the result indicates a more significant change in male mood compared to McCloughan et al. (1999) research. Knez (1995) result also indicates negative emotions in men when the illuminance level is increased. His result is indicating that women tend to perform better in warm light, compared to men who performed better in cold light, which is also supporting the statement that there is a difference in how light is perceived depending on gender.

### **2.3.3 Human perception of shapes and patterns**

Shapes and patterns were considered as an important part of the research around light. Partly because the shape and design of the light source affects the overall impression of the car design. The shape of a projected light would also impacts on the car design. The form of a product can, like color, be associated with other objects or properties. Jordan (2000) uses an iron as an example. The pointed design of the iron could communicate speed, which would be perceived as a positive aspect in terms of ironing clothes. But at the same time, the pointy design could also look less caring and even risk damaging the clothes. In this case the choice of design is purely to affect how the product is perceived and has nothing to do with actual product characteristics. In other words, a pointed iron does not mean it becomes faster and it does not necessarily mean that it will damage the clothes.(Jordan, 2000)

## **2.4 Product Quality and Illumination**

In this project it was of essence to investigate and define what quality of illumination is. This was done by using the eight dimensions of quality, presented by Garvin (1984). Four of the dimensions were sorted out, due to the scope of the project where focus was on how to design a light concept in order to affect the user perception. The remaining dimensions were performance, features, aesthetics and perceived quality. The first one is defined as the primary operating characteristics. One interpretation of this could be that the illumination should provide enough light for all users in all kinds of situations. The second one is, according to Garvin (1984), very similar to the first one but is defined as the secondary characteristics. This could for instance add-ons used to create an atmosphere in the car. The final two dimensions, aesthetics and perceived quality, are the most subjective of the eight dimensions. Sometimes customers do not possess information about a product's characteristics. In a situation like that, they need to consider less objective attributes like images, advertising and brand. For instance, if a new car model is released by a car manufacturer known for its high quality vehicles, it will not only be evaluated for what the car itself can perform. The brand performance in general will also affect how consumers perceive the quality of the car. (Boucherat, 2017)



# 3

## Market Analysis

The following chapter will explain the main findings from the trend analysis as well as how it was performed.

### 3.1 Analysis approach

A benchmark was performed at car dealers in Gothenburg, Sweden. The result was structured and related to the perceived brand quality. The researchers visited available dealers found in the city: Audi, BMW, Ford, Hyundai, Jaguar, Lexus, Land Rover, Mercedes Benz, Mini Cooper, Porsche, Renault, Tesla, Toyota, Volvo and Volkswagen. The research was focused on car models available in the dealer shop. The cars needed to fulfill the performance dimension, which was mentioned in Chapter 2.4, and also have some interesting characteristics in the other dimensions otherwise it was not taken into further analysis.

Interesting information was also gathered from technology fairs like The Consumer Electronics Show (CES) and Geneva car show. Concept cars were used as a source to the latest trends and gave an insight into which direction the market seemed to be heading. A lot of the information was also gathered from the different car brand's webpages.

As a complement to the benchmark, a patent analysis was conducted, in order to compile some information from different inventors. During the patent research the Google Patent engine was used and different filters were added. Focus was on International Patent Classification (IPC) B60Q and patents no older than 5 years in order to find latest new inventions that might be implemented in the next years. The B60Q classification focus in the arrangement of signalling or lighting devices in vehicles in general. Besides the filters mentioned, some keywords were used to find results focused in the related topic. The used keywords were: ambient, lighting, environment, driver, car, interior, lights. The related synonyms were used as well in order to expand the search.

### 3.2 Quality related aspects

Different quality related aspects, identified during the car dealer visits, are presented in this chapter. The identified aspects were divided into three groups connected to light color, design and movement. According to a report by the Wall street journal “brand is a key consideration along with reliability, price, design and safety” (Jones, 2016). This makes it interesting to look deeper into how different brands designed illumination in order to also understand how customers will perceive different solutions. ALS did a survey in 2012 (Read, 2012), analyzing the familiarity and perceived quality of different brands. They presented the result in a graph where it is possible to locate how the perceived quality is ranked compared to different car manufacturers.

#### 3.2.1 Color of light

In several models colored LED stripes was added to e.g. doors, dashboard, central tunnel and seats. The ambient lights came in matching color. The BMW 7 Series (740e limousine version, 2017) is equipped with a continuous LED lighting stripe applied in the frame around the skylight,

see Figure 3.1. In table: 3.1 a comparison of available colors and themes are visualized and sorted depending on grading in the ALS.



**Figure 3.1:** BMW's mood light and BMW's front lamp

**Table 3.1:** Table of benchmark

Model:	Quality perception ALS (Read, 2012):	Colors/themes:	Comment:
Mercedes Benz Class E	83	64 colors	
BMW 7-series	80	12 themes in 6 different colors	
Audi Q7	75	32 colors	Choose freely from color palette, select drive mode or predefined color themes.
Ford Edge	70	7 colors	
Renault Megane	70(Nissan)	7colors	
Mini Cooper	57	8 colors + theme with randomly changed colors	

In the Mercedes, see Figure 3.2, the user was allowed to choose from the largest collection of colors. Audi Q7 had a solution which included LED lighting with three predefined color profiles, one connected to the Audi drive select mode and a custom color. The custom color opened up for the possibility to choose between 32 different colors and also customize which area of the interior lighting it would affect. However, allowing the user to change between different colors could lead to a mismatch in style.



**Figure 3.2:** Mercedes Benz customizable screen and door lights

Even though some parts of the illumination had customizable color in some of the models mentioned above, there were aspects which did not change color. These areas often had a fixed blue color. This can for instance be found in the speakers and design details in the headlamps of the BMW. Tesla had also equipped their car with blue light in the USB and exterior charging port. Toyota's C-HR model, see Figure 3.3, is equipped with a blue plastic frame in the same areas as the LED stripes. The plastic frame was complemented with blue decorative light in e.g. cup holders, doors and a logo projection outside the car.

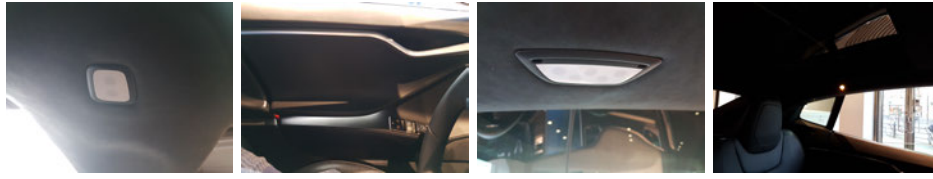


**Figure 3.3:** Toyota's cup holder and door trim

An interesting design factor, found in the Renault Megane, is the possibility to match the ambient light with the cluster. Once the user has selected one of the ambient colors, the cluster and the knob to navigate in the menu will use the same color as selected for the illumination which will lead to a matching style.

### 3.2.2 Design of light sources

In many cases there was a continuous theme in how the light sources were designed. The light sources in the 2017 Model X Tesla, see Figure 3.4, had a frosted plastic cover on most of the light sources. The car also had hidden light sources in the speakers which gave a very clean impression. The S-model had similar frosted cover of the light sources but the placement differed between the models. In Model X, the backseat light source was placed in the center ceiling compared to Model S where they were located just above the side window. Model X also had a more circular shape of the light sources compared to Model X which reminds of the ones used in homes. The luxury car brand Bentley also uses this shape of their light sources in the interior of their cars.



**Figure 3.4:** Model X's light sources and circular Model S's backseat light source

The BMW series 7 is a good example of a continuous design, see Figure 3.5. The same design lines were found in both the interior and exterior light sources as well as inventory design details. Besides the rear lamps, the design lines were also found in a projected light pattern outside the passenger doors. This light projection was developed in cooperation with Fraunhofer Institute of applied optics. (Fraunhofer Institute, 2015)



**Figure 3.5:** BMW's reading lamp

In the Toyota C-HR, the same “boomerang” shape can be found in both the rear lamps and the interior light sources. The same pattern could also be found in the ceiling, where diamond-shape graphics were ‘scooped’ out of the material and also in the door material. Same goes for the Mini Cooper exterior lights and their matching infosystem.

#### 3.2.3 Behaviour of light

In some of the models, e.g. BMW, Volvo, Mini and Renault, the user was able to customize the intensity of the light. An interesting factor in Audi is the use of ambient lightning to let the user know that the SUV is ready to drive. Once the engine is on, an ambient light starts, letting the user know when the vehicle is ready to start a new journey. The brand also use the door lights to warn the user before exiting the car in case of a car is passing by. The SUV is also equipped with capacitive reading lamps, which allows the user to turn on the lamps just by approaching the finger, see Figure 3.6.



**Figure 3.6:** Audi's capacitive reading lamp



The color of the circular LED stripe in the Mini Cooper is changing depending on different actions in the settings. For instance, the “navigation” function is linked to green and an increased sound volume equals a movement on the LED-stripe.

### 3.3 Trend related findings

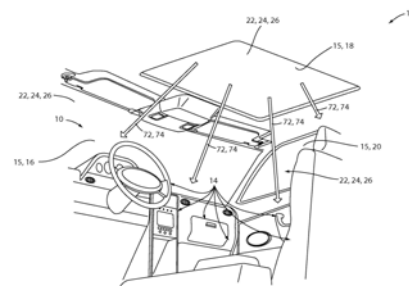
The following chapter presents findings which are related to the identified market trends.

#### 3.3.1 Results from patent analysis

During the research, many results were obtained regarding lighting in the vehicle. The Research showed different ideas and inventions from the latest years. The most relevant or interesting concepts for this project will be shortly described in the following sections.

##### Color changing and disinfecting surfaces (US20150273092A1)

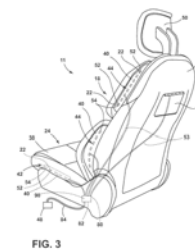
This patent relates to an apparatus inside the car which is configured to disinfect the surfaces of the vehicle. A LED arrangement is configured to disinfect the surfaces and areas inside the car as the Figure 3.7 shows. With a system like this, the interior surfaces will be disinfected from bacteria and germs that might accumulate inside the car. This device will allow the user also to choose from a variety of colors to use the LED lights to create an ambient lighting. (Holub et al., 2015)



**Figure 3.7:** Color changing and disinfecting surfaces.(Holub et al., 2015)

##### Seat having ambient lightning (US20160311367A1)

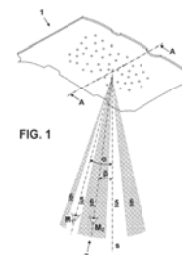
This patent proposed by Ford Global Technologies LLC, introduce ambient lightning in a seat where predefined gaps hold the LED components. This proposal include LED in the side of the seat, back side and under the seat.(Ford Global Technologies, 2014)



**Figure 3.8:** Seat having ambient lightning.(Ford Global Technologies, 2014)

##### Illuminated inner trim for vehicles (US20160356449A1)

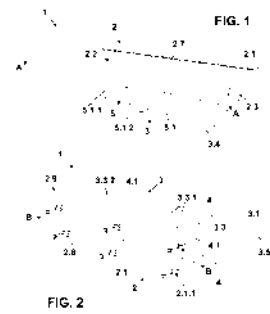
One of the major manufacturers of interiors parts is Grupo Antolin. The case the company has created an illuminated inner trim for vehicles, where this act as a decorative lining. This product is unseen when the lights are off. When the LED's are on, due to the arrangement of LED's, the passengers experience different light intensities and shadows in the vehicle which creates a sparkling effect. (Jorro de Inza et al., 2016)



**Figure 3.9:** Illuminated inner trim for vehicles.(Jorro de Inza et al., 2016)

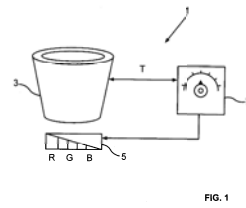
### Luminous decorative assembly for vehicle interior (EP3053778A1)

This solution, by Grupo Antolin-Ingenieria S.A, allows a light module to appear like an ordinary decorative assembly with the ability to permit light onto a motif. This is done by using an opaque material which is still concealing the lighting device and the motif when module is set to off-mode. The module can be used for decorative or indicative purpose. (Pérez and Lugo, 2016)



### Color-adjustable RGB-ambient lighting for a cup-holder arrangement (US20130342104A1)

The patent US20130342104A1 granted for Audi, is focused on latest technologies for cup holders, where these have the capabilities of heat or cold the beverages. The patent consist in a cup holder which control the gradient of the lighting included, depending on the temperature defined for the beverage. (Mayer and Pfeil, 2013)



**Figure 3.14:** Color-adjustable RGB-ambient lighting for a cup-holder arrangement.(Mayer and Pfeil, 2013)

### 3.3.2 Concept car and auto show designs

Looking at concept cars and auto shows was considered as an efficient way to spot upcoming trends on the market. These concept cars are regularly used to show off a new style suggesting new trends, and how these might affect their future cars and illumination.

#### *Central design patterns*

##### *Minimalist designs*

During the exploration of concept cars, it was noted that a lot of manufacturers had focused on fewer details in the exterior design. Instead, focus seemed to be on creating continuous and large surfaces. Examples of this could e.g. be found in Tesla, BMW and Toyota. In the Geneva motor show 2017, this could also be seen in brands like Infiniti, Lexus and Volkswagen, see Figure 3.15. It is possible that this could affect the interior lighting, e.g. push the design of the light sources in a direction that puts attention on smooth and continuous surfaces, in order to match the exterior of the car.



**Figure 3.15:** Minimalist designs

##### *Technical themes*

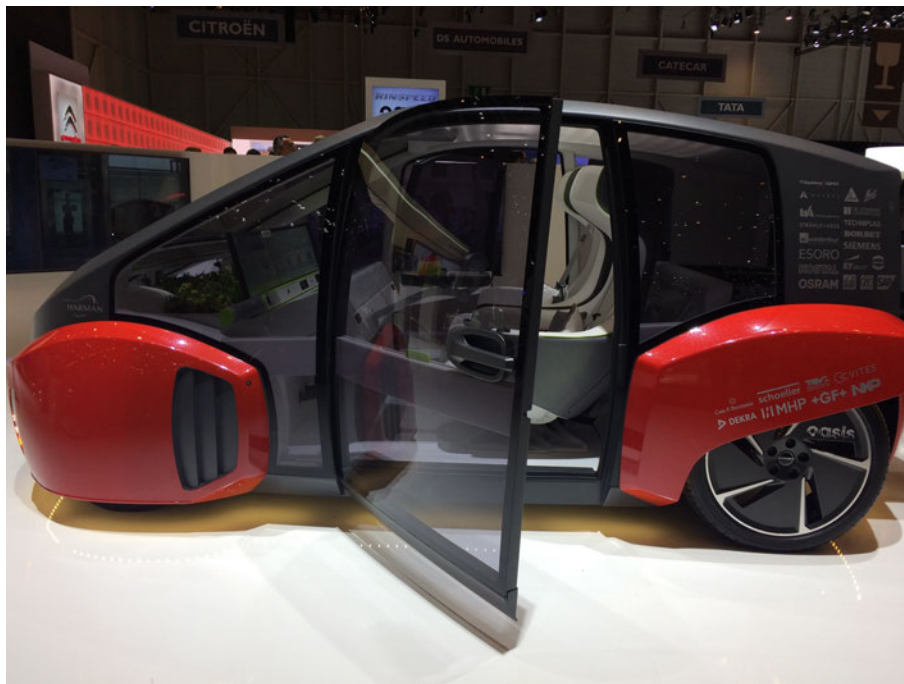
Another trend in the car design, is the addition of simple and matching patterns in the car. In March 2017, a concept car from Mercedes was presented in the Mobile Word Congress, see Figure 3.16. The “EQ” concept from the German brand, tried to illustrate how a car, in our the future, will look like. The designers from Mercedes, attempted to illustrate a transition between today’s car and a fully automated one. One of the most interesting things from this concept car is the clear patterns. Clear and defined lines can be observed in the grilles, rims, headlamps, side mirrors and rear lamps. This pattern also were considered the interior of the car.



**Figure 3.16:** Technical themes

#### *Organic themes*

When looking at the architecture and design of buildings, it is common to add organic aspects (Siltanen, 2016). Future city housings will have integrated gardens because of e.g. limited space and the future need of sustainable households. This has also influenced the car industry, as seen at the CES fair in January, 2017, both Rinspeed and BMW presented concept cars which had living plants, see Figure 3.17. (Rinspeed, 2017) (Vossler, 2017)



**Figure 3.17:** Organic themes

Even though a mobile garden might not be a product for the market yet, the organic trend has already made its mark on illumination designs. This can for instance be seen on DS7 Crossback and BMW i8, which is equipped with a unique tail light design, see Figures 3.19. The new OLED technology also opens up for new design solutions in tail lighting which can be seen in multiple concept cars, one which can be seen in Figure 3.18.



**Figure 3.18:** Audi TT OLED Rear lamp



**Figure 3.19:** DS7 & BMW's Rear lamp's with organic designs

Organic patterns is also visible on other parts of the car. A concept car from BMW (Muoio, 2016) presented below has surfaces around the wheels with the possibility to “*flex*” when the wheels are turned which brings the thoughts of snake skin or even the armour of an insect.

Rolls Royce has been working in creating unique luxury concepts for their customers, for example “*Under the stars*” headliner (MotorCars RollsRoyce, 2007). This unique headliner integrates as the company describe it, a “*magical experience with a stellar scene above you*”. By using fiber

optic they have recreated a “constellation” in the headliner. This headliner is handcrafted and the mounting takes between 9 and 17 hours.

#### 3.3.3 Car as new living room

The number of cars in traffic is keeps growing which means that we will get less space on the roads (Voelcker, 2014). This will probably lead to more traffic queues, despite attempts to expand the roads. Therefore, more time will be spent in traffic and in the inside of our cars. This, in combination with new technology allowing self-driving vehicles, will probably change our behaviour in the cars. At the CES-fair 2017, Hyundai presented a smart home concept where the car is integrated into the living room (Hawkins, 2017). Hyundai says in an interview that with this concept they would like to *“blur the line between mobility and living and working space, integrating the car into the daily lives of users”*. BMW also presented a concept, which could be considered as inspired by a living room atmosphere as it had its own bookcase and a large TV-screen for the backseat passengers. To sum this up, future illumination will not only be focused on making the driving easier, it will also contribute to a satisfactory and attractive environment.

#### 3.3.4 Internet of cars

Future cars will be connected to other vehicles and devices and will therefore possess a higher level of digital intelligence. This can also be seen in other products e.g. home electronics. Internet of things will enable vehicles to share traffic information, e.g. information about accidents, recommended roads and so on. This means that there is a lot of available information for the driver which could be useful and enhance the drive. Recent projects like the self-driving car, from Google is not only focusing in the autonomous driving, but also into a more pleasant experience for the user and other drivers. According to Chris Urmson, head of the project, they are *“trying to make them drive more humanistically”* with a more natural driving behaviour. By integrating more human traits into the cars, the companies reflect their intention of the future in the automobile industry. (Titcomb, 2015)

Light designs could be one way to improve this communication. However, it could also create confusion and make the driver remove focus from the road. Connectivity can also help increase the personalization of the car. It will allow the car to get to know, and gather data about the user. It will also enable the car to update itself in order to keep of with the fast changing market. As a part of BMW group’s vision *“next 100”*, the company has decided to inspire their different brands with six hypotheses for the upcoming decades based on megatrends(BMW Group, 2016). From these hypothesis, each division of the company is aiming to a similar goal. The german company will aim for an artificial intelligence along with a more intuitive technology implemented in the cars. A concept car from Mini will be able to change the exterior and interior appearance depending on the personality of the user and even to greet the user with a personal message. In order to achieve this customization of the appearance, the car will come with a clean design - a “clean canvas” as they call it. Different designs will then be made possible by the use of illumination.

#### 3.3.5 Summary and conclusion of market analysis

The market analysis indicated on an increased focus on illumination in future cars. This due to the fact that the number of autonomous cars will increase, and therefore change how people behave inside the cars. Future focus will probably be more towards creating an efficient and enjoyable environment inside the car. With more connected cars, users will be provided with more information than before. This opens up for the possibility to use illumination as a medium for communication. To stand out from the crowd in a competitive market, is essential for a novel brand. Fast changing customer needs also creates a new demand for customization.

Many car manufacturers had also focused on light projection concepts. The most common was to project a brand logo on the ground simultaneously as the door is opened which could be seen in e.g. Toyota C-HR, Mercedes Benz GLE and Ford Mustang. BMW had taken this to the next level

in their Limousine model, mentioned in Chapter 3.2.2, when they implemented a light projection with only lines. It also existed patents about how to add movement to the projection as mentioned in Chapter 3.3.1. As a part of the “*Next 100*” - vision from the BMW group, Rolls Royce had also hinted about welcoming light carpets: “*The spectacle is additionally underscored by light projections, which create a “red carpet” showing the way out and turn every arrival into a Grand Arrival*” (BMW Group, 2016). A light projection would enable for customizable, sophisticated and eye catching illumination design to attract new users.





# 4

## Idea Development

This chapter represents the motivation for the idea selection and hypothesis developed from previous analysis. A list of requirements and brief explanation of the developed concepts is also included.

### 4.1 Motivation for focus of development

According to the previous research in this project, car manufacturers are focusing more into creating attractive cars starting from the outside and moving on to the inside. In psychology, the first representation or the “*first impression*” is one of the most important, since this is the foundation for the subsequent repetitions (Digirolamo and Hintzman, 1996). By designing an attractive welcoming and providing a first good impression, it is possible to affect how the user will experience the rest of the car. This motivates a solution on the exterior of the car, activated when the user approaches the car. This also enables the company to reflect their brand values, from the point the users first lay eyes on the car until they exit the vehicle. This situation is especially useful when a brand is new in the market. Therefore, the creation of a whole experience, which attracts the customer, is essential to outstand from competitors.

Many of the existing cars only focus on lighting up the front and back sections of the car, leaving the sides of the car as opportunity areas to give a nice welcome to the car. The focus in this area has been limited according to the performed market analysis in this report which creates an opportunity to innovate and integrate illumination in that area of the car. By increasing the illuminated areas in the surroundings of the car, it is believed that the user will perceive the surroundings as more safe. Other car manufacturers have recently put more attention into this area by implementing primitive light projections in order to create patterns and brand logos. However, these solutions are fixed and does not provide much opportunities to create emotions in the user. Considering the previous mentioned research from this project, the researchers believe that by integrating movement as well as variation in color and forms, it is possible to evoke emotions which in turn will give the user a chance to connect with the car on a superior level. As light is being used in a larger extent in cars, it is also interesting to investigate if methods used in other areas, e.g. architectural designs, can also be used to evaluate projected light designs in cars.

### 4.2 Hypothesis

The development in this project will be focused on how different light aspects are perceived by the user in the welcoming exterior illumination located on the sides of the car. The aim is to develop an understanding of how different factors can be adjusted, in order to reach the wanted effect on the user. From the theoretical research and market analysis, a number of hypotheses were developed.

#### ***Hypothesis 1 - Technology levels***

The technical solution will be based on four levels of increasing technology. A higher level of interaction and movement were believed to create a better user experience. This because it contains more human traits (Titcomb, 2015).

### *Level 1 - Fixed*

This level represents a fixed colored light source projected in a pattern with the use of a filter. It is activated by actions originated in car key, smartphone or door handles.

### *Level 2 - Partly fixed with limited movement*

This level represents a colored light source projected in a pattern with the use of a moveable filter. This enables for certain movement in the projected light. It is activated by actions originated in car key, smartphone or door handles.

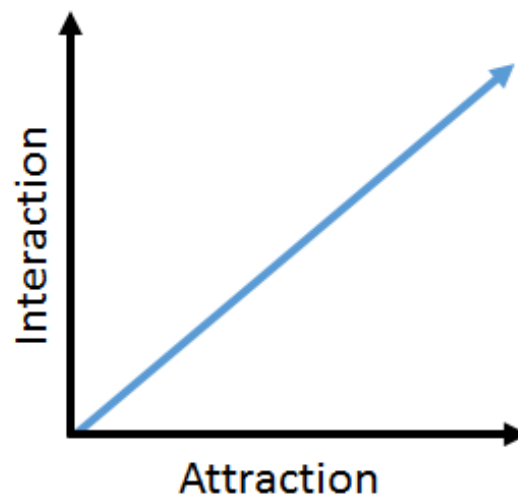
### *Level 3 - Projector*

This level enables the user to choose from a variety of colors, movements and patterns. Similar to level 1 and level 2 it is activated by actions originated in car key, smartphone or door handles.

### *Level 4 - Projector with user interaction*

Similar to level 3, this level also enables the user to choose from a variety of colors, movements and patterns. A higher level of interaction with the user could also be added via e.g. presence sensors.

This different of levels could be represented in a graph where the higher the interaction of the light projection, the higher the attraction from the user.



**Figure 4.1:** Iteration vs Attraction

### ***Hypothesis 2 - Unique design***

It was believed that in order to reflect a strong brand, a certain level of individuality was needed. By integrating particular design aspects that could be identified in the models, the brand can replicate it and be easily be identified by its style.

### ***Hypothesis 3 - Correlation between increased light and safety***

Because of a large focus in safety in the automotive industry it was believed to be beneficial to enhance the perception of safety in the car. It was believed that increasing the amount of light would also increase the perception of safety (Schreuder, 2008).

### ***Hypothesis 4 - Cultural and gender effect on perception***

In the theoretical research it was stated that previous research had identified certain differences in how men and women perceive light colors. There were also indication of cultural differences.

### 4.3 Requirements of light concept

The intention of the concept is to evoke positive emotions in the user. Because of limited time it was decided not to verify any negative perceptions.

The requirements for this light concept were based on the needs found during the walkthrough analysis, see Appendix A, and the theoretical research. Different scenarios were proposed for this analysis. The user was supposed to approach to the car, unlock it and perform subsequent actions. The scenario ends when the user sits in the car and closes the door. This walkthrough contemplates different environments where the user might have parked the car.

#### *List of requirements:*

##### *Ease entering of car*

To fulfill the first quality dimension Chapter 2.4, it was believed that the solution should result in the entering of the vehicles being perceived as simple. This activity might be considered as difficult for people with e.g. physical disabilities or decreased vision as they might not see the ground surrounding the car. All kinds of users are considered to be in a vulnerable situation when entering the car because of the placement of many parking lots, e.g. right next to a road. A light projection could also make it easier for other trafficants to detect when someone is trying to enter the car, which could lead to them decreasing the speed or use other ways to show respect, which will in turn increase the safety.

##### *Reflect brand identity*

It was believed that high demands on a strong brand identity was required in order to break into a competitive market with a novel brand. The target user for the light concept is a self confident urban citizen. He or she is conscious about the surroundings which enables for both empathy and determination. An open mind and social character impinges a playful and “*living in the moment*”-personality. With this target group a number of objectives were developed in order to communicate a brand identity concept:

- High contrasts
- Athletic and playful
- Colorful design
- High tech emphasis
- Unexpected fragments
- Unique way of thinking

##### *Perceived as HQ design*

As with any other product, it is desired to be perceived as high quality. A high quality is desired in a car, since this represents a large investment for many people and therefore there are anticipations on a relatively long product life. A continuous design theme throughout the whole car was considered as a high quality element from the market analysis. By engraving the same design style both in the exterior and interior of the car, a consistency will be perceived from customers. To fulfill the quality dimensions it was also considered as important to create a perception of equally distributed illumination and design.

##### *Perceived as interesting*

It was believed that in order to create an effective welcoming of the car and also attract new customers, it was necessary to create a concept perceived as interesting by users. This hypothesis was supported in Sung et al. (2016) who claims that “*Interest attracts people to new, unfamiliar things*”. According to Silva (2008), also alleges that interest has an emotional profile very similar to liking Silva (2008).

##### *Increase the perception of safety in the area around the car*

Safety is an important part of the automotive industry and in order for the user to connect to the

car on a deeper level, it needs to be perceived as safe to use. According to Montante (2006) safety is often described as “*looking out for each other*”. This can be developed into a perception of the car taking care of the user (Montante, 2006).

### *Increase self-assurance with the user*

According to the PANAS-X (Positive and negative affect schedule expanded form) self-assurance is including proudness and confidence. This is believed to play an important role in any investing situation. According to McFerran and Aquino (2014) pride can in turn be connected to luxury, exclusiveness and extravagance (McFerran and Aquino, 2014).

### *Perceived as attractive*

According to different researchers, consumers buy and use products in order to construct and maintain their images (Townsend, 2015) (Bloch, 1995). Aesthetics is also one of the cornerstones to quality. It is also alleged that buying a beautiful product “*causes a person to feel better about themselves*”. An attractive light projection would therefore not only make the user feel more pleased, it would also seduce new customers.

### *Create an exciting first impression of car*

In many ways it is possible to consider a car’s exterior as some kind of product packaging. Research have found evidence that the decision of buying a product are many times affected by the product packaging. It is also suggested that the product experience can be affected by the way the product is packed (Becker et al., 2011). The light projection should therefore provide an attractive and exciting “*packaging solution*” for the car.

### *Implement current market trends*

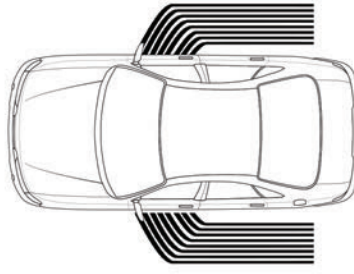
The Lynk & Co brand should also communicate a modern and high tech product. In order to achieve this and keep up with competitive products, it is believed that current market trends need to be integrated to the illumination design.

## 4.4 Development of concepts

After setting up with the requirements for the proposed idea, different concepts were designed taking different elements into consideration. Some of these considerations were aligned with the brand or as reference point for the test. In general, the researchers took inspiration for the different designs like: videos related to projection mapping, motion graphics, prototype cars, trends and the previous market research.

### 4.4.1 Reference concept

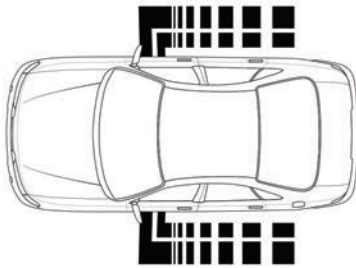
It was considered interesting to use a reference object already on the market to identify possible improvement areas for future development. The only comparable concept on the market was the one from BMW, therefore the researchers decided to replicate similar graphics along the perception test. This concept will be referred to as the reference concept from this point. The following pictures show the resemblance and similarity between both graphics. For this concept it was considered important to keep it at Level 1 in interaction, no movement, only a simple light projection.



**Figure 4.2:** BMW reference concept

#### 4.4.2 Blocks concept

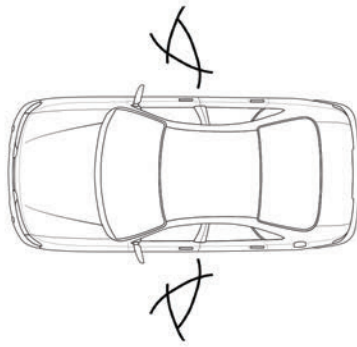
Since one of the requirements in the project was to create a design harmony, it was a natural decision to integrate design elements of the 01 model in this concept to create a good harmony. The proposed design was inspired from the rear lamps, using dense squarish shapes which highlights the driver's door, in order to create a welcomeness into the vehicle. This concept was considered to keep in a L2 in interaction, by integrating movement along the different shapes. The intention with this movement was to create a *“pulse”* feeling, highlighting the doors of both the driver and passenger, creating more interaction between the user and the car. The *“pulse”* feeling consisted in making the blocks appear and disappear, starting from the door direction and continuing towards the end. A picture sequence of the animation can be found in Appendix B.



**Figure 4.3:** Blocks reference concept (CEVT AB, 2017)

#### 4.4.3 Free lines concept

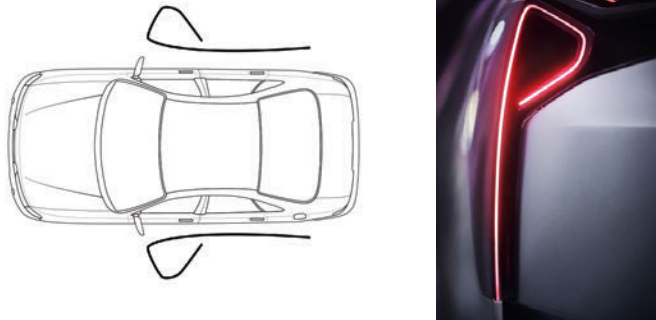
The last concept was inspired by the brand values mentioned earlier in this chapter. The graphics used should therefore reflect the *“freedom”* and *“playfulness”* of the brand. In an early stage these graphics were combined with specific design details as well, *“playful”* lines were chosen to shape a section of the rear lamp. These *“lines”* appeared from nowhere, moving towards each other, which eventually formed the same shape used in the rear lamps. This design was believed to achieve a level 3 of interaction. A picture sequence can be found in Appendix B.



**Figure 4.4:** Free lines reference concept

### 4.4.4 Arrow concept

Like in the previous concept, some inspiration was taken from the brand, in this particular case it was decided to select a concept car which was presented in a car show in Berlin 2016. For this concept the researchers decided to use the same minimalistic aspects from the rear lamps of the concept car and align the trends in future cars with the proposed idea. The pictures below shows the design decision between the concept car and the graphics used for perception test. For this concept also the first level of interaction was kept.



**Figure 4.5:** Arrow reference concept

# 5

## Light Perception Test

How users perceive light and design is a matter of highly subjective aspects. In other words, there are no universal truth in how illumination designs are perceived. However, this study's aim is to investigate if it is possible to establish useful recommendations on how designers can affect the users perception of the car by using different design aspects in a light projection. The aim with the tests was also to evaluate the chosen test method. Inspiration was taken from the BMW group study about the influence of ambient lighting (Caberletti et al., 2016). The result was believed to be most valid if multiple iterations of user experiments were performed. Due to limited time, two iterations of user tests were considered optimal for this project.

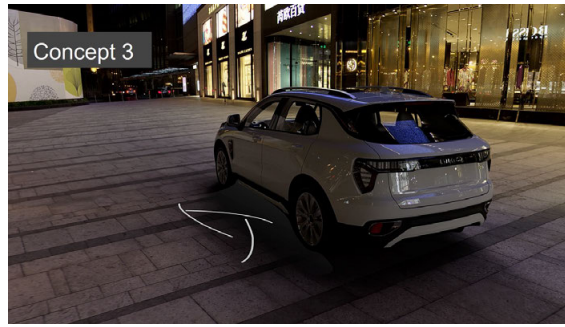
Both these iterations will in turn be divided into two parts. The first part will provide data useable for comparison between the two iterations and the second part will provide deeper information about how to aim future development. The comparison between the iteration will not only give information about if the development is going in a positive direction, it can also be used as an evaluation of how well the chosen method provided useful and correct information to the project. Therefore, a design of experiments (DOE) approach was considered as a useful method. A design of experiment is a *“systematic method to determine the relationship between factors affecting a process and the output”* (Sundararajan, 2000).

Because of the potential impact of different ages, cultures and social classes it was preferred for both iterations to use a mixed group of people (Bloch, 1995). However, because of classified material it was necessary to use people from the company. The test subjects were therefore picked, on a voluntary basis, from different departments. In order to improve the results of the experiment, it was decided to combine the group of test subjects for the second iteration, where test subjects from the first iteration will participate along with *“new test participants”*. This will allow the study to verify not only the selected factors and how these affect the users, but also verify the first impression caused for *“new users”*.

### 5.1 User test iteration 1

#### 5.1.1 Method

The reason for the first iteration is to screen the number of initial ideas and create a direction for further user tests concerning accuracy of the illumination levels, design of graphics, user expectations and ranking of requirements. This is done by exposing a group of test subjects to a number of short looping videos representing the different concepts. The short animations were created in Adobe After Effects containing a vehicle render in a dark environment merged with a light animation demonstrating the concepts, see Figure 5.1. The choice of using digital mockups was motivated by the possibility to present the concept to a group of people simultaneously. The renders presented for the test users can be found in C Figure 5.1 below is an example of the renders shown.



**Figure 5.1:** Concept free lines

The eight test subjects were gathered in a room, see Figure 5.2, and asked to individually fill out a form in order to catch the impression of each concept, see Appendix D. The questions were aimed towards perceived attractiveness, excitement and high quality. In order to help the test subjects with the grading, a self-assessment manikin (SAM) scale was used stretching from 1 to 9 (Bradley and Lang, 1994). The range was deliberately chosen as an uneven number to force the test subjects to take a stand.



**Figure 5.2:** Focus group

When all concepts were presented and evaluated, interviewers provoked a discussion in the group by using predefined questions, see Appendix D. The questions were related to the requirements and covered topics like welcomeness, how to create interest, how to increase safety and what they thought the Lynk & Co brand represented. This process was similar to a “*think aloud protocol*”, which is a preferable method to use when trying to figure out how people react and also the reason behind their reaction (Jordan, 2000) (Wanga et al., 2017). Performing this kind of evaluation in a group of people is also believed to provoke more emotions and opinions as well as be more time efficient. The method was tested on a separate test subject, before the actual test occasion, in order to fine-tune the test setup. A transcript of the discussion carried with the test subjects can be found in Appendix E.

This first DOE was based on findings in the theoretical research, the chosen factors were: light color temperature, design density and movement according to table 5.1. The design factors and levels were not presented to the test subjects as it might have affected how they perceived the concepts.

**Table 5.1:** Design of Experiments

	-	+
Light color temperature	Cold	Warm
Design density	Minimalist	Maximalist
Movement	Fixed	Motion

In a majority of previous performed research, focus had been on how different people perceives



the color temperature of the light. Although, all found research had been performed on light installations in buildings or in the interior ambient light of the car. In this case the study would focus on an exterior light projection on a vehicle. As it was explained in Chapter 2.2, light can be evaluated in terms of color temperature, for this specific experiment two levels were chosen to do opposites, one representing cold light (7000 K) and one representing warm light (2500 K) (Fuxén and Fagrell, 2015).

As it was explained in Chapter 4.4, the design patterns were inspired by identified market trends and also an idea that the amount of light could affect the perception of safety. The use of minimalist design was chosen as the lower level for the experiment while the maximalist design resulted in a high level. One of the patterns were also chosen to be identical with BMW's light projection pattern in order to act as a reference for the other designs. With the intention to deliver more sophisticated patterns, it was decided that it was not required to use identical design patterns when comparing the two movement levels.

The use of movement was believed to accomplish a higher level of interest and communication between the user and the car. However, all of the design patterns were not believed to function both as a fixed pattern and an animated one. Therefore it was decided to create two separate patterns representing design density as well as movement. This means for instance that the animated dense design pattern was designed as squares while the still dense pattern was designed as lines. Possible sources of error will be mentioned in Chapter 6.

The following Figures 5.3 represent the concepts shown to the participants, see Appendix C.

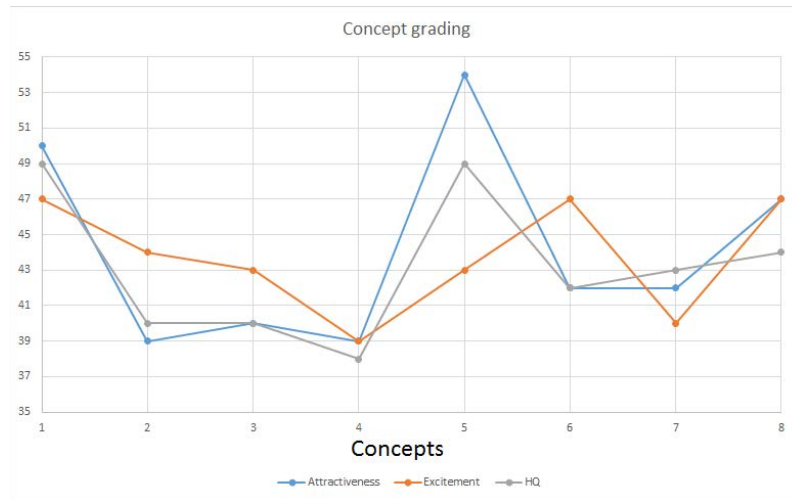


Figure 5.3: Renders shown

### 5.1.2 Result from iteration 1

#### *Factorial evaluation*

The following chapter will present the findings connected to the design factors and the chosen levels. Figure 5.4 summarizes the gradings of the participants in the three different categories according to the order of appearance during the test. The slope helps to visualize similarities and differences between the three categories. The first concept is graded comparatively high which could be due to a successful design, but could also be affected by the fact that this was the first concept the users were exposed to. Later on, it is noticeable how the gradings of the different concepts drop in the following concepts. The fall stopped when concept five was displayed, highlighting an increment in the attraction and perceived quality on the test subjects.

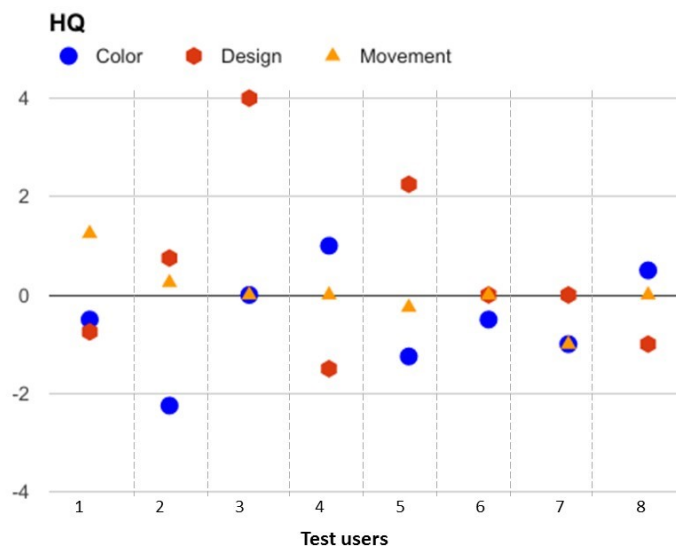


**Figure 5.4:** Summarized concept grading in the order of exposure

According to Figure 5.4, the 5th concept was the concept with the highest grading in attractiveness and high quality, even though during the discussion this concept was not mentioned as many times as concept 1. Some users referred to the 5th concept as an attractive concept, due the fact they connect the design of the rear lamps to the graphics used in such concept. This concept design indeed was inspired by the rear lamps, a dense pattern with a cold color temperature and more interactive.

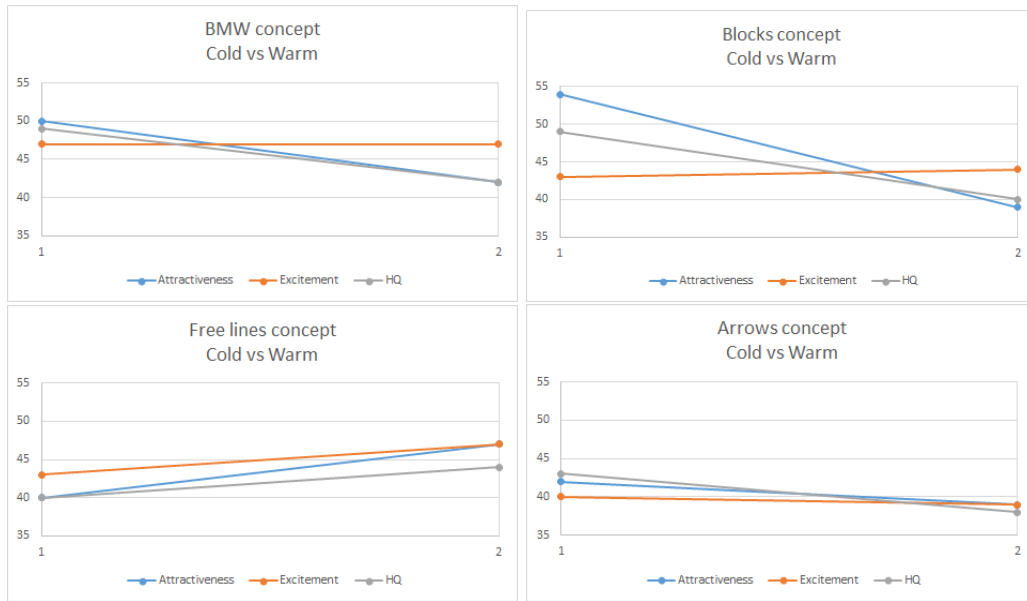
#### *High quality impression*

The test subjects were asked to describe the expectations on a high quality car and also which of the concept they connected with high quality. In the discussion, the importance of a continuous design was once again mentioned. In Figure 5.5 the individual effects are presented; a blue dot represents the effect from changing from cold to warm color, a red hexagon represents the effect from changing from a low density to a high density design and finally the yellow triangle, represents the effect from changing from a fix to a moving design. By considering how many individuals that received a positive effect compared to negative effect, it was possible to identify a trending result. In other words, identify how the majority of the users were affected. This indicated in a relationship between attractiveness and the perception of high quality. Although, the result for concept 5 was less clear.



**Figure 5.5:** Summary of effects in HQ.

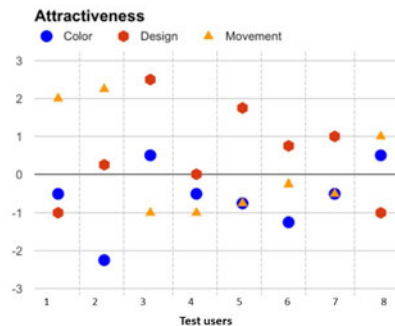
Analyzing the individual results indicated on cold color having a positive impact in the perception of high quality among users, see Figure 5.5. It was only for “the free lines”-concept that the effect was in the opposite way, see Figure 5.6. One reason could be that this pattern was considered as more playful and therefore it was more fitting with warm color. Another aspect supporting this could be that the warm light was perceived as “color” and the white light was perceived as “regular light”.



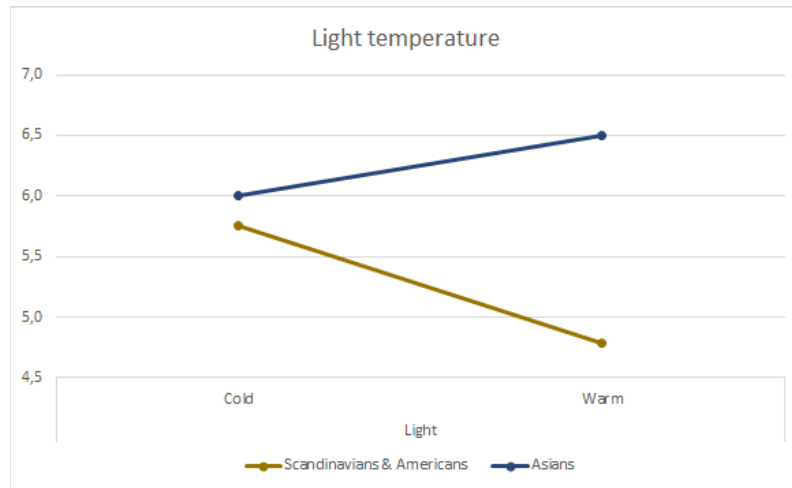
**Figure 5.6:** Summarized grading in concepts

### *Perceived attractiveness*

The result of the analysis indicated that the perceived attractiveness towards a concept was positively affected by a high design pattern density, see Figure 5.7. This result could also be strengthened by the fact that users detected the connection between design aspects, in the car and the projected pattern, easier in the high density patterns. The result could also have been affected by the fact that one of the high density patterns was the first one presented to the users and that the grading became more positive because of that. Like the perception of high quality, a cold color was preferred for all concepts except for 3 and 8. A cultural difference was also identified in how the light color was perceived, see Figure 5.8.



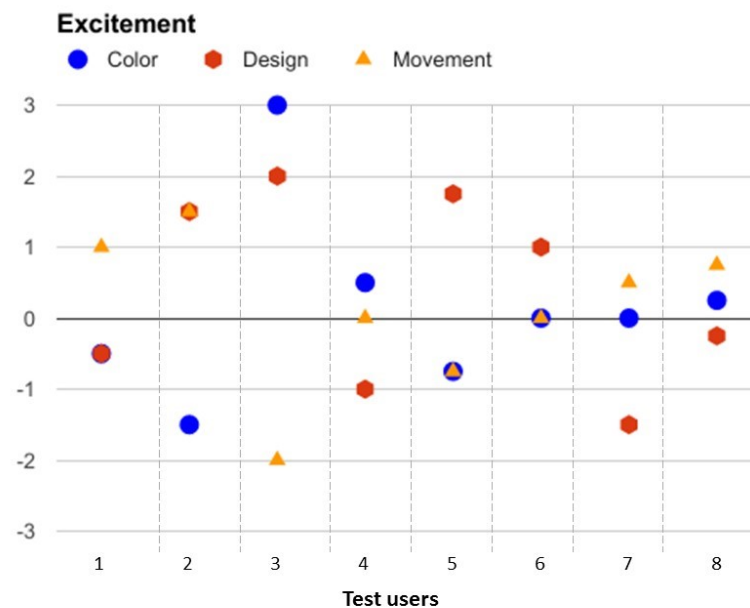
**Figure 5.7:** Attractiveness in test users



**Figure 5.8:** Cultural comparison of mean gradings for attractiveness light temperature

### Excitement

In the discussion, during the test, the test subjects expressed that animation was considered a good way to catch the attention among users. The movement was described as “*eye catching*”. This effect can also be seen in the individual effects. A majority of the test subjects reacted positively on the animated concepts, see Figure 5.9. Color temperature did not seem to have a large impact on the excitement, see Figures 5.6. It was, once again, only for concept 3 and 8 that the users seemed to think differently. The excitement was not affected in the same way as attractiveness and the impression of high quality, see Figure 5.4. However, it seemed like the excitement level was stable when maintaining the same design pattern.



**Figure 5.9:** Individual effects for excitement

### 5.1.3 Findings related to requirements

The result from the first user iteration made it possible to verify many of the previous mentioned requirements. The requirements not connected in the test will not be mentioned in this chapter.

#### *Ease entering of car*

When asked “*what makes you feel welcome to the car*” many of the test subjects replied that they preferred the concepts which indicated on what direction they should move, in order to enter the car. They especially commented on movement towards the car. They also did not like the concepts that “*blocked*” the path to the car. Some of them also commented that the projected light might create some sense of dominance over that particular space. In other words, it would indicate that the area is allocated to the user. Many of them also said that they felt welcome when the interior lights were activated as an indication that the car is ready.

#### *Reflect brand identity*

When the test subjects were asked what they thought the Lynk & Co brand represented a majority communicated adjectives like youth, revolutionizing, new, modern and unusual. All the test subjects were CEVT employees and had a rather good idea about what the brand values were. The next task for the test subjects was to discuss which concept that felt most like “*Lynk & Co*”. After some discussion a majority of the test subjects agreed that the less “*conventional*” concepts, concepts 3, 8, 4 and 7, fit better into the previously mentioned brand identity. They also mentioned that in order to create a more fulfilling concept and strengthen the brand connection, it is preferable to integrate design details from other parts of the car into the projection. Although, what design details that connection should be linked to remains indefinitely.

#### *Increase the perception of safety in the area around the car*

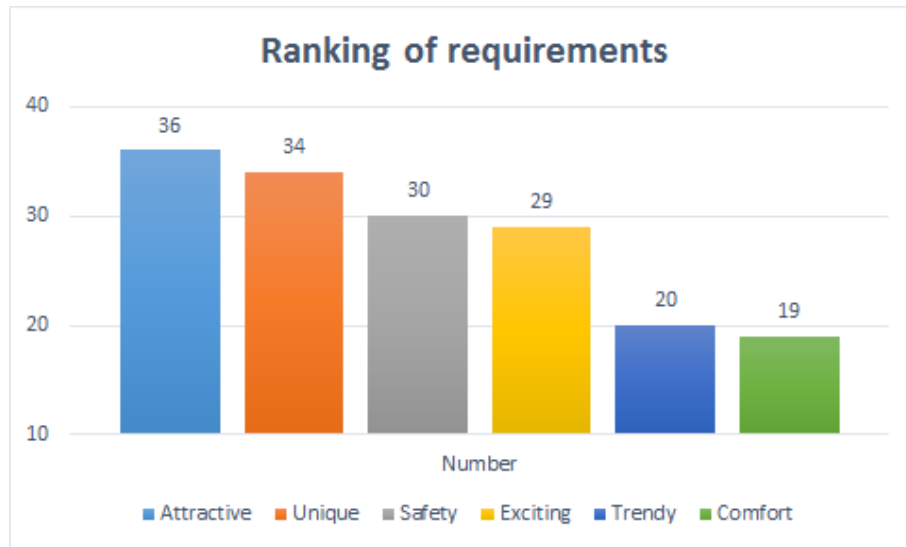
The result from the user test indicated that a trade-off will be needed regarding the light projection and safety. Light creates a more safe environment as it provides a better overview of the interior and closest exterior of the vehicle. It also provides an indication that the car “*is working*” which will lead to a more secure impression of the car. However, there were also some concerns from the test users, regarding how obvious it will become that a user is unlocking or approaching the vehicle and if this will increase the risk of getting e.g. robbed.

#### *Increase self-assurance with the user*

The result from the user test indicates that it requires individual measures in order to increase the self-assurance among users. One user expressed the need for a discreet and small light projection which wouldn’t be considered as an attempt to “*show off*”. Another test subjects wanted something with color which would be considered as more artistic. Another user also suggested that in order to feel confident presenting the concept to other people, it needs to suit different kind of people, in different ages, with different backgrounds etc. The different answers suggests that people have different requirements and preferences in this matter. The design of a light projection concept needs to be aimed towards the same type of customer as the rest of the design. Some test subjects also expressed the need to present a clear intention with the light projection in order to feel confident with the light projection.

### 5.1.4 Results of requirements ranking

During the first iteration of the experiment, the users were also asked to rank the requirements of such a product. These requirements were ranked from the most important to the less important in order to know what was considered as important. Each level of ranking were given weight (1-6) and each requirement had its grading summarized. The following Figure 5.10 shows the results, giving a final order from the most important to less important aspect.



**Figure 5.10:** Ranking of requirements

These different requirements reflect the main aspects the users will look for in a product that offers a welcoming light for users. It is possible to divide the different requirements into three levels of importance. The users seemed to believe that it was important to have an attractive concept with unique elements. This result was also supported in the following discussion where uniqueness was mentioned when talking about showing it to others and also as a reason for creating interest for the product.

The second most important aspects seemed to be safety and that the concept should provide some level of excitement. By this stage the meaning of “*safety*” had not been explained to the test subjects which led to a belief that they were considering safety in general, e.g. not receive physical damages while using the light projection.

In the bottom, rated as the least important requirements, comes trendy and comfort. The low ranking of these can be explained by the fact that this is a fairly new concept and that no clear trends have been developed yet. Uniqueness could be seen as an opposite of a trend, but it is also believed that something can be unique and at the same time trendy. Comfort is probably ranked low because this is a visual product immediately connected to physical conveniently.

### 5.1.5 Summary of iteration 1

Many of the ideas from the previous analyses, which also shaped the requirements, were confirmed in the first user test iteration. This indicated that the project was moving in the right direction. The hypothesis that movement would result in an increased level of interest and excitement was also confirmed. Although, it was also added that the movement itself should be aimed towards the car. It was also noted that the pattern itself unconsciously affected how the users felt about approaching the car. For instance, the pattern should guide the user towards the doors and should not “*prevent*” the user. This is especially an issue when the user is approaching the vehicle from different angles and could have an effect on how the projection is perceived.

One of the most interesting results obtained from the first user test is the importance of the attractiveness as a requirement of the user. A light projection integrated to welcome the user should stand out and be attractive in order to have a positive feedback from the users. A curious factor from these results, is the close relationship between the perception of high quality and the attractiveness of the product. In a competitive market, the introduction of a new product might be tough but by adding solutions that increase this attractiveness, the product will be perceived as good quality product. There were also some uncertainty about if the users were affected by the

first impression because of the novelty in this kind of product.

In the particular case of this project, the attractiveness of the light projection can be controlled by a mix between the color and design used. The first results prove there is a strong dependency between these factors, which can create a higher attractiveness of the whole product. In addition to the design of the actual light projection, the brand identity should be considered into the design by integrating elements that reflect the overall design intention. By integrating these design elements into the projection, the attractiveness will increase.

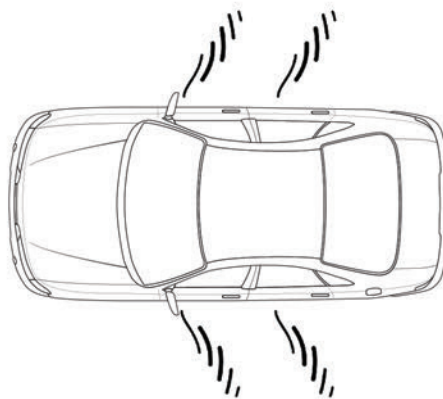
The test also revealed the existence of conventional concepts which was considered as suitable for a large amount of cars. However, the conventional ones were not considered as fitting for the Lynk & Co brand, as it was considered as more *“playful and revolutionizing”*. The possibility to customize the color of the light was discussed before and during the user test. Although, the first iteration of user test raised a new question emerged: how users would perceive different color if they also had the chance to choose the color?

## 5.2 Method iteration 2

Results from the first verification enabled the number of concepts to be limited for the second user verification iteration. The best rated concepts from the first iteration were presented with improvements and other add-ons developed from the result in the first iteration. The improved concepts from iteration 2 was named concept 1, concept 2 and concept 3 dependent on the order they were presented to the test subjects. From these concepts it was easier to test different factors like, the increased level of technology where Level 2 and Level 3 was tested or if previous users were affected by first impressions compared to test users which haven't seen this before.

As it was previously mentioned, concept 2 and 3 were improved in some aspects from the feedback received from the first iteration. The improvements conducted for the second concept, consisted only in changing the direction of the movement of the *“pulse”*. In the first iteration the movement was flowing from the door towards the end of the design, for this last test the movement was reversed to guide towards the door.

As for the third concept, the free lines were modified with the intention to provide a function more than only the aesthetics, these indicate the location of both doors, see Figure 5.11. For the movement of this concept, it was decided to create a *“smooth”* flow towards the doors, for a image sequence of this modified concept refer to Appendix B.

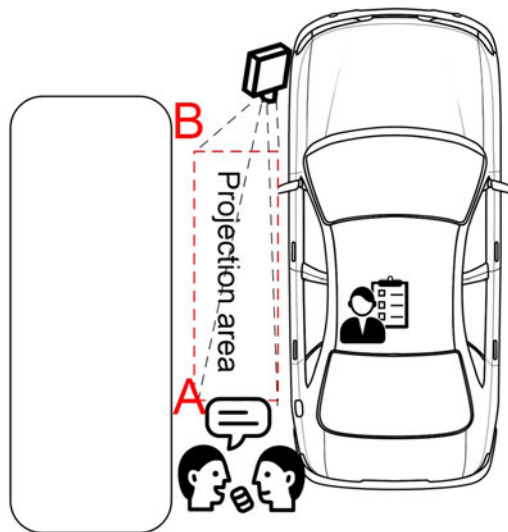


**Figure 5.11:** New *“free lines”* concept

This time the test was carried out in a real environment in order to create a more life-like situation.

The eight test subjects were individually exposed to different projections with a parked car in a controlled area. Once again, the test was performed with an independent test subject to evaluate the chosen method and identify possible areas in need of improvement. The different concepts were shown with the use of a mini projector aimed at the area just outside the car doors. The projector used for this second iteration was a PicoProjector, model PPX3610 with 100 lumens, this allowed a higher level of interaction between the user and the illumination which was not possible to test in the first iteration.

The following Figure 5.12 shows the used arrangement for the second iteration test. The projector was located in the front section of the car at an approximated height of 94 cm, while the test subject was accompanied with an interviewer in the back side of the car. Meanwhile another interviewer inside the vehicle, was presenting structured questions to the test subject, see Appendix F. The questions covered a vocal grading, scale 1 to 9, of the concepts considering the same areas as in iteration 1, perceived attractiveness, excitement and high quality, as well as the reason behind the chosen grade. Since a vocal grading was used, the user was able to change the value of previous concepts. For concept 2 and 3, the users will also have the opportunity to customize the color of the concept right after grading it. For concept 2 they had the possibility to choose between three different colors, while for concept 3 they had seven options which can be found in Appendix B. This enabled for analyze regarding if users get a more positive perception of a concept if offered the possibility to choose color. A cold white color was chosen as default color for all the concepts. The different concepts also had an increasing level of sophistication in three steps. Gradings of these concepts revealed if there were any positive effects on test subject with increasing level which was one of the main initial hypotheses in the project.



**Figure 5.12:** Second iteration arrangement

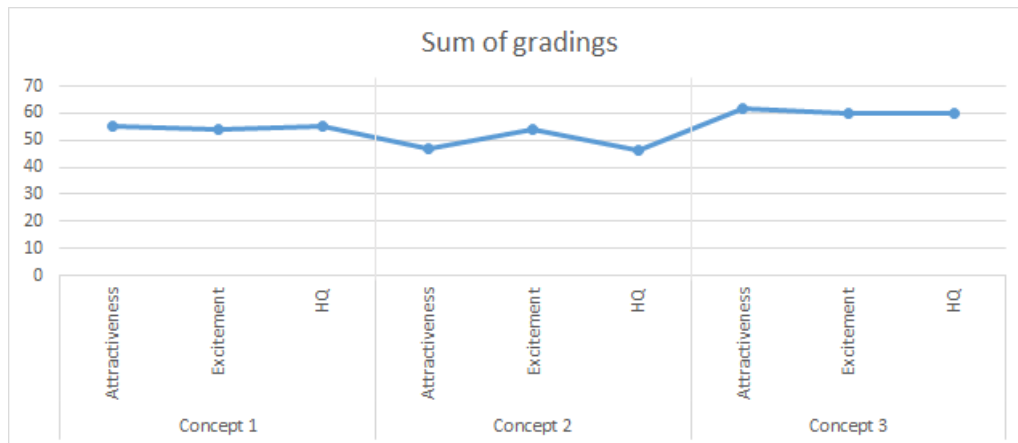
When all concepts were presented, the test subjects were asked a number of questions about light concepts related to the requirements. Some of the questions for this second iteration were based in the previous iteration, related to findings from the focus group. In iteration 1, some keywords related to the brand identify was mentioned, see transcript in appendix F. These words were also supported by findings on the Lynk & Co webpage. In this second iteration, it was decided to include some of those keywords and know which concept was related to each word, the chosen keywords were: *“Playful”* *“New Tech”* and *“New Thinking”*. The test subjects were asked to choose which one of the concepts they associated most with the word. Finally, the test subjects who attended to the earlier test also were asked to compare the experience of the first iteration and the second in order to identify major differences in the two chosen methods.



In order to recreate a dark environment, the arrangement shown before was covered with a thick fabric to prevent exterior illumination. The different concepts were manually controlled by one of the interviewers by using a smartphone connected wireless to a computer. In this particular experiment, it was a complex task to present a high level of graphics quality due the angle of projection. For this specific reason some adjustments to the graphics were required, in order to compensate the keystone effect, blurriness of images along the projected area, optic lens correction and color compensation.

### 5.3 Results iteration 2

Transcripts from all individual interviews can be seen in Appendix F. From the grading in the second iteration it was possible to designate concept 3 as a winner in perceived attractiveness, excitement and high quality, see Figure 5.13. The graph represents the summarized gradings for each concept in each category. A majority of the test subjects thought that this concept performed best in these fields, see Appendix G.

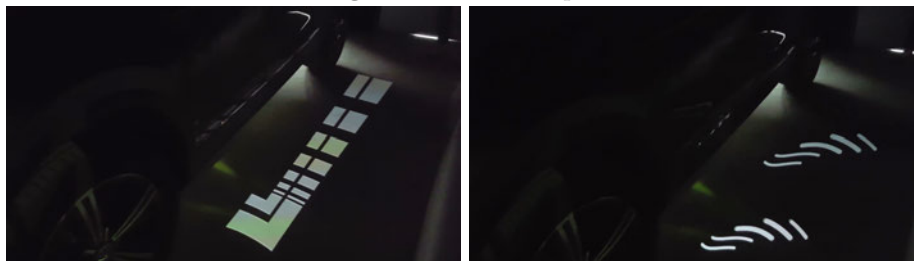


**Figure 5.13:** Summed gradings in concept 1-3

The following Figures 5.14 & 5.15, display the concepts shown to test users in the life-like situation proposed from the second iteration.



**Figure 5.14:** Concept 1



**Figure 5.15:** Concept 2 & Concept 3

### *Pattern and movement*

From this test it was noted that using an “free” and more “open” pattern, as seen in concept 3 which does not focus in either driver or back seat, was preferred in almost all the test subjects. In both concept 1 and 2 the pattern is directed towards the driver seat. However, no measurement was performed of how affected the test subjects actually were by this e.g. 5,10 meters away. The movement of the animation should feel smooth and natural. This conclusion could be done by considering the gradings of concept 1 and 2 compared to concept 3, where concept 3 was considered to have a more “dynamic movement” or “alive” compared to concept 2’s “formal movement” (Test subject 6). Many of the test subjects also spoke out loud that they liked concept 3 better than concept 2 because of this. This supports the hypothesis presented in Chapter 4.2 where an increased level of technology and sophistication in the movement was believed to increase the overall grading of the concepts.

“I like the feeling that it is still kinda elaborate. I think that is what really stands out with this one for me, not as predictable as the other two.” - Test subject 6

Although, the pattern and movement should be picked carefully as the test subjects seemed to relate it to different things, e.g. snakes, water and fish. This finding is also supported by literature mentioned in Chapter 2.3.3. Initially, the grading was believed to be affected by something called “first impression” effect by the researchers. This was supposed to contribute to a higher grading when users were presented with the concepts. This hypothesis was however not supported by the findings in this test.

Also it was found, the graphics are perceived differently not only in the door the user is aiming for, but also depending in the direction of approach. Concept 1 and concept 2, were perceived more welcoming when the user’s approach from the back (Point A) but not so inviting from the front (Point B). Concept 3 was perceived as the most welcome concept since the test users did not

not felt any difference approached from either direction, this due the graphic direction towards the car in a perpendicular orientation, than a parallel direction from the first two concepts.

“From each side or drivers or passenger.... I would feel the same welcome into the car” - Test subject 4

These findings can be connected to the performance quality dimension, another aspect that seemed to affect the perceived quality was how unique the concept was considered. Some of them described high quality as as something that stood out from the rest and delivered something one of a kind.

“Eight because its uniqueness. . . different from what you would expect” - Test subject 2

### *Color and customization*

The test subjects were exposed to a color selection where they were asked to choose which color they favoured in two different concepts. The most favoured color was considered a very subjective matter and often dependent on present mood. The motivation of chosen color differentiated between people who went for the color they preferred and chose a color they thought would last a longer period of time and others who did not feel a need to be able to change color at all if they enjoyed the default color. However, a substantial number of test subjects liked to have the possibility to customize the color according to their personal taste and color of the vehicle. If the default white color was considered as a non-color, it was possible to draw the conclusion that people went for colors from the warm scale in both concept 2 and concept 3. Some of the test subjects also commented on the number of choices in concept 2 compared to concept 3.

“Its nice to choose your own color and personalize it....but also limit it with few options not to complex things” - Test subject 7

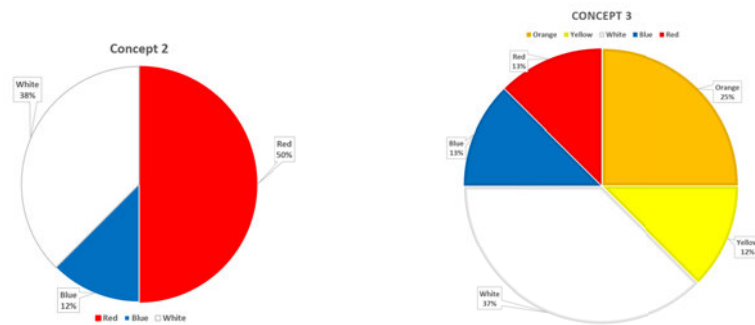
It is easy to believe that, by allowing for more user options, you are making the customer a favor. Although, the result indicated that the number of choices should be limited to make the selection easier. Some users wanted the car to choose color and another test subject even suggested that the perceived quality and sense of a premium product could be jeopardized.

“I think that quality can go lower. I feel like you are buying a party car, that you go out and impress people with. For me that is more tacky again.” - Test subject 8

The concepts used in this test was only presented in one color. However, a render mistake made some parts of the pattern shift in color. One of the test subjects also connected the amount of light with quality as it was related to a powerful light source.

“Because it is so big (referring to the area of lighting), I think its quite high quality. . .”  
- Test subject 5

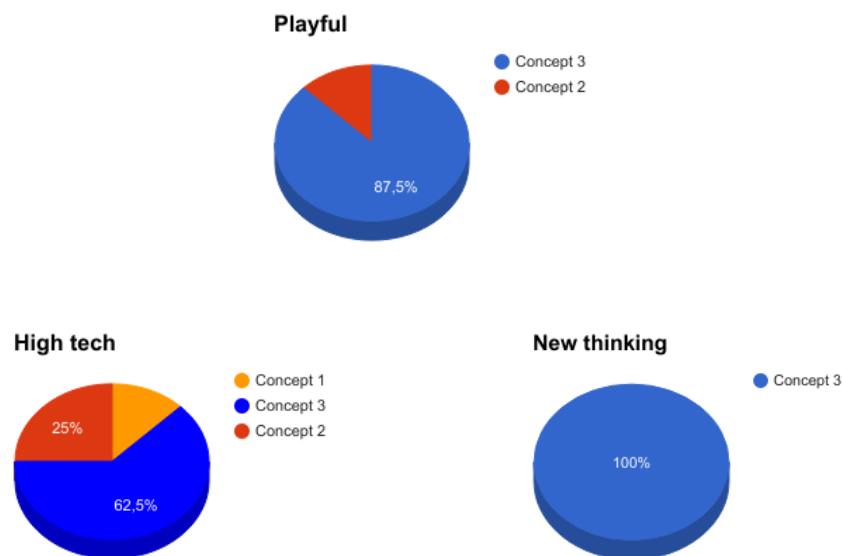
The results from the color customization selection are summarized in the following Figures 5.16, where most of the users preferred a warmer shade in case they selected a different color than the "default" white color.



**Figure 5.16:** Customization color results

### *Brand perception*

The result from the concepts associated with the brand words is presented below. Concept 3 seemed to be the concept most associated with all the words. When choosing concept 3 as the most playful the test subjects motivated this with the concept having “free” and “dynamic” movement. The movement was also mentioned when describing the same concept as high tech. The ones that chose concept 1 as the most high tech pointed at the “*shape of the lines*” while the ones choosing concept 2 motivated the choice with an abstract pattern and intense illuminance. When considering “*New thinking*”, 100% of the test subjects chose concept 3 mainly because of the fact that this concept was perceived as the least predictable.



**Figure 5.17:** Brand perception results

It was also noted that concept 1, which was a BMW reference, was linked to the brand itself by many of the test subjects.

“If I had a BMW I would go for concept 1.” - Test subject 3

This indicates a very good work done by the designers of the german company, in order to establish a strong brand identity in the light projection. Concept 1 was also considered the most conventional concept which according to the researchers also reflects what the BMW brand is about.

### *Self-assurance and use of light projection*

A majority of the test subjects would feel confident having a light projection on the vehicle they were using. Although, some of the test subjects expressed a reluctance to put in extra money just to get a light projection.

“I would feel comfortable and confident to show this to other people. Since it’s a nice feature, and it’s cool, new thinking, alive, giving extra to the vehicle, i would feel comfortable...” - Test subject 7

In general, the test subjects could see themselves using the light projection in most situations. However, when presented with the scenario of an unsafe dark street some of them said that they would like to have the opportunity to turn the lights off from, e.g the key, in order to enter the car in a more discreet manner. Some of the test subjects also made comments about the car being perceived as a safe zone, which also supports having light in the car in order to increase the perception of safety.

“Yes, because I would feel guarded to my car, companion to my car. If I have the car, I will take it as a friend/pet and I would expect interaction with it, specially if it is dark and I am alone.” - Test subject 2



# 6

## Discussion

### 6.1 Choice of Method

One of the aims with the user tests was to evaluate different methods and provide recommendations for future research in the subject. The following chapter will explain and discuss how differences in the execution of the two tests might have affected the outcome and in which situations each method is to be preferred.

#### 6.1.1 Test Environment

One of the aims with the user tests was to evaluate different methods and provide recommendations for future research in the subject. One of the main differences between user test iteration 1 and 2 was how the concepts was mediated to the test subjects. In iteration 1, short videos, representing someone approaching the car from behind, was presented to the users. This way of presenting made it possible to verify the perception among multiple people simultaneously. However, the concepts with a fixed movement had a "turn on/turn off" sequence that could have been perceived as movement by the test subjects. If this was the case, it would only increase the indication that movement is preferred. From this first iteration, movement was also considered as more "welcoming", especially if it was moving towards the car. Another thing that was considered to increase the level of interest, was to present something unique and different compared to other surrounding vehicles.

Meanwhile in iteration 2, the concepts were presented as a projection outside a real car. This kind of test requires a dark environment which turned out to be a problem. Initially, the plan was to create a situation where the test subject was to approach, unlock and enter the car from different angles. Because of the arrangement to create a dark environment, the dark area was limited and the plan needed to be changed. Because the test subjects were asked to participate individually, the test turned out to be more time consuming compared to iteration 1. However, this seemed to open up for deeper discussions about the concepts and test subjects expressed that it was easier to imagine themselves using the idea for real. It will also provide a good opportunity to test hardware and identify possible future issues. The gradings were in most cases equally distributed in iteration 1 compared to iteration 2. However, some test subjects explained that they had changed opinion completely after seeing one of the concepts in the prototype environment which also suggests caution when eliminating concept from the short video presentation tests.

"I think that the 2nd concept looked better in the 2D test. When I saw it I didn't like it." - Test subject 8

In other words, there is a risk that good concepts was eliminated in iteration 1 because of this difference between the short videos and use of a prototype. One possible way to improve the perception in the short videos presentation could be to expose test subjects to a real set-up first. This would probably make it easier to imagine the image in a real situation.

### 6.1.2 Number of Test Participants

Pros and cons with performing tests in group versus individually were also identified. When performing the test in a group the test subjects was affected by the comments and opinions presented by others (Jordan, 2000). This could lead to a result being very affected by outgoing individuals, but in the test it was considered as a good way to force the test subjects into thinking and get an opinion in the subject. This suggests that using a group might give a more valid result if the discussed topic is novel to the test subjects. Although, to provoke a discussion it is necessary to have some level of different views in the group to avoid an immediate unified answer. Because of the efficiency of the method, it is also considered a good way to screen ideas and identify the “general” opinion about something. Because the test is performed simultaneously for all the test subjects the risk of using different test properties, e.g. time of day and phrasing of questions, becomes lower. However, performing individual interviews seemed to allow for deeper and more personal answers. It also allowed for introvert individuals to speak their mind.

### 6.1.3 Collection of gradings

Another difference between the iterations was how the individual gradings and comments were collected. A predefined online form was used in the first test. This was a quick way to collect the data and translate it into tables and graphs which makes it an efficient method to screen ideas with. It also secured that the questions were phrased identically for every test subject. However, this method was not optimal when trying to understand the background to the opinions as the test subjects might not be motivated to write enough explanations. Also, the method did not provide any opportunity to ask follow up questions. A vocal collection of gradings opened up for a more sophisticated dialogue about the concepts - with more detailed explanations using body language and possibility for follow-up questions. It also made the collection faster during the test itself, although it demanded translation afterwards. This method is motivated when trying to improve a small number of concepts.

The use of a nine-digit scale should have enabled for catching small differences in gradings. However, since the test subjects had to grade the reference object themselves, most of them started off with comparatively high gradings which often lead to the lower part of the scale never being used. To be able to utilize the whole scale it is recommended to highlight the reference concept, present an overview of all the concepts or use fixed gradings for the reference concept. It is also believed that this becomes more important with an increased amount of concepts.

In iteration 2, the test subject were given the opportunity to change their gradings if they changed their mind during the test. This probably removed all effects related to the test subjects never seeing something similar before. It also gave the test subjects an extra opportunity to think about the gradings which might have conspired to a more accurate grading. However, the possibility to change grading can become difficult if the test contains of multiple concepts.

In general it was considered very important to set aims for the test before execution in order to develop a clear strategy. It helped when phrasing the form and interview questions as well as when the result was analyzed.

### 6.1.4 Number of Presented Concepts

The number of presented concepts was also something that differed from iteration 1 and 2. Presenting more concept obviously gives researchers the opportunity to verify more concepts simultaneously. It also provides a chance to forget details about previously shown concepts if this could benefit the result of the test. It also allows for design of experiments which will make screening of concepts more efficient. However, the risk of tiring the test subjects also increases with the number of concepts which might lead to them not grading correctly. Presenting less concepts makes it easier for the test subjects to remember a reference object which could make the grading more accurate and makes it possible to investigate each concept in more detail.



### 6.1.5 Selection of Sample Group

Finally, when choosing sample group for a more comprehensive analysis, this study has shown that differences in how light is perceived exists between cultural background. Furthermore, because of the limiting use of CEVT employees for this study, almost all of the test subject had an educational background as engineers. It is recommended to use test subjects with different educational backgrounds. They were also aware of what the Lynk & Co brand stood for which was considered a pro for this study as it provided more valid result regarding what design aspects that was connected to the brand.

## 6.2 Design outcomes

Findings about design aspects is presented in the following chapters. These are also coupled back to the hypotheses presented in Chapter 4.2.

### 6.2.1 Intention of design

It was noted along the different tests, that from a user's perception the light should provide an intention. One intention identified was that the light projection should advocate movements towards the car. This movement towards the car should proceed until the user has stepped into the car.

The different ways to propose the movement towards the car can be achieved by using different graphic elements which could show where the different doors are located. These graphic elements are not necessary arrows pointing the door, but small details that exhort the location, e.g. curves, unique elements or graphics orientated to the doors. Besides the suggestive graphic details, as the results showed in the tests, smooth animations with dynamic movements towards the doors can unconsciously help the users e.g. pulse movements towards the car or shapes "*entering*" into the car like the third concept in the second iteration.

Once the primary action has been fulfilled, it is suggested the graphic elements "*play*" creating an "*alive*" effect and users can feel when the car is "*waiting*" for the user to enter into the car. By achieving this, something will always be happening in the illuminated area and dark spaces will be avoided. To enable a functioning communication between car and human, as stated in Chapter 3.3.4, the design should be intuitive and have humanistic traits. Movement with an intention can be one way to send a message from the car to the human. It can also function as an important creation of a first impression as an "*intelligent vehicle*".

### 6.2.2 Design of shapes

From the design perspective for the graphics, it is highly advised to use design elements from the exterior of the car. Many of the test subjects made comments about how well the design pattern matched the rest of the car. This supported Hypothesis 2, *unique design*, and it was also noticed during the benchmark that a number of brands have already adapted this way of thinking. In addition, symmetrical shapes should be considered both for driver and passenger door, hence a commensurated design for all the users in the car. The design should also avoid blocking the user's path to the car, as mentioned in the results from iteration 1 discussing patterns and shape. This is an interesting finding as it indicates on how important the mental perception is. There is nothing physically hindering the user from approaching the car, but still it has an affect on the welcomeness.

One of the identified trends was the use of minimalistic patterns which gave rise to concept 3 in iteration 2. This turned out to be the most preferred concept by the test subjects and it was also connected to words like "*New thinking*" and "*Unique*". This could be interpreted as an indication of minimalistic design enhancing the perception of a light design.

The identification of conservative and playful concepts is considered as one step towards understanding what the perceived quality dimension is about. Even though Lynk & Co is considered as

a more playful brand, it could still be important to consider conservative design aspects as there is a risk that the playful ones being perceived as lower quality. An interesting factor from the results of the tests, it is the segmentation of users, it is easy to spot on two different profiles of people. One group of people were slanted towards a more conservative graphics and the rest towards a more playful graphics, especially if they were asked to think about the Lynk & Co brand. Another aspect to consider from a quality perspective, according to the researchers, is that the pattern design should be in harmony with the movement, e.g. if the shape of the pattern indicates fast movement then the animation should also be given a slightly increased velocity to give harmony to the whole concept.

Chapter 5.2 mentions which technical difficulties were encountered in order to achieve a good projection for the second iteration, e.g. Keystone effect, blurriness and color correction. The way to overcome them was to use some of the tools provided by the After Effects software, where some visual effects were applied to compensate the optic lens of the projector and reduce the amount of keystone effect. Also some color ramping was used to try to achieve a more even color and light intensity along the projection. Later on, it was discovered that not only by applying visual effects it was possible to compensate for the difficulties, but also by adapting the design of the graphics. While the BMW lines (concept 1) looked distorted without any visual effect, the free lines (concept 3) did not require any effect in order to look good. This was due the shape of the graphics used, from the angle and location of the projection it was easier for the BMW lines to seemed curved due the high parallelism they have. In the other hand, perpendicular “*lines*” from the third concept, with changing width was not affected by these effects. In conclusion, the shapes of the used design might be affected by optical distortion, but can be fixed with visual effects or less affected by the form of the shapes.

#### *Color perception*

Results from both tests indicated that a white light is less tiring in the long run and also perceived as more appealing for the test users, especially when these are asked to keep the same projection color light for long periods. Besides the selection of a white colored light, as it was mentioned before, the test users had the opportunity to chose from a variety of cold and warm colors. While most of them preferred to select a warmer color when they had the opportunity, some stayed with their selection of white light. With this in mind, it is not possible to assure these test users who remain with the white light prefer indeed cold light colors. It is possible to think that most of the users perceived the light projections in three different main colors: cold, white and warm. From the studies and the different comments received during the interviews, users who selected this warm color, was due to a warm welcomeness when approaching the car.

Furthermore, most of the users perceived the light projections as more playful when they had to choose between different colors. In addition, due to a rendering mistake in iteration 2, it was discovered that even a mixing more than one color in the same graphics it is enjoyable by the users, providing this an even higher level of interaction. In order to please a larger group of people a compromise between color and white light could be considered, e.g. a pattern with a majority of white light and only add colored details. Another solution could be to divide the pattern into different areas (e.g. background, details, main shape) and allow customization for these areas.

In the beginning of this report, theory shows a relation between color preferences and gender of users in ambient light. However, the tests indicated that for the projected lights in the exterior of the vehicle there is no relationship between these two factors. However, in iteration 1, a cultural difference was identified. The result from the study could be considered to contradict previous research done by Wanga et al. (2017) where the preferred color temperature for indoor LED lighting was investigated. In that study it was suggested that western cultures prefer warm light and eastern cultures prefer a cold light temperature. The result from iteration 1 do confirm a difference between western and eastern cultures. However it suggests an opposite result where western cultures perceived a warm light as less attractive than a cold one. This result can be explained by the limited sample size, but it can also indicate a difference between preferred light temperature depending on if its interior or exterior illumination. Another reason could be that

this is a projected light image and the test subjects are not surrounded by the light.

As it was mentioned in Chapter 2.2, light surfaces with grayish colors tend to be sensitive to external influences, said this is important to mention the gray color of the floor where the test was performed. This sensitivity of the grayish surface is believed to have changed the perception of some colors for the test users. Moreover the texture of the area where the projection is performed is also a factor that might change the perception of the figures and colors. For the second iteration test, this factor was eliminated due the usage of a flat untextured surface to project the different concepts.

The previous outcomes mentioned, are summarized in the next figure 6.1, where the BMW, the blocks and the two versions of "*free lines*" from iteration 1 and iteration 2 are included. It presents a correlation where the color used for a light projection will be dependant on the style of the graphics. In case the concept is playful, it will be recommended to use variety of colors or warmer colors. While in concepts were more conservative graphics are used, its preferred white color for the light projection.

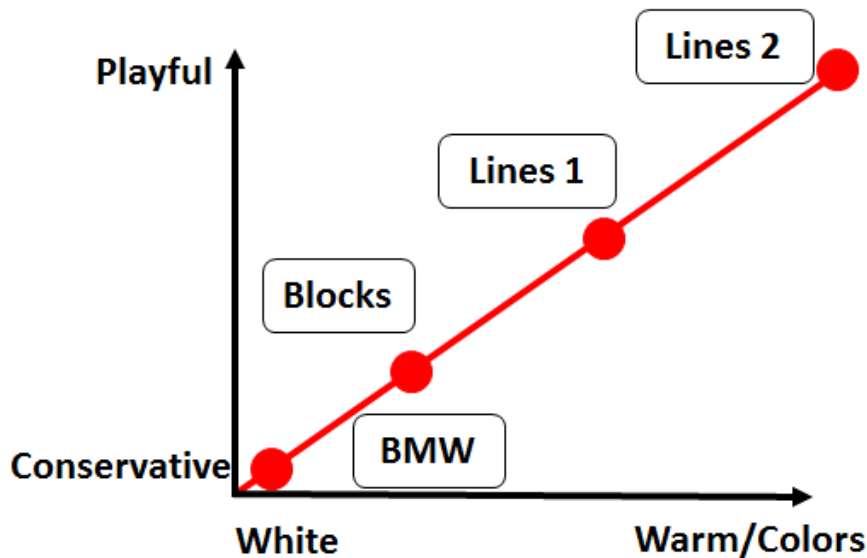


Figure 6.1: Correlation between color and interaction

### 6.2.3 Customization

The result from both iterations indicates on a customer need of different customization levels. Preferred colors and patterns are a highly subjective matter and can also change due to time and environmental factors, e.g. color of the car. Some test subjects mentioned a downsides of offering too many options, e.g. difficult to choose and perceived as less quality. This conclusion came from the comparison between a three and seven choices selection. This indicates that seven options could be considered as a limit, although this study did not provide enough evidence to identify an optimal number of choices. By comparing this result to the benchmarked vehicles in Chapter 3.1, it is possible to believe that many of the leading car manufacturers are offering too many options to their customers. The result from the study also suggests that there should be two options regarding how noticeable the design pattern is. The study revealed that there are two different kind of opinions in this matter, one motivating use of discreet designs and the other one motivating an extravagant design.

Similarly, the customization of the controls of the light projection is also required. The results shows that the users indeed are positively affected by the option of customizing the product, e.g. at what time of the day the projections should be turned on or if the user is encountering a sit-

uation where he/she don't want to draw too much attention. A proposal from the researchers is to control the light projections from the keyfob, depending on the number of times the user press the unlock key. For instance, pressing one time could lead to the system not turning on since only the driver's door will be unlocked, meaning that is driving alone and wants to keep a low profile. If the user press the unlock button twice, the system is activated.

One way to gather different users, is by giving the opportunity to users to customize the light projections using different profiles that suit as many people as possible. In the interface is possible to recommend specific settings, such as graphics, colors and movement that fit in harmony with the specific version the users acquired. Besides the settings recommended from the manufacturer, the possibility for the users to choose their own, will be highly appreciated, especially if these have the same name as the model version.

### 6.2.4 Out-turn of requirements

The result from iteration 1 showed that the most important aspects in a light projection is attractiveness and uniqueness. When grading the concepts in iteration 2, uniqueness was mentioned as a motivation for a high scores. Hypothesis 3 claimed that by increasing the amount of light it would also increase the perception of a safe car. This turned out to be a truth with modification. Light increased the perception of safety as it was an indication of the car working, but on the other hand it will also put attention on the user which might not be preferred in all situations.

Because the requirements were not explained to the test subjects in iteration 1, it is not certain how they perceived the different requirements. However, the reason for not providing an explanation was not to bias the perception in the test subject and only use their own personal understanding. It was also believed to have worked as a warm-up session for the test subjects, helping them to get ready to discuss the topic in the following group discussion.

One issue identified in this project was the difficulty of translating design recommendations into design specifications as this is a highly subjective area. Further research will be needed in order to identify what specific numbers regarding light flux (lm), illuminance (lx), size of the area lit up, velocity of movement etc, if it will ever possible to specify these kind of numbers.

## 6.3 Implementation of solution

The following chapters are discussing possible concerns when implementing the solution. It is also presenting some suggestions for future applications developed during the project.

### 6.3.1 Placement

The placement of the light projector has not been in focus in this project. However, it was still considered as interesting to mention certain findings and ideas about the placement which arose during the project. During the benchmarking two different placements were identified - underneath the side mirror and behind the front wheel. There are pros and cons with the two placements presented in table 6.1 but one common downside is that the placement only covers the side area of the car. This project has not investigate the effects from using light projections in front of or in the back of the car. However, it is believed to be an area that should be considered for light projections as this is the area in focus if the car is parked in e.g. a crowded parking lot.

Placing the components underneath the side mirror would decrease the keystone effect on the projection compared to mounting it behind the wheel. As the placement is further away from the ground, it would probably also result in less contact to dirt. However, if the side mirror gets hit by another car or if someone tries to steal it the maintenance cost might be higher compared to a solution mounted behind the front wheel. Another pro is that the interference with e.g. an opened door will be minimized. Although, the low placement might lead to an increased contact to dirt

and damage, related to e.g. stone chip. With time there is a risk that dirt and minor damages will lower the quality of the projection which must be taken into consideration by aiming for a robust projection designs.

**Table 6.1:** Table of possible placement

<b>Underneath side mirror</b>	<b>Behind front wheel</b>
Higher mounting which leads to decreased keystone effect	No interference with opened door
Less dirt	More contact to dirt
Risk of getting hit	Risk of damage
Risk of stealing	

### 6.3.2 Possible add-ons

Adding a light projection to the vehicle also opens up for endless possibilities of functionalities, where these different possibilities can start prior the driving. By creating more connections with the user, the car will be able to provide useful personalized information and increase the driver experience. This type of personalized information, might be retrieved from the user preferences, current status of the car (fuel, locked, tire pressure, etc), location, weather conditions, available seats or even contents from the phone such as: calendar, contacts, missed notifications and preferred theme. This could e.g. mean that the car will adapt the design of the light projection depending on if it is your birthday, morning or night time, Christmas or if the user is going out on a date. This function could be extra useful if the vehicle is shared between different users but a level of personalization is favoured. These projections might also explore new possibilities where users might interact with the projections e.g. video games or kid animations.

The light projection could also decrease the risk of being hit by other trafficants when e.g. opening car doors in a busy street. It would provide an extra indication of human presence around the car which could lead to both decreased speed and enhanced awareness. This would be especially useful if some of the users are children. It could even suggest to the user which door that might be safest to use according to current situation. In crowded parking lots, trafficants and pedestrians could be provided with help, e.g. extra information about if a car is about to back out from a parking space. The light projections could also increase the effect of the vehicle's hazard lights.

Light projections might also add value when exiting the car and contribute to a complete experience. The pros with providing a welcome to the user have been mentioned multiple times in this report but the same motivations can also be used on creating a nice goodbye to the user when he is exiting the vehicle. This could be a powerful way of ending the usage of the vehicle in a positive manner or marking the change between two different users. Other functionalities that could be integrated are for instance providing help for the user not to forget about sensitive groceries in the trunk or if they have forgotten their smartphone.



# 7

## Conclusion

The conclusion from this project is that by experimenting with shape, color and movement of the light it is possible to affect the perception of the car. This fact has been used and exploited when designing architectural light designs. However, the results from two iterations of user tests indicates that it is not possible to apply the same theories on an exterior light projection on a car. The reason for this is most likely that there is a difference in how surrounding light is perceived compared to surface projected light. The different tests also showed in a complex relationship between these three factors, and a trade-off between color, movement and patterns are necessary. These tests also demonstrated the need of considering at least two different profiles, where users could feel identified in a outgoing or reserved profile. Additionally, is appreciated by users when there is light, therefore it is important to avoid darkness while the light projection is running otherwise the projection might loose sense.

It was mentioned during the interviews, how several users would appreciate having such device in their vehicles, and the possibility to personalize it according to the car's paint color. The results showed the color selection for a light projection, is a subjective decision but most of the users would like to be able to personalize it and create a personal harmony between their color preference and the vehicle.

Users also reacted positively when they were exposed to lights when these involve movement. Lights moving towards the car were better perceived from the users, therefore if a light projection in a L2 or higher level is moving towards the car, will be highly appreciated especially if these are moving smoothly similar to an alive behavior. Furthermore, movement is not the only aspect that should resemble a direction, the patterns used are quite important as well.

The design of the pattern should not only guide the user to the car, but also should be robust enough to withstand some dust or dirt that the projector might encounter while using the car in a daily basis. In the same way, the shapes of the selected pattern should be selected carefully, since these patterns can help to reduce any visual issues the angle of projection may raise. In the other hand, the selected pattern should consider cultural differences since these may be interpreted wrong and perceived as low quality.

The overall perception of quality is a matter of a combination of components. Using a light projection correctly is believed to increase the overall quality of the car as it is a unique extra feature. However, if used incorrectly it is believed to risk creating a cheap and low quality appearance. All of the test subjects expressed an interest in having a light projection on their own car.

It is believed that with an increased amount of autonomous cars the user behaviour towards cars will change. This will in turn put more focus on creating an enjoyable atmosphere outside and inside the car. Intelligent cars also put new demands on how information is communicated to the user. Light is believed to play a big part in this increase of communicative surfaces. Future users will probably also have higher demands on the possibility to update and customize their products.

One of the identified brand values was being perceived as a new high tech car. Presenting a light projection is believed to elevate this perception in the user as it is still considered as a unique concept. As this is an exterior solution it will probably also create interest in people passing by

which creates an efficient channel to spread design features connected to the Lynk & Co and also generate new future customers.

The importance of a clear reference was identified in order to ease the identification of important design aspects. Individual interviews should be preferred when aiming for more detailed information but performing tests in groups was considered more efficient and provided a general point of view. A real-life test environment was considered to provide the most trustworthy result even though the setup itself might have some downsides. If images are used for initial screening of ideas, caution should be paid when eliminating concepts. The recommendation for future research is to investigate the limits for options in customization and identify cultural differences in the perception of shapes, colors and movement.



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# A

## Appendix 1

### Walkthrough of course of events

The initial state of the walkthrough is when the car is parked and a user is approaching it. The car can be parked in different environments e.g. a parking lot or beside the street. This environment can either be lit up or comparatively dark. The walkthrough will also be affected by technical limitations - if the car will be able to detect users approaching or if the activation of the light requires an action from the user, e.g. unlock the vehicle. This results in two different scenarios being described below.

#### *Approaching car*

Scenario 1 is only prevailing if the technology allows the car to recognize presence of the key or the smartphone. The light is then activated when the user is approaching the car, see figure A.1. The distance of when the light should be activated depends on several factors. It could for instance depend on how safe the user perceives the surroundings. Users might not want other people to know which car he is approaching in an environment where there is a high risk of being mugged. Another example of this is if the car is parked in a private garage where there is no need for the light to go on before the user is entering the garage or in a crowded parking lot where it is impossible to see the projection anyway. If someone is about to utilize a shared car they might not know where the car is parked or how the car looks like. In this type of situation, a welcoming light might provide a good support and even enhance the perception of safety for the user. In other situations it might be necessary for the user to see if the car is locked or not. For instance when someone is walking away from the car and starts to wonder: “*Did I really lock it?*”. The welcoming light should communicate that the car is awake and ready. Also, if the environmental light is not able to light up the ground around the car, the user might risk hurting himself.

#### *Unlocking car and choosing door*

After this point, the user can proceed in two different ways: either unlock the car while approaching it and then choose a door or unlock it when standing right next to the already chosen door. The main difference between the two alternatives are the distance between the user and the car. If the user chooses to unlock the car while approaching it could once again be convenient for the user to notice if the car is already unlocked, in other words see if this activity is even necessary in order to proceed. The head and rear lamps will provide a feedback to the user when the locking or unlocking command is activated from the key.

The user also has to choose which door to encounter and if the user is also known as the driver, the decision might not be that complex. But imagine a situation where the car already has passengers, it is dark outside and the car have tinted windows. In that case it can be difficult for the user to know which door to choose without risking to choose one that is already taken.

#### *Open and closing door*

In order to open the door correctly the user needs to stand in a correct position otherwise he might be in the way of the opened door. If the user is carrying luggage, he could also choose to approach the trunk instead of a passenger door.

If the trunk was opened and then closed, the user has to choose another door in order to be seated in the car. In this situation it could be helpful to receive some feedback as well that the trunk was closed in order to avoid troublesome situations where the user needs to exit the car and go back to the trunk. As soon as the passenger door is opened there is a shift in attention in the user. Focus will now move from the exterior to the interior of the car in order for the user to be seated. By the time the user is seated inside the car focus have shifted almost completely to the interior.

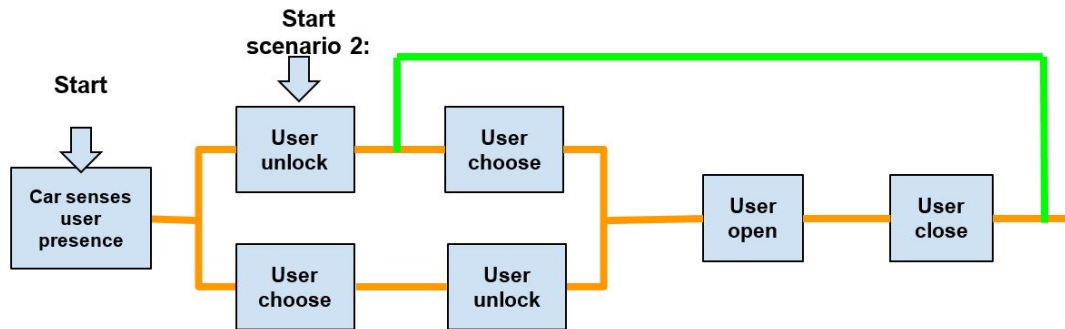


Figure A.1: Walkthrough of course of events

# B

## Appendix 2

Sequence of pictures



**Figure B.3:** Free lines 2 concept sequence

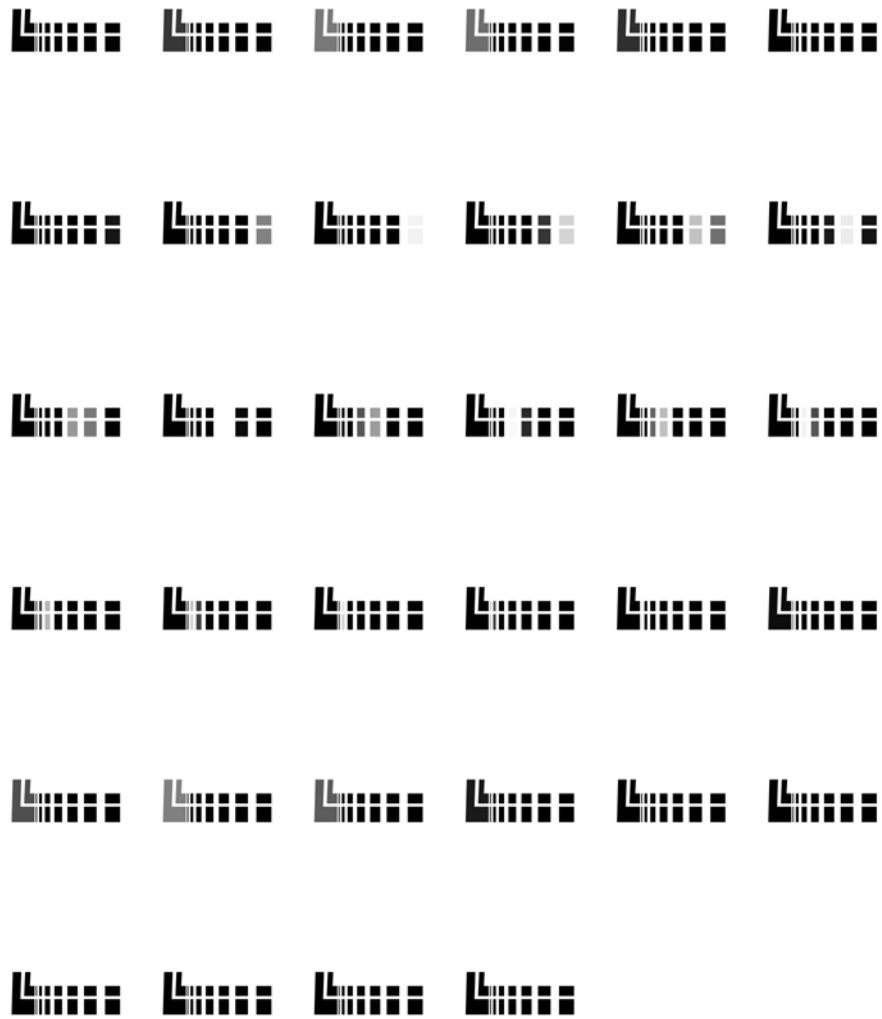
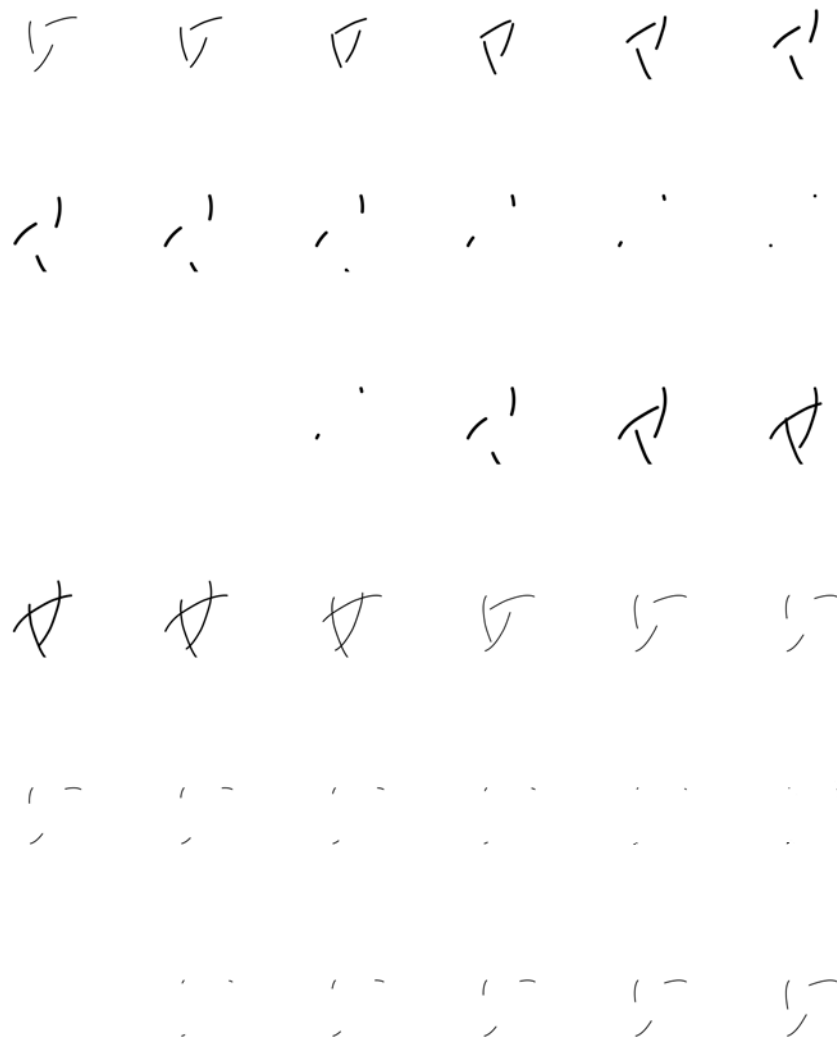
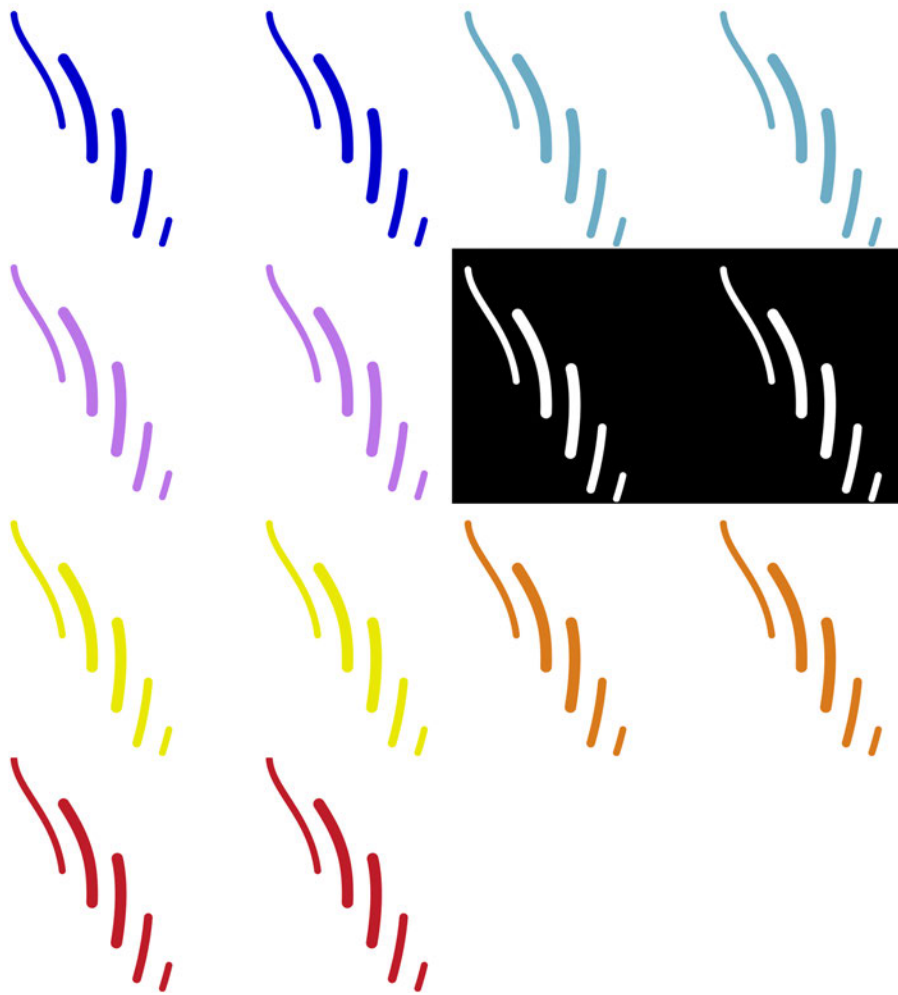


Figure B.1: Blocks concept sequence



**Figure B.2:** Freelines concept sequence



**Figure B.4:** Free lines 2 concept sequence different colors



# C

## Appendix 3

Renders from first iteration



Figure C.1: Concept 1



Figure C.2: Concept 2

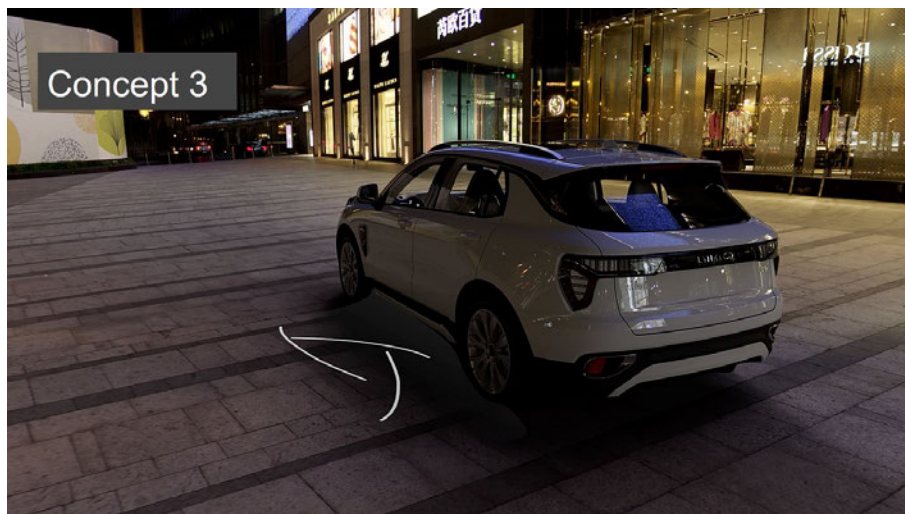


Figure C.3: Concept 3



Figure C.4: Concept 4

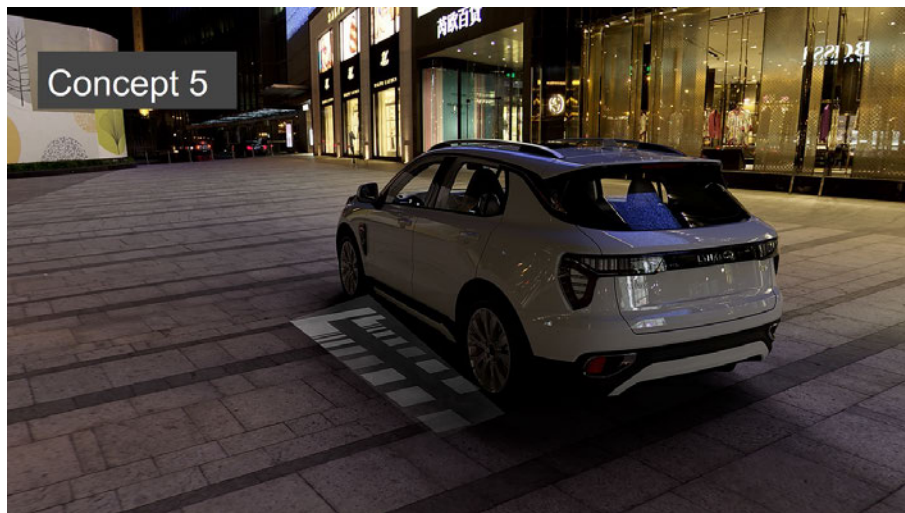


Figure C.5: Concept 5

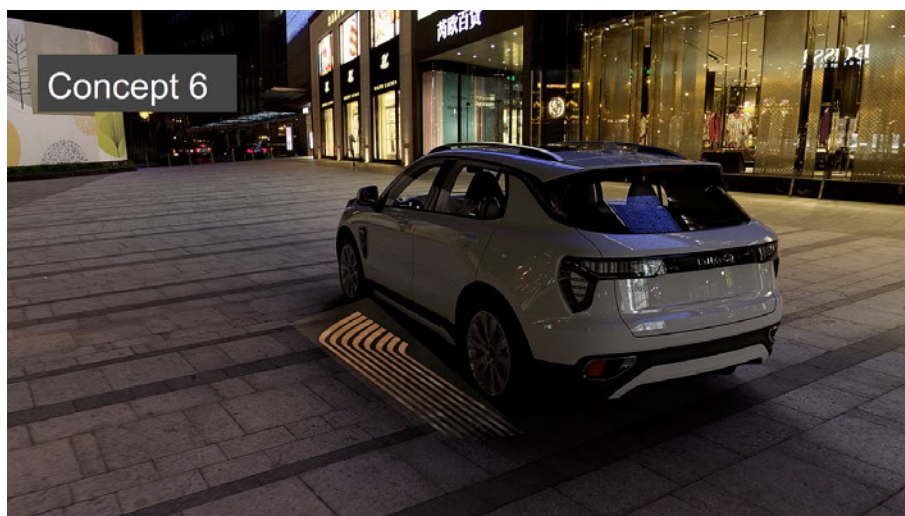


Figure C.6: Concept 6





Figure C.7: Concept 7

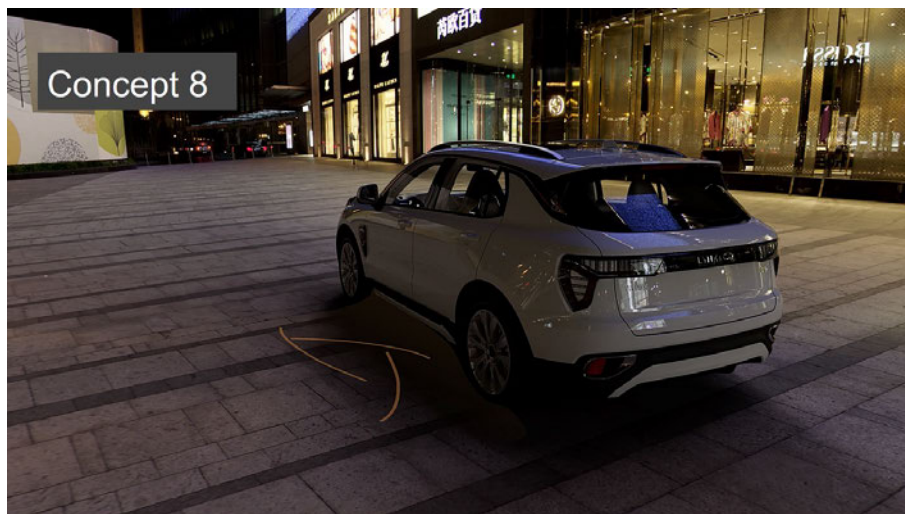


Figure C.8: Concept 8

# D

## Appendix 4



7. What aspects of the light makes you feel this way?

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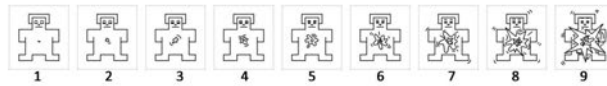


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8. How exciting do you find this concept? \*



Mark only one oval.

	1	2	3	4	5	6	7	8	9	
Boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Makes me want to know more

9. What aspects of the light makes you feel this way?

---



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---



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10. Do you consider this concept as high quality? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	
Low quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	High quality

11. Why?

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### Evaluation of concept 2

Please answer the questions according to your current perception. The images can be used as a help to identify your current state. It is preferable to describe the first impression, rather than spending a long time thinking about each concept. You will have about two minutes to describe each concept.





# E

## Appendix 5

Transcript from focus group discussion.

*Interviewer*

- What makes you feel welcome to the car

*Swedish, male, 5*

“Interior and smell”

*Indian, 3, male*

“Attractive looks from outside, see through the inside, features that draw attention”

*Interviewer*

“Let’s say you haven’t open the door of the car, what makes you feel good from the outside ”

*Mexican, 4, male*

“Clean, means is new and fresh”

*Swedish, male, 1*

“Mostly about the molds” “from a door closed I have already set up my mind”

*Interviewer*

Would you say it’s more about a modern car?

*Swedish, male, 5*

“The design says pretty much everything”

*Swedish, male, 1*

“BMW car makes me more fuzzy, overall experience”

*Swedish, female, 6*

“Looks like a whole car” “Should look nice” “I don’t care that much”

*Chinese, female*

“More interaction with the user, should look like bumblebee, change according to the mood to the owner” “Body of exterior change according to my mood”

*Swedish, male, 1*

“Adapt the keys, depending on users”

*Indian, 3, male*

“Small details that add value to the car” “Looks like a majestic car”

*Mexican, 4, male*

“Feel a good sensation when you close the door” “Isolated noise”

*Interviewer*

“When you are approaching to the car, how would you like to behave? (39.00)

*Swedish, female, 2*

“Shows you where to go” “Not only this is the car, you are supposed to enter here”

*Chinese, 8, female*

“React like a dog” “Car is happy to see me”

*Interviewer*

“Which of this concepts makes you feel more welcome to the car” (40.00)

*Swedish, female, 6*

“Concept 1, it was a great pattern and great color”

*Swedish, male, 5*

“Concept 1,5 and 6, it resemble, the light of the tail” “Other concepts too far away from car”  
“Aspects that resemble the car”

*Swedish, female, 7*

“Shows you where to enter” “Shape showing you a path” “Race track”

*Indian, 3, male*

“Concepts 1, 2, 5 and 6, 1 and 6 Minimalistic, zebra or tiger” “2 and 5 guiding steps”

*Swedish, male, 1*

“2 and 5, looks like a warning, fire alarm follow this path.” “1 and 2 (all of them), supposed to walk from back side, if you walk from the front side. Feel wrong to walk from the other side.” “Not guiding lines with 3,4,7,8...here’s the door” “Guide lines”

*Swedish, female, 2*

“Mix between 3 and 5, not showing movement. Showing lights in the ground, like more flowing”

*Interviewer*

“Opinion of fixed vs movement patterns” (45.40)

*Swedish, female, 2*

“Prefers movement, more soft”

*Mexican, 4, male*

“Like #4 Subtle lights, invites you to board, arrow shape” “1 and 2 too much light” “3 and 8 , look like advertisement.” “4 and 7, 4 warmer color, like warmer, more welcoming”

*Chinese, female*

“7 and 4 resemble brand” “1 and 5 too many lines”

*Indian, 3, male*

“3,4,7 and 8 small, less light...easy to miss the light at night.” “3 and 8 disco lights” “other, safer to go options”

*Interviewer*

What makes you feel interested in a parked car?

*Swedish, female, 6*

“unusual car, that you don’t see everywhere”

*Swedish, male, 5*

“Car that stands out from the parking lot”

*Swedish, female, 6*

“Unique design features”

*Interviewer*

“How do you think you can make a car unique?” (49.00)

*Swedish, male, 5*

“With design

*Swedish, female, 6*

“Design, and lights” “Stand out from design”

*Indian, 3, male*

“Tail lights, catchy specs, spoiler, lines of the car” “Not a big brand, but not too many cars from that brand”

*Interviewer*

Would you feel attracted to the car with similar projections? (50.50)

*Chinese, female*

“If it’s moving into the car”

*Interviewer*

“movement towards the car”

*Mexican, 4, male*

“Attractive, show space that someone will take over, step in or step out of car” Dominance of space

*Swedish, female, 7*

“Something not that common, so it will attract your attention” “In future all cars will have it”

*Interviewer*

Any particular graphics that draw your attention more

*Swedish, female, 6*

”Concept 1, but is not moving” Darker, not during light

*Mexican, 4, male*

“Only. . . .When open the door?”

*Interviewer*

“What would you prefer?”

*Indian, 3, male*

“The light starts from the back wheel to the front wheel. This means that I would perceive it as a guiding light.” He is pretty close to the car.

*Interviewer*

“concept 3, would that be different?”

*Indian, 3, male*

“As I said, concept 3 looks more like a disco light to me. So I might perceive it like a theft detection alarm.”

*Swedish, male, 1*

Mentions that it would be cool if the car recognizes which direction you come from. From wherever you approach the car, the guiding light would be straight towards you.

*Interviewer*

“Like following you?”

*Swedish, male, 1*

“Yes, exactly. That would be really exclusive.”

*Interviewer*

- You just bought this Lynk & Co car, and it's a brand new car so everyone would like to see it. But which of these concept would you feel most confident to have in your car? Maybe the one that would make you feel proud? Something you could show to your family and friends. Someone.

*Indian, 3, male*

“ I would go for concepts 2 or 5.

*Mexican, 4, male*

“Concept 4.” “Because it looks , like very modern, and at the same time I can see the intention of it. I like that it is with some color, not just light. It feels like the most artistic concept.”

*Swedish, male, 1*

“It fits to the car, to the modern generation.”

*Swedish, male, 5*

“I would also say number 1 and 5, because it resembles the car. And for the number one, the people at CEVT has seen it before \*shows CEVT homepage, image of rear and headlamps on a busy road during night time.\* And number five resembles the tail light.”

*Swedish, female, 7*

“If you are showing a new car you want everyone to like it. So I guess number one I would say that most people in different ages would like. It's not super weird about it or anything.”

*Interviewer*

“So you would like that your parents to like it but also like your kids?”

*Swedish, female, 7*

“Yes”

*Swedish, male, 1*

“Number four if it is moving. I would just like to add.” “Because it is more eye catching. A small space moving through it, kinda. “ Like a pulse.

*Interviewer*

“Do you think there is a difference in if you are showing the car to people you know compared to if you are parked on a busy street and a lot of strangers is walking by. Do you think there is a difference?”

*Swedish, female, 2*

“I don’t want it to be too much. I would like it to be a small detail.” Don’t want people to see me as someone who is showing off. “Maybe you would like to show off, but not like super showing off. Something cool, not like flashy...”

*Interviewer*

- what makes you feel safe in the environment around a car? Imagine that you are approaching a car in a parked street and it’s dark and probably difficult to see the surroundings. What would you think would make you feel safe in the environment around the car? Outside the car.

*Swedish, female, 7*

“If you are parked in a dark street it feels like you would like to come into the car quickly. Somehow, it lights up so you can easily find where to open the door... Because it feels like it is safe inside the car.”

*Chinese, female, female*

“With some warming but not like the red. Its warning light.”

*Mexican, 4, male*

“I think that the interior is lighten up, it’s important that you can see that no one is inside your car.”

*Swedish, female, 6*

“Yeah lighting would make it more safe. If the car lights up... ” “ But then if there is light in the car, and there is like a sketchy person maybe they can see that someone is getting into the car and they will rob me. So I don’t now.” “I don’t really know how I feel about this.”

*Indian, 3, male*

“But even now with the current cars that we see once we are walking towards the car we just unlock the car from a distance just to see what is there in the dark environment. Even then the ambient lights they go off.”

*Swedish, female, 6*

“I usually wait until I get really close.”

*Indian, 3, male*

“Maybe what I would prefer is, maybe in the future...” Gives idea about autonomous car approaching user when you are unlocking it. That it would come to the place where you are waiting for it. Gives another idea about the car starting the engine when it is unlock in order to give away a scaring sound. Jokingly says “like a tiger”.

*Chinese, 8, female*

Gives idea that you should get unlocking feedback in the key. “So other people can’t see it, only you.”

*Interviewer*

“Which of these concepts would you like to have in a situation like that? That would make you feel more safe? Like in a lonely dark street?”

*Swedish, male, 1*

“The emergency lanes, I guess” \*Points at animated blocks concept\* “Because they are really, ... ‘run as fast as you can’”

*Swedish, female, 6*

“I would like to have the ones without the lights. ... if I’m alone in a dark place.”

*Interviewer*

“So you would probably want to deactivate it?”

*Swedish, female, 6*

“Yes.”

*Mexican, 4, male*

“I like 2 and 5 also. I thought the animation was in the wrong direction, because it was going backwards and not towards the door.”

*Interviewer—whenwouldyoulikethislighttobeactivated?Imaginethesethreesituations : wehavealargeparkinglot, car*

*Swedish, female, 6*

“I don’t see the purpose having it activated during the day.” “But if it doesn’t drain the battery then it can be on during the day also.”

*Chinese, female, female*

“I think it can be customized in the app by the phone. It shouldn’t be fixed from the manufacturing.”

*Swedish, male, 1*

“Also, the color of it should adapt to the car. If you have a green car then maybe you don’t want an orange light. “ “But if it is a fixed light, kinda like in the centered picture\*referring to car parked on a street\*, a car length apart. So maybe three or four meters.”

*Indian, 3, male*

“If you are talking about the distance which the light has to be activated or the reach of the light. ...” Continuing talking about changing wavelength of light in order to detect it from greater distances.

*Interviewer*

“Would you like to have different behaviour? If I’m at home or at the parking lot.”

*Indian, 3, male*

“When you are at home you know where the car is so there is no need for the light. Even though it’s like crowded parking lot (...) the light could be blocked by cars parked beside your car. So most likely, if it is like a empty street (...) then it is better to have one.”

*Swedish, female, 2*

“Couldnt it be like even though it’s crowded you have to empty the car and then you need some space. Even though it’s not that eye catching.” “It’s nice when you get very close. ...”

*Swedish, male, 1*

“I would say what you said about a couple of hundred meters. It is not necessary to see the light.”  
(...) When it comes to the scenarios of parking for me i wouldn’t care. Because as she said that even you are in a crowded parking lot you would still have 30-40 cm to be able to open the door. Then you could absolutely have some lights in those areas.”

*Mexican, 4, male*

“For me it only makes sense in the night but I wouldn’t care about the surrounding so much.”  
Doesn’t care about if the light projection interferes with obstacles.

*Interviewer*

“Do you think that you would like these concepts at home or is it always the same?” (Voices in background saying “always the same”)

*Swedish, female, 6*

“Maybe some people would like to change. They would like to have different patterns.”

*Indian, 3, male*

Referring to previous discussion about obstacles interfering with projection. “Maybe it’s better to have lights in front and in the back of the car rather than on the sides.”

*Interviewer*

“What do you think the Lynk & Co brand represents and why?” “Can you describe Lynk & Co using some words?”

*Swedish.Female, 6*

“Hipster” (Male voice agrees)

*Female*

“Youth”

*Male*

“Connected”

*Interviewer*

“If you take all these words, and you put them into a design, what would that be like?”

*Male*

“Breakthrough”

*Male*

“Adventure”

*Indian, 3, male*

“Revolutionizing, Trendsetter”

*Interviewer*

“So something new?”

*Indian, 3, male*

“Yes it has to be something new.”

*Swedish, male, 1*

“Yes, new and cool I would say.”

*Interviewer*

“Which of these concepts would you say is Lynk & Co?”

*Swedish, female, 6*

“Number one. Because of the design, the pattern and the color and it’s clean and it’s nice. And that’s also like the race track that we are used to.”

*Swedish, male, 5*

“Number 5. Because it is the same as the tail lights.” “They are not that pretty, but it is something that resembles to the car.”

*Swedish, female, 7*

“I would say 4. Cause it’s sort of the shape of the...”

*Chinese, female, female*

“Four and seven.”

*Swedish, male, 1*

“I would say number 1, 2, 5 and 6. Those are the pattern that you expect a car to have if they have this light thing. For example 1,2 ,5 ,6 any car can have those. BMW, Kia those are the concepts that you expect a car to have while number 4,3... the rest of them are more like unique, cool...” “When you see number 1,2,5,6 then you are like ‘cool they have a light thing’. But when you see the rest of them it’s more like ‘cool, they have a light thing and it’s a strange shape’ (think it is meant as positive).” Not something you would expect from a car.

*Interviewer*

“It’s weird but it is unique?”

*Swedish, male, 1*

“Yes exactly...”

*Indian, 3, male*

“Concepts 1,2,5,6 are more safer and conventional. Can suit to anybody. But if you think about Lynk & Co as a joyo-brand or trendsetting brand then maybe people would appreciate the ‘disco’, like concept 3 and 8.”

*Swedish, female, 6*

“I agree, I change my answer.”

*Interviewer*

“If you also consider the color?”

*Swedish, male, 5*

“The color should match the paint.”

*Mexican, 4, male*

“For me I would say number 5 because it’s more like Lynk & Co just because of the tail lights.”

*Swedish, male, 1*

“If I owned the car I guess I would like to change the color.”

*Interviewer*

“Depending on?”

*Swedish, male, 1*

“I guess the color of my mood. For example winter, summer...”

*Male*

“Maybe you don’t want a white color during the winter.”

*Interviewer*

“So it’s dependable on the color of the car, the ground and also the mood?” (Agreeing)

*Male*

“It should be changeable in the app.” (Agreeing voices)



# F

## Appendix 6

Questions for individual interviews in iteration 2 User form

Name: , Nationality: , Age:

Performed user test before?

### Concept 1

On a scale 1-9, how attractive do you perceive this concept?

What is it that you find attractive or unattractive with this concept?

On a scale 1-9, how exciting would you say this concept is?

What makes you feel excited or less excited about this concept?

To what level do you agree this feels like a high quality concept?

What makes this concept HQ or low quality?

Do you think there could be any difference in how welcome the light would make you feel depending on if you approach from the front or the back? Why?

Do you think that there could be a difference depending on if you are entering in the driver or in the backseat? Why?

### Concept 2

On a scale 1-9, how attractive do you perceive this concept?

What is it that you find attractive or unattractive with this concept?

On a scale 1-9, how exciting would you say this concept is?

What makes you feel excited or less excited about this concept?

To what level do you agree this feels like a high quality concept?

What makes this concept HQ or low quality?

Do you think there could be any difference in how welcome the light would make you feel depending on if you approach from the front or the back? Why?

Do you think that there could be a difference depending on if you are entering in the driver or in the backseat? Why?

Chosen color?

Can you explain why you chose this color and not the others? Do you want to change your previous gradings; attractiveness, excitement and HQ?

### Concept 3

On a scale 1-9, how attractive do you perceive this concept?

What is it that you find attractive or unattractive with this concept?

On a scale 1-9, how exciting would you say this concept is?

What makes you feel excited or less excited about this concept?

To what level do you agree this feels like a high quality concept?

What makes this concept HQ or low quality?

Do you think there could be any difference in how welcome the light would make you feel depending on if you approach from the front or the back? Why?

Do you think that there could be a difference depending on if you are entering in the driver or in the backseat? Why?

Chosen color?

Can you explain why you chose this color and not the others? Do you want to change your previous gradings; attractiveness, excitement and HQ?

**General:**

Which one was your favorite concept? Why?

Which one of the concepts made you feel most welcome to the car? Why?

Which of the concepts do you think is the most?

-Playful

-High Tech

-New thinking

How did you feel about the opportunity to choose between different colors?

What is your opinion about using a light projection? Is this something that you would like to have on your own car? Why?

Would you feel proud showing this to others? Which concept would you choose in that case?

When would you like the light to be activated? Can you describe at least one of those situations?

Imagine that you are alone in a dark street and aim to enter your car.

How do you feel about the light projection?

Only for experiences user: What is your opinion about the 2D-image test compared to the use of a real car? Did you experience any difference?

*Transcript of individual interviews in iteration 2*

*Test subject 1*

*Interviewer(00 : 30)*

Brief introduction to experiment, aims for experiment, ask age to user.

*User(00 : 50)*

Rating the concepts?

*Interviewer(01 : 00)*

We will present different concepts and rate each concept. Propose situation, where user is about to enter to car, unlocking the car and car shows the first concept. Interviewer shows first concept.

*Interviewer(01 : 29)*

In scale 1 to 9 how attractive do you perceive this concept?

*User(01 : 35)*

Simplistic, I'll give a 7

*Interviewer(01 : 40)*

What is it that you find attractive?

*User(01 : 45)*

Simple and kind of easy to recognize, not distracting just a single light/ not glowing in cycles, or blinking...it's nice in that way, it gives the zebra kind of feel...blank and white, different

*Interviewer*(02 : 16)

In a scale 1-9 how exciting this concept it is?

*User*(02 : 22)

When you say exciting, how do you define exciting?

*Interviewer*(02 : 28)

how do you define exciting? What it is exciting for you?

*User*(02 : 30)

For me it's like a guiding lamp, there's no wow factor, it's ok different feature, but it's not exciting.... It's not like gives me wow, maybe for the first time in a car...for that i would give a 5-6....6

*Interviewer*(03 : 08)

You explain it by, it's not something super special, something you would expect?

*User*(03 : 20)

if it's for a luxury car, in a few years this will come a regular feature, i'm assuming you are planning for future market...that might not look very exciting

*Interviewer*(03 : 50)

To what level do you agree this feels like a HQ concept, 1-9?

*User*(04 : 02)

You mentioned something about HQ in previous sessions. ...HQ for you is different?

*Interviewer*(04 : 27)

Then we will like to know what's your perception of HQ... I think you should focus, if you see this in a car, how would you perceive this as a whole car, higher quality?

*User*(04 : 45)

Yes, it will look like a HQ and look good

*Interviewer*(04 : 50)

You would grade it as....?

*User*(04 : 55)

8

*Interviewer*(04 : 58)

Can you explain why you feel like this?

*User*(05 : 00)

For now looks new to me, interesting and HQ car to me...maybe we don't see it in a Volvo now...but if I buy a car with this, it will be something new.

*Interviewer*(05 : 27)

the fact that is something new and unique it makes it HQ for you?

*User*(05 : 31)

Yes, Yes!

*Interviewer*(05 : 40)

Do you think there would be any differences in how welcome you will feel depending if you are approaching from the front or from the back of the car? Imagine you are coming from that side to the drivers position.

*User*(06 : 08)

Not that much difference since i'm standing here, really close to the car... but if i'm approaching from a longer distance, it's usually really short...how's the range you are planning for this?

*Interviewer*(06 : 27)

We haven't decided yet, as we have it now it's up to this last wheel and from the driver's seat. But we don't know when this will be activated.

*User*(06 : 32)

How far from the car I'll be able to see this?

*Interviewer*(06 : 40)

We are analysing this, as it is now...up to the rear wheel. We don't know yet when it will be activated. If you are aiming for the passenger seat any difference?

*User*(07 : 10)

I don't feel a difference, it's a guiding lamp...it does its purpose

*Interviewer*(07 : 20)

You will feel the same for both positions?

*User*(07 : 40)

Maybe I will feel different with the same pattern for the driver as for the passenger

*Interviewer*(08 : 10)

Second concept is shown...How attractive do you think is in a scale 1-9?

*User*(08 : 30)

A 9, because its pulsating, it looks like steps ...two lights with a childish impression, that its guiding me. Kids will love it

*Interviewer*(09 : 06)

How exciting is this concept from 1-9?

*User*(09 : 20)

9 same reasons

*Interviewer*(00 : 30)

High quality?

*User*(09 : 40)

9, compare to the previous...it gives a royal feel, two steps and i'm in the car. It's simple, not complicated, maybe the spacing, the design is more scandina-vian...sticks to the concept. Swedes love to have something simply

*Interviewer*(10 : 40)

Is there a difference from which side to approach?

*User*(10 : 50)

Its a ramp, I would feel different...if you replicate it depending of the position i'm located. From the back I can easily find it, from the front i will require the same towards me.

*Interviewer*(12 : 00)

Is it the design or the placement of the light?

*User*(12 : 20)

It would be easier if the light comes from the front towards me, why the lights in the back if i'm coming from the front

*Interviewer*(12 : 40)

how welcome would you feel if you aim for drivers or passenger seat?

*User*(12 : 50)

It looks more for the driver...you only have the guiding point towards the seat, its not a problem but if they are expecting that quality, why not some design for the passenger seat and replicate it to the other direction...but design will be complex

*Interviewer*(13 : 40)

Two more color options, which one is your favorite?

*User*(14 : 25)

white looks bright and welcoming, blue is OK good but not HQ....red looks good, for me the higher wavelength compared to the other colors this might be associated with danger...maybe not give me a welcome feel. I would go for white as user, but as engineer red...Red would be my color.

*Interviewer*(16 : 10)

now that you know the color options would you change your gradings?

*User*(16 : 30)

I would stay with the highest, blue and white 8, and red 9 in all the factors (attractiveness, exciting, and HQ)

*Interviewer*(18 : 00)

Now 3rd concept. . . .

*Interviewer*(18 : 19)

How attractive do you find this concept?

*Testsubject*

“Its attractive, so Id say I will give it a 7. But if you ask if it’s exciting (...) It makes me think about a snake going under the car. So maybe it’s not that exciting to me. So in that case I would only give it a 3.”

*Interviewer*

Can you explain why you find it attractive?

*Testsubject*

“One thing is that it is simple and it is for both the doors. (...) Its not very fast aswell. . . its “lagom”. “

*Interviewer*

To what level does it feel like a HQ concept?

*Testsubject*

“5, its sort of neutral to me. (...) Its sort of based on an average of my to previous ratings.” Im not able to pinpoint why its neither high or low.

*Interviewer*

Difference if you are approaching from front or back?

*Testsubject*

“No difference because it is coming from the side.” Same thing with the front and back seat.

Test subject presented with different colors.

*Interviewer*

You have seven different options. Same movement and pattern. You pick your favourite.

*Testsubject*

“I’d say orange is good. It’s like a safe between the user and the engineer.”

*Interviewer*

Now that you know you have the possibility to change colors, would you like to change your previous gradings?

*Testsubject*

I would keep attractiveness and excitement the same. "But maybe the excitement can be raised to a 5. Because the orange looks quite appealing to me right now."

*Interviewer*

Now you have seen all the concepts, which one was your favourite?

*Testsubject*

"My most favourite, is the blinking ones, the second concept." Chose the red color. "But if I would have an orange choice I would take that, as a personal choice."

*Interviewer*

Which one of the concepts would you feel welcomes you to the car, the most?

*Testsubject*

"The second one."

*Interviewer*

I have some words for you. Which one of the concepts do you feel is the most - playful?

*Testsubject*

"I'd say concept 3 is the most playful." "I don't know why I'm able to associate this with playfulness." It could be because of the movement. "The shape of the movement." Could be because he resembles it to something else. It resembles of water aswell.

*Interviewer*

- High Tech

*Testsubject*

"Its concept 3 again. Because the first two are relatively simple." "This is high tech because of the movement of this pattern." "Its simple but elegant, it sort of looks a bit different."

*Interviewer*

- New thinking

*Testsubject*

"Concept 2 as well as 3." "I would say it looks more like ramp, so it sort of takes inspiration of a dancefloor and you have incorporated it into a car." "Taken it from something else, but it's more welcoming." "Not so exciting, but still very attractive."

*Interviewer*

How did you feel about the opportunity to choose between different colors?

*Testsubject*

“I would like that option. “ “I would feel privileged to have the option to choose between different colors. So maybe two or three colors would be good.” It was easier to choose between three colors. Too much confusion when choosing between 7 colors.

*Interviewer*

What is your opinion about using a light projection? Would you like to have that?

*Testsubject*

Especially in dark places, like Sweden, and where there is no streetlights.

*Interviewer*

Do you think you would feel proud showing this to others? Which concept would you choose in that case?

*Testsubject?*

Concept 2. “In red or orange or white as well. Blue looks too... maybe not very visible from a distance.”

*Interviewer*

When would you like the light to be activated? Can you describe a situation when you would like the light to be activated?

*Testsubject*

“Maybe three or four meters away from the car.” This is the distance of when the user will normally unlock the car. Want it to be connected to the unlocking activity.

*Interviewer*

If you are imagining that you are alone in a dark street and you are approaching your car. Would you like to have this kind of light? Maybe you feel a bit unsafe?

*Testsubject*

“If there is an option for me to deactivate it temporarily in the key...” Explains that he likes to mute the unlocking sound in the car. Silent mode.

*Interviewer*

You attended our other test. What is your opinion about the test, if we compare the two tests? Image and rendering compared to this test?

*Testsubject*

“This looks more real, and I can imagine and put myself into that situation much easier.”

Test subject 2

*Interviewer*

Concept 1 is shown... In a scale 1-9 how attractive?

*User*



A 6, it's quite bright and visible, unattractive. . . .too many lines a little bit intense

*Interviewer*

In a scale 1-9 how exciting?

*User*

7, i think is the kind of feel welcome to the car.

*Interviewer*

Would you be excited with this projection when you arrive to the car?

*User*

I think it's really clear path to the door

*Interviewer*

In a scale 1-9 to what level HQ?

*User*

I think a 7 as well. . . .above the average, the pattern with the car I can't see much connections...I prefer to have a symbol or something from the car. Maybe I haven't seen the whole picture of the car. . . .In general its good.

*Interviewer*

to sum it up, it should resemble the car. Do you think there would be any difference from the front or back?

*User*

From the front, the pattern seems smaller more tight. . . .from the back side its more wide

*Interviewer*

Does that affect your perception?

*User*

Yes, from the back it's more welcome its wider. . . . I can feel kind its brighter, and in the front it's just the light, no interaction. If I come from the back it would be easy to go in the car. It's more leading from the back.

*Interviewer*

Is there any difference between drivers and passenger seat?

*User*

More welcome to the driver's seat,

*Interviewer*

Concept 2 is shown. In the scale 1-9 how attractive would you feel this concept?

*User*

7, its shining and it's bling bling...unattractive, looks like the lines of a road...it blinks

*Interviewer*

How exciting would you feel this from 1-9?

*User*

7, its because of the movement, the blinking of the patterns

*Interviewer*

From what level do you agree this is a HQ?

*User*

7, because of the brightness and the bling bling... I like the bling bling... it it's not moving, it's just there and I think it's the road

*Interviewer*

if you approach from the back or from the front?

*User*

Its better from the first one... When i'm standing from the front always feel it's smaller and because of it's movement. From the back it's more welcome...the difference it's smaller than concept 1, a little bit better...maybe because of the movement and the light has a gradual change in the color

*Interviewer*

Is it more inviting? And it works its way towards the car, would you feel the same welcome to drivers seat or passenger?

*User*

More welcome to the driver seat

*Interviewer*

Because light intensity? design?

*User*

I think because of design, showing you the way to follow, the colors point to the drivers seat. I like wide in the back and narrow in the front to the drivers seat.

*Interviewer*

Now we show 2 different color options, blue and red...which one you like the most?

*User*

I think i like blue, and red as second. Blue and red high quality than white... Red and blue feels more like with design, different from white...white its too normal...more decorative

*Interviewer*

Would you change the gradings after seen different colors?

*User*

Attractiveness 8, excitement 8, and HQ 8 as well

*Interviewer*

3rd concept is shown...How attractive would you rate this concept?

*User*

It's different from previous ones, 7... the direction of the graphics is attractive. It feels like snakes or worms moving to the car, and feels not so attractive. I feel afraid of snakes, maybe because of that.

*Interviewer*

How exciting would you rate this concept?

*User*

7, I would feel sleepy and see this and awake.

*Interviewer*

What makes you feel excited about this?

*User*

The movement of the graphics, and it is uncommon...unique

*Interviewer*

And from 1-9 HQ?

*User*

8 because its uniqueness...different from what you would expect, second one it blinks, not that movement...like lights in the streets or stores, but this is graphic, different, with more personality

*Interviewer*

How do you feel about approaching from back or front?

*User*

I feel different, the pattern feels different from the back, bigger and leads to that way... It much better in the front than in the back side. Compared to the previous concepts, 3 its better, but the pattern is not my favorite because of snakes resemblance. Maybe some blossoms would be more welcome.

*Interviewer*

Would you feel the same welcome, from drivers and compared to passenger seats?

*User*

I would feel the same, two groups of lines, and approaching to each door at same time.

*Interviewer*

Now showing 7 different colors. . . . Which one is your favorite?

*User*

Yellow, because its warm not so reddish, not too bloodish appearance.

*Interviewer*

Would you change your gradings with Yellow?

*User*

Maybe attractiveness 7 and 6 in the previous with white. Excitement and HQ stays the same.

*Interviewer*

Which concept is your favorite?

*User*

Number 2. . . . number 1 is bossy not my style, imposing and not dynamic, number 2 and 3 better for me, but 3 it's scary for me.

*Interviewer*

would a different shape would change your mind for 3?

*User*

yes

*Interviewer*

Which concept is the most welcome to the car?

*User*

Number 1, because it's like a guide dog, not like pets not interactive, you can trust/imposing

*Interviewer*

We will present some words and which concept resemble to each word? Playfull

*User*

Number 3, because its unique pattern and movement

*Interviewer*

Hightech?

*User*

Number 2 in a color. . . . in white it resembles the road. Number 1 seems like a PCB, number 2 its more dynamic due the blinking

*Interviewer*

New Thinking?

*User*

Number 3, even though is scare for me. Disruptive innovation, very good or very bad. . . .number 3 its new

*Interviewer*

How do you feel with the opportunity to choose color?

*User*

I like to have options, i prefer more options to choose, but from concept 2 it is easier to choose and concept 3

*Interviewer*

What do you think about this light projections, something would you like to have?

*User*

Yes, its more interaction with me and its my car, like my pet...if I buy it I want some feedback

*Interviewer*

Would you feel proud to show this?

*User*

I would show 2, or 3...3 with another pattern. Maybe color 2 with red color

*Interviewer*

When would you like to have this light?

*User*

After party, i think during daytime its not visible, but at night it will be easy...after work to cheer me up, like winter or rainy

*Interviewer*

In a lonely dark street? Would you like to have it?

*User*

Yes, because i would feel guarded to my car, company to my car. If i have the car, I'll take it as a friend/pet and I would expect interaction with it, specially if its dark and im alone.

*Interviewer*

you want some interaction, here I am, welcoming you?

*User*

Yes

*Interviewer*

Did you experience differences from this test than the previous?

*User*

There's something different, 3rd concept was not shown before, concept 1 its different from picture, it was boring...but in real its more real, looks better. Concept2 almost the same but better.

*Interviewer*

would you prefer something with more purpose or more decorative?

*User*

Last time it was not leading to car, maybe lines should disappear when leading to car...instead of snake Test subject 3

*Interviewer*

How attractive from 1-9 would you feel to have this in your car?

*Testsubject*

Asks about the functionality of the light projection. "If this was a BMW, I would give a 9 to it (...) because it looks like BMW's taillights." Would give it a 9 if "it signifies something on the body." (03.38)

*Interviewer*

1-9, how exciting would you say this concept is?

*Testsubject*

"The first time you see it, it looks very exciting. But with time it gets boring." "It would be better if it were a bit more dynamic, if it could change the color, the mood, the temperature..." That could be very welcoming.

*Interviewer*

To what level do you think this is a high quality concept? High quality as in how much this concept would benefit the car to be perceived as a high quality car.

*Testsubject*

"It looks very sharp in its appearance which looks HQ." Complains about the blurry part of the projection. Would prefer a design even simpler than this. (07.00)

*Interviewer*

Do you think there could be any differences in how welcome you would feel depending on if you are approaching from the front or the back?

*Testsubject*

"It also depends on if I'm the driver or if I'm having a chauffeur and I'm sitting in the rear seat all the time. If I'm the driver this looks very welcoming when I'm

coming from behind.” \*Walks to the front\* “This looks very interesting aswell, it looks like an old 70s with the exhaust pipes. . . ” “It was more welcoming from behind because of the guiding lines guiding you to the cabin.” Would appreciate that if it was a two seater.

*Interviewer*

You feel a difference because the light is pointing towards the driver seat, why that difference?

*Testsubject*

Would feel the same way if I’m entering in the backseat. (09.40)

*Interviewer*

1-9, how attractive do you think this concept is?

*Testsubject*

“This looks less attractive than concept no. 1” “Its shart, and it’s good to be sharp, but when its bigger squares like this (...) something makes it looks less attractive.” Thinks that this concept is suited for the driver.

*Interviewer*

1-9, how exciting would you find this concept?

*Testsubject*

“More than the other one, since it is dynamic. . . ”

*Interviewer*

To what level do you agree this feels like a high quality concept?

*Testsubject*

“Less than the previous. For me it doesn’t look very premium. It’s too sharp on the endes, bigger solids and the edges look sharp. That is why it looks less premium.”

*Interviewer*

Do you think you would feel any difference in the welcoming if you are approaching from the back or the front of the car?

*Testsubject*

“I like it more when I’m approaching from behind.” Because it’s pointing towards driver seat and it’s moving.

*Interviewer*

What do you feel if you are approaching to the passenger seat or the driver seat?

*Testsubject*

Stronger feeling than previous because “it is pointing towards the driver seat, but now the movement is also guiding you there.”

*Interviewer*

We have prepared more options for you to choose from. \*Presents two more colors\* Which is your favourite one? (15.54)

*Testsubject*

Chooses the white color. “Blue and red looks a bit mood dependent. It looks like if I have a blue here I would feel a bit more sporty. Red would be a bit more soft. White is neat and looks more premium.” “It’s good to be colorful, but if I had to stick to one color that would have been white.” (17.21)

*Interviewer*

1-9, how attractive do you find this concept?

*Testsubject*

More than in the first one. This one is more dynamic. Not a regular shape or pattern. It looks sharp in sense that it doesn’t go blurry in the edges.

*Interviewer*

How exciting would you say this concept is?

*Testsubject*

Better than the first concept. Same reasons as attractiveness. “It moves along...it looks good.”

*Interviewer*

To what level would you agree this feels like a HQ concept?

*Testsubject*

Higher than the previous concept. This (concept 3) looks more modern compared to concept 2.

*Interviewer*

Do you think there is any difference if you are approaching from the front or the back?

*Testsubject*

No for this one.

*Interviewer*

Differences if you are approaching to driver seat or passenger seat?

*Testsubject*



No I don't think I would feel any differences there. (21.18)

*Interviewer*

\*Presents color options\*

*Testsubject*

Wonders if it is still the same pattern. Chooses the white again because that is the color that would remain. Would choose orange during the winter.

*Interviewer*

Would you like to change the gradings now when you know that you can change the colors?

*Testsubject*

Would like it more if the car automatically changed color compared to manually adjust the color.

*Interviewer*

General questions. Which one of these concepts was your favourite and why so?

*Testsubject*

"If its my car and I'm driving for most of the time I would go for the first concept."  
"The 3rd concept looks modern and looks modern, gives passenger and driver the same feeling. . . it just looks a bit 'on boys level than on men's level'. Looks more like a toy."

*Interviewer*

Which of these concepts would make you feel the most welcome to the car?

*Testsubject*

"The 3rd concept, because I get a feeling of very exciting, it feels like someone is standing there opening the door and say welcome. It's very nice."

*Interviewer*

We are going to say some words. Please tell us which of these concepts you identify with the words. - Playful

*Testsubject*

Concept 3, because "Too much of movement", "more curvy", "looks a bit toy'ish" (27.40)

*Interviewer*

- High tech

*Testsubject*

High tech is really good performance, like BMW M5. So I would choose concept 1. Can't explain why he connects BMW with high tech and the lines.

*Interviewer*

- New thinking

*Testsubject*

Concept 3, because “it’s not the common one, it’s good dynamic (...) looks pretty interesting.” Looks modern.

*Interviewer*

What do you think about the opportunity to choose the colors?

*Testsubject*

“I’d like to have color radiance, but if I had to pay huge money for it I would rather have white.” Don’t want to have the possibility to change color manually, would like it to be automatic.

*Interviewer*

What is your opinion about using a light projection like this? Would you like to have one on your own car?

*Testsubject*

“Yes, of course... I would like to have one of my own. This is unique and not something you see on every-day cars.” This might change if more car would have light projections.

*Interviewer*

Would you feel proud showing this to someone else? Which concept would you choose in that case?

*Testsubject*

“Depends on which car I’m driving. If I had a BMW I would go for concept 1, a muscle car 2nd concept and mini cooper I would go for concept 3 (...) I would feel very proud showing it.”

*Interviewer*

In what situations would you like to activate this?

*Testsubject*

It doesn’t matter in what environment, as long as I can see it (dark hours).

*Interviewer*

\*Presents dark street scenario where people might feel unsafe.\* Would you like to have a light projection like this?

*Testsubject*

“If I’m on my stealth-mode, I wouldn’t do this. Because it is really significant that I’m entering this car.” Switch-on on the key. Test subject 4

*Interviewer*

Introduction to DOE...how attractive 1-9?

*User*

Looks more attractive than previous experiment, it’s very static, as I said before from the back is perfect but from the front is not the same.

*Interviewer*

What do you think from the front or back of the car?

*User*

Not that bad from the front...shows where to enter, at the end it’s perfect aligned with backside doors and everything...if you are the driver shows perfectly where you need to go.

*Interviewer*

any difference from front or back?

*User*

Clearly better in the back, I’ll follow the lines....From the back is more interactive, from the front is just guiding system

*Interviewer*

back to attractiveness and a grading...

*User*

7, timeless...something that you don’t get tired of it, the negative effect, it’s not typical lynk and co, this one fits better with a volvo, if you understand between the brand.

*Interviewer*

From 1-9 how exciting?

*User*

In the beginning is exciting... Perhaps the first year its a detail you don’t notice... then if you show off , you would be proud to show it. 9 maybe...sticks out from other car brands.

*Interviewer*

What about the HQ 1-9?

*User*

quality goes with exclusiveness...quality is good overall, the quality of projection is good...perhaps 8. This concept is HQ is more like the car in whole, if you have this and car is more exclusive that gives a good quality... Something unique no one has it.

*Interviewer*

Any difference between passenger and driver welcome?

*User*

Driver is more welcome...the curves aim at driver, passenger its the second... Still have guiding space

*Interviewer*

Next concept 2nd...how attractive do you find this one from 1-9?

*User*

I don't think is that attractive...perhaps attractiveness 5, neutral...it looks like a construction site, follow the lines and you will survive...emergency lines...the movement of the lights is causing it...also the lines seems like emergency.

*Interviewer*

How exciting do you find this concept?

*User*

7, because is cool to have it if i don't know about this, and i see this I'll say its cool because of the projector not due the design...the first one the design. The attractiveness affects my excitement.

*Interviewer*

Perception as a HQ? 1-9

*User*

Yes as HQ because the projection...the quality that the car has it....maybe a number 7 because, i would not think the design was not really taught about. The first one is more design...

*Interviewer*

If you approach from the back or front any difference?

*User*

Still the same, attractive from back than front....i have more interaction, if I approach from the back lights follow the design. From the front is only showing where to driver is supposed to go....

*Interviewer*

two colors... any preference? Choose a color

*User*

White is too mainstream, I would prefer red, more attractive in this place, depends of the color of the car, color depends on vehicle's color...both colors look better than white, but i would choose red.

*Interviewer*

would you change your gradings with red color?

*User*

a little bit, since white its simple... 8 in attractiveness, better impression with color

*Interviewer*

3rd concept...in a scale 1-9 how attractive do you find this concept?

*User*

if its a link and co car, very attractive...9 , its new thing for the attractiveness, fits the brand identity...what vehicle represents.... It looks good personally

*Interviewer*

how exciting is this?

*User*

9 as well, you dont expect to look like this...the first one something you would expect but this is wow whats happening.....

*Interviewer*

and to what level 1-9 hq concept?

*User*

pretty high I'll say, this one is moving good, at high fps the frames, probably at 8

*Interviewer*

for this would you feel different if you approach from the back or front?

*User*

No, is one of the first things that I tought, from each side or drivers or passenger.... I would feel same welcome to the car

*Interviewer*

we have 7 different options... which one would you pick?

*User*

I kind of like the orange....it fits more colors of the car, especially if the color is not 100

*Interviewer*

would you change your gradings?

*User*

attractiveness would be higher...9+, quality side, customization with color HQ it's higher but for every concept

*Interviewer*

General questions.....which one was your favorite?

*User*

3rd concept, because its welcome from all passengers, all the sides and its not as elegant as the first choice, its more Lynk and Co...first is more volvo

*Interviewer*

which one makes you more welcome?

*User*

3rd concept

*Interviewer*

some words and which concept fits best? playfull

*User*

3rd one, because its new thinking...first choice is more welcoming if you enter from the back and you are the driver...but playful the 3rd

*Interviewer*

high tech?

*User*

I would say 1st and 3rd, if the 1st with movement with some flow... The movement makes high tech...everyone one has a picture, but you want something to happens

*Interviewer*

last word...new thinking

*User*

all of them, but then 3rd because its nothing you would expect from the car

*Interviewer*

how did you feel when you got the chance to choose the color, did you like that?

*User*

yes, it raises the quality a little bit...i prefer to have more options like in the 3rd, if the projector manage to have some colors.... A wheel of colors, could be really good from a lot of colors.... You would choose between some colors, and i would change it each month or something...but its good to have the option with the wheel, specially from engineering point of view. People like to customize it more.

*Interviewer*

would you like to have a projection in your car?

*User*

yes, because its innovative, makes the car pop out from the rest

*Interviewer*

would you feel proud to show this?

*User*

yes, even though i have it for a year, and then change the car or a friend would see it, i would feel proud to show this off.... It would depended on the concept.... 3rd concept in our age, first concept to parents

*Interviewer*

when would you like to have this activated..... ??

*User*

10 mts away, when the car can feel that I am close...like parking lot.

*Interviewer*

what bout if you are in a dark street?

*User*

yes i would like it, i don't see why not...it's like here I am, 2 seconds after you are inside, you will not stay there until someone arrives.

*Interviewer*

what's the comparison between this test and the previous one?

*User*

this one is better, you can see it in real life and not only pictures, the first concept is a lot better than pictures. It's better in real life, the difference is high, people will get a lot more positive surprise with a real life situation and I did and I was prepared for it. Test subject 5

*Interviewer*

On a scale 1-9, how attractive do you find this concept?

*Testsubject*

"I like it because it is welcoming towards my door at least. But if we are two people. . . ." "I think it is good if I'm alone (...) I feel like it's aimed for the driver." Would feel more special if I were the driver.

*Interviewer*

On a scale 1-9, how exciting do you find this concept?

*Testsubject*

"Maybe a 6, because it is not moving. I thought it would be interesting if it moved a bit" "When I see it the first time, it's amazing. . . but the next time Im entering. . .

*Interviewer*

To what level do you agree this feels like a HQ concept?

*Testsubject*

"Because it is so big (the area of lighting) I think its quite high. . ." Connects this with a strong powersource.

*Interviewer*

Do you think there is a difference depending on if you are approaching from the back or the front?

*Testsubject*

Light projection perceived as more "decorative" from the front and more guiding or leading from the back.

*Interviewer*

1-9, how attractive do you find this concept? (07.30)

*Testsubject*

"I like this because it is moving. I also like that the size of the boxes are getting smaller." Indicates that you are getting closer to the vehicle.

*Interviewer*



1-9, how exciting would you say this concept is?

*Testsubject*

Rates it high. "Because it is moving, it's like an animation, not just the light. Something is being animated."

*Interviewer*

To what level do you agree this feels like a HQ concept?

*Testsubject*

"Maybe a bit more than the last one." The movement makes it more technical, something extra...

*Interviewer*

Do you think there is a difference depending on if you are approaching from the front or behind?

*Testsubject*

Liked concept 1 better from the front. "It moves in the wrong direction" "Maybe if it was faster, it would be more like a highlight of the car...but now when it is slower it is more like 'go this path'" "I really like that it is clean, only white... like very graphical." (12.13)

*Interviewer*

Do you think there is a difference depending on if you are entering the driver's seat or the backseat?

*Testsubject*

Its the same as previous with that little curve towards the driver's seat.

*Interviewer*

\*Presents the color options\* Which one do you think is the best or your favourite?

*Testsubject*

"I think it depends on the car..." Mentions the rose gold detail on the Lynk&Co car. "But I think I am a very simplistic person so I would probably enjoy the white more." "Its more clean."

*Interviewer*

Do you think that the gradings would change when you have the possibility to choose color?

*Testsubject*

Stay the same.

*Interviewer*

1-9, how attractive do you find this concept?

*Testsubject*

“The movement is very harmonic, and it is towards both doors as well...” Moving nicely and smooth. Likes low velocity of movement in this one, because there is another design.

*Interviewer*

1-9, how exciting do you think this concept is?

*Testsubject*

“It demonstrates the feeling you should have when you are entering your car. You shouldn’t be in a rush.” “But I liked in the 1st and 2nd concepts that they were covering a larger area than this.” Expresses that it would be nice if the car could detect how many people that is approaching the car and activate light outside equal amount of doors.

*Interviewer*

To what level do you agree this feels like a HQ concept?

*Testsubject*

“Its a more complex movement.” “It feels like it is two projectors and not one.” (21.11)

*Interviewer*

Do you feel like there is any difference compared to if you are in the front or in the back when you are approaching?

*Testsubject*

Likes it better from the back. Movement felt upside down from the front. No difference depending on if you are entering front or backseat. Concept feels more like the car is going for my attention than a guiding light.

*Interviewer*

\*Presents the color options\* Which one is the one you like the most?

*Testsubject*

“I like the colors more in this concept compared to concept 2” Concept 3 has thinner graphics which goes better with color. Refers red to error. Blue feels like a more neutral color. Mentions that it would be great if the color could automatically adjust according to e.g. time of day. No difference in gradings. “If I’m pleased with the color, I don’t think I would change it.” (30.00)

*Interviewer*

Which concept was your favourite?

*Testsubject*

1st and 3rd one the best. "I like the 3rd one because it is very pleasing in the movement. The other ones are more constant light. It light all the time." More light is preferred because it highlights the car even more.

*Interviewer*

Which concept made you feel the most welcome?

*Testsubject*

"3rd concept. Because it is moving towards the car and the doors."

*Interviewer*

Im gonna present you with some words and I would like you to tell me which of the concepts you think fits best with these words. - Playful

*Testsubject*

3rd concept. Playful movement.

*Interviewer*

- High tech

*Testsubject*

Concept 2. "It feels very abstract." "This is the brightest and the biggest, maybe that is why I feel like it is high tech."

*Interviewer*

- New thinking

*Testsubject*

Concept 3. "Because it has movement." Compared to concept 2's movement: "Concept 2 is static, its like one is lit up, one is not lit up... the other one is more like dynamic movement."

*Interviewer*

How do you feel about the opportunity to choose between different colors? (37.02)

*Testsubject*

Liked the default white color. "Maybe I would like to use a majority of white color and just add small amounts of color."

*Interviewer*

Do you like the whole idea of using a light projection? Is this something that you would like to have on your car?

*Testsubject*

“Yes! I felt enthuisastic just by seeing something that Im not used to.”

*Interviewer*

Then you would feel proud showing this to other I guess?

*Testsubject*

“Yes, I think so.” Most proud of 3rd concept because of dynamic movement. Doesn’t like that it is black between the animation (lines disappear).

*Interviewer*

When would you like to have a light like this?

*Testsubject*

When Im unlocking it or when Im approaching it and it detects my presence.

*Interviewer*

\*Presents unsafe situation in dark street\* Would you like to use a light projection then?

*Testsubject*

Would probably unlock the car when standing close to it. Then it would be unnecessary with projection. Don’t want light projection to be activated when approaching in this situation. Discusses that it could also be intimidating to have a light projection and that it could prevent e.g. e robbery becuase it could looks liike someone is waiting for me in the car. It also puts a lot of attention on the car so other “nice” people would look that way aswell. Test subject 6

*Interviewer*

Introduction to project. .... Show concept 1. .... From 1-9 how attractive would you find this concept?

*User*

I would say 5, i do like the light and the concept of have this. . . . i dont like so much lines, its too straight

*Interviewer*

how exciting would you say is this concept?

*User*

I would say 8 in the beginning, but then 7 once you get use to it. . . .its good to have it outside, you dont expect this.

*Interviewer*

to what level do you feel this is a high quality level. . . .from 1-9?

*User*

I like the reflections in the side of the car, is a nice touch, the pattern dont scream HQ...its something new...but the pattern itself is not that exciting and that goes with HQ...perhaps a 7, its not tacky but is not screaming HQ... HQ is having this type of light, only the shape dont scream HQ.

*Interviewer*

Would you feel different, from the back or from the front?

*User*

the shape looks better from this angle ( front) but in a way from the rear end, it's a flow then going into the car. It looks better from the front than from the welcome part in the back, in the back its more welcome. In the front, its more about the bend.

*Interviewer*

would you feel different from driver, or passenger position...?

*User*

Not that much, kind of highlights the drivers, but still looks universal...like an extra step from some cars, or a red carpet...but i dont feel a big difference.

*Interviewer*

2nd concept is shown....how attractive do you feel this concept?

*User*

I like the pattern but i dont like the movement, its too much...maybe if it would be more subtle, highlight the driver seat...its kind of mechanical movement. I would change the first for 7 and this one a 6...

*Interviewer*

and how exciting is this concept from 1-9 ?

*User*

i would say its the same level of excitement...its good with movement, i dont like it but its exciting

*Interviewer*

how about the HQ for this concept 1-9?

*User*

a 5...ok maybe 6, because the shape is good and the pattern, says modern, modern-classic, not mercedes but more lynk and co. . . . but i dont like the movement, is too strict, and there's movement, maybe more smoother.

*Interviewer*

how about the back and front approach? any difference?

*User*

maybe more welcome from the back, due the movement

*Interviewer*

and what about drivers or passenger door?

*User*

it highlights the drivers seat. . . . I do feel that extra step, not the same because of the shape, it looks more metallic, but it seems like this is the entrance.

*Interviewer*

now we have 2 colors. . . .which one is your favorite?

*User*

I think the red . . . white feels too bright, maybe because of floor, this one looks more warm and welcome. . . i like that, still classic, blue is too cold

*Interviewer*

would you change your gradings?

*User*

a little bit higher. . . .attractiveness an 8, excitement that stays the same, and HQ I would rise to 7. . . . but add that i'm a color blind...

*Interviewer*

3rd concept is shown. . . .in same way, on a scale 1-9 how attractive?

*User*

(interviewer reminds gradings..) I would say 7 or 8, when you first see it, it looks good, then just disappear, and goes black. . . .its not stopping at the car and then its gone. . . . i would expect something else would happens when it reach the car, I would expect something more to happen when reach the car, change color or stays there. 7 for sure

(20.52)

*Interviewer*

On a scale 1-9, how exciting would you say it is?

*Testsubject*

“I would say 8. It could have been 9 if something more would have happened. Cause when I first see it I feel very excited, but then it kinda goes down.”

*Interviewer*

What gives you that feeling of excitement in the beginning?

*Testsubject*

“The movement and I think the shape. The shape of the lines together with the lines are kinda attractive. You got it quite good.” “It feels like welcoming and maybe even. . . . sensual. . . .”

*Interviewer*

To what level would you agree this is a high quality concept?

*Testsubject*

“It feels more elaborate. . . like there is more thought behind it.. Feels more soft. “Someone put a lot of effort into it which makes it feel like high quality.”

*Interviewer*

Do you think there is a difference depending on if you are approaching from the front or the back in how welcome you would feel?

*Testsubject*

I didn't say that there were any difference with the previous concepts, but “I would say it's even less difference with this.” Also less difference between driver seat and backseat. (26.36)

*Interviewer*

\*Presents color options\* Which color would you like to use?

*Testsubject*

Makes a difference between what he thinks is the coolest one and what he would actually want in his car. Also makes a difference in where he would use it. Takes Sweden as an example where it should be more “show off” (chooses blue) and China where it is ok to “show off” (chooses yellow). Also mentions that it depends on the color of the car.

*Interviewer*

Now when you know you have the possibility to change color, would you like to change your previous gradings?

*Testsubject*

\*Raises attractiveness gradings\*

*Interviewer*

Which concept is your favourite?

*Testsubject*

“The combination of the shape and the movement I would say. And that it is exciting and still kinda subtle. I like the feeling that it is still kinda elaborate. I think that is what really stands out with this one for me, not as predictable as the other two.”

*Interviewer*

Which concept would you say is the most welcoming, or inviting?

*Testsubject*

The third again. “Partly because of the movement. Something is moving towards the car.” The second concept felt very mechanical, this feels more like a gentle welcome.

*Interviewer*

Im gonna present you with three different words and I would like you to tell us which concept you connect to each word. So the first word is - playful. (34.05)

*Testsubject*

The first one is very static, not playful. The second one feel more like marching. The last one feels more relaxed but still HQ. Explains that its the “free movement” compared to the “fixed” movement in concept 2 that he likes.

*Interviewer*

- High Tech

*Testsubject*

2nd or 3rd one because of the movement. “Well I could associate both 2nd and 3rd with high tech (...) because of the movement. But maybe the third being more “modern” high tech and the second one is more like when the internet first came, more basic.”

*Interviewer*

- New thinking

*Testsubject*

The third concept. “It feels least predictable. Most like interesting.”

*Interviewer*

We were also wondering about your opinion about the opportunity to choose colors.

*Testsubject*

“I liked that.” “Seven options was too many. (...) I don’t need seven different ones.”

*Interviewer*



What's your opinion about using a light projection like this. Is this something that you would like to have on your car for example?

*Testsubject*

"Yes I would like to have it, but I would probably not pay extra to have it." Says it gives luxury and something extra.

*Interviewer*

Would you feel proud showing this to others or confident?

*Testsubject*

"Confident, yeah sure, in a Swedish way not showing of... \*laughs"

*Interviewer*

In what situations do you think you would like this light to be activated?

*Testsubject*

For sure at night when it is dark. I would say pretty much every time I approach the car until I open the door.

*Interviewer*

It is interesting to see in which situations you see yourself use this.

*Testsubject*

"When it is dark or dusk and it's dark or grey and you are walking across a parking lot and you can see where your car is." Test subject 7

*Interviewer*

Introduction to experiment..... In a scale 1-9 how attractive do you find this concept?

*User*

8, It's kind of cool, shows your car is special, the design of light could change...i Think its a cool feature.

*Interviewer*

If you stick to this design, what is what you like from this design....

*User*

Maybe the flow of stream lines, dynamics, like the car is fast or is going fast

*Interviewer*

From 1-9 how exciting do you find this concept? You see this everyday, you can turn it off if you want

*User*

8 again, its the same. . . .the stationary vehicle as always the same, but when you get to the vehicle, it interacts and lights up. . . .resembles your presence, knows you are there and shows off the area

*Interviewer*

To what level would of HQ concept, from 1-9?

*User*

Its in the details, the car makes a HQ ish, this detail increases the overall quality...you don't see this when driving, this shows off the features of the car. I think its cool, otherwise it would lower the quality. . . . . An 8

*Interviewer*

Do you think there's a difference if you approach from the back or from the front, in how welcome you will feel?

*User*

I don't think i would feel something, it this is close to a different vehicle, then I would feel something, but I dont think so..

*Interviewer*

Is there any difference if you enter to drivers or passenger seat? Less or more inviting?

*User*

I don't think so, i would feel the same. I like the reflexion in the doors in the paint.

*Interviewer*

2nd concept is shown now. . . in a scale 1-9 how attractive would you feel?

*User*

Previous one was better. . . . This one a 3 maybe, reminds me of a crosswalk, something you see everyday. . . .not unique. . . .it's not the same but it reminds me that

*Interviewer*

1-9 how exciting do you think is this concept?

*User*

ThE light is part is good. . . . I would pick the first one, but this one has movement so a 4, dont like the design, but the light i like. . . .as the projection of function.

*Interviewer*

From 1-9 what level of HQ concept?

*User*

4, because its the design, nothing special...it decrease the quality

*Interviewer*

would you feel any difference from the front or from the back of the car?

*User*

looks better from the back, its a nice reflection from the back...more illuminated area in the back...part of the experiment in the front space is not too big, but the amount of light in the front is not that much...maybe the movement affect a little bit and the light, and maybe a little bit of design.

*Interviewer*

Would you feel different if you approach to the driver or to the passenger?

*User*

no its the same

*Interviewer*

two colors is presented....which one is your favorite?

*User*

Depends on my color of my vehicle... it is important to match the color exterior and the projection.... But i want to choose the color, and see how it looks with my decision...if i have to pick one color, i would like to have the same color tone in front and back....(bad effect in projection).... I think the red, in a black car it would look awesome.

*Interviewer*

would you change your gradings, with red color?

*User*

yes,6 attractiveness instead of 3, 7 in excitement instead of 4, 7 in HQ instead of 4....

*Interviewer*

3rd concept is shown.... How attractive would you find this concept 1-9?

*User*

I would say 8, because everything is moving compare to others...always in motion, showing where the vehicle is...alive feeling, is not static as the first or just turn off and on as the second....

*Interviewer*

how exciting?

*User*

8, same argument, alive, showing vehicle passage to doors in both sides

*Interviewer*

what about HQ?

*User*

8, i think like the first, theres a function, showing the vehicle, something extra...extra feeling

*Interviewer*

would you feel any difference from approaching from back or front?

*User*

No, I don't think so... I would feel the same, maybe from the side, its even nicer

*Interviewer*

what about the driver or passenger seat?

*User*

the same

*Interviewer*

7 different color options, which one is your favorite?

*User*

Maybe a dual color, I like the purple...I would choose a classic color, white, red...its nice to have yellow but not always, I would like to change it....I think the red...

*Interviewer*

what's up with the red? Just because matches with a black car?

*User*

maybe associate with HQ...

*Interviewer*

would you change your gradings? With this new color?

*User*

I would expect that option, if i'm paying for my car. . . . 8 stays...you buy a car, but i want to choose the color as well.

*Interviewer*

Some general questions now. . . . Which one is your favorite?

*User*

3rd its alive is in motion. . . . I like that feeling

*Interviewer*

which one is the concept that makes you feel welcome?

*User*

i'll feel more welcome because of the light, but not enough

*Interviewer*

what makes you feel welcome then?

*User*

maybe if my car is ready, warm up and stay out of my door so its ready to drive. . . .automatic drive to park, but i want to drive.

*Interviewer*

a different concept? Or more attractive? Something that calls you?

*User*

its attractive now, but maybe i can't think as welcome, if it talks to me "welcome XX " ...maybe a text with my name

*Interviewer*

we will say some words and relate it to the concept? playfull?

*User*

something with motion, the second one...playfull is less quality for me, i didnt like the second one so. . . .

*Interviewer*

High tech?

*User*

I would say the 3rd, because its moving in a nice smooth way, showing where my vehicle is.

*Interviewer*

new thinking?

*User*

i would say the concepts all of them are new thinking. . . .the 2 of them in motion more new thinking. . . .i would say 3rd

*Interviewer*

do you like the opportunity to change the color?

*User*

its nice to choose your own color and personalize it. . . .but also limit it with few options not to complex things

*Interviewer*

opinion in light projection? Would you like to use it?

*User*

I would use it, I would like to have it, in a situation when its dark, if i'm approaching to the car it should light up!

*Interviewer*

would you feel proud to show something like this?

*User*

maybe not proud, because of it's something that i didn't myself. . . .not ashamed, but i would feel comfortable and confident to show this to other people. . . .since its a nice feature, and its cool, new thinking, alive, giving extra to the vehicle, i would feel comfortable

*Interviewer*

when would you like to have this activated?

*User*

10-20 mts away, if i'm walking towards the car, that the car knows that i'm approaching. . . .

*Interviewer*

in a dark street, alone, kind of creepy. . . .would you like to have it?

*User*

some cars have that option only for unlock drivers, maybe if you are in that situation, it should not turn on. . . .otherway it would attract attention from other people. If

it recognize the danger, it would be good, its a nice feature, but still should be able to turn off the function Test subject 8

*Interviewer*

On a scale 1-9, how attractive do you find this concept?

*Testsubject*

Comments on the uneven thickness of the lines being something she doesn't like. Likes the bright light.

*Interviewer*

On a scale 1-9, how exciting do you find this concept?

*Testsubject*

"The excitement is mainly about this being a new thing". Have less to do with the design.

*Interviewer*

To what level do you agree this feels like a HQ concept?

*Testsubject*

"It feels a little bit like an add-on. But I still think it is cool..."

*Interviewer*

Do you think there is any difference in how welcome you would feel depending on if you are entering from the front or the back?

*Testsubject*

Standing in front: think it looks like more sense with the uneven lines because they get thicker the closer you get.

*Interviewer*

Will you feel a different welcome depending on if you are entering in the backseat or the driver's seat?

*Testsubject*

"Less in the passenger seat. Because the bend is focused in the driver's seat." Feel more welcome in front seat.

*Interviewer*

1-9, how attractive do you find this concept?

*Testsubject*

If you compare this concept to concept 1, in this you can see that something is happening and it is not just "paint on the ground". "But still it is a little bit disco

feeling, which is bad. Because it's tacky." Suggest at this point that a more smooth movement would be perceived as higher quality. Likes the movement, but have a problem with the pattern itself.

*Interviewer*

On a scale 1-9, how exciting would you say this concept is?

*Testsubject*

"It is more fun, something is happening and its like different shapes - bigger and smaller - something is happening. Its more fun."

*Interviewer*

If you think about the quality in this concept how would you perceive it?

*Testsubject*

Refers to design being tacky which is also connected to low quality.

*Interviewer*

If you approach from the front, will you get a different feeling?

*Testsubject*

It is not focusing in \*this\* area at all. "It would be better if it moved towards the car." Doesn't feel the flow of the light unless you are approaching from the back.

*Interviewer*

If you are entering in the backseat or the driver's seat, do you think you could feel different then?

*Testsubject*

No particular answer:

*Interviewer*

\*Presents color options\* Which color is your favourite?

*Testsubject*

Red is danger. "White is more clean."

*Interviewer*

Just by knowing that you can change the color, do you think that you would like to change the scores?

*Testsubject*

"I think that quality can go lower. I feel like you are buying a party car, that you go out and impress people with. For me that is more tacky again."

*Interviewer*



\*Presents concept 3\*

*Testsubject*

“I like this one!”

*Interviewer*

1-9, how attractive do you find this concept?

*Testsubject*

“9, its so nice!” Movement towards the car, the lines are following eachother but they are still independent. They look like small fishes.

*Interviewer*

1-9, how exciting is this?

*Testsubject*

“Its a 9, because it is new, and something is happening... I can’t stop looking at it.” Its nice when you are moving around outside the car. No difference between front and backseat.

*Interviewer*

What about HQ?

*Testsubject*

The quality is very tricky for me. Because I have trouble seeing the light projection as high quality. But this one is more nice and clean so its going higher... Yeah definitely higher.

*Interviewer*

\*Presents color options\*

*Testsubject*

Dont like red, yellow or orange. Likes the blue ones better. Would go for the white light, but “it’s nice with options”. Maybe most white light and then just small details in color. Gradings stay the same.

*Interviewer*

Which one of these concepts was your favourite and why?

*Testsubject*

The third, it has the movement towards the car, something is happening. And something is happening but it is still very clean.

*Interviewer*

Which one of the concepts made you feel most welcome to the car and why?

*Testsubject*

The last one, because it moves towards the car in every angle.

*Interviewer*

I will present some words and I would like you to connect them to the concept you think fits the most. The first one is - playful.

*Testsubject*

The last one. Because of the movement again, it has to do with the thing that the lines are following each other.

*Interviewer*

- High tech

*Testsubject*

Concept?

*Interviewer*

- New thinking

*Testsubject*

The last one. "This is actually moving, something is happening, its a different shape... Its out of the box"

*Interviewer*

How did you feel when you got the opportunity to choose color? You weren't that into that? But was it because you liked the white which was the default color?

*Testsubject*

"I think so, but also maybe if there are other factors like how they are going to look on different grounds and surrounding lights." You want to match it with the color of the car, you choose the color of the car and you get the light that belongs to that.

*Interviewer*

What do you feel about light projections? Is this something that you would like in your car?

*Testsubject*

"If I had a new car, it would be a really cool effect." If using shared car, would "be happy to have this car for one evening" and would probably rent it again.

*Interviewer*

Would you feel proud?

*Testsubject*

Yes, everybody else would be like "oooh look at this..."

*Interviewer*

When would you like to activate this?

*Testsubject*

“When you are unlocking the car.” Can imagine using it in all kind of surroundings.

*Interviewer*

\*Presents unsafe situation\* Would you like to have the light then?

*Testsubject*

“I want ot be discreet and just jump into my car...”

*Interviewer*

What do you think about this test compared to the other one we had?

*Testsubject*

In the other one it was really hard to put numbers on them and I forgot what I put on the other ones. It was easier when it was only three concepts. Its easier in that case if you get an overview.

*Interviewer*

Is there something you have realized now when you have seen them in real life?

*Testsubject*

I think that the 2nd concept looked better in the 2D test. When I saw it I didn’t like it. You can also see the concepts from different angles.



# G

## Appendix 7

