



Enhancing awareness of biodiversity crisis in families that visit Naturalis

Master Thesis by Yamila van der Heide

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In collaboration with

Naturalis

Contribution to

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Preface

Dear reader,

This project is executed to close of my master's Design for Interaction for the technical University of Delft. It took around 100 days, over a time span of seven months; february 2023 to august 2023.

For the project I immersed myself in the world of biodiversity, museums and transformative experiences. I did this in collaboration with Naturalis and the Museum Futures Lab.

From what I can remember I have always been interested in nature and everything that comes with it. Have been a member of WWF and Stichting Aap, have been visiting lots of nature areas, try to live a sustainable lifestyle, read and listen about nature etc. During my studies I raised even more interest in the topic and focused on sustainable courses. It was quite obvious I had to choose a project for my final masters course that had to do with sustainability.

It moves me that it is not going well with nature. This has been a big reason for starting this project. I think it is highly important to care for nature and to contribute to increased biodiversity. But that is something we all have to contribute to. Therefor I decided to focus on enhancing awareness on the biodiversity crisis.

When Arnold, my chair, suggested to contact Naturalis to possibly work together, I was convinced. Because what is a better place to contribute to change than a biodiversity centre? After sending an e-mail I was invited to Naturalis. They were very enthusiastic to receive me, I was just as enthusiastic to explain about my thoughts. It was quite a coincidence that they were currently thin-

king of ways to bring the biodiversity crisis to their audience.

The Museum Futures Lab is currently exploring ways to create transformative experiences for museums. This perfectly fitted the goal of my assignment. A lot of students have been working for the Museum Futures Lab which was a great way to exchange thoughts and help each other out.

I expected the biggest challenge to design a transformative experience in such a way that it attracts people instead of moves them away. From own experiences I notice that people tend to feel overwhelmed and hopeless when you talk about sustainability issues such as biodiversity decrease. During the project I learnt ways how to best connect to your audience and keep them close. I think the concept I came up with is a positive way of transformation and I am proud of it. Hopefully it has some aspects that Naturalis can use as inspiration for the future. My fear for the project was that I would feel very sad because of all the research on the crisis. However, I can say that I felt very positive throughout the project because many people I spoke to gave me hope and the theories on transformation or behavior change showed me that it is really possible to create a change.

When it was clear that I would work at Naturalis for at least half a year I was very happy. Therefor I want to thank Naturalis. For all your interest in my work, the neverending help and all tools and possibilities. I met really great people, for each question there is someone that is able to help. Each day I walked inside the building I started the day happily.

I found it really cool to feel like people were involved in my project. At many times I got messages with information that could be valuable for my project. For example, research on bees or news articles on biodiversity. Or I received

photos from people planting the right plants in their garden.

In particular I would like to thank Matthijs Vegter and Pieter Aartsen, my two coaches from Naturalis. Each time they were there at the right times. At times I was stuck on what to do with the project. Matthijs, your patience and attention is really special. I always have been able to share my emotions and thoughts with you and you were able to say the right things to help me out. Pieter, I really liked working together with you, and I learnt a lot from your way of designing. Sometimes when I did not know how to design in a good way, you said just one thing which already was enough to proceed.

Himanshu, I liked our weekly meetings on the process. You always had good comments on the aspects of the project I needed feedback on the most. It is really special you felt what were the right topics to discuss. Arnold, it is really fun to work together with you. It inspires me how you can explain difficult theory in such a relaxed and clear way I can understand it easily. From both of you I appreciated that you were always there for a talk on the project. The way you give feedback is really constructive and clear. I have experienced meetings with you as really pleasant, besides that, on a personal level, I liked meeting you.

The conversations I had with all visitors of Naturalis have also been memorable. Especially the children surprised me. They have more knowledge on the topic than I thought. And they can handle more than you might think. In particular in the end it was really special to see my design being used by families, seeing them laugh, talk about the topic and interact with it.

I want to thank all experts on their field and opening up to me, teachers, behavior change psychologists, biologists, exhibit builders. Talking to lots of people and combine thoughts is an activity

I generally like to do. This project gave me the opportunity to do that.

Without my dear friends I had not been able to go through this process. The fun part is that the entire group of friends is in their time of graduating and we helped each other through. Celebrating the mid-term and greenlight, but also smaller moments such as arranging an interview with an expert.

In particular, Nina and Maureen, thank you for always being there and helping me out with all kinds of questions. Pepijn, thanks a lot for thinking along about how to create a prototype of the concept. Sam and Jurre, my housemates, thanks for listening to all my stories on my graduation project. Special thanks to my family for support and bringing the opportunity to build the model in the backyard and treat me well with tea during the difficult deadline times.

I hope you will like reading my project and experiences. It has been the most difficult, yet exciting and informative project I have done throughout my master's. It perhaps inspires you and gives you new perspectives on this topic, just like it did to me.

Enjoy!

Yamila van der Heide

Executive Summary

Currently, biodiversity is under worldwide pressure. The organization Naturalis Biodiversity Centre wants to discover ways to address the biodiversity crisis in their museum. Within this project, several areas: Naturalis, biodiversity, transformative experiences, and Naturalis' visitors are explored to create an interactive and playful transformative experience.

For the design process, the double diamond method is applied. In the first half of the project, the topic is explored widely, and in the second half, it is worked towards a design that aligns with the insights from research. Through desk research and interviewing experts, the concept of biodiversity is explored. To have a clear focus early on in the project and make the design process more manageable, it is chosen to focus on the decrease of insects. Insects are an undervalued group despite their importance, and they require more attention as humankind depends on their existence. There is a high urgency to raise awareness about their decline. A German research study shows that since 1970, 76% of certain insects have disappeared from German nature parks.

Biodiversity decline is a phenomenon seen throughout history, but for the first time it is mostly caused by human activity. The causes of the decline can be at individual and systemic levels, with examples such as light pollution, agriculture, pesticides, and habitat destruction. Museums are good environments to address complex problems like the biodiversity crisis, because of the large audience and the ability to share current events and context. However, museums face challenges due to visitors' limited time for each installation, short attention spans, and the relatively slow pace of designing exhibits, which can delay the implementation of new installations.

It aims on transformation, making the audience aware of the problem and encouraging them to reflect on their own role. These steps are the first two stages of a simplified plan that leads to transformation. To refine the installation further, the Com-b model of behavior change is used. This model describes that there are three aspects that lead to behavior change: motivation, opportunity, and capability. To motivate the audience to change their behavior, it is essential to adapt to their beliefs and connect with them on a personal level, and creating emotional involvement. Providing perspective on actionable steps is also needed. Finally, the environment, physical and social, plays a role in influencing behavior.

In the strategic plan of Naturalis, the organization aims to describe biodiversity, strengthen its collection as a foundation for discoveries, and foster a love for nature among visitors, creating awareness about the consequences of the Anthropocene. While the biodiversity crisis is addressed through the website, app, and educational programs, there is nothing on it in the museum itself. Together with employees from the educational and exhibit departments, a message on biodiversity crisis is thought of, which is summarized in three pillars: connectedness, taking care of nature, and motivating the visitors.

To understand how families experience Naturalis and how they want to be approached regarding the biodiversity crisis, families visiting Naturalis are interviewed and observed. This has led to insights, resulting in the development of three personas representing certain types of families, Little Leaders, Nature Navigators and Eco Explorers. The persona of 'Little Leaders' is the most promising group for transformation, because they are a bit hesitant about difficult and negative topics. For the Little Leaders, children take the lead, and are supported by the elder. This trans-

lates to a design that mainly focuses on children.

The design goal that focuses on this persona is as follows: To design a playful transformative experience at Naturalis where family members can develop a deeper understanding of the biodiversity crisis and discover how they can contribute to biodiversity in their surroundings.

The exhibit journey consists of three steps: approach, interact, and take-away, with the interpretation of these steps based on transformative experiences, the Com-b model, and the mission of Naturalis. The installation will be located near the entrance, where families are still open to trying something new and are motivated to learning and playing.

Based on all the gathered insights, the project has created initial rough ideas that were shared in a primary school classroom. By consulting biologists and Naturalis employees, hosting brainstorm sessions with fellow design students, visiting museums for inspiration, and testing with families, the project has come towards a final concept. The resulting interactive installation allows families to discover which elements contribute to a bee-friendly environment and which do not. By interacting with physical wheels representing elements such as flowers, lighting and herbs, families can observe the effects of their choices on a screen, which also provides an explanation. The concept was understood and appealing to families, particularly the interactive part with the wheels and screen. However, feedback suggests that the effect part should be redesigned in consultation with a bee specialist and children's illustrator. Additionally, the game element needs an interaction, with a focus on solely bees to keep it understandable and engaging.

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1 introduction to the project

This chapter dives into the motivation to start this graduation project and shows the approach, involved parties and the research areas that will be investigated and through which research activities insights will be gathered.

1.1 Emergence

The 'Naturalis Biodiversity Centre' is a research institute and museum. Within the museum, they showcase all facets of biodiversity, from dinosaurs to the origin of humankind. This is presented in a way to astonish its visitors by emphasizing the beauty of nature. However, its beauty also has its fragility; we are currently in the middle of a biodiversity crisis, which is caused by humans and can also be solved by humans. In order to do that, transformation has to take place, which means, people need to change their perspectives and, eventually, their behavior.

Naturalis recently started to explore possible ways to cover these topics within their organization and to be a guide on how to tackle future problems. Mostly out of their own motivation and the feeling of responsibility to tell the story, but also influenced by external factors. For example, Extinction Rebellion organizes protests within and around Naturalis with the goal to make Naturalis transfer these crises to its visitors. They try to inspire Naturalis to be the frontrunner on this topic and set a good example, figure 1.

Naturalis is not clear on how to bring this topic to their families due to a lack of expertise in transformative experiences and the biodiversity crisis. Therefore, this graduation project dives into this topic with the main goal of coming up with an interactive transformative installation that can be placed in the museum.

There is a direct focus on the decrease of insects in the Netherlands. This focus is derived from research that insects are undervalued, even though they are really important for biodiversity.



figure 1. Extinction Rebellion demonstrators in front of the entrance of naturalis

1.2 Focus

The design brief can be found in appendix A1, which explains the scope, assignment, collaboration and personal interest into more detail.

1.2.1 Scope

This project focuses on families that visit Naturalis, where families are parents, caretakers or grandparents with children from 4-12. A design will be made for the museum and aims to be a transformative exhibit through an interactive emplacement. An overview of all involved parties within this context can be found in figure 2.

1.2.2 Assignment

‘To design a playful transformative experience for families in Naturalis with the effect to make them aware of the biodiversity crisis and possibly make them reflect on their role on this topic.’

1.2.3 Collaboration

Museum Futures Lab

The Museum Futures Lab is dedicated to two primary research areas. The first area focuses on designing meaningful experiences within museums, while the second area explores the use of Augmented Reality and Virtual Reality (Museum Futures Lab, 2023). This project concentrates on the first area, exploring how to design transformative experiences within museums.

Naturalis

Naturalis is an institution that houses a vast collection of 43 million natural objects. In addition to the collection, they have a museum where some of these objects are exhibited. Naturalis actively collaborates with schools to enhance biodiversity education.

1.2.4 Personal Interest

I have always had a broad interest in nature, sustainability and museums. Therefore I like to get the chance to work at Naturalis since there is much knowledge available and they give enough freedom and possibilities (target group, location, resources, knowledge) to explore the topic and come up with a design. I also like to work together with the Museum Futures Lab to learn from them and connect their knowledge to Naturalis. The climate and biodiversity crises are so complex and big that this tends to make people not act out on solving it anymore. I see it as an opportunity to create a design that makes people think differently and reflect on themselves with the long term goal to change behavior.

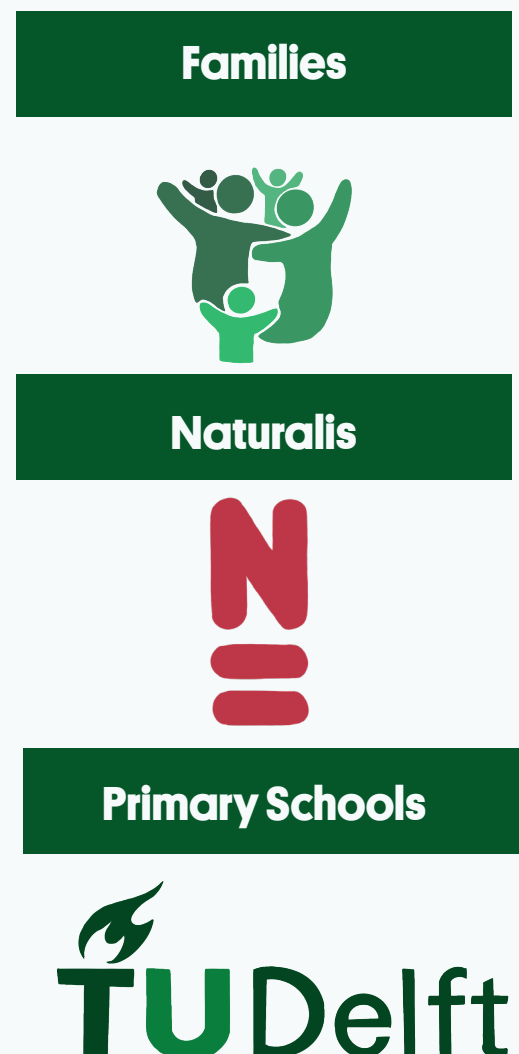


figure 2. involved parties in the context

1.3 Project Approach

1.3.1 Method

The project moves along the Double Diamond method that exists of four phases: discover, define, develop and deliver. (British Design Council, 2019). First, the context is explored by ex-

panding and delving (discover). Then, all insights from research activities are combined to get to a specific design direction (define). For this direction, ideas are tested by bringing aspects to involved parties (develop). Through testing it becomes clear what design is fitting Naturalis and is advised to implement within the museum (deliver). Figure 3 explains this project approach.

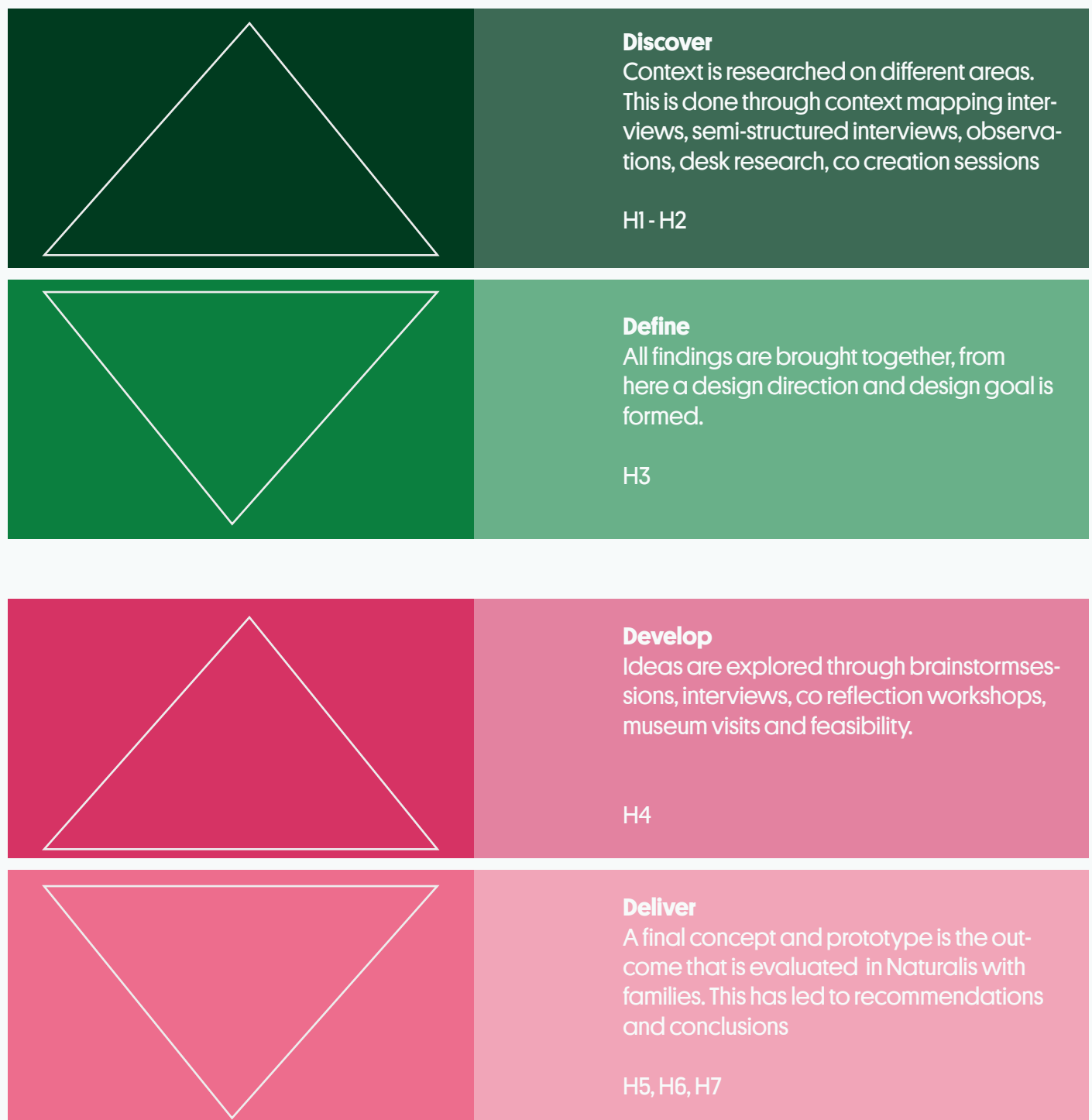


figure 3. project approach

1.3.2 Research Areas

Multiple research areas are explored within the phase: 'discover'. These are:

1. Families that visit Naturalis
2. Biodiversity and its crisis
3. Naturalis
4. Transformative Experiences in Museums

Within these areas, multiple research questions are formulated, that are listed below. In figure 4 can be found through which research activities this is explored and the additional research questions, that are numbered and shown in the green surfaces. Chapter 2 is about mapping the context where these questions are answered.

Families that visit Naturalis

1. In what way are families related/ intertwined to biodiversity?
2. To what extent is the biodiversity crisis known under families that visit Naturalis?
3. What are possible ways to confront people, in particular families, with heavy topics
4. In what way do families want to be confronted with the biodiversity crisis?
5. How is the museum reviewed by visitors?
6. What do families like in the museum and what is relevant to them?
7. How and what do families learn about biodiversity (crisis)
8. How do children like to learn?
9. How is a family visit to a museum characterized?

Biodiversity and its Crisis

10. What does the (Dutch) biodiversity crisis look like? (Effects, causes etc.)
11. To what extent is the concept of biodiversity known among Dutch inhabitants?
12. What is the importance of preserving biodiversity?

Naturalis

13. What is the current strategy of Naturalis?
14. In what way does Naturalis want to implement the biodiversity crisis?
15. How is the biodiversity crisis currently brought to visitors of Naturalis?
16. How are visitors of Naturalis characterized?
17. Why is it important to bring the biodiversity crisis to Naturalis' visitors?

Transformative Experiences in Museums

18. What are current approaches to bring a complex topic to museum visitors?
19. How can you foster transformative experiences within the topic of biodiversity crisis?
20. What strategies on behavior change are suitable to use
21. What are transformative experiences, how to design for it?

Desk research [reading literature, articles]	1, 3, 5, 8, 9
Context mapping Interviews [trigger materials, interview questions, sensitizing booklet]	1, 2, 4, 5, 6, 7
Semi-structured interviews [interview questions with experts]	1, 3, 6, 7, 8
Testing [test materials and interviews]	3, 4
Observations [observing families in the museum]	5, 6
Co creation session [together creating ideas with involved parties]	3
Co reflection [involved parties creating ideas, discussing those and own ideas]	7, 8
Brainstorm session [using brainstorm techniques to come up with new, other ideas, individually or in a group]	1, 2
Informal conversations [in between conversations with involved parties]	1, 2, 4, 5, 7

Biodiversity crisis	Naturalis	Transformative Experiences in Museums
10, 11, 12	13, 15, 16, 17	18, 19, 20, 21
11	16	
10, 12	13, 14, 15, 17	18, 19, 20, 21
11	16	
	15, 16	18, 21
	13, 14, 15	
10, 12	13, 14, 15, 16, 17	

figure 4. overview of research questions and activities

2 explore the context

Several areas have to be explored to be able to come up with a transformative experience: Museums, transformative experiences, families and Naturalis. These areas are explored by several research activities such as desk research, qualitative research, co reflection sessions and co creation sessions.

2.1 The Problem

2.2.1 Less space for nature

Room for nature is of high importance for biodiversity, however it faces threats from external factors. Cities are expanding increasingly. Nearly half of the world's population lives in urban areas, and this number is expected to increase to 60% by 2030 (Miller, 2005). Whilst cities are in drastic need of biodiversity, there is a decrease of it. (WUR, 2018). Research conducted by Natuur & Milieu revealed that more than half of neighborhoods in 32 governments are becoming fossilized environments (Natuur & Milieu, 2022). Within the Netherlands gardens take up to 3 billion m². However, 1.4 billion of that is not green, making it challenging for animals to find food or shelter. (Natuurmonumenten, 2022). The division of land in the Netherlands, figure 5, shows that nature or half nature covers only 16% of the land surface, while the agriculture takes almost half of it, which mainly exists of monoculture. (CBS, 2022). Monocultures disrupt the natural balance in soil life, which can lead to pests, plant diseases and draught (Sukkel, 2019).



figure 5. division of land in the Netherlands

2.2.2 Disconnection to nature

Research from Jantje Beton shows that children spend less time outside, comparing 2013 and 2018. They are mostly occupied with digital activities. This means they are in less contact with nature. (Kaal, 2022). This, while contact with nature is an essential component in creating favorable feelings towards it. (Soga, 2016). If people get disconnected from nature, they get unaware of its importance. Children that are experiencing nature frequently are likely to support protecting biodiversity. (Snaddon, 2008). Increasingly, nature is seen as something that you can visit, rather than as humans being part of it. People visit nature less often which leads to less interaction with animals. (Soga, 2016). The shifting baseline syndrome is a phenomenon in which a situation becomes normalized for a new generation, due to a lack of memory and knowledge about a past situation. This normalization can lead to a tolerant view of the degradation of nature and a lack of urgency to act on it because they don't know what has been lost in comparison (Soga et al, 2018). For example, between 1870 and 2017, butterfly populations have decreased by 84 percent (CBS, 2019), as shown in figure 6. New generations might not be aware of this decline, and they become used to the current situation.

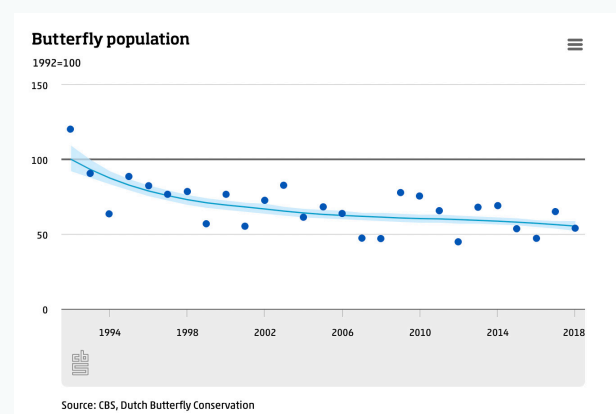


figure 6. decrease of butterfly population over 26 years

2.2 Biodiversity Crisis

This paragraph explains the definition of biodiversity and its crisis.

2.2.1 Biodiversity

Biodiversity is described as the variability of life, from the tiniest organisms to forests. (Beery, 2016). It is about the bigger picture, the interactions between all those living organisms and systems, that have evolved over the past billions of years. (Naturalis, 2023). Yet it is not only about diversity, also about the amount of individuals of species, that all come together in ecosystems. This involves the emergence of new species and also the extinction of species, whose roles get exchanged by others again. Extinction is part of life: about 98% of all organisms that have ever lived are now extinct. (NHM, 2023).

Importance

It is important to preserve biodiversity since it serves as a safety net for a well functioning planet. (WUR, 2023). If biodiversity is higher, this leads to healthier ecosystems where species can survive more easily. (Natuurmonumenten, 2023). It makes nature more resilient and the disappearance of species can easier be dealt with because of the existence of all other species.

Healthy ecosystems are also of importance for the quality of human life. Our economies and lives depend on biodiversity, since we make use of natural sources such as food, water, and medicines. (WUR, 2023).

Awareness

Research has been conducted on the relationship between Dutch inhabitants and biodiversity through an online survey with 1230 participants aged 18–80. The results show that the definition of biodiversity is not generally known in the Netherlands, only 2/5 of the respondents are familiar with its meaning.

On the positive side, a great part of the respondents show a desire to take action regarding biodiversity. However, they are unsure about what specific actions to take and do not feel personally addressed by the issue (Motivaction, 2020).

2.2.2 Biodiversity Crisis

Mass Extinction

Over the past 500 million years there have been five mass extinctions: the Ordovician silurian, the Devonian, Permian, Triassic, Cretaceous. These events happened because of extreme temperature changes, sea level rises or falling, volcanic eruptions or asteroids that hit earth. In contrast to the first five mass extinctions, the sixth one is directly caused by humans. The term anthropocene describes the time during which humans have had a great impact on our planet. Our species, Homo Sapiens, negatively influence biodiversity. Especially in the past 60 years, this influence has increased, because human activities increased as well. (NHM, 2023). Examples of human activities are intensive agriculture, industrial revolution, infrastructure, climate change and construction. (Natuurmonumenten, 2023). See figure 7. It is the first time that a single species has caused such devastating effects on the world and is also aware.

Biodiversity Decrease

Currently one million animal and plant species are threatened with extinction. Because of the rapid pace this is all happening, species do not have the time to adapt anymore. (Ipbes, 2019).

The MSA (mean species abundance) provides a measure of the typical or average representation of each species in an ecosystem. It is expected that global biodiversity will decline from an MSA of 70% in 2000 to 60% in 2050. In comparison to Europe and the rest of the world, the biodiversity in the Netherlands is significantly lower. The MSA has been reduced from an average of 40% in 1900 to an average of 15% in 2000 (CLO, 2013). Also, there is an increasing number of plant and animal species that have appeared on the 'Red List of Threatened Species' (IUCN, 2015).



Intensive Agriculture



Construction



Climate Change



Infrastructure



Industrial Revolution

2.2.3 Insects

Importance

Insects are a large portion of biodiversity, in terms of total biomass and in the amount of species. They serve as an important component within biodiversity because of several reasons. They play a central role in many processes: pollination, herbivory, detritivory, nutrient cycling and are a food source for other animals. (Harvey et al, 2020) Based on this importance and the wideness of the concept of biodiversity, it is chosen to focus on the group of insects.

Decline

An estimated 40% of insect species are threatened with extinction (Sanchez-bayo, 2019). In Germany, there has been a decline of insects by 75% over the past thirty years (Hallman, 2017), as shown in figure 8. Between 1989 and 2016 (x-axis), insects have been monitored at 63 locations in Germany, and a decrease in insect populations was observed at all these places (Trouw, 2017). A similar trend can be seen in the Netherlands, where it is estimated that 40-60% of insects have disappeared (Staatsbosbeier, 2023).

However, this trend expresses differently across the world. Research by van Klink et al. (2020) demonstrates variance between German nature environments and those in North America. This is due to differences in intensive human land use and the protection of natural areas. For example, in the Netherlands, issues like the nitrogen crisis, urbanization, and monocultures in agriculture are clear contributing factors. Pollinators rely on flowers, which are often removed due to mowing policies. Despite these differences, these declining insect populations are a concerning issue.

Intensive human land use, the protection of natural areas, and the use of pesticides are identified as the three main causes of this insect decline. It has been observed that insects retain these pesticides, with 47 different traces of toxic substances found on the collected insects. In 16 areas, the prohibited pesticide thiaclopid was detected, highlighting its devastating consequences (Bruhl et al, 2021). Moreover, light pollution is also contributing to the decrease of insects as it hinders their orientation, reproduction, and causes fatigue (Spoelstra, 2023).

Caught insects per trap in [grams per day]

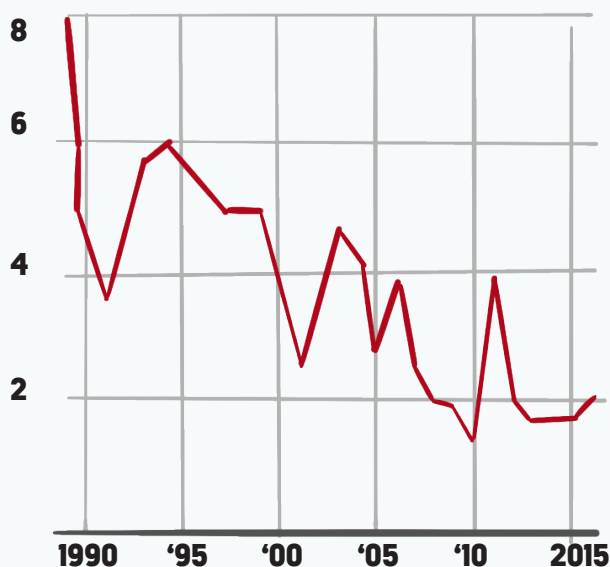


figure 8. insect decrease in Germany over almost 30 years



Light Pollution



Agriculture, Nitrogen Excess



Pesticides



Disappearance of habitat

Human and Insects

Despite this decline in insects, it seldom gained media attention. Insects are often perceived as being less relatable compared to other animal groups, primarily because they are not from the same group as humans. This can make it more difficult for people to identify with them. (Snaddon, 2007). Furthermore, children's stories in books are often about exotic animals and pets. These play the main characters, where it is seen that birds and insects generally were less present. This can enhance that children think that nature is something from far away. (Hooykaas, 2021). A research on perception of rainforest biodiversity amongst children showed that some groups of organisms as insects and annelids are underrepresented, while others were overrepresented: mammals, birds and reptiles. (Snaddon, 2008). Quantitative research on attitudes towards 210 children supports this, which reveals that insects are generally the most disliked animals (Almeida, 2015). Within the group of insects, there are differences in popularity. Research showed that butterflies and ladybirds are most popular, where dragonflies and bees are less popular. Childhood experiences influence later perceptions and preferences later in life. Therefore it is important that children get in contact with the group of insects as well. Emphasizing lesser known species would even be better since a more balanced view is created. (Snaddon, 2007).

Future

Insects have the potential to recover as they reproduce quickly (Kroon H., 2019). Solutions to support them include systemic changes like altering mowing policies by governments, as well as individual efforts such as leaving space for nature in gardens and growing native, eco-friendly plants (Staatsbosbeheer, 2023). By taking action at various levels, the decline can be reversed and insects are protected.

2.3 Museums

2.3.1 The Role of a Museum

The International Council of Museums defines a museum as:

A museum is a not-forprofit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing (ICOM, 2022).

The core task of a museum is to collect, preserve, manage and present objects and stories. Museums are of high importance for the social purpose, they play a role for various values:

collective

Objects that are collected are of importance to all of us, since they express a shared history and identity. Through these objects, answers are repeatedly created.

connecting

A museum can serve as a platform to combine different fields, such as education, the cultural sector and business.

educational

In a museum as a visitor you learn about topics in an informal and voluntary way. Visiting a museum can be seen as meaningful leisure time. For kids, this way of informal learning is of importance for development of their world view, self image, personality, identity and social awareness.

experience

Museums make you think and reflect about certain topics and even incite action. This is possible because of the available time and space to reflect and act. At the same time it is a fun and enjoyable activity. It brings other perspectives and new impressions and might in the long term also bring changes in ideas and visions.

economic

Museums have an economic strength, because it for example attracts tourists, brings employment opportunities and voluntary positions. (Nederlandse Museum Vereniging Amsterdam, 2011)

2.3.2 Complex Problems

Opportunities

Complex problems are something that can be brought to an audience in a museum as well. Museums serve as an ideal platform to discuss actualities and bring a context. Natural history museums, in particular, face challenges in transferring the biodiversity crisis to its audience, which has never been more important than now. They can play a major role in development of research leading towards the understanding, conservation and sustainable use of biodiversity. (Krishtalka L. 2000).

Challenges

The context of a museum also brings one big challenge: time. This is explained through three points, in consultation with Naturalis:

1. Limited amount of time to share a message. It can be difficult to address a wicked problem and make it understandable.
2. The attention span of the audience is of influence, especially when families and thus children are involved.
3. The department 'exhibits' within Naturalis is can be slow, because of complexity of development process that leads to quality.

Practice

Figure 10 shows examples of complex problems in museum-like environments. On the left side examples are shown where the visitor is confronted with a problem. On the right side is

shown how visitors are informed on solutions for a problem. These are pictures taken in: 1) Natuur Historisch museum of Rotterdam, 2) Blijdorp Rotterdam 3) London Historic. Appendix B1 shows more photos.

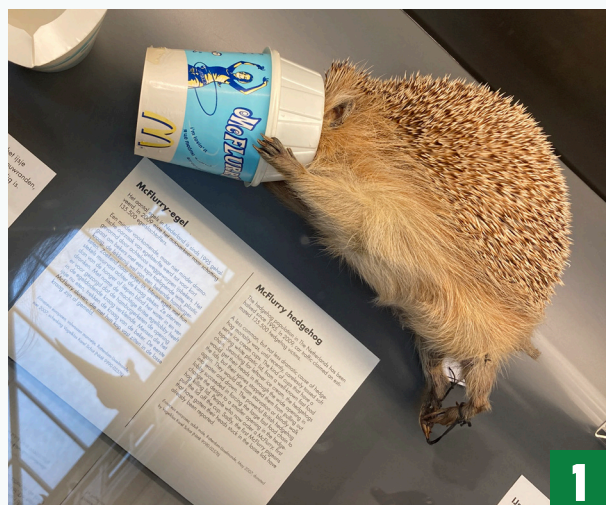


figure 10. examples of complex problems in museums

2.4 Transformation

2.4.1 Transformative Experiences

Within this project there is a focus on Transformative Museum Experiences. Transformative experiences can be described as a process in which we develop new attitudes, interests, appreciation beliefs or values in an informal voluntary context. This process that is followed, is described below and is based on Mezirow's steps for transformation. (Kitchenham, 2008). These can be summarized into four overarching phases, which is proposed by Arnold Vermeeren, as can be seen in figure 11.

1. Awareness

The process starts with a catalysator for transformation. It is all about raising awareness and bringing a certain topic to attention. This is often done through confrontation, in which the person is presented a disorienting dilemma (a dilemma that makes people think about their own stake). In this case, the dilemma concerns the biodiversity crisis on the one hand and about someone's own beliefs, assumptions and behavior. The dilemma can be solved, then one's view should be changed, or it can be accepted that there is a biodiversity crisis and that it does not matter. It is not only about understanding the dilemma, it is important to also to be emotionally connected and feel its importance.

2. Self-reflection

After this moment of confrontation, the viewer can possibly reflect on his or her role on this topic, if it is immersed enough into the topic. The role of the museum could be to foster deeper understanding on the topic and possibly inspire action. Two topics are important to touch upon: the problem and the solution.

1. How do humans contribute to this problem and how do I contribute to this problem?
2. What needs to be done by humans to solve the problem and what role can I play in this?

Not to overwhelm, it is needed to guide the viewer through this process of self-reflection. Probably not all questions can be answered, especially not in the context of a museum, where time is scarce. In general with reflection is meant exchanging views and ideas between people. Within this, it can take shape in many different forms, which are explored during the ideation phase.

3. Prepare for transformation

The next step in this transformational process makes the viewer prepare for a transformation in daily life. So far the viewer has been made aware, encouraged to reflect and now is supported in actions on the problem. The role of a museum can be to initiate and support explorative steps towards this transformation. This can be done by either providing ideas for first explorative steps or opportunities to experience what it is like to take those steps.

4. Integrate in daily life

In the most positive scenario the change is also anchored in daily lives, and not something for just once. A museum can help the viewer to integrate this behavior in daily life by reminding. Reminding considers staying in touch with the museum to make sure there is supported sustained change.

Focus

Within this project there is a main focus on the first two steps, so making aware visitors of a problem by presenting them a dilemma where they are part of, and make them reflect on how they contribute to the problem and what role they can play to solve this problem. They are inspired to take action.



figure 11. steps transformative experiences

2.4.2 Design for Behavior Change

After interviewing Loes Kreemers, a psychologist specialised in behavior change, it was advised to also look at the com-b model and integrate the theory into the design, because it is a model that can be used for changing behavior in the first stages. It supports the approach for the transformative experiences, it can be used to give substance to creating awareness and stimulating reflection.

COM-B Theory

The COM-B theory (capability, opportunity, motivation and behavior), can be used to analyze human behavior. (Michie et al, 2011). These three elements are related to each other and decide whether to or not to act on certain behavior. This model is used to design an exhibit on the biodiversity crisis.

Capability is about the physical and psychological capacities that are needed to act on behavior. So on the one hand the physical skills and on the other hand knowledge.

Opportunity is about the physical and social environment

Motivation is about the conscious, drivers and motives, and unconscious, such as habits, motivation.

Motivation

To design for behavior change, it is very important to know the motivation and beliefs of your target audience, to find a way to connect to them. (Renes, Hermesen, 2016). 'The topic you are presenting to the audience should be close to them and they should recognize it in order to make them interested, preferably telling them in an emotional and personal way', from an interview with Loes Kreemers. This follows the strategy of documentary style: following a story that informs and is conveying knowledge in an emotional way. Create a character and bring it close to the audience.

Easily explaining and telling your audience the problem that we are facing, is an insufficient strategy. (Renes, Hermesen, 2016). Enforcing, or in other words saying what the other one should do, is usually not a good strategy to use, it might even be counter productive. It works better if the person feels motivated to make a conscious choice and is involved, which can be seen in the 'Bob campaign'. (Heuts, 2022).

Capability

Next to that, messages on the degradation of the environment can lead to a disengaged audience. (de Lange, 2022). Topics such as biodiversity crisis are rather abstract

and invisible which makes it difficult to address the problem. Humans have evolved in a way that we solve local and experience-based threatening problems. (Brick, 2021). It is not only abstract and invisible, yet also difficult. Because of this complexity, people tend to feel overwhelmed.

Vice versa, messages that trigger positive emotions can help to inspire action and engagement. It creates curiosity, creativity and appreciation of new perspectives. (de Lange, 2022). Emphasizing how people already contribute to a solution, makes them feel motivated to pursue. It is important to show progress, benefits (Steg, 2020) of the new behavior and feasible goals in the short-term. With these strategies in mind, it is still possible to bring the rather negative threat, as long as it is balanced with actions or solutions.

Opportunity

To know which behavior is desired, people look at others' behavior. Showing what others do, can create a norm. (Renes, Hermesen, 2016). Relational organizing can be described as sharing information and encouraging others to engage in desired personal behavior. This can be very effective since it can create new norms. (Jones, 2022).

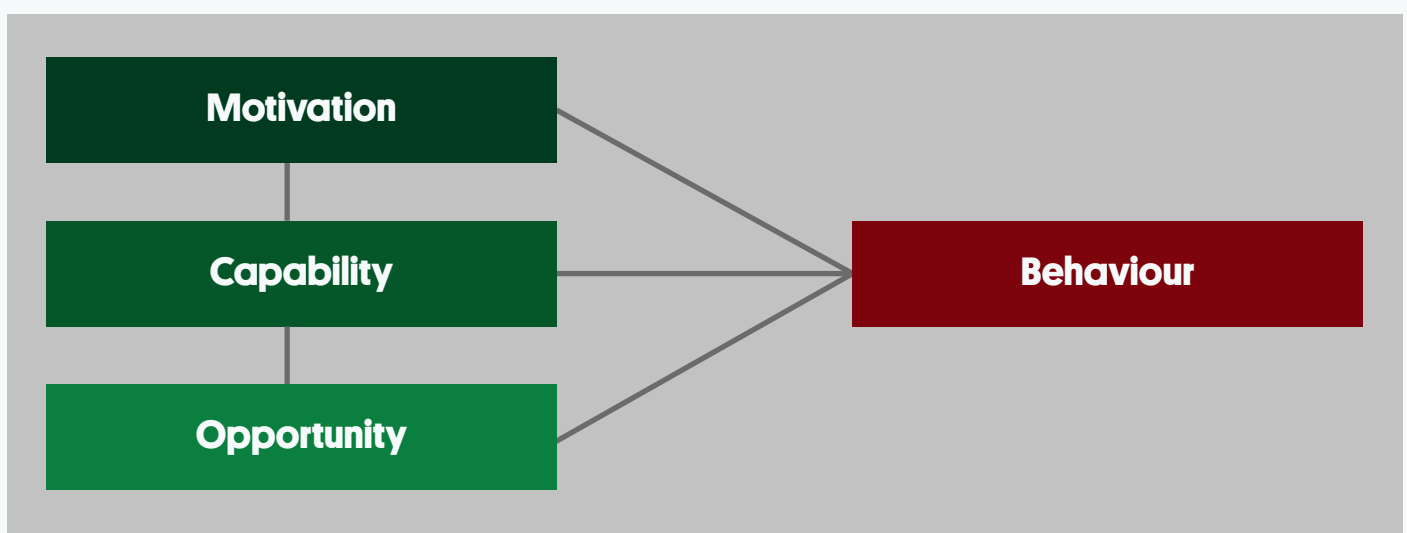


figure 12. com-b model

Practice

There are already many solutions to change people's behavior within the topic of biodiversity crisis, specifically on the decrease of insects, such as: NK Tegel Wippen (<https://www.nk-tegel-wippen.nl/>), National counting of Bees (<https://www.nationalebijentelling.nl/>), Bloementuintjes, see figure 12, (<https://www.ivn.nl/bloementuin/over-bloementuintjes/>).

The example of bloementuintjes can be explained using the com-b model. It motivates users because they can grow flowers themselves and brighten up their environment. It makes growing flowers really easy, everyone can do it by just adding water, which adds to the capability, and for opportunity it is possible to grow the flowers in the garden, balcony, in the house. Also, when other people use the bloementuintje it stimulates others to also grow the flowers.



figure 12. flowers from bloementuintje AH

The theory on transformative experiences can be simplified to four steps, where in this project is focused on the first two: creating awareness and stimulating self-reflection. The com-b design for behavior change model shows three pillars that are needed for change. This two theories strenghten each other and can be used to create a design.

Awareness can be created by presenting a dilemma on the problem. If the audience is involved enough into the problem, it can possibly start to think about their own role in this.

The audience should be motivated to do so, this can be done by connecting to their beliefs and presenting something they are familiar with or can easily connect with. Also, they should be capable to change their behavior on the presented problem, and their environment, physical and social, should be providing enough.

key insights

2.5 Naturalis

2.5.1 The Organization

Naturalis Biodiversity Centre

‘Naturalis Biodiversity Centre’ is a research institute in the field of biodiversity and nature historical museum, located in Leiden. In 2019, the renovated and extended institute opened, figure 23. The focus is to describe and preserve biodiversity, which is fundamental for the protection of it.

Strategic Plan 2021 – 2024

The strategic plan of 2021 – 2024 (Naturalis, 2021) describes three strategic priorities. Starting with ‘Accelerating identifying, describing and understanding biodiversity’, powered by science, taxonomic knowledge and promising technologies. Second, ‘strengthen the collection as a fundament for discoveries’, to understand biodiversity and deepen and share

knowledge that are relevant for the present social challenges in the Anthropocene. Last, ‘showing the beauty of nature with the effect of people falling in love with it’ by creating awareness on the consequences of the Anthropocene; the fact that if we don’t do anything, our living environment will get lost.

2.5.2 The Museum

Renewed Museum

Compared to the old museum, the new one had a shifted focus a to family and experience museum.

Exhibitions

The department of exhibitions is responsible for arrangement and conceptualization of the museum. This has been thought out around fifteen years ago. The museum itself has nine halls where exhibit installations are showcased, with each of them having their own theme. These different exhibit halls are described below.

‘Life’ shows stuffed animals and combines light, audio and projections to create an experience, see figure 13.

‘Earth’ shows the planet’s strength: from volcanoes to earthquakes, see figure 14.



figure 13. ‘Life’



figure 14. ‘earth’

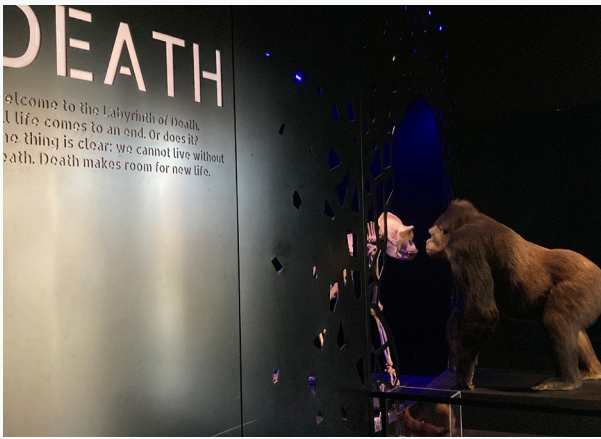


figure 15. 'death'



figure 16. 'ice age'



figure 17. 'seduction'



figure 18. 'early humans'

'Death' shows how death and life come together. The effect is to make visitors think about their own path and spot in the universe, see figure 15.

'Ice age' shows a big sized maquette of the Netherlands in the ice age, with its own ecosystem, see figure 16.

'Seduction' shows the reproduction in nature with all of its aspects: seduction, mate, taking care. This is exhibited in a playful way, see figure 17.

'Early Humans' explains how man came to be, by showing fossils of Homo Erectus, our earliest ancestors, see figure 18.



figure 19. 'dinosaur era'

'Dinosaur Era' presents fossils of several dinosaurs, with in particular the T. rex. It takes the visitor back 160 million years in time, see figure 19.



figure 20. 'evolution'

'Evolution' explains the relationships between all life on earth and the evolutionary steps that have been important for the existence of diversity around us, see figure 20.

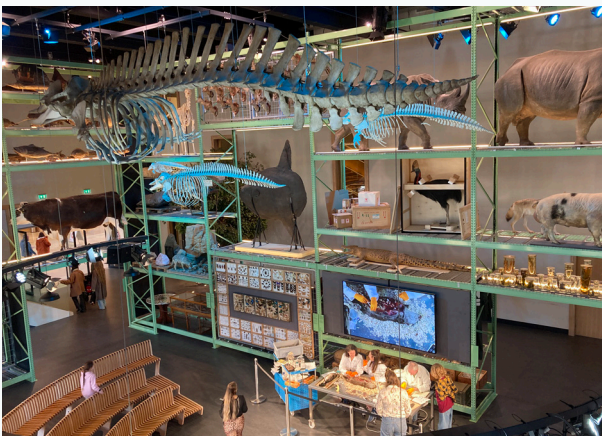


figure 21. 'livescience'

'LiveScience' makes it possible for visitors to meet researchers and collection managers, who are able to explain the work they do, see figure 21.



figure 22. 'hall 10'

'Hall 10' is a hall for temporary exhibitions, see figure 22.



figure 23. Naturalis museum

2.5.3 Visitors

The museum shifted from a museum for everyone, to a museum for families, about 8 years ago. Families, existing of parents or grandparents with children (4-14), which means that all exhibitions need to be engaging for all those ages. Nonetheless, there are many other visitors as well, such as couples and elderly.

Personas

Two different personas (Motivaction, 2021) that translate needs and wishes from visitors are created as guidelines for creating new content or exhibits for Naturalis. The first persona is called 'Johan en Anneke'. It resembles families that already have a fascination for nature and want to learn something new. It is not needed to try to pull these towards the museum, they will visit the museum, nonetheless. The second and last persona is called 'Frenk en Diana', which resembles a relatively new and small (only 10% of visitors) group of families that has a main goal to be entertained. In order to reach this target group and increase the number of visitors, Naturalis has chosen to create an experience based museum, and the exhibits are focused on both personas. It is recommended to bring nature closeby for Frenk & Diana, bring stories they are familiar with. For Johan and Anneke it is important to provide them with extra information on nature, a deeper level.

Reviews

Through online google reviews, there can be found many opinions on the museum. The points of improvements and valued aspects can be interesting to take into account during ideation. The museum is seen as mostly fun as a family. The diversity, greatness and amount is appreciated and there is a lot to learn. It is exhibited in such a way that it captures imagination. In contrast, visitors notice that there are less interactive installations compared to the earlier museum. They think this is a

pity because they like to discover and do things themselves. Next to that, the depth, storytelling and consistency is lacking at some points.

2.5.4 Biodiversity Crisis in Naturalis

In order to see what solution to implement within the museum, first is looked at the current role of biodiversity crisis within the organization. Crises such as climate and biodiversity is something that is increasingly being adopted into the organization and is tried to convey to its visitors.

Naturalis describes biodiversity as follows: 'all life is dependent on other life. That is called biodiversity. Biodiversity stands or falls with us. Because if plants and animals disappear because of us, we can also protect them. And we are currently just in time to do that.' (Naturalis, 2023).

Naturalis uses the tower of life, as a metaphor to explain the general concept of biodiversity, see figure 24. All individual jenga blocks represent objects within biodiversity. Once you take out one jenga block, it gets more unstable. And at one point, the entire tower collapses. It is not predictable what specific block would lead to a collapse, as Bart Braun explains, employee at Naturalis.



figure 24. Jenga Tower that is used to explain the concept of biodiversity

Website

There is one webpage within the Naturalis website about biodiversity and the relation to human activities. One piece of text explains the definition of biodiversity and its relevance, see figure 25. Visitors of the website are called up to action. This is done through a magazine with tips on how to contribute to biodiversity. There are call-ups to join national actions such as the event for counting bees. There is a biodiversity helpdesk which gives you the opportunity to ask questions. Through stories you are able to read about biodiversity. Lastly it shows the collaborations with other organization. The website is not focusing on children from 4-12, yet on elder people. Therefore they miss a part of their target group.

App

Naturalis has an app, see figure 26, where tours are promoted so visitors can explore how we as humans have an influence on nature. The tour can be done within the museum and guides you through exhibits. Through questions, the visitor is being stimulated to discover new information. It focuses on the entire family and can be an addition to the museum visit.

Museum

The main goal of the museum is to astonish visitors and make them fall in love with nature. This is purely done in a positive way. Purely in an implicit way, the biodiversity crisis is shown in the museum. This can be seen in the hall evolution (information on snails), and in the hall 'Death', where the Dodo is exhibited and a bumper with insects that died.

Education

The education department educates school classes in the museum following specific guidelines. (Naturalis, 2023). These have recently been elaborated with a sixth element: 'action', see figure 27. From now on, programmes will focus on action as well, in other words, child-

ren from schools are supported in how they can take action for biodiversity.

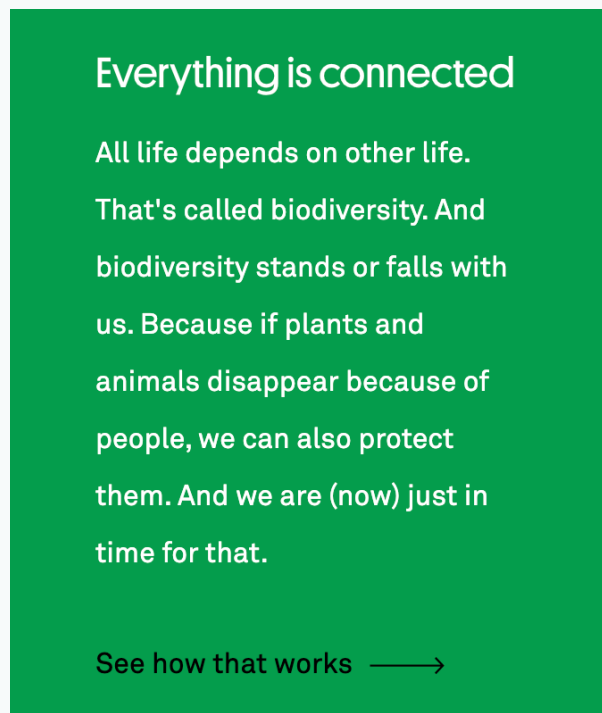


figure 25. screenshot of website

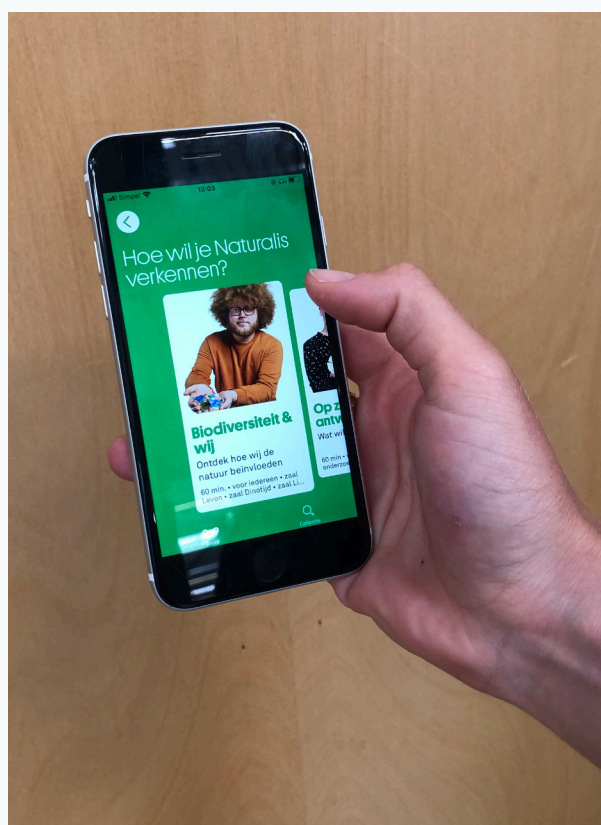


figure 26. app of Naturalis

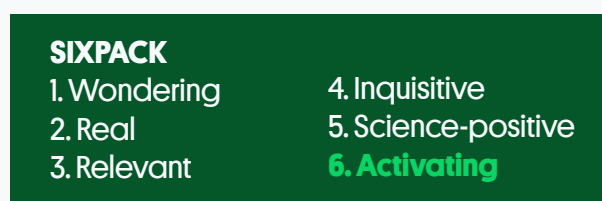


figure 27. sixpack of department education

2.5.5 Opportunities

Method

To get closer to a design that fits the organization, a co creation session, see figure 28, was hosted to bring together multiple perspectives and knowledge, and to involve stakeholders by taking along their beliefs and opinions. Appendix B5 shows details. Participants are colleagues from departments of education and exhibitions, n=8, originating from the Netherlands, 1 intern, 2 employees who work for 1 year, others for more than 5 years. The goal was to find out how Naturalis wants to address biodiversity crisis and to work upwards ideas on transformative experiences.

Protocol

The session exists of two parts, each part during one hour. Employees are brought together in a workshop hall in the museum. First a definition on biodiversity crisis is asked from each participant to create one definition that is used throughout the workshop and

to bring everyone at the same page. Then is brainstormed on the message to spread on this topic, to create one representation of Naturalis. Then, four groups are created that all come up with examples where biodiversity crisis can be seen in the world, and map this on an axis from individual to worldwide. These examples can serve as a base in the final ideas. In this stage, the focus on insects was not chosen yet. Within the same groups, there is brainstormed through HKJ, see figure 30, on topics that are linked to the transformative experiences: for example, how to create awareness, how to initiate reflection. Insights from these questions are connected to the target group of families, figure 32. Finally, participants are asked to combine HKJ's with examples of biodiversity connected to create several ideas that are fitting the target group. These ideas are presented to each other. Aspects from these ideas are taken along into the design phase.



figure 28. co-creation session with Naturalis employees

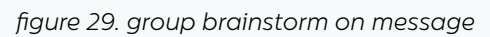
The session led to a mind map on the definition of biodiversity crisis and the message to spread, see figure 29. Also, idea cards, figure 31, are created.

Together the following definition is created for biodiversity crisis: through human activities there is a decrease in nature which is critical for the existence of human beings.

- connectedness:
humankind is responsible for the decrease of biodiversity and balance should be maintained.
- taking care:
we should care for nature because of its fragility and our dependence of it.

The ideas have certain aspects that can be interesting to take along to the design phase:

- future prospects
- show consequences
- show connectedness
- together maintain something
- influencing a situation
- gathering points
- compete for highscore
- confront with dead animals or causes of the problem



The word biodiversity crisis is barely used through communication channels. It is mainly about showing the importance of biodiversity and explaining ways how you can contribute to preserving it. In line with that, throughout the museum there is very little exhibit content on the biodiversity crisis.

The final design should fit the organization Naturalis and its vision, which is partly described in the strategic plan.

Naturalis really believes in the strategy of astonishment and does not want to differ from that very sudden. Naturalis does not want to confront their visitors too much with negativity and wants to bring the visitor a fun day out.

Naturalis wants to motivate visitors to act on the problem.

It is advised to start at the beginning of the transformative steps, awareness and reflection, especially because they have nothing on biodiversity crisis in the museum. In a later stage or through educational programmes they can also focus on inspiring and motivating for action.

key insights



figure 32. combining insights

2.6 Target Group

The target group are families with children between 4 and 12. This paragraph explains how this group is characterized, their preferences are described, their current relationship with biodiversity and its crisis. For researching this target group there is a focus on children only and on families as a whole.

2.6.1 Children

One of the goals of the assignment is to design for play and learning in the context of a museum. It is chosen to only focus on how children like to play and learn. To learn more about their preferences, primary schools are visited and primary school teachers are interviewed. At the same time the connection between children and biodiversity is explored.

Method

It is explored in which way children like to play. This is done through hosting a co-design session with children in a school class. Details on the session can be found in appendix B4. Through their ideas can be seen how they would design a playful museum experience. To arrange such a session, a primary school teacher is contacted, which is an acquaintance of a Naturalis employee. She teaches at a primary school in Gouda. This school is visited, and a session is held with a group of 20 children with ages from 9-11 and took 2 hours.

Two primary school teachers are interviewed via conversations at a school and a semi-structured interview. One is interviewed through a phone call, the other is asked through online communication.

Protocol

For the co-design session, the concept of decrease of insects is explained to get across the urgency and goal of the session, see figure 33. After that, a

general discussion on game elements elements is organized where children were asked to explain their favourite game and also why, see figure 34. After that is asked if they memorize certain museum experiences they value. These group discussions are held to warm up the participants, make them understand the topic, create input and be able to create a game for Naturalis themselves in the end.

The children were asked to design their own game that they could play in a museum, concerning the topic of 'saving the insects'. In four groups, the children got 30 minutes to draw a game at one single sheet of paper, which they present to other children in the classroom, see figure 35. These presentations are voice recorded. The children were able to ask questions on the games to the other groups, regarding the rules or how it works.

The interviews with primary school teachers focuses at a two main themes: in which way is biodiversity and the crisis present in the classroom, and if it is present how is it taught, second in what way do children learn and how do they like to learn. These questions are asked to know how to connect to children's current knowledge and to create a transformative experience that is appealing to them.

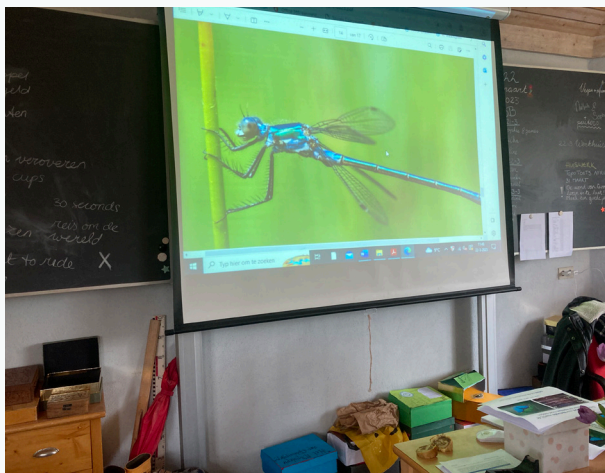


figure 33. presentation on decrease of insects

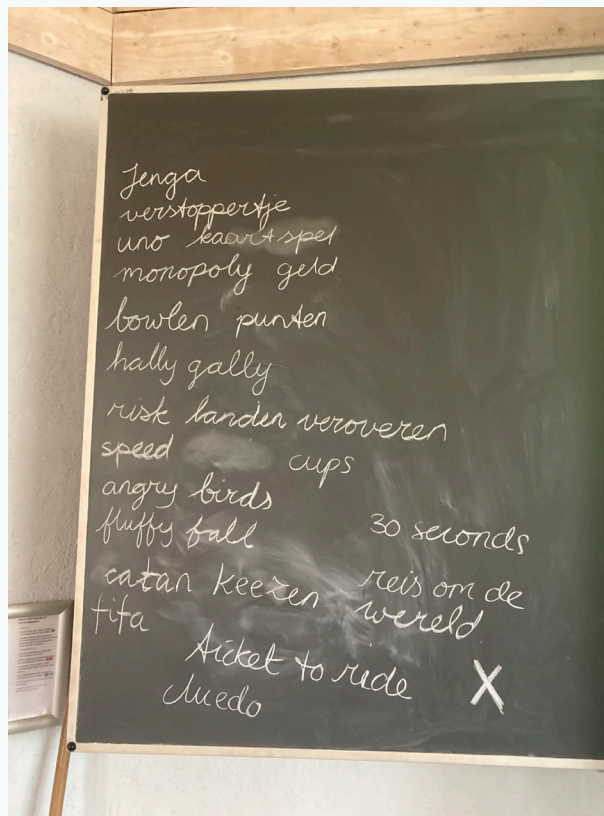


figure 34. valued games



figure 35. created ideas

Results

Insights from interviews from both teachers are placed side by side to find agreements and differences. The ways through which children like to learn according to teachers are compared to the children's answers and clustered. Appendix B2 shows transcripts of interviews.

At primary schools, the topic of nature is a required subject, only the school or teachers can decide for themselves how it is taught. It adapts to the interest of the children in the classroom. It can be addressed either thematic, on weekly basis or spontaneous discussions occur in the classroom. Children like to discover their own natural environment, such as the forest in their neighborhood. They receive specific assignments to discover nature, with the goal to make them value nature.

They learn at best and like to learn in a practical way, so if they can experience it through a workshop or if you take them on an excursion. An expert explaining the topic is valued as well.

The topic of nature decrease, climate change or biodiversity crisis, is not a required subject, here it is also up to the school and teachers to what extent the topic is discussed. Teachers are asked about if they think it is important to bring this topic to their children. They think it is an important topic, especially to focus on the fact that it is because of us humans. Furthermore children know that there is a problem but they don't really realize it. This is also supported by the fact that children see other things than that they hear. For example they mention that there are more wolves in the Netherlands or they suddenly see an increase in birds. This contrast in receiving information and experiencing makes them feel confused. It can also lead to discussions in the classroom where teachers don't really know how to guide that. All children have different opinions on the topic. That is why

it is very important to bring it into practice and to really show the problem and make them aware. This can be done by for example going to the field and seeing that there actually only is a mono culture.

Conclusions

Below it can be found what is valued in museums and how children like to learn and play. From the created games, see figure 35, and earlier museum experiences, frequent called components are taken along.

Museums and Children

- interactive
- discovering
- sensory
- touching
- videos
- challenges
- exploring
- real objects
- scavenger hunt

Learning and Children

- seeing and touching real object
- workshop
- listening to someone
- field trip
- with the body
- quiz
- playing

Play and Children

- velocity
- earning something
- competition
- collaboration
- variation
- recognition
- avatar
- interactive
- sensory
- using the body

2.6.2 Families in Museums

Family Visit

From research from Lyn Dierking, it was found that generally families visit a museum for about 1-2 hours, and this visit also follows a few phases.

Phase 1. orientation

This phase takes 3-10 minutes where families orientate, think of activities as buying tickets, finding out what to do, looking for a map, see figure 37.

Phase 2. Intense Exhibition viewing

This phase takes around 25-30 minutes. Families, familiar with Naturalis, will go to specific exhibitions, where newcomers have the need to discover the entire museum. Within this phase, families are most focused on the exhibits by carefully read, interact with exhibits and each other and converse.

Phase 3. Exhibition cruising

After these two phases, families tend to get tired and specific focus gets lost. New visitors still want to see the entire museum, but tend to get more critical on where they stop. This phase can last 30 to 40 minutes.

Phase 4. Leave taking

The museum visit is ending and visitors are preparing for leave. Some stop at the gift shop or visit the restaurant again.

Naturalis

Research from Motivaction shows that the average visit to Naturalis takes up about 3 hours. (Motivaction, 2021). The general walkthrough of Naturalis follows a similar: orientation, buying tickets at the ground floor, to live science to discover new research, figure 36, to follow up to the main halls, to leave and probably hop by the shop or restaurant at the ground floor again.

Some differences can be named, between the two Naturalis personas. Johan and Anneke would visit almost all halls.

They would read information at the signs to learn in the intense exhibition viewing phase. They value livescience higher than the average. Frenk and Diana want to see the entire museum visit all the halls (Motivaction, 2021). They are most excited for the entertainment and 'to do' halls, such as dinosaur era, life and rexpérience.

Location

The second phase, intense exhibition viewing, will be the phase to focus on, since biodiversity crisis is a topic that needs attention. Therefore it would be best to locate the exhibit somewhere near the start, hall 1 or live science, the suggested start of the visit.



figure 36. livescience 'start here'



p verdieping
oor

9

Café & terras

Cafe & balcony



Toiletten

Toilets

7

De verleiding

Seduction

De dood

Death

5

De ijstijd

Ice age

De vroege mens

Early humans

Evolutie

Evolution

Werkplaats Toen

Workshop The past

Werkplaats Ontwerp

Workshop Design

Koffiehoek

Coffee corner

Picknickruimte

Picnic area



Toiletten

Toilets

3

De aarde

The earth

Dinotijd

Dinosaur

Rexperie

Rexperience



Winkel

Shop

Toiletten

Toilets

2

Werkplaats Nu

Workshop The present

Auditorium balkon

Auditorium upper circle

Auditorium

Auditorium

Servicebalie

Service desk

Restaurant

Restaurant

Winkel

Shop



Garderobe/Toiletten

Cloakroom / Toilets

Uitgang

Exit

De tribune / Atelier / Garderobe groepen

The stands / Atelier / Cloakroom groups

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Volg interactieve tours en ontdek van alles
over onze collectie. Zo haal je nog meer uit
je bezoek!



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and get even more out of your visit.

figure 37. family finding their way
through Naturalis

2.6.3 Families interest in Naturalis and biodiversity

Method

A) Observations in the museum are done to find out how families walk through the museum and experience it, with random and invited families. Since the design will be an interactive installation, during observations there was a focus on what causes interaction within the museum to derive elements that can be useful for the final design. During observations it is also talked to three people from visitor support, people that provide visitors of information and help through the museum.

B) There is done a context mapping approach with sensitizing materials, see figure 38, and semi structured interview with in total five families. Details can be found in appendix B6. The sensitizing is done to see what the current experience and knowledge is of the families. The set up is based on research from Hanzehogeschool Groningen. (Pauwels et al, 2018). These families are recruited via own acquaintances. There is a focus on three areas:

- how Naturalis is experienced
- in which way families are connected to biodiversity in their daily lives
- confrontation on biodiversity crisis

Answers are written down, photos are taken during the interviews.

C) A test with families on how to confront with biodiversity crisis has been done in the museum. It aims on random families, with a focus on families with kids from 9-12. In total 18 groups of visitors are spoken to. The goal of the conversations is to learn what information on the biodiversity crisis triggered families and what they are specifically interested in to learn more about. Appendix B3 shows materials that are used for these interviews.



figure 38. observation of family

Protocol

A) Invited families are observed at the beginning of their visit, without guiding them where to go, figure 38. On top of that, two half days are spent on observing random visitors and talking to visitor support. This is done in all the halls in the museum. Observations and insights from interviews with visitor support are written down.

B) In total five families are asked to visit Naturalis and walk through the museum, where they are asked questions through interviews. All families are provided with a sensitizing booklet. The first two families are welcomed to Naturalis, asked to fill in the consent, observed for first half hour, and interviewed afterwards with sensitizing materials. For the last three interviews, the set up has been iterated on, since it was concluded that the minimum age to have a conversation with a child on biodiversity, is nine. Furthermore, it was noticed that it was too difficult to suddenly bring families into the topic of biodiversity crisis. There was a lack of a starting

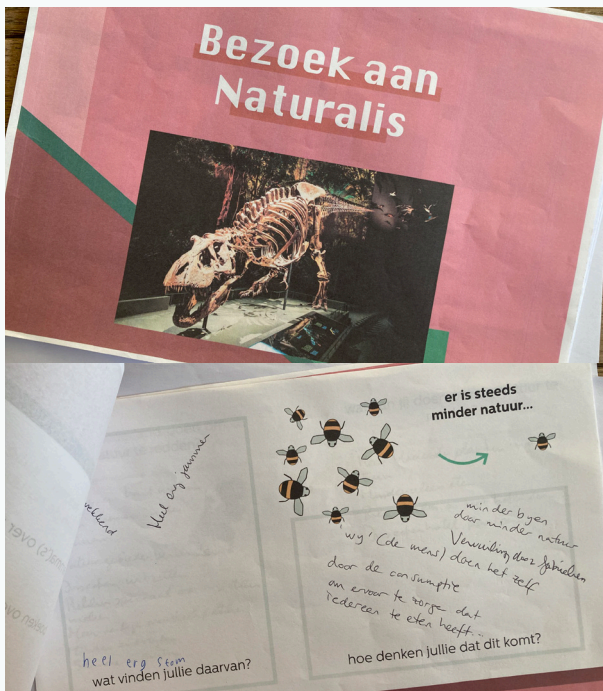


figure 39. sensitizing materials



figure 40. part of exhibit in hall 'death'



figure 41. interviewing families



figure 42. interview with family

point to open the conversation, despite the sensitizing. This is solved by looking for a location in the museum that is in some way connected to biodiversity crisis, which has been a challenge. One of the few locations that was suitable can be seen in figure 40. It is chosen to bring families to the hall 'death', where one exhibit goes in depth on the death of insects that encounter cars, see figure. Also, it was seen that directly asking questions during the museum visit is a better way, see figure 41. Therefore the families are interviewed during the visit on top of afterwards, see figure 42. After the interview, families are thanked for their participation and provided with a present.

C) The conversations in LiveScience, see figure 43, are supported through trigger materials. On two different areas the visitor's opinion is asked. First of all, five posters with different information on aspects of biodiversity crisis, from closeby to far away, are hung up on the wall. Secondly, four cards with information on the extinction of bees are layed down: causes, effects, current solutions, solutions, see figure 44. Families are asked which poster touches them the most and which bee card they would like to know more about.



figure 43. live science hall

Results

First the insights from interviewing families are clustered and after that combined with the insights from observations and conversations in the museum. The main points are described in the next paragraph and are supported with quotes. The green quotes are from contextmapping interviews, the red ones from conversations with visitors.



figure 44. interview set up in live science

Conclusions

The age of 9–12 is suitable for the topic of biodiversity crisis. It is old enough to understand what it is about, and young enough to learn in a playful way and still being agile and open for new perspectives and change. Despite the choice for 9–12, the design will be implemented in the museum and be experienced by younger children as well, which is something to take into consideration during ideation. They might not understand the core message entirely, but should interact with it in a way they are still entertained.

Families current Naturalis experience

Families liked to do interactive activities in the museum together as a family. This is also seen during the co-creation session at a primary school. The 'Rexperience' is appreciated because you don't know what is going to happen, which gives a surprise effect. The binoculars in hall 'iceage' stimulated a conversation between family members because they could together look at something and discuss that.

The Rexperience was a surprise what was going to happen, this made us connect as a family
– Mother

Families like to discover and explore within the museum, for example open drawers, smell scents, and feel elephant skin. To get even more excited to discover, it would be nice to receive something at the end of the museum visit.

If the kids can earn something like a certificate, they are more invested
– Mother

Especially objects from nature they recognize are valued

Have a look! These are stones that mum has at home – Child

Hey it is a capibara!
– Child [f3]
They recognize it from memes
– Father [f3]

Furthermore it is appreciated to feel real objects, because that is something you can normally not do, figure 46.

I like to see the inside of the animals, because that is something you don't normally see
– Child

Overall, families agreed on the fact that there was a lack of depth within the exhibitions, despite all the written information. Reading is something that most of the families did not do, since it takes too much time. The fact that there are too many objects exhibited makes families feel uninterested and confused about where to focus on.

I saw lots of books, why are they in the museum, that would take way too much time to read
– Child

The kids run through everything and don't carefully interact with the exhibits. They have to get access to information in another way than text

The content is interesting to them, however at the point they want to know more, they don't know how to acquire the information. Therefore, when there is an interactive lecture, this raises families' interest because this gives more depth. The storytelling was also something that can be improved; families did not see a coherent story between the halls. All families agreed that the museum could be more interactive.

We want to do more interactive stuff: more activities and games!
– child

Connection to biodiversity

The sensitizing booklet and interviews explored the relation between families and nature. Families like to explore nature, the diversity and amount of all objects. They visit nature in their neighborhood to explore, discover, play, rest in nature. Children are interested in animals that they know from the environment, see on television, read about, have at home, have inspiring functions. Animals such as panthers, lions are highly appreciated because they are seen as beautiful.

I don't want the butterfly to go extinct because it can fly, and I think that is cool

- Child

During interviews, instead of 'biodiversity', the word 'nature' is used, since it was assumed that 'biodiversity' is not known among children.

Children know that there is a decrease in nature, they hear about that in their environments. They also know that we as human kind are partly responsible for that. Things such as urbanization, CO₂ emissions, overpopulation are mentioned. They are not directly aware why there is a decrease in the diversity, that stays relatively abstract. It is hard to notice or see it.

I think it is bad that there is a decrease in nature, but I don't notice it myself

- Child

For adults it is more concrete to see differences in time.

I notice a decrease in butterflies over the last years, there are less and less in my garden

- Adult

Families know that protecting nature is important to ourselves, because 'trees give oxygen', and without that we can not live. If the function of the natural object is important for us as humans, some families agree that it is more important to save those. For example the bees, families are aware that they are necessary for our food production. Families can also name some solutions to protect nature, such as eating less meat, less stones in the garden, planting trees, cycling instead of using the car and protecting the animals.

Some families think it is important to discuss the topic at home. For others, the topic is discussed at home when there is a trigger such as a tv spot, or if there is an environmental disaster such as a flood. If the children have heard about it at school, it can also be a conversation starter at home.

For example when there is a flood at Sao Tome, we explain the children what happened and how

- Mother

The importance of preserving biodiversity within Naturalis is also asked of families. They were astonished and also confused by the fact that so many researchers work on the preservation of objects every day, see figure 45.

I don't understand why you have to save so many lady bugs

- Child

Parents think that it is important to show research and all life on earth. Kids mostly think it is for entertainment purposes by showing cool nature or they do not specifically know why it is exhibited.

As earlier mentioned, insects are under-represented and less popular among many people, it is harder to identify yourself with an insect. That they are small also contributes to that.

I am more sad if one rabbit dies because of a car, than if 1000 insects

- Child

I think the dead flies on a car are dirty

- Father

Perspectives on the species of insects are very diverse. After presenting the fact that 75% of biomass of insects has gone lost over the past 30 years, discussions between family members arose. Sometimes the importance of insects is not entirely clear among families.

Those insects can die, they are annoying

- mother

No mom, but insects are important to us

- child

In other cases, adults were actually aware of the importance of insects, specifically for ourselves.

If the insects are gone, the rest will follow and disappear

- mother

I think it is important to save insects because I want to eat my apple in 20 years

- father

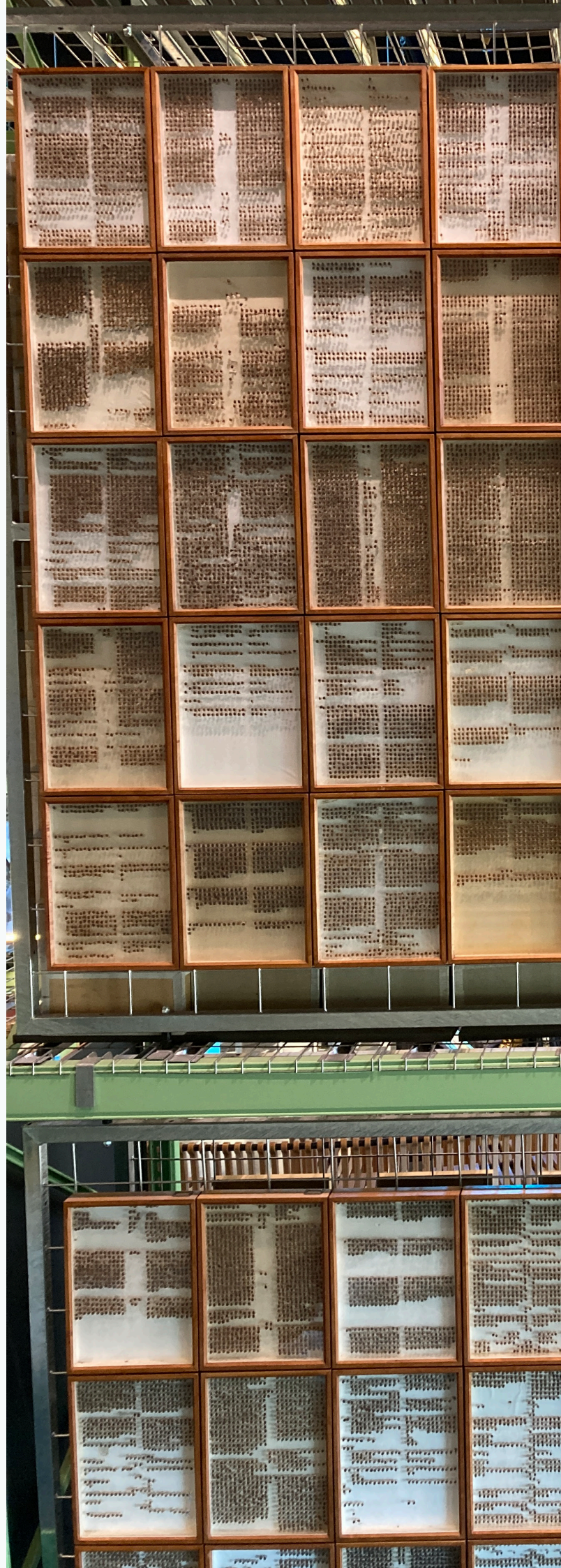


figure 45. thousands of lady bugs

Confrontation with biodiversity crisis

All families agreed that they could not find anything on the biodiversity crisis (nature decrease) within the museum, with the exception of the exhibit on the Dodo. Families are asked how and if they want to be confronted with a complex and negative topic such as the biodiversity crisis. Most families agreed that Naturalis has to exhibit this problem of the crisis, see quote below on the page, with a few exceptions.

I am visiting a museum because I want to be entertained. I also visit the Rotterdam Film Festival to feel good, not to feel bad
- Father

Opinions varied on the right method to do this, from small interventions that relate to existing exhibits, to a new hall entirely focused on this theme. For example it is possible to give more information on the current state of the animals that are exhibited, yet also possible to create a new hall that completely focuses on the biodiversity crisis.

Important is that there is a good balance between a positive and negative message. Families want to know about the crisis, but at the same time want to walk away from the exhibit with the idea that there is something they can do. That gives them a feeling of autonomy and brings perspective.

However, the solutions that are suggested should be unique, new and feasible otherwise families get uninterested.

I expect the solution to be an insect hotel, but we already have one
- Visitor

Overall, families are interested in the bigger picture and the context. Now they see the objects from nature from history but don't know if they still exist, or what human influence is. This raises interests to the actualities, so a new exhibition on this topic would close the circle and bring handles to shape the future. Other families think it is important to educate their children on the protection of nature and that it explains how they can shape the future.

We want to know what the future looks like. We can change and shape it
- Mother

Families are interested in the causes of the problem, since it triggers curiosity.

I am interested in the causes for it, since it can still be everything
- Visitor

I think if you bring feasible and short-term solutions to the problem, I expect the visitors won't mind hearing about the biodiversity crisis'

- Mother



figure 46. child interacting with
Naturalis employee

3 **define the focus**

From the insights from research activities, a design focus is established, which is described in this chapter. Since insights on families are so divergent, three personas are created to be able to focus on one within the design phase. Finally, the design goal is presented.

3.1 Design Direction

Clustering, see appendix C1, all insights led to the following design direction:

Bringing families that visit Naturalis a recognizable aspect of biodiversity crisis by letting them **create** a situation together and see the **effects**

Causes and Effect

Families have expressed they expect more interactive exhibit in Naturalis. They like create something themselves. There is not so much interactive exhibit in Naturalis which leaves room. Showing causes and effects can be processed in an interactive way.

Recognizable

Following theory on transformative experiences, for creating awareness it is important to bring it closeby. Families get excited by objects they recognize.

Biodiversity Crisis

On biodiversity crisis families want to mostly learn about causes. If they are confronted with it, it should be mostly positive and in a way that they know what they can do themselves to solve the problem. This is in line with Naturalis' view: a mostly positive story with a perspective on how to act on solving the problem. From theory on behavior change was seen that the message should be mostly positive.

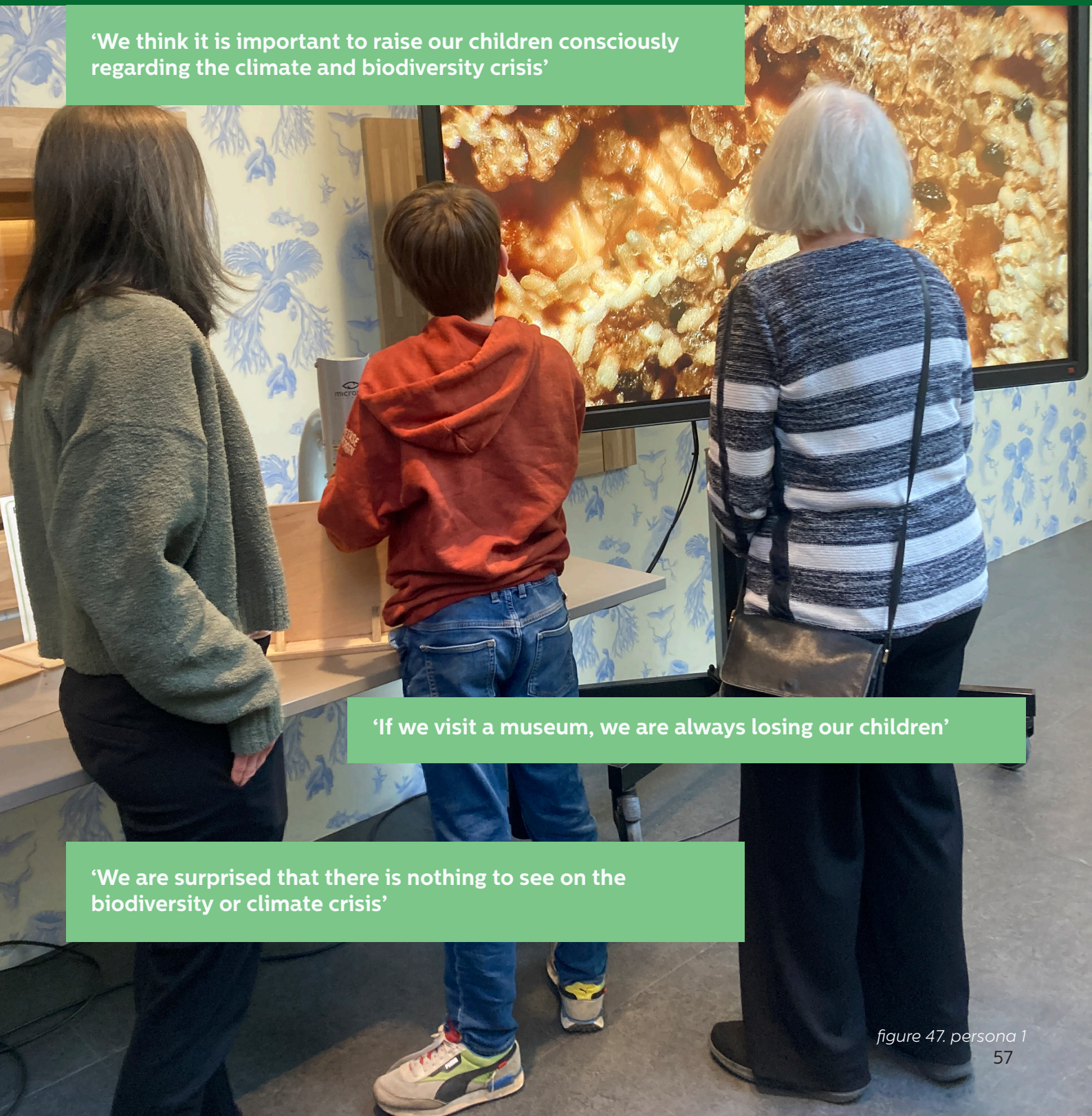
3.2 Personas

All insights from families are gathered and clustered after which three personas are created to show the differences between families and bring contrast. Personas are fictional characters that represent real people. They are based on data that is gathered during research. (van Boeijen, Daalhuizen & Zijlstra, 2020). It is used to simplify all gathered data and take certain input to focus on for the design. There are differences in current knowledge, experience of the museum, how they would like to be approached on topics, how nature or nature decrease is part of conversations. These personas, figure 47, 48 and 49, are an addition to the existing Naturalis personas and focus more on the biodiversity and crisis part; how they want to be confronted with it and in what way it plays part in their lives.

The first persona describes parents and children with an equal interest in nature and they discover the museum with the same intent. Most of the time of the visit they split up. Sometimes share what they see with each other. The topic of the biodiversity crisis is something that is discussed at home very often, since the parents think it is important to raise their children consciously. They also think it should be present a lot in the museum of Naturalis and really expect that to be part of it.

ECO EXPLORERS

'We think it is important to raise our children consciously regarding the climate and biodiversity crisis'



'If we visit a museum, we are always losing our children'

'We are surprised that there is nothing to see on the biodiversity or climate crisis'

The second persona describes a family where the children take their parents by hand and explain to them about what they see in the museum and what they know. Children learn about nature decrease at school and sometimes confront their parents with it. On the other hand, parents can be a bit hesitant about their children being confronted with complex and difficult problems in the museum and think that the museum should mostly be entertaining.

LITTLE LEADERS

'Shall we first go to the dinosaurs?' – Child

'These insects are important to us, mum' – Child

'I am visiting a museum to be entertained, also visiting the film festival to feel good, not to feel bad' – Father

The parents take the children by hand and explain to them about nature and the importance of it. They guide their children through the museum and enthuse them for exhibits. If there is a trigger such as a tv spot, the topic of nature decrease is discussed at home. The parents expect Naturalis to give more information about the decrease of nature, related to already existing exhibits.

NATURE NAVIGATORS



‘Look at the appearance of those insects!’ – mother

For example, when there is a flood at Sao Tome, we explain the children what happened and why’ – mother

‘I think if you bring feasible and short term solutions to the problem, I expect the audience won’t mind hearing about the biodiversity crisis’. – Mother

figure 49. persona 3

Conclusions

The personas are mapped out on a graph, see figure 50, with axes on ‘alone vs. together (while strolling through the museum)’ and ‘unconscious vs conscious (on the biodiversity crisis)’. It is most interesting to design for persona 2 and 3. Persona 2 is most challenging, since they are most unconscious about the biodiversity crisis. At the same time, children learn and hear about nature decrease anyhow, and will confront their parents with that at some point. This can lead to interesting conversations that can be enhanced through the exhibit.

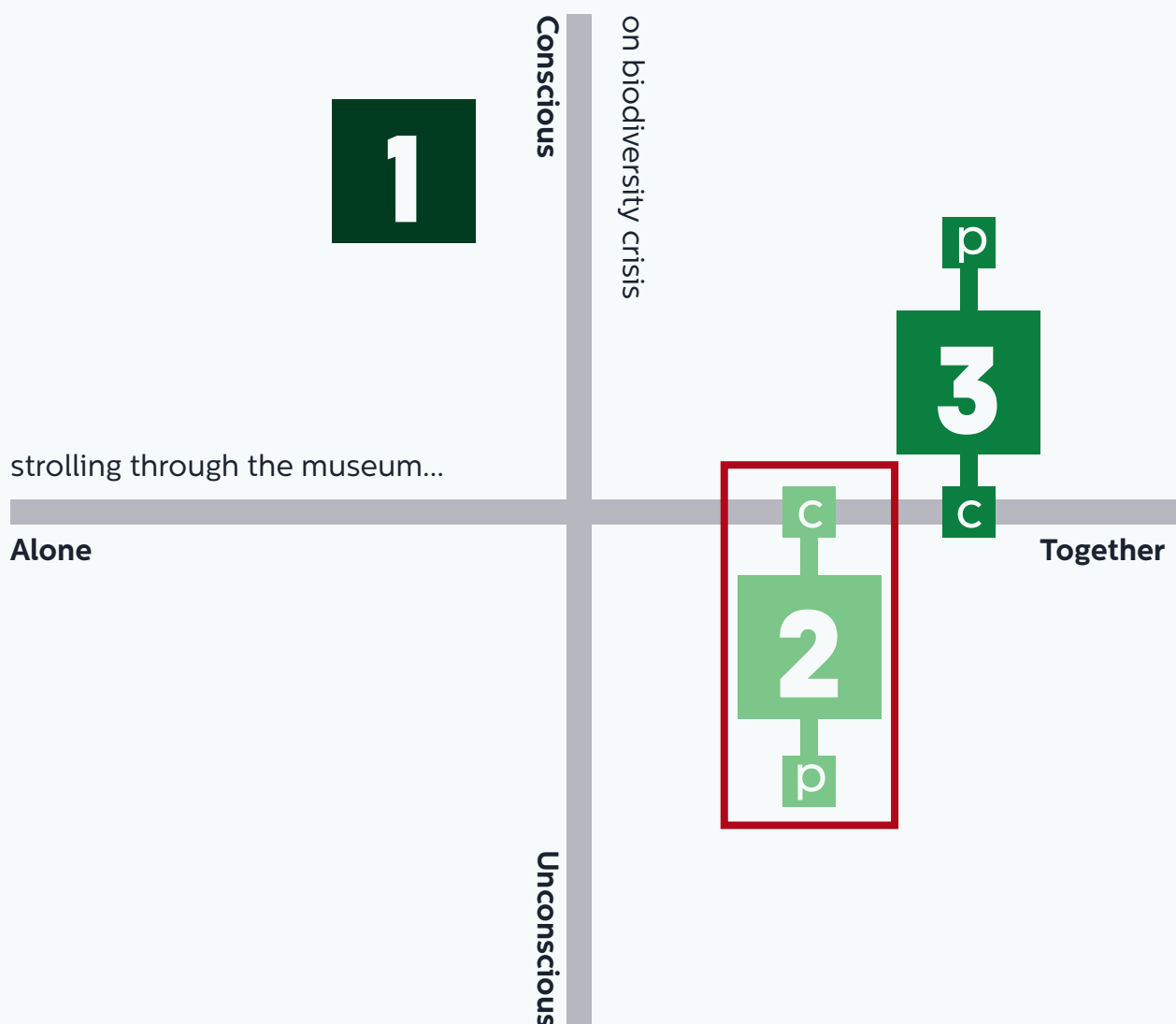


figure 50. graph on personas

3.3 Exhibit

An exhibit itself generally consists of two main elements: content and form. The content includes the storytelling. The form includes the appearance. An exhibit includes several steps, from approaching, to interacting, to walking away from it. This is discussed with employees from Naturalis from department exhibitions. It is chosen to define the content first where the form follows the content.

3.3.1 Journey

Figure 51 shows the steps that families follow when they experience an exhibit. These steps are discussed with employees from Naturalis. The interpretation of the steps are following the theory on transformative experiences and behavior change. The exhibit needs to attract families, that can be done through recognition and an appearance that is appealing to families. Once they are attracted, they can decide to interact with it. The problem is presented and there is room for reflection. The last stage, the take-away completes the exhibit in a positive way and can be the moment to remind families.

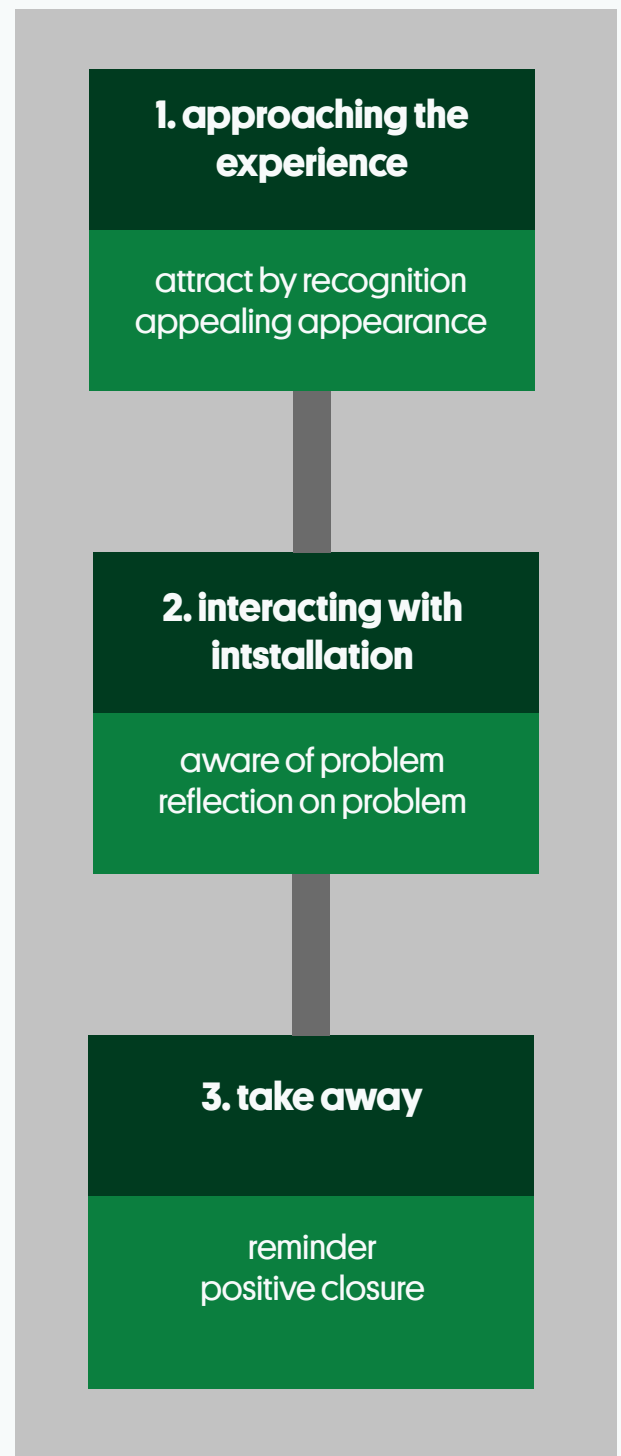


figure 51. exhibit walk through

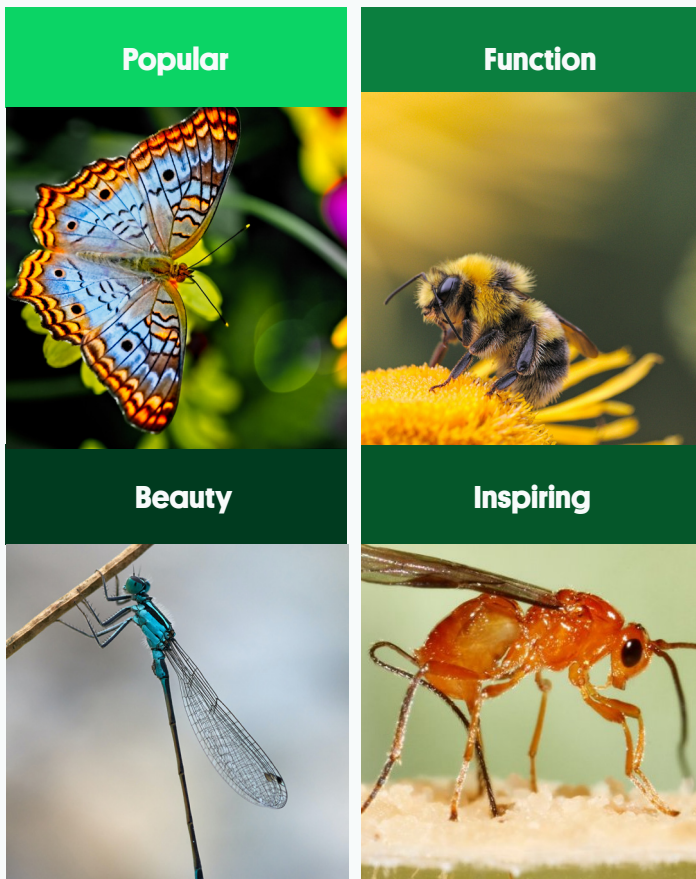


figure 52. ways to connect to the target group

3.3.2 Content

The topic of insects is a challenge, since it is not really close to people, yet interesting because insects are highly important for biodiversity and can not be forgotten, see chapter 2 on biodiversity crisis. There are multiple ways of bringing this topic to the families. In figure 52 there are listed 4 ways that can be followed. This is concluded from conversations with biologists that work at Naturalis, and Michiel Hooykaas who advocates to make insects more well known. It can help to focus on insects that are popular such as the butterfly or focus on insects that have a clear and well-known function to us (bee for our food production), or emphasizing the beauty of an insect (dragonfly). Or show insects that are inspiring, biomimicry.

The installation will focus more on the individual change to connect to families. Therefore the contexts such as the street, city, garden, balcony, schoolyard are interesting, see figure 53 for an example.



figure 53. context of a garden

To design a **playful transformative** experience in Naturalis where family members together **develop a deeper understanding** on the biodiversity crisis and **discover how to contribute** to biodiversity in their surroundings

3.4 Design Goal

The Goal

Deeper understanding on the biodiversity crisis means that they walk away from the museum with increased knowledge on biodiversity crisis; dependence, being part of the problem and solution, as human beings.

Secondly, discover on how to contribute to biodiversity describes how families actively find out about their role in this topic and what consequences are of their actions.

Achievement

In order to reach the goal of developing a deeper understanding, it is on the one hand needed to explain the concept of biodiversity: the interconnectedness between all living things; we need each other to have healthy ecosystems. Secondly, to further increase knowledge, it must be conveyed that humans are partly causing the crisis.

To foster discovery to contribute, the effects of human actions that influence biodiversity must be shown immediately after an action, negatively but also positively. This will eventually make clear what families can do at an individual level.

4 develop the solution

After conducting research and determining the design goal and its direction it is time for the design. This is done through several design methods, such as scamper, individual brainstorm and co-reflection sessions. Some testing has been done in the museum and interim insights are shared with stakeholders to get to a final concept, which is explained in chapter 5.

4.1 Design Approach

To meet the design goal, several design activities are carried out. Below this is shown in a general overview.

First of all, based on the focus of chapter 3, three initial ideas are created. These are used as a base for further ideation; they are brought to a class of children and also to biologists and designers who work at Naturalis. This is brought in a way of co-reflection.

The outcome of these co-reflections led to another individual brainstorm where all insights are combined into one mid idea.

This idea is brought into a brainstorm with co design students from the TU, with the goal to build upon the mid idea and go a level deeper.

From these insights, an exploration on existing museum techniques to see what the possibilities are by visiting museums, talking with Naturalis employees and previous museum visits.

Three possible options are brought to visitors of Naturalis to see which playful elements work best.

Exploration on techniques is done to see how it would work physically and is built to see if it is feasible.

Based on those insights, a cardboard scale model is build, which is brought to visitors in Naturalis in a co-reflection setting.

The completion of the playful element is tested with co students to define the guidelines of the exhibit.

4.2 Design Guidelines

Little Leaders

The focus lies on the Little leaders, which translates into design that mainly aims at children. Practically that means the **size** is important, **easy** to understand. Aesthetically it means it should be **attractive** to children and content wise it should be **recognizable**. The exhibit should be **interactive**, and have an option to **earn** something.

Naturalis

Guidelines for the exhibit are discussed with employees from the exhibition department to see what they prefer in the exhibit and take into account their advise. Elements within the installation should be **sturdy** since children are using it and often do not realize their powers. For example, the binoculars in hall 'ice age' often are out of use because they are broken. Furthermore, the experience must be **safe**. That means that it should either be an open experience, or there must be someone near the experience the entire time. Because of the importance of the topic, every visitor should be **able to join** the experience or at least see it. Therefore, an escape room or a group experience is not ideal, since this limits the amount of people. Loose elements within exhibits can be stolen or destroyed by visitors so ideally all parts are **attached**.

Figure 54 shows a collage that is the result of combining these guidelines.

4.3 Initial Ideas

4.3.1 Individual Brainstorm

There are three initial ideas that were derived from HKJ's on creating awareness and fostering reflection during an individual brainstorm session.

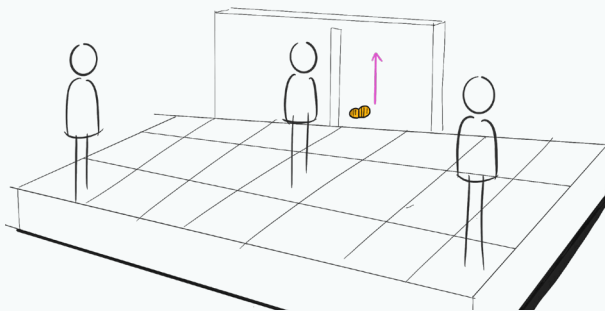


figure 55. idea 1

The first idea is in the context of a schoolyard, where families must turn around stones on the ground to make the bee go up in the graph; make it come alive, see figure 55.

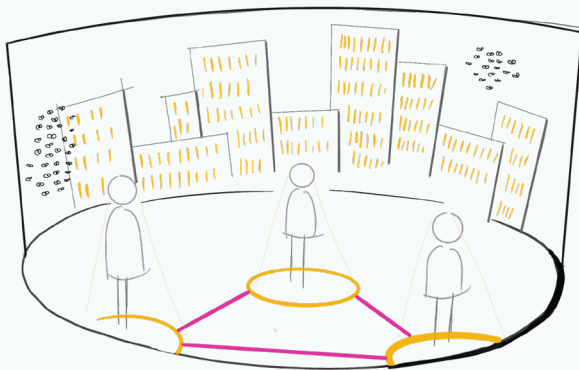


figure 56. idea 2

For the second idea, family members are 'the problem' themselves; they are light bulbs and they must eliminate each other. This will make the lights turn off in the buildings and make insects come in, see figure 56.

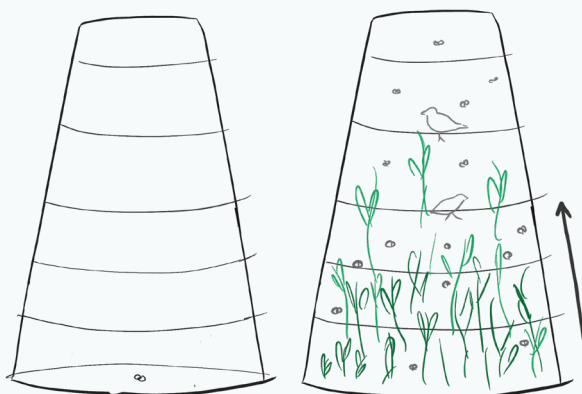


figure 57. idea 3

The final idea presents an insect that is barely alive, in a life size dome, where family members have to make it come alive and create a chain (insect, plants, birds), see figure 57.

4.3.2 Share the Ideas

School Class

A co reflection workshop has taken place at a primary school in Schiedam, group 6, ages from 8-10. First the project and design goal is explained in class, whereafter the children were asked to come up with an idea, figure 58, for an exhibit for Naturalis in groups of 5 to get a feel for the topic and to make them able to reflect on the ideas I present them. Lastly, the three initial ideas are presented classically to see what aspects they like and which do not.

The children mentioned they liked physical elements and being able to move those; to **create** something and **lose fantasy**. Also **seeing** a change or **effect** of an action is appreciated. Both **collaboration** and **competition** is valued. They liked being involved in the installation. The completion of the ideas was not yet clear to them. For example, if it is a quiz, what kind of questions? If you have to compete against each other, how does that work? And if the game is done, how does it get back to its initial state?

Insect Experts

The three initial ideas are also proposed to two insect experts Roy Kleukers and Jan Wieringa which mostly helped in choosing. They advised to choose an insect where its **function** is already clear. This led to choosing for the bee, yet another species than the well known honey bee, since it is important to show that there are many more species such as solitary ones. These are bees that look for food, find nests and lay eggs all alone. They also agreed that it is best to choose a problem that is as closeby as possible. That made them both choose for **the first idea** and eliminate the second idea.

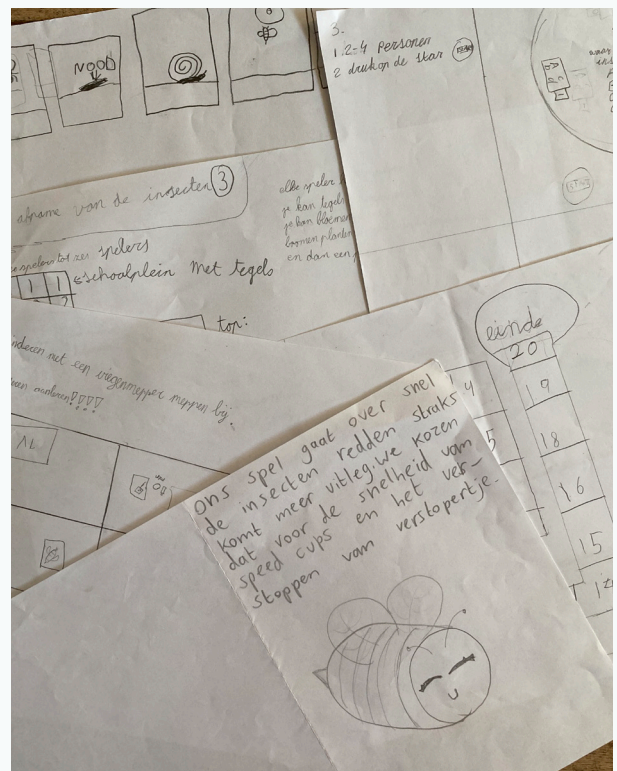


figure 58. outcome from co-reflection workshop

Within these solitary bees, **'Vosje'** is chosen, see figure 59. This choice is based on the list of the Bee Count 2023. (Nationale Bijentelling, 2023). It is chosen to take one bee to be able to create a bond between the animal and the visitors. By giving it a name, making it bigger, etc, chances on creating a bond increase. This is discussed with Loes Kreemers, behavior change psychologist.

From all input so far, a first concept is created, see figure 60. Within this concept, visitors approach a nearly alive bee. Through a quiz and answering the right questions, they have to make it come alive. Visitors are standing around the bee, which is placed in a big cone. In the ideal situation, so when questions are answered right, the bee rises up and other elements of nature appear to show the recovering of biodiversity.

Top 10 meest gespotte bijen in Nederland

1	Honingbij	11.198 x	6	Vosje	2.338 x
2	Gehoornde metselbij	6.594 x	7	Bijvlieg	2.070 x
3	Rosse Metselbij	6.257 x	8	Tuinhommel	1.573 x
4	Akkerhommel	2.906 x	9	Steenhommel	1.519 x
5	Aardhommel of Veldhommel	2.741 x	10	Sachembij	1.473 x



figure 59. top 10 most seen bees in the Netherlands, number 6: 'Vosje'

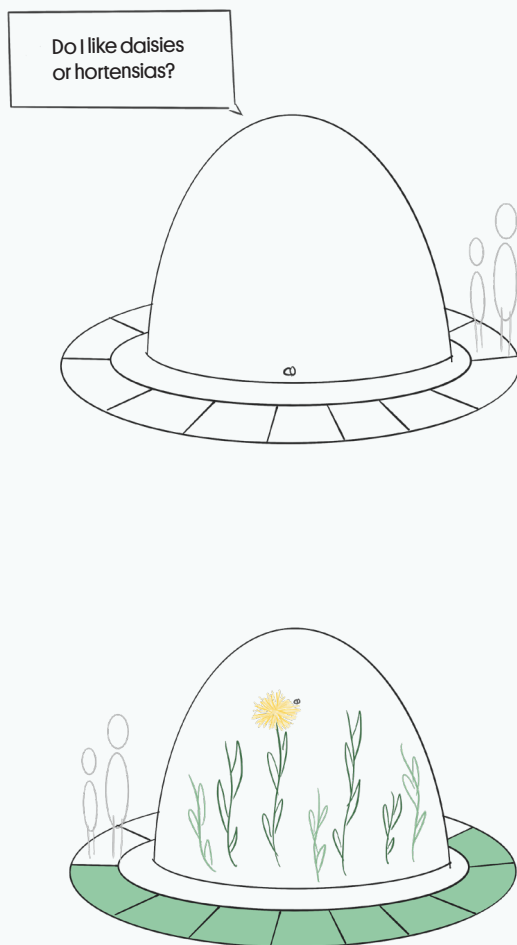


figure 60. idea that is brought to scamper brainstorm

The design direction gets more focus: families can create in a physical way, and see the effects of those actions in a digital way.

The story is about a solitary bee to enhance awareness on diversity of bees and to connect to the families.

Awareness on the problem is created by presenting a nearly alive bee.

Reflection is created by making families discuss answers on questions together.

The context where the story will take place will be the garden.

key insights



figure 61. brainstorm with fellow design students

4.4 Ideation

4.4.1 Brainstorm Session

The concept from figure 60 is brought to fellow design master students from TU Delft in a brainstorm session, figure 61. Appendix D1 shows the insights that are gathered. First, to make the participants get into the topic, a round of WWWWWH, (van Boeijen, Daalhuizen & Zijlstra, 2020), is initiated where they are allowed to ask all kinds of questions on the problem statement. After, several rounds of HKJ's are facilitated to think of ways to design for the problem statement. Lastly, the method of Scamper is used. Scamper is a method where an initial idea, is presented and in several steps is changed in the following order: substitute, combine, adjust, modify, put to another use, eliminate, reverse. The idea is that there appear new refreshing ideas that can be used again, (van Boeijen, Daalhuizen & Zijlstra, 2020).

The character that is chosen for the experience could possibly return at other locations in the museum to remind visitors and add to the storytelling. For example, the character could be sold in the museum shop. Images of the bee could be shown throughout the museum.

To attract visitors to the experience, there could be made use of sensory elements, such as sounds of bees when you walk by, or visuals of bees on the wall that go around a corner.

Regarding the physical part and creating, it could be more like collecting the right elements instead of a quiz.

The shape of the installation can be totally different than the cone idea.

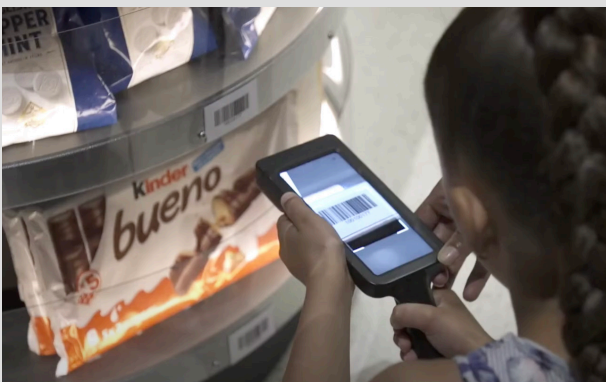
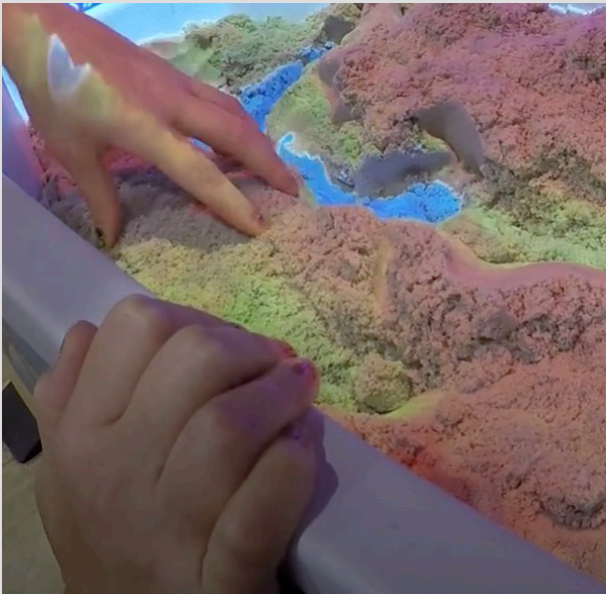
key insights

4.4.2 Realization Possibilities

After diverging different ideas to deepen on the first concept, see appendix D2, possibilities regarding existing techniques are explored, to get inspired for own design.

Physical

life size chess board / kinect / scanning



Several examples are listed below that are divided over two areas: creating and seeing effects, based on the design direction.

Digital

pepper's ghost / movie / projection

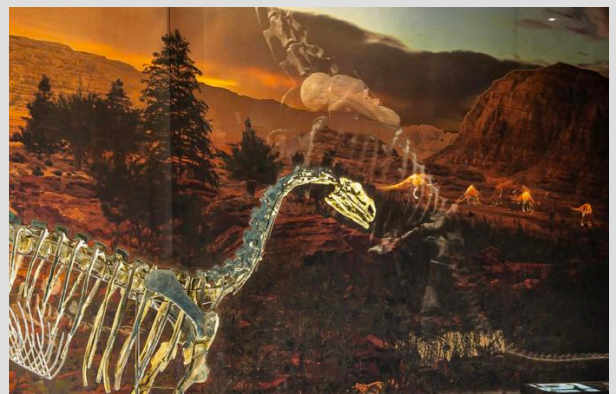
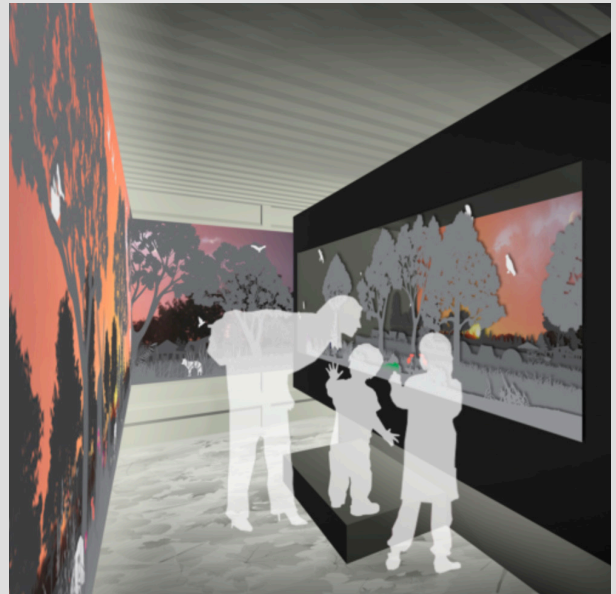


figure 62. existing museum experience techniques

4.5 Shaping the Concept

4.5.1 Validating the Concept

Physical

The first aspect of the concept to be validated with families, is how they can create. In total, 10 families are asked to join. They were given three options:

- a) quiz, figure 63. Daisies or hortensias?
- b) sliders, figure 64. Stones to wild.
- c) searching, figure 65. Selection of things to put in a garden.

Families were invited to join the interview, where they were asked to create the ideal environment for a bee three times. When finished, a video of a bee coming to life was shown. Afterwards it was asked what play element of the three is most valued and why. The interactions with the prototype are observed.

When participants are busy creating they do not look at, nor notice the digital video. The exhibit should be designed in such a way that the digital part also stands out.

The video of a bee coming to life was not rewarding enough. After making a choice, it should show an immediate effect, otherwise action is not clear.

The selecting part was most valued, since this gives most feeling of freedom.

Most kids immediately grabbed the swimming pool card. This was a starting point for conversations between family members.

key insights

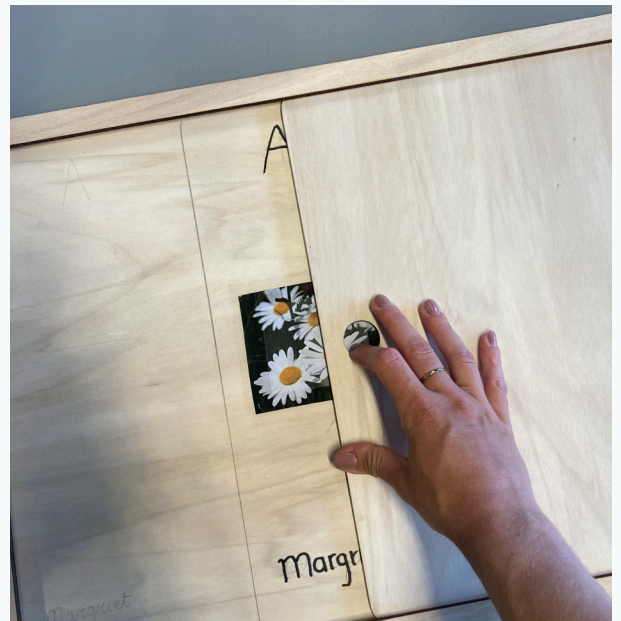


figure 63. test: quiz



figure 64. test: slider



figure 66. test: collecting

Digital

The effect of the choices that visitors make, so the part they see on the screen, is also first tested with fellow students. They were asked to select pictures they want to put in their ideal garden. The effects of those actions are shown on the screen, the bee can go one step in the wrong or good direction. The goal is to reach the middle green circle. In figure 67 can be seen the pictures that were to be chosen and the lay out on the screen.



figure 67. test with photos and Figma

From these tests was seen that it took a long time before to finish the experience.

It is about a balanced garden and not about the amount of elements in the garden. So, it is simplified to one step (either in the middle, or out), instead of 5 options.

key insights

4.5.2 Realizing the Concept

Scale Model

A scale model is built to create a combination of the physical and digital part. Families in Naturalis are asked to reflect on it and share their opinions. In total eight families joined. For the game to succeed, they have to select the three right elements that create a good environment for a solitary bee. There are 8 elements: tree, hortensia, roses, bee hotel, daisy, bench, grass and a hedge. Through the sticks on the front, families are able to flip elements upwards. If families finish, a video in the background plays, where a bee comes to live and pollinates a flower, see figure 68.

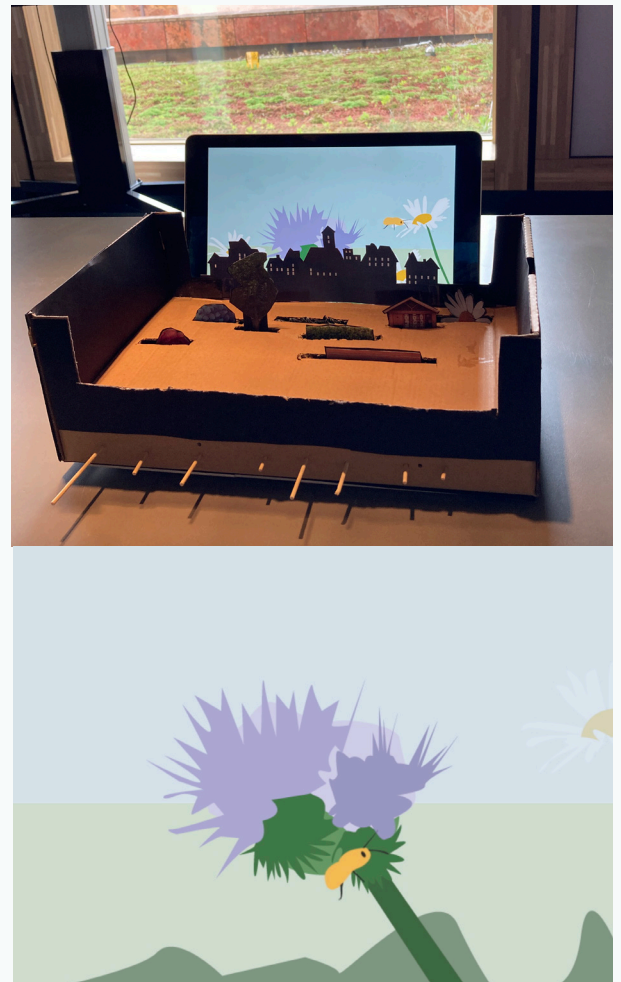


figure 68. test with scale model

Visitors would like to receive direct feedback on choices they make. Why is something good or bad? Families expected their choice to appear on the screen.

The animation should be more realistic and it must be clear what kind of animal it is.

The physical way of selecting elements is valued, the more elements the better.

It is currently not understandable without guidance, because there were no written instructions.

The game should be more about human and bees together, and creating a situation where both can live.

Only the effect of seeing a bee pollinating a flower is not fulfilling or exciting enough, since families do not have a bond with the bee.

key insights

Functioning

Physical part will be done through gears that enables certain elements to go up. These elements suggest parts you can add to arrange a garden, for example a daisy, see figure 69. With the pole, visitors can from a distance select an element to come up, see figure 70. This enables families to create a decor by themselves. Appendix D3 shows more photos on the development of the model.

Through animation, families can see information on their choice and also the effect. Each element is connected to a piece of video that is showed when the element is turned up. If the element is turned down, the piece of video changes again. The animations are shown on a screen that is positioned behind the physical part.



figure 69. gear



figure 70. mechanics

4.5.3 The First Concept

From the scale model, a first concept is created. It consists of a journey following the presented steps in paragraph 3.3.1.

Walk through

Families enter a poster with a character that is called 'Vosje'. It says: 'I am a Vosje, would you like to get to know me?'. Families can decide to follow the character and go inside. See figure 71.

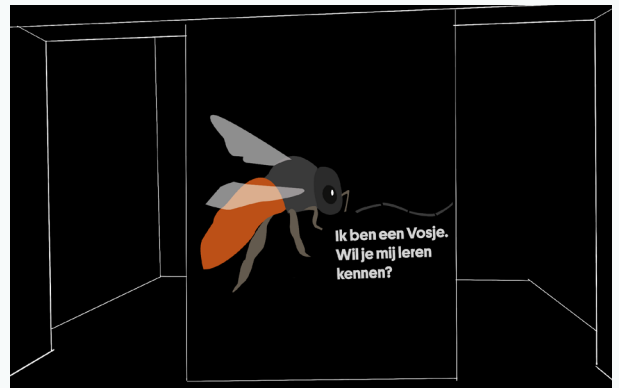


figure 71. step 1: approach

If they are attracted to follow the character and decide to go further in the experience, they enter information on solitary bees in the Netherlands and their importance through a poster. It explains there are 360 species of bees, and that 'Vosje' is one of them. That is lives alone, settles in hollows, and pollinates flowers. See figure 72.

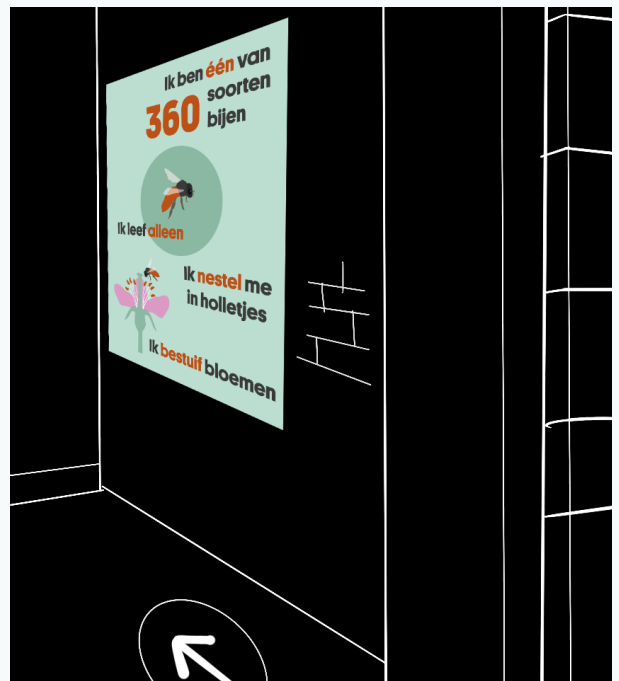


figure 72. step 2: information on bees

Families encounter the main part of the experience where they are invited to 'create their ideal garden where Vosje and family can live together'. They can choose out of 12 options that they can put in the garden. If they make a selection, they see the effect and explanation on the choice appear on the screen. They can explore for some time and discover how they can contribute to an environment where both human and bees can live. See figure 73.



figure 73. step 3: overview experience

After some exploration they walk to the last part of the experience where they can read about why bees are important and they can grab flower seeds that they can plant themselves in their personal surroundings. See figure 74.

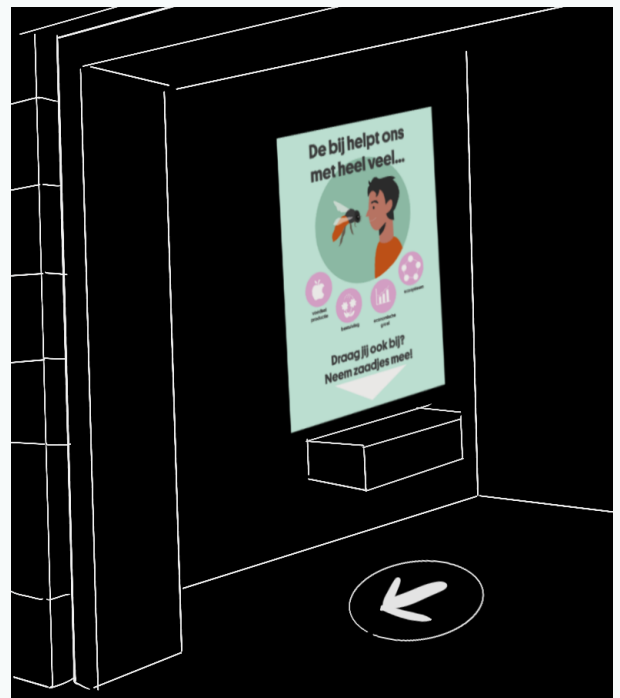


figure 74. step 4: reminder

Model

Visitors can turn the poles and choose for specific elements they want to put in their garden. There are 12 options to select from, which are chosen in consultation with biologist and research from

PNAS. (Kawahara A. 2021). The height of the poles are set on an average children's length. The wooden installation has to be put in front of a screen. See figure 75.



figure 75. inside of the model

The choice for the element, is also shown on the screen, to make extra clear that the physical output is corresponding to the physical choice. The choice is supported with an explanation. For example: 'a tulip is not good for a bee, it is often exposed to poison', see figure 76. Then the effect on either the human or bee is seen on the screen, figure 77 and 78. The goal is to create a balance where human and bee are both in the middle. This, to explore playfully how you as a person can affect a situation in the garden. They can get in the middle by making a right choice for a human or bee.



figure 76. explanation on choice

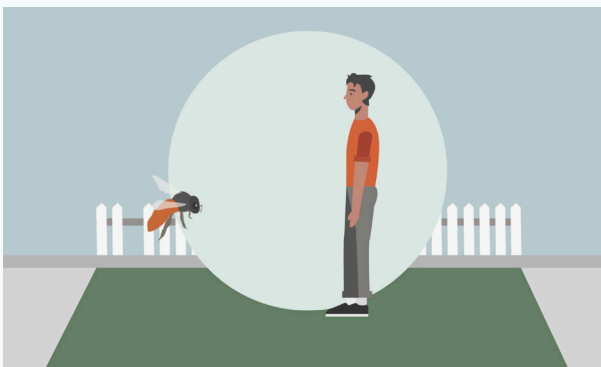


figure 77. optional screen

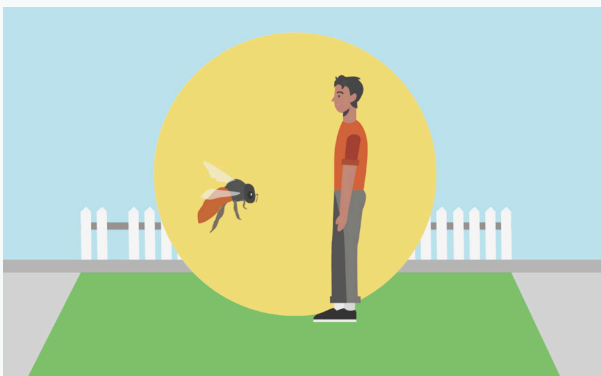


figure 78. game finished

Iteration

After discussing the first concept and prototype, see figure 79, with Naturalis and coaches from TU Delft, a few adaptations are made. According to Naturalis, the main message is not clear enough and the playful part is not rewarding and exciting enough. Usually for installations in the museum there is only one message and that is translated in a minimalized way: there is a title, instructions on use and a bit more in depth reasoning.

Furthermore, the interaction with the installation is also not clear without guidance, which is a requirement before testing it with families in the museum.

It is strived to align the physical and digital part, so to have them in same style to make sure that it is clear these are connected. This can be improved since for both are used different styles; organic vs. illustrator style.

Instead of four posters that inform families, it should be brought back to one poster to be more clear and create overview.

Adaptions should be made on the physical installation, such as adding wheels, arrows, clear instructions on use.

The playful part has to be made more challenging, which will be done through adding several steps.

The visual appearance of digital and physical will be more in the same realistic style.

key insights

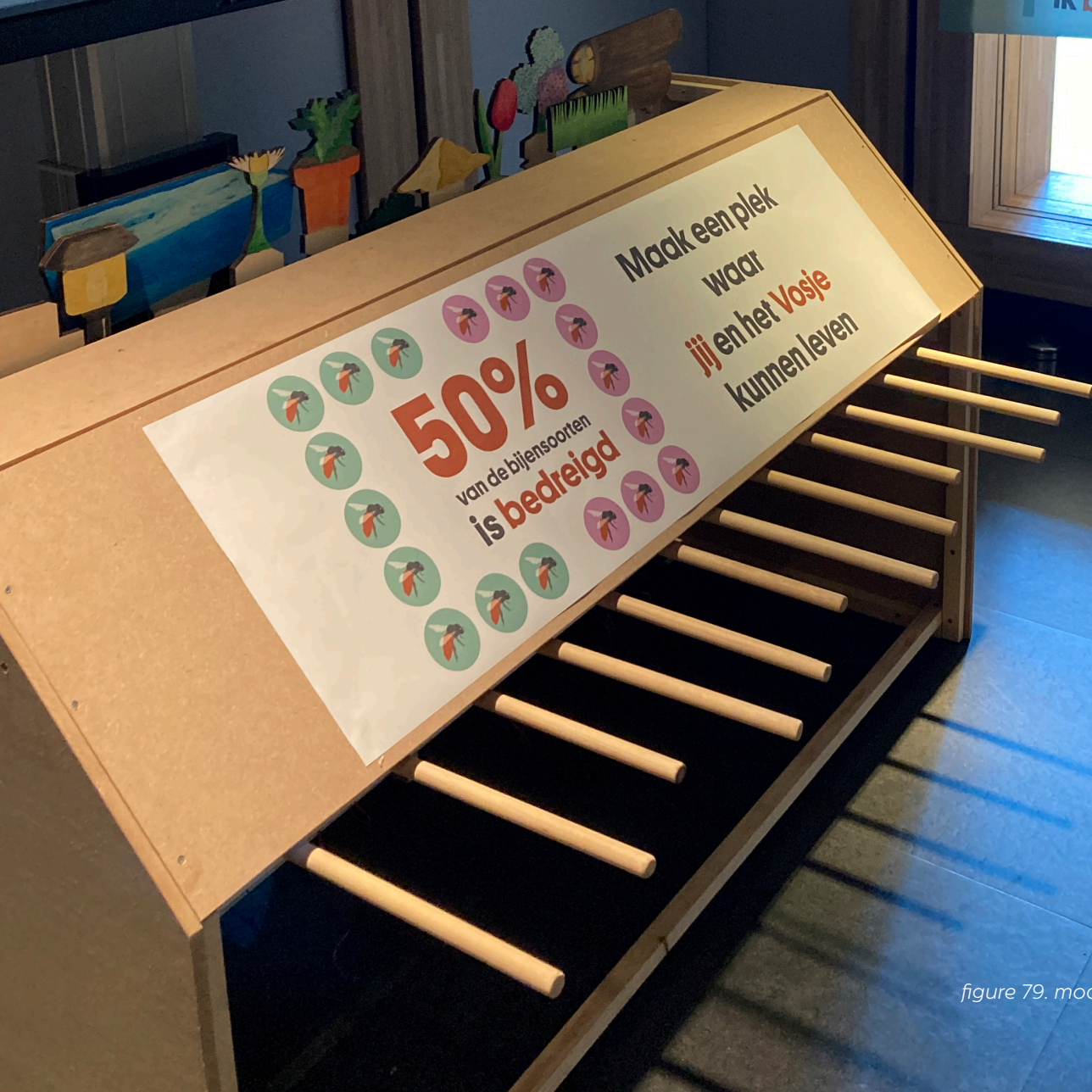


figure 79. model in the museum

5 the design

Within this chapter the final design that is derived from research activities, will be described. This is done through presenting the concept and its key elements and the storyboard which explains how interactions work. From the concept is made a final prototype that can be tested in Naturalis. Lastly the a possible way for implementation is explained.

5.1 The Concept

5.1.1 Description

‘Bijdrage’ is a playful transformative experience designed for Naturalis and their visitors. It is created to show families the concept of the biodiversity crisis, in a way that it is closeby and personal. It has the following message:

Insects we are dependent from are decreasing rapidly partly due to human activity, yet we can prevent that from happening by making the right choices.

It inspires families on how they themselves can contribute to a solution. This is accomplished by making them explore actions that they do and after show the effects of those and why.

The experience is in the form of a decor where families can create an environment of a garden themselves, that exists of a physical and digital part.

The name ‘Bijdrage’ has ‘bee’ in its name in Dutch and is translated as: Contribution, see figure 80 for the logo.

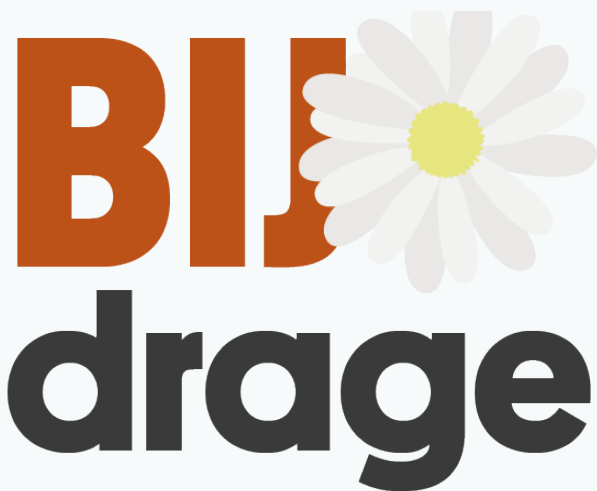


figure 80. logo of concept

5.1.2 Design Goal

The design goal is:

‘To design a playful transformative experience where families can together discover how they can contribute to biodiversity in their surroundings and gain deeper understanding on biodiversity crisis.’

Develop a deeper understanding on biodiversity crisis

Families are informed through a poster on the existence of solitary bees, diversity and the rapid extinction. Through the screen, it is showed that action is needed to create room for insects such as bees.

Discover how to contribute

Families learn through playful experience which elements create biodiversity. They have the freedom to create several situations and see the effects of those by making choices.

Own surroundings

The story is in the context of a garden which is recognizable for children and adults. As well as the bee Vosje, which is a species that lives in the Netherlands and can be found in gardens.

Playful

The goal is to bring a bee and a human closer to each other. This can be done through collaborating with the family and discussing on the right choices, in an interactive and physical way. There is variation, lots of options to choose, you can earn flower seeds in the end.

Together

It aims on letting children steer the wheels, which initiates interaction and being supported by the elder who can explain a choice by reading out loud and in that way help. The effects on the screen maintain a conversation, reflection moment between family members.

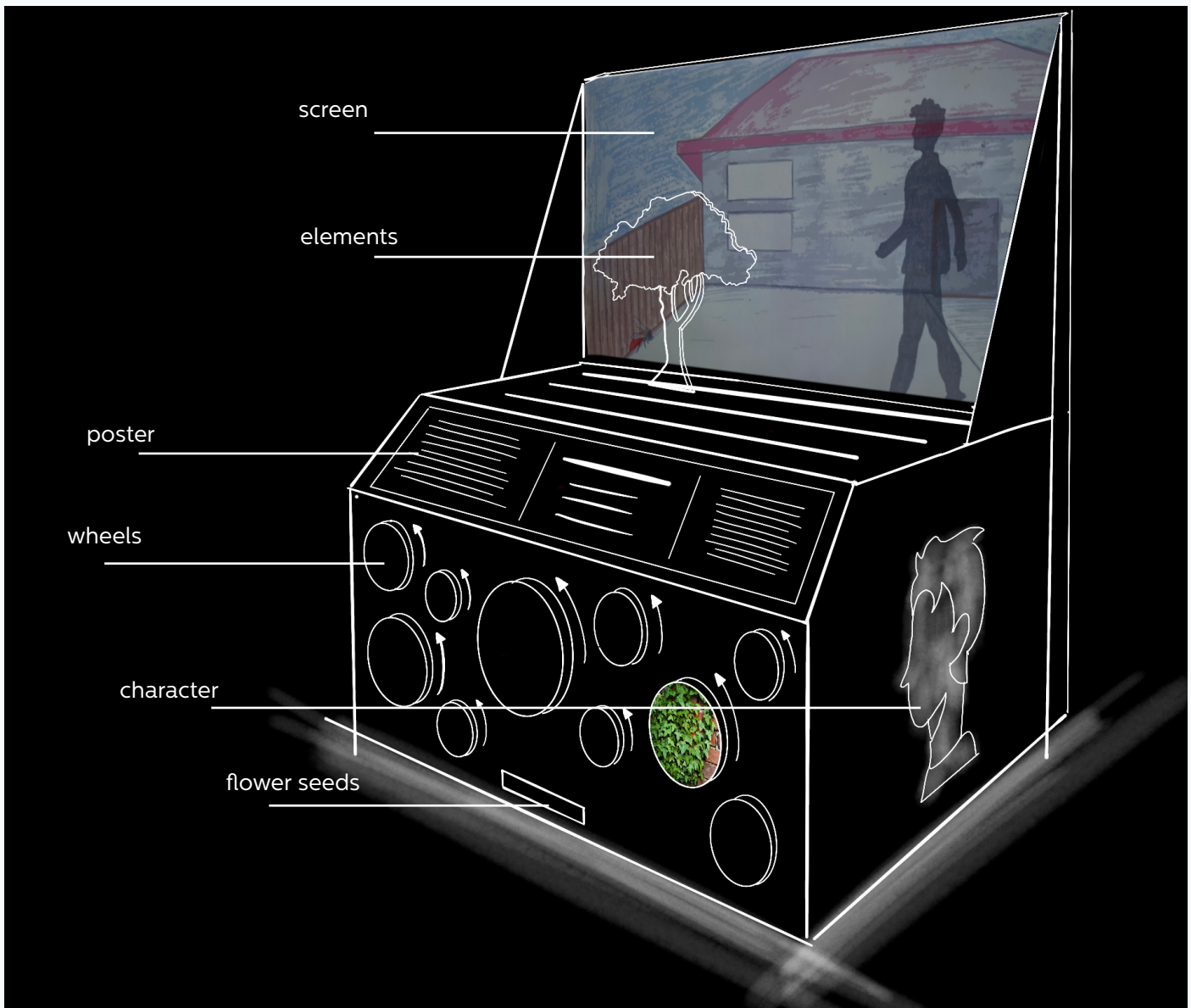


figure 81. drawing of concept

5.1.3 Key Aspects

The concept can be seen in figure 81.

Elements

There are several physical elements that can be chosen. These are 'objects' that can be put in a garden, such as grass, trees, bee hotels, stones. These are based on the living areas of bees and on functionality or entertainment for human. In consultation with biologists a set of elements is selected, this can vary.

Wheels

With the wheels families can make their choice appear by turning to the left, and also select it by pressing it in. Pressing it in again will unlock the wheel. On

the wheels, all options are visualized. It is made on children's height.

Character

The story is about a specific type of bee, the 'Vosje', which is introduced within this installation, to create awareness on the diversity in bee species.

Effect on Screen

The screen shows information on the choice and an effect. The effect is either an increase in species, a change in conditions or emotions. The screen is on elder's height.

Information

On the front you can find a poster with information: a title, instructions on use, explanation on decrease of insects.

Flower Seeds

When a family succeeds the game, which means, human and bee are in the middle near the flower, flower seeds appear, which come outside the installation. On these flower seeds, see figure 82, is written how to contribute to a well balanced garden. For example: 'interested in a bee hotel?', you can buy them at On the bottom you find a sentence on flower seeds: 'Take away flower seeds here!'



figure 82. flower seeds paper

5.1.4 Storyboard

The storyboard shows how families approach, interact and walk away from the exhibit.

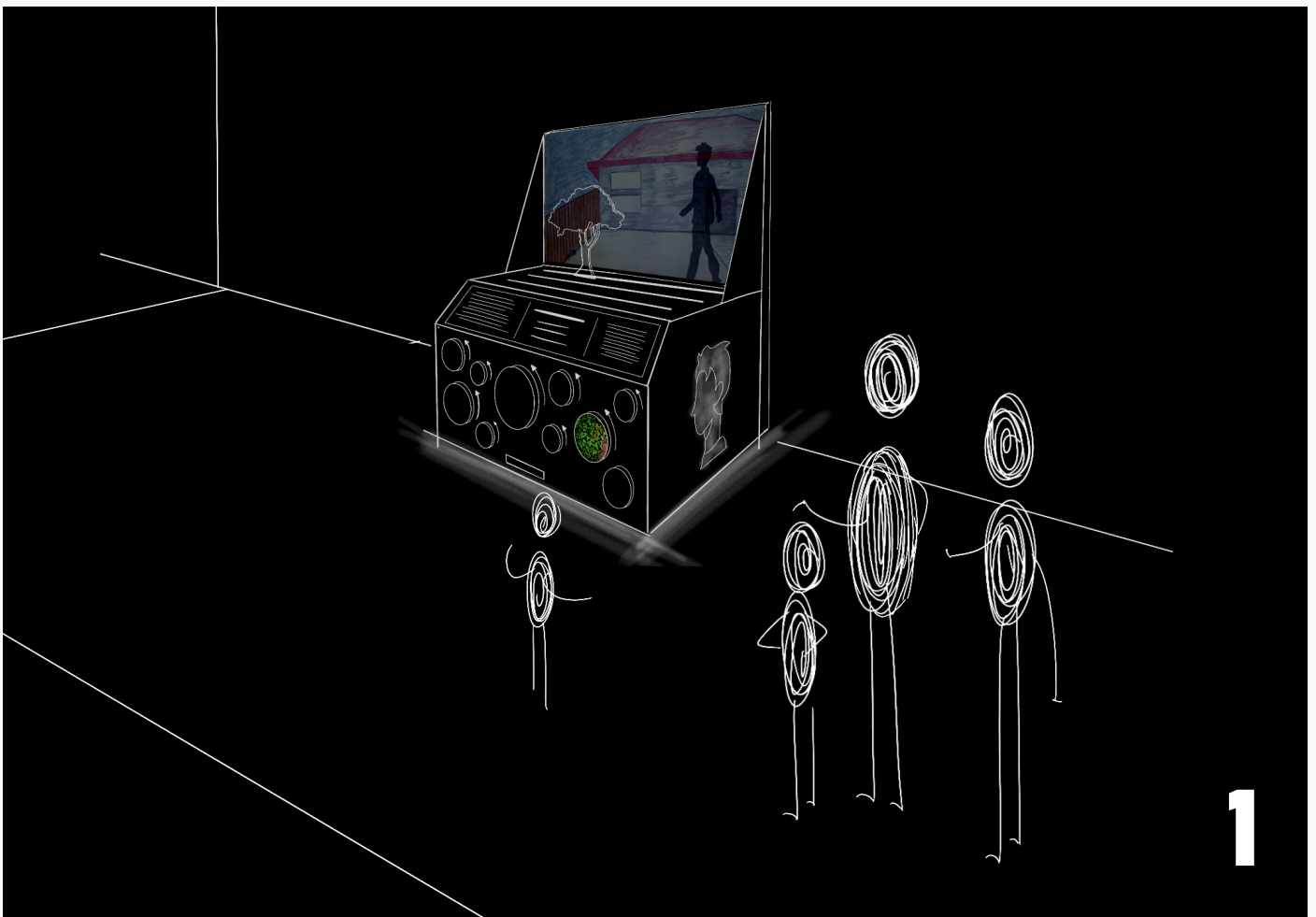


figure 83. step 1: approaching the experience

1. Approaching

The installation is located somewhere in Naturalis. Visitors approach the installation and can decide to try it out. Figure 83.

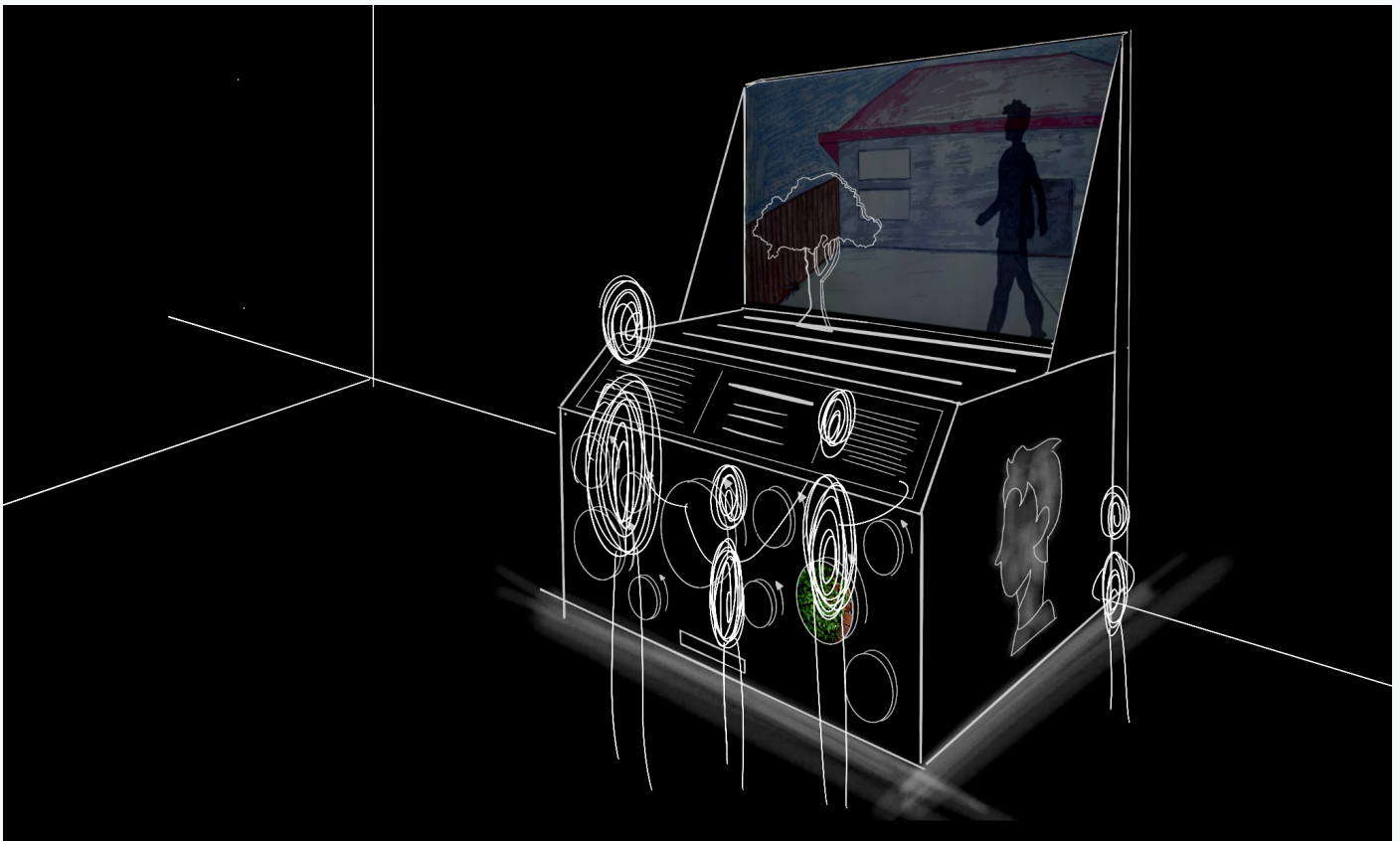
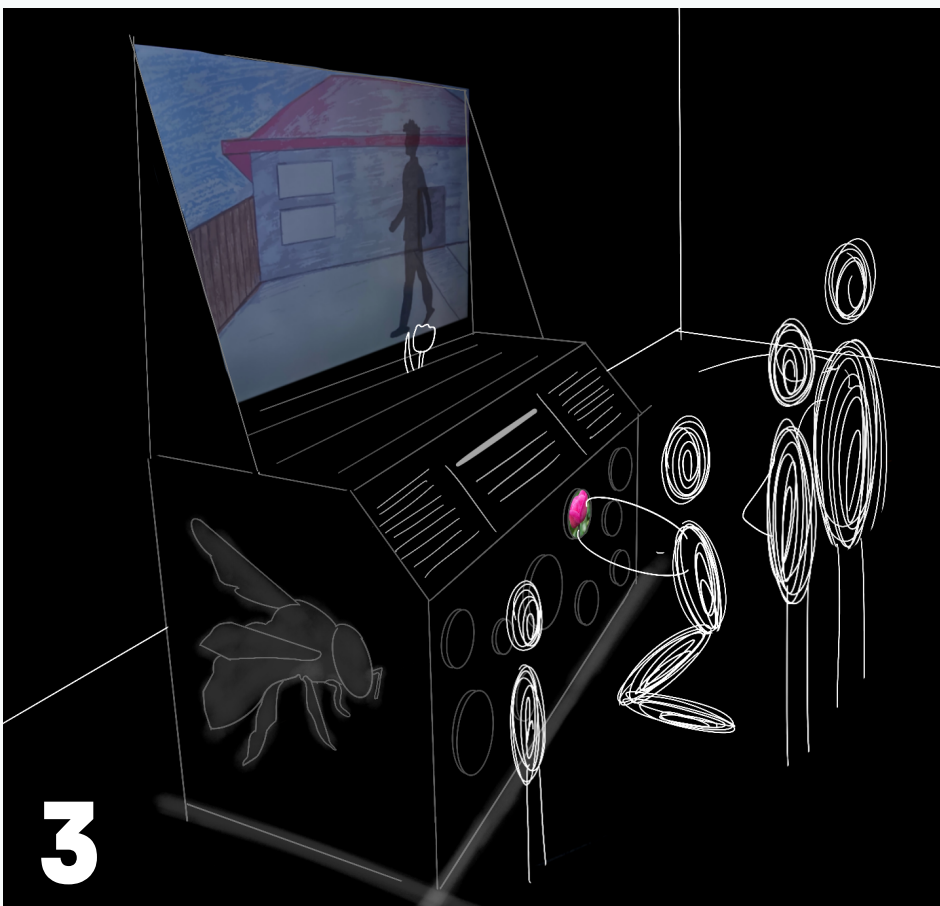


figure 84. step 2. looking at experience,
reading information

2. Reading

Families look at the installation, possibly read the text on the poster where instructions on use are visible and information on decrease of insects and bees. Figure 84.



3. Discovering

After reading they start to look at the wheels, make choice, steer and find out what happens. When they want to select a choice, they can press on the wheel. Figure 85.

figure 85. step 3: interacting with experience

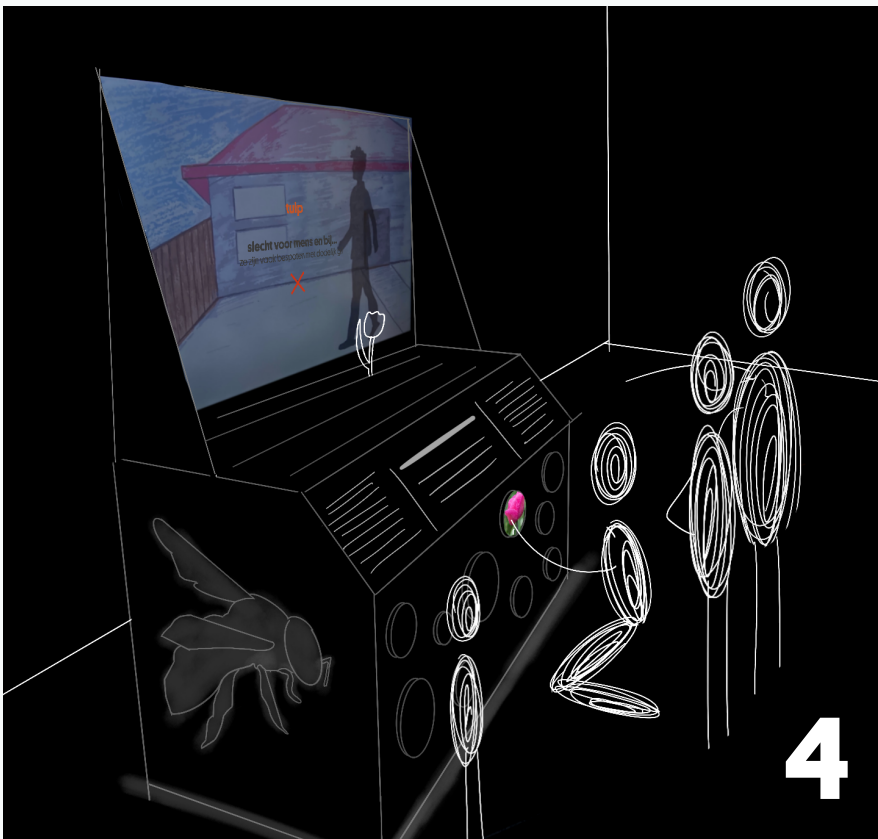


figure 86. step 4: seeing the effect

4. Seeing the Effect

On the screen they can find information on their choice. For example for the tulip:

A tulip is bad for human and bee, because they are often sprayed with poison. With this information they can anticipate on their choice. They can undo a choice by pressing on the wheel again and steering it the other way around. Figure 86.



figure 87. step 5: completing the experience

5. Completing

When families choose for the right combinations of elements, they complete the game. Bee and humans increased in amount and are together in the middle. Figure 87.

6. Receiving flower seeds

A card consisting of flower seeds comes out of the installation. Families can take it along. After that, the game refreshes and it goes back to its initial state. Figure 88.

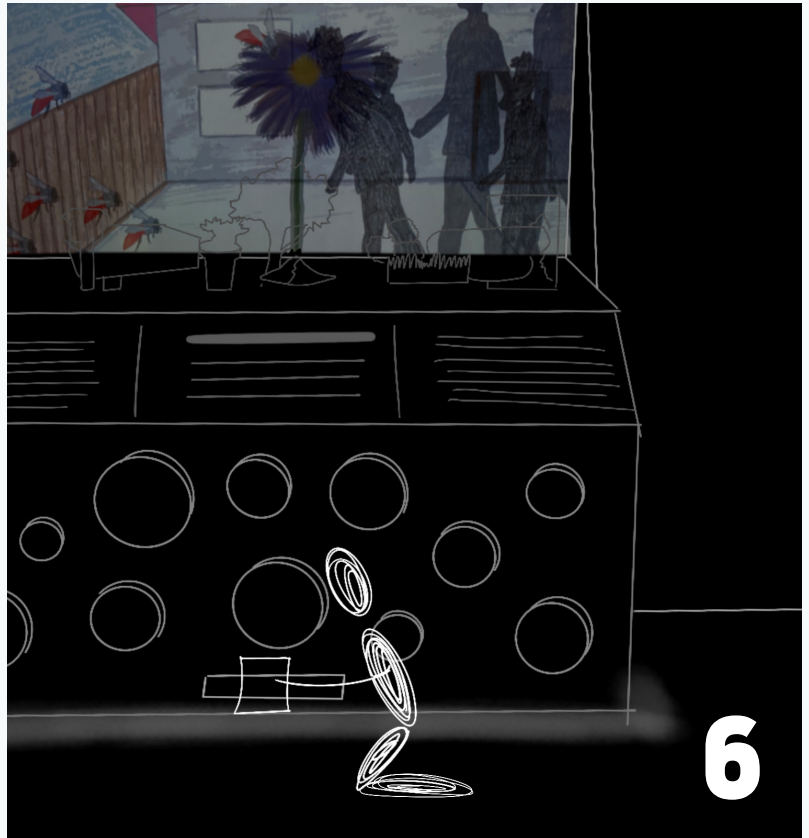
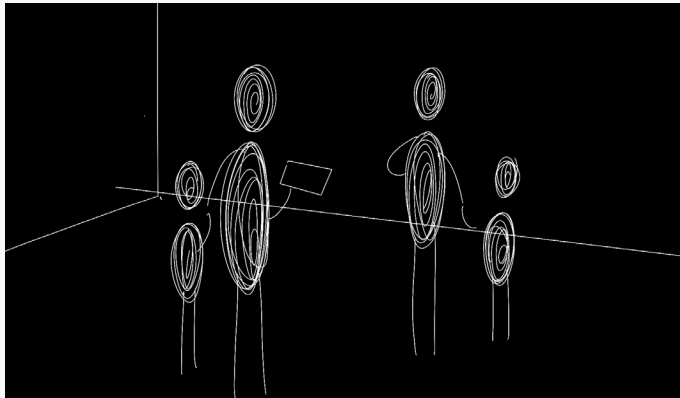


figure 88. step 6: taking flower seeds



7. Flower Seeds

Families read what is on their card and can possibly plant their flower seeds in their surroundings (garden, park or neighbourhood). Figure 89.



figure 89. step 7: planting flower seeds in garden

5.2 The Model

5.2.1 Physical Part

To show the concept and be able to test it, a prototype is made. This represents the interactions with the installation, yet there are differences between the concept and the prototype.

The prototype is build in Fusion 360, see figure 92, whereafter all parts are individually exported as illustrator files which are lasercutted. All parts are connected to each other and constitute a whole, figure 91. It is enclosed by a wooden box, figure 94.

An element can be turned up or down, figure 93. When it is turned up, a switch turns on, see figure 90. These switches are the connector to the digital part.

Materials

1. wooden parts
2. monitor
3. switch (12x)
4. poles (12x)
5. wheels
6. videos
7. stickers
8. posters
9. 3d elements
10. bee flower seeds

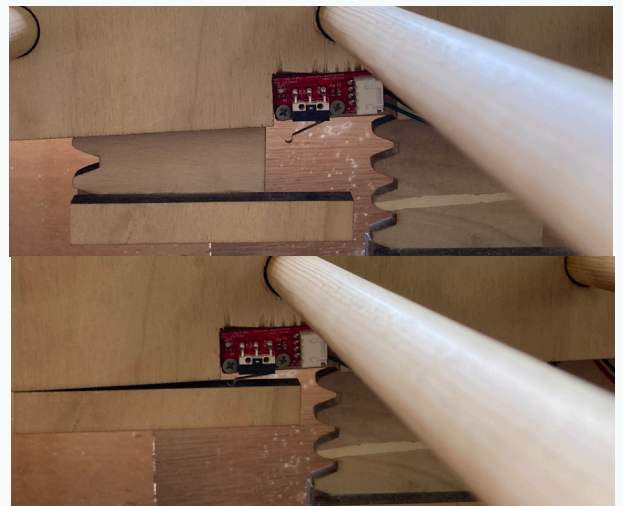


figure 90. switches



figure 91. elements and gears

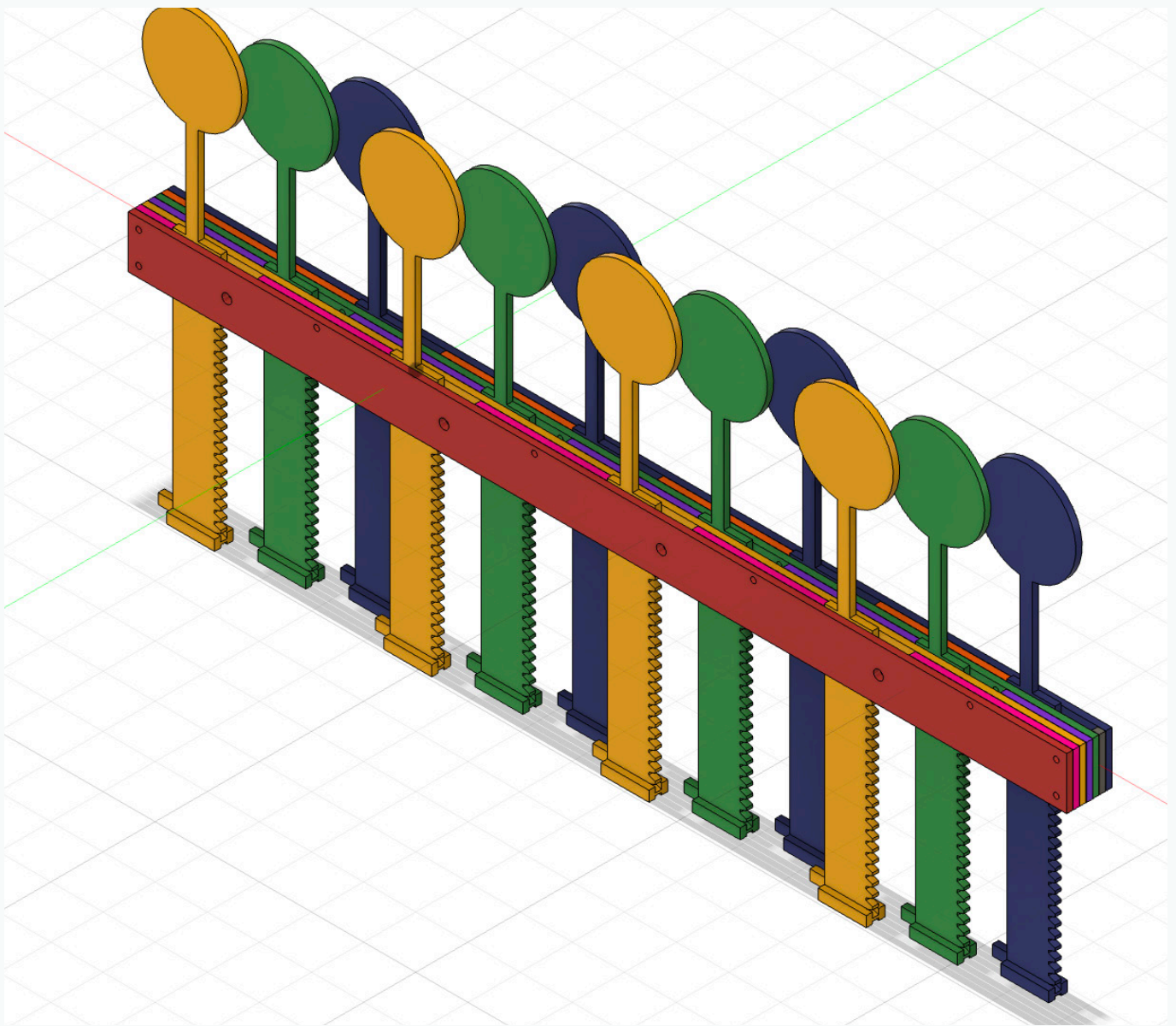


figure 92. digital model

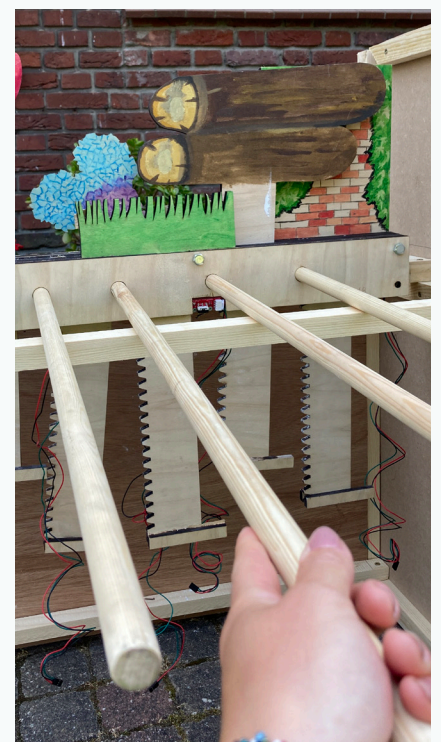
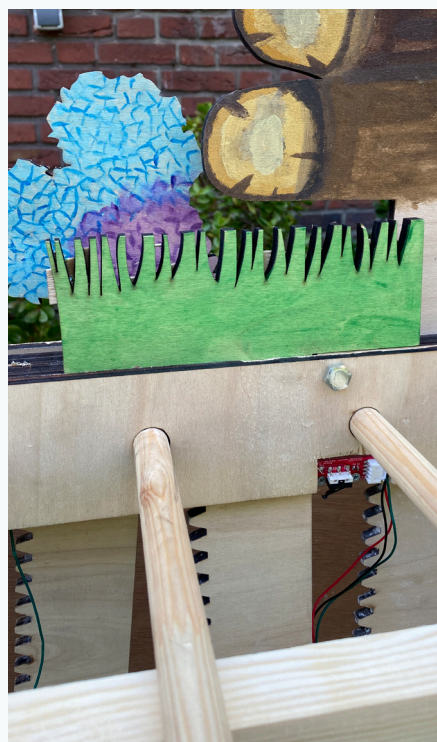


figure 93. physical action

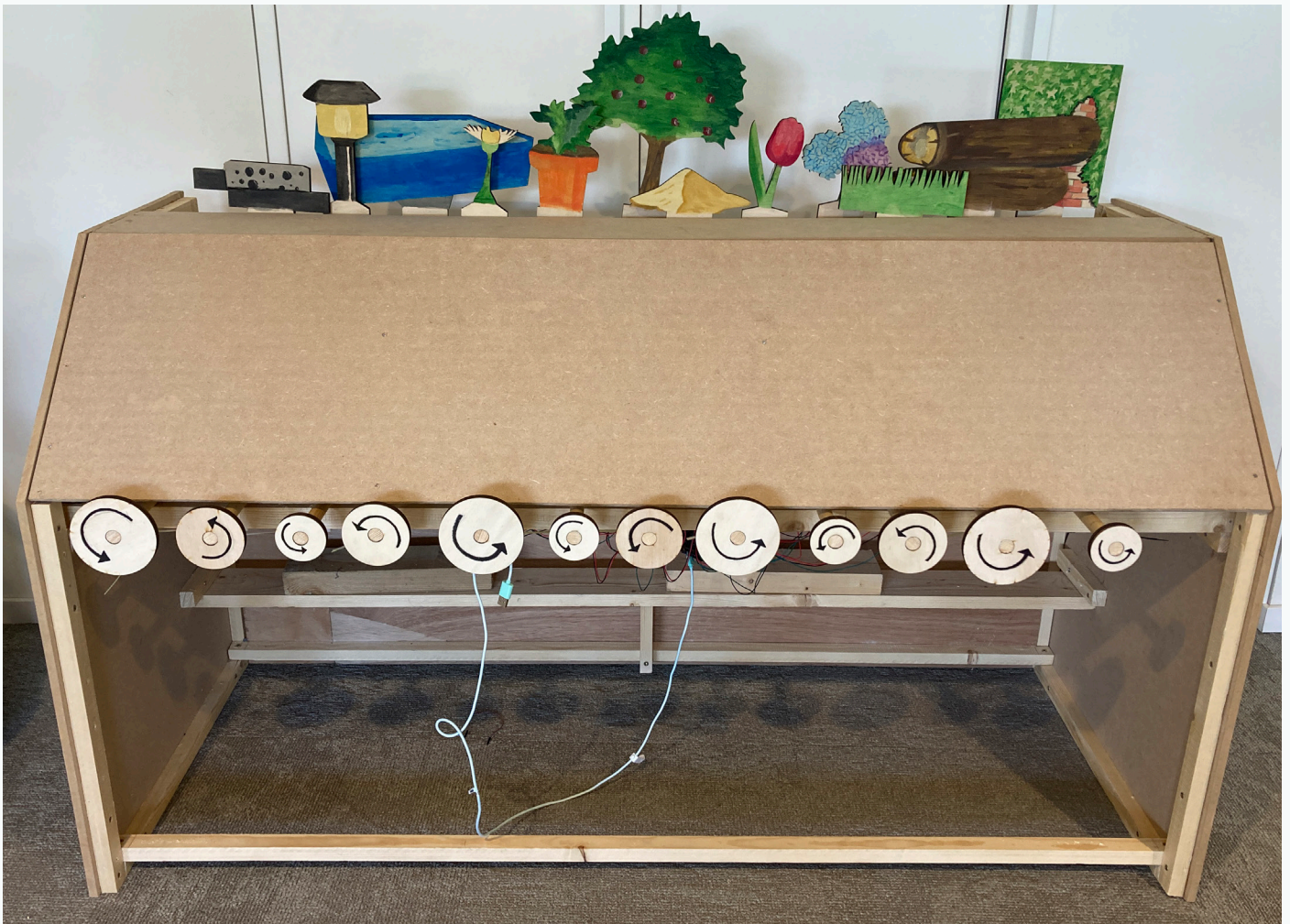


figure 94. the model

5.2.2 Key Aspects

Elements

There are 12 elements chosen for the model, with points for either human or bee: lawn (+1-0), apple tree (+1-+1), herbs (+1, +1), stones (-1, -1), tulip (-1, -1), hydrangea (1, 0), daisy (0, +1), dead trees (0, +1), sand (0, +1), ivy (0, +1), light (+1, 0), swimming pool (+1, 0). Figure 94.

Flower Seeds

The flower seeds are for the model represented as a paper card and seeds, see figure 95.

Character

An sticker of Vosje and a person is shown on the side, on the front and screen, figure 96

Wheels

The wheels are wooden circles with arrows pointing towards the left, see figure 97.

Poster

On the front a poster can be seen, figure 98.



figure 95. flower seeds

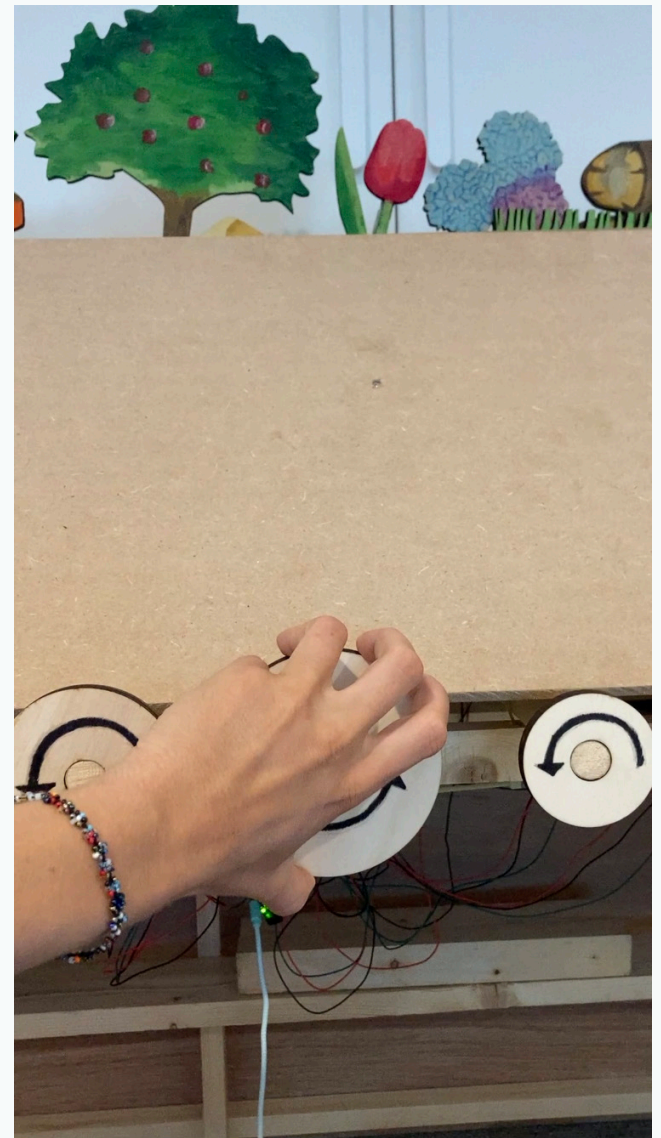


figure 96. characters

figure 97. wheels

Bijen in Nederland

Vosje is een bijensoort. Het is een solitaire zandbij die zich nestelt in holletjes. In Nederland komen wel 360 verschillende bijensoorten voor. Helaas is 50% daarvan bedreigd. En 34 soorten zijn al verdwenen. Bijen zijn belangrijk voor de biodiversiteit en dus ook voor ons bestaan. Ze houden ecosystemen in stand, door onderdeel te zijn van voedselketens. Ze bestuiven planten en bestuiving is nodig voor meer dan 70% van onze voedselgewassen. Hierdoor dragen ze indirect bij aan economische groei. We kunnen dus niet zonder ze!

'50% van bijensoorten is bedreigd'

Kom in actie!

Het is hoog tijd voor verandering. En voor verandering is het nog niet te laat. Ook jij kan daarbij helpen. Wat is jouw bijdrage?

maak een tuin waar jij en Vosje **in balans** leven en win een prijs

1. maak een keuze
2. draai aan het wiel
3. breng Vosje en mens bij elkaar

Biodiversiteit

Al het leven is afhankelijk van ander leven. Biodiversiteit heet dat. Het gaat niet goed met de biodiversiteit in de wereld, waaronder in Nederland. Biodiversiteit is steeds meer aan het afnemen door menselijk toedoen, wat we de biodiversiteitscrisis noemen. Neem bijvoorbeeld de insecten. Uit Duits onderzoek blijkt dat 78% van de insecten in de afgelopen 27 jaar is verdwenen. Eenzelfde trend is in Nederland ook te zien.

gevangsten insecten per vierde dag in Duitse natuurgebieden

figure 98. posters information

Connection

To connect the digital to the physical, an arduino board is used that contains physical switches and shows an effect on the screen regarding the switch. Appendix E2.

5.2.3 Digital Part

When an element is fully switched on, this creates an effect on the screen. First, the element that is chosen is explained on the screen with a title, its effect and a description. For example: 'tulip' - 'bad for people and bees' - 'often exposed to poison', figure 101. Appendix E1 shows animations. Second, the effect of the choice is shown. This means that more bees or human ap-

pear, but also that they come closer to the flower in the middle, see figure 99. When all the right elements are put up, the a bee and human meet each other at the flower, figure 103. The background is an illustration of a garden, figure 102. All separate videos are put in the video programme 'Resolume Arena' where it is possible to switch on or off certain videos.



figure 99. animation of bees



figure 100. animation of people

tulp

slecht voor mens en bij...
ze zijn vaak bespoten met dodelijk gif



figure 101. explanation on choice

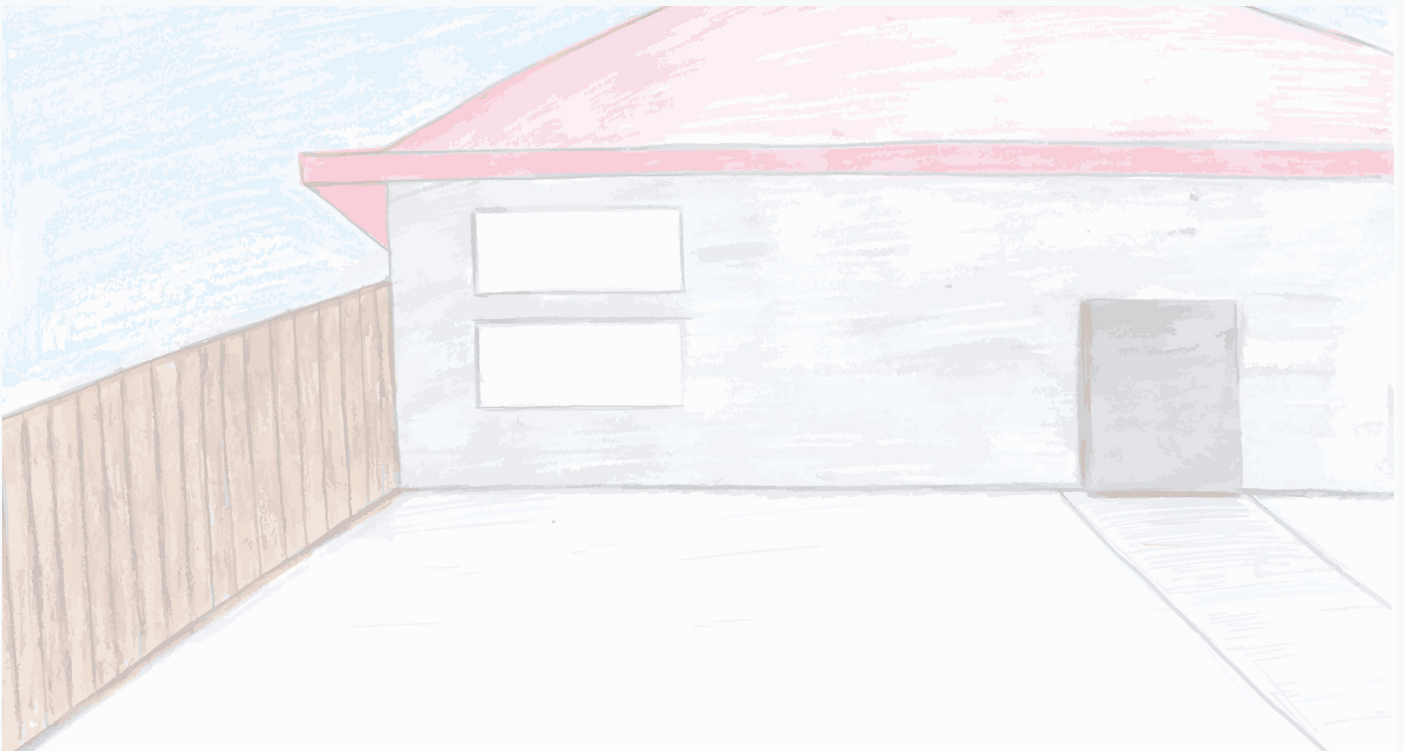
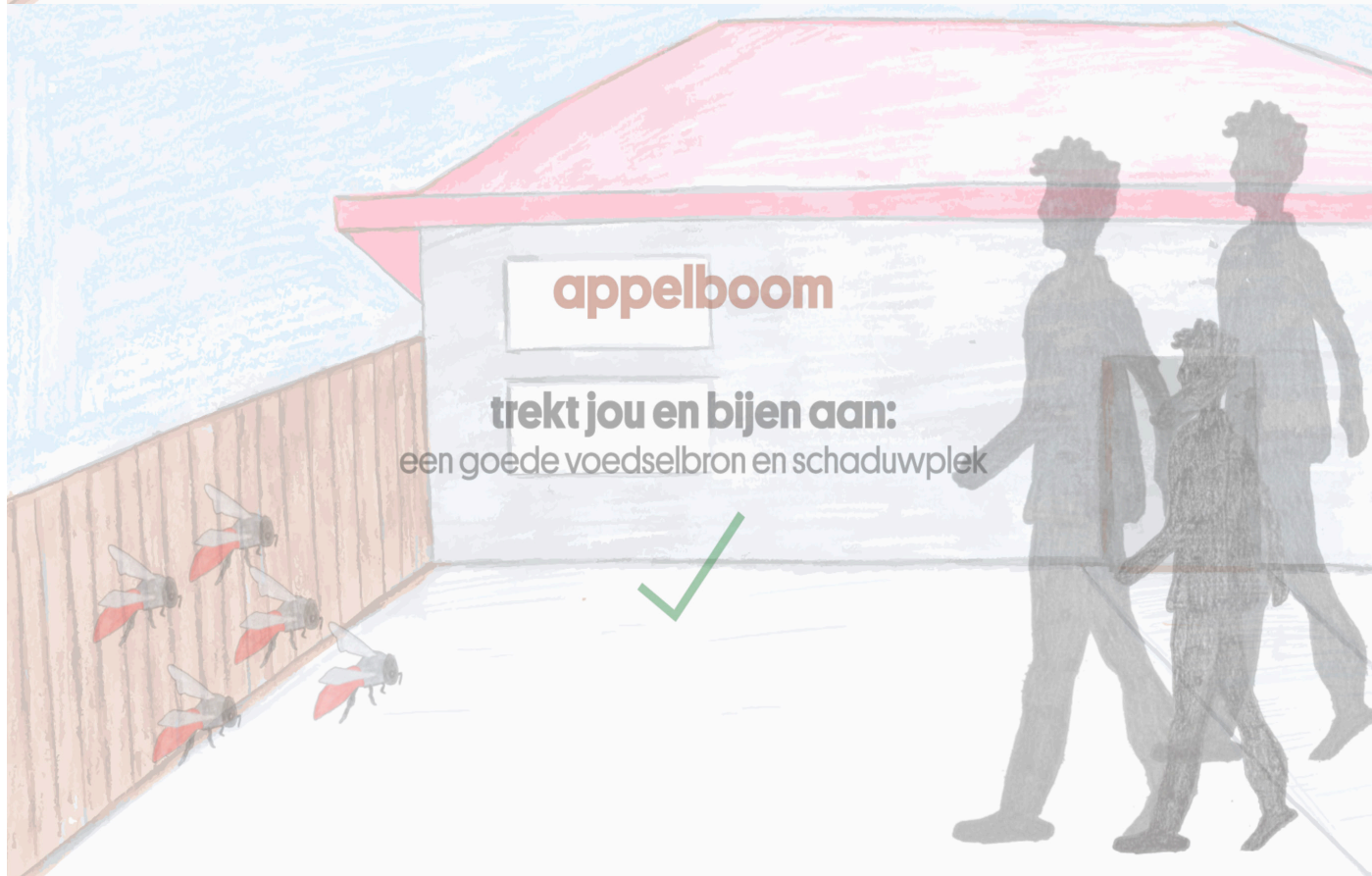
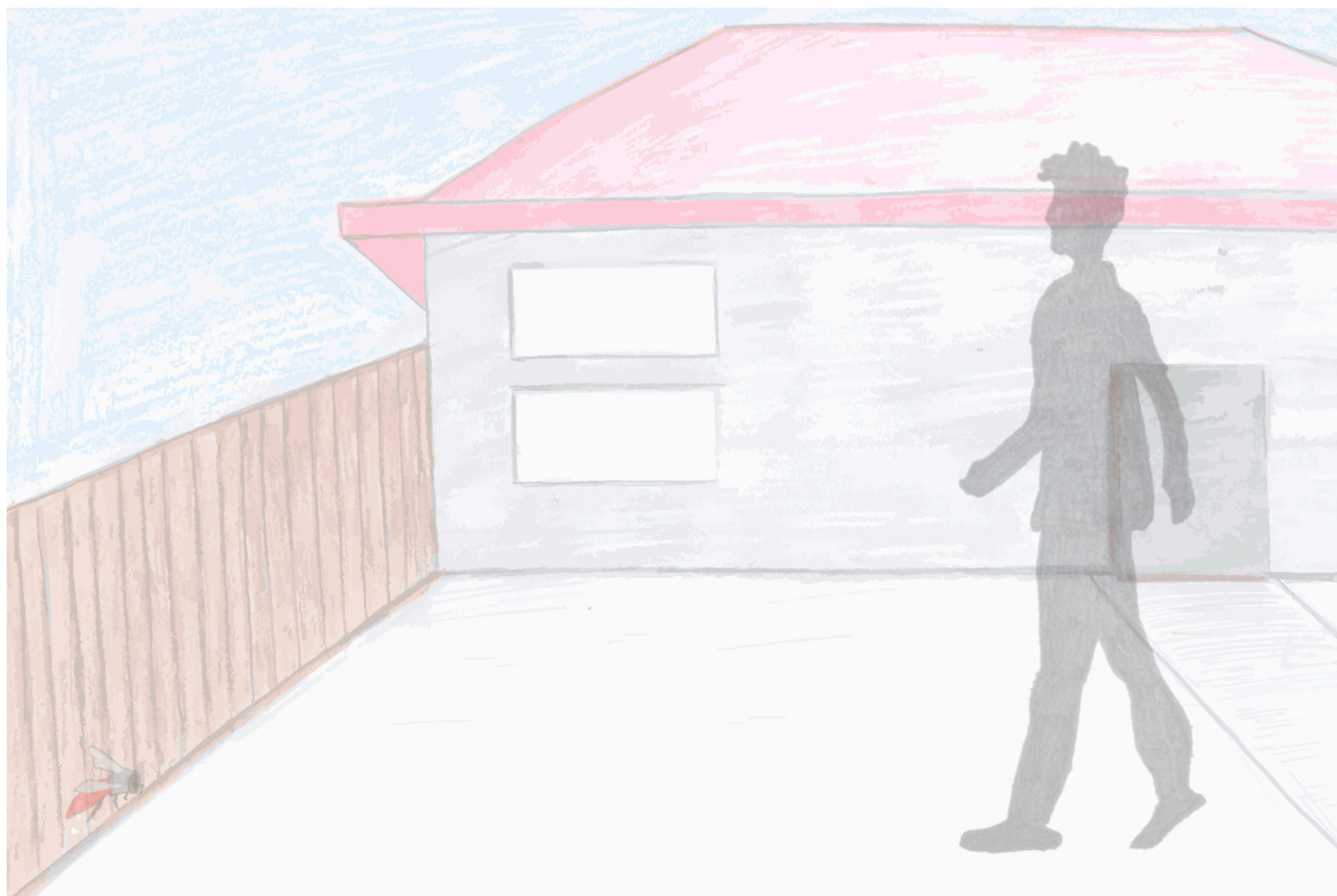


figure 102. background animation



5.3 Implementation

5.3.1 Implementation Plan

Short term

The first model will be tested with families in Naturalis concerning two aspects: design goal and usability. From these test, insights are gained and conclusions are derived. Based on these conclusions, a new and improved model can be designed. This can be done in collaboration with external parties such as Kossmanndejong or Bruns. Because of the high concern of the topic, it is advised to make an improved model as soon as possible, in the years of 2023, 2024, and look for a suitable location in the museum. Next, it is also advised to expand the concept, by using 'Vosje' as a character and repeat it throughout the museum. This will create more connection to the story and strenghtens the bond, which leads to more awareness.

Long term

Solely implementing the presented model will contribute in a way to transformation, however this can be increased. It is advised to think of ways to present the biodiversity crisis at more locations throughout the museum and make it fit the entire story instead of Naturalis and a detached installation. This can be done by creating a new concept hall that explains biodiversity crisis in more depth or by repeating the concept at multiple locations in the museum. When doing this, it is important to keep it positive so families are not scared away and provide or show ways on how to take action.

See figure 104 for an overview of the implementation plan.

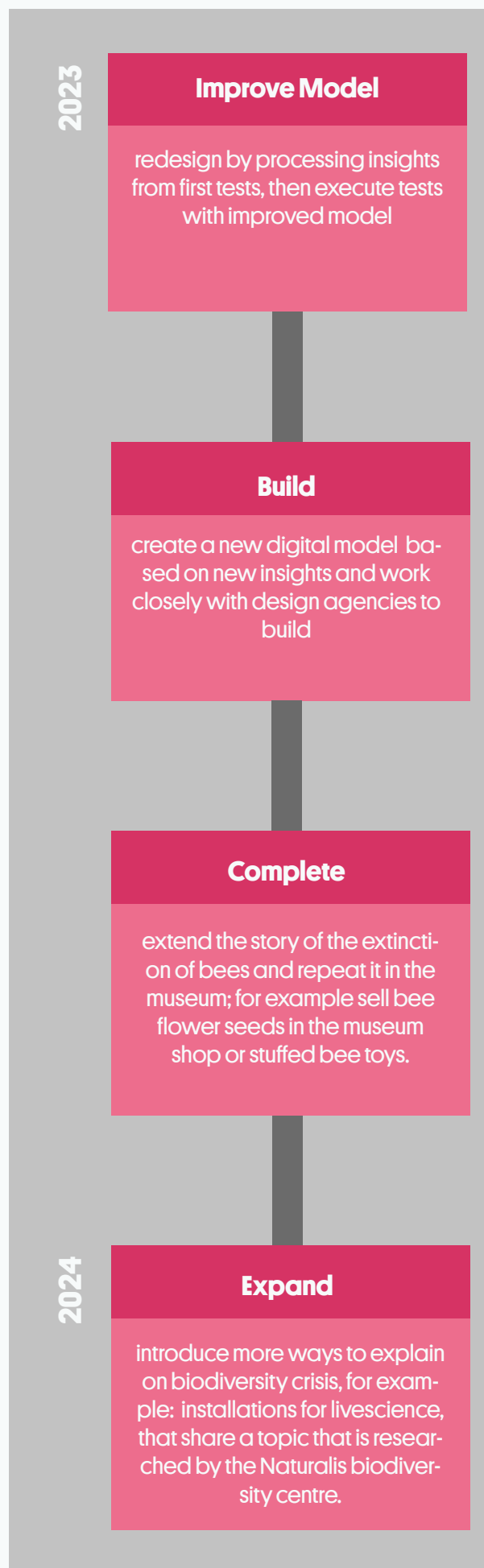


figure 104. overview implementation plan

6 **validate the design**

The model that is described in chapter 5 is tested with families in Naturalis, to test if the design goal is met. Furthermore a usability test is done with Naturalis employees. The evaluation plan for both tests are described. Insights from usability tests are shared and results from the transformation test.

6.1 Evaluation Plan

There is a main focus on testing if the design goal is met; if transformation takes place, in other words if families learnt more on biodiversity crisis and know what they can do themselves.

Before testing on the design goal, a usability test is done.

6.1.1 Usability Test

Method

Testing the usability will be done at the department of exhibitions in the office of Naturalis, see figure 105.

One individual testing takes 10 minutes. Interacting with the installation takes 5 minutes, whereafter participants are asked to fill in a questionnaire which also takes up to 5 minutes. The questionnaire gives participants the possibility to share how they felt on performing the tasks and to elaborate on possible uncertainties and improvements.

Employees from department exhibitions, n=6. These employees are partly influenced and are aware of the goal of the installation, however they have not used the prototype before the test and thus can give valuable insights for a usability test.

The model will be used for testing, where digital part is connected to the physical part through arduino and Resolume Arena.

Protocol

Participants will test the prototype and are interviewed afterwards. This will be done individually, so participants are not influenced by each other. They are asked to perform several tasks.

1. Make a choice for one element.
2. Select a right element for a bee.
3. Select a right element for a human.

4. Select a wrong element for both.
5. Undo a wrong selection
6. Select a right element for both.

After performing each task, participants are asked to fill in a scale 1-5, unclear – clear and why. This can be done through a questionnaire. During testing, participants are observed. In the appendix F3 the questionnaire and supporting elements for the interview can be found.



figure 105. usability test

Participants expected information on their choice before they steered the wheel.

Instructions on use, it should be first to make a choice and after to steer the wheel.

It was not clear that they could earn bee flower seeds.

It is debatable and too subjective whether certain elements are good for bees or for humans. This causes confusion.

key insights

6.1.2 Design Goal Test

Method

Testing the design goal will take place in the workshop hall 'Ontwerp', which is located at the fifth floor. Testing is spread over two days in the weekend, when lots of families are visiting Naturalis. How it all is set up can be seen in figure 108, 109, 110. There is a spot for the moderator, to react on actions from families, a spot for filling in the questionnaire, and lastly a spot for interacting with the prototype, see appendix F2.

Families, with a focus on children between 9-12, that are visiting Naturalis will be actively asked to join the testing. The interview questions focuses on the entire family with a slight focus on children.

To be able to test the prototype and to avoid complications with the arduino, a simplified version is created. The physical and digital part are both used, only testing follows a wizard of ozz approach. Creating a digital effect is done by the moderator of the test. Animations on the screen are shown through the application Resolume, appendix F1.

If the design goal is met, the before and after evaluation method is used. This means that before using the installation, questions are asked by using scales, and also after use. The scales are derived from the design goal, appendix F4. The following scales are used:

1. I know what biodiversity means
2. I am conscious biodiversity is under pressure
3. I know why it is not going well with biodiversity
4. I know what needs to be done to improve biodiversity
5. I know what I can do to improve biodiversity in my own surroundings

The insights from evaluations are compared to measure transformation.



figure 106. workshop hall design



figure 107. test location

Protocol

Once a family agrees to participate, it will be welcomed by the moderator, and it is explained what the project is about. Families are asked to fill in five scales on current knowledge and behavior. After filling in the scales, the reasoning behind the answer is asked from family members. Then, the prototype will be shown and families are invited to interact with it. After that, it is asked to fill in the scales again and provide reasoning. Lastly, families are thanked for participation.

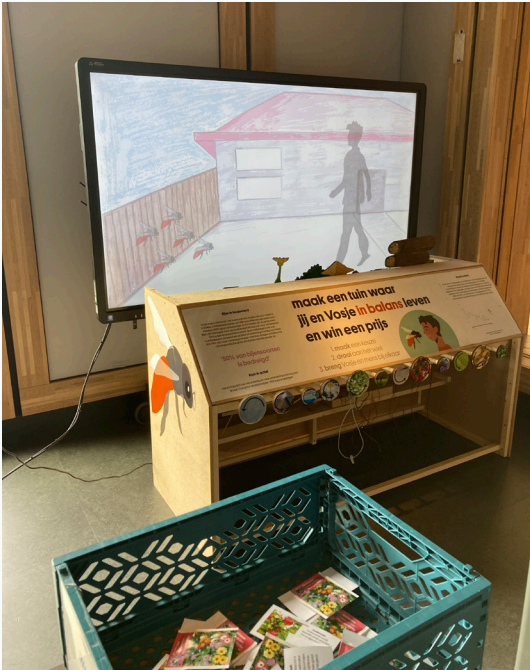


figure 108. flower seeds



figure 109. wizzard of ozz set up



figure 110. test set up front view

6.2 Results

6.2.1 Transformation

During testing, there is a main focus on the transformative experience, and secondary focus on the use and experience. To evaluate transformation, five scales are used. Insights from families can be found in appendix F6.

For each scale the average scores are calculated where before and after scores are compared with each other. Appendix F5 shows this. Averages are also shown in pie charts, 109. Only three families dedicate a lower score on the some scales after testing the prototype. No single family rates a score of 1 after testing the prototype at one of the scales. Scales 4 and 5 show that after testing, families don't grant a score of 1 or 2.

Knowledge on the definition of biodiversity is low: 9 families indicate a score of 1 or 2 on the first statement. The definition of biodiversity is not entirely clear before, a bit more clear after.

Before: 'Biodiversity.. something with bio?'
- child

After: 'Biodiversity is something about animals and people'
- child

Many families indicate they got to learn more about the effects of certain elements. Mostly the lawn, tulips and hortensia were surprising to them.

Oh no, the hortensias? But I love those!
- mother

Information on their choice made them reflect on their choice and possibly choose for something else and remove it from the garden.

Oh the tulip is not good, remove the tulip boys!
- father

It also initiates the conversation on what they already know or experience.

I see lots of stones in gardens, which is not so good
- child

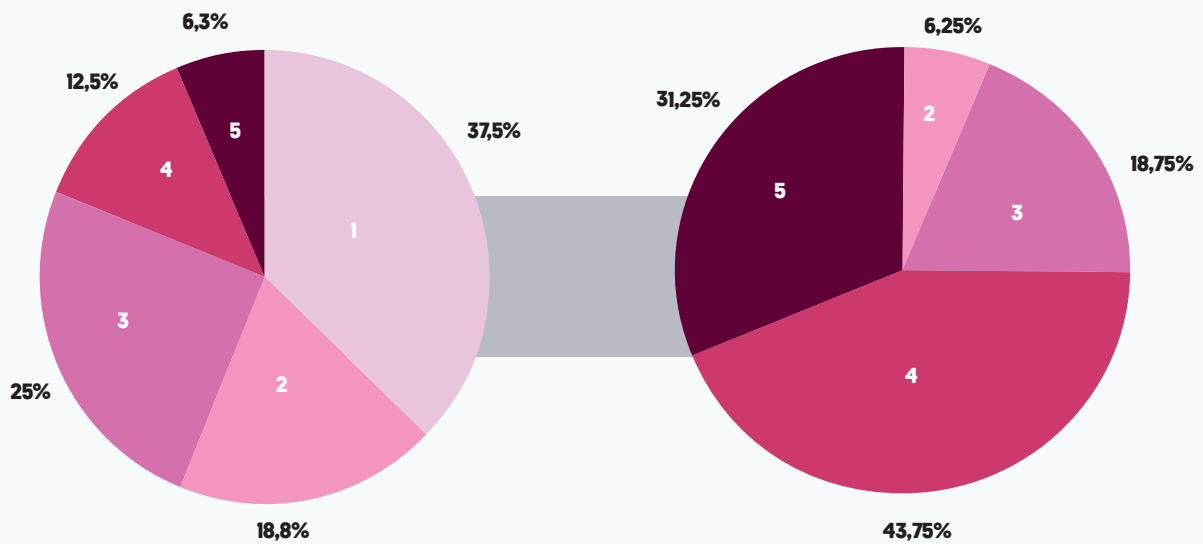
The few families that read about the insect decrease were astonished.

76% decrease? That is a lot, really hard to imagine
- mother

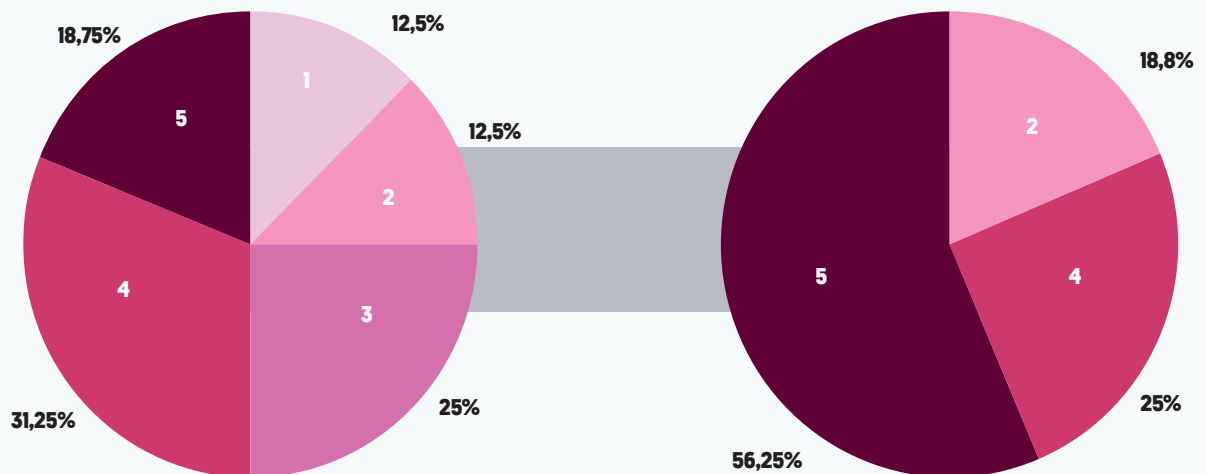
Despite families mentioned they discovered, they doubted whether they would also really act on the behavior.

I learnt something, this does not mean I am also going to do this
- father

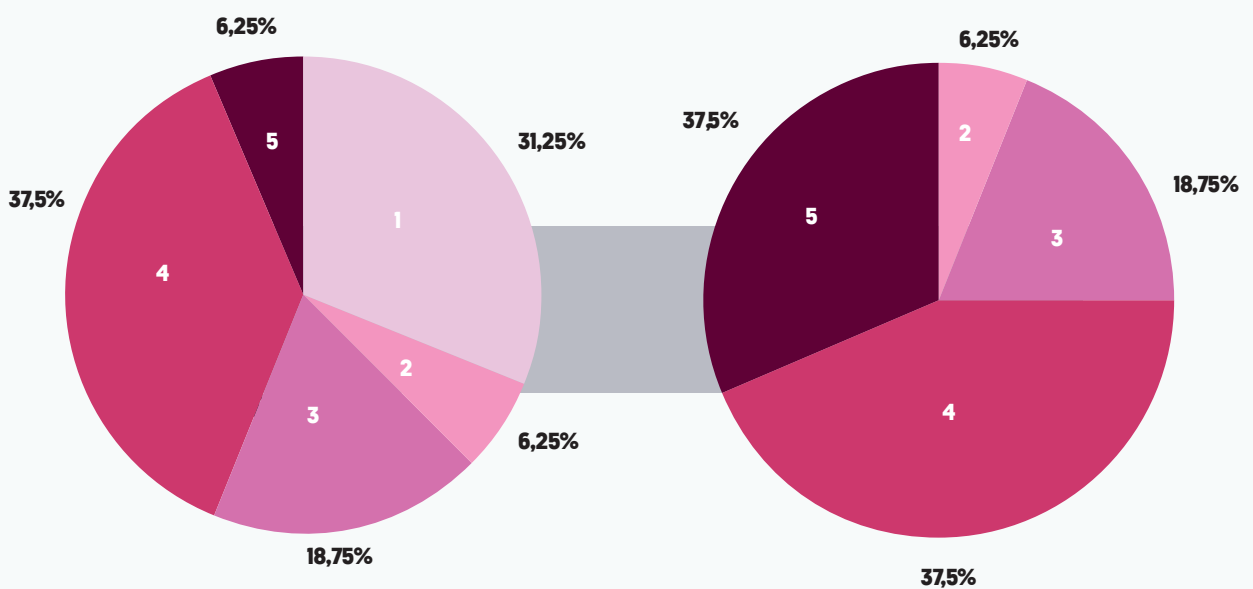
1. I know what biodiversity means
1 = strongly disagree, 5 = strongly agree



2. I am conscious biodiversity is under pressure

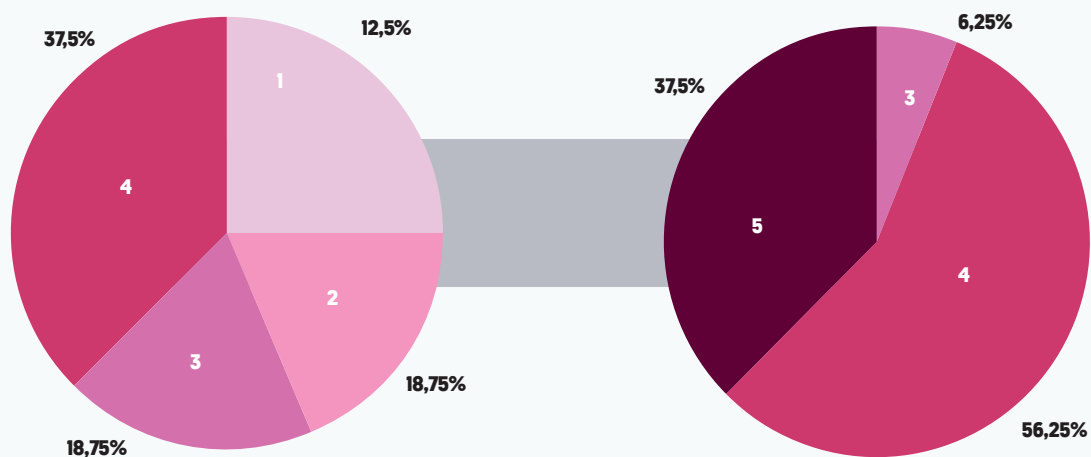


3. I know why it is not going well with biodiversity
1 = strongly disagree, 5 = strongly agree



4. I know what needs to be done to improve biodiversity

1 = strongly disagree, 5 = strongly agree



5. I know what I can do to improve biodiversity myself in my own surroundings

1 = strongly disagree, 5 = strongly agree

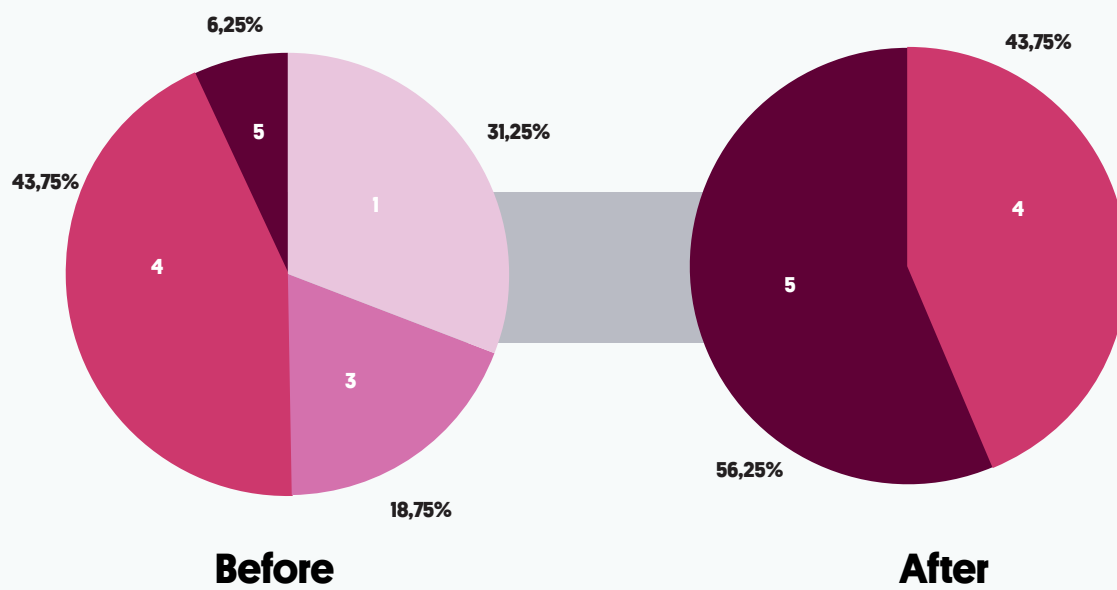


figure 109. results evaluation

6.2.2 Use

It is observed how the prototype is used by families, quotes and actions are written down. This brings the following insights.

In all cases the children were steering the wheels and the parents or caretakers were reading the text on the screen and supporting to the children on what to do. The balance game is not once understood by a family. This is partly due to the title, which was too difficult to understand. All 16 families were assuming they had to create a garden for a bee and choose only good elements for bees. This can be seen when families read information on the screen, such as: 'cooling, but not good for bees', which made them remove the swimming pool. The informing texts on the screen were clear, only should be visible for a longer time. The information on the screen sometimes created distrust.

'Is this true? Bees in my garden like the hortensias'
- child

The explaining text was clear enough, not too short not too long. It made them reconsider their choice or more gained more trust. Although it was clear, the effect and the information on the screen was not always seen by children because they were too busy with the wheels. In most cases this was read by adults. All families understood the concept of 'Vosje' and they made a link with the name and the bee on the screen. The information on the poster also helped.

'Vosje? That must be the bee then'
- mother

to all families. It was expected to be more clear when the wheel was fully turned upwards.

'On sand: What is this, mushrooms?'
- child

6.2.3 Experience

Families appreciated the interactive aspect of it: seeing direct effect of a choice. Furthermore the diversity in choices and discovering and at the same time learning something is valued.

The arrows on the wheels made it clear what to do. The installation attracted children, they wanted to turn the wheel immediately and try it out. The pictures on the wheels were not entirely clear



figure 110. interacting with the model

7 discussion on outcomes

Chapter 7, the final chapter, again shares conclusions on research on several areas and the validation of the concept. Furthermore, these conclusions are discussed by comparing them with expectations and explaining constraints. The final paragraph, recommendations shares what can be improved on the design and how.

7.1 Conclusions

The project started with a question on how Naturalis was able to make their visitors aware of the biodiversity crisis. This is investigated by diving into several areas: the organization of Naturalis, transformative experience theories, biodiversity, families with a specific focus on children between 9-12. It was found that Naturalis only hits the subject of biodiversity crisis in a subtle manner through their website and app. In the museum there is nothing on the topic. They are open to implement, only when it is presented in a positive and family friendly way. Furthermore, to be in line with the education department, they want to inspire their visitors for action. From theories on transformative experiences and behavior change models it was found that to create awareness, it is important to choose for a story that is closeby, to which people feel connected. This strengthens the interest and bond. In addition to that, it is a good strategy to present your audience a dilemma in which they are playing a part. To create a moment for reflection on the problem it is needed to make your audience talk about possible solutions and discover on them. Next to that it is important to have a good balance between negative and positive messages. You can present a rather negative message, as long as it goes hand in hand with a positive message, it is preferred to close off positively. On top of that, when you want people to change their behavior, it is best to make people intrinsically motivated, to show how they can change their behavior by presenting solutions that are within reach and fitting the target group. Biodiversity is still an abstract, new and difficult topic, especially for younger children. It can be described as the diversity and amount of all life on earth. This is under pressure, partly due to human activity, which we call biodiversity crisis. The definition of biodiversity is not generally known in the Netherlands.

Therefore it is important to choose a closeby and well known subject within the concept. In contrast, research shows that children often know just one species, for example, the elephant. This is also the case for birds and insects, despite the high diversity in these species. For example, there are already 350 species of bees in the Netherlands. Therefore it is important to give attention to this fact and less popular species. In general families expect more interactivity and connective installations in Naturalis. To focus three personas are created that represent families that visit Naturalis: that differ in expectations, how the museum is visited and their relation to biodiversity. The final design focuses on the persona of Little Leaders since it was seen that it has highest potential for transformation. The design that is created, is an interactive playful installation that contributes to transformation in the first stages: creating awareness and reflection. It creates awareness by making use of the bee as a character, which is recognizable for the audience. To create more awareness on the diversity of species, it is chosen to focus on a rather unfamiliar species: 'Vosje'. Dilemmas are shown by making use of the interactive video concept, to be able to make choices between good and wrong elements for humans and bees. Reflection is initiated by providing information on a choice which makes the audience (re)consider a choice. To give a first hint for action, it is possible to gain flower seeds with a text that repeats the message from the installation and provides suggestions on how to act.

The installation is validated with a primary focus on the transformative aspect and a secondary focus on the use. This is done through the before and after evaluation technique where the same questions are asked before and after testing. During testing, 16 families are observed and interviewed. The concept of biodiversity became a bit more clear, yet also after testing children did

not fully know how to give a definition. It can be more prominent and more explanation is needed. It is seen that lots of participants learnt more about what they can do themselves to increase biodiversity in their surroundings. Some insights even surprised them. The information presented on the screen that explained the effect, started conversations between family members and also made them think about their own situation or remind them of earlier experiences. Families learnt more about the biodiversity that is under pressure, only it can be even more clear why it is under pressure. It is seen that the goal of the playful element is not understood by a single family. The experience is interpreted as if the goal is to create a good environment for the bee, Vosje. The concept of Vosje was understood well; everyone knew it was about a bee species. Yet, the human aspect has not really sunk in, despite the effect that is presented on the screen. Choosing between different elements already created the dilemma moment even before seeing the choice physically appear.

The design fits the little leaders, since it attracts children to steer the wheels and take the lead. That is because of the height of the wheels and the colorful illustrated style. They can anticipate on their choice and discover what other choices to make. The instructions on use were understood, all participants knew how to make a choice, change a choice and see the effect. Despite the text and element, more feedback was expected, either sensory, visually or auditory. The text on the screen should be longer visible because sometimes participants missed the point. Not all of the illustrations on the wheels were clear.

7.2 Discussion

Before testing the interactive transformative installation it was expected the interactive part, steering wheels to change a situation, attracts children. This turned out to be the case since children runned towards it and tried it out for several minutes. The arrows on the wheel, its shape and the colorful style turned out to be a success.

The playful part is not understood by participants. There are multiple reasons to name that lead to this. The installation mostly focuses on the bee; there is information on species, and on biodiversity decrease amongst insects. However, there is no information the human part. Furthermore, the explanation for the elements can be misleading, for example for the garden lighting it says: 'functional, yet it chases bees'. This leads to participants removing the lighting again, while this is not necessary since it is a balance game. Also, focusing on two characters, bee and human, can be overwhelming to participants which makes them confused on what the installation really is about. Especially when time is scarce, this can lead to a disengaged audience.

Because the game was never finished, it was not possible to reach out the flower seeds as a reward and thus not testable possible reactions or if it adds to the transformative experience. Despite that, the cards were handed out after testing the prototype.

During testing the model, there was only one moderator that executed multiple actions as observing, interviewing, noting and guiding. A downside is that possible insights are not heard and or written down.

It is possible that the moderator influenced the participants by providing hints and explanation. In reality there won't be someone near the installation.

For example, it occurred that families asked questions like, ‘is it possible to also steer the wheel back again?’ When this happened, the right way was explained in some cases.

From research on families that visit Naturalis it was seen that children from 9–12 are most ready for a topic as biodiversity crisis. However, during testing children with an age starting from 4 are also asked to join in. That is done because Naturalis demands all their installations to fit families with children with all kinds of ages.

Participants are asked on the spot which means there is not much time to execute the test, since participants also want to spend their time on other parts of the museum. On top of that, children are easily distracted, so therefore there was little time to go in depth on questions on the transformative experience.

The questions that are asked are presented to the entire family, which means it is a shared answer. So there is no information on differences between family members, while knowledge levels on the topic can differ.

7.3 Recommendations

First of all it is advised to revise the playful part and execute more testing. Since the balance game did not work out well, it would be a better strategy to focus on the bee alone, to create an environment for Vosje. This already brings across the message of biodiversity crisis, brings a disorienting dilemma and makes it more clear for the audience what the goal of the installation is.

Because the concept of biodiversity was still not entirely clear after testing it is advised to bring more emphasis. This can be done by adding extra and more type of bees within the anima-

tions, which shows diversity and the amount. Animations can be redesigned with an illustrator that knows how to draw attractive illustrations for children. Awareness is created on decrease and diversity of bee species, yet this can even be more emphasized. This can be improved through a redesign of the poster, where there is a better focus on biodiversity decrease and the reasons for it.

Children recognized the bee and they immediately started to interact with the installation. The theme can even be enlarged by giving more emphasis to the character of the bee.

The effect on the screen can be even more intertwined with the physical elements, which creates a well combined whole. This can be done by for example make the animations react on the physical elements: a bee that flies towards a certain flower. It would increase the bond with the audience and the visitor if the bees show emotions. Furthermore the environment, the garden, can also adapt to the situation that is created.

The interactive part can be made more clear by adding sound effects or a voice that explains, which indicates a good or wrong choice.

The installation was located in a workshop hall on the fifth floor. It is preferred to locate it near the entrance so families still have attention to understand the new and difficult topic. Furthermore, in contrast to the Naturalis museum, it was distinct from further installations which does not add to the storytelling. If Naturalis wants the message to stick, it can be possible to add more on the topic around the installation or make use of repetition throughout the museum.

In case the goal is reached: all right elements are selected, it should go back to an initial state, so new visitors experi-

ence it in the way it is meant. Therefore a reset setting should be added to the installation.

The elements that are chosen are based on right living conditions for bees and comfortable living for humans. These can also be adapted to other elements or elements can be added. The elements that had unexpected effects were most leading to a moment of reflection and conversation.

Figure 111 shows an iterated concept with lights that show a good or false choice, the emphasis on the bee and animations with bees that react on the physical part.

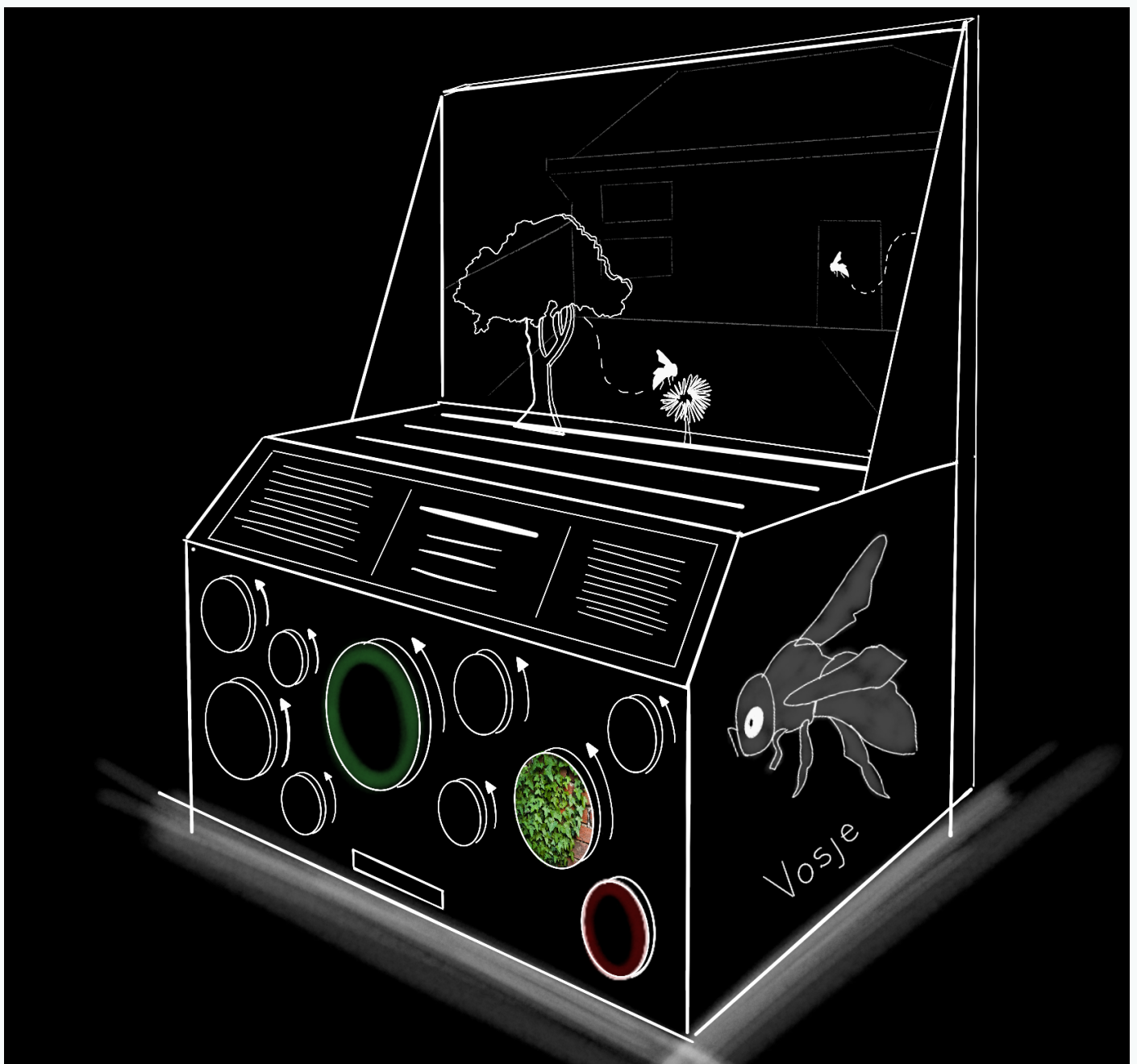


figure 111. iterated concept

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Appendix

A

1. Project Brief

DESIGN
FOR our
future

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".

Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !



family name van der Heide
initials YME given name Yamila
student number 4553152
street & no. _____
zipcode & city _____
country _____
phone _____
email _____

Your master programme (only select the options that apply to you):

IDE master(s): ☐ IPD ☒ Dfi ☐ SPD

2nd non-IDE master: _____

individual programme: _____ (give date of approval)

honours programme: ☐ Honours Programme Master

specialisation / annotation: ☐ Medisign

☐ Tech. in Sustainable Design

☐ Entrepreneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair Arnold Vermeeren dept. / section: HCD
** mentor Himanshu Verma dept. / section: SDE
2nd mentor Pieter Aartsen
organisation: Naturalis Biodiversity Centre
city: Leiden country: the Netherlands

comments (optional) From the organisation Naturalis there is one mentor, Pieter Aartsen. Matthijs Vegter will provide extra support during this project.

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..



Second mentor only applies in case the assignment is hosted by an external organisation.



Ensure a heterogeneous team In case you wish to include two team members from the same section, please explain why.

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Arnold Vermeeren

date 13 - 2 - 2023

signature 

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 27 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 27 EC

List of electives obtained before the third semester without approval of the BoE

☒ YES all 1st year master courses passed

☐ NO missing 1st year master courses are:

name Robin den Braber

date 21 . 02 - 2023

signature RdB

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks?
- Does the composition of the supervisory team comply with the regulations and fit the assignment?

Content: ☒ APPROVED ☐ NOT APPROVED

Procedure: ☒ APPROVED ☐ NOT APPROVED

comments

name Monique von Morgen

date - KE 6/3/2023

signature MvM

Enhancing awareness on biodiversity crisis to visitors of Naturalis

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 06 - 02 - 2023

07 - 07 - 2023

end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money, ...), technology, ...).

Next to the climate crisis we are currently in, we are also facing a biodiversity crisis. Biodiversity is described as all life on earth, from animals, plants, people, micro-organisms and fungi, that have spread on earth and evolved over billions of years. The crisis part describes that the extinction of all these species is increasing at a rapid pace. More specifically, the populations of mammals, birds, fish, reptiles and amphibians has decreased with 69% since 1970. A primary cause for this development is humanity itself. Threats are for example destruction of habitat, population growth or overfishing. The consequences of the actions that threaten biodiversity, will eventually affect us humans. This increases the importance of biodiversity even more (WWF, 2022).

The Naturalis Biodiversity Centre is a national research institute in the field of biodiversity. They are engaged on understanding, maintaining and describing biodiversity. They collect millions of objects that are also showcased in the museum. The focus of their exhibition within the 9 display halls, is to astonish museum visitors with the beauty of nature. A main goal for Naturalis is to give their museum visitors a fun day trip for the entire family. They make use of the 'social on' strategy: all activities in the museum are configured on experiencing nature together as a family. The crisis is not much present within the Naturalis exhibitions yet. This is due to their multi year plan that describes a strategy to bring biodiversity to the visitor, by mainly presenting the beauty of nature.

Possible ways will be explored on how Naturalis can bring the Dutch biodiversity crisis to their visitors with an effect of (small) behaviour change on an individual or/and systemic level. Awareness and reflection on the biodiversity crisis of Naturalis' audience can be increased. Naturalis wants to implement this topic within the museum and wants to discover how to.

Naturalis is open for a change within their museum strategy and wants to find out how to use design in order to go a step beyond their current approach. Next to that, the main type of visitors, families, go to Naturalis for educational purposes and spending spare time for social purposes (recreational learning). This means that they are most likely open for learning about the diversity crisis. Furthermore, children are likely to learn and discover. They have their entire lives ahead of them, so teaching in an early stage of life could give a better result. Lastly, there is enough room for a design intervention, there is plenty of knowledge, space and sources to experiment. Naturalis collaborates with students a lot and therefor can provide good support.

This project will contribute to the Museum Futures Lab of TU Delft.

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introduction (continued): space for images

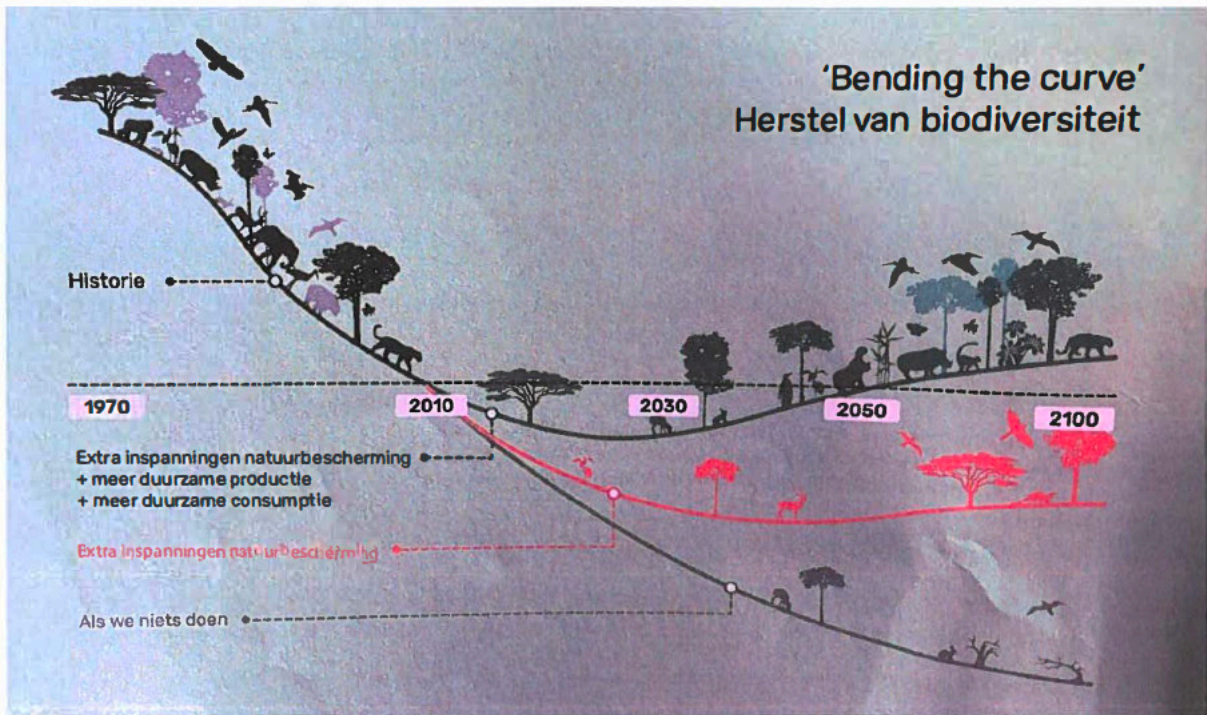


image / figure 1: The possible trends of biodiversity over the upcoming years (WWF magazine)

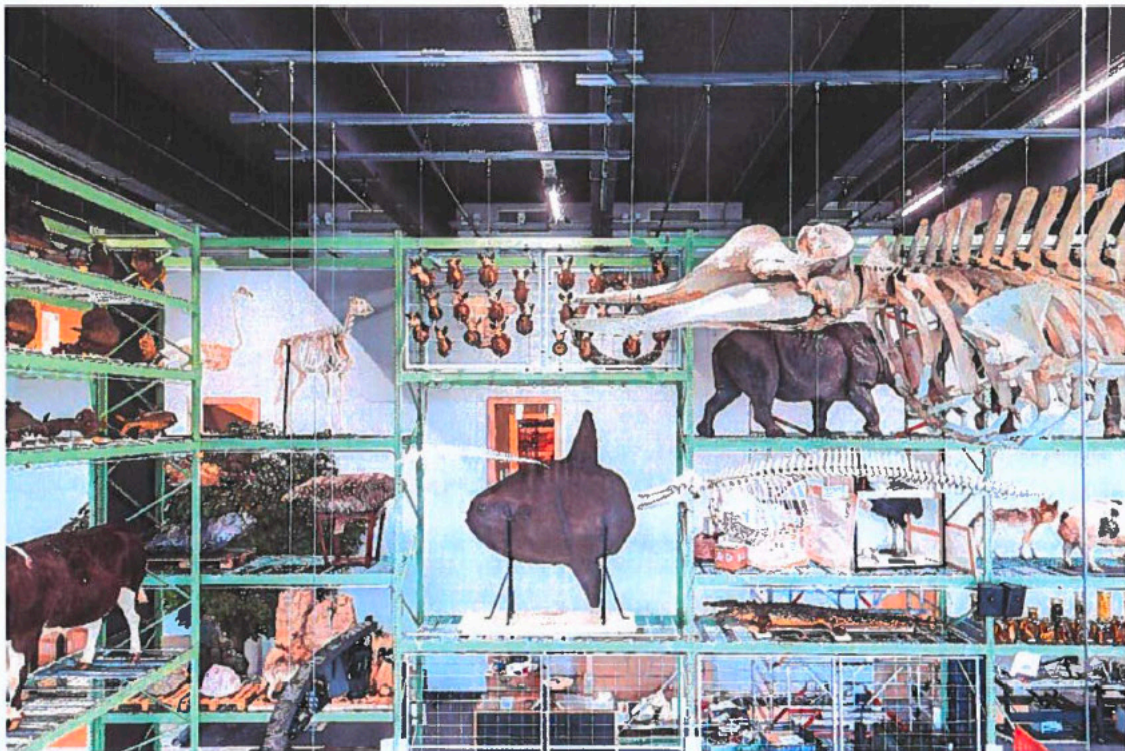


image / figure 2: Biodiversity Centre Naturalis - a showcase of all life on earth (Naturalis.nl)

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project

There will be designed according to research on designing for transformative museum experiences. It is possible to divide this strategy of transformation into four main phases. This process starts with confrontation and works towards integration in everyday life. Within this project there will be focused on the first two phases, since these are most likely to realise in given time and at the location. So, either on raising awareness by confronting the audience with a dilemma, or to foster deeper understandings by stimulating self-reflection. The design focuses on families, which consist of parents and their children. These two target groups bring their own challenges, overall they should together enjoy themselves and learn something. Visitors absorb and experience nature mainly within the walls of Naturalis. In order to create a change, it might be needed to implement design outside Naturalis as well. The entire visitor journey will be researched and then will be decided where it is best to implement the design.

The question comes with some challenges and limitations. As earlier stated, visitors come for social purposes. The museum should stay a fun activity where visitors should leave with a good feeling. It will be a challenge to bring such a heavy and difficult topic to the visitor in a light way. Besides, families want to be quickly entertained and it can be challenging to hold their attention. Also, visitors are only in the museum for a couple of hours and it will be difficult to measure the long term effects of the design intervention. Lastly, the concept of biodiversity is quite complex problem; if one specie in the system disappears, this could mean that others also disappear. For me it will be the task to make sense of this complexity and bring it to the target group in a understandable way. In the first weeks, a focus within biodiversity will be chosen, based on what appeals the target group the most.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

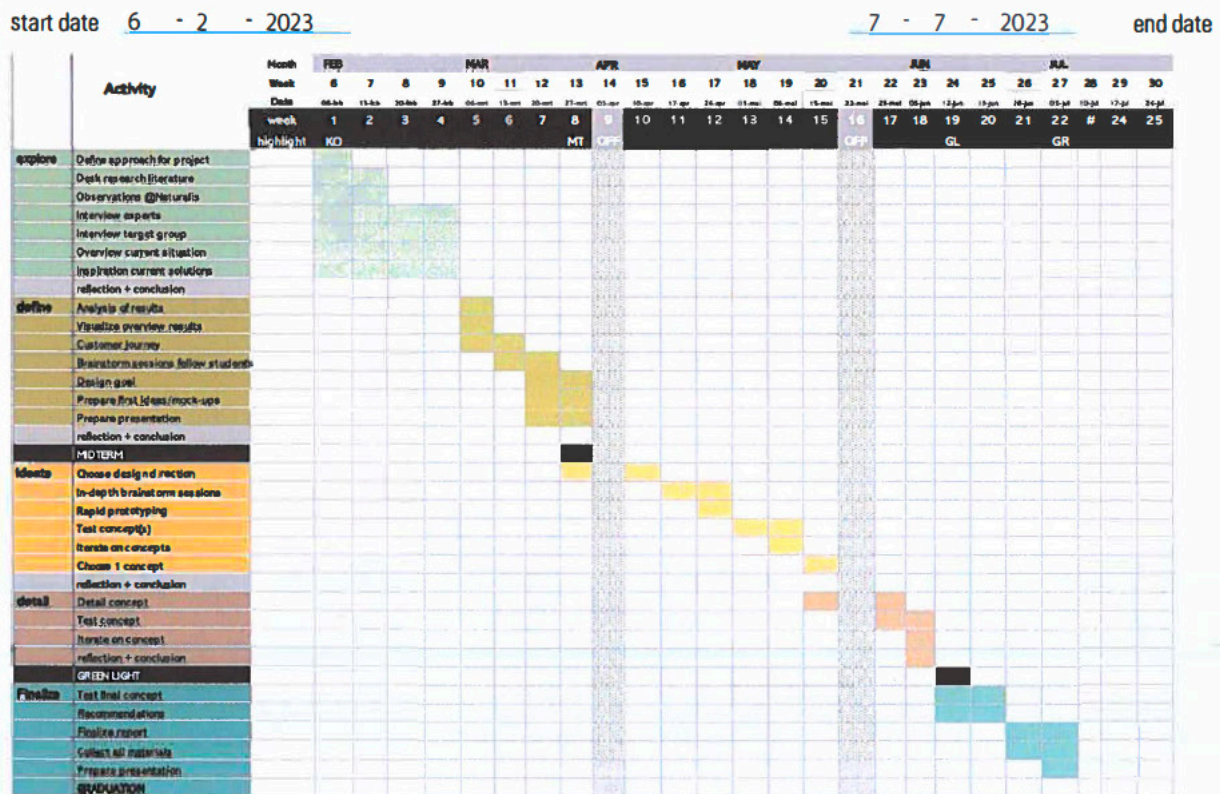
I want to design a playful transformative experience for families in Naturalis with the effect to make them aware of the biodiversity crisis and possibly make them reflect on their role on this topic

In the first weeks I will be in contact with families a lot: observations, conversations, in-depth interviews, mainly at Naturalis to gain insights on their current view on the topic. Next, look up existing examples of transformative experiences and find ways to implement this to Naturalis. Gain insights through talking to experts on biodiversity which helps me to divide the topic into parts and choose a focus. During the mid-term I will present all insights I gathered and decisions I made. With these insights I create the design goal and will start small testing, designing by doing, and ideation at the same time. Lastly the final prototype will be tested with families.

I am expecting to design a playful interaction that confronts families with the crisis and makes them reflect on themselves. The design brings families together and makes them explore the topic where they can learn from each other and have fun with each other. There is a play element which can come in several ways, either a product, intervention or installation. In which specific way will be decided in the first weeks by looking at existing examples implemented in other museums. I have a strong preference for physical design, which possibly can be supported with digital technology. The final design will be supported with a long term strategy on how Naturalis can strengthen awareness and reflection.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.



I have defined 5 phases: explore, define, ideate, detail and finalize.

I'll start with exploring the current situation: gather data via literature research, conversations at naturalis with visitors, generative sessions (booklet) to gain insights on the user journey (prepare for museum visit, visit and after), talking to experts (in the field of biodiversity, target group and transformative/behaviour change), look at existing designs and initiatives. In consultation with Naturalis I choose a specific topic within biodiversity.

Within the define phase I will analyze all results (clustering and finding gaps to design for). This will be presented in visual overviews. With these results I want to first come up with a design direction and design goal to create first rough ideas with individual brainstorm sessions. All of this will be presented during the mid-term presentation. If the time allows, I also want to bring these ideas (with sketches) to the target group.

After the midterm presentation, the ideation proceeds, where I will do more in-depth brainstorm sessions with fellow students and visitors, based on the first ideas presented during mid-term. Then, I'll choose 1-3 potential ideas which will be realized by making first prototypes that can be tested quickly with families at home.

Out of this 1 concept comes out that will be detailed in the detail phase. The concept and final test set up will be discussed during the green light meeting.

I will use the last four weeks to after green light to finalize: final test with the prototype at the fitting location, analyze results, recommendations, finish the report, collect all materials, visualize and in the end prepare the presentation.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge on a specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

I've always had a broad interest in nature, sustainability and museums. I like to get the chance to work at Naturalis since there is much knowledge available and they give enough freedom and possibilities (target group, location, resources, knowledge) to explore the topic and come up with a design. I also like to work together with the Museum Lab to learn from them and connect their knowledge to Naturalis. In terms of the subject: what I often notice in my surroundings: the climate and biodiversity crises are so complex and big that this tends to make people not acting out on solving it anymore. I see it as an opportunity to create a design that makes people think differently and reflect on themselves with the long term goal to change behaviour.

During DfI I improved my skills in conducting in-depth interviews and organising sessions with the target group. This is a part of the design process I like a lot, because of my interest in other people's beliefs and behaviour and gaining new insights to build on. I have a strong preference for designing physically (either a physical experience or product), rather than solely digital solutions such as apps. Furthermore, I have learnt the benefits of starting doing lots of testing in an early stage, that is why I want to start testing right away after the mid-term. This rapid testing helps to gradually work towards a design that fits the target group well. The fact that the graduation project is individual, which can be quite challenging at times, the continuous input of target group will also help to move forwards. A weekly moment of individual reflection will also help me to see if I am still on track. During my studies I have also been interested in finding ways to present my work. I have experience in making video's, animations, photos and graphic design. I am planning on using this a lot.

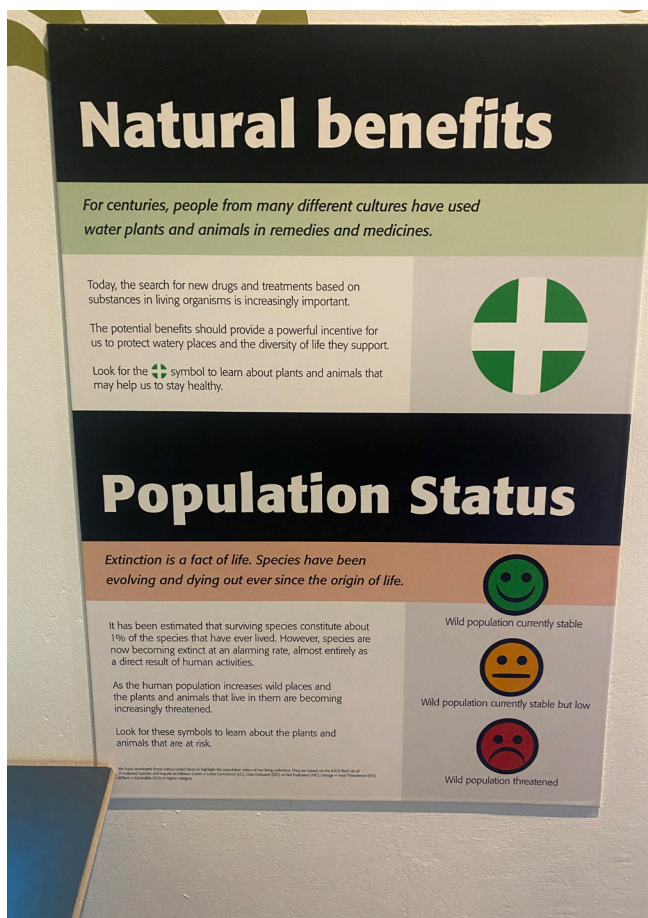
There are a few personal learning ambitions I want to address during this project. When I look back at all design projects I am mostly a conceptual designer and it will be a personal challenge to detail and deliver a well finished design. This will be a part of the project I want to focus on a lot, especially because it will also be tested in the real situation near the end of the project (most likely at Naturalis). I strive for designing something that can be tested on itself and is aesthetically pleasing. Biodiversity I know about, but I'd like to gain more in-depth knowledge on this topic. The field of transformative museum experiences is still quite new to me and I am looking forward on talking to experts and dive into research on museums. The design methodology of speculative design is one that interests me a lot, however I haven't used it yet throughout projects. This project is an opportunity to experiment with it, especially because it fits the scope a lot. Lastly, I want to explore on ways how to present my work, convey the story by an interactive presentation. This is based on experiences where I found it challenging to present work in a concise and clear manner.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

B

1. Photos Museums



Sustainability

The Natural History Museum works hard to make its exhibitions as sustainable as possible. We strive to use sustainable materials in constructing installations and ensure the components have as long a life as possible. All this contributes to our commitment to care for the natural world.

The history of our collections

As well as looking to the future, the Natural History Museum is committed to examining its past.

create a city full of nature!

“De biodiversiteit staat onder enorme druk! Dat hebben we als samenleving zo ver laten komen. Maar dat kunnen we dan ook als samenleving weer oplossen.”
— *prof. dr. Louise Vet, voorzitter Deltaplan Biodiversiteitsherstel*

“Biodiversity is under tremendous pressure! We as a society have let it get this far. But we can also solve this problem as a society.”
— Prof. Dr. Louise Vet, chair Delta Plan for Biodiversity Recovery



2. Interviews primary school teachers

1. Welke groepen heb je lesgegeven?

3-4-5

2. Wordt er op school aandacht gegeven aan het belang van natuur?

In deze groepen is geen methode op gebied van planten, dieren, omgeving, aarde. Wij besteden aandacht aan natuur tijdens projecten.

3. Welke onderwerpen binnen natuur vinden kinderen leuk en zijn relevant voor kinderen?

De eigen omgeving ontdekken.

Naast onze school is het bos. Met de kinderen gaan we soms naar het bos.

Wij geven dan gerichte opdrachten, zodat ze anders en met verwondering gaan kijken naar de natuur.

4. Wordt op school aandacht gegeven aan dat het niet zo goed gaat met de natuur?

Weinig.

5. Vind jij het belangrijk dat er aandacht wordt gegeven hieraan en waarom?

Ja dat is zeker belangrijk. Het is goed om ze bewust te maken van hoe belangrijk de natuur is voor het leven van de mens.

6. Welke kinderen zijn het meest klaar voor dit thema?

Voor kinderen van de bovenbouw; 9 t/m 12.

7. Hoe leren kinderen in jouw klas het liefst?

Praktijk, workshop, ervaren.

1. Welke groepen heb je lesgegeven?

Alle groepen lesgegeven, bovenbouw in stukjes. Onderbouw jaren.

2. Wordt er op school aandacht gegeven aan het belang van natuur?

Thematisch onderwijs, stukje waar natuur in zit. 6 weken dieper op in gaan. Met de hele school de grutto gaan volgen. (reis, eet, doet, land).

Andere scholen methoden. Bloembol kijken en hoe die groeit. Een uur per week.

Verschil onder- en bovenbouw. Onderbouw tuin in. Alles van de tuin bekijken en dan met de kinderen naar kriebelbeestjes kijken of wat er groeit. Hangt van seizoen af.

Middenbouw. Wat een aardappel nodig heeft, proefjes doen.

Bovenbouw. Helpen de tuin te verzorgen. Erover lezen wat heb je nodig. Om de tuin zo goed mogelijk te helpen.

Natuur is verplicht vak (traditioneel vak). Vrijer mag je kijken hoe je het aanbiedt. Waar interesse ligt kan je op aanpassen.

Hangt heel erg af van de leerkrachten en scholen hoe het aan bod komt. Kunt ook natuurlessen inkopen (gesubsidiëerd), week mee bezig.

Sommigen een eigen tuin en die verzorgen dat.

3. Welke onderwerpen binnen natuur vinden kinderen leuk en zijn relevant voor kinderen?

Plastic soep aanboren, ook onderdeel natuur. Vraag vanuit de overheid dan gebruik je dat in onderwijs.

Naar dierentuin met de kleuters. Kinderen gaan aan op de zeekoe. Sommigen zien het kleine vliegje aan tafel die komt mee eten. Kinderen gefixeerd op mus-

jes. Als je een mierenboerderij hebt in de klas gaan ze erop in maar met een houten olifant ook. Hoe je het brengt is het belangrijkste.

Naar het oog kijken van vlinders. Kudde dieren voelen aanstormen met geluid en trillingen. Zo gek maken als je zelf wilt zolang je maar er goed ingaat.

Als er een toets aan vastzit dan leren ze het wel want ze willen het halen. Bovenbouw vlinderkas inzetten, worden super goed verzorgd. Andere manier ernaar kijken. Hier op een school daar zijn ze gek op paarden. Spelen in bovenbouw ook nog paardje.

Geen verschil in onderbouw en bovenbouw.

4. Wordt op school aandacht gegeven aan dat het niet zo goed gaat met de natuur?

Verschilt ook weer per week. Thematisch. Dagelijks alles scheiden afval. Jaarlijks een lessencyclus. (Groen doen: cyclus over plastic soep). Oude meubels naar een ander land. Ene school heeft action andere school met spullen Zehands. Vanuit overheid niet. Je moet maatschappelijk lesgeven dus daar mag je het zelf onder verstaan.

Het gaat wel eens over dat er minder dieren zijn (bovenbouw). Komen er dan ook wel vragen vanuit de klas. Mag je geen stikstof uitstoten en dan hebben ze hier dat trekkefestival. Dan zou je ook wel discussies in de klas krijgen. Kinderen van loonwerkers die verdedigen alles met hand en tand. Wisselt ook met stad en dorp. Dan moeten kinderen wel klaar voor zijn.

5. Grootste verschil tussen Friesland en Amsterdam?

Geen verschil! Allemaal hetzelfde.

6. Vind jij het belangrijk dat er aandacht wordt gegeven hieraan en waarom?

Wel op aansturen als ik in zo'n thema zit. Kinderen hebben het niet echt door.

Wolven komen en steeds meer roofvogels en je ziet ze hier ook. Dus dat strookt niet met het idee dat er minder dieren zijn. Gigantisch hoeveel ganzen en weidevogels je ziet.

Als ik het zou bespreken dan zou ik het in de praktijk doen. (Bos in Duitsland). Als je het zomaar bespreekt dan krijg je die discussie.

7. In welke vorm zouden kinderen het best hierover kunnen leren? (praktijk, lezen, luisteren, film, onder ogen zien, workshop)

In Sneek: naar de groene boer, stukje land bekijken. Is ook een man die geeft natuurlessen. ADHD, drukte werkt, geen blad voor de mond. Die neemt ze naar buiten. Het gras is uit Engeland maar dat komt niet uit Nederland. Niet inheemse. Dan komen ze met plantjes. De rest is onkruid dat trekken we weg, dat is toch raar.

8. Hoe leren kinderen in de bovenbouw het liefst?

Met alle zintuigen, horen, voelen, zien, prikkelen, lichaam erin, dingen vastpakken. Allemaal onderzoek

9. Hoe zou jij dat zelf doen in Naturalis

Ik ben iemand van de praktijk, te hak op de tak om gedachtegang uit te leggen. Als ik de tuin in ga dan zit ik er middenin, en dan gebeurt er gewoon iets. Zintuigen erbij en hoe je die kan aanspreken. Ik zou naar een klas gaan, lekker in de buurt. Delft: dvs (hoogopgeleid wit). Verschil tussen platteland en stad wel anders want je ziet ze vliegen. Maarja eigenlijk ook weer niet want in de Bijlmer ook weer in de grond wroeten. Verschil: kinderen hoogopgeleide ouders of laag? Alleen in taalbegrip verschil.

3. Interview Materials



Wist jij dat het aantal **bijen** in Nederland sterk afneemt? Van de 360 soorten in Nederland, is meer dan de helft met uitsterven bedreigd. (Rijksoverheid)

Wil je weten **waardoor** dit komt?
Draai dan de kaart om.



Bijen hebben een **gebrek aan nestgelegenheid** en **voedsel**, door onder andere intensieve landbouw en verstedelijking.



Wist jij dat het aantal **bijen** in Nederland sterk afneemt? Van de 360 soorten in Nederland, is meer dan de helft met uitsterven bedreigd. (Rijksoverheid)

Wil je lezen hoe de bij al **geholpen** wordt? Draai dan de kaart om.



Aandacht vanuit bewoners en gemeenten lijkt de **bijen** te helpen. Het maaibeleid is in veel gemeenten aangepast en mensen zaaien in hun tuin. Bij de 3e nationale bijentelling in 2020 werden een record aantal bijen geteld.



Wist jij dat het aantal **bijen** in Nederland sterk afneemt? Van de 360 soorten in Nederland, is meer dan de helft met uitsterven bedreigd. (Rijksoverheid)

Wil je weten wat de **gevolgen** zijn?
Draai dan de kaart om.

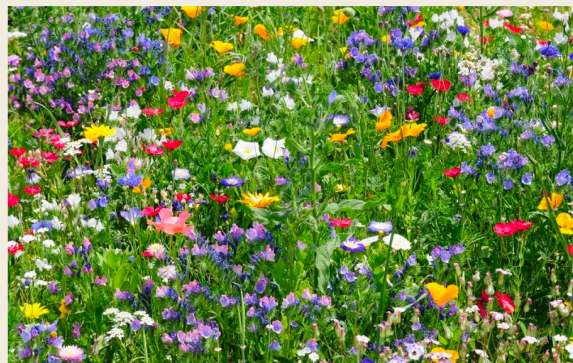


Gewassen zijn afhankelijk van bestuiving. Een tekort aan **bijen** beperkt de hoeveelheid voedsel die kan worden verbouwd. Dit kan een probleem worden voor onze voedselvoorziening.



Wist jij dat het aantal **bijen** in Nederland sterk afneemt? Van de 360 soorten in Nederland, is meer dan de helft met uitsterven bedreigd. (Rijksoverheid)

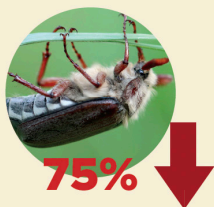
Ben jij benieuwd wat **jij** hiertegen kan doen? Draai dan de kaart om.



Je kunt de **bijen** onder andere helpen door je balkon of tuin te voorzien van bloemen waar bijen op afkomen, tegels weg te halen of je gras wat minder vaak te maaien.



Hoeveel insecten tel jij er nog? De totale biomassa aan insecten is met **75%** afgenomen in **Duitse natuurgebieden**, sinds **1989**.



Heb jij de Grutto wel eens gezien? De weidevogel van **Nederland**, is met de **helft** afgenomen sinds het **begin van deze eeuw**.





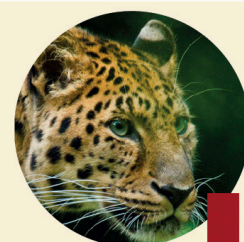
Ken jij het land
Madagascar? Op
Madagascar zijn van de
219 diersoorten **op dit**
moment 110 met
uitsterven bedreigd.



50%



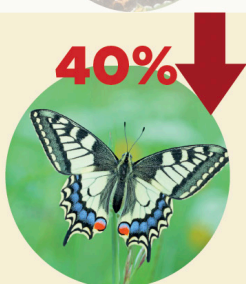
Heb jij het al gemerkt?
Sinds **1970** zijn
wereldwijd populaties
vissen, vogels,
zoogdieren, reptielen en
amfibieën met **68%**
afgenomen.



68%



Vind jij vlinders ook zo
mooi? Er zijn steeds
minder vlinders in de
tuin omdat het aantal
vlinders is in Nederland
sinds **1992** is
afgenomen met **40%**.



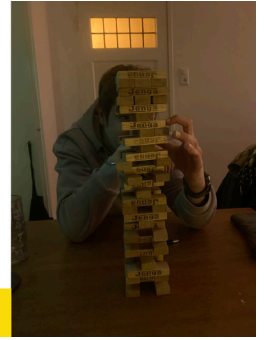
40%

4. Co Creation Session Materials



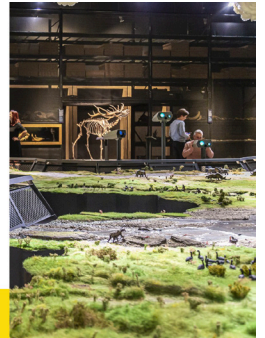
spel

welke **spellen** vinden jullie leuk om te spelen?



museum

wat vinden jullie leuk om te doen in een **museum**?



Yamila

Delft

Naturalis

mens tegen insect voorbeelden



Mijn doel

spel ontwerpen voor in het **museum** waar families
leren dat er steeds **minder insecten** zijn

1.

licht 's avonds

op straat

Doordat wij in de nacht willen zien,
doen we het licht aan. Denk
bijvoorbeeld aan lantaarnpalen. Helaas
zorgt dit ervoor dat insecten hun
navigatievermogen kwijtraken en op het
licht afvliegen. Daardoor raken ze
uitgeput en gaan ze uiteindelijk dood.



2.

stenen

op het schoolplein

Vaak worden pleinen vol gelegd met
stenen zodat er geen onderhoud aan is.
Hierdoor hebben insecten minder plek
om te leven, waardoor zij verdwijnen.





3.

bestrijdingsmiddelen

op gewassen

Wij eten in Nederland dagelijks heel veel groenten en fruit. Een groot gedeelte hiervan is bespoten met pesticiden om te zorgen dat insecten de groenten en fruit niet opeten. Helaas gaan er hierdoor veel insecten dood.

richtlijnen

1. fysiek spel
2. in een museum
3. samen met familieleden
4. kort (maximaal 10 minuten)



4.

minder plek voor natuur

in de stad

Wij trekken massaal naar de stad om te werken en leven. Maar dat betekent ook dat er minder ruimte komt voor natuur, waardoor insecten geen leefgebied hebben.

vragen

1. aantal deelnemers?
2. samenwerken of competitie?
3. hoe groot is het?
4. hoe kan je winnen?
5. wat zijn de regels?
6. wat heb je nodig om het spel te maken?



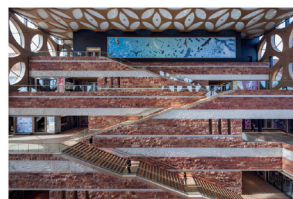
5.

gif

in de tuin

Wij trekken massaal naar de stad om te werken en leven. Maar dat betekent ook dat er minder ruimte komt voor natuur, waardoor insecten geen leefgebied hebben.

Bedenk een **spel** voor **Naturalis** waarbij de bezoeker de **insecten** moet redden



fysiek. kort. familie. museum.

teken op de achterkant jullie spel

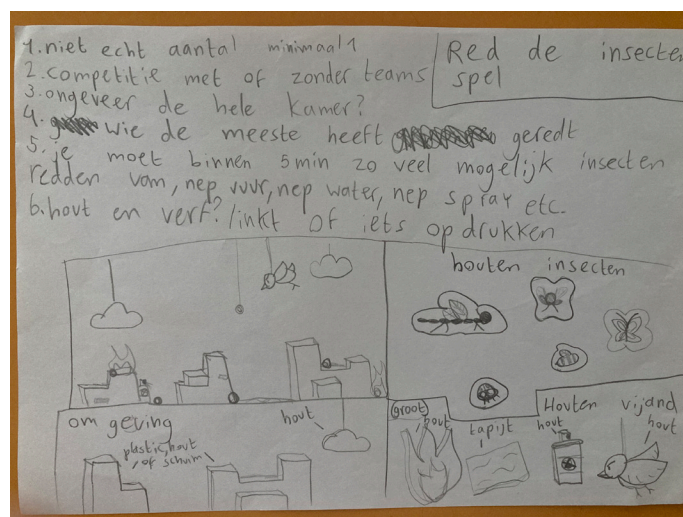


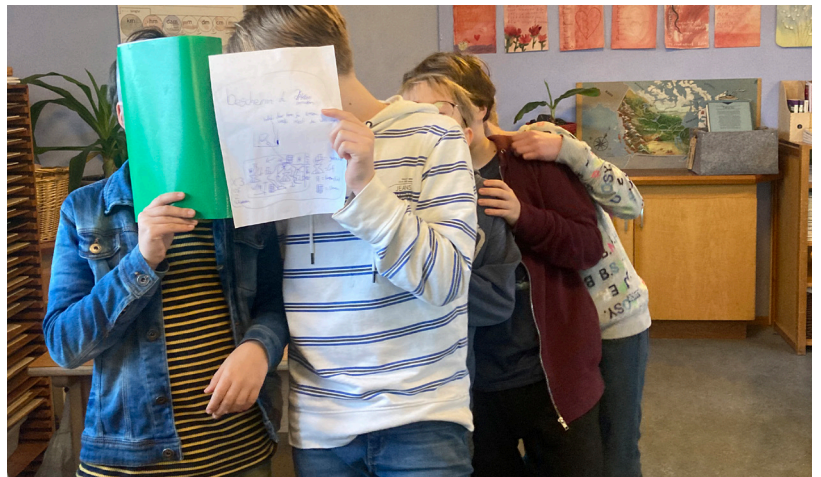
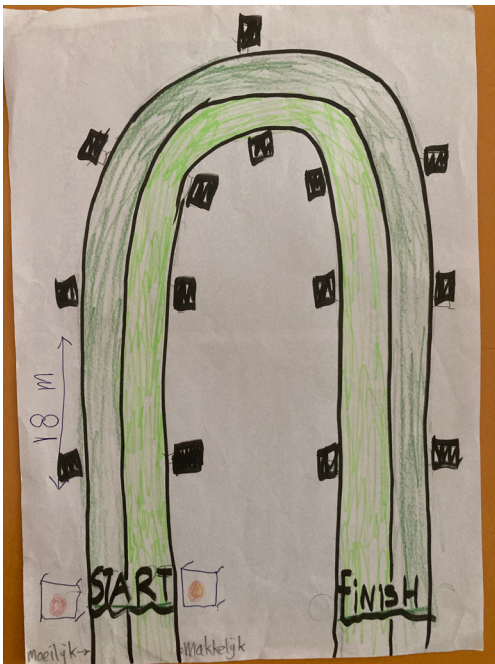
En nu jullie!

bedenk nu samen een spel

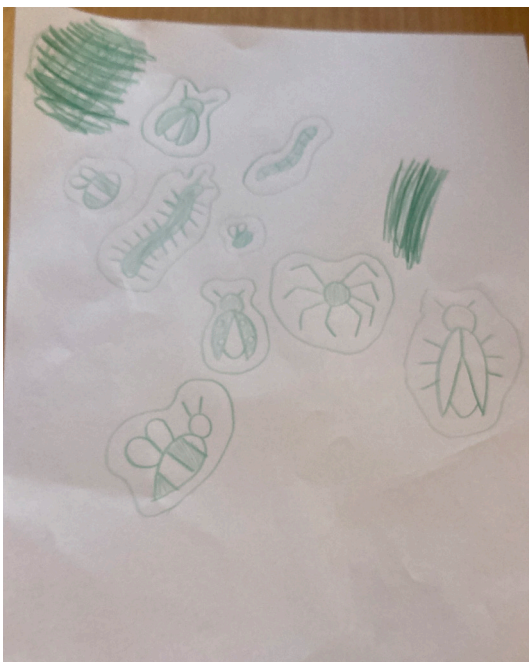
maak je eigen groepje met 5/6

opdracht: bedenk een leuk spel waarbij je als bezoeker de insecten moet redden





1. Introducing myself to the group
2. Explaining my challenge: to design an exhibit for Naturalis
3. Classical conversation on games they prefer
4. Classical conversation on things they like to do in museum
5. Explanation on examples of enemies of insects (light pollution, pesticides, verstering, decrease of wild nature, anti-insect spray)
6. Explanation on the assignment: design your own game for in the museum
7. Explain the guidelines of the game: museum, together with a family, educative, game should last 5 minutes maximum
8. Groups of 5 children each come up with one game
9. Each group presents the game classically



Leuke Spellen

Jenga	Verstopperje	Uno	Monopoly	Bowlen	Hally gally	Catan Keezen	Ticket to Ride
Risk	Speed Cups	Angry Birds	30 seconds	fluffy fall	reis om de wereld	Fifa	Cluedo

Elementen

Verschermbaard	Geld	Iets kopen	Uniek	Mikken	Punten	Veroveren	Snelheid	Wegrennen
Tijdsdruk	Simpel	Veel levels	Herkenbaar (ik zit ook op voetbal)	Tijdverdrijf	Samenwerken	Tijdsdruk	Kijken hoe de ander op iemand reageert	Vrij spelen

Museum

Verdielen	Verzamelen	Kattenkabinet: kat zien	Nieuw	Leren	Zo veel te doen	Maquette	Kunst bekijken	Variatie
Speurtocht	Doe dingen	Experimenteren	Proefjes	Interactief	Aanraken	Voelen	Ontdekken (binnenkant van een dier zien)	

5. Session with Naturalis

Session Naturalis

1. Group brainstorm on definition of 'biodiversity crisis'
2. Define definition of biodiversity crisis individually in 1-2 sentences
3. Group brainstorm on message Naturalis wants to spread to its visitors
4. Define message Naturalis wants to spread individually
5. Brainstorm in groups of 4 on examples that indicate biodiversity crisis
6. Map examples on axis (individual - world)
7. Brainstorm HKJ's on:
 - how to get inspired
 - how to share information
 - how to create awareness
 - how to initiate reflection
8. connect input from HKJ's to the target group of families
9. Create ideas through combining input from HKJ's and examples of biodiversity crisis
10. Both teams pitch their ideas to each other, plenary discussion

Sessie		welke boodschap willen we uitbrengen	wat is biodiversiteitscrisis	welke voorbeelden van biodiversiteitscrisis zijn er	welke voorbeelden passen bij de doelgroep
1	Welke woorden komen er bij je op bij het woord biodiversiteitscrisis?	Klassikaal woorden opschrijven			5 min
2	Schrijf nu in 1-2 zinnen de definitie van biodiversiteitscrisis op, op een post-its	Individueel definiëren			3 min
3	Nu gaan we verder in 2 groepen	Groepen maken			2 min
4	Voorbeelden waarin je de biodiversiteitscrisis ziet terugkomen	Brainstormen op post-its			5 min
5	Mappen op een as (wereld-individueel)	Post-its mappen op een as			5 min
6	Brainstormen met HKJ's	HKJ			5 min
	HKJ leren	HKJ 'spelen' stimuleren	HKJ geïnspireerd raken		
	HKJ desoriënteren	HKJ reflecteren			
7	Koppeling met de doelgroep	Ui			5 min
8	Combineer de as met de ui	Ideekaarten			5 min
9	Pitch	Ideekaarten			5 min
10	Afronding	Klassikaal afsluiten en bedanken			5 min

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de families die Naturalis bezoeken?

installatie zoals zonnen stelsel waar ze re dan een bloem bestuift en de vogel de bloem nodig heeft, wat als X weg valt? groene weg, heilworm, ...

Wat gebeurt er als X weg gaat?

Supermarkt-schap Nu en over 50 jaar als we zo door gaan

betreft op wild & planten

omschrijving

P.O. Box 9517, 2300 RA Leiden, The Netherlands

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de families die Naturalis bezoeken?

A/B spel: Kies de meest duurzame! Zo hoog mogelijke score halen. Iets meegeven (of QR-code) om thuis nog eens door te nemen.

of duurzaam benig invulling met andere bezoekers-challenge

Impact laten zien!

omschrijving bv. plastic vs bamboe-tandenborstel + boterhamzakje vs broodtrommel

tekening

P.O. Box 9517, 2300 RA Leiden, The Netherlands

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de families die Naturalis bezoeken?

Samenwerkingsspel * Yenga toren: samen willen we de toren behouden tegen omvallen, terwijl een tegenkracht hem afbrekt

tekening

omschrijving

P.O. Box 9517, 2300 RA Leiden, The Netherlands

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de bezoeker (families) die Naturalis bezoeken?

Condoleance-register voor een dood dier (bryn) uitgestorven

Ander ideeetje: Onbekende kleine dieren net zo groot maken als een mens, zodat ze echt een gezicht krijgen

omschrijving

tekening krijgen

P.O. Box 9517, 2300 RA Leiden, The Netherlands

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de bezoekers (families) die Naturalis bezoeken?

* Draai aan de knoppen van de wereld. Welke dieren profiteren? Welke redden het niet? knoppen: temperatuur industrie

tekening

omschrijving

P.O. Box 9517, 2300 RA Leiden, The Netherlands

N Naturalis
Biodiversity Center

idee kaart

Hoe brengen we de Biodiversiteitscrisis bij de families die Naturalis bezoeken?

Zou leven (etc.) Kies de impact van plastic laten zien; het is overal; zek licht opkwal.

tekening

omschrijving

P.O. Box 9517, 2300 RA Leiden, The Netherlands

6. Contextmapping Interviews

1. Families receive a sensitizing booklet through post, which was expected to be filled in prior to the visit
2. Families are welcomed by interviewer in the museum
3. Families are observed for the first 30 minutes of their visit
4. After entire visit they are interviewed together, where trigger materials are brought to remind them of the visit

The iterated set-up

1. Families receive a sensitizing booklet through post, which was expected to be filled in prior to the visit
2. Families are welcomed by interviewee in the museum
3. Families are asked to walk around live science for 15 minutes whereafter they are asked questions on their experience
4. Families are brought to hall 'death' where they are asked specific questions on exhibit part of death of insects
5. Families are asked to walk through the museum freely where they are observed for a maximum of 15 minutes
6. Families visit their visit and final questions are asked afterwards

Further details on semi structured interviews can be found in the appendix .

Family 1.

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilia van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoende beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

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De onderzoekers nemen de geldende COVID-19 richtlijnen in acht. Als deelnemer aan dit onderzoek zal ik de COVID-19 maatregelen respecteren en de aanwijzingen van de onderzoekers opvolgen.

Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Zitman Achternaam Lauri Voornaam
17/2/2023

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Bliemer Achternaam milan Voornaam
17/2/2023
Datum (dd/mm/jjjj) MD (moeder) Handtekening

jullie en de natuur

wat vinden jullie leuk aan de natuur?

alle dieren die erin leven

aquarium met visjes
planten in huis
de bloemen met de beestjes in de tuin

hoe kun je natuur vinden bij jullie thuis?



Naam	Yamilia	Naam	milan	Naam	Lauri	Naam	
Leeftijd	25	Leeftijd	4	Leeftijd	37	Leeftijd	
Hobby	muziek	Hobby	speles	Hobby	sport	Hobby	

Wij zijn al eens in Naturalis geweest: Nee ☒ een keer ☐ vaker

vul in en teken jezelf in

teken en schrijf om het woord

dierjes (de dierentuin)
bos & blaadjes
Natuur
bloemen met de beestjes (bijen)

wat betekent natuur voor jullie?

3

schrijf je favorieten hier op

tv programma('s) over natuur



milan kijkt graag naar dieren op iets met dino's

boeken over natuur



Het grote dino-boek

dieren



Dino's

planten



In de tuin met de beestjes

plek in natuur



het bos

5

niet leuk, jammer dat er steeds minder wilde dieren zijn

er is steeds minder natuur...

De wereld verandert. Meer verstedelijking en minder respect voor de natuur van mensen

wat vinden jullie daarvan?

hoe denken jullie dat dit komt?

afname van natuur

6

wat kan Nederland doen om de natuur te redden?

gebieden beschermen

wat kan jij doen om de natuur te redden?

geen afval op straat

natuur goed verzorgen, met respect

natuur in onze eigen tuin maken

jouw oplossing

7

Route

- komen voor de ervaring
- mee laten nemen

Waar zijn jullie nog naar toe geweest nadat ik even weg ging?

Alle zalen behalve livescience

Wat waren hier de hoogtepunten?

Evolutie: handscaaner (interactie)
 Dino: T-Rex (fan vindino's)
 Ijsijd: waterbazen, verrckijker
 de Dood: gorilla
 de Verleiding: knuikenjes eten geven met ballen
 de Vroege mens: zei niet zoveel
 Leven: alle dieren
 Qarde: zei n niet zoveel (te veel info)

Pak de foto's van de zalen erbij

Afsluiting

Hoe zijn jullie hierover te weten gekomen?

> in museum is al iets over 'dood' - dood beest die ligt

>

Willen jullie hier meer over leren in Naturalis, zo ja wat precies?

> visualiseren van afname natuur
 > het museum is voor ons gefocust op evolutie en vroeger. Afname van natuur is iets in de toekomst. Misschien een extra zaal toevoegen die het verhaal compleet maakt

De Inhoud

Naturalis laat veel natuur zien. Wisten jullie dat er steeds minder natuur is?

algemeen zin wel bekend, specifiek niet

Zo ja... wat weten jullie hier over?

> door reclames op tv, dat is wel een conversatie starter
 (Mulan vraagt er wel eens naar. (moet wel een triggerpunt zijn))
 > Op school krijgt hij er nog niks over mee

Jullie ervaring

Wat vonden jullie het leukst om samen als familie te doen en waarom?

in de ijsijd samen door de verrckijkers kijken en op die manier reflecteren over wat er allemaal te zien valt

Wat vonden jullie het leukst om over te leren?

in de zaal dood > we bestaan uit deeltjes maar lossen ook weer op. 'interessante manier om elkaar te kijken!'
 Wilden wel meekijken maar was al iemand mee bezig
 'Ik weet niet of we echt wat geleerd hebben...'

Afsluiting

Wat mogen andere families echt niet missen in het museum?

handscaannen in de zaal evolutie

interactie, wat werkt:

- animatie
- interactief
- 3d cirkel zaal dood
- in een situatie meegenomen worden

wat werkt niet:

- scherm
- informatiebordjes

Family 2.

van Naturalis

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Paolini
Achternaam
21/02/2023
Datum (dd/mm/jjjj)

Bo
Voornaam
[Handtekening]
Handtekening

Monique en Jonas

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

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Wjbrands
Achternaam
21/2/2023
Datum (dd/mm/jjjj)

Monique
Voornaam
[Handtekening]
Handtekening

Monique en Jonas

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Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren en te gebruiken voor onderwijs- en onderzoeksdoeleinden.

Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

Met mijn handtekening bevestig ik dat ik de informatie over het onderzoek heb gelezen en dat ik de aard van mijn deelname heb begrepen. Ik begrijp dat ik mijn deelname aan het onderzoek op elk moment kan intrekken of kan stoppen. Ik begrijp dat ik niet verplicht ben om vragen te beantwoorden die ik niet wil beantwoorden en dat ik dit kan aangeven bij het onderzoeksteam.

De onderzoekers nemen de geldende COVID-19 richtlijnen in acht. Als deelnemer aan dit onderzoek zal ik de COVID-19 maatregelen respecteren en de aanwijzingen van de onderzoekers opvolgen.

Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Wolff
Achternaam
21/02/2023
Datum (dd/mm/jjjj)

Alte
Voornaam
[Handtekening]
Handtekening

Monique en Jonas

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilia van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

Mij is bekend dat dit onderzoek bestaat uit:

1. Onderzoeksactiviteit 1. Invullen van een 'sensitizing booklet', voor het bezoek aan Naturalis.
2. Onderzoeksactiviteit 2. Door het museum heenlopen en geobserveerd worden.
3. Onderzoeksactiviteit 3. Vragen beantwoorden achteraf aan onderzoeksactiviteit 1 en 2.

Ik ben mij ervan bewust dat tijdens het onderzoek gegevens worden verzameld in de vorm van bijvoorbeeld aantekeningen, foto's, video's en/of geluidsopnames. Ik geef toestemming voor het verzamelen van deze gegevens en het maken van geluidsopnames, foto's en video opnames tijdens het onderzoek. Gegevens zullen geanonimiseerd worden verwerkt en geanalyseerd (zonder naam of andere identificeerbare informatie). Deze gegevens zijn alleen voor het onderzoeksteam en hun TU Delft begeleiders en Naturalis beschikbaar.

De foto's, video's en/of geluidsopnames zullen worden gebruikt ter ondersteuning van het analyseren van verzamelde gegevens. Video opnames en foto's kunnen tevens worden gebruikt ter illustratie van onderzoeksbevindingen in publicaties en presentaties over het project.

Ik geef toestemming voor het gebruik van foto's en video opnames van mijn deelname:

(selecteer wat van toepassing is)

☒ waarin ik herkenbaar ben voor publicaties en presentaties over het project.

☐ waarin ik niet herkenbaar ben voor publicaties en presentaties over het project.

☐ enkel voor data analyse doeleinden en niet voor publicaties en presentaties over het project.

Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren en te gebruiken voor onderwijs- en onderzoeksdoeleinden.

Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

Met mijn handtekening bevestig ik dat ik de informatie over het onderzoek heb gelezen en dat ik de aard van mijn deelname heb begrepen. Ik begrijp dat ik mijn deelname aan het onderzoek op elk moment kan intrekken of kan stoppen. Ik begrijp dat ik niet verplicht ben om vragen te beantwoorden die ik niet wil beantwoorden en dat ik dit kan aangeven bij het onderzoeksteam.

De onderzoekers nemen de geldende COVID-19 richtlijnen in acht. Als deelnemer aan dit onderzoek zal ik de COVID-19 maatregelen respecteren en de aanwijzingen van de onderzoekers opvolgen.

Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Voor
Achternaam
21/2/2023
Datum (dd/mm/jjjj)

Jonas
Voornaam
[Handtekening]
Handtekening

teken en schrijf om het woord

milieu

natuur

dieren

planten

wat betekent natuur voor jullie?

3

jullie en de natuur

wat vinden jullie leuk aan de natuur?

schrijf je favorieten hier op

park

hoe kun je natuur vinden bij jullie thuis?

4

er is steeds minder natuur...

verstedelijking

CO2

te veel

wat vinden jullie daarvan?

hoe denken jullie dat dit komt?

afname van natuur

6

schrijf je favorieten hier op

tv programma('s) over natuur

boeken over natuur

dieren

planten

plek in natuur

David Attenborough

BLU

Bomen

het park en de zee

5

Wat kan Nederland doen om de natuur te redden?

minde auto's

Wat kan jij doen om de natuur te redden?

minder vlees eten

jouw oplossing

7

even voorstellen

Naam

Leeftijd

Hobby

Wij zijn al eens in Naturalis geweest:

Nee

een keer

vaak

vul in en teken jezelf in de vakjes

2

De Inhoud

Naturalis laat veel natuur zien. Wisten jullie dat er steeds minder natuur is?

zo ja... wat weten jullie hier over?

8

Jullie ervaring

Wat vonden jullie het leukst om samen als familie te doen en waarom?

Wat vonden jullie het leukst om over te leren?

9

Afsluiting

Wat mogen andere families echt niet missen in het museum?

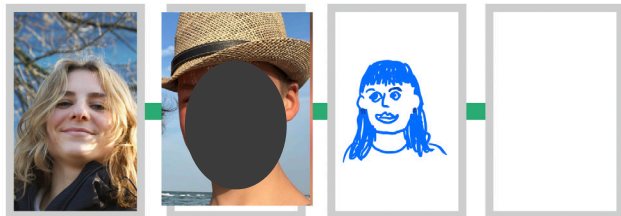
10

Route

Waar zijn jullie nog naar toe geweest nadat ik even weg ging?

Wat waren hier de hoogtepunten?

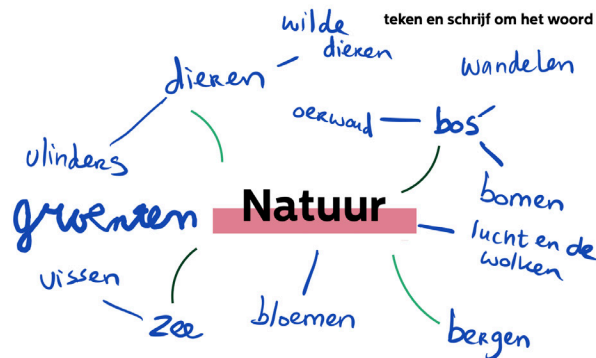
11



Naam	Yamilia	Naam	Jonas 10	Naam	Monique 45	Naam	
Leeftijd	25	Leeftijd	10	Leeftijd	45	Leeftijd	
Hobby	muziek	Hobby	gamen	Hobby	kickboksen	Hobby	

Wij zijn al eens in Naturalis geweest: ☒ Nee ☐ een keer ☐ vaker

vul in en teken jezelf in de vakjes



wat betekent natuur voor jullie?

3

jullie en de natuur

wat vinden jullie leuk aan de natuur?

- altijd nieuwe dingen ontdekken
- dieren
- frisse lucht

- planten en bloemen
- verzamelde stenen

hoe kun je natuur vinden bij jullie thuis?

4

schrijf je favorieten hier op

tv programma(s) over natuur



boeken over natuur



dieren



planten



plek in natuur



?

Yukon-Fluoroman

Kat

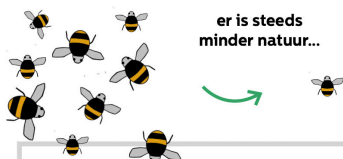
appelboom

zeemat, Zwitserland
bergen

5

- jammer
- zorgelijk

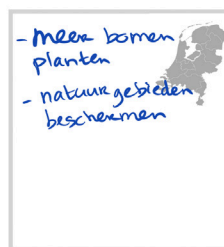
wat vinden jullie daarvan?



- CO2 en methaan (zegt jonas)
- teveel mensen

hoe denken jullie dat dit komt?

wat kan Nederland doen om de natuur te redden?



wat kan jij doen om de natuur te redden?

- meer bomen planten
- opletten op wat we kopen en weggooien
- minder met uitjes

Family 3.

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilva van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

Mij is bekend dat dit onderzoek bestaat uit:

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3. Onderzoeksactiviteit 3. Vragen beantwoorden achteraf aan onderzoeksactiviteit 1 en 2.

Ik ben mij ervan bewust dat tijdens het onderzoek gegevens worden verzameld in de vorm van bijvoorbeeld aantekeningen, foto's, video's en/of geluidsopnames. Ik geef toestemming voor het verzamelen van deze gegevens en het maken van geluidsopnames, foto's en video opnames tijdens het onderzoek. Gegevens zullen geanonimiseerd worden verwerkt en geanalyseerd (zonder naam of andere identificeerbare informatie). Deze gegevens zijn alleen voor het onderzoeksteam en hun TU Delft begeleiders en Naturalis beschikbaar.

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☐ waarin ik niet herkenbaar ben voor publicaties en presentaties over het project.
☐ enkel voor data analyse doeleinden en niet voor publicaties en presentaties over het project.

Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren en te gebruiken voor onderwijs- en onderzoeksdoeleinden.

Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

Met mijn handtekening bevestig ik dat ik de informatie over het onderzoek heb gelezen en dat ik de aard van mijn deelname heb begrepen. Ik begrijp dat ik mijn deelname aan het onderzoek op elk moment kan intrekken of kan stoppen. Ik begrijp dat ik niet verplicht ben om vragen te beantwoorden die ik niet wil beantwoorden en dat ik dit kan aangeven bij het onderzoeksteam.

De onderzoekers nemen de geldende COVID-19 richtlijnen in acht. Als deelnemer aan dit onderzoek zal ik de COVID-19 maatregelen respecteren en de aanwijzingen van de onderzoekers opvolgen.

Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Kuipers

Achternaam
3/3/2023

Datum (dd/mm/jjjj)

Michelle

Voornaam

Handtekening

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilva van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

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Ik ben mij ervan bewust dat tijdens het onderzoek gegevens worden verzameld in de vorm van bijvoorbeeld aantekeningen, foto's, video's en/of geluidsopnames. Ik geef toestemming voor het verzamelen van deze gegevens en het maken van geluidsopnames, foto's en video opnames tijdens het onderzoek. Gegevens zullen geanonimiseerd worden verwerkt en geanalyseerd (zonder naam of andere identificeerbare informatie). Deze gegevens zijn alleen voor het onderzoeksteam en hun TU Delft begeleiders en Naturalis beschikbaar.

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(selecteer wat van toepassing is)

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☐ enkel voor data analyse doeleinden en niet voor publicaties en presentaties over het project.

Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren en te gebruiken voor onderwijs- en onderzoeksdoeleinden.

Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Van der Wiel

Achternaam

3/3/2023

Datum (dd/mm/jjjj)

Max

Voornaam

Handtekening

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilva van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

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Ik ben mij ervan bewust dat tijdens het onderzoek gegevens worden verzameld in de vorm van bijvoorbeeld aantekeningen, foto's, video's en/of geluidsopnames. Ik geef toestemming voor het verzamelen van deze gegevens en het maken van geluidsopnames, foto's en video opnames tijdens het onderzoek. Gegevens zullen geanonimiseerd worden verwerkt en geanalyseerd (zonder naam of andere identificeerbare informatie). Deze gegevens zijn alleen voor het onderzoeksteam en hun TU Delft begeleiders en Naturalis beschikbaar.

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Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren en te gebruiken voor onderwijs- en onderzoeksdoeleinden.

Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

Met mijn handtekening bevestig ik dat ik de informatie over het onderzoek heb gelezen en dat ik de aard van mijn deelname heb begrepen. Ik begrijp dat ik mijn deelname aan het onderzoek op elk moment kan intrekken of kan stoppen. Ik begrijp dat ik niet verplicht ben om vragen te beantwoorden die ik niet wil beantwoorden en dat ik dit kan aangeven bij het onderzoeksteam.

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Van der Wiel

Achternaam

03/03/2023

Datum (dd/mm/jjjj)

Kasper

Voornaam

Handtekening

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilva van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

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Ik ben mij ervan bewust dat tijdens het onderzoek gegevens worden verzameld in de vorm van bijvoorbeeld aantekeningen, foto's, video's en/of geluidsopnames. Ik geef toestemming voor het verzamelen van deze gegevens en het maken van geluidsopnames, foto's en video opnames tijdens het onderzoek. Gegevens zullen geanonimiseerd worden verwerkt en geanalyseerd (zonder naam of andere identificeerbare informatie). Deze gegevens zijn alleen voor het onderzoeksteam en hun TU Delft begeleiders en Naturalis beschikbaar.

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Ik erken dat er geen financiële compensatie gegeven wordt voor deelname aan het onderzoek.

Met mijn handtekening bevestig ik dat ik de informatie over het onderzoek heb gelezen en dat ik de aard van mijn deelname heb begrepen. Ik begrijp dat ik mijn deelname aan het onderzoek op elk moment kan intrekken of kan stoppen. Ik begrijp dat ik niet verplicht ben om vragen te beantwoorden die ik niet wil beantwoorden en dat ik dit kan aangeven bij het onderzoeksteam.

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

vanderWiel

Achternaam

3/3/2023

Datum (dd/mm/jjjj)

Boris

Voornaam

Handtekening

Family 4.

Joost

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilia van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Modderman
Achternaam
02/03/2023

Joost
Voornaam
[Handtekening]
Handtekening

Joost

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilia van der Heide (0624932833)

Toestemmingsverklaring participant

Ik neem vrijwillig deel aan dit onderzoek.

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Een kopie van deze toestemmingsverklaring zal aan mij worden gegeven.

Leenaars
Achternaam
02/03/2023

Lonneke
Voornaam
[Handtekening]
Handtekening

Joost

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

Dit onderzoek wordt uitgevoerd als afsluitend afstudeerproject van de MSc opleiding Industrieel Ontwerpen aan de TU Delft.

Contactpersoon: Yamilia van der Heide (0624932833)

Toestemmingsverklaring participant

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Ik erken dat ik vooraf voldoende informatie en uitleg heb gekregen over dit onderzoek en al mijn vragen zijn naar voldoening beantwoord. Ik heb de tijd gekregen die ik nodig had om in te stemmen met de deelname. Op elk moment kan ik vragen stellen met betrekking tot het onderzoek.

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Modderman
Achternaam
02/03/2023

Joost
Voornaam
[Handtekening]
Handtekening

Joost

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Modderman
Achternaam
02/03/2023

Joost
Voornaam
[Handtekening]
Handtekening

wat kan Nederland doen om de natuur te redden?

- minder boeren doen in groningen
- natuur beheer
- meer verpakkingen van papier
- bomen planten en/of kappen
- plastic opruimen uit de zee
- groen in de steden
- sedem daken

wat kan jij doen om de natuur te redden?

- Geen plastic in de natuur gooien
- Minder plastic verpakkingen
- minder water gebruiken
- minder mensen
- minder wassen
- bloemen voor bijen planten
- meer natuur, minder tegels in tuin

jouw oplossing

7

schrijf je favorieten hier op

David Allenborough, jumeel geograph / Freek / Zapp

tv programma(s) over natuur

boeken over natuur

dieren

planten

plek in natuur

Combinatie bos, duinen, strand, Rockanje strand outdoor valley, Schoorl

jumeel geograph / Freek

vege

palmboom kalamita

veel, vissen / katten

meervulke, kwaratie 4

de beste foto van eiland, waar op de boot op hantigriet 5

er is steeds minder natuur...

Wat vind ik leuker met wat vinden jullie daarvan?

Bomen die gekapt worden voor hout & papier & landbouw hoe denken jullie dat dit komt?

afname van natuur

6

jullie en de natuur

wat vinden jullie leuk aan de natuur?

Dieren
Bomen
vogels spotten
vrij fris
wind
groot kunnen bewegen
rennen
spelen
groen

op tv
onze kwarpen
langs de rotte
park
in de tuin
plant in pot
hoe kun je natuur vinden bij jullie thuis?

4

teken en schrijf om het woord

Natuur

de elementen

dieren bomen

ruimte vryheid

wind door de baren

ontspanning sport opgeruimd roffel

lekker rusten

wandelen

Spelen

zou vanden

Samen sneeuw

zee avontuur

schuif

onderhoud

halve blaas hup

alles van planten en duren

Wat betekent natuur voor jullie?

niet gamen!

sadi

3

even voorstellen

Naam Yamila Naam Sep- Naam Kwan Naam

Leeftijd 25 Leeftijd 10... Leeftijd 12 Leeftijd

Hobby muziek Hobby voetbal Hobby lezen Hobby

Wij zijn al eens in Naturalis geweest: Nee een keer vaker

vul in en teken jezelf in de vakjes

2

Family 5.

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

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Contactpersoon: Yamila van der Heide (0624932833)

Toestemmingsverklaring participant

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Pina
Achternaam
5/3/2023
Datum (dd/mm/jjjj)

Nikau
Voornaam
Nikau
Handtekening

Vergroten van bewustzijn over de biodiversiteitscrisis onder bezoekers van Naturalis

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Nina
Achternaam
5/3/2023
Datum (dd/mm/jjjj)

darja
Voornaam
[Handtekening]
Handtekening

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Achternaam
5/3/2023
Datum (dd/mm/jjjj)

Nikau
Voornaam
[Handtekening]
Handtekening

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Oberones-dan Neves Pina
Achternaam
5/3/2023
Datum (dd/mm/jjjj)

Rina
Voornaam
[Handtekening]
Handtekening

			
Naam Yamila	Naam <i>Sahar</i>	Naam <i>Sahar</i>	Naam _____
Leeftijd 25	Leeftijd <i>9</i>	Leeftijd _____	Leeftijd _____
Hobby muziek	Hobby <i>skaten</i>	Hobby _____	Hobby _____

Wij zijn al eens in Naturalis geweest: Nee een keer vaker

vul in en teken jezelf in de vakjes

de natuur en de bomen zijn heel belangrijk, anders kunnen we niet leven!
teken en schrijf om het woord






Schoon
Voetballen
Groen
Planten
Wat
bossen
Kihluu
Spelen
Aankomst van de natuur
Rozet in de natuur

Natuur

Pakken go
lee
Bomen
Vegetatie
leeuw
panda
toren

wat betekent natuur voor jullie?

schrijf je favorieten hier op

tv programma('s) over natuur		<u>Wales Walla</u>
boeken over natuur		<u>de Zotte Zwijger redden de natuur</u>
dieren		<u>Panda + Zebra</u>
planten		<u>Kaulvraag + bloembollen</u>
plek in natuur		<u>Bussalo</u>

5

jullie en de natuur

- wat vinden jullie leuk aan de natuur?
- Sijne vind spelen in de natuur leuk
- Dave houdt van voetballen op het gras
- Dieren

Natuur is bij ons thuis om de hoek. We hebben bossen in de buurt, parken en de Uithoek.


De rivier de Gysel loopt door de rivier en we wonen dichtbij de Veluwe en de Houtbeek.

Bussloo is een grote plas waar we in de zomer zwemmen

hoe kun je natuur vinden bij jullie thuis?

4

wat kan Nederland doen om de natuur te redden?

- Nederland kan meer gaan fietsen of lopen 
- de diersoorten beschermen
- geen gaten geven (dave)


wat kan jij doen om de natuur te redden?

- ik (en papa en mama) maken meer fietsen
- geen troep op straat gooien
- geen bomen omkappen (dave)

Wat vinden jullie daarvan?

- niet goed
- niet leuk
- stom
- de bomen geven ons zuurstof en anders gaan we dood

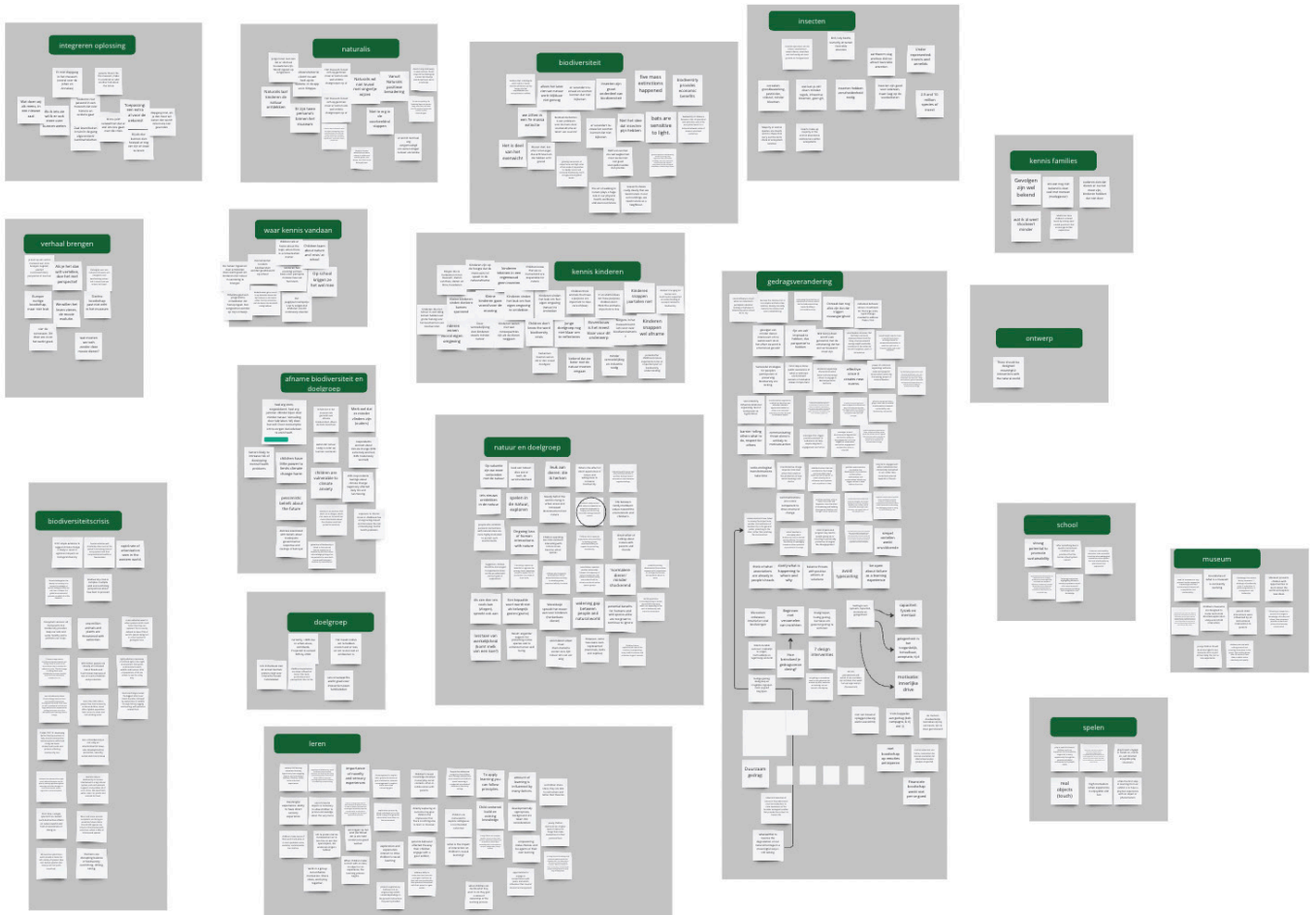
er is steeds minder natuur...



hoe denken jullie dat dit komt?

C

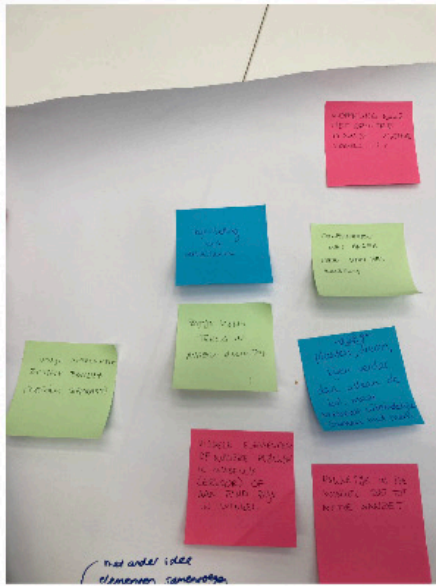
1. Cluster insights



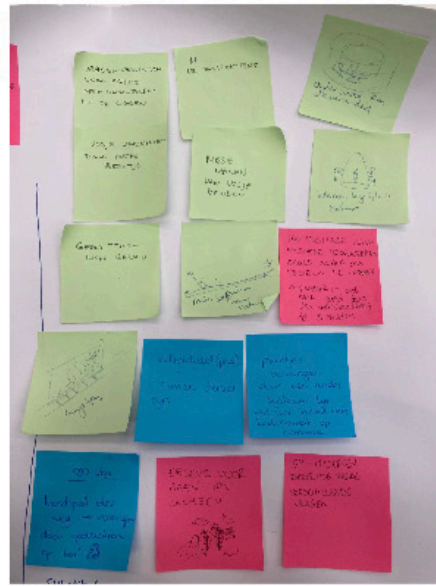
D

1. Scamper Insights

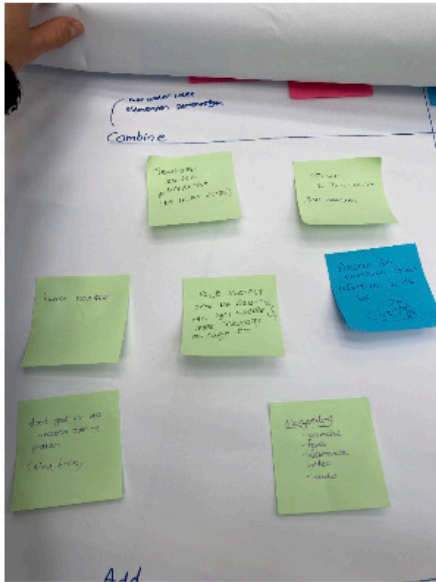
Combine



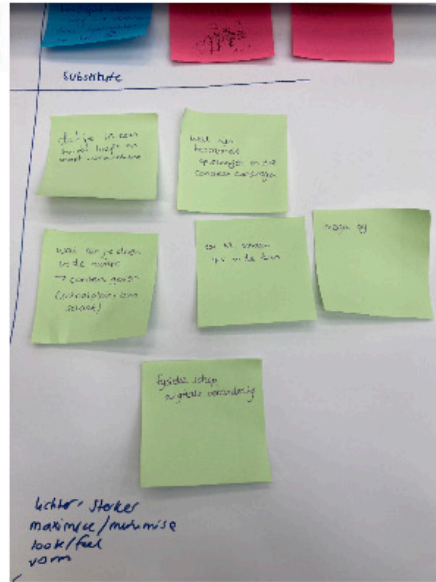
Substitute



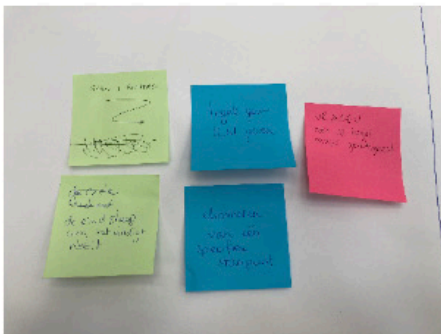
Add



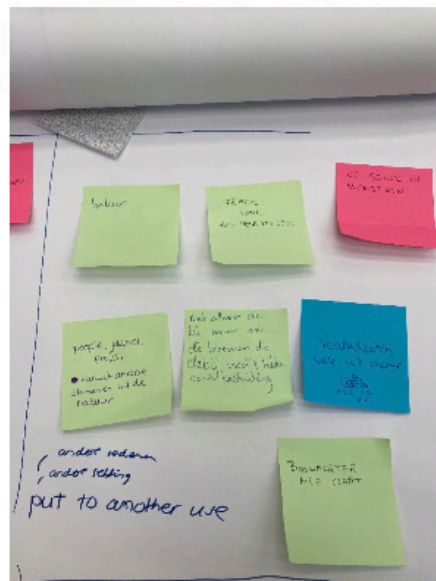
Modify



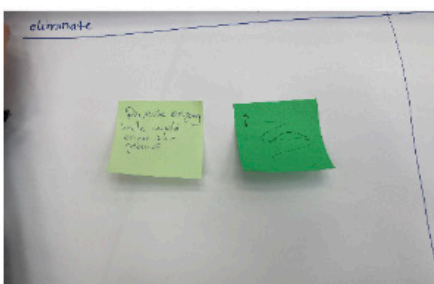
Eliminate



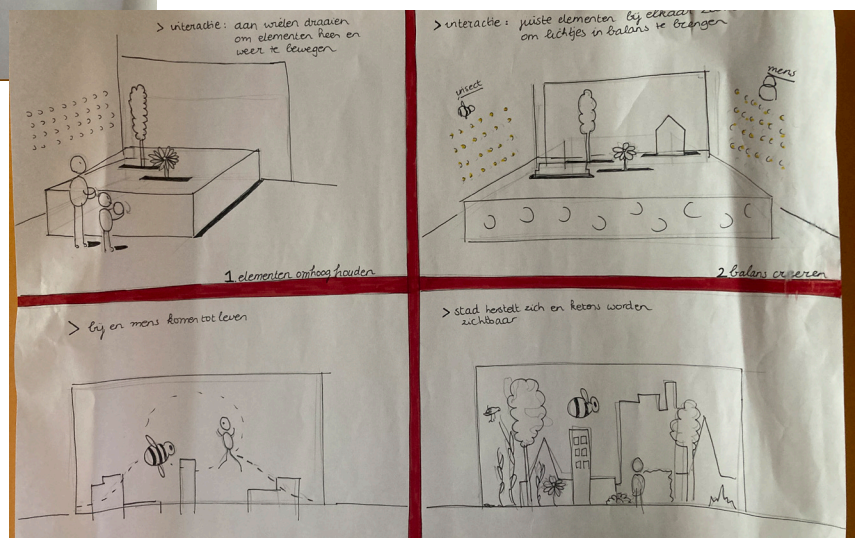
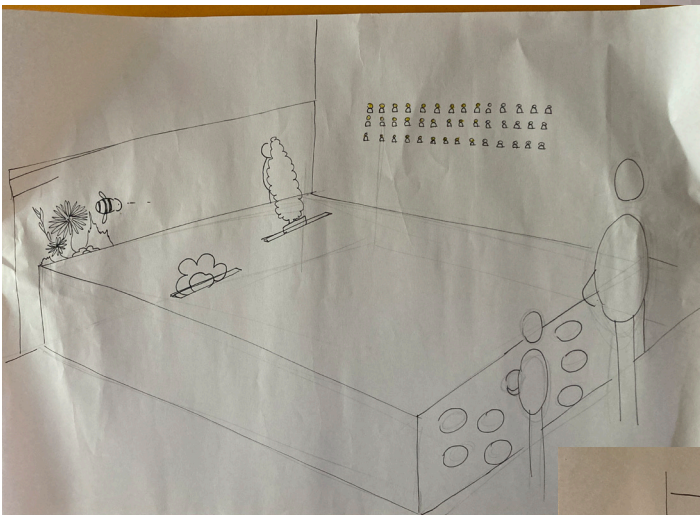
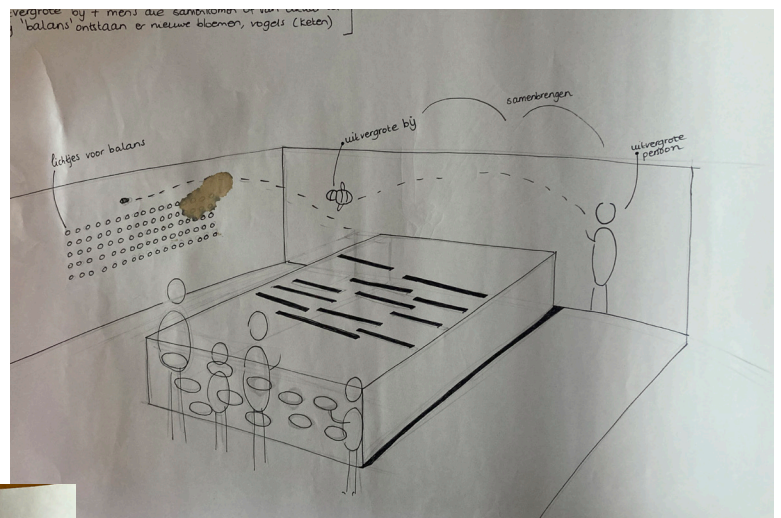
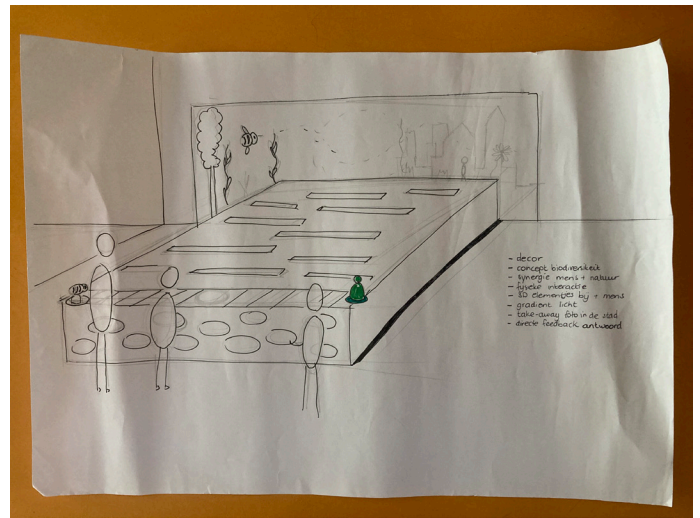
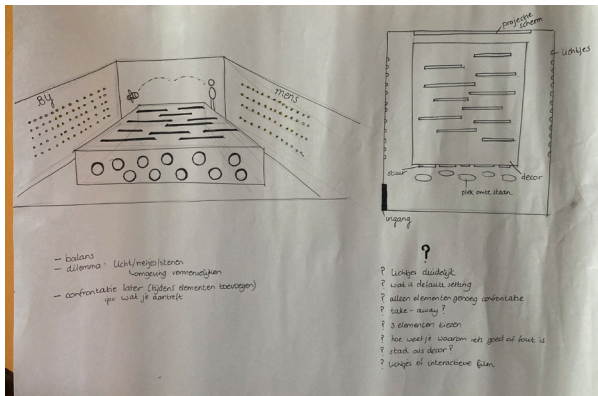
Put to another use



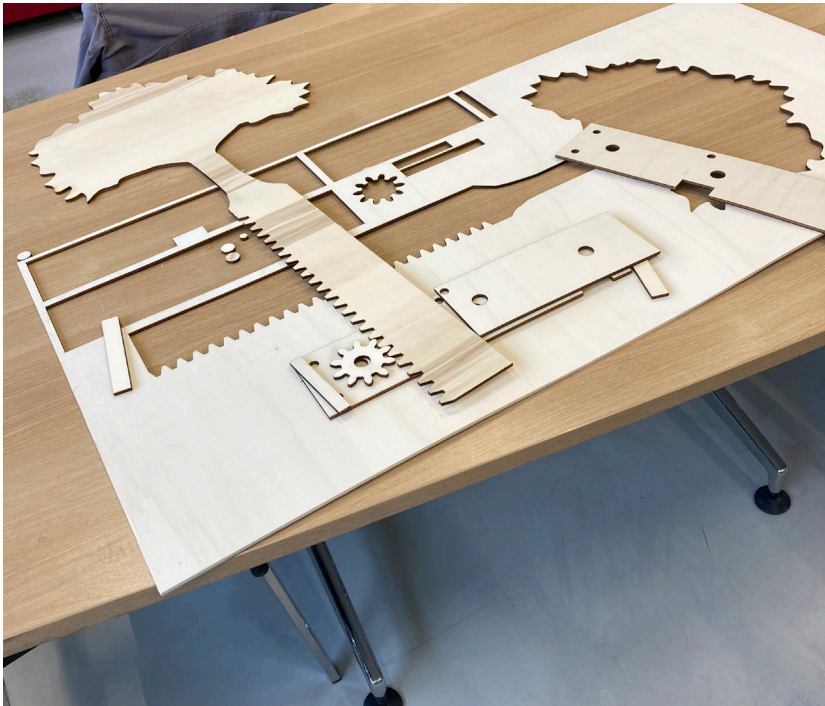
Reverse



2. Ideation



3. Model development





E

1. Animations

madelief

trekt bijen aan:

inheemse plantensoorten zijn een goede voedingsbron

kruiden

trekt mens en bij aan:

het is een goede voedingsbron



tuinverlichting

functioneel, maar schrikt bijen af:

kunstmatig licht verstoort het natuurlijke ritme

zand

trekt bijen aan:

het is een goede nestelplek

zwembad

lekker verkoelend,

maar schrikt bijen af:

mogelijke leefruimte wordt ingenomen

tulp

slecht voor mens en bij...

ze zijn vaak bespoten met dodelijk gif



appelboom

trekt jou en bijen aan:

een goede voedselbron en schaduwplek



slecht voor mens en bij:

vangt geen regen af en neemt mogelijke leefruimte in



holle boomstammen

trekt bijen aan:

het is een goede nestelplek

gazon

ziet er mooi uit, maar schrikt bijen af:

hier kunnen ze geen bloemen
ofwel voedsel vinden

hortensia

ziet er mooi uit, maar schrikt bijen af:

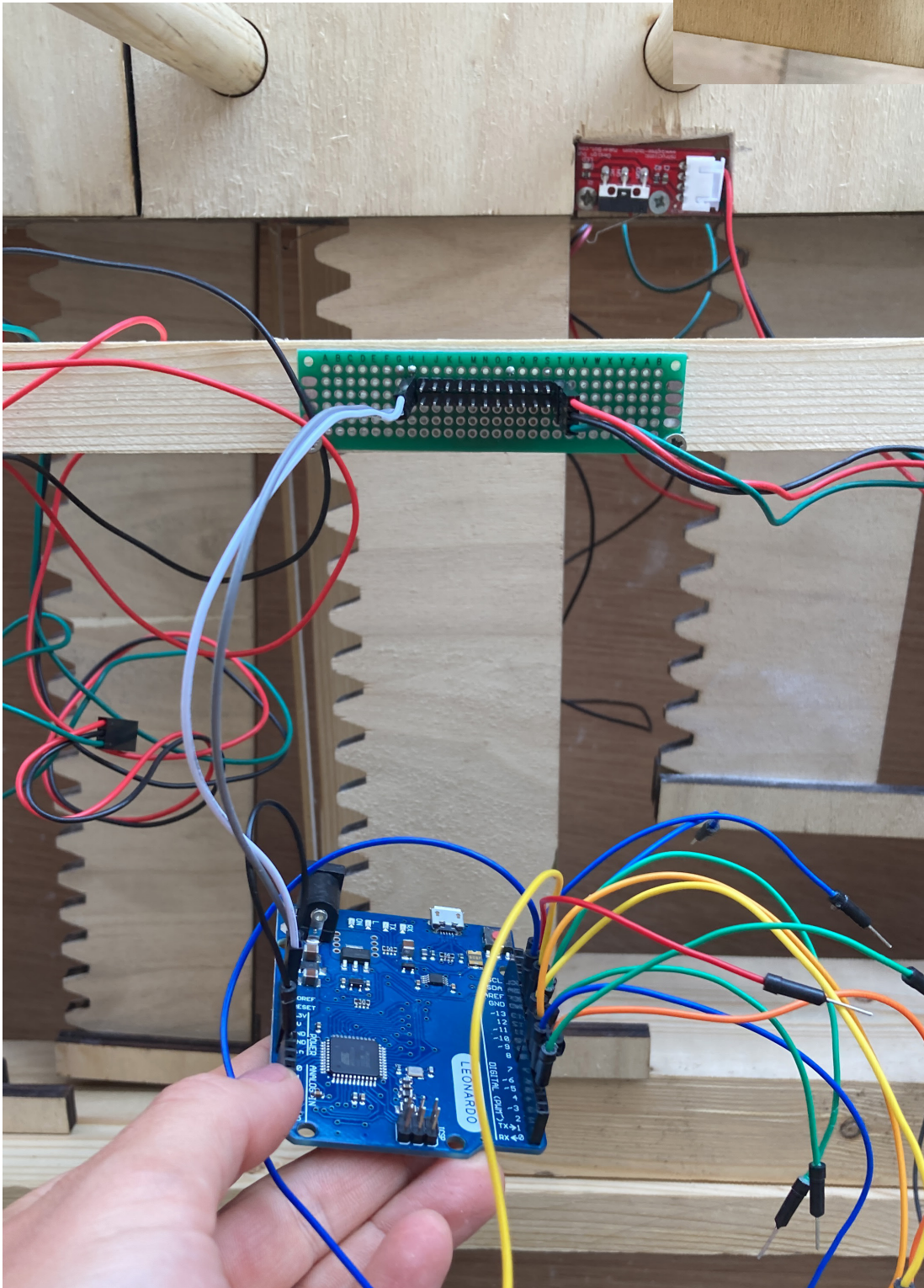
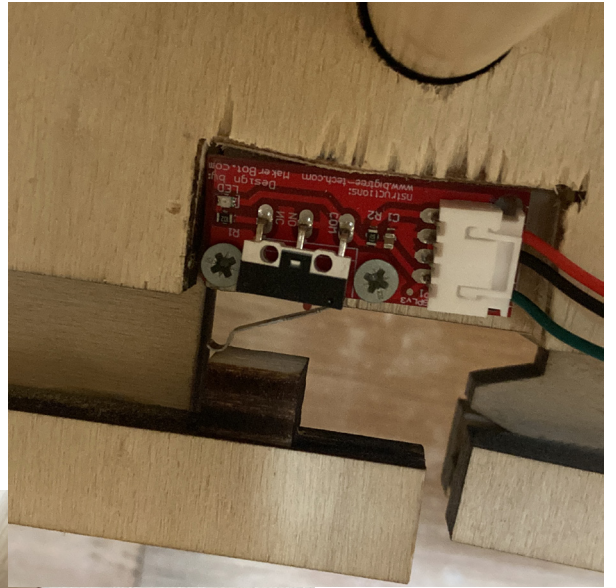
uitheemse soorten zijn vaak geen
goede voedingsbron

klimop

trekt bijen aan:

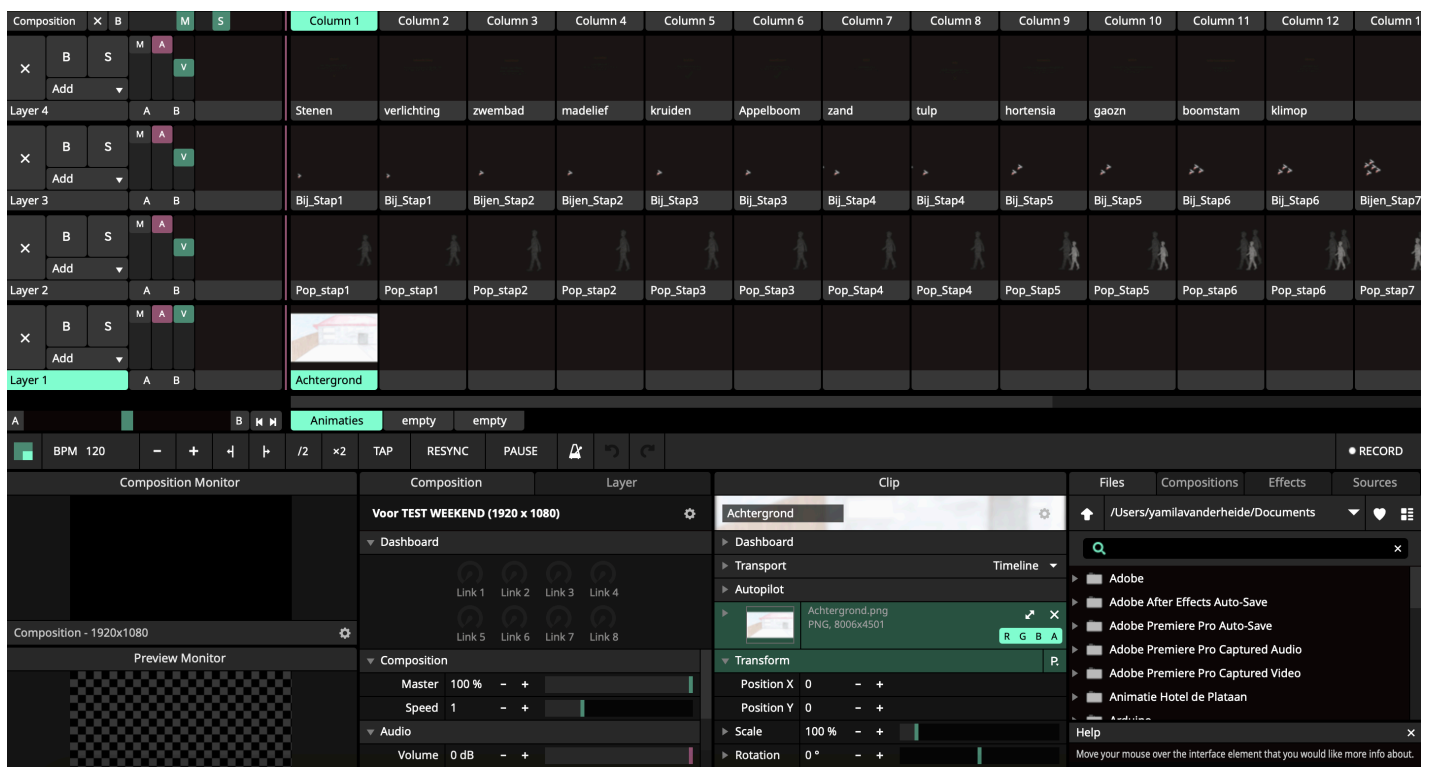
het is een goede eerste
voedselbron na de winterslaap

2. Arduino

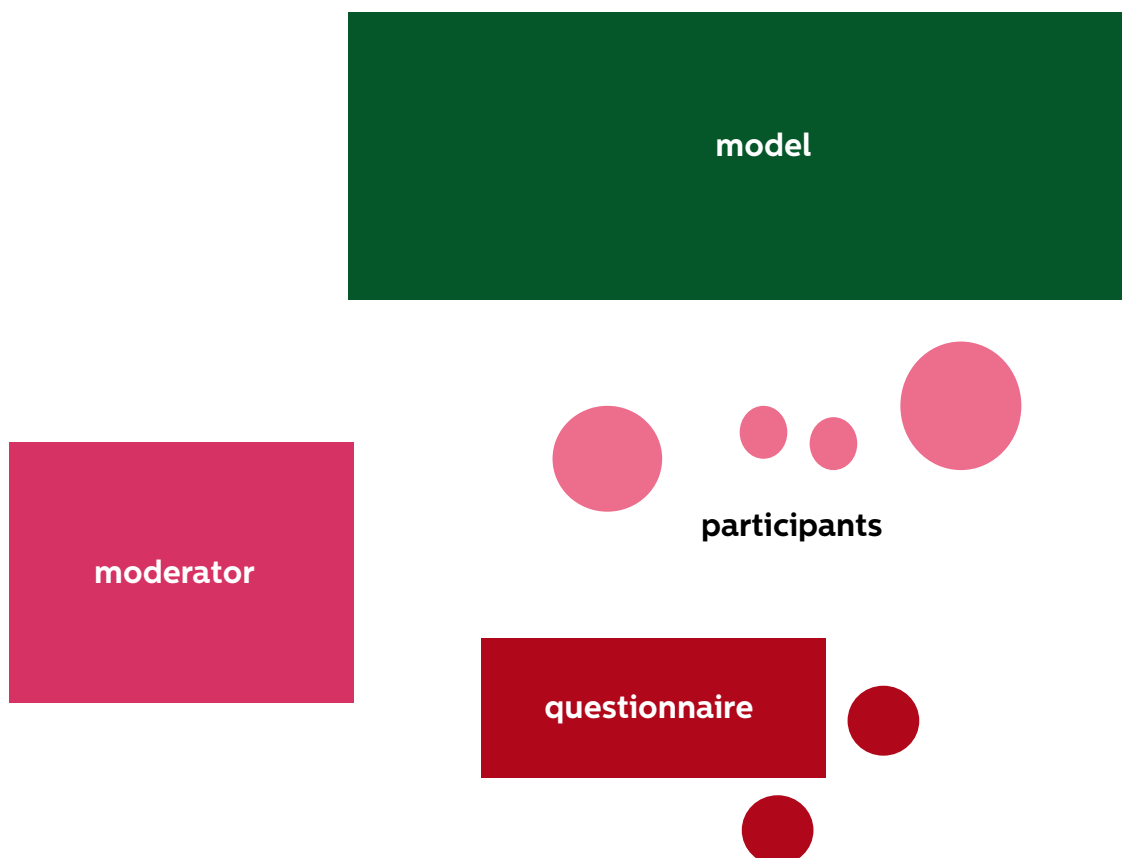


F

1. Resolume Arena



2. Set up Test



3. Evaluating Use

Kies 1 object uit die je in de tuin wilt hebben

	1	2	3	4	5	
Onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Duidelijk

Kies 1 object uit die goed is voor bijen

	1	2	3	4	5	
Onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Duidelijk

Kies 1 object uit die goed is voor mensen

	1	2	3	4	5	
Onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Duidelijk

Kies 1 object uit die slecht is voor bijen én mensen

	1	2	3	4	5	
Onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Duidelijk

Kies 1 object uit die goed is voor bijen én mensen

	1	2	3	4	5
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Haal een object weg in de tuin

	1	2	3	4	5	
Onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Duidelijk

Evaluatieformulier

Familie

Namen en leeftijd

Stelling 1.

Ik weet wat biodiversiteit betekent

1

2

3

4

5

helemaal niet

helemaal wel

Stelling 2.

Ik ben me bewust dat het niet goed gaat met biodiversiteit

1

2

3

4

5

helemaal niet

helemaal wel

Stelling 3.

Ik weet waarom het niet goed gaat met biodiversiteit

1

2

3

4

5

helemaal niet

helemaal wel

Stelling 4.

Ik weet wat er moet gebeuren om biodiversiteit te verbeteren

1

2

3

4

5

helemaal niet

helemaal wel

Stelling 5.

Ik weet wat ik kan doen om biodiversiteit te verbeteren in mijn eigen omgeving

1

2

3

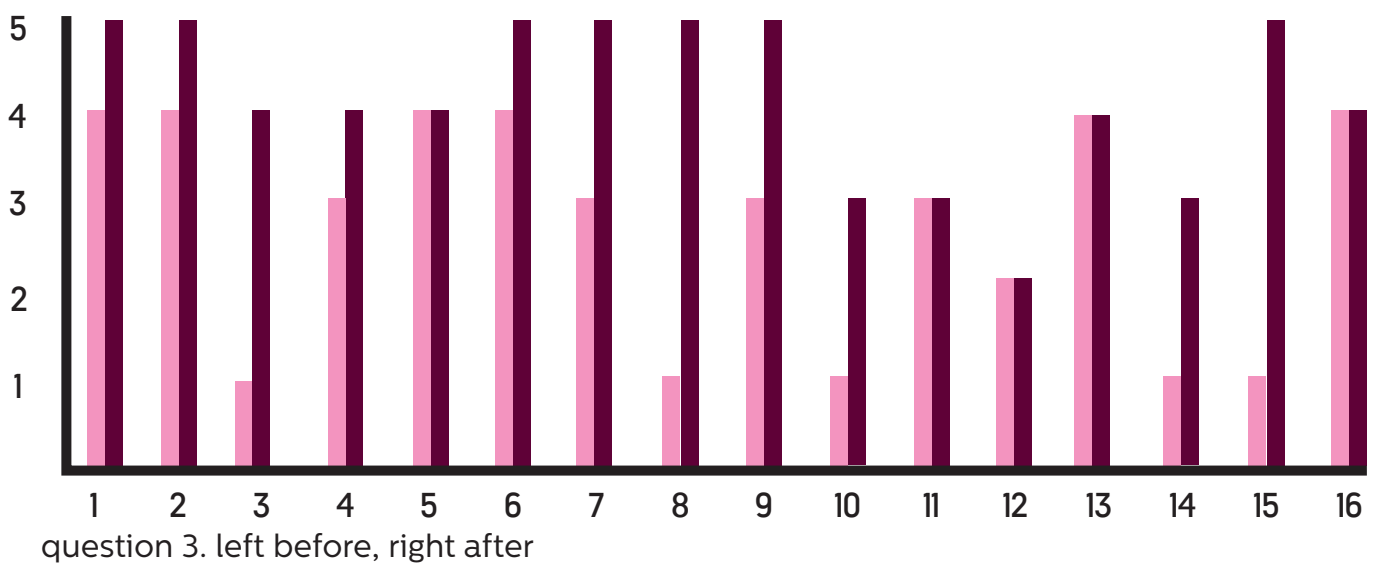
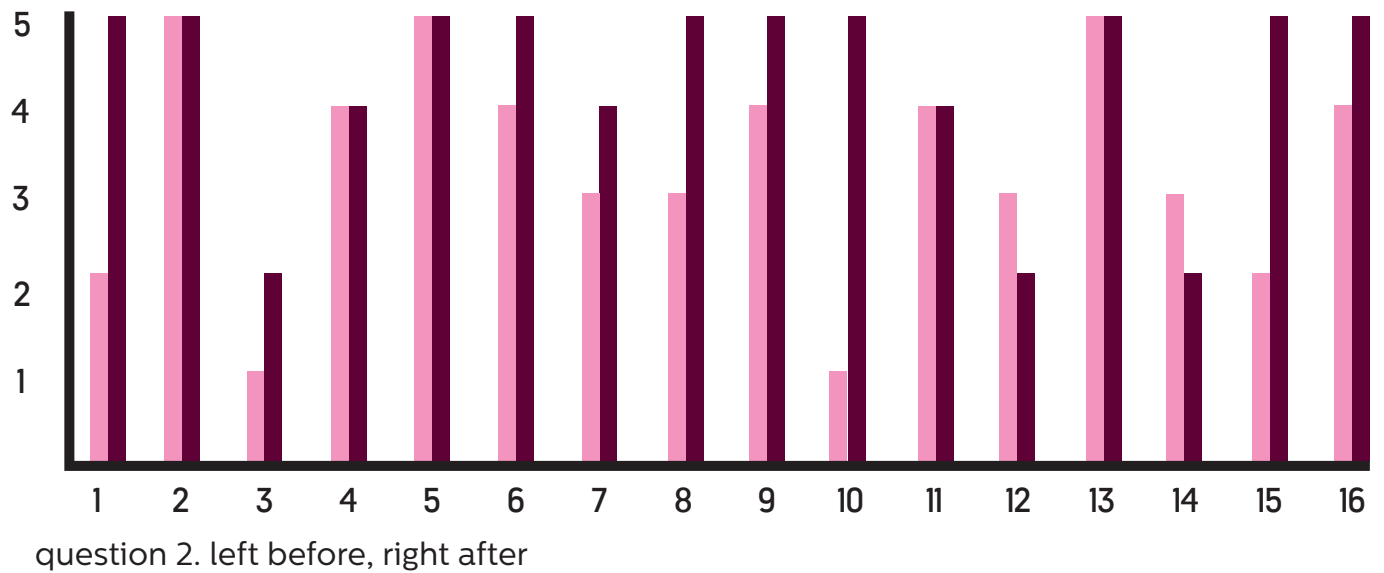
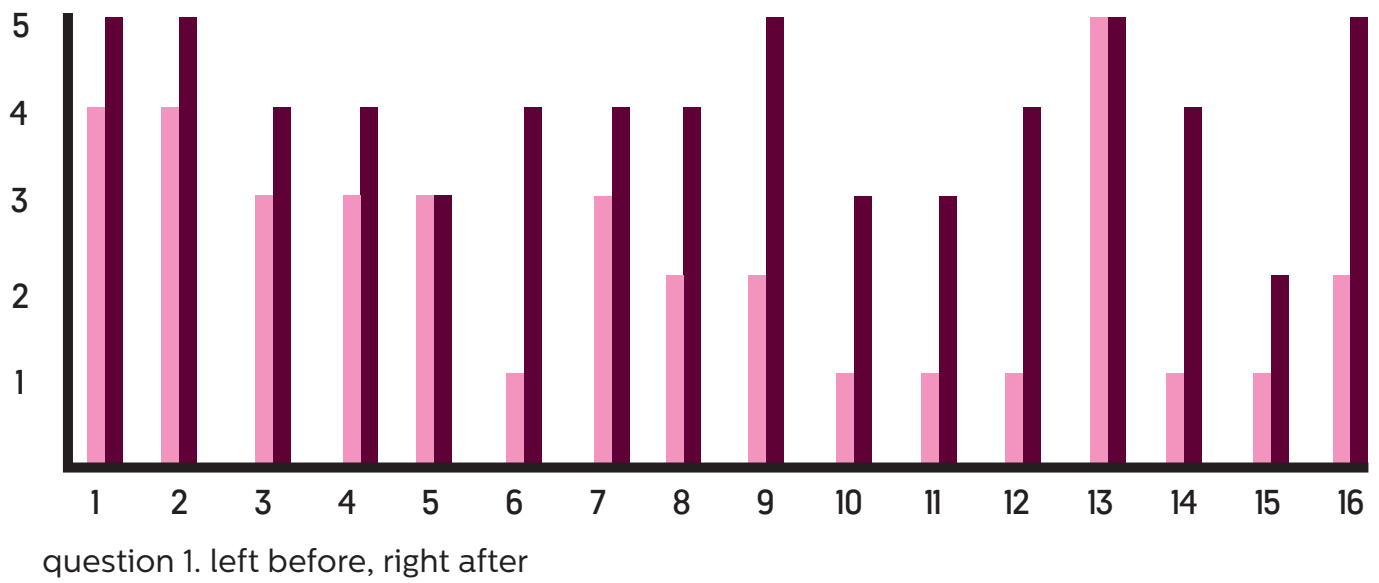
4

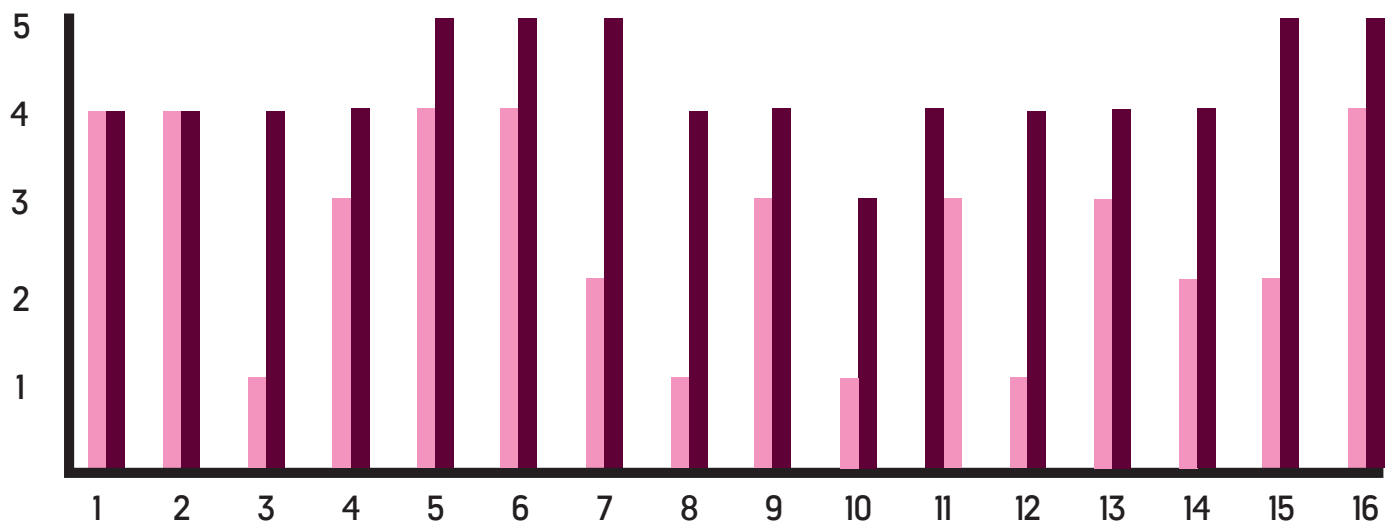
5

helemaal niet

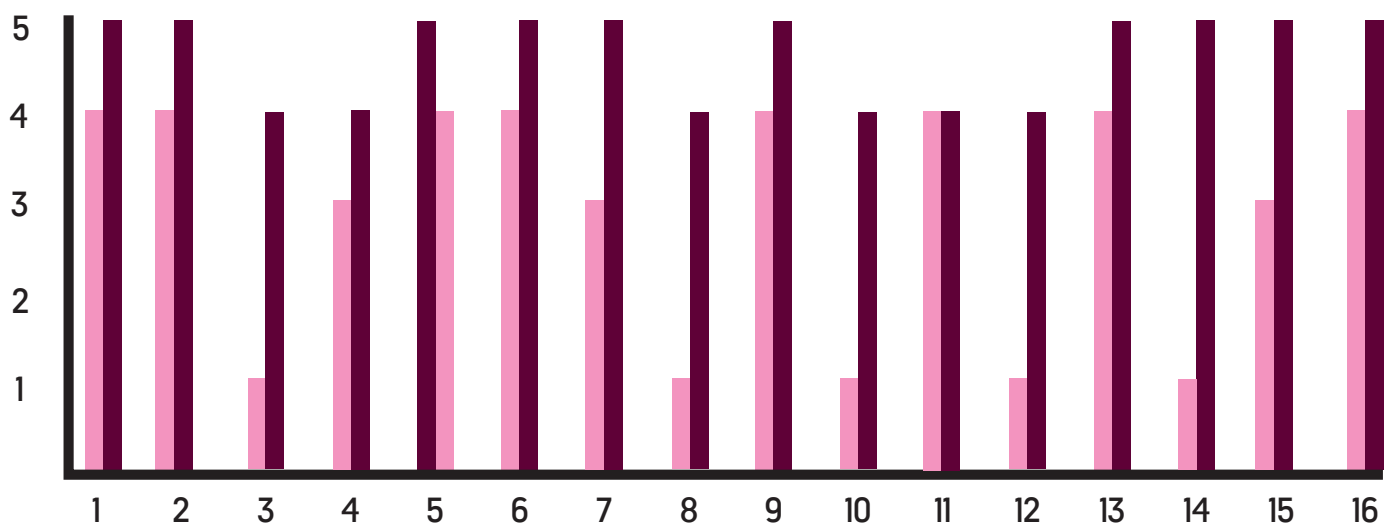
helemaal wel

5. Results evaluation Design Goal





question 4. left before, right after



question 5. left before, right after

6. Insights valuating Design Goal

familie 1.

- ik wist niet van de hortensia en het gazon
- oh dit is niet goed voor de bij nou haal die dan maar weer weg (impliceert dat het niet duidelijk is dat het om mens en bij gaat)
- 'ik wil ze allemaal wel even zien eigenlijk'
- jongetje wist heel veel over oorzaken voor afname biodiversiteit
- gingen draaien (was moeizaam om te draaien)
- 'plastic in de zee, co2 uitstoot, afval', kind wist veel en die ouders waren daardoor wel verbaasd.
- 'leuk hoe alles zo samen komt'
- we hebben zeker meer geleerd
- einde spel is niet gehaald
- directe feedback was duidelijk
- als er tekst staat als; slecht voor bijen, dan gaat dat mis want dan doen mensen m weer weg

familie 2.

- boomstammen was nog niet bekend
- zand niet duidelijk
- niet duidelijk dat je helemaal tot het einde moet draaien
- door scherm zag ik wel meer mensen en minder mensen
- dacht dat het voor de bijen was
- hebben een bijenkast dus zijn op de hoogte
- geluidseffect van schakelaar klikje gaf wel meer richting dat het goed ging
- soms niet bezig met het scherm, vooral met zoeken en draaien

familie 3.

- foutje in evaluatieformulier
- beter inzicht doordat je het laat zien
- je leert er wel van
- leuk om te draaien
- ze deden ze allemaal omhoog en sommige niet naar beneden
- uitdagend is het wel want het einddoel is nog bij geen een geraden

- plaatjes helpen goed om te zien wat het is
- kinderen willen er tegelijk aan gaan draaien
- 'nee ik wil eerst draaien!'
- 'Ik weet wat ik zelf kan doen maar dat betekent niet dat ik het ook echt ga doen'

familie 4.

- die draaiden wat sneller (zoals ik het bedacht had)
- jongetje moest lachen toen er een mens bij kwam
- tekst op het scherm begrepen ze niet
- het kruis bij de tulp en stenen begrepen ze niet (niet duidelijk genoeg dat die eruit moeten)
- begonnen gelijk met draaien (nodigt uit om te draaien)

familie 5.

- biodiversiteit, jongen wist het niet. Doe is een gok: 'dieren', bio = dier, diversiteit = verschillend
- vader helpt: weet je nu wat er gebeurt als we alleen maar gras zwembaden en hortensia's plaatsen
- 'wat zou je kunnen doen', gras inwisselen voor zand
- directe feedback is leuk waarom het wel of niet goed is
- kort en bondig wat er stond (was goed leesbaar)

familie 6.

- steeds meer mensen zorgen slecht voor natuur
- minder afval in natuur en meer in prullenbak
- goed zorgen voor planten en dieren
- bloemen in de tuin strooien
- 'noem is twee voorbeelden' —> hout en kruiden en appelboom, klimop (wel bijgebleven)

familie 7.

- komt door klimaatverandering
- verbeteren: meer planten

- ouders nemen kinderen heel erg mee in het verhaal
- spel weer niet gehaald
- soorten dieren op veel plekken
- straatverlichting slecht, stoepen, dat weten we nu
- sommige planten zijn dan weer niet goed, weten we nu ook
- 'wij hebben geen tuin', maar als ik er een had dan wist ik het
- minder stoeptegels
- gemakkelijk, kind ook tekst gelezen, misschien gelezen in het museum weet niet zeker, draaien aan knoppen

familie 8.

- nee hij hoeft niet weg hoor, het gaat om de balans (vader)
- uitproberen, tulp en steen doen ze meteen weer weg (werkt goed)
- interessant dat zo'n klein beestje zo belangrijk kan zijn en wij ook eigenlijk
- interessant om af en toe bij stil te staan
- wij hebben al heel bewust niet alleen maar tegels
- zoon vond het leuk om te spelen (keek heel blij)

familie 9.

- vraag 1, weet het helemaal niet, iets met bio, dus beetje
- bewust dat het niet goed gaat, 'ja? maar je weet niet eens wat het is'
- bomen worden gekapt, terwijl bomen CO₂, van bomen maken ze papier
- 'divers' nieuw? nee verschillend
- minder bomen kappen
- meer planten, meer toevoegen
- leest als eerst de titel
- 'vosje is een bijensoort'
- leest eerst links
- dat moet vosje zijn
- interactieve is leuk, interessant
- dat er iets gebeurt als je draait, directe feedback
- huh maar waarom zijn tulpen slecht dan? die doen het bij ons juist goed

familie 10.

- mensen kunnen ook blij worden van bloemen
- golfbal, mensen niet blij omdat ze dan kwijtraken in hoog gras
- ze keken niet naar de informatie over de elementen (misschien met geluiden of lichten extra werken)
- balans element niet super duidelijk
- als het slecht is dan wilden ze het meteen weer weg doen (verlichting)

familie 11.

- leren veel over bijen op school
- vader support veel
- tulp. nee. fout. (kruis is duidelijk)
- hortensia weet niet of het inheems is echt
- ik wist al dat grasveld slecht is
- familie gaat weer focussen op de bijen
- 'wat moet je verbeteren voor de bijtjes?'
- tulp en gazon niet goed dan, (dus ze weten wat ze zelf kunnen doen)

familie 12.

- Vosje een bij? Niet helemaal duidelijk, staat wel in de tekst, maar mag misschien wat overduidelijker
- Solitaire bijen gezien bij het klokhuis
- draai maar, kijk maar wat er gebeurt
- haal tulp maar weg
- tekst te kort
- zwembad weg
- hortensia zitten ze wel op bij ons in de tuin
- gras ook niet goed
- toch een redelijk tuintje voor elkaar gekregen
- biodiversiteit betekent dat dieren en mensen samen zijn - kind
- bewust dat het niet goed gaat (niet heel helder geworden na prototype)
- niet wijzer geworden over waarom het niet goed gaat
- wel goede tips gekregen dus wel geleerd wat ik kan doen
- prototype mag wat steviger

- boodschap was te snel weg
- wel leuk dat je iets kan kiezen en het effect meteen zien dat is positief

familie 13.

- willen meteen gaan draaien
- ouders lezen vaak de tekst voor
- afname biodiversiteit wordt niet gelezen
- leuk om direct effect te zien
- tekst bij de wielen van wat het is, is niet duidelijk
- proberen en kijken wat er gebeurd is leuk
- om te zien wat er fout is, is leuk
- je kan alleen bij t eind komen met voorkennis

familie 14.

- ouders gaan uitleggen wat biodiversiteit is
- beginnen met lezen van titel en instructions on use
- 'oh daar staat iets over biodiversiteit'
- 'grafiek: steeds minder soorten'
- titel met vraag is niet helemaal duidelijk
- 'zwembad sowieso niet
- 'hoeveel bijen zijn er nu, tellen op het scherm'
- 'tulpen niet goed'
- leerzaam en interessant
- te moeilijk, weet niet wat de bedoeling is
- weinig instructie
- effect om te zien is leuk
- vanuit wiens perspectief moet je dit zien
- je wilt geen insecten in je tuin vanuit de mens, maar betekent niet dat je niet openstaat voor meer natuur
- ik wil die bijen juist weg hebben
- niet een huis als basis, maar meer een park (shared omgeving)
- park omgeving van de natuur

familie 15.

- kind begon gelijk met aan de wielen draaien
- tulp, echt??

- hortensia i love those
- weten nu welke planten we moeten plaatsen
- sound erbij zou helpen vooral voor kleine kinderen
- voelt als een videogame en dat is leuk

familie 16.

- biodiversiteit, leven en natuur,
- vosje. Meteen lezen: vosje is een bijensoort
- we horen altijd dat de tuin groen moet zijn en dat er vlinderplanten moeten zijn etc.
- veel mensen doen alleen stenen in de tuin en dat is niet goed
- weet wel meer wat er moet gebeuren
- voor kinderen is het leuk, het draaien en het zien
- voor de oudere kinderen iets kunnen lezen
- van heel veel dingen niet bewust
- van tulp en gazon wist ik het niet