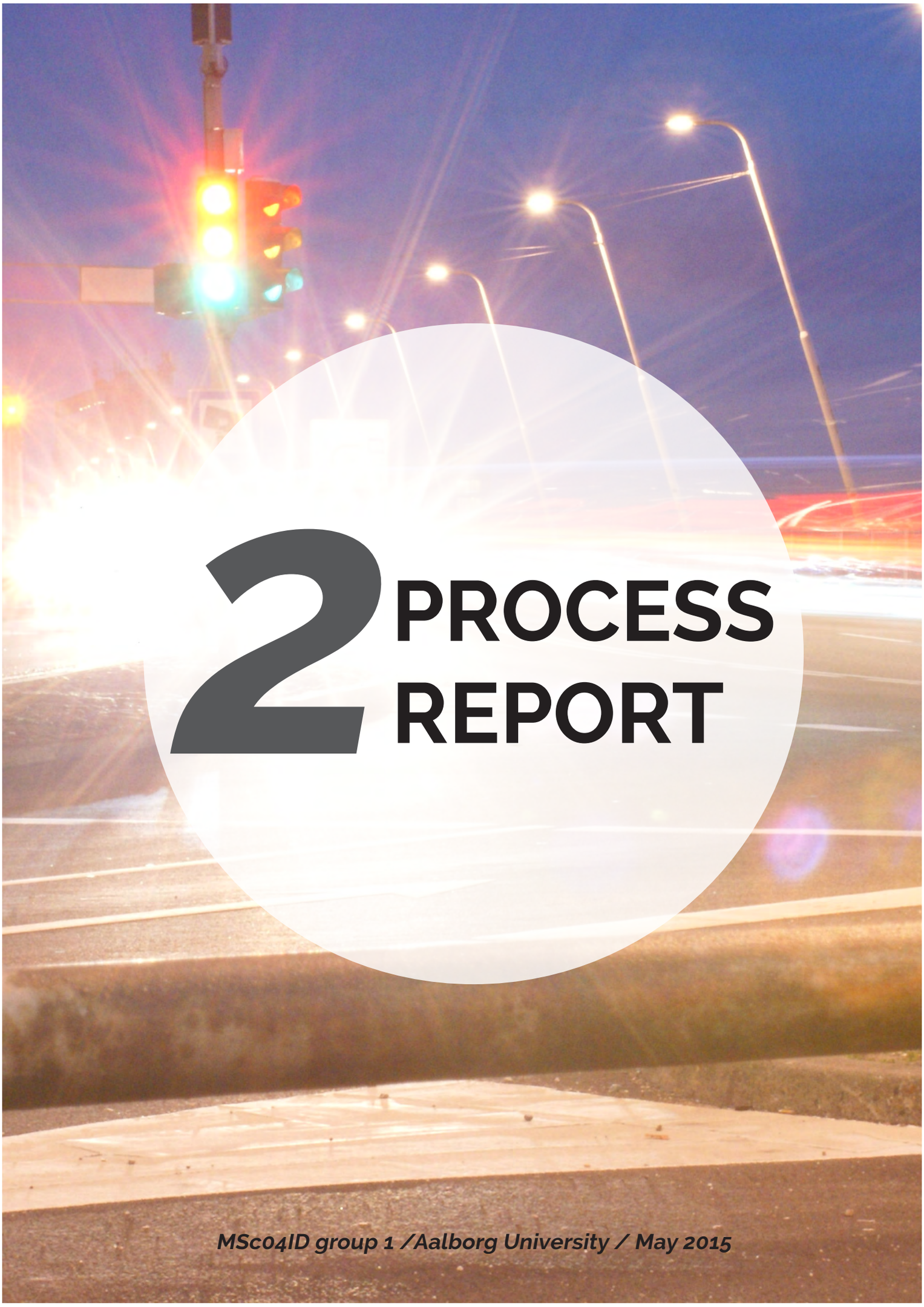


2 PROCESS REPORT

MSc04ID group 1 /Aalborg University / May 2015

TITLEPAGE

Title	Lumiline
Theme	“To be seen in the dark”
Period	04.02.2015 - 27.05.2015
Group	Group 1, MSc 04, Industrial Design Institute of Architecture, Design & Media Technology, Aalborg University

Supervisor	Finn Schou
Co-supervisor	Benny Endelt
Issues	6
Number of pages	67
Appendix	14

Marie Skovgaard Mikkelsen

Trine Hæstrup Friberg

ABSTRACT

Projektet omhandler udviklingen af et produkt med hovedemnet "at blive set i mørket", hvor fokus er cyklister som bruger lys til at gøre opmærksom på sig selv i trafikken. Det er svært for bilister at se cyklister i mørket, da udsynet forringes og det er derfor nødvendigt med synlighed, hvilket dette produkt medhjælper. Der skabes opmærksomhed omkring cyklisten, ved brug af forskellige lysfeatures, blandt andet ved at have ekstra belysning og vise cyklistens orientering i trafikken. Produktet er udviklet gennem interview, eksperimenter og analyse af trafik og sikkerhed.

READING GUIDE

The report is structured in 6 phases, based on Stepping Stone which also is used in the development of the product.

The Harvard method is used as a source reference and illustrated by the author and year of publication, or the name of the website or topic. The list of references and illustrations is placed in the back of the report, after appendix.

Small boxes are illustrated continuously in the report and sum up important information, decisions, requirements, etc.

Table of content

PREFACE

Road safety is a worldwide problem, because of the growing number of vulnerable road users as cyclists and pedestrians and many roads are not adapted to this fact. It is difficult for car drivers to see the vulnerable road users, especially in cities with a lot of visual "noise" and at night when the cyclists or pedestrians wear dark clothes. Almost all car drivers have tried to drive on a dark road, maybe a little bit too close to the roadside, and suddenly a person is in front of you. It is like they appear from nowhere and the shock overwhelmes you, your adrenaline is high and your heart beats fast. It is an uncomfortable situation that could be avoided if the vulnerable road users are more visible.
But how can you make people use products who makes them more visible in traffic, both for the car drivers and vulnerable road users best interest. The choice of products on the market are much alike and focus on the more practical view. It seems like it is difficult to make people buy the products, like reflectors and vests with a high visible colour, probably because it is more practical than pretty and does not fit daily activities like shopping.

In 2013 there were 3.585 personal injuries from traffic accidents reported to the police, 1.672 were car drivers, 809 cyclists and 423 pedestrians(færdelsuheld.PNG). These numbers can be reduced by making it easier for the car drivers to see the vulnerable road users and thereby give them a better chance to avoid an accident.

...a big thanks to

Finn Schou / supervisor

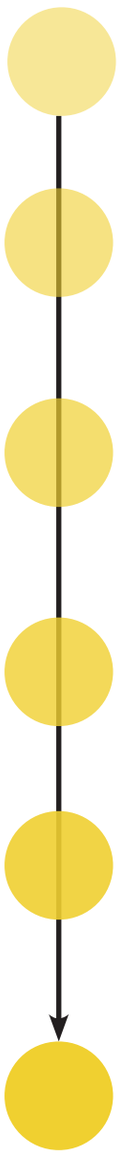
Benny Ørtoft Endelt / technical supervisor

Esben Skovsen, Thea Lind Thomsen, Louise Jensen, Hans Henrik Skovgaard, Jes Jakobsen, Toke Ploug Henriksen, Harry Lahrmann, René Højer, Flemming Andersen

METHODS

Stepping stone

Stepping stone is a design tool with six "stones" that each describe a phase of the design process. The order is as following; Alignment, Research, Mission, Vision, Concept and Product Development. Even though it is a chronological method, is it often necessary to go back and forward through the different stone, when you get new knowledge and therefore have to reevaluate earlier decisions. Stepping Stone is used with the objective to have structure in the design process, and thereby create a flow and work with all aspects in the development.



Alignment:
The foundation for the whole project, where the group make a contract involving the group members roles and how the project should be executed.

Research:
In this phase information about the topic is gathered, with the objective to find a project focus and set up requirements for the concept. Here different methods is used, for example interview, experiments and literature search.

Mission:
The mission is "the leading star" in the process and state the meaning of the product and the values the end product creates. This is often reevaluated several times during the design process, when new knowledge is gathered.

Vision:
The vision looks into the future and how the products impact the user and/or surroundings. It is the best scenario possible but not always achievable.

Concept:
In this phase different ideas is developed, which all have one or more principles that are based on the mission. It contain several ideation rounds, which often are followed by research that can support or somehow help developing on the principals.

Product:
When the final concept is settled, the product development starts. In this phase the details is developed, with the objective to design the most suitable product.
(Stokholm, 2011)

Interview

Interviews is used to obtain knowledge from experts in different fields, for example Jes Jakobsen, Industrial Designer at Reelight and Harry Lahrmann, Associate Professor at "Vej og Trafik". When interviewing it is important to be aware of that it is often one person's own opinion and not neutral. Also the questions can lead up to a certain answer, which possibly is not the most true answer. (Brinkmann & Tanggaard 2010).

In this project semi-planned interview is used. Here the overall focus is planned, but it is not fully structured. This type of interview is chosen with the objective to go more into depth, and give the interviewed person a chance to give as much information as possible. This often brings up things that was not the interviewer's initial thought about a certain subject.

Experiments

Experiments are used throughout the whole process with the goal to obtain new knowledge and derive requirements for the product. An advantage with experiments is that you try it on your own body quickly and experience new things. It is also a good way to prove principles or set limits.

Prototyping

Prototyping is used to prove electronic solutions, where the distance and placements of lights is evaluated. Beside stating if the principle work, does it also give an idea of dimensions and what is needed to get the wanted functions.
More basic models showing the shape is used to evaluate the form and dimensions, because it is different than seeing a 3D model in Solidworks. Prototyping is a fast way to get a feeling of the shape, compare the product with existing solutions and visualize the product in context.

Competitor analysis

A competitor analysis is used with two objectives; one to evaluate on existing solutions and thereby choose what functions the product should have. The other competitor analysis is a Strategy Canvas of existing bicycle lights, where different values are compared, to see how the products differ.

1 PROJECT SCOPE

PROJECT SCOPE

The initial scope of this project, "to be seen in traffic" is decided after being in contact with Rene Højer the head of safety at Trygfonden Denmark. Rene Højer specifies, through conversation, that "to be seen in traffic" to a greater extend relates to "be seen in the dark", which in his mind is a crucial matter in traffic.
Trygfonden helps with the initial scope of this project and contributes with material concerning legal requirements, articles and projects relating to traffic and safety. Furthermore, Rene Højer sets up a contact with Harry Lahrmann, who is a part of "Projekt Cykeljakken", a corporation between Aalborg University and Trygfonden, concerning safety in traffic.

There has been made no contract between this group and Trygfonden, allowing this group to work with other companies if desired.

Harry Lahrmann has no direct impact or saying in the project, but has agreed to help out as much as possible, after being contacted by Rene Højer. Harry Lahrmann gives lectures regarding road and traffic safety and contributes with background information to this subject. Harry Lahrmann is free to contact and available for meetings.

Ill. 1

Ill. 2

Ill. 3

TrygFonden

René Højer
Area manager of safety
(fire safety, traffic safety & beach and water safety)
Trygfonden

Ill. 4

AALBORG UNIVERSITET

Harry Lahrmann
Associate professor
Aalborg University
Byggeri og Anlæg, "Vej og Trafik"

2
RESEARCH

"PROJEKT CYKELJAKKEN"

"Projekt cykeljakken" is a report composed in close corporation between Trygfonden and Aalborg University. The hypothesis of the project is that "cyclists' safety can be improved by increasing their visibility in traffic". The report studies whether the use of a bicycle jacket in a colour of high-visibility reduces the risk of cyclists' accidents. "Projekt Cykeljakken" is the starting point of this project, and is the first material underlying some of the initial problems regarding being seen in the dark.

"Projekt Cykeljakken" holds concerns regarding the project, such as the design of the bicycle jacket, how to recruit participants, how to communicate and gather information from the participants, and practicalities concerning the whole project. The analytical data refers to the use of data and data errors while the results highlights the effects of the bicycle jacket and evaluates comments from the participants. The project is concluded by a discussion and a conclusion. It is not in this groups interest to recruit and screen for participants and therefore, it will not be included in this project.

"Projekt Cykeljakken" consists of a test group and a control group, where the test group uses the jacket throughout the whole project and the control group receives the jacket after the experiment. Every month, both groups are asked through a questionnaire whether they were involved in a car accident as a cyclist, and whether they wore the jacket or not. The degree of use was measured to 77%, by random questionnaires. The self-reported accidents show that the test group had 38% less personal injury accidents than the group who did not use the jacket.

Throughout the report, the group gather several questions. According to this project, one of the more interesting question concerns the development of the jacket since it has a bigger effect in "Projekt Cykeljakken" than what was initially indicated. Therefore the group arranges a meeting with Harry Lahrmann to clarify the questions. The questions are written in the sum up box.

INTERVIEW

with Harry Lahrmann

The interview with Harry Lahrmann gives insight to the problems with bicycles and how they can be more visible when it is dark. "Projekt Cykeljakken" showed that the cyclists are more visible when wearing the jacket, but also that it is uncomfortable to wear when the weather is warm/ the jacket becomes warm, and at the same time is it not "smart". Harry Lahrmann also mentioned that the participants in the project was very loyal/interested and therefore wore the jacket more than a typical cyclist would.

Harry Lahrmann is interested in two types of products; a smart product that people want to wear or safety equipments. It is important to design a product that is visible both within the city and the country road. Light is the visibility equipment that stands out the most in different surroundings, compared to reflectors and high visibility colours.

It is important to stand out in order for the car drivers to notice the vulnerable road users, and it is discussed if it should be possible to distinguish the cyclists from the pedestrians as well. This could be done by using bio-motion where light makes it possible to see the joint movement.

The whole interview is transcripted and can be read in Appendix 1.

Which demands have you set up for the jacket? - other design solution?

"...shell jacket in high visibility colours with a limited amount of reflective material". - Why a limited amount of reflective material?

What had been your thoughts on night/day? Summer/winter?

What are your thoughts on high-visibility colours, lights and reflectors?

ARTICLES

The initial scope from Trygfonden is "to be seen in the dark", why a literature search about being seen in the dark is started. Especially MOTOR, FDM's car magazine, writes about how to be seen in the dark and which products to use, both as a cyclist and pedestrian.

"*Trafikklar i mørket*" is mostly seen from the car drivers point of view and the difficulties that they have when driving in the dark. The article states that the risk of a traffic accident is bigger when it is dark, because you cannot see as far in front of you compared to when it is daylight. The visibility gets even worse when it is raining because the lights, for example street lights, reflect in the windows. This means that it is necessary to be more careful in traffic, both when dealing with speed and by orientate oneself in traffic.
The article also mentions the problem with the small diode lights, which are almost impossible to see from inside a car, why they are illegal now. As a pedestrian is it also important to use reflectors, especially the high visibility colour vests, because of the bigger area with reflectors that goes the whole way around you. The importance of the vest is also stated in the article "*Vesten gør hele forskellen*". The article is based on a test, involving a truck, which shows that the vest can be seen from 350 meter and without the vest only from 35 meter. (Jensen, 2012) (W. Jensen, 2012)

"*Cyklister, vi kan ikke se jer!*" is a test of how easy it is for the car driver to see different bicycle lights, when the cyclists are on a distance. Before the test, MOTOR posted a question on Facebook, adressed to car drivers, asking if anyone have been in a situation where an accident were close to occur, because they did not see the cyclist. To that question many answered yes, and some on a daily basis, because the bicycle lights was not powerful enough.
Kristian Thomsen from Cyklistforbundet does not approve the magnet lights, because the placement is too low and difficult for the car driver to see.
The winner of the test is Lezyne, which is also the most expensive, however they are easy to see from a 300 meter distance, in the side mirror and at the same time it does have a good driving light for the cyclist. (Jensen, 2014)

An opposite problem is that the light can blind the car drivers, which FDM states in their article "*Motionsløbere blænder bilister*". Here, the problem is that the light is placed on the forehead up high and therefore hits the car drivers eyes. At the same time can it be confusing with this "jumping" light and it does not fit into the traffic environment. (Jensen, 2015)

Look at appendix 2 for all the articles.

Ill. 5

Ill. 6

Ill. 7

Ill. 8

Not blind the fellow road users

Characterize the user

Visibility on a distance

STATISTICS

In order to get more precise numbers of the people involved in accidents, the type of road users, and the country which use the bicycle the most, a research on statistics is conducted. The statistics are used to support and delimit the problem scope from TrygFonden and "Projekt Cykeljakken".

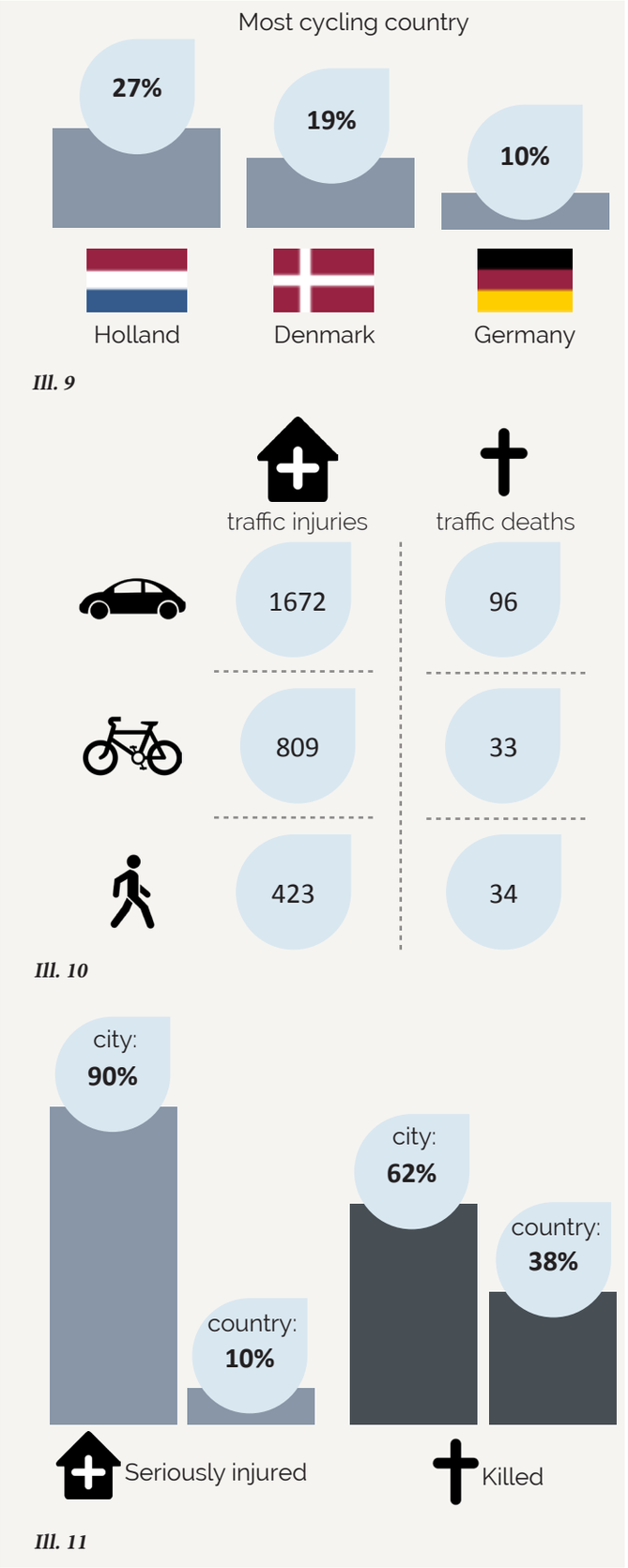
The statistics shows that the Netherlands, Denmark and Germany is the three countries with most transportation on a bicycle. The focus is placed on Denmark because the Netherlands already are innovative when it comes to bicycles and invest more money to improve the traffic safety for bicycles. In comparison, Amsterdam is planning to use 200dkr per inhabitant the next four years and Aarhus Municipality is going to invest 35dkr per inhabitant the next five years. Notice that the forward years are from 2007. (Celis, 2007) Furthermore, the Netherlands have a different set of regulations, which make statistics from the two countries different to compare.

Illustration 10 is an extract from Danmarks Statistik Bank (Dsb, 2013) and shows that cars, cyclists and pedestrians are the most injured and killed road users in 2013. The statistics only include accidents where the police are involved and there is a "dark figure", including contact to hospitals after an injury or no contact at all. As an example hospitals in 2010 registered 2.892 accidents for cyclists where one or more road user were involved. The statistics from 2013 only mention 809 injured cyclists in traffic (sikkertraffik).
Statistic for cyclists show that most traffic accidents happen in the city, illustration 11 (Rådetforsikkertrafik, 2014). The amount of traffic is bigger in the cities, both for cars, cyclists and pedestrians, and therefore the risk of being involved in a traffic accident is greater. The percentage of killed cyclists increase for the country road, compared to the percentage of injuries, because of the speed of the car.

It is decided to work with cyclists, because the bike is the second most injured in traffic only exceeded by car-drivers

Bicycles are the persons closest to the danger, the cars.

Cyclists move faster than pedestrians - less time for the driver to react on sudden changes



Ill. 9

Ill. 10

Ill. 11

BIOMOTION

Harry Lahrmann introduced the tern “biomotion” when being interviewed. Below is a quick overview of the term, and its possibilities.

The term “biological motion”, often mentioned as “biomotion”, refers back to Gunnar Johansson who studied the motion perception in vision. In his paper “Visual perception of biological motion and a model for its analysis” from 1973, Gunnar Johansson lays out a method for studying the information from a motion pattern. The motion of the body was represented by a few bright spots, which describe the motions of the main joints (hands, elbows, shoulders etc.). Gunnar Johansson found that the spots could evoke the impression of a human walking, running dancing etc. (Johansson Gunnar, 1973)

Today biomotion is used in a broad variety of fields. The medical industry uses it to evaluate how patients recover after an injury. Light shows how the body is moving and it is therefore possible to recognize movement compensations. In the car industry, biomotion is used in regards to the body and safety in crash tests. See illustration 12 of the spots placed on joint in live motion at http://www.biomotionlab.ca/Demos/BMLwalker.html.

Ill. 12

In relation to this project biomotion is an obvious possibility to incorporate as a concept, in order for the car drivers to identify the type of vulnerable road user and perhaps estimate their speed.

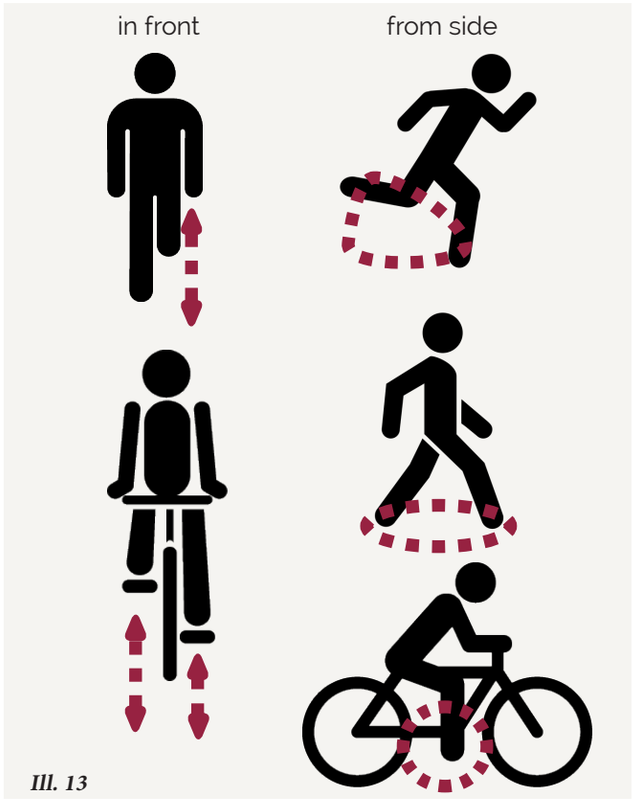
Next step is do an experiment, placing light on the feet, to figure out if it is possible to distinguish the motion of biking between running and walking, and whether this can be used in the scenario of increasing safety in traffic.

EXPERIMENT

biomotion

In this experiment, biomotion is used to show the type of road user by placing light on different parts of the body, for example the feet, which is shown in the exercise below.

The exercise is set up with a person wearing a light source on their feet while walking, running and cycling. The test shows that the movement when cycling, walking or running looks similar when standing in front of, or behind, the person moving. The only difference is the speed of the movement, but here cycling and running still looks and share similar points. When seeing the person from the side, there is a noticeable difference, as seen in illustration 13.



Ill. 13

Too see videofottage of miomotion experinents see appendix 4

Bio-motion:
shows the type of road user from the side.
same movement from the front and back.
illustrate the speed.

Incorporating biomotion in upcoming ideation could be beneficial, with the objective to distinguish the vulnerable road users in traffic.

EXPERIMENT

testing different existing products

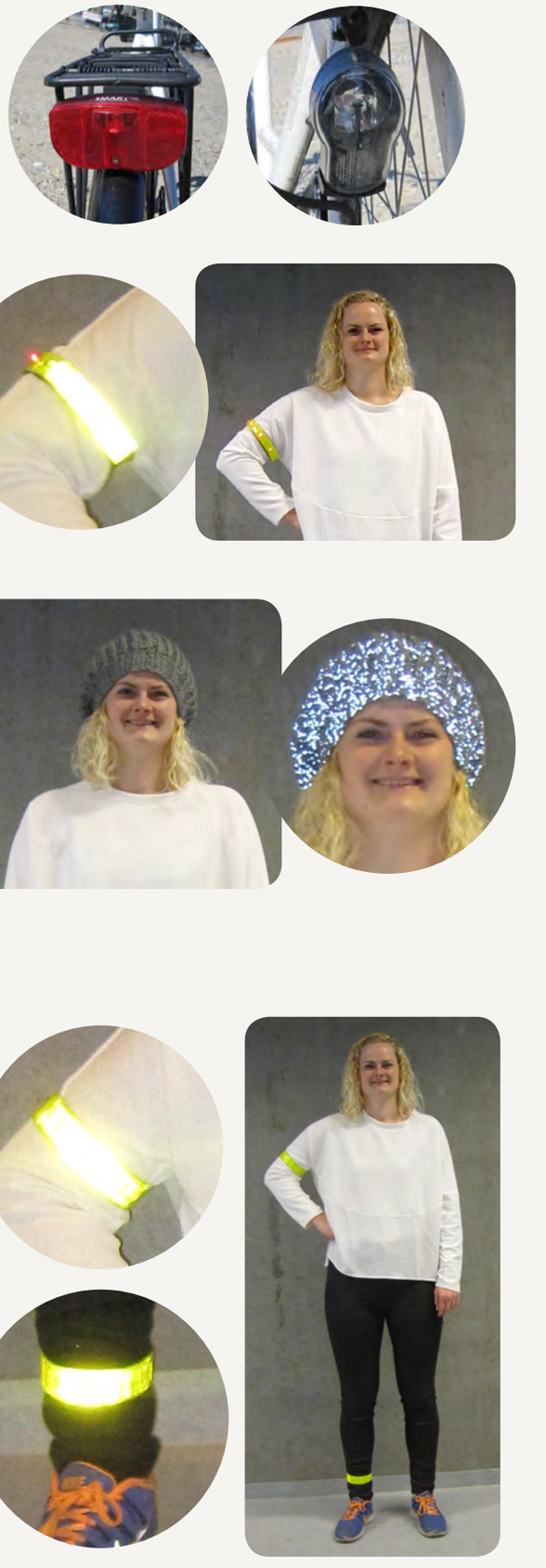
The test of different products on the market is executed in two rounds; one where pictures are taken from inside a car and a second test where pictures are taken when standing on the road. The first test is executed on a country road with poor light and the second test in the city, both with street lamps and without. The objective is to see how visible different products are in diverse lighting.

The first test did not succeed because it was difficult to take good pictures from the car, even though the car was parked on the roadside. The pictures are blurry because of shakings due to the handhold camera. Even though the test did not succeed, it is clear that it is difficult to see cyclists in a dark road, even with front and back light on the bike and wearing a reflective hat.

The second test shows that high visible coloured clothes are invisible when it is dark. The reflectors, both on the vest and as an individual product, quickly disappears in the surroundings. The reflectors are more visible when they are placed on the back of a person, probably due to the size of the surface but also because the back is in a noticeable height.

The light is the most visible and does not disappear in the surroundings as quickly, as the other products have a tendency to do. All tested products, including light, are difficult to see when there is oncoming traffic because it blends in with the light from the oncoming vehicle.

The pictures, on this page, are not from the test itself, but just of the products. Look in appendix 3 for pictures from the actual test.



Ill. 14

MARKET RESEARCH

During the initial investigation, there are three categories of objects that can make a difference in order for the vulnerable road users to be seen; lights, reflectors and high visibility clothes. These categories are listed in illustration ? with advantages and disadvantages with the objective to define the scope of this project.

Ill. 15

Ill. 16

Ill. 17

Ill. 18

Ill. 19

Ill. 20

Ill. 21

Ill. 22

Ill. 23

	advantages	disadvantages
high visibility clothes	draws attention in daylight can be purchased cheap	not visible at night dislike the colour uncomfortable to wear the look does not fit all activities not fixed to the bike
reflectors	visible at night cheap can be fixed to the bike	not visible in the daytime only visible when lights hit them need a big area with reflectors not visible for a long distance
lights	visible at night visible when the weather is bad can be fixed to the bike (placing) different technologies available can be seen in daylight visible for a long distance	battery placement can trouble the driver big range in cost price can blind fellow road users

Ill. 24

Light has most advantages, it is for example the product that is most visible at a longer distance. It is visible both during night and day, at all seasons and can easily be fixed to the bicycle. Furthermore, the cyclist does not have to wear the product, when for example going shopping, which was one of the discussed disadvantages with the high visibility vest from "Projekt Cykeljakken". There are many possibilities when working with light and some of the disadvantages can be solved, for example placement and the fact that light can blind the fellow road users.

Approach to the market

It was considered to cooperate with professionals, for example Post Danmark, Bring and By-expressen as they use bikes on a daily basis when working. In the end, none of the companies was chosen for this project because they did not require any special light or reflectors. By-expressen, Bring and Post Danmark did not have any special requirements:
"*Vi har ingen særlige regler, udover at vi opfordrer vores bude til at køre med cykelhjelm og overholde færdselsreglerne.*" - Nicolai Thilo, By-expressen

"*Vi stiller de krav til vores cykelbude, at de naturligvis skal køre på en godkendt cykel, ud fra de paragraffer Færdselsstyrelsen stiller i Udstyrsbekendtgørelsen.*" - Cecilia Serednicka, Bring

"*Vores cykelbude cykler jo typisk først ud på ruten efter kl. 8, så anvendelsen af lygter og reflekser er jo umiddelbart ikke et parameter, der gør sig gældende for tiden, hvor der bliver lyst før kl. 8, og slet ikke i forhold til den lysere tid der venter foran os nu.*" - Christian Dahl Svendsen, Post Danmark

On that basis, this project focus on "the normal bicycle user", who use their bicycle as a means of transport to work and other activities.

CHOOSING BICYCLES AND LIGHT

During the research, the focus of the project is narrowed down to cyclists as the user group and light as the main source in the product. The cyclists as a user group are chosen based on own observations and statistics on traffic accidents, whilst number of cyclists. The test of existing products showed that light stands out the most when it is dark, both when there is light in the context and when an oncoming car is approaching.

The illustration below sums up the reasons for choosing cyclists and light as a driven factor in this project.

Why cyclists?

Closer to the car compared to pedestrians

Faster

Make quick turns and movements

The second most injured in traffic only exceeded by motorist

Many accidents which are not notified to the police

Encourage more to take the bike instead of the car, for example by making campaigns

Increasing number of cyclists
(Vejdirektoratet, 2015)

Why light?

Visible day and night

Visible for a longer distance

Visible in the city environment as well as country roads

Many different technologies and possibilities

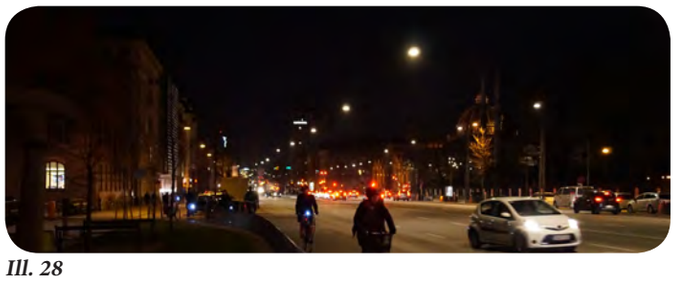
Can be fixed on the bike

Easy to bring in a pocket if not fixed

Ill. 25

Ill. 26

Ill. 27



Ill. 28

Ill. 29

LEGAL REQUIREMENTS

The bike in general
- maximum width: 1 meter, 1,25 meter if the bike have more than two wheels.
- maximum length: 3,5 meter.

The light
Luminous intensity minimum 4 candela when standing right in front of the light, at least 0,4 candela when standing 20^0 to each side and 0,05 candela when standing 80^0 to each side. Run-time at least 5 hours (battery-powered).

A white/yellow/blue headlight:
- visible for minimum 300 meter.
- placement maximum 0,5 meter from the front of the bicycle.
- not blind fellow road users.
- fixed so it does not change position when driving.
- can be flashing when not yellow.

A red rear lamp:
- visible for minimum 300 meter.
- placement maximum 0,4 meter from the back of the bicycle.
- visible from the sides.
- not blind fellow road users.
- fixed so it does not change position when driving

Possibly brake light:
- start immediately when using the brakes
- a visible difference in brightness compared to the rear lamp.

Possibly direction indicator:
- visible in daylight.
- flash frequency between 60 and 120 flashes per minute.

Reflectors
- A white reflector that is visible in the front.
- A red reflector that is visible on the back.
- Minimum two yellow reflectors that are moving and visible from the back.
- Minimum one yellow reflector on each wheel or white reflective tire that is visible from the side (Duus, 1999) (Hansen, 2012).

Ill. 30

OUR REQUIREMENTS 1.0

The first draft for requirements are listed below. They are based on previous research on the topic and own observations. The requirements are divided in "need to have" and "nice to have".

Need to have

Draw attention when it is dark

Fit all seasons

Visible from minimum 300 meter

Not blind fellow road users

Durable

Waterproof

Possible to be fixed

Universal solution

Nice to have

Low cost

Long lifespan (self-power-generating)

Clarify the type of road user

Visible from all angles

Not attract attention from the bike when it is not being used.

Only visible when being used

The product needs to work both when it is warm, cold, dry or wet. A problem with Projekt Cykeljakken is that it is too warm in the summer and therefore did they not use it during summer.

An article from FDM state that some lights blind the fellow road users, for example a forehead light. (Jensen, 2014)

The thought behind "possible to be fixed" is to make it convenient for the cyclists, not have in mind always to bring the product. Harry Lahrmann states that most cyclists do not wish the hassle with the product.

When talking universal solution the focus for this project is still Denmark, but the requirements include legal laws and traffic from Holland (Holland being the country with most active cyclists).

When knowing the type of road user, it indicates something about speed and act on the road. For example a pedestrians does not make fast turns in the same degree as cyclists.

The requirements are still vague and need to be specified, but it gives an idea of the direction and focus points for the ideation. In order to make the requirements more specific and give a clear direction for the concept ideation, the universal solution and aesthetics must be discussed to be able to clarify how it should be durable and research how the product is most visible without blinding for instance the fellow road users.

3

MISSION

We want to improve the traffic safety in the dark, by making cyclists more visible and make it easier for the car drivers to see how the cyclist is moving in the traffic. This will be carried out by designing a product cyclists want to use, why it should not be a hassle or create attention when not in use. The source to create attention will be light, because it stand out from the city environment, as well as the country road.

4
VISION

Improve the traffic safety for the cyclists and make them feel more safe when cycling in the traffic close to cars and other vehicles who are faster and more heavy.

5
CONCEPT

IDEATION

brainstorming (words)

There are several parameters that affect the traffic and makes it harder to see the surroundings, for example how well a car driver sees a bicycle. The parameters are listed below.

"different degrees of darkness"

"difficult to see the type of road user"

"rain complicate the view from the car"

"difficult to see the speed"

"surroundings change night and day"

"bike is seen from different angles"

"lac of streetlight on the country"

"visibility on a distance"

"blind spots"

"durability of material"

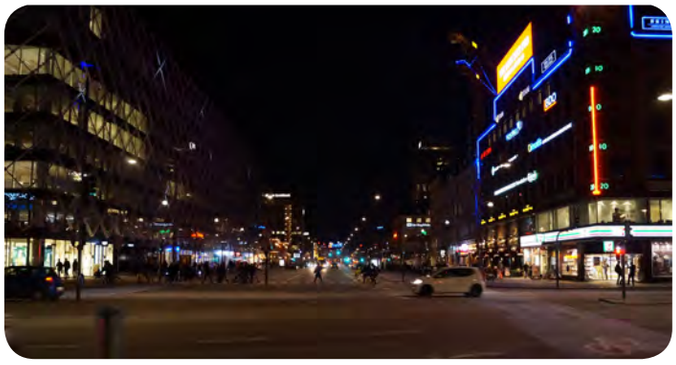
"placement of bicycle lights"

"confusing products (strong headlights)"

"light disturbance in the city"

These parameters are based on own observations and the interview with Harry Lahrmann. The problems are used to create ideas for possible solutions in order to notice the bicycle easier in the dark.

Ill. 31



Ill. 32

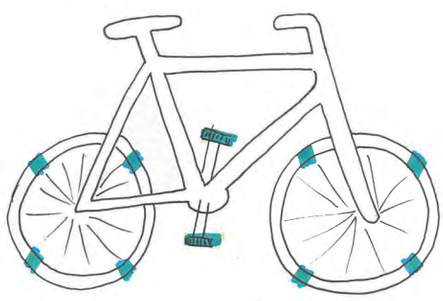
Ill. 33

Ill. 34

IDEATION 1.0

concept (drawings)

The first ideation is based on the initial requirements (page 17) and parameters that affect traffic safety (page 21). At this point, the focus and direction are still not clear enough, but all ideas contributes to make the bicycle more visible.

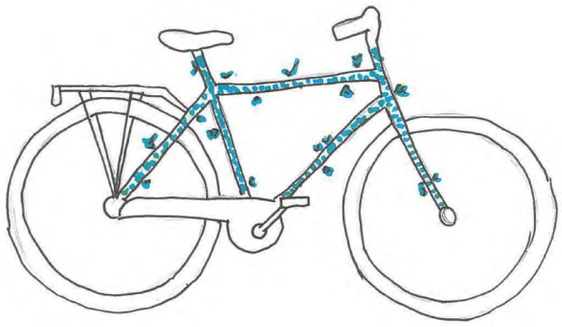


Ill. 35

This idea is inspired by bio-motion. Light are placed on different moving spots on the bicycle, for example the wheels or pedals. This should indicate what type of vulnerable road user it is and create attention for the fellow road users.

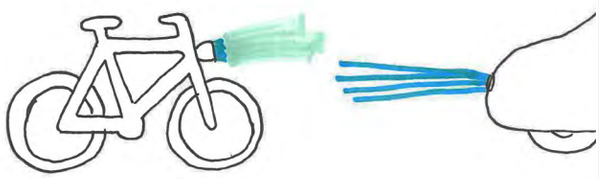
Ill. 36

The arrow shows the direction that the bicycle is moving, which help the fellow road users to act on it. therefore, it is easier for the car drivers to avoid an accident occuring. The arrow could be a hologram in the air or laser on the cyclist's back.



Ill. 37

The bicycle lights up when a car light, or similar light, hits the bicycle. The light creates attention from all angles and makes the cyclist more visible.



Ill. 38

The headlight have extra light that light up when car light hit the headlight, with the objective to create awareness.

It is decided to work further with bio-motion, hologram and laser. They have many possibilities and create more attention than a normal bicycle lamp.

The next step is to research on the possibilities within these concepts and make further development.

RESEARCH
hologram and laser

The objective with this research of hologram and laser is to find inspiration and discover new possibilities for the development of the concept. Laser is already used to make the bicycle more visible, where hologram mostly is used for creative visualizations.

Hologram

The advantage with a hologram is that it can make 3D illustrations that moves, and thereby creates even more attention. It can be seen at night as well as in daylight, but the machine uses a 1kHz pulse laser and it is not sure whether it is possible to use holograms on a bicycle (Hologram).

Ill. 39

Ill. 40

Laser

The advantage with laser is that it is possible to use on a bicycle, but it is not blue ocean as the hologram. Hologram is not used on any bikes, or to create attention in traffic, as far as research shows.
Lasers create sharp images in many sizes and can be purchased rarely cheap. The downside of lasers is that it can damage the eyes, if you look directly into them, therefore it is not the safest solution.

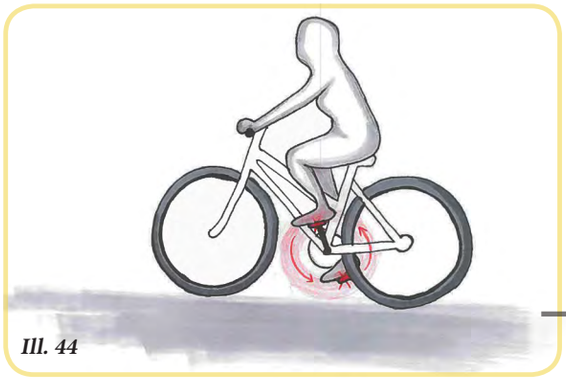
Ill. 41

Ill. 42

Ill. 43

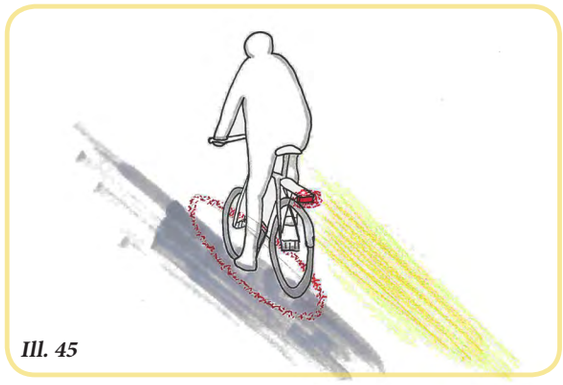
CONCEPTS FOR 1st MIDTERM

The three chosen concepts from previous ideation are presented at the first status seminar. The concepts are bio-motion, hologram and laser, which create attention in different ways.



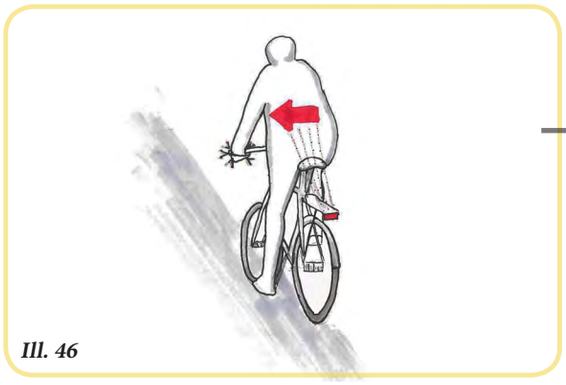
Ill. 44

Bio-motion shows the movement of the body by placing light on different parts of the body, for example a hand or knee. This should make it possible to distinguish the cyclist from a pedestrian. The experiment where light is placed near the feet, demonstrates that the movement does not change when looking from behind or in front of the person with bio-motion light. If bio-motion is going to be the final concept, it needs further development in order to make the movement stand out.

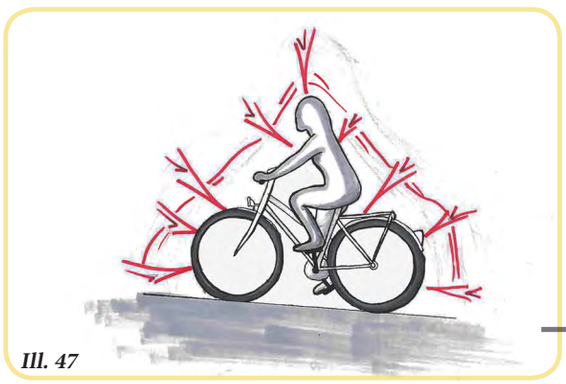


Ill. 45

Laser can be used in different ways, for example by making an projection on the ground or on the cyclist. One laser concept illustrates the movement of the cyclist to make it easier for the car driver to notice the cyclist. It can be difficult to see if a cyclist makes a turn when it is dark, because the arm is not visible unless they have light or reflectors on the arm, which almost none of the cyclists have. If the car driver thinks that the cyclist is driving forward when actually making a turn, a dangerous situation can occur. One of the challenges with this concept is to find a space for the projection. It needs to be visible for the fellow road users, but not to interfere with other object, for example a bag on the back of the cyclist.



Ill. 46



Ill. 47

Hologram lights up the surroundings and therefore does not need a clear space for the "projection", like the laser. The concept is more futuristic than the other concepts and the technology is more complex. It is the concept that creates most attention, and have maybe the highest blue ocean value. The hologram can also be a disadvantage because it might confuse the fellow road users and make them pay more attention to the hologram than the traffic.

1st MIDTERM

output, further development

The critique from the 1st midterm evaluation is useful and new eyes bring new ideas on how to evolve this project.

As expected, the critique towards the requirements is negative because of the lack of clarification. Specific requirements are essential when choosing a concept and making further development. Working with vague requirements will result in a vague product. It is also important to figure out a success criteria and thereby establish what would make our product stand out from the rest.

Another criteria is the aesthetics and the appeal for the customer. Especially the hologram and the laser concepts is mentioned because it draws to much attention which is not desirable. Another comment is that the customers probably want it to be theft-proof, without having to bring the product along when not using the bike.

Another advice is to consider a cooperation with a company, for example Reelight, in order to get insights and their professional input about light and other concepts.

After midterm evaluation, it is important to set up new requirements and reevalutate the initial requirements, in order to choose a concept that fits the mission the best.

The next steps in order to choose a concept and have a clear direction

Clarify and reevaluate the initial requirement

Set up succes criteria

Aesthetics; how to make it appealing

Eventually cooperate with a company

EXPERIMENT

light measuring

In order to have an idea of the environment the product is going to function in, a study of the light intensity was carried out in the nearby area Aalborg and worst case scenario of light, downtown Copenhagen, measuring the intensity with a light meter as shown on ill. XX.

The experiment as executed by holding the light meter horizontal pointing the white ball upwards. This way the light meter measures all light in the context, compared to pointed the white ball at the source, only getting the source excluding the context.

The exeperiment shows that the lux taken in Aalborg ranges between 0,1 to 13 lux and in Copenhagen 1,1 to 41,5 lux (160-180 lux 2 meters in front of the light billboard at the Town Square Hall). The experiment was also carried out in Amsterdam, but the range of the measurements was inbetween the spand of Aalborg and Copenhagen. These can be seen in appendix 5.

The data from the experiment will be used in the requirements, to ensure that the product will stand out in the city environment including the different light sources.

Ill. 48

Ill. 49

Ill. 50

RESEARCH
legal requirement, Holland

The legal requirements change from country to country, which is why the Dutch requirements concerning bicycles are researched. Holland is researched because it is the country in the world with most cyclists. They make innovative solutions in order to make it safer for cyclists, for example a bicycle roundabout.

Most requirements for lights are similar to the Danish laws, for example a white head light and a red rear light. Two rules differ from Denmark; flashing light are illegal, unless it is used to indicate change of direction, and loose lights are allowed if it is visible and attached to the upper body. Loose lights, that are not fixed to the bicycle, are not allowed to be placed on the head or the limbs.
In Holland, it is a requirement to have reflectors on the back, pedals and tires, but it is not a requirement to have a white reflector in the front, as it is in Denmark.

A few traffic regulations differ from Denmark to Holland, it is for example legal to have a passenger on your bicycle in Holland and it is allowed to talk on the phone while cycling. The fact that there can be an extra person in front or back of a bicycle, set requirements for placement of the developed product, because more parts of the bicycle is hidden.
(bicycledutch, 2015) (holland-cycling)

Ill. 53

no flashing light unless showing change of direction.

loose lights on the upper body, as long as it is visible

no reflector in the front

legal to have a passenger in the front and on the back

Ill. 51

Ill. 52

Ill. 54

Ill. 55

REQUIREMENTS 2.0

The second version of the requirements are more specific and are based on legal requirements, experiments and research on existing products.
The requirements are still divided in “need to have” and “nice to have”, under here aesthetics, function and construction.

Need to have

Aesthetics

Desirable
Simple
- easy interaction
- not take attention, when it is not being used

Easy to clean
- clean surface
- no hollows

Construction

Durable
- not brake when bicycle overturn
- waterproof
- strong material

Possible to be fixed
- “Stealing proof”

Function

Show the orientation (road of the bicycle)
Visible from all angles
Only visible when in use
Visible from minimum 300 meter
Not blind/distract fellow road users
Draw attention when it is dark
Draw attention in daylight
Universal solution (North Europe)
- Only flash if showing direction
- Not fixed to limbs
- Visible in different lightning (0,1 to 180 lux)

Nice to have

Function

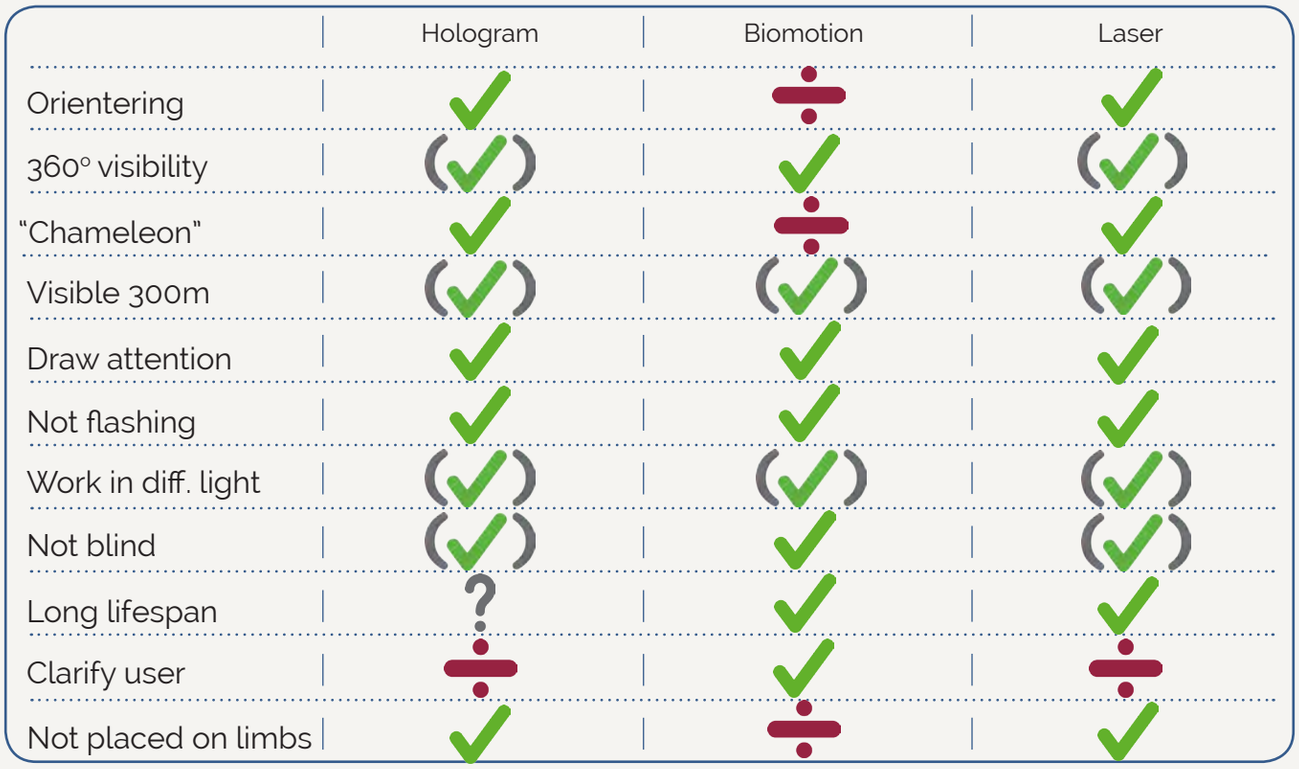
Clarify the type of road user

Construction:

Long lifespan (no ordinary battery)

SELECTION OF CONCEPT

Based on the revised requirements it is now possible to choose the final concept. In addition, the three concepts are listed in a schedule to show how well they fit the requirements.



Ill. 56

The schedule shows that hologram and laser meet most requirements, especially the most important ones; orientation and visibility.
Bio-motion does not fulfil the requirement since it cannot be fixed on the limbs, which is a legal requirement in Holland. Also bio-motion is the concept fulfilling the fewest requirements, why it is not chosen to be a future part of this concept.

There is a huge development for both the hologram and laser concepts, and how to utilize most of their technology. Therefore it is decided to work further with both of them adding "placement", "technology" and "orientation" to the concept.

Use hologram and laser to show the cyclists' orientation and create attention

Most optimal placement of product on the bicycle

Bio-motion discard, meet fewest requirements

ORIENTATION

existing solutions

Some of the earlier concepts deal with how the cyclists move in traffic, whether they are turning left or right, which as a concept is called "orientation". Orientation is a discussed topic, because it is observed that cyclists make quick turns and movements that the car driver does not always expect. When it is dark, it is difficult to see if a cyclist signals with the arm, and therefore more difficult for the car driver to react hereupon.

It is discussed why a bicycle does not have flashing light to signal direction, like a car. A car is bigger and drives at a higher speed, which causes greater damage than a bicycle. For that reason, it is important for the fellow road users to see what direction the car is driving, therefor the indicator lights. This makes it possible for the other road users to react on the car, but what about the other way around? It still seems old fashioned that cyclists signal with their arms, especially with all the technology available, also having in mind the increasing number of cyclists on the road.

To find out which "indicator light" products exist on the current market, a quick web search is carried out. This gives an idea of the principles used and whether these can be transferred into a concept in this project.

Ill. 57

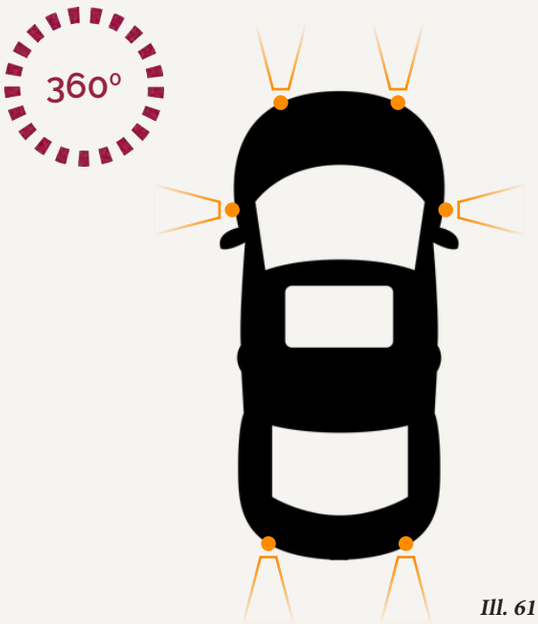
Ill. 58

VISIJAX®

Ill. 59

Ill. 60

COBI



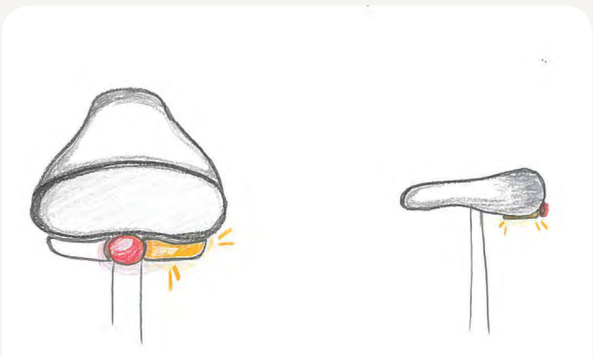
Ill. 61

The next step is to develop further on the concept "orientation" with the objective to make the cyclists direction visible from more angles.

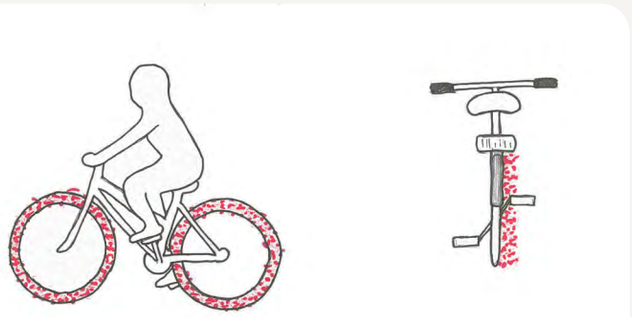
IDEATION 2.0

orientation, laser and hologram

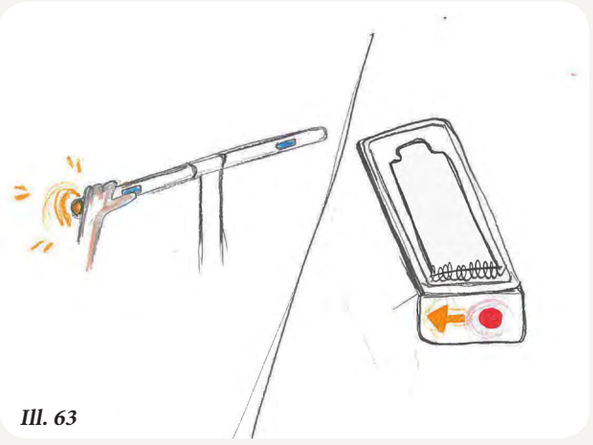
This ideation focuses on how to show the orientation of the cyclist by using either laser, hologram or light. The placement does not include the body because it is illegal, but instead it is on the bike or the surrounding context. Most of the ideas incorporate the pedals, handlebar or the area around the luggage carrier.



Ill. 62



Ill. 65



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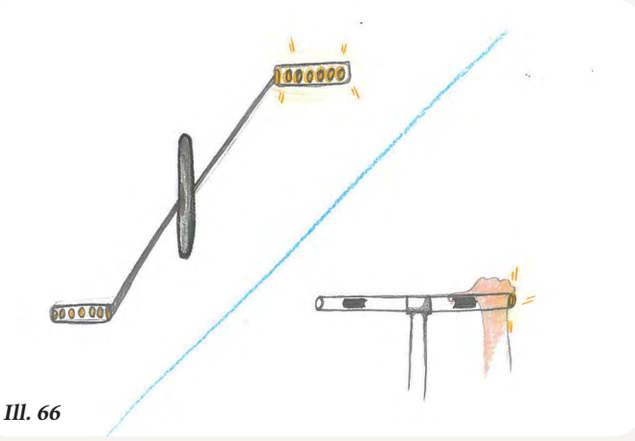

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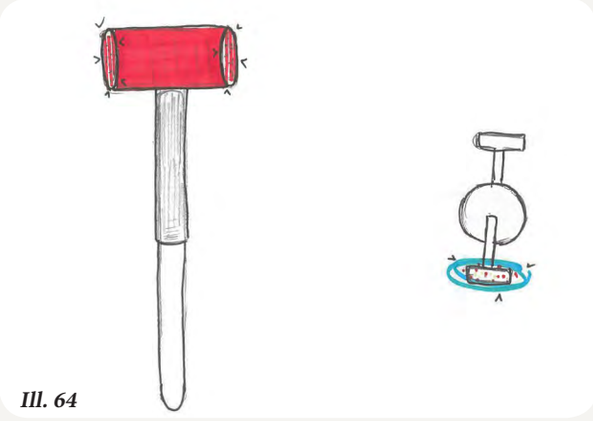

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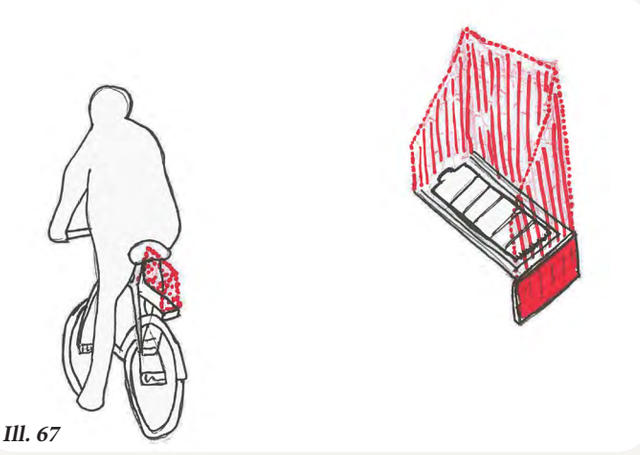
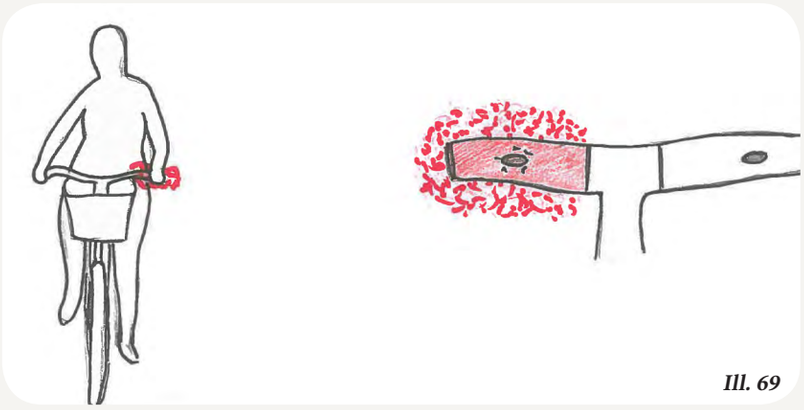


Ill. 67

Ill. 68



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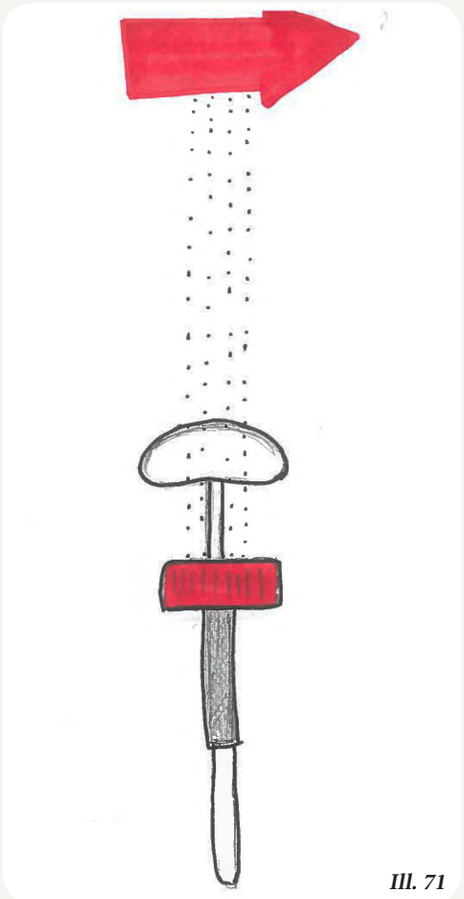
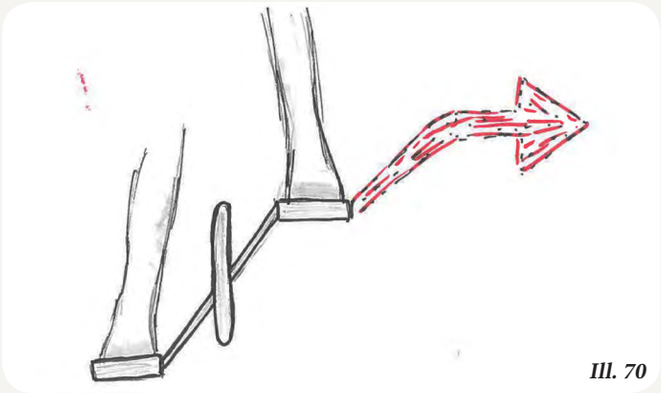


Ill. 71



Ill. 70

The variation of the sketches show that the placement needs further development. The problem is to find a place to fix the light where it is visible for the fellow road users, and at the same time does not get covered when using the bike. It is necessary with experiments; one showing possible areas to place the light on the bicycle, having for instance bags placed on the bike, and second incorporates the overview of the bicycle from the car and truck driver's point of view.

Another obstacle is how to show the orientation by using symbols, flashing light, etc.

EXPERIMENT

visibility from car

An experiment is made with the objective to determine at what distance the cyclist is seen by the car driver. The experiment is done by taking video clip from the driver seat of the car. One video clip where the car driver follows the bicycle by turning the head and another video clip seen from the side-view mirror.

The experiment is conducted with a Citroën C4 and a men's bicycle, which is 0.5m from the car. Here the bike is visible from approximately 85cm and up when turning the head. Using the side-view mirror the whole is bike visible at all times, until the bike is in the "blind spot" of the car. The cyclist is visible at all time when it is on the side or in front of the car, but the bike's headlight is not visible when the cyclist is on the side of the car. The car driver can see the ground and therefore ,the whole bikeat 4,4 meter in front of the car and 4,9 meter on the side.

The height on the cyclist on illustration 72 is 1,5 meter, which is the average height for cyclists. (Havarikommissionen, 2006) See video of the experiment in appendix 6.

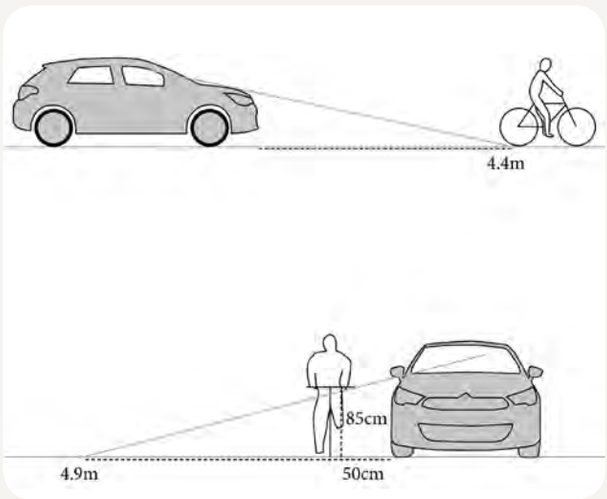
visibility from truck

A truck is the worst case scenario when talking views and blind spots in traffic. The truck and also the windows are higher above the ground which reduces the front view of road. This means that the cyclists need more distance in front and on the side of the truck to get noticed compared to the car.

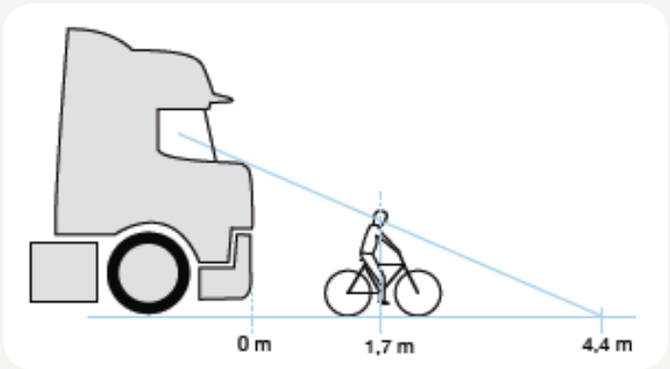
This is shown on illustration 73, which shows that the cyclist needs to be 1,7 meter in front of the truck and on illustration 74, 3,2 meter from the side, and here it is only the head that is visible.

The truck driver can see the ground 4,4 meter in front of the truck and 8,0 meter on the side of the truck.

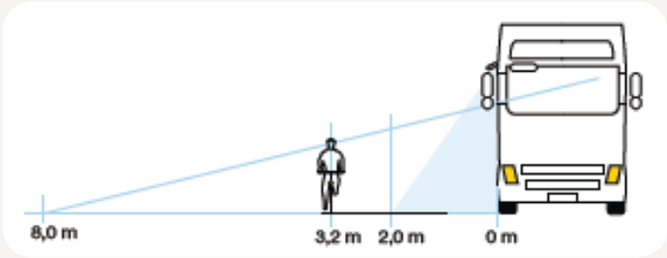
The data and illustration is from the project "C-sense" conducted last year by Toke Ploug Henriksen (Henriksen 2014).



Ill. 72



Ill. 73



Ill. 74

Both the car and truck driver have blind spots, which is why the placement of lights is important.

"*Both car ad truck driver can see the ground 4,4 meter in front of the car.*
The truck driver cannot see the cyclist before it is 3,2 meter from the side of the truck. If the cyclist is less than 2 meter from the truck, can the truck driver see the cyclist in a mirror, but only if the cyclist is visible."

EXPERIMENT

"covering up" the bicycle

An experiment is made with the objective to discover which areas on the bycicle is free of bodyparts and for instance bags when the bicycle is in use. Different objects are placed on the bicycle, one object at a time and illustrated by taking pictures from the front, back and the side in order to see it from more views.

A city bicycle and a lady bicycle are used in the experiment in order to see if the areas differ.

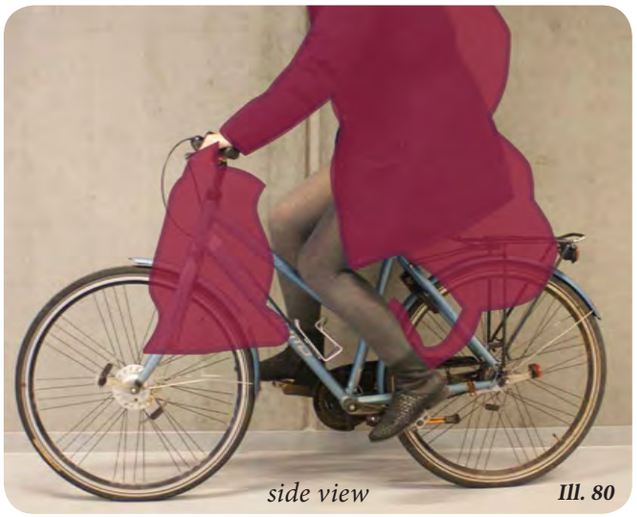
back view *Ill. 75*

Ill. 76

front view *Ill. 77*

Ill. 78

Ill. 79



side view *Ill. 80*

The illustrations show the free areas on bicycle.

Back view
The space from luggage carrier and down free, but not the luggage carrier itself.

Front view
The frame next to the front wheel is free.

Side view
The lower part of the frame is clear, but in use the legs will shade the middle of the bicycle.

See appendix 7 for illustrations where a person is sitting on the luggage carrier and the handlebars, which is legal in Holland.

INTERVIEW
with Jes Jakobsen, Reelight

Reelight is a bicycle light company located in Aarhus that specialize in using magnets for generating power instead of batteries. The interview is conducted with Jes Jakobsen, who is an industrial designer from Aalborg University, now working at Reelight.

Reelight gets most of their requirements from the Danish requirements, because it is one of the strictest in the world, only exceeded by Germany. Besides the legal requirement, Reelight tries not to solve "all the problems in the world", but looks at where the bicycles have the highest risks of getting injured and how they can solve these with light.

Reelight works with two types of light; safety light and driving light. Safety light is visible for fellow road users but is not any good for the cyclists view, and the end price is therefore smaller. Jes Jakobsen estimates the purchase price to be around 600dkr for driving light and 300dkr for safety light. The price depends on the power output and here the magnets is lacking behind. Instead Reelight is focusing on the easiness when using magnets as the power-source, because it is a one-time placement and has endless power.

Reelight makes most of their prototypes with a 3D printer at the company and outsource more difficult prototypes. The final production is placed in China. Reelight do not do any simulation test on their products, before doing a droptest in real life, but of course they have gained knowledge about durability for that type of product.

Reelight would be interested in some kind of cooperation if it is decided to work with magnets or flashing light, because it fits with their portfolio. It is a possibility to contact Jes Jakobsen later in the process to discuss specific details in the product.

Ill. 81

Jes Jakobsen, Industrial Design Engineer

SUM-UP REQUIREMENTS 3.0

Aesthetics

Desirable

Simple
- easy interaction
- not take attention from the bicycle when it is not being used

Easy to clean
- clean surface
- no hollows

Construction

Durable
- not brake when bicycle overturn
- waterproof
- strong material

Possible to be fixed
- vertical and horizontal bars
- different sizes of bars
- moveable placement

"Theft-proof"

Function

Show the orientation (road of the bicycle)

Only visible when in use

Visible from minimum 300 meter

Not blind/distract fellow road users

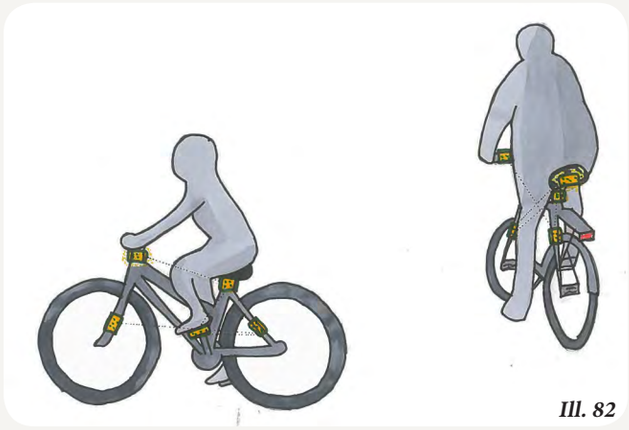
Draw attention when it is dark

Visible on the ground at least 4.4 meter in front of the bicycle

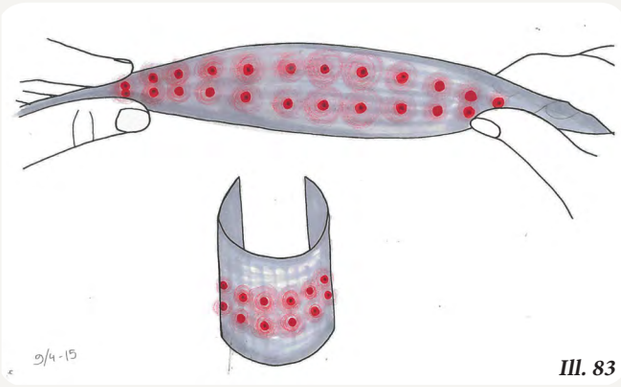
Universal solution (North Europe)
- Not flashing light unless showing orientation
- Not fixed to limbs
- Visible in different lightning (0,1 to 180 lux)

IDEATION 3.0

Indledning



Ill. 82



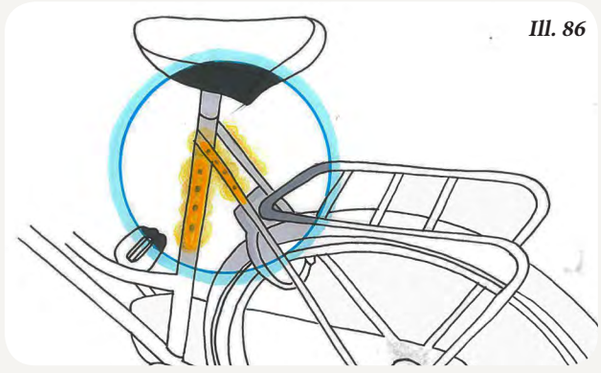
Ill. 83

1. Flexible light bands that can be placed in different areas on the bicycle by using magnets. These can be fixed horizontally, vertically and different sizes of bars, but does not make it clear on which side the light is flashing.

Ill. 84

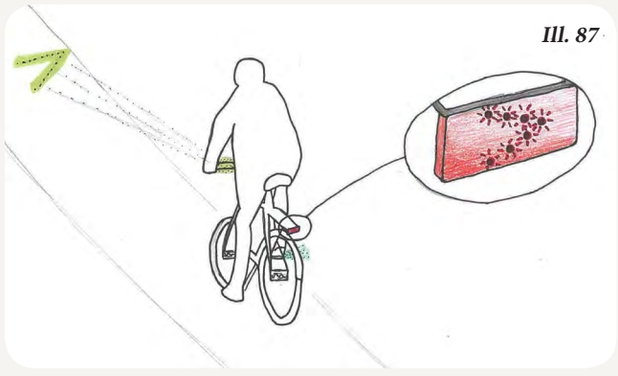
2. Flexible light that can be pulled out and thereby further away from the bicycle and closer to the traffic. Here it is not hidden behind any objects and is therefore visible for the fellow road users, unless they are on the opposite side.

Ill. 85



Ill. 86

3. Thin bands that can be placed on both sides of the bicycle. Opposite the flexible light bands, is it not placed around the whole bar and it is therefore easier to control what side that is flashing.



Ill. 87

4. Flashing light in the back that shows orientation and light/laser in the front that creates attention. The laser/light is around 5 meter in front of the bicycle.

CHOOSE CONCEPT

Below is the most influenced functional requirements listed and used to evaluate on the four different concepts.

Green: fulfils the requirement
Red: does not fulfil the requirement
Numbers represent the concept from page 39.

"Show the orientation" (road of the bicycle)
1 2 3 4

"Only visible when in use"
1 2 3 4

"Draw attention when it is dark"
1 2 3 4

"Visible on the ground at least 4.4 meter in front of the bicycle"
1 2 3 4

"Not flashing light unless showing orientation"
1 2 3 4

Concept number four (show orientation and draw attention in front of bicycle) is the only concept that meets all requirements.

Ill. 88

FURTHER CONCEPT

It is decided to have a concept with two different products; a headlight that creates attention at least five meter in front of the bicycle and a rear light that shows the direction the bicycle is moving.

The pictures below show that it is difficult to see when the cyclist reaches out the arm and that the car driver cannot see the light from the bike when the cyclist is next to the car.

Ill. 89

Ill. 90

The headlight consists of two features; a normal light for the cyclist to see the ground and a more powerful light that lights up at least 5 meter in front of the bike and therefore is visible for the car or truck driver.

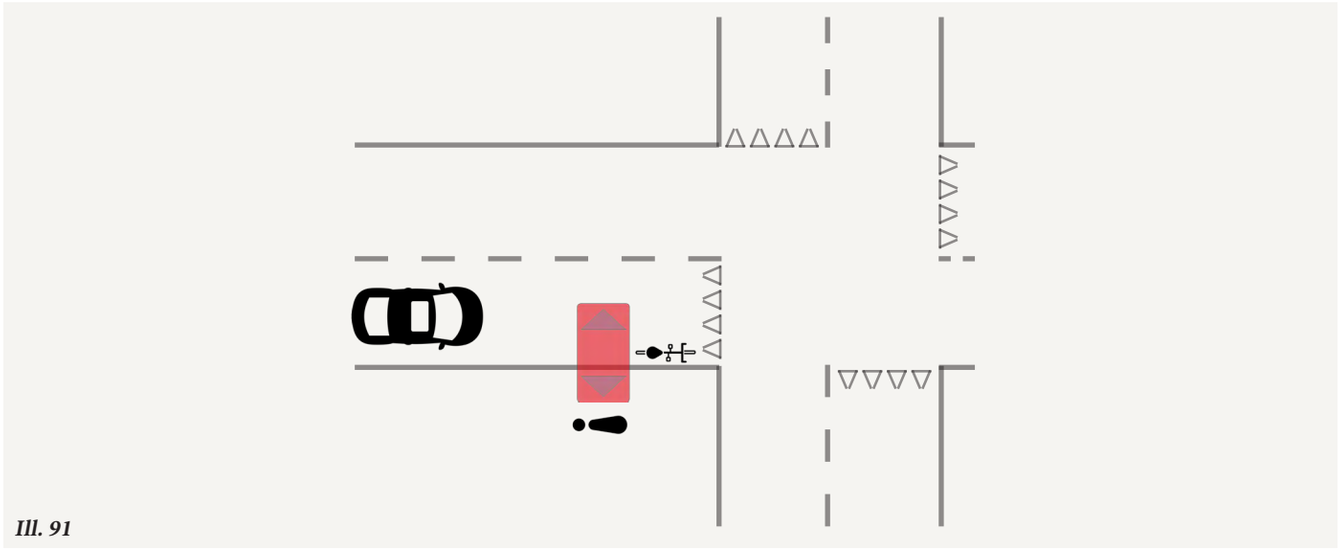
The rear light shows the change of direction by using flashing light as it is seen on cars.

The placement for the rear light needs to be moveable because different things can be placed on the bicycle, while the headlight needs to be in the middle of the bike and in a height that gives the best light but still moveable.

SCENARIOS

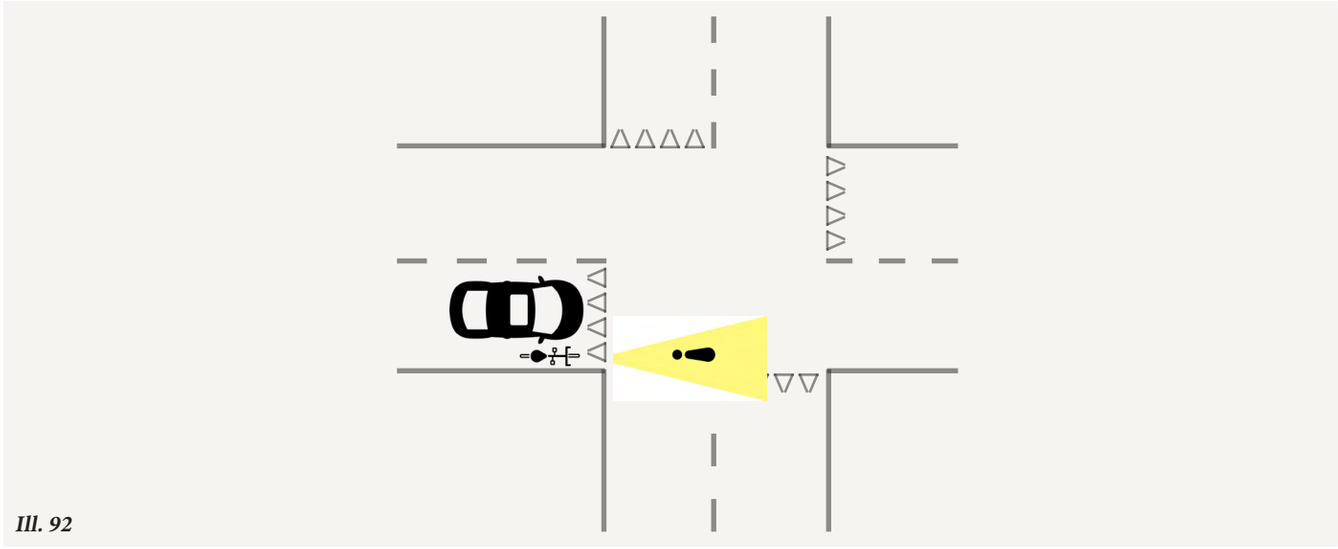
in traffic

The two scenarios illustrate when the headlight and rear light make the cyclist more visible and thereby encreasing safety on the road. A road is normally between 3 and 3,5 meter and on the illustrations it is 3,25 meter and therefore 6,5 meter in total (Vejdirektoratet, 2000).



Ill. 91

The rear light shows in what direction the bicycle is moving before the cyclist is starting to change direction. This make it easier for the car driver to react and avoid the cyclists, because there are no sudden turns or surprises.



Ill. 92

When the bicycle stands still next to a car, the cyclist can turn on the extra light that is visible for the car driver. This light creates attention and make the car driver aware of the cyclist, but says nothing about the direction.

This light is especially important when the cyclist is next to a truck and it is dark, because it is difficult for the truck driver to see the cyclist in the mirror.

HEADLIGHT

call attention to the bicyclist

It is decided that the headlight mainly will function as a light to draw attention to the bicyclist. The headlight will still have regular driving light, but should additionally have a light that makes the other road users aware that there is a bicyclist to show regards to.

It has been decided that this attention light should not be a laser, because of the increasing safety regulation and dangers associated with them (Aabenhus, 2015) (Norre, 2015).

Instead it will be a possibility to look at the blue spot safety light attached to trucks working in big manufacturing halls that prevent people turning corners from running into moving trucks. The blue light is attached to the truck throwing a blue point 5 meters in front of it (Linde).

Ill. 93

Next step is to figure out whether this spot will have a preventive effect and whether the truck drivers, who are worst case scenarios when it comes to blind spot, can see its benefits. Hereto, there are some concerns as to whether the spot should be flashing, what size it should have, and which luminosity for it not to disappear in all the lights in traffic.

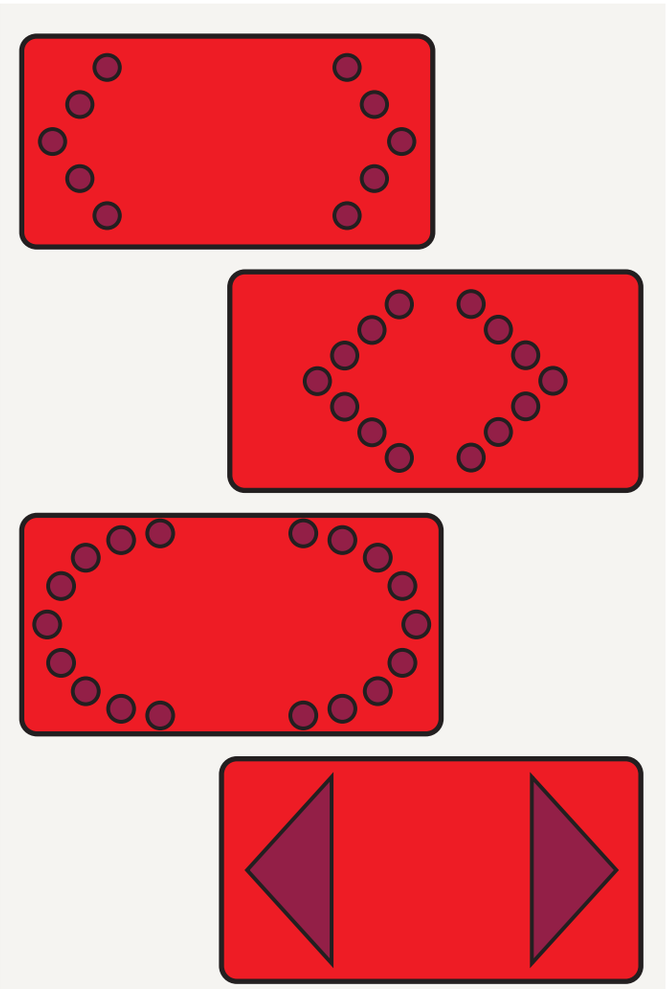
REAR LIGHT

show orientation

When it comes to the rear light, it is decided that it should show the orientation of the bicyclist as well as also having regular safety light.

The orientation will be expressed trough diodes placed in the left and the right side of the rear light between a gap.

Below an ideation of how the diodes could be designed in order to show the orientation.



Ill. 94

Next step is to test different symbols made in diodes, and whether it is possible to see these on a distance of 5 meter. It should also be tested whether the left and right symbol should be flashing or having a motion to the diodes, and the strength of these. Additional it should be tested whether there needs to be a certain distance between the left and right diodes.

The idea is to control the lights from a wireless controller placed on the handlebars.

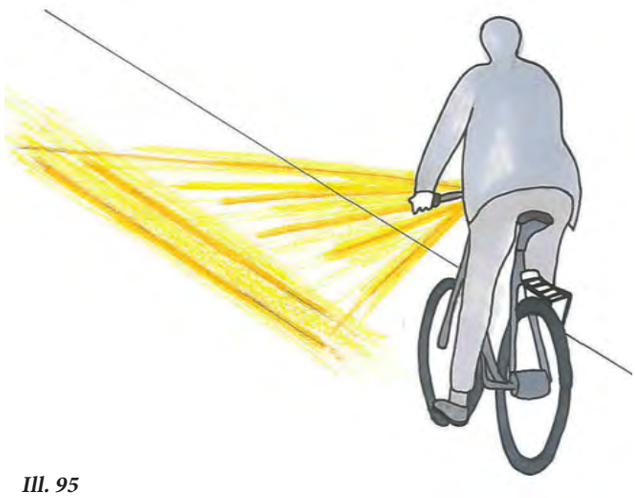
6 PRODUCT DEVELOPMENT

VISIBILITY

head light

When further discussing pro's and con's of the blue point safety spot from Linde, it is clear that the point draws attention, but if not familiar with the product, it can be difficult to know from where the blue point comes.
The same problem is present if transferring the concept to the headlight. The problem especially becomes bigger by the fact that earlier tests show that to have an effect and be visible for the truck driver, the spot has to be at least 5 meters in front of the bike. (The head light needs to have a gradient, in order to have the wanted length, which is calculated to be 10 degrees (See appendix 8)). When the light is 5 meter in front of the bicycle, the spot will quickly drown in the interference between car light, street light ect. For that reason, it is considered, how one is able to connect the point to a source in order for the concept to work.

A way of connecting the source could be to have the point followed by a light source shown by a stripe of light. It could be illustrated as a point with a stripe or just a stripe that illustrate where the light is coming from. It is discussed whether the point or stripe should flash or stand still on the ground when in use in traffic.



Ill. 95

In order to figure out whether some of the existing powerfull diodes, maybe with some alterations, could be used in this project, a test of the luminosity of different headlights are conducted in order to see the distance.
Furthermore, a test with a truck will be set up to see how these headlight react around this environment.

EXPERIMENT

visibility

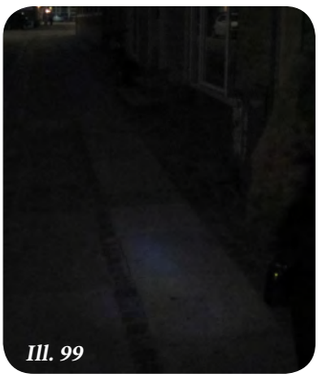
Test length
An experiment is made with the objective to see how far an existing products light up, and thereby estimate what kind of diode is needed, in order to light up 5 meter in front of the bicycle. Two different LED lights are used in the experiment, Asivik H Super light with 122 lumen and Mix Pro with 5 lumen.

Ill. 96

Ill. 97

Ill. 98

Asivik, 10 meter



Ill. 99

Mix Pro, 3 meter

The pictures show that Asivik can light up the ground up to 10 meter in front of the bicycle and Mix does not have power enough to create attention. The light from Asivik is somehow controlled, but our product need the light to be more centred in order to have a clear light that the fellow road users will notice (See appendix 9 for more pictures).

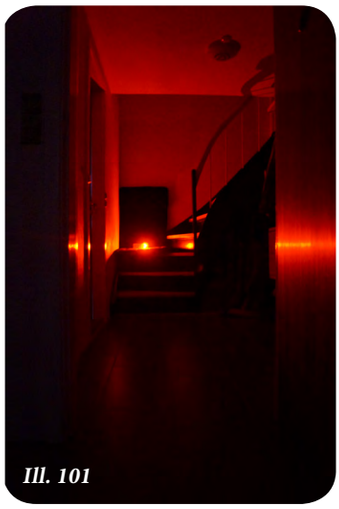
Furthermore, a test with the Asivik light is carried out next to a truck to see whether the type of diode and the parabolic reflector is visible in this context.

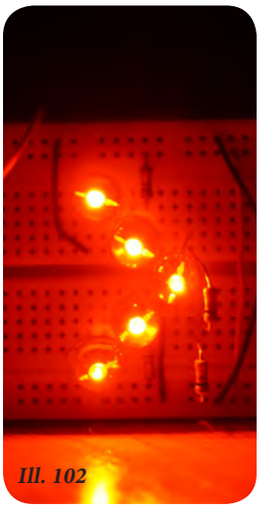
Ill. 100

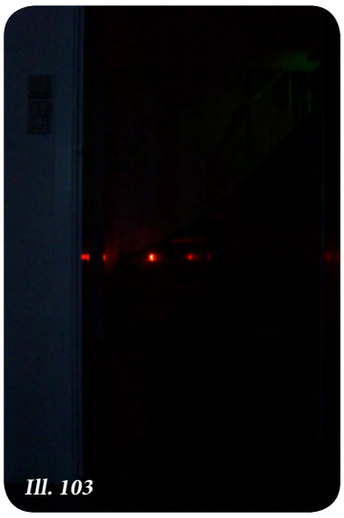
The test with the Asivik light next to the truck shows that it is possible to see the light (see appendix 10 for pictures and videos).
In order to create and draw attention, the parabolic reflector should be more narrow. A test of different sizes parabolic reflectors should be set up to test whether such thing could centre the light and meet our concept or other methods should be considered.

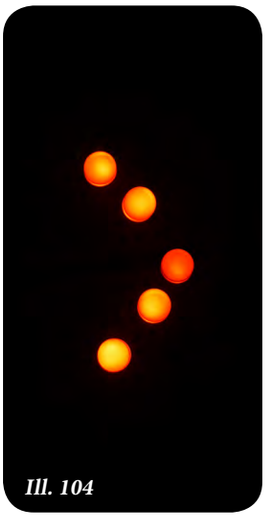
EXPERIMENT
orientation

It is decided to use the rear light to orientate other road users of the movement of the cyclist. As said earlier, a test with different diode design is set up to see whether it is possible to see the design from a distance.


Ill. 101


Ill. 102


Ill. 103


Ill. 104

The test shows that the first set of diodes (0,5W) makes it difficult to see the diode design 5 meters away, because of the angle on the light. On the second set of diode it can to a degree be easier to see the diode pattern, but the intensity of the diodes is too low (approx. 0,05).

Besides the design of diodes, there is also the question of how far apart the left and right side of the signal lights should be placed.

The quick test show is possible to see both lights when standing around 7 meter from a truck, but the more powerful light interrupt the other light, because of the angle and intensity, as also seen previously,


Ill. 105

On motorcycles is the rule that the front turn signals need to be 24 cm from each other and the back turn signals need to be 18 cm from each other (Hansen, 2012). This will be too much on a bicycle that compared to a motorcyle is much smaller. In order for the fellow road users to see what side that is flashing, is an experiment with two rear lights is set up. The experiment shows if both lights are visible if they have a distance around 10 cm.

The experiments help specify how the front light should create attention and how the rear light should show the orientation of the bicycle.

Front light:
- Need to create more attention than the Asivik light, by using parabolic reflectors or similar products
- Make it clear where the light comes from

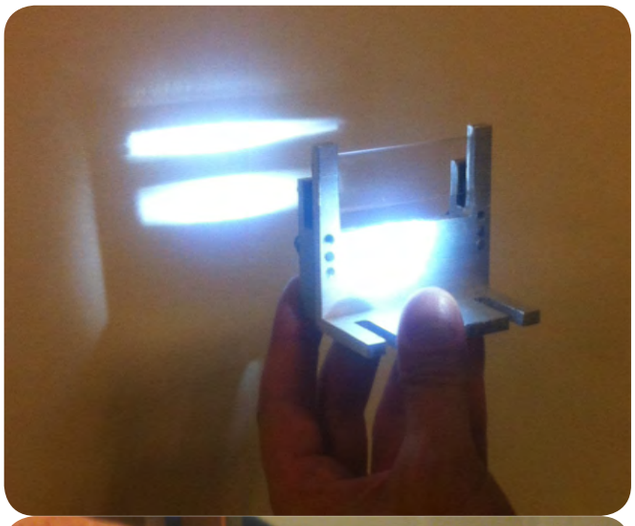
Rear light:
- Not use arrows
- Too powerful lights can interrupt other lights

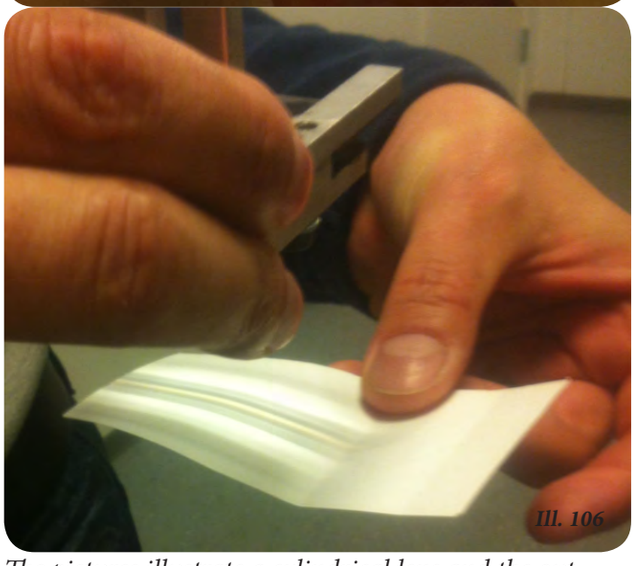
OPTICS

Lenses are used to direct the light, for example to make a cone or spot where the light is more dense. In this case the lens will be used to make a line from the headlight and at least 5 meter in front of the bicycle.

There are many types of lenses with different outcome and therefore a meeting with Esben Skovsen from Department of Physics and Nanotechnology, Aalborg University is established.

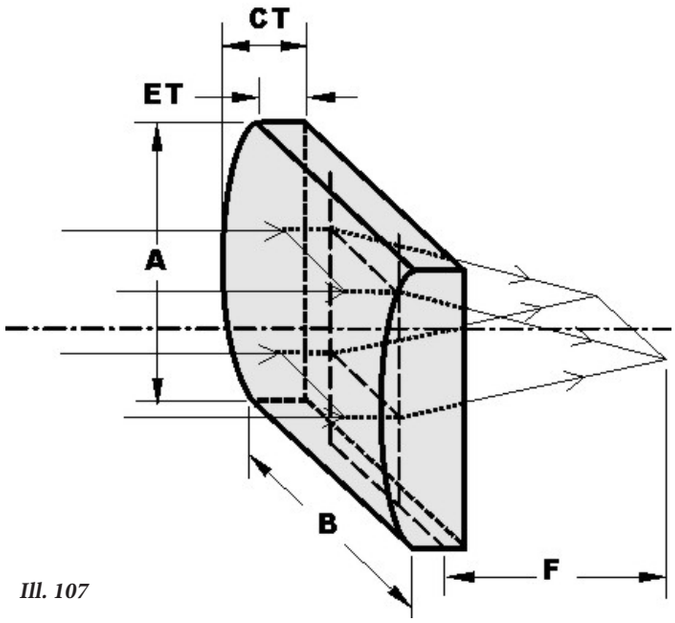
After explaining the product and feature needed, he demonstrated how a cylindrical lens works. A cylindrical lens create a line of light, which in this case need a focal length at 3 to 5 meter (3000-5000mm). The focal length depends on how far away from the bicycle, the line starts.





The pictures illustrate a cylindrical lens and the outcome.

Cylindrical lenses are relatively simple. They have one flat surface and one spherical surface.



Ill. 107

A problem with the traditional cylindrical glass lenses is that they are expensive, around 95 euro for a lens with a focal length at 1500mm (Eksma).
Therefore it is decided to use a plastic lens, which is cheaper, but not as accurate. It is not important to have sharp edges, but to show where the light is coming from, which is why it is enough to use a cheap plastic lens.

The price for cylindrical plastic lenses starts from around $7 and up, but because the lens needs to have a focal length on 3-5 meter is it going to be more expensive (Alibaba-lenses).

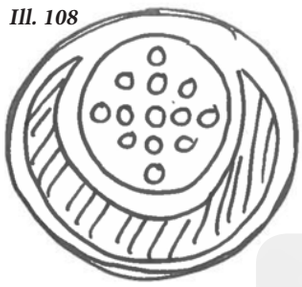
Plastic lenses can be injection moulded, which is decided to do in this project, because of the expensives, and ammount of parts.

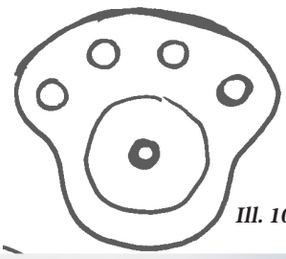
Because of the complexity concerning the surface, curvature, dimensions and the difficulties in obtaining the wanted outcome, with the plastic lens, the "lens" is refered to on a conceptual basis.

AESTHETICS, FORM

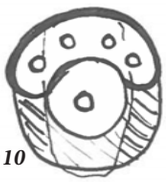
The form of the product is explored by sketching. The round shape is brought in on the basis of the round diodes and the prismatic because of one of the diodes being angled towards the ground. Both of the shapes are modelled in SolidWorks with the objective to evaluate the dimensions and expression.

Ill. 108



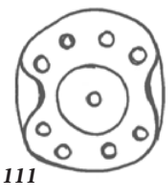


Ill. 109

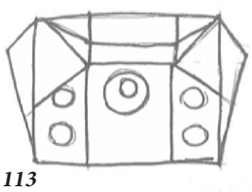


Ill. 110

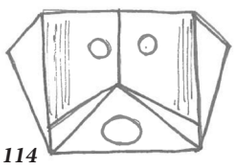
Ill. 112



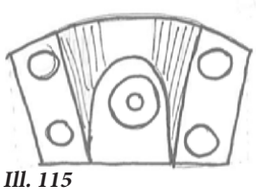
Ill. 111



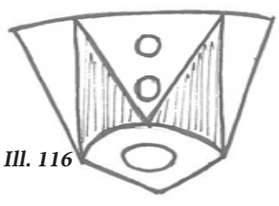
Ill. 113



Ill. 114



Ill. 115

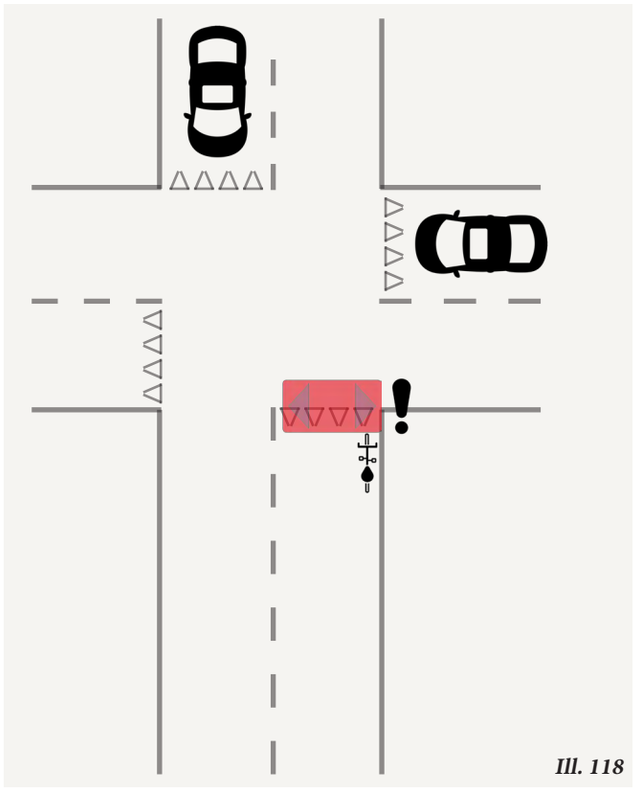


Ill. 116

Ill. 117

More functions

During the form process, it is discussed if the headlight also should show the orientation in order for the oncoming cars to see what direction the cyclist wants to go. Illustration 18 shows the scenario where it would be beneficial to see the orientation in the headlight. This function gives new requirements for the headlight, because it now needs to be as wide, as the rear light.



Ill. 118

Form

It is decided that the headlight also should show direction in order to make the orientation clear for the oncoming cars. For that reason, the round shape is not suitable because it would be difficult to see what side of the light that flashes, unless the product is really wide.

The prismatic shape is not dynamic and does not appear as a product to use when being active. Another problem with the prismatic shape is that it does not show the functions; driving light and stronger light on the ground that is visible for the car and truck drivers, when in the blind spot. The prismatic form is heavy to look at, especially when carrying the number of LED's enabling flashing lights and direction.

AESTHETICS, FORM

existing solution

The bicycle environment, involving bicycles and accessories for bicycles, is explored with the objective to start a new ideation about form. The ideation should fit the environment that the bicycle light will be placed in and therefore follow the shapes.

The existing bicycle lights are generally organic, light, show the functions, and are small. Because of the different functions in both lights, especially with regards to the orientation, it is not possible to make a small light like the ones below.


Ill. 119

Ill. 120

Ill. 123


Ill. 121

Ill. 122

Bicycles and their equipment have both more organic and dynamic shapes, mixed with straight lines. This shape is seen in all the shown products, but is more noticeable in the bicycles and the helmet on the right. The thickness goes from thin to thicker, or the uppersset way around, for example on the saddle and the city bike.

In general, when looking at both the lights, bicycles and accessories, the idiom is simple and does not have any unneccessary details. When talking colour, it is also simple with few different colours. Mostly products only have two colours: a primary colour and a colour used as a contrast at the interface.


Ill. 124


Ill. 125


Ill. 127


Ill. 126

Ill. 129


Ill. 128

Organic
Dynamic shape mixed with straight lines (speed)

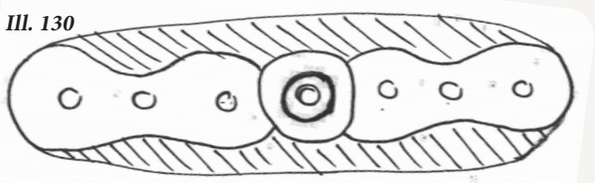
Simple
Few details
Few colours

Show functions

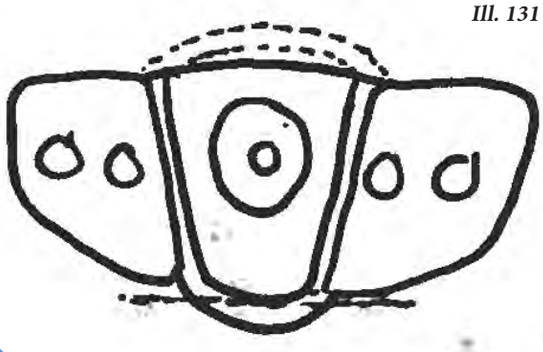
ideation

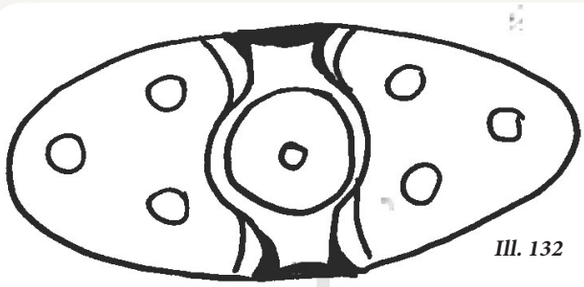
The new sketching process starts with the objective of making a more dynamic shape that fit all three functions for the headlight. In the middle a driving light and a stronger light that is visible on the ground and then flashing lights on each sides, to indicate the cyclists' orientation. The optimal solution would fit both the rear and headlight in order to use the same mould, and thereby save cost in production.

Ill. 130



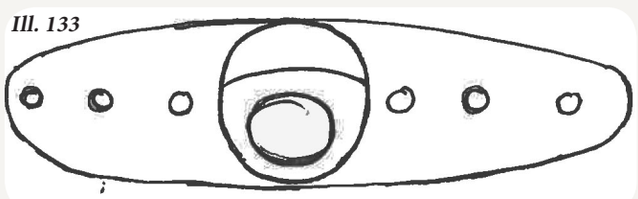
Ill. 131





Ill. 132

Ill. 133



The chosen shape has the driving light in the bottom of the middle and the attention light in the top, which is tilted in order not to blind the fellow road users. Both sidesfrom the middle have an organic shape and is quite long in order to make it possible to see what side is flashing. There is a contrast between the organic sides and the straight lines in the middle, which indicates that the middle has other functions than the sides.

Form follows function for the bicycle light, because the function is depending on the gradient of the middle LED and the length. When talking size, it is important that the rear light is no longer than the luggage carrier and saddle, which is approximately 14cm (Appendix 11). This way, the luggage carrier takes the fall and not the rear light. It should not be smaller than the luggage carrier, in order to have a distance between the right and left sides of LED's. The edges are rounded off in order to make the lights more durable and not as exposed as sharp edges.

Ill. 134

Form

Form follow function
Show that there are different functions
Organic shape
Length smaller than luggage carrier
Possible to see what side of the light is flashing

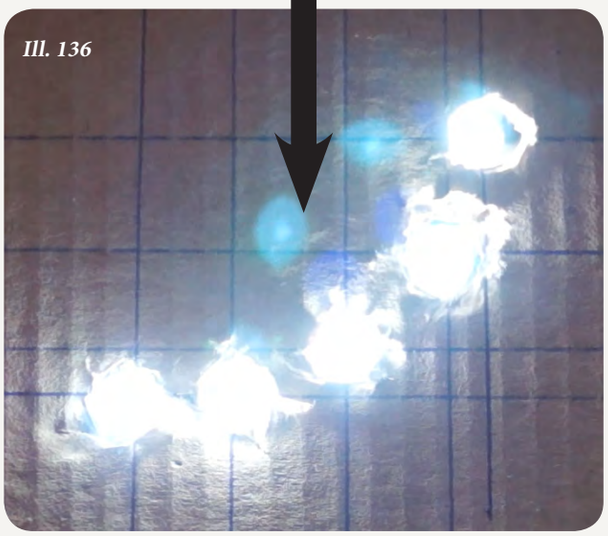
EXPERIMENT

flashing light

At last it should be tested if the diodes should flash all at the same time or one at the time, as the angle of the diodes could cause blur and not making it possible to distinguish left form right. In the video one diode has been placed in the middle in order to have a fixed point in relation to the other diodes. The diodes are close to each other and does not illustrate a clear direction, because of the small size og the light, when flashing all at the same time. See video in appendix 12.

First option

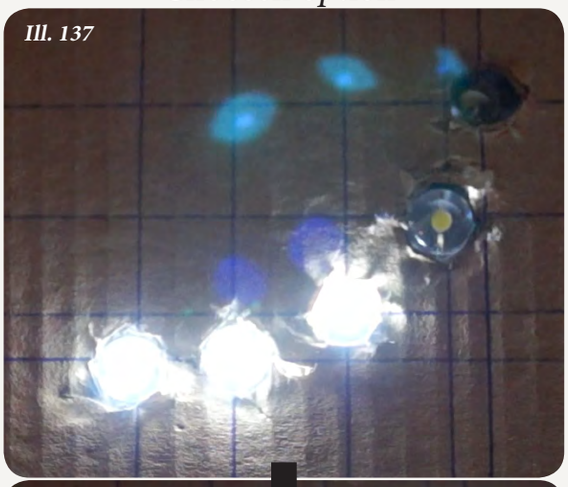
Ill. 135



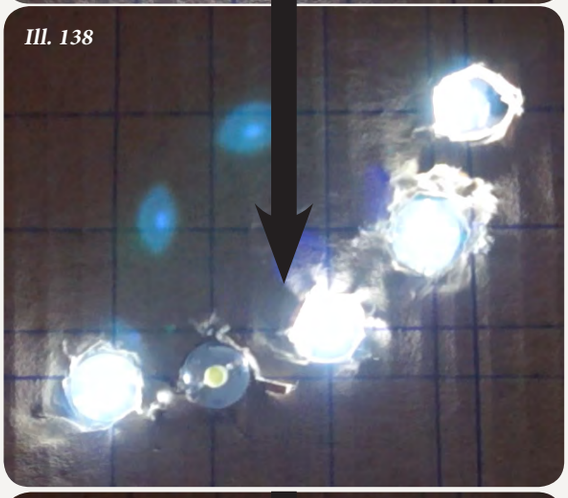
Ill. 136

In the first sequence it is difficult to se the direction, therefore different squences are tested out. The last sequence seen on the video is choosen, because it gives the desired outcome; showing movement in relation to the fixed point (driving light).

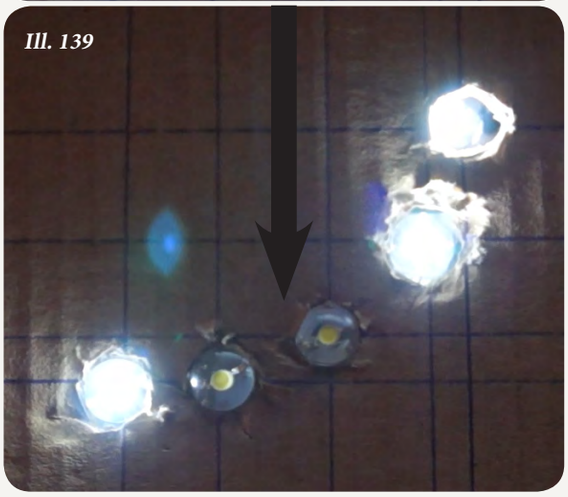
Choosen option



Ill. 137



Ill. 138



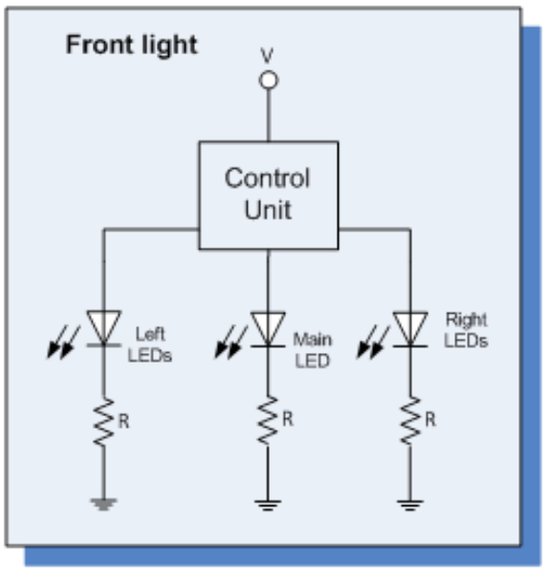
Ill. 139

The diode test shows that the most optimal way to indicate the direction on the limited amount of space is with the last sequence of flash in the video, where the diode flash like the movement of the a caterpillar.

ELECTRONICS

The present design of the lights requires some additional controling of the LEDs than just applying power to them.

In order to be able to control each LED individually to perform patterns and flash animations a small microprocessor is needed.



Ill. 140

The figure above indicates that each LED can be controlled individually. Left and right LED is actually 4 LED each.

The control unit can be any kind of little microprocessor which is power efficient and with a small footprint.

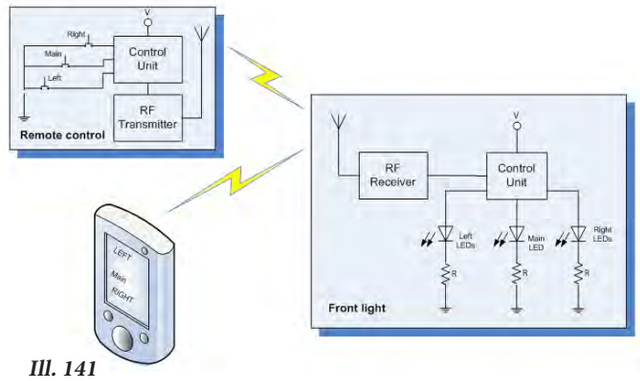
The Control unit (microprocessor) will have to be controlled by the cyclist somehow.

There are basically 3 ways of interfacing to the Control unit:
-Wireless interface
-Wired interface
-No interface, the light runs some patterns automatically when turned on.

Wireless interface

The wireless interface can be split up in the follwing ways of interfacing to the Control Unit:

-Separate unit which have dedicated buttons to control the LED-groups individually.
-Via a special app on a smartphone.



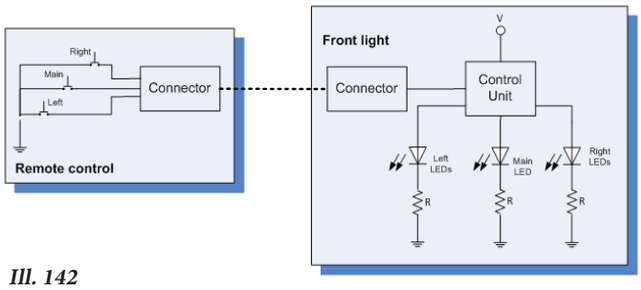
Ill. 141

The above figure indicates that an additional RF unit is needed in the Light in order to be able to transmit "commands" from the "remote control".

Wired interface

The wired interface uses the same separate unit with dedicated buttons to control the LED-groups individually as mentioned under the wireless interface.

The remote control in this case is less complicated as it only needs the 3 push buttons to operate the Control unit in the light. There is no need for the Control unit and RF transmitter in the remote control.



Ill. 142

Operating headlight and rear light

Different interfaces are listed with advantages and disadvantages with the objective to find the most suitable way to control the lights.

Smartphone

Advantages
- Easy connection to lights
(transferring data through bluetooth)
- Use existing products (smartphone)
- No wires
- Many possibilities for interface (screen designs)
- Compatible
(existing products already use smartphones, COBI)
- Most people always bring their smartphone

Disadvantages
- Need to possess a smartphone
- Fragile
- Not weather resistant
- Expensive to purchase
- Expensive if you forget to bring along and someone steals it
- Special fixture for smartphone

Buttons

Advantages
- Weather proof (housed in waterresistant materials)
- Durable
- Possibility of small dimensions
- Easy interaction
- Button near the hand, ensures the possibility to interact without letting go of the handlebar.

Disadvantages
- May need wires
- Fixed interface (compared to a smartphone)

Automatic
(for example when turning the handlebars)

Advantages
- The cyclists do not have to let go of the handle
- Easy interaction

Disadvantages
- Trust regarding automatic solutions
- Complex and expensive technology
- Automatic signaling can be dangerous, if errors in electronic occurs.

In traffic it is essential that people trust their product in order to feel safe, therefore an automatic solution is not suitable. Smartphones are expensive products and are therefore not suitable for having on a bike. The smartphone can easily break if the bicycle overturn and extra precausions has to be taken into account when in bad weather, like rain. Buttons are the best solution to control the lights, because it is a small, easy and cheap interaction. Beside that buttons are durable and weather proof operators.

Wireless

To prove that it is possible to have a small wireless transmission on a bicycle, that is achievable, why bicycle computers are researched.

Ill. 143

Ill. 144

Cateye Strada Wireless gets the informations from a sensor measuring the motion of the magnet placed on a spoke. The cost is 549dkk without sale (Cykelpartner). If looking at only the Cateye Strada components, that makes it possible to operate the headlight and rear light, the cost of the lights will be lower.

Wireless operating of headlight and rear light

Interface with buttons to control the lights

Fairly cheap components (to operate the lights)

Power

Bicycle lights can get their power from several sources, which all have advantages and disadvantages, which are listed below.
It is important that it is easy to recharge the product, if the cyclist notices that the power is dead when he or she needs the bicycle light. It is also essential for the product that the power source is strong enough to run the driving light, a more powerful light, and the flashing light.

Battery:

Advantages
- Easy to shift
- Easy and cheap to purchase
- Enough power for the product

Disadvantages
- Buy new batteries every time the batteries die (if not rechargeable)
- Take up place inside the light

USB:

Advantages
- No need to buy batteries, etc.
- Enough power for the product

Disadvantages
- Takes time to recharge
- Cannot be recharged without a socket outlet, computer, etc.
- Highly sensitive to humidity, if not protected properly

Magnets/dynamo:

Advantages
- Do not need to recharge
- Endless "power"

Disadvantages
- Limited placement possibilities
- If not having more magnets, there is no constant light, but only flashing light
- Do not give enough power for the product

On the basis of the above, batteries are the best solution because they are easy to replace, and there is the possibility to recharge, or buy new ones if the power is dead.

Specifications

Earlier test of diode (Asivik and mixpro headlights) showed that the Mixpro headlight LED was sufficient for ordinary driving light as well as for the flashing lights. Therefore the specifications of the Mixpro LED is used in the headlight and rearlight (white and red), apart from the attention light in the headlight. The attention light that creates the line, uses a "star" LED 3W, which is also the one used in the Asivik headlight.

Summed up below is the specifications of the component required for the product.

Battery :
- 3 AAA
- Height: 22,5 mm
- Diameter: 10,5 mm

Battery case: (containing 3 AAA)
-Height: 13 mm
-Depth: 36 mm
-Length: 52 mm

Light:
Headlight, extra visibility
- Star LED
- 3W
- 750mA
- Cool white

Headlight, driving and flashing light
- LED
- 0,5W
- 100mA
- Cool white

Rearlight
- LED
- 0,5W
- 100mA
- Red

FIXING

It is a requirement that the light needs to be placed at different areas on the bicycle, why it should be possible to fix the light both on a vertical and a horizontal bar. The solution should also fit both the head-, rear light and different sizes of bars (Appendix 13), be easy to fix and bring with you, and it should not make it difficult to access the batteries.

A research of existing products with easy fixing is conducted with the objective to gather inspiration.

Ill. 145

Ill. 146

Ill. 147

Ill. 148

Strap

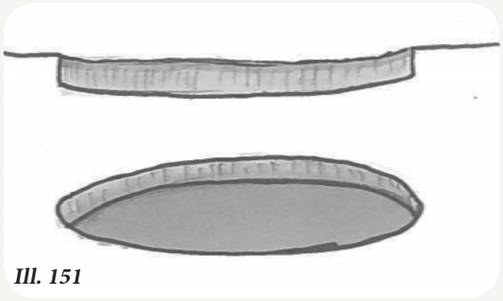
It is decided to use silicon rubber, as both Mix Pro and Glo Ember use, because it is flexible and elastic and therefore, fits more sizes of bars. Especially Glo Ember is used as an inspiration, because the hook as closure is easy to use and the holes in the rubber give more opportunities for different sizes of bars.

Ill. 149

Ill. 150

Fixing

To attach the strap to the light an ideation on different fixing solutions is seen below.

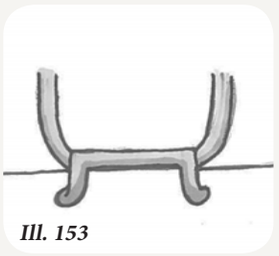


Ill. 151

Magnets hold the two parts together.

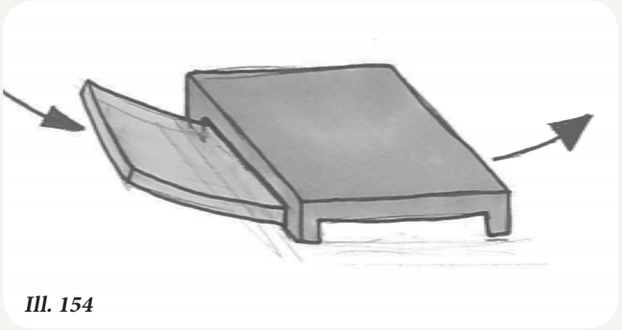
Ill. 152

A claw fix the two parts together and creates a tension.



Ill. 153

A claw fix the two parts together. The claw both consist of a hard material (the bottom) and rubber.



Ill. 154

The strap slides in between the plastic part, as Glo Ember.

Magnets are discussed as a principal to connect the fixing and the light together, which would make it possible to bring the light and leave the "fixing" on the bicycle. It would also be a way of rotating the "fixing" if the position is changed from a horizontal to a vertical bar. It is estimated that the magnet needs to be really strong in order to hold the headlight, when for example driving on a bumpy road, and is therefore rejected again.

It is decided to make a fixing solution where a plastic part with grooves in snapped to the back of the light. Then a strap, similar to the one from the Glo Ember, is going through the grooves.

Ill. 155

Ill. 156

The fixing solution does not fit bicycles with a basket in the front, which many bicycles have. Therefore is it necessary to have a second solution for fixing the lights, so that the customer can choose which one they prefer.

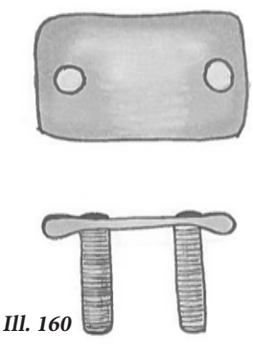
The second solution is similar to the ones that is already on the market, but contains the snap as mentioned earlier as the link between the light and the basket fixture, also used in the other fixings.

Ill. 157

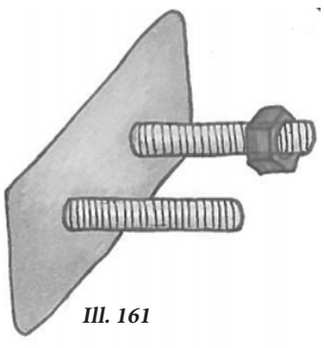
Ill. 158

Ill. 159

The solution is illustrated on the sketch below.
It is a plate with two holes, where the screws joint the plate with the bicycle basket.



Ill. 160



Ill. 161

INTERFACE

It is decided that the operating of the light should be wireless with buttons and that it should give feedback in order for the cyclist to trust the product.
It is researched how the interface should be placed, where motor cycles and scooters are used as inspiration.

Ill. 162

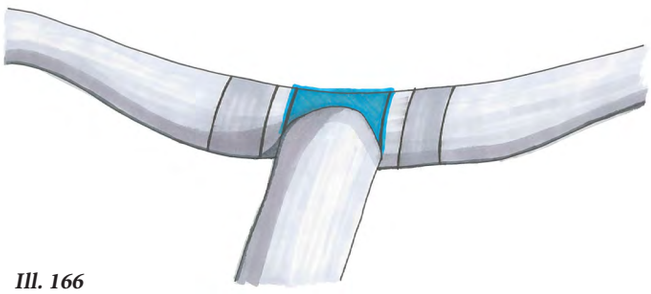
Ill. 163

Ill. 164

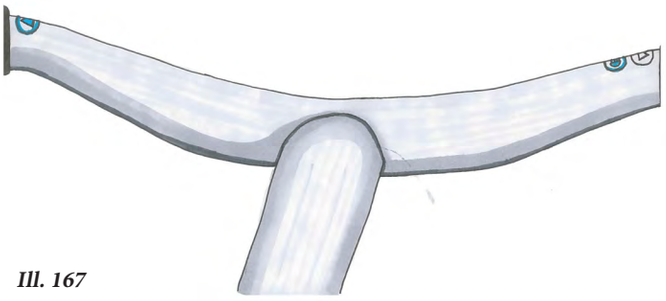
On a motor cycle, the signal lights is operated from the interface located on the left side. The interface is a slider the motor cyclist can slide to the right or left, depending on which side the motor cyclist is turning. The motor cycle has more functions on both sides and the whole interface is therefore more complicated. It would be difficult if the buttons for the flashing light was placed at each side, because of all the other functions.

An ideation on the interface is conducted with the objective to discuss possibilities with different placements on th ehandlebar and apperances of the interface.

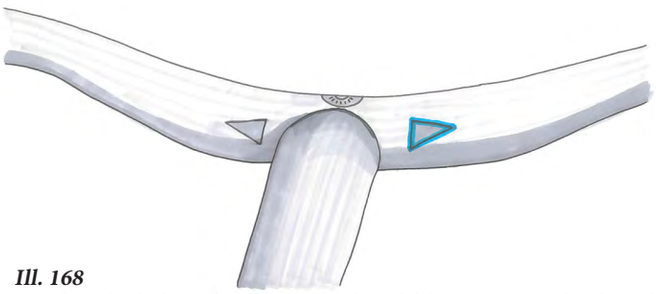
Ill. 165



Ill. 166



Ill. 167



Ill. 168

It is decided that the buttons should be near to the hands in order for the cyclist to operate them without moving the hand away from the handlebar.

The operating buttons should all be at the same side and close to each other, because the cyclist can use the same hand and are not depending on what direction the cyclist is turning. This should make it easier for the cyclist to make it a habit and not be confused about which hand to use.

FINAL REQUIREMENTS

4.0

Aesthetics

Desirable
- small size
- dynamic
- “quality” material

Simple
- easy interaction
- few details
- few colours
- not take attention from the bicycle when it is not being used

Construction

Durable
- not brake when bicycle overturn
    - size smaller than 115mm
- waterproof
- strong material

Possible to be fixed
- vertical and horizontal bars
- fit different sizes of bars

(diameter between 8mm and 29mm)
(circumference between 25mm and 91mm)
- moveable placement

Theft proof
- easy deattach to bring with you

Easy opening to batteries

Function

Show the orientation (road of the bicycle)

Only “visible” when in use

Visible from minimum 300 meter

Not blind/distract fellow road users (gradient)

Draw attention when it is dark

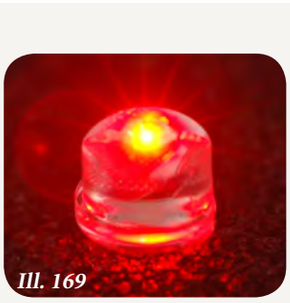
-Visible on the ground at least 4.4 meter in front of the bicycle
- 10 degrees gradient

Universal solution
- Not flashing light unless showing orientation
- Not fixed to limbs
- Visible in different lightning (0,1 to 180 lux)

CONSTRUCTION

The insides

Inside the light is the batteries, battery casing, printed circuit board and two types of LED lights; a star LED light for a stronger light (3W) and 6 or 7 (0,5W) LED lights. 6 LED light for the flashing light and one for the driving light, in the head light. The “star” LED is surrounded by a parabolic reflector in order to dense the light.


Ill. 169


Ill. 170


Ill. 171

Ill. 172

Join parts

There are different solutions in order to join the different parts and some of them are listed below with advantages and disadvantages.

Self-tapping screws

Advantages
- Can take it off in order to fix the insides
- Dissimilar materials can be joined together

Disadvantages
- Only strong in certain spots, not the whole connection between the parts
- Material needs a certain thickness in order for the screw to grab
- Takes more place than ultrasonic welding
- High stress around the screw
- High strain when inserting screws
- Deform material
(machinedesign)(plastics)

Ultrasonic welding:

Advantages
- Always works when the edges are straight and the material thickness is "good".
- Avoid screws and catch.
- Strong contact between the parts and not only contact in some spots.
- Fast process.

Disadvantages
- The end result depends on the material and a small variation in the material can influence the welding
- Not many design possibilities; straight edges
- Noisy for the workers
- Can be difficult in start up
(Munck, 2001)

Snap fit (flexible cantilevered lug):

Advantages
- Easy to assembly and disassembly
- Can be integrated in the mould tool
- Can use ABS plastic, like the back part
- Cheap

Disadvantages
- Cannot snap with PC because it is not flexible
- High bending stress when joining the parts
- Possibility that it breaks under disassembling
(snap-fit)

Snap fit is the easiest way that the parts can be assembled and disassembled and it is integrated in the mould tool. When using ultrasonic welding and screws, there is a risk that the product will break, because it is a force that is supplied. The stress is especially big when using screws, but the ultrasonic welding process is also unsteady because it depends on the material. The transparent PC top will be glued together, as many lights are today, for example the mustang rearlight. The internal components will be attached with ordinary welding.

MATERIALS

Advantages and disadvantages for different materials are listed with the objective to choose a material that fits the requirements for the product.

Plastic (ABS)

Advantages
- High striking force
- Nice surface/finish
- Stabile dimensions
- Electrical insulation
- Cheap
- Low weight
- Processes: injection moulding, extrusion, blow moulding, rotation moulding and thermo forming

Disadvantages
- Not weatherproof, breaks down in sunlight
- Look and feel cheap
- Not transparent
(Plastnet)

Plastic (PC)

Advantages
- Transparent and non transparent
- High striking force
- Almost unbreakable
- Works in cold and hot weather (-40 to +120 degrees)
- UV stabile (if improved)
- Not easily scratched (if improved)
- Electrical insulation
- Good optical qualities
- Processes: good for injection moulding and extrusion

Disadvantages
- Looks and feels cheap
- Water that is more than 60 degrees break down PC plastic
(Materialekendskab, 1998) (Induflex)

Rubber (EPDM)

Advantages
- Good tensile strength
- Weather proof, both water and sunlight
- Electrical insulation
- Works in cold and hot weather (-50 to +150 degrees)
- Can be stretched (flexible)
- Does not easily break when bicycle turn over

Disadvantages
- Not resistant to oil
- Surface attracts more dirt, because of the sticky surface
(AAG-gummi)

Aluminum

Advantages
- High strength
- Durable
- Light weight
- Easy to form and work with
- Conduct heat and electricity
- Can be reused
- Many process possibilities, for example extrusion and hydro forming
- Different surface treatments

Disadvantages
- Need a surface treatment
- More expensive than plastic
(Sapa)

Housing
It is decided to use ABS plastic covered with EPDM rubber. EPDM rubber is weather proof and does not break as easily as plastic if the bicycle turns over. ABS plastic have stabile dimensions, electrical insulation, light weight and are cheaper than for example PC plastic (Alibaba-abs)(Alibaba-pc). Aluminum is too expensive to use unless it is for the aesthetics, and here it is decided to have a more soft surface and not the masculine expression that aluminium create.

PC plastic is used for the transparent part because ABS is not transparent and PC is almost unbreakable. The transparent part is not covered with rubber, while it, especially here, is important for the plastic to be durable.

Attachment
The ordinary fixing (around bars) is made of ABS plastic, because it is flexible and is suitable for snapfit solution.

The plate for fixing the lights to bicycle baskets are made i ABS. It could also be made in metal, but with no other parts in metal, it seemed obvious to continue this direction.

The screws for fixing the plate to the bycycle basket is standard M5 steel with maching steel bolts.

The strap will be made from EPDM rubber, because of its flexability and good in different weather conditions.

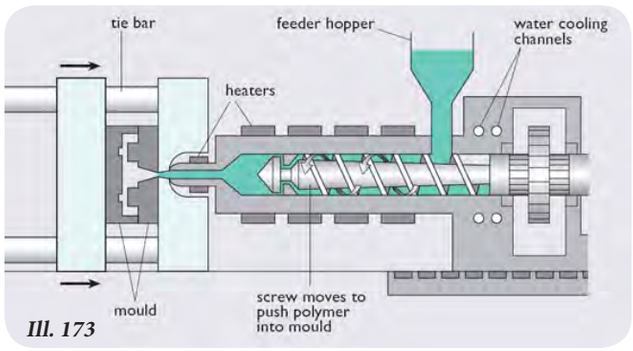
PRODUCTION

Plastic (ABS and PC)

The earlier part about materials stated that both injection moulding and extrusion are good processes to use, when working with ABS and PC plastic. Extrusion is not suitable for the product, because the form is too complex to be extruded.

Injection moulding can make complex forms where different materials are used which gives a design flexibility with many different details. In this case, it is necessary to use two materials because the lower part is made with ABS plastic and the upper part is made with transparent PC plastic. A disadvantage with injection moulding is that the starting process is expensive because of the tools. It can be worth using injection moulding when making mass production.

In injection moulding, the material is moving from a hot cylinder to a moulding tool by using pressure. The moulding tool gets cooled all the time and the injected material is therefore quickly stabile. This makes it possible to move the material from the moulding tool right away and keep producing new parts (denstoredanske) (avplastic).



Ill. 173

EPDM rubber

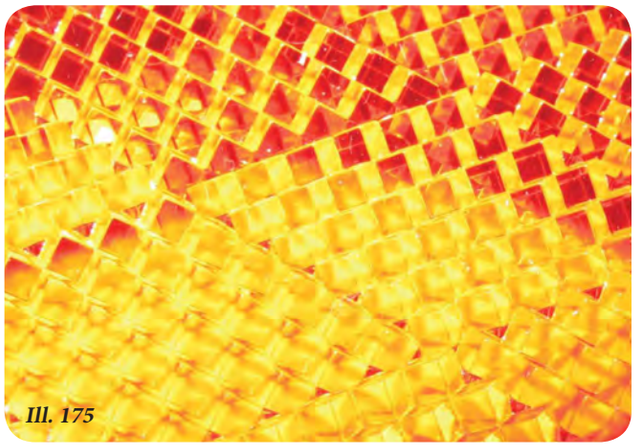
The outside of the product is at mentioned made out of rubber. Rubber is moulded in the same tool as the plastic, also called multi-component injection moulding. When using this process, it is possible to use more materials and colours, and the object can therefore be more complex. Another advantage is that it is a finished product that does not need to be assemblied or further work (Plast).

Membrane
The membrane is injection moulded, as the other parts. The mould is expensive, but the cost per part is low when producing many parts, and it will therefore pay off in the end. The end result is presice and does not need further work (Dowcorning). Below on illustration 174 a similar EPDM membrane.


Ill. 174

Reflective material

The reflective material is retroflection, also called prism reflectors. It is moulded tranparent plastic where one surface is smooth and the other have many angled spherical beads or micro-prism. The form make sure that the light, for example from cars, reflect back to the light source. Almost all light reflect back and very little is lost in the surroundings (Dual).


Ill. 175

COST

Production numbers

The estimated number of products, that is going to be sold, is based on the number of purchased bicycles in Denmark and Holland, because bicycle lights often are purchased with a bicycle.

In total 1,4 million bicycles are purchased in Denmark and Holland in 2012/2013. Notice that the number of sold bicycles in Europe is from 2012, and the countries percentage of purchased bicycles in Europe is from 2013, why the numbers are not accurate. (Statista, 2012)(Statista,2012)

It is estimated that Lumiline will be 0,5% of the number of purchased bicycle lights in Holland and Denmark, which would result in 7000 products per year. The development is quite fast in the industry, why it is predicted that Lumiline will be on the market in 2 years, which gives a total of 14.000 sold products.

Production price

Trough the site "custompart.net" the total price of per part is calculated. The site calculates the cost of the different parts when entering data about size, volume, wall thickness, number of parts produced, tolerance, surfaces, complexity and the material. In the cost is the cost of material, production and tooling. All the measures are found on the basis of the parts modelled in SolidWorks.

Not being able to calculate the exact price on all components, the following cost price have been colour coded; green reliable prices, yellow vague prices, red not reliable and black not existing.

Following parts have been calculated:

Headlight clear plastic
$15,897 ($1.129 per part) 14000pcs

Rearlight red clear plastic
$15,897 ($1.129 per part) 14000pcs

Back plastic
$20,043 ($0.716 per part) 28000pcs

Regular fixing
$13,705 ($0.489 per part) 28000pcs

Hook for fixing
$8,411 ($0.200 per part) 42000 pcs

Fixing for handlebar basket
$13,886 ($1.389 per part) 10000pcs

Reflector White
$9,837 ($0.703 per part) 14000pcs

Reflector Red
$10,607 ($0,758 per part) 14000pcs

Battery case 3xAAA
$13,940 ($0,498 per part) 28000pcs

Top interface
$10,785 ($0.770 per part) 14000pcs

Bottom interface
$19,092 ($1.007 per part) 14000 pcs

Parabolic reflector
$8,975 ($0.641 per part.) 14000pcs.

Support profile for star LED
$10,091 ($0.360 per part) 28000pcs

Not being able to calculate at custompart.net:

LED white 0,5W 8mm
$0.36 9 pcs
(Alibaba-LED)

LED red
$0.239 9 pcs.
(AlibabaLED2)

Star LED 3W
$0,6 1 pcs
(AlibabaLED3)

Moulds for rubber is estimated to be $7448,29 (50.000dkk)

EPDM strap 4.19grams
($0,185 per part) 42000 pcs.
(0.00419kg * $1.84 = $0.0077)
($7,448.29 / 42,000 = $0.117)

EPDM membrane lights 1.11grams
($0,268 per part) 28000 pcs.
(0.00111kg * $1.84 = $0.002)
($7,448.29 / 28,000 = $0.266)

EPDM membrane interface 0.51grams
($0,533 per part) 14000 pcs.
(0.00051kg * $1.84 = $0.00092)
($7,448.29 / 14,000 = $0.532)
(Indexmundi)

Printed Circuit Board

Price in total for one set with regular fixing:
$13.536 = 90.82dkk

Price for one set wth fixing for bicycle basket:
$14.54 = 97.56dkk

Man hours:
3269 hours per year * 2 years = 6538 hours

Operator: 143dkk per hour
= 934,934dkk
Per set of bicycle lights: 66.781dkk

Various costs:
149,169dkk
Per set of bicycle lights: 10.65dkk
In total normal placement: 168.25dkk
In total fixing on bicycle basket: 174.99dkk

The price for both lights are round up to 175dkk, as a production price, but with packaging and shipping, so it is round up to 200dkk.
Our contribution margin is 50% (see appendix 14, mail from Jes Jakobsen, May 17th)
Price = 400dkk

Bicycle stores have a mark up on 2-3 (see appendix 14, mail from Jes Jakobsen, May 17th), in this case 2.5
350 * 2.5 = 1,000dkk.

The product costs 1000dkk
(E-conomic)

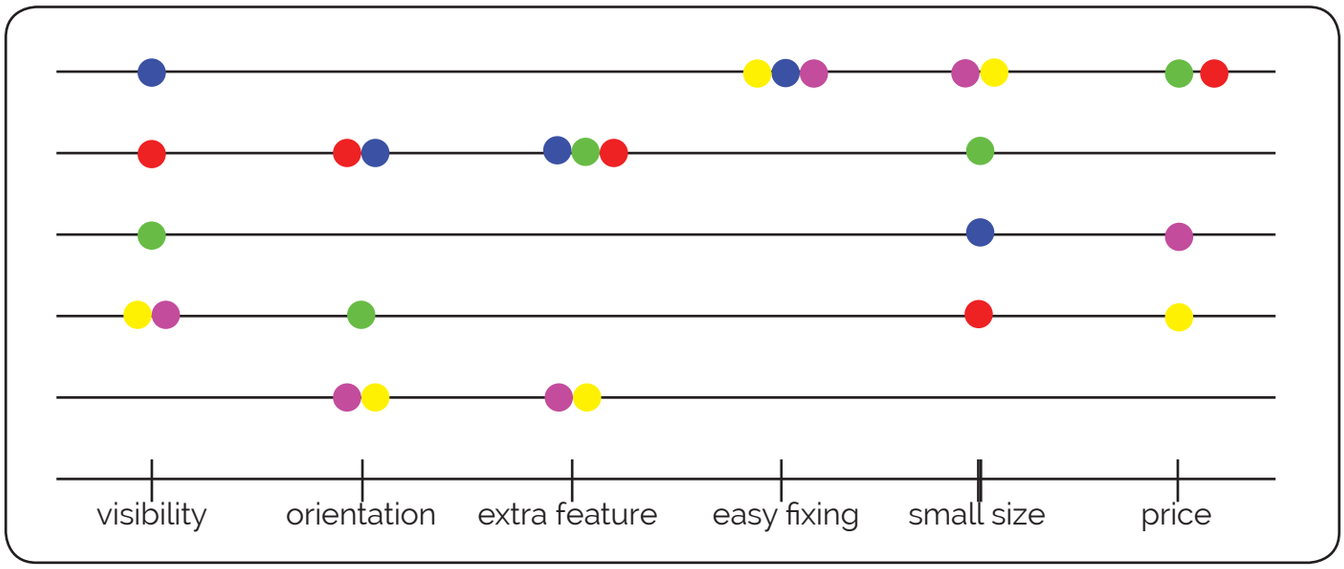
Break-even point:
Contribution margin for each set of products: 200dkk
The total cost for materials, etc.: 2,592,596

2,592,596dkk / 200dkk = 12,963 set of bicycle lights need to be sold in order to reach break-even point.

The production can be cheaper, if producing it in China were the man hours a cheaper than 143dkk per hour, and thereby is the break-even point before.

strategy canvas

Strategy canvas is used to compare our product with existing products with the objective to find out which values that can increase the sale. They are compared by the degree of visibility, clear orientation, extra feature, easy fixing, small size and price. The priority is in the same order, where visibility is the most important.



Ill. 176

Ill. 177

Ill. 178

Ill. 179

Ill. 180

Ill. 181

LUMLINE	COBI	SPOOKLIGHT	REELIGHT	MIX PRO
1000dkk	1300dkk	570dkk*	400dkk	330dkk**

* only rear light
** only headlight

Visibility: draw attention when it is dark (lumen).
Orientation: Show the orientation of the cyclist.
Extra feature: show orientation and extra attention when it is dark.
Easy fixing: placement on vertical and horizontal bars, fit different sizes of bars and moveable.
Small size: easy to bring with you.
Price: depends on features and lumen.

The weakness of our product is the size of it, which is necessary in order to have a clear orientation where it is possible to see on what side the light is flashing.

The product has the clearest visibility because of the extra feature; extra light on the headlight that even is visible for a truck driver.

None of the other products with turning light have an easy fixing, which is both suitable for a horizontal and vertical bar.

BUSINESS

The Business Model Canvas shows how the product will be sold, the customers, channels, values, etc. It gives an overview of the business plan and the products strength and weakness, where expertise is needed.

Key Partners

Optimization:

Professionals with expertise about production plastic and rubber.

Experts:

- Electronics.
- Optics.
- Traffic and safety.

Key Activities

Production:

Designing.
Making prototypes.

Problem solving:

Research a specific area and discover new ways to solve a problem, in this case "being seen in the dark".

Key Resources

Physical:

Production out of house.

Value Proposition

Newness:

hows direction in the front and back of the bicycle.

Extra light to create more attention.

Convenience:

Easy fixing.

Cost Structure

Mostly value-driven, but also cost-driven.

Value-driven:

Visibility in traffic.
Shows orientation.
Safety.

Cost-driven:

Production: mould cost.
Use standard components.
Wider market.

Revenue Streams

Asset sale:

Fixed price; List price.

Customer Relationship

Can choose between personal assistance and self-service.

Personal assistance: Professional point-of-view and guidance in the purchase.

Self-service: through the campaign with Trygfonden or the bicycle store's websites.

Customer Segments

Mass market:

The "normal" cyclists, who use their bicycles to work, school, hobbies, etc.

Niche market:

Features that attract the customers who want to spend more money in order to be more safe in traffic.

Channels

1. Awareness:

Campaign through Trygfonden.
- Focus on safety and visibility in the dark.
- Posters at public bicycle sheds, for example at the train station, schools, etc.
- Firstly, a test period.
- An offer around autumn holiday where it starts to get dark, for example "Buy one for your best friend and get one for free", "buy an insurance and get the lights for free" or "buy the lights and get discount on your insurance".

2. Evaluation:

Continuously evaluation of the product in the test period, as "Projekt Cykeljakken" which both describe when the test pilots use it, if there is any difficulties, the number of accidents they are involved in, etc.
Customer service through e-mail.

3. Purchase:

Trygfonden.
Bicycle stores and their websites.

4. Delivery:

By mail if it is purchased through Trygfonden or a website. This places a certain value on the product since it is easy to purchase, the customer do not need to leave their home or transport the product from a store to home.

When buying the product in a bicycle shop, the customer gets the product right away and the salesmen, which are professional within this field, can help and demonstrate how to use the product.

5. After sales:

Instructions, step by step.
Contact a bicycle store or contact the company by mail.

CONCLUSION

Initial problem
This project started with an initial problem from Trygfonden: "to be seen in the dark". They had a project in cooperation with Harry Lahrmann from Aalborg University about a high visibility vest, with the objective to compare the number of accidents for cyclists with and without the vest. The result was not surprisingly; that the cyclists that wore the vest, were in fewer accidents, but the users was not completely satisfied with the product. Therefore Trygfonden, as well as Harry Lahrmann, interested in a new product that would create attention and make it easier for cars to notice the vulnerable road users.

Focus
The need from Harry Lahrmann is a product, that makes the vulnerable road user visible in traffic, when it is dark, but it should not be a hassle for the user and not create attention when they do not use it. The focus is narrowed down to cyclists, for example because they are the ones closest to the cars. Cyclists also move faster than pedestrians and it can be difficult for the car drivers to identify in what direction they are driving, for example in a traffic light. Therefore orientation is a new focus in this project, so that the car driver both notice and gets aware of the cyclists movements.

Lumiline
Light is the existing product that creates most attention in the dark, which is why the product, Lumiline, create attention and by using light. Lumiline is a head- and rearlight that generate more attention than normal bicycle light. Both lights have orientation lights, as seen in cars and on motor cycles. The cyclist push a button when they are turning, and a wireless connection makes sure that the light flashes in front and back at the desired side.
When a cyclist is holding still next to a truck, the truck driver can only see the cyclist in a mirror, but when it is dark is it difficult to see the cyclist. Therefore the head light possess an extra light that outline a line on the ground, which starts after around 2 meter and light up 5 meter in front of the cyclist. This line makes it possible, even for a truck driver, to see that there is a cyclist next to the truck.

Easiness
A rubber strap makes it easy for the user to fix the product on the bike, because of the elastic band that is closed by placing a hook in the hole that fit the bar. Lumiline fits different bars, both horizontal, vertical and different sizes, because of the elastic material. Different fixing possibilities can be snapped, on the back of the light, making Lumiline fit to bikes with and without bicycle baskets. This makes it easy for the cyclist to fix the light where it is visible and not interrupted by bags or other things that is brought on the bicycle.

Lumiline both creates attention and make the fellow road users aware of the cyclists orientation on the road. This makes it more safe for the cyclist to go about in traffic, without them getting unwanted attention or need to wear a product on themselves.

REFLECTION

Process

Finding focus
In the beginning of the project, was it important to find a clear scope and narrow the focus down. There are many aspect, concerning traffic safety in the dark, also when the focus is narrowed down to cyclists. Therefore was it necessary with a success criteria, which is based on what the group see is the biggest issues when talking cyclists in the traffic; Visibility, which was a focus from the project start, and orientation. The last success criteria, orientation, came later in the process, which both helped the group thinking in a wider scale and other possibilities with light, but also made the start up confusing and "fluffy".

Vague requirements
One reason that it was difficult to find a focus, was the vague requirements, because it was difficult to choose a concept and direction to go. The requirements are reevaluated throughout the whole process, when experiments and new knowledge, could specify or add new requirements. The final requirements are made when almost all details were in place, because it was necessary to establish experiments for many features, for example how the light should flash and the different sizes of bars, that the fixing solution should fit.

Prove concept
As mentioned before was many experiments executed with the objective to prove some principals, but not all principals where possible to prove in a realistic environment. Especially lenses, because it needed to create a longer line that was possible with the equipment at Aalborg University. The cylindrical lenses on the market was expensive and at the same time was it difficult to find a lens with the right focal length. Therefore is the correct size of lens on a principal basis, but proved in a smaller size.

Experts
During the process is many experts contacted, in order to gather information inside different fields. A electronics engineer, Industrial Designer for Reelight and professors in "Vej og Trafik" and "Optics". This gave a depth in the project and the group were confident in the solutions, even though it was outside the comfort zone.

Planning time
It was late in the process, that the final product was found, because there was used a lot of time on research. Even though the research phase ended in planned time, the concept phase contained a lot of research as well. During the whole process many small experiments was executed, in order to prove different principals. This took time from the product phase and final detailing, why many decisions, for example concerning construction and final form, was carried out in SolidWorks .

Product

Placement
The placement was an obstacle in the project, because of all the limitations. The placement/fixing of the product should with horizontal, vertical and different sizes of bars, be fixed to a bicycle basket, on the back and front of the car, and at the same time not be hidden behind any objects. All these were not possible to incorporate in one solution, why it was necessary to have two solutions, where the customer can decide the one that fits their needs.

Aesthetics
The overall form was developed by sketching, but the final details were, as mentioned before, carried out in SolidWorks. The aesthetics were not leading factor in the process, because focus have been put on the functions. From the beginning was it a requirement that the product should be desirable, but also not stand out and take attention from the bicycle, or traffic in general. This is achieved by being inspired of bicycles and their equipments, which are fairly simple. This also fit the user, which Jes Jakobsen stated, that are traditional in their habits, when talking bicycle lights. They do not want to stand out, why Lumiline looks like an ordinary bicycle light.

Final detailing
Many details were estimated, some of them were carried out in SolidWorks and others are still on a more conceptual phase. Most of the insides were made in SolidWorks, because it was important that it could fit into a certain space and not interfere with each other.

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APPENDIX

APPENDIX 1

Iinterview Harry Lahrmann 12.02.15

Snakker om lys på biler

Harry: "..de havde fået færre ulykker af det og cykler og fodgængere, der var ikke sket noget der. Og så kan man sige, hvis man så begynder, hvordan kan man så tolke det? Så kan man tolke det sådan at bilerne er blevet mere synlige overfor hinanden og mere synlige overfor fodgængerne og cyklister. Omvendt er cyklisterne og fodgængerne blevet mindre synlige overfor bilisterne, men det bliver så kompenseret af at de i højere grad har opdaget bilisterne og derfor er der ikke sket en ændring med dem. Det er ligesom det ene, og det andet er at i alle årene har der altid været en diskussion om synlighed, opmærksomhed og optrapning af afmærkningsniveau. Indenfor vejsektoren har det altid været sådan at "vi sætter lige et skilt mere op eller større og sådan, ikke". Man kan sige på et eller andet tidspunkt ender det med at vi alle sammen kører rundt med blåt blink, så det er så den diskussion der hele tiden har været "hvordan afvejer man synlighed og opmærksomhed med sikkerhed" og det kan man sige er det fundamentale. Den underliggende diskussion er kampen om opmærksomhed og det giver også udslag i alle reklamerne og bymiljøet og sådan noget, ikke? Der kan man sige at i helt gamle dage havde vi styr på bymiljøet og man fik ikke lov til alt det skrammel. Idag, kommunerne vandt jo penge og så får de lov at sætte deres busskærme op og store boards osv. Os trafiksikkerhedsfolk siger jo at når hennes og maurits de har reklameskilte, så ser befolkningen på det i stedet for trafikken og det kan vi ikke lide. Det er hele den diskussion der er, hele den underliggende diskussion. Så kan man sige i forhold til cyklisterne, for 10 år siden der var der sådan en gut der kom til en af mine gamle studerende i Odense kommune og præsenterede en cykellygte der kunne blinke og der sad sådan nogle magneter i gearet(?). Så ringede Troels til mig og spurgte om ikke vi kunne bruge det til et eller andet og så tog jeg derned og sådan noget. Jeg kunne godt lide at det var permanent og så siger jeg at vi laver squ et forsøg og så og så gik vi hjem og regnede lidt og fandt ud af at hvis vi skulle lave det ordentligt, skulle vi have i alt 4000 deltagere, 2000 i kontrol og 2000 testpersoner. Det er det helt traditionelle forsøg ligesom ved medicin, hvor man får en pille og så må man se hvad der sker. Der gik et par år, hvor vi skulle samle penge til det, det var noget opstart, og så lige pludselig var der nogle der kom ind og kunne organisere det og sørge for at det blev produceret og sådan og så lavede vi forsøget og det gav et vældig flot resultat. Det har vi så afrapporteret og sådan noget. Og så tænkte vi at det kunne være lidt sjovt at gå videre den vej. På et eller andet tidspunkt kiggede jeg på Trygfonden, vi skal hele tiden have nogle penge til vores forskning, så hvad kunne de interessere sig for og sådan noget. og de interesserede sig for sådan noget som det der, så præsenterede vi det her for dem og det var de med på (jakken). Vi fik i alt 4,3 millioner til det her. Det lyder af mange penge, men når du skal producere 8000 jakker og dele dem ud med posten, går de fleste penge til det. Så er der kun, jeg tror, 1,4 millioner tilbage, haha, men ja det meste gik til omkostninger. Men det lavede vi så og producerede så. I har fået en pdf, men nu kan i få den i fin tryk og i må også gerne få jakken her. Der er nogle få tilbage, den her er til kontrolgruppen, dvs de fik den først bagefter og derfor, den er magen til den anden, bortset fra på dem der fik den oprindeligt, der står der testpilot. Når jeg så, i kan prøve at kigge på den. Og det her er lidt interessant i forhold til jer og sådan, fordi sendte jeg også det der notat vi havde hvor vi havde spurgt til hvordan de kunne lide jakken og sådan?"

Marie: "Nej det tror jeg faktisk ikke, for det har vi også som spørgsmål til idag"

Harry: "okay, men det kommer jeg så tilbage til. Fordi der er jo ingen tvivl om at det viser jo også at det har en fantastisk effekt, det har i læst, men så er diskussionen så, hvordan søren får vi folk til at gå med det? og der kan man sige, og det siger spørgeskemaet jo noget om, hvad barriererne er. Det der er hovedvarianten, der er masser af varianter i den der, det er der. Men en af varianten er også at "ah, hvis jeg skulle på strøgtur""

Marie: "Ja det er nok ikke alle der lige..."

Harry: "Nej det er ikke lige.. og i hvert fald fik vi også skrevet nok på den. Her står der dog kun "jeg bliver set i trafikken" på bagsiden. Men på den anden står der også testpilot, og så kommer man ind i forretningen og så tror de at de skal testes.. Der er en hel masse med at den er for varm og sådan noget, ikke. Den skulle være åndbar, men i kender godt de der tæthed, holdbarhed (mere..?), ikke? Der er ingen lommer i den, der er ingen hætte på den og ærmerne er ikke aftagelige og sådan nogle ting. Så det er en udfordring. Nå.. Så... men til gengæld så kan man sige at vi fik nogle gode.. så har vi snakket med Trygfonden om hvordan vi kommer videre, for vi vil gerne videre. Og måske ikke knapt så meget forskningsmæssigt, for at komme videre ud af den vej der, og der har vi snakket lidt om at vi vil forsøge at lave en designkonkurrence ligesom med stigen. Der vil vi nok gå noget bredere ud og sige det ikke nødvendigvis skal være en jakke. Altså dengang vi startede med det, havde vi nogle temmelig store diskussioner inden vi lagde os fast på jakken. Om det skulle være et stykke sikkerhedsudstyr man tog på når man cyklede eller noget der var smart som man havde lyst til at tage på. Det er to helt forskellige veje at gå. der endte vi med at sige at det skal være noget der er smart at tage på som man har lyst til og så endte vi med den der.. men det var det jo nok ikke rigtigt.. altså vi havde

jo 8000 mennesker der var vanvittigt dedikeret. Altså vi havde jo en besvarelsesprocent på ??, det var vanvittig højt.. Folk tror ikke på det. Men det var fordi det var frivilligt og de meldte sig. De var så dedikeret, ikke. Det er så også det der er problemet med resultaterne. Når vi har analyseret at dem i kontrolgruppen, de har nok undladt at rapportere nogle uheld, ikke, fordi de tror meget på projektet. Det er så det vi har prøvet at kompensere på, ved at kigge på.. men fred være med det. Der kan man sige, at der satte vi os nok lidt mellem to stole, vi fik aldrig en rigtig smart jakke. Jeg synes ikke den er rædselsfuld, det er ikke det, men altså.."

Marie: "Nej nej, men jeg synes stadigvæk.."

Harry: "Ja, men det gjorde vi nok ikke. Omvendt så kan man sige at så fik vi heller ikke det sikkerhedsudstyr der er nemt at tage på og have med og sådan noget, ikke. Det gjorde vi heller ikke. Så man kan sige at det er nok lidt det der vil blive diskuteret i designkonkurrencen og oplægget. Og der vil helt sikkert ende med at man kan vælge hvor er det jeg vil ligge. Skal mit produkt være det man har lyst til at tage på hvor det er smart, også på strøgtur, eller skal det være noget der er nemt at tage på og kan gemme væk. Det kunne være et bånd, eller hvad ved jeg. så det er ligesom det ene, det andet vi også snakker lidt om, det er der er jo ligesom række ting man kan arbejde med. Man kan arbejde med flurisende (?) farver, pangfarver, man kan arbejde med reflekser, man kan arbejde med lys. Det er de grundlæggende 3 komponenter man kan arbejde med og de har deres styrker og svagheder. Fx flourisende farver hjælper ikke en hujende fis når det er mørkt."

Marie: "nej det har vi også været inde på, og det kan vi godt se"

Harry: "Der er reflekserne gode, de hjælper til gengæld ikke om dagen. Og lyset, jamen det kan jo både hjælpe om aftenen og om dagen. Til gengæld er det en udfordring med strøm. Men man kan jo godt forestille sig noget med på en eller anden måde intelligent tøj, tekstil, hvad ved jeg. Det er nok sådan nogle ord der kommer til at stå der. Det er i hvert fald en anden af de ting vi arbejder med. Så har vi også lidt diskuteret, kender i det der hedder biomotion?"

Marie og Trine: "Nej det er vi ikke stødt på.."

Marie: "men jeg tror som du siger, vi er også ude i en lidt bredere retning. så det er noget man lidt tager på"

Trine: "vi har snakket lidt om lys.."

Marie: "Ja"

Harry: "Ja, ja.. jeg skal lige.."

Marie: "Vi så noget fra Holland med cyklister, hvor de nemlig også sagde at det var godt med det high visibility farver men det hjalp ingenting om natten overhovedet. Nu har vi også været ude at tage en masse billeder selv og der var det helt klart reflekserne der var det bedste. Nu havde vi, hvor er vores huer? Trines mor har strikket os dem her faktisk hvor det sidder indeni"

Harry: "ja.. ja.."

Marie: "det fungerer faktisk ret godt, men ligeså snart der er 100meters afstand så er det faktisk næsten allerede væk."

Harry viser biomotion

Harry: "Nu skal i prøve at se. ... det er nogle der har lavet nogle animationer. Idéen er at ved de punkter kan man se hvordan vedkommende går, om det er en mand eller kvinde."

Harry viser hvordan man kan ændre animationen, fx. gøre den nervøs.

Harry: "Pointen i det her, det er, og det er det vi på en eller anden måde vil ligge op til, jamen kan vi på en eller anden måde, og det her handler ikke nødvendigvis kun om cyklister, vi vil nok mere ligge op til at det er bløde trafikanter i den her konkurrence. Kan vi ligge op til at vi på en eller anden måde kunne, det kunne være hvis vi nu det var sådan nogle punkter der, det kunne være LEDløsning. Kunne man forestille sig at man kunne have noget tøj med nogle få indbyggede LEDløsninger, hvor som på en eller anden måde når man kigger, så kan man ligesom vælge at så har man den moad, og så signalerede det hvad det var det der, lidt det med reflekserne der sidder indeni hjulet eller dem der sidder på pedalerne som på en eller anden måde giver en indikation på hvad det er du ser. Så det er vel lidt af det vi snakker om, der kommer til at stå i konkurrencen."

Marie: "Men det er også det vi kan se, at det helt klart er hænderne og fødderne der bevæger sig mest og der var det bedst med refleksbånd."

Harry: "Hvad var det der var i den?"
Snak om reflekshue.

Harry: "Men der er pointen så lidt at det er om dagen at de bløde trafikanter kommer til skade. I hvert fald cyklerne."

Marie: "og så ligeså snart vi var ude at tage billeder, var

det 100m?, så forsvinder den hurtigt. og så med hensyn til andre lys og sådan noget, ikke?"

Harry: "Men det behøves heller ikke være én ting."

Marie: "Men der var det nemlig at vi havde en lyserød vest man løber i, hvor der er to rimelig store reflekser bagpå og det lyste rigtig kraftigt op. Der undrede det os egentlig at i ikke havde mere på ryggen og at det sad mere forneden."

Harry: "Lige præcis hvorfor det sidder der, det må du dybest set ikke spørge mig om. Vi havde faktisk den aftale, vi lavede faktisk en skarp skillelinje. Trygfonden havde både ansvaret for design, produktion og udsendelsen af den her. Det eneste vi gjorde var faktisk at vi leverede en adresseliste og så var vi selvfølgelig med i lidt dialog, ikke? men i sidste ende var det dem der trak af på det og her er de væsentligste refleks, nok de bånd."

Marie: "Det er også dem der har valgt at det skulle være en jakke så?"

Harry: "Ja. I sidste ende var det dem der valgte det. Men det var vi nu enige om, ikke, så det var ikke derfor. Det var nok i proces, men hvis jeg skulle have bestemt det, skulle der have været aftagelige ærmer."

Marie: "Vi kiggede på den også, og kunne se at anvendelsen faldt ret meget i løbet af sommeren."

Harry: "Helt sikker ja. Konklusionen kan også være at man ikke kan lave en der spænder over hele året og dag/nat. Og så må man sige, at så kunne man jo sælge det med to i hver pakke. Så kan man sælge en sommer og vinterudgave, og så er det det der er konklusionen på det."

Marie: "Kom de tilbage med et svar på hvorfor de ikke brugte den om sommeren?"

Harry: "Det var fordi der var for varmt. Det kan i se, i skal nok få det notat. Vi opdagede det og sådan noget, og der skrev vi så ud til dem at de bare kunne tage en vest på. Og det er der også mange af dem der gjorde.
Men hvordan er jeres, hvad er kravene til jeres projekt? Hvad er udfaldskravene? Er det en prototype eller kunne det være oplæg til en designkonkurrence"
Marie: "Jeg tror mere vi er ude i et færdigt produkt og det er også derfor vi helst skulle finde nogle vi kunne arbejde lidt sammen med, med hensyn til teknologi og sådan. Så jeg tror helt klart at i sidste ende er målet at få lavet noget vi kan have med...."

Snak om phD studerende der muligvis kan hjælpe med materiale.

Harry: "Det der med, hvis vi vil prøve noget der måske ikke er så mange der har arbejdet med, så tror jeg det biomotion er noget man kan kaste sig lidt over. Fordi det er klart nogle af de andre ting, jeg tror det er svært og, ja jeg ved squ ikke hvad udfaldskravene er, men det er der rigtig mange der har arbejdet med, hvorimod hvis man kan lave et eller andet mønster som er meget let genkendeligt. I skal prøve at tænke på, at det der sker, hvis i ser i sådan et bymiljø og det vælter rundt med indtryk, så er det jo at de her bløde trafikanter har det med at forsvinde. Der er alt muligt der sker, ikke? Hvis man kunne få en bevægelse man umiddelbart associerer med henholdsvis cyklister og fodgænger eller kun en af dem, fx det vi snakkede om med hjulene der kører rundt eller pedaler der går op og ned, hvis nu man på en eller anden måde kunne få det ind i produktet. "

Marie: "Ja, også bare fordi hvis det er regnvejr, bliver det 1000 gange værre. Så det har vi også snakket om, at det er noget der skal være med i kravet. Vi har også været inde at kigge på lys, og der er mange der har gjort sig en masse overvejelser også i forhold til laser og sådan. Det skal også være noget folk vil købe, for du kunne se hvor svært det er bare at få folk til at købe cykellygter. Så det har vi også snakket om i forhold til krav at det skal være noget man har lyst til og ikke bare fordi man får en bøde. Har i brugt den til andet ellers, altså jakken? I andre forsøg eller sådan."

Harry: "Nej nej.."

Marie: "Ellers har vi også skrevet nat/dag og sommer/vinter. For der stod godt nok deri at det skulle være med begrænset reflekterende materiale, men det kan godt være at det er Rene jeg skal snakke om det med så, for det lød som om at der var en ide bag at det skulle være begrænset reflekterende materiale?"

Harry: "Ja, det var der helt klart. Det er helt klart tanken bag, at man skulle have lyst til at gå med den. Det er lige præcis det, ikke. Det skulle ikke være et stykke sikkerhedsudstyr. Altså det var sådan set, det var helt klart målet. Men der må vi nok erkende at det var det nok knap og nap. Måske også fordi vi skrev testpilot og jeg kan blive set i trafikken. Det skulle vi nok ikke have skrevet, dybest set. Det vil jeg i hvert fald mene her bagefter at det var ikke smart. Men det var fint nok, der står også Trygfonden på den, og det synes jeg var fint nok, det var ikke det. Det var lige præcis at der stod testpilot der foran."

Marie: "Men det er også svært, for en af dem jeg sad i praktik med det sidste halve år, han var med i det i

Århus, og han sagde, og det er nok også det med engagement, for jeg tror at han var stolt nok af at være testpilot, men det er også lidt der"

Harry: "Ja det er så fordi at det er den der særlige gruppe vi har fået. For hvis du skal have det ud til den der gymnasiepige der.. (griner)"

Marie: "Ja, jeg kan godt huske hvor meget min far punkede mig for det."

Harry: "Ja, at få cykelhjelmen på.. så, men det er jo også sjovt. Jeg har kigget lidt på at man kan få sådan noget udstyr, det er jo utroligt hvor lidt der er."

Marie: "Det kører meget i den samme genre"

Harry: "Ja, ja. Altså man kan godt få en cykeljakke, men der er ikke et stort udvalg."

Marie: "Nej, for vestene ligner jo også meget hinanden. Nu ville jeg så gerne have en pink, det var satme svært at få. Det var gul, ellers var det til børn. Så min far måtte finde en, ja jeg ved ikke hvor han fandt den henne. Men det der med selv at få lov til at vælge, det kan være svært. Det er nok også derfor folk vælger det fra."

Harry: "Ja, hvis man nu ikke kan lide den gule farve. Men man ser flere og flere."

Marie: "Men vi havde besluttet at vi i udgangen af den her uge vil sætte os fast på hvilken retning vi vil køre i. Og indtil videre snakker vi om lys, men på en måde hvor det er lidt mere intelligent og du både slipper for det med batteri, så det selv skal kunne lades op, men måske også noget som ikke køre hele tiden men kun når der er et eller andet der bliver ramt eller indikerer at nu er der behov for det. Men det er meget koncept. "

Harry: "Der findes et, altså det der med at slippe for batterier, enevy harvist (? 25:36) hvor det er vibration der samler noget energi og så kan du få noget til at lyse, men jeg ved ikke lige hvor realistisk det er i forhold til tøj."
Marie: "Vi har snakket meget om det der med om det skal placeres på cyklen eller på personen, fordi der er størst, altså selvfølgelig er der en stor flade på ryggen, men kommer du forfra, så er det ligesom en anden sag. På cyklen er der det med sikkerhed og går den i stykker hvis den vælter og det ene og det andet."

Harry: "Altså hvis det er i direkte forhold til cyklen, så har jeg jo altid, så går vi lidt tilbage til det med kørelys og det kunne det måske også være, men der har jeg jo synes at man skal gøre ligesom, jeg ved ikke om nogle af jer sejler, men os der sejler, vi ved jo at det her det er hvidt hvis man sejler i den retning, og det her det er grønt og det her er rødt...(viser tegning). Der vil jeg dybest set gerne have et lys på cyklen der lyste hvidt hele den vej der, undskyld, og ja så rødt i de sidste 120 grader. Det kunne så passende sidde på bagagebæret og den der kunne sidde på styret. Og så kunne man måske også overveje, i forhold til sikkerhed, hvorfor skal cykler ikke have blinklys på? Hvorfor skal cykler ikke have bremselys på? Og hvis man søger lidt på nettet, så kan man faktisk finde sådan noget lys og lygter til cykler hvor bremserne kører på sådan nogle akserometer som på smartphone, så snart man begynder at bremse, begynder det at lyse og så er der en lille knap til blinklys."

Marie: "Det er klart, det er også noget man ikke kan se om natten. Altså når man bare stikker lappen ud."

Harry: "Ja og måske var det nemmere at få cyklisterne til at bruge et blinklys end at få dem til at række hånden ud. Man kan også sige at hvis man tænker lidt nærmere, nu er vi helt væk fra tøjet, altså når man tænker lidt over det med at cyklister skal give tegn til at svinge og holde, så kan man sige, at det kræver jo at de kun har en hånd på styret. Det er dybest set ikke særlig smart, der er noget sikkerhedsmæssigt i det, ikke? Så man kan sige med den teknologi vi har idag med LED og sådan noget hvor det faktisk er nemt at have en energikilde med, så er det meget gammeldags. Der kan man sige, hvorfor skal cyklerne ikke have, det kan være et eller andet genopladeligt batteri eller bare et almindeligt batteri, det behøves jo dybest set ikke særlig meget strøm til at drive sådan noget der. Men det er klart, der er selvfølgelig en udfordring i det hvis det ikke er indbygget i cyklen fra starten af. Med vedligeholdelse og sådan noget af det. Men det kunne man jo også arbejde med og gå i en helt anden retning."

Marie: "Ja det er rigtigt. Jeg kan også huske at jeg snakkede med en jeg var i praktik med, og han snakkede om, han cykler nemlig meget mountainbike, hvor han sagde hvorfor man ikke med de lygter måske havde sat dem i stellet på en eller anden måde. Det er klart, det er selvfølgelig en fordel men det kræver også at alt det bagud, der kan man ikke gøre noget ved det. Der skal du stadig have den gammeldags lappeløsning med at sætte noget på, ikke. Så vi skal helt sikkert finde noget hvor folk ikke skal bruge for meget tid på det og ikke skal investere i noget nyt, så ja.. Det bliver lidt en udfordring fordi det vi skal ind på også, er hvad vil de så påtage sig af ting for det er svært nok at få dem til at tage cykelhjelmen på. Så at lave noget yderligere som de skal have på, det skal vi i hvert fald.."

Harry: "Ja, jeg tror det skal være noget der skal være fastmonteret på cyklen og det er også derfor de der små blink-

ende lygter de har haft så stor succes. Det er fordi det er en gang du skal gøre det, ikke."

Marie: "Der er ikke noget med man glemmer dem"

Harry: "Nej, men til gengæld selvom de gav en rigtig god effekt og sådan noget, så er vi lidt kede af at de kun sidder på den ene side."

Marie: "Ja, jeg har læst noget om at de ofte sidder for lavt i forhold til bilens udsyn og så kan man stadig ikke se dem."

Harry: "Ja det er jo det"

Marie: " Jeg var selv ude at investere i nogle fordi begge mine lygter var gået i stykker. Der var jeg inde at kigge på det og valgte de helt gammeldags med batteri fordi de andre sad så lavt. Så er der også den problematik med at mange af de lys, de lyser så meget at de faktisk forvirrer bilisterne. Det har vi også været inde over."

Harry: "Ja, det er så det næste. Efter der er kommet alle de mountainbike-lygter som kan lyse en helt vej op. Der bliver det spændende om næste gang der kommer cykeludstyr om der så kommer en max belysning der er lovligt."

Marie: "Ja det har jeg også oplevet, det var så godt nok en løber der lyste så kraftigt at man ikke vidste hvad det var."

Harry: "Ja, men der er i hvert fald nok at kaste sig over. Der er lidt at tænke over og ikke bare lave en lille ændring men tage fat i noget mere grundlæggende... bringe nye elementer i spil. For det med det bio der, vi kan jo alle finde ud af at sætte blå blink på der bare roterer, men hvis nu man kunne være smartere ved at lave et eller andet der gjorde at de her bløde trafikanter skiller sig ud i det forvirrende miljø i byen. Og hvis det så er en mock-up, så må i ud at videofilme. Først kommer jeres forsøgsperson uden noget og så i det der forvirrende bybillede og så kommer de med sådan noget der blinker på en særlig måde som man nu så på den video. Sådan et eller andet, ikke. Det kunne da være sjovt."

Afsluttende snak om kontakt i forhold til Trygfonden og phD studerende, samt han giver os jakken og snakker om rekruttering hvor de var afhængige af presseomtale, samt der var problemer med at jakken var produceret i forvejen og dem der meldte sig var mindre i gennemsnit end de havde regnet med.

APPENDIX 6

placement on bicycle

1. illustration of a bicycle from the side with a person in the front and the back.

2. illustration of a bicycle from the back with a person in the front and the back.

3. illustration of a bicycle from the front with a person in the front and the back.

1.

2.

3.

4. illustration of a bicycle from the side with a person in the front and the back.

5. illustration of a bicycle from the back with a person in the front and the back.

6. illustration of a bicycle from the front with a person in the front and the back.

4.

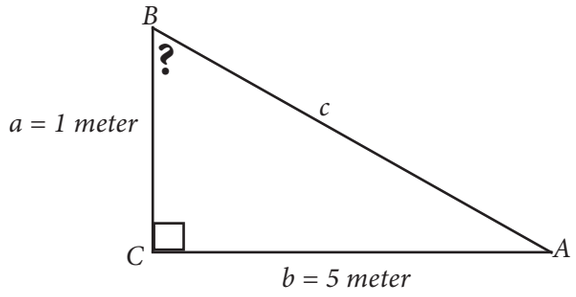
5.

6.

APPENDIX 7

gradient light

The gradient for the head light is calcuted, so that the bicycle light is visible 5 meter in front of the bicycle.



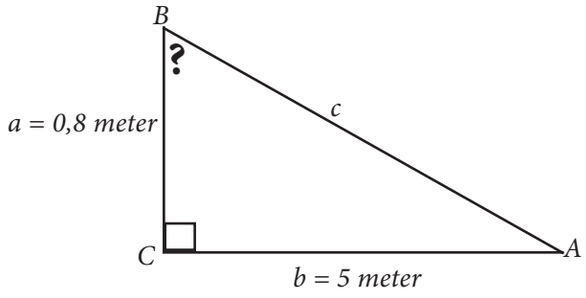
Firstly, c is calculated.

$a^2 + b^2 = c^2$
$1^2 + 5^2 = c^2$
$26 = c^2$
c = 5,1 meter

Now it is possible to calculate B

sinB = b/c
sinB = 5/5,1 = 0,98
= 78,5°

90° - 78,5° = <u>11,5°</u>



Firstly, c is calculated.

$a^2 + b^2 = c^2$
$0{,}8^2 + 5^2 = c^2$
$25{,}64 = c^2$
c = 5,06 meter

Now it is possible to calculate B

sinB = b/c
sinB = 5/5,06 = 0,99
= 81,9°

90° - 81,9° = <u>8,1°</u>

APPENDIX 14

mails

Jes Jakobsen, Industrial Design Engineer, Reelight

12. maj 2015:
Hej Jes.

Tak for sidst, det var godt at høre lidt om cykelkulturen og hvad man skulle tænke over. vi har ikke kontaktet dig yderligere, da vi umiddelbart ikke havde meget at tilbyde jer, da vi ikke arbejder med magneter eller har lavet yderligere undersøgelser om blinkfrekvens.

Vi er ved at nå ved vejs ende i projektet og skal til at tænke på produktion, pris, osv.
For at kunne finde en ca. pris for produktion skulle vi gerne have en ide om hvor mange cykellygter der er muligt at sælge, og her tænkte vi om du kunne give et bud på det udfra hvor mange i sælger?

Det drejer sig om en for- og baglygte der blinker når man drejer til højre og venstre, samt både har kørelys og et ekstra sikkerhedslys på forlygten som man kan slå til og fra.

Igen tak for hjælpen :)

Venlig hilsen Trine

13. maj 2015:
Hej Trine,

Jeg kan lige svare på dit spørgsmål her i første omgang. Jeg kan desværre ikke gå i detaljer med vores salgstal, men kan fortælle at vi sidste år solgte ca. 20.000 sæt SL120, som er et af vores mest sælgende produkter.

Håber det hjælper lidt :)

Glæder mig til at se hvad I er nået frem til!

Best Regards

JES JAKOBSEN

14. maj 2015:
Hej Jes

Tak fordi du vil bruge til på at hjælpe os :) og det hjalp også at vide at i solgte ca. 20.000, så har vi et lille indblik i hvad der er muligt at sælge.

Jeg har vedhæftet en hurtig rendering af vores forlygte og en teknisk tegning, så du har en ide om størrelsen. Baglygten er magen til, bortset fra at den kun ikke har et ekstra skarpt lys i midten.

Det øverste lys er en stjerne LED som er kraftigere og i dette tilfælde skal den lave en ret linje fra cyklen og ca 5 meter frem - vi mangler dog stadig at tilføje en cylindrisk plastik linse i modellen. Nedenunder den er almindeligt kørelys og resten er blinklys, som kan styres vha. en knap på styret.
Der er brugt ABS plastik, samt PC plast hvor det er transparent. Rundt om er der gummi, hvilket heller ikke er vist endnu. Af produktion vil vi bruge sprøjtestøbning.

Det vi gerne vil spørge dig om er hvad du tænker man kan tillade sig at tage for produktet, samt om du har en ide om produktionspris.
Hvilke tolerancer der er normalt at bruge for sådan et produkt.
Hvilke linser bruger i?

Venlig hilsen Trine

16. maj 2015
Hej igen

Lige et par ekstra spørgsmål på falderebet :)

Er det iorden hvis vi sætter et billede ind af dig i rapporten? Det er ved vores interview, for at vise hvem det er vi har snakket med.

Jeg har søgt lidt på reflektivt materiale i cykellygter og fundet frem til at det er transparent plastik der bliver støbt, men kan du give flere detaljer? Det er nemlig ret svært at finde noget om.
Her tænker jeg hvilket materiale det oftest er, om det bliver støbt sammen med resten af formen eller om der er en nemmere/billigere metode.

Det var vist alt :)

Venlig hilsen Trine

17. maj 2015

Hej Trine,

Tak for tilsendte, det ser godt ud! Hvad er formålet med at anvende en stjerne LED fremfor en almindelig 1W SMD?

Jeg skal prøve om jeg kan svare kort på nogle af dine spørgsmål:

1. I må gerne bruge et billede af mig i rapporten. Kan I bruge det der er på hjemmesiden?

2. Jeg har ikke så meget erfaring med reflekser, men mener måden vi har gjort det på tidligere er ved at støbe et specielt prismemønster ind i plasten og have en chrom overflade bagved. Materialet er så vidt jeg ved bare almindelig PC. Det er både en nem og billig måde at gøre det på.

3. Mht. prisen er et vigtigt parameter hvor mange lumen lygten kan levere. Hvis du kigger på markedet vil du se at priserne oftest afhænger af denne parameter samt batterilevetid. LED'er har altid en lumen rating ved en given effekt, så jeg vil råde jer til at kigge på den og udregne batterilevetiden. På den måde kan I nemt sammenligne med andre lygter med lignende lumen og batterilevetid. Husk at der er lystab i linse og lygteglas. I kan regne med ca. 10 % tab i begge.

4. Det er svært at give et bud på produktionsprisen uden at se en BOM. Plast emner koster typisk ikke meget at producere, men PCB'et kan være bekostligt afhængigt af hvilke komponenter I har valgt. Her kan i finde priser på Farnell og Alibaba ved at skrive til leverandørerne. Regn med at producenten skal have et dækningsbidrag på ca. 50 % og at cykelhandlerne og supermarkederne har en markup på 2 eller 3.

5. Vi har typisk fået designet vores egne linser og producerer dem derfor selv. Dog har vi fornylig kigget en del på linser fra Carclo og Ledil som begge har ganske fine og kompakte linser til en fornuftig pris. Ledil laver en Ø10mm linse der giver en halveringsvinkel på ca. 15 grader.

Håber det var svar nok på jeres spørgsmål? Ellers må i endelig sige til :) Jeg rejser i Kina i morgen, men vil forsøge at svare når jeg kan.

Mvh
Jes

Nicolai Thilo, By-expressen

10. februar 2015
Hej By-expressen

Jeg skriver til jer fordi jeg sidder med et afgangsprojekt på Aalborg Universitet, hvor jeg godt kunne bruge jeres hjælp!

Vi er i gang med et projekt under emnet "At bliver set i mørket" med hovedfokus på cyklister. Det er her jeg håber i kan hjælpe? Da i igennem jeres arbejde til dagligt bruger cyklen, ville vi høre om i havde nogle regler (arbejdsmiljø regler) med henblik på færden, lys, reflekser på cyklen som vi kunne få indblik i? Vi er interesseret i at høre om de generelle regler men også hvordan jeres ansatte evt. føler sig sikker i trafikken. Alt efter hvad der er lettest for jer, kommer vi gerne til København for at snakke med jer, ellers er vi også mere end glad for alt hjælp vi kan få over mail.

Vi håber på jeres hjælp!

Mange hilsner Marie Skovgaard Mikkelsen & Trine Hæstrup Friberg
11. februar 2015
Hej Marie og Trine,

Vi har ingen særlige regler, udover at vi opfordrer vores bude til at køre med cykelhjelm og overholde færdselsreglerne. Det indebærer, at cyklen skal have det udstyr loven kræver og at der skal lys på, når det er mørkt. Budene kan få bøder af politiet ligesom alle andre og dem skal de selv betale.

Ved nye ansættelser har jeg en enkelt ting, jeg siger omkring sikkerhed: Din og andre trafikanters sikkerhed er altid 1000 gange vigtigere, end den tur du kører med, uanset hvor meget den haster. Lad være med at tage chancer.

Ellers er det op til det individuelle bud, hvad der skal til for at han føler sig tryg. F.eks. vil nogen helst køre med klikpedaler og føler sig usikre på almindelige pedaler (fordi man så kan glide af) - andre føler sig utrygge ved at være låst fast i pedalerne og foretrækker flade pedaler. Så det er meget forskelligt hvad der skal til og derfor lader vi det være op til budet selv.

Med venlig hilsen

Nicolai Thilo

Cecilia Serednicka, Bring

10. februar 2015
Hej Bring

Jeg skriver til jer fordi jeg sidder med et afgangsprojekt på Aalborg Universitet, hvor jeg godt kunne bruge jeres hjælp!

Vi er i gang med et projekt under emnet "At bliver set i mørket" med hovedfokus på cyklister. Det er her jeg håber i kan hjælpe? Da i igennem jeres arbejde til dagligt bruger cyklen, ville vi høre om i havde nogle regler (arbejdsmiljø regler) med henblik på færden, lys, reflekser på cyklen som vi kunne få indblik i? Vi er interesseret i at høre om de generelle regler men også hvordan jeres ansatte evt. føler sig sikker i trafikken. Alt efter hvad der er lettest for jer, kommer vi gerne til København for at snakke med jer, ellers er vi også mere end glad for alt hjælp vi kan få over mail.

Vi håber på jeres hjælp!
Mange hilsner Marie Skovgaard Mikkelsen & Trine Hæstrup Friberg
12. februar 2015
Kære Marie og Trine

Tak for din henvendelse og vi vil naturligvis gerne hjælpe med empiri til jeres afgangsprojekt.

Tænker vi i første omgang, kan tage korrespondancen via mail og hvis det viser sig, I får brug får at mødes, kan vi selvfølgelig også godt gøre det.

Prøv at send mig en udspecificering af de oplysninger I præcist søger.

Med venlig hilsen
Cecilia Serednicka

13. februar 2015

Hej Cecilia

Tak fordi du vil hjælpe!

Det vi søger er om i har nogle forholdsregler, arbejdsmarkedskrav osv. til jeres cykelbude mht sikkerhed. Det jeg tænker er om de anvender lys, reflekser, veste osv. Om det er et krav fra jeres side (firmaet) eller om de selv har ansvar for det? Er der noget udstyr på cyklen, som går udover det sædvanlige udstyr?

Tak!
Mange hilsner Trine & Marie

17. februar2015
Kære begge

Vi stiller de krav til vores cykelbude, at de naturligvis skal køre på en godkendt cykel, ud fra de paragraffer Færdselsstyrelsen stiller i Udstyrsbekendtgørelsen. Af ekstra udstyr kræver vi, at cykelbudene kører med for- og bagskærm dette primært for, at minimere jord og mudder på rygsæk og uniform, samt på evt. forsendelser der stikker op af rygsækken.

Endvidere skal vores bude køre med en godkendt cykelhjelm og naturligvis overholde gældende færdselsregler.

For at sikre, at det nu også er sådan virkeligheden er, fortager vi kvalitetstjek hver den først onsdag i måneden.

Med venlig hilsen
Cecilia Serednicka

Christian Svendsen, Post Danmark

11. februar 2015
Hej Christian

Som tidligere aftalt sender jeg hermed en mail men henblik på hjælp til vores afgangsprojekt på Aalborg Universitet med emnet "At blive set i mørket".

Vores hensigt med at kontakte PostDanmark er at få et indblik i jeres sikkerhed, vaner evt. arbejdsmiljøkrav og hvordan postbudene på cykel oplever deres daglige arbejde i trafikken og blandt andet i mørke.

Vi havde forestillet os (hurtigst muligt og gerne i denne måned) at kunne få lov til at se postcyklerne med henblik på lygter, reflekser osv. Er det en mulighed ville det være fedt at kunne få lov til at observere postbuddet i arbejde.

Vi er selvfølgelig klar på at tilpasse os, jeres arbejdsvaner, tidsplaner og vil selvfølgelig være så lille en gene som muligt for arbejdet. Virker dette for tidskrævende, er vi også interesseret i et møde på bare en halv time, eller det materiale i kan sende til os pr. mail. Alt det data vi samler sammen, kan hvis ønskes, forblive fortroligt og kun blive brugt internt i vores projekt.

Tak for hjælpen allerede, og forhåbentlig tales vi ved!

Mange hilsner
Trine Hæstrup Friberg & Marie Skovgaard Mikkelsen

11. februar 2015
Hej Trine

Tak for din mail. Jeg går i gang med at undersøge mulighederne, og om der er nogle, der har tid og ressourcer til at deltage.

Nu kan jeg se, at emnet er "at blive set i mørket". Vores cykelbude cykler jo typisk først ud på ruten efter kl. 8, så anvendelsen af lygter og reflekser er jo umiddelbart ikke et parameter, der gør sig gældende for tiden, hvor det bliver lyst før kl. 8, og slet ikke i forhold til den lysere tid, der venter foran os nu.

Så jeg ved ikke, om vi overhovedet er en relevant case (hvis det i det hele taget kan lykkes)?

Med venlig hilsen

Christian Dahl Svendsen

11. februar 2015
Hej Christian

Vi ved godt at det ikke er helt aktuelt nu og derfor er observation ikke nødvendig. Men vi er stadig interesseret i at høre hvilke udfordringer de møder i hverdagen, da de engang imellem kører i mørke. Vores fokus er nu mørke, men der er også problematikker i dagslys eller når det regner, og disse bliver (nogle gange) forværret hvis der også er mørkt.

Tak for hjælpen og det hurtige svar.
Venlig hilsen Marie og Trine

18. februar 2015
Hej Trine

Så har jeg undersøgt det, og jeg har fået den melding, at det desværre ikke er noget, vi pt. har ressourcer til at kunne hjælpe jer med.

Venlig hilsen
Christian

Lumiline

PRODUCT REPORT 1

MSc04ID group 1 / Aalborg University / May 2015


1

TITLEPAGE

Title	Lumiline
Theme	"To be seen in the dark"
Period	2/2 - 2015 to 11/6 - 2015
Group	Group 1, MSc 04 ID, Industrial Design Institute of Architecture, Design & Media Technology, Aalborg University
Supervisor	Finn Schou
Techincal supervisor	Benny Ørtoft Endelt
Issue	9
Number of pages	28

ABSTRACT

Denne produktrapport er en præsentation af Lumiline som er et sæt cykellygter, der medhjælper at cyklisten er mere synlig i mørke og medtrafikanter kan se i hvilken retning cyklisten skal. I rapporten er produktets features vist først, hvorefter brugen er vist i form at fiksering til cyklen, samt styringen. Herefter bliver produktets komponenter beskrev og til sidst business, herunder pris og salg. Her er brugt renderinger, visualiseringer og produktet i kontekst, for at vise produktets features.

INTRODUCTION

This product report shows Lumiline, which is bicycle light designed for the normal cyclist who use their bike to work, school, etc. The intention with the project is to design a product that creates attention in the dark and thereby increase the traffic safety for cyclists. The bicycle lights contain a rear and headlight, which both makes the cyclist more visible when moving around in traffic, where the cyclists are one of the road users that are involved in most accidents.

ILLUSTRATIONS

Frontpage: own illustration

Page 1-4:
Background http://www.futuristech.info/etc/new-display-adjusts-automatically-based-on-your-vision-no-more-reading-glasses

Page 5-12: own illustrations

Page 13-14: picture from http://www.4shared.com/all-images/qLTMbpmK/Cool_HD_Desktop_Wallpapers.html. Own renderings

Page 15-22: Own pictures and renderings

Page 23:
http://www.rabatkortet.dk/images/logo/cykelpartner-logo.jpg
http://www.cykelogautoboersen.dk/upload/fricykler.jpg
http://bestofskive.dk/f/blog/article/5bb83baabb0769e67a49d-2356a86b4e7dca8edc5.png
http://www.trygfonden.dk/Om-Tryg-Fonden/Presse

Page 24: picture from http://www.kristeligt-dagblad.dk/liv-sj%C3%A6l/psykel-regulering

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MISSION

"We want to improve the traffic safety, by making cyclists more visible and make it easier for the car drivers to see how the cyclist is moving in the traffic. This will be carried out by designing a product cyclists want to use, why it should not be a hassle or create attention when not in use. The source to create attention will be light, because it stand out from the city environment, as well as the country road."

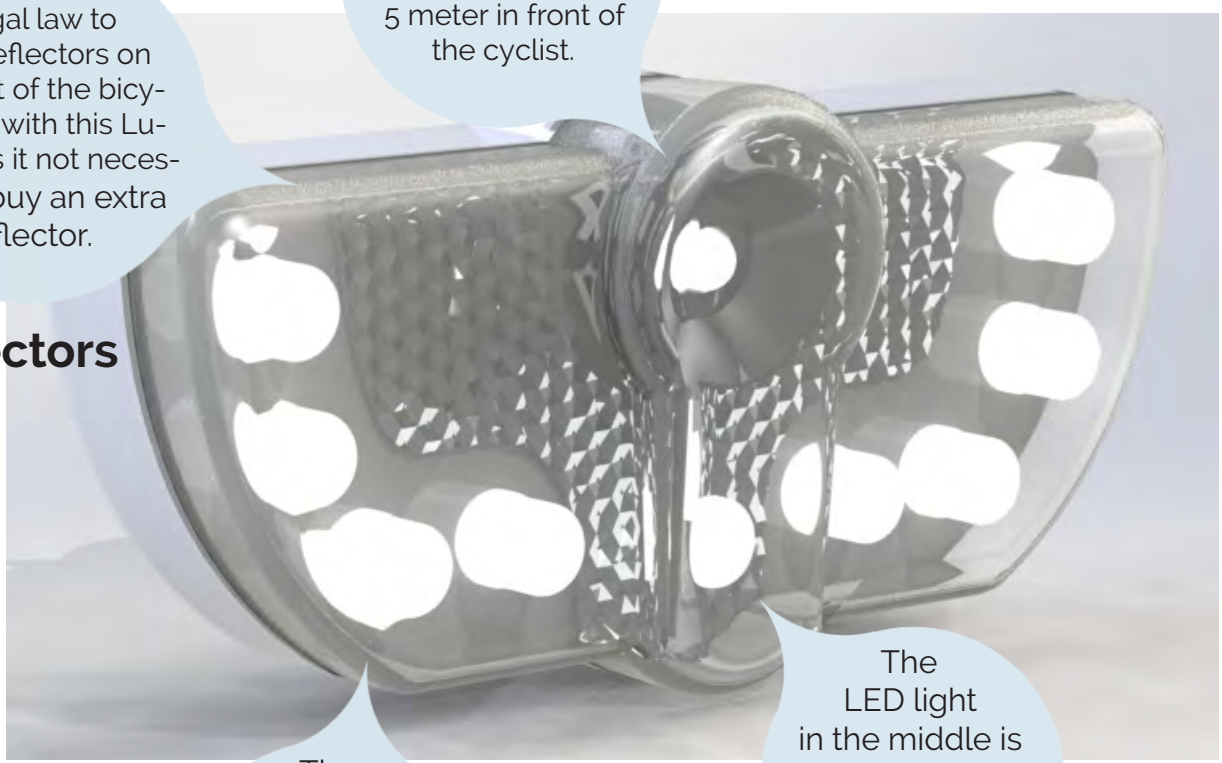
FEATURES

visibility light

A
star LED and
a cylindrical lens
creates a line of
light, that is visible
5 meter in front of
the cyclist.

It is
a legal law to
have reflectors on
the front of the bicy-
cle, and with this Lu-
miLight is it not neces-
sary to buy an extra
reflector.

reflectors



The
LED lights
blink two at the
time, from the mid-
dle and out, when
the cyclist turn
it on.

orientation light

The
LED light
in the middle is
always lightning
when the bicycle
light is turned
on.

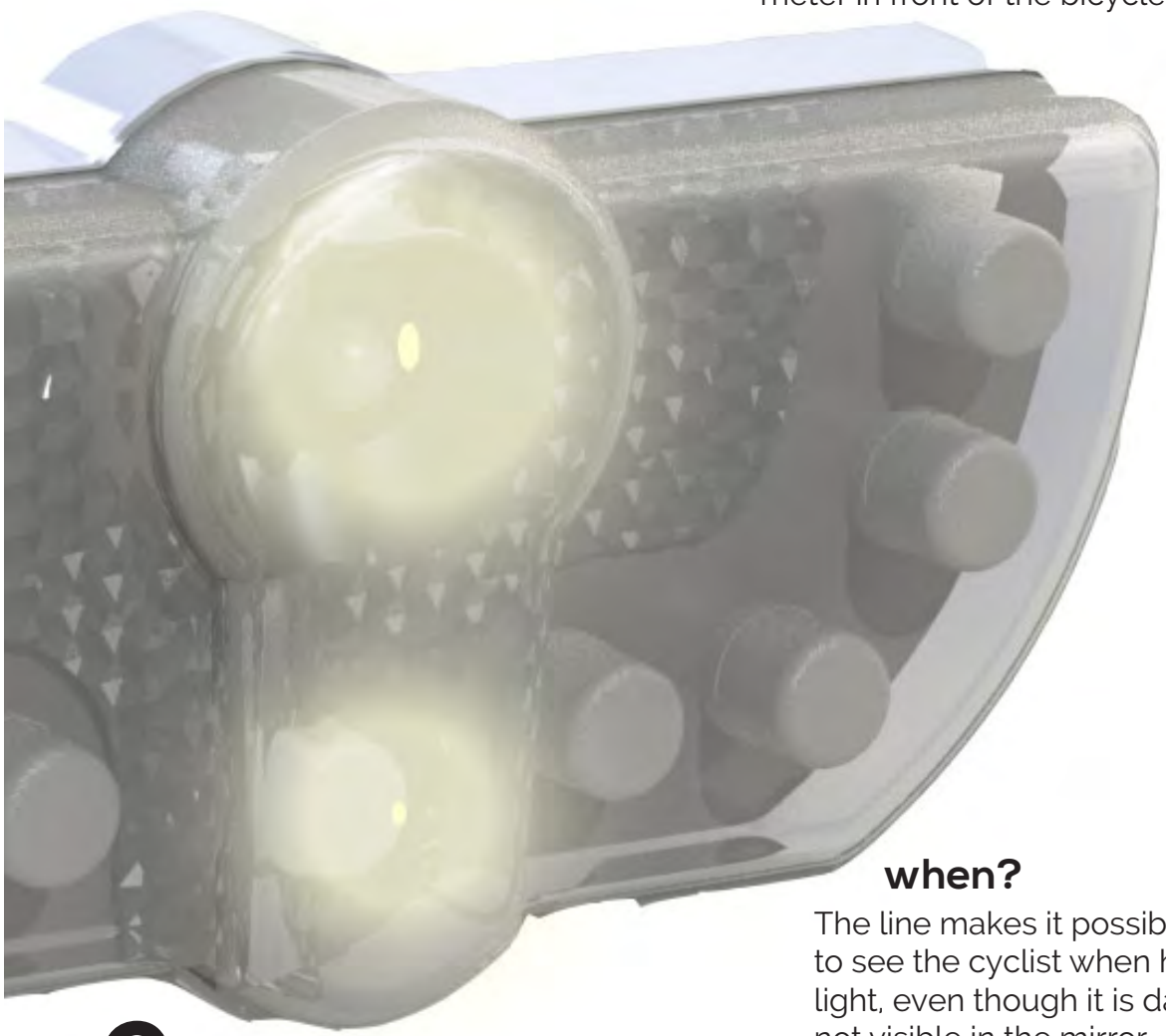
driving light


VISIBILITY
8

VISIBILITY

line of light

A cylindrical lens reflect the light, and thereby creates a light line on the ground. The line is visible 5 meter in front of the bicycle.



when?

The line makes it possible for the truck driver to see the cyclist when holding still in a traffic light, even though it is dark and the cyclist is not visible in the mirror.


ORIENTATION
11

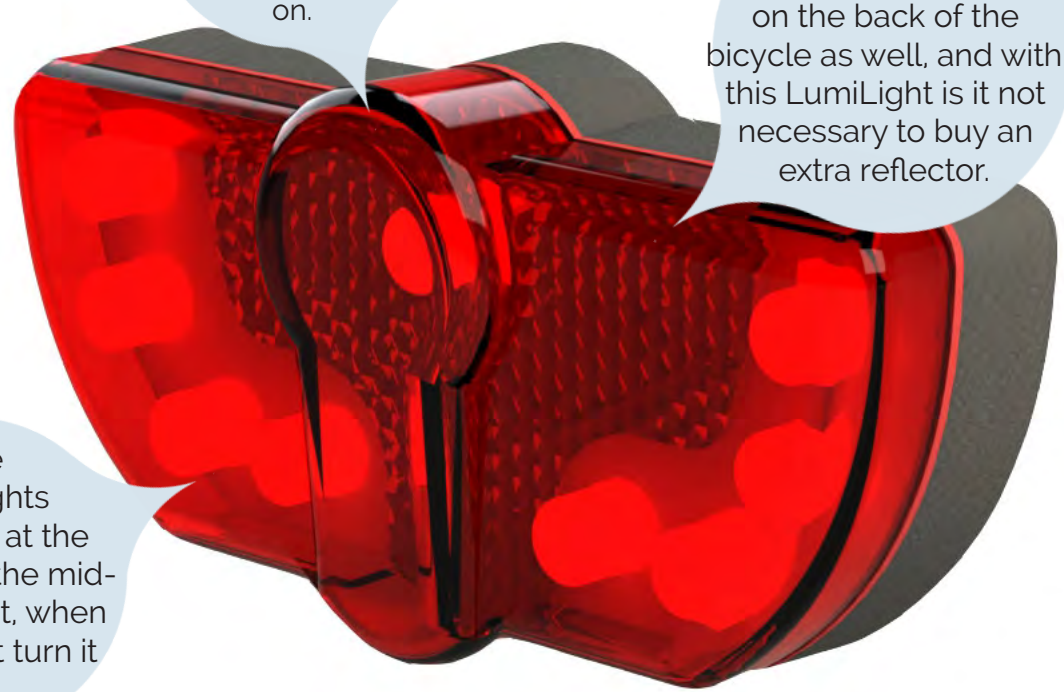
FEATURES

safety light

The LED light in the middle is always lightning when the bicycle light is turned on.

reflectors

It is a legal law to have reflectors on the back of the bicycle as well, and with this LumiLight is it not necessary to buy an extra reflector.



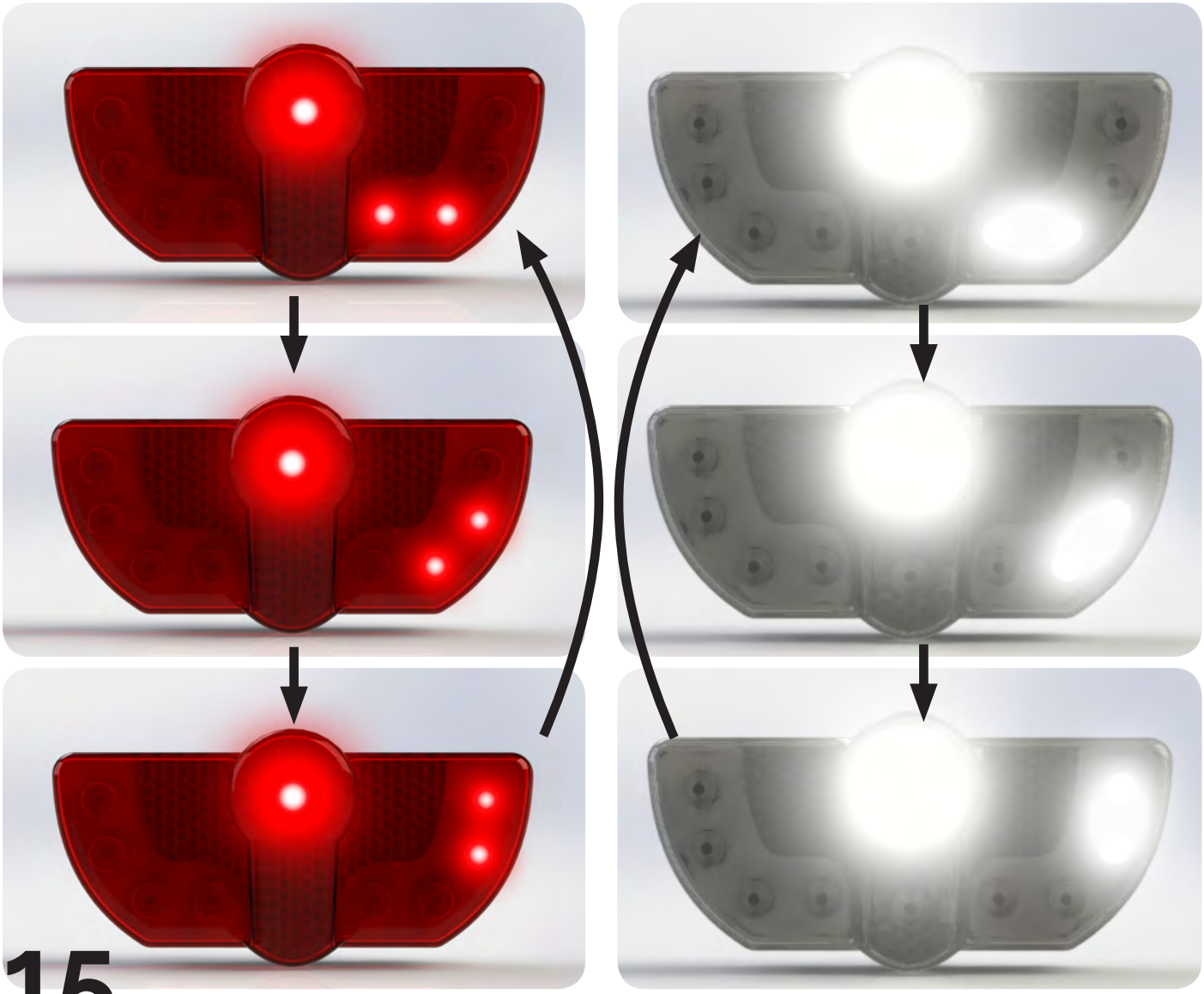
The LED lights blink two at the time, from the middle and out, when the cyclist turn it

orientation light


14

ORIENTATION

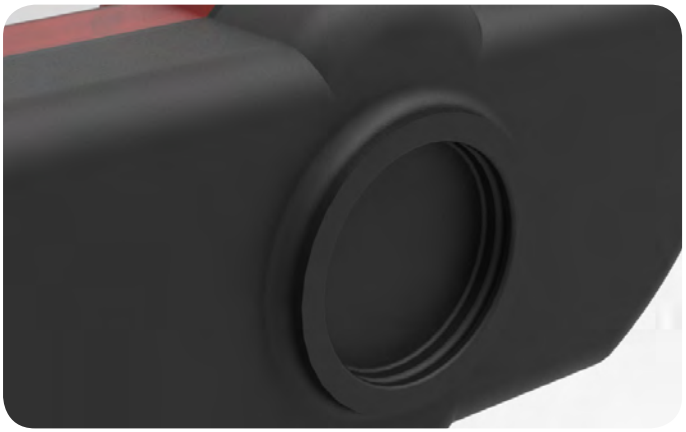
Interface on the handlebar moustage control both head- and rearlight.



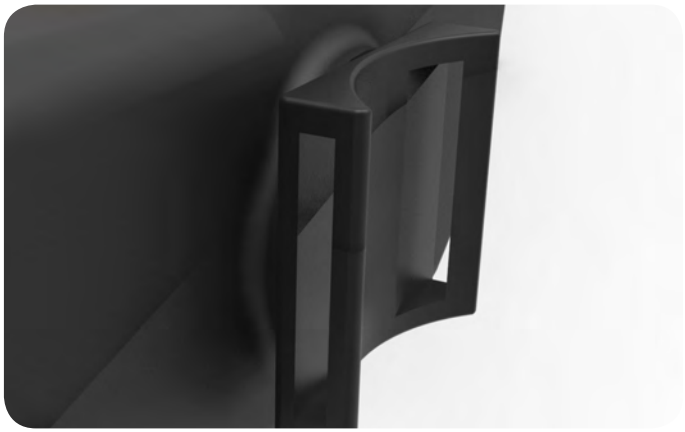
ATTACHMENT

fixing for bars

The lights are overall two parts; the bicycle light and a fixing part. There are two different fixing parts, one for the bars and one for a bicycle basket.



1. The back of the light have a round snap fit.

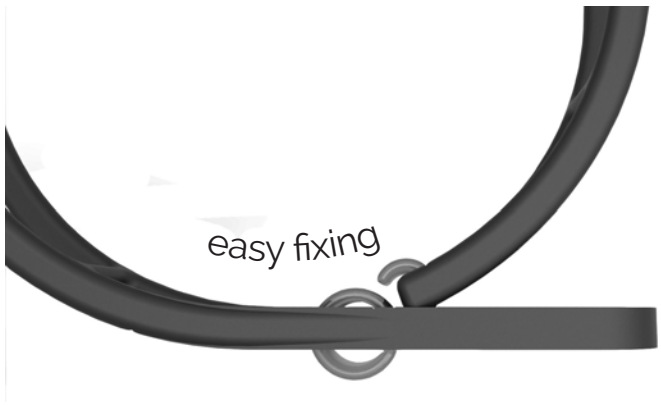


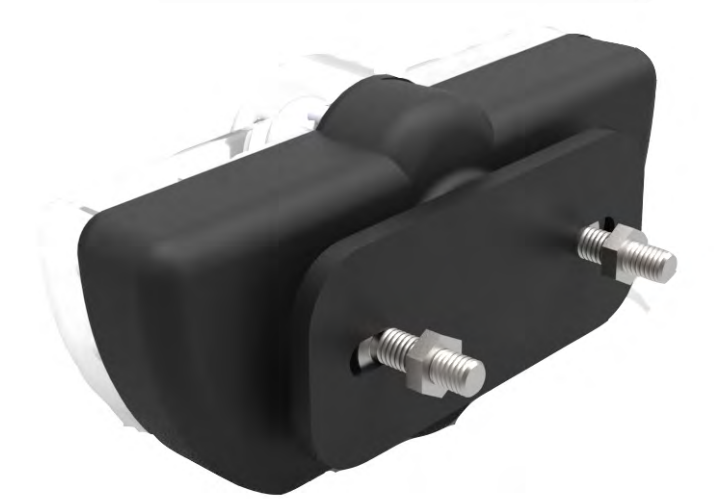
3. The parts are fastened and the strap can be slided through the holes.

2. This part snap to the back of the light.

4. The bicycle light, ready for the bicycle!

fixing for bicycle baskets





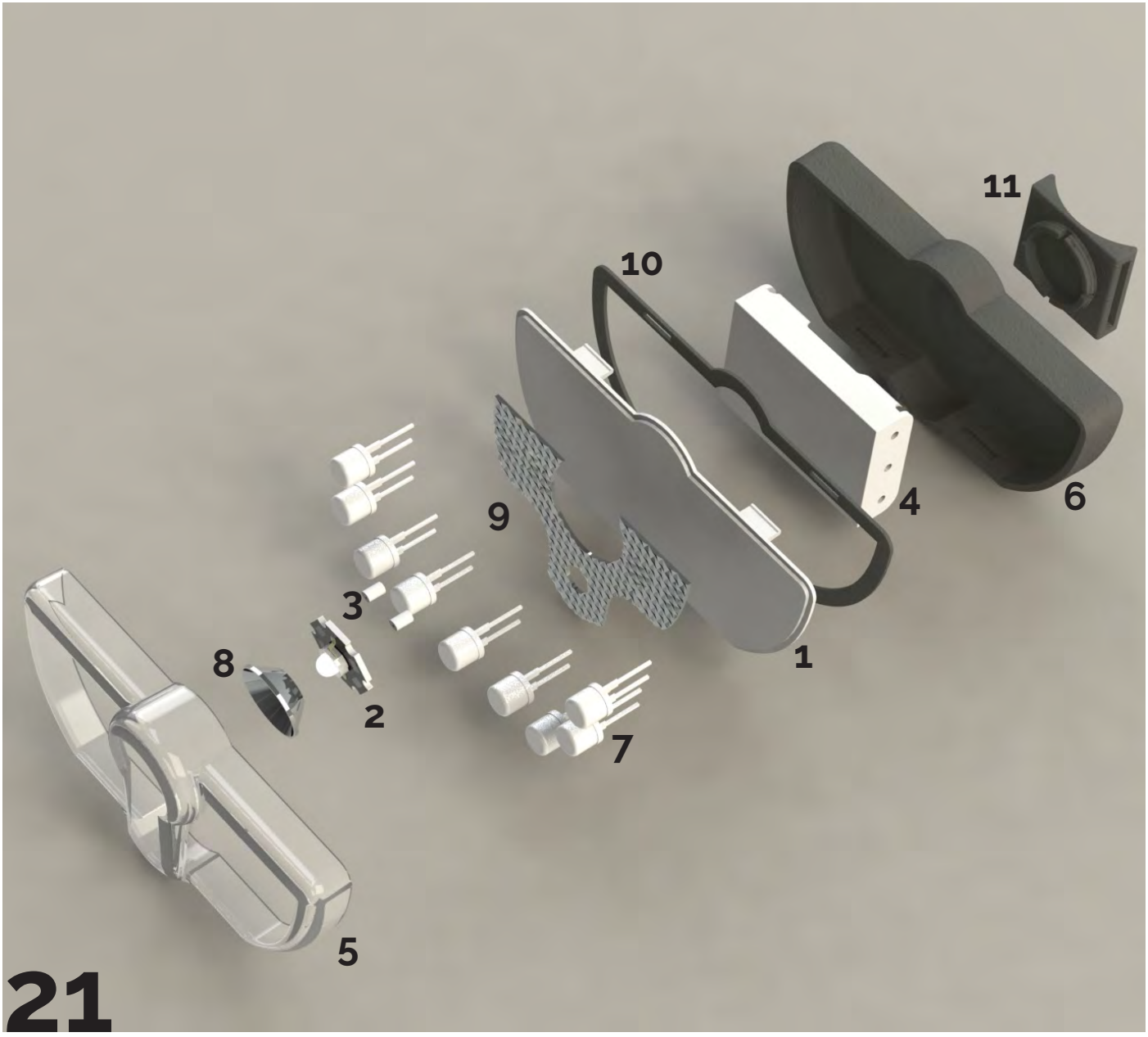
A plate is fixed to the bicycle basket with two screws. The snap fit is the same as when fixing the light to bars.

INTERFACE

The interface consist of three buttons, that operate the signal lights and the extra visibility light.
The interface, with its mutiple attachment possibility, allow the user to decide on its own, in which side of the handlebar, it should be placed.

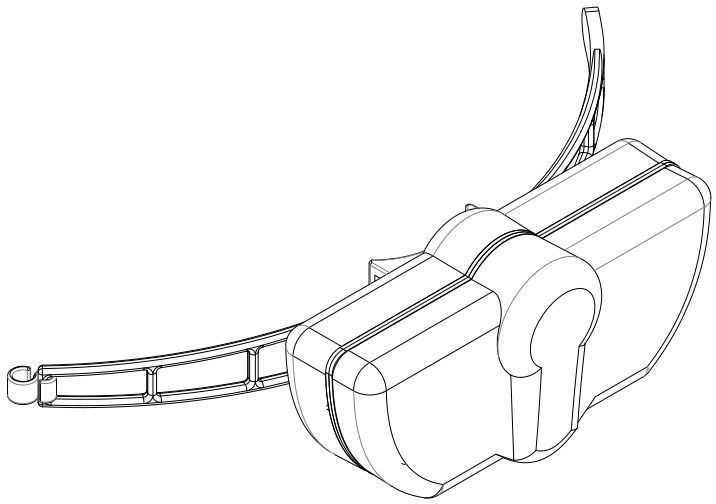

weather proof
EPDM covered housing
feedback
Button lights up when activated
easy interaction
Few buttoms to operate
EPDM esnures soft surface
soft surface

COMPONENTS

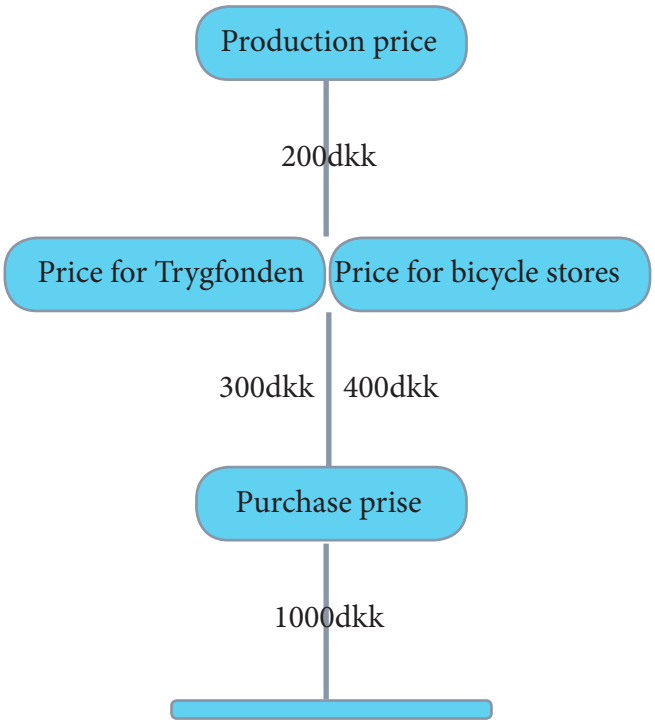


BOM

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Print Curcuit Board	Fibreglass	1
2	Star LED	3 watt	1
3	Support profile	ABS	2
4	AAA battery case	ABS	1
5	Transparent top housing	PC	1
6	Bottom housing	ABS	1
7	White LED	0,5 watt, Ø8mm	9
8	Parabolic reflector	ABS	1
9	White reflector	ABS	1
10	Membrane	EPDM	1
11	Fixture	ABS	1
12	Rubberband	EPDM	1
13	Hook	ABS	1



BUSINESS



It is estimated that 14000 will purchase Lumiline. This number is based on that 1.4 millions bicycles are sold every year in Holland and Denmark, and it is expected that Lumiline will be 0.5% of these lights for two years.

When producing 14000 set of bicycle lights, 28000 bicycle lights in total, the production price will be around 200dkk.

Then the cost for the bicycle stores is 400dkk, and they sell it to the customers for 1000dkk.

When running a campaign with Trygfonden, Trygfonden can purchase the bicycle lights cheaper than the normal bicycle store. This due to the fact that they help promoting the product.

awareness

Awareness about Lumiline through Trygfonden, who often have campaigns.
Campaign about safety as a cyclists when it is dark, where the customer get an offer if it is purchased through Trygfonden.

TrygFonden

after campaign

In bicycle stores and on websites.

Cykelpartner.dk
Cykler, tøj, udstyr og reservedele

Fri CYKLER

Fri BikeShop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