Color Makes Sense

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Introduction

Introduction

In this report I will show how I developed my concept. The project is called 'Worn Identities' where the goal is to create a wearable that makes the users able to express their identity.

"In this project you will design concepts for such a wearable in close contact with a target user group. The emphasis will be on developing a deep understanding of the end user and designing for personalization and communication of the users." – Project description Worn Identities

First the report is focused on how I came up with with the context by seeking a context around my material research. In the second part the focus is on how I created a concept around this context.

Table of content

Contents

Beginning

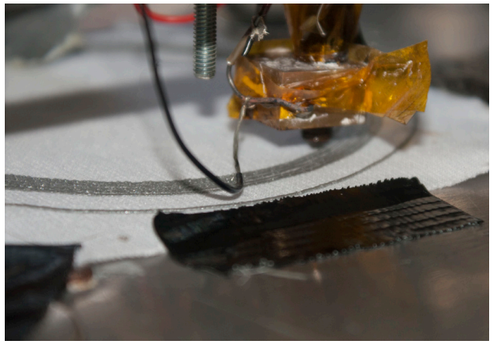
Pressure cooker

During the first week we worked in groups on a pressure cooker, we focused on the boundaries between the information that you share and the information that you want to keep private. We looked into the digital data that you create and make this visible using a wearable. From this basis we all created a different wearable. I created a T-shirt that shows your location history. This shows where you are from and where you have been, those elements are a big part of your identity.

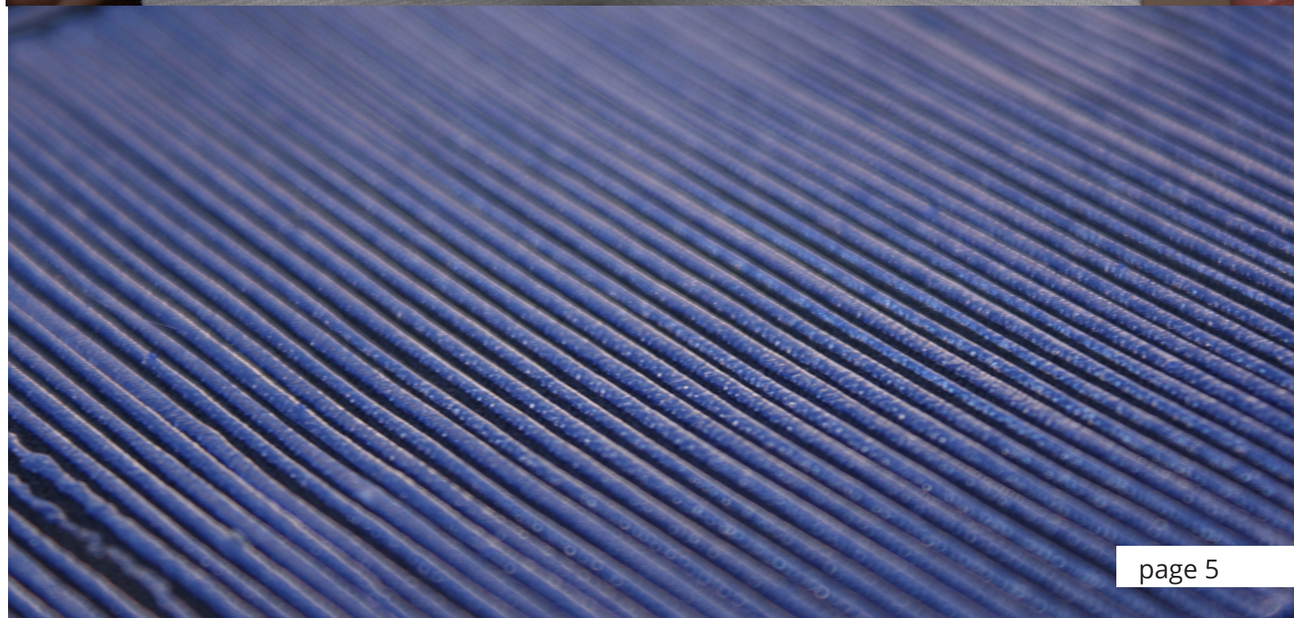
Material research

After the pressure cooker I started with doing research on the project description. What products are already on the market that change during time, or that can be personalized during production. Because I'm really interested in manufacturing technologies I wanted to learn more about textiles and technologies to create clothes. I also have some history in 3D printing so I tried to combine them to create clothes with an added value by 3D printing on top of them. By doing this I was able to constrain the clothes in various directions, make parts of clothing tactile and make the material bend in a certain direction when stretched.

My location history based on google data sewn on a T-shirt



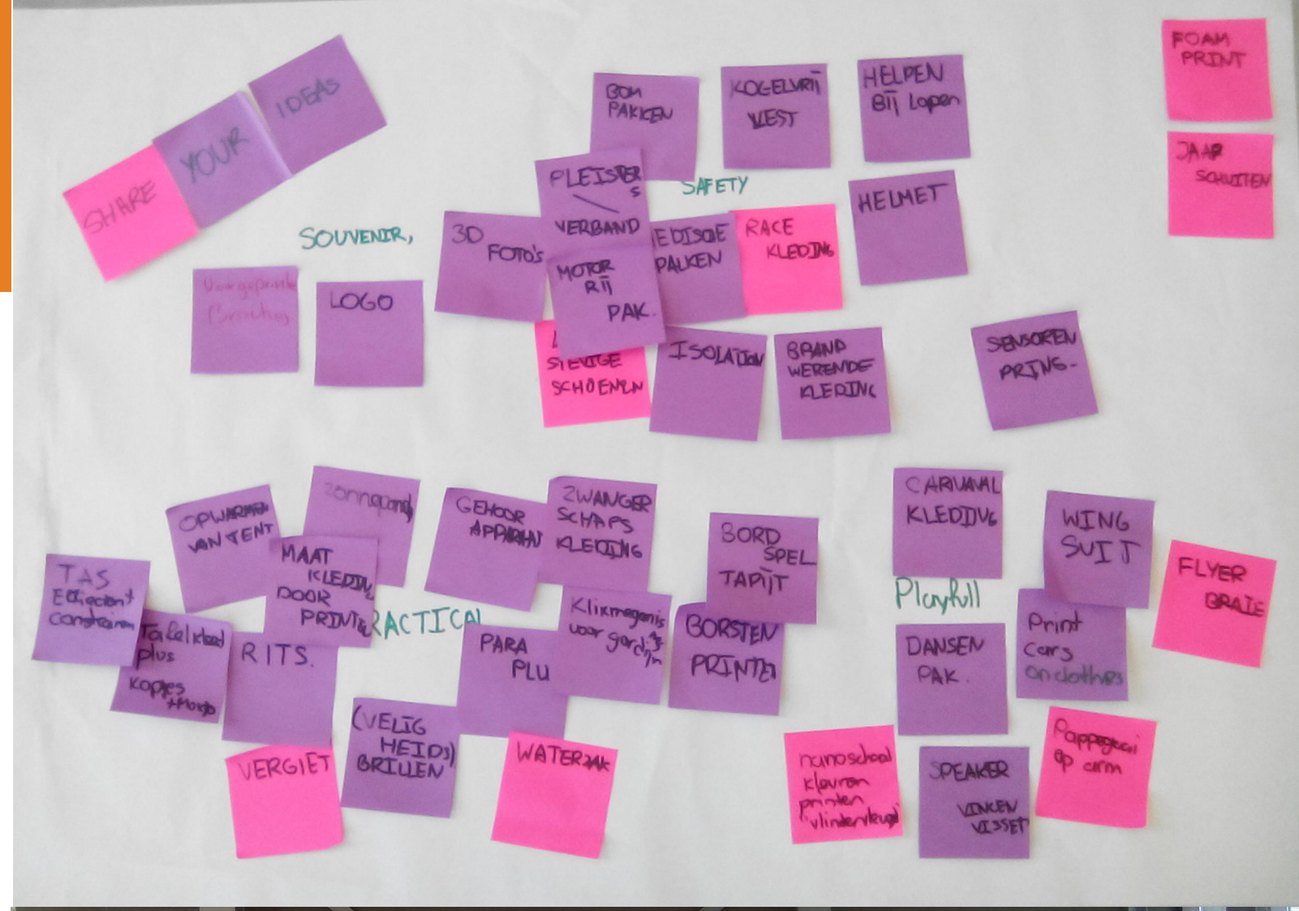
3D printing test on textile.



Seeking context

Crowd brainstorming

I wanted to know if there are more applications for this technology, so I presented this technology in front of students passing by the main building and asked them for input and feedback. As reward they would get a cup of coffee.
Besides that it was great fun to do this action, I did get a lot of input from different fields both from professors and students. By opening your design process to people from different fields I was able to also get some out of the box idea's, or what is possible if you take this technology to its limits (super-small, super-big) or what happens when using other materials (shape-changing material, conductive material, transparent material).



the setup for crowd-brainstorming

Choosing context

Applications

Combining all this information, I tried to get the most valuable contexts for this project. Where this technology can really give an added value to the users by adding an tactile layer, hiding parts or giving constraints in movement.
Three different contexts where this technology can really make sense are for handicapped people (shaking, unpredictable movements) 3D printing on their clothes can constrain their movements in certain directions so they could be able to become more independent.
This technology can also add safety to 'normal' clothes, by constraining movements in certain directions. This can be really interesting for skaters or other people who want to hide or show their personalized safety gear.
Another possibility is making clothes tangible for blind people, so they can distinguish their clothes, express identity and make the visible prints on clothes tangible.
I chose to design for blind people because they are an interesting user-group and 3D printing for them can really add an extra layer of information. I tried to print different shapes on textile and also developed a technology that can print braille directly on textile.

Problems:	Values:
Blind people aren't able to express themselves by graphical prints on clothes.	It gives blind people the opportunity to express themselves It gives them the possibility to distinguish different clothes.
Stakeholders:	**Solution:**
blind people, people who interact with blind people	Printing 3D on clothes instead of only colors. Focus on the tactile experience

Prototyping

To have something tangible to communicate with users about the concept I wanted to experiment more with 3D printing on textile and made a technology to 3D print braille directly on textile. So I developed a new way of using 3D printers to print dots instead of objects and published this technology online [4]. Within a few hours I received a question from a braille company in Canada that was interested and wanted to use this technology.

I did lots of itterations to reach to final settings

Mid-term

During demo day I showed my experiments together with the application of printing braille on textile. By having this prototype I got feedback on this specific application but also had discussions about how blind people could relate to clothing. During demo-day a lot of opportunities were discussed. I received the feedback that a T-shirt is probably the most obvious wearable to come up with and the question if blind people even care about what they wear (what color it is, how it looks) or that they only focus on the tactile aspects of wearables (what kind of material, shape). Also many people liked the aesthetical aspects of braille (so it could also be interesting for people with normal sight.
The main feedback during demo day was to get in contact with blind people and talk with them about how they relate to clothing. Find out what kind of element are important for them if it is about clothing and become aware of their situation (how do they choose and buy clothes) or how their wardrobe looks like.

By Tom Kölker

By Tom Kölker

Getting in contact

Directly after the mid-term demo day I contacted several organizations for blind people, posted messages on social media. Quite fast people responded to my messages. The message was published on a Belgium network for blind people and people started mailing me with experiences. Also a DressCoach called Stimme Vendel responded, she researched if blind people would want to get coaching in choosing their clothes and also asked questions that I can use in my project such as: 'What do you define as good clothing?', 'How do you experience shopping?', 'How do you distinguish clothes?' or 'With who do you go shopping and who advices you?'. Based on those answers (see the appendix) I concluded that when you are blind it doesn't mean that you don't care about matching colors and choosing good-looking clothes. Of course just like normal sighted people there are people that care less about clothes, but it really depends on the preferences of the individual.
Also the professional Dutch care-organization blind people 'Bartimeus' responded and asked me to come to a lunch in the dark with their

partners and clients. It was interesting to talk to different professional people about being blind and I also talked to several blind people that were at this lunch about their experiences. The main insights were that most of the blind people become blind on a later age, becoming blind is most of the time a slow process and that some people too late ask for help, they can become depressed and helpless.
I met Jan Huybers there, he is blind and a chairman of a group of more than 15 people that are blind or have low-vison in Veldhoven called 'Zichtbaar' he asked me to come over to a meeting of their association.
One of the most important parts of clothing for normal sighted people is what color it is and if the colors match together.

Desk research

What really interests me is how blind people think about color, an how they relate different colors to each other. So I started with searching scientific research around this subject. G.S Marmor [2] publiched research in the Journal of experimental child psychology in 1978 on how early-blind people and late-blind people develop of the semantics of color names.
I found some interesting insights in this paper. One is that there is a difference between early-blind people (people who have never really experienced color, or at least don't remember it) and late blind people (people who had sight for a longer part of their life, but lost their sight during their lives.). According to the people I spoke to (that were all late-blind) the late-blind group is much bigger than the early-blind group, but Tonny van Breukelen e-mailed me "Kleurverlies vond ik één van de meest aangrijpende zaken in het proces van gezichtsverlies." (translated "Losing color is one of the most striking facts in the process of becoming blind.").

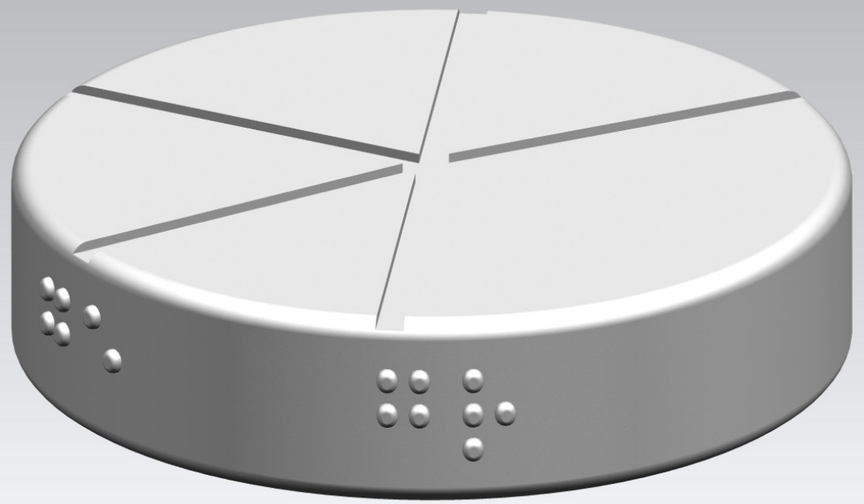
"The early blind tended to stress two kinds of color experience: (1) chance conversations in which colorful objects and events like rubies and sunsets were discussed, and (2) conversations about how to dress to please the sighted public." - page 274

"To language experience, the color blind add experience with a limited range of colors and the sighted add experience with the full color range." - page 275

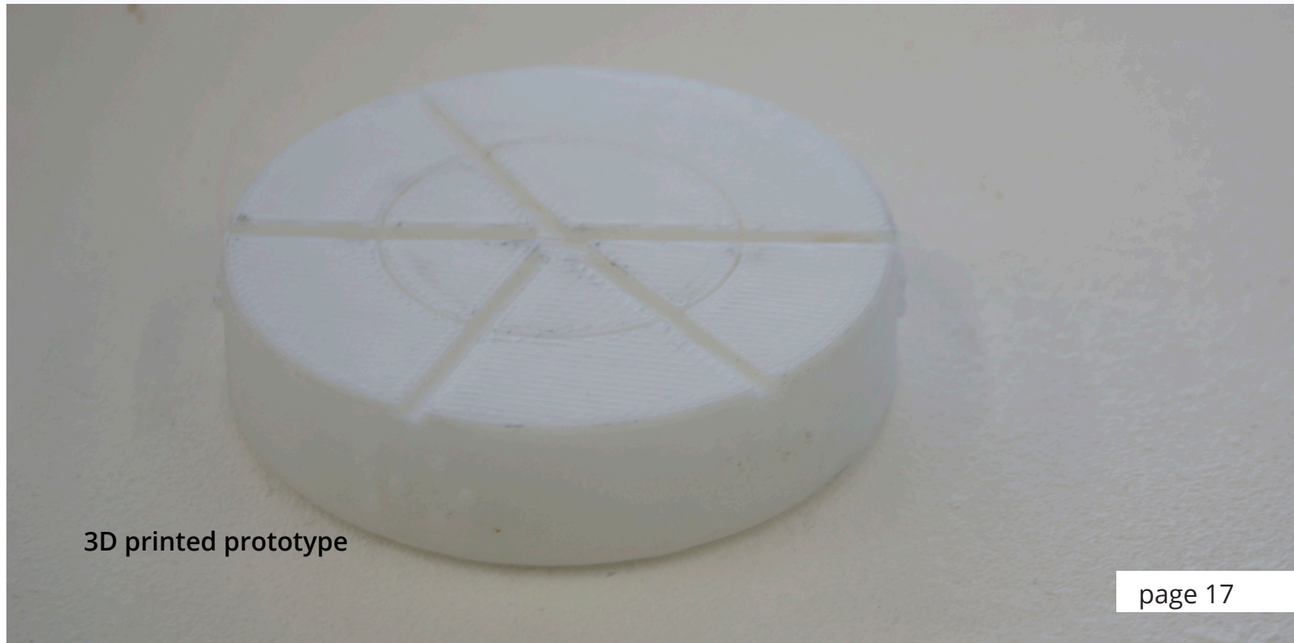
The paper also said in the discussion that most early-blind people 'learn' color by conversations about colorful elements in nature or about clothing.
Because early-blind people can only describe colors by words, color become limited to a certain range, but sighted and late blind know that colors are a continuous spectrum.
Based on this information I chose to make something that can give late-blind people a way of showing and 'reading' color in a continuous way. Because in that way they will be able to sense small nuances and perhaps be able to make color combinations based on this approach.

Prototypes

Before I went to the meeting with ‘Zichtbaar’ (The blind association in Veldhoven) I also wanted to have a tactile prototype based on a continuous color spectrum, so I can discuss both practical and conceptual elements with those people and they will have a better insights in what I’m aiming at.
First I wanted to make an interactive color wheel where they can feel what color the device is pointing at. But because I didn’t have enough time before the meeting I decided to make a static color wheel where I can put point out color by adding clay on top of it. I chose to make a circle where the first letters of the primary colors are written on the sides in braille. The color wheel also has relief on top so they can feel how far colors are away from each other. I designed the color wheel in CAD software (Siemens USG NX) and 3D printed it, so it is a real tactile prototype.



3D model of the prototype



3D printed prototype

‘Zichtbaar’

During the meeting with ‘Zichtbaar’ I showed them my first prototypes (T-shirts with braille printed on it) and the color wheel. We discussed the value of the concepts and I asked for feedback from their side.
The first prototypes didn’t work at all. Because braille is already hard to feel, and it is printed on textile (the textile stretches and bends when they want to read to braille) they were unable to read the text. Also most late-blind people can’t read braille nowadays, because there are many applications that can speak that are easier and not so super-expensive as braille devices and texts. So this concept didn’t really help them in this setting.
They also use other ways of marking their clothes such as sewing different shaped buttons on clothes that feel similar, putting them in other corners of their wardrobe or using a color to speech device. Although the color to speech devices were not that accurate because a range from purple to pink will be called dark-red for example. And those devices are quite expensive so not everyone had them.
They also told me that there are several devices to mark objects for blind people, penfriend for example is a device with which you can record a voice message based on a small sticker. This kind of devices are mainly used in the kitchen for distinguishing for example salt and sugar.
The idea of being able to feel color nuances in a continuous way did speak to them, but it was hard for them to imagine how that would be in reality.

Sound

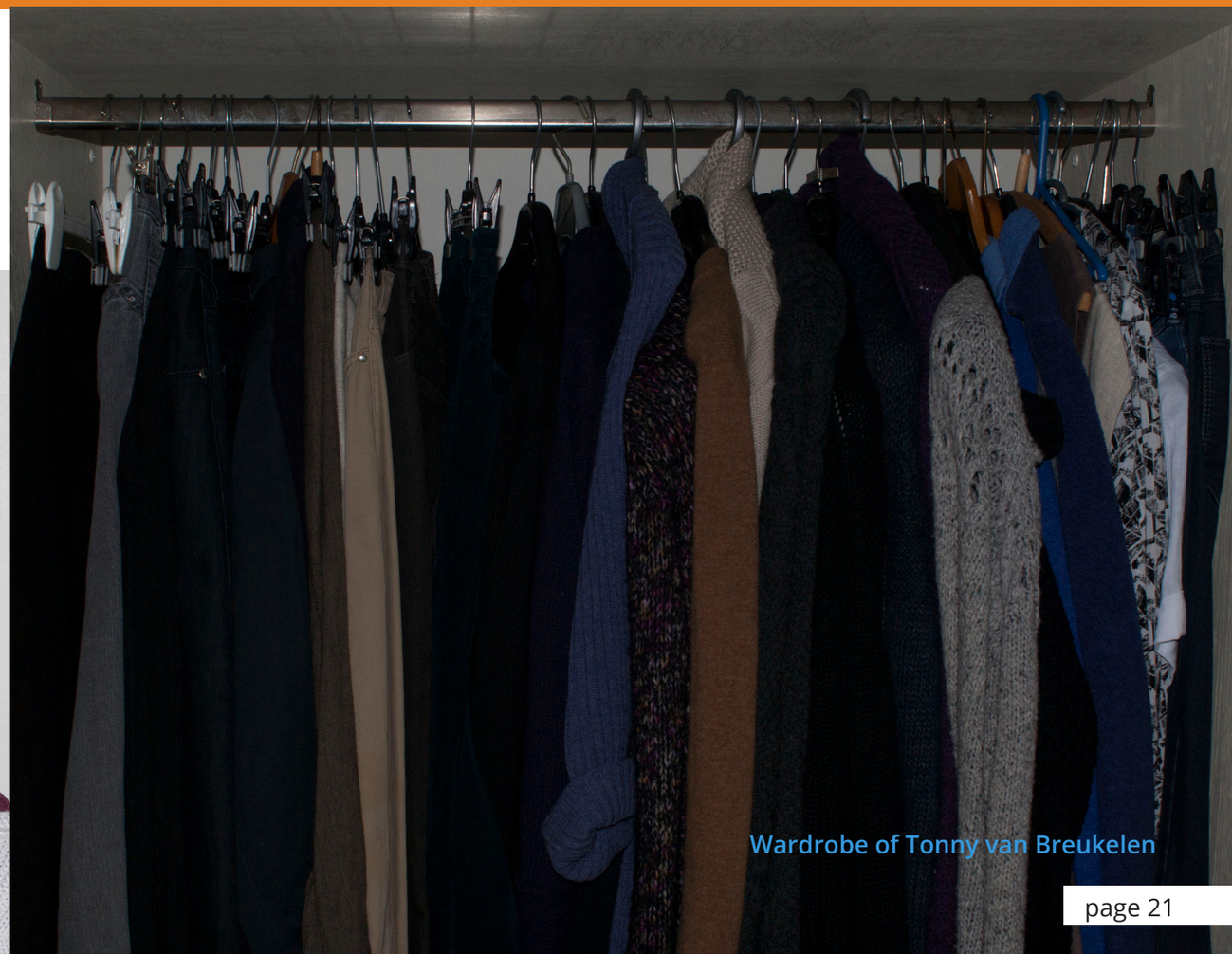
So I decided that I wanted to give late and early blind people the possibility to get an continuous experience of color. One way of doing this would be to map color to sound and see if blind people can learn to distinguish colors in this way. An interesting part of this is that sound in itself is also a continuous spectrum.
To get more insight in this possibility I arranged an expert meeting with Berry Eggen, an expert in Sound-Design. We talked about different ways of mapping sound to color; for example by using three different notes for the primary colors and by combining those create a combination of notes that sounds good.
Or direct mapping the frequency of notes to the frequency of light, the downside of this is that red and purple are in the light spectrum far away from each other, but people don’t see it that way. Another problem with direct mapping frequency of light to frequency of color is that it only represents the hue of the color and not the brightness or saturation.

Evaluate

Tonny van Breukelen

With all those knowledge I wanted to meet Tonny van Breukelen a blind woman living in in Hazerswoude. We talked about my concept and she showed me how her wardrobe was ordered and different devices for blind people. Because she was writer for Dedicon (the Dutch orginasation for texts for blind people) she could show me different devices for her work. If it was possible to make devices silent she preferred that, because sound is her only way of sensing the world around her, interact with people and recognize danger. She showed me a silent watch for blind people, she really liked this device because other people don't hear that you are using the device and you can still focus on the world around you. When I used the computer for blind people I got what she meant. All the text on websites was converted to speech and without breaks told to you. She also showed me her color device, but it didn't work really accurate because the distance to the object that you want to sense did really influence the color that the device sensed (for example when she put the device close to her jumper it said that the jumper was black, but in reality it was lightgrey). We also experienced that people translate colors differently (her husband said that something was purple, but I said it was dark red. We were both sort-of right because the color was in between those colors.

Tonny van Breukelen



Wardrobe of Tonny van Breukelen

Final concept

Concept development

Combining all this information I decided that I want to make color continuous and tactile for late and early blind people, without the need to learn braille. Because the feedback van Tonny van Breukelen and the insight that if it is possible to create a silent device that it would be better I do not develop the color to sound concept further.
To gain more insight in how color can be converted to a tactile experience I wanted to build a working prototype that I can test to get more valuable feedback. The feedback on the 3D printed passive prototype was quite positive, so I wanted to use the idea of the color wheel in my prototype. Also because it should really work the technological possibilities are more constrained than with the static prototype.
The reason that I chose a tactile experience instead of using sound is that users commented that sound is their sense for their environment (danger, interaction with other people), and that sound can also be heard by other people.

Another interesting part of using tactile experience instead of sound is that deaf blind people can also use the device.
So the concept that can be made within the limited time, and creates a tactile experience of color works as follows. The user can set a certain color on a color wheel and receives tactile feedback on the distance between those colors. In this way the user has a continuous sense of color instead of discrete (when using words to describe colors) sense. The user is also able to feel contrast in colors and the user doesn't have to learn a lot to use the device.

Based on the distance between the sensed color (red) and the color where the token is on the color cricle (green-blue) the device will set its vibrating delay.

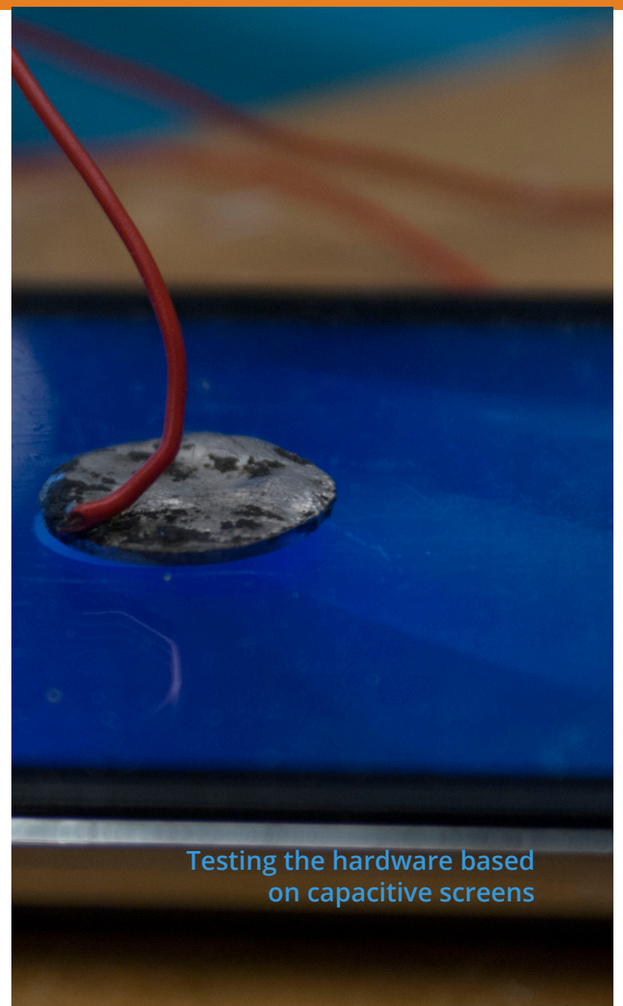
The device won't vibrate

The device will vibrate more when the two colors become more similar

Prototyping

Interface
In previous user-involvement sessions I also showed the users different interfaces that they can use to choose a color on a color wheel. Because token based interface got positive feedback (and it physically remembers its position it was a good way to use this for my prototype). I researched on how I can sense the position of the token and finally used a technology investigated by L. Chan et al. [1] about sensing tokens using touch screens. The most important insight they shared was that the lenght of the wire connected to the token should be as long as possible to get the best result.

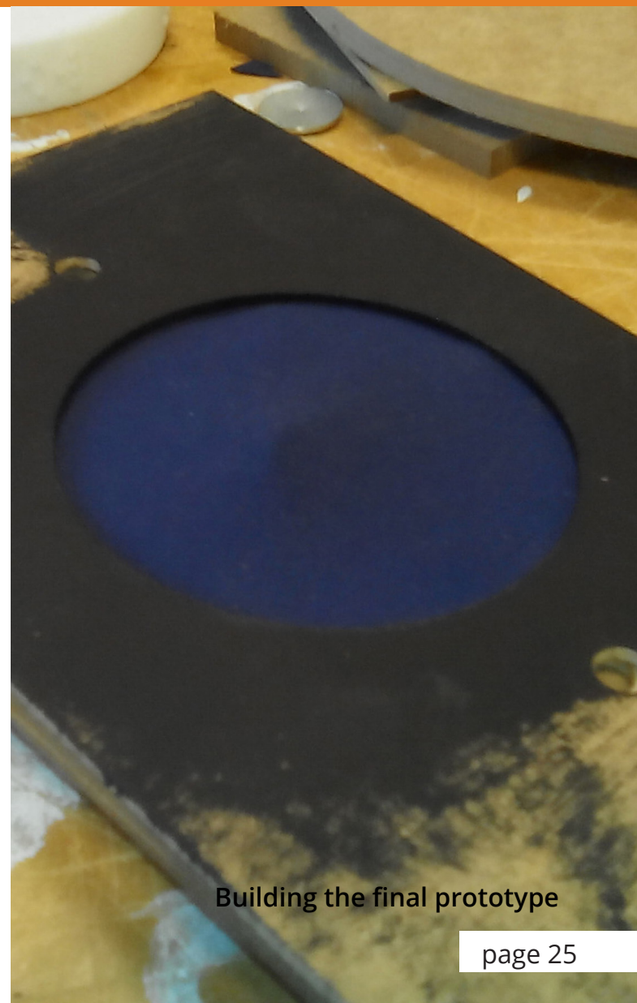
Hardware
In the prototype I used as android phone as hardware because this contained all the parts that were necessary to make it work (an capacitive screen that gives 2D coordinates, a camera for color-sensing and a vibration actuator as tactile feedback). An Android phone is also relatively easy to programming, although it still needs some skills and developing to make it really work.



Testing the hardware based on capacitive screens

Software
The code for this prototype can be found in the appendix. It senses the middle pixels from the camera, gets the position of the token (on the color wheel) and calculates the distance in color from those two pieces of data (ignoring the brightness of the color) this value is used to calculate how long the phone should vibrate.
I used polar coordinates to map hue to the angle and saturation to the distance from the middle. The brighness is in this programme totally left out becasue I was not able to use that with this specific interface.

Form
The form of the prototype shouldn't be symmetrical, because than it is hard to learn what orientation of the device is 'right' and where the colors are on the color circle. Because of technical limitations the device should fit the hardware (so an android phone should fit the device). The color circle should be as big as possible because then it is hard to feel differences.



Building the final prototype

Future

Future
This project is within the next nature space, and this gives me the opportunity to also look into the future and use technologies that are currently being developed. One of those technologies that is currently developed is Stimuli-responsive surfaces, that are surfaces that change shape (or texture) when light hits that surface. This technology could be used on the top of your finger and by using a color filter different parts of your finger-top could be sensitive for different colors. In that way blind people could really get a sense for color by using their fingers.

Impact
If this concept will really work, blind people can touch objects or point to objects and they will feel what kind of color that objects will have. Also color-blind people can use this technology to confirm their idea of what color an object is. Because this technology is almost implemented into the finger blind it will be an extension of the body, and probably the brain will recognize it as an extra sense.

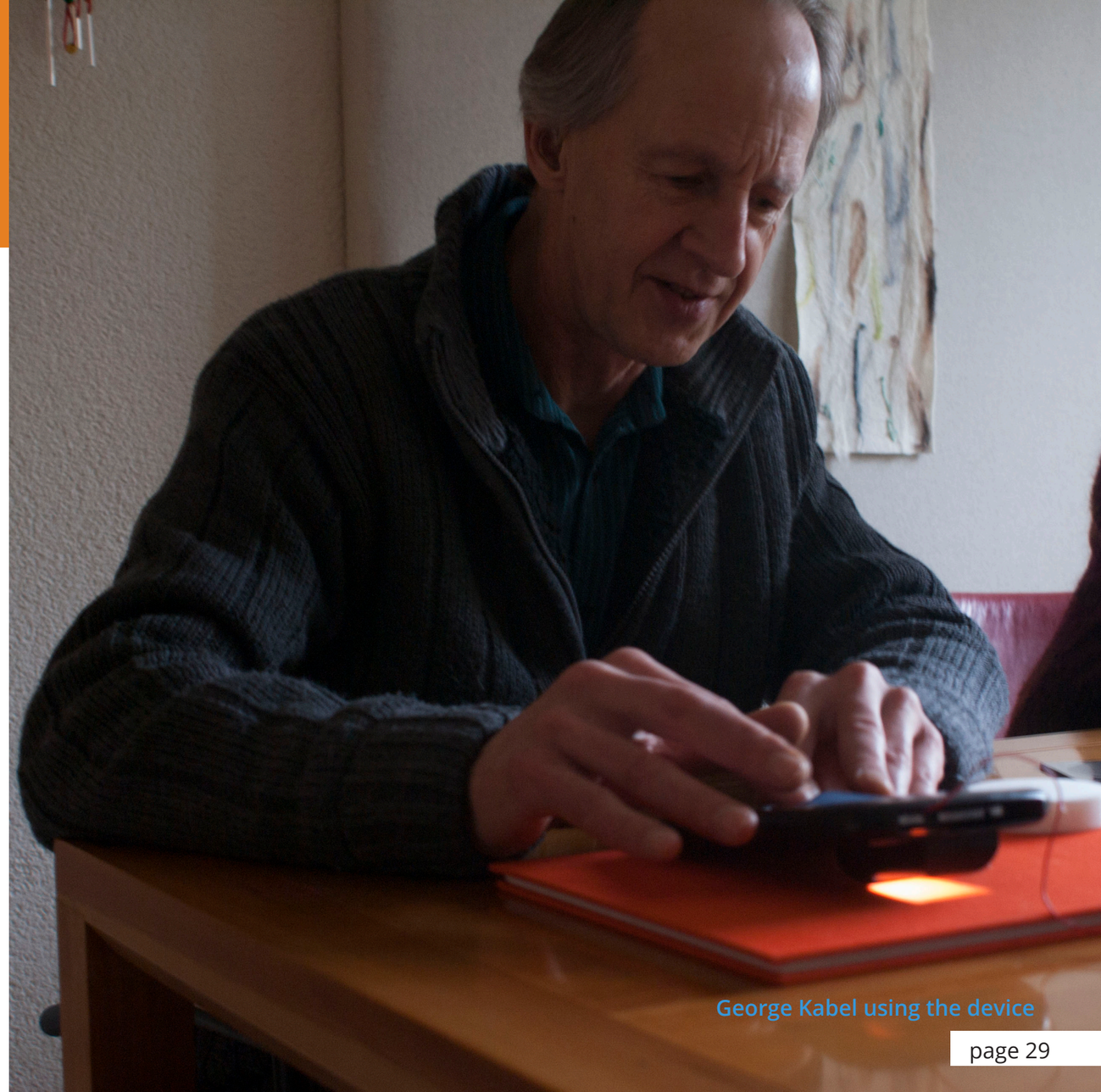
It would be possible to feel colors by touching (or coming close to) them

different parts of your finger will be triggered by different colors by using a color filter

User test

George Kabel

After my interactive prototype was done I wanted to test it with blind people, because my contact with the van Abben Musuem I was able to contact George Kabel. He is blind, lives in Eindhoven and is sculptor.
After this user-test I changed some details of my prototype before demo-day; The vibration behavior is the other way around (when the colors are close to each other the device vibrates more, instead of less). The threshold for changing the vibration behavior changed (the device starts earlier with reacting on the user).
Some other feedback that is quite interesting to take into concern but I didn't change in my final prototype was that paint colors(red, green, yellow) could be more familiar with people than light colors (red, green, blue). Another remark was that using the way of vibration the could tell the darkness of the color. George also said that a joystick interface could be a better way to set the color instead of the token based interface, because by using an unfamiliar interface you introduce two concept in one.
There was also a discussion about how it would be in the future. George said that it could be hard to feel nuances in this way, because braille is also hard to learn for people who become blind on a later age. It could also be possible to use different fingers for different colors, although this makes it also more difficult (because you have to touch an object with all your fingers on the same place to know the color of that place).

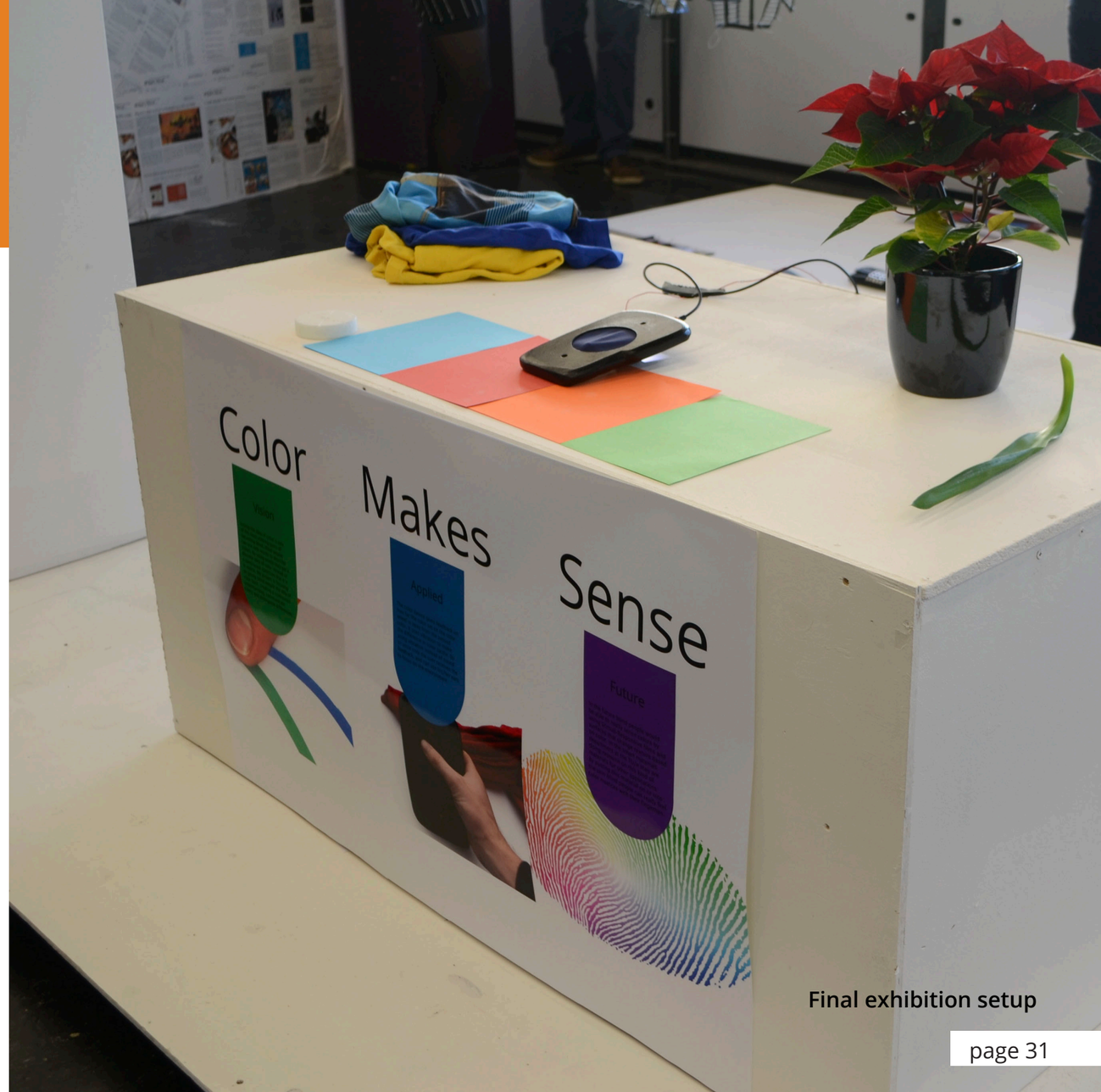


George Kabel using the device

Final exhibition

During the exhibition I received lots of feedback and remarks on my concept. It was hard for people to imagine how the future prototype would work, because I was not able to build this right now (and I didn't create a prototype that faked the interaction of the future prototype but focused more on building a real working prototype based on hardware that I can use. Although many people did appreciate that I had a working prototype, but the interface was sometime a bit lacking (could be software and hardware problems). Also moving the token in the interface should be easier and give a better feeling.
Also people made the remark that color is more than color of objects, but also can describe a atmosphere. For example blind people don't have the experience of a cozy room based on what colors are used, but they need their other senses for experiencing atmosphere.

The final interactive prototype didn't take brightness into account; this is of course an important part of the color that you sense. But it was technical hard to implement the brightness in the color wheel because the color wheel has two dimensions (hue, the angle and saturation the distance from the middle) and the camera will get a more bright picture when the device is closer to the object that you want to sense.
It could still be interesting to dig deeper into using sound to describe colors, but because of reasons mentioned above I did choose to go for vibration (tactile experience) and change in texture in the future.
It is still not really clear what the stimuli-responsive material can and how much light is needed to let it change texture, because of that reason it is still a speculation that it could work in the future. I have planned a meeting with the researchers on this material, but it will be after the death line for the report.



Final exhibition setup

Conclusion

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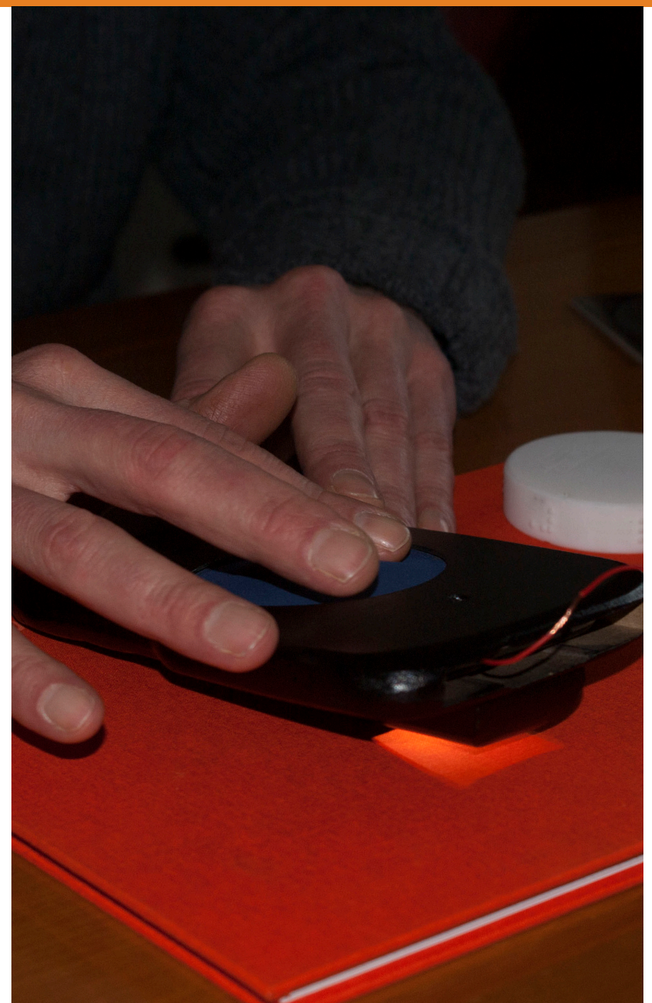
Reflection

In the beginning of the semester I didn't have a clear context, and thus it was hard to develop a good concept. I hadn't any idea in what direction this project will go and because of that fact it was hard to become really enthusiastic and innovative. When I started to create a context around my material research I was able to dig deeper into this context, I learned a lot by talking to blind people and discussing concepts with them. By receiving feedback from users and enthusiast responses from professionals in the field I also become more confident and enthusiast about the project. I experienced that I needed to kill my darling to go further and focus on the users instead of where I started. By talking to people with low-vision I got an idea how it would be to live with such disabilities. The project was not my first choice, so in the beginning I didn't really find a way to fit my identity and vision in the project description, but during the project when it also got more context I was able to create a concept that I really believed in and bent the project description towards my identity. This project really got me into a context that I was totally unfamiliar with, and showed me how the world for people with without vision is like. I needed to gain network in the world of blind people to learn more about the context. I've never used so much user involvement in a design project; and it was an interesting experience to really build a concept around a specific context. In my earlier projects it was almost the other way around (having a concept and searching for a valuable context).

When looking back at the project description I did develop a deep understanding of the end user, and designed for communication of the users. Although I didn't really make a wearable that is personalizable or changes during time based on the behavior of the end-user. It was hard for me to come up with a concept that totally fitted the project description, added real value to the context and fitted my interest as a designer. So my final concept is a combination of those elements where I tried to keep the core of the project (developing a deep understanding of a specific context)



but left out the direction of creating a personalizable wearable.

I also did meet with people from different disciplines (caretakers for blind people, researchers on therapies for blind people and learned a lot from them. I used scientific papers as a way to learn more about the context and create a design opportunity. To make my prototype working I designed a new interface that is based on research. This project also showed me the importance of tactile experience, especially for blind people it is really important that all the information is not visible but tactile. Also the form of products can help blind people to find the interaction possibilities (for example totally flat surfaces with not tactile buttons are really difficult for blind people), or knowing what is the state of the coffee-machine (no water, no coffee, coffee ready, processing, on, off). If possible it is interesting and crucial for a product designer to give hints that are also based on sound or tactile experience.

References

[1] Chan, L., Müller, S., Roudaut, A., & Baudisch, P. (2012). CapStones and ZebraWidgets: sensing stacks of building blocks, dials and sliders on capacitive touch screens. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2189-2192.

[2] Marmor, G.S. (1978). Age at Onset of blindness and the Development of the Semantics of Color Names. In Journal of experimental child psychology, 25, 267-278.

[3] Shepard, R.N., Cooper L.A., (1992). Representation of colors in the blind, color-blind, and normally sighted. In American Psychological Society, 3 (2), 97-104.

[4] http://www.thingiverse.com/thing:503408

Appendices

```
/**
Color Makes Sense
@author: Geert Roumen
@hardware: DOOGEE Voyager 2 D310
@description:
This application compares the color sensed by the camera and the color set by using
a color wheel. This difference is converted to vibration.
 */
//Import the needed libraries to make the camera and vibration working
import ketai.camera.*;
import ketai.ui.*;
KetaiVibrate vibe;
KetaiCamera cam;
//Set the frame per second to create a better throughput for the program
int fps = 7;
//Set the global variables to use for future calculations
color cam_color = color(0);
color wheel_color = color(0);

float cam_color_sat = 0;
float cam_color_hue = 0;
float user_color_sat = 0;
float user_color_hue = 0;

//Define the size of the top and bottom rectangle
int rect_size = 300;

//Declare the setup
void setup() {
  //Set the orientation of the android device to landscape
  orientation(LANDSCAPE);
  //Use the center as reference (for positioning)
  imageMode(CENTER);
  //Define new camera (the rear camera of the smartphone
  cam = new KetaiCamera(this, 176,144, 14);
  //Use manual settings (to disable auto white balance), but didn't really changed
   cam.manualSettings();
   //Show the camera settings (resolution, device...)
   println(cam.dump());
   //Define the vibration device
   vibe = new KetaiVibrate(this);
   //set the framerate
   frameRate(fps);
}
```

Appendix

```
//Declare the draw fucntion
void draw() {
  noStroke();
  //Get the color from the camera (See function below)
  cam_color = getColorFromCamera();
  //Set the color mode to Hue Saturation Brightness
  colorMode(HSB, 255);
  cam_color_hue = hue(cam_color);
  cam_color_sat = min(255,saturation(cam_color) *1.3);
  //draw a rectangle with the color measured by the camera
  fill(cam_color_hue,cam_color_sat,255);
  rect(0,0,rect_size,height);
  colorMode(HSB, 255);
  wheel_color = getColorFromWheel(mouseX,mouseY);
  user_color_hue = hue(wheel_color);
  user_color_sat = saturation(wheel_color);
  //draw a rectangle with the color from the color wheel
  fill(wheel_color());
  rect(width-rect_size,0,width,height);
  //draw the image gained from the camera
  image(cam, width/2, height/2);
  //draw a circle on the place where the screen is touched (as debugging feedback)
  ellipse(mouseX,mouseY,10,10);
  //create the variable for the distance between colors
  float d = dist(cam_color_sat*cos(cam_color_hue*(2*PI/255)),
                 cam_color_sat*sin(cam_color_hue*(2*PI/255)),
                 user_color_sat*cos(user_color_hue*(2*PI/255)),
                 user_color_sat*sin(user_color_hue*(2*PI/255)));
  println(d);
  //let the phone vibrate for a certain time
  vibe.vibrate(max(0,1000/fps-int(d*0.8)));
}

void onCameraPreviewEvent()
{
  cam.read();
}
```

```
// start/stop camera preview by tapping the screen
void mousePressed()
{
  if (!cam.isStarted()){
    cam.enableFlash();
    cam.start();
  }
}
void keyPressed() {
                  cam.start();
  if (key == CODED) {
    if (keyCode == MENU) {
      if (cam.isFlashEnabled())
        cam.disableFlash();
      else{

      }

    }
  }
}
```

Appendix

```
color getColorFromCamera(){
  long col_r = 0;
    long col_g = 0;
  long col_b = 0;
  int number = 0;
colorMode(RGB, 255);
  for(int i= 68;i<108;i++){
    for(int j = 52;j<92;j++){
      number ++;
      col_r += red(cam.get(i,j));
        col_g += green(cam.get(i,j));
      col_b += blue(cam.get(i,j));

    }
  }
  return color(col_r/(number), col_g/(number), col_b/(number));
}
color getColorFromWheel(int x, int y){
    colorMode(HSB, 255);
    float dX = (width/2)-x+0.01;
    float dY = (height/2)-y;
    println("tan:");
    println(atan2(dY,dX));
    float deg255 = (255/TWO_PI)*atan2(dY,dX);
    println("deg255: ");
    println(deg255);
    if (deg255<0){
      deg255=255+deg255;
    }
    println(deg255);
    float distance = min(height/2,dist(mouseX,mouseY,width/2,height/2));
  return color(deg255,distance*(255/(height/2-40)),255);
}
```

Appendix

User-test / discussion with George Kabel

Small device improvements (before Demo-day)

1. Making more nuances in vibration frequency (now it is not clear in what direction to move the interface), but only when reached the color it is clear.
2. Inverse the vibrating behavior, when close to the needed color it will vibrate instead of vice versa.

Some discussion (for future improvements)

1. Using a joystick like interface instead of my capacitive color wheel
2. Why using vibration (doofblind, keep the focus on the environment sounds) or using sound (more intrusive, but it can also contain more data (grayscale, what direction to go).
3. Input from floris: Using the color wheel for paint (RedGreenYellow) instead the color wheel for light (RedGreenBlue screen colors)
4. Input from annelies (also show the colors on the device for people with limited sight instead of total blind
5. Biggest application is in clothes, but also grocery, nature (although George is not so much into gardening. George is also an shape artist, but since he is blind he doesn't really care about the colors of his creations
6. Braille is only used by 10% of the blind people, especially late-blind people are not able to learn braille in such a good way as early blind people can (think of cycling, walking). Braille is already quite difficult to learn for late-blind people.
7. George also used the 'knoopjes' in his clothes to mark which color they have.
8. Floris: Using numbers to differentiate in colors (Red-Purple 20%, is for example more red)
9. Hard to feel the difference between details and the overall color (for example in granite)
10. Working with notes to define colors would be difficult for blind people with no feeling for music (such as George)
11. Most projects that come over to discuss their vision with them (DAE and TU/e) don't reach the market...

Co-creation (When George would design this device)

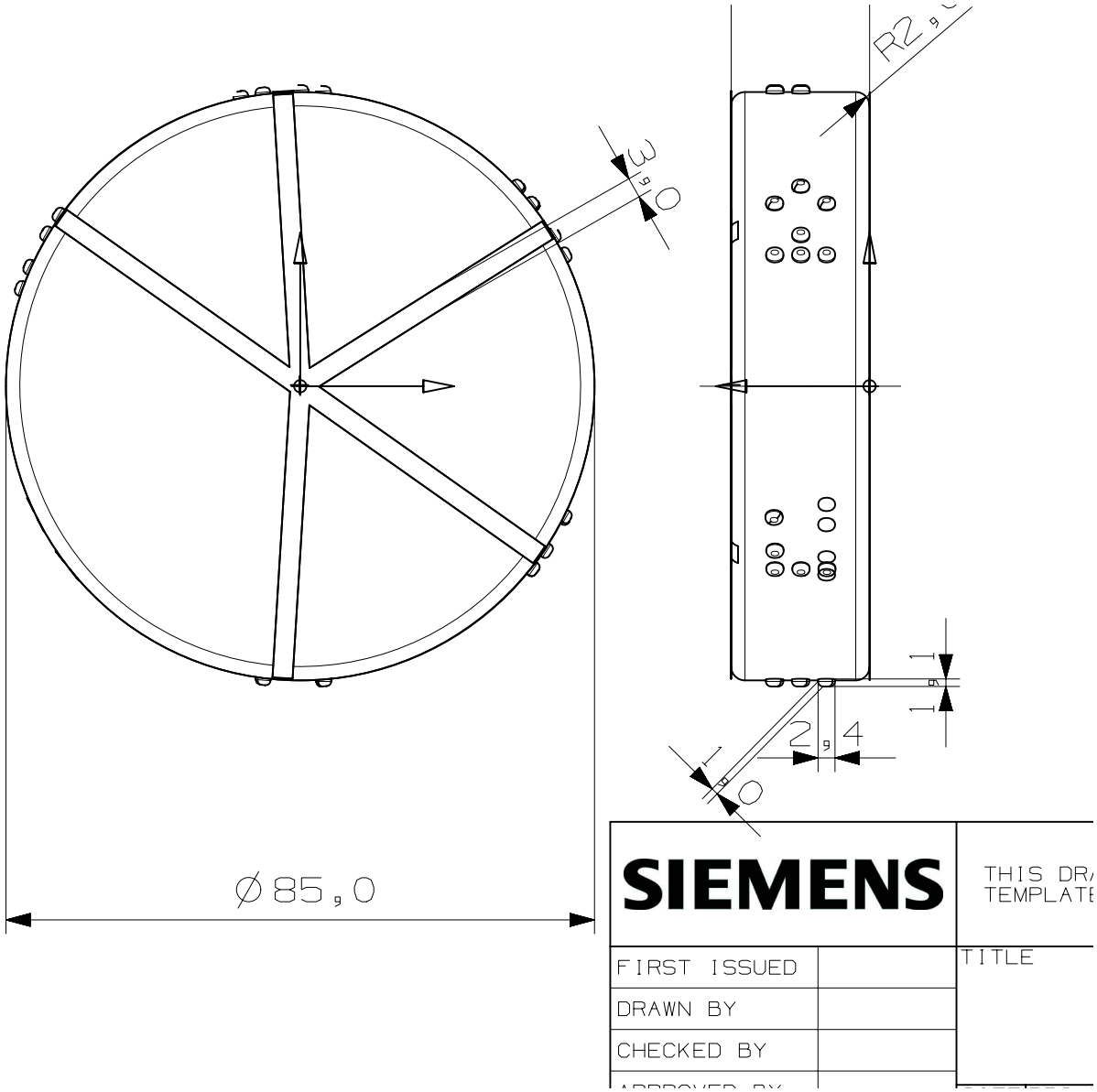
- First speak what color direction (Purple-Red or Red-Purple) and combine that with moving a joystick to a certain direction

Some discussing about the next nature proposal

1. Could be hard to feel nuances (although he has to experience it)
2. Annelies: Using multiple fingers for different colors
3. Association between colors, waves for blue...
4. See point 5 (it would be difficult to learn on a later age)

	criteria	Mode & shopping	Is your style changed by being blind?	offline/online	advice
Person 1 (f) (Became blind)	it has to fit, it should look good. it shouldn't be to expensive	not focussed on mode. Likes shopping. Shops together with mother or friends	-	Offline because it is hard too get an idea of the clothes, and not every site is made for blind people	
Persoon 2 (Became blind)	Ask the color of the clothe, feel the textile	Focus on a goal when shopping	Buying less clothes with prints on it, because it is hard to imagine how it looks. Influenced by people around you	Offline	
Persoon 3	Good quality			Offline	Some
Persoon 4 (have always had a visual handicap)	Praktical, Representative, Color should be nice, It should fit nice	Difficult, because you need help	-	Offline	Friend

advice by who	focus point when buying clothes	How to gain trends in mode	wardrobe	Services	other remarks
Mother or friends, did styling advice at bartimeus. Boyfriend is not usefull because of different taste	No sweaty textile. not to expensive. Has to fit	By speaking to friends. Although I'm not really into the latest trends	Divided on type of clothes, I'm trying to get a color detector	Those are expensive	Magazine about mode for blind www.dedicon.nl
Mother and sister. When (they are) in doubt I follow my	Mainly on color, Type of textile		Divided on type of clohtes, Using color detector when in doubt		
Some good friends	Natural textiles (wool etc.), Price	I go for the praktical approuch, I buy what I need	Try to buy as many different tactile clohtes, so I can distinguish them. No confidence in color detectors	Could be interesting	
Friend of family	Material, Color, Price and how it fits	-	Not really ordened		Not really shopaholic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