Hanne Sivertsen

The Perception of Waiting

Designing for children facing stressful situations

December 2019

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Master thesis - Department of Design, NTNU - December 2019

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Many children are nervous when facing health related procedures, such as dental appointments and hospital visits. This can be stressful for the children involved and is additionally both time consuming and cost in-efficient for the institutions concerned.

The assignment originates from the work done by Hanne Sivertsen in the fall of 2018 – "Designing compassionately for situational anxiety" – and Marikken Høiseth´s current work on children with dental anxiety.

The goal of the assignment is to explore how one can design to relieve stress associated with health related procedures, by improving the perception of waiting. The focus is put on *waiting* to broaden the area of exploration, which in turn can prove useful to various institutions.

The assignment will primarily include:
- Literature review to gain knowledge on health-related anxiety amongst children
- Qualitative insight gathered from relevant institutions
- Aesthetic and emotional exploration
- Prototyping and testing

The thesis is conducted according to "Retningslinjer for masteroppgaver i Industriell design".

Responsible tutor: Marikken Høiseth, NTNU
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Abstract

This thesis explores various professional disciplines, natural phenomenons, and common sense, in order to gain knowledge on how to improve the perception of waiting, specifically for children waiting for something that might appear stressful. By concretising insight into a design brief, and creatively explore how to answer that brief, it aims to suggest a way of increasing the child's bodily awareness, in order to shift focus from what lays ahead.

The result is an interactive balance board named Tilt. It is a versatile item that affords all kinds of play, focused mainly on children aged between three and eleven years old. Tilt appears to be fun, in addition to having soothing characteristics that affect people around both directly and in a more subtle way. It is not a toy, because it has no wrong way of being used, and it is not a game, because it has no specific goal. It is merely a materialisation of theory put to life.

Sammendrag

Denne masteroppgaven utforsker forskjellige fagdisipliner, naturfenomener og sunn fornuft, for å få kunnskap om hvordan man kan forbedre oppfatningen av å vente, spesielt for barn som venter på noe som kan virke stressende. Ved å konkretisere innsikt til en design brief og svare på briefen gjennom kreativ utforsking, tar den sikte på å foreslå en måte å øke barnets kroppslige bevissthet for å skifte fokus fra det som ligger i nær framtid.

Resultatet er et interaktivt balansebrett som heter Tilt. Det er et allsidig objekt som gir grunnlag for all slags lek, hovedsakelig fokusert på barn mellom tre og elleve år. Tilt fremstår som morsom, i tillegg til at det har beroligende egenskaper som påvirker menneskene rundt både direkte og på en mer subtil måte. Det er ikke et leketøy, fordi det ikke har noen feil måte å bli brukt på, og det er ikke et spill, fordi det ikke har noe spesifikt mål. Det er rett og slett en livlig materialisering av teori.

TILT

BALANCE BOARD

Lights providing feedback

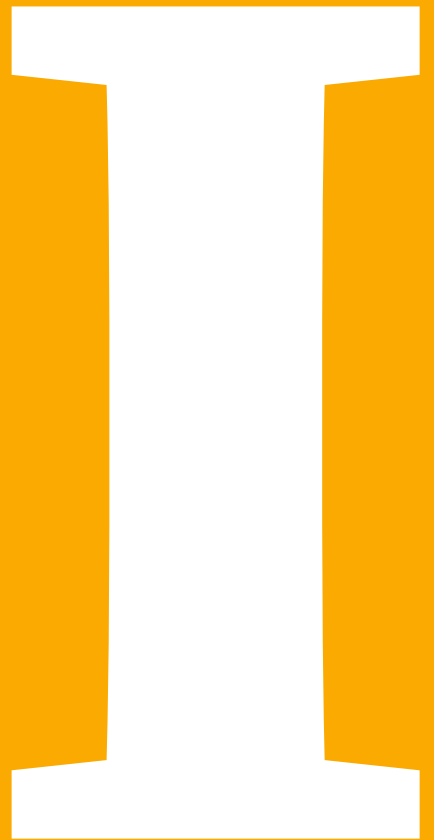**Triangular bottom that challenges your balance**

Grip tape for friction

INTRO

I

The perception of waiting - What does it mean?

This thesis focuses on both the physical and mental state of waiting. The latter, because it is interesting to explore how and why many experience a change of mentality during the time they spend between arrival and appointment. The physical aspect, on the other hand, helps scope the project, framing it to concern waiting rooms and areas.

Waiting rooms and areas are usually the spaces where people end up spending the most time in health-related institutions such as hospitals, and doctors and dentist offices. Despite this, they seem to get the least attention when the building is planned. Although many areas of this kind have both paintings and fancy colors, the feeling you get while being in one is often the same: The odd sensation that you should not be too comfortable. This is experienced by people of all ages, and there exists substantial research on how adults are affected by waiting in general (Biddiss, Knibbe, & McPherson, 2014; Gelinas-Chebat, Vaninski, & Filiatrault, 1995; Mowen, Licata, & McPhail, 1993; Tanner, 2002; Thompson & Yarnold, 1995; Waltz, 2016; Xie & Or, 2017). For kids, on the other hand, research is limited but interesting. This will be further elaborated in chapter two.

Related to the mental state of children, it is known that more than half of them associate waiting rooms with being bored, anxious or both. (Gates, 2008) This is rooted in biological mechanisms in children that would improve their possibility to survive thousands of years ago. Separation from loved ones, anticipation of unknown procedures and unfamiliar people are all factors that naturally enhance anxiety in children (Pedro et al., 2007). Making waiting something that is soothing might help the children calm down and/or get sufficiently distracted so that their mental state when leaving the waiting room is more relaxed. Furthermore, this will help the health practitioners perform their procedures in a good way, instead of postponing the appointment or use a significant amount of time causing other patients to wait longer. Additionally, it will be positive for the parents, both emotionally and practically, to have a happier and more cooperative child.

Waiting in this thesis refers to the physical waiting room, and the mental state of potentially anxious children.

We process our surroundings through perceptions and experiences. These two familiar, though distinctive, expressions describe our understanding of the world. For this thesis, the focus lays on perception which is defined as "*the process of which people translate sensory impressions into a coherent and unified view of the world around them. Though necessarily based on incomplete and unverified (or unreliable) information, perception is equated with reality for most practical purposes and guides human behavior in genera*l" (B. Dictionary, 2019). While experience is "*the process of getting knowledge or skill from doing, seeing or feeling things*" (C. Dictionary, 2019), perception is an underlying mechanism that is constantly receiving and processing sensory input. The moment we learn something from what is perceived we call it experience.

Perception is the translation of our momentary impressions and how it makes us feel.

Why does it matter?

"A waiting room, by definition, functions as a place we pass through on the way to somewhere else, a temporary stop rather than a destination." (Tanner, 2002)

This might be the reason why waiting rooms are not given equal attention as the doctor's office, surgery room or any other room where a procedure is carried out. However, for a lot of patients, the time spent in the waiting room is often significantly longer than the time spent on the procedure or consultation (Xie & Or, 2017). Several papers argue for how reducing waiting time makes for a better service experience (Thompson & Yarnold, 1995), however, waiting time reduction will not be a topic in this thesis.

Waiting rooms are often similar in structure, with semi-comfortable sofas or chairs lined up along the walls or in structured groups. This results in people sitting at an awkward distance from each other, not knowing where to rest their eyes. Children usually get a corner with toys, a small table and chairs. This, along with the temporary setting, make for an unusual state both in body and mind - a setting most people find a bit straining. Giving children something else to focus on during their wait might help them perceive waiting as a positive thing, and thus improve their state of mind prior to meeting the professional.

Even though my focus is not to reduce waiting time as such, improving each child's state of mind before a doctor's appointment might reduce the overall waiting time. Looking at it from a socio-economic perspective, working to keep the child in a cooperative state of mind, rather than a stressed one, will benefit more people than the child itself.

Back in 2015, one hour at the doctor's office would cost an employer approximately 370 NOK per employee in Norway (NHO, 2015). The same year there were 13,9 million doctors' appointments in Norway, where about 1,4 million of them were children aged between 0-15 years, probably accompanied by a parent that had to leave work. If all waiting that year got reduced by one minute, due to the cooperation of a child during their appointment, 86,2 million NOK would have been saved (SSB, 2015). Therefore, improving the perception of waiting can posetively affect other factors than just the children concerned.

The perception of waiting matters because improving it will help both potentially stressed children and other people visiting.

My motivation for doing this project is the multidisciplinary aspect of design. I am curious of how theoretical findings from different fields of studies can be manifested in a concept and tested. On top of that, I find it interesting to explore an area that might not get a lot of attention elsewhere.

I will use my skills as a designer to merge findings from different disciplines into something that can have a positive effect on waiting children.

How to investigate it?

Using my previous work about *designing compassionately for situational anxiety*, I continue to look into the field of psychology to get an understanding of my current challenge in the best possible way. The project is divided into three phases that have a somewhat chronological order, but oftentimes runs in parallel.

First, approximately eight weeks is filled with theoretical insight from podcasts, documentaries, and interviews with professionals such as psychologists, teachers, pediatric doctors, and people who make or use games or toys to distract or engage children. Additionally, to make sure I understand the children themselves, without breaking any ethical rules (more on this on the next page), I have appointed fellow designers to report back to me about what they observe when they bring their children to a waiting room.

During the insight process several hypotheses will emerge and I will try to validate these along the way. At the end of the first eight weeks, insight is organized and concentrated into key findings which will later form a clear statement and a design brief that guides the project throughout the creative exploration. The following eight weeks consists of ideation, sketching, prototyping and testing, to ensure that the final concept is right. Ultimately, the last four weeks focuses on refining the end result and to evaluate the overall process.

Considering the ethical aspect of working with stressed children, a vulnerable user group, testing in real life settings is not possible during this thesis. Therefore, the theoretical part of my work will serve as the means to understand, empathize and acknowledge stressed children's perceptions. The insight is done to increase the probability that the final concept can have a calming effect on children in stressful situations. User testing will be conducted on children without any known stressors, to ensure that the final concept is engaging. The result will therefore be a high-quality prototype ready for testing in real life environment by for example SINTEF's ongoing project on children with dental anxiety. My goal is to deliver a final concept that makes sense as a result of the theory, design brief and creative exploration.

The investigation is done by gaining insight from several fields, translating it to a design brief, and answering that brief through creative exploration.

Define

Designing the right thing

Investigate

Ideate

Prototype

Designing the thing right

Test

Present

Frames and constraints

This thesis is conducted during 20 weeks, and within this time period my chosen theme – improving the perception of waiting - could be approached several ways. One way could be to restructure the service of, for example, going to the doctor.

I have, however, chosen to not make this a service design project. Despite this, I do acknowledge that the whole user experience is defined by a series of events that all together make up a rather complex user journey. Therefore, I will bear in mind that this complex totality cannot be neglected or ignored whatever my solution might be.

This is not a service design project, but I acknowledge how the user journey affects the waiting.

Isolating the perception of waiting calls for a solution that might work for several types of waiting rooms or areas. If I am to design something that is not directly related to a specific service, the final result can serve its purpose in several different situations. Maybe it would be nice to place at a hairdresser or in the departure hall of an airport? You never know where children might need to calm down and shift focus. The final result will therefore not be linked to a specific doctor's or dentist's office, and thus interior or structure of the room will not be taken into concern.

This is not an interior design project, but I acknowledge how the interior can affect the waiting.

My chosen frames also enhance the importance of here and now. We are constantly receiving and processing information we get through our senses. By solely focusing on the waiting room, I get to flirt with people's perception in the moment they are there, rather than trying to change their experience of the visit as a whole. If my final result evokes positive feelings, it might, however, have positive side effects on the total experience and thus make future visits more enjoyable.

The focus lays on the here and now, but I acknowledge how feelings that emerge can affect future visits.

Problem   Contact   Travel

Waiting

Consultation

Waiting again

Instructions, payment and leaving for pharmacy
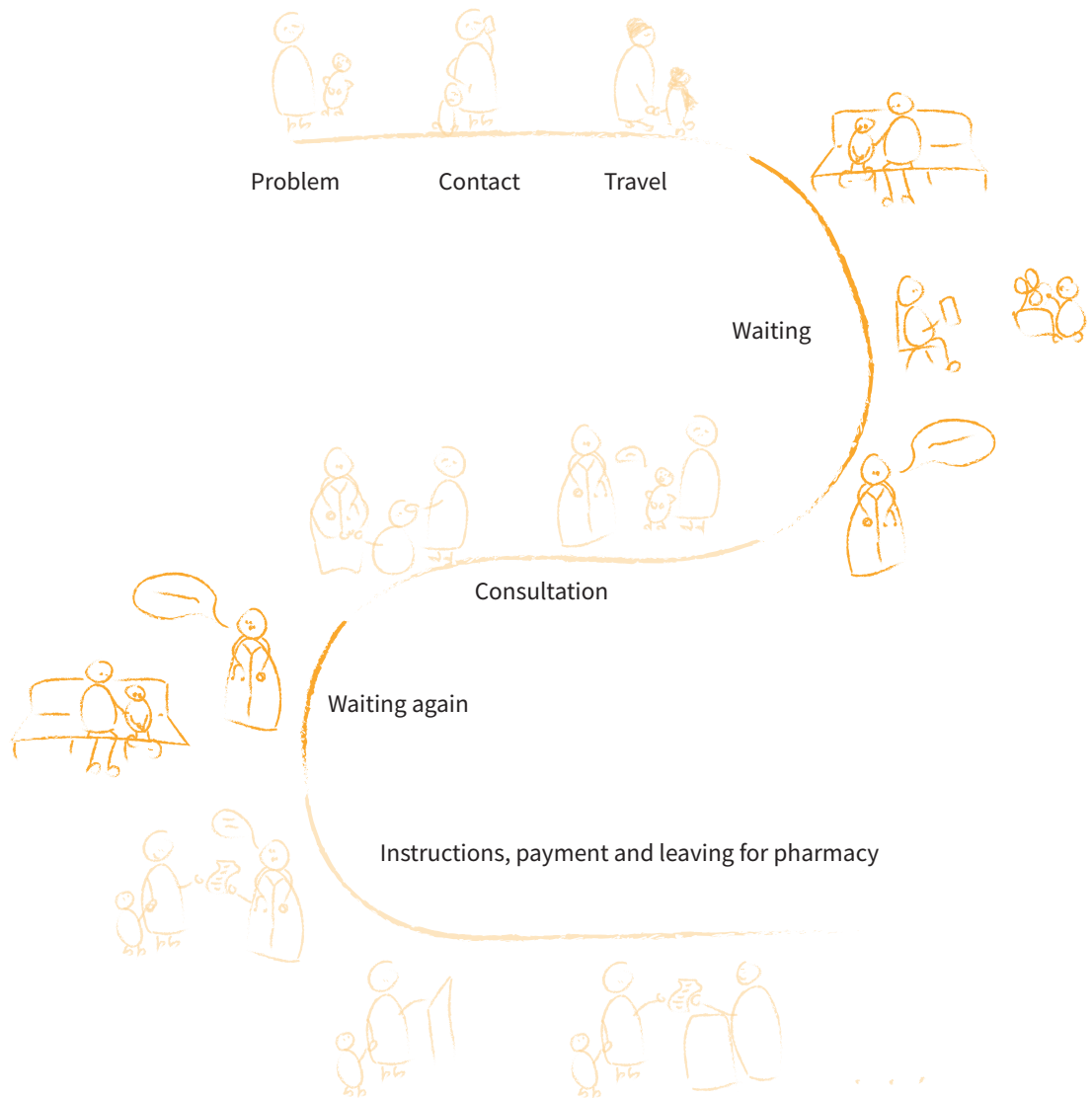
INSIGHT &
INSPIRATION

1

DESIGNING FOR CHILDREN

Being an adult and designing for children requires commitment to gain understanding of how they view the world. Many design processes highlight how crucial it is to be able to put yourself in the user's shoes (Kouprie & Visser, 2009). However, when designing for children, these shoes are literally too small. Fortunately, literature from the field of psychology can help in creating an awareness of a child's perspective. An overview of psychologist Jean Piaget's theory of cognitive development (Singer & Revenson, 1997) states that children go through the following developmental stages:

Sensory motor stage (0-2 years): At the age of two the child has learned that objects are permanent, even though they are out of sight.

Preoperational stage (2-7 years): During this stage the child shows more curiosity and a greater understanding of the surroundings. The child is now more interested in both the people and the objects around them, but it is still from an egocentric point of view.

Concrete operational stage (7-11 years): This is the stage where the child becomes able to recognize the characteristics of an object and classify them according to that. This is the beginning of processing mental operations, but only in the present time.

Formal operational stage (11-16 years): When processing mental operations in this state the child begins to think of not only the present, but also the future, the abstract and the hypothetical.

These stages help narrowing the target user group for this project, especially considering the upcoming user testing. Even though the project is in its early stages and it is early to make conclusions, children in the sensory motor stage can be ruled out because they are not able to communicate at a desireable level. Furthermore, children in the formal operational state will not be targeted because I want to focus on the present moment – the here and now - which is when perception happens.

Aiming for children who are not able to think of the future yet is thus suitable. This leaves me with children between the age of two and eleven, which is still a diverse group. Going forward this might be further narrowed down.

While psychology is mainly biologically focused, sociology is based on how social aspects are affecting us. Childhood sociologists are emphasizing the importance of focusing on what children can do instead of what they are missing, and thus seeing them as the human beings they are in the moment, rather than human becomings (A. James, Jenks, & Prout, 1998). I see it as very impor-

tant in this project to take children seriously and thus focusing on them as individual human beings, and at the same time using biological knowledge as a background for understanding them even better as to where they are developmentally.

To make sure a child wants to engage and interact with the final design, it is preferable to create some sort of product attachment. This can be achieved by successfully incorporating factors based on usability, longevity and sentimental value: To make a product desirable for a child, it needs to be fun, understandable and challenging. In the long run it should be either evolving, modular or timeless, and it can very well take part in forming habits. The sentimental aspect emphasizes that it needs to create memories, a factor that is common for both children and adults in

regards to product attachment (Tvedt, 2016). Many of these factors are connected to experience rather than perception, but they are still important to keep in mind to ensure that the final result is appealing to its users.

Designing for children requires understanding of where they are developmentally and how the world looks from that perspective.

.. AND NOT WITH THEM

According to Allison Druin, a child can have a role as user, tester, informant or design partner, and which role is the right one depends on which outcome you want (Druin, 2002). If the focus is to develop a new product for children and you want to know how to optimize usability, then you need the child to be your design partner. She argues for the importance of this and that more designers needs to see children as potential co-creators to achieve better results.

For this project however, I will see the child as a tester, which means bringing them in after the first prototypes have been made. I want to see their reactions to my materialized findings, rather than necessarily talking to them about it. This is because of the earlier mentioned ethical restrictions when it comes to vulnerable users, and thus realistic testing is not possible. When realistic testing is not possible it is often better to not test or test with other goals in mind (Kandal, 2019). Therefore, my goal is to identify what it takes to make something interesting and engaging.

During my prior project on situational anxiety I learned that anxiety often comes with a great deal of shame. This is related to the understanding adults have of their surroundings, and the expectations they have to their personal selves and how they are being perceived. Considering Paget's cognitive development theory, children are initially egocentric beings situated in the presence, and thus they might be less receptive to feeling shameful about things like being afraid of the dentist or doctor. I see this as a good thing in relation to this project, because if it is ever to be tested in a real-life scenario it will probably give honest test results.

Since I am working with a vulnerable user group and I am making prototypes based on interdisciplinary investigation, I mainly want to observe how children engage with the prototypes I make and therefore I regard them as testers, rather than co-creators.

WHY DO CHILDREN GET STRESSED?

Throughout childhood there are two natural phases children tends to get stressed. The first one happens between the age of three and seven years old, and this is when the child suddenly appears to fear things such as darkness or monsters under the bed. This is a mechanism that evolution has anchored within us to survive.

When humans lived as hunter gatherers, children that learned to walk started exploring on their own, and if they were not naturally sceptic towards the world they would less likely survive. Nowadays we do not need the same type of skepticism, but it is still there to protect us. For most children this will fade away and not bother them anymore after some time, and therefore psychologists are not especially worried about this phase (Klingenberg, 2019b).

The second phase happens between the age of eight and 12 years old, and this is when the child have started to understand the world to a greater extent. Now fears can be related to for example burglary, the climate crisis or war. Similar to the previous phase this will most likely fade after some time, but it needs to be met with both understanding and comfort to make it better during the struggle (Halvorsen & Montgomery, 2019).

In relation to my thesis, children in the first phase might think that the dentist is a monster, shile children in the second phase might believe that the vaccine they are getting at the doctor's office is going to hurt or maybe they have heard of scary side effects. This is perfectly normal, but if these thoughts influence the child to the extent that it is no longer cooperative it is a problem for both the child, the professional and the parent.

The common denominator for these two phases is uncertainty. This goes for stress felt by all age groups, including adults, but the difference between children and adults is that children has less ability to rationalize in stressful situations. As the well-known Norwegian psychologist Hedvig Montgomery says in her podcast Foreldrekoden: "*Child anxiety is when something scares you so much that your thoughts stop functioning*" (Halvorsen & Montgomery, 2019). She also enhances that being stressed is not dangerous to children as long as they are accompanied by an adult that they trust. I find this very interesting and it is something that might be valuable to bring forward to the creative exploration.

Children get stressed partially because of innate survival mechanisms, and partially because of social impressions. In both cases the challenge is that children are not able to rationalize in the same way adults can.

WHAT IS STRESS?

A stressful situation can be everything in between a situation you find a bit uncomfortable, to paralyzing situational anxiety. What a stressful situation is not, in this thesis, is a situation where you experience physical stress, which is stress as a result of too much to do or being late. Mental stress is unease that can be caused by various factors, for instance worries, loneliness or bullying. This stress can manifest itself bodily in an increasing degree, from anxiousness to anxiety.

Imagine being invited to a party where you know very few of the other invitees: A lot of people would feel a bit anxious about meeting so many new people and this might cause pondering beforehand, bringing one beer too many or being a bit late. People suffering from social anxiety, which is a situationally dependent anxiety, might not sleep the day before, cancel, get overly drunk, or constantly wonder what the other people might think of them both during and after the party.

In my prior work, I found that the bodily experience of anxiety is the same no matter what you are afraid of. The common denominator is that it is triggered by irrational fear (Sivertsen, 2018). As human beings we are supposed to feel anxiety because that is what has kept us alive for hundreds of thousands of years. If we heard something moving in the bushes it was better to fear that it was a lion and flee rather than assume it was a pigeon and get eaten.

If flight is not an option, we go into fight mode. Both states demands the body to be fully activated, sending all your blood to your muscles, increasing the rhythm of breath, and managing all brain functions to focus on the situation you are in. When this happens, a part of the brain called amygdala is activated. Amygdala can be viewed as the control center for everything that might be a threat, and when suffering from anxiety the amygdala is activated by situations that are not actually dangerous (Berge & Repål, 2012). When you experience this to such an extent that it obstructs your daily life it is called anxiety. Anxiousness, on the other end of the scale, triggers the same responses in your body but you can still function normally.

Further on in this thesis I will refer to everything in the span between anxiousness and anxiety as stress, and the amount of stress as level of activation. By doing so it is easier to talk about the window of tolerance, which is crucial for this thesis.

The window of tolerance is when your level of activation is optimal, that is, when you are in touch with your feelings and emotions in a healthy way. In this window we are able to learn and to be consciously aware of our surroundings. If you are above the window, you are hyperactivated, which is associated with increased heart rate, shortened breath and tense muscles, in other words anxiety.

Hyperactivation

Level of
activation

Window of tolerance

Hypoactivation

Time
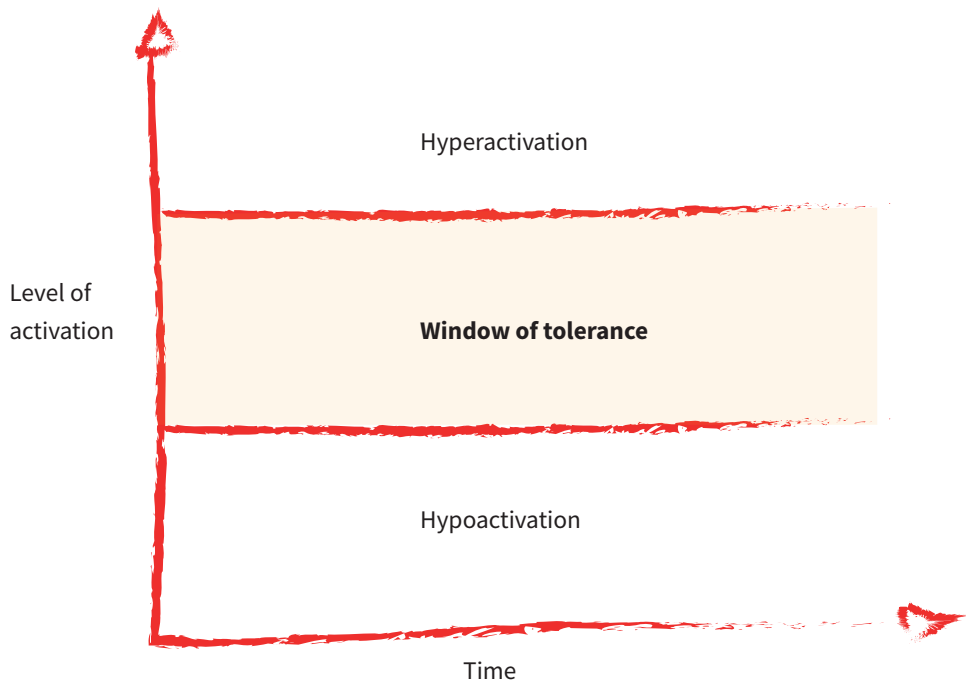
At this state we are not able to process any-
thing rational, and for therapists the focus is
to bring the patient back to the optimal level
of activation (Nordanger & Braarud, 2014). If
below, you are hypoactivated, which is recog-
nized by apathy and depressive symptoms.

Positive emotions and bodily reactions like
smiling are known to have a counteracting
effect on stress and are therefore interesting
to look further into in the creative explora-
tion (Klingenberg, 2019a). The window of
tolerance is part of the literature that makes

pursuing a thesis like this meaningful. If I can
contribute to decrease the level of activation
before a health-related procedure it will most
likely be easier to go through it for all people
involved.

**Stress in this thesis is the sensation we get
in our body when we are afraid of some-
thing that is irrationally motivated.**

STRESS AND OUR BRAINS

Simplifying a complex system such as our brain needs to be done deliberately. I have chosen to base my understanding of the brain on MacLean's triune brain model (MacLean, 1982), which is referred to in other articles about children and how they react to trauma (Jørgensen & Steinkopf, 2013). Well aware of other ways of seeing the brain (Cory Jr, 2000; Gazzaniga, 1998; Potgieter, 1999), researchers seem to agree upon the fact that it is a complex organ and a result of adaptations throughout evolution.

The triune brain model can be viewed as a hierarchy or a team. On top, we find the pre frontal cortex, also known as the rational part, which is where our reflecting and reasonable thinking happens. This part functions as the leader of the team, which makes choices, creates meaning and solves problems based on reason and analysis. The leader takes both past, present and future into consideration, and has access to the imagination. Under normal circumstances this part is a good leader, but as soon as something threatening pushes the level of activation above the tolerance window, the leader is shut out of the team and the imagination starts producing worst case scenarios.

Next in line is the limbic system, also known as the emotional brain. This functions as the slightly neurotic planner of the team, scanning the environment for threats based on emotions, connection systems and perception memory. Through the mentioned amygdala it alerts the rest of the team if a threat is identified. The planner has access to all previously stored happenings, sorted in what impact it had on the team last time.

Finally, we have the reptile brain, or the part monitoring the body. This one is known as the "doer" on the team. It handles all basic bodily functions as well as regulating the level of activation. As long as everything is running as normal, it takes orders from both the leader and the planner. However, as soon as the planner identifies a possible threat, it runs to its archives, looking through the previous happenings. If these happenings are stored under "scared", "hurt" or other negative feelings, it alerts the team. When this is done, the doer increases the levels of activation to be ready to handle the threat. This results in the leader being shut out and left alone with the imagination until the threat is handled.

There are two main reasons for using this exact model:

1. When a human being gets sufficiently stressed the level of activation rises, and if risen above the window of tolerance the rational part of the brain shuts down.

2. The brain of a child is, due to it being under construction, less capable of being rational about possible threats.

Pre frontal cortex

Reptile brain   Limbic system
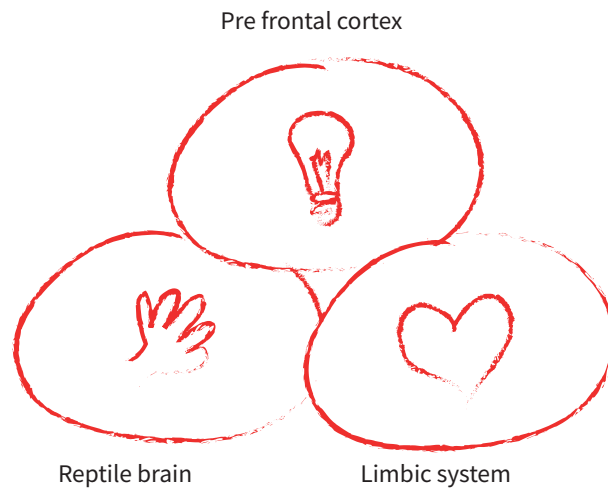
Dealing with stress can be done in many ways, and methods such as metacognitive therapy (Wells, 2008), cognitive behavioural therapy and exposure therapy (Sivertsen, 2018) are proven to be very helpful. This thesis will, however, not focus on such methods because they demand all parts of the brain to be present to succeed. With everyday challenges such as social anxiety, there is more time to try and fail and thus train the three parts, or team members, to be equally accessible.

Making something to shift the children's focus is comparable to dealing with stress with distraction or denial. Logically this would not be a good way to go about if stress occurred on a day to day basis. Research done on how children coped when sealed in a room under a missile attack in Israel, shows that the children who focused on emotion-ori-

ented coping involving denial indicated less post-war stress reactions (Weisenberg, Schwarzwald, Waysman, Solomon, & Klingman, 1993). Since visiting the doctor or dentist is something the majority of children does occasionally, it will be of more help to mainly focus on the emotional part and the part monitoring the bodily functions. We see this way of working in sensorimotor psychotherapy (Fisher & Ogden, 2009) and psychomotor theory (Tan, 2007), although both uses the body and emotions to elicit a good state of the rational mind.

When the rational part of our brain shuts down, the part controlling our body can influence the emotional part in such a way that the rational part can start working again.

EMOTIONS AND THE POWER OF NATURE

Emotions give us instructions on how to bodily react to elements in our environment, and evolutionary psychology therefore explains emotions as the mechanism that helps us survive (Plutchik, 2001). This is an innate trait that has evolved over thousands of years, resulting in us reacting before we can even register what we were reacting on. This trait is evident for all our emotions, but we often focus on fear. Because, as mentioned, when fear is felt without any threat being present, it is called anxiety. And anxiety can be a serious problem if it is not understood and dealt with.

What is especially interesting with this trait is that it happens on a level that we seldom reflect upon or necessarily understand. It is normal to be afraid when meeting a snake, happy when you see someone you like, or sad when you lose someone close. We also often agree upon how certain things make us feel. Walking in beautiful nature can be soothing, and might evoke happiness during daytime, but fear during the night. If you are lost in the woods, no matter how beautiful it is or what time of the day it is, worry, fear and even anger can become the natural to feel. Thus, emotions depend on the overall context. Some researchers state that our emotions are subordinated in regards to which one is more important in terms of survival (Haselton & Ketelaar, 2006). This can explain why emotions shift according to context.

Research suggests that nature is a common denominator for what humans prefer, if compared with an artificial environment (Calvin, Dearinger, & Curtin, 1972). This finding is not that surprising seen from an evolutionary perspective: after all we have lived longer outside than inside. In a study done on emotional response on advertising, the ads that had a natural scenery evoked more positive emotions than those who showed an urban environment (Hartmann & Apaolaza-Ibanez, 2010). It seems like we carry this preference from the very beginning of our life.

An American research team in Houston Texas did a study aimed at determining whether art preferences varied across age groups. Not very surprisingly, they found that children's art preferences changed as they aged. However, all children preferred images with elements of nature, especially bright colored ones (Nanda, Chanaud, Brawn, Hart, & Hathorn, 2009). Why nature evoke positive emotions within us is hard to say, but the fact that it happens in various situations makes it an interesting thing to bear in mind during the ideation phase.

Additionally, nature has also proven to be somewhat helpful to post-operation recovery. Between 1972 and 1981 patients recovering from cholecystectomy were examined to determine whether the view through their window had any impact on their recovery.

The results showed that "*twenty-three surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than 23 matched patients in similar rooms with windows facing a brick building wall.*" (Ulrich, 1984). This awakens the curiosity about how emotions are embodied, which is a great starting point for diving a little deeper into how our body reacts to our emotions.

Emotions helps us survive by telling our body to react to our surroundings, and as long as the surroundings are safe nature seems to evoke positive emotions across ages.

EMBODIMENT AND SENSORY INTEGRATION

"..the bodily changes follow directly the perception of the exciting fact, and our feeling of the same changes as they occur is the emotion." (James, 2013)

It is common to think that if we meet a lion, we first get frightened and then we flight, but James (2013) proposes that the order is different: When faced with a potential danger, we first flee and then get frightened. If we look at fleeing as a reaction from the reptile brain, and fear as a reaction from the emotional brain, this makes sense because the reptile brain is the oldest and the one running on autopilot to save us. However, as mentioned earlier, one can also look at the emotional response as the trigger for the physical reaction.

Whatever the order, it seems reasonable to state that emotions are embodied. We can feel sadness as a physical sting in the heart; happiness tends to bring out a smile and, as we already know; and fear raises the heart rate in a split second. Bearing in mind how obviously intertwined the three parts of our brain are, it is interesting to further investigate how we might affect our state of mind through our body.

Sensory integration is the process that happens when we receive information about our surroundings through our senses and restructure it to take part in whatever is happening

in that moment. Thus, it is a combination of perceiving and the immediate reaction on the perception. Jane Ayres, who is the main woman behind sensory integration, has based her theory on neurobiology. It is used in therapy to help people with autism, movement or learning disorders, or other challenges related to the sensory system (Smith Roley, Mailloux, Miller-Kuhaneck, & Glennon, 2007). We are talking about sensory motor functions or psychomotor functions, where the latter is used to clearly state the relationship between the mind (psycho) and the body (motor). This mind-body relationship makes it evident to think of the connection between perception and emotion (Sælebakke, 2002).

These theories and therapy methods are based on the fact that we have eight ways of sensing. First, we have the five well-known ways which are seeing, smelling, tasting, hearing and touching. These help us understand the world around us, thus they are directed outwards. Next, we have the three following senses:

The **vestibular sense** is the sense of balance. Through this we receive information about our body's positioning in relation to gravity. This sense is located in our ear.
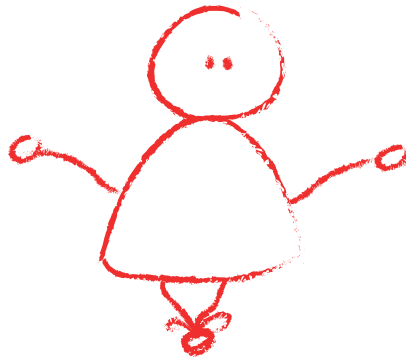
The **proprioceptive sense** is the sense of where our body and body parts are in relation to each other. We get this information through our muscles, joints and ligaments.

The **tactile sense** is located in our skin and receives information about weight, pain, temperature and texture.

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These three are all directed inwards, helping us understand ourselves and our body. That is also the only difference between the tactile sense and the sense of touch. Another interesting thing about the tactile sense is that it is unevenly distributed across our skin.

Already early in the twentieth century, the first model of this distribution was mapped out and illustrated through distorted little "man" called "the homunculus". The size of his body parts represents the amount of cortical area dedicated to motor or somatosensory functions (Catani, 2017). His huge hands emphasize the importance of tactility in my final result, which means that I can already see a tendency to stay clear of non-tactile solutions, such as screen-based activity.

Finally, I want to spend a few sentences on the act of breathing. We find great focus on breathing in practices such as mindfulness and yoga, and there must be a reason why "breathe with your stomach" is a common saying when things are challenging. Rumor has it that even giving birth gets easier if you breathe right! In Norwegian psychomotor physiotherapy "the pattern of respiration is regarded as superior, reflecting the vitality of the action of the person" (Marie Øien, Iversen, & Stensland, 2007). This means that breathing and sensing are closely related and therefore used as an indication of how the patient is accepting the treatment. From this, I take that

if my result can encourage a steady breathing pattern it might help lower the level of activation, and maybe even provide positive emotions.

The mind-body relationship of sensory integration and the way emotions are embodied substantiates why focusing on bodily awareness might be a good direction for this thesis.

Homunculus man (Fairbrother, 2019)

SECURITY AND ATTACHMENT

"Attachment behavior is any form of behavior that results in a person attaining or maintaining proximity to some other clearly identified individual who is conceived as better able to cope with the world." (Bowlby, 1982)

For children this clearly identified individual is often the mother, father, sibling or any other caregiver that has been able to establish a close and steady relationship to the child over time. Knowing that the caregiver is around and responsive makes the child feel secure. Security in this thesis refers to the perceived security and not the physical safety. Bowlby also talks about how the primary caregiver, usually the mother, figures as a secure base for the child both to seek comfort and to explore the world from. He emphasizes the importance of this caregiver's presence both mentally and physically, especially when facing potentially stressful situations (Nilsen, 2012).

Humans are social and relational beings already from the day of birth (Størksen, 2007). A long with being a secure base for the child, the caregivers will work as role models during life. A mother will for instance model empathy for her child, as children cannot regulate emotions on their own, they learn how to do so over time. Regulating emotions is important to be able to cope with a stressful situation or achieve a goal in a constructive way. (Panfile & Laible, 2012). As the child grows the need

for caregivers change from mother, to friends, to partners and eventually maybe their own children.

To a child the ultimate answer to feeling secure will always be its closest caregiver, and thus the final result should encourage either physical or visual connection between the child and the caregiver.

THE IMPORTANCE OF PLAY

Children learn, evolves and express themselves through play. Playing is neither a game nor a sport and should not be treated like it by adults. Children often plays in ways that can seem mysterious to adults, and an adult can rarely foresee how the child is going to play when presented to something new. Ultimately, the child is the professor of play and will always have the answer of which form of play is the best form (Ginsburg, 2007). There is great difference between a game, a toy and play. A game has a goal and a toy has a purpose, both can be played with but play in itself does not need either. Cas Holman designs for play and is the woman behind the company Heroes Will Rise. She talks about how important it is that the things she designs can be manipulated by the child to fit their imagination (Netflix, 2019).

Ablemagic is another company designing for play. Its office is situated in Trondheim and the two lovely ladies behind it, Nina Fjelnset and Marte Rye Bårdsen, has had great success in merging the physical and the digital world of play. Their concepts often aim to engage the child in action, as well as the other people in the area. Like Holman, they point out the importance of letting the children play in their own way according to their imagination. Most of the time the adult's expectation and the child's execution does not match, and therefore testing every concept thoroughly is essential. There should never be a wrong way of playing. Another duo agreeing about that is Veronica Skjønberg and Marthe Eidissen Holmeide. They run Melhus Sansesenter, a center that offers stimulation of all seven senses as health promotion for visitors that struggles with anything from grief and insomnia to nevrological outcome as ADHD and autism (Appendix A).

Playing is highly important for children to express themselves and learn. Since playing is dependent on the child's imagination it should never be a wrong way of playing with something.

ESSENCE OF INTERVIEWS

Throughout this project I have conducted seven interviews with different relevant people. These are the key findings.

"The children least capable of staying focused manages better to summon concentration for physical tasks than cognitive tasks."

- Teacher

"Most children are in between untroubled and extreemely anxoius, and therefore in your target group"

- Child psychologist

"Maybe the thing you make can be brought into the practitioners office"

- Pediatrician

"I often use extensive amounts of time on stressed children"

- Pediatrician

"You can't be petrified if you are commanding your body to move"

- Purser and course instructor

"The children we work with would have great use of a product that can help them shift focus and calm down before treatment"

- Pediatric nurse

"You can never neglect the child-caregiver relation"

- Child psychologist

SUMMARY CHAPTER 1

Designing for children
Designing for children requires understanding of where they are developmentally and how the world looks from that perspective.

...and not with them
Since I am working with a vulnerable user group and I am making prototypes based on interdisciplinary investigation, I mainly want to observe how children engage with the prototypes I make and therefore I regard them as testers, rather than co-creators.

Why do children get stressed?
Children get stressed partially because of innate survival mechanisms, and partially because of social impressions. In both cases the challenge is that children are not able to rationalize in the same way adults can.

What is stress?
Stress in this thesis is the sensation we get in our body when we are afraid of something that is irrationally motivated.

Stress and our brains
When the rational part of our brain shuts down, the part controlling our body can influence the emotional part in such a way that the rational part can start working again.

Emotions and the power of nature
Emotions helps us survive by telling our body to react to our surroundings, and as long as the surroundings are safe nature seems to evoke positive emotions across ages.

Embodiment and sensory integration
The mind-body relationship of sensory integration and the way emotions are embodied substantiates why focusing on bodily awareness might be a good direction for this thesis.

Security and attachment
To a child the ultimate answer to feeling secure will always be its closest caregiver, and thus the final result should encourage either physical or visual connection between the child and the caregiver.

The importance of play
Playing is highly important for children to express themselves and learn. Since playing is dependent on the child's imagination it should never be a wrong way of playing with something.

KEY FACTORS FOR MOVING FORWARD

To move forward I have concluded the findings from this chapter into some key factors that will guide my creative exploration process. I will use these principles as a basis for which items, situations and activities to investigate, as well as a framework for ideation.

Control of movement / bodily awareness

Nothing can be wrong / versatility

Social connection / attachment

Nature elements / natural feeling

Target group:
Children between the age of 3 - 11 years

The exploration will be broad but with a few rigid constraints when it comes to possible outcomes:

It needs to be easy to clean. Waiting rooms are visited by numbers of people daily and the thing can note contribute to spread infectious bacteria more effectively than any other item present. In general, it means that it will not be fabric or have angles or features that are hard to clean.

It will not be entirely based on human-screen interaction. Both because it excludes the bodily awareness and because bright screens increase the level of activation (Higuchi, Motohashi, Liu, & Maeda, 2005), which is the opposite of what this thesis is aiming for.

It **will not be, or be dependent on, the interior or structure in the room**. Both because it should work in whatever waiting room and because the effect of interior and room structure is another professional field and thus outside the scope of the project.

CREATIVE
EXPLORATION

2

MOODBOARD

I often create moodboards in search for the right feeling. My final result should be inspired by, and hopefully evoke feelings like:

Empowerment
Accomplishment
Confidence
Security

INSPIRING ARTEFACTS AND TOYS

Throughout this project I have let myself be inspired by numerous of different things. Everything from situations that evokes good feelings and items that soothes me in some way, to popular concepts such as ASMR and mindfulness for children.

One example is my friend that graduated this summer. He had made extremely detailed models made for a museum lined up on the wall in different sizes and materials. Along with the finished models he brought the tools he used to make them, and among the tools there was this slowly spinning carousel, used to make silicon models, that spun in a peaceful rhythm making every spectator stop and stare at it for more time than they used looking at the actual result.

Another item that gave me a similar feeling was the pulsing light my old MacBook gave me. It is called the sleep indicator light, indicating that it still has power when it is closed. This light shines through the thin aluminum, appearing from nothing, increases in intensity slowly before it turns around and disappears again equally slow, mimicking breathing in a way. The steady rhythm made me calm and I remember going to sleep while watching it for years.

When studying children playing, I was very inspired by how devoted they are in it, no matter what the play is it is somehow instantly embodied in them. Another fascinating thing is how much that happens in their imagination, that other children seem to get right away. When watching videos from Anji Play, a company that provides materials and environments for play that are a bit more "risky" than usual, I understood how little children need to be visionary in their play. Anji Play playgrounds consists of items like pieces of wood, barrels and ladders that are just laying around for the children to build and explore with.

The two first examples are representing soothing by rhythm, and rhythm is something we find in nature as well. Both in the fact that all mammals have a beating heart and a rhythmic breath, and in how everything lives in endless cycles repeating over and over again. Maybe it will be nice to create something that can be rhythmic in some way, either to be soothing or maybe to encourage rhythmic movement.

The third example confirms what I found in chapter one about how children are the masters of play. Seeing it made it even clearer how items for play does not need to be shiny plastic toys to be fun. To investigate this further I found a list of the 60 most popular toys throughout history and sorted them into categories to find out what similarities there are and thus which area to focus on going forward.
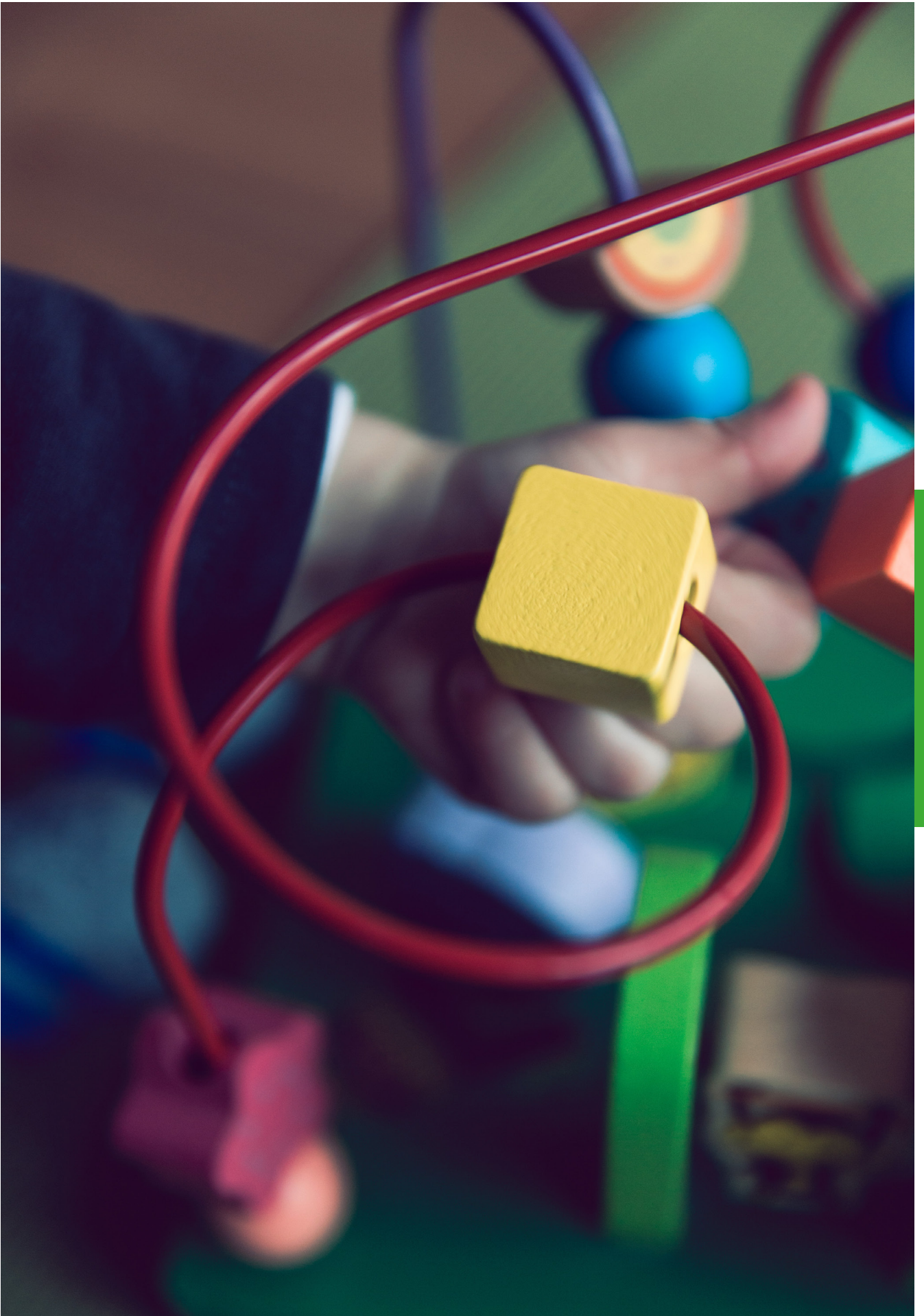
In this sample of the categorization it is fascinating to see how a cardboard box and a stick is aligned with GI Joe, Lego and dolls in terms of popularity. According to theory, insight and inspiration the right region to focus on is the one in between physical activity and fantasy, here you have to use your body and at the same time nothing can be wrong.

MENTAL
ACTIVITY

FANTASY
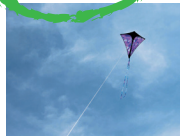
PHYSICAL
ACTIVITYITY

CHARACTER

EXISTING ITEMS

Further I roamed the health sector to see what already exists. In nearly all waiting rooms there is a section for kids of various size. In this section you can find toys of any kind, both related and unrelated to the approaching procedure. Along with toys some waiting rooms have a TV for kids to watch either cartoons or information about what is about to happen.

Bearing in mind what my motivation is, I want to create something that is non-related to the procedure, to make it more versatile, and physically interactive to encourage movement.
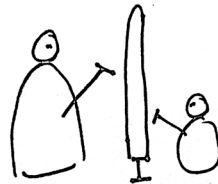

DETACHED

RELATED

UNRELATED

INTERACTIVE

EARLY IDEATION

The early part of the ideation process hap-
pened concurrent with the investigation.
Some sketches emerged while reading or
in company with the people I interviewed,
others just burst out as a result of new knowl-
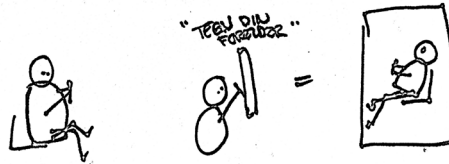edge maturing.

At this point I was completely open to any
kind of idea and I tried to look everywhere for
inspiration. The process was as unrestricted
as it could be, but when the mentioned key
factors and constraints appeared obvious, it
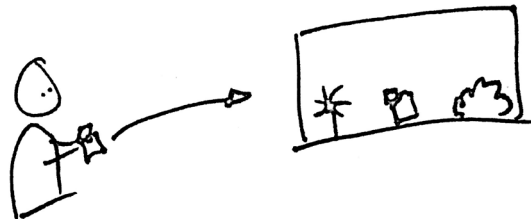steered the ideas in the right direction.
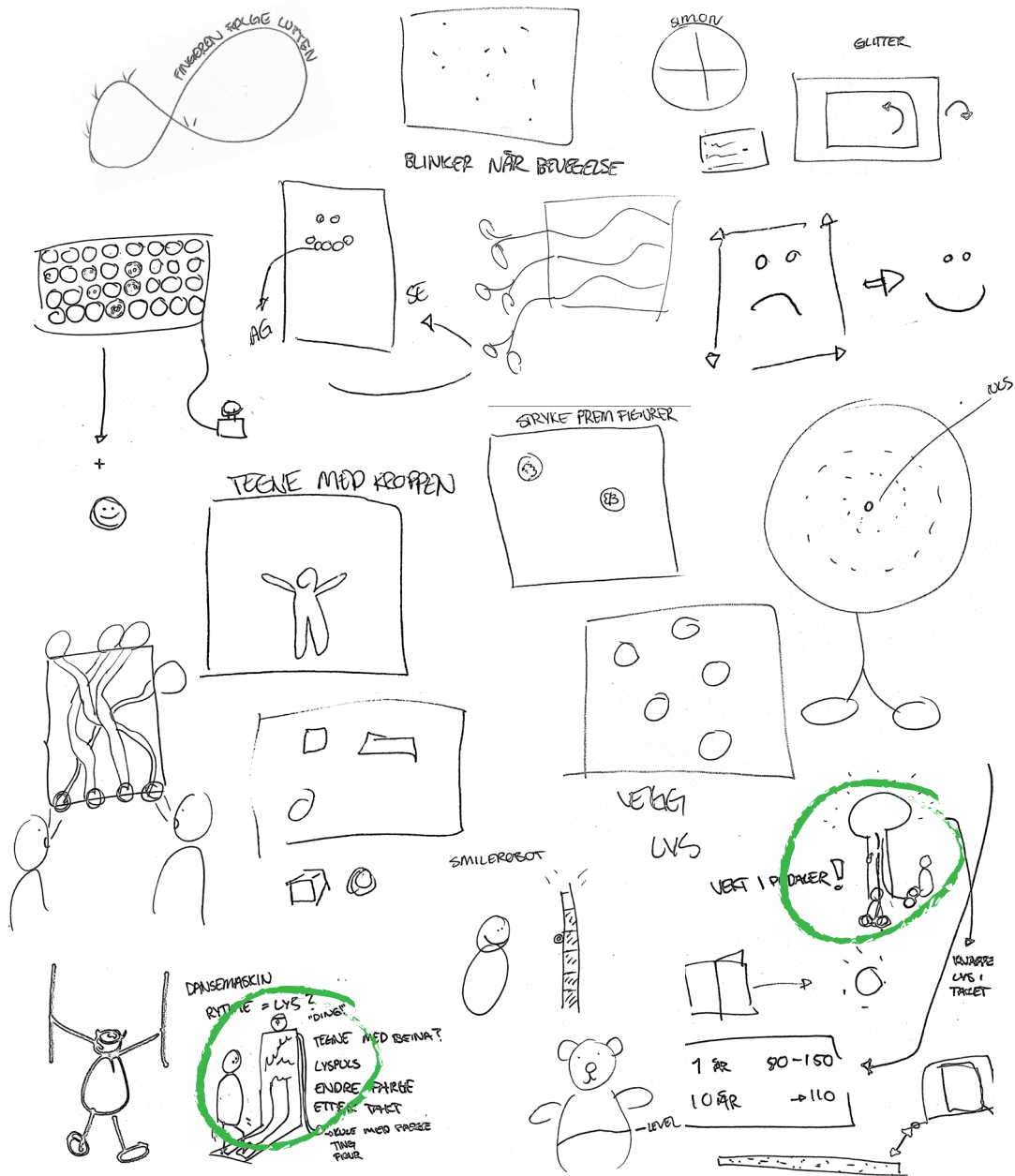
FINGEREN FØLGE LUTTEN

BLINKER NÅR BEVEGELSE

amon

GLITTER

SE

AG

STRYKE FREM FIGURER

LYS

TEGNE MED KROPPEN

VELG
LYS

SMILEROBOT

VEKT I PEDALER!

KNAPPE
LYS I
TAKET

DANSEMASKIN
RYTME = LYS?
"DINE"
TEGNE MED BEINA?
LYSPULS
ENDRE FARGE
ETTER TAKT
SKULE MED FARGE
TING
FIGUR

LEVEL

|		
1 ÅR	90 - 150	
10 ÅR	→ 110	

61

THE IDEA OF THE TREE

There is always a point in the ideation session where I think I have a great idea, which is just a phase I have to push myself through to get to the ideas that are actually good. This tend to be buried underneath some layers of blindness due to the fake eureka going on, also known as the *einstellung effect* (Bilalić, McLeod, & Gobet, 2008).

This time the "great idea" was a something similar to a tree. A big tree-like figure that would have a crown of pulsing light the kids could change the color of. By marching on some buttons on the floor they were supposed to find the right rhythm to visually push light in a specific color up the stem and when the color reached all the way up it would fill the crown.

I hung on to this idea for weeks and I really believed in it, but at the same time I knew that I was not there yet. There had to be a better and easier way of solving this. Maybe a way that did not include forcing a huge thing in the face of everyone in the waiting room.

So, I asked myself WHY? Why am so hung up on this tree? And after substantial time of deconstructing my own idea I was left with an answer I could accept. In the tree I had somehow managed to incorporate almost everything I had thought of throughout the process. It was merely a materialization of my key factors, and they were equally weighted.
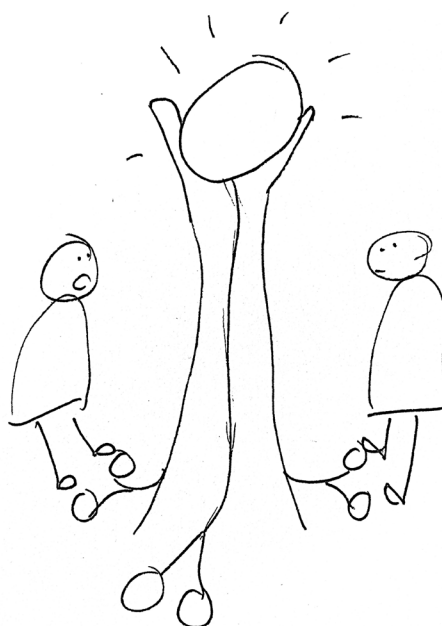
After understanding this I needed to prioritize, so I broke down the key-factors into must, should and could, and from there I defined a clear design brief, to make sure I did not lose track of the main goal.

Must
Enhance bodily awareness
Be easy to clean

Should
Encourage movement
Encourage connection
Have a natural feel
Be versatile

Could
Be rhythmic
Be soothing

Design brief
I want to stabilize or reduce the level of activation by encouraging children to take control of their own body.

IDEATION - BODY

This time I tried shetching everything I could think of that would encourage bodily aware-ness. King sized puzzles, spinning wheels with ropes hanging from the ceiling, touching lights on a wall, jumping one spot to another and huge drawing walls. All the time balancing in between body and mind and in the world of play, trying not to create a toy or a game.

MIRRORS

CLOUDANIMALS

RGB   RFID

MAG(NET)ISK

TOMBSTONE

LYS-SHIL!
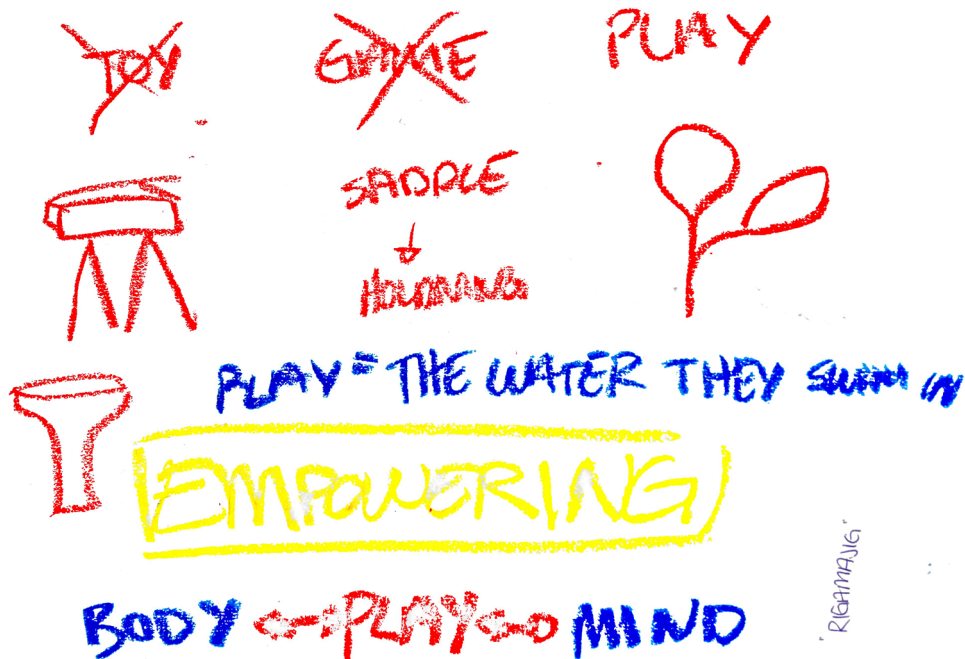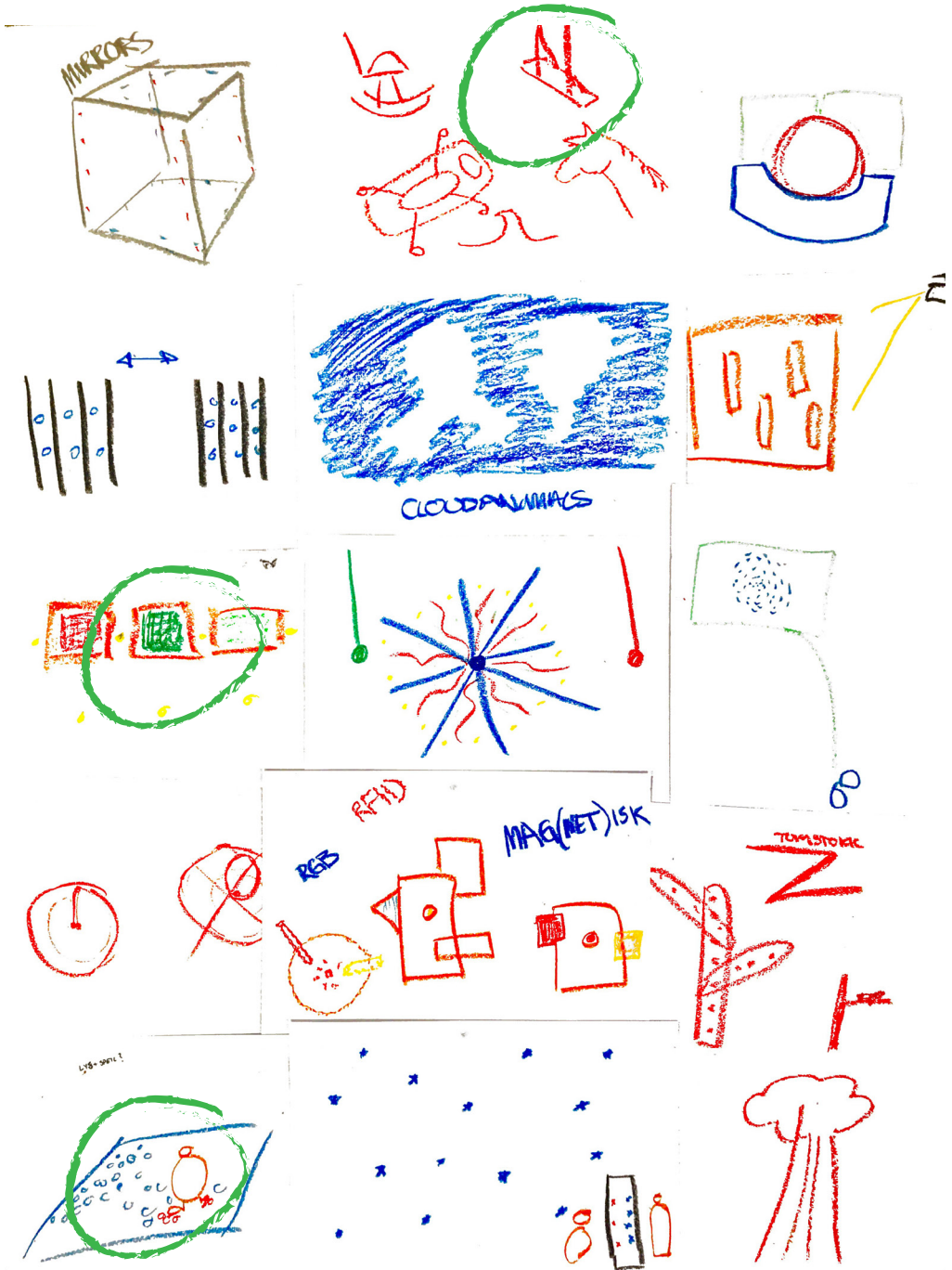
LOOKING FOR INSPIRATION AGAIN

After another round of sketching I realized I needed to zoom out and look for more inspiration. This time I asked myself what physical activities are the ones that demand most concentration to do. I found three fairly good examples:

Climbing or bouldering
You need to fully focus on the activity to not fall off the wall or boulder. It can vary in difficulty, but it will always require physical strength.

Slackline
Balancing requires a lot of concentration and managing to walk a slackline will be easier with repetition and improved technique. The learning curve is steep and it can be a bit unmotivating in the beginning.

Horseback riding
To ride a horse you need to have control of your body and how it affects the horse. First just staying up there might be hard, but after a while you can use your body to signal what you want the horse to do.

These three activities have two things in common that I want to elaborate. First, they require you to focus your concentration on a physical activity to cope with something many will naturally respect or think of as scary or even sublime. Height, horses and making a fool of oneself are related examples of

such things. All of these are out of or control and therefore represent uncertainty, which we now know as the main reason for being stressed.

The other common thing is balance, which is what I am focusing on going further in the creative exploration. Balancing does not differ between gender, and the only parameters that makes it vary in difficulty is compared to your own body, such as height, weight, age and strength. It requires bodily awareness to ensure controlled movement, which in turn requires concentration. To be able to concentrate you need to be calm, and to be calm you need a steady breathing rhythm.

When looking into the psychology behind flow theory, it makes sense to bring balance forward. Flow is "*the experience of complete absorption in the present moment*" (Nakamura & Csikszentmihalyi, 2009), and says that to feel flow the relationship between the level of challenge and the level of skill needs to be linear.

To achieve this for my target group it is highly important that the final result is versatile, so that it is neither to simple nor to difficult no matter the age of the child.
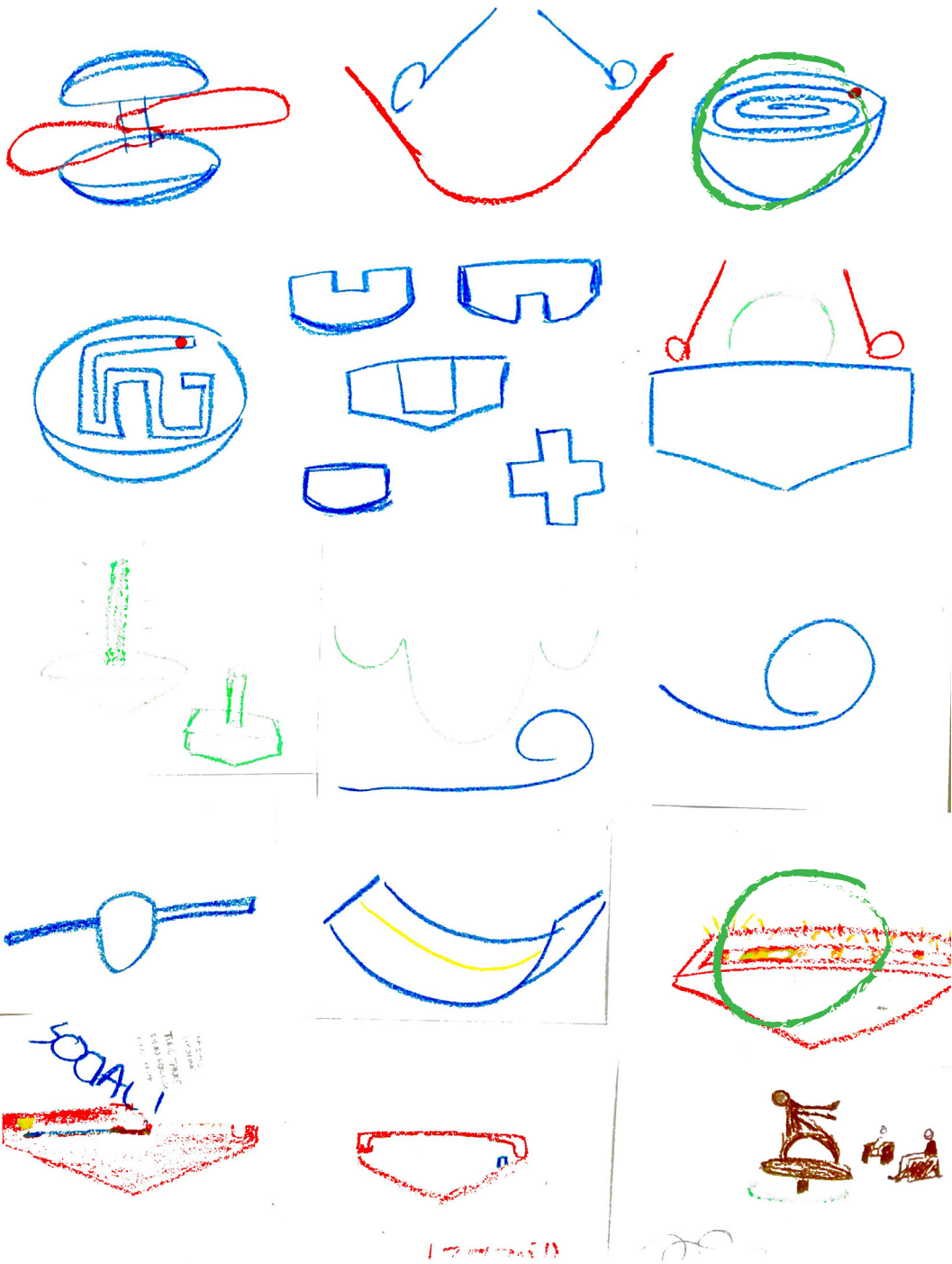
Boredom

Skills

Flow

Anxiety

Challenge

IDEATION - BALANCE

Focusing on balance I was inspired by things
I knew from childhood as well as what I see
children do when playing. For a long time
I wondered if I could make something that
engaged more than one person at a time. This
turned out to be a bit to big to use indoors as
one piece, and too complex to rearrange into
modules.
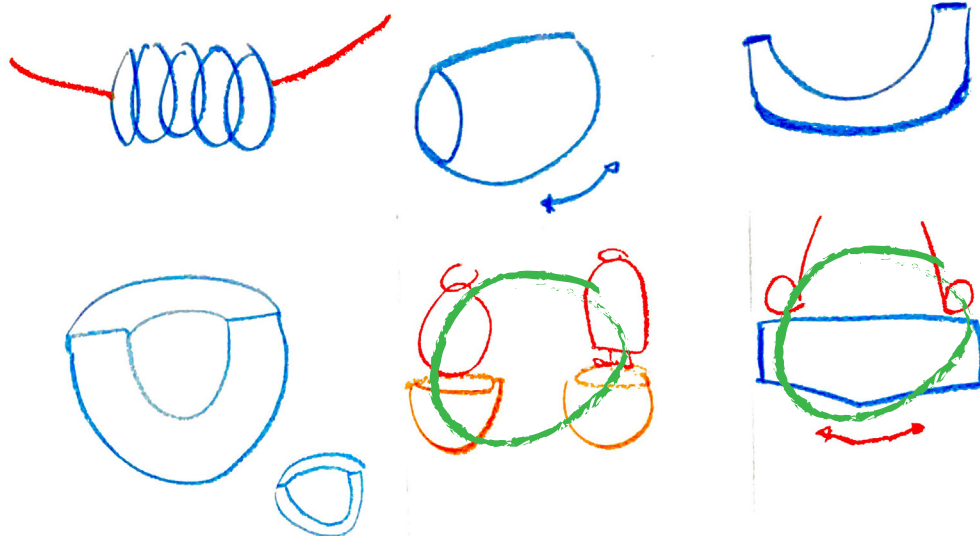
BALANCE BOARD

After going back and forth I have landed on that the best solution to answer my brief, is to make some sort of balance board. This is not a completely new concept, but I have never seen it in waiting rooms, neither have any of the people I have spoken to. A balance board is freed from the room itself, it is possible to use for more than just balancing and it can be fun for everyone. If the child is too young to stand on it alone, it might get help from a parent or sibling, which is encouraging inter-personal connection.

Furthermore, according to the prioritized key factors and the design brief, this upcoming balance board will differ from the existing ones because of the aim to make it rhythmic and soothing.

At this point the track through the rest of the creative exploration is visible, I now just have to figure out how the train driving on in looks. To do that I am diving in to the first round of prototyping.

PROTOTYPING

The very first prototype was made quickly and immediately proved to be too wide. It gave a good indication of what would be a more correct size, and otherwise it got quite a lot attention for just being something simple to challenge the balance.

For the first round of testing I wanted to have both different bases and two differend shapes. I made one round board, and four square ones with different bases. Bases with edged bottom has a tilted starting position, while rounded bases are self balanced.

Next up is to find out wether they are interesting at all, as well as getting a hunch of which base is the preferred one. To do that I need to talk to the experts themselves – children.

FIRST TEST

The goal for this test is to see if the boards are interesting at all, and to figure out which two types of boards to move forward with. I introduced the five different boards to kids between three and six years old.

At three the most interesting thing was to rearrange the prototypes in relation to each other and balance either from one to another or in between them. I observed that the square ones were too high which made it difficult to stand on them. However, when trying to balance on them the ones with a tilted starting point was preferred.

The older children thought it was fun to balance on the boards, especially the round one to see how many rounds the ball would go around. The height of the round one made it almost too easy to balance, leaving them with only the hoola hoop-movement to move the ball. Initially they thought the square one was great fun, but it was a bit high, slippery and had sharp outer edges, which was not good in combination with bare feet.

Good
Entertained children for an hour. The ball was fun. Best if the startingpoint is a tilted board.

Must improve
Less slippery surface. Smoothe edges. The square ones must be lower, and the round one could be higher.

MORE PROTOTYPING

Before the next test I modified the round one to be a bit higher. I decided to make a new square one in solid wood so it would be a bit less slippery. I also lowered it a bit, and kept the edged bottom to ensure a tilted starting point. Both boards are now about 600 mm wide and 100 mm high, which seemed to be a nice size for the previous testers.
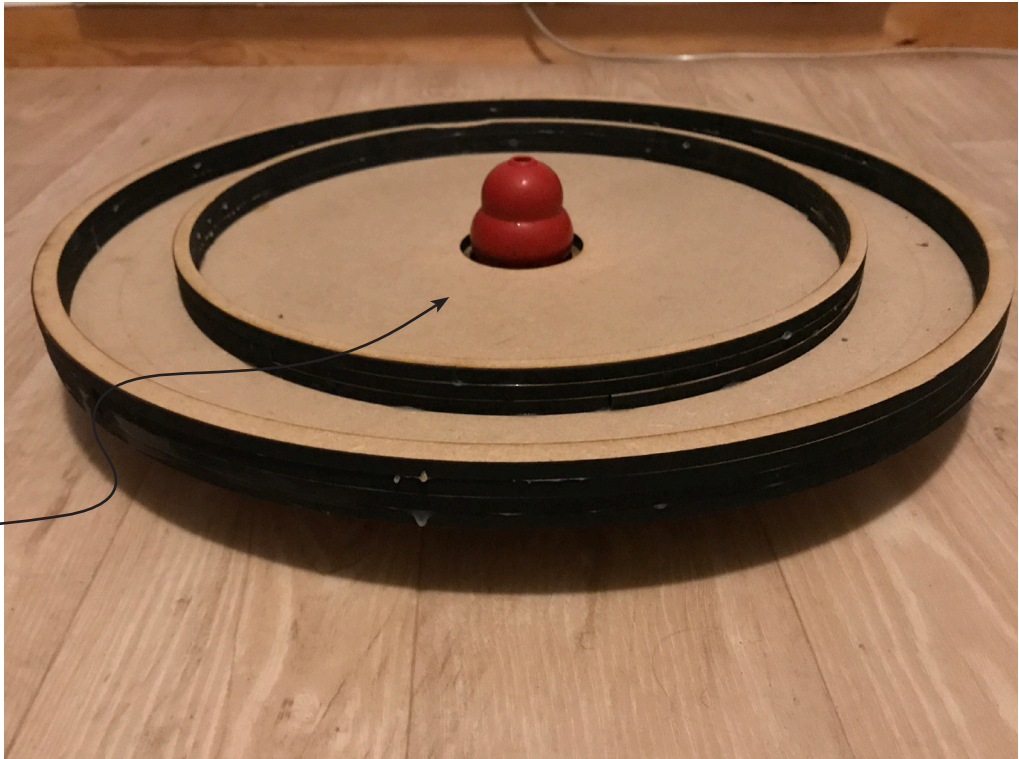
Higher center point

Solid wood

Edge to ensure a tilted starting position

SECOND TEST

This time the focus is to see if the boards are engaging for children a bit older than last time, and at the same time find out which board is the most fun. The testers are third grade pupils at an elementary school, 21 eight year olds divided in two groups.

The first group got no instructions and had no problem using their imagination to have fun with the boards. They functioned as a seesaw, a spinning top, a catapult and a wheel for a while, before I asked what they thought would happen if they stood on them.

They got excited and lined up behind the prototypes to try each of them. Trying to balance, rocking back and forth and turning in circles was reported as great fun. One said he liked the rhythm the square one made when the ball rolled from one side to the other.

The next group saw what the first group did so they got the hang of it right away and the feedback was similar to the previous group.

When finishing up I asked all the pupils to lay their head on the desk and close their eyes. Then I asked for them to raise a hand if they thought the round one was the best, and subsequently I asked the same for the square one. The square one won with 18 votes, which was a clear response to guide me forward.

KEY TAKEAWAYS

At this point the following criterias can be ticked off:

Must
~~Enhance bodily awareness~~
Be easy to clean

Should
~~Encourage movement~~
~~Encourage connection~~
Have a natural feel
~~Be versatile~~

**Could**
Be rhythmic
Be soothing

 It enhances **bodily awareness** and **movement** because it encourages balancing.

Connection happens because young children often need help to balance, and older ones might want to show off if they accomplish it.

User testing shows that children finds it fun to play with even before they know what it is, which makes it **versatile**.

Going into the next phase I need to figure out how to make it easy to clean, and have in mind that it should feel natural. Additionally, it would be nice if I can enhance the rhythmic element and make it soothing in some way.
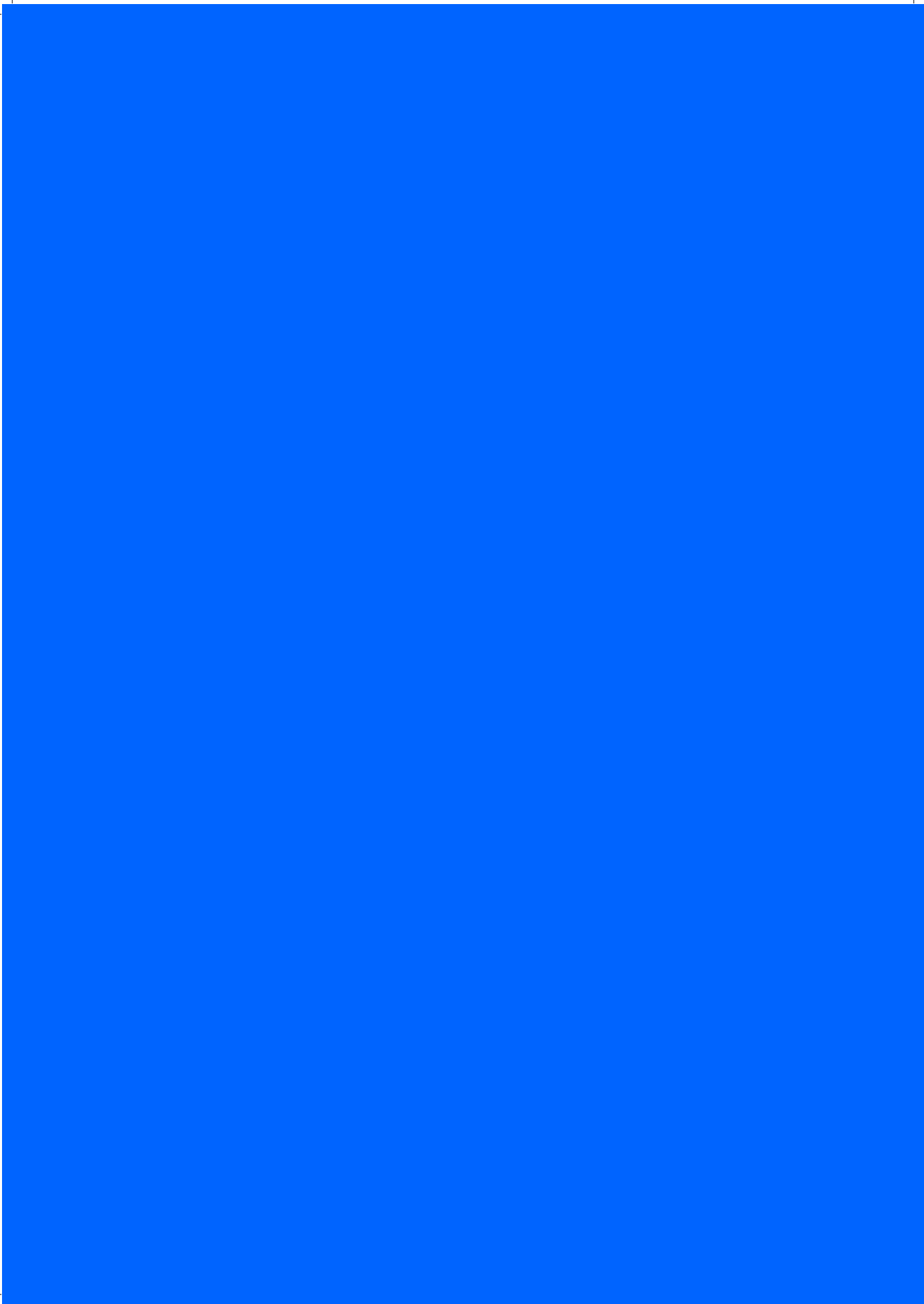
CONCEPT

3

TILT
BALANCE BOARD

UNDERSTANDING THE CONCEPT

Tilt is a balance board that challenges all ages. When left alone he is breathing steadily, waiting for a new friend. If moved he wakes up - ready for play. Play can be done in many ways but when he is tilted back and forth his core changes color, and if stabilized he starts breathing again.

Inside his core are LED lights and a steel cylinder. The lights mimick breathing by pulsing slowly, this can feel soothing to the people watching him. Additionally, giving him life this way can trigger the childrens interest. This interest might make them approach him, which in turn might lead to them waking him up. The lights now stop pulsing.

From this point they might be curious about his reactions. When tilted the steel cylinder rolls from side to side pushing buttons mounted in each end. This internal movement makes the lights change color, while also challenging his point of equilibrium.

For the youngest children it might be interesting enough to sit and play with him with their hands. The older the children, the more they can challenge themselves in relation to Tilt. They can generate the same color changing feedback by for instance sitting on him, standing with support from others, or standing on their own. Because of his shape nearly all contact requires balancing of various difficulties.

The rhythmic aspect is also covered by the steel cylinder inside him. It can only roll at a certain speed, which makes the rhythm steady. Additionally, the buttons can only trigger change every second time they are pushed, which forces the tilting to go back and forth.

For the oldest children it can be fun to see if they manage to stay completely still at equilibrium. This is rewarded with reactivating the steady breathing. However, this requires a lot of concentration and therefore the main reward is related to tilting and not to reaching equilibrium.

CHOICE OF MATERIAL

Wood

When deciding which materials to use I focused on choosing something that feels close and natural. Wood has several positive properties, in addition to being simply beautiful.

First of all was the aspect of nature. A thing can remind you of nature by its shape, material, sound, smell or function. Tilt is made from birchwood because I wanted him to have a friendly, robust and warm expression. Wood as a material is something humans have known since the very beginning. We have an idea of how it feels, which weight it should have and the temperature of the surface. It appears honest and familiar, which in turn feels safe.

Secondly, I had to think of the cleanliness. Since it is going to be handled by many different (and possibly sick) children it needs to be easy to keep clean. In regards to that I made a minimal shape with no corners or holes, and I decided on birch because of its antibacterial properties (Duric, Kovac-Besovic, Niksic, & Sofic, 2013), in addition to having a smooth surface after sanding.

Acrylic

For the bubble pattern I chose to use acrylic because it is easy to work with. I needed it to let light through the holes and at the same time diffuse it.

During this project I have had a brief look into alternatives, but since this needs to be both robust and easy to clean I eventually went for acrylic. If I were to take this further I would explore different ways of making a diffusor from a non-plastic material.

MAKING - WOOD

The base consist of three slabs of birch laminated to one big piece. To make room for the electronic components in the base and get a precise pattern on the top, both parts were milled by a CNC-router. The edges and bottom are done by hand with saws and sanding paper.

I did a test version of the base in pine and the top in MDF to se how the thickness would work, and decided to make it a bit thicker for the final version.

The only surface treatment is a colorless coat of food-safe oil, this to enhance the natural color of the birch, and to protect against stains and liquid.
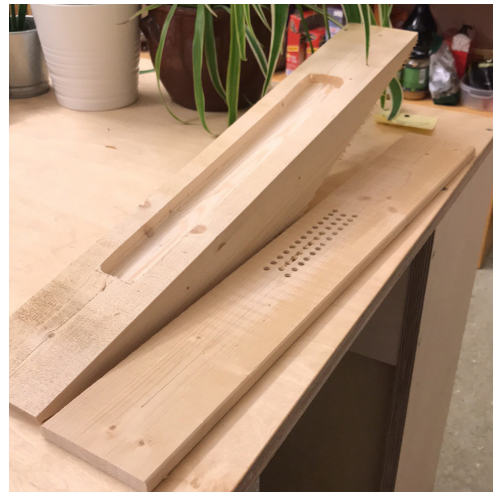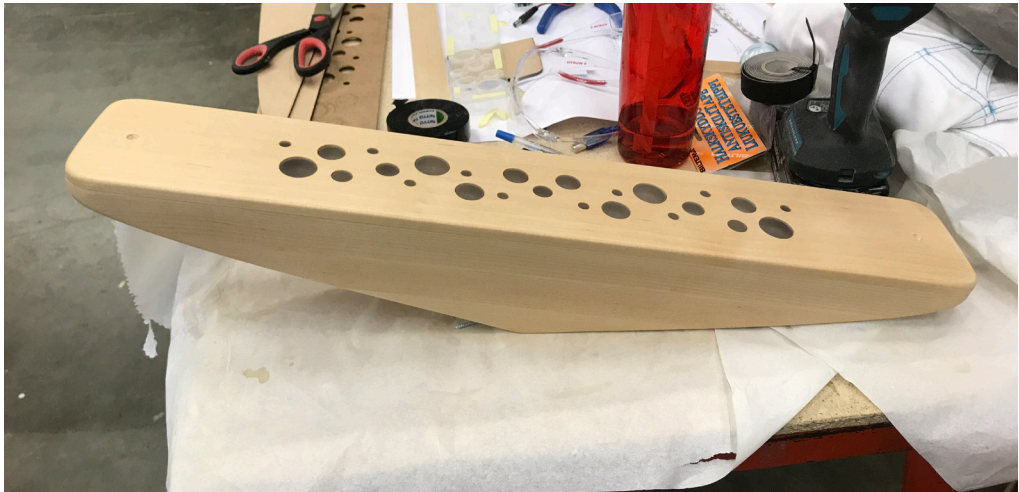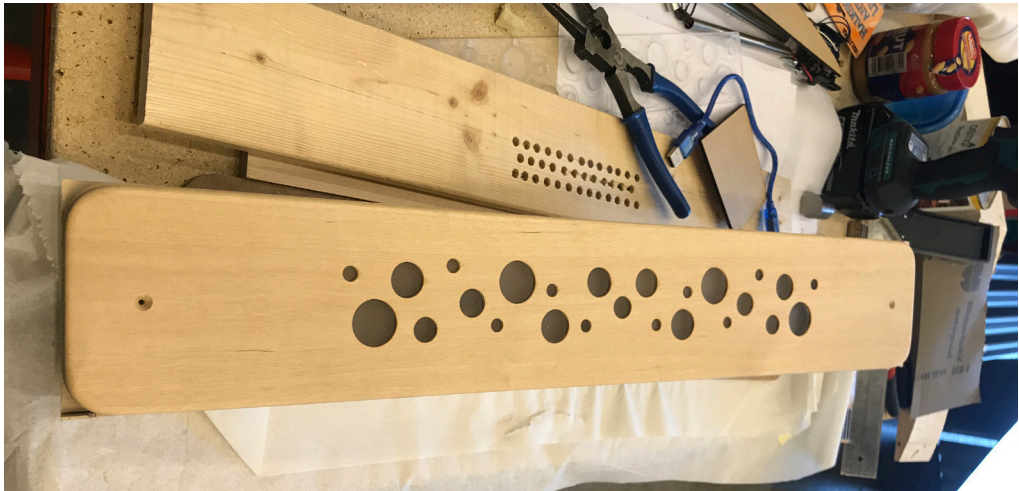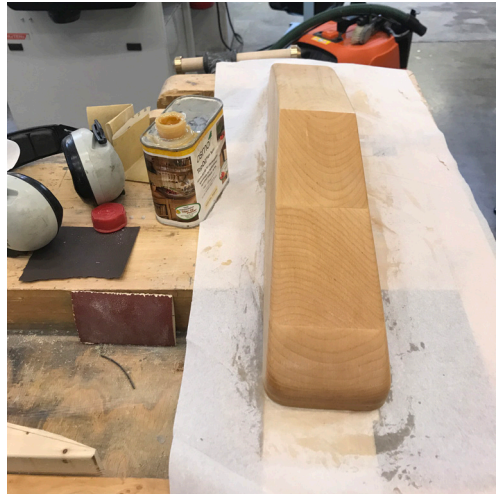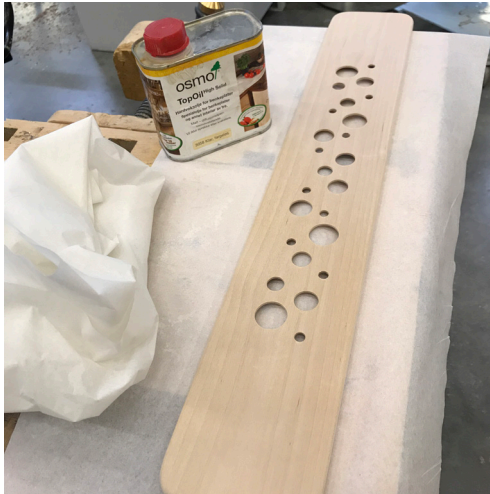
MAKING - ACRYLIC

The acrylic was milled in a reverse pattern to fit the top layer of birch. To make it work as a diffusor, I sanded it to an opaque finish using fine grain sanding paper.

The pattern is inspired by bubbles. Some doctors blow bubbles for children to calm them down. They appear soothing because of how they dance gracefully in the air. Before settling the pattern, I tried different varieties of lines and icons made up from tiny holes. Initially I wanted the light to shine through by using super thin veneer, but when proved hard to do I decided upon acrylic. I am glad I did so because it works well in the bubbly pattern.
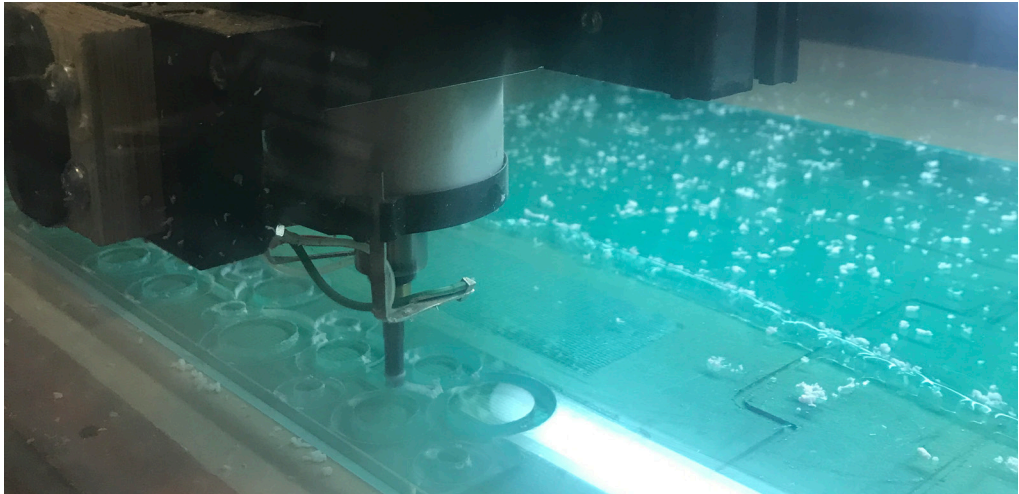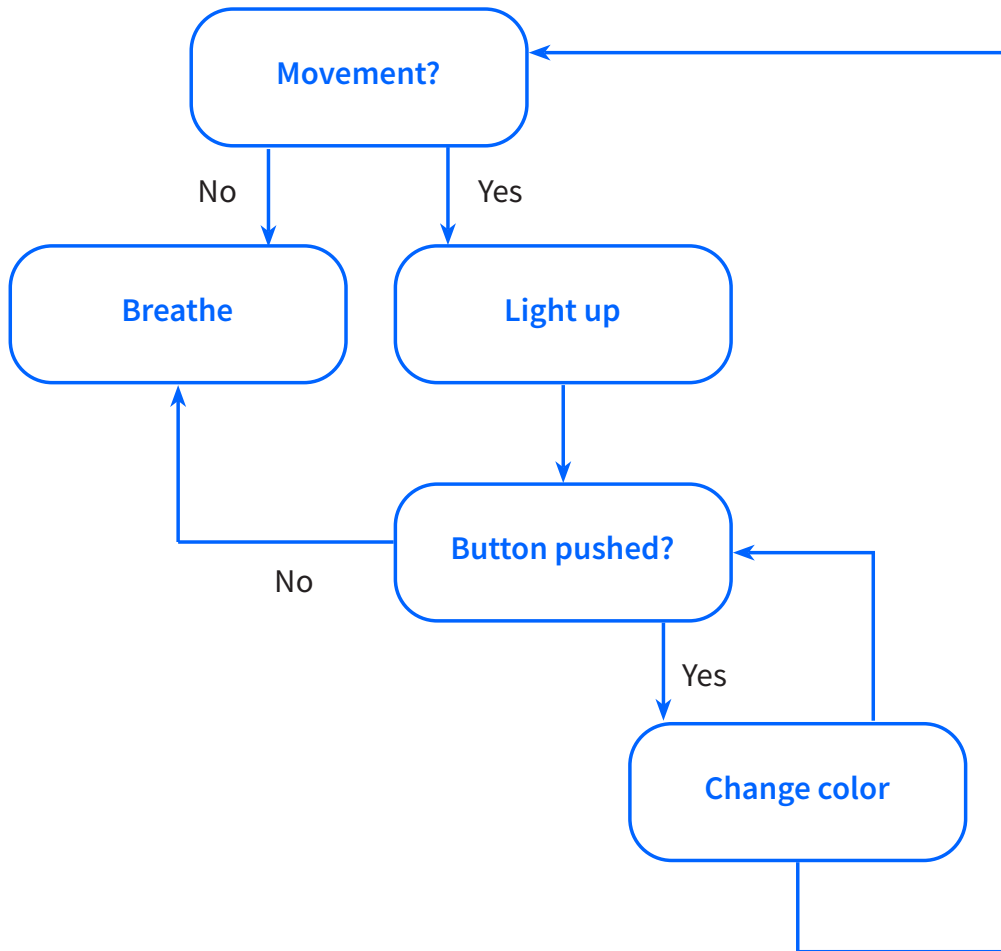
PROGRAMMING AND ELECTRONIC COMPONENTS

To make Tilt come to life a little bit of programming had to be done, and since what I wanted him to do was fairly simple I decided to do it myself.
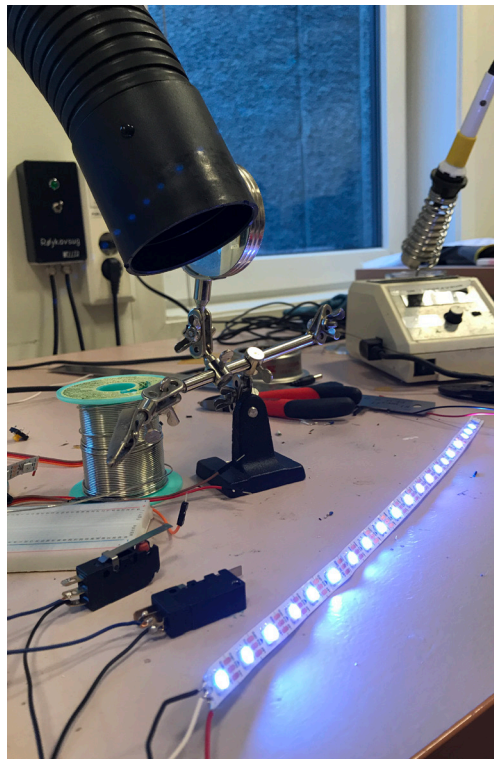
Tilt's starting point is pulsing light that mimicks breathing. This got its own function in the code based on a pre-programmed llibrary for RGB-leds.

When moved Tilt lights up. To make this happen I used an accelerometer that detects motion. A difference in motion triggers the LEDs to be constantly white. This also got its own function in the code.

The function that changes color is getting input from two switches. These are mounted on each side, so that the cylinder triggers them when rolling back and forth.

When all three functions were tested and working, I merged them together into one looping function. All programming is done in Arduino IDE and the components used are an Arduino Uno, a LED-strip with 17 RGB lights, an accelerometer and two switches. Additionally, I added a 9V battery and a small converter to make full use of the battery.

```
                    ┌─────────────────┐
                    │    Movement?    │◄──────────────────┐
                    └─────────────────┘                   │
                  No │              │ Yes                 │
                     ▼              ▼                      │
        ┌─────────────────┐  ┌─────────────────┐          │
        │     Breathe     │  │    Light up     │          │
        └─────────────────┘  └─────────────────┘          │
                 ▲                    │                    │
                 │                    ▼                    │
                 │         ┌─────────────────┐             │
                 └─────────│  Button pushed? │◄──────┐     │
                     No    └─────────────────┘       │     │
                                     │ Yes           │     │
                                     ▼               │     │
                           ┌─────────────────┐       │     │
                           │  Change color   │───────┘     │
                           └─────────────────┘             │
                                     └───────────────────┘
```
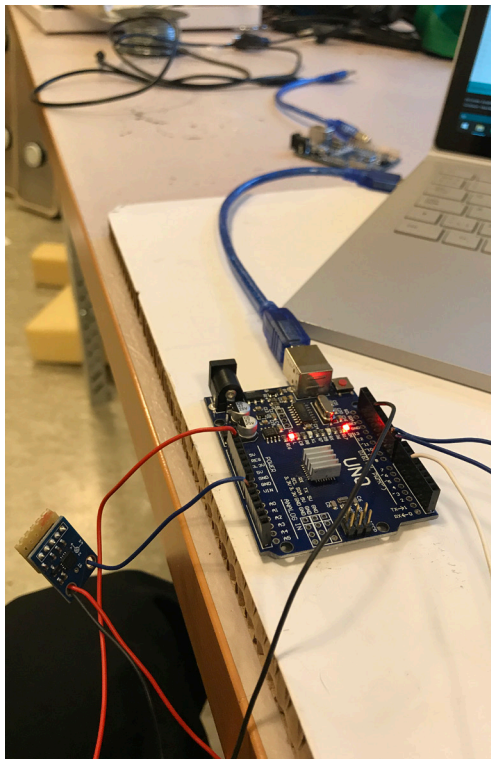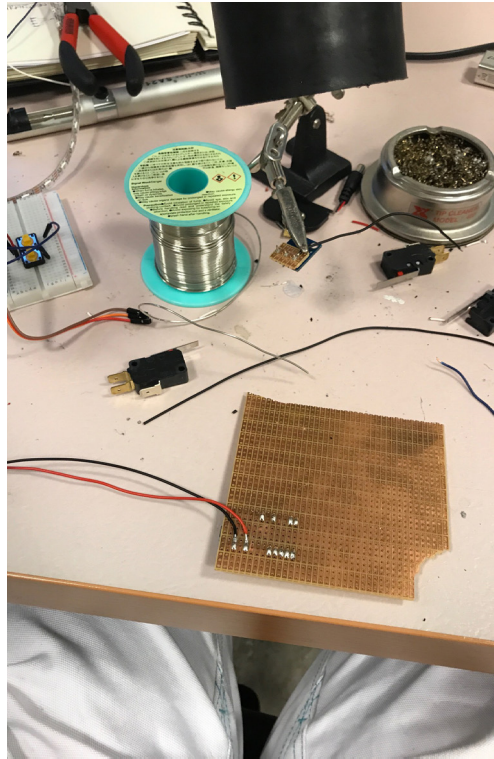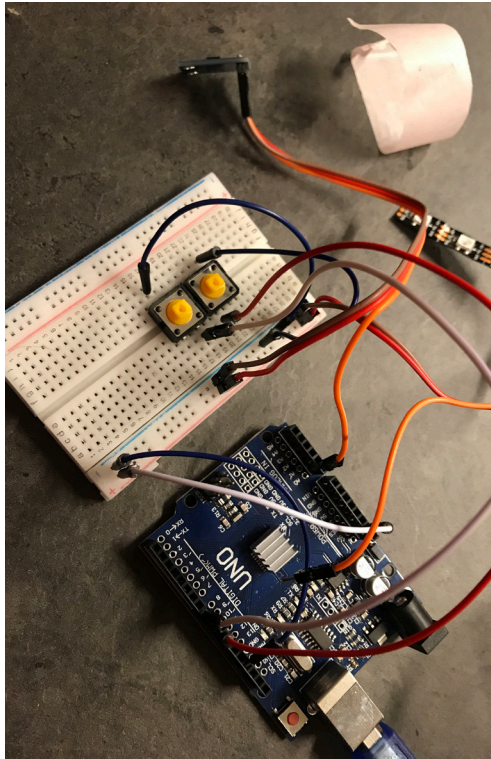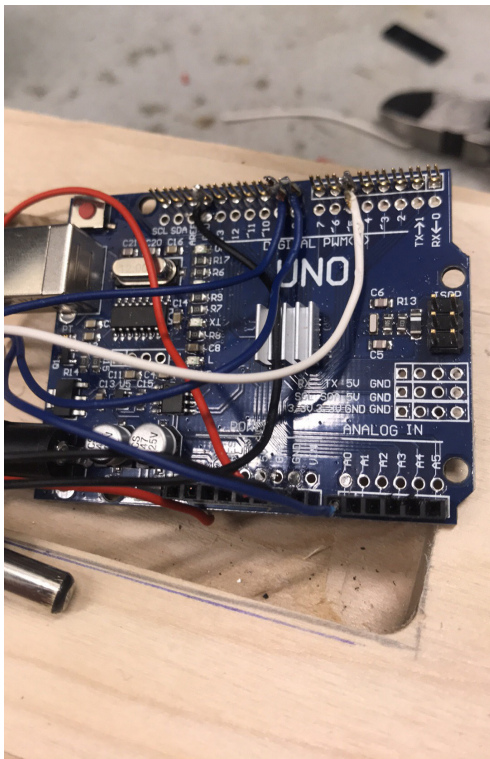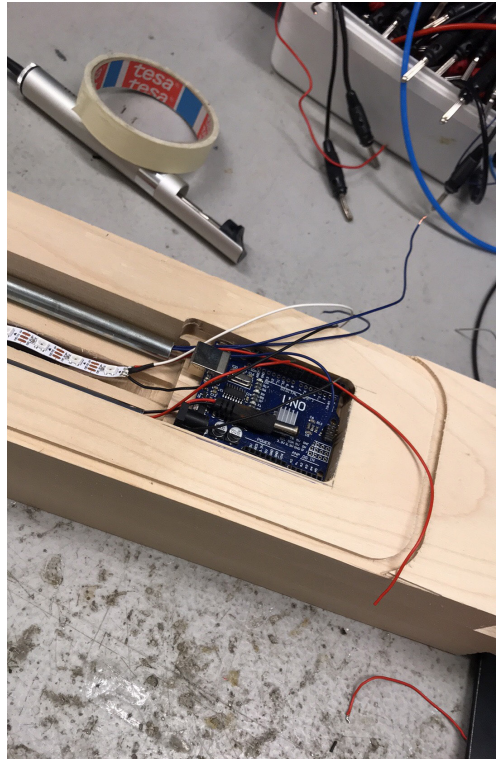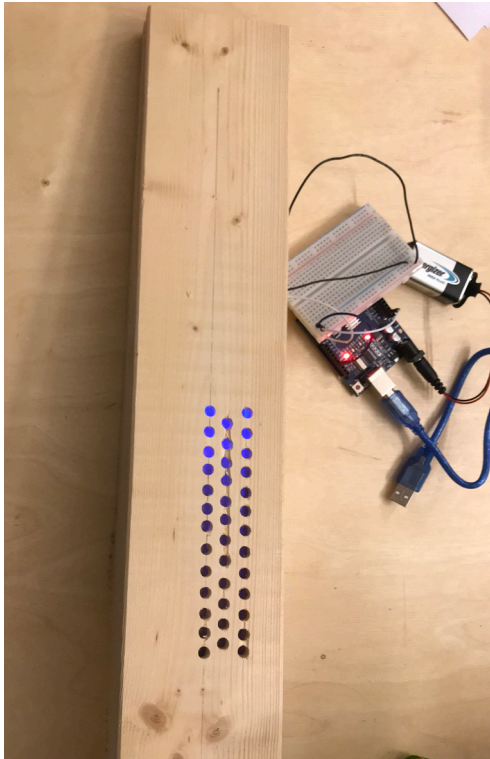
GRIP TAPE FOR FRICTION

When everything was mounted together the only thing missing was something to prevent the children sliding off. I explored sock-stop glue, a mix of sand and glue and eventually I chose grip tape made for skateboards. I cut it into circles to continue the bubbly pattern, and used the outer circles to hide the screw holes.
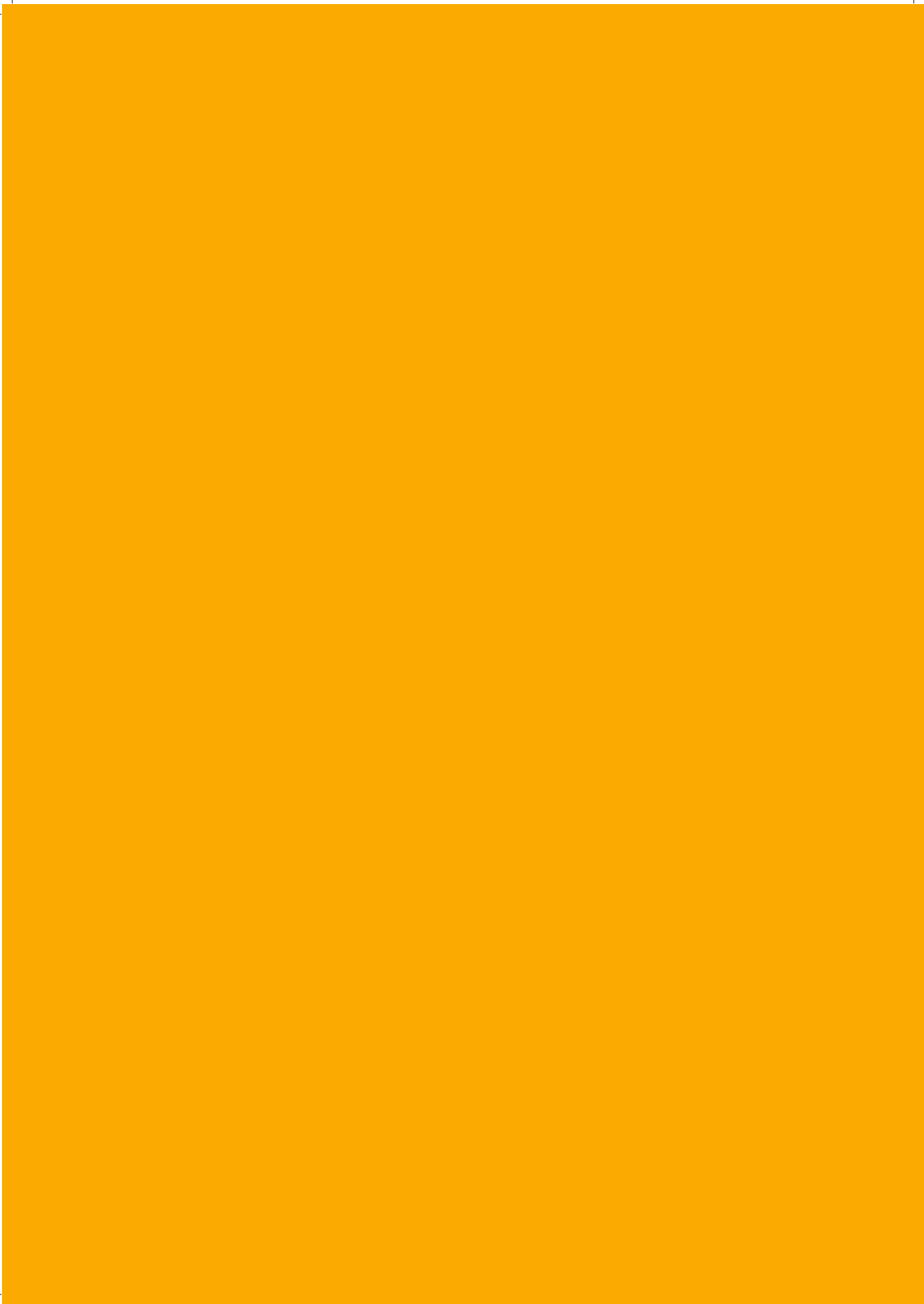
IN ACTION

OUTRO II

Evaluation

Looking back at the key-factors and design brief again:

Must
Enhance bodily awareness
Be easy to clean

Should
Encourage movement
Encourage connection
Have a natural feel
Be versatile

Could
Be rhythmic
Be soothing

Design brief
I want to stabilize or reduce the level of activation by encouraging children to take control of their own bodies.

As a physical product, Tilt answers the design brief in an appropriate way. As concluded in chapter two:

It enhances **bodily awareness** and movement because it encourages balancing.

Connection happens because young children often need help to balance, and older ones might want to show off if they accomplish it.

User testing shows that children find Tilt fun to play with even before they know what it is, which makes it **versatile**.

During the process of making the product, the last four factors on the list can be crossed off as well:

It is **easy to clean** because of the minimal shape with hard and smooth wood surface.

The choice of birch as the main material, combined with the bubbly pattern and the breathing, gives it a **natural feel**.

Both the tilting back and forth during interaction and the breathing when on standby make it **rhythmic**.

The **soothing** feeling can be achieved by the tilting movement and the visual stimuli of looking at the constant breathing.

This might not be the only appropriate way of answering the brief, but as a conclusion of my findings during the insight phase, making a balance board appeared to be a logical solution. Additionally, it is satisfying to be able to manifest the complex insight into something this concrete and simple.

Possible future

Even though Tilt is merely a materialization of insight into a project that places equal focus on theory and making, it has ended up as something that could possibly have a commercial value. It has gotten solely positive feedback from all spectators, and the user tests implies that the children might like to play with it in more settings than in a waiting room. I mainly see it as a business-to-business product, something that can be offered to children in public spaces. Nevertheless, if it turns out to be of sufficient interest, it could probably be sold to consumers as well. However, if this ever were to be produced, some adjustments would have to be made:

First of all, the lid needs to undergo careful inspection considering the dimensions and the fastening of it, to ensure that it is robust enough for rough use over time.

Next, as I have mentioned, the choice of acrylic should be revisited in search for a material that works better as a diffusor and is healthier for the planet. Birchwood, however, I see as a good choice if produced here in Norway, because it is a hardwood that is sustainable to harvest. Having said that, if produced in other parts of the world, other types of wood should be considered, in regard to sustainability. The majority of products made for children are made of plastic because it is cheap and durable. Hopefully, the reason for making this product in wood is clear, and thus it should be easy to understand that if made in any other material it will lose a critical part of its purpose. Additionally, because of its simple shape, it should not be overly costly to produce this in wood. The whole thing can be milled with a CNC-router and a proper jig.

Eventually, it would be beneficial to let experts go over the code and the choice of components to make it more robust and precise. An on/off button, for example, would be a nice thing to add.

Reflections

Throughout this project, I have learned a lot and I will now try to summarise this somewhat straight forward:

Sketching with crayons

To maintain a childish mindset I have consequently used wax crayons on plain paper when sketching. This has been surprisingly liberating. Actually, making lines on paper have never been easier! I think it is the way I free myself from precision when the chosen medium to work with makes it almost impossible to create precise lines. Additionally, working on plain paper, rather than a sketchbook, makes it easier to make mistakes because I can just throw away the piece of paper and start over. In the future, I will strive to make it as easy as possible for myself to be creative and visual, and if doing so means using crayons, then crayons it is.

Read, absorb and then write

Throughout this whole project, I have read literature that might be of relevance to my work, as well as talking to all kinds of people I meet about what I work with and what I have read. To summarise this insight, I have written down key points along the way, supplemented by sketches and additional questions. This has allowed me to think ahead and absorb knowledge weeks before writing anything useful. By doing so, I have been able to remember the essence of my chosen theme and sort out what is actually important for my work. My goal has been to write a thesis that is fun to read and easy to follow, and thus not contain unnecessary information.

Ethics

Early on in this project, I learned that working with children can be hard because they are not of legal age and thus their interests are carefully protected by ethical rules and guidelines. However, it is not impossible to work with healthy children as long as consents are given and they are not linked to the theme of the project. Therefore, this thesis contains only healthy consenting children. If I was to work with children with a diagnosis I would need to go through a tedious procedure that takes several months to complete. This affected my way of structuring the project, and in the end, I am glad I did it the way I did.

Multidisciplinary aspect

As mentioned in the introduction, my personal motivation for doing this project is the multidisciplinary aspect of design. I am thrilled about the opportunity I have as a designer to submerge myself in various disciplines in search of an answer. I get to meet interesting people and, without exception, everyone I have talked to for this project has happily shared their knowledge. There are however some

things I have made sure to bear in mind when stepping into other professional areas:

1. I find it important to explain my role as a designer and let them know that they are the experts in their field and I am there to absorb what they can teach me.

2. I make sure to show respect in regards to their time and knowledge, and at the same time inviting them into the creative field if they want to. Sketching with non-designers very often leads to better conversations because it ensures that we are on the same page talking about the same things. Additionally, some great ideas or inspiring doodles will most likely take form.

3. I know how easy it is to stay for too long in the insight and inspiration-part of a project. Therefore I make sure to have a solid plan for when to narrow it down and make the findings concrete. This way I have time to breathe and wonder during the creative exploration, which somehow tends to bring out the good ideas. Luckily, it is never too late to go back to look for more inspiration and insight if it turns out to be useful. If so the search is often more effective because I have then set the overall direction, and thus it will not slow me down.

Projects like this light my inner flame because the main goal is to help people. The possibility of doing so by making something this concrete is a dream come true, and even though it has at times felt like being lost in a jungle, I would not have done anything differently.

"You are on the right track when you want to rip all your hair off your head"

- Crazy Dutchman

Thank you for your attention

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