

# **Design Document**

## **Virtual Daylight System**



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**Design Document**

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## **1. Context**

Sunlight provides the man many advantages, both psychologically and physically. Because people are now increasingly working and learning indoors and spending much more time indoors, they spend less time in contact with sunlight. Also, the dark days in the winter affects the people generally. The lack of sunlight creates the famous "winter blues".

All this lack of sunlight has considerable influence on people. They are easily depressed and they feel not as good as on a summer day. Also, the human body depends on the sun for the production of certain vitamins and substances that we need.

In order to address this a system is developed that offers the benefits of the sun by using UV light. This is called the Virtual Daylight System. By using UV light, which is the active factor behind some benefits of sunlight, you can stay indoors without missing the benefits of the sun.



## **2. Assignment**

For my minor I have been instructed to create an interaction and interface design for the Virtual Daylight System. The complexity of all light elements and the control of a Virtual Daylight system must be made simple and manageable, so that the average user, the normal Dutch consumer, can use the Virtual Daylight System.

It is required of me that I come with many innovative concepts, the end user at all times is key and I'm trying to make any final design prototypes. I must also consider Ethnographic design and the psychological response of users to the Virtual Daylight System.

Some other demands made are;

- Complexity of the system must be hidden
- Create simple shapes of interaction
- Positive psychological / physiological effect must be supported
- Ethnographic Design should be applied
- Consider any psychological response to the draft

### **3. Appointments**

Important appointments on the Minor;

- The complexity of the VDS should be hidden.
- A simple and insightful interaction should be designed.
- Individuals should have the ability to create a perfect day experience for particular time and locations.
- The psychological and physical benefits of the sun should be supported.
- The design is, chosen in a particular context, focusing on hotels bathrooms.

### **4. Problem**

As more people spending more time indoors, and also because people spend increasingly long hours on the indoors workplace, there's initiative to develop a system that actually brings the sun indoors. This system has to compensate the disadvantages of lack of natural sunlight and has to provide the benefits of sunlight to people spending much time working, living and staying indoors.

The problem in the project has been prepared on the basis of the context and mission on the Virtual Daylight system. The core of my mission is to design a good interface for the Virtual Daylight System used by an innovative and comprehensive end-user interaction of offering the psychological and physical benefits of the sun. It is very important to hide the complexity of the light elements and UV light.

After the initial configurations of the problem it is not changed. This is because many students and people with whom I have discussed the problem, have indicated that they felt that this approach of the problem was powerful enough.

The problem as an issue which I use for the project is as follows;

"How can I, through an understandable and manageable communicate interface elements and values of (UV) light to the end user?"



## **5. Audience Description and justification**

The chosen context of my case focuses on the hotels bathrooms.

My target audience is; Business people who regularly stay in a hotel because of their work.

The Virtual Daylight system certainly has something to offer to this group, in my vision. The connection of the product in this group, in short, the 'click', lies in the multiple benefits that UV light provides for the customer.

To briefly go, the UV light can provide include relaxation, tanning the skin and is good for the skin. In addition, UV light is good for the mood.

These are all things that the businessman benefit from it. Business people are often busy because of their responsibility and because of they are very much involved with their work. They also are busy very often. And they are relatively often stressed.

The VDS is able to offer a relaxed feeling in relatively little time, so the businessman comes across better on his business partners. Of course this is well and healthy for himself. The VDS can also improve mood, which also ensures that the businessman senses better to the people he will face. On the other side a good mood makes people more productive. The VDS can also enable a tanned skin. Ideal for a businessman who has little time, but still wants to look good and also counts getting a tanned skin.

The UV light is anyway good for the skin. And as with the previous point, a businessman wants to look good if he meets business partners or other people. So, the business man is benefited on two points regarding his appearance. With the above points, I think the VDS is ideal for business people. But that does not mean that other people cannot take advantage of the VDS.

However, there is a sub-target only regarding the research. Namely hotel owners. I think it's important to know what their vision to the Virtual Daylight System is. It is directed to their hotel so hotel owners have to see the added value of Virtual Daylight System.

I also wanted to know what the vision of hotel owners is regarding the site of the system within a bathroom and on other applications.



## **6. Research strategies and choices**

Research plan

- What should I know?
- Audience Research
- Product Research
- Research of interaction design

### **What should I know?**

Before the research began, I first put on a list for myself what information I needed to run the case. So I have a list of everything I should be familiar.

Some examples are shown below;

- What kind of interaction works (from the audience) as best for a system that is developed to bring the sun in home?
- What are the elements of light and which are important for the end user?
- Are there other requirements that the target has on a Virtual Daylight System?
- What positive effects do the sun and UV light have on humans?
- How can the controls of the light elements been made manageable for the end user?
- Which elements in the system must be adaptable and to what extent?
- What opportunities does the end user prefer in such a system?

## **7. Audience Research**

After the target was determined, I went building up interviews to the target groups. For the end user and the hotel owners, I have both made separate interviews with questions specific to the vision and preferences of each target to be exposed.

For end users, I have handled the interview questions mainly pertaining to the operation of certain elements within the Virtual Daylight System. There is also asked to the expectations of a Virtual Daylight System and UV light. I also inquired to any additional applications that the interviewees saw in UV light, a mood lighting system and how they would combine the system with standard lighting.

After the interviews, I began to analyze them and did so with the needs and preferences of the group of potential users and putted them together a list for myself. I did the same with any ideas and proposals that emerged from the interviews. I also focused on the vision of hotel owners.

The vision of hotel owners is hardly applicable for the interface and interaction design. However, the appearance and design of the Virtual Daylight System as a product on the market, the vision of hotel owners can include somewhat important content. One example is that many hotel owners say that the Virtual Daylight System in appearance is needed to be able to go into the design and style of a hotel.

## **Personas**

Based on interviews with end users, I have put together some personas. These are fictional people who serve as a comprehensive reference material for the design phase. These personas are used to identify problems or errors in the interaction design in the draft phases.

I have chosen this because this is a very effective method to design similar to the requirements of end users. Plus you can more easily find points where the design must be improved or adjusted.

## **8. Product Research**

After the audience research I started the product research. The product is actually light, or rather UV light. I have therefore investigated the elements of light, color, infrared light as a phenomenon in itself and existing (atmospheric) lighting. I also investigated the possible applicability of infrared light and an ambient lighting system.

There is also done research into various existing interaction forms used for other light systems to control, but also the interaction with sunbeds and devices that use infrared. This is intended as a small preliminary research of the interaction.

I opted for an extensive product research because UV light is the essence of the entire Virtual Daylight System. So therefore should I well know what UV light is and what we can do with it. Besides, if I want to add a mood lighting system or infrared light to the system for offering additional possibilities, I should of course know how this can work.

### **UV light**

There are three types of UV light, as opposed to UVA, UVB and UVC. Of these, only UV-A is a possibility in the VDS, as this is the only form of UV light what is not harmful to humans. UV-C, the most harmful form, reaches the earth by the filtering action of the atmosphere. Like visible light, UV light is brighter on the water, by reflection. UV light is also reflected on the ground and most notably on white sand and snow.

UV radiation is expressed in "minimum erythemal dose". MED is the amount of radiation that causes skin reddening.

### **Disadvantages UV light**

UV light is largely responsible for skin aging, eye damage (cataracts) (at a minimum excess UVB) sunscreen to the skin.

UVA can penetrate the skin rather deep, where it can cause damage to DNA and cell bodies. Also UVB can cause snow blindness and skin cancer.

### **Benefits UV light**

UV is responsible for the production of vitamin B, which is essential for health. UV also allows the production of pigment, which colors the skin brown. In addition, UV stimulates the production of endorphins, that makes people feel good. In addition, UV light is the cause of a slight warming of the skin.

UV also works against skin diseases like eczema, vitiligo, psoriasis.

## **9. Research on interaction design**

To achieve the best possible interaction design to get on hand, I looked at the interaction design of other light-related products. I also have my concepts compared to the needs and preferences of end users.

The investigation of the interaction is intended to both concepts to be strengthened, and to be able to design the interaction so that end users do not have completely opposite expectations when manipulating the elements in the Virtual Daylight System.

I also researched the possibilities with the Kinect as interaction form. There is also research into new forms of interaction that match existing, typical interaction that takes place in the hotel bathrooms already.

## **10. Conclusions group research**

### **The interviews**

Very many types of people might use a hotel. Sometimes this is a once a year, sometimes this is on a regular basis. Such as businessmen who travel a lot are on average overnighiting about 2 to 3 nights a week in a hotel.

Some are families, elderly people who sometimes want to leave home for a few days, many businessmen and sometimes a person who has been set out of his house or through other circumstances not has a home to sleep.

Many times people only sleep in their hotel room. Other times they prefer to stay outside in the restaurant or they visit a café nearby. Heart of the matter is that people really only stay in the hotel room for sleep or for personal care.

### **Expectations**

The average expectation is that the system must be easy to operate. They do not want to mess around and juggle to achieve the correct settings. It is expected that the Virtual Daylight System gives a fit and a summery feeling.

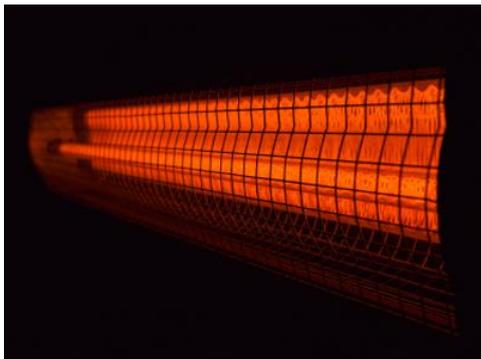
The group also has the simple expectation that the Virtual Daylight System must be safe, cannot cause any fire and that the system is not harmful to health.



## **11.      Additional ideas**

From the interviews several additional ideas have been emerged.

- Some interviewees suggested the idea that UV light also helps against psoriasis, skin eczema and other skin diseases. They may still use UV lamps to shine on places on the skin to heal the skin.
- Infrared lamps are also discussed, which people use to relieve muscle aches.
- A few people from the audience came up with the idea of Virtual Daylight System as well as a wake-up use. The VDS would be as the natural dawn to simulate the light slowly but surely to burn brighter.
- Another idea that is often suggested, and I myself have thought about it, is the addition of a mood lighting system.
- It is the idea to several versions of the Virtual Daylight system to sell them. There have been several versions named as elongated lights along the ceiling or along the wall, or else a compact device that shines the entire space.
- Some of the audience indicated that it would be nice if the Virtual Daylight System would include a remote control.
- Also automatic or programmed settings were referred to as a good addition to the capabilities of the Virtual Daylight System.



## **12. Solutions used in the concept**

### **Insights features UV light**

This intermediate target is the reason for me to focus the Virtual Daylight System on one of the most common type of hotel visitors, businessmen.

### **Prevention of fiddling with the interface**

As business people often have little time, I opted for the interaction as simple and effective as possible. If they are at their hotel, they want to spend time on personal care, recreation and to rest.

That is why I have chosen for a simple interaction design to make sure that a hotel guest can quickly set the system to his wishes and so that he is able to understand how to use the system within a few minutes. Even when he has never seen the system before.

To prevent fiddling I added some extra options as well. As first I added a help what can be reached by the help button in the upper right corner of the main screen. I also added a screen where everything is explained about safe use of the system. The user is able to prevent uneasy situations by reading these safety instructions. If the user is just exploring the system and not want to use it immediately, he is able to return to the main screen easily by using the back buttons.

The target group is businessman. However, I have take into account dyslexics, poorly sighted and low literacy. For these people I added a voice function what will explain the content and use of the system with a pleasant voice. The user can switch this option on or off by using the special button with a mouth on it. This button is shown on the main screen.

To prevent fiddling with the language, I added the language button. This button makes it possible for the user to switch to another language. In the presentation model of the interface, I added english, dutch and german. But almost all languages in the world can be added.

### **Best interaction solution**

The interaction study has also revealed that a touchscreen interaction in this situation is the best solution.

So I finally opted for a touchscreen interface, with a help screen to support the use of the system. I also added a screen where safety instructions are explained.

To reach these different sceens simple buttons are added with a short, effective description. And when the user is on the screen where he can select a skin type and start the UV light, he can simply compare himself to descriptions given on six cards/ buttons which are representing the six skin types that people could have.

### **Preventing too much UV radiation**

To prevent that the user is receiving to much UV radiation, I designed a system of cards. These cards are shown on an extra sceen what can be reached by pressing the "Set UV light" button. On these cards are descibed the existing skin types and the user may choose one of them comparing the description to himself.

Depending on what card is chosen, the system gives a maximum amount of UV radiation. This amount is depending on the skin type and will never be to high. By example, the amount of radiation given when skin type 2 is chosen is lower then

if the skin type 4 is chosen. But the maximum radiation, the amount that is given by choosing skin type 6 will never be too dangerous for someone with skin type 4. This is because of people sometimes are not able to effectively choose the right skin type. So the amount of radiation is already weakened somewhat.

I also added the behaviour in the system that it will switch off the UV light after 3 hours. The system is thus set to give 3 hours of UV radiation to all type of skins. The system also has a security that is controlling that at maximum 3 hours of radiation are given per day.

### **13.      Concept**

My concept is aimed to let the user enjoy the benefits of the sun and UV light as simple as possible. To this end, the simplest possible interface is designed, which allows to reach the desired settings within a few seconds.

The main screen contains a slider what can be used to control the visible light, what is needed to see in the dark. So the control for normal lamps is also implemented. Next to the slider are two buttons. These are named "Set UV light" and "UV light off". The first button is used to reach a screen where the user can select his skin type on one of the six cards/ buttons. As next, he touches the button "Switch on UV light" to start the UV lamp. The other button on the main screen, called "UV light off" can immediately be used to switch the UV light off.

So the main content are the slider and the two buttons to control the UV light (in combination with the 2nd screen where the skin type is selected).

The other buttons on the main screen are for support. At first, we have the help button in the upper right corner, which gives the user the possibility to get help to understand the working of the system. So this button gives access to the help screen.

As second, there is the language button, which allows the user to switch to another language. In the presentation model are English, Dutch and German as languages. But all languages in the world are possible to be added in the system.

As third, there is the button "What is safe?" This button shows a screen where safety instructions are given and where the user is informed about how to use the system as safe as possible.

As fourth, there is a special button. Down to the help button, there is a button which shows a mouth on it. This button gives the user the possibility to switch on or off a voice function. This voice function will activate a pleasant voice who will tell the user what the buttons on the main screen are doing and when the user goes to the help screen or the safety instructions, the voice will tell the user what is written on these screens.

This button is added to give dyslexics, poorly sighted and low literated the possibility to use the system as well.

#### **13.1   Position**

The interface is positioned into a touch screen display that is posted on the wall. Its placement looks like any other display that is posted on a wall. For the owner of the hotel it is his own choice where in a bathroom the system is exactly positioned. But the core is that the display is posted against or into the wall.

Of course, as the system is developed for and meant to be placed in the bathroom, it would be logic that the display is placed in the bathroom.



#### **14.      System behavior**

In the system, which in my case has a lot to do with the interaction design, the main goal has been to get the interaction as simple as possible.

My system is aimed to let end users make the desired settings as simple as possible regarding the UV and visible light. I also tried to let the user set certain preferences in the expert panel as simple as possible. By a clear, simple communication towards the user, he is able to understand within a few seconds how the user can use the system and enjoy the benefits.

The entire interface is implemented in a touchscreen.

##### **Starting up**

Once the system is turned on or off, the touch screen and the rest of the system is thus started. If this is technically desirable, a loading screen follows. Then the standard interface appears on-screen. It is intended that a user can start enjoying the sunshine in house within two seconds after starting the Virtual Daylight System.

##### **Elements**

Once the UV light is ordered to start, the elements begin to adapt. This is the same for the normal light (what we need to see in the dark), when the user is moving the slider. So the lighting and radiation levels respond directly to the user actions. Thus, the user is able to immediately experience and feel how the new settings please him. After selecting a skin type and activating the UV light, the system will return to the main menu.

### **Switching screens**

When the user is switching to another screen, the targeted screen appears immediately. Also if the user chooses another language, the interface is immediately changing to another language.

### **Indicate choice for skin type**

When the user has chosen a skin type, the concerning button will change its background colour to yellow instead of white.

### **Switching on the voice function**

When the user switches on the voice function, the voice will start telling about the functions of the buttons on the main screen. The voice will also say it when the user is going to another screen or is choosing another language.

When the user switches to the help screen or the screen with safety instructions, the voice will indicate that the user is entering another screen and what screen this is. After this the voice will start to tell what is readable on these screens.

When the user chooses for the "Set UV light" button, the voice will start explaining what skin types are distinguished and where they are located on the map of cards/ buttons.

After that the voice will tell where the back button is and also where the button is to switch on the UV light. When the user choose one of these buttons the voice will tell the user that he is returning to the main screen and that the UV light is switched on or not.

## **15. Design Choices**

### **• Why do I have the simplest possible interface design?**

Because users often do not feel likely to read the manual, I have chosen the to keep the interaction so clear and simple to maintain, that even no instructions are needed for a successful use of the device.

### **• Why did I choose for a touch-screen interface?**

I opted for a touchscreen interface because this is a good basis for the simplest possible interface. It has all the controls together in a compact, relatively small screen. In addition, this makes a physical button panel superfluous and hences any knowledge needed to understand more complex systems.

### **• Why is the interface designed in such a way as?**

The interface has got it's current form by the simple layout of buttons and the minimum of functions. The interface is designed as such because I believed that a simple, clean interface was important for a clear visual communication between device and user.

### **• Why are infrared light and the ambient light color system not added?**

The infrared light and the ambient light color system are not added because it is not on the one hand the vision of half the audience. Secondly, it makes the system much more complicated.

- **Why did I choose to add a voice function?**

I was checking out a list of check points on the internet when I was looking for good points where the functionality have to be tested on. When I watched this list I saw a point what made me think. "Are dyslexics, poorly sighted and illiterate people taken into account in the interaction?"

Under that question I saw that dyslexics, poorly sighted and illiterate people are groups of respectively 238.000, 825.000 and 1.500.000 people in the Netherlands only. Added together this are more than 2,5 million Dutch people. Then I did nothing say about the rest of the world population.

Because of this group is yet 15% of all Dutchmen and because I have a physical disability myself, by being hard of hearing, I understand these people and could not doing anything else than take them into account.



- **Why did I choose for a system with skin types?**

I choosed for this system because of people with skin type 1 are physically reacting in a very other way than people with skin type 5 or 6. This also means that they can not tolerate a to high amount of radiation. With this system I want to prevent people from getting to much UV radiation.

- **Why did I add a screen with safety instructions?**

Because of the system may not bring in danger the user. Therefor is the security system added to the system to ensure that not to much radiation is given pro day. To understand what is happening if the 'UV is not going on anymore', the screen with safety instructions is added.

Also is explained to the user that he has not to take into account the time he is spending in the real sun. Also he has not to take in to account the strenght of the real sun. To make this possible the amount of radiation needs to te be strictly specific.

- **Why did I omit the geographical and situational atmospheres from the previous concept?**

When I was thinking about the previous concept, I realized that it was for a part illogical. I had added the Brazilian sun by example and the Indian sun as well. Someone with skin type 1 or 2 can not safely choose for one of these radiation types because of the Brazilian and Indian sun are much more stronger. Some human with these skin types would burn fastely and therefor I choosed for a system what is much more safe cause it is based on the skin types of people.



## **16. ISGVO model applied to the VDS**

### **Content (message, background)**

The VDS is intended to offer users the benefits of sunlight. Because of UV lamps can be used to receive a lot of UV radiation, the benefits of sunlight can be offered indoors. Some examples of these benefits, tanning of the skin, preventing winter blues, dealing with certain skin diseases like acne, psoriasis and (skin)eczema.

The VDS is designed to provide the benefits of the sun as easy as possible, while people do not have to go outside.

The VDS contains a UV lamp and a standard lamp, ample shining into the bathroom. The device has a simple but effective interaction design which is expressed in a touchscreen.

The interaction is designed so that a simple interface is enough to operate the system effectively.

### **Structure (layering, narrative)**

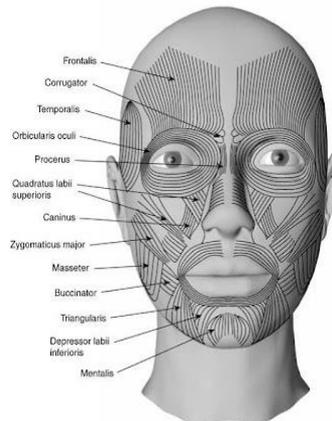
The structure of the VDS is aimed to make it as simple as possible for the user to use the VDS to set the right strength of UV radiation for their skin.

The structure is basically that after switching on the Virtual Daylight System, people see a screen showing all the buttons needed for the system to do what is desired.

There is one elongated slider, which can be adjusted by placing the finger on it and scroll. By sliding up, the light intensity of the normal light (what we need to see in the dark) is adjusted upwards. And sliding down, the intensity is adjusted downwards.

By choosing the button "Set UV light" the user can choose a skin type by comparing the cards to himself. On the main screen is also a button to simply switch off the UV light.

For support are a help screen and a safety screen added, which must allow the user to understand the system and the safety regulations.



## **Behaviors (interaction, feedback)**

### **Operating elements**

If the end user starts the Virtual Daylight System, he can control the system via a touch-screen. He may choose to turn on the UV light and / or visible light. These two elements can be controlled separately and function independently.

The visible light is controlled by a vertical drag button that seems like beams. To use this option the user simply has to move his finger up or down on the touch screen.

The UV light is set by choosing the right skin type on a screen that appears by choosing the button "Set UV light". On this screen are shown some cards representing the six different skin types. By choosing on these skin types and tapping the button "Switch UV light on" he will activate the UV light.

By tapping the buttons to the help and safety screens, he will let the system open these screens, what allows the user to get the information on them.

### **Form (imagination/ appearance)**

The appearance is a touchscreen display. This display is located on the device that possibly contains the lamps and UV lamps and all what the actual Virtual Daylight System is. The lamps can also be placed anywhere else and have not to be placed on the system display.

On this screen all operations for the VDS are integrated. So the touch screen display with the designed interaction for Virtual Daylight system only needs to be placed on a device that is capable to transmit UV light and visible light.

### **Environment (context)**

The Virtual Daylight system is designed for the bathroom in a hotel.

As a hotel guest comes into his bathroom, perhaps to take a shower himself, he can turn the VDS on and enjoy the cheerful mood that the UV light grasp in humans. This all while the user just is taking a shower.

The VDS is ideal for busy, stressed businessmen. Because this businessman is usually short on time and often stressed by all the pressure, the VDS offers him the opportunity as well to relax, tan and get a better mood to within ten minutes while he restly takes a shower.

## **17.            Functionality test, user test and experience**

To test the functionality of the interface for the Virtual Daylight System I did a test run. I used a number of key requirements with which the interface must satisfy.

First I checked all the points myself and kept them in eye during the realization of the new design. After the realization of the interface I performed a small user test in which subjects were asked about some points which were tested in the functionality test.

Some points which are tested about the functionality;  
(These points were addressed in both tests)

- Can the user search for information if he does not understand something?
- Are there special ways of interaction that require input?
- Is information what is lost for color blind?
- Is there enough contrast between text and characters and background on the other hand?
- Are the colors and the parts of the interface applied consistently?
- Are the names of the buttons effectively enough?
- Is the explanation in the help screen effective enough?
- Is the system to select a language effectively enough?
- Does the system take into account people who have difficulty with reading?
- Does the system take into account people with hearing loss?
- Are users able to undo actions?

My own answers to the questions in the functionality test;

1. *Can the user search for information if he does not understand something?*  
To make it possible for the end user to understand how the main screen and therefore the most important part of the system are working, I added a help screen. On it is a smaller model of the main screen along with function descriptions for each button.

Aslo there is a window added that explains safe use of the system treats the user how the system can be used at best.

2. *Are there special ways of interaction that require input?*  
The buttons in the final draft during the expo can be controlled with the mouse. Upon realization of a final product would be a touch screen for what the user does not need to use anything else than his own fingers.

3. *Is there information lost for color blind?*  
Because the text in black letters on a light background are placed, there would not be read problems for color blind people. The symbols are shaped with bright

colors and dark areas on light backgrounds that they have to be no obstacle for color blindness.

*4. Is there enough contrast between text and characters and background on the other hand?*

As mentioned in question 3, the texts is in black on white backgrounds and thus the contrast is high enough to provide good legibility.

*5. Are the colors and the parts of the interface applied consistently?*

On each screen are components of the interface with a consistent color. Black text on gray backgrounds for the buttons and blue frames on the help screen. This blue was in appearance to match the color blue in the Philips logo. The buttons on the screen "UV Set" all receive a yellow background when selected.

*6. Are the names of the buttons effectively enough?*

User testing has shown clearly enough that the names are found clear by the subjects. This is tested by the digital interface provided on the laptop.

*7. Is the explanation in the help screen effective enough?*

I believe that the explanation itself is effective enough. I kept it on short, straightforward reaching statements. The user's test showed that the explanation has been very effective. Even so effective that the system requires virtually no further verbal explanation.

*8. Is the system to select a language effectively enough?*

I have copied the system for switching between languages as this is done at the application WhatsApp on the mobile phone. Because it is so simple, it was already quite effective because people naturally see that the language is changed when the button is pressed. The subjects in the user test also indicated no problems seen in the language selection system.

*9. Does the system take into account people who have difficulty reading?*

For these people there are symbols placed on the buttons and above the slider. There is also a speech system that provides verbal explanation. On the main screen a voice explains which buttons have what functions. On the screen "Enable UV / skin type select" a voice explains which skin types there are and under which buttons these skin types are placed. On the help screen a voice explains what this though text is described. For safe use on the screen is the same. For the screen for safe us this is the same.

*10. Does the system take into account people with hearing loss?*

For these people there are descriptions in the text about how to use the system. These texts are also provided for users without physical limitations. The information described is the same as the verbal information that is offered by the voice funtion.

*11. Are users able to undo actions?*

Yes, each screen has a button to return to the main screen back on.

Also, the light can, of course, always set in a desired strenght with the slider.

If someone do not wish to switch on the UV-light, also the return button can be used. An extra button on the main screen is added to switch the Uv light off.

## User test

To test the efficiency of the designed system, I did give a few assignments to two subjects and watched how easily they could carry them out. I also asked them some questions relating to the designed system.

My subjects are Joris, a man who lives in my neighborhood, and Johan a boy I have been approaching on the street. The test have been made directly on street where I met these people, since I had brought my laptop with me.

The commands and results;

1. *Go to the help menu.*

-Both John and Joris are finding the help menu unerringly by clicking the button with the question mark button.

2. *Find information about safe use of the system.*

-Both people quickly know to find the right screen by clicking on "What is safe?"

3. *Set the English language.*

Both fast-takers know to find the language button and switch with a single click to English.

4. *Now switch back to the Dutch language.*

Both people are clicking directly on the language button to discover that there is a window in German and by one more time clicking they return to Dutch.

5. *Turn off the UV light to your skin type.*

-Johan clicks on the button "Set UV" and begins to read the frames with the specified skin types carefully. He tells me he hesitates between Type 1 and 2. This moves me to tell him that he should better choose the lightest type of the two.

-Joris opts for skin type 4 and switches on the system.

6. *Turn off the UV light again.*

-Both people do this flawlessly by pressing the "UV off" button.

The interaction of the subjects with the interface seems to run smoothly by this.

Only one adjustment must be added: On the help screen and the screen with skin types it must being made clear that if someone hesitates about the choice for a skin type, the user has to choose the lightest of two options.

## Experience

John and Joris were afterwards asked what they thought of the design of the system and its use. Both John and George indicate that the system is simple and fast. They do not have to think as much and found almost all information they needed.

They founded the system desgined beautifull and without fuss. They praised the adding of the voice function what must help all people who can not read very easily and said to me that they would buy the system if it is working as promised indeed.

## **18. Visualisation of active UV light**

To make visual for the user that the UV light is active or not, I devised something little innovative. By doing research on how to make UV light visible, I found that UV light can be made visible with optical brighteners.

Optical brighteners are used in detergents to make laundry and textile looking whiter and cleaner. The washed textile is not whiter, but it looks like it is.

Now, I devised that if a small tube with optical brighteners is added to the display, this could make possible that the UV light is visible for users. This tube can be posted on the display or near the UV lamp.

When the UV light is off, the tube looks normal and you can even see that there is a white powder within in. But when the UV light is activated, the tube will glow.

The optical brighteners convert the UV radiation in blue light. This blue light will look like the blue light seen on neon lamps.

This will be a clear and nice way to show the user that the UV light is on or off. The only simple indication that the UV light is active, is the blue glowing tube, what brings a magical effect with it.



Left: A tube with optical brighteners exposed with UV light.  
Right: A tube with optical brighteners NOT exposed with UV light.

## 19. Visualizations

The main screen



The screen "Set UV light"/ "Choose skin type"

