Art across Realities:

helping painters to generate more profit by selling their painting process

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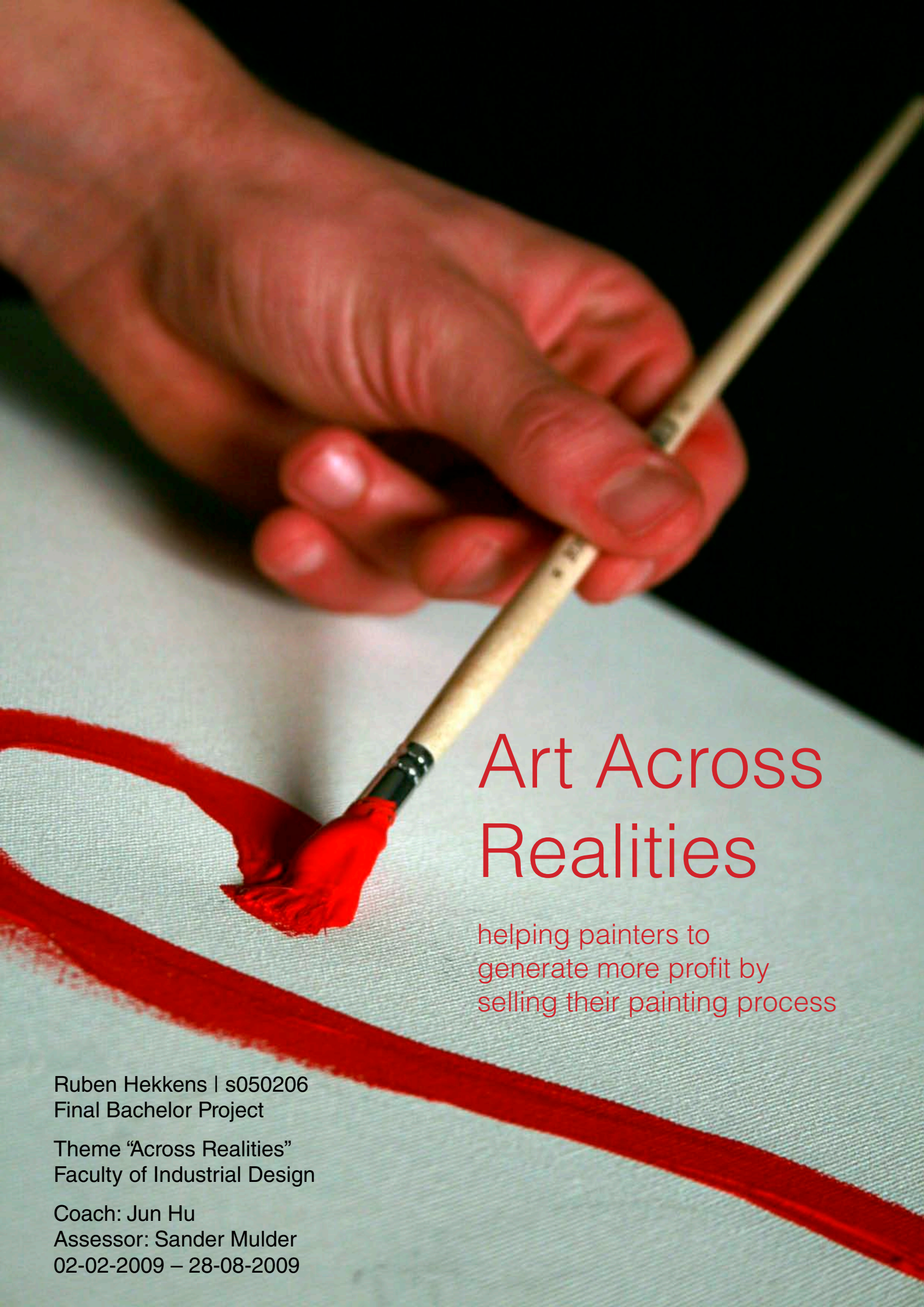

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Table of Contents

1 Introduction

Project Rationale

Professional traditional painters find it very hard to generate a proper living from their painting activities [1]. Some do a job on the side. The web offers new opportunities for generating exposure and income, for instance via Youtube or a personal website [2/3/4]. However, it is hard for painters to exploit these possibilities, as they have few finances and insufficient IT-knowledge to do so. In this project, I explore a new product-service-system for painters, which helps them generate extra money while still keeping interaction with the user very simple.

The project is a spin-off of the project 'Virtual trace of the real world' [5]. The objective of this project was to design a transition between the real world and a virtual world (e.g. SecondLife). From an analysis of the virtual world [6], I defined my user group as creative people. When in a later stadium of the project my final user group had no use for a solution involving a virtual world, I decided to focus on the user group and drop this part of the project. In my conclusions, I consider a scenario applying my final service to a virtual world and I reflect on the concept of value transfer.

The system I designed is quite complex; it has a lot of components and stakeholders. To explain it properly and thoroughly, I will first set out design requirements. I drew these from interviews with a number of painters I did. Secondly, I will illustrate the working of the system with a system map and scenarios for the different user types. I then will describe how my concept is backed up from the perspectives of user, technology and design. Finally, I will comment on how users evaluated my prototype, relate the project to the old objectives of 'Virtual trace of the real world', and reflect on my process and development throughout this FBP.

Opportunities for personal competency development

For me, this project had opportunities in practicing different competencies related to my identity that I learned elsewhere. I got the chance to implement image processing techniques that I learned about at my study of Artificial Intelligence. I also implemented theory about business processes and 3D-CAD that I learned at my exchange in Milan. Valuable learning points from my project were acquiring the ability to ground my decisions better and thereby become a more independent designer, plus many insights in user research.

Final painting, validation test #2

2 Objectives

Prior to setting up my problem statement, I held interviews with five members of my target group to find out which problems they experience in their work. These interviews were set up to find qualitative information; as a result they were quite long, extensive and loosely guided by questions I had prepared in advance. More details on the exact structure, sampling and results of these interviews – as well as transcripts - can be found in the Appendix [1].

From my research on virtual worlds, I was wondering whether painters were interested in using these worlds as a context for communicating and cooperating in. I quickly discovered that the concept of a virtual world was hard for my target group to understand, their IT capabilities were low. Some of them had neither an Internet connection, nor a PC. As for the communication and cooperation with others, there were interviewees that mentioned initiatives concerning painting with others. However, these initiatives never really expanded beyond the idea-phase. One reason for this is that traditional painters in general are solitary people, without the social skills or drive to manage such initiatives. More important probably is the second reason, which is a lack of funds. Painters have a lot of costs for their canvases, painting materials, painting spaces and so on. Although a painting is expensive, the painter really doesn't make a lot of profit when all his costs are deducted.

For a painter who is not widely recognized, selling art is very difficult, especially given the current economical context. I have mentioned that painters may lack social qualities. These qualities however are very important in selling a canvas. An acquisition rarely happens directly from artist to buyer. Galleries are an important node in the selling process. Therefore, an artist should have a vast network of gallery holders via which he can promote his art. Due to an abundance of art, the gallery holder has the strongest bargaining position in his relation with the artist; he makes the rules.

There are alternatives available for artists who want to promote themselves. Exto[2] is an online art community. Artists can logon to upload their paintings here as photos. Galleries and expositions can also be found on this website. Motivations of artists to join are 'to have an online portfolio', 'so I can show my work to friends and relatives', 'to gain more exposure'. Advantages of the service are that it is free and relatively easy-to-use for artists. A disadvantage is that artists are ranked based on an assessment by colleagues, an assessment they consider very subjective. Considering self-promotion, most painters do not use this site to its full potential. The majority of the profiles is set up once as an online advertisement. A lot of profiles are rarely updated, and the painters I interviewed did not use the opportunities that the site offers for creating a personal network.

Krabbedans [7] is an art centre in Eindhoven that organizes expositions and hosts a design shop plus an art rental service. Artists can apply for the art rental service by inviting Krabbedans's selection committee to one of their expositions. If an artist is selected, Krabbedans buys one or more of their art pieces and exposes them in their rental space. Anyone can then rent this art against prices ranging from 6 to 34 euro a month. The art can also be bought. An interesting fact is that a lot of art which is first rented to a customer, gets bought afterwards by the same customer, because after the renting period he cannot part from it anymore. An obstacle for painters to apply is the requirement that they first need to have another exposition in order to invite Krabbedans's committee.

With this research in mind, I can define my research question. The project objective can be stated in one sentence as follows:

"How can we help traditional painters to generate more exposure and profit for their paintings with a product they can administer easily?"

Requirements include high ease of use, with technology and IT being made simple and accessible for this user group. The final service/product cannot be expensive itself, because this is unaffordable for the user. The requirements are extended and refined further after a second user session in which a prototype is tested with the users. This is described in chapter 5 about the User.

Screenshot of the web interface. An interactive version is available online [8]

Concept description

The final concept consists of a product and a supporting system. The product is a bulb-like object, in which a camera is embedded. This camera monitors the artist's canvas while she is painting by taking snapshots every second. These snapshots are broadcasted to an online server, which optimizes the pictures in size and quality with special software. No connection with a computer or network is necessary, as the bulb draws its power from a lamp and broadcasts the images over a phone (GPRS) network.
People interested in the painting process can subscribe to an artist's image stream via an application on for instance their cell phone or their computer. They can then receive the snapshots of the artist's canvas in real-time and follow the progress of the painting. The viewer pays a small fee for using the application. This fee is distributed over the painters who contribute their paintings, so that they have an extra financial reward for their work. For artists who want extra control over their image stream, there is an online interface available that allows them to adjust colors, lighting and order of their paintings' image streams [8]. The system also offers help in distributing their stream to others, so that the painter can advertise her work. Furthermore, the system offers statistics, so that the painter can evaluate how many viewers have watched his paintings, and how much money this has earned him.

Scenario | *Painter*

1 acquisition

The product is sold in shops that sell also other products for artists.

2 contents

The box contains the bulb, plus a manual for users who want extra control and more features with the product.

3 installation

The user has to install the bulb in his atelier, which is simple as screwing it in a lamp and positioning it.

4 operation

The bulb monitors the painter while she is working.

Scenario | *Viewer*

1 target group

Peter is an art lover. However, due to his busy job, he can only visit the museum once in a while.

2 interface

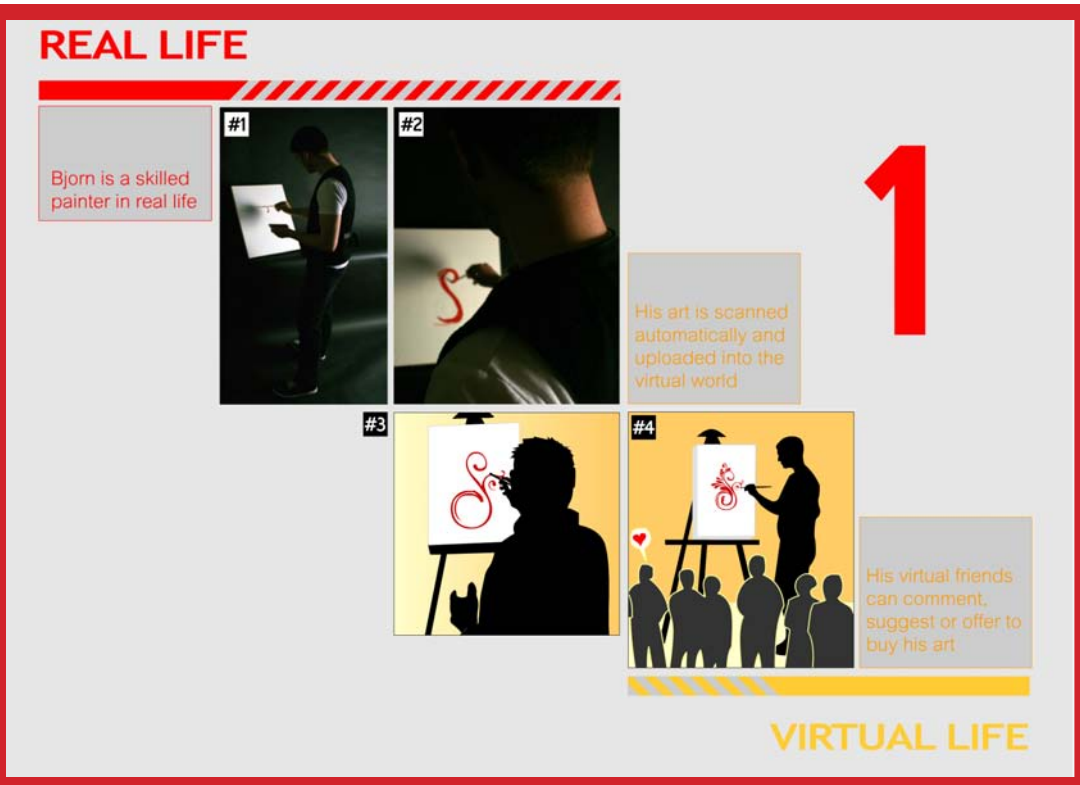
Peter recently bought a new cell phone with an internet subscription.

3 application

The user has to install the bulb in his atelier, which is simple as screwing it in a lamp and positioning it.

4 operation

The screen shows updates of the painter while working



First scenario for transferring the canvas to a virtual world. This scenario is still possible when the final product is connected to a virtual world. However, for my target group it is not an appropriate solution.

3 Design

In this section, I will explain how my design evolved into its final form. I will explain how technology and user insights influenced this process, and use these to justify the characteristics of the final design.

3.1 | Idea Generation and Concept Development

My idea generation started when I was investigating the possibilities of virtual worlds. Soon I saw that these worlds offer a lot of opportunities for creative people and this led me to develop a device for digitalizing art. Different ideas were explored, involving different painter props (brush, easel).
This part of the idea generation was highly influenced by technological and social insights. A painter always wants to work with his own material. Thus, it is not an option to make him paint with a newly-developed high-tech brush. Once I decided that a camera was the best way for digitalizing art, I got more concrete in my ideas and developed monitoring devices, first a lamp; later only the bulb. Different sketches were made and forms were explored, with two special requirements in mind.

- The design had to be user-friendly. In this case it was important that the user could tell intuitively which sides of the camera are the broad side and the up side. This is essential in order to be able to position the lamp well.

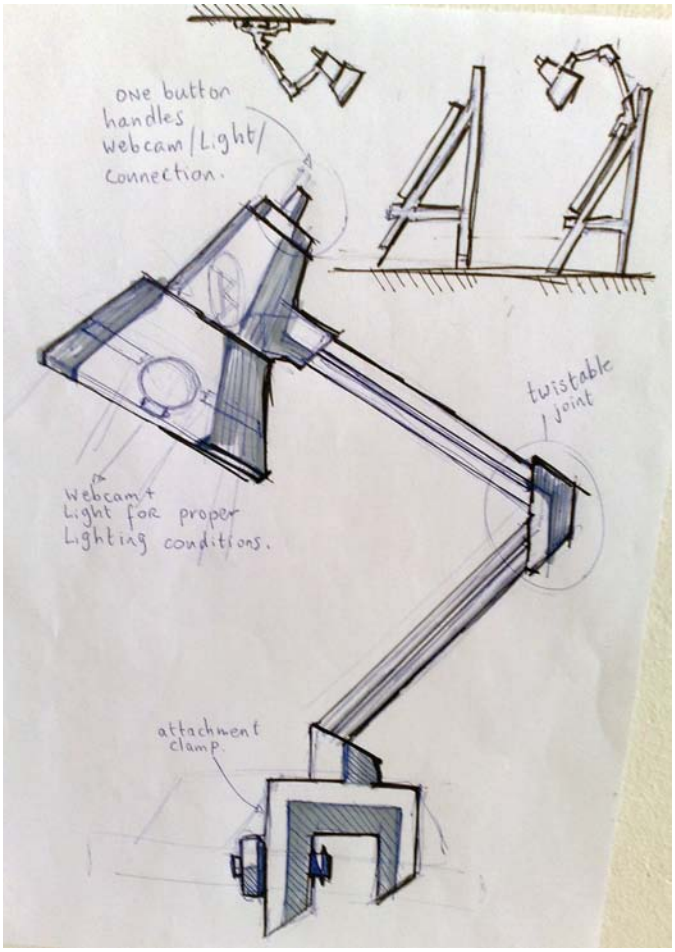
Pictures: (1) Conceptual sketches for the bulb worked out in Illustrator, (2) Inspiration from real bulbs, (3) Final design

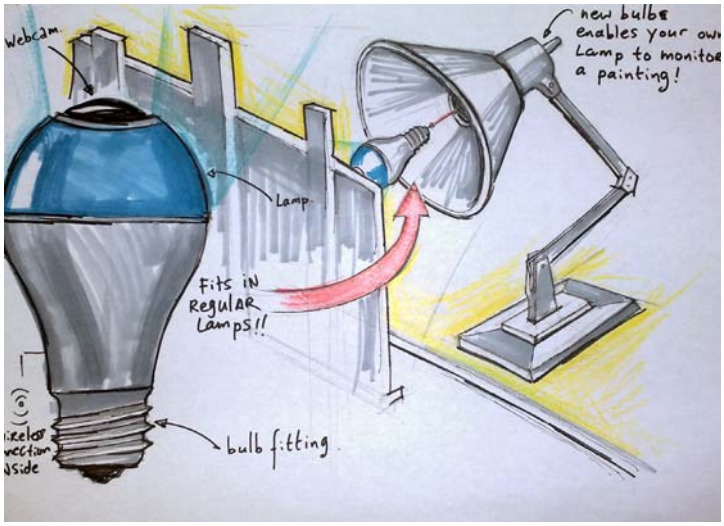
• The aesthetics of the product had to be traditional. While I tried to develop an interesting shape, as I learned in my assignment Aesthetics of Senses, at the same time I wanted the shape of a bulb to be implicitly conveyed in the shape. This will help the painter to embrace the product, consisting of new and intimidating technology, in his work environment.

The images shown are form sketches for the final prototype. The bulb shape communicates to the user that the product has only one affordance – screwing the bulb in! This unites the conceptual and user model of the working of the product [9]. Another motivation for the bulb-like shape is the fact that a light bulb is a common piece of technology to the target group. This will make them feel more at ease when using the product.

All shapes are asymmetrical. Form-wise, this brings a bit of tension in our shape [10]. From an angle of usability, this communicates to the user which side of the camera is the upside. Although the shapes are more complex in form, their basis still suggests the shape of a regular bulb.

The final form is bigger than the others and offers more inner volume. Although I didn't flesh out which exact components are needed in the final model, I expect they will at least consume this space (based on comparisons with other electronics (cell phone) with the same components). Also the shape ends in a rectangle at the front. This communicates the dimensions of the camera to the painter, so that positioning is easier for him.





Above: (1) Sketch for lamp-design, (2) low-fi prototype with an IKE-lamp and a webcam, (3) sketch for bulb design

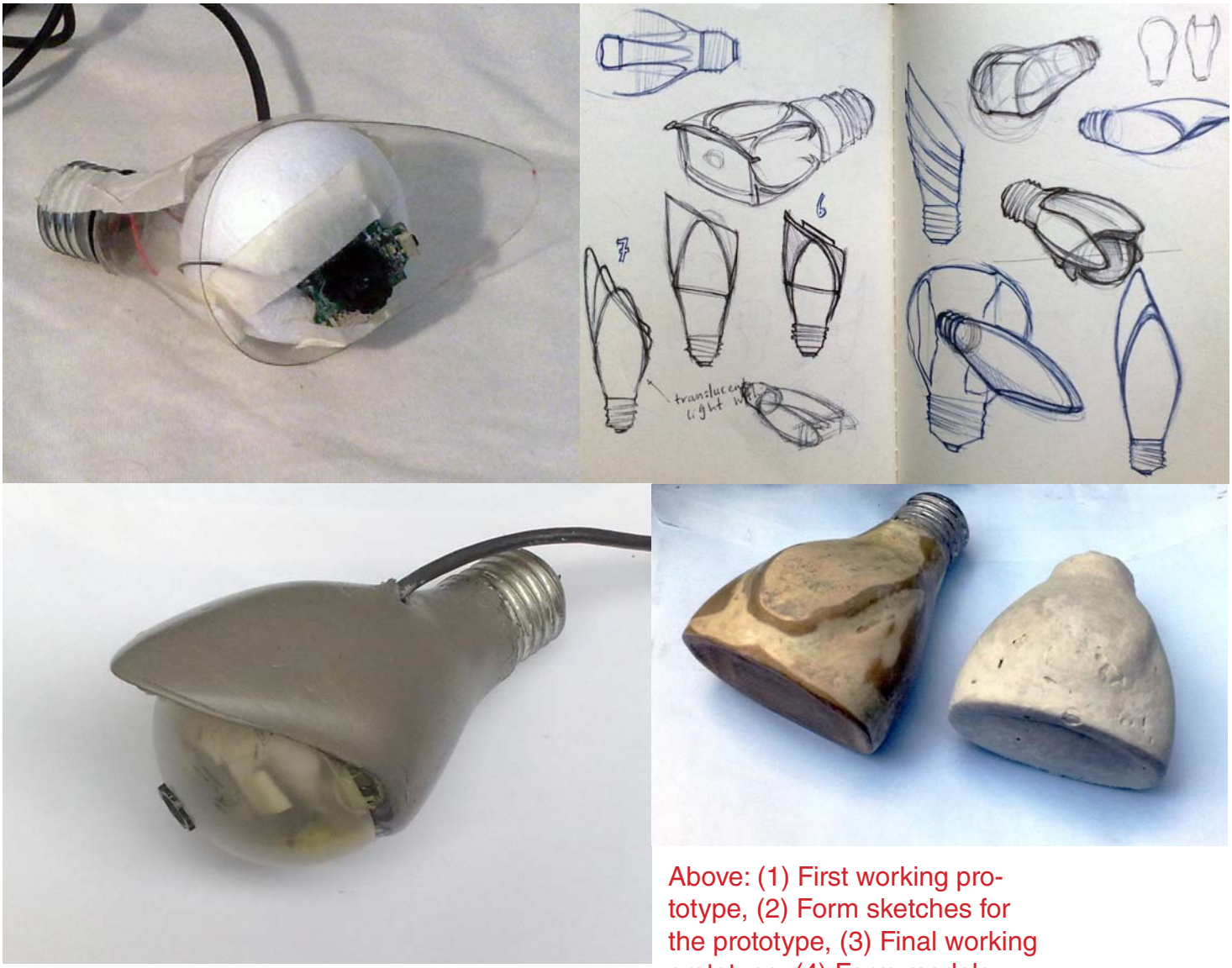
3.2 | Design

Technology-wise, it seemed the best option to digitalize the painter's art using a camera. This was a cheap option with a high quality result. As a consequence, an important design problem arose: How do we monitor the painter well without disturbing him?

I tried to co-create a solution for this problem by having the users solve it during my first user test. They came up with different and surprising results. One user for example taped the camera to his hand, another user mounted it on a nearby table (which is creative use of the test environment!). Although these solutions were fun, they did not satisfy the problem. Image quality was bad and shaky and the canvas was often not visible because the view was blocked by the painter, or the camera was misdirected. Also, the camera diverted the painter's attention.

I then came up with a product that would be stable, easily adjustable and fitting in the user's environment. Initially this was a lamp. I did measurements to maximize viewing angle when attaching the lamp to the painter's easel. The results were sufficient. However, it was hard to capture the entire canvas from this close a distance and it could still impede the painter. From a business perspective, the lamp imposed an extra cost, where essentially only the camera would be necessary.

I then chose to design only a bulb. Here, the responsibility of placing and positioning is

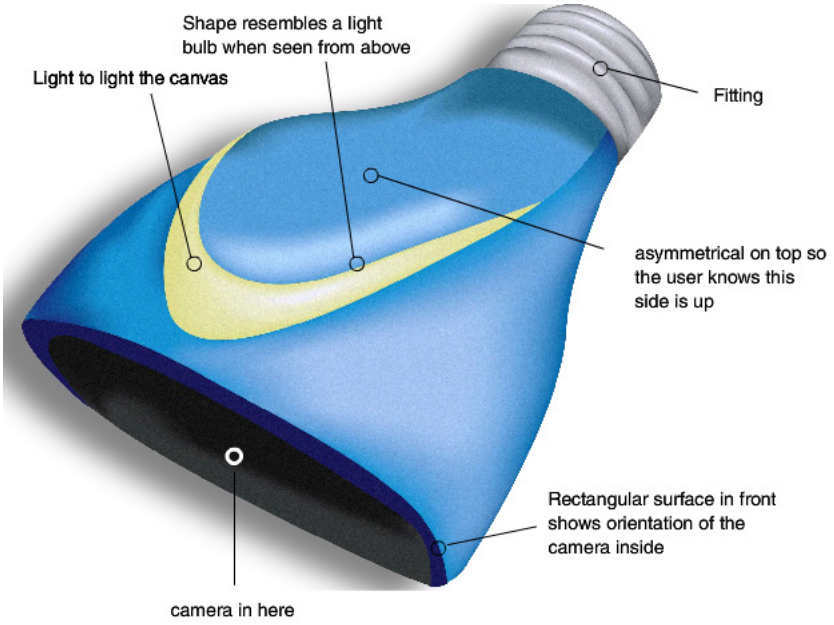


Above: (1) First working prototype, (2) Form sketches for the prototype, (3) Final working prototype, (4) Form models for the final shape in MDF and plaster

Below: Visalization of final model with justification of aesthetics

left to the user. The bulb fits in each working environment and functions intuitively.

For the monitoring, there was another problem. Filming the whole process resulted in a large data stream of relatively low-quality images. Quality was an absolute must-requirement for the painters. Thus, I decided to include high-quality pictures every so-many seconds. This concurs with the painter's process, which is so slow that only interval pictures are required to make the stream interesting. Disadvantage is that the product loses its value as teaching material for painters, because gestures cannot be recognized anymore.



WiiMote	Touch screen	Webcam
+ Fast connection	+ Fast Connection	- Fast Connection
- Not an accurate copy	- Not an accurate copy	+ Quite accurate copy
- Sight can be blocked	+ Sight cannot be blocked	- Sight can be blocked
+ Cheap	- Expensive	+ Cheap

Technology appraissal for the hardware component of the system

image before software processing

image after software processing

The software optimizes the image for output to the viewer by using (among others) an edge detection algorithm.

4 Technology

In this section, I explain what technology is required by my concept and how this differs from what is already there. I discuss my appraisal of technology and go a little more into depth about the software and data architecture that is used in my concept. Finally, I give the technical configurations for both my prototype and the final product [hypothetical].

4.1 | Current Issues

From a technological perspective, the vital aspect to this project is monitoring the artist's canvas. Furthermore, some image recognition and image processing is applied via computer algorithms – this recognizes the canvas in the camera image, cuts out this piece of the image and optimizes it. Then, there is some infrastructure that allows data to be stored and sent from painter to viewer. The service we provide is essentially a combination of different steps, which could be performed independently by computer-savvy people. You need a webcam, an internet connection, and the knowledge to build an application or website which can display your image stream. This is simply put – in reality there's a lot more problems considering data connections and encryptions, especially if you want your customers to pay for the images.

This scenario is a bumpy road, since a lot of different installations, uploads and so on are required. Of my user group, not 5% would be able to perform these actions. Plus, these

things are very time and effort-expensive. There is not yet a system which streamlines this process. Another constraint which particularly applies to my target group is the availability of a computer and internet access. Some fifty percent of my interviewees did not have this (although they all had an online profile on Exto.nl).

4.2 | Project goals

The technological goals of this project are to digitalize art in the best possible quality. To optimize this, we selected technologies from two different domains:

Hardware

Different strategies can be employed to digitalize art. One can track the canvas with a camera (I), or track the movement of the brush by either making the canvas touch-sensitive (II) or tracking the movements of the brush with an IR-camera (WiiMote, III) [11]. The pros and cons of each method are summarized in the following graph.

In an experiment, the WiiMote proved insufficiently capable of resembling the image on the canvas in good quality. Applying the touch-sensitive canvas had the same problem, plus it would make the eventual product too expensive for the user group. Thus, to meet the target group needs, the webcam technology was selected. The two negative points for this particular technology were dealt with in the 'Design'-section.

Software

Software is used to fully optimize the quality of the image. We use an algorithm for detecting the canvas, centering it out, optimizing color and sharpening the image. Since the algorithm for edge detection is related to artificial intelligence, an area I have particular interest in, I will explain this more into depth in the appendix [17].

Edge detection is (for a designer) a quite complex algorithm that determines the edges of the canvas by comparing the white pixels of the canvas with the darker pixels of its direct surrounding. I implemented a pre-cooked algorithm I found online [12,13]. What I think is an important characteristic for a designer, is that I'm able to understand complex data structures and processes like these and am able to implement them in my own projects. An important thing to notice about algorithms is that they can be tweaked to fit a particular problem better. In my case, we are not looking for any random edge in the image, but for the edges of the canvas. Since we have some information about the canvas, we can derive some heuristics for the algorithm to work better for this specific purpose:

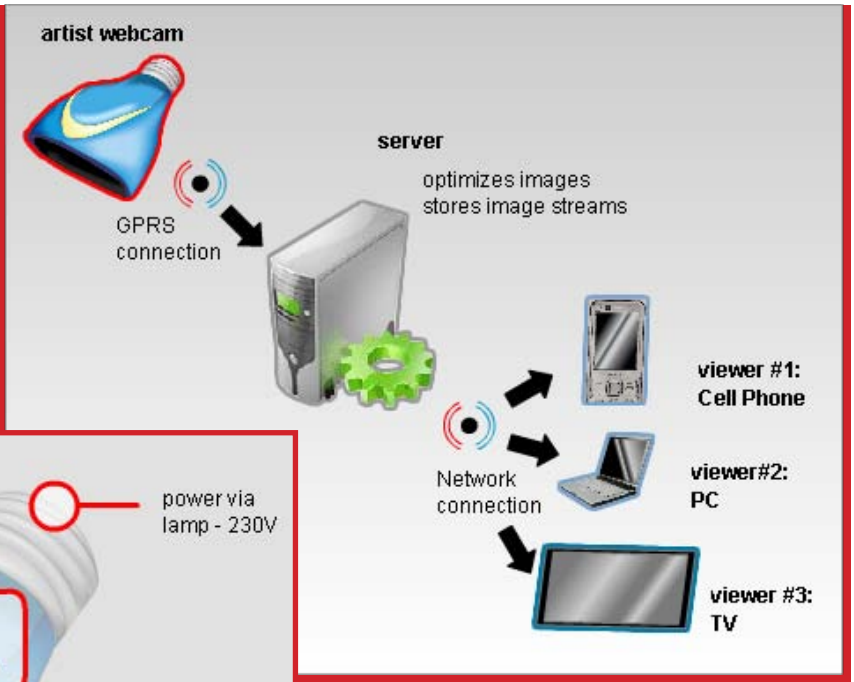
1) A canvas consists of a rectangular four-corner frame
2) A canvas is symmetrical
3) A canvas is white

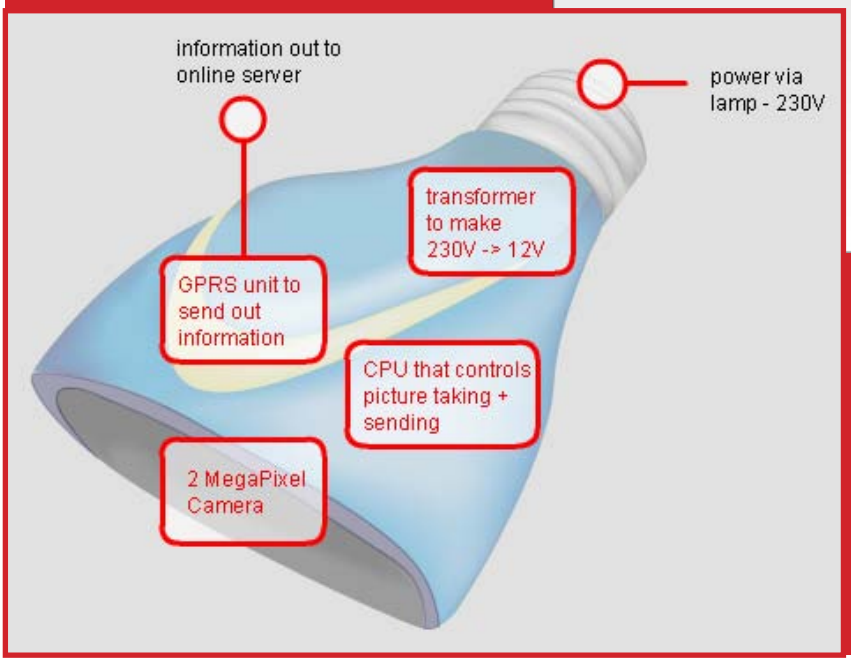
To cut-out the canvas, we only need to find the four corner points of our canvas. Since we know a canvas is rectangular, most edges will either be vertical (blue) or horizontal (yellow). At the corner points however, the corner points will be diagonal (red or green). A concentration of these points will indicate to us that there's a canvas corner at that point. However, there may be other objects or color differences in the webcam's image (for example an easel), which may distract our algorithm because they also have diagonal edges. To avoid this 'noise' we use our other heuristics. We accredit an edge-pixel extra points if it's on an edge of a white object, and if there's a similar edge symmetrical to this pixel across the X- or Y-axis.
To improve the edge detection even more, we have to give the user clues as how to position the camera. This is done via the form of the product, as described in the section on Design.

Infrastructure

When the system is deployed in real, appropriate infrastructure must ensure that the images can get from the artist's product to the viewer's interface smoothly. The pictures must be processed on a server and then stored in a database on this server, from where they can be requested from by the viewer's application. When building my pro-

Technical System Infra-structure





Components in the final product

totype I found out this can cause quite some trouble. When the artist's product starts uploading a new picture, this takes some time. However, the viewer's interface can already 'see' that there is a new file on the server and will start to download it. When this incomplete file is downloaded, at best the interface will show false or incomplete information, and at worst the viewer's application will crash.

A solution to this problem is creating a 'lock' with each file [15]. The lock is a binary status for the accessibility of the file, if it's a 0 the file can be accessed freely and if it's a 1 the file is locked and can only be accessed by the entity that owns the lock. Of course, multiple viewers need to be able to access the file at once. This is not a problem, for the viewers do not make changes to the file. The only one obtaining and releasing the lock is the product that uploads the images. There are different types of locks and for this kind of problems alone there is an entire branch of research called 'concurrency control'. Since this matter is more closely related to computer science, I will not go any deeper into this. For a system the size that I designed in this project, a designer will never have to develop the infrastructure. It is better and cheaper to buy an existing system that has proved reliable. An oft-used system for sending media across the internet is Adobe's Flash Media Server [14]. Costs of this system depend on database size and bandwidth.

Developing software for cell phones

In this project I developed software for a cell phone for the first time. The viewer's interface was built in Flash Lite on the Symbian platform. I chose to make software for the mobile phone because this was one of the scenarios I had in mind for the final product. I also wanted to acquire this skill for my personal competency development. Another argument for making the viewer interface on cell phone was that the prototype camera had a low quality. By choosing the phone as interface, the low-pixel images are still well-presentable.

The switch to the mobile platform has a number of consequences for developing the software. Although the Flash Programming Environment can still be used, Flash Lite uses a different programming language than Flash CS4 for Windows, basically an old version of Flash. As a result, no Object Oriented Programming can be used, the program will get more cluttered with code, programming errors are easier to make and harder to correct. Furthermore, the Symbian platform which I programmed for has far less RAM than Windows has. This results in slow animations. Flash is famous for its 'tweens': transitions in position, shape or color/transparency, but these effects are not suitable on a mobile platform.

4.3 | Technical Configuration

For this project, the differences between the final product and the prototype will be substantial. This is due to the fact that the final product has to function well in a product service system of sophisticated data structures. The infrastructure has to be robust and fast even under high load, which means it will be costly. The prototype will implement parts of the final system to prove technological and conceptual validity of the project. Since the prototype is only tested by a limited amount of users, we use other data structures that can only process limited data and data connections at a time because they are easy to obtain and cheap to test with.

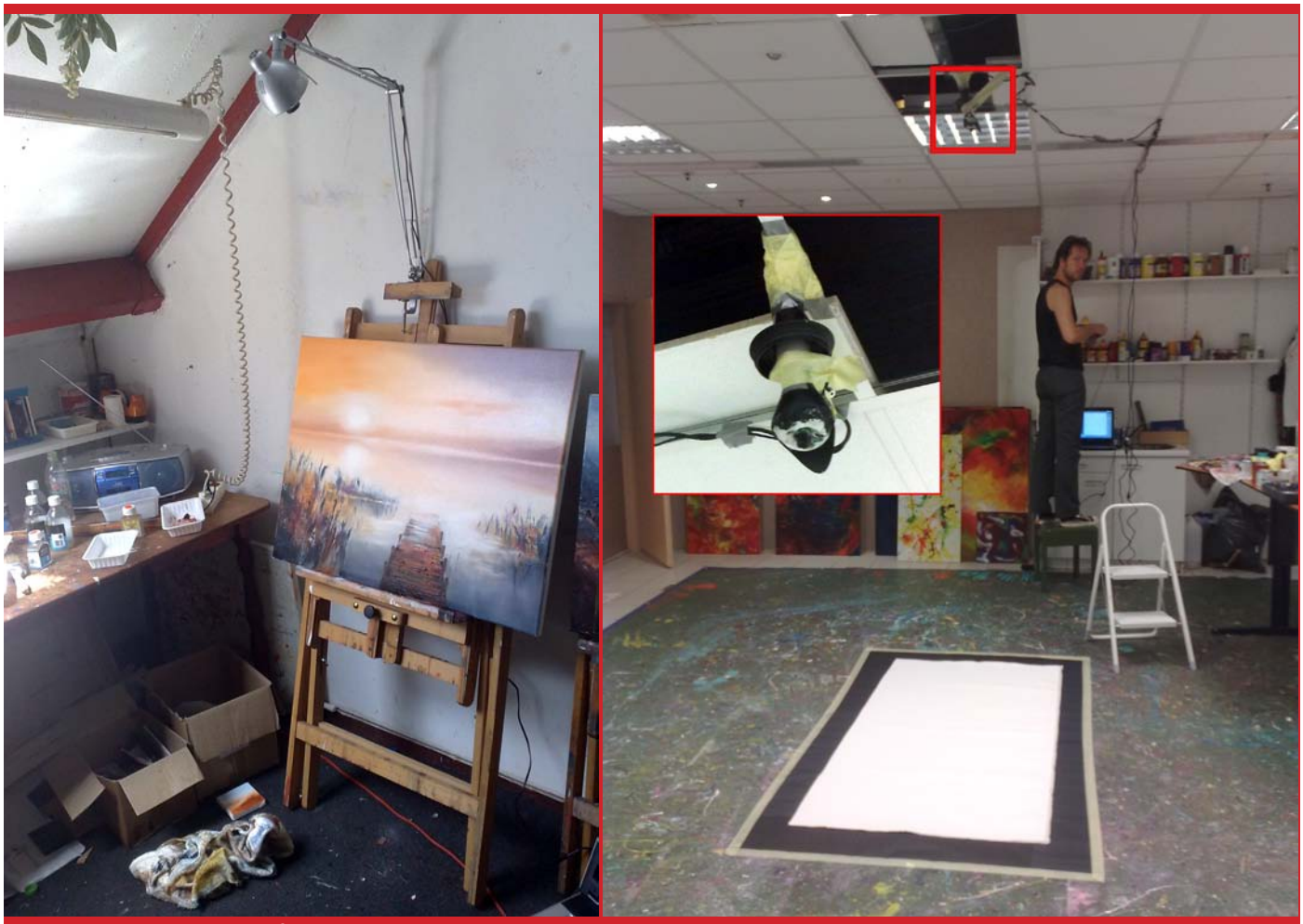
Prototype

The prototype uses a low-quality webcam to capture VGA-resolution pictures (640x480). In the tests, the camera is connected to a computer via an USB-line. This line also takes care of powering the prototype. The computer runs a Flash Air application that saves the images to an online location. Images are optimized via a Photoshop-batch process. A mobile-phone runs the Flash Lite viewer application using an internet connection to retrieve the images.

Final Model

The final model uses a high-quality webcam to capture pictures with a resolution of 2 megapixels. In the next chapter, I discuss five types of output interfaces for the viewer. Of these, HD-television has the highest resolution, of 1920x1080 pixels, so around 2 megapixels. Therefore, we will take this as a guideline.

The product will function independently on the power provided by the lamp in which it is screwed. This means that a transformer is embedded inside to provide for the appropriate power (some 12V). Furthermore, a GPRS-module is embedded to transmit data to the online data storage. This line has to be secured, because otherwise others could steal the information while it is sent to the database. The database has to be able to contain multiple gigabytes of information per user. This means that there should be several servers storing the data. These servers need to provide access to thousands of customers at any given moment. Raw data is sent to the server, where the images are optimized with the software algorithms as described above.



Product Installation for both validation tests

5 User

In this section, I discuss the focus of my user research. I will explain briefly the goals, methods and results of each test. Among this research is also the business plan I wrote for my system.

5.1 | Qualitative research

After my green light meeting, I decided that the focus of my project would be on the painters. I wanted to make sure that they could use the product properly, and that they would benefit from it. To evaluate usability, I chose to do qualitative tests. The first test will be used to determine user requirements in detail, and the second one will use a final prototype to validate these requirements. To research how and to what extent the painters will benefit financially from my service, I made a business plan and discussed it with an expert. To gain some basic information on viewers, I made an online questionnaire.

First user session

The first user session was planned at the Centrum voor de Kunsten in Eindhoven [16]. In this session, I let five painters/painting instructors install a webcam, position it to monitor a canvas, and paint. I gave them no further restrictions, as I was curious to see which strategies they would come up with to interact with the webcam. Afterward, the painters filled in an individual questionnaire about the experiment and we held a group discussion setting. The preparation document, questionnaire and consent form for this user session can be found in the appendix.

From observing the video footage of the user session, plus interpreting the user questionnaires and group discussion transcripts, I drew with the following requirements:

- The system has to be very easy-to-use and have a minimal interaction between user and technology
- The system needs to be applicable to the user's own environment and tools
- The user needs to be able to position the system precisely with ease
- The user's easel needs to be well-lit
- The user can be reluctant towards technology. The product will have to be comforting for him, which can be reflected in a traditional exterior
- o The quality of the final stream has to be high
- o The system needs to be relatively cheap-priced

  The user has to have full and fast control over the final video stream. Features he is interested in include hi-res pictures of different stadia in his painting, different cameras, a moving camera, showing paint-mixing.

  The user would like the option to add spoken or written commentary with his paintings

The first five requirements are pinpoints of my final prototype. Design and technology aim to satisfy these demands, and they will be validated in my final user test. The seventh requirement (quality) is important, but will not be satisfied in the prototype as it will make it expensive. The eighth requirement will be dealt with in the business plan. The final two requirements illustrate the diversity of the target group: each individual has other demands, and factors he likes to control. However, more control means a more complex product. I tried to keep the product itself as simple as possible. In order to provide more technology-savvy users with extra options, an online interface was designed to make adjustments to the stream possible.

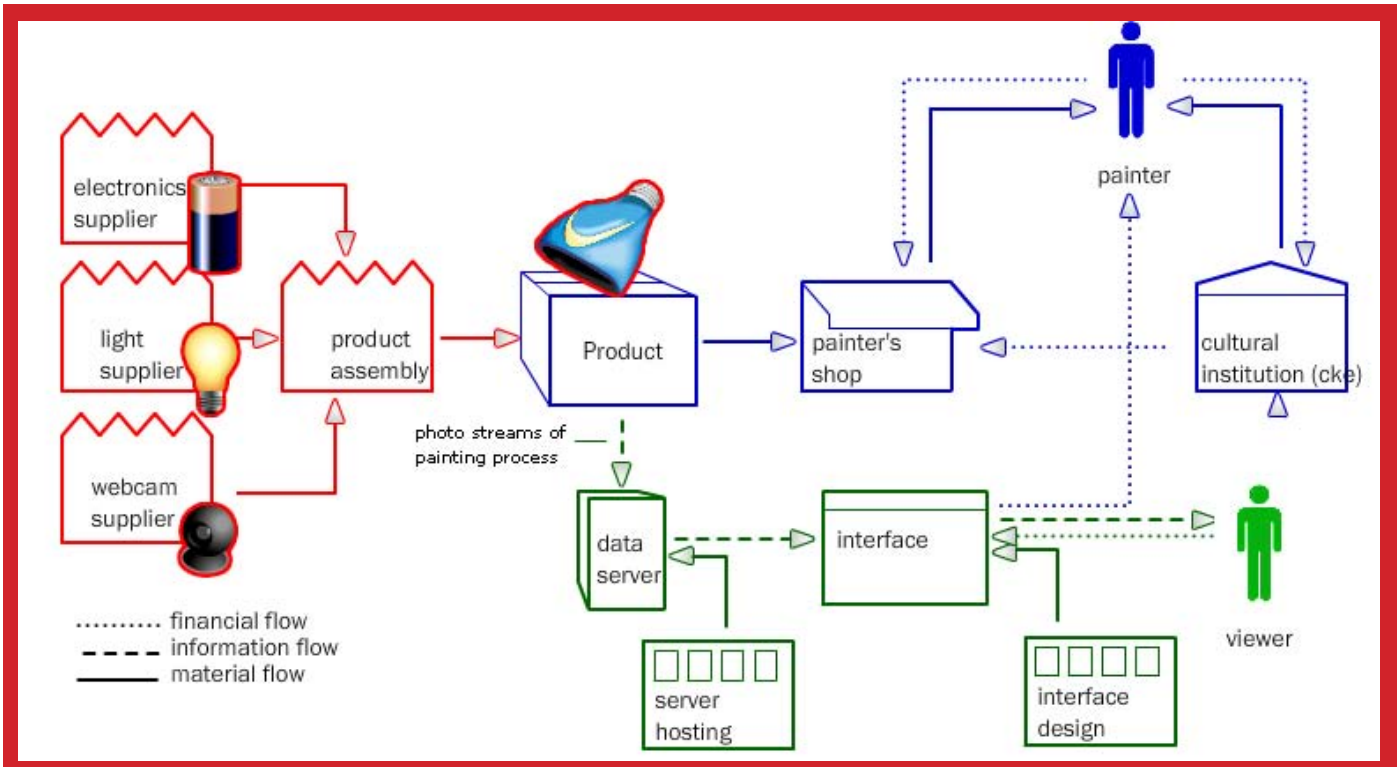
Second user session

In the second user session, an advanced prototype is used. This prototype was made bulb-like. This time, the product is tested in the user's own environment. The user is asked to install the product, position it and paint while being monitored. This time, the product actually takes snapshots and processes them into an image stream, just like the final product will do. The user is left alone to work just as he would normally do, and afterwards he grades the prototype on the requirements that were mentioned in the second user test. A full preparation document and the questionnaire for this research can be found in the appendix [23].

Considering the fact that only two users did the final test, it is hard to say how reliable the results are. For one user the whole process of installing, positioning and painting went smoothly. The setup for the second user test was very different: the way of painting (action-painting) and the size of the canvas required the canvas to be on the floor and the camera on the ceiling. As a result, installing the system was hard and I had to help out a lot during the test, which made it confusing to the painter what the final system could and couldn't do.

Some criticism on my planning is appropriate. I went into the final tests with two goals: to obtain a proper photo stream of a painting for my presentation, and to evaluate the system's usability. These goals conflicted, because I didn't let the user's work totally independent (wanting good quality photos for my presentation). Furthermore, the prototype didn't have full functionality. In hindsight, some actions, like installing the bulb and assessing the form of the product, might have been done better with a mock-up prototype. Also, the setup of the user test should have been more formal. I should have been stricter with rules and I should have hidden my computer better. This was difficult, because I was in the painters' work environment.

The user knows how to handle the product well in all steps, except for positioning. The product apparently does not give clear feedback here, although the final shape was not implemented at that time. Lighting of the canvas is well qualitative in the photo streams, although light reflects in the wet



System map for the product-service system I designed in this project

paint at times, and the painter blocks the light with his body sometimes. It was clear for the user how to start and stop the stream, other options are not available. Both participants were not made uncomfortable by being monitored. They both indicated that this service would be interesting for getting more profit and exposure, although they wanted an estimate of how long it would take before they would break-even (earned their investment in the product back). I will reflect more on this in the business plan.

5.2 | Business plan

The goal of the business plan is to check which opportunities there are for providing the painter with financial reward and more exposure for his work when using the product. This plan discusses which components are in the system, how these interact, which value is offered to the actors in the system and how we generate income for the painter. The full business plan, too comprehensive to include here, is included in the appendix [24].

In our system, we create value by making the viewer pay a small fee for being able to request photo streams of the making of paintings of different painters. Each painter receives part of this fee as compensation for his work. The entrepreneur makes money by selling the product to the painter. He also receives a percentage of the money paid to the painter by the viewer.

Value propositions for the various actors in the system are:

Painters have trouble generating income and exposure from their paintings. Our product offers them a chance to exploit their painting process, which requires only a single investment in our product. There is not yet a product available that integrates all the activities of digitalizing the art process and transferring it to the customer with such ease of use.

- The product makes a task (monitoring canvas and broadcasting the image on the internet) that until now has been quite difficult, usable for every one, even without computer experi ence.
- Applicable to the painter's own work ing environment and tools
- The painter has freedom to keep him self out of sight, and easily maintains control over the video stream
- The painter gains extra exposure and financial benefits for his work

Given the annual rate of visual arts museums, a lot of people are interested in artist's work [18]. Experts mention that there is interest in the painting process as well [6, section "Idea Generation"]. However, this process is unavailable to the art adept, since most painters work solitary. Our service offers the viewer easy and ubiquitous access to the work of painters, while it's still under construction.

- The viewer is directly updated with the latest works of his favourite painters
- The viewer gets an insight in how the painter works and how a painting is constructed
- The viewer sees the 'story' of a paint ing and thereby becomes more at tached to it
- The viewer has a cultural and enter taining image on his phone, desktop or on a screen in his living room

Suppliers, manufacturers, service providers and intermediates will receive finances for their share in the process. However, it might be smart to include some of them in our business model (partner alliances):

- Since there are few network cover age providers in Holland (e.g. Vodafone, T-Mobile), their position is strong. We can offer them a share in our profit from viewers instead of regular payment. This could open up other business models, where viewers for instance have a painting app pre-installed on their Vodafone phone which has some initial credit for them to try the service out.
- A cultural institution like the Centrum voor de Kunsten Eindhoven can be a strong channel to the painters. We could offer them a share in our profit too, or provide provision on each product sold via them. The CK/e might be interested in our product for them, to educate or expose painters. Dis count offers can be made, or product demonstrations can be arranged.

Please notice that our product partially serves a social purpose, since it helps a profession with low income gain more money. It also helps bringing more attention to culture. This makes it possible for the entrepreneur to ask for government or local subsidies. Another business model may be broadcasting a canvas on an urban screen – which shows city culture in public and gives the city an identity. Perhaps there are opportunities for giving out limited credits for our service with a cultural subscription (Museum-jaarkaart), or hand out credits with a museum ticket.

The plan was discussed with expert dr. Brombacher [21]. His main feedback was that is it hard to finance a plan for such a comprehensive system. He recommended pitching the idea to a company that currently possesses the hardware (the most expensive component) to build such a system, i.e. cameras that can broadcast there images to the internet. Such a company would be for instance Linksys [19]. A disadvantage is that they will want to develop the idea and that I will be at best rewarded as an employee of their company; I will not receive the profit of the system. Another option would be to patent the idea and try to sell this patent. A quick scan did not reveal any patents related to my idea. [20]

Final painting [detail], validation test #2

Considering the value creation process, dr. Brombacher had important feedback. He stated that in this time, the willingness-to-pay for online content is very close to zero. He doubted that viewers would pay money to receive updates from the paintings. Solutions for this problem are introducing the service as a limited-time free application or giving away credits for the system with partner-services (taking a course at the Centre of Arts, visiting a museum). Another solution could be to focus more on creating more exposure for the painter than on creating concrete financial benefit.

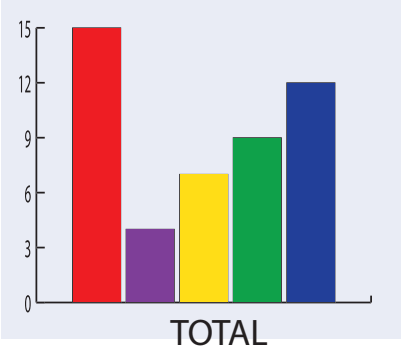
5.3 | Quantitative research

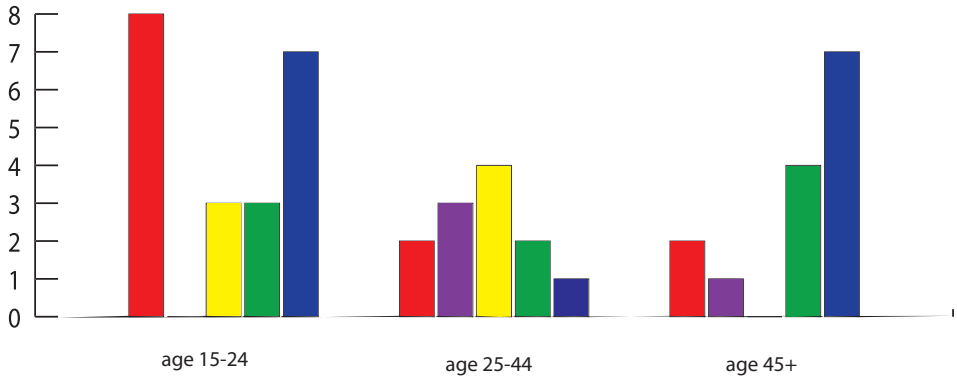
To find out more about the viewers, I conducted a small quantitative research. This was done via an online questionnaire [22]. The questionnaire is meant to have a global overview of how painters would like to receive their photo stream. The user (sample of friends, colleagues and family) is given a choice out of a fixed number of options. The answers were correlated only with age and museum visit (as a measure for cultural motivation) to keep the survey short and maximize response rate in a small timespan.

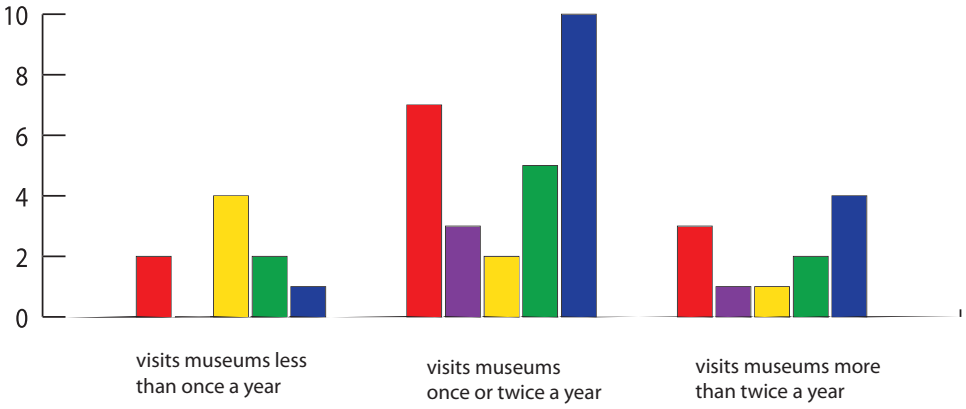
The results show that the viewers rated 'background of a digital photoframe' and 'background of computer' best. This may imply that users see the photo stream as some-

thing that they would like to check every now and then, but not follow consciously all the time. However, the viewer's motivation should be investigated more thoroughly via qualitative research to confirm these assumptions.

Output options and the preference of the viewers (47 respondents)







Intermediate result of painting, validation test #1

6 Conclusions

In the validation test, which had the prototype set up in the user's work environment, usability was tested. The usability requirements are approved in this test, however positioning of the lamp is not. The system should provide better feedback to the user on this respect. The final shape of the product has not been evaluated yet on usability and aesthetic quality. More users have to be tested to make the results more reliable.

The users that were tested in the validation research, indicate that they can see the business potential of the product. However, when evaluating the business plan, expert dr. Brombacher reported that it is quite hard to earn money with the current business model. In the second section on Objectives, I stated my research question as follows:

"How can we help traditional painters to generate more exposure and profit for their paintings with a product they can administer easily?"

Given the research results summarized above, we can say that it will be difficult to generate profit for the painters from our service, especially when they have to break-even with the price of the product itself. In what way more exposure can be generated is dependent on the interface to the viewer. Qualitative information is necessary to do more reflections on this part. The quantitative results suggest that different channels are needed to reach viewers with different demographics.
Although usability has been partially approved by the user, another test should be run to evaluate aesthetics and usability of the final prototype.

I have found that painters as a target group, although I focused specifically on traditional, professional painters, are still very diverse, probably due to their creativity. It is hard to make one design for all.

When trying to relate this project to the objective of the original project 'Virtual trace of the real world', the research is of little merit. However, the prototype can be used to do research on value transfer. Schwarz assumes in his paper [25] that painters, being one of the 'free professions', have a high Stimulation value. In the research I did before the Green Light meeting [6], I hypothesize that virtual worlds are a good environment for painters. This could be tested by designing scenarios where a painter and non-painters communicate with first the real world and then the virtual world via my current prototype. The results can then be verified with a Schwarz Value Survey [26].

User painting, validation test #2

7 Reflection

At the Green Light Meeting, there were three important remarks on my process:

- What grounds do you use for decision making? You tend to alternate be tween you as a student [with limited budget and time], the artist [with lim ited budget and technologic compe tencies], you as designer and your contribution to academic knowledge.
- What is the exact goal of the project? This is not concisely stated in report or presentation and keeps your pro cess from being directed. Focus.
- We need to see your level of develop ment in all competencies. Provide evidence either in you project or via other activities that you show in your showcase. If you state something is a key competency for you, show depth in the evidence. Within this project there are opportunities to show your development in 'Analyzing complexity', 'Design process' and 'User focus and perspective'

In the final part of the project, I took a goal that is clearly stated in the Project Objective and is referred to and developed throughout the research process. In the conclusions, this objective is evaluated and improvement points are mentioned.

During the process, I stuck to this project objective as a guideline for making my de- sign decisions. Where these did not impose

a clear direction, I chose for activities that would best benefit my personal competency development (e.g. when developing the output software for cell phone instead of PC). Qua user research, I had some important insights in comparison with research in previous projects, where the research always was done by multiple people. The qualitative interviews went fine on my own. The tests however, where I had to employ the roles of both facilitator of the test and observer of the participants, did not go so well at times. I had too many tasks at a time, got nervous and started making mistakes because of this. Solutions for this problem include recruiting another person to do the test with me, taking more time for the test itself, and preparing different strategies for each test so that there's a back-up plan in case the expected work plan fails. During the test, I should be more formal in my attitude towards the participants and more focused on the deliverables I want to get out of the test or the questions I want the test to answer.

During the validation test, problems occurred because I had two goals that conflicted. During my process it is clearly visible that I'm doing a lot of things at once. Although diversity in my tasks keeps me motivated, doing so many tasks at the same time makes them all lack quality. In the future, it is best to focus on doing a couple of things with a high-quality end result.

The reflection above I already did before in block 2.2. The reason that it went wrong again is that I messed up in the first phase of the project. Because I arrived late from Milan, and did not expect to be doing this particular project, the start of my project was chaotic. I had trouble getting acquainted to the initial subject of virtual worlds.

A bit later in the process, I noticed that I have trouble generating ideas on my own. I flourish in creativity processes when I am able to build upon the ideas of others. Without this synergy I feel lacking inspiration. Plus, without the comfort of a team I often lack the courage to make a choice and focus on a specific idea. This may explain why I am experiencing trouble in focusing my activities on a couple of goals. These problems all had place in the problem setting phase of the project. This phase can benefit if I discuss my project with different people to get more views on the subject, and if I remain calmer during this phase instead of stressing out. Getting the problem setting phase right automatically will improve the quality of the rest of my process, since it will be more clear what I need to know and why I need to do it.
To improve my sketching and visual language, I will go and work as a graphic designer for half a year after finishing my Bachelor. This will also give me time to take a step back from design, re-evaluate my progress, and visit a lot of extra-curricular events. After this half year, I will return to ID to do the Master's program in order to improve my design process further.

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