Flow

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Introduction

For Project 1 Design, the theme Vital People focuses on design that causes behavior change for healthier lifestyles, with projects contributing to both physical and mental vitality and healthy living. Within the Vital People Theme, our team was from the start very interested in combining both physical and mental health within design and researching how the two can relate to each other. Therefore, we designed Flow, a water system that relieves stress.
The goal within this project is to develop your overall competence in design and your scientific and professional skills (TU/e, n.d.). By acquiring knowledge from different Expertise Areas, we were able to use certain design proficiencies in the Project to further develop ourselves. We got the opportunity to start creating our Professional Identity and Vision, achieve goals from our Personal Development Plan and develop as a future Industrial Designer by setting new goals.

To make our development visual, we wrote a report in which we will discuss our experiences and learning points during Project 1 Design in terms of our iterations, final outcome, and design process.

Project goal

Stress affects people's physical health and mental health, especially for students. ((Park & Shankar, 2016)). Stress has a big influence on mental health conditions, including chronic fatigue, depression, and anxiety. The consistent increase in heart rate, and elevated levels of stress hormones and blood pressure, can take a toll on your body (American Physical Associations, 2018).

In our performance-oriented society, stress has become a relatively big problem for students. They can experience so much stress, that it becomes dangerous for their health. Since Covid-19 stress only worsened. Most student’s lives take place in one room: they live, study, and sleep in there. This makes it hard to set boundaries and it can lead to feeling guilty when doing something different than school, especially when deadlines and exams are coming up. As students, we identify ourselves as part of this group and know firsthand what it's like to be in this situation. We were curious to learn more about this topic and wanted to come up with a solution. Therefore, we chose to focus on students who experience stress as our target group.

The goal we want to achieve with this project is releasing stress for students. We want to do this unconsciously, as students often do not have or take the time to do stress-reducing exercises. Our more specific project goal is realising that you experience stress and recognising your own patterns.

Iterations

Before we came up with the concept of Flow, we went through four iterations (see figure 1). After each iteration we collected the good points and implemented the feedback into our new concept. To gain an overview of our development throughout the design process, we will include and illustrate these iterations and specifically explain the idea, goal, methods and results per iteration.

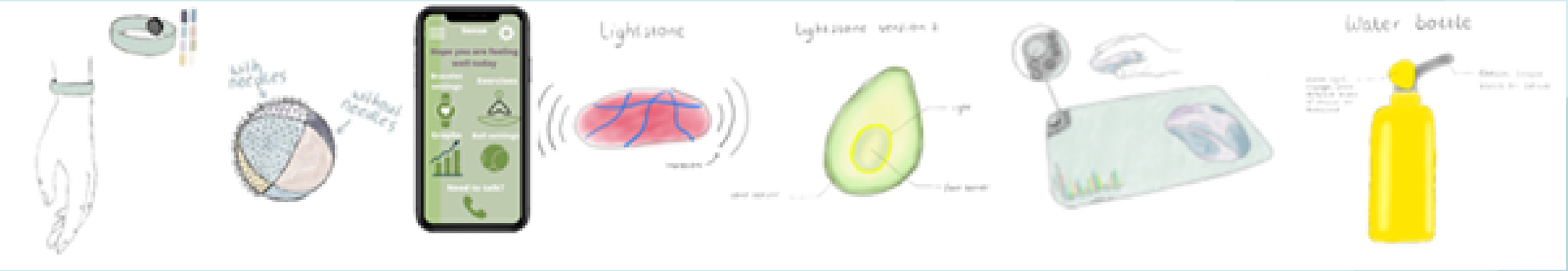


Figure 1: Concept development in chronological order.

Iterations

Pressure Cooker

During the Pressure Cooker (see figure 3), an exercise in which participants need to go through a speeded-up design process, we thought of an acupuncture ball (see figure 2). Acupuncture is used for stress release (Rarani, 2021) and we wanted to bring this into a format where people could apply this by themselves. Besides that, we wanted to keep track of the user's stress with the correlated bracelet and visualise this to the user with the app. Also, different exercises and settings of the ball (for instance how long the pins are) could be managed in this app. At the beginning of the Pressure Cooker, we found out that stress was a recognisable problem for us. Therefore, we decided to design something that releases stress, which is the goal of the acupuncture ball. However, we were not satisfied with the way in which we conveyed stress release thus we wanted to rethink our design options for the future. Nevertheless, the result of the Pressure Cooker was that our goal of releasing stress among its users was determined. This goal remained throughout the entire process of the course Project 1 Design.

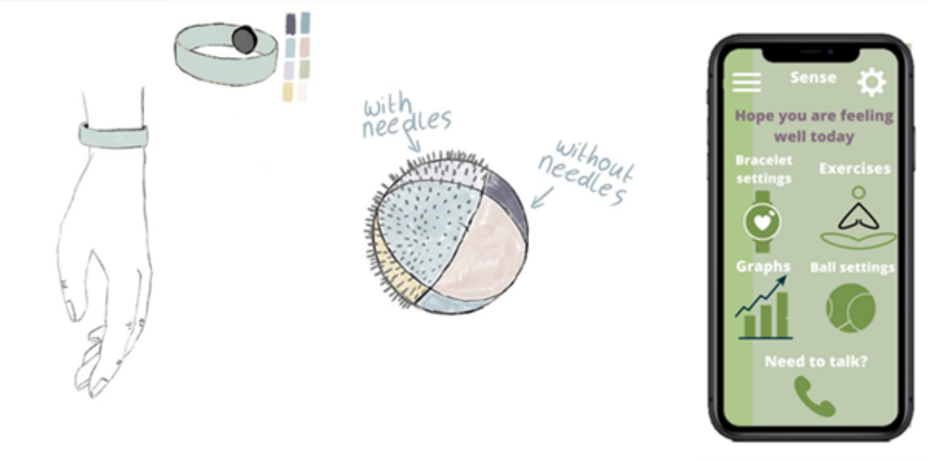


Figure 2: Acupuncture ball with complementary bracelet and app.

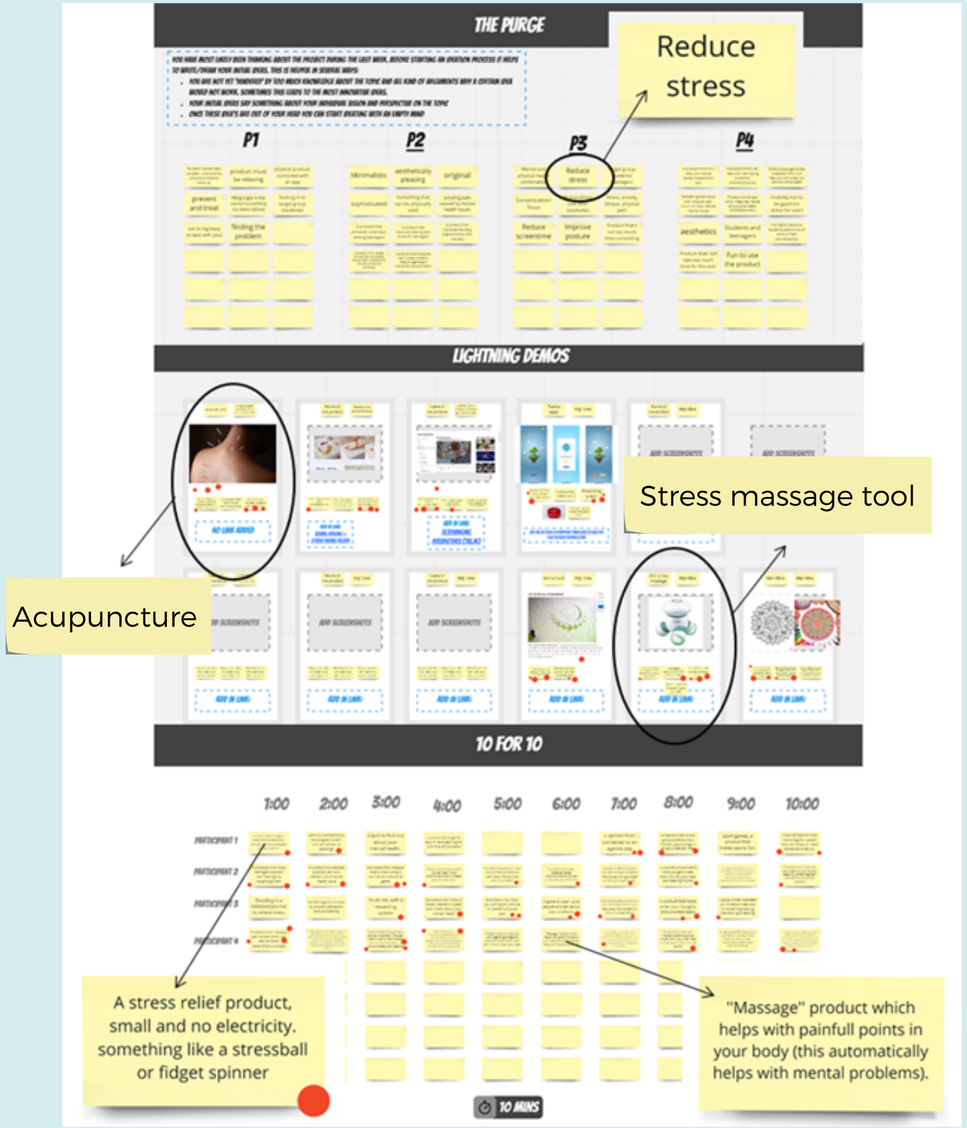


Figure 3: Highlights of the Pressure Cooker.
https://miro.com/app/board/o9J_lVv4Akg=/

Iterations

Lightstone

We continued with the topic of stress by thinking of two variations of another concept named Lightstone (see figure 6) with the use of ‘Brainstorming for all senses’ (Wardt, 2021) as can be seen in figure 4 and 5. These light stones emit several colours of light that represent the user’s emotional well-being. With this visualisation the user could reflect on why the user is feeling a certain way. The difference between the two versions is that the former one also depicts the physical behaviour of the user with the colour of the lines and the stone vibrates during a change of colour. Furthermore, the way in which data is collected differs between the versions. The first light stone makes use of a heartrate and perspiration sensor and the latter one of a voice and face sensor which improves the usability since the light stone could be placed anywhere.

By visualising the user’s mood, we believed we could achieve the goal of self-reflection. Subsequently the user could take long-term measurements when stress is being visualised constantly. However, we were not satisfied that the product displays the user’s stress level with the colours as this might be obtrusive. Even though Lightstone did not meet our aspiration, the idea of obtaining the user insights has been important for our further design process. This is also the result we obtained from generating this idea and the property we implemented in next designs.

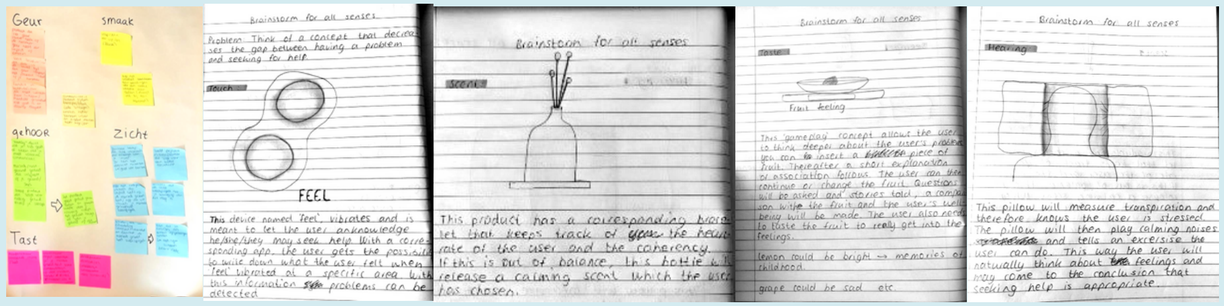


Figure 4: Brainstorming for all senses results.

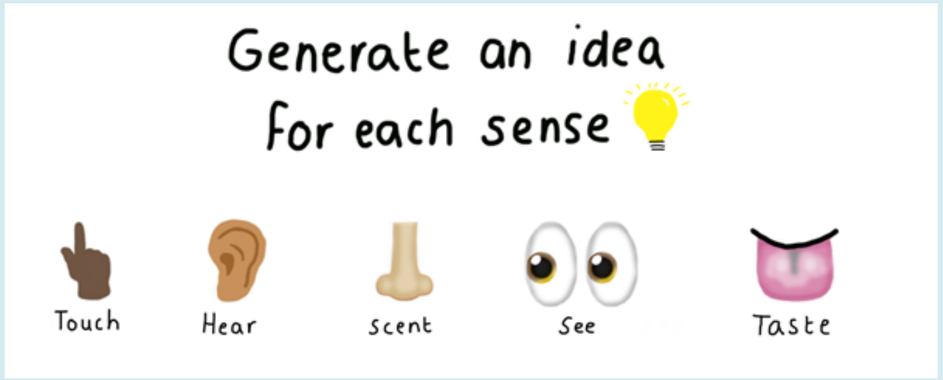


Figure 5: Basic concept of brainstorming for all senses.

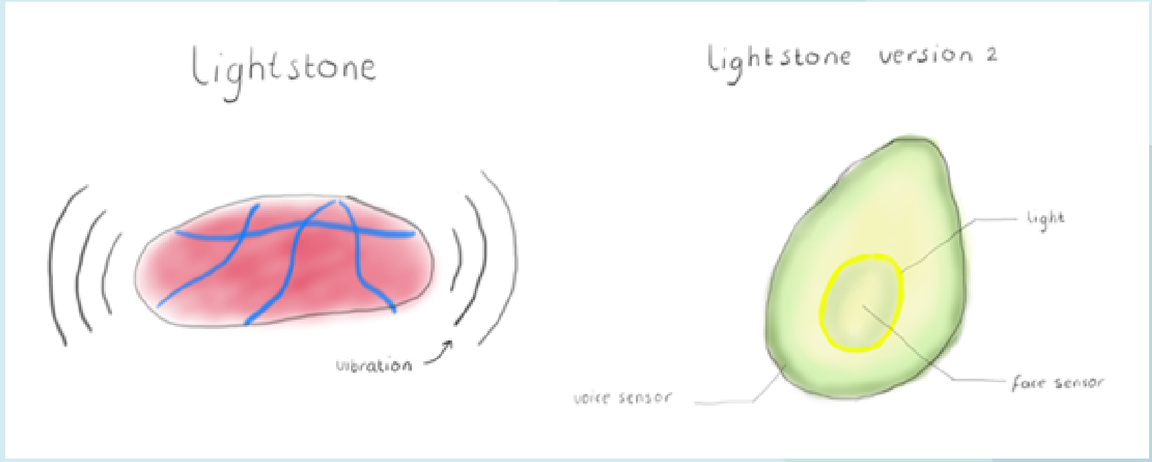


Figure 6: Lightstone version 1 and 2.

Iterations

MoodMouse

Besides giving insight, which was done with Lightstone, we wanted to release the stress of the user immediately. Therefore, we made use of the impact colour can have on people. Certain colours can namely influence people's mental state (2018). Inspired by the light stones, we wanted to implement the effect of colour in the shape of light in the concept named MoodMouse (see figures 7, 8 and 9). However, with MoodMouse we wanted to display the colour that represents a mood that needs stimulation with the user. Therefore, if the user feels sad, the mouse mat of MoodMouse will show the happy colour yellow (2018). In order to determine which colour must represent which mood, we did research and we have made a questionnaire (*Interpretation of colours*, 2021). Furthermore, the usability has been improved by the design of the mouse since it keeps track of the perspiration and heartrate of the user when their hand is placed on the mouse. If the user feels stress, a stress ball that is included within the mouse and a clip that can be placed on a pressure point in your hand could be used as well. It appeared to be important for us to make the product simple to use so no further stress would be awakened. This was the goal that we wanted to achieve with MoodMouse. Since MoodMouse consists of four different parts (mouse, mouse mat, pressure clip, and stress ball), we decided after some feedback that we needed to keep our next concept simple which was our main learning point.

For more information about MoodMouse, see the Midterm Demo Day discussion page on Canvas: Topic: Vital People Team 3B (tue.nl)

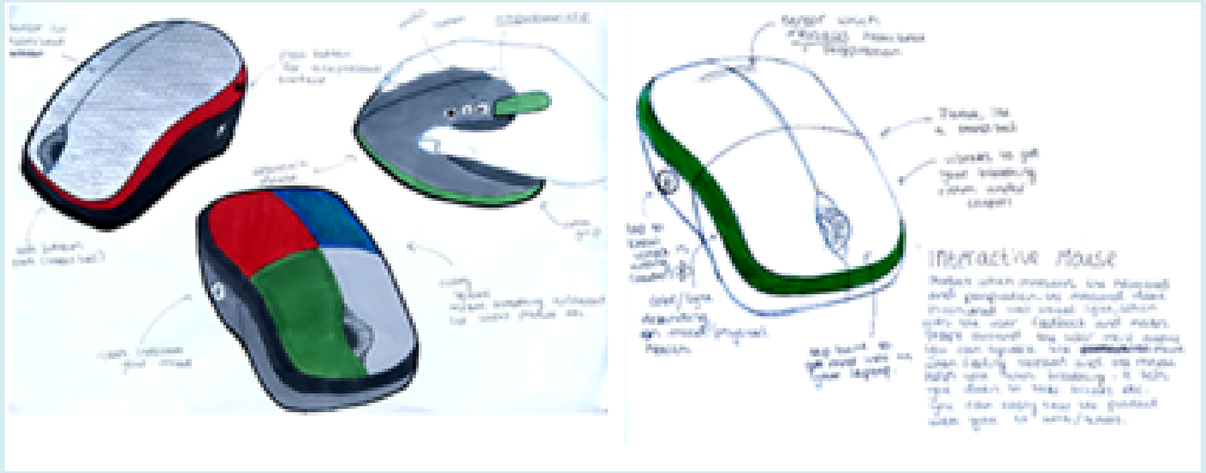


Figure 7: Sketches MoodMouse.

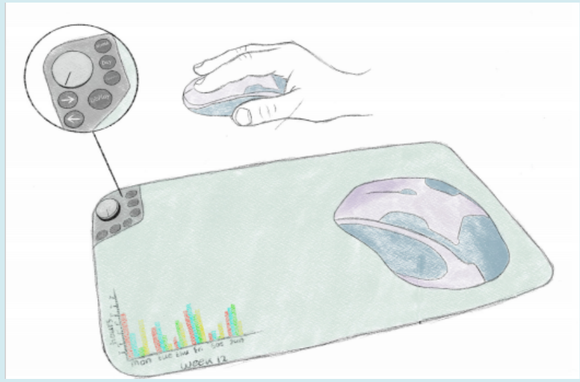


Figure 8: Sketches MoodMouse mat.

Figure 9: MoodMouse prototype.

Iterations

BOTTLE

In the beginning of this iteration, we focused on implementing the feedback and our main learning points from the previous ones, namely:

- Release stress among the users.
- Giving the user insights about their stress for reflection.
- Give the user an immediate possibility for stress release.
- Keep it simple.

With this approach we came up with BOTTLE (see figure 10), a water bottle which measures stress with a cortisol sensor based on saliva (Momentary Emotions and Salivary Cortisol: A Systematic Review and Meta-Analysis of Ecological Momentary Assessment Studies, 2021), (Psychological Structure and Neuroendocrine Patterns of Daily Stress Appraisals, 2021) and a light bulb that emits different colours of light depending on the stress level of the user. When stress is detected, the light changes to the relaxed colour blue for instance (2018) and if the user has got an average stress level (Highly Sensitive and Non-Invasive Electrochemical Immunosensor for Salivary Cortisol Detection, 2019), green light is emitted to stimulate endurance (2018). This offers the user a point of reflection and their stress is released with the use of colour. Also because the concept consists out of one piece, it is simplistic. Thus, we achieved our goal of including the points stated above. Nevertheless, as we deepened into this concept even more, we came to know that a cortisol sensor based on saliva is not that accurate (see “GSR sensor”) which made the concept of the bottle not applicable anymore as well as that the idea of drinking water out of a bottle that contains electronics was not pleasant. Subsequently we replaced that for a Galvanic Skin Response (GSR) sensor (Galvanic Skin Response - WikID, the Industrial Design Engineering Wiki, 2011), see more in the section “Overall results” under the subheading “GSR sensor”(page ...), which resulted into our final concept named Flow.

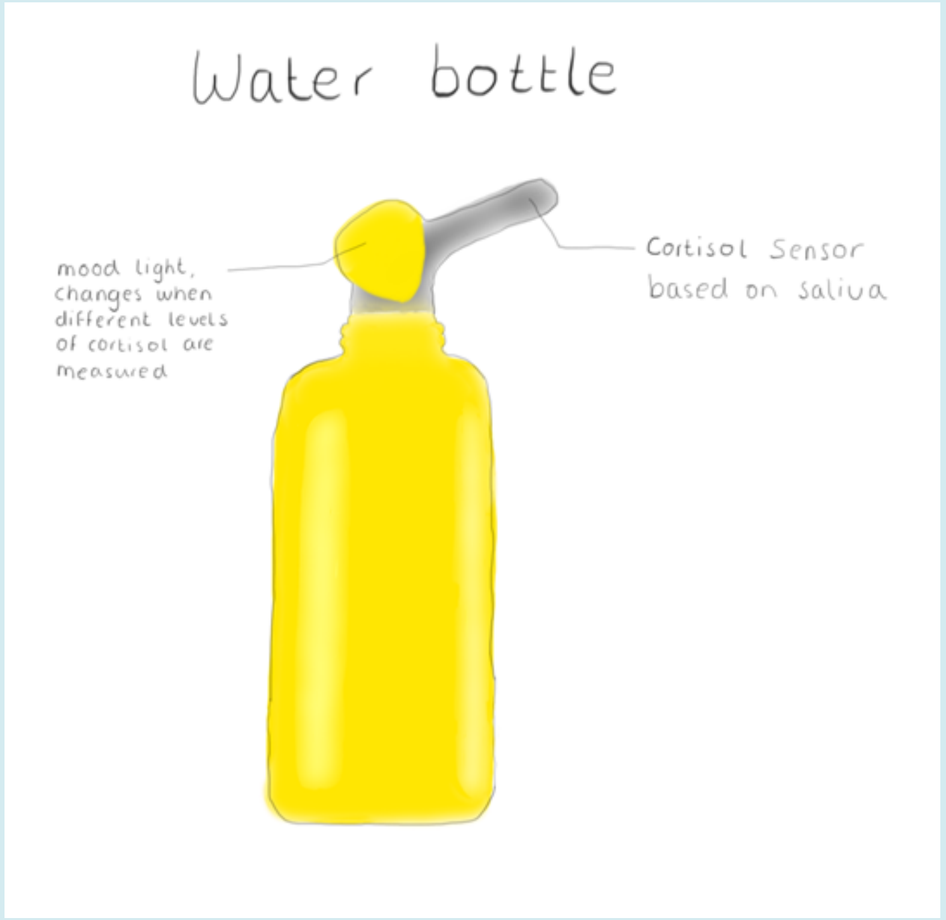


Figure 10: BOTTLE sketch.

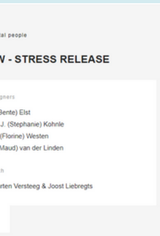
Overall results

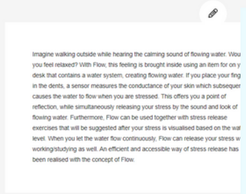
The four iterations explained previously functioned as steppingstones for achieving our goal, stress release, through the best concept. In this next section of the report, the specifications and realisation of our final concept, Flow, will be discussed.

Overall results

Hereby we introduce Flow:
Imagine walking outside while hearing the calming sound of flowing water. Would you feel relaxed? With Flow, this feeling is brought inside using an item for on your desk that contains a water system, creating flowing water. If you place your fingers in the dents, a sensor measures the conductance of your skin which subsequently causes the water to flow when you are stressed. This offers you a point of reflection, while simultaneously releasing your stress by the sound and look of flowing water. Furthermore, Flow can be used together with stress release exercises that will be suggested after your stress is visualised based on the water level. When you let the water flow continuously, Flow can release your stress while working/studying as well. An efficient and accessible way of stress release has now been realised with the concept of Flow.

Figure 11: Flow presented on Demo Day
https://demoday.id.tue.nl/projects/PJYjd2pLz4





Overall results

Technical realisation of Flow (prototyping)

Many technical aspects were involved in making Flow.

Visual and Sound

- *Water flow*
  The most challenging part was how to get the water flowing smoothly and hearable. Water flows while being in ‘level’(waterpas), so the point of overflowing had to be the same height and the same angle of the slope over which the water ran.
- *Waterproof*
  We also had to consider that it must be waterproof, but at the same time that the individual parts of the prototype were in the right place so that the water could run smoothly.

Material

- *PVC*
  For our concept it was important that the water is clearly visible, so we used transparent PVC. PVC was also very useful because it is bendable while using heat, as we wanted to make round and natural shapes for our aesthetics (see figure 12).
- *Nano tape and silicone rubber*
  To assemble all the individual parts, we used nano tape and black silicone rubber. Nano tape is transparent, which ensures that you can follow the water flow in the prototype very well. The advantage of nano tape is that it seals the parts from water. We glued black silicone rubber to the outside because it is stronger than nano tape (see figure 14).
- *Hose clamp*
  The hose clam ensures that the prototype stays together. Since the prototype has to be waterproof, it is important that there is a lot of pressure from the outside, which a hose clamp provides. The hose clamp prevented the inner part of Flow from leaking while flowing and made the outside waterproof too.

Figure 12: Bending the PVC with heat fohn for outside component.

Figure 13: Different components of the prototype.

Figure 14: Soldering everything together.

Overall results

Technical realisation of Flow (prototyping)

Pumps

The arrangement of the pumps was very important. We made several sketches to visualise how the pumps should be placed. We tested our setups on a test model of the prototype (see figure 16).

We noticed that making prototypes is trying things out because although we think it works on paper, it was often extremely different in real life. Something that was very important for the pump set-up, was that the pumps should pump water from two separate “water chambers”. Those water chambers were created by adding the inner shape inside of the circle. The PVC wall would either make the water go up or down, depending on which pump you are controlling at that moment (see figure 18 for schematic). If they were placed in the same room (see figure 15), the water that one pumps would be partly sucked in by the other pump. This could cause the water to not be pumped around at all or create random movements instead of going in a circular movement. When you would place the pumps like in figure 15, we also could not create the water flow to be in the opposite direction (inside out), but only in one direction. This way we could not create the water visualisation levels and the 'up and down' motion while doing breathing and mindfulness exercises, so we changed our plan. The pumps should both be placed in the middle so that the water would go up to both the left and right side of Flow (see figures 17 and 18).

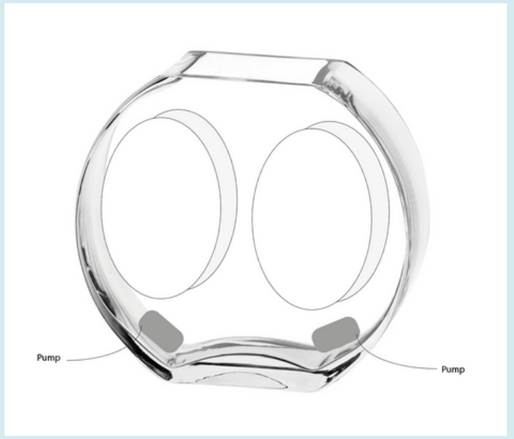


Figure 15: First setup idea for the pumps.

Figure 16: Test model prototype.

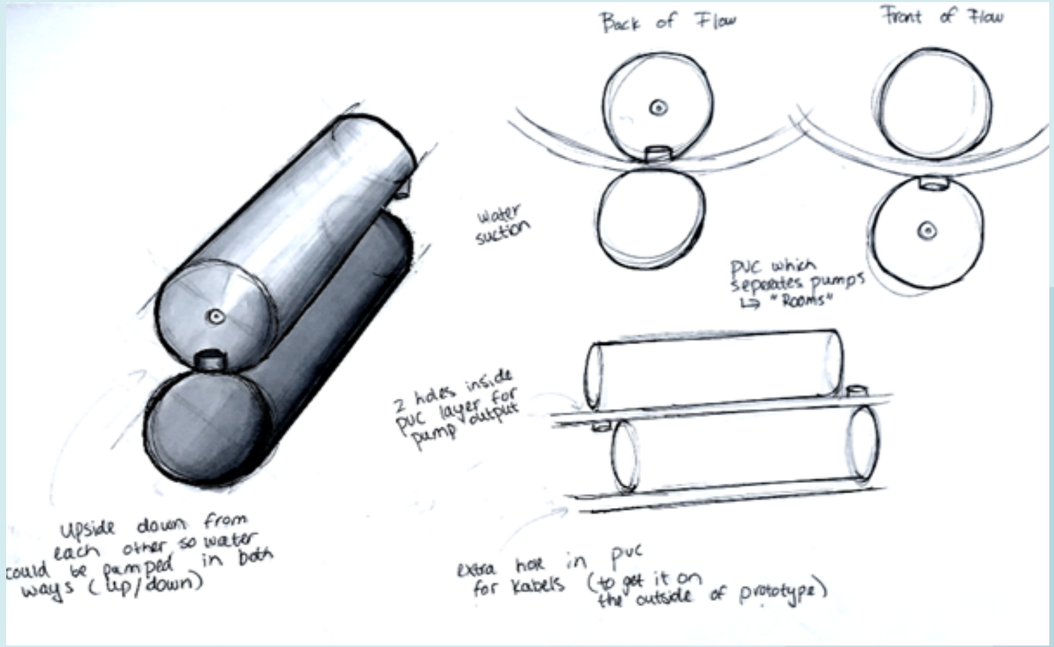


Figure 17: Technical sketch of the final pump setup.

Overall results

Technical realisation of Flow (prototyping)

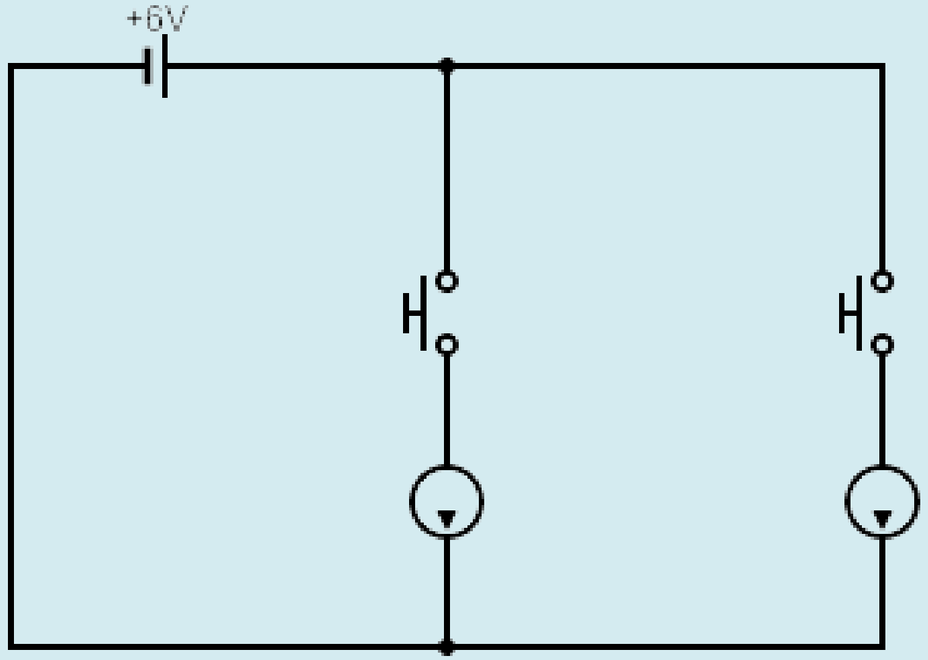


Figure 18: Circuit of the pump installation

The parallel circuit contains:

- 6V power source
- Two push buttons
- 2 pumps

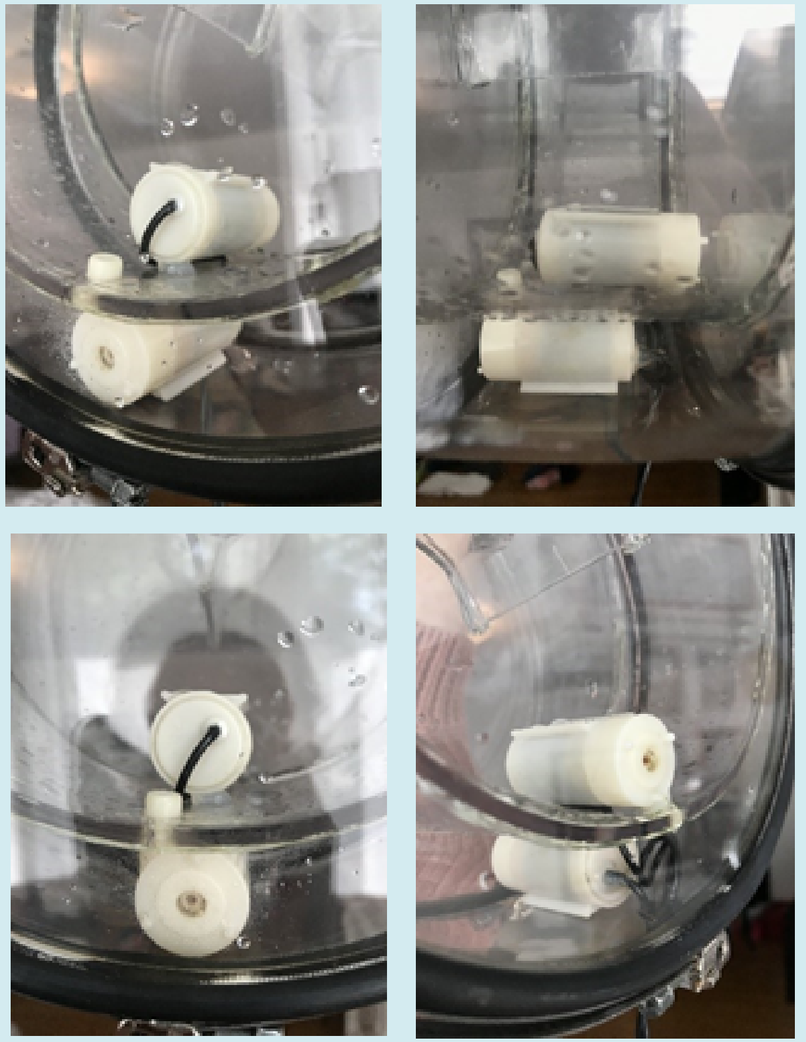


Figure 19: Technical installation pumps

Overall results

GSR-sensor

In order to conduct the user test, we installed a Gavanic Skin Response (GSR) sensor, which measures the conductance of a person's skin. The GSR sensor we used could be applied with straps around the fingers (Kiwi Electronics, 2012) (see figure 20). We connected the wires of the GSR sensor to an Arduino Uno (see figure 23) board (Arduino UNO - Arduino UNO REV.3, Chipset: ATmega328, Voeding: 6–20V (Excl.), Digitale I/O: 14 pins (6x PWM), Analoog: 6 pins., 2005). Thereafter we dived into programming on Arduino and Processing software. For the Arduino code, we used several YouTube videos as leading guidance (Sun Robotronics Technologies, 2021). When applying this code, the GSR sensor worked and GSR averages (µS) could be measured (see figure 21). However, we were striving to depict these GSR values within a graph, this would give a clear overview during the user test but also for in the results. Therefore, we decided not to stop here but to rediscover Processing. In Processing, we tried to import serial data from Arduino and with this serial data to draw a graph. For this we also watched YouTube videos to learn more (Programming for People, 2017), (Gadget Reboot, 2018), (AOK stem, 2016). Eventually, we succeeded in importing serial data and drawing a graph, but the graph still displayed some errors. For this reason, after investing many hours into this, we decided to go for the backup option which was the serial plotter installed on Arduino software. Even though this is not ideal because of the automatic scale function, we tried to solve it by using CoolTerm. With this application, the GSR values that are measured could be saved in a TXT file (Tabletop Robotics, 2019). Subsequently, we could make clearer graphs after the user test to visualise the results (see Figures 24 and 25) with the use of the code from Jan Rouvroye meant for Creative Electronics. Only after the user test, we came to know that the Programming code did work but that the error was probably caused by the laptop on which the program was run in the first place (see figure 23).

Not only for the user test, but for our ideal prototype we would make use of a GSR sensor. From one of the earlier stages of our design process we did research to several ways to measure stress, namely:

- Heartrate in combination with perspiration (Lovett, 2018), (Heartbeat interval dynamics in response to acute stress in human: A case study of real fear of snake, 2018).
- Cortisol measurement based on urine (El-Farhan, 2017).
- Cortisol measurement with the use of blood (Blocka, 2020).
- Cortisol sensor based on saliva (Salivary Cortisol Results Obtainable Within Minutes of Sample Collection Correspond With Traditional Immunoassays, 2015), (Cruickshank, 2021).
- GSR sensor

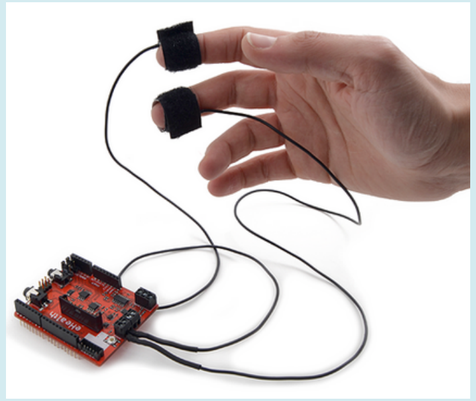


Figure 20: Example of how a GSR sensor fits around the fingers (2014).

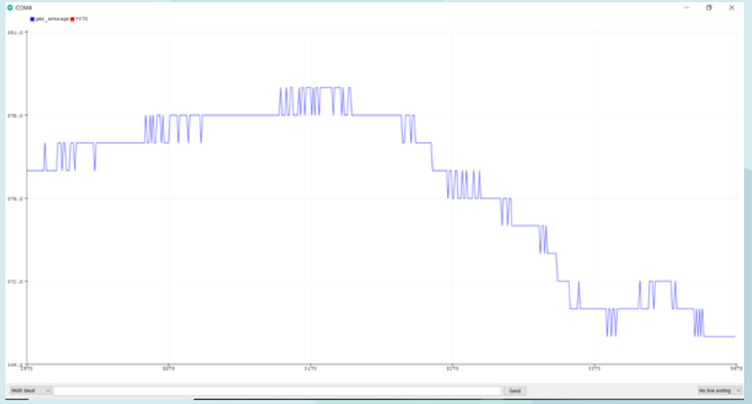


Figure 21: Serial Plotter Arduino

Overall results

GSR-sensor

Currently, for medical tests, a cortisol measurement is done with a blood test. These tests are very accurate but the time in between the blood test and the results is so long that the stress level from the patient already could differ (Ambulatory Measurement of Cortisol: Where Do We Stand, and Which Way to Follow?, 2019). Also a blood test was not applicable for our concept since we do not have a medical license. Since we value the usability of our concept, we decided not to go for a cortisol measurement based on urine either. Furthermore, we had seen in our first iterations that heartrate in combination with perspiration is difficult to measure accurately within our designs. After the Midterm Demo Day, we decided to look further into the calming effect of water and from this point BOTTLE arose. Within this idea it was the most logical to go for a cortisol sensor based on saliva as this could be easily placed in the lid. When we came to know that stress could also be measured with the use of the conductance of the skin, we preferred this since it is more accurate as the concentration of cortisol within saliva becomes quite low when drinking water. From this moment we also decided to shift our concept from BOTTLE to an item with a water system that could be placed on a desk which later became Flow.

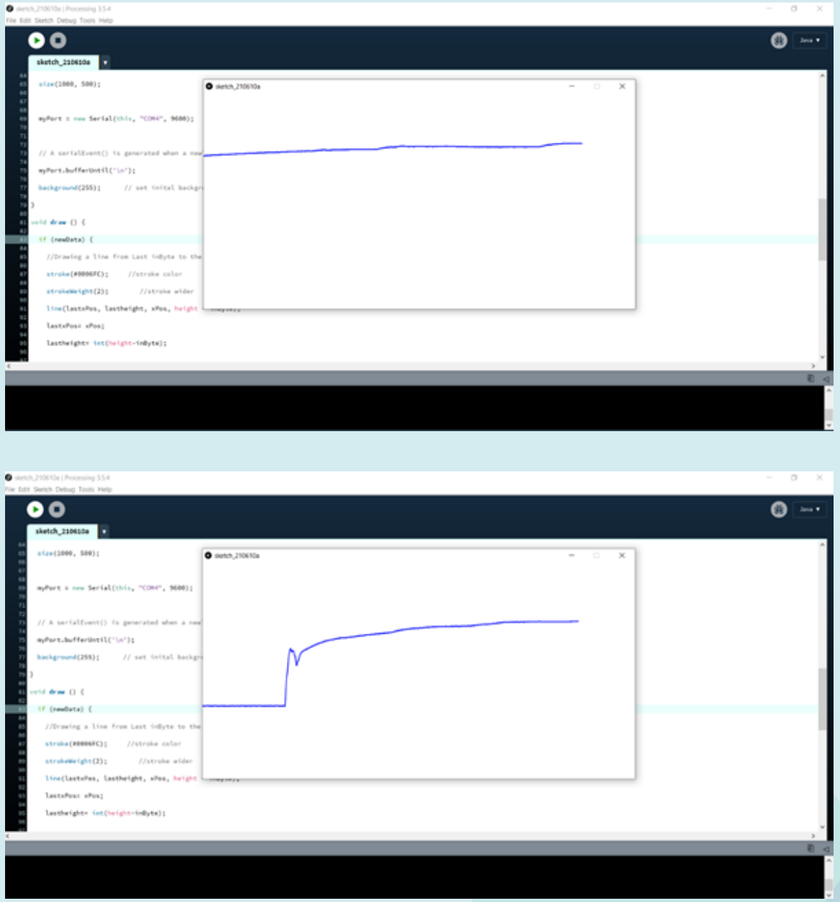
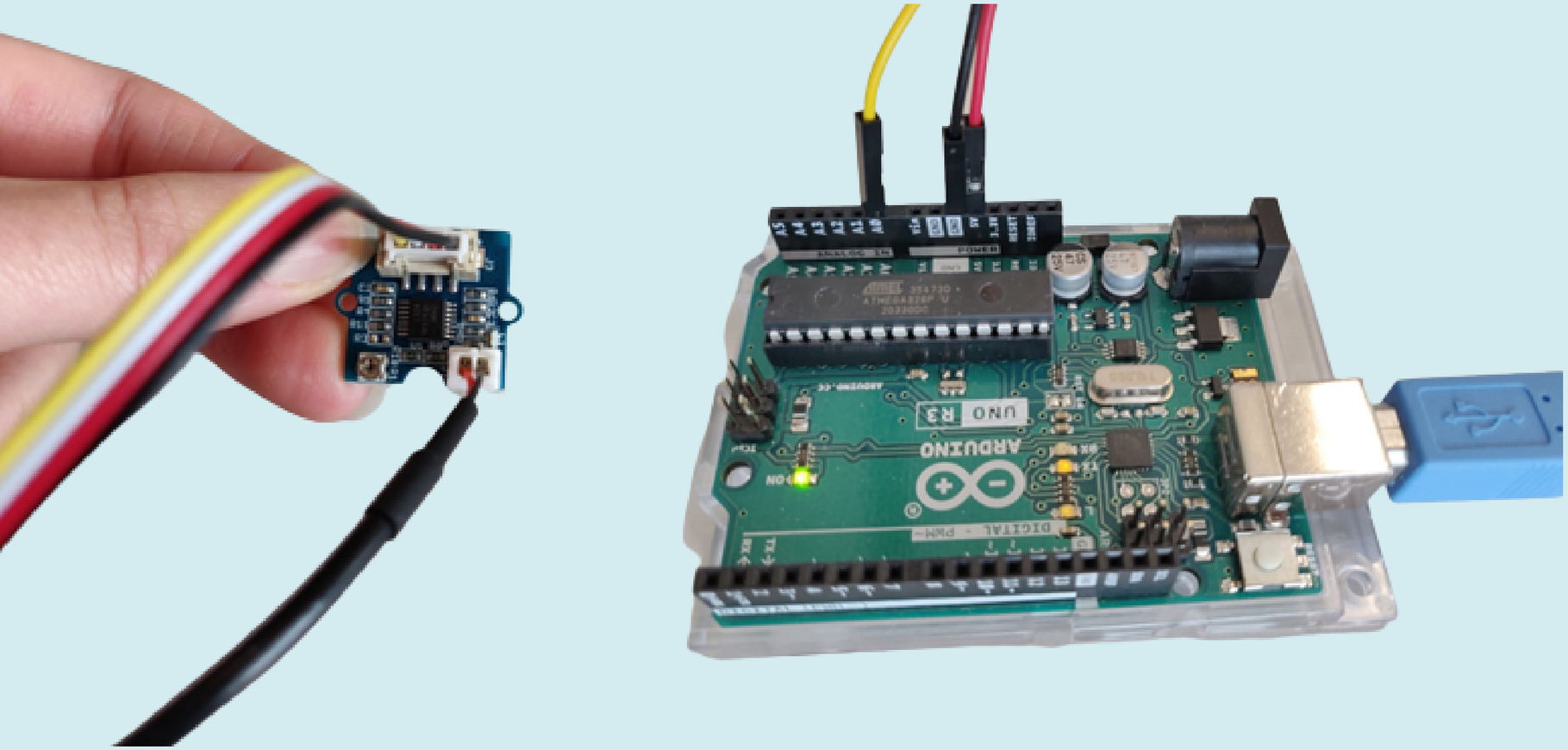


Figure 22: Processing graphs.

Overall results

GSR-sensor installation and Arduino board



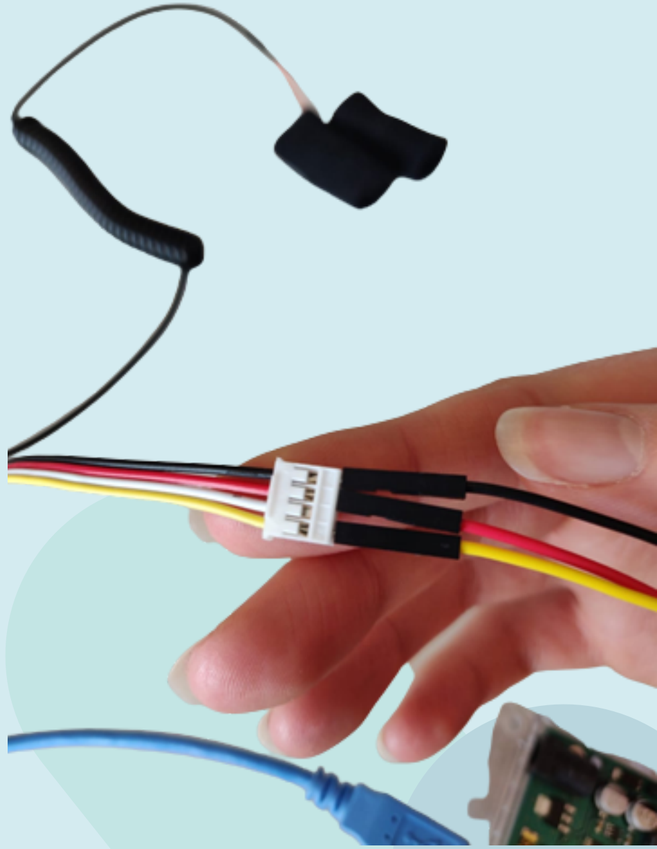


Figure 23: Arduino Uno and GSR sensor

User Test

USER AGREEMENT

The participant reads the agreement and signs it

CONNECTION GSR SENSOR

The person who guids the test connects the GSR sensor to two fingers of the participant, which is connected to an Arduino Code

TEST 1 VISUALS AND SOUND OF FLOW

The participant receives the instructions to focus on the movement and sound of water inside Flow. A stopwatch is set for 45 seconds

TEST 2: SOUND OF FLOW

The participants receives the instructions to close his/her/their eyes and focus on the sound of water of Flow. A stopwatch is set for 60 seconds

TEST 3: SOUND OF YOUTUBE VIDEO

De participant receives the instructions to close his/her/their eyes and focus on the sound of the Youtube Video. A stopwatch is set for 60 seconds

SAVE MEASUREMENTS

The sensor measurements are saved via Coolterm to an TXT sile

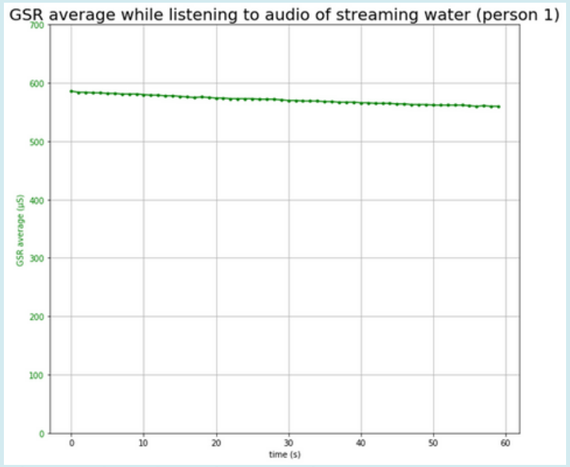
CONVERT TO GRAPH

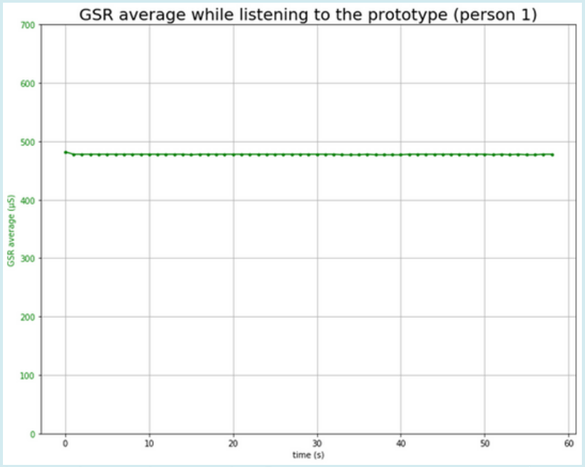
The saved measurements are converted to a graph by using a Python Code

Overall results

User test

User test results





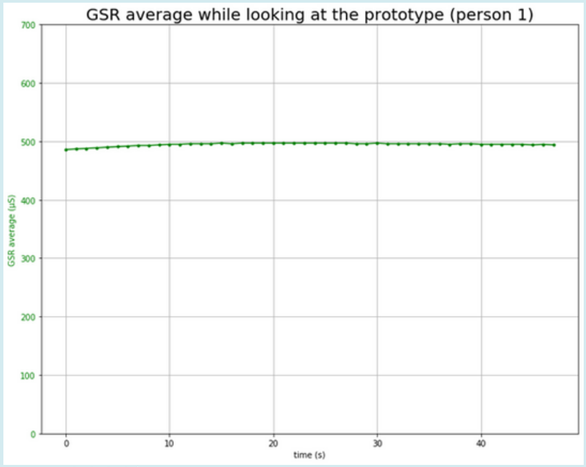
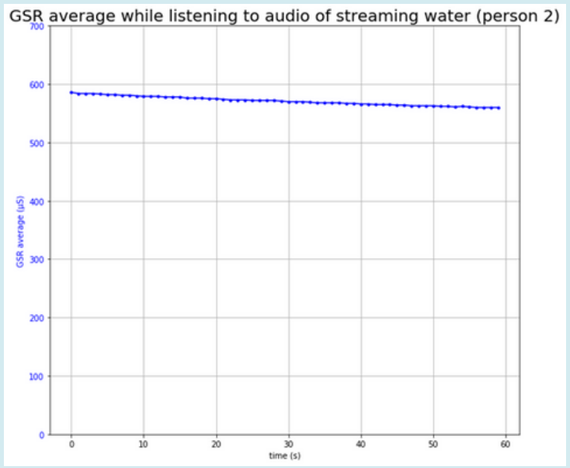
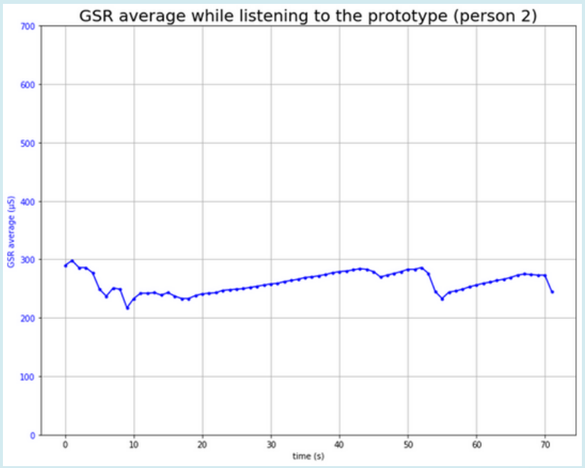


Figure 24: Graphs result user test person 1, based on the code from Jan Rouvroye (Rouvroye, 2020).





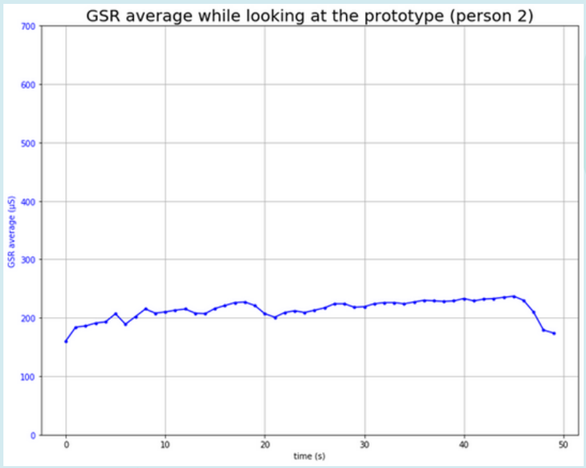


Figure 25: Graphs result user test person 2, based on the code from Jan Rouvroye (Rouvroye, 2020).

Overall results

User test

Discussion user test
By analysing figures 24 and 25, we believe the GSR sensor is very sensitive, both for stress and other emotions. It is very difficult to create a setting where someone can fully focus on Flow without being disturbed by other sounds. In addition, the user can be distracted by his/her/their thoughts, which has an impact on the sensor. The pumps may also have influenced the result. The pumps made a buzzing sound which might have caused the user to focus on that, instead of focusing on the water. It could create irritation, because of the sound the pumps made.

Conclusion user test
This test has given us many insights about the sensor and Flow. We can conclude from the results and the discussion that the tests are not 100% reliable. It depends on the setting, external sounds and the person. In addition, the sensor measures changes in all emotions, not solely stress, which may have led to our results being very different. Therefore we can conclude that the GSR sensor is not accurate enough to be used as substantiation in the ideal concept of FLOW.

Overall results

Aesthetics

Prototype

After our iteration of BOTTLE, we liked to continue with a concept based on water. We wanted to make the water move but wanted to avoid that it looks like a miniature fountain. Therefore, we came up with the idea to let the water flow from the outside towards the middle, which is the opposite of how water flows in a fountain. This way water movement also offered many possibilities for stress-relieving exercises (see "*Mindfulness Exercises*"). We preferred to use round shapes since curves are often regarded as harmonious, relaxing, or pleasant (Gómez-Puerto et al., 2016), which are things we want to encourage with our product. With that idea in mind, we explored many different designs as can be seen in figure 26 and 28.

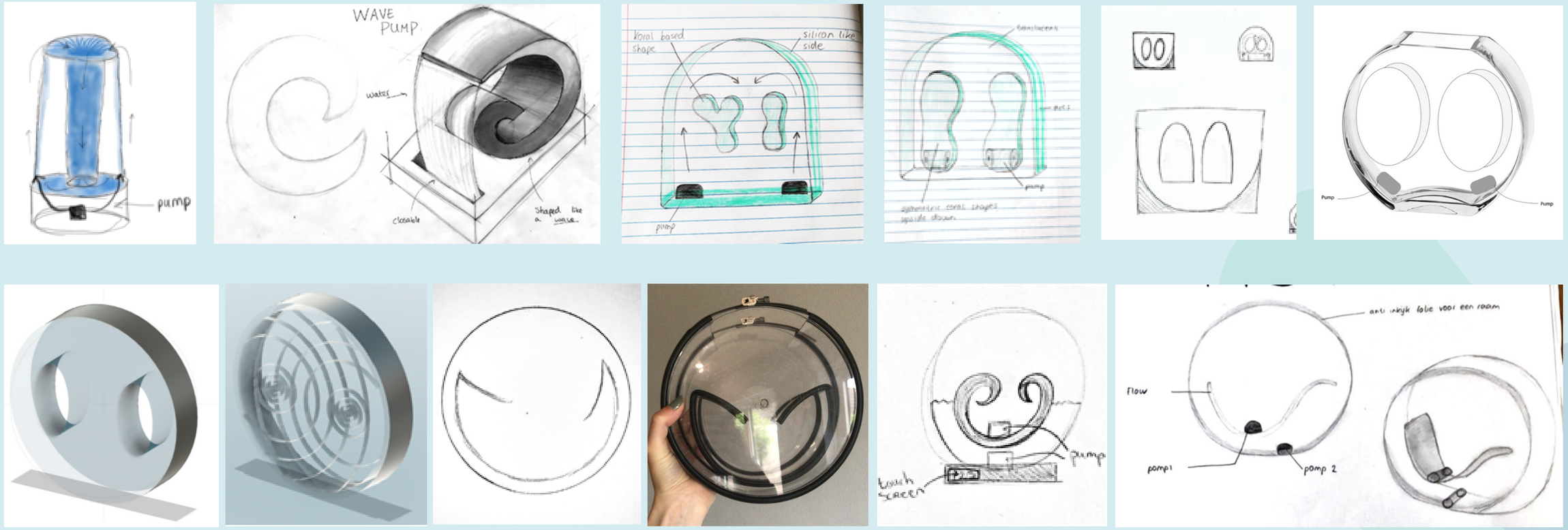


Figure 26: Overview of different design ideas for Flow that led to the final design in chronological order.

Overall results

Aesthetics

Prototype

At first, we used clear tap water. When we spoke to a stakeholder (see “Expert/stakeholder pitch"), she suggested using a colour would make it more visible and therefore easier to follow. We chose to colour the water blue with a marker (figure 29). At the beginning of the project, we created a questionnaire about colour-interpretation (Interpretation of colours, 2021). When asked which colour the respondent associated with calmness, 34 out of 87 respondents chose blue-green and 9 chose blue (see figure 30). On large scale, water appears blue and the abstract wave in the final prototype represents a real wave, like in an ocean. Considering the above, we think blue suits best.

Logo

For the finishing touch, we designed a logo (see figure 27). While creating it we considered the appearance and influence of curves and the calming effect of the colour blue-green as can be read in the paragraph of "Prototype”. Subsequently, we experimented with different rounded fonts and blue-green shades. The colour was chosen by considering the association of water. Therefore, we emphasised blue but we still added a touch of green to get this colour. Eventually, the logo was created with two different fonts, the f, l, and o are namely part of the font "WDSolaris Eclipse” and the w is actually an upside-down m in the font "Rounded Elegance". Additionally, we included the abstract waves on the inside of the prototype in the o of the logo. With all these aspects we wanted to make the aesthetics coherent as well as appropriate for stress release.

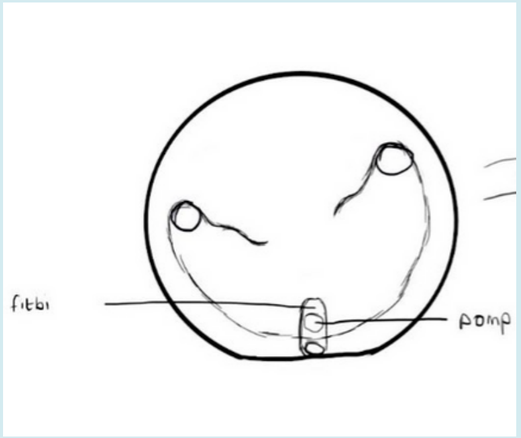


Figure 28: Final sketch for prototype.

Figure 29: Final prototype.

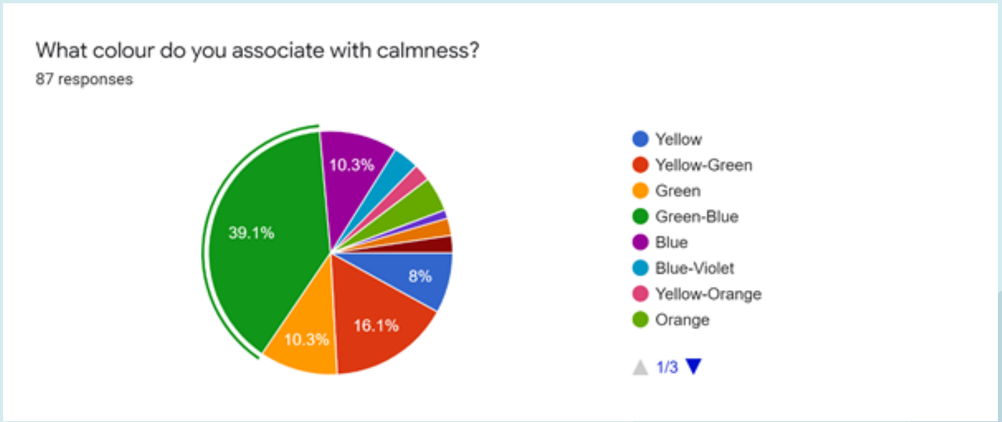


Figure 30: Chart from questionnaire Interpretation of colours.
(Note that the colour of the chart doesn’t allign with the colour of the answer)

Figure 27: Logo.

Overall results

Aesthetics

Ideal product

Even though we are already happy with our final prototype, we still have some ideas for the aesthetics in an ideal version. Firstly, we would like to get rid of the stand. A small portion of the bottom could be flattened to make Flow balanced and stable without a stand. Currently, the prototype is open at the top (see figure 29), because it was easier to empty it before transporting it to campus. In the ideal situation, we thought it would be better to close it since it is meant to be placed on a desk and you do not want to accidentally spill water on your schoolwork or laptop. However, on Demo Day someone pointed out that closing it off might affect the sound of the flowing water so we have to do material research in order to prevent this.

Furthermore, we would like the entire object to be transparent, so no black bands. Additionally, we would like the sides to have a transparent wave-like structure as illustrated in figure 30. As can be seen in figures 28 and 30, we attached a Fitbit to the prototype as a screen to display the stress-relief exercises on. In the ideal version, we would like to integrate the exercise icons on the front side of Flow itself. This idea is inspired by futuristic hologram screens. In figure 31, it is illustrated what this would look like. The user can tap anywhere on the front surface of Flow and an icon will appear. One icon at the time will be visible and the user can swipe between all options. The user can select which exercise they want to do. When the exercise starts, the icon will disappear. As also shown in figure 31, the GSR sensor would be integrated into dents that make it comfortable to place two fingers on it. Lastly, we would like to use a different substance than tap water that is non-perishable. For indoor fountains, it is often advised to use distilled water (Gardner, 2014), since it contains fewer minerals and pollutants that could stain the product.

In our ideal concept, we would also want to look into water energy. Water energy is created by means of water force (ENGIE, n.d.). The energy is supplied by the power of flowing or falling water. Water energy is still a new concept, which has been used in in big systems, way bigger than Flow. Although, it would be very innovative if it also could be possible on smaller scale.

Figure 30: Side view showing transparent wave-like structure.

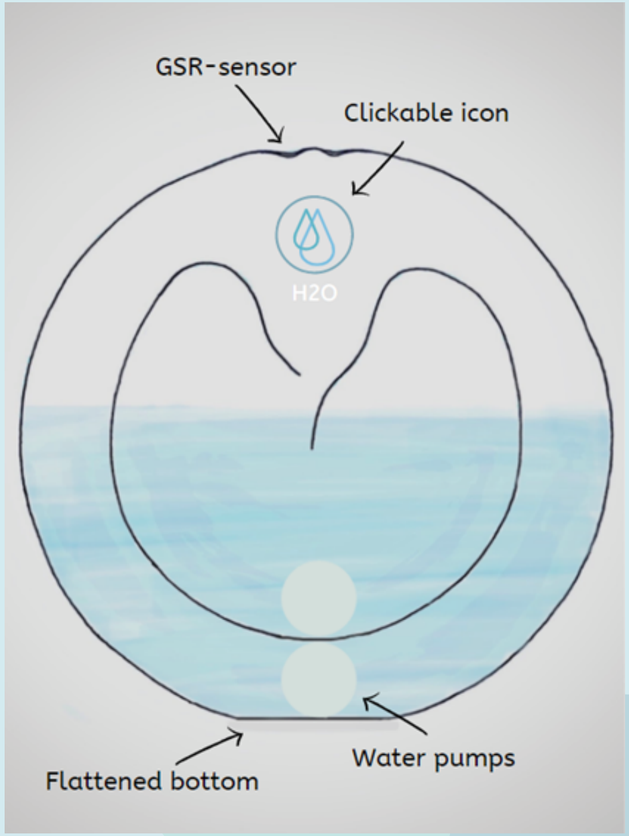


Figure 31: Illustration of features in ideal version.

Overall results

Function of water and nature

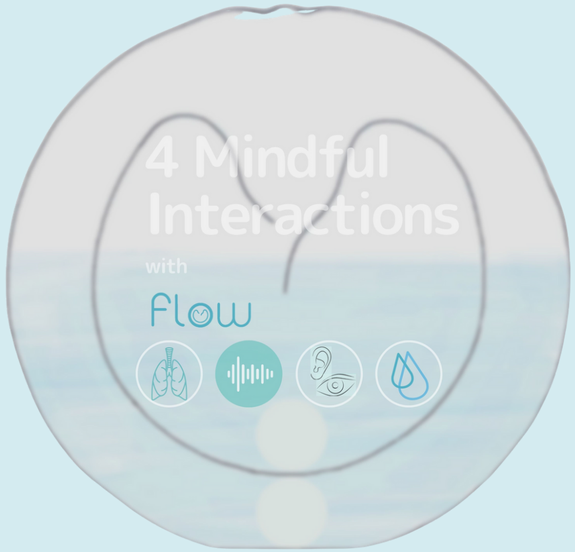
Research showed that being in nature, or even viewing scenes or visuals of nature, reduces stress and increases a calm feeling. It turns out that more than 2/3 of people chooses a natural setting to retreat to when feeling stressed (Delagran, n.d.). Water has a big impact on the mental and physical wellbeing of people. People can experience the benefits of water whenever they are near the ocean, a lake or a river, by just listening to the sound of water and watching the water itself. Even if you are not close to an area where there is access to water, people still experience huge emotional benefits. It turns out that just looking at images of water makes people feel calmer. Humans are naturally drawn to blue space (Nichols, 2014). Our human senses are engaged while being in contact with water. The deep biological connection with water triggers an immediate response in our brains of neurochemicals when we are near water, which reduces blood pressure, heart rate, muscle tension and production of stress hormones. Contact with water induces a meditative state which makes us happier, healthier, calmer, more creative and promotes relaxation (Livni, 2018). It helps us to counter our "gray minds", which means spending too much time inside on our screens which can lead to lack of motivation, dissatisfaction and a worse ability to pay attention. Water sounds have been used a long time in meditation to create a soothing atmosphere for our minds.

Overall results

Mindfulness exercises (mindfull interactions with Flow, 2021)

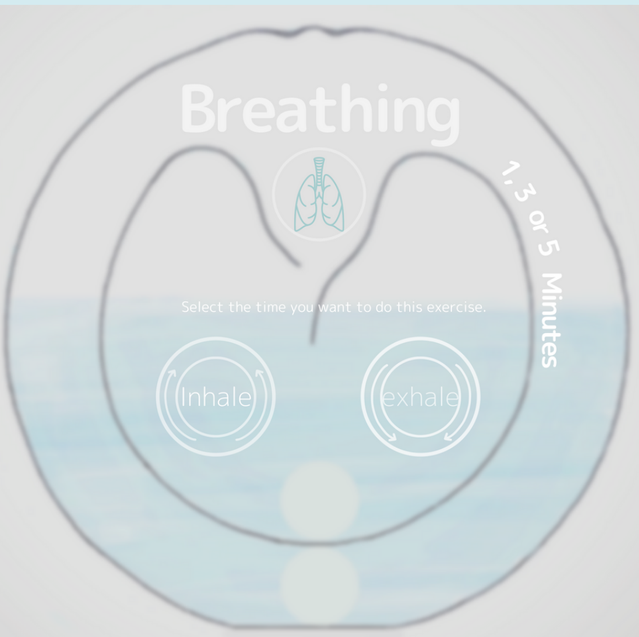
Flow offers 4 mindfulness exercises:

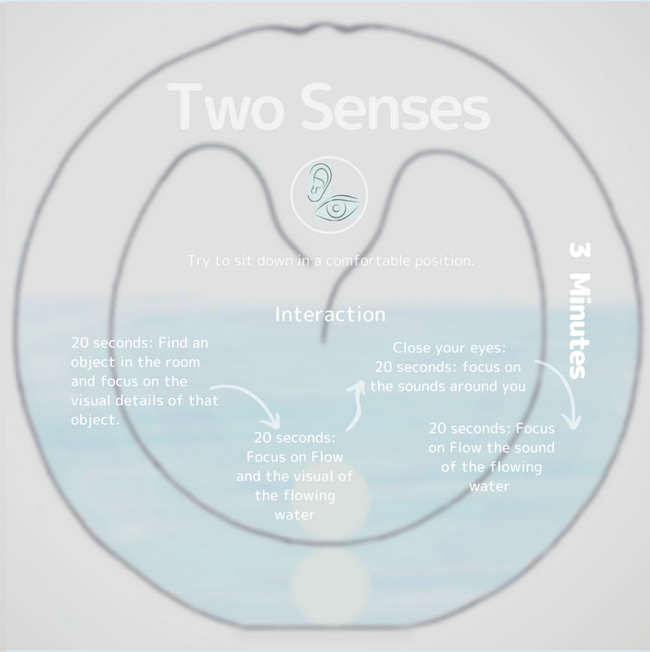
- Breathing
- H2O
- Sounds
- Two senses



Flow offers these interactive exercises for moments when the user feels too stressed and wants to release stress in an active way instead of unconsciously. Flow suggests it after your stress measurement is too high, or you can choose to do one manually. You can do these exercises whenever you want, for example during a break or when you notice that you have a hard time breathing on a normal pace due to stress. Flow guides you through these exercises by means of water movement. The user can swipe on the transparent screen. If the user want instructions about how to perform the exercises you can tap on the logo and tap twice if you want to start.

Check out the video on the ID Demo Day platform for a better impression of the exercises and possibilities with Flow
https://demoday.tue.nl





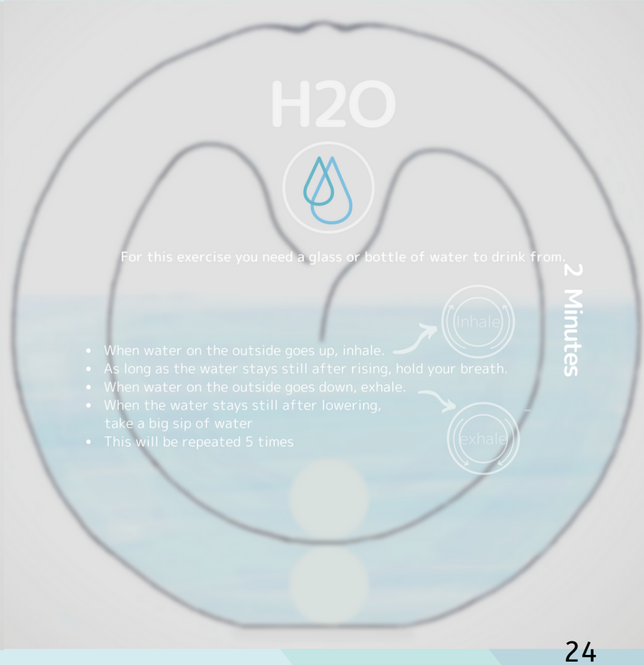


Figure 32: What the interactions would look like.

Overall results

Stress level visualisation

We wanted to visualise the user's stress level in a non-confronting way. Therefore, we decided it would be best to do this by means of the water level rather than numbers or graphs. When you put to fingers on top of the GSR sensor, your current stress level will be measured. First your previous measurement will be shown and shortly afterwards your current stress level will be visible (see figure 33). By doing this you can compare your stress level and check if it is higher or lower at specific moments/events of the day, for example before and after finishing a deadline. In figure 33, in the left picture, the user's stress level is relatively higher than in the right picture. This offers the user a point of reflection.

Figure 33: Comparison between the user's current stress level and previous measurement.

Other activities with Flow

Our brain interprets the noises we hear when we are awake and when we are asleep as either threats or non-threats (Hadhazy, 2016). A sound like an alarm triggers the threat-activated vigilance system, which keeps us from sleeping. Sounds like wind or rain we naturally tune out. These noises are interpreted as sounds of non-threats, which causes people to feel calm. Water sound helps us to sleep because it has a function of masking a form of noise that your brain interprets as a threat, so that you can continue sleeping without waking up. People can use Flow when they experience sleeping problems. Flow can be placed on your night desk, while the flowing water sound makes you feel relaxed right before falling asleep. When you experience you wake up a lot in the middle of the night, Flow can help you with canceling out the threat noises. You can have a more regular sleep pattern and feel more rested when you wake up.

Flow offers four different stress release exercises see "Mindfulness exercises", but there is room for the user to be creative. The user could do schoolwork, while listening to the water in the background, or they could do yoga. When water flows continuously, creating a calming sound, there are endless possible exercises or activities the user can do.

Overall results

Business model Canvas

Explanation Business Model Canvas:

- To get a better impression about how we could get our product on the market, we created a Business Model Canvas. A business model canvas is about how a company creates value for itself while delivering products or services for its customers (Steenbakkers, 2021). It contains nine components that conclude all the basic pieces of a business.
- Value Proposition
  The Value Proposition is about what problem our product solves and what gain we are creating for potential buyers.
- Customer Segments
  This component will answer the question: Who are going to be my customers or target group and why would they want to buy the product?
- Channels
  Explain how your product values get to the customers. Nowadays we have a lot of options for channels because of the digital world we live in.
- Customer Relationships
  How to get customers, how to keep them and how to grow with them.
- Revenue Streams
  Revenue Streams are crucial because it contains how your business could make money. You must think about what value the customers are actually paying for, and how are you going to capture it.
- Key Resources
  This includes the main assets required to make the Business Model work. It is divided in: Finance, Physical, Intellectual, and Human Resources.
- Key Partners
  They are required for making deals within your business. As a business, you must consider what partners you need and what activities they are going to perform. The types of partnerships can change a lot over several years because the partnerships you need as a startup are definitely not the same as for a bigger company.
- Key activities
  Key activities make a company aware of what they want to achieve. For example, you can be an expert in the production business, the problem-solving business or the supply chain management.
- Costs
  This component is important for the operating actions. Observe the most expensive resources or key activities and about what are fixed costs and variable costs.

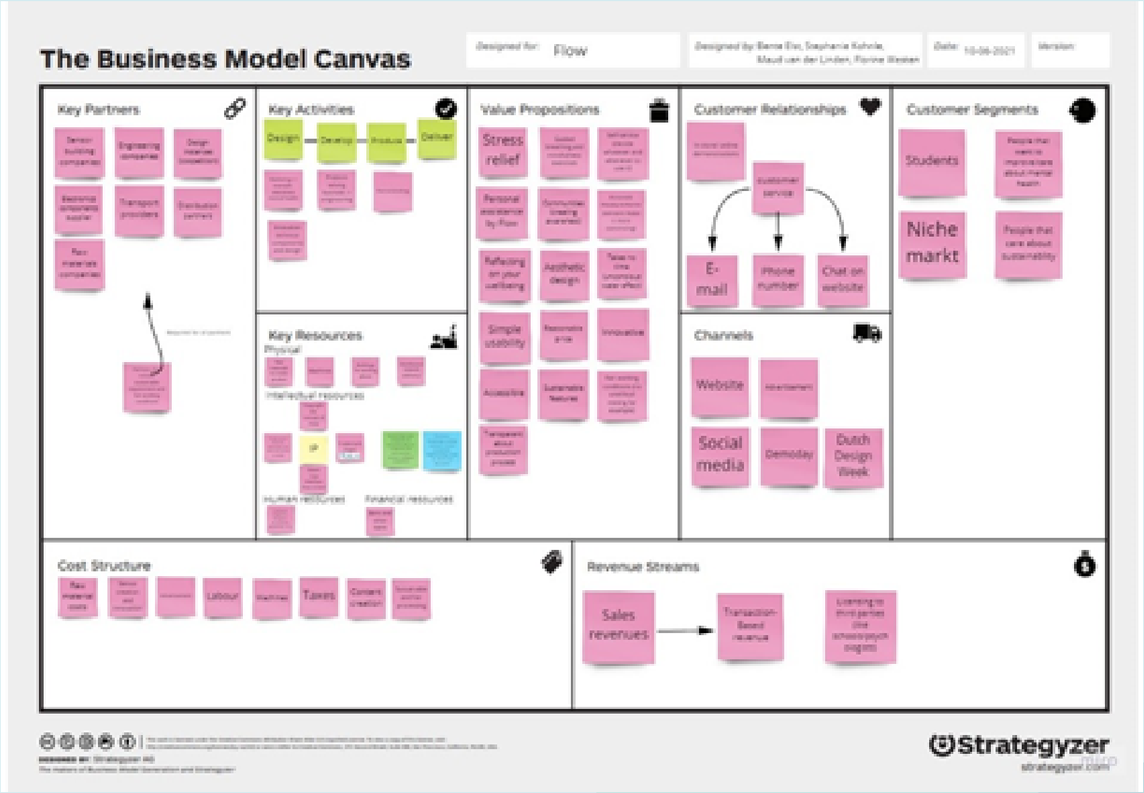


Figure 34: Business model canvas on Miro Board: https://miro.com/app/board/o9J_lANIV-A=/

Overall Results

Expert/stakeholder pitch

In order to make sure that our concept promises a solution for stress release, we gave a pitch (see figure 35) to a psychologist who treats patients with stress related problems. We planned a Microsoft Teams meeting in the final stage of our design process so that our concept was as worked out and detailed as possible. This way we obtained enough material for feedback which we thereafter implemented in the finishing touch of Flow. The feedback that we received from the psychologist was:

- Colour the water blue for a greater visual impact.*
- Do something with the different water levels.*
- For exercises, research heart coherency and mindfulness.*
- Think about the necessity of the cable with a plug.*
- Explain more clearly where the user can measure their conductance.*
- Perhaps the user could have straps around their fingers such that their conductance can be measured while continuing with work.
- Explain more clearly if and when the conductance can be measured manually.*
- Explain how the exercises work.*

*Feedback that we implemented in the final concept of Flow.

Figure 35: Poster for the expert/stakeholder pitch.

These learning points got us thinking about our design. We inherited most of the feedback and analysed every point critically. Eventually, we decided to include everything except from the suggestion to use finger straps for measuring the conductance. While working with the GSR sensor we noticed that these straps are quite tight and therefore it is not wise to leave them around your finger for a long time. However, it was meaningful to think about this aspect. Giving the pitch has helped us defining Flow even better.

Besides that, we could combine this pitch with a stakeholder pitch since our concept was almost finished. Our intention for Flow is to be used as a tool that therapists give as a homework assignment to their patients as well. In this case, the purchase of Flow would be covered by an insurance company about which more information can be read under the subheading “Market analysis”.

Process

Process

Setting our first design requirements

During the first lesson of Project 1, the project groups were made, based on the shared interests between students. The shared interest that brought our group together was Mental and Physical health. The second lesson consisted of a Pressure Cooker, at the end of the Pressure Cooker, our final idea was an acupuncture ball focussed on stress relief (see "Iterations"). The focus on stress relief spoke to all of us once we made contact with this concept. At this point, we set our project goal as "Helping the user with stress". Stress is a broad topic, so to narrow down the project goal we did a lot of online research.

The most important things the research taught us:

- Students are a vulnerable group when it comes to mental health and especially stress (Balon et al., 2015).
- Mental health problems, including stress, are most common in students compared to other age and career groups (RIVM et al., 2019).
- When someone is feeling constant stress, their physical health gets negatively affected (Bradley University, 2018).
- Most students with mental health problems do not seek help for these problems (Pretorius et al., 2019).

We did a market analysis as well, the analysis was still fairly superficial. (Vital People, 2021)
(https://tuenl-my.sharepoint.com/:b:/r/personal/b_elst_student_tue_nl/Documents/Market%20analysis%20Project%201.pdf?csf=1&web=1&e=sXYhua)
The market analysis taught us two important things as well.
Firstly; for help with mental health problems, there are for the most part only apps or services available, but physical products are more difficult to come by.
Secondly; there are mostly two types of products on the market for mental health. Products that give you insight into your mental state and products that help you better your mental state. Products that combine both of these aspects were difficult to find.

With all this new knowledge we set some requirements for our future design (see figure 36).

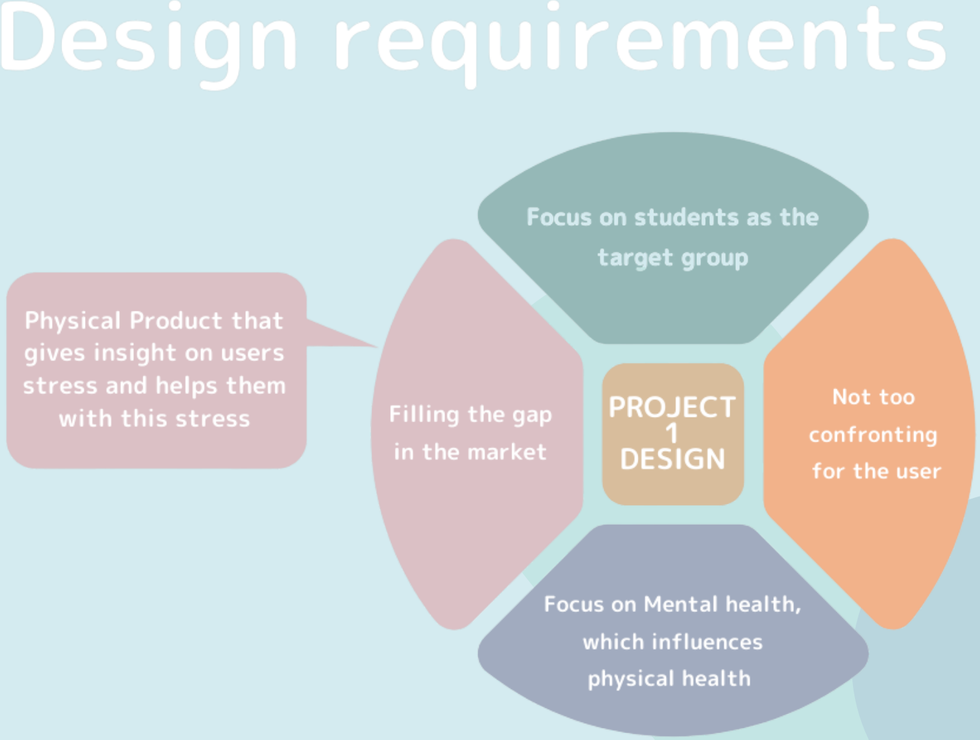


Figure 36: Future design Requirements (made with Canva)

Research Development

Research for problems regarding mental/physical health (amongst students/teenagers) and the target group.
Research into existing products with the same topic to gain inspiration. We also looked at the function and purpose of products.

Light research for our Lightstone iteration. What influence does light have on your mental and physical wellbeing? What is the relation between colours and wellbeing?

-How is cortisol measured, what requirements does it need?

-How can we visualise the fact that adolescents need to think about their physical and mental health?

Research about materials, technical realisation of water flow in combination with pumps, sustainable features

Research about the current target group (adolescents who cope with mental problems but are not diagnosed with a mental illness.
How to visualize communication without being confronting, how to decrease the gap to acknowledge problems.

- Stress symptoms and how to measure it
- Measuring heartrate
- Measuring transpiration/perspiration
- Light intensity influence
- Prove assumption: acknowledging
-Visualising data
- How can we encourage asking for help

User test research
(ethically approved)

Research about different water interactions:
overflowing, vortex, wave and bubbels.

Above you can see our research development in chronological order from left to right.

Process

Figure 37: Brainstorming for all senses sketches (made with Canva)

Brainstorm for all senses

We rewrote our project goal to: *"Helping users with stress, by making it easier for them to seek help for their problems by visualizing their stress."*
During a meeting together we did a session 'Brainstorming for all senses' (Wardt, 2021) with the use of sketches (see figure 37), this is where we came to the Lightstone concept. Even though this concept was too confronting for the user, the Lightstone got us interested in the visualisation of stress. Also because the light stone was quite obtrusive, we found it important to improve our design in such a way that it is easy to use and not confronting. Therefore we came up with the idea of an everyday product and started doing research on visualisations with the use of shapes and colors.

The first user test

Besides searching for clear data on colours and their influence on emotions, we created a questionnaire to collect data ourselves (Interpretation of colours. 2021). We believe this was valuable since we could collect input from our target group directly on their associations with certain colours. Even though we ended up not implementing light within our concept, we still used these results for the aesthetics of Flow.

Technical aspect of design

The concept of MoodMouse arose when we wanted to apply an everyday product (see "Brainstorm for all senses") and when we started looking into the technical sides of our design. Since we thought measuring stress with the use of heartrate and perspiration was appropriate, we designed MoodMouse as we believed this data could be measured within the user's hand.

Process

Midterm Demoday & reflecting

During the midterm demo day, we pitched the MoodMouse concept, to our coaches, peers and a second assessor. The feedback we got, made us reflect on our design process as well as our concept and Project Goal (see figure 38).
During the reflection we realised three things;

1) **Our design did not reflect our design goal anymore.**
   After this feedback, we decided to create a Miro board to see what we really wanted to achieve (see figure 38).
2) **We kept adding new unnecessary features to our design**,
   We wanted too much which made our design too complicated and not very innovative. Afterwards, we were curious how we could implement the useful features in a simplistic product. We thought creating an app or other accessories is the easy way out, so we saw it as challenging and innovative feedback.
3) **The sensors we used were difficult to incorporate in our design and were too difficult to use for a user.**
   We used this feedback to look for a sensor which could be more reliable for stress measurements and easy to use (see "GSR sensor").

'We rewrote our goal to state:

'Helping the user with their stress by visualising their stress levels and simultaneously helping the user better their stress level"

Changing to a cortisol sensor and water

After rewriting our goal we started research on finding another sensor. The new sensor we found was a cortisol sensor based on saliva, which is more reliable for stress. By doing research, we knew that the visual and sound of water are proven to be relaxing (Matt, 2019) (Verena, 2018). Subsequently we came up with BOTTLE. We chose to use water with both visualizing and helping with the user's stress.

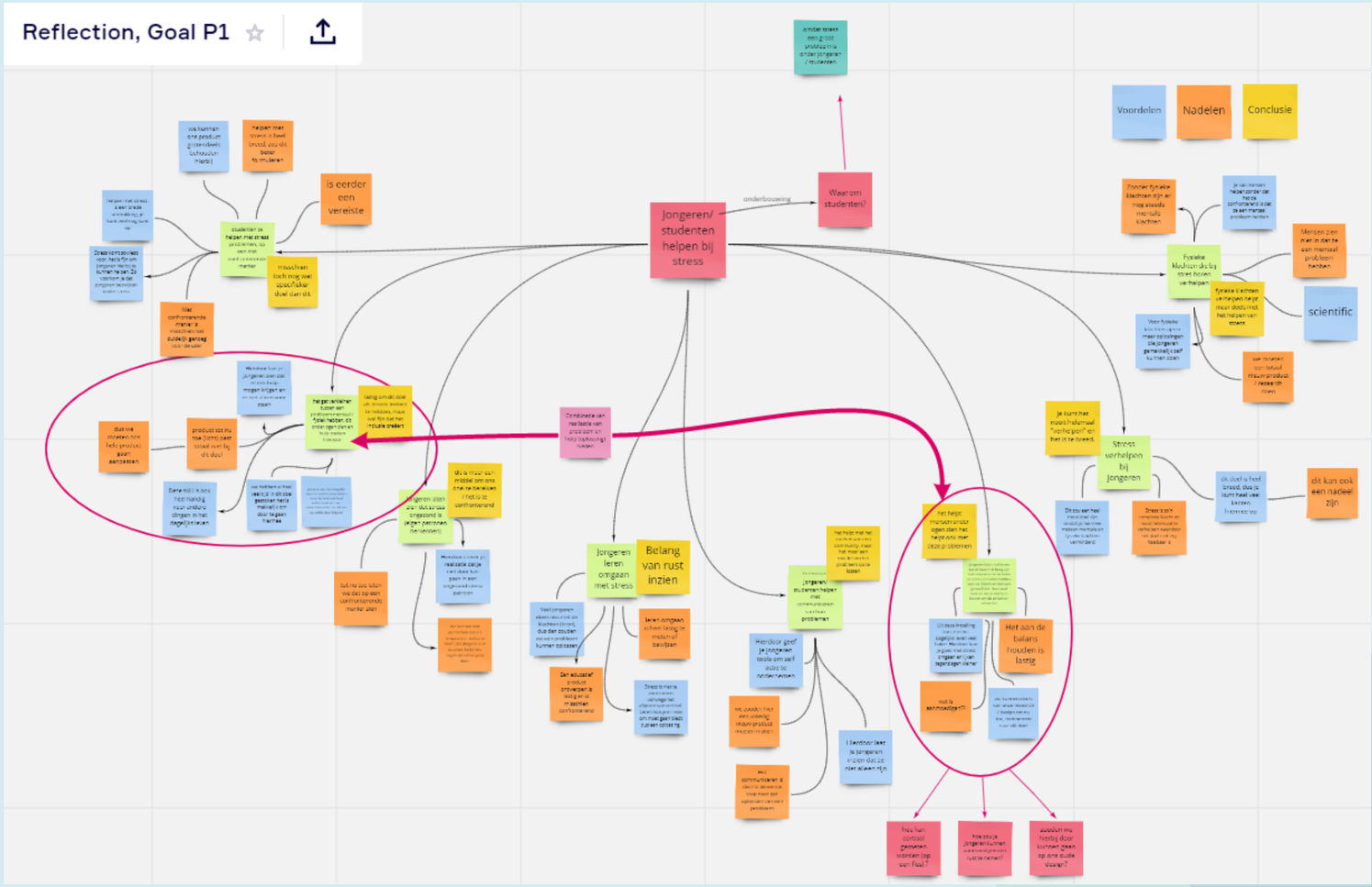


Figure 38: Miro board reflecting after midterm demoday (Miro, 2021)
https://miro.com/app/board/o9J_lN1-KzE=/?openNotes

Process

Low fidelity Prototypes

We tested 4 ways to move water in a bottle (see figure 40) with the use of low fidelity prototypes:

- Bubbles
- Overflowing
- Vortex
- Waves

We learned that the flowing water version ([Bente Elst], Youtube, 2021 (https://youtu.be/5Lwusd1MYh4) sounded and looked the best, but moving water in a bottle is a difficult task.

Changing to a GSR sensor

After more research on our cortisol sensor, we learned that this sensor also would not be ideal for our concept (see "GSR sensor"). After more research on measuring stress, we found the GSR sensor, which was proven to work in multiple papers (Fernandes, 2014). Also, the GSR sensor would be more easy to use for the user and to implement in our design. With the GSR sensor, we ended the process of collecting data (see figure 39).

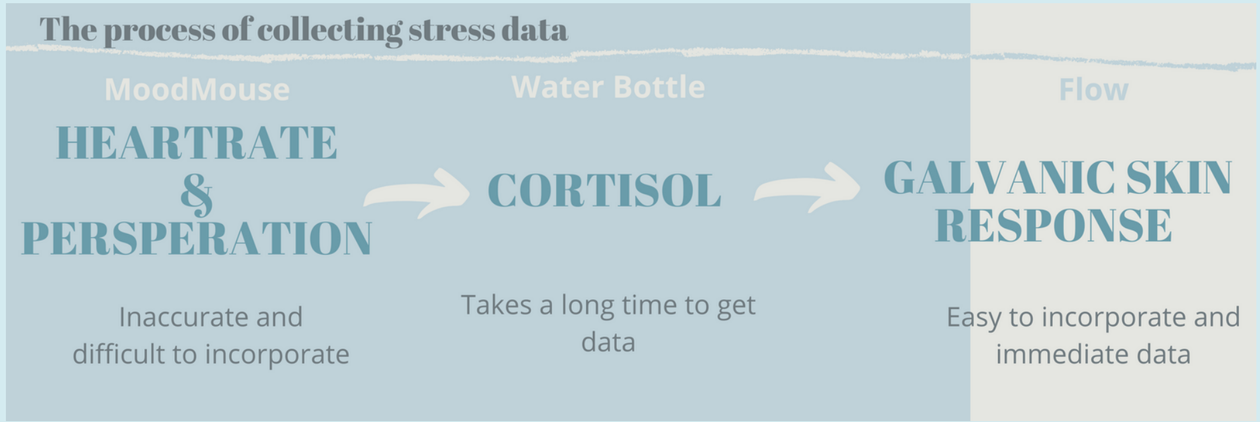


Figure 39: Process of collecting data (made with Canva)

Figure 40: Moving water in a bottle.

Process

From BOTTLE to Flow

The idea of flowing water was still interesting to us, but we did not see the value of an everyday product anymore because the product is focused on more private and personal use at home. So we developed it into an aesthetic product. We decided to make a flowing water system that looked aesthetically pleasing to set on a desk. We worked with rounded shapes, because they are more pleasing to look at and calming (see aesthetics), subsequently we came up with the concept ‘’Flow’’.

The user-test

During the research we did on the effects of flowing water, all information we found focused on water in nature, like a creek or the ocean. We wanted to test what impact water has on a more smaller scale. This is why we decided to do a user-test ourselves where we could use our prototype of Flow and the GSR-sensor. We learned to create a user agreement (Elst B, 2021), collect and store data and create clear visualisation of our data.

Involving an expert/stakeholder

Nearing the end we chose to involve an expert to get feedback from (see expert/stakeholder pitch). We involved a psychologist with knowledge about stress among our target group and the existing market for stress-related products. We learned to pitch our product and got multiple tips to implement in our product. The most useful; adding mindfulness exercises into our product and giving the water a blue tint to make it more visible, other learning points can be seen in the section "Expert/stakeholder pitch".

The project goal process

In the final stage of our process we finilised our goal by implementing the passive and active possibility, for the user, to release stress:

‘’ "Helping the user with their stress, by giving a point of reflection in terms of visualising stress in a unobtrusive way and simultaneously decreasing the stress unconsciously or with active interactions."

From this moment our goal remained the same. This gave us the opportunity to reflect on this goal when we were making decisions throughout the remainder of the process (see figure 41).

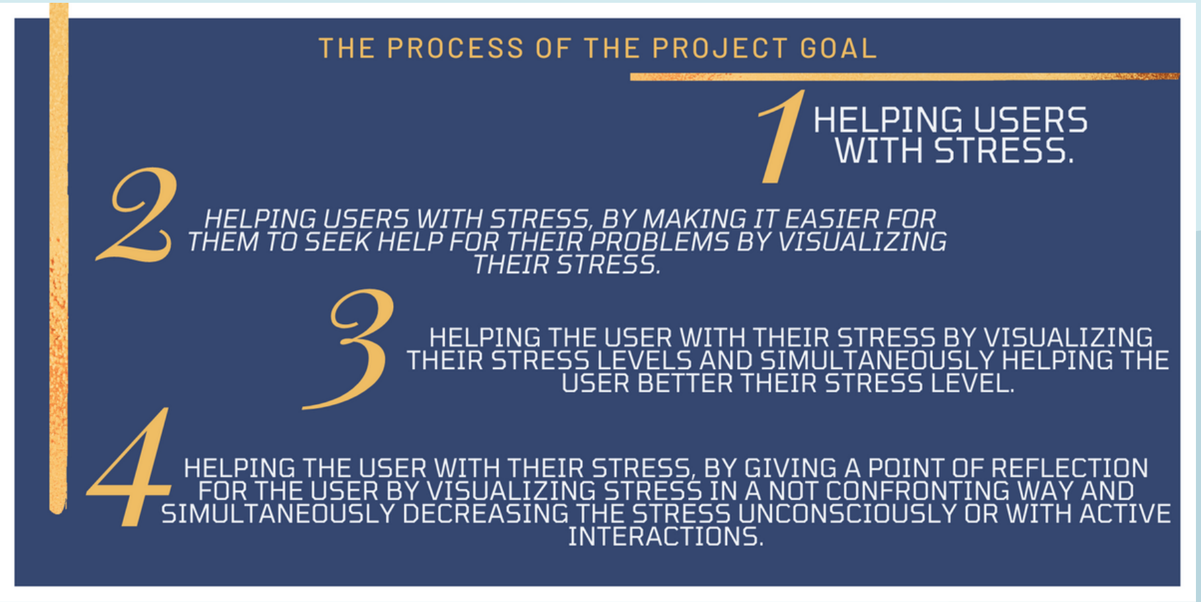
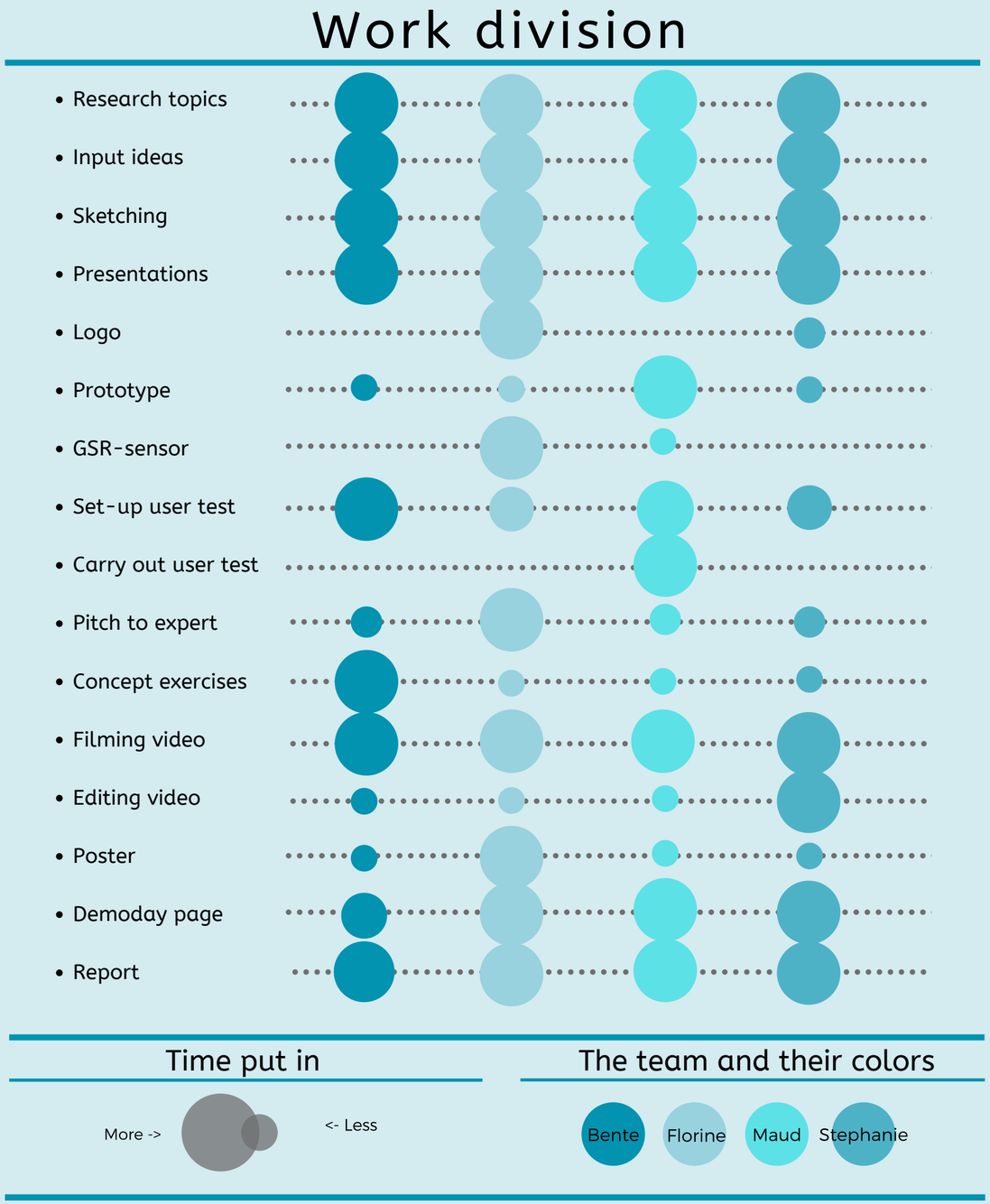


Figure 41: Process of the Project goal (made with Canva)



Process

Designing a concept obviously entails planning, organisation and collaboration. For this reason, we have made a visalisation of the work division throughout our entire learning trajectory. Within our planning, we worked together mainly in the first stages of the design process and later on, we started to divide more tasks. This gave us the opportunity to decide together which direction we wanted to go in with our concept and to efficiently work on that in the later stages.

The work division is divided into all the steps we have taken (see figure 42). Corresponding to that each team member has a circle with a specific colour. The size of the circle represents the input of the team member, so when the circle is larger, more work has gone into this aspect.

Conclusion

Conclusion

In the end of the project, we had both used low and higher fidelity prototypes for research and communication. We involved a stakeholder in our process and formed a business model, focused on both aesthetics and technical aspects, collected input of our target group via a questionnaire, and did a user test next to our online research.
During the process, we went through multiple design iterations and changed our goal multiple times. This was a big part of our growth during the project and made it possible to, in the end, have a product with the best parts of every previous design we had.

Our Flow prototype did exactly what we wanted it to do, and gives a good impression of our concept. The materials, screen, and some details were not a complete image of our ideal concept, but this was not something we were going for.

Flow reflects our project goal well, Flow is not overly complicated but has just enough features to fulfill our goal and help the user with what it is meant to do.

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Individual reflections

Bente Elst

From the start of the project, the group dynamic was very open, everyone gave each other constructive feedback and compliments on what the others made or came up with. This created an open environment were we all could freely out our opinions, which caused good communication during the the whole project.
Sometimes we as a group had very different opinion, but because everyone listened to what others had to say, we could always find a way in-between where everyone was happy with our design. The communication on everyone's personal work was the one thing that could hav gone better, since sometimes there were some misunderstandings due to this fact, luckily the misunderstanding were cleared up quite fast.
I think that good communication and valuing everyone's opinion are both important when working in a team, because this means that in the end everyone can be as happy with their end product and process.
I often have a strong opinion, especially when it is about a topic I am passionate about. During this project I learned to value others opinions just as much as my own. Sometimes this was difficult because I needed to suppress myself, but over time it got easier to let go since I trusted my teammates.
The work division in our group worked great, at the end of every meeting we divided some tasks for the next week and sometimes we divided some as well for over a longer period of time. (like Prototyping Flow). In the end we needed to work extra hard to get our whole concept together for the demoday, this showed me the importance of looking forward and making a clear planning, especially for a project over a longer period of time.

During the project I learned not only about working together but also about the design process as a whole. This was the first time I worked on a Design process from start to finish and this taught me all the things a design process consists of.
I also made big leaps on every Area of Expertise, form pitching you design to a stakeholder, to setting up a user test to using visuals for exploration of designs. The Project introduced me to prototyping for research, before this project I did not know this was a thing even. Now I have learned how important prototypes can be for not only communication your design, but also using your design as to get more date, just like we did with our 4 Low fidelity water moving prototypes and the use of Flow and our GSR-sensor in a user test.

The project also got me to figure out my personal identity further, working with mental and physical health on this project showed that this definitely a area I want to explore further.
In the end, Project 1 was a great way to get to know the design process and develop myself as a designer.

Stephanie Kohnle

Group dynamics and communication are very important in a project group. In the early stages, we already discovered we were all motivated and excited to do this project, which is really helpful for the overall atmosphere. I sometimes have a hard time expressing my opinion, since I naturally take an observing and listening role in a conversation. However, everyone in this group shows genuine interest in hearing each other's opinions. This created an open and safe environment for everyone to express their opinion, which helped me to confidently take a more active role in a conversation/discussion.
In a meeting, I feel most confident when I get the opportunity to prepare myself before a meeting. After researching topics and coming up with ideas myself, I think group discussions and brainstorming sessions are very useful. You can learn from each other's knowledge and get inspired by each other's ideas. Feedback is played a big role in our design process. When discussing downsides through constructive criticism, and taking the best aspects of everyone's ideas, we gained new insights and got more creative. Hence, I think working in a group and giving feedback on each other is very valuable in a design process. However, even with four people with slightly different opinions and views, you can get tunnel vision and get stuck on one idea. Therefore, feedback from an outsider (e.g. peers or coaches) is also very useful and offers new insights.

Rather late in the design process, we pitched our concept to a psychologist with expertise in stress-related issues. Involving a stakeholder, other than the user target group, was new to me. It was very useful to hear the opinion and questions of someone who isn't involved in the design field. I think next time, it would be even better to include an expert in the middle of the design process as well. Moreover, I think it is better to start earlier with prototyping next time because prototyping brought us a lot of new insights.

Another thing I learned in this project is how interesting learning about the topic of mental health is to me. There is so much to learn about it, and I surprisingly really enjoy doing literary research on it, which usually doesn't appeal to me. This also showed me I should be more open to reading and educating myself on certain topics. I knew I loved film and photography, and once again I noticed how much I enjoyed making the video for Demo Day, from coming up with a concept, to filming parts, featuring in it, and editing it.

Maud van der Linden

While working in a group project, I learned a lot of things. Collaboration and communication within a group is very important. Sometimes things went wrong in this group that caused stress, but we always tried to work it out. It is also important that everyone is listened to and treated with respect. We learned how to go through a design process online, which was sometimes quite a challenge. During this design process we separated the tasks into tasks we did together and individual tasks. That worked out well for us. It was important that tasks as research, brainstorming and sketching were done by everyone and discussed together, so that everyone was aware of concept developments. What can be improved in this regard is that it we have to communicate more often with each other about how the individual tasks are going and if someone could not finish their parts due specific reasons. This caused that some important things were missing, which then others had to make extra time free to solve it. In the next project, I want to make clear agreements about this with my group and speak up sooner (possibly talking with a coach and project group together) if it happens. I usually want to solve things withing the group first before talking with a coach about it, but next time I will take into account that that also could be an option if things go wrong.

I also made a lot of individual progress during this project. I have been able to use all the knowledge that I have learned over the past year from different areas of expertise. I have been able to achieve and develop in goals from my PDP such as improving: sketching, prototyping, user testing, doing research and brainstorming. I have also broaden my knowledge about mental health, which I thought was very interesting and sometimes even confronting. I learned a lot about myself. I have found out that I like almost all parts of the design process and because of that sometimes want to do too much. Therefor I have to make a clear plan for myself what exactly I want to learn in the next projects. Now I feel like I have been able to gain skills of every design part, which has broaden my knowledge and made me realize which parts I am really interested in and about what parts I still need to learn a lot about. This way I can deepen my knowledge even more.

Florine Westen

Since this was my first time to go through an entire design process over a longer period of time, I developed myself in this area. Not only did I learn things about designing but also about what it means to be a designer for me. Therefore I will write a reflection about my learning points in terms of the project and my overall growth as an Industrial Designer.

Initially, I learned how to do proper research since this was necessary for substantiating choices for our concept. Compared to the beginning of Project 1 Design, I can find valuable information much quicker. Besides that I realised the impact visuals can have. Previously I used to write elaborate texts but now I try to summarise everything into one or more great visuals, which I tried to apply within the report. The same holds true for prototyping, by making concepts visual and tangible, new ideas and insights appear that without prototyping would not be discussed. These skills are definitely handy for further projects and I am excited to apply this even more. Other skills that are relevant for a design project are collaboration, organisation and planning. Within the first stages of our process we did not have great organisation an planning, however the collaboration has always been good. There is definitely room for improvement when it comes down to organisations an planning, since we only divided small tasks but we did not plan much ahead. This caused a great workload near deadlines, so for the next time I will spread this more evenly. In the final stages, around the Demo Day, we improved our planning and I experienced working like this was more efficient. Therefore I will explore more approaches on how to organise work within a project.

Lastly, I also got to know my professional identity more by following Project 1 Design. Being involved in a design process that revolves about improving mental health is something that I want to continue in the future. Personally I liked all the iterations of our project so that we finally could come up with the best possible solution to achieve our goal. In the end I am really satisfied with what we have designed and this is definitely something I would like to work on again. Therefore I got to define my vision as well due to this project. Apart from knowing where I want to go with designing, I also obtained more knowledge about how I can present myself, my work and my development by giving a weekly heads up to my coaches. These skills especially improved after learning more about the portfolio. Subsequently, I also got to experience the relevance of my portfolio which will motivate me next times to keep this up so I can convey a clear message of what design means to me.

All in all, Project 1 Design was a great learning experience for me in order to become more skilled in design competences as well finding out my own way of what kind of Industrial Designer I want to be.

Appendix

Arduino code with the use of the Serial Plotter

```
const int GSR=A0;
int sensorValue=0;
int gsr_average=0;
void setup()
{
Serial.begin(9600);//Initialising the serial port for data upload
}
void loop()
{
long sum=0;
for(int i=0;i<10;i++) //Average the 10 measurements USING FOR LOOP
{
  sensorValue=analogRead(GSR);
  sum += sensorValue;
  delay(5);
}
gsr_average = sum/10;
Serial.print("gsr_average =");
Serial.println(gsr_average);
int human_resistance = ((1024+2*gsr_average)*10000)/(516-gsr_average);//FOLLOW DATASHEET
// Serial.print("human_resistance=");
// Serial.println(human_resistance);
Serial.println(gsr_average);
}
```

Arduino code for combining it with Processing:

```
void setup() {
  Serial.begin(9600);
}


void loop() {
  Serial.println(analogRead(0));
  delay(50);
}
```

Processing code for the graph

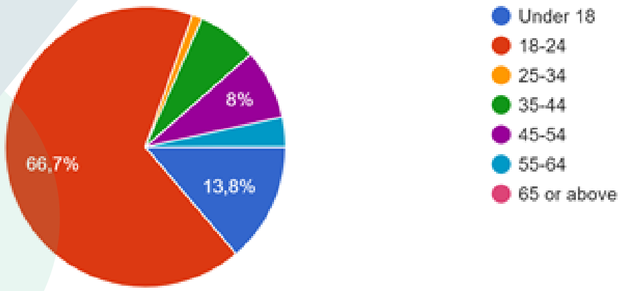
```
/*
Hacked together by Gadget Reboot 2018 from two separate sources:
https://arduining.com/2013/08/05/arduino-and-processing-graph-example/
https://forum.processing.org/two/discussion/14060/#Comment_57867
Based on the Tom Igoe example.
Mofified by Arduining 17 Mar 2012:
  -A wider line was used. strokeWeight(4);
  -Continuous line instead of vertical lines.
  -Bigger Window size 600x400.
--------------------------------------------------------------------------------
This program takes ASCII-encoded strings
from the serial port at 9600 baud and graphs them. It expects values in the
range 0 to 1023, followed by a newline, or newline and carriage return
Created 20 Apr 2005
Updated 18 Jan 2008
by Tom Igoe
This example code is in the public domain.
*/


i


}
```

```
mport processing.serial.*;


Serial myPort; // The serial port
float inByte; // Incoming serial data
boolean newData = false;
int xPos = 1; // horizontal position of the graph


//Variables to draw a continuous line.
int lastxPos=1;
int lastheight=0;


void setup () {
 // set the window size:
 size(1000, 500);


 myPort = new Serial(this, "COM6", 9600);


// A serialEvent() is generated when a newline character is received :
  myPort.bufferUntil('\n');
  background(255);      // set inital background:
}
void draw () {
  if (newData) {
    //Drawing a line from Last inByte to the new one.
    stroke(#0006FC);     //stroke color
    strokeWeight(2);        //stroke wider
    line(lastxPos, lastheight, xPos, height - inByte);
    lastxPos= xPos;
    lastheight= int(height-inByte);
    // at the edge of the window, go back to the beginning:
    if (xPos >= width) {
      xPos = 0;
      lastxPos= 0;
      background(255);  //Clear the screen.
    }
    else {
      // increment the horizontal position:
      xPos++;
    }
   newData =false;
}
}


void serialEvent (Serial myPort) {
  // get the ASCII string:
  String inString = myPort.readStringUntil('\n');
  if (inString != null) {
    inString = trim(inString);                // trim off whitespaces.
    inByte = float(inString);           // convert to a number.
    inByte = map(inByte, 0, 1023, height, 0); //map to the screen height.
    newData = true;
  }
```

Results of the questionnaire

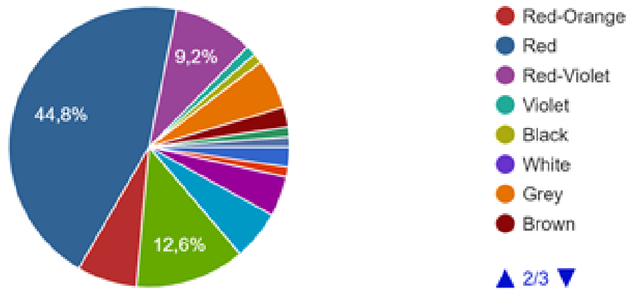
What is your age?

87 antwoorden



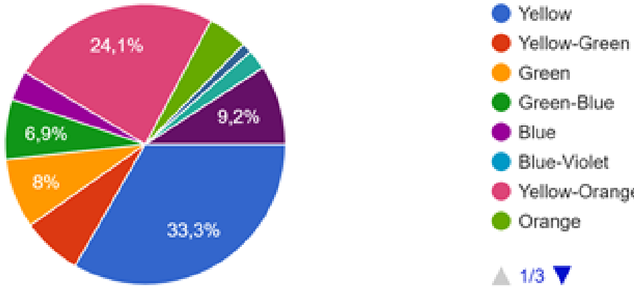
What colour do you associate with stress?

87 antwoorden



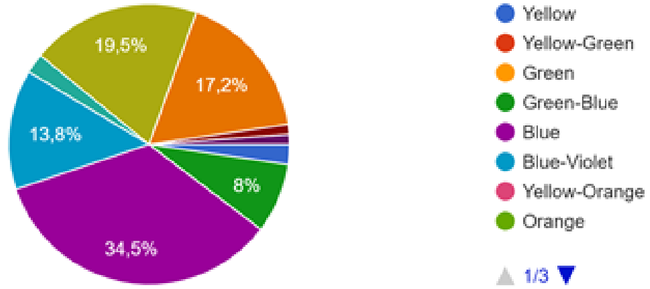
What colour do you associate with joy?

87 antwoorden



What colour do you associate with sadness?

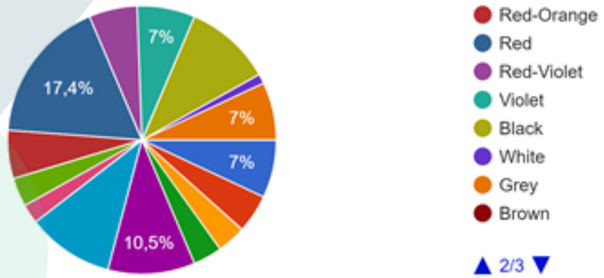
87 antwoorden



Results of the questionnaire

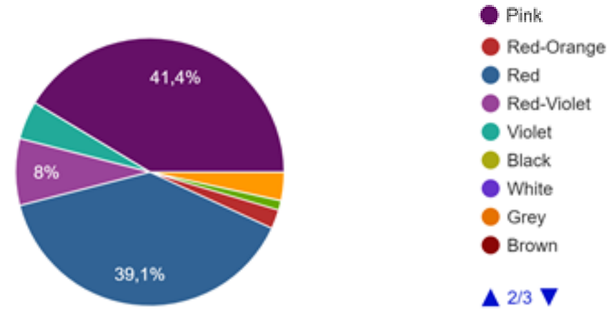
What colour do you associate with anxiety?

86 antwoorden



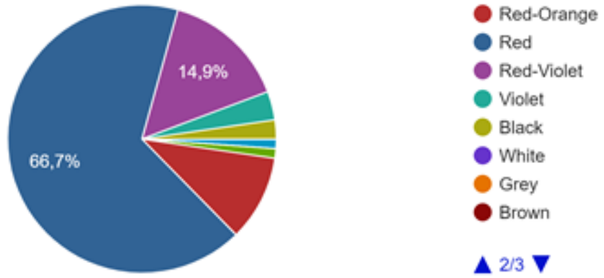
What colour do you associate with love?

87 antwoorden



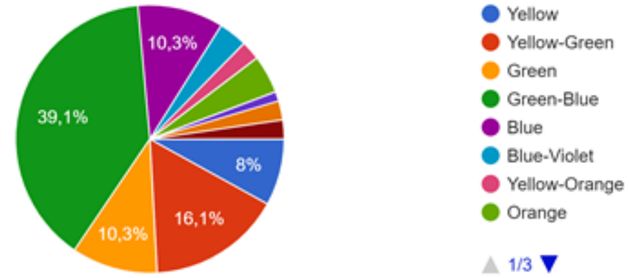
What colour do you associate with anger?

87 antwoorden



What colour do you associate with calmness?

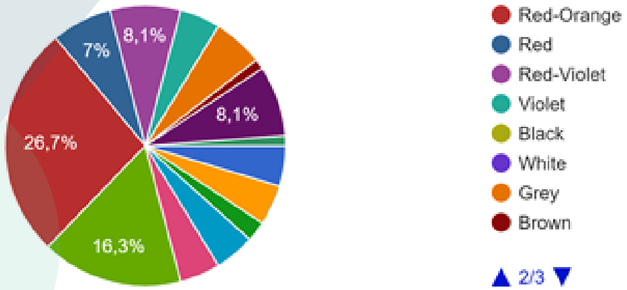
87 antwoorden



Results of the questionnaire

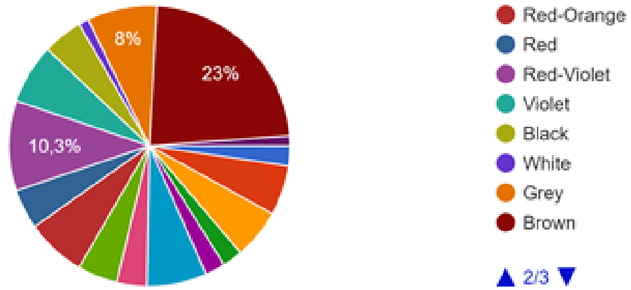
What colour do you associate with embarrassment?

86 antwoorden



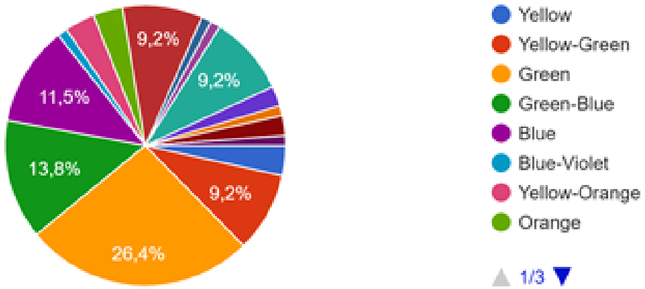
What colour do you associate with discomfort?

87 antwoorden



What colour do you associate with comfort?

87 antwoorden



User agreement

The user agreemeent, that can be found on the next three pages, is written in Dutch. Because the participants of the user test come from the Netherlands, we have decided to write the user agreement in Dutch to make them the most comfortable. Also we wanted to make sure every participant did understand what the user test entails and fully agrees to participate.

User agreement

Informatie
Dit onderzoek gaat over de audio en het beeld van stromend water en het effect dat dit heeft op stress.

Uitvoerders onderzoek:
Het onderzoek wordt uitgevoerd door één persoon, dit is het geval i.v.m. Corona. Die persoon is een eerstejaars Industrial Design student aan de Technische Universiteit Eindhoven. Het onderzoek wordt afgenomen door een van de volgende studenten:
- Bente Elst
- Maud van der Linden
- Florine Westen
- Stephanie Kohnle

Het contact persoon is: +316 ********
Bente Elst
b.elst@student.tue.nl

Dit houd het onderzoek in:
Na de toestemmingsverklaring ondertekent te hebben wordt de deelnemer gekoppeld aan een GSR sensor. Dit is een elektronisch component wat de weerstand van iemands huid kan meten, doormiddel van het laten lopen van een klein voltage, namelijk 0,5V. De stroom is klein genoeg zodat de deelnemer niks voelt. De weerstand van iemands huid is afhankelijk van de hoeveelheid vocht op zijn/haar/hun huid, dit is op zijn beurt weer afhankelijk van hoeveelheid die hij/zij/die zweet. Extreme emoties zoals stress hebben invloed op de hoeveelheid zweet die een persoon produceert. Dit betekent dat met de GSR sensor, de deelnemers stress en andere extreme emoties gemeten kunnen worden.
Meer informatie over de GSR sensor is gegeven onder het kopje ‘’De GSR sensor” in dit document.

Na het om krijgen van de GSR sensor, krijgt de deelnemer een video met audio te zien van stromend water. Er is ook een kans dat de deelnemer stromend water fysiek te zien en horen krijgt. Het is de bedoeling dat de deelnemer focust op het beeld van het stromend water, meer hoeft de deelnemer niet te doen. Tijdens het volgen van het stromende water worden de gegevens van de GSR sensor in de gaten gehouden om te kijken of het stromende water effect heeft op de huid weestand.

Het onderzoekt eindigt met een kort interview, hierbij krijgt de deelnemer een aantal vragen gesteld gerelateerd aan stres. Deze vragen zijn gemaakt om wat extra kennis op te doen over stress onder studenten, hoe studenten met die stress omgaan, de deelnemers mening over invloed van stromend water op stress en andere stress gerelateerde vragen.

User agreement

De GSR sensor:
Een GSR sensor staat voor Galvanic Skin Response sensor. Met deze sensor kunnen we de activiteit van de zweetklier meten, wat verband houdt met emotionele opwinding. Om de GSR te meten profiteren we van de elektrische eigenschappen van de huid. Om precies te zijn, hoe de weestand van de huid varieert met de zweetklier activiteit. Des te meer zweetklier activiteit, hoe meer transpiratie en dus des te minder de huidweerstand.
De methode gebruikt om een GSR-signaal te meten in de situatie van dit onderzoek is gebaseerd op een constant spanningssysteem, ofwel de exosomatische methode. Hierbij past de GSR sensor een constante spanning toe van ongeveer 0,5 Volt op twee elektroden die in contact komen met de huid. Het doel van dit circuit is om de huidgeleiding en zijn variatie te meten.
De variatie in weerstand gemeten wordt tot slot weer gegeven in de vorm van een lijngrafiek op de laptop.

Data:
Tijdens Het onderzoek worden verschillende soorten data verzameld. Deze data houd in:

- een audio opname van het onderzoek
- een video opname van het onderzoek
- geschreven notities die gemaakt zijn door de persoon die het onderzoek afneemt tijdens het onderzoek
- de gemeten weerstand van de deelnemers huid tijdens het onderzoek.

Al deze data wordt opgeslagen op OneDrive bestanden die alleen in te kijken zijn door de 4 personen van het project. Dat zijn dezelfde mensen benoemd boven in het bestand als personen die het onderzoek kunnen afleggen. De data opgeslagen staat niet op naam en is dus anoniem.

De data wordt gebruikt voor onderzoek naar de invloed van stromend water op stress en onderzoek naar stress onder jongeren. De uitslag van dit onderzoek kan gedeeld worden tijdens een project presentatie onder andere eerstejaars Industrial Design studenten. Deze studenten hebben geen toestemming om de data zelf in te zien. De data verzameld tijdens dit onderzoek zal niet buiten de zonet besproken groep mensen gedeeld worden.
De data worden voor maximaal een jaar bewaard en worden dus ook binnen een jaar vernietigd.

Deelnemers Rechten:
Na het ondertekenen van de toestemmingsverklaring mag de deelnemer ten allen tijden de gegeven toestemming intrekken en stoppen met meedoen aan het onderzoek. Hiervoor hoeft de deelnemer geen reden te geven.

User agreement

Toestemmingsverklaring

Gegevens:
Naam:
Geboortedatum:
Telefoon:
Contactpers. Telefoon:

Lees de volgende voorwaarde goed door als je akkoord gaat met wat er staat, vink de box aan.
Als je alle voorwaarden hebt gelezen en wel of niet heb aangevinkt kan je de pagina onderteken.

- Ik ben 18 jaar of ouder.
- Ik heb het informatieblad volledig doorgelezen en begrijp wat het onderzoek inhoud.
- Ik heb het informatieblad volledig doorgelezen en ik weet wat mijn rol is in dit onderzoek.
- Ik weet dat ik ten alle tijden mijn toestemming mag intrekken zonder een reden te geven.
- Ik weet dat het onderzoek gelijk stopt als ik aangeef dat ik mijn toestemming wil intrekken.
- Ik weet welke data er verzameld wordt en ik geef toestemming om mijn data te verzamelen op de aangegeven manier in het informatieblad.
- Ik weet hoe mijn verzamelde data opgeslagen wordt, wie toestemming heeft tot deze data en hoelang deze data opgeslagen blijft. Ik geef toestemming om mijn data op de op het aangegeven manier in het informatieblad op te slaan.
- Ik weet met wie mijn verzamelde data gedeeld kan worden en ik weet dat ik anoniem blijf als mijn data gedeeld wordt. Ik geef toestemming om mijn anonieme data te delen onder de in het informatieblad aangegeven mensen.
- Ik weet dat het onderzoek gaat over stress en dat dit een gevoelig onderwerp kan zijn. Ik ben emotioneel stabiel genoeg om te praten over dit gevoelige onderwerp.
- Al mijn extra vragen die ik had/heb over dit onderzoek heb ik gesteld en zijn beantwoord. Ik heb geen vragen meer over het onderzoek nu.

Onderteken hier:

Information about the user test

Informatie 1:
Dit onderzoek gaat over de audio en het beeld van stromend water en het effect dat dit heeft op huid weerstand.

Uitvoerders onderzoek:
Het onderzoek wordt uitgevoerd door één persoon, dit is het geval i.v.m. Corona. Die persoon is een eerstejaars Industrial Design student aan de Technische Universiteit Eindhoven. Het onderzoek wordt afgenomen door een van de volgende studenten:
- Bente Elst
- Stephanie Kohnle
- Maud van der Linden
- Florine Westen

Het contact persoon is: Bente Elst
+316 2338872
b.elst@student.tue.nl

Dit houd het onderzoek in:
De deelnemer wordt gekoppeld aan een GSR (Galvanic Skin Response) sensor. Dit is een elektronisch component wat de weerstand van iemands huid kan meten. De weerstand van iemands huid is afhankelijk van de hoeveelheid die de deelnemer zweet. Extreme emoties kunnen invloed hebben op de hoeveelheid zweet die Hij/Zij/Die produceert. Dit betekent dat met de GSR sensor extreme emoties gemeten kunnen worden.
Meer informatie over de GSR sensor is gegeven onder het kopje “De GSR sensor” in dit document.

Na het om krijgen van de GSR sensor, krijgt de deelnemer één keer geluid en beeld te zien/horen, ook krijgt de deelnemer twee keer alleen geluid te horen.
1) Geluid 1 en Beeld:
De deelnemer krijgt het fysieke prototype van het design "Flow" te zien en horen.
2) Geluid 1:
De deelnemer krijgt het geluid van het fysieke prototype van het design "Flow" te horen.
3) Geluid 2:
De deelnemer krijgt het geluid van een digitale audio opname van stromend water te horen. Running Water Soft Relaxation Sounds | White Noise for Sleep, Studying, Focus | 10 Hours - YouTube

Voor Geluid 1 en Beeld, is het de bedoeling dat de deelnemer comfortabel gaat zitten en focust op het beeld en het geluid van het stomende water in het Prototype. Dit doet de deelnemer voor 45 seconden.
Voor Geluid 1 en Geluid 2, is het de bedoeling dat de deelnemer focust op het geluid van het stromende water. Dit doet de deelnemer door Comfortabel te gaan zitten en zijn/Haar/Hun ogen te sluiten voor beide geluiden doet de deelnemer dit voor 1 minuut Tijdens het volgen van het stromende water worden de gegevens van de GSR sensor in de gaten gehouden door de Student die het onderzoek afneemt, om te kijken of het stromende water effect heeft op de huid weestand.

Information about the user test

De GSR sensor:
Een GSR sensor staat voor Galvanic Skin Response sensor. Met deze sensor kunnen we de activiteit van de zweetklier meten, wat in verband staat met emotionele opwinding. Om de GSR te meten profiteren we van de elektrische eigenschappen van de huid. Om precies te zijn, hoe de weestand van de huid varieert met de zweetklier activiteit. Des te meer zweetklier activiteit, hoe meer transpiratie en dus des te minder de huidweerstand.
De methode gebruikt om een GSR-signaal te meten in de situatie van dit onderzoek is gebaseerd op een constant spanningssysteem, ofwel de exosomatische methode. Hierbij wordt de GSR sensor verbonden met twee verschillende vingers naar keuzen op dezelfde hand. De GSR sensor pas een constante spanning toe van ongeveer 0,5 Volt op de twee elektroden die in contact komen met de huid van de twee vingers waar de elektroden aan zijn verbonden. Het doel van dit circuit is om de huidgeleiding en zijn variatie te meten.
De variatie die in weerstand gemeten word, wordt tot slot weergegeven op de laptop van de student die het onderzoek afneemt. Deze weergave is in de vorm van zowel een lijngrafiek als waardes in de vorm van cijfers.

Data:
Tijdens het onderzoek worden verschillende soorten data verzameld. Deze data houd in:

- een audio opname van het onderzoek
- een video opname van het onderzoek
- geschreven notities die gemaakt zijn door de persoon die het onderzoek afneemt tijdens het onderzoek
- de gemeten weerstand van de deelnemers huid tijdens het onderzoek.

Al deze data wordt opgeslagen op OneDrive bestanden die alleen in te kijken zijn door de 4 personen van het project. Het gaat hier over dezelfde mensen benoemd boven in het bestand als personen die het onderzoek kunnen afleggen. De data opgeslagen staat niet op naam en is dus anoniem.

De data wordt gebruikt voor onderzoek naar de invloed van stromend water op stress en onderzoek naar stress onder jongeren. De uitslag van dit onderzoek kan gedeeld worden tijdens een Project presentatie of Project report onder andere eerstejaars Industrial Design studenten en begeleiders/beoordelaars van dit project. De zonet benoemde personen hebben geen toestemming om de data zelf in te zien. De data verzameld tijdens dit onderzoek worden niet buiten de zonet besproken groep mensen gedeeld.
De data worden voor maximaal een jaar bewaard en worden dus ook binnen deze tijd vernietigd.

Deelnemers Rechten:
De deelnemer mag ten allen tijden de gegeven toestemming intrekken en stoppen met meedoen aan het onderzoek. Hiervoor hoeft de deelnemer geen reden te geven.

Toestemmingsverklaring 1:

Information about the user test

Gegevens:
Naam onderzoek afnemer:
Naam:
Geboortedatum:
Telefoon:
Contactpers. Telefoon:
Datum:

Lees de volgende voorwaarden goed door. Als je akkoord gaat met wat er staat, vink de box aan.
Als je alle voorwaarden hebt gelezen en wel of niet heb aangevinkt kan je de pagina onderteken.

- Ik ben 18 jaar of ouder.
- Ik heb het informatieblad volledig doorgelezen en begrijp wat het onderzoek inhoud.
- Ik heb het informatieblad volledig doorgelezen en ik weet wat mijn rol is in dit onderzoek.
- Ik weet dat ik ten alle tijden mijn toestemming mag intrekken zonder een reden te geven.
- Ik weet dat het onderzoek gelijk stopt als ik aangeef dat ik mijn toestemming wil intrekken.
- Ik weet welke data er verzameld wordt
- Ik geef toestemming om een audio opnamen van het onderzoek te maken.
- Ik geef toestemming om een video opnamen van het onderzoek te maken.
- Ik geef toestemming om geschreven notities tijdens het onderzoek te maken.
- Ik geef toestemming om een GSR-data opnamen van het onderzoek te maken.
- Ik weet hoe mijn verzamelde data opgeslagen wordt, wie toestemming heeft tot deze data en hoelang deze data opgeslagen blijft.
- Ik geef toestemming om mijn verzamelde data op de op het aangegeven manier in het informatieblad op te slaan.
- Ik weet met wie mijn verzamelde data gedeeld kan worden en ik weet dat ik anoniem blijf als mijn data gedeeld wordt.
- Ik geef toestemming om mijn anonieme data te delen onder de in het informatieblad aangegeven mensen.
- Ik weet dat de Studenten die het onderzoek afnemen niet aansprakelijk zijn voor fysieke of mentale schade als ik deze oploop tijdens het onderzoek.
- Ik ga akkoord dat de Studenten die het onderzoek afnemen niet aansprakelijk zijn voor fysieke of mentale schade als ik deze oploop tijdens het onderzoek.
- Al mijn extra vragen die ik had/heb over dit onderzoek heb ik gesteld en zijn beantwoord. Ik heb geen vragen meer over het onderzoek nu.

Deelnemer: Afnemer:
Onderteken hier: Onderteken hier:

Information about the user test

Informatie 2:
zoals beschreven in het "Informatieblad 1" voor het onderzoek begon:
De GSR-sensor kan extreme emoties meten aan de hand van de deelnemers huidweerstand over twee vingers.

In dit onderzoek focuste we op de emotie; stress.
De data verzameld van de GSR-sensor gaat over de stresslevels van de deelnemer gedurende het onderzoek.
Het doel van het onderzoek is om meer informatie op te doen over het effect wat beeld en geluid van stromend water op stress hebben.

Wetende dat dit onderzoek over stress gaat, is er een kans dat de deelnemer zijn mening veranderd over de data die verzameld wordt.
Vandaar dat er een tweede Toestemmingsverklaring is.

Information about the user test

Toestemmingsverklaring 2:
Gegevens:
Naam onderzoek afnemer:
Naam:
Geboortedatum:
Telefoon:
Contactpers. Telefoon:
Datum:

Lees de volgende voorwaarden goed door. Als je akkoord gaat met wat er staat, vink de box aan.
Als je alle voorwaarden hebt gelezen en wel of niet heb aangevinkt kan je de pagina onderteken.

- Ik weet dat ik mijn toestemming ten alle tijden mag terugtrekken.
- Wetende dat dit onderzoek gaat over stress, ik geef toestemming om de audio opnamen van het onderzoek te gebruiken.
- Wetende dat dit onderzoek gaat over stress, ik geef toestemming om de video opnamen van het onderzoek te gebruiken.
- Wetende dat dit onderzoek gaat over stress, ik geef toestemming om de geschreven notities tijdens het onderzoek te gebruiken.
- Wetende dat dit onderzoek gaat over stress, ik geef toestemming om de
- GSR-data opnamen het onderzoek te gebruiken.
- Al mijn extra vragen die ik had/heb over dit onderzoek heb ik gesteld en zijn beantwoord. Ik heb geen vragen meer over het onderzoek nu.

Deelnemer: Afnemer:
Onderteken hier: Onderteken hier:

_____ _____

4 Mindful Interactions

with

Flow

Breathing

1, 3 or 5 Minutes

Select the time you want to do this exercise.

Inhale

exhale

Sounds

Sit or lay down in a comfortable position an close your eyes.

interaction

Focus on the sound of **flowing water** for around 20 seconds

Then Focus on your **breathing** for around 20 seconds

Keep **switching** your focus until Flow shuts off

3 or 5 Minutes

H2O

For this exercise you need a glass or bottle of water to drink from.

2 Minutes

- When water on the outside goes up, inhale.
- As long as the water stays still after rising, hold your breath.
- When water on the outside goes down, exhale.
- When the water stays still after lowering, take a big sip of water
- This will be repeated 5 times

Two Senses

Try to sit down in a comfortable position.

Interaction

20 seconds: Find an object in the room and focus on the visual details of that object.

20 seconds: Focus on Flow and the visual of the flowing water

Close your eyes:
20 seconds: focus on the sounds around you

20 seconds: Focus on Flow the sound of the flowing water

3 Minutes