From You To Nature

Designing an interactive installation to encourage reflection on biodiversity and human impact at Naturalis Museum

Master Thesis by Panotkorn Torntham

From You To Nature:
Designing an interactive installation to encourage reflection on biodiversity and human impact at Naturalis Museum

Master Thesis
2025
MSc Design for Interaction
Faculty of Industrial Design Engineering
Delft University of Technology

Author
Panotkorn Torntham

Graduation Committee
Chair: Mathieu Gielen
Mentor: Arnold Vermeeren
Mentor from Naturalis: Pieter Aartsen

In collaboration with
Naturalis Biodiversity Center

Contribution to
Museum Futures Lab, TU Delft
Play Well Lab, TU Delft

Preface

The starting point of this thesis was my long-standing interest in children and child-centered design. Ever since my first year in the master's program, I knew I wanted to work on a topic related to children. As a parent myself, I've always been fascinated by how children grow, learn, and develop. I believe that today's children are tomorrow's adults, and it's important to help nurture them into thoughtful, responsible individuals. Whether through education, play, or informal learning experiences, I've always wanted to contribute in some small way to their development.

When I first heard that Mathieu Gielen was an expert in designing for children, I made it my goal to someday work with him. Back then, I had no idea what my thesis topic would be, but I was determined to do something for children. I still remember attending his PlayWell Lab presentation. After the session, I immediately approached him to express my interest. His reply was kind but clear—it was too early to decide, and I should contact him again when my thesis time came, with a topic that aligned with his expertise. Thankfully, when I finally found a topic that fit, Mathieu agreed to supervise my thesis—a decision I was truly grateful for.

The journey of finding the right project topic was far from easy. I explored multiple ideas, met with different professors, and felt at times like I was speed-dating academic advisors—trying to find someone whose interests aligned with mine, and who also felt a good connection with me as a student. That's when I met Arnold. One of my other interests has always been museums, especially after being inspired by the wide variety of high-quality museums here in the Netherlands—so different from what I was used to in my home country. I hoped that gaining experience in this field might someday help me contribute to museum development back home.

Talking with Arnold felt natural from the start, and he encouraged me to approach museums for collaboration. I knew from the beginning that I didn't want just any museum—I wanted to work with an organization that excited me, and that saw value in the project. After many rejected emails, I was close to giving up. Naturalis was among the museums I had contacted, and their initial response was also a polite rejection. But something made me rethink the project scope and send a follow-up proposal—and this time, Naturalis said yes! I still remember the nervous wait for final confirmation, but thankfully, everything worked out.

Working with Naturalis has been one of the highlights of this project. Although I had only visited the museum once before, I was already impressed by its engaging exhibitions and playful approach to learning about nature. I've always cared about nature and the environment—not to the extent of being a full activist, but I've had some level of awareness. This project deepened that awareness. Although I knew about biodiversity issues before, I had never actively contributed to conservation. This thesis gave me that chance.

Looking back, this project has taught me more than just design skills. Compared to my undergraduate thesis, where each step was predefined, this master's project pushed me to manage my own process, set my own boundaries, and stay adaptable through changes and unexpected turns. I've grown better at project management, flexible planning, and problem-solving. There were moments when plans had to shift completely, but each challenge helped shape the final outcome.

Perhaps most importantly, this project made me more aware of the biodiversity crisis facing our planet. What started as an academic topic became a personal learning journey. The more I researched and designed, the more I realized how urgent the situation is. I started making small changes in my own behavior—saving water, taking stairs, reducing meat consumption. In one Naturalis meeting, Matthijs (the project manager and one of my key coaches) asked me, "What is your own transformative museum experience?" At the time, I struggled to answer. Now, I believe this project itself has become part of my personal transformative experience.

I hope that, through this installation, children and families will gain new perspectives on their daily choices, just as I have. And hopefully, they will leave with small but meaningful steps they can take for our beautiful planet.

So... what small step will you take today?

Panotkorn Torntham
2 July 2025

Acknowledgements

First and foremost, I would like to sincerely thank all the people who made this project possible. This thesis would not exist without their support and guidance.

I am deeply grateful to my supervisors from TU Delft: Arnold and Mathieu. Thank you Arnold for being a steady source of reassurance. Your quick and thoughtful responses always helped ease my worries. Whenever I had doubts or needed direction, I could count on you for practical advice and useful resources—especially in the field of museum design. Knowing I could reach out and get timely support made the process much less stressful.

Mathieu, thank you for your sharp and insightful feedback, as well as your expertise in designing for children—something I first experienced in your Child and Play Perspective course. What I learned in the course also helped me a lot in this project. What I appreciated most was your high standards and structured way of guiding. You always gave clear, honest feedback, but always constructive. That precision and discipline pushed me to step up my work, stay focused, and continuously improve. It made me want to do my best—not just for the project, but also because I didn't want to disappoint you. I truly hope the result meets your expectations.

A big thank you as well to the Naturalis team—Pieter and Matthijs—for giving me the opportunity to carry out this project. Thank you both for trusting in my proposal and making the collaboration happen. Pieter, thank you for your creative input, supportive conversations, and for making me feel welcome from the start. Matthijs, thank you for always checking in on my progress and for your crucial advice on project planning. When I was feeling overwhelmed by how much needed to be organized in advance, your practical tips and experience in project management gave me perspective and inspired me to structure my work more effectively.

Daniël, thank you for making the co-creation session possible. Despite your busy schedule, you gathered the education team and made sure the session could happen. Your support saved this project from major scope changes and definitely saved my mental health! Your feedback throughout the process was invaluable.

A big thank you to all Naturalis experts, the education team, and the presentation team who joined interviews, brainstorming sessions, and provided valuable feedback throughout the project.

To my daughter Mari, you have been my greatest motivation to complete this degree. To my family in Thailand—thank you for your unconditional love and support. Special thanks to my parents for always being there for me, both emotionally and financially, making this journey less stressful in many ways. To P'Biab, thank you for good care of house, Mari and delicious food during Mid-term period. To my sister, thank you for being my advisor in critical moments and for always listening to my worries, even you are always busy.

To Marc, my husband and biggest supporter—thank you for absolutely everything. From helping connect with participants when I was struggling to recruit, to being my assistant during the long day of prototype testing. Thank you for creating such a warm and comfortable home where I could fully focus on my work. Most importantly, thank you for taking care of Mari during my most chaotic deadlines, giving me the time and space I needed to concentrate. And of course, thank you for calming my nerves with good food, weekend getaways, and countless moments of encouragement. This thesis truly wouldn't have been possible without you by my side.

Thank you also to Marc's family—Patricia and Ron—for their warm hospitality and support, especially for helping care for Mari during critical moments like the user testing day.

Special thanks to Matthew for being such an essential supporter throughout this project. From the very first Naturalis meeting where I pitched my idea, to driving me to museum case studies, and acting as my translator during many sessions—you were always there. Thank you for being both a practical and emotional support, joining me on spontaneous outings when I needed a mental break, and for making the tough days lighter. Your help made this journey much easier and more enjoyable.

To my classmates and friends—especially Sai for academic and every advice, Sander for being a Naturalis project buddy to exchange ideas with, and everyone who joined my feedback sessions—thank you for being part of this journey.

Thank you to my Thai friends in Delft for your company, food, and friendship during the most stressful times.

Finally, thank you to the families from Marc's network who kindly participated in the Contextmapping and prototype testing, and especially Mirjam, the nature teacher, for allowing me to observe her class and for her helpful feedback.

To everyone who contributed your time, energy, knowledge, and encouragement—thank you for being part of this journey. This project would not have been possible without you.

Executive Summary

This project focused on designing an interactive museum installation for Naturalis Biodiversity Center to encourage family visitors to reflect on how their daily behaviors affect biodiversity. The design was grounded in two key theoretical frameworks: Transformative Experience Design Theory (TED), which emphasizes supporting learners in making meaningful connections between educational content and their everyday lives, helping them apply new knowledge in personally relevant ways, and Self-Determination Theory (SDT) from behavior change design, which emphasizes autonomy, competence, and intrinsic motivation.

The research process combined multiple methods, including literature review, stakeholder and expert interviews, a co-creation session with Naturalis staff, and a context mapping study with target users: children aged 9 to 12 and their families. These insights informed the development of the design vision, narrative framing, and interaction flow.

A prototype was developed through iterative design and tested with seven family groups. The user testing provided key insights into comprehension, engagement, and the installation's ability to support personal reflection and learning. One major finding was the emergence of a strong "right vs. wrong" effect during gameplay. Many children approached the experience as a quiz, focusing on choosing the "correct" answer rather than exploring all behavioral options or reflecting on their real habits. Additionally, the test revealed differences between audience groups: families with less prior environmental awareness reported stronger learning gains, while more nature-aware families sometimes felt the experience was "too easy" due to their existing knowledge and habits.

Despite these challenges, the testing confirmed that the installation concept holds strong potential for encouraging visitors to recognize the environmental consequences of their daily choices. Participants showed reflection on their behaviors and expressed willingness to make small changes, such as reducing plastic use or turning off lights.

The project concludes with recommendations to refine the installation, including adjusting moral framing, increasing scenario complexity, and enhancing opportunities for long-term engagement. Broader strategic recommendations were also developed to strengthen emotional impact, expand educational applications, and better integrate the installation within the museum's visitor journey and mission to inspire care for nature.

Content

Chapter 1 : Introduction

This chapter introduces the project scope and origin, developed in collaboration with Naturalis Biodiversity Center. It outlines the museum's mission and strategy for integrating biodiversity awareness, and presents the design brief, visitor personas, and exhibition context. Key insights from previous museum studies are also highlighted as a foundation for the design process.

1.1 Introduction

Biodiversity includes all forms of life on Earth, from plants and animals to organisms in diverse environments such as land, oceans, and air. It provides essential resources like food, clean water, and air, crucial for our survival (Achmea, 2024). Despite our dependence on these natural systems, their importance is frequently overlooked. To safeguard human life, we must prioritize preserving the natural world (The Lancet, 2024).

The Naturalis Biodiversity Center, a leading natural history museum in the Netherlands, is dedicated to improving public awareness and understanding of biodiversity. By combining scientific research with educational programs and immersive exhibitions, Naturalis demonstrates the importance of biodiversity and promotes conservation efforts. At the Naturalis Museum, the emphasis is on engaging and touching visitors' emotions about nature rather than directly highlighting the biodiversity crisis. However, they plan to expand the focus on this critical issue in the coming future.

Naturalis is focusing on deepening visitor engagement and understanding through its exhibitions. Recent research has highlighted a significant gap in visitors' comprehension of the biodiversity crisis and their role in mitigating it. To address this, Naturalis plans to enhance its "Leven" exhibition by integrating the core message, "Nature doesn't need us, but we need nature to survive." This guiding principle will be echoed throughout the installations, emphasizing our critical dependency on ecosystems. The content approach, "You depend on nature. If ecosystems collapse, we collapse too," aims to make the biodiversity crisis more accessible and relatable, underlining the urgency and personal relevance of conservation.

The problem lies in the current lack of deep understanding and awareness among visitors regarding biodiversity's critical role in sustaining human life. The Leven exhibition, while effective in showcasing nature's beauty, does not fully address the present-day biodiversity challenges or highlight the urgency of protecting ecosystems. Visitors may appreciate the exhibit's aesthetics but leave without understanding how biodiversity directly affects them or how they can contribute to its protection.

To address this communication gap, this graduation project aims to engage visitors through relatable and emotionally resonant content, encouraging them to reflect on their personal connection to biodiversity. By making the value of ecosystems tangible and relevant to everyday life, the design encourages a deeper understanding of biodiversity's role in human survival and promotes a sense of personal responsibility for its protection.

1.2 Project Overview

The Naturalis Museum focuses on creating a sense of amazement and emotional connection to nature, without specifically emphasizing the biodiversity crisis. However, they would like to include this story more directly in the future. To explore how, they conducted research to understand what their target audiences, especially families, want to learn about biodiversity.

Insights from this research showed that visitors, particularly families with young children, are already aware of the biodiversity crisis. However, they often do not clearly understand what causes it or what they can do about it. The research also mentioned that audiences prefer to experience this kind of story in one dedicated room, rather than having the message spread across different exhibition areas.

As part of their long-term plan to enhance the museum experience, Naturalis selected the Leven exhibition for this design intervention. The exhibition is located at the start of the visitor journey and sets the tone for the rest of the museum, making it a meaningful place to introduce the story of biodiversity. Following this direction, Naturalis offered me the opportunity to build on their research and create a new interactive experience within the Leven exhibition.

I continued exploring the areas that were still unclear in the previous study and developed a concept that could turn these insights into a tangible museum experience. Through this project, I aimed to help Naturalis's audience better understand the importance of biodiversity and begin to explore how they can contribute to protecting the nature we all depend on.

Figure 1. Naturalis Museum, Leiden (Photo by Daria Scagliola & Stijn Brakkee)

1.3 Project Focus

1.3.1 Scope

In this study, we aim to enhance the Naturalis museum's "Leven" exhibition to deepen understanding of biodiversity and clarify the public's role in preserving it. One of the main target group of the museum is families. Thus, the project specifically targets families with children aged 9 to 12, utilizing interactive experiences to spark their interest and comprehension. See Appendix A for the initial project brief.

The exhibition design encourages visitors, especially young ones, to understand the interconnectedness of nature and recognize their individual impact on the environment. By engaging with the exhibition, visitors are expected to develop a stronger commitment to environmental stewardship. Ideally, this experience will alter their perspectives, motivating them to adopt sustainable practices in their daily lives to support biodiversity. The ultimate aim is to create a transformative experience that shifts visitors' attitudes towards proactive conservation and sustainability, fostering a deeper connection with nature.

1.3.2 Problem Definition

The "Leven" exhibition at Naturalis faces two main challenges. First, it struggles to effectively communicate the critical importance of biodiversity and its impact on human survival to its visitors. Despite showing nature’s beauty, the exhibition does not adequately convey the urgency of the biodiversity crisis, leaving visitors without a clear understanding of how these issues affect them personally or what actions they can take to help.

Second, there is a challenge in finding communication strategies that resonate with a diverse audience, particularly families with young children (ages 9-12). The exhibition needs to identify and implement engaging methods that simplify complex biodiversity concepts in a way that is accessible and impactful for this younger demographic, while also ensuring that everyone can engage and interact meaningfully.

1.3.3 Assignment

To design an interactive installation to make biodiversity relatable and engaging, enhancing understanding and conservation actions among visitors, especially families with children aged 9-12, at Naturalis's 'Leven' exhibition.

1.4 Collaboration

This project is a collaboration with three key stakeholders: Naturalis Biodiversity Center and two labs from the Delft Design Lab: Museum Futures Lab and Play Well Lab. Each partner brings unique expertise and resources, enriching the scope and impact of our work together. Through this collaboration, we aim to blend innovative museum experiences with practical approaches to child-focused design and biodiversity conservation.

1.4.1 Naturalis Biodiversity Center

Naturalis Biodiversity Center combines research with public education to preserve biodiversity. As a research institute and museum, it showcases extensive collections from fossils to living specimens, highlighting the importance of biodiversity for the planet's future. This research informs efforts to tackle global environmental issues, emphasizing the interconnectedness of nature. Additionally, the museum educates the public through interactive exhibits and programs that make science engaging and accessible, fostering awareness and conservation efforts among visitors of all ages. Naturalis also collaborates with primary and secondary schools to provide education about biodiversity through online platforms, workshops, and lectures during museum visits (Naturalis, n.d.).

1.4.2 Museum Futures Lab

The Museum Futures Lab explores the design of meaningful experiences using digital technologies like AR/VR, 3D scanning, and digital 3D fabrication to engage both researchers and museum audiences with cultural heritage artifacts. These rich, digital representations allow users to interact with artifacts in ways not possible with the originals, enhancing the understanding and appreciation of cultural heritage. The lab is particularly focused on transformative experiences, aiming to advance research, develop new technologies, and optimize existing ones. (Museum Futures Lab, n.d.) This project will focus on the transformative experiences design.

1.4.3 Play Well Lab

The Play Well Lab is dedicated to creating play experiences that focus on children's well-being and the genuine value of play. It stresses that play should be free and self-directed, supporting children's independence and personal growth. The lab combines research and design to make academic studies on play more practical for designers, improving how play is incorporated into children's lives and enhancing overall play quality. This effort aims to professionalize the field and promote playfulness in daily activities. (Play Well Lab, n.d.)

Figure 2. Naturalis Museum (Naturalis website, 2025)

1.5 Naturalis Museum

1.5.1 Overview and Mission

Naturalis Biodiversity Center serves as both a scientific institute and a public museum. Its mission is to strengthen the connection between people and nature by promoting biodiversity awareness and encouraging responsible behaviors. Through immersive exhibitions and public programming, Naturalis aims to make scientific insights accessible and relevant to everyday life. This project builds on that mission by designing an experience that helps families see the impact of their daily choices on nearby ecosystems.

1.5.2 Values and Design Implications

The core values of Naturalis include openness, collaboration, continuous learning, and a strong commitment to biodiversity. These values shape how the museum communicates with the public, prioritizing curiosity and emotional engagement over confrontation. While this approach fosters a welcoming environment, it can also make it more difficult to address the urgency of biodiversity loss. This project reflects these values by presenting biodiversity as something worth caring for, rather than framing it as a crisis. Visitors are invited to reflect on their actions through familiar, everyday scenarios that encourage empathy and dialogue.

"A world in which nature and humanity coexist in balance, ensuring a sustainable planet."

- Naturalis's Vision -
(Naturalis, n.d.)

"We accelerate the understanding of biodiversity and activate society to value the natural world."

- Naturalis's Mission -
(Naturalis, n.d.)

1.5.3 Strategic Direction and Project Relevance

Naturalis's strategic plan for 2025 to 2028 prioritizes addressing the biodiversity crisis through a combination of cutting-edge research and public engagement. The institute aims to foster a biodiversity-positive society by making the urgency of preservation visible and personally relevant to a broad audience. This includes expanding research using tools like artificial intelligence, data science, and genetics, while also investing in community education and outreach. In response to these ambitions, this project offers a hands-on installation that connects large-scale goals to small-scale actions. By focusing on urban animals and familiar household behaviors, the design encourages reflection and awareness, helping visitors understand how biodiversity protection begins with everyday choices.

Figure 3. Naturalis's strategy diagram (Naturalis website, 2025)

Figure 4. Lives science, Naturalis (Naturalis website, 2025)

1.5.4 Integration in the Project Context

These institutional goals and values provide a meaningful context for the development of this project. The design aims to support Naturalis's broader mission while also addressing its limitations. By offering visitors a clear link between personal habits and local biodiversity, the installation adds depth to the museum experience. It complements Naturalis's educational vision through an engaging, relatable, and thought-provoking interaction that bridges scientific knowledge and everyday life.

1.5.5 Target Audience and Persona

Naturalis targets two main visitor groups. The first group, represented by personas "Johan and Anneke," are cultured, nature-loving, higher-educated individuals who seek depth in their museum visits, often with family for educational purposes. The second potential group, "Frenk and Diana," typically finds museums less appealing, preferring leisure activities. They represent average-educated, middle-income families who might consider museums for casual, fun outings with children. Naturalis aims to enhance experience for both groups, ensuring engaging visits that exceed expectations.

Moreover, Naturalis emphasizes educational content for families, with a particular focus on children aged 9 and above. This aligns with Jean Piaget's Concrete Operational Stage of cognitive development, in which children between the ages of 7 and 11 begin to think logically about concrete events, understand analogies, and apply reasoning to real-world situations (Ansorge, Gatta, & Gopal, 2024). Naturalis designs its exhibitions to engage this age group in understanding biodiversity through hands-on and meaningful experiences. While the primary focus is on older children, the exhibitions are also intended to be visually engaging and welcoming to younger visitors. Even if they do not fully grasp the complex concepts, the content is designed to avoid overwhelming them, encouraging inclusive family participation.

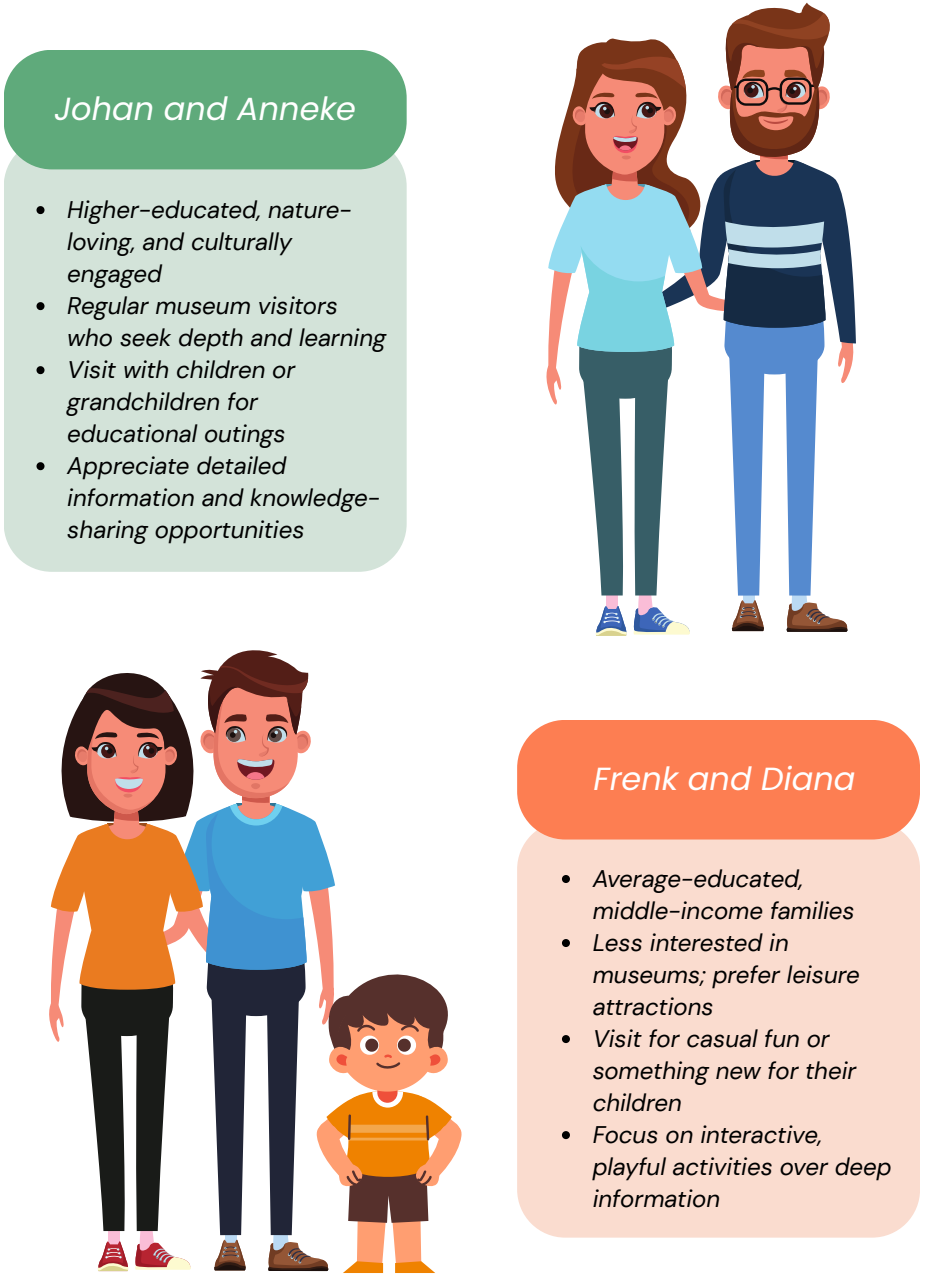


Figure 5. Overview of Naturalis's two key visitor personas

** Illustrations of the personas are from Canva built-in feature*

1.5.6 The Exhibition

Naturalis features nine exhibition halls designed to immerse visitors in the beauty of biodiversity. The exhibitions primarily showcase the aesthetic of nature and currently include limited content on the biodiversity crisis. The goal is to leave visitors with a positive impression, reinforcing the message that "You are part of nature." This approach aims to foster a connection between visitors and the natural world, encouraging a sense of personal involvement in nature's preservation.

Figure 6. Leven Exhibition

Exhibition 1: Leven (Life)

This exhibition serves as the museum's entrance gallery and offers a captivating journey through diverse landscapes, beginning underwater and ascending to a mountain peak. Along this journey, visitors encounter a diverse array of animal and plant species, enhancing the immersive experience. (Naturalis, n.d.) See Figure 6.

Figure 7. Earth Exhibition

Exhibition 2: Earth

The Earth gallery is a tribute to our planet's vast abilities: it not only nurtures life but also has the power to destroy. This gallery takes visitors to places where they can witness and feel these natural forces at work. (Naturalis, n.d.) See Figure 7.

Figure 8. Dino Era Exhibition

Figure 9. Ice Age Exhibition

Figure 10. Early Humans Exhibition

Exhibition 3: Dino Era

This gallery features a major highlight: Trix the T. rex. This exhibition transports visitors back 160 million years to the era of the dinosaurs. (Naturalis, n.d.) It showcases numerous dinosaur skeletons and offers an immersive experience with sounds of dinosaurs walking and projectors that make these ancient creatures come to life. See Figure 8.

Exhibition 4: Ice Age

The exhibition transforms the familiar Dutch landscape into a wild, natural setting against a stark prehistoric backdrop, making it unrecognizable. (Naturalis, n.d.) It recreates the Netherlands during the Ice Age with a giant model landscape populated by Ice Age animals. Visitors can use binoculars to see these animals come to life on the model. After a while, the scene shifts to present-day Netherlands, where natural landscapes have given way to concrete and urban development, illustrating the dramatic changes over time. See Figure 9.

Exhibition 5: Early Humans

This exhibition explores the origins of humans through the fascinating story of Homo erectus, one of our earliest ancestors. It features a set of unique fossils and tells the story of Eugene Dubois, a Dutch researcher in the 19th century who was captivated by the question of human evolution. His discoveries, including crucial fossils of Homo erectus, offer a glimpse into the evolutionary puzzle of how humans came to be. This display not only showcases these significant finds but also highlights the historical journey of understanding human origins. (Naturalis, n.d.) See Figure 10.

Figure 11. Evolution Exhibition

Exhibition 6: Evolution

The exhibition illustrates how all life—animals, plants, fungi—is interconnected through evolution. It emphasizes that every living thing, past and present, is linked by the evolutionary process, which explains the emergence and change of various species over time. This concept underscores the fundamental interconnectedness and continuity of life on Earth. (Naturalis, n.d.) See Figure 11.

Figure 12. Death Exhibition

Exhibition 7: Death

This exhibition explores the essential role of death in nature's cycle, illustrating how death facilitates the emergence of new life. This exhibition examines the idea that while all life eventually ends, death itself is crucial for the continuity of ecosystems. It presents the concept that we cannot live without death, as it makes room for new generations and ongoing life cycles. (Naturalis, n.d.) See Figure 12.

Figure 13. Seduction Exhibition

Exhibition 8: Seduction

The Seduction gallery focuses on the theme of reproduction in nature. It playfully showcases various rituals related to courtship, mating, and parenting, providing insights into the diverse ways animals and plants reproduce and raise their offspring. (Naturalis, n.d.) See Figure 13.

Figure 14. Temporary Exhibition Triceratops: the Herd

Figure 15. Rexperience (Dark Ride Database, n.d.)

Exhibition 9: Temporary Exhibitions

This hall features a temporary exhibition called "Triceratops: the Herd." It includes five Triceratops skeletons and provides a fun and interactive way for visitors to learn about these ancient dinosaurs. The exhibit is designed to be child-friendly, with activities and displays that help explore the world of the Triceratops and understand how they lived 67 million years ago. (Naturalis, n.d.) See Figure 14.

Rexperience

The Rexperience is an immersive simulator that takes visitors 66 million years back to the age of dinosaurs. Participants board a futuristic space capsule to encounter a lifelike Tyrannosaurus rex in her natural habitat. This experience combines motion simulation, visual effects, and storytelling to create an engaging adventure. The Rexperience complements the Dinosaur Era gallery, where Trix's actual skeleton is displayed (Naturalis, n.d.). See Figure 15.

Figure 16. Exhibition Leven

1.5.7 The Exhibition “Leven”

The Leven exhibition (see Figure 16,17,21) was selected as the focus of this project because it marks the beginning of the museum experience and is already part of Naturalis’s plan for enhancement. This section explores the content and context of the exhibition in more detail. The following information is based on an interview with the content developer at Naturalis.

The "Leven" exhibition is a key component of the Naturalis Museum's renewed visitor experience. Situated at the start of the museum's galleries, the "Leven" exhibition aims to immediately immerse visitors in the wonder and beauty of the natural world.

Content and Approach

The overarching aim of the "Leven" (Life) exhibition at Naturalis is to spark a sense of wonder and emotional connection in visitors from the moment they enter the museum. Rather than using a traditional, diorama-style layout, the exhibition follows a more theatrical and experiential approach. It is designed as a narrative environment that encourages visitors to interpret the carefully curated collection of animal specimens, models, and audio-visual elements using their own imagination. The intention is not to provide detailed educational content, but to create an emotional experience that sets the tone for the rest of the museum journey.

Figure 17. Exhibition Leven

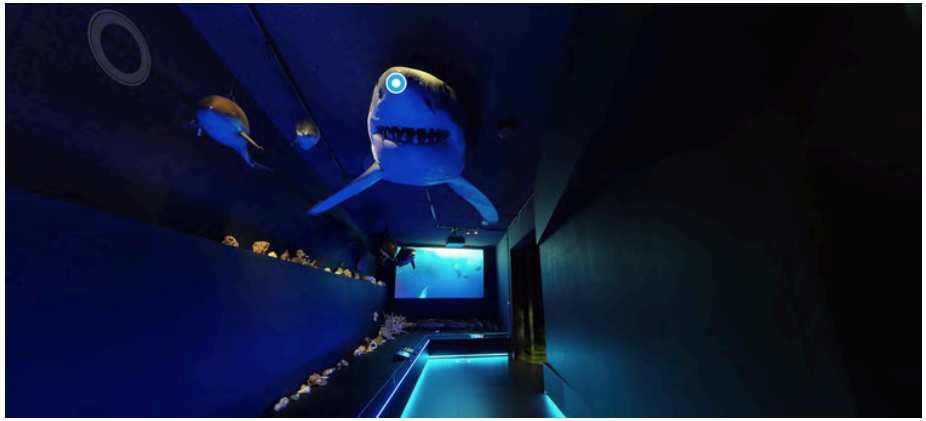


Figure 18. under the sea at the entrance

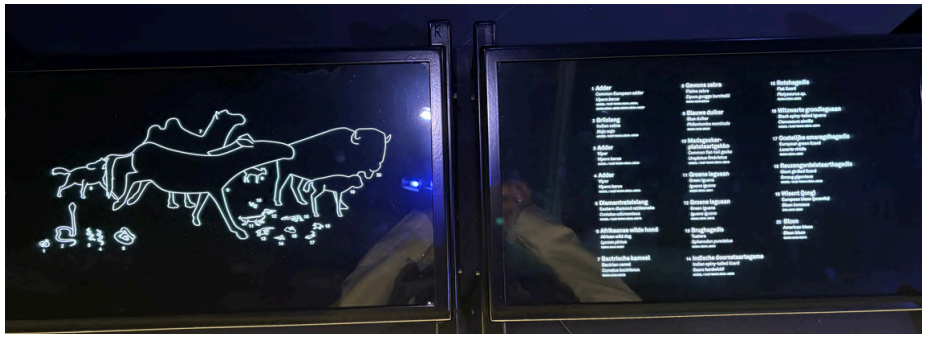


Figure 19. Simple sign showing the animals'name, without details

Figure 20. Animals with screen to show how they come to life

The exhibition begins in the deep sea, where visitors encounter a variety of marine creatures. (see Figure 18) Throughout the space, simple labels display the names of the animals but do not include further information (see Figure 19), allowing visitors to focus on observation and imagination. As the path gradually rises, it transitions from ocean to land, showcasing animals such as giraffes, zebras, elephants, and bears. Along the way, birds, insects, and underground animals like worms further enrich the experience.

Dynamic lighting and video projections simulate natural cycles and events—such as day and night or passing storms—enhancing the immersive atmosphere. The exhibition acts like a stage on which the diversity of life unfolds, illustrating that life exists everywhere: in water, on land, and in the sky. Every species, including humans, has a special place in this interconnected natural world (Naturalis, n.d.).

Key Features

Some of the notable features of the "Leven" exhibition include:

- **Immersive lighting and soundscapes** that simulate natural environments and enhance the sensory experience.
- **Lifelike arrangement** of animal specimens and models to create the impression of movement and interaction.
- **Audio-visual elements**, animation of animals on screen in their habitats, to add realism and depth. (see Figure 20)
- **Minimal textual information,** encouraging free exploration and personal interpretation of the displays.

Figure 21. Exhibition Leven

1.5.8 Naturalis Education Platform

Application

Naturalis has developed an app designed to enhance visitors' understanding of biodiversity and engage them more deeply during their museum visit. The app features several sections, including "Biodiversity & Us," which integrates with the "Leven" exhibition tour. It provides detailed information about various animals, explains the threats they face from nature and human activities, and encourages users to think about conservation strategies. Despite its educational value and detailed coverage of the biodiversity crisis, many visitors are still unaware of the app's existence. (Figure 22)

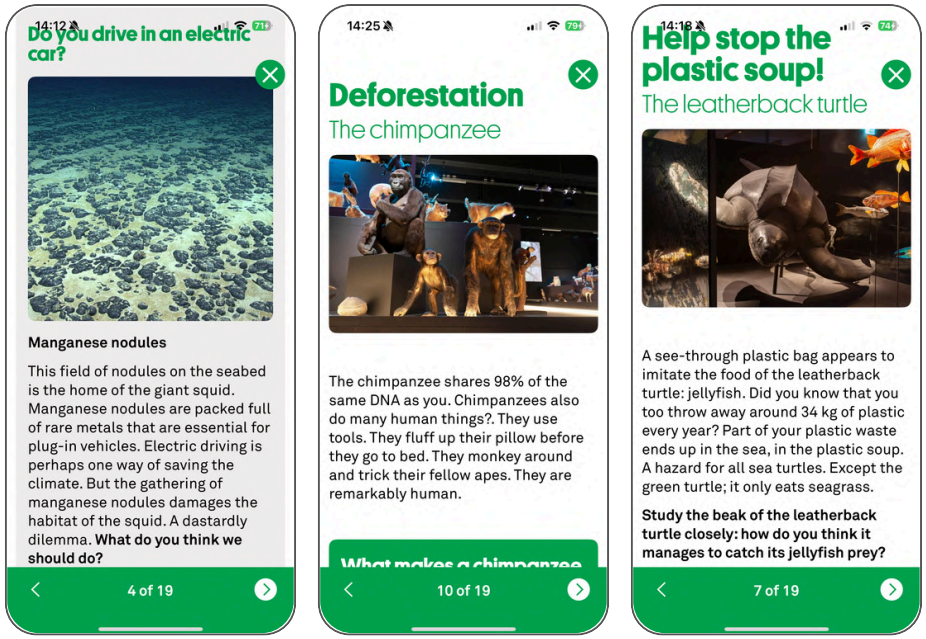


Figure 22. Naturalis Application

Education website

Naturalis also has a website dedicated to educating about biodiversity, managed by the educational department. This site is used in collaboration with high schools across the Netherlands to help teach students in classrooms. (Figure 23)

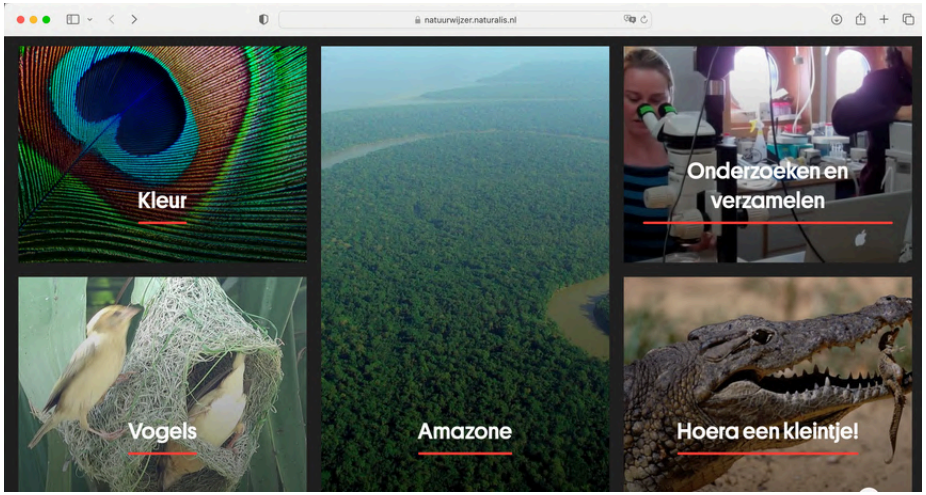


Figure23. Education website for school

School Programs

Naturalis offers school programs that include workshops or short lectures and activities designed to teach children about the importance of biodiversity. These educational initiatives help to engage young learners with critical environmental issues in interactive and informative ways.

1.6 Previous Study

Naturalis Museum is widely recognized for its ability to showcase the beauty of nature. However, the museum is now taking steps to incorporate more explicit references to the biodiversity crisis within its exhibitions. To support this shift, Naturalis conducted research to better understand how visitors, particularly children and families, perceive biodiversity and what information they seek. The insights from this research were shared with me and have served as a foundation for this graduation project.

The findings from this previous study revealed that although many visitors are aware that nature is facing challenges, they often lack a deeper understanding of what is causing the biodiversity crisis and how their actions may contribute to it.

Parents expressed that they would like the museum to address this topic more directly, as their children are the ones who will face the long-term consequences. Children showed particular interest in learning about lesser-known aspects of environmental decline, which they often encounter in schools, zoos, and media. This suggests that there is a general need to improve public understanding of biodiversity and its relevance to everyday life. (See Appendix B for clustering)

Desing Guidelines

Based on the research conducted by Naturalis, the following guidelines were established to inform the design of the new installation:

1. Use clear and simple language to make the content accessible for a broad audience.
2. Focus on personal and small-scale examples to help visitors relate to the information.
3. Emphasize the importance of individual action in supporting biodiversity.
4. Present the seriousness of the biodiversity crisis in a direct but balanced manner.
5. Maintain a hopeful and motivating tone to encourage engagement.
6. Create content that captures attention and encourages curiosity.
7. Offer concrete suggestions for how visitors can contribute, preferably with support from Naturalis.
8. Provide moments for reflection and allow visitors to form their own conclusions.

What Audiences Want to Know

According to the research, visitors expressed a strong desire to better understand the role of biodiversity in maintaining the balance of natural systems, and how human actions are connected to this balance. They wanted more detailed explanations about the causes and consequences of the biodiversity crisis, and valued content that used real-life, relatable examples to make these issues easier to grasp.
The research also revealed that audiences were eager to learn about practical steps they could take in their own lives to support biodiversity. Many participants responded positively to content that included hopeful messages and real-world success stories. This kind of approach was seen as more encouraging and made the idea of taking action feel more achievable.

Communication Strategy Ideas

The research provided several suggestions for effective communication strategies:

- Select themes that reflect a wide range of topics to appeal to different interests.
- Encourage both observation and interaction within the exhibition.
- Support shared learning by encouraging children to communicate what they have learned with their parents.
- Include playful and educational elements such as games.
- Use sensory elements like sound and touch to support understanding through experience.

Initial Concepts and Potential Topics

Based on the research findings, several early concept directions were suggested. These included simulated nature walks, animal-based storytelling, and experiences that illustrate the impact of the biodiversity crisis. The goal of each concept was to help visitors connect with the topic in an engaging and meaningful way.

The research also identified promising topics to focus on. These include:

- Familiar everyday locations, such as the home, school, park, or playground
- Children's favorite animals
- Food and its connection to ecosystems and wildlife

These topics were seen as especially effective because they are familiar and relevant to families, making it easier for visitors to relate the exhibition content to their own lives. These research insights played a key role in shaping the direction of this project, ensuring the final design is aligned with the needs and expectations of Naturalis's visitors.

Chapter 2 : Discover

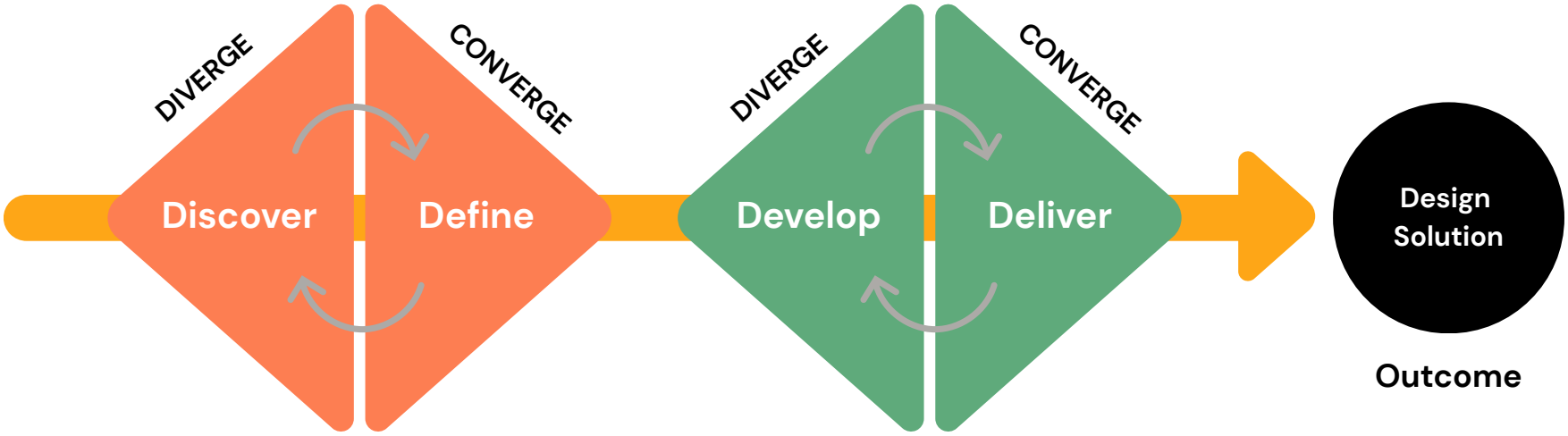
This chapter describes the research phase, which involved expert interviews, field visits, and co-creation with families and Naturalis staff. Together with supporting theories and frameworks, the findings helped define the design direction and qualities, highlighting opportunities to support engagement, reflection, and learning about biodiversity in a museum setting.

2.1 Project Approach

2.1.1 Research Methodology

In this study, the Double Diamond design thinking process is used. The Double Diamond is a design framework created by the Design Council in 2003. It serves as an effective tool for developing innovative solutions to complex challenges. (Design solutions to problems, 2023) See figure x

There are four steps: Discover, Define, Develop, Deliver. In the first step (Discover), everything related to the context of the topic is explored and gathered to help define the design direction (Define). Next, potential concepts are developed through ideation and iteration (Develop) to find possible solutions. Finally, a prototype is created and tested to arrive at the proposed design outcome for Naturalis (Deliver).



Discover
Finding all the relevant data to understand the problem

Define
Combine all the insights data and identify a design direction

Develop
Explore possible ideas by brainstorming, testing, and analysing

Deliver
Test and evaluate the final design. Discuss recommendations and conclusion.

Figure 24. Double Diamond design process diagram

2.1.2 Research Questions

Main Research Question:

How can we design an **interactive installation** that makes the complex topic of biodiversity **personally relatable and emotionally engaging** to deepen **understanding and promote conservation** action among daily visitors, particularly **families with children aged 9-12**, at the Naturalis Biodiversity Center within the existing **"Leven" exhibition ?**

Sub-Questions:

1. **Audience Understanding:** What are the existing knowledge and interests about biodiversity among children aged 9-12 and their families visiting Naturalis?
2. **Engagement Strategies:** What interactive methods are most effective for engaging children aged 9-12 and their families in learning about biodiversity?
3. **Content Delivery:** How can complex concepts of biodiversity be simplified and made relatable for young visitors and their families? and which content is the most appropriate in the context?
4. **Conservation Motivation:** How can the installation inspire visitors, particularly children, to take actionable steps towards biodiversity conservation after their visit?

Research Activities

During the study, multiple research activities were carried out to gather data and insights:

- **Desk Research:** Reviewing articles, academic papers, and materials provided by Naturalis to build foundational knowledge.
- **Interviews:** Engaging with experts and stakeholders to gain specific insights and perspectives relevant to the project.
- **Observation:** Observing a nature class at a primary school to understand how children engage with biodiversity-related content in an educational setting.
- **Contextmapping[1] :** Conducting interviews with target audiences to better understand their experiences, needs, and perceptions.
- **Brainstorming:** Rapidly generating and exploring potential ideas and directions for the design.
- **Testing:** Presenting concept sketches or prototypes to target audiences or stakeholders to gather feedback and evaluate the feasibility and relevance of the ideas.

[1] *Contextmapping is a method that involves users as experts of their own experiences, using tools like workbooks and creative sessions to help them reflect on their daily lives and provide insights that guide the design process. (Stappers, n.d.)*

Each sub-question is addressed through specific research methods, which are outlined in the table below:

1. **Audience Understanding: What are the existing knowledge and interests about biodiversity among children aged 9-12 and their families visiting Naturalis?**

Sub-Questions	Methods	Stakeholder	Remark
Deepen understanding: what do they already know, what do they need to know? Individual learning or family learning?	Desk Research	-	Previous studies from Naturalis
What are their current understanding about biodiversity?	Contextmapping	Target audience	
What aspects of nature and biodiversity resonate most deeply with them?			
What do they know about effect to the animals they can related to (e.g. pet, zoo, wildlife etc.)?			
How do visitors perceive their role in the ecosystem?			
What are the mutual topics of their interest?			

Table 1 Sub-Research questions and research methods 1

2. Engagement Strategies: What interactive methods are most effective for engaging children aged 9-12 and their families in learning about biodiversity?

Sub-Questions	Methods	Stakeholder	Remark
What is the concept of biodiversity and its ralated to animals?	Interview & Desk Research	Naturalis	
What are the key characteristics of the 'Leven' exhibition at Naturalis that should be considered when designing a new interactive installation within it?			
What is Biodiversity crisis around us?			
How to commnicate Biodiversity importance and impact on human under the theme in simply way?	Brainstorming Session		
What content will be the most appropriate for the context?			

Table 2 Sub-Research questions and research methods 2

3. Content Delivery: How can complex concepts of biodiversity be simplified and made relatable for young visitors and their families? and which content is the most appropriate in the context?

<table>
<tr><th>Sub-Questions</th><th>Methods</th><th>Stakeholder</th><th>Remark</th></tr>
<tr><td>What is transformative museum design, and how can its principles be applied to create a meaningful and engaging experience in the context of the 'Leven' exhibition at Naturalis?</td><td rowspan="2">Desk Research</td><td>-</td><td></td></tr>
<tr><td>What is needed to emotionally engage this visitor group?</td><td>-</td><td>Previous Studies from Naturalis</td></tr>
<tr><td rowspan="2">What are the most effective methods to communicate the critical impacts of biodiversity loss to visitors of different age groups? Visual metaphors, Interactive experiences, or Emotional and sensory design elements?</td><td>Field Research</td><td>-</td><td>Case study from museums visit</td></tr>
<tr><td rowspan="2">Testing</td><td rowspan="2">Target audience</td><td></td></tr>
<tr><td>How can the exhibition best maintain and stimulate the interest of children and parents?</td><td></td></tr>
</table>

Table 3 Sub-Research questions and research methods 3

4. Conservation Motivation: How can the installation inspire visitors, particularly children, to take actionable steps towards biodiversity conservation after their visit?

Sub-Questions	Methods	Stakeholder	Remark
What design elements or strategies support conservation-related behavior change?	Desk Research	-	Based on literature from behavioral design

Table 4 Sub-Research questions and research methods 4

2.2 Desk Research

To better understand the topic, this section summarizes existing knowledge about biodiversity based on literature and trusted sources.

2.2.1 Biodiversity

Biodiversity refers to the variety of living organisms from all sources, including land, oceans, and other aquatic environments, along with the ecosystems they belong to. It includes differences within species, between different species, and among entire ecosystems. (Convention on Biological Diversity, n.d.)

Biodiversity, a short term from “biological diversity”, is ‘the variety of life’ (Gaston&Spicer, 2004). It refers to the diversity of life within a particular habitat or ecosystem, encompassing the variety of species, from plants and animals to fungi, algae, and microorganisms such as bacteria. It serves as an essential measure of an ecosystem's health. (Lindwall, 2022)

Why is it important?

The European Environment Agency (2020) states that biodiversity is vital for ecosystem services, the benefits provided by nature, which include pollination, climate control, flood prevention, soil enrichment, and the production of food, fuel, fiber, and medicinal resources. One example of an ecosystem service is pollination, which is essential for the production of fruits, vegetables, and seeds. Bees, butterflies, birds, and other animals help pollinate plants, which

> ***" Biodiversity means the variety of life forms on earth. You might first think of beetles, birds and mammals, but this also includes plants, fungi, bacteria and us, too. But biodiversity is even more. The huge variation of life between individuals, populations, communities and ecosystems: this is biodiversity! "***
>
> *(Naturalis, n.d.)*

Figure25. A vibrant collage illustrating biodiversity (EcoMatcher, 2023)

contributes to food security and agricultural productivity. This service is crucial not only for the environment but also for economies that rely on agriculture.

Ecosystems with high biodiversity are more resilient. When many species are present, ecosystems can better adapt to challenges such as climate change or disease. This increases their ability to recover from damage (WWF, 2022).

Biodiversity also supports agriculture. Around 75 percent of global food crops rely on animal pollinators (IPBES, 2019). A diverse genetic pool among plants and animals helps ensure crops and livestock can adapt to new conditions.

Additionally, many medicines originate from nature. Aspirin, for example, comes from willow bark, and some cancer treatments are derived from tropical plants. Losing species may mean losing future medical breakthroughs (Latham, 2021).

In short, biodiversity is vital for the environment, food security, health and well-being. Protecting it is essential for both nature and people.

The connectedness

Lindwall (2022) also mentioned that biodiversity is crucial for maintaining the complex network of relationships within ecosystems. In these systems, species depend on each other for essentials like shelter and food. Figure x shows all the interconnected food chains within an ecosystem.

As species begin to vanish, the delicate balance that maintains the ecosystem's stability and health starts to deteriorate as well. For example, species like bees play a vital role by pollinating plants, which is essential for the production of fruits and vegetables. When key species like bees decline, the balance within the ecosystem is disrupted, affecting food production and the health of the environment.

“Each player in an ecosystem fulfills its niche, Once you start losing species that were playing specific ecological roles, the whole thing starts to unravel.”
NRDC forest conservation expert Jennifer Skene (Lindwall, 2022)

Nature doesn't need us, but we need nature

Nature can survive without human intervention, but humans cannot live without nature. Natural systems provide fresh air, clean water, food and a stable climate. In areas left untouched by people, such as the Chernobyl zone, wildlife has often returned and flourished. This shows that ecosystems can recover in the absence of humans.

At the same time, human activity is the leading cause of biodiversity loss. Scientists estimate that up to one million species are at risk of extinction due to deforestation, overfishing, pollution, climate change and invasive species (IPBES, 2019). These threats are largely driven by industrial practices, land use change and greenhouse gas emissions (WWF, 2022).

Habitat destruction removes homes for animals and plants. Pollution and pesticides harm insects and aquatic life. Climate change alters habitats and places stress on species. These impacts also threaten human well-being. For example, fewer pollinators can lead to lower food production, and the loss of forests increases the risk of floods and droughts (Díaz et al., 2019).

Nature does not depend on us, but we rely on the essential services it provides. Recognising this connection is key to building a sustainable future.

How Biodiversity affects our daily lives?

Biodiversity supports many parts of daily life. Medicines are made from plants. Foods like fruits and vegetables rely on insects for pollination. Without pollinators such as bees, crop yields would decrease and food prices could rise (IPBES, 2019).

Biodiversity supports mental health. People often feel better and less stressed in natural spaces. Parks and green areas with more plants and animals are more enjoyable and restorative (Mechelli, 2024).

Biodiversity also helps create opportunities for outdoor recreation, tourism and education. It connects people to nature and improves quality of life.

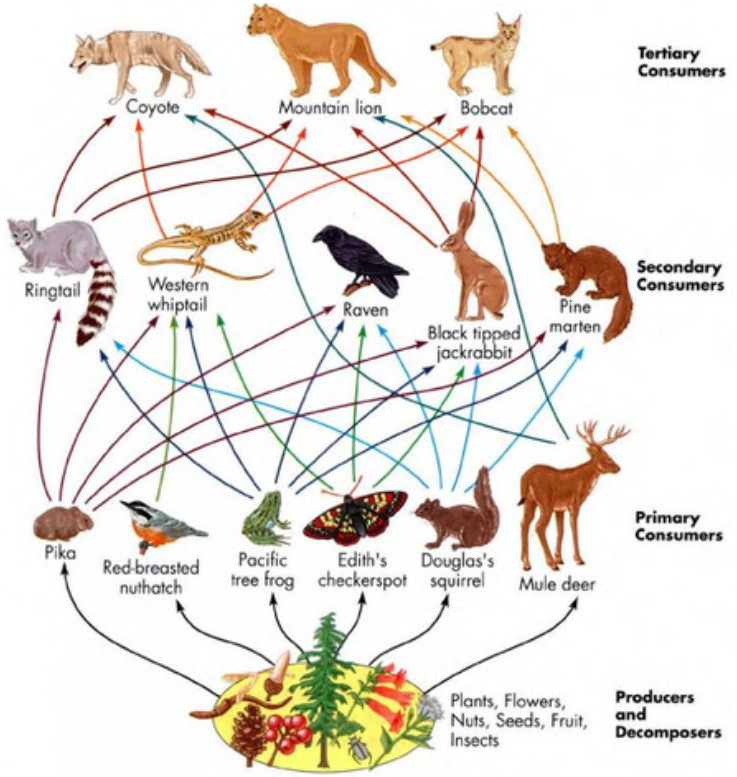


Figure 26. Food webs in the ecosystem (ScienceSFP, n.d.)

Nature without Biodiversity | Nature with Biodiversity

Figure 27. Visual comparison of biodiversity and nature. (Convention on Biological Diversity, n.d.)

2.2.2 Biodiversity Crisis

The biodiversity crisis is primarily driven by human activities, including habitat destruction, overexploitation of resources, pollution, introduction of invasive species, and climate change. (Figure 28,29,31,32) These actions have led to significant declines in species populations and the degradation of ecosystems worldwide (IPBES, 2019).

The consequences of this crisis are profound for humanity. The loss of biodiversity undermines essential ecosystem services that are vital for human survival, such as pollination of crops, purification of air and water, and regulation of climate. For instance, the decline in pollinator populations threatens global food security, while the destruction of wetlands and forests exacerbates climate change by releasing stored carbon dioxide into the atmosphere. Moreover, degraded ecosystems are less resilient to environmental changes, increasing the vulnerability of human communities to natural disasters and diseases. The World Health Organization highlights that changes in ecosystems can affect livelihoods, income, local migration, and may even cause or increase political conflict (WHO, n.d.).

Addressing the biodiversity crisis requires immediate and coordinated global action to mitigate human impacts, restore degraded ecosystems, and implement sustainable practices that balance ecological health with human development.

Figure 28. Habitat destruction (Animals International, n.d.)

Figure 29. Overexploitation (World Wildlife Fund, n.d.)

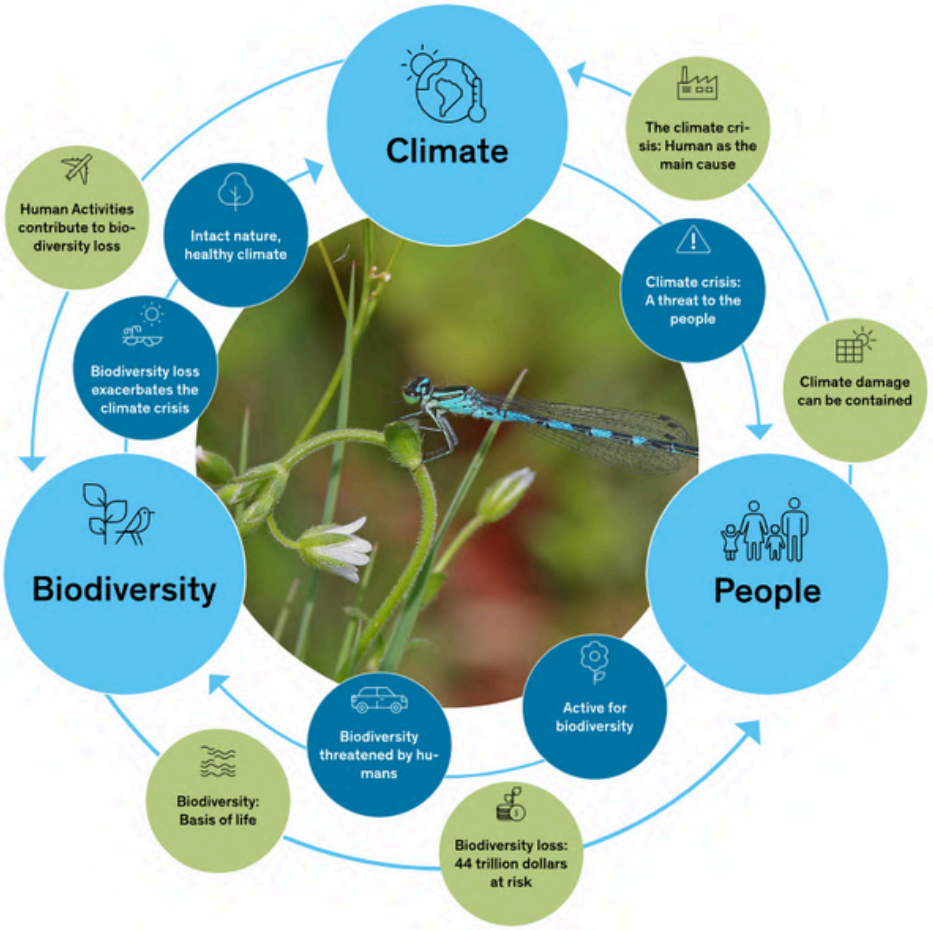


Figure 30. influence on each other. Graphic by myclimate, Photo by SFFN / S. Tschanz

The diagram (Figure 30) shows how climate, people, and biodiversity are interconnected. Human activities contribute to both climate change and biodiversity loss, which negatively affect people. It also suggests that actions like conservation and climate solutions can restore balance and strengthen ecosystems (MyClimate, n.d.).

Figure 31. Air pollution (European Respiratory Society, n.d.)

Figure 32. Climate change (One Tree Planted, 2022)

2.2.3 The Role of Animals in Ecosystems and Human Life

Animals play a crucial role in maintaining the balance of ecosystems. They contribute to key ecological functions such as pollination, seed dispersal, pest control, and nutrient cycling. For instance, insects like bees and butterflies are vital pollinators for both wild plants and crops (Figure 33), supporting food production and biodiversity. Birds and mammals help distribute seeds (Figure 34), ensuring the regeneration of forests and green spaces. Predatory animals help regulate prey populations, contributing to ecological balance (Kremen & Merenlender, 2018).

These services are not only essential to the health of natural ecosystems but also directly support human wellbeing. Ecosystem stability helps provide clean air, fresh water, and fertile soil—resources that are fundamental for survival (IPBES, 2019). When animal populations decline due to habitat loss or pollution, the entire ecosystem suffers, ultimately threatening human livelihoods and quality of life. Protecting animals and their habitats is therefore not just a conservation issue but a societal necessity.

Figure 33. A bee collecting pollens from a flower (P.manchev, 2011)

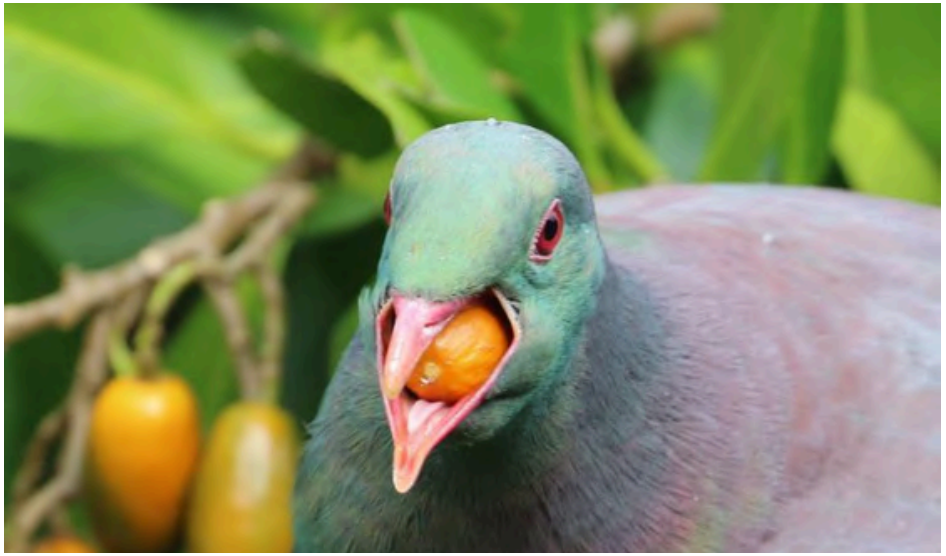


Figure 34. The kererū (New Zealand pigeon), one of the important birds for seed dispersal in the forest ecosystem. (de Lisle, G., n.d.)

2.2.4 Human Behavior That Impacts the Ecosystem

Human activity is the leading cause of biodiversity loss. Large-scale practices such as industrial agriculture, deforestation, urban expansion, and pollution have significantly degraded ecosystems around the world (WWF, 2022). These impacts often seem distant or too complex for the general public, especially for children and families, to relate to. That is why this project focuses on small, everyday actions. These behaviors are familiar, visible in daily life, and offer age-appropriate opportunities for children to learn and feel empowered.

In this project, five specific behaviors that are common in everyday family life in the Netherlands are highlighted: food waste, overconsumption of clothing and toys, littering, feeding ducks and wild animals, and nighttime light use. These behaviors were selected because they are familiar, age-appropriate, and linked to local urban biodiversity, making it easier for families to understand their impact on nature and feel capable of contributing to positive change.

Food Waste

Food waste is a widespread issue across the world (See figure 35), contributing significantly to environmental degradation. In the Netherlands, households waste an average of 33.4 kilograms of solid food per person annually, especially bread, vegetables, and fruit (Voedingscentrum, 2024). This level of waste leads to unnecessary land use, water consumption, and greenhouse gas emissions. Moreover, the demand for more food production can result in habitat loss and degradation, reducing space for wild species. Reducing food waste helps preserve natural habitats and reduces pressure on biodiversity.

Figure 35. The Food Index Report (Statista, 2024)

Overconsumption of Clothing and Toys

In the Netherlands, people buy an average of 46 new clothing items each year and throw away about 40, contributing to pollution and overuse of resources (HvA, 2018). Similarly, around 90% of toys are made from plastic, and most are not recycled, often ending up in landfills or the ocean (Robertson-Fall, 2020). Producing and disposing of these items harms

ecosystems through pollution and habitat loss. Reusing clothes and toys and buying less can reduce this impact (Ellen MacArthur Foundation, 2017). See figure 36.

Littering

Littering poses significant risks to urban wildlife. Animals such as birds and hedgehogs may ingest or become entangled in plastic waste, which can lead to injury or death. Although specific data for children aged 9–12 is limited, studies in the Netherlands have found that adolescents aged 12 to 18 are among the most likely to litter, with peer influence playing a key role in these behaviors (Wageningen University & Research, 2013). This highlights the importance of addressing the issue at a younger age. See figure 37.

Feeding Ducks and Wild Animals

Feeding ducks and other urban wildlife is a common practice, often done with good intentions. However, leftover bread and other human food can harm animal health, pollute waterways, and attract pests like rats. In some Dutch municipalities, feeding ducks is even discouraged or fined (DutchNews.nl, 2022). Allowing animals to forage naturally supports healthier populations and more balanced ecosystems.

Light Pollution at Night

Artificial light at night disrupts the natural behavior of nocturnal animals, such as moths and birds, and affects their ability to navigate, hunt, and reproduce. The Netherlands has some of the highest levels of light pollution in Europe, especially in areas like Delft and Westland (Falchi et al., 2020). Reducing nighttime lighting supports urban wildlife and helps maintain healthy ecosystems.

Figure 36. Landfill site from overconsumption (themists, 2014)

Figure 37. Littering in the street in Rotterdam (climatecypher, 2021)

2.3 Theory and Design Framework

Museums are increasingly seen as agents of change, shifting from collection-centered institutions to audience-centered spaces that facilitate learning and social impact (Calvi, Vermeeren & Sabiescu, in press). In the context of biodiversity education, museums, like Naturalis, aim not only to inform visitors about nature but to foster a deeper personal connection with the natural world and to motivate small behavioral shifts toward conservation. Achieving these goals requires drawing on theories of transformative learning, experience design, and interactive engagement.

2.3.1 Understanding Transformative Learning

Transformative learning, first developed by Jack Mezirow, is a process in which individuals revise their previously held beliefs through critical reflection. It typically begins with a disorienting experience that challenges one's assumptions and is followed by deep self-reflection and engagement with alternative perspectives (Mezirow, 1991). Rather than simply accumulating knowledge, learners experience a fundamental shift in how they see themselves and the world.
Mezirow (1991) outlined a ten-phase model of transformative learning:

1. Disorienting Dilemma
An event or experience that disrupts your usual way of thinking or understanding the world.
2. Self-Examination
You begin reflecting on your feelings, assumptions, or reactions to that experience.
3. Critical Assessment of Assumptions
You start questioning your beliefs and whether they still make sense.
4. Recognition of the Need for Change
You recognize that your discomfort is part of a deeper issue and that changing your perspective may be necessary.
5. Exploration of New Roles and Actions
You begin thinking about alternative ways of seeing, acting, or being.
6. Planning a Course of Action
You decide how to explore or try out these new perspectives in real life.
7. Acquiring Knowledge and Skills
You gather the information or tools needed to support the change.
8. Trying New Roles
You start experimenting with the new behavior, mindset, or identity.
9. Building Confidence and Competence
You gain confidence and feel more capable in your new way of being.
10. Reintegration
You fully adopt this new perspective or identity into your everyday life.

While comprehensive, this process can be distilled into four overarching phases suitable for museum design, as described by Vermeeren (2025): awareness, self-reflection, exploration, and integration. See figure 38.

- **Awareness** refers to the moment when a visitor encounters something unexpected or emotionally stirring that challenges their existing beliefs. For instance, an immersive exhibit on endangered species might create an emotional connection that prompts visitors to question their role in nature.
- **Gaining a deeper understanding and Self-reflection** follows as the visitor considers why they were affected, examining their thoughts and values. Reflection prompts in the exhibit can encourage visitors to think about their own behaviors and their impact on the environment.
- **Exploration** is when visitors engage with new perspectives or possibilities, often through interaction or storytelling. This might include learning how conservation efforts are made or trying out decision-making scenarios through interactive components.
- **Integration** is the phase where new understandings are carried into daily life. The exhibit may provide follow-up resources, opportunities to take action, or invitations to join citizen science projects.

These four phases provide a useful foundation for designing exhibitions that aim to promote long-term learning and behavioral change.

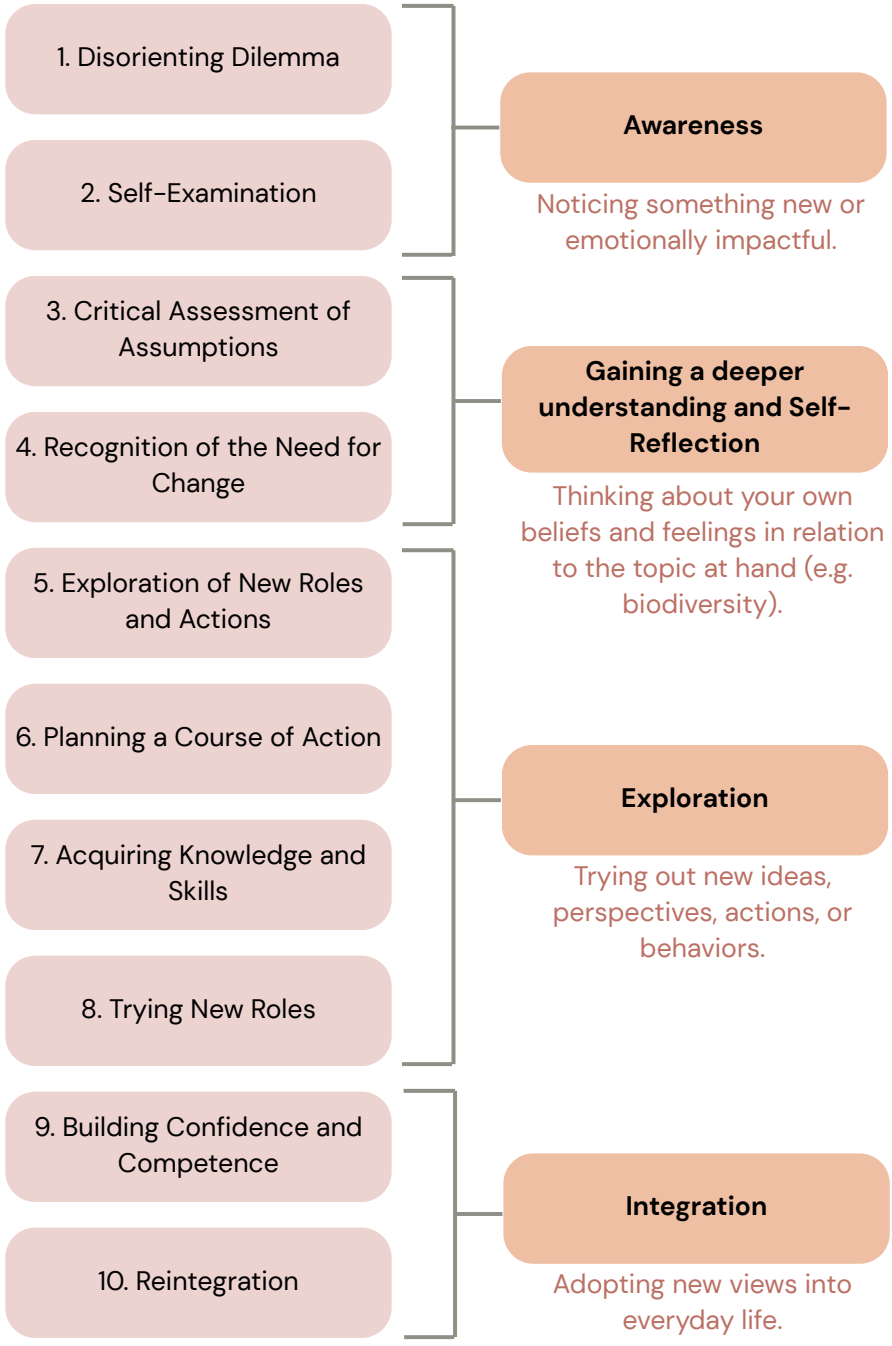


Figure 38. how 10 steps of Mezirow is overarched to 4 phrases

2.3.2 What Is Transformative Experience Design?

Transformative Experience Design (TED) applies the principles of transformative learning to real-world environments, such as museums, to foster deep engagement and personal growth. According to Pugh (2011), a transformative experience is one in which a person applies a new idea in their everyday life and values the change it brings. It is not just about learning new facts but about seeing the world in a new way.

Liedgren, Desmet, and Gaggioli (2023) developed the Liminal Design Framework to guide the design of transformative experiences in museums. This framework highlights three design elements:

- **Narrative Desire:** presenting relevant and surprising content that captures interest
- **Optimized Abstraction:** using symbolic or immersive representations to engage imagination
- **Suspension of Disbelief:** creating coherent, believable experiences that encourage emotional investment

These principles aim to create experiences that temporarily suspend visitors' routine perspectives and allow them to reimagine themselves and the world around them. When the experience concludes, visitors ideally return to everyday life with a changed outlook.

2.3.3 Museum Design

According to Vermeeren, Calvi, and Sabiescu (2018), designing for transformative engagement means focusing on the visitor's journey rather than just the content. Museums should be seen as part of broader ecosystems that include families, schools, and communities. Experiences should be personal, participatory, and extend beyond the museum space. Designing with this mindset involves:

- Framing the museum as a social space where visitors can reflect, share, and engage
- Supporting a variety of learning styles through visual, tactile, and narrative modes
- Embedding the experience in larger educational and social systems, such as schools or environmental campaigns

While this project does not extend into wider systems such as formal education or activism, it adopts these principles by aiming to create a reflective, emotionally engaging experience within the museum context

2.3.4 Interactive Communication in Museum Experiences

While TED provides the emotional and experiential foundation, the framework of Interactive Communication helps operationalize it through engagement strategies. In museum contexts, this means focusing on how visitors actively engage

with content:

- Physical interaction (touching, building, manipulating)
- Social participation (group games, collaborative learning)
- Co-constructed meaning-making (responding to prompts, leaving opinions, evolving narratives)

Unlike traditional one-way communication, interactive communication sees visitors as participants who create understanding through doing, moving, or responding (Vermeeren, Calvi, & Sabiescu, 2018). Design strategies such as hands-on exhibits, real-time feedback loops, group activities, and sensory immersion help build not just knowledge but also emotional connection and reflection (Calvi, Vermeeren & Sabiescu, in press).
This framework is especially relevant in projects involving children and families, who learn best through tactile and embodied experiences.

2.3.5 Design for Behavioral Change

Design for behavioral change focuses on encouraging individuals to adopt new actions or attitudes that support positive social and environmental outcomes. In museum contexts, this means creating experiences that inspire visitors to make meaningful changes in their everyday lives—such as reducing waste, conserving nature, or being more mindful of biodiversity. Museums are particularly well-suited for this role, offering emotionally engaging environments that blend storytelling, education, and interaction in ways that leave a lasting impression.

Self-Determination Theory

This project draws on Self-Determination Theory (Ryan & Deci, 2000) (Figure 39), which explains how intrinsic motivation arises when three basic psychological needs are fulfilled: autonomy (feeling that one's actions are self-chosen), competence (feeling capable and effective), and relatedness (feeling connected to others). When these needs are supported, individuals are more likely to adopt new behaviors willingly and maintain them over time.

The exhibition is designed with these principles in mind. It gives children and parents opportunities to make their own choices (autonomy), take achievable actions (competence), and develop emotional connections to nature and each other (relatedness). These elements aim not only to engage visitors during the experience but also to spark long-term motivation for sustainable behavior in everyday life.

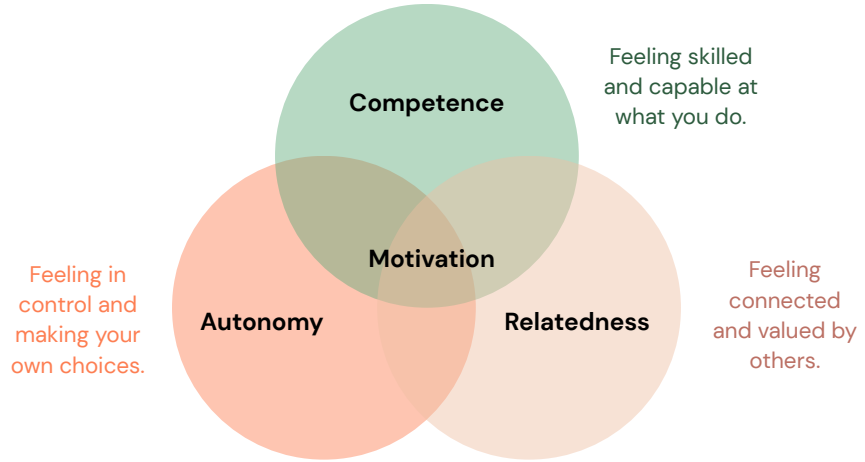


Figure 39. Self-Determination Theory Diagram

2.3.6 Conclusion

This project integrates several frameworks to support transformative learning and behavioral change in biodiversity education. (See figure 40) Mezirow's theory defines the stages of transformation—awareness, self-reflection, exploration, and integration—while Transformative Experience Design (TED) offers strategies to create immersive, emotionally engaging experiences that prompt mindset shifts.

Museum Design principles emphasize personal and participatory learning journeys, while Interactive Communication ensures visitors actively engage through doing, talking, and reflecting. These frameworks together foster moments of curiosity, connection, and discovery.

To encourage lasting impact beyond the visit, this project also applies Self-Determination Theory (SDT), which supports motivation through autonomy, competence, and relatedness. The design enables families to feel capable of making choices and understanding how their small actions affect nature.

By combining these approaches, the installation aims to move visitors from simply learning about biodiversity to caring about it—and ultimately to taking meaningful, sustainable action in their daily lives.

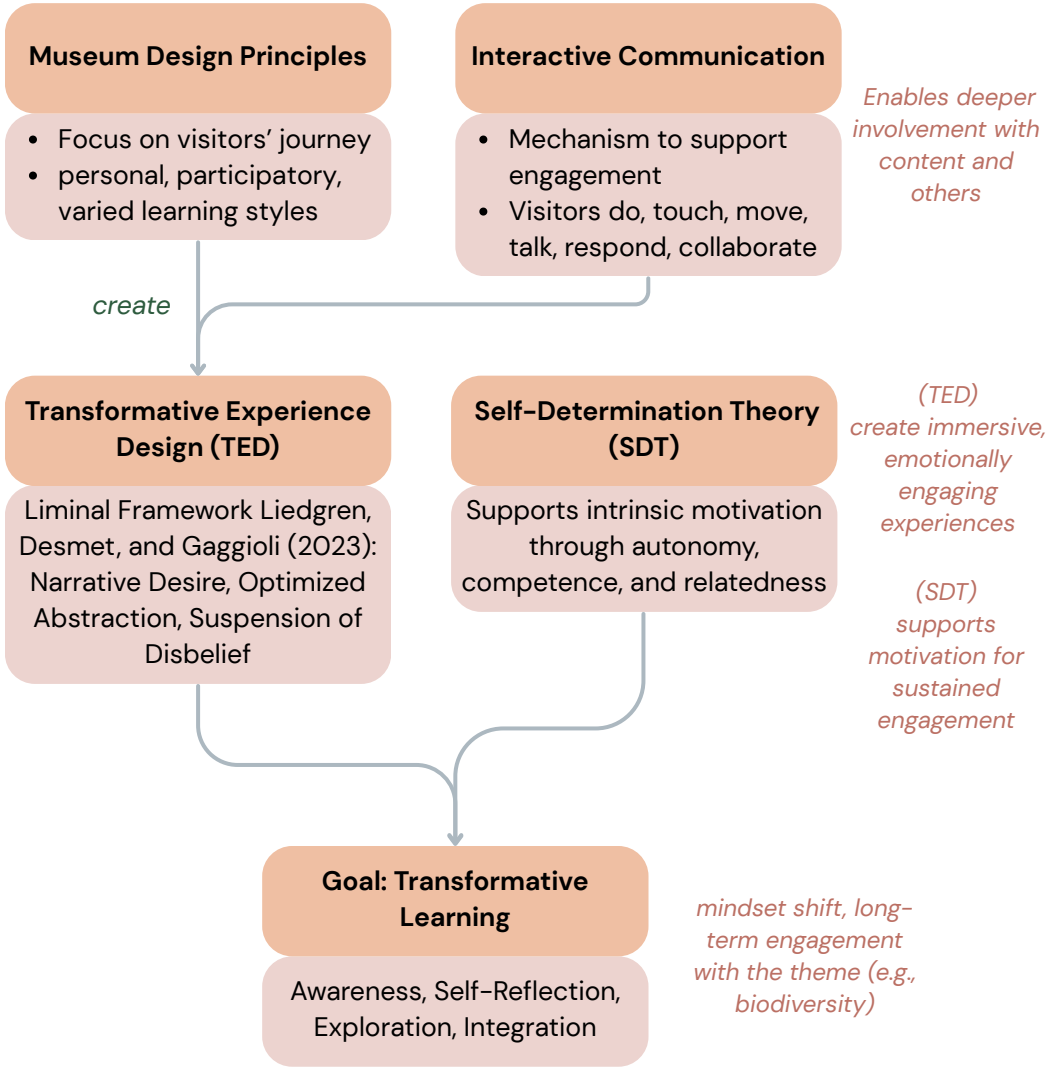


Figure 40. Flowchart Diagram illustrates the theory and framework connection in the project

2.4 Design Approach

2.4.1 Content Development Process

When designing an exhibition, it is essential to first define the main content and key message. The steps I followed in this project are outlined in Figure 41.

The process began with interviews with experts from Naturalis to gather valuable insights and keywords related to biodiversity, with a focus on animals. At the same time, I observed a nature education class and conducted contextmapping research with families and children aged 9–12 to better understand their interests in nature.

Next, I brought together the findings from these activities in a brainstorming session with Naturalis staff to generate ideas for the exhibition content. To support this, I also visited several museums to study how they use interactive exhibits to communicate messages effectively to different audiences. These visits helped me explore potential ways to present the message in this project.

With the content and communication approach defined, I created three design concepts and tested them with children to identify which one was most engaging and effective. Based on the results of these tests, I developed a prototype and refined it into the final design.

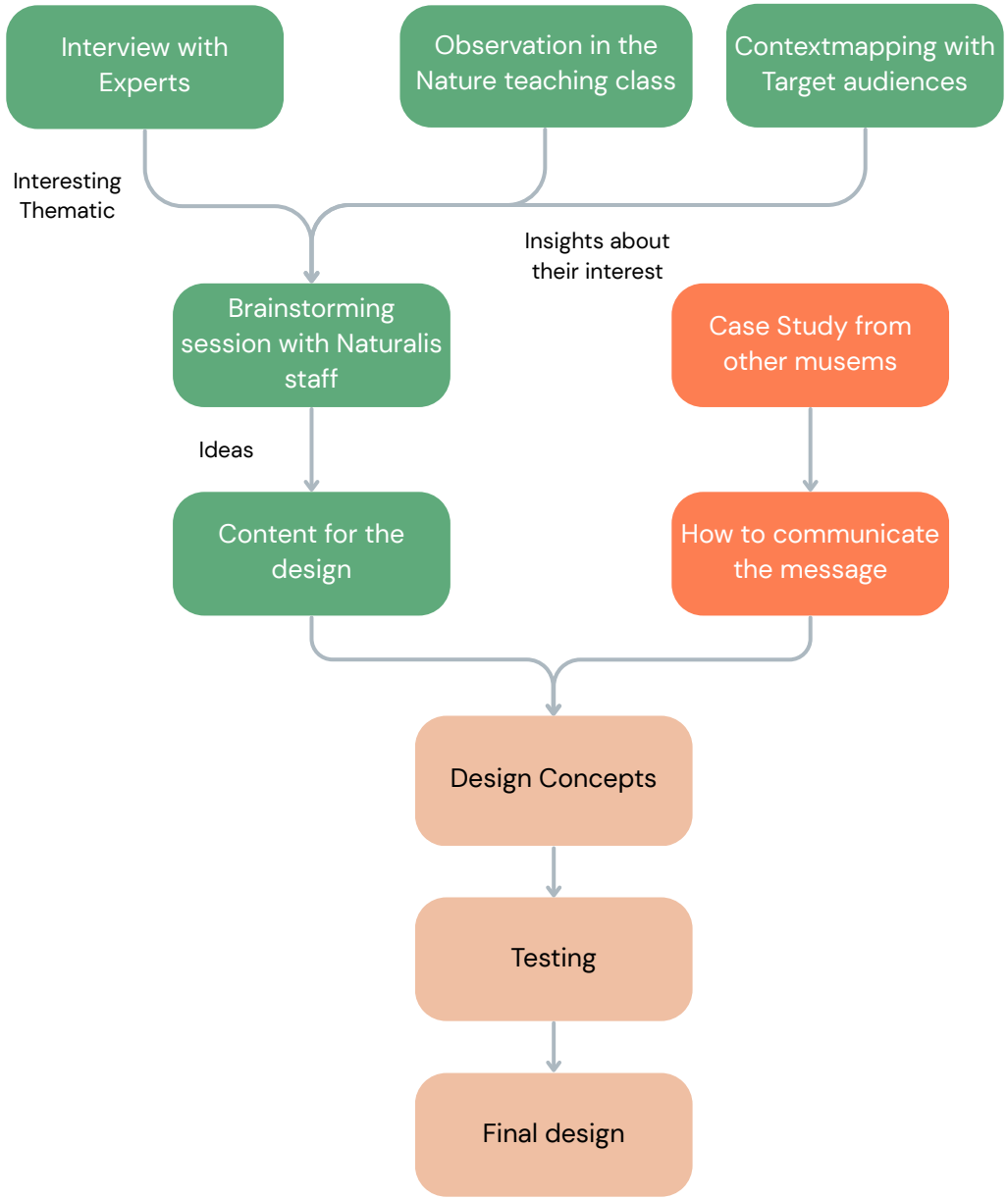


Figure 41. Diagram shows working process on how to get final design

2.4.2 Experts Interview

To gain foundational knowledge about the Leven exhibition and to understand key perspectives on biodiversity and the current crisis from the viewpoint of Naturalis staff, I conducted interviews with three individuals.

The first interview was with a content developer from the design department, who is responsible for shaping the overall museum experience. This included gaining a deeper understanding of the Leven exhibition and exploring how my project might align with or be integrated into it.

The second interview was with a pollinator expert. This helped me understand how biodiversity is viewed from a scientific perspective within Naturalis, and what kinds of narratives could be relevant for the exhibition.

The third interview was with staff members from the education department. This provided insight into how Naturalis communicates scientific content to the public.

In each interview, I also asked about potential storylines that could be used in my design project. These conversations were essential in identifying meaningful directions for the content of the exhibition. See Appendix C for the interview questions and the clustered insights gathered from the interviews.

Interview Insights

- **Interconnectedness of Life**

The experts emphasized that biodiversity is not just about the number of species, but also the relationships between them and the systems they form. This includes visible animals such as mammals and birds, as well as less visible life forms like fungi, insects, and soil organisms. The idea that everything is connected appeared in examples such as worms helping plants grow and humans depending on nature for basic needs like food and clean air.

- **The Role of Biodiversity in Resilience**

Biodiversity helps ecosystems stay strong and adaptable. Interviewees highlighted the role of small, often invisible species like pollinators and organisms in the soil. These species help ecosystems stay balanced and recover after disruptions. This concept of resilience through diversity was seen as an emotionally engaging and educational opportunity for exhibition visitors.

- **Understanding the Biodiversity Crisis**

The interviews stressed the impact of human activities such as climate change, urban development, intensive agriculture, and pollution. These factors lead to habitat destruction and species loss, which disrupt the function of ecosystems. Visitors may not notice these problems until they affect their lives, so using relatable examples, such as food systems or familiar animals, was recommended to raise awareness.

- **Making the Loss of Biodiversity Visible**

A recurring insight was that people are less likely to care about species they never knew existed. Therefore, exhibitions should introduce the richness and variety of species in a way that helps people feel the impact of their absence. Helping visitors discover lesser-known species can create stronger emotional connections.

- **Unseen Layers and Real-World Consequences**

The interviews also pointed out the importance of underground biodiversity and microscopic life, which are often ignored. Showing the real-world effects of species loss—such as how it impacts food security or ecosystem health—can help visitors reflect on human impact more meaningfully.

From the interviews, four main keywords were identified: connectedness, resilience, loss of species, and loss of habitat. These themes were used in a brainstorming session and were found to match closely with the contextmapping research, confirming their relevance for children aged 9 to 12 and their families.

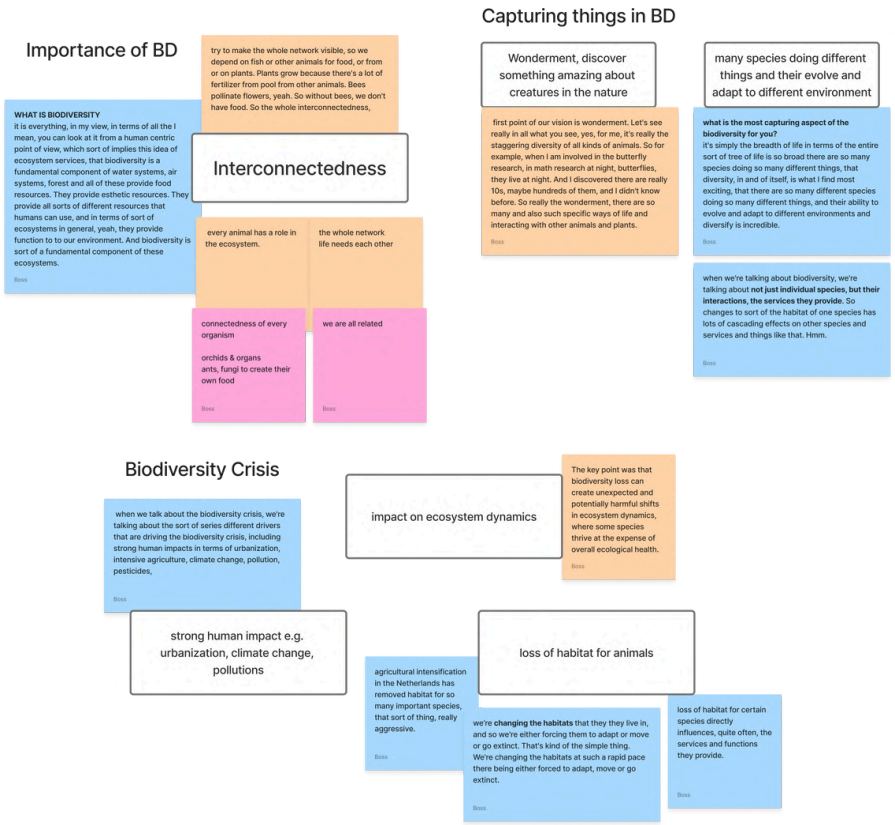


Figure 42. Clustering of statement cards from the interview. See more in Appendix C

2.4.3 Voedselbos Observation

To explore how children engage with nature-based learning, I observed a nature class of group 5/6 (children aged 8 to 10 years old) at Voedselbos in Vlaardingen. I also spoke with the teachers to learn more about how they introduce topics related to nature and biodiversity, what activities spark children's curiosity, and how the children interact with their surroundings. This observation helped me understand how environmental education is delivered in practice and what kinds of experiences are most engaging for children in this age group.

Structured Activities Observed

- **Bird Watching:** Children used binoculars to observe birds and played a game of "bird bingo," learning to identify species and their behaviors. Activities also introduced predator-prey dynamics in a playful way.
- **Plant Learning and Cooking:** Children learned about wild garlic (daslook) through sensory activities such as smelling, tasting, and cooking with the leaves they found in the forest. (Figure 43)
- **Building Bird Nests:** Students explored how birds construct nests, using materials and mirrors to simulate a bird's perspective, learning about structure and adaptation.

Student Engagement

- **Younger Children (9–10 years):** Engaged most with interactive, playful, and surprising activities. Short attention spans were managed using games and peer learning.
- **Older Children (11–12 years):** Showed more social influence and were drawn to group tasks and exploratory challenges like taste testing.

Figure 43. Cooking station. See Appendix D for more pictures.

Interaction with the Environment

- **Learning by Doing:** Children responded well to hands-on experiences, especially involving nature tools and real plants or animals.
- **Curiosity and Exploration:** Activities that allowed them to smell, touch, and manipulate natural elements generated strong engagement and curiosity.

Teaching Approaches

- **Use of Questions and Storytelling:** Small prompts and open-ended questions were used to guide exploration.
- **Sensory Learning:** Most effective teaching methods included touch, smell, and observation-based tasks to help children make sense of natural systems.

Key Takeaways

The observation at Voedselbos offered useful insights into how children engage with nature-based learning. Children were most responsive to hands-on, sensory activities such as cooking with wild garlic, building bird nests, and playing games that involved movement and role-play. These activities encouraged curiosity, exploration, and emotional connection.

It was also clear that children enjoy learning through discovery rather than explanation. Teachers used prompts and open-ended questions to guide exploration, which helped children develop their own understanding. Peer interaction played an important role as well, with children often learning by observing or sharing with one another.

These insights support the idea that the exhibition should involve active participation, sensory engagement, and playful formats. Real-life relevance, such as the connection between biodiversity and food, also proved effective in helping children understand abstract concepts. Making hidden aspects of nature visible—like soil life or animal perspectives—can further enhance engagement.

Figure 44. Visual aids for children

2.4.4 Contextmapping with Target Audiences

To gain deeper insight into how children aged 9 to 12 perceive nature and biodiversity, I conducted a contextmapping study. Contextmapping is a design research method that involves users as experts of their own experiences. It utilizes tools like workbooks and creative sessions to help participants reflect on their daily lives, providing insights that guide the design process (Sleeswijk Visser et al., 2005).

To prepare for the interviews, I created a sensitizing booklet (Figure 45) titled “Natuur om me heen: Samen op ontdekking” (Nature around me: Let's exploring together), which was shared with eight children a few days before the session. The booklet encouraged them to reflect on their experiences with nature in a playful and accessible way, using drawings, logbooks, and short writing prompts. This step helped the children become more aware of their environment and made it easier for them to share detailed insights during the interviews.

From the group, five children and their parents were contacted for one-on-one interviews. Each session lasted approximately 45 minutes and included a mix of drawing, storytelling, and conversation. This approach allowed the children to express themselves in different ways and provided rich insights into their daily experiences with nature, emotional responses to environmental changes, and preferences for learning. See Appendix E for filled booklet and insights clustering

Figure 45. Sensitizing booklet

Insights

- **Children's View of Nature**

Children described nature using both factual and emotional terms. They mentioned trees, animals, and landscapes, but also referred to how nature makes them feel—happy, calm, peaceful, or even tired. Many associated nature with fun, play, and creativity. They also mentioned its usefulness, such as air to breathe and plants to eat, which reflected an intuitive understanding of nature's value.

Figure 46. Mindmap drawing by a child showing their associations with nature. This example illustrates how children relate to nature using sensory details, personal health connections, and factual elements like animals and plants.

- **Nature in Their Daily Lives**

Children shared vivid stories of daily encounters with animals, gardens, parks, and green areas near their homes or on the way to school. These included personal experiences like collecting eggs from chickens, walking in the forest, or observing frogs in ponds. This shows that many children already have a strong connection to nature, especially when it is linked to their routines or family activities.

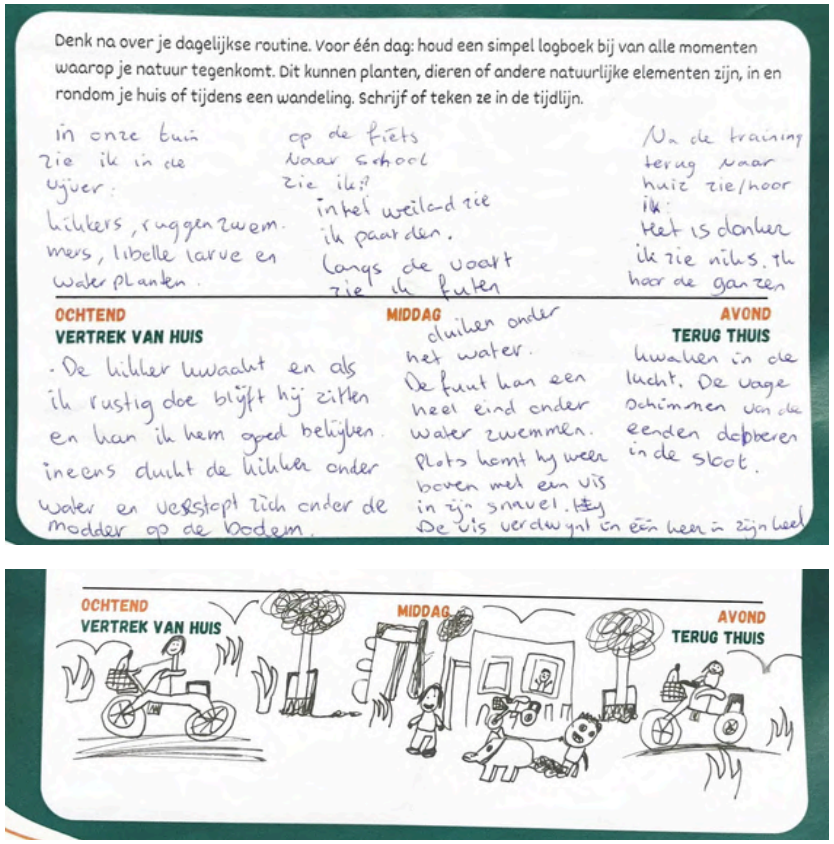


Figure 47. Drawing and written reflection from a child's daily nature log.

- **Feelings Toward Environmental Change**

Many children expressed concern about changes in nature. They mentioned loss of trees, trash in the environment, and fewer animals. Some linked these changes to emotions such as anger, sadness, or worry. Interestingly, they also discussed causes such as money, human action, and urbanization. These responses suggest a growing awareness of environmental issues, even at a young age.

> *Ik vind dat stom wat de natuur is leuk en heel belangrijk. Het maakt me boos als er bomen worden gekapt, "waarom zou je die kappen als het zo belangrijk voor je is?"*
>
> - 12 years old child -

Translation: *I think it's stupid that nature is being destroyed. Nature is fun and very important. It makes me angry when trees are cut down. "Why would you chop them down if nature is so important to you?"*

> *Ik vind het niet goed, want als er meer bomen verdwijnen, hebben we minder zuurstof. Ik voel me niet blij als alle natuur weg is.*
>
> - 9 years old child -

Translation: *I think it's not good, because if more trees disappear, we will have less oxygen. I feel unhappy when all nature is gone.*

- **Understanding of Biodiversity**

Children demonstrated an early understanding of biodiversity concepts. They talked about the variety of plants and animals, and how species depend on one another. Some recognized that the loss of one species could affect others. Keywords like "connectedness," "resilience," and "loss of habitat" came up naturally in their explanations, which matched closely with themes raised during expert interviews.

Figure 48. Mindmap from a child showing their understanding of biodiversity. This drawing shows that the child recognizes different types of plants and animals, such as "eetbare planten" (edible plants), "soorten" (species), and "dieren" (animals). The way they connect these elements suggests an early understanding of biodiversity, including the variety of life and how living things relate to one another.

- **Personal Actions and Responsibility**

Children showed a surprising level of thoughtfulness about how they could help the environment. Ideas ranged from picking up trash and planting trees to using less plastic and discussing issues with parents. Some acknowledged their limitations but still believed small actions matter. These responses reflect an emerging sense of agency and responsibility toward nature.

> *If we help together we can save it, even small things.*
>
> - parent of a 11 years old child -

> *I will ask parents what to buy (what product is good for the nature)*
>
> - 12 years old child -

Figure 49. Children's responses about helping nature. Children suggested actions like picking up trash, planting flowers, and being mindful about buying choices.

- **Learning Preferences and Museum Interaction**

Children expressed a strong preference for learning by doing. They enjoy workshops, games, treasure hunts, and hands-on interaction with exhibits. They liked sensory experiences, such as touching and experimenting, and were more engaged when the content was presented in a playful or storytelling format. Group learning and discussing things with parents were also important for their understanding.

> *I want to go to museum to see rare animals that I can't see in real life.*
> *There are a lot of background information of them*
>
> - 11 years old child -

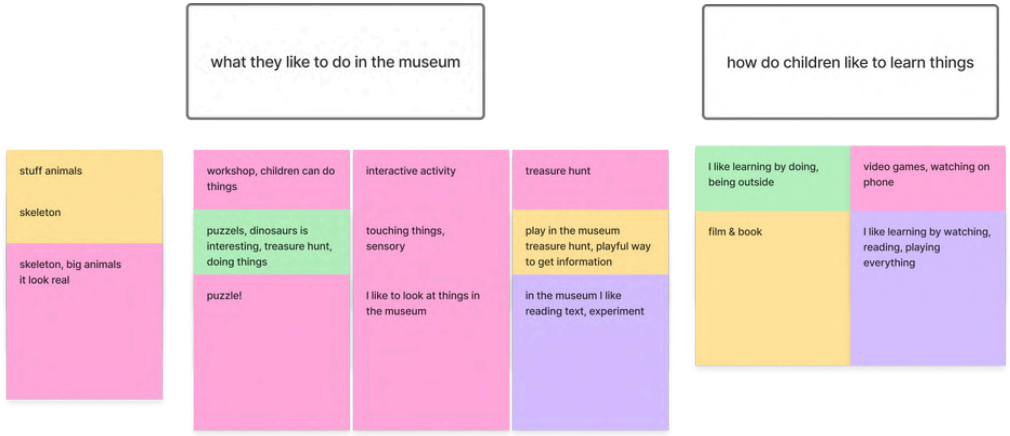


Figure 50. Post-it notes created during interviews with children. These notes capture children's thoughts on how they enjoy learning and what they like to do in museums, highlighting preferences for hands-on, playful, and exploratory activities.

Summary and Design Implications

The contextmapping session provided a clear picture of how children perceive and interact with nature. They connect with it emotionally, understand its importance, and are curious about how it works. Their learning preferences highlight the need for interactive, sensory-rich, and play-based experiences. The alignment between children's language (e.g., “animals help each other,” “we need trees to breathe”) and scientific biodiversity concepts suggests that the exhibition should aim to bridge everyday experiences with ecological understanding in a simple and engaging way.

These insights informed the selection of key themes—such as connectedness, resilience, species loss, and habitat loss—that were carried forward into the brainstorming and design phases of the project.

Limitations

The children who participated were recruited through a local sports club in Vlaardingen. Although the booklets were shared broadly, it is possible that the families who responded were already more interested in nature, which could explain the similarity in their answers. Interestingly, one returned booklet stood out by expressing no concern about the loss of nature. Unfortunately, there was no opportunity to speak with this child to understand their reasoning, even though it would have been valuable to explore. Overall, the responses from the participating children are in line with previous findings from Naturalis, which supports the relevance of the insights gathered in this study.

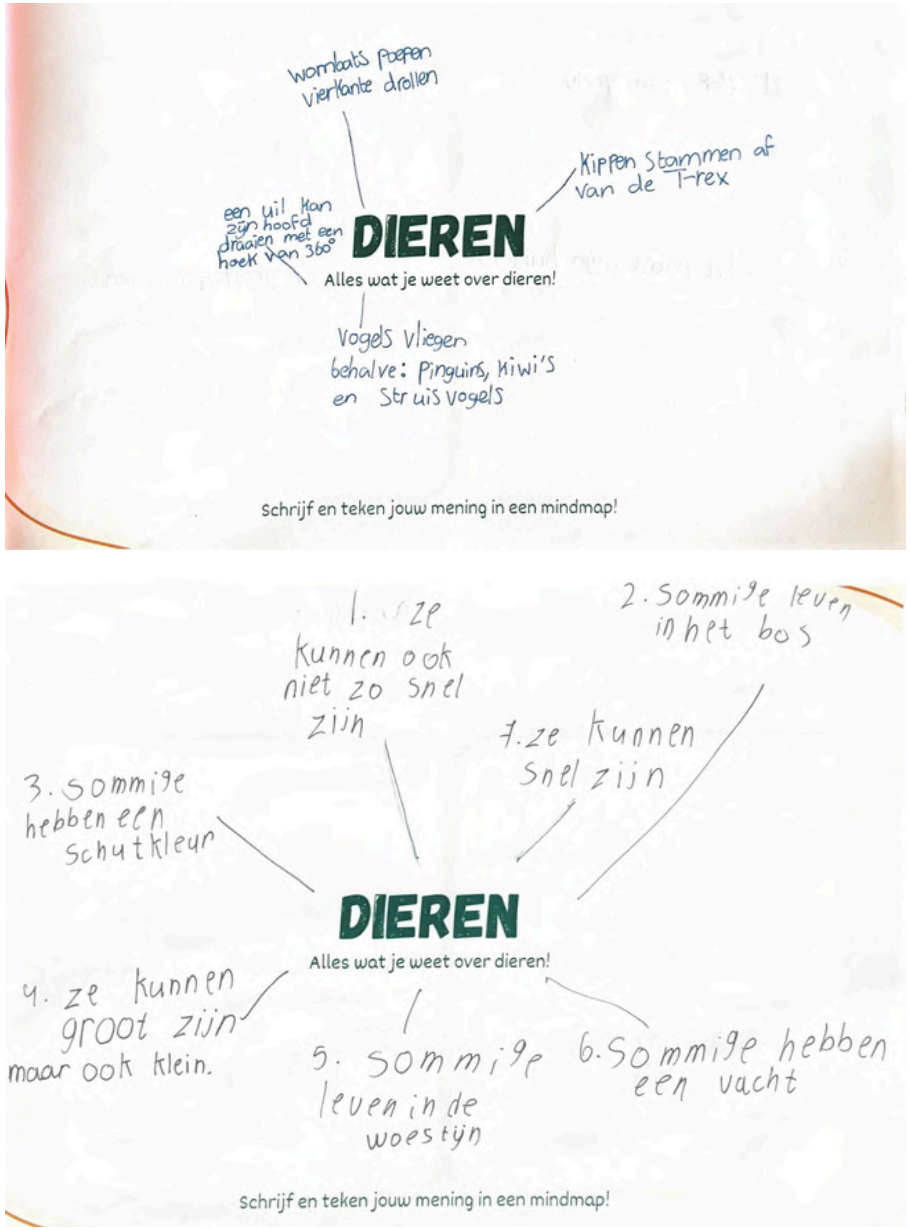


Figure 51. Mindmapping about animals from a sensitizing booklet

The world is slowly getting worse and we try to change it. There are more people doing bad more than good.

– parent of a 11 years old child –

In opstand komen maar dat komt niet in mijn eentje Ik ben een kind. U weet niet wat ik kan doen, nemen ze mij serieus?

– 12 years old child –

Translation: *Standing up for nature isn't something I can do alone. I'm just a child. You don't know what I can do—will they even take me seriously?*

Ik vind het jammer want dan heb je minder natuur speelplaatsen

– 12 years old child –

Translation: *I think it's a shame, because then we'll have fewer nature play areas.*

Ik vind het stom en ik ben teleurgesteld

– 11 years old child –

It's the industry. It's all about money. When people want more money, they're more greedy.

– parent of a 11 years old child –

I don't know if the people are ready for the change. Why? Yeah, it was not changing right now. People are not ready for changing because they're live already too long situation.

– parent of a 11 years old child –

I think when everybody does some small things, you can do it together.

– parent of a 11 years old child –

The ideal world with nature for me is very colorful. With like other flowers, a lot of trees, bushes everywhere, and animals like birds and bees flying around and collecting honey."

– 11 years old child –

2.4.5 Brainstorming Session

Session Setup

To synthesize insights from the expert interviews and contextmapping research, a 45-minute brainstorming session was held with staff members from the design and education departments at Naturalis. The goal was to explore possible content directions for an interactive installation on biodiversity that would appeal to family visitors, particularly those with children aged 9 to 12.

There were seven participants in total. They were divided into two teams—one from the design department and one from the education department. Both teams were asked to design for a fictional target group: the Bakker family. This persona was developed using insights from the contextmapping research and represents a typical museum-visiting family, curious and eager to learn together.

The Persona: The Bakker Family

This family represents a typical museum-visiting household with two children, around 9 years old, who are curious, playful, and interested in nature.

In daily life, the family lives in the city where they often see birds, cats, and insects while walking to school or playing outside. They occasionally bike past fields with farm animals or visit relatives with gardens and chicken coops. Nature is also part of their free time—weekends may include forest walks, fishing, or camping, where they enjoy hands-on experiences like cooking outdoors or picking berries.

Figure 52. Brainstorming Session at Naturalis

These details helped participants design concepts grounded in familiar routines and emotional connections to nature, making the interaction more meaningful and engaging for children and families.

The Bakker Family persona was developed as a project-specific, child-centered tool to guide design, representing a more focused subset of the broader “Johan and Anneke” nature-engaged visitor group. (See section 1.5.5)

Session Process

The session began with a short warm-up activity in which participants brainstormed ideas around four keywords that had emerged in previous research: connectedness, resilience, loss of habitat, and loss of species. These keywords served as the thematic foundation for the next step.

Following this, the Bakker family persona was introduced, and participants were given 15 minutes to design an interactive concept aimed at helping this family understand the chosen theme, become aware of related environmental issues, and feel inspired to care or take action. To support the process, I provided hint cards containing creative prompts such as metaphors, comparisons between past and present, sensory triggers, and emotional cues.

After the design phase, each group presented their ideas to the others. To conclude the session, a voting activity was introduced: each participant received three stickers to vote for the ideas they found most compelling. The idea that received the most votes won a small prize adding a playful, motivating element to the session.

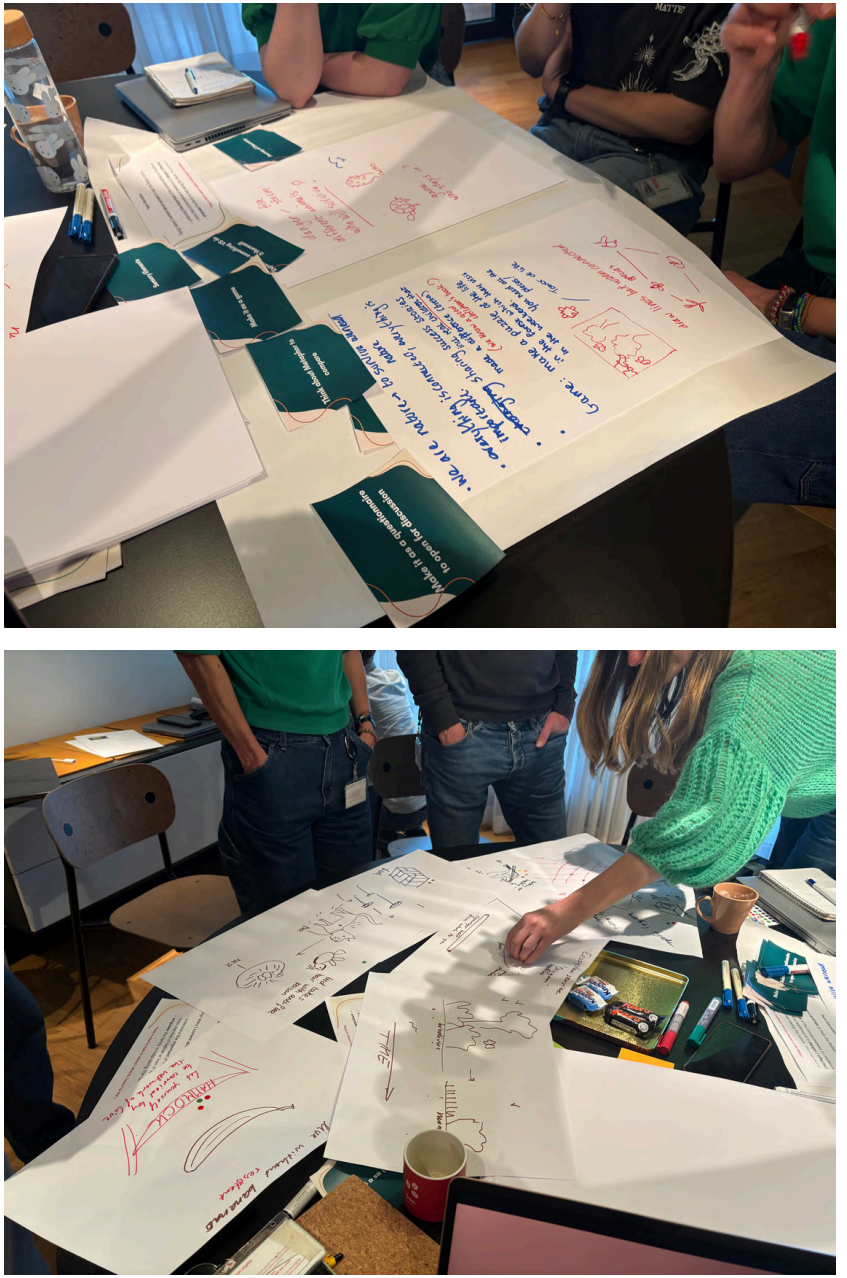


Figure 53. Brainstorming Session at Naturalis

Key-Takeaways

The session generated a wide range of creative concepts, from network-based games and sensory installations to story-driven experiences and hands-on ecosystem challenges (See Appendix F). These ideas could be grouped into three main thematic clusters:

- **Collaborative Action & Empathy:** Concepts that encouraged children and families to work together—either with each other or with animals/plants—such as repair missions, community challenges, or empathy-building through animal perspectives.
- **System Thinking & Interconnectedness:** Installations that visualized ecosystems or chains of cause and effect, such as food webs, life cycles, or "what happens if…" storylines showing the ripple effects of human actions.
- **Tactile, Emotional Learning:** Interactive formats that invited visitors to build, touch, compare, or emotionally respond to situations—e.g., time travel stories, before–after scenes, or imaginative futures.

A strong theme that emerged across ideas was the **importance of collaboration**—working together, both within nature and as humans, to protect the environment. The key message of biodiversity as **a web of connections** became clear: when one element is lost, others are affected. These clusters helped clarify which ideas resonated most and informed the next phase of narrative and experience development.

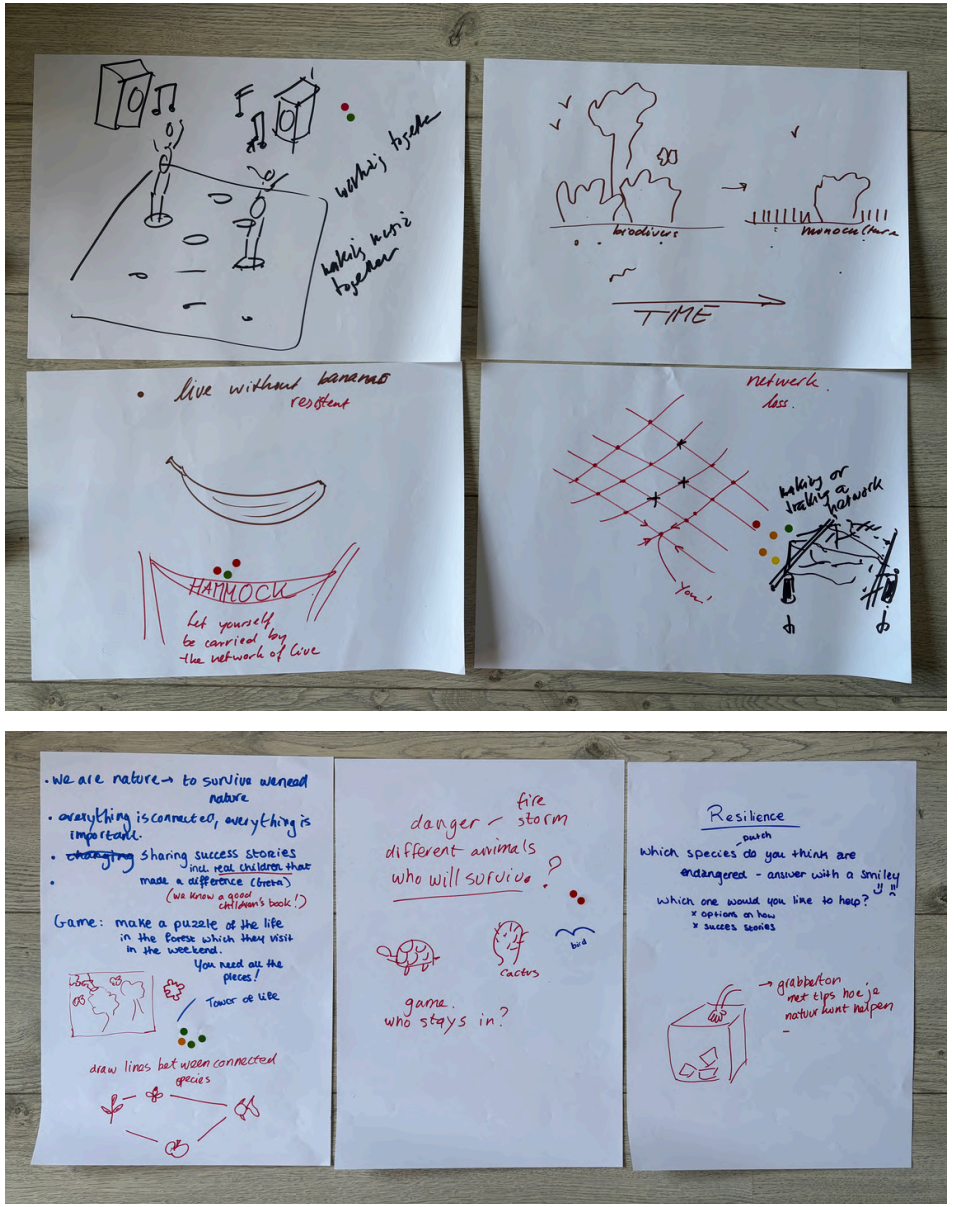


Figure 54. Some co-creation ideas from the session (See Appendix F)

2.5 Case Study

2.5.1 Interactive Exhibition in Museum

To deepen my understanding of how museums communicate complex topics in emotionally engaging and interactive ways, I visited several museums in the Netherlands, including NEMO Science Museum, Omniversum, Beeld en Geluid, and Naturalis itself. These visits were focused on observing how exhibit design supports learning, emotional connection, and playful engagement, especially for children and family audiences.

During the visits, I documented a variety of exhibits and assessed them using three self-defined criteria (See Appendix G):
⭐ Emotionally surprising or touching
❤️ Fun to interact with
👍 Potentially applicable to my project

I selected several standout examples and analyzed them further by clustering common elements and comparing them to two theoretical frameworks I adopted in this project: Transformative Experience Design (TED) and Interactive Communication.

This analysis revealed a number of recurring design strategies, which I grouped according to the relevant framework:

Transformative Experience Design (Liminal Framework)

- **Narrative Desire:** Exhibits that presented content in surprising or emotionally resonant ways such as a scoreboard (Figure 55) showing unexpected results.
- **Optimized Abstraction:** Interactive tools that translated complex systems, such as water flows or environmental balance (Figure 57), into understandable visual experiences.
- **Suspension of Disbelief:** Immersive, theatrical setups that drew visitors into an emotionally engaging storyline or environment, such as the red-lit dinosaur tunnel at Naturalis (Figure 56).

Interactive Communication

- **Embodied Interaction:** Use of full-body movement to engage with the content, such as stepping on answers (Figure 58).
- **Tangible Play:** Physical elements that encouraged hands-on exploration and creative experimentation such as make your own robot (Figure 59).
- **Real-Time Feedback:** Exhibits that provided immediate visual or sensory responses to visitor actions, reinforcing cause-and-effect learning such as Alien lab (Figure 60).
- **Personal Relevance:** Activities that related to the visitor's identity or values, such as customization stations or reflection quizzes (Figure 61).
- **Collaborative Participation:** Group-based or social interaction elements like voting walls and discussion prompts (Figure 62).

These insights offer practical direction for my concept development. They suggest that creating an emotionally engaging biodiversity experience for children and families should involve multi-sensory immersion, hands-on interaction, personal connection, and social reflection. The findings from the museum analysis will guide my next step in designing a concept that not only informs but also transforms the visitor's understanding and emotional relationship with biodiversity.

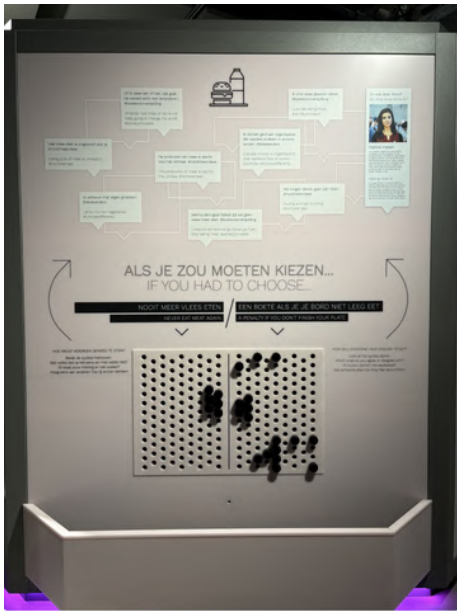


Figure 55. Scoreboard with quotes from both sides (Nemo), creates emotional impact through social comparison, as the surprising collective results provoke self-reflection and spark curiosity about how one's own views align with or differ from others. (Narrative Desire)

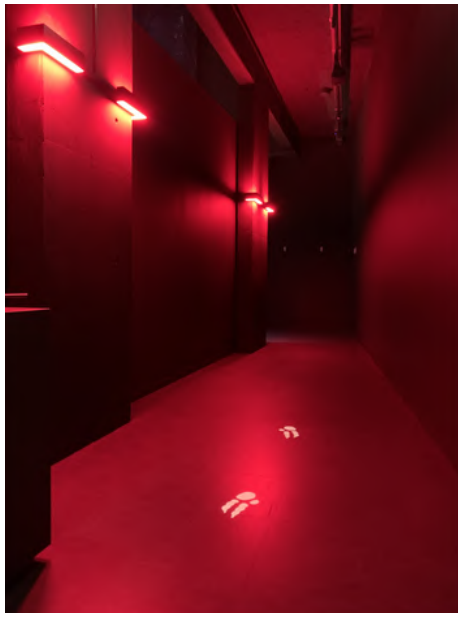


Figure 56. Sound and projector of the Dinosaur's footprint in the hallway (Naturalis), simulate the environment of the Dinosaur to life (Suspension of Disbelief)

Figure 57. Water management installation (Nemo), to see the impact of environmental actions in real time, which makes the complexity of ecological systems more graspable. (Optimized Abstraction)

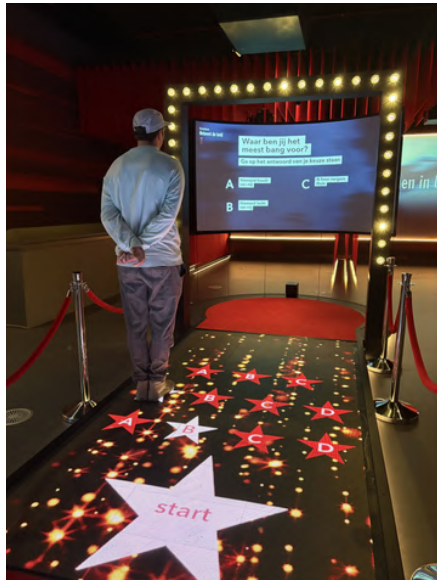


Figure 58. Stepping to answer (Beeld en Geluid), stepping to control the game element (Naturalis) (Embodied Interaction)

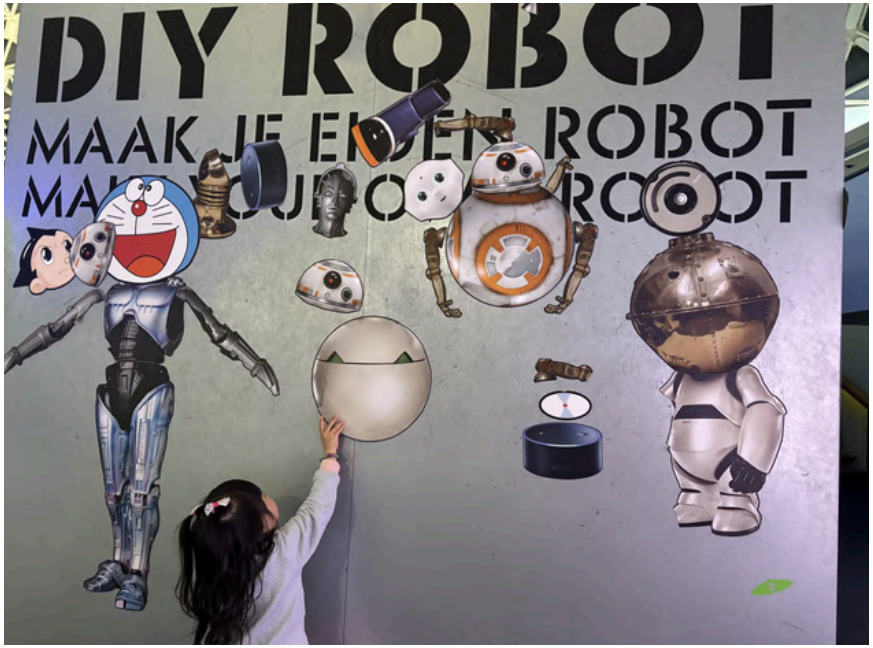


Figure 59. DIY Make your own robot by magnetic (The Next Nature) (Tangible Play)

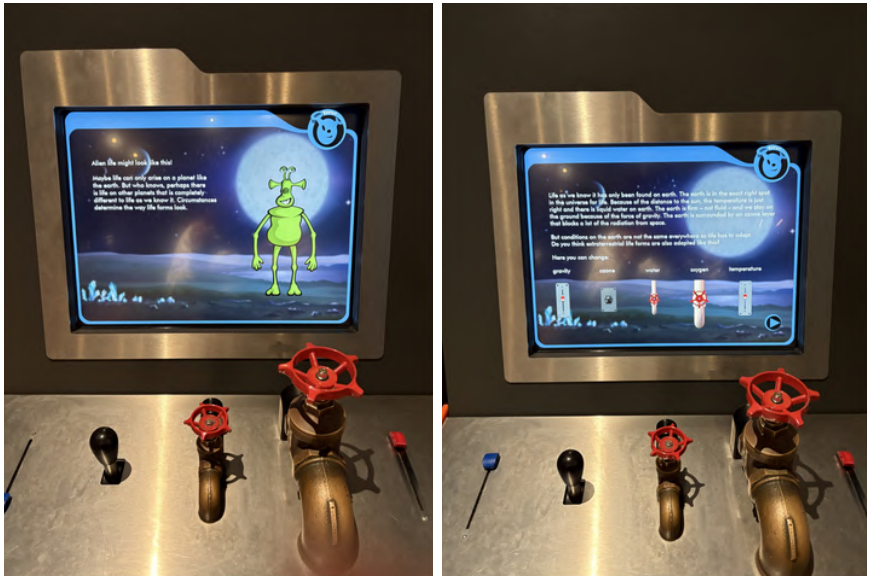


Figure 60. Alien Lab, see how alien will look like if you adjust each elements in the planet (Real-time Feedback)

Figure 61. Your techonology Privillege, answer questions based on your own reflection, the story changes based on your answer (Personal Relavance)

Figure 62. Voting wall (The Next Nature) (Collaborative Participation)

Chapter 3 : Define

This chapter describes how insights from research (Chapter 2) were translated into concrete design directions and concepts. Rather than settling on a single direction early on, the process involved exploring multiple interpretations of the design goal through iterative concept development, prototyping, and reflection.

3.1 Initial Design Direction

The design journey began with two recurring themes identified through expert interviews, contextmapping sessions, and brainstorming session with museum stakeholders: interconnectedness in nature and the loss of species. These themes were central to how children and educators understood biodiversity, seeing it as a web of life where one change can ripple through an entire system. These ideas became the foundation for the early design direction.

Figure 63 illustrates how the two core messages—interconnectedness and loss of species—helped shape the three key educational aims of the design:

- **The importance of biodiversity**, communicated through the message that all living things are connected.
- **The decline of biodiversity,** made tangible through the emotional impact of species loss.
- **What can I do about it?**, a guiding question aligned with previous Naturalis studies showing that visitors are often aware of environmental issues but uncertain about their role or ability to contribute.

These three guiding messages were used to define the content focus of the installation. To ensure the design would be effective in achieving its goals, it was also aligned with criteria from Transformative Experience Design (TED). This meant that the experience should be:

- **Relatable** to the everyday lives of families,
- **Curiosity-sparking** to initiate learning and exploration,
- **Reflective** to deepen personal understanding, and
- **Support individual action**, encouraging visitors to take small but meaningful steps for biodiversity.

Together, the focus messages and design characteristics informed the development of early concept directions.

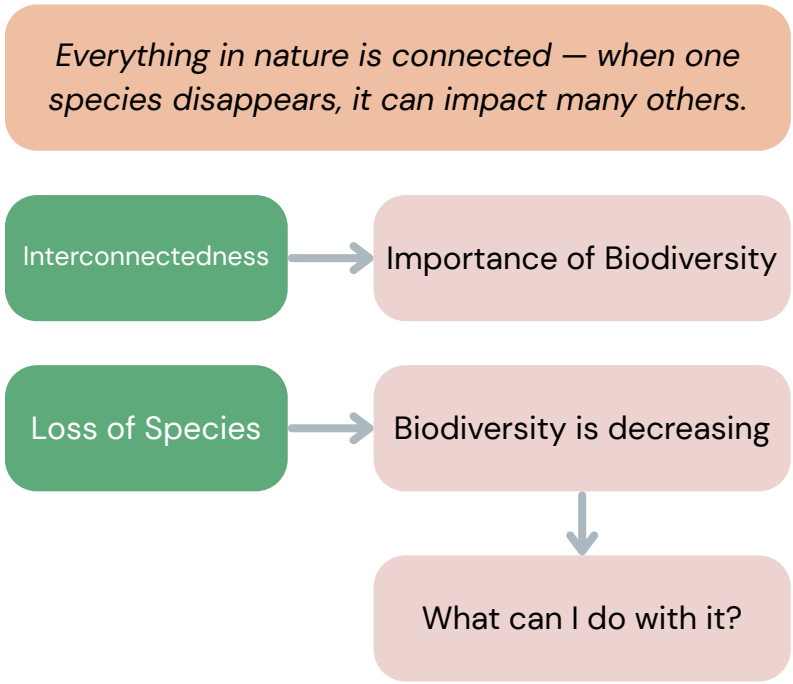


Figure 63. The initial key message

3.2 Iterative Design Process

3.2.1 Overview

The development process followed an iterative path shaped by continuous feedback, testing, and refinement. It began with four initial concept directions—Build Your Own Neighborhood, The Nature Hero, Help the Earth, and Apple Tree—informed by the design focus on biodiversity as an interconnected system. These ideas were presented during the midterm review to gather feedback from supervisors and Naturalis mentors.

From this feedback, two promising directions—Build Your Own Neighborhood and Apple Tree—were developed by combining and refining ideas from all four original concepts. These two were prototyped and tested with design peers, focusing on clarity of interaction and engagement.

Insights from testing led to Build Your Own Neighborhood Version 2, with a stronger narrative and more relatable interactions. This was evaluated by Naturalis education and design staff, who advised narrowing the focus.

This led to the Connected Choices concept, built around the key message: "Every choice affects nature because everything is connected." It formed the foundation for the final design direction and content, further refined through stakeholder feedback.

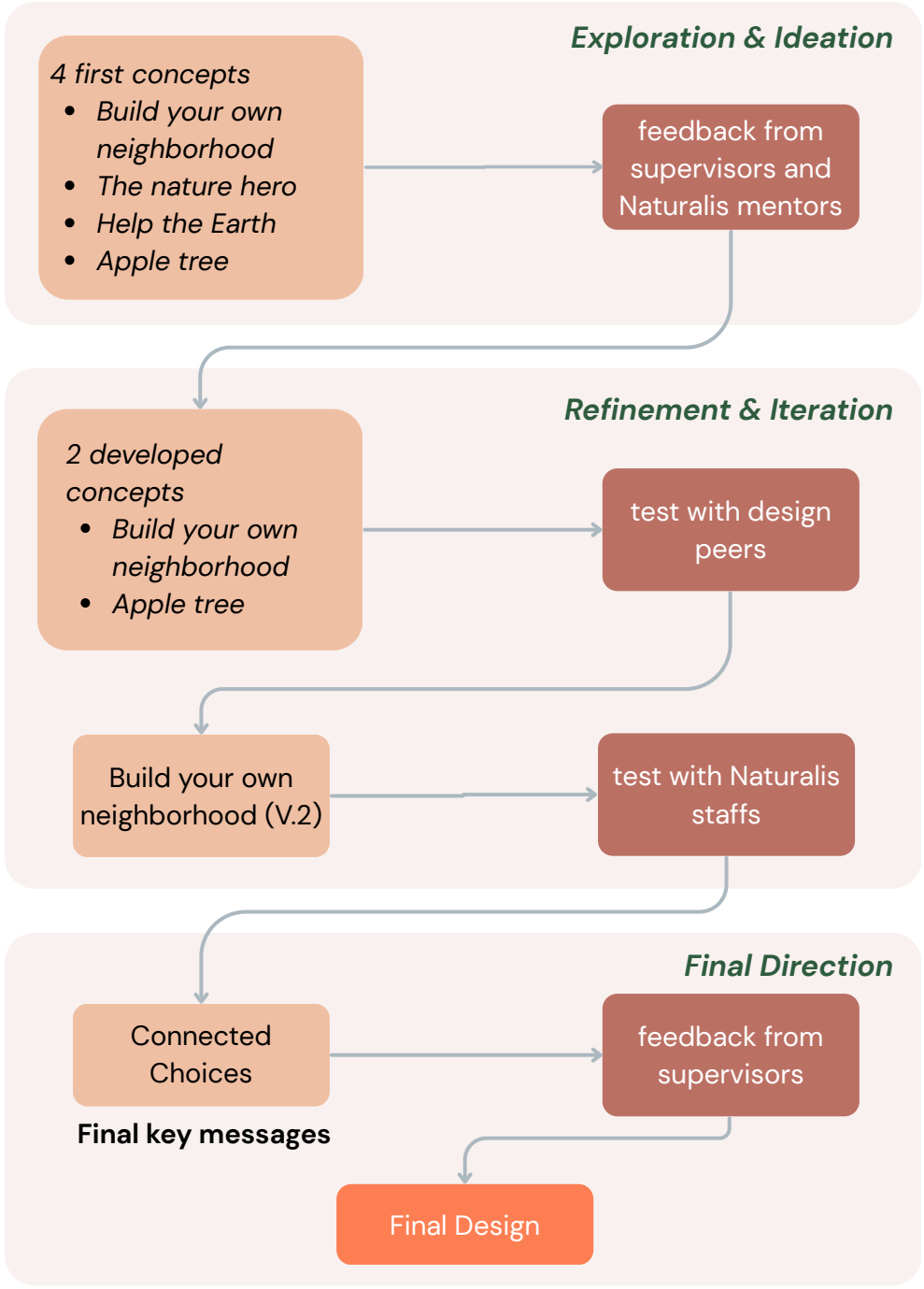


Figure 64. Diagram showing the process overview

3.2.2 Exploration & Ideation

The ideation phase began with four early concept directions that were created based on the initial design focus: illustrating the interconnectedness of nature and the consequences of species loss. These concepts aimed to make biodiversity tangible and relatable for children aged 9–12 and their families, while sparking curiosity and encouraging reflective thinking.

The four initial concepts (Figure 65) were :

- **Build Your Own Neighborhood** – A simulation where visitors construct a neighborhood by placing natural and urban elements, and observe how their choices affect animals and plants within the ecosystem.
- **The Nature Hero** – A mission-based experience that guided visitors through different biodiversity challenges, allowing them to connect the web of life, explore threats, and consider their individual role.
- **Help the Earth** – A narrative journey from a dystopian future back to the present, where participants take actions (e.g. reducing pollution, planting trees) to restore balance in the ecosystem.
- **Apple Tree Story** – A sequential activity that followed the journey of an apple growing from seed to fruit, showing the ecological relationships and human decisions affecting each stage.

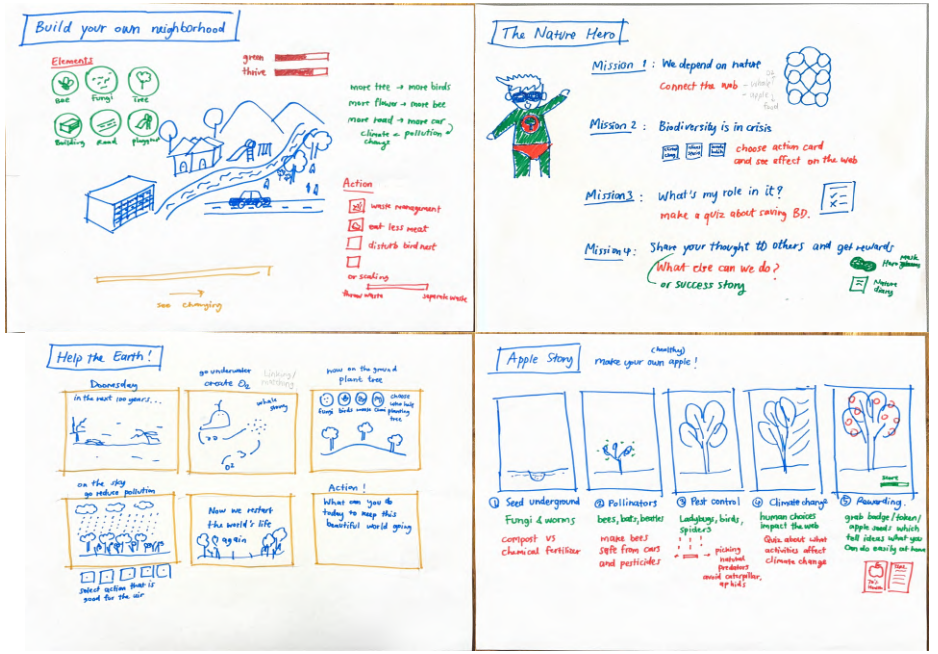


Figure 65. the first 4 concepts

These concepts were presented during the midterm review to supervisors and Naturalis mentors. Feedback highlighted the need to avoid framing humans as controllers or saviors of nature. Instead, the narrative should reflect our dependence on nature and the shared responsibility to maintain ecological balance. Concepts that positioned humans as separate from or dominant over nature were discouraged.

Based on this, Build Your Own Neighborhood and Apple Tree Story were chosen for further development, as they offered good potential to be refined in a more balanced and meaningful direction.

3.2.3 Refinement & Iteration

Following the midterm feedback, two concepts—Build Your Own Neighborhood and Apple Tree—were selected for further development. While both were initially derived from the four earlier directions, they were synthesized and refined to better align with Naturalis's feedback on tone and narrative framing.

Build Your Own Neighborhood

This concept evolved into a narrative-driven experience where families begin in a dystopian future, where nature has disappeared. Participants then travel back in time to uncover the causes—focusing particularly on human behaviors such as food waste, overconsumption, pollution, and transportation. Through a combination of reflection quizzes and exploration of nature's interconnected web, users are ultimately invited to build their own neighborhood. As they make choices, they receive immediate feedback on how their decisions affect local ecosystems, reinforcing how human behaviors influence biodiversity over time. (Figure 66)

Apple Tree

Apple Tree was developed as a two-player game in which one participant acted as a "disruptor," making harmful environmental choices, while the other took on the role of a "healer," trying to undo the damage. Each choice triggered a visible ripple effect in the apple tree's ecosystem, illustrating how even small behaviors could impact broader ecological systems. The game aimed to create emotional resonance through contrast, responsibility, and collaboration. (Figure 67)

Figure 66. Example of Low-fi prototype for Build your own neighborhood

Figure 67. Example page of Low-fi prototype for Apple Tree

** These prototypes were created using Canva, including illustrations from Canva's built-in features.*

Peer Testing and Feedback

Low-fidelity prototypes of both concepts were tested with design peers (Figure 68). Feedback emphasized the importance of clearly linking human behavior to its broader consequences for nature, cities, and biodiversity. Daily behaviors were seen as a strong entry point for encouraging family reflection and conversation. However, several areas for improvement were identified:

Build Your Own Neighborhood

- Children from different backgrounds—such as urban or rural environments—may connect with different scenes. It was suggested to reflect a broader range of relatable settings or keep the environment more neutral to ensure wider relevance.
- The connection between human behaviors (e.g., food waste) and their consequences for nature should be made more visible and straightforward, helping children understand how actions affect ecosystems.
- Reordering the experience to begin with the past, followed by the present, and ending with a personal creation phase was recommended to support clearer storytelling and reflection.
- Participants also suggested offering more flexibility by allowing visitors to choose which scenes to explore and placing reflection moments, and put quizzes, at the end of the experience.

Apple Tree

- While the game effectively communicated the idea of biodiversity as a connected system, the cause-and-effect sequences were considered too complex for some children aged 9–10 to fully grasp.
- Certain tasks, such as farming-related activities, were seen as too abstract or unfamiliar, potentially limiting engagement.

Overall, the feedback underscored the need to make the experience more intuitive, relatable, and flexible to better support understanding and reflection among diverse family audiences.

Figure 68. Concept testing with design peers

Concept Refinement and Feedback From Stakeholders

In response, Build Your Own Neighborhood was further developed into a second version (V2) (Figure 69), featuring a more cohesive storyline and a clearer focus on the connection environmental effects. This version was tested with Naturalis education and design staff. The feedback emphasized the need to narrow the narrative scope and focus on a single, strong message. This led to the next concept iteration, Connected Choices, based on the key message:

"Every choice affects nature because everything is connected."

This insight laid the foundation for the final design direction, which would be fully developed in the next phase.

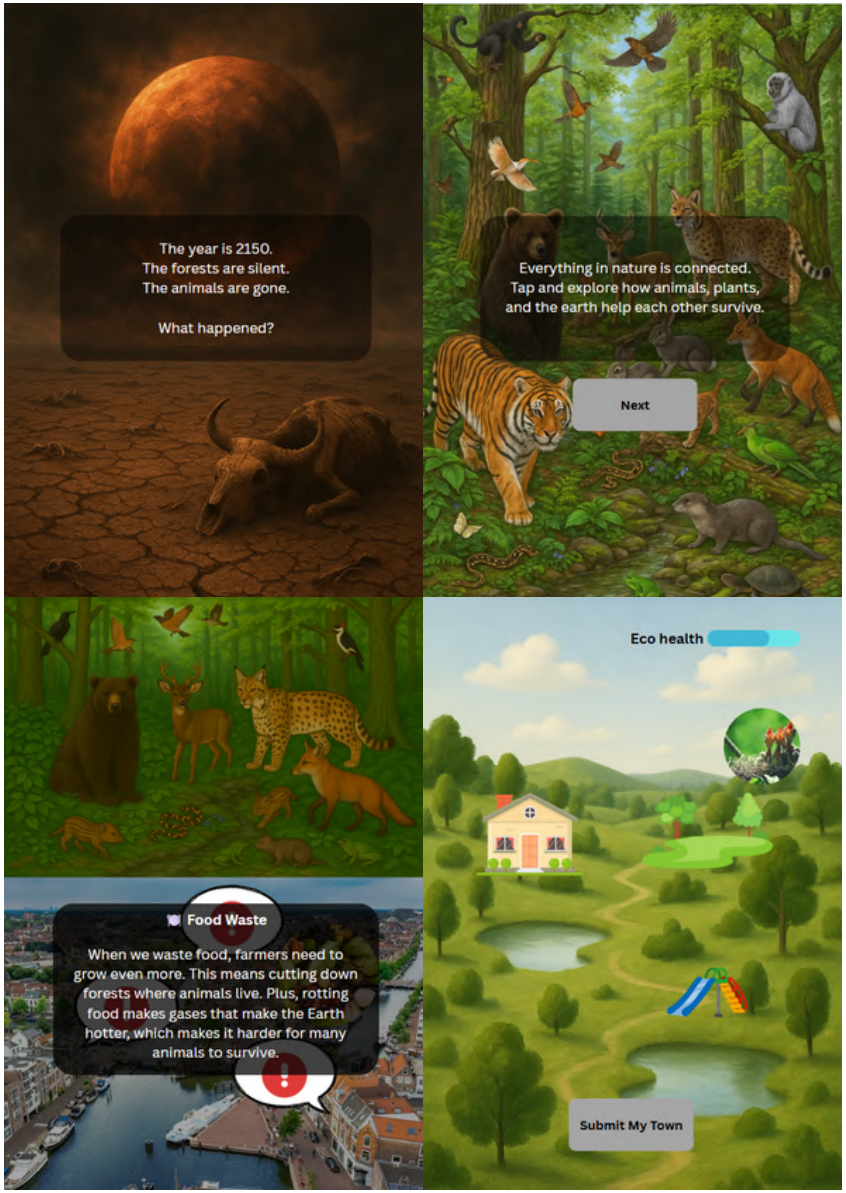


Figure 69. Screen prototype of Build Your Own Neigborhood V.2

** These prototypes were created using Canva, including illustrations from Canva's built-in features and AI-generated image.*

3.3 Final Design Direction

The final design direction was shaped by insights gathered throughout the iterative process and guided by feedback from both supervisors and Naturalis staff. At this stage, the design became more focused, aiming to help families, especially those with children aged 9 to 12, understand how their everyday actions impact nature.

The core design goal was to create an interactive experience that is relatable and engaging, while encouraging understanding and conservation actions. Rather than portraying humans as controlling nature, the design highlights how people are part of an interconnected system and depend on nature for well-being.

To support this goal, the design direction focused on the interconnectedness of nature and the consequences of human behavior. These themes were communicated through relatable examples and moments that prompt reflection and discussion.

The final design was guided by four key characteristics. It should be relatable, spark curiosity, encourage reflection, and motivate individual action. These qualities were captured in one clear message: *Every choice affects nature because everything is connected.*

Core Design Goal

To design an interactive installation to make biodiversity **relatable and engaging**, enhancing **understanding and conservation actions** among visitors, especially **families with children aged 9-12**, at *Naturalis's 'Leven' exhibition.*

Design Direction

To focus on illustrating the **interconnectedness of nature and the consequences of human behavior,** aiming to help families with children understand **why biodiversity matters and how their actions affect it**.

Design Characteristics

The design should be **relatable, spark curiosity, encourage reflection, and motivate individual action.**

Key Message

Every choices affects nature because everything is connected

Chapter 4 : Develop

This chapter presents the development of the final design, beginning with the initial concept and progressing through iterative refinements informed by expert feedback and testing. The section is structured into two main parts. The first part explains the initial version of the final concept, focusing on reflection-based interaction, followed by feedback and exploration of alternative interaction possibilities. The second part presents the refined final design, showing how it aligns with research insights and theoretical frameworks.

4.1 Design Concept

The final design is grounded in the idea that small, everyday behaviors can have a meaningful impact on local biodiversity. The experience invites families on a journey through familiar moments, using short, relatable scenarios to explore how daily routines—such as finishing meals, handling waste, or deciding whether to feed ducks—are connected to the natural world. Each scenario focuses on behaviors that children themselves can choose to do in their daily lives, encouraging personal reflection and a sense of responsibility. These seemingly simple actions become entry points for a deeper understanding of the relationship between humans and nature.

To make this connection more tangible, each behavior is linked to a visible consequence in a local environment. These effects are illustrated through changes that impact animals commonly found in Dutch neighborhoods, including hedgehogs, ducks, birds, and bees. By featuring familiar species and recognizable settings, the design makes ecological relationships more emotionally engaging and easier to grasp for children.

This concept aligns with Self-Determination Theory (Ryan & Deci, 2000), which highlights autonomy, competence, and relatedness as essential for intrinsic motivation. The selected behaviors are simple, concrete, and realistically achievable for children, helping them feel capable of making a difference.

Because these actions are within their control, the design also supports a sense of autonomy. Showing consequences through familiar urban animals helps strengthen children's emotional connection to nature, which supports personal engagement with the theme. Furthermore, by encouraging discussion in their behavior at home between parents and children, the design also fosters social connection and shared reflection—further supporting relatedness by SDT.

The design also incorporates Transformative Experience Design principles (Pugh, Linnenbrink-Garcia, & Perez, 2010), which encourage individuals to see everyday experiences in new and meaningful ways. By linking routine actions to broader ecological impacts, the design helps children view their behavior as more relevant and powerful, supporting lasting awareness and learning beyond the museum visit.

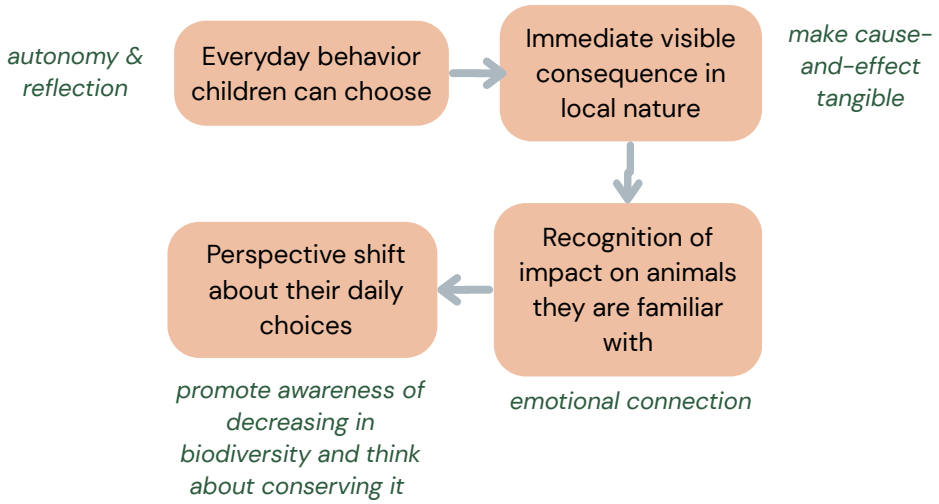


Figure 70. Design concept diagram

4.2 Initial Versions

Before arriving at the final design, several versions were explored to evaluate different possibilities for interaction flow, input mechanisms, and feedback presentation. Each version was developed to test specific ideas, guided by research insights, theoretical frameworks, and considerations of the museum context. The goal was to identify an approach that supports the project's core design characteristics: reflection, engagement, clarity, and emotional impact (see Section 3.3)

4.2.1 Early Prototype and Testing

An initial prototype was created based on a one-way flow structure. Visitors followed a fixed sequence of five questions about daily behavior, each triggering visual and audio feedback on a Dutch neighborhood model. The questions were phrased directly to the visitor (e.g., "Do you always finish your food?") to encourage personal reflection. Feedback was shown using paper cutout animations layered on a background, such as disappearing animals or dark sky, and reset after each question (Figure 71). At the end, a final result was calculated based on the answers and was presented.

This version was tested with a nature educator (also a parent of a 12-year-old) and reviewed by supervisors and Naturalis staff. Feedback highlighted strengths in clarity and emotional relatability, but also pointed out that the one-way flow limited exploration and autonomy, and the screen-based setup felt too similar to mobile apps. The physical cutout feedback was engaging but did not support cumulative consequences well. These insights prompted a broader exploration of interaction possibilities.

Figure 71. Low-fidelity prototype using paper cutouts to simulate feedback. Manually moved elements illustrated behavioral consequences, helping evaluate emotional engagement and storytelling before developing more advanced interaction methods.

4.2.2 Interaction Flow

Two types of interaction flow were explored:

- **One-way flow:** Visitors followed a fixed sequence of five questions, each prompting reflection before moving to the next. This version ensured all visitors encountered the full narrative but limited freedom and exploration.
- **Explorative flow:** Visitors could choose the order of their journey by moving a figure around a neighborhood model, selecting locations freely. Each location represented a behavioral decision point embedded in a narrative journey. This structure aimed to support autonomy and playful exploration, based on findings from the research that children prefer experiences they can control.

Both structures had benefits. The one-way flow supported message clarity and coherence, aligning with the museum's educational goals. However, the explorative flow better reflected user research insights. Children showed a preference for hands-on, exploratory activities like treasure hunts during the context mapping study. This interaction style allowed them to choose their own paths, supporting autonomy as defined in SDT (Ryan & Deci, 2000).

4.2.3 Input Mechanisms

Multiple input mechanisms were explored to balance clarity, engagement, and cognitive load:

- **Touchscreen (Yes/No choices):** Simple and accessible, this format allowed for clear user input and reduced potential confusion.
- **Joystick + physical buttons:** This setup enabled visitors to move a character around the model and answer questions using physical controls. Although it provided embodied interaction, informal testing showed it increased complexity and risked shifting focus away from reflection toward the mechanics. (Figure 72)
- **Interactive table with embodied interaction:** This concept allowed multi-user interaction through a large interface. While engaging, it made it harder to maintain a coherent narrative and concentrate on individual behavior-consequence links. (Figure 73)
- **Adjacent Model Interaction:** A mock-up model next to users allowed physical selection of locations. Although intuitive and tactile, combining this with a separate screen interface risked cognitive overload and lacked clear feedback integration.
- **Tangible Triggers (e.g., sliding bread, turning on a light):** These playful, scenario-based actions made choices feel concrete. However, they were difficult to apply uniformly across all topics and posed mechanical challenges.

In the end, combining with other elements, the touchscreen was chosen for its simplicity, ease of use, and ability to maintain narrative focus—especially important for younger visitors.

Figure 72. Joystick and physical buttons (picture generated by AI)

Figure 73. Interactive table with embodied interaction (Chariot Display, n.d.)

4.2.4 Feedback Mechanisms

Four main feedback presentation styles were considered:

- **Digital animation on screen:** This method clearly conveyed cause-and-effect through smooth, expressive visuals. It enabled storytelling in a structured flow and was easy to prototype. However, it lacked the distinctive material quality expected in museum exhibits and risked resembling digital learning experiences at home, which could reduce engagement and novelty for visitors.
- **Physical cutouts with animation:** This approach used layered characters and environmental elements on a static background, producing a playful, puppet-theatre-like effect. It offered a tactile and handcrafted quality, enhancing emotional engagement. Several variations were explored, such as combining cutouts with stop-motion animation (Figure 74) or projection mapping, to add dynamism. However, these options were not pursued further, as the full table model with projection (see Section 4.3) provided better spatial clarity and stronger cumulative visual feedback.
- **Pepper's Ghost effect:** Known for its magical, holographic-like projection, this technique was considered for its ability to surprise and delight. However, it required a fixed viewing position and did not support a full overview of the environment, making it less suitable for group interactions or for presenting a neighborhood-scale narrative. (Figure 75)
- **Projection mapping on a Dutch neighborhood model:** This method enabled animations to appear directly on a physical 3D model, offering a bird's-eye view of the space. It allowed cumulative, layered feedback to unfold across locations in context. Compared to other options, this approach offered the best spatial clarity, emotional engagement, and educational visibility. It was therefore chosen as the final feedback mechanism.

Figure 74. Stop-motion animation with layered cutouts (Captured from @trisha_zemp Youtube channel, 2023)

Figure 75. Interactive table with embodied interaction (Chariot Display, n.d.)

4.3 Final Design

4.3.1 Final Design Concept

The final design centers on an interactive, narrative-driven experience in which visitors guide a fictional family on a one-day outing through their neighborhood. At five different locations, visitors encounter short, everyday scenarios that are about the common topics – food waste, overconsumption, feed bread to wildlife, littering and light polluion – that prompt them to make behavioral decisions on behalf of the family. These decisions are not framed as moral judgments, but as simple, familiar choices, such as whether to leave snack wrappers behind or feed ducks with leftover bread.

This structure maintains the original concept's intent to connect daily behavior with visible impact on local biodiversity, but it now does so within a light narrative framework. The narrative introduces a subtle emotional arc, inviting users to reflect on how ordinary actions accumulate to shape the environment they live in.

Interaction is designed as a hybrid between one-way storytelling and free exploration. Visitors begin at a central point(the house) and can choose the order in which they visit each location. This reinforces a sense of autonomy and control—children are not told what to do, but rather empowered to decide how the story unfolds.

Feedback is delivered through projection mapping onto a white 3D model of a Dutch neighborhood, showing gradual changes in the environment based on each decision. These changes—such as the appearance or disappearance of birds, bees, ducks, or plants—accumulate to create a unique final scene. This cumulative result emphasizes the idea of interconnectedness and makes systemic change tangible and emotionally resonant.

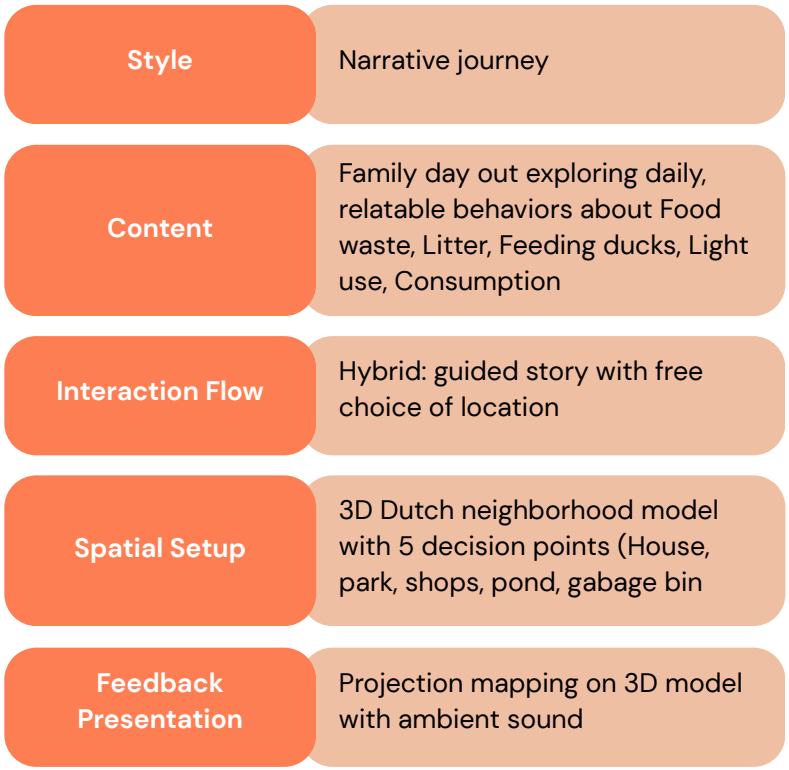


Figure 76. Diagram showing the key elements in final design concept

Figure 77. Visualization of the proposed final design, showing how visitors would interact with the neighborhood model and projection-mapped feedback. (Illustrative mockup created with AI and graphic editing tools.)

4.3.2 Design Meaning and Theoretical Foundations

This section builds on the theoretical principles outlined in Section 4.1 by showing how they are applied in the final design. It is structured around four guiding characteristics—**relatable, spark curiosity, encourage reflection, and motivate individual action**—to illustrate how the design supports emotional engagement and meaningful behavior change.

Relatable: Familiar Contexts and Everyday Behaviors
To make biodiversity personally meaningful to families, the experience is situated within a typical Dutch urban neighborhood. Each decision point centers on familiar, small-scale behaviors—such as feeding ducks, discarding snack wrappers, or buying clothes—making it easy for visitors, especially children, to connect their own experiences with those depicted in the installation. This approach increases accessibility and recognition, helping visitors feel that the message is about their real lives, not distant or abstract issues.

This design choice aligns with Self-Determination Theory (Ryan & Deci, 2000), particularly the dimension of competence, which emphasizes the importance of making people feel capable of taking effective action. Research from Naturalis further highlighted the need for concrete, localized examples to help children and families relate to biodiversity. The chosen behaviors are both ecologically relevant and within a child's sphere of influence, strengthening the sense that small personal actions matter.

This also reflects the Liminal Design principle (Liedgren, Desmet, & Gaggioli, 2023) of Optimized Abstraction—by translating complex ecological systems into symbolically rich, everyday scenarios, the design makes abstract biodiversity challenges more accessible and emotionally resonant for children and families

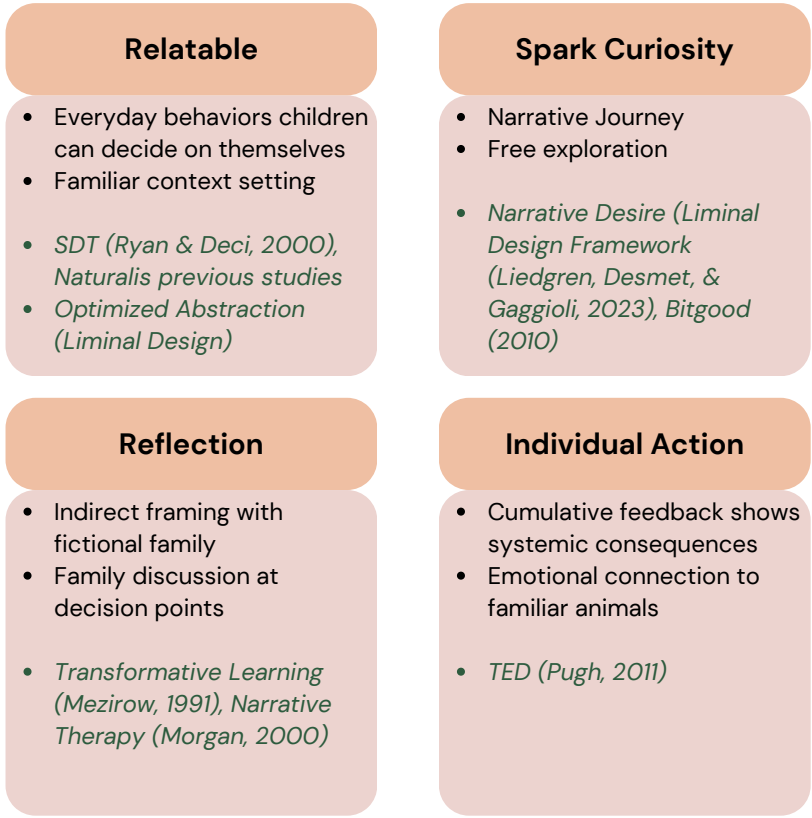


Figure 78. Diagram illustrates the meaning behind the design based on the design characteristics

Spark Curiosity: Narrative Structure and Explorative Flow
Rather than using direct reflection questions or didactic messages, the installation invites visitors to guide a fictional family on a neighborhood outing. This light narrative structure creates a sense of journey and suspense—what will happen next? Each scenario prompts curiosity-driven decision-making: "What happens if they feed the ducks? Or if they don't?" By posing open-ended choices without right or wrong answers, the design leverages what the Liminal Design Framework calls narrative desire—a motivation that arises from the tension between the known and the unknown (Liedgren, Desmet, & Gaggioli, 2023).

The interaction design combines the clarity of a one-way story with the autonomy of free exploration. Visitors choose which location to visit and in what order, allowing them to shape the journey. This supports the autonomy principle in Self-Determination Theory and echoes Bitgood's (2010) emphasis that visitors engage more deeply when they can self-direct their experience, move at their own pace, and match content to their interests. Such open-ended, visitor-led formats enhance attention and perceived value—key drivers of learning and satisfaction in museums (Bitgood, 2010).

Encourage Reflection: Indirect Framing and Family Discussions
Instead of asking visitors to directly evaluate their own behavior—which can feel confrontational—the installation uses indirect framing by letting them make decisions for a fictional family on a "day out." This psychological distance allows visitors, especially parents and children, to reflect openly on their real-life habits without fear of blame or judgment. Research shows that direct moral judgment can shut down family discussions (Gibson & Rumeh, 2012; Smetana, 2006). By externalizing decision-making to a fictional family, the installation reduces defensiveness and creates a safe, playful space for exploring values and consequences (Morgan, 2000; Dulwich Centre, n.d.).

Because families must agree on a single answer at each decision point, the interaction naturally sparks conversations. Parents and children often reflect on their own habits as they discuss how their choice might affect the virtual neighborhood. Even when a child leads, parents may challenge or add perspectives, creating space for shared learning. This supports the relatedness dimension of Self-Determination Theory (Ryan & Deci, 2000), fostering meaningful social interactions and reinforcing values within family relationships. The playful, narrative framing strengthens both environmental awareness and family connection.

Motivate Individual Action: Cumulative Feedback and Perspective Shift
At the end of the journey, visitors see how all their choices have combined to shape the neighborhood. This cumulative feedback—whether animals thriving or leaving, greenery flourishing or fading, or the pond becoming clean or polluted—makes the abstract idea of "environmental impact" concrete and visible.

By linking daily actions to system-wide ecological consequences, the design encourages visitors to consider how their real-world behaviors ripple out into the environment. For children especially, seeing the wellbeing of animals they care about—like ducks, bees, and hedgehogs—affected by their choices builds emotional engagement and empathy. This emotional connection supports the internalization of pro-environmental values, helping visitors reinterpret everyday behaviors through a new lens (Pugh, 2011).

Rather than offering didactic moral lessons, the installation promotes a subtle but powerful mindset shift: what was once seen as a small or harmless action (e.g., leaving lights on, feeding bread to ducks) now feels significant. This perspective shift lays the foundation for behavior change beyond the museum setting.

Summary
Each element of the final design has been intentionally crafted to connect theory with experience. Familiar scenarios build relevance; narrative choice sparks curiosity; indirect framing enables safe reflection; and systemic feedback fosters emotional and cognitive engagement. Together, these elements reflect a layered approach rooted in both Self-Determination Theory and Liminal Design, aiming to create a transformative museum interaction—one that not only teaches visitors about biodiversity, but also helps them care about it and imagine how their own actions, however small, might shape the world around them.

4.3.3 Design Detail

Proposed Design and Model Layout
The final installation centers around a miniature 3D neighborhood model that is visually engaging and approachable for visitors of all ages. This choice was intentional. While the Leven exhibition focuses on showcasing individual animals, the neighborhood model adds an environmental and spatial context that connects human behavior with biodiversity impacts. This helps create a meaningful bridge between the Leven exhibition and the new installation.

The recognizable Dutch neighborhood setting makes the scenarios relatable to visitors' everyday surroundings, reinforcing the educational message that small daily actions affect local wildlife. The small-scale layout also allows visitors to observe the entire scene and its changes in one glance, enhancing the impact of the projection mapping.

The open design encourages visitors to gather around the installation. Lighting and visual effects are visible to both active players and those standing nearby. This visibility draws attention, inviting others to pause, observe, and eventually participate. This approach helps create a social, curiosity-driven atmosphere within the museum space.

Narrative Style and Storytelling
The installation presents a light, conversational narrative following a family figure during a “day out” in a Dutch urban neighborhood. Visitors accompany the family as they explore different locations, such as their home, the park, the pond, the shop, and the bench near the tree. At each location, visitors help the family make small daily decisions that affect local animals and the surrounding environment.

The tone is non-judgmental, friendly, and accessible, designed to engage both children and adults. Rather than giving direct moral instructions, the narrative frames each situation as a familiar, relatable moment from daily life. This approach encourages visitors to reflect on their own habits and think critically about behavioral choices in a low-pressure way. Each decision point begins with a short narrative scene, followed by a simple, open-ended question and two possible choices. To avoid overly binary or judgmental framing, each choice is written with realistic motivations, showing why someone might choose it. This encourages critical thinking about trade-offs, rather than simply selecting what seems like the "correct" answer. See figure 79.

For example, during the pond scene, visitors are asked:

Scenario:
“You’re walking through the park and see ducks by the pond. Luckily, you brought some bread from home.”

Question:
“Should you share some bread with the ducks?”
Choices:

- “Feed the ducks—they look hungry and happy to see you.”
- “Keep the bread—you might get hungry later yourselves.”

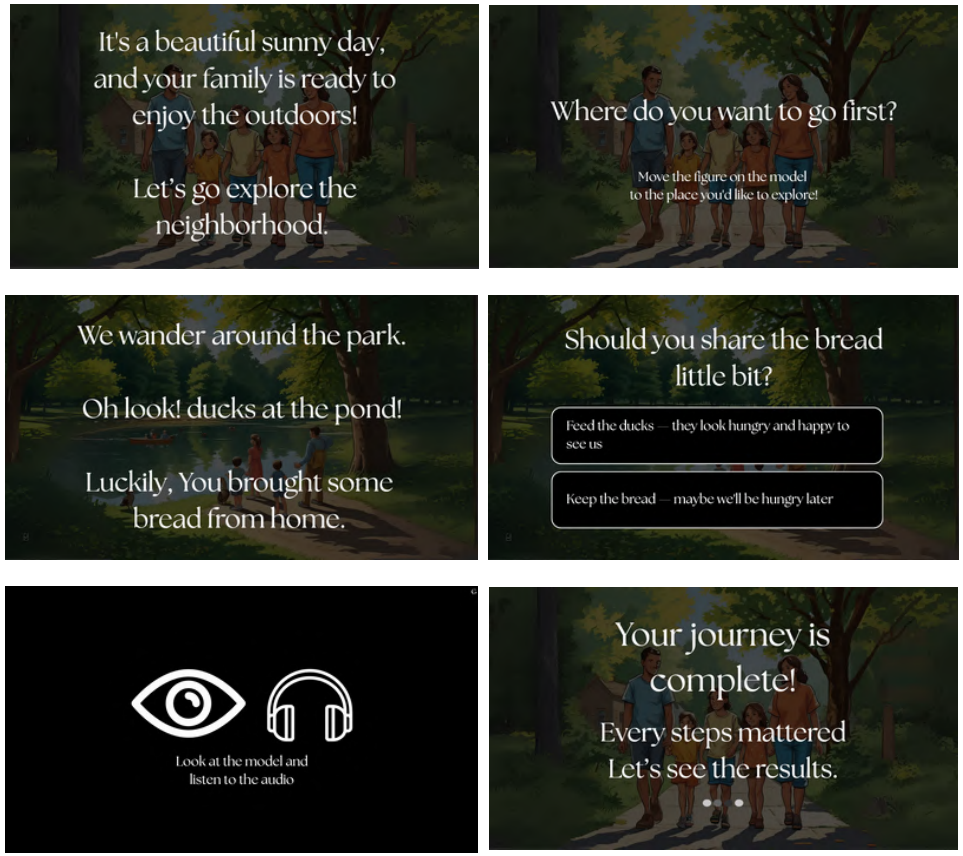


Figure 79. Some example of screens from the prototype

Similarly, when the family returns home at the end of the day:

Scenario:
"It's getting dark. Time to go home and rest after a fun day."
Question:
"What should you do with the lights before going to bed?"
Choices:

- "Turn off the lights—save energy and see the stars!"
- "Leave the lights on—it's cozy and feels safe."

This choice-based narrative structure fosters autonomy, emotional connection, and critical thinking—key learning goals for the installation.

Cumulative Feedback: Visualizing Impact Over Time
A key feature of the installation's learning strategy is the use of cumulative feedback, where the environmental effects of each visitor choice build up and become gradually visible across the entire neighborhood model. This design choice reinforces the overarching theme that "every choice matters", making the concept of cause and effect both tangible and emotionally engaging.

Rather than providing isolated, location-specific responses, the system allows environmental consequences to accumulate across all five locations. This creates a unique final scene at the end of the experience—one that reflects the total pattern of decisions made by each visitor group.

For example, if visitors consistently select environmentally harmful options across different locations, the model will display escalating negative changes (Figure 80):

Figure 80. The start scene at the beginning of the experience

- After choosing to buy new toys at the shop, air pollution might appear in the sky, less bees, the water becomes green, and the duck struggles. (Figure 81)

Figure 81. Example of localized feedback after choosing to buy new toys at the shop, introducing air pollution in the sky.

- Following that, feeding bread to ducks at the pond could cause algae growth and duck sickness. (Figure 82)

Figure 82. Accumulated feedback after feeding bread to the ducks at the pond, showing algae growth and duck sickness following the earlier shop decision.

- Later, Littering at the park could cause rats or plastic pollution to appear. (Figure 83)

Figure 83. Further cumulative impact after littering at the park, leading to increased rats or visible plastic pollution.

Conversely, positive or mixed decisions will result in healthier, more vibrant environmental feedback—such as blooming trees, clean water, and active wildlife.

The gradual unfolding of these visual changes invites visitors to compare the before-and-after state of the neighborhood, prompting reflection on how small daily actions can accumulate into larger environmental consequences over time. (Figure 84)

This cumulative design approach aligns with Transformative Learning Theory, encouraging visitors to recognize patterns, reflect on their choices, and leave with a new perspective on their real-life behavior.

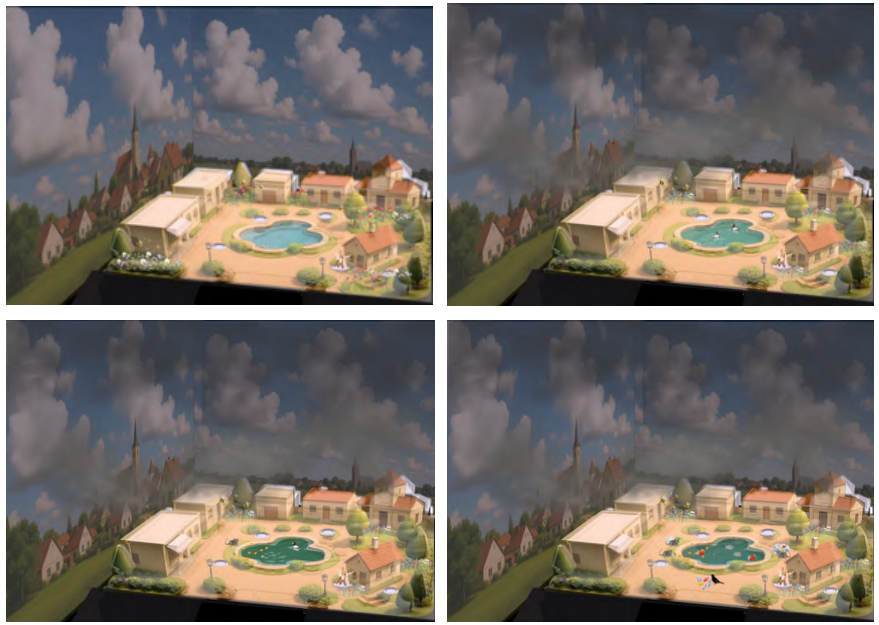


Figure 84. Side-by-side overview showing the neighborhood's environmental changes progressively building up after multiple environmentally harmful decisions.

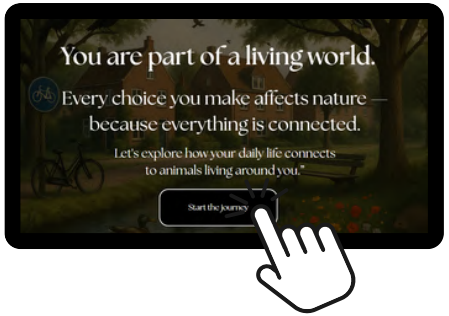
4.3.3 Storyboard

Visitors begin by seeing a model of a Dutch urban neighborhood with five glowing hotspots. As they guide the family figure to a spot, a short story plays out, prompting them to make a choice. After each decision, the environment visually changes to show the effects. This continues until all five spots are visited. At the end, users see the final state of their neighborhood, shaped by their collective decisions.

The installation is located at the end of the 'Leven' exhibition. After seeing animals and nature inside the exhibition, families arrive at the interactive installation.

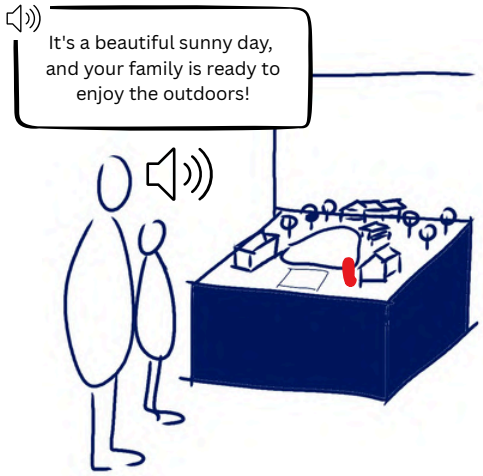
Visitors spot the installation and walk over.

They walk close to the installation and noticed the screen in front of the model.

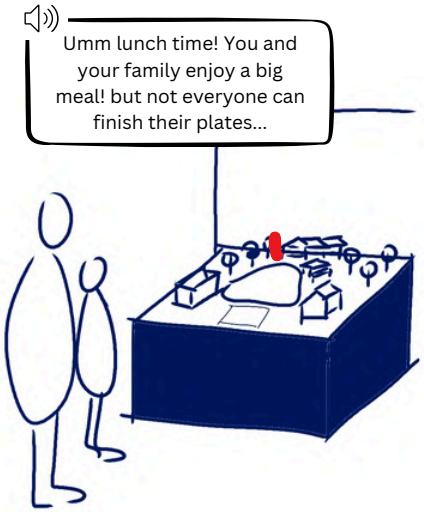


They tap 'Start the Journey'. The screen welcomes them and invites them to join a family's day out.

They move the figure to a chosen spot. The model lights up to guide them. They place the figure to continue.



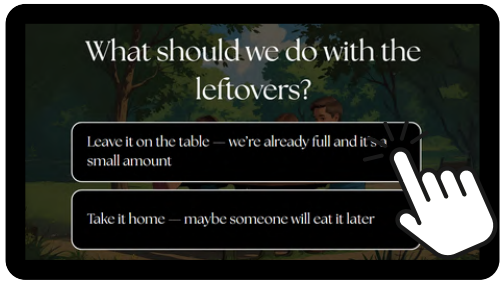
They start to hear the narrator introducing a story.



Then a short story plays. The narrator explains a simple situation, like lunchtime at the park.

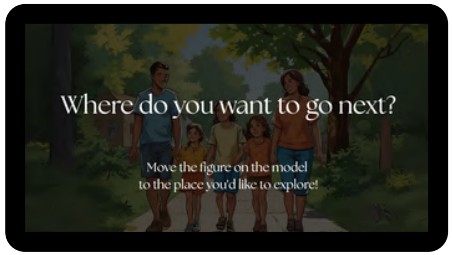
* The system registers the figure's placement and temporarily locks further movement until the scenario and feedback are completed to prevent interruptions or confusion.

They are asked: 'Where do you want to go first?' The screen shows the question, and lights appear on the model showing available locations.

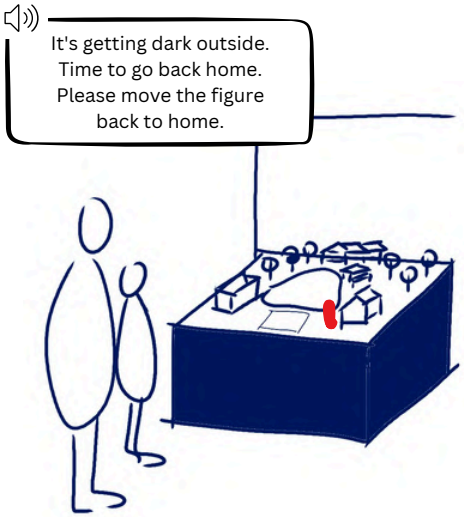


A question pops up. The screen asks what the family should do (e.g., throw away leftovers or take them home).

The model shows a result. A short animation by projection mapping appears on the model, showing the effect of their choice on the neighborhood.



They choose the next place. The process repeats. Visited places go dark, and they continue the journey.



At the end, they are asked to bring the figure home(the start spot) and answer one final question about light habit at night.

After the final question, they see a replay of how their choices impacted the neighborhood. The model shows each environmental change in sequence, narrated with short explanations of the effects. The experience ends with a summary scene, reflecting on the overall outcome and encouraging visitors to make positive choices in real life.

The ending screen appears. A message wraps up the story. They scan a QR code links to personalized tips and more info about nature-friendly habits.

4.3.3 Technical Setup and Spatial Design

To bring the interaction and feedback system to life, the installation's technical setup was carefully designed around the physical accessibility, projection visibility, and spacial constraints.

Model Dimensions and Reachability

The model measures 120 cm in width and 80 cm in depth, forming a panoramic layout of a Dutch urban neighborhood. The limited 80 cm depth ensures that all five interactive zones—home, park, pond, shop, and bench—remain comfortably within reach for children aged 9 to 12, even those standing at the front edge. The height of the platform is approximately 75 cm, making it suitable for children to see and interact without crouching or stepping up. (See figure 85) The overall size and shallow depth were intentionally chosen to ensure that players can view the entire projection mapping effect within a single eye-level field of vision.

To accommodate projection mapping, the model is positioned with one side close to the wall where the projection will appear. The opposite side remains open, allowing more visitors to gather around and observe while others interact. This open layout encourages spontaneous attention from nearby visitors, drawing them toward the installation.

Projection Mapping System

Two short-throw projectors are mounted at the upper center of the model, angled downward to fully cover the model surface (Figure 86). These projectors animate visual feedback such as animals appearing or disappearing, trash accumulating, or greenery blooming based on user choices. The short throw minimizes shadow interference, ensuring visuals remain clear even with close-up interaction. (Figure 87)

Material: PVC Foam Board

The model is constructed from white matte-finish PVC foam board—a lightweight, smooth, and durable material well-suited for projection mapping. Its non-reflective surface optimizes light diffusion, while also being resistant to dents and wear. To ensure long-term durability, especially in areas where visitors may frequently touch the model, additional internal reinforcement may be added.

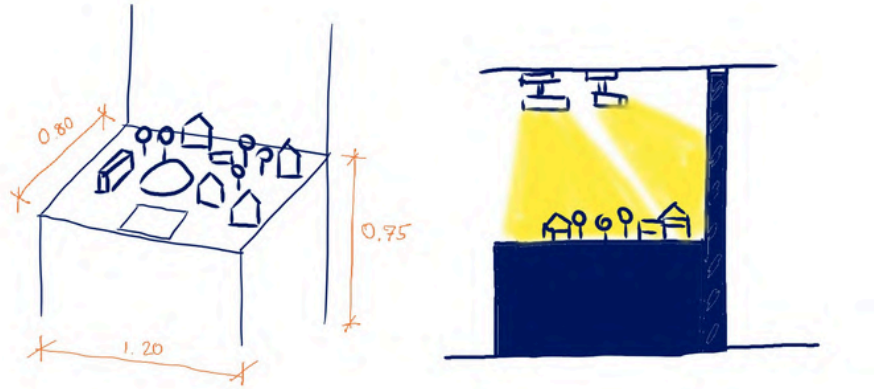


Figure 85. (Left) the drawing shows specification of the installation, Figure 86. (Right) section showing two projections project on the model and on the wall.

Tangible Animal and Environment Integration
Key animals such as ducks, hedgehogs, and mice are crafted from white PVC foam and positioned in relevant zones on the model. These static figures serve as neutral surfaces for projection-mapped animations showing environmental changes, such as animals appearing sick, active, or confused, based on visitor choices. Environmental elements like trees and vegetation are also modeled in white to accommodate varied visual feedback, such as turning green, yellow, or dry depending on cumulative impact. Subtle under-platform mechanical movement may be added to select figures, introducing gentle motion that enhances realism without disrupting projection alignment, increasing emotional and visual engagement.

Localized Audio Delivery
To prevent sound from spreading across the entire gallery, the installation will use focused, directional speakers. This technology ensures that audio feedback, such as narration and environmental sounds, remains concentrated around the model, making it audible for players without disturbing other museum visitors.

Lighting Conditions
The installation will be placed within the "Leven" exhibition, which already features a generally darkened environment. This ambient low-light condition helps maximize the contrast and visibility of the projection-mapped visuals on the model.

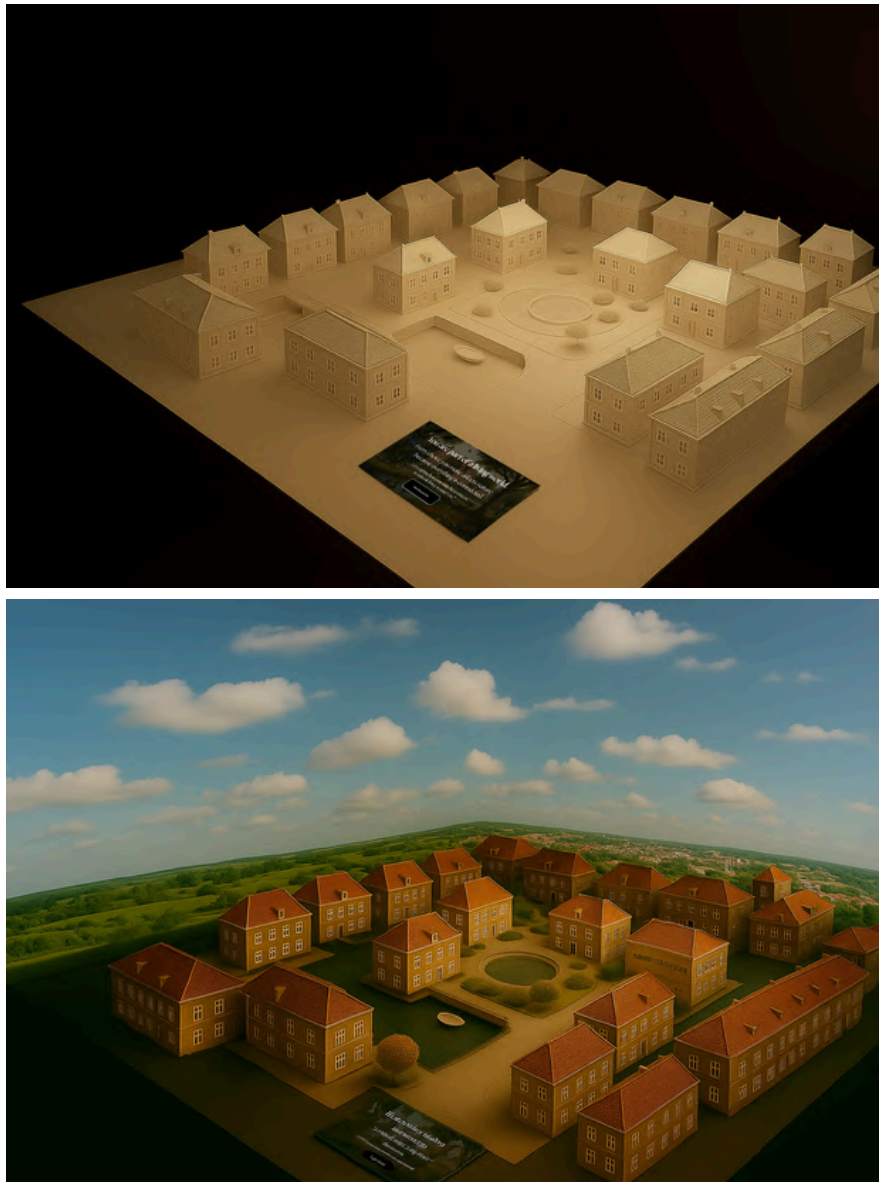


Figure 87. Pictures showing the model with and without the projection mapping. (Top: without projection, Bottom: with projection)
Pictures generated by AI and edited in graphic editing tools.

Chapter 5 : Deliver

This chapter presents the final testable prototype and describes the user testing process conducted at Naturalis. It explains the setup, participant group, and research methods used. The chapter then summarizes key findings from the test, offering insights into how the prototype performed in relation to the learning goals and interaction design.

5.1 Prototype Testing

5.1.1 Purpose of the test

The purpose of this user test was to evaluate the interaction and educational impact of the final design concept. The installation aimed to help children aged 9–12 and their families understand how everyday choices affect local biodiversity. Specifically, the test assessed whether the experience supported key design goals such as relatability, emotional engagement, reflection, and motivation for individual action. The evaluation also explored the clarity of the interaction flow and the extent to which the installation sparked curiosity and family discussion.

To do so, the test focused on the following aspects:
Comprehension: Do users understand how the interaction with the installation works?
Engagement & Meaning: Does the interaction (figure movement, storytelling, feedback) feel fun, engaging, and not overly complex?
Reflection & Discussion: Do users talk about their choices and think about their behavior?
Feedback Clarity: Is the cause-effect feedback from each answer clear?
Design Goal: Does the whole experience help them realize how everyday choices affect nature?

5.1.2 Prototype Detail

A medium-fidelity prototype was developed to simulate the core interactions of the envisioned installation. Due to time and technical limitations, the physical and digital elements were simplified. The prototype (See figure 90) consisted of the following elements:

1. **A printed layout** of a neighborhood model with five interactive "decision spots" (the pond, bench, shop, picnic table, and house) (See figure 88)
2. **A non-touchscreen display** showing questions and visual/audio feedback, controlled through a Wizard of Oz setup (where the facilitator manually mirrored and triggered content)
3. **Custom-made animations** representing the consequence of each choice
4. **A large screen** for displaying the animations
5. **A character figure** symbolizing the visiting family navigating the neighborhood
6. **A speaker** amplifying the audio feedback, ensuring participants could clearly hear the consequences of each choice.

The initial prototype was developed in English and later translated into Dutch by AI for testing. All screen visuals flow and custom animations were created using Canva, with AI-generated voiceovers also produced via Canva's text-to-speech tool. The family figure was crafted from foam board with printed character illustrations. (Figure 89)

For the prototype, the based model scene for feedback animations were created using a combination of hand-drawn sketches, AI-generated visuals, Photoshop editing, and illustrations from Canva. (See figure 80, section 4.3.3, P.85) This visual style intentionally differed from the final proposed design to keep production manageable and visually clear for participants. The goal was to ensure that environmental changes were easy to notice during testing, while avoiding unnecessary complexity given time and resource constraints. Although simplified, the prototype effectively demonstrated the intended interaction flow and feedback concept.

Participants were informed that the final design would use a miniature 3D diorama model enhanced by projection mapping and directional audio to create a magical, immersive experience.

Figure 88. Elements in the prototype. (Top) A Printed layout.
Figure 89. (Bottom) A character figure made from foam board

Figure 90. Prototype set up in the Werkplaats Ontwerp room

5.1.3 Methodology

Participants

Seven families participated in the user test, each including at least one child aged 9–12, which was the intended target group. One additional participant, an 18-year-old, joined unexpectedly during a session alongside another family. Although not part of the original recruitment criteria, she chose to participate and was included in the observation and interview. Two families had previously taken part in the contextmapping session, while the remaining were recruited on-site at the Naturalis museum. Family compositions varied, including parents, grandparents, and multiple children.

Test Procedure

Each session took place at the Werkplaats Ontwerp (Figure 91), a workshop space on the fifth floor of the Naturalis museum. Sessions lasted approximately 15–30 minutes and began with a brief introduction and informed consent process. The facilitator first explained what the final version of the installation would look like by presenting a generated visual of the design (Figure 92), along with a video example of the projection mapping effect.

Participants were then invited to explore the prototype independently. Throughout the session, observations were made regarding gestures, verbal interactions, and general engagement during play. System feedback and choice responses were simulated by the facilitator using a Wizard of Oz method. At the end of the experience, participants were shown the cumulative feedback visual.

Figure 91. Werkplaats Ontwerp (Workshop Design Room), where a session took place. The bottom picture is a board to recruit museum visitors for a test.

Following the interaction, a short open-ended interview was conducted with both children and parents to capture their reflections on the experience. All interviews were audio-recorded and transcribed by TurboScribe. Most interviews were conducted in Dutch. During the sessions, real-time translation support was provided by the facilitator's partner. Afterwards, the full transcripts were translated from Dutch to English using ChatGPT.

Interview Questions

- What do you think this game or story wanted to tell you?
  → *Understand the key message takeaway; alignment with the biodiversity theme.*
- Did it make you think about anything you do at home or in real life?
  → *Test for relatability and behavioral reflection.*
- What did you learn that you didn't expect or didn't know before?
  → *Capture moments of surprising insight or new knowledge.*
- Was there any part of the game that made you curious? What was it, and why?
  → *Assess if curiosity or desire to explore was stimulated.*
- What part did you enjoy the most? Why?
  → *Measure engagement and memorable moments.*
- Was there anything confusing or hard to understand?
  → *Identify issues with interaction, flow, or clarity.*
- Is there something small you think you could do after this game, to help animals or nature?
  → *Understand motivation for conservation action.*

Figure 92. Visual shown to participants during testing to illustrate the intended look and feel of the final installation.

Figure 93. Naturalis staffs playing with the prototype.

5.2 Testing Result

The following section summarizes the findings from the user test at Naturalis. The results are presented according to the five aspects defined in the test setup: comprehension, engagement and meaning, reflection and discussion, feedback clarity, and design goal alignment. Additionally, a sixth theme emerged during analysis: perception of moral framing and correctness.

1. Comprehension
All participants quickly understood the core interaction: selecting locations and making decisions using the figure on the board. Children showed little hesitation and began navigating the experience almost immediately. One family noted that both audio and visual prompts helped guide the experience, particularly because their child had dyslexia.

> *Het was allemaal duidelijk. Ik wist gelijk wat ik moest doen.*
>
> - 11 years old child -

Translation: *Everything was clear. I immediately knew what to do.*

No major usability issues were observed. However, none of the families initially noticed the QR code for more information. Once it was pointed out, they responded positively, expressing that it was a useful way to deepen the learning outside the main game.

2. Engagement and Meaning
Most children showed strong engagement with the installation. Several families actively discussed where to navigate next, especially when more than two people were involved. In one group, the children debated their options before making a decision, showing engagement with the decision-making flow.

One child laughed during a scene where a mouse appeared unexpectedly, and in another family, the parent physically acted out the opening animation ("De zon schijnt en jullie zijn klaar voor een dagje uit") with a cheerful walk, showing immediate enthusiasm.

> *Whoo, a day out! Let's go on an adventure!"*
> *(while grabbing his son's hand and doing a cheerful walk)*
>
> - parent of a 10 years old child -

Some adults who seemed disengaged at first (such as a grandparent in one group) became increasingly interested during play and later commented positively on the experience.

> *Ik vond het eigenlijk heel leuk. Dit zou echt goed zijn voor op school.*
>
> - grandmother in a family -

Translation: *I actually really liked it. This would be great to use in schools.*

One family observed that the game felt too easy because the child already behaved in environmentally responsible ways. This led to a spontaneous suggestion during the interview:

> *Maybe you start when the world is awful, and then you make good choices to make it beautiful.*
>
> – parent of a 11 years old child –

Additionally, many participants, both children and adults, encountered new knowledge that surprised them. Seven out of eight families stated they did not previously know that feeding bread to ducks is harmful.

> *I knew it wasn't good for the duck itself, that it could get sick. But I didn't know it was bad for the environment.*
>
> – 12 years old child –

The topic of light pollution was also new for most children. While they were aware that turning off lights saves energy, they did not know about its impact on nocturnal animals. These discoveries often led to spontaneous comments of surprise or realization, even from adults.

> *Well, with turning the lights off, I didn't know it affects the animals outside. I thought it was just about electricity costs, but I didn't know it had that kind of impact.*
>
> – parent of a 11 years old child –

Figure 94. Participants moving the figure character to choose the spot

Figure 95. Participants listening and watching to the feedback from their choices

One participant specifically mentioned enjoying the freedom to choose the next location themselves, reinforcing the importance of autonomy and playful exploration in the design.

> *The part I enjoyed the most is the free choice of where you going*
>
> -A family of 10 years old child -

Some feedback was also given about the use of AI-generated voice for narration. A few participants noticed that the voice lacked emotion or natural rhythm, which may have affected the immersion.

While the narration helped guide comprehension, especially for children with dyslexia, the delivery was perceived by some as mechanical and could be improved in future iterations for a more engaging experience.

3. Reflection and Discussion

Participants frequently reflected on their own behavior while playing. In some families, parents pointed out habits during relevant scenes. For example, one parent pointed to the light choice and mentioned their child sleeps with the light on and an eye mask.

> *She always sleeps with the light on, and then with a sleep mask.*
>
> - parent of a 12 years old child -

Some adults also reflected on their own behavior. For example, one participant said:

> *I think I heard somewhere that bread is bad for ducks, but I still do it*
>
> - A family member of 10 years old child -

Several families reflected further when they learned about the consequences of light pollution, with one adult remarking:

> *Now I'm wondering what street lighting does, too.*
>
> - parent of a 10 years old child -

In families with more than two participants, there was often active discussion during play about where to go next and which choice to make. These discussions were sometimes led by children, and sometimes involved the entire family negotiating or reflecting on what they usually do at home. In contrast, families with only one child present typically let the child decide independently, resulting in less verbal exchange.

A consistent pattern across all families was that participants tended to choose the option that aligned with their real-life behavior, rather than making hypothetical or aspirational choices. As one parent commented:

> *We choose what we actually do in real life.*
>
> – A family of 10 years old child –

This tendency was especially clear when families discussed their routines around topics like leaving lights on at night or feeding ducks at the park.

4. Feedback Clarity

Participants generally understood how their choices influenced the scenes. The cause-and-effect structure of the prototype was clear, and both the visual and audio feedback during each step were well received. No major confusion was reported during any of the sessions. At the end of the experience, the cumulative result of their choices was explained verbally by the facilitator. Participants understood this summary immediately and commented that it would be even nicer to see this visually in the final projection mapping version. Several families expressed enthusiasm about the future projection-mapped version

> *Dat wordt leuk om echt te zien straks, op het bord.*
>
> – parent of 12 years old child –

Translation: *That will be fun to really see later, on the board.*

Note*: The participant was referring to the physical surface used in the test setup, which will later be replaced by a 3D model with projection mapping in the final version.*

Figure 96. Participants reading and deciding for the answer to the question

Figure 97. Participant scans the QR code to read more information

5. Design Goal: Understanding Nature & Everyday Impact
Participants generally understood that the game aimed to raise awareness of how small, everyday decisions affect the environment and biodiversity (See quotes in p.103). Children frequently related the choices in the game to their own daily behavior, and several said they would try to change those habits.

> *Ik ga mijn oma vertellen dat ze geen brood meer moet geven aan eenden.*
>
> - A 10 years old child -

Translation: *I'm going to tell my grandma to stop giving bread to ducks.*

Other families also mentioned small actions they could start doing after the game, such as using less plastic, recycling, or bringing bottles back to the store.

One parent commented specifically on the design choice of the trash can scenario, recognizing its role in encouraging small behavior changes:

> *I think it's a good idea to make this trash can, because it's really meant to make you think about the small things you can start doing now.*
>
> - parent of a 11 years old child -

In general, the test showed that the prototype offered a fresh perspective for families, helping them realize that nature not only deserves appreciation but also needs care and support.

> *This is really a new dimension for the museum... They always show the beautiful side of nature, but this shows that nature also needs help.*
>
> - parent of a 10 years old child -

6. Moral Framing and Perceived Correctness
Although not an original test criterion, a recurring theme emerged: many children interpreted the game as containing "right" and "wrong" answers, and this sometimes affected their experience. In one session, a child hesitated before feeding ducks, and another participant stopped him with:

> *Nee, dat mag niet!*
>
> - One of the participants -

Translation: *No, you can't do that!*

Another child visibly celebrated making what he believed was the "correct" choice by shouting "Yes!" with arms raised after selecting the environmentally friendly option.

These moments suggest that the game was often experienced as a test with correct answers, rather than an open-ended exploration of possible consequences.

Some of participants'answers of the question "What do you think this game or story wanted to tell you?"

Wat je moet doen in de natuur. Om de natuur netjes te houden.

– 10 years old child –

Translation: *What you should do in nature. To keep nature clean.*

Ik denk dat de keuzes die je maakt, dat dat een invloed heeft op... op je omgeving.
Dat als je het beter doet voor de natuur, dat er ook meer dieren in de buurt komen.

–A family of 12 years old child –

Translation: *"I think that the choices you make have an effect on... your environment. That if you do better for nature, there will also be more animals around.*

Hoe je de natuur beter kan maken. Wat er gebeurt als je je afval op straat laat liggen of het licht aan laat staan.

– 10 years old child –

Translation: *How you can make nature better. What happens if you leave your trash on the street or leave the lights on.*

Quotes about behavior reflection and other thought

Soms laat je toch een lampje branden, toch?

– parent of a 10 years old child –

Translation: *Sometimes you do leave a light on, right?*

Soms ga ik naar een speeltuin en dan neem ik een snoepje mee, maar uiteindelijk gooi ik het wel weg in de brug.

– parent of a 11 years old child –

Translation: *Sometimes I go to a playground and bring candy, but eventually I do throw the wrapper away in the bin.*

Not always, but he tries his best to finish his plate.

– parent of a 10 years old child –

Als ik afval op straat zie, dan pak ik het op en gooi het in de prullenbak.

– 12 years old child –

Translation: *If I see trash on the street, I'll pick it up and throw it in the bin.*

Chapter 6 : Evaluation and Conclusion

Following the testing and evaluation activities presented in Chapter 5, this chapter presents a broader discussion of the findings, design recommendations for future development, and the final conclusion of the project.

6.1 Discussion

6.1.1 Key Findings Analysis

This user test provided valuable insights into how the prototype conveyed the intended learning goals and how participants engaged with the interaction flow. Although the prototype was a simplified version of the final installation, the findings offer important guidance for final implementation and future improvements.

Alignment with Learning Goals

The results indicate that the prototype effectively communicated its core message: small daily behaviors have a direct impact on biodiversity. Children frequently related in-game scenarios to their real-life actions, mentioning behaviors such as leaving lights on, giving bread to ducks, or littering at playgrounds. Several families spontaneously mentioned small actions they might take after the experience, such as picking up trash, using less plastic, or bringing deposit bottles back to the store. This suggests that the design successfully fostered personal reflection and motivation toward conservation behavior.

Both families with higher environmental awareness and those with less visible engagement with biodiversity topics showed learning effects, though the depth and novelty of learning varied across participants. For example, the family with the least prior connection to Naturalis or biodiversity topics reported learning the most during the session.

This observation aligns with the museum's audience strategy to engage both visitor personas[1] described earlier.

A key strength of the design was its focus on familiar daily behaviors linked to unfamiliar ecological consequences. This aligns with the principle of disorienting dilemmas from Transformative Experience Theory, where new information challenges visitors' assumptions and encourages reflection. For most participants, the link between light pollution and its effect on animals was entirely new, despite their familiarity with energy-saving advice. Similarly, seven out of eight families did not know about the negative impact of feeding bread to ducks before the experience. These findings support the project's content strategy: highlighting hidden environmental effects arising from routine actions to promote attitude and behavior change.

However, whether the chosen urban neighborhood setting created a stronger emotional connection than other biodiversity contexts (such as marine or exotic wildlife) remains untested. Participants appeared to respond primarily to the behavioral message itself rather than to the specific types of animals featured. Further testing would be needed to evaluate how different environmental settings might influence emotional engagement and learning outcomes.

The Family Figure Framing and Reflection Dynamics

The family figure was designed to create psychological distance and help visitors explore both positive and negative behaviors without feeling personally judged. However, user

[1] This was described in Chapter 1, 1.5.5 Target Audience and Persona p.17

testing revealed that this mechanism was not strictly necessary. Most participants naturally reflected on their own habits, regardless of the fictional framing. This may be because the narrative tone and phrasing—asking "What would you do?"—encouraged them to relate directly to their real-life behavior and imagine it as their own family's day out.

One recurring pattern was that many children perceived the experience as having clear "right" and "wrong" answers. This focus on correctness limited open-ended reflection, with some children hesitating before making choices they believed were "bad" and celebrating when they selected the "correct" option. While this effect might partly stem from the presence of observers during testing or the game-like feel of the interaction, it points to how moral framing can shape the way children engage. Interestingly, despite this, several participants still shared honest reflections about their actual habits, including less environmentally friendly ones.

Some environmentally aware participants also described the experience as "too easy," suggesting they quickly recognized desirable behaviors. In some cases, this seemed to result from noticing patterns in earlier questions, allowing them to predict which choices would have positive outcomes.

The planned cumulative visual feedback showing environmental change could further amplify this effect. Visitors may feel increased pressure to "fix" the environment rather than engaging in honest self-reflection.

Group Composition and Reflection Patterns

Family composition affected how much discussion occurred during play. In larger groups, discussions and negotiations were more frequent, especially when deciding where to go or what choices to make. Single-child sessions showed less verbal reflection. However, group dynamics did not appear to significantly affect comprehension or learning outcomes. Most children still related their choices to real-life behavior, regardless of whether they played alone or with others.

During testing, two unrelated families (with children aged 10 and 18) played together, and the older teenager sometimes influenced the younger child's choices. While this situation falls outside the intended design goal of supporting reflection within family groups, it highlights how group dynamics can shape decision-making. Since the installation is primarily designed for families to play independently, this is not a core issue but may be worth noting as an edge case.

Behavioral Complexity and Real-World Impact

While participants understood cause-and-effect links, it's uncertain how deeply these reflections would translate into sustained real-world behavior change. Some participants mentioned small actions they might take, but long-term impact cannot be concluded from this short test. The reality of inconsistent human behavior (e.g., sometimes buying new toys, sometimes trying to fix them) suggests future designs could acknowledge and embrace this complexity, perhaps by showing gray-area scenarios or recognizing that change happens over time.

Engagement and Contextual Factors
Most participants appeared engaged during the session, but it is important to recognize that the study took place in a structured, facilitated environment. Participants were aware that they were part of a study, which likely increased their willingness to stay focused and complete the experience. In a real museum setting, without direct facilitation, engagement levels may vary. Some visitors may choose to leave the experience early, while others might fully explore all available choices. This remains an open factor that could not be validated within the current test setup.

A positive observation was that many families expressed excitement about seeing the final installation, especially with the projection mapping and environmental effects. However, because these elements were not part of the prototype, their actual impact on engagement remains untested.

Although not formally included in the target age range, one 5-year-old child participated with her parent. While she struggled with the decision-making and question-answering components, she showed engagement with figure movement and on-screen animations. This suggests that younger visitors may still enjoy the installation's visual elements, especially when enhanced with the full projection mapping planned for the final version.

6.1.2 Limitations of the Study

Audience and Sampling Constraints
This study involved a relatively small and context-specific participant group: seven families and one spontaneously participating teenager. There were no participants aged exactly nine years old, limiting feedback from the lower end of the target age range. Three of the participating families lived in the same city and likely shared similar urban environments, which may have limited diversity in perspectives.

Many of the participating children had similar personalities and attitudes—generally open, cooperative, and reflective. This homogeneity may have reduced the range of observed behaviors and reactions. It is possible that children with different backgrounds, interests, or personality types would interact with the installation in other ways.

Additionally, No formal data on participants' prior environmental knowledge, attitudes, or interest levels was collected. Observations about participants' familiarity with biodiversity topics were based solely on their spontaneous comments during the session and in interviews. This introduces a degree of subjective interpretation, and assumptions about their environmental awareness should be viewed with caution.

Language and Facilitation Limitations
As the primary facilitator, I do not speak fluent Dutch. While I was able to observe gestures and catch key words, much of

the real-time conversation between family members may have gone unnoticed or been misunderstood during play. Although interviews were audio-recorded and later transcribed and translated using AI and native speaker assistance, some nuances of family discussions may have been lost. Additionally, only two facilitators were responsible for technical operation, observation, facilitation, and interviews. This limited the depth of data collection and may have resulted in missed observations or insights.

Prototype and Setup Differences
The prototype was tested in a workshop room (Werkplaats Ontwerp) on the fifth floor of Naturalis, rather than in its intended exhibition location. Therefore, its emotional link to the preceding "Leven" exhibition could not be evaluated during this study.

Key elements of the final installation, such as projection mapping, spatial sound, and physical environmental effects, were also absent from the prototype. The cumulative feedback was delivered verbally only, meaning visitor responses to the full sensory and narrative arc remain unknown.

Families were quickly guided from gameplay to interviews, leaving limited time for natural post-game reflection or the option to replay and explore alternative choices. This makes it difficult to assess whether, in a real museum context, visitors would choose to replay the installation to see different outcomes.

Audio Quality Constraints
The AI-generated narration was sufficient but noted as "robotic" and lacking emotional tone. This temporary solution will be addressed with professional audio production in the final installation.

6.2 Recommendations

6.2.1 Core Recommendations from User Testing

Based on the valuable insights from this user test, several key recommendations will guide the final installation's design and future iterations. The aim is to create an experience that is both deeply engaging and highly effective in conveying its core message about biodiversity.

Refining Moral Framing and Supporting Behavioral Complexity

Two key challenges emerged from testing: many participants perceived the choices as “right” or “wrong,” limiting open-ended reflection, and real-world environmental behaviors are rarely consistent or absolute. To address these, the design should move away from binary scenarios and include more nuanced, realistic options that reflect the complexities of everyday life. Representing gray areas encourages visitors to think critically about their actions in a relatable way, rather than simply selecting the obvious “correct” answer.

This approach also responds to feedback from environmentally aware participants who found the experience “too easy,” ensuring engagement for visitors with varying levels of familiarity with biodiversity. By presenting layered motivations and consequences, the design can inspire deeper reflection and curiosity while fostering a stronger connection to real-life behaviors.

At the same time, choice complexity should be balanced with decision-making time to avoid overwhelming players. For example, in a food waste scenario, options might include composting, saving leftovers, or throwing food away, each with different environmental consequences.

Validating Projection Mapping and Feedback Effects

Although the user testing focused on narrative flow and decision-making, the prototype did not yet include projection mapping or dynamic environmental effects on the physical model. Interestingly, many families expressed excitement about seeing these elements in the final installation. Since projection mapping and cumulative visual feedback are core to the intended experience, it will be critical to validate how these features impact engagement, comprehension, and reflection in future iterations. Testing the full setup will ensure the feedback feels intuitive and reinforces the link between daily actions and ecological change.

Testing and Refining Narrative Engagement

The user test did not specifically evaluate whether the narrative tone, script style, or delivery was optimally engaging for the target audience. Future development phases should include user testing of different narrative approaches, such as comparing playful, dramatic, neutral, or emotionally rich tones. This should cover both the spoken audio delivery and the overall storytelling style. Exploring how narrative tone influences visitor engagement and reflection will help ensure that the final installation delivers both emotional resonance and educational clarity.

Maximizing "Surprise Moments" with Novel Insights
To sustain attention and create meaningful learning moments, the installation should continue focusing on daily behaviors with lesser-known environmental consequences. Surprise topics, such as the impact of light pollution on animals, proved highly effective during testing. Expanding this approach, future content could include small, actionable choices that children can easily relate to and control, such as the length of hot showers, leaving water running, or creating paper waste. Less obvious actions, like picking flowers or overwatering plants, which might seem harmless but have ecological consequences, could also highlight unexpected environmental effects. To ensure relevance, further research on common behaviors among children is recommended. By centering on familiar, manageable actions with visible outcomes, the installation can strengthen children's sense of agency in their environmental decision-making.

Enhancing Post-Experience Engagement
To extend the learning beyond the immediate interaction, the design should ensure the QR code for additional learning content is more prominent and easily discoverable without prompting. Furthermore, allowing for natural post-game reflection or optional replay opportunities within the museum setting would be beneficial. This would enable visitors to explore alternative outcomes or deepen their understanding, providing valuable insights into their willingness to re-engage with the content.

Enhancing Audio Production
Finally, to enhance the overall immersive experience and avoid the "robotic" perception noted in the prototype, it is crucial to confirm that the final installation incorporates professionally recorded narration. This will ensure emotional tone and improve the overall quality of the auditory experience.

6.2.2 Additional Recommendations

Beyond the core improvements directly identified by user testing, several opportunities for the installation's future development emerged from discussions with stakeholders and further design considerations. These recommendations aim to deepen impact, enhance engagement, and explore broader applications of the concept.

Deepening Engagement and Impact through Design

Addressing Inaction as a Behavioral Choice
One idea raised during the Green Light meeting was the importance of highlighting that inaction can also negatively affect nature. To convey this subtly within the experience, the design could implement a soft-timer during decision moments. If players hesitate too long or fail to make a choice within a set time, the environment could begin to show visible decline as a direct consequence of inaction. An alternative approach is to include scenarios where "doing nothing" is presented as one of the selectable choices, making its environmental impact visible alongside active options.

Enhancing the Emotional Effect of Cumulative Feedback
To maximize the installation's impact and encourage personal confrontation with environmental consequences, explore making the cumulative feedback more visually compelling and subtly exaggerated. This could involve gradually escalating the visual representation of impact, moving from individual actions to a magnified depiction of what would happen if many people consistently made similar choices. This aims to create a memorable and thought-provoking experience.

Enhancing Engagement and Learning for Diverse Audiences
While the design primarily targets children aged 9–12, one session involved an older teenager (18) who influenced a younger child's decisions during play. Although this was not typical of the intended audience, future iterations could consider ways to accommodate broader age ranges and mixed groups. For instance, offering layered content complexity might ensure engagement for both younger and older visitors. However, addressing moral framing and binary choice structures (see section 6.2.1) may already help balance reflection opportunities across diverse audiences**.**

Introducing Tangible, Physical Interactions
Consider incorporating elements that allow for more tangible, physical interactions where feasible. For instance, scenarios like choosing to dispose of candy wrappers in a bin versus dropping them on the ground can be highly engaging and fun for children. Implementing such features requires careful consideration of the questions and actions to ensure they are both relatable and physically manageable within the installation's design.

Expanding the Concept's Reach and Thematic Connection

Broadening Scene Settings and Storytelling Variability
To maintain novelty and encourage repeat visits, future iterations could explore multiple narrative settings or environmental contexts. Examples include changing seasons, different urban neighborhoods, or entirely new biodiversity settings such as underwater scenes or forests. However, this would require the physical model to become more modular and adaptable to accommodate scene changes without major reconstruction.

Strengthening the Connection to the "Leven" Exhibition
To improve visitor comprehension of the installation's connection to the broader museum experience, future iterations should explore a more explicit link to the "Leven" exhibition. One promising avenue is to allow visitors to personalize their experience by selecting specific animals from the "Leven" exhibition (e.g., via NFC-enabled wristbands or tags). This would enable them to then observe how their choices within the installation directly affect those chosen animals. This personalized approach may also necessitate the physical model being more flexible, potentially supporting multiple scene settings or highlighting different elements with lighting to accommodate diverse animal habitats.

Adapting the Concept for Broader Educational Use
One participant suggested that the installation would be well-suited for educational contexts, such as school programs. To enable this, the concept could be adapted into more portable formats, such as interactive screen-based animations or digital classroom tools. This would allow Naturalis to extend the reach of the project through school programs or temporary exhibitions in other venues.

Enhancing Long-Term Engagement and Personalization

Developing Take-Home Learning Tools
To reinforce the learning experience and encourage continued reflection at home, develop the QR code functionality to offer personalized takeaways. This could include a digital representation of the visitor's cumulative scene based on their choices, or tailored information and actionable tips for improving their environmental impact in daily life, directly related to the behaviors explored in the installation. This would provide a tangible link between the museum experience and real-world behavior.

6.3 Conclusion

This project aimed to design an interactive museum installation that encourages family visitors at Naturalis to reflect on how their daily behaviors affect biodiversity. Through a research-driven and iterative design process, the final prototype successfully addressed the key learning goals. It made the environmental consequences of small, everyday actions both visible and personally meaningful to visitors.

The project process integrated multiple research methods, including literature review, stakeholder input, expert interviews, a co-creation session with Naturalis staff, and a context mapping study with the target audience. Insights from these phases shaped the design vision and interaction concept. The final prototype was developed through several design iterations, each informed by ongoing user feedback and expert consultation.

User testing with seven families demonstrated that the design effectively helped visitors understand the link between their daily choices and the well-being of local animals and ecosystems. Participants showed personal reflection and a willingness to consider behavioral changes, such as reducing plastic use or turning off lights. The test also revealed areas for further improvement, including the need to reduce moral framing, offer more nuanced choice scenarios, and enhance long-term engagement opportunities.

Limitations related to sample size, participant diversity, and the test setting were acknowledged. Additionally, the short project duration did not allow for measuring long-term behavioral change. Nevertheless, the findings provide strong evidence that the installation concept holds potential for encouraging pro-environmental reflection and behavior change in a museum setting.

In conclusion, this project demonstrates how interactive storytelling and playful engagement strategies, informed by Transformative Experience Theory and behavioral change models like Self-Determination Theory, can help make complex topics like biodiversity both accessible and personally meaningful for museum visitors. While long-term behavioral change could not be measured within this project's timeframe, testing results showed encouraging signs of personal reflection, relevance-making, and motivation—core principles emphasized in the guiding theoretical frameworks.

Reference

Reference

Text Reference

- Achmea. (2024). Biodiversity whitepaper final version. https://www.achmea.nl/-/media/achmea/documenten/duurzaamheid/documentatie-mvb/biodiversity-whitepaper-final-version-2024.pdf
- Ansorge, R., Gatta, F., & Gopal, A. (2024). Piaget Stages of Development. Medically Reviewed by Jabeen Begum, MD. https://www.webmd.com/children/piaget-stages-of-development
- Ball, J. (2019, September 17). The Double Diamond: 15 years on. Design Council. https://medium.com/design-council/the-double-diamond-15-years-on-8c7bc594610e
- BiteSize Learning. (2023, July 25). Design solutions to problems with the Double Diamond process. https://www.bitesizelearning.co.uk/resources/double-diamond-design-process-explained
- Bitgood, S. (2010). An Attention-Value Model of Museum Visitors. Center for Advancement of Informal Science Education.
- Calvi, L., Vermeeren, A., & Sabiescu, A. (Eds.). (in press). Transformative museum experiences. Springer Series on Cultural Computing.
- Chariot Display. (n.d.). Interactive table projection. Chariot Display. Retrieved June 8, 2025, from https://www.chariotdisplay.com/news/interactivetableprojectionchariottech-37100658.html
- Convention on Biological Diversity. (n.d.). Biodiversity and nature: Close but not quite the same [PDF]. https://www.cbd.int/idb/activities/difference-biodiversity-nature.pdf
- Delft Design Labs. (n.d.). Museum Futures Lab. Delft Design Labs. https://delftdesignlabs.org/museum-futures-lab/
- Delft Design Labs. (n.d.). Play Well Lab. https://delftdesignlabs.org/play-well-lab/
- Díaz, S., et al. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. Science, 366(6471). https://doi.org/10.1126/science.aax3100
- Dulwich Centre. (n.d.). Externalising – commonly-asked questions. Retrieved from [Insert actual URL here, e.g., https://dulwichcentre.com.au/externalising-commonly-asked-questions/]
- DutchNews.nl. (2022). Feeding ducks in Rotterdam could land you with a big bill from July 1. https://www.dutchnews.nl/2022/03/feeding-ducks-in-rotterdam-could-land-you-with-a-big-bill-from-july-1/
- Ellen MacArthur Foundation. (2017). A new textiles economy: Redesigning fashion's future. https://www.ellenmacarthurfoundation.org/a-new-textiles-economy
- European Environment Agency. (2020, February 10). Biodiversity - Ecosystems. European Environment Agency. https://www.eea.europa.eu/themes/biodiversity/intro

- Falchi, F., Furgoni, R., Gallaway, T. A., Rybnikova, N. A., Portnov, B. A., Baugh, K., Cinzano, P., & Elvidge, C. D. (2019). Light pollution in USA and Europe: The good, the bad and the ugly. Journal of Environmental Management.
- Gaston, K. J., & Spicer, J. I. (2004). Biodiversity: An introduction (2nd ed.). Blackwell Publishing. Retrieved from https://books.google.nl/books?hl=en&lr=&id=0Bjp2o5CVnQC
- Gibson, S., & Rumeh, J. (2012). Adolescent moral judgment and perceptions of family interaction. Journal of Genetic Psychology, 173(3), 296-311.
- Hogeschool van Amsterdam (HvA). (2018). Measuring the Dutch Clothing Mountain: Final Report. https://www.hva.nl/binaries/content/assets/subsites/kc-fdmci/fashion/measuring-the-dutch-clothing-mountain_final-report-1.pdf
- IPBES. (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
- Kremen, C., & Merenlender, A. M. (2018). Landscapes that work for biodiversity and people. Science, 362(6412), eaau6020. https://doi.org/10.1126/science.aau6020
- Latham, K. (2021, October). How biodiversity loss is jeopardizing the drugs of the future. *The Guardian*. www.theguardian.com/environment/2021/oct/09/how-biodiversity-loss-is-jeopardising-the-drugs-of-the-future
- Lee, S. W., & Holyoak, K. J. (2020). "But he's my brother": The impact of family obligation on moral judgments and decisions. UCLA Reasoning Lab.
- Liedgren, J., Desmet, P., & Gaggioli, A. (2023). Designing liminal experiences for transformative engagement. In A. Sabiescu, L. Calvi, & A. Vermeeren (Eds.), Transformative museum experiences at a time of transformation (pp. 23–40). Springer.
- Lindwall, C. (2022, April 22). Biodiversity 101. Natural Resources Defense Council (NRDC). https://www.nrdc.org/stories/biodiversity-101#whatis
- Mechelli, A. (2024, May 8). Why biodiversity is good for your mental health. Greater Good Science Center. https://greatergood.berkeley.edu/article/item/why_biodiversity_is_good_for_your_mental_health
- Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.
- Morgan, A. (2000). What is narrative therapy?: An easy-to-read introduction. Dulwich Centre Publications.
- MyClimate. (n.d.). What is the relationship between the climate crisis and biodiversity loss? Retrieved April 12, 2025, from https://www.myclimate.org/en/information/faq/faq-detail/what-is-the-relationship-between-the-climate-crisis-and-biodiversity-loss/
- Naturalis. (n.d.). What is biodiversity? Naturalis Biodiversity Center.https://www.naturalis.nl/en/science/biodiversity/what-is-biodiversity

- Naturalis Biodiversity Center. (2025). Strategic Plan 2025-2028. Naturalis Biodiversity Center. Retrieved from https://drive.google.com/file/d/1Yuors-FvTAdo6gN7HYvshX6JtwDVvpHA/view
- Pugh, K. J. (2011). Transformative experience: An integrative construct in the spirit of Deweyan pragmatism. Educational Psychologist, 46(2), 107–121.
- Pugh, K. J., Linnenbrink-Garcia, L., & Perez, T. (2010). Teaching for transformative experiences in science: An investigation of the effectiveness of two instructional elements. Teachers College Record, 112(6), 1311–1351.
- Robertson-Fall, M. (2020). A life cycle assessment of the environmental impact of children's toys. https://www.sciencedirect.com/science/article/abs/pii/S2352550922000550
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68
- San Francisco de Paula Science Department. (n.d.). Unit 4 – Ecosystems & Biodiversity [Image]. Retrieved April 12, 2025, from https://www.sciencesfp.com/unit-4---ecosystems--biodiversity.html
- Sleeswijk Visser, F., Stappers, P. J., van der Lugt, R., & Sanders, E. B. N. (2005). Contextmapping: Experiences from practice. CoDesign, 1(2), 119–149. https://doi.org/10.1080/15710880500135987
- Smetana, J. G. (2006). Conceptions of moral and social rules. In M. Killen & J. G. Smetana (Eds.), Handbook of moral development (pp. 53-81). Lawrence Erlbaum Associates.
- Stappers, P. J. (n.d.). Contextmapping. TU Delft, Faculty of Industrial Design Engineering. https://www.tudelft.nl/io/onderzoek/research-labs/hcd-studiolab/contextmapping
- Statista. (2024, September 24). The enormous scale of global food waste. https://www.statista.com/chart/24350/total-annual-household-waste-produced-in-selected-countries/
- The Lancet. (2024). Biodiversity loss: a health crisis. The Lancet, 404(10463), 1615. https://doi.org/10.1016/S0140-6736(24)02350-X
- United Nations Foundation. (2022). Biodiversity explained: Facts, myths, and the race to protect it. https://unfoundation.org/blog/post/biodiversity-explained-facts-myths-and-the-race-to-protect-it/
- Vermeeren, A. P. O. S., & van Boeijen, A. (2022). Elements for Museum Experience Design: A Six-Box Model.
- Vermeeren, A. P. O. S., Calvi, L., & Sabiescu, A. (Eds.). (2018). Museum experience design: Crowds, ecosystems and novel technologies. Springer. https://doi.org/10.1007/978-3-319-58550-5
- Voedingscentrum. (2024). Consumer food waste. https://mobiel.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Factsheet%20Consumer%20Food%20Waste_2024.pdf

- Wageningen University & Research. (2013). Effective interventions on littering behaviour of youngsters. https://www.wur.nl/upload_mm/9/2/6/4beb526f-d6cc-4ac9-8bee-636a53de7068_Effective%20interventions%20on%20littering%20behaviour%20of%20youngsters%20%28Final%20report%20ACT-group%201530%29.pdf
- World Health Organization (WHO). (n.d.). Biodiversity. https://www.who.int/news-room/fact-sheets/detail/biodiversity
- WWF. (2022). Living Planet Report 2022. https://www.worldwildlife.org/publications/living-planet-report-2022

Image Sources

- Animals International. (n.d.). Habitat destruction [Image]. Retrieved April 12, 2025, from https://www.animalsinternational.org/issues-impacting-animals/habitat-destruction/
- de Lisle, G. (n.d.). Kererū feeding on karaka berry [Photograph]. Science Learning Hub – Pokapū Akoranga Pūtaiao. Retrieved April 12, 2025, from https://www.sciencelearn.org.nz/resources/103-seed-dispersal
- EcoMatcher. (2023, October 24). What is biodiversity and why does it matter? [Photograph]. https://www.ecomatcher.com/what-is-biodiversity-and-why-does-it-matter/
- European Respiratory Society. (n.d.). Study of people exposed to air pollution reveals greater effects on females than males [Image]. Retrieved April 12, 2025, from https://www.ersnet.org/news-and-features/news/study-of-people-exposed-to-air-pollution-reveals-greater-effects-on-females-than-males/
- Foundation myclimate – The Climate Protection Partnership. (n.d.). What is the relationship between the climate crisis and biodiversity loss? [Image]. Retrieved April 12, 2025, from https://www.myclimate.org/en/information/faq/faq-detail/what-is-the-relationship-between-the-climate-crisis-and-biodiversity-loss/
- One Tree Planted. (2022, October 6). 7 effects of climate change happening right now [Image]. Retrieved April 12, 2025, from https://onetreeplanted.org/blogs/stories/climate-change-effects
- P.manchev. (2011, June 28). Bee collecting pollen [Photograph]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Bee-collecting-pollen2.jpeg
- Reddit user. (2021, June 28). A typical playground in Rotterdam [Photograph]. Reddit. https://www.reddit.com/r/Netherlands/comments/o8dl1s/a_typical_playground_in_rotterdam/

- San Francisco de Paula Science Department. (n.d.). Unit 4 – Ecosystems & Biodiversity [Image]. Retrieved April 12, 2025, from https://www.sciencesfp.com/unit-4---ecosystems--biodiversity.html
- United Nations Foundation. (2022). Biodiversity explained: Facts, myths, and the race to protect it. https://unfoundation.org/blog/post/biodiversity-explained-facts-myths-and-the-race-to-protect-it/
- World Wildlife Fund. (n.d.). Overfishing [Image]. Retrieved April 12, 2025, from https://www.worldwildlife.org/threats/overfishing
- Zemp, T. [@trisha_zemp]. (2023, October 8). Paper Cutout stopmotion [Video]. YouTube. https://youtube.com/shorts/L-AKmCHEEuM

Appendix

Appendix A

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

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

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	Torntham 7588
Initials	P
Given name	Panotkorn
Student number	5931215

IDE master(s) IPD ☐ DfI ☑ SPD ☐

2nd non-IDE master	
Individual programme *(date of approval)*	
Medisign	☐
HPM	☐

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Mathieu Gielen	dept./section	HCD / CDSC
mentor	Arnold Vermeeren	dept./section	HCD / FE
2nd mentor	Pieter Aartsen		
client:	Naturalis Biodiversity Centre		
city:	Leiden	country:	The Netherlands
optional comments			

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

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Digitaal ondertekend door Mathieu Gielen
Datum: 2025.03.03 17:25:51 +01'00'

Name Mathieu Gielen Date 3-3-2025 Signature

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, 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 _____ EC

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

★	**YES**	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

L. Boot Digitaal ondertekend door L. Boot Datum: 2025.03.12 09:04:52 +01'00'

Name Lisette Boot Date 12-03-2025 Signature _____

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is …

★	**ALLOWED** to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

u ieiobelbgi geunougs Deg ee

Name Monique von Morgen Date 12/3/2025 Signature _____

Personal Project Brief – IDE Master Graduation Project

Name student Panotkorn Torntham **Student number** 5931215

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Dependent by nature: Fostering understanding and care in Biodiversity for family visitors at Naturalis Museum

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

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

This project is about enriching a current exposition at Naturalis around biodiversity. Biodiversity includes all forms of life on Earth, from plants and animals to organisms in diverse environments such as land, oceans, and air. It provides essential resources like food, clean water, and air, crucial for our survival (Achmea, 2024). Despite our dependence on these natural systems, their importance is frequently overlooked. To safeguard human life, we must prioritize preserving the natural world (The Lancet, 2024).

The Naturalis Biodiversity Center in the Netherlands aims to educate people about biodiversity. Although one of the current exhibitions "Leven" showcase nature's beauty, they fall short in explaining the urgent biodiversity crisis and its impact on our lives.

Naturalis plans to update the "Leven" exhibition to make this message clear: "Nature doesn't need us, but we need nature to survive." This core idea will underline our deep need for healthy ecosystems. The updated exhibition will also make the connection between human survival and healthy ecosystems clearer with the message, "If ecosystems collapse, we collapse too." This approach aims to make the topic of biodiversity more relevant and understandable for every visitor.

➔ *space available for images / figures on next page*

introduction (continued): space for images

click to add picture

image / figure 1 People focused on the Immediate, ignored the crucial Biodiversity Crisis. (Brunswick)

image / figure 2 “ Leven ” exhibition at Naturalis Biodiversity Centre (naturalis.nl)

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

The "Leven" exhibition at Naturalis faces two main challenges. First, it struggles to effectively communicate the critical importance of biodiversity and its impact on human survival to its visitors. Despite showing nature ' s beauty, the exhibition does not adequately convey the urgency of the biodiversity crisis, leaving visitors without a clear understanding of how these issues affect them personally or what actions they can take to help.

Second, there is a challenge in finding communication strategies that resonate with a diverse audience, particularly families with young children (ages 4-12). The exhibition needs to identify and implement engaging methods that simplify complex biodiversity concepts in a way that is accessible and impactful for this younger demographic, while also ensuring that everyone can engage and interact meaningfully.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Design an interactive installation to make biodiversity relatable and engaging, enhancing understanding and conservation actions among visitors, especially families with children aged 9-12, at Naturalis's 'Leven' exhibition

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

My project starts with desk research in partnership with Naturalis, reviewing existing knowledge on biodiversity and public awareness. Following this initial phase, I will conduct field research through context mapping with museum visitors, particularly focusing on children aged 9-12. This age group is identified as ideal for learning about biodiversity because they are old enough to understand the complexity of the topic, yet young enough to be engaged by playful elements.

From this research, I will develop three prototypes using visual metaphors, interactive experiences, and emotional design elements to educate and create transformative experiences for visitors. These prototypes will be tested to evaluate their effectiveness in communicating biodiversity's critical role in human survival and inspiring conservation action.

Feedback from these tests will guide the iterative redesign of the exhibition, ensuring the final installation not only educates but also resonates deeply with visitors, encouraging them to reconsider their impact on ecosystems and take actionable steps towards sustainability.

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a ***kick-off meeting, mid-term evaluation meeting, green light meeting*** *and* ***graduation ceremony****. 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 course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	20 feb 2025
Mid-term evaluation	17 apr 2025
Green light meeting	26 juni 2025
Graduation ceremony	31 juli 2025

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	✔
For how many project weeks	24
Number of project days per week	4

Comments:
I will be doing Dutch course on the side in the first quater, which takes approx. 10 hours per week.

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

I'm drawn to this project at Naturalis for three main reasons: my passion for children's design, my commitment to environmental conservation, and my desire to expand my skills beyond familiar areas.

My background in designing for children fits well with Naturalis's diverse audience, which includes families and young children. This project challenges me to use 'multi-layered' communication, which is creating designs that convey information effectively across different age groups and learning styles. This approach is a step beyond the simple designs I'm used to, pushing me into new areas of creativity.

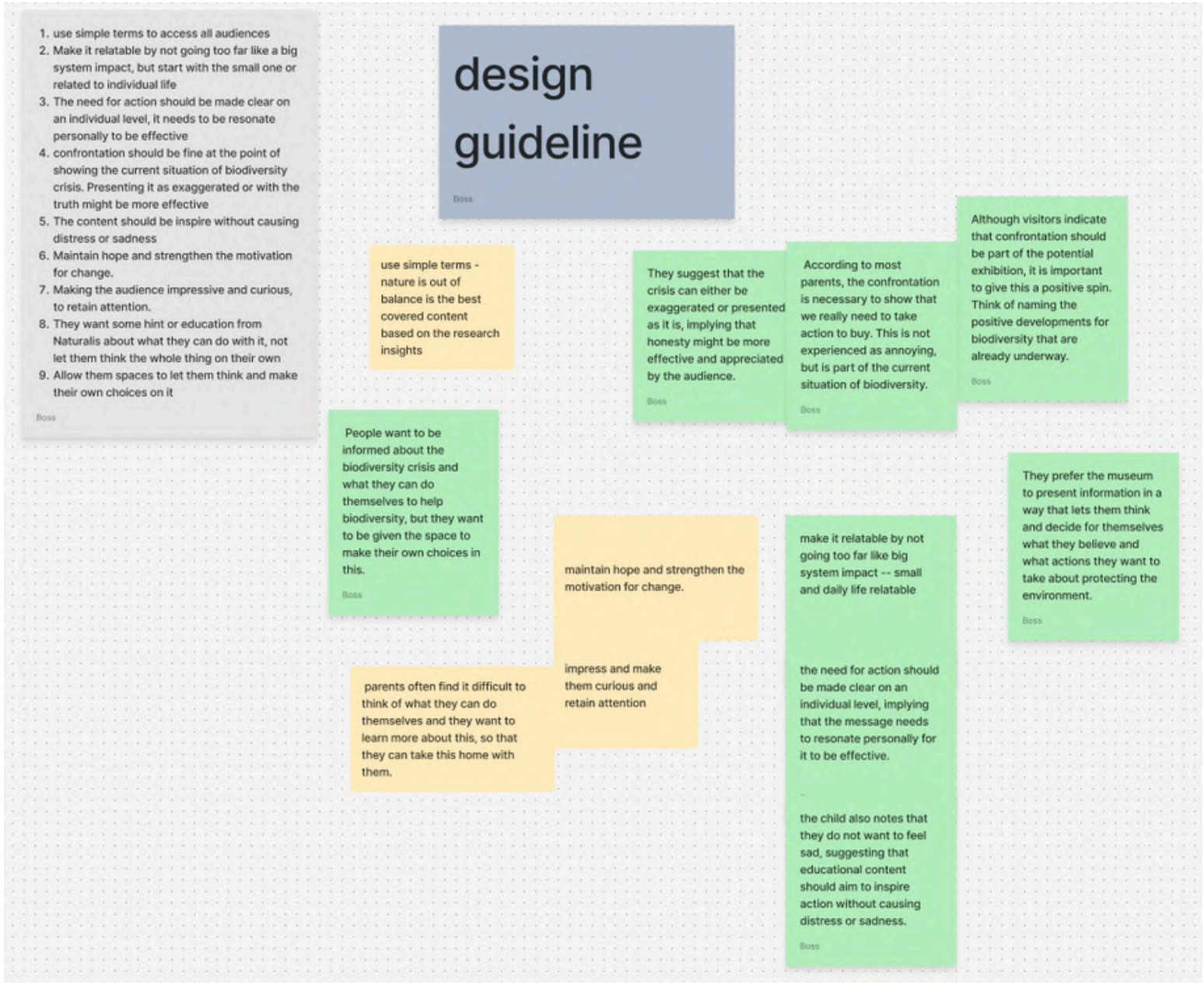
My interest in conservation aligns perfectly with Naturalis's mission to educate the public about environmental issues. Although my experience has mainly been with digital interfaces like apps and websites, this project offers a thrilling opportunity to work with physical and advanced technological products.

Collaborating with Naturalis and the Museum Futures Lab will help me develop a more integrated approach to combining digital and physical design elements. This experience will enhance my skills in interactive and environmental design and deepen my understanding of effective educational techniques in museums, making me a more versatile designer in educational and environmental fields.

Project Start Date	Participant Involvement	Note	Time (Working days / Approx)	Start	End	Mar							Apr					May							June											
Progress						☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Stage						WK0	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	WK12	WK13	WK14	WK15	WK16	WK17	WK18	WK19	WK20	WK21	WK22	WK23	WK24						
Date						10 Feb	17 Feb	24 Feb	3 Mar	10 Mar	17 Mar	24 Mar	31 Mar	7 Apr	14 Apr	21 Apr	28 Apr	5 May	12 May	19 May	26 May	2 Jun	9 Jun	16 Jun	23 Jun	30 Jun	7 Jul	14 Jul	21 Jul	28 Jul						
Project Milestones							Kick Off								Mid-Term			Small break							Green Light				Graduation Ceremony						
Phase 0 – Getting Ready																																			
Team Forming				16/1/25	2/4/25																														
Design Brief				30/1/25	11/2/25																														
Phase – Research																																			
Kick-Off Meeting			1	20/2/25	20/2/25		Start																												
Desk Research & Literature Review			12	21/2/25	13/3/25																														
HREC application			3	27/2/25	4/3/25																														
Participants Recruitment & Prepare Sensitizing Toolkit		- Define participants - Online or Print	8	3/3/25	13/3/25																														
Generative Session (Participant Fill in + Interview + Discussion)			8	17/3/25	27/3/25																														
Data Analysis - Key Insights			11	17/3/25	2/4/25								Insights																						
Phase – Ideation & Pre-lim Testing																																			
Explore best effective ways to communicate the key message		e.g. visual metaphors, interactive experiences, and emotional design elements.	2	1/4/25	2/4/25																														
Ideation & Conceptualization		*Quick Prototype based on each methods*	8	3/4/25	16/4/25																														
Mid-term Evaluation		**Prepare Form +Hand in before meeting 3 Days**	5	10/4/25	17/4/25																														
Pre-lim testing with participants			5	18/4/25	28/4/25																														
Conclude Test Result		Generate Insights > Final Design	7	21/4/25	30/4/25												Final Design Direction																		
Phase - Design & Development																																			
Prototype Planning			2	7/5/25	8/5/25																														
Final Prototype Development		Develop Final Design based on the pre-lim testing result	11	12/5/25	26/5/25																Final Prototype														
Phase – Evaluation																																			
User Test Plan & Recruitment			10	19/5/25	30/5/25																														
Conduct Test & Discussion			10	2/6/25	13/6/25																														
Analyze, Visualize, Conclude Test Results			10	9/6/25	20/6/25																														
Prepare for Green Light			8	16/6/25	25/6/25																														
Green Light Meeting		80% Done	1	26/6/25	26/6/25																														
Phase – Final Deliverables																																			
Report Hand-in - during the process		Hand-in updated regularly during the whole period	90	20/2/25	25/6/25																														
Report Hand-in - final		1 Week prior Graduation Day	17	1/7/25	23/7/25																														
Presentation			19	7/7/25	31/7/25																														

Appendix B

Clustering insights from Naturalis previous research



Recommendation 3
Ensure that the exhibition answers the visitors' 'why' questions, so that they can gain a better understanding of the causes and consequences of the biodiversity crisis, and therefore understand why the current situation needs to be improved.

Recommendation 2
Consider shifting the focus of the exhibition to other aspects of the biodiversity crisis that may be less covered in other educational settings.

People want to be informed about the biodiversity crisis and what they can do themselves to help biodiversity, but they want to be given the space to make their own choices in this.

Boss

Recommendation 1
Explain the biodiversity crisis in concrete terms and focus on connections between animal species, plant species, and humans.

what they want to know

Boss

"I would like to get tips on how I or we people can do something.

I want to see why the animals are endangered and how we can stop this

Why is the bee so important?

Will this crisis also change us?

the importance of different animal species and the impact when this decreases. should be explain first -- for deepen understanding about IF NATURE COLLAPSE

Boss

1. understanding of the importance of biodiversity, how everything is connected and that they are part of that, causes and consequences of biodiversity crisis, therefore they will understand why the current situation needs to be improved
2. explain it in concrete terms and focus on connections between animal species, plant species, and humans
3. the importance of different animal species and the impact when this decreases.
4. What they can do with it
5. positive development and actions that already been done to help this

1. Why the animals are endangered and how we can stop this
2. Why is the bee so important

Boss

also show positive development and actions that already been done to help this

visitors first need to understand the importance of biodiversity, how everything is connected and that they are part of that. Only then can they understand the impact of the biodiversity crisis.

Boss

Follow-up question
How can the exhibition explain these deeper connections within nature and human impact in an accessible way?

Follow-up question
How can the exhibition strike a balance between showing the seriousness of the crisis and offering hope and positive action points?
Follow-up question
How can you talk about the biodiversity crisis without coming to systemic problems?

Follow-up question
How can educational programs and activities be designed to make visitors aware of their role in promoting biodiversity in their own living environment?
Follow-up question
Where does a child's world of experience begin and where does it end?

topic ideas

Boss

1. own backyard, or immediate surroundings e.g. home, school, park, playground
2. favourite animals
3. food

Boss

Follow-up question
How can the exhibition best maintain and stimulate the interest of children and parents?

What are the mutual topics of their interest?

start with their own backyard or immediate surroundings

start with something familiar e.g. favourite animals

Food is important for our living environment, you can really do something with it

related food and animals?
meat

animal
food

Boss

children do not always relate meat to an animal and are not aware of organisms in and on their bodies.

Boss

find out the mutual interested topics within families ?

Boss

communication strategies

Boss

1. thematic choosing -- varies areas so it covered more theme that can resonate wider audiences
2. Experience the exhibition (e.g. watching, listening, reading) VS. participate in it (interactive actions with the exhibitions)
3. children share their knowledge to parents so they learn new perspectives from each others
4. Game
5. Sensory intuition

Boss

1. walking through the nature
2. animals character in the forest
3. experience the impact of crisis
4. Journey of discovery

Boss

experience the exhibition
vs
actions

thematic choosing

Follow-up question
In what ways can sensory experiences be effectively integrated into the exhibit to improve visitor understanding of the biodiversity crisis?

1. small actions that can be done easily
2. take home items for inspiring of maintaining conservation behaviours
3. beautiful images to evokes hopeful aspect of the future world

Boss

journey discovery
yourself

game
exploring experience
journey of discovery

Boss

images can help them remember the information better

Boss

sad things in game

walking through nature

animal characters who live in a fictional forest and convey news and moral lessons in the form of fables, often with a humorous twist.

Boss

the beautiful images can evoke onder among visioters and show how the world would look like in the future and therefore evoke hopeful aspect

Boss

sensory intuition e,g, tactile materials, sounds

provide small actions that can be done to help improve biodiversity

take home items for inspiration of contributing positive actions

children share their knowledge to parents so they learn new perspectives from each other

Boss

They want to experience the impact of the crisis on themselves and on the world, and then see what is already being done and what they can do themselves.

Boss

Appendix C

Interview questions for Naturalis experts interview

For Content Developer:
"How does Naturalis define and communicate the concept of biodiversity, particularly in relation to animals, to the public?"
"What are the key messages about the importance of biodiversity that you think are essential for the public to understand?"

"Could you explain the primary goals and educational objectives of the 'Leven' exhibition?"
"I've heard about the 'Suriname' exhibition as well. What are the main themes of this exhibition and how might they inspire elements of the redesigned 'Leven' exhibition?"

"In your view, what are the most critical aspects of biodiversity that should be highlighted to make a meaningful impact on visitors?"
"Do you have any suggestions or ideas on how we might integrate these critical aspects into the current exhibition layout?"
Staff X and Staff Y have suggested me to focus on small thing and make it big, for example if we don't have bee, we don't have apple, Given the emphasis on starting with small, relatable examples, do you have ideas on specific aspects of biodiversity, that could effectively demonstrate the impact of biodiversity loss on daily life?

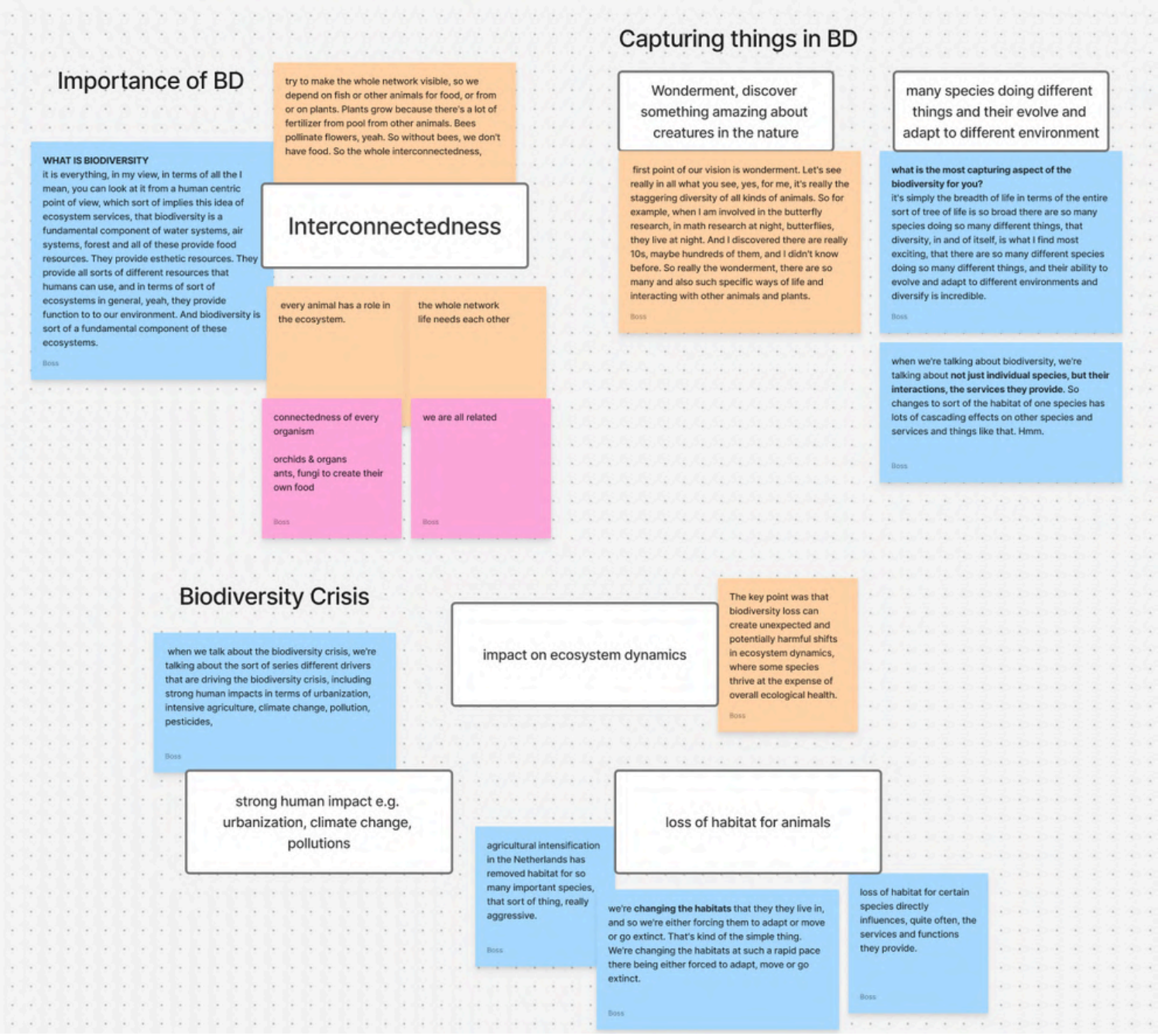
"What content strategies do you find most effective in communicating complex topics like biodiversity? For instance, do you prefer using metaphors, direct explanations, or interactive storytelling to engage the audience?"
"Can you share examples of how these strategies have been implemented in past exhibitions like 'Suriname' or others at Naturalis?"
What metrics or indicators does Naturalis use to assess the educational impact of exhibitions like 'Leven' and 'Suriname'

"What communication strategies have been most effective in engaging visitors at Naturalis?"
"Are there particular methods or interactive elements from past exhibitions that you think could be effective for the 'Leven' redesign?"

For other experts
"How does Naturalis define and communicate the concept of biodiversity, particularly in relation to animals, to the public?"
"What are the key messages about the importance of biodiversity that you think are essential for the public to understand?"
What is the most capturing aspect of Biodiversity for you
Biodiversity crisis, what is the significant impact for animals
the importance of different animal species and the impact when this decreases.

What would be the potential story of the pollinators or other animals in biodiversity system, to make people see the importance of them? like no bee no apple, are there any other story around that? because no bee no apple is of course simple but many people already know about it so it's not new? could you think about other potential interesting story about it,

Clustering from Naturalis experts interview



Content Ideas from Naturalis Interview

Show value (+)

How each animals depend on each other

introduce the variety so they can feel when they are missing

people can't aware something is missing when they don't know it. They can't compare

I think knowing species, just knowledge of species diversity, also helps people to realize when something is lost, if you don't know that it exists, you won't miss it.

I think if we remove the worms from the soil, then you really have very big problem, soy and the nematode. So they're very small worms. They're only this big. I think they're very huge impact. If the soil doesn't work, then you can use nothing anymore.

undiscovered species are become extinction without us even know it

there are species that we will never discover, that will go extinct without us ever knowing they even existed, that, to me, is far more exciting than the honeybee,

threaten animals, I'm close to extinction

The richness of species

insects or small species are often overlooked inspite of their important role in the biodiversity

special relationship in the nature

Figs

importance of resilience in BD

resilience of small things, small parts of interactions

the interactions and the resilience and the value of the total diversity, so not just the big, common things we know about, but the value of all the small things, all the small parts of a network, or the small parts of an interaction that provide sort of resilience to these systems.

if we lose species and we lose diversity, we're losing resilience as well.

creating a resilient system where we have lots and lots of different pollinators pollinating our apples. It's like a much healthier, safer way of having food than just relying on human, managed honey bees.

Keeping honey bees is like keeping chickens.

- it's source of manmade

สร้างความหลากหลายและยืดหยุ่นของระบบนิเวศ building food security by resilience

So if we create an environment where there's nesting resources, food resources, alongside our food production, we can basically harness the power of this, the diversity, or pollinator diversity, to ensure our food production.

if we talk about the sort of importance of diversity, that maybe we can still have our food security with just honey bees, but that doesn't provide us any long term security in terms of being able to maintain pollination services in a wide variety of habitats.

Show effect (-)

CONNECTEDNESS climate change → loss of species → loss of services

how climate change effect animals

I think a lot of people understand the basics of climate change, but what that actually means for species?

how diversity is impacted from global change events

the importance of diversity, for me, would be a very nice thing to show and how that diversity is being strongly impacted by by different global change events.

how climate change or land use change or pollution or pesticides directly impact biodiversity, and so that their actions, or the actions of people around them, how that can be linked to loss of species, which means loss of services. So that whole connection between we have this type of agriculture, it changes the species in this way, and it impacts me this way. That whole circle is important to connect so people understand, yeah, not their their impact, but sort of human impact on the world.

directly show how climate change or land use change or pollution or pesticides directly impact biodiversity, and so that their actions, or the actions of people around them,

how that can be linked to loss of species, which means loss of services

showing the effect of losing something related

lost of uniqeness

This refers to the fact that there are many unique and diverse species in nature, and if we lose biodiversity, we'll be losing that uniqueness forever. Each species has its own special adaptations and role in the ecosystem.

In England, for example, in the past, there are a lot of those bushes between fields. In those bushes, there were a lot of birds hiding nestling. So they removed those bushes, and they got larger patches of fields, but then those birds had disappeared and then there came a lot of rats and lot of pest animals. So that's quite a clear example of what happens when you remove, yeah, when you change the

showing the effect of losing something in the ecosystem

if certain bushes are removed from fields (which normally provide habitat for birds), the bird population declines, and then rats can multiply excessively, becoming a "plague".

project the example of losing something related to their life e.g. cocoa beans

that if a particular fungus were to affect coca bean crops, it would be a moment when people would suddenly realize there's a serious problem with biodiversity.

---

now we can get everything from the supermarket so it's not really effect us now

that's why people don't really aware, because it's not directly to them. It doesn't really touch them.

Until such a dramatic event occurs, most people remain unaware of the potential risks to our food supply

Dilemma

green action that affect sea creatures

would be really interesting to have some object which triggered the fault of people like,

the manganese nodules example:

a. Location: On the sea floor
b. Current use: Harvested for electrical car batteries
c. Complexity: Many animals live in and around these nodules
d. Ethical dilemma: Harvesting them for "green" technology (electric cars) could destroy marine life

1. The purpose of such an object is to:
   - Provoke thought about environmental trade-offs
   - Show the hidden complexity of ecosystems
   - Demonstrate how seemingly positive technological solutions can have unintended ecological consequences
2. The speaker suggested this as an example of an object that could:
   - Trigger people's imagination
   - Show the context of living and non-living things
   - Illustrate the interconnectedness of environment

Visualization ideas

you have to start as a new tournament. This is the bigness and diversity of wires. So maybe the interactions is something quite hard to visualize, but you can visualize the broadness and also, yeah, the life under the under the surface, because that's, you don't see it now in the life exhibition,

Boss

1. Underground Life Visualization:
- A glass window showing soil life
- Displaying different layers of life from sea level upwards
- Showing animals living beneath the surface
- Highlighting the importance of soil organisms like:
- - Nematodes (tiny worms) - Earthworms - Microorganisms in the soil
1. Specific Suggestion:

The speaker directly proposed having a glass window in the exhibition where visitors can see:
- Different levels of underground life
- How organisms interact in the soil
- The complexity of life beneath the surface
1. Purpose:
- To show that life is not just what we see above ground
- To demonstrate the diversity and interconnectedness of ecosystems
- To make invisible life forms visible and understandable

Boss

Mark said you can do the things in augmented reality, for example. So when you use the Naturalis app that you can point to certain animals, you see the environment come to light, for example, or to see more information about it, maybe even holograms.

Boss

find the "key message" simple + clear

Boss

sth you can take with you, question mark, sth you can out everywhere

Boss

choose one animals and put in environment

e.g. bears and climate change

Boss

dont tell them directly, let them realised on their own

Boss

Don't do

Cats & dogs

example of one specific species

the most important thing for me is not to focus on specific species examples, but really specific examples of diversity, that where the diversity is, what provides the service and the function for humans, and where that diversity is at risk.

against cats and dogs, they are not part of this beautiful world

Boss

it's dangerous to try and connect with the general public with single species examples.

Boss

I would definitely not make it about people and their impact. I would make it about like, the broad scale impacts of large industries and things like that, and climate change and yeah, but

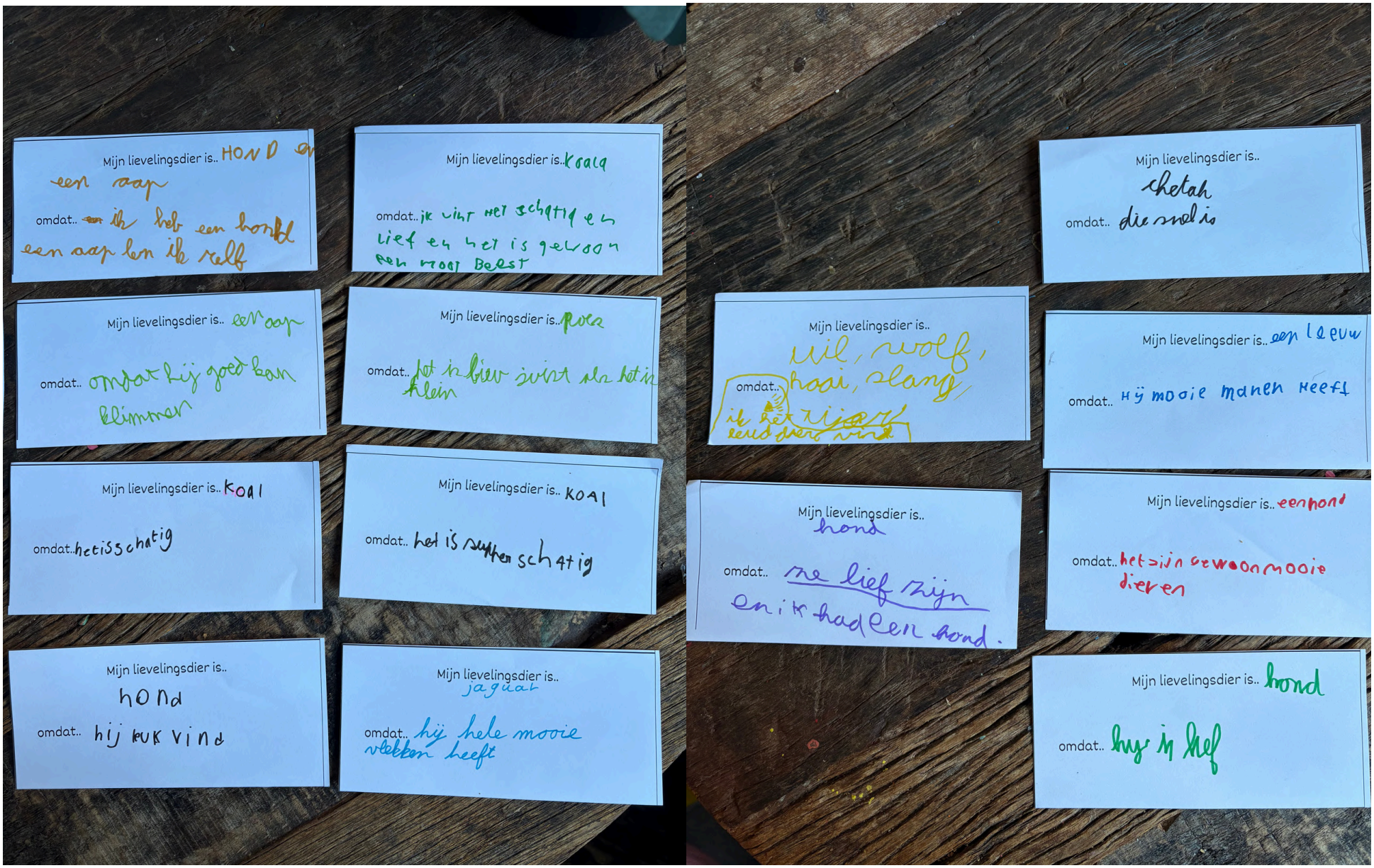
Boss

Appendix D

Observation students Groep 5/6 in Voedselbos Vlaardingen


Zorg voor de mens. Zorg voor de mens.
Eerlijk
alles delen.

Children’s favourite animals



Observations in the Class:

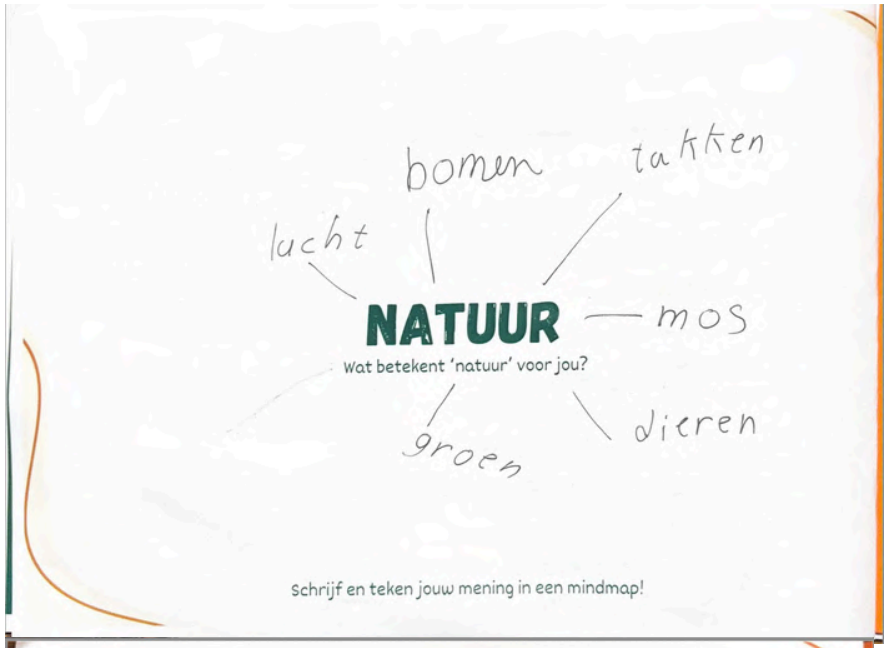
1. **Student Engagement:**
   - Observe how students react and engage with different aspects of the lesson. Which activities or topics capture their attention the most? Are there moments when they seem particularly curious or excited?
2. **Teaching Methods:**
   - Note the teaching styles and methods used. How does the teacher convey information about nature and biodiversity? Do they use storytelling, hands-on activities, or visual aids?
3. **Student Interaction with Environment:**
   - Pay attention to how students interact with the natural elements within the Voedselbos. Which elements (plants, animals, tools) do they seem most drawn to?
4. **Collaboration and Teamwork:**
   - Observe how students work together. Are there collaborative tasks? How do they manage teamwork in an outdoor setting?

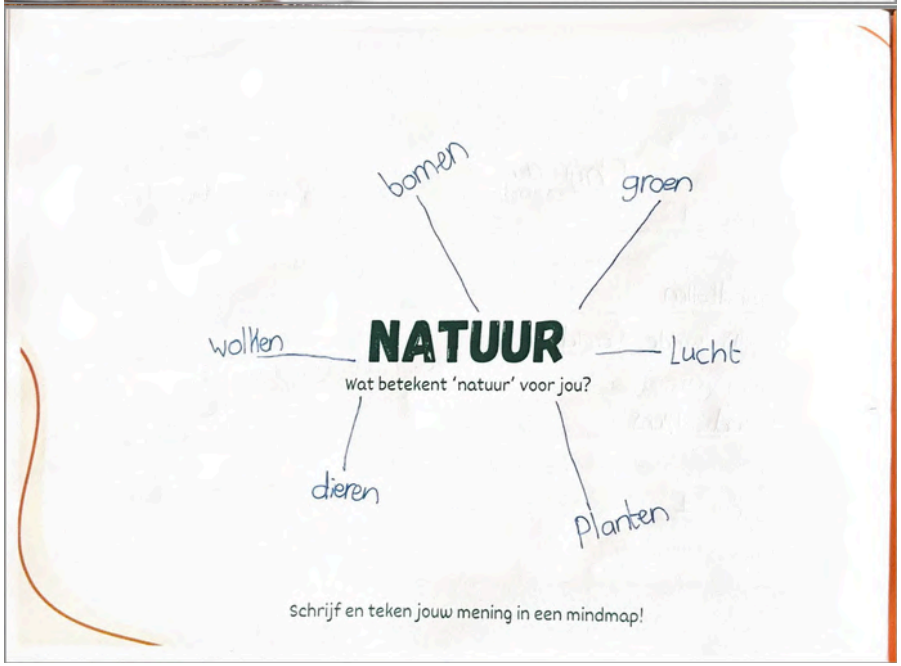
Questions for the Teacher:

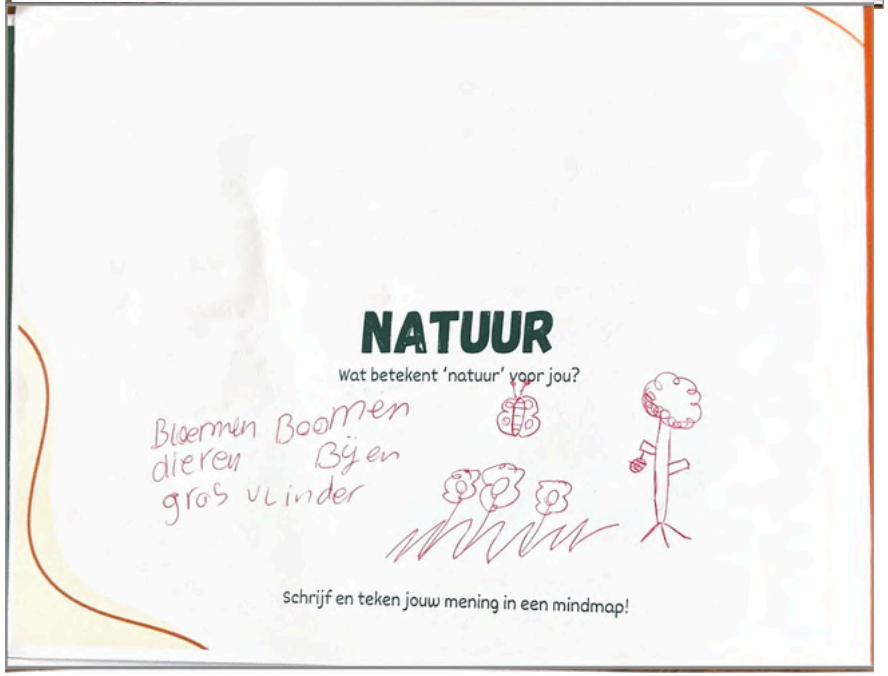
- How do you incorporate the concept of biodiversity into your lessons?
- What challenges do you face when teaching young students about biodiversity and conservation?
- Can you share any success stories or significant learning moments that have occurred in these classes?
- What types of materials or resources do you find most effective for teaching about biodiversity in a forest school setting?
- Are there any particular books, tools, or activities that you would recommend for engaging children with the topics of nature and biodiversity?
- From your experience, what aspects of biodiversity are children most interested in?

Appendix E

Filled Contextmapping Sensitizing Materials (Booklet)







buiten

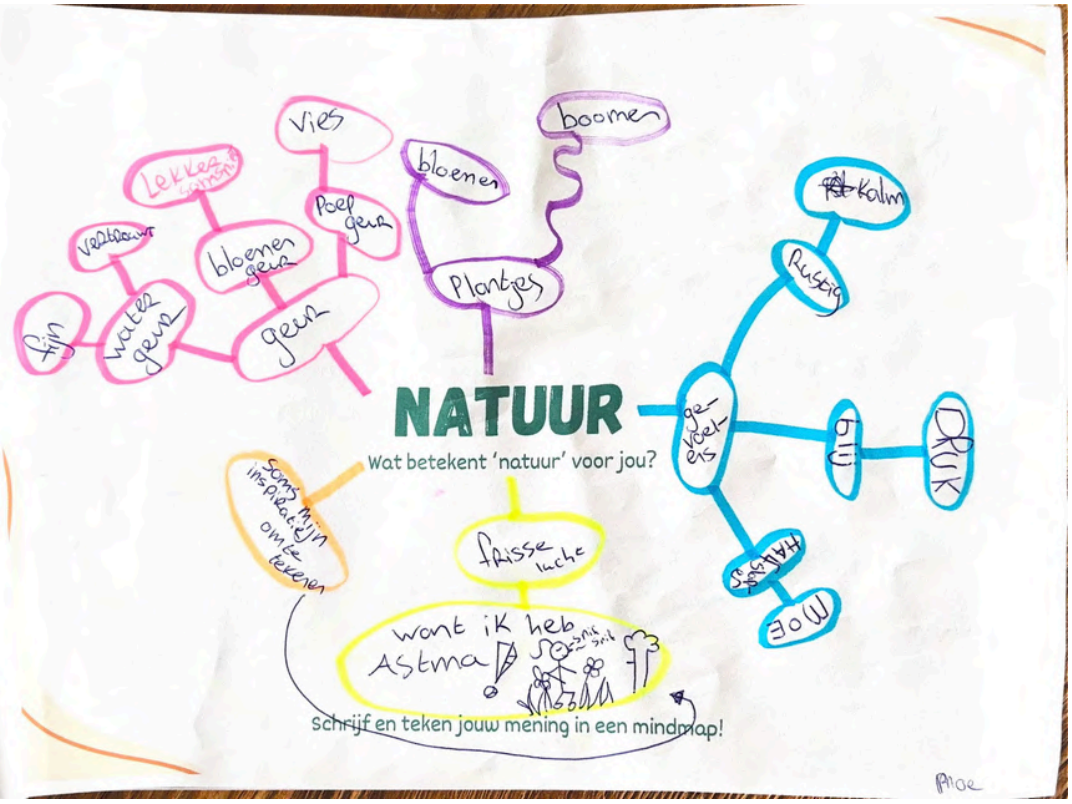
NATUUR

Wat betekent 'natuur' voor jou?

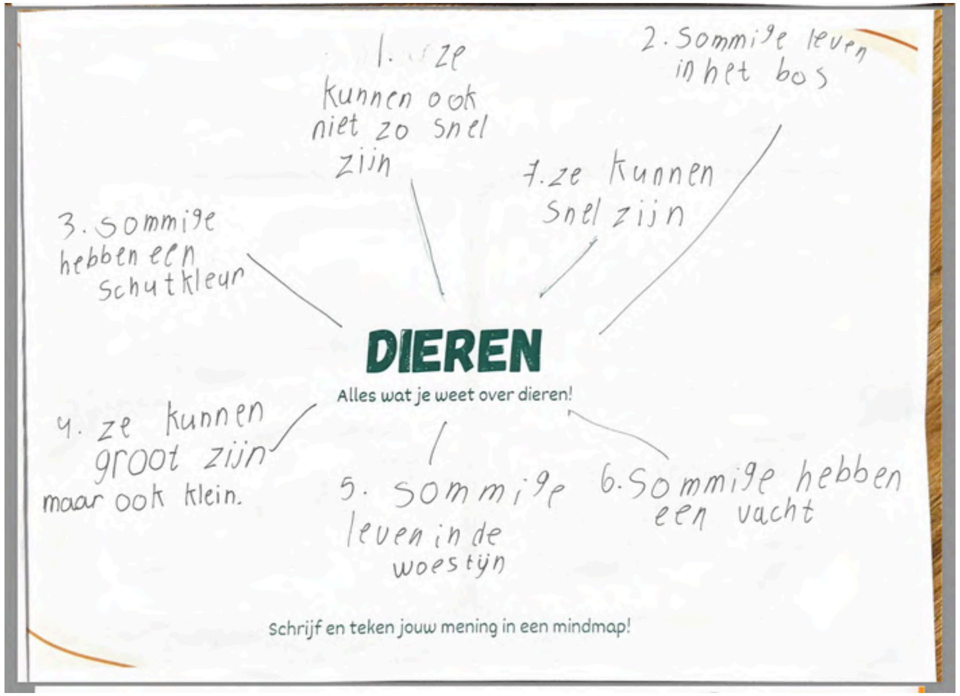
bomen

groen planten

Schrijf en teken jouw mening in een mindmap!




DIEREN
Alles wat je weet over dieren!
gevaarlijk soms
leeuw
slim - dingen leven
behulpzaam (hulphond)
dom (staart achterna)
inspirerend - kunnen veel van te leren
- hoe te vliegen
libel - helicopter
mooi
vacht
aangepast op het klimaat waar ze leven
veel verschillende
vechten
schattig - zeehond
lelijk - hyena
Schrijf en teken jouw mening in een mindmap!


1. ze kunnen ook niet zo snel zijn
2. Sommige leven in het bos
3. sommige hebben een schutkleur
7. ze kunnen snel zijn
DIEREN
Alles wat je weet over dieren!
4. ze kunnen groot zijn maar ook klein.
5. sommige leven in de woestijn
6. Sommige hebben een vacht
Schrijf en teken jouw mening in een mindmap!


wombats poepen vierkante drollen
Kippen Stammen af van de T-rex
een uil kan zijn hoofd draaien met een hoek van 360°
DIEREN
Alles wat je weet over dieren!
Vogels vliegen behalve: Pinguins, Kiwi's en Struis vogels
Schrijf en teken jouw mening in een mindmap!


DIEREN
Alles wat je weet over dieren!
Beer
ze zyn lief
Schattig en Sterk
Schrijf en teken jouw mening in een mindmap!

Zoogdieren

DIEREN

klein

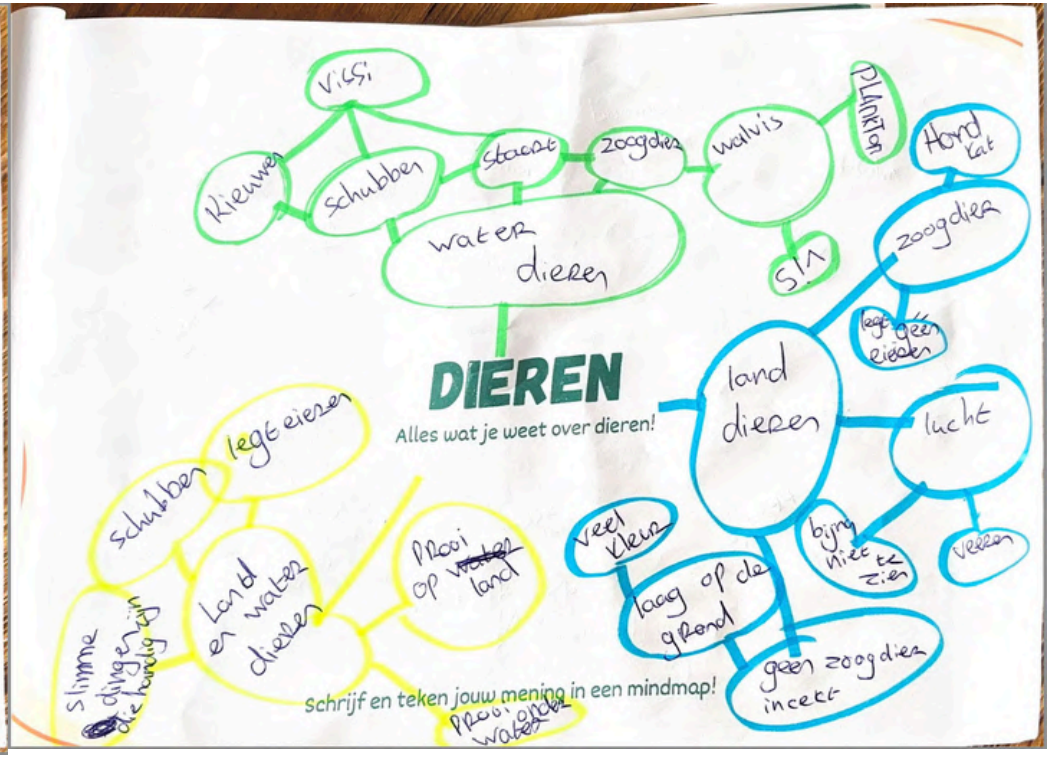
Alles wat je weet over dieren!

gemeen

lief

groot

Schrijf en teken jouw mening in een mindmap!



DIT IS MIJN FAVORIETE...

NATUURPLEK

1 Het voedselbos
2 vlakbij surfmeer huttenbouw plek

omdat.. 1. ik kom daar heel vaak en ik ben daar opgegroeit
2. leuk hutten kan bouwen met vrienden en chillen

DIEREN

1. pinguin
2. cheeta

omdat..
1. grappig en cool hoe ze waggelen
2. cheetha vind ik heel mooi

DIT IS MIJN FAVORIETE...

NATUURPLEK

het hof (een Park)

omdat.. daar een leuke kinder speeltuin is en er is veel groen.

DIEREN

Paard en hond

omdat.. ik zelf een hond heb en paarden vind gewoon mooi.

DIT IS MIJN FAVORIETE...

NATUURPLEK

Het Hof (een park)

omdat.. het naast mijn huis is.

DIEREN

alpaca

omdat.. ze er grappig uitzien

DIT IS MIJN FAVORIETE...

NATUURPLEK

omdat.. Het Bos Het daar mooi is en het er zyn veel dieren door

DIEREN

Parkiet

omdat.. ik ze zelf Fook heBen ze zyn Heel klein

DIT IS MIJN FAVORIETE...

NATUURPLEK	DIEREN
ons huisje in Bosnië langs het meer.	katje
omdat.. het is heel rustig waar je bomen, water, dieren hoort	omdat.. ze heel schattig zijn

DIT IS MIJN FAVORIETE...

NATUURPLEK	DIEREN
omdat.. klantenwond → het is leuk	rode Panda omdat.. ze zijn schattig

DIT IS MIJN FAVORIETE...

NATUURPLEK	DIEREN
De Veluwe omdat.. het al heel oud is (grote dikke bomen), Het Ruikt lekker. Er is ook mooie paarse Heide met grafheuvels je kan er sporen zoeken en wild spotten	① axoltl ② giraffe ③ blauwe vinvis (en andere walvissoorten) ④ Spinosaurus omdat.. ① schattig, roze, lijkt alsof ze lachen. Hij lijkt bijna niet echt ② Omdat mijn lievelingsknuffel een giraffe is ③ grootste zoogdier op aarde, al heeeel oud, super groot Heeft iets misterieus ④ mooiste dino, houdt van vlees, net als ik. mooie kleuren

NATUUR OM ME HEEN

Denk na over je dagelijkse routine. Voor één dag: houd een simpel logboek bij van alle momenten waarop je natuur tegenkomt. Dit kunnen planten, dieren of andere natuurlijke elementen zijn, in en rondom je huis of tijdens een wandeling. Schrijf of teken ze in de tijdlijn.

In onze tuin zie ik in de vijver: kikkers, ruggenzwem-mers, libelle larve en waterplanten.

op de fiets naar school zie ik? Inkel weiland zie ik paarden. Langs de vaart zie ik futen

Na de training terug naar huis zie/hoor ik: Het is donker ik zie niks. Ik hoor de ganzen

OCHTEND
VERTREK VAN HUIS

- De kikker kwaakt en als ik rustig doe blijft hij zitten en kan ik hem goed bekijken. Ineens duikt de kikker onder water en verstopt zich onder de modder op de bodem.

MIDDAG

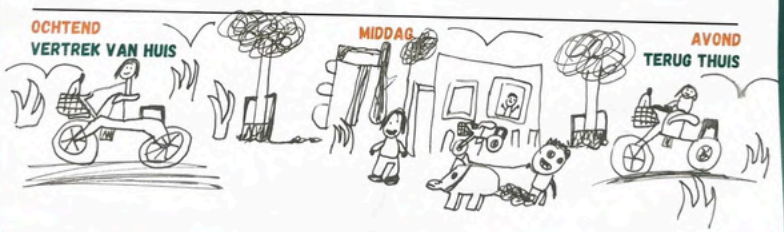
duiken onder het water. De fuut kan een heel eind onder water zwemmen. Plots komt hij weer boven met een vis in zijn snavel. Hij De vis verdwijnt in één keer in zijn keel

AVOND
TERUG THUIS

kwaken in de lucht. De vage schimmen van de eenden dobberen in de sloot.

NATUUR OM ME HEEN

Denk na over je dagelijkse routine. Voor één dag: houd een simpel logboek bij van alle momenten waarop je natuur tegenkomt. Dit kunnen planten, dieren of andere natuurlijke elementen zijn, in en rondom je huis of tijdens een wandeling. Schrijf of teken ze in de tijdlijn.



NATUUR OM ME HEEN

Denk na over je dagelijkse routine. Voor één dag: houd een simpel logboek bij van alle momenten waarop je natuur tegenkomt. Dit kunnen planten, dieren of andere natuurlijke elementen zijn, in en rondom je huis of tijdens een wandeling. Schrijf of teken ze in de tijdlijn.

NATUUR OM ME HEEN

Denk na over je dagelijkse routine. Voor één dag: houd een simpel logboek bij van alle momenten waarop je natuur tegenkomt. Dit kunnen planten, dieren of andere natuurlijke elementen zijn, in en rondom je huis of tijdens een wandeling. Schrijf of teken ze in de tijdlijn.

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

Vaeddelbos zijn paadjes en er zijn bomen en planten die je kunnt eten. Er is water. Ik kom er veel te vaak. Het is een fijne plek om te komen. Het liefst maak ik iets in de boshutten van de Producten die er zijn. En Popcorn maken boven het vuur vind ik erg leuk

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

kippen die heb ik in mijn achtertuin. Ik stil de eieren uit hun hok.
Duiven vliegen over onze tuin en stelen het kippenvoer
Heel soms zie ik een specht in de boom. En andere vogels bijvoorbeeld de Gaai
Een specht is heel bijzonder om te zien. En de bij de Gaai zie ik de mooie blauwe gloed

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

groen, soms ga ik ernaar het licht ook aan het weer en als het echt mooi weer is soms 2x.

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

vogels, soms katten en ook honden. soms kom ik ze tegen.

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens.. ligt eraan wat het weer is en anders 2keer per dag

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens.. honden heel vaak want ik heb een hond en. Vogels ook heel vaak want hier zijn ze overal

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

Bomen, Bosjes, mos en ~~Bloemen~~
Bloemen

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

Vossen ~~Honden~~, Katten en Vogels
Honden

Honden iedere dag
vos zag ik een keer
Kat iedere dag
Vogels ook elke dag

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

- rivier Mes veel bomen en bloemen

Mijn wijk is nieuw en er zijn heel veel bomen gepland.

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

vogels en insecten

ik zie ze idere dag buiten op de bomen en de grond en in de lucht.

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

~~[illegible]~~

ik bezoek niet vaak een natuur -plek.

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

ik zie alleen vaak katten in mijn beurt

IN DE BUURT VAN MIJN HUIS, ER ZIJN...

NATUURPLEK

Hoe ziet het eruit? Hoe vaak bezoek je het? Vertel eens..

Broekpolder : bos, water, wandelpaden Schotse Hooglanders, Houten Speeltuin bloemen : paardebloemen, madeliefjes. struiken.

Midden delfland gebied weilanden, met rechte sloten, wandel en fietspaden. Bloemen langs de sloten

DIEREN

Hoe is het? Hoe vaak kom je ze tegen? Vertel eens..

Schotse Hooglanders → 1x per maand
duiven → dagelijks
ooievaar → 2x per week
Reigers → 5x pw.
zwanen → dagelijks
eenden, meerkoet enz → dagelijks
poezen → dagelijks
insecten zoals slakken, vliegjes, wormen, mug, bijen, lievebeestje. → dagelijks
vlinders → 3x per week

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

Ik vind dat stom want ~~dit~~ de natuur is leuk en heel belangrijk. Het maakt me boos als er bomen worden gekapt, waarom zou je dit laten gebeuren als het zo belangrijk voor je is?"

IK KAN..

Wat kun je doen om ze te beschermen?

- Staken?
- in opstand komen maar dat heeft niet in mijn eentje
- Saboteren de stroop doorhalen
- Ik ben een kind ik weet niet wat ik kan doen, nemen ze mij serieus?
- dingen recyclen en hergebruiken
- biologische producten kopen
- Nadenken over het product waar komt het vandaan?
- ouders informeren zelf kopen

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

ik vind het erg en ik vind het erg voor de dieren.

IK KAN..

Wat kun je doen om ze te beschermen?

je kan zelf bomen of bloemen zaaien in je tuin of in een Park.

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

ik vindt het jammer want dan ~~kan~~ heb je minder natuur Speelplaatsen

IK KAN..

Wat kun je doen om ze te beschermen?

afval uit de natuur halen

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

↓ niet goed omdat ~~ze~~ als er meer Bomen omgaan dan hebben we minder zuurstof

↓ niet blij als al het natuur weg is

IK KAN..

Wat kun je doen om ze te beschermen?

Protesteren en ekstra Planten Planten

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

ik vind het jammer

IK KAN..

Wat kun je doen om ze te beschermen?

geen afval in de natuur gooien

ER IS STEEDS MINDER NATUUR, DAG NA DAG

IK VOEL ME..

Wat vind je ervan? Hoe voel je je?

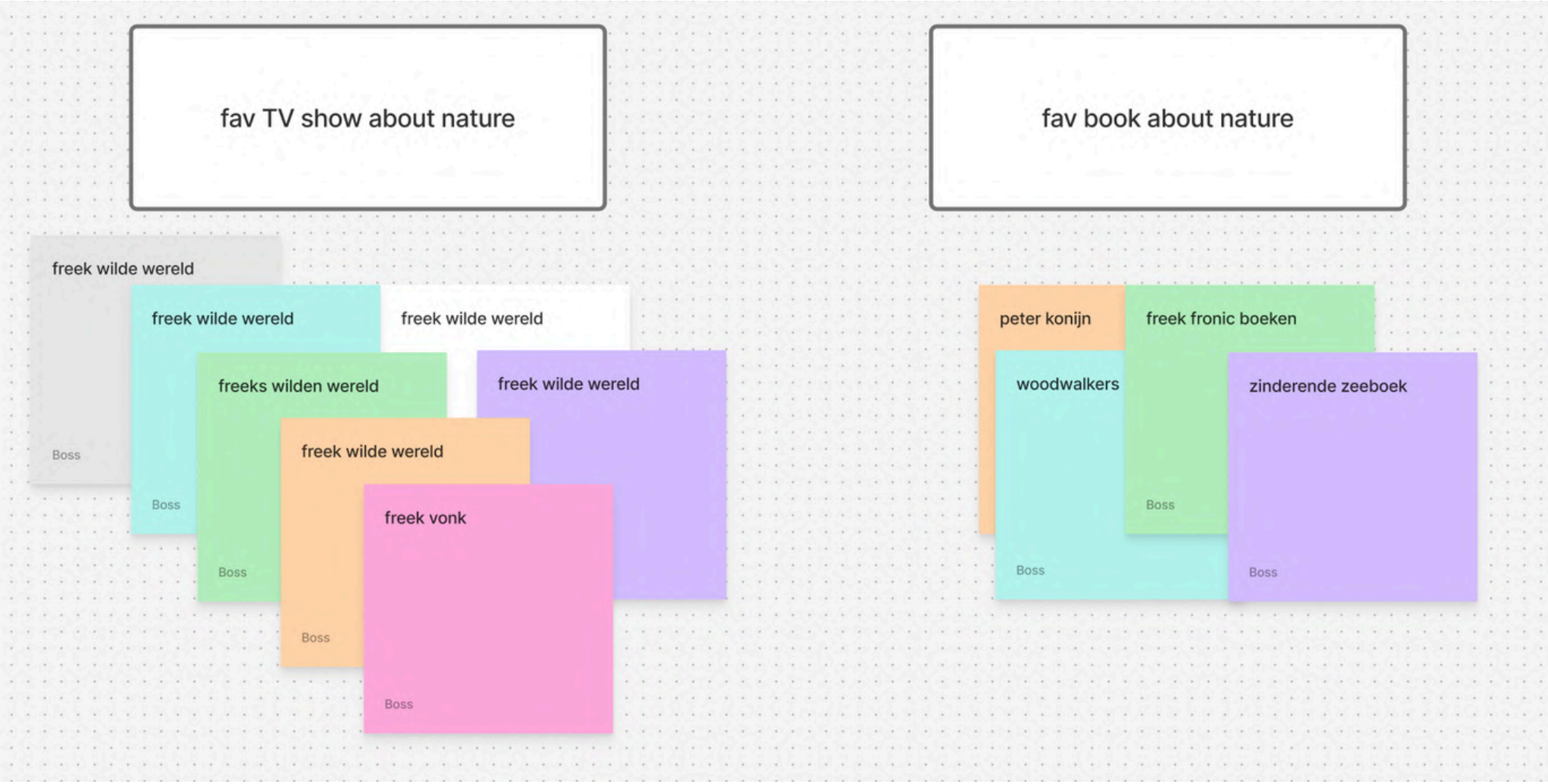
ik vind het stom en ik ben teleurgesteld

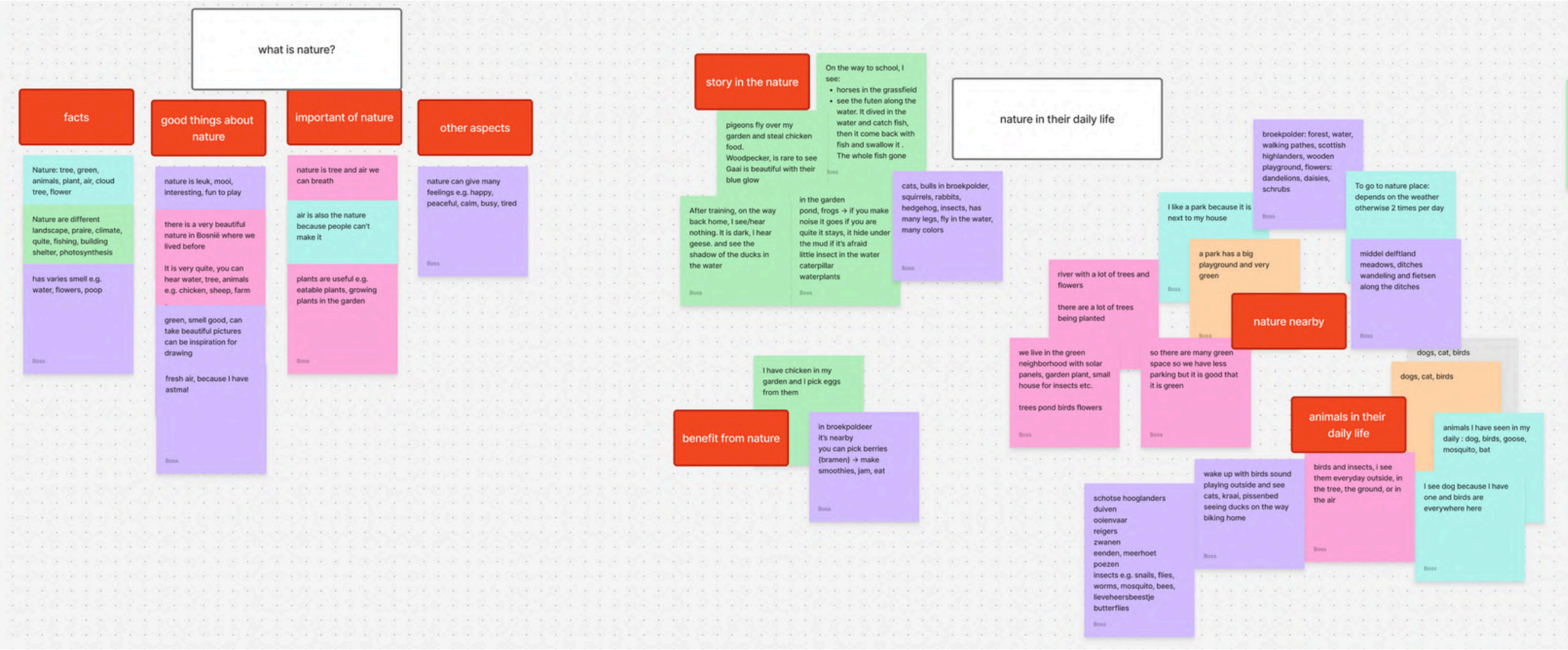
IK KAN..

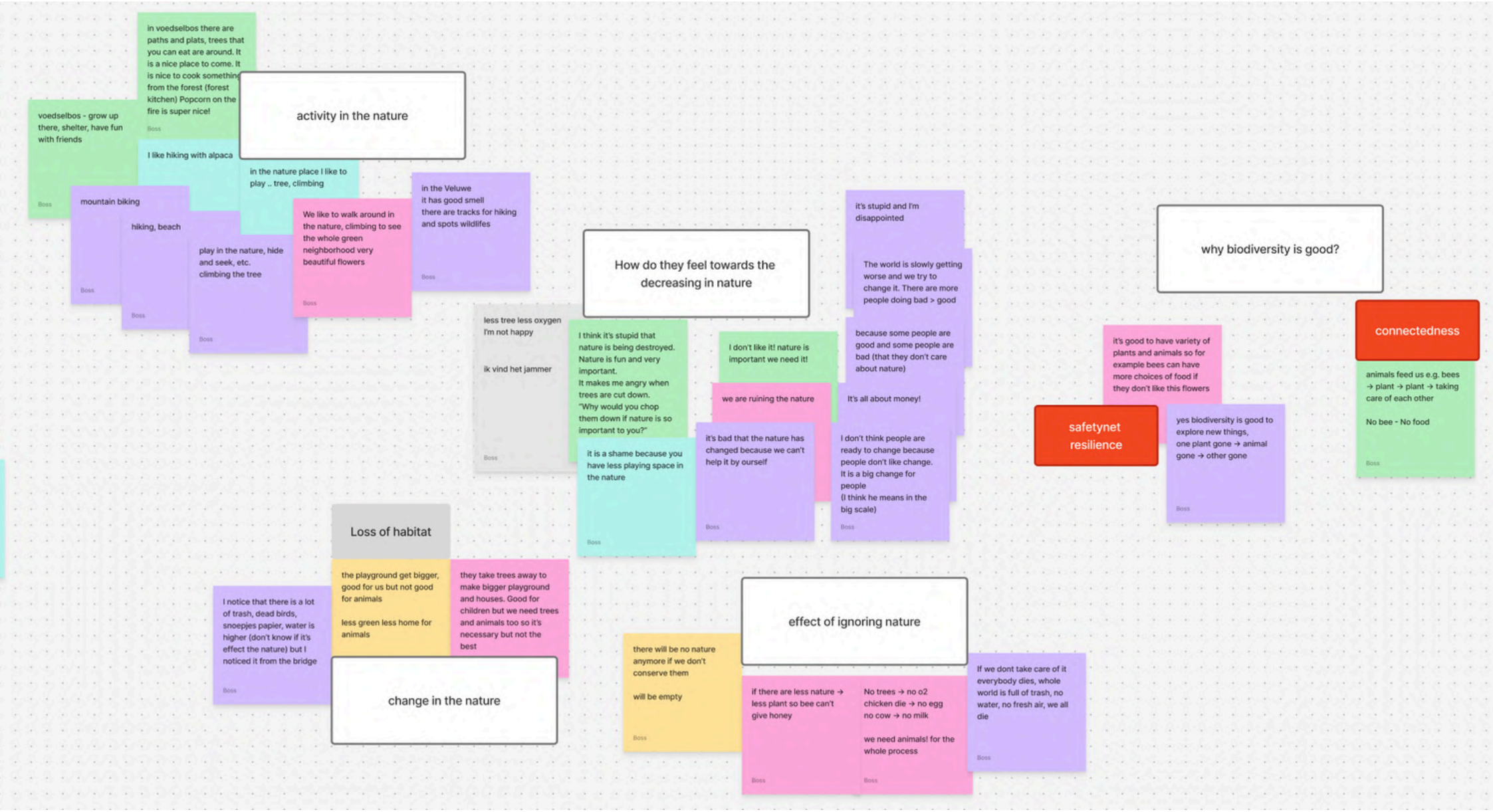
Wat kun je doen om ze te beschermen?

afval opruimen
minder met de auto reizen
of boot of vliegtuig of bromes
afval scheiden
vegetarisch eten
zonnepanelen
elektrisch koken

Cluster from Contextmapping interview




what is nature?
facts
Nature: tree, green, animals, plant, air, cloud tree, flower
Nature are different landscape, praire, climate, quite, fishing, building shelter, photosynthesis
has varies smell e.g. water, flowers, poop
good things about nature
nature is leuk, mooi, interesting, fun to play
there is a very beautiful nature in Bosnië where we lived before
It is very quite, you can hear water, tree, animals e.g. chicken, sheep, farm
green, smell good, can take beautiful pictures can be inspiration for drawing
fresh air, because I have astma!
important of nature
nature is tree and air we can breath
air is also the nature because people can't make it
plants are useful e.g. eatable plants, growing plants in the garden
other aspects
nature can give many feelings e.g. happy, peaceful, calm, busy, tired
story in the nature
On the way to school, I see:
horses in the grassfield
see the futen along the water. It dived in the water and catch fish, then it come back with fish and swallow it . The whole fish gone
pigeons fly over my garden and steal chicken food.
Woodpecker, is rare to see
Gaai is beautiful with their blue glow
cats, bulls in broekpolder, squirrels, rabbits, hedgehog, insects, has many legs, fly in the water, many colors
After training, on the way back home, I see/hear nothing. It is dark, I hear geese. and see the shadow of the ducks in the water
in the garden pond, frogs → if you make noise it goes if you are quite it stays, it hide under the mud if it's afraid
little insect in the water
caterpillar
waterplants
benefit from nature
I have chicken in my garden and I pick eggs from them
in broekpoldeer
it's nearby
you can pick berries (bramen) → make smoothies, jam, eat
nature in their daily life
broekpolder: forest, water, walking pathes, scottish highlanders, wooden playground, flowers: dandelions, daisies, schrubs
To go to nature place: depends on the weather otherwise 2 times per day
I like a park because it is next to my house
a park has a big playground and very green
middel delftland meadows, ditches wandeling and fietsen along the ditches
nature nearby
river with a lot of trees and flowers
there are a lot of trees being planted
we live in the green neighborhood with solar panels, garden plant, small house for insects etc.
trees pond birds flowers
so there are many green space so we have less parking but it is good that it is green
dogs, cat, birds
dogs, cat, birds
animals in their daily life
animals I have seen in my daily : dog, birds, goose, mosquito, bat
I see dog because I have one and birds are everywhere here
birds and insects, i see them everyday outside, in the tree, the ground, or in the air
wake up with birds sound playing outside and see cats, kraai, pissenbed seeing ducks on the way biking home
schotse hooglanders
duiven
ooienvaar
reigers
zwanen
eenden, meerhoet
poezen
insects e.g. snails, flies, worms, mosquito, bees, lieveheersbeestje
butterflies


in voedselbos there are paths and plats, trees that you can eat are around. It is a nice place to come. It is nice to cook something from the forest (forest kitchen) Popcorn on the fire is super nice!
Boss
activity in the nature
voedselbos - grow up there, shelter, have fun with friends
Boss
I like hiking with alpaca
in the nature place I like to play .. tree, climbing
mountain biking
Boss
hiking, beach
Boss
play in the nature, hide and seek, etc.
climbing the tree
Boss
We like to walk around in the nature, climbing to see the whole green neighborhood very beautiful flowers
Boss
in the Veluwe
it has good smell
there are tracks for hiking and spots wildlifes
Boss
How do they feel towards the decreasing in nature
less tree less oxygen
I'm not happy
ik vind het jammer
Boss
I think it's stupid that nature is being destroyed. Nature is fun and very important.
It makes me angry when trees are cut down.
"Why would you chop them down if nature is so important to you?"
it is a shame because you have less playing space in the nature
Boss
I don't like it! nature is important we need it!
we are ruining the nature
it's bad that the nature has changed because we can't help it by ourself
Boss
it's stupid and I'm disappointed
The world is slowly getting worse and we try to change it. There are more people doing bad > good
because some people are good and some people are bad (that they don't care about nature)
It's all about money!
I don't think people are ready to change because people don't like change. It is a big change for people
(I think he means in the big scale)
Boss
why biodiversity is good?
it's good to have variety of plants and animals so for example bees can have more choices of food if they don't like this flowers
safetynet
resilience
yes biodiversity is good to explore new things,
one plant gone → animal gone → other gone
Boss
connectedness
animals feed us e.g. bees → plant → plant → taking care of each other
No bee - No food
Boss
I notice that there is a lot of trash, dead birds, snoepjes papier, water is higher (don't know if it's effect the nature) but I noticed it from the bridge
Boss
Loss of habitat
the playground get bigger, good for us but not good for animals
less green less home for animals
they take trees away to make bigger playground and houses. Good for children but we need trees and animals too so it's necessary but not the best
change in the nature
effect of ignoring nature
there will be no nature anymore if we don't conserve them
will be empty
Boss
if there are less nature → less plant so bee can't give honey
Boss
No trees → no o2
chicken die → no egg
no cow → no milk
we need animals! for the whole process
Boss
If we dont take care of it everybody dies, whole world is full of trash, no water, no fresh air, we all die
Boss

what children think about animals

facts about animals

animals:
some live in the dessert, some have a coat, some is big and small, some live in the forest, some is slow, some has a camouflage color

adaptation (e.g. camouflage)

animals eat, and being eaten

water animals, land animals, land and water animals

they lay eggs,
some are smart in useful things

they have many colors

they prey on land or unde water

blue whale,
biggest sea animals, beautiful, mysterious animals, sometimes it is in the beach, sometimes you found it in the other side of the land

mammals (zoogdier)

funfacts about animals

e.g. owl can turn head 360
wormbats poop is cube
chicken comes from T-rex
birds can fly except penguin, kiwis

thoughts towards animals

beautiful, hair, skin

family of animals foxes cats dogs

animals are dangerous for humans because humans got attacked by them

penguin, funny the way they walk
cheetah, colors, pattern beautiful

some are not smart e.g. staart achterna

hyena, vulture is ugly

all animals are different

people are not much better than animals

fighting

animals are helpful

animals are cute (cats) and helpful for people e.g. bees make honey → tree → there we can have air to breath

animals help ppl e.g. dogs for blind people, horse to ride

inspiration e.g. can learn a lot from them, fly, helicopter

preference on animals

I like sea animals

I like cat because it is cute

I like birds because they are cute and they can fly

I like alpaca because it is funny

horse and dog
- have a dog
- like to ride a horse and it's beautiful

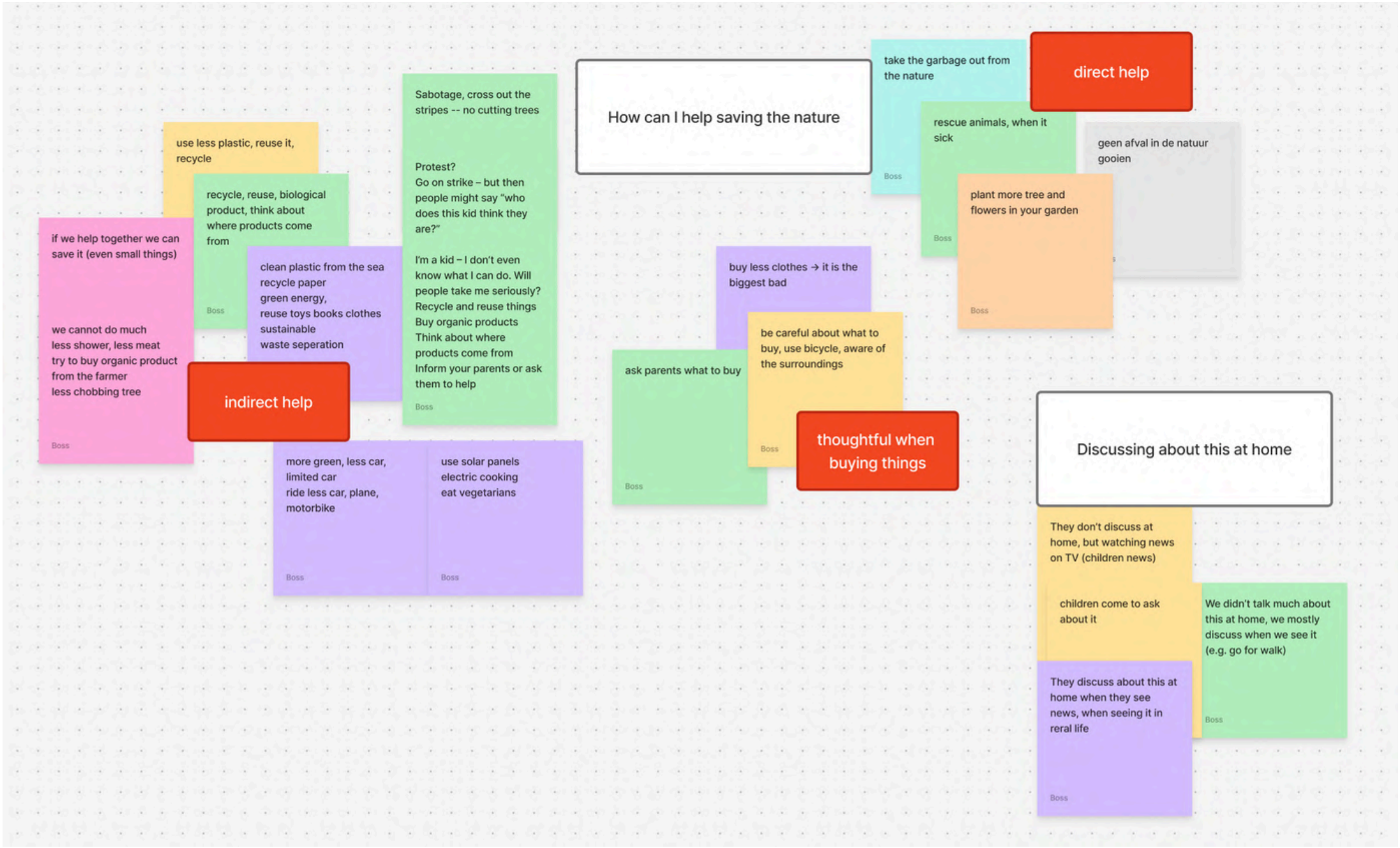
Giraffe because it's my favorite toys

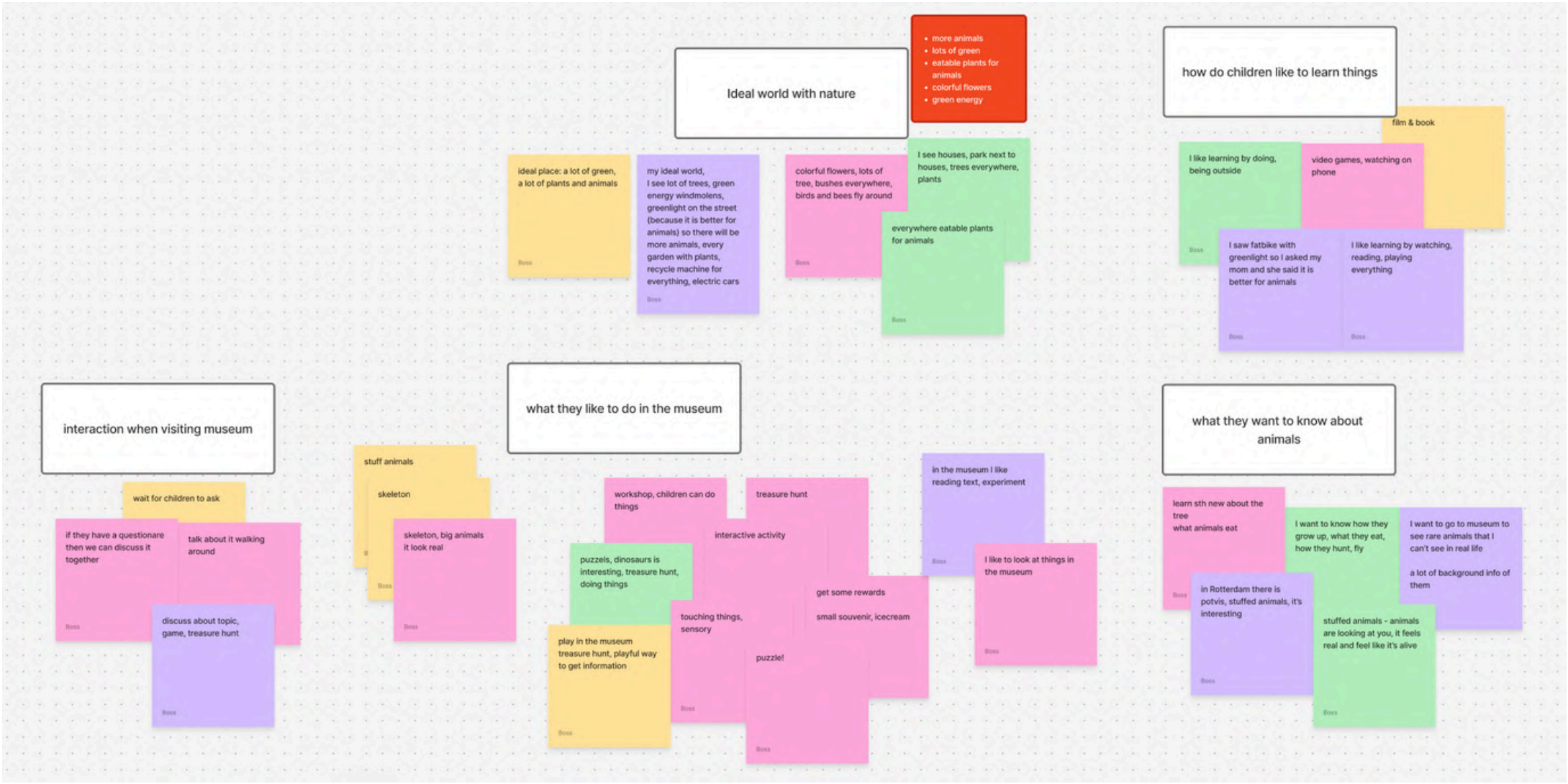
She likes sea animals, it is nice

I like axoltol it is cute, pink, it's like they're smiling and it doesn't look real

I like blue whale because it is the largest mammal on earth, it's something mysterious

I like spinosauraus because it's the most beautiful dino, love meats just like me, beautiful colors


How can I help saving the nature
direct help
take the garbage out from the nature
Boss
rescue animals, when it sick
Boss
geen afval in de natuur gooien
plant more tree and flowers in your garden
Boss
Sabotage, cross out the stripes -- no cutting trees
Protest?
Go on strike – but then people might say "who does this kid think they are?"
I'm a kid – I don't even know what I can do. Will people take me seriously?
Recycle and reuse things
Buy organic products
Think about where products come from
Inform your parents or ask them to help
Boss
use less plastic, reuse it, recycle
recycle, reuse, biological product, think about where products come from
Boss
clean plastic from the sea
recycle paper
green energy,
reuse toys books clothes
sustainable
waste seperation
if we help together we can save it (even small things)
we cannot do much
less shower, less meat
try to buy organic product from the farmer
less chobbing tree
Boss
indirect help
more green, less car, limited car
ride less car, plane, motorbike
Boss
use solar panels
electric cooking
eat vegetarians
Boss
buy less clothes → it is the biggest bad
be careful about what to buy, use bicycle, aware of the surroundings
Boss
ask parents what to buy
Boss
thoughtful when buying things
Discussing about this at home
They don't discuss at home, but watching news on TV (children news)
children come to ask about it
We didn't talk much about this at home, we mostly discuss when we see it (e.g. go for walk)
Boss
They discuss about this at home when they see news, when seeing it in reral life
Boss


Ideal world with nature
more animals
lots of green
eatable plants for animals
colorful flowers
green energy
ideal place: a lot of green, a lot of plants and animals
my ideal world, I see lot of trees, green energy windmolens, greenlight on the street (because it is better for animals) so there will be more animals, every garden with plants, recycle machine for everything, electric cars
colorful flowers, lots of tree, bushes everywhere, birds and bees fly around
I see houses, park next to houses, trees everywhere, plants
everywhere eatable plants for animals
how do children like to learn things
film & book
I like learning by doing, being outside
video games, watching on phone
I saw fatbike with greenlight so I asked my mom and she said it is better for animals
I like learning by watching, reading, playing everything
interaction when visiting museum
wait for children to ask
if they have a questionare then we can discuss it together
talk about it walking around
discuss about topic, game, treasure hunt
what they like to do in the museum
stuff animals
skeleton
skeleton, big animals it look real
workshop, children can do things
treasure hunt
interactive activity
puzzels, dinosaurs is interesting, treasure hunt, doing things
touching things, sensory
get some rewards
small souvenir, icecream
play in the museum treasure hunt, playful way to get information
puzzle!
in the museum I like reading text, experiment
I like to look at things in the museum
what they want to know about animals
learn sth new about the tree
what animals eat
I want to know how they grow up, what they eat, how they hunt, fly
I want to go to museum to see rare animals that I can't see in real life
a lot of background info of them
in Rotterdam there is potvis, stuffed animals, it's interesting
stuffed animals - animals are looking at you, it feels real and feel like it's alive

Interview Script

📣 Introductie van het project
Hallo allemaal! Super bedankt dat jullie meedoen vandaag! Ik ben Boss. Dit project is mijn afstudeerproject. Ik ben een masterstudent aan de TU Delft en ik werk samen met het Naturalis Museum in Leiden.
Ik ontwerp iets om mensen beter te laten begrijpen hoe belangrijk biodiversiteit is, en dan vooral over dieren. Daarom ga ik jullie vandaag wat vragen stellen over de natuur en dieren.

📋 Wat gaan we doen (agenda)
Eerst praten we samen over wat jullie hebben opgeschreven in het boekje.
Daarna praten we over dieren in de natuur en wat jullie daarvan vinden.
En tot slot hebben we het over hoe jullie het vinden om naar een museum te gaan.

🧠 Hoe werkt het?
Alles wat jullie zeggen is anoniem. Niemand zal weten dat het van jou komt.
De vragen zijn open, dus er zijn geen foute antwoorden. Je mag gewoon zeggen wat jij denkt!
Deze sessie wordt opgenomen: met geluid, foto's en misschien een video. Maar geen zorgen: alles wordt alleen voor dit onderzoek gebruikt.

✅ Toestemming
Als je een vraag niet wilt beantwoorden, dan is dat helemaal oké — je mag altijd een vraag overslaan.
Heb je nu al een vraag voor mij?
En vanaf nu praten we in het Engels, maar je mag ook gewoon Nederlands praten als je dat fijner vindt. Je ouders kunnen je helpen met het vertalen als dat nodig is.

Zijn jullie er klaar voor?

Talking about booklet
Explain what is nature, and what do you know about animals?
What is your favorite animals? Why do you like it?
(go through the booklet)

Wat vinden jullie leuk aan de natuur in jullie buurt, of in jullie dagelijkse leven?
What is the nature-related activity that you guys like to do together
You both mentioned enjoying [activity/place]. Can you tell me what makes it special for each of you?

Do you notice if the nature around your living place, home, has any changed? how is it? how do you feel about it?
Do you think it is important to have lots of different types of plants and animals? why?
How do you feel about the changes happening in natural environments?
Do you discuss these topics at home?
(Parent) Do you have the same or different perspective about this?

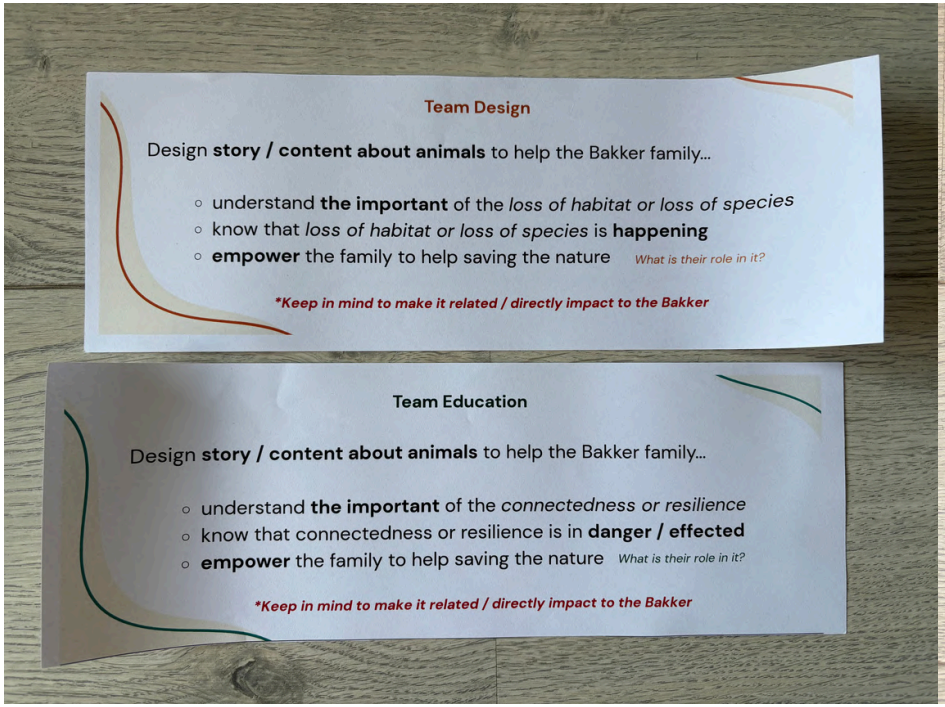
What do you think how the world will be if we don't take any action to protect animals and nature?
If you could help protecting animals or nature, what would you like to do?"
What is your ideal world with nature look like?
(Parent) Do you have the same or different perspective about this?

Do you like learning by watching videos, playing games, or reading books? Which one helps you learn the best?
Have you been to any museum that is about nature, animals?
What impress you the most in that museum?
How do you usually learn or interact in the museum together?
What would make you want to visit a museum exhibit about nature?
What should it include to be make it more interested for both of you? e.g. a lot of game, a lot of activities etc.
Is there anything you want to talk about that I haven't mention about it?

and that's all! Thank you so much for helping!

Appendix F

Brainstorming Session with Naturalis Staff

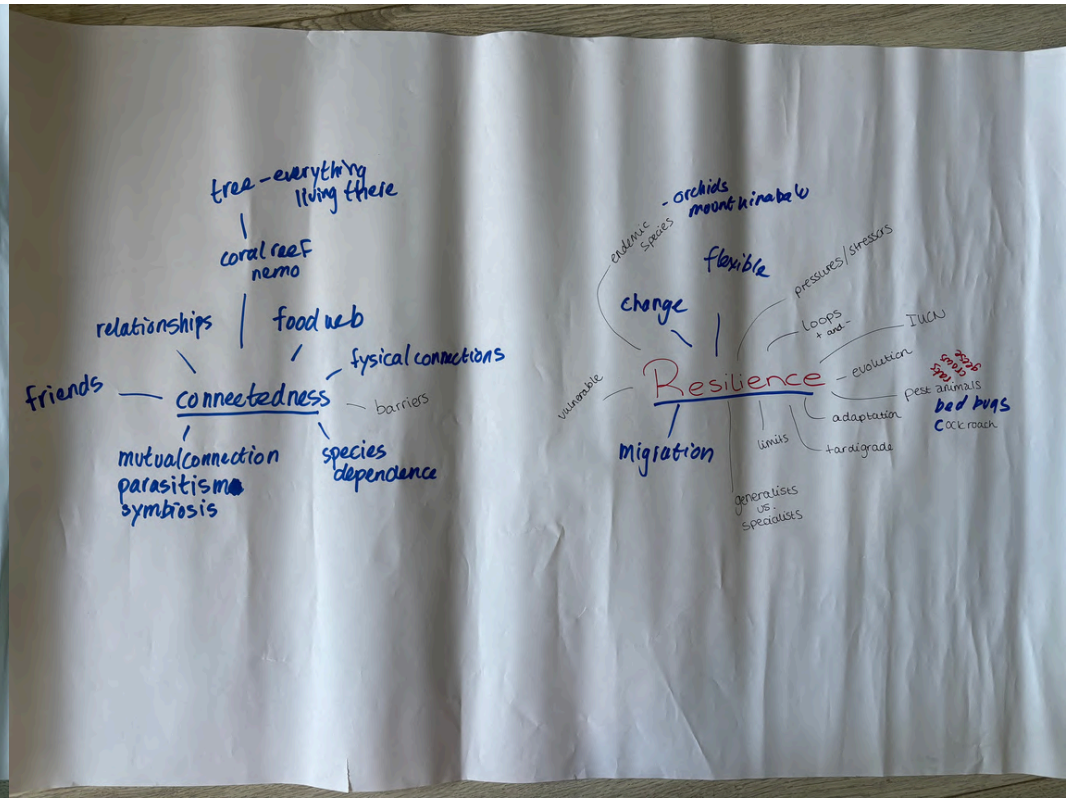


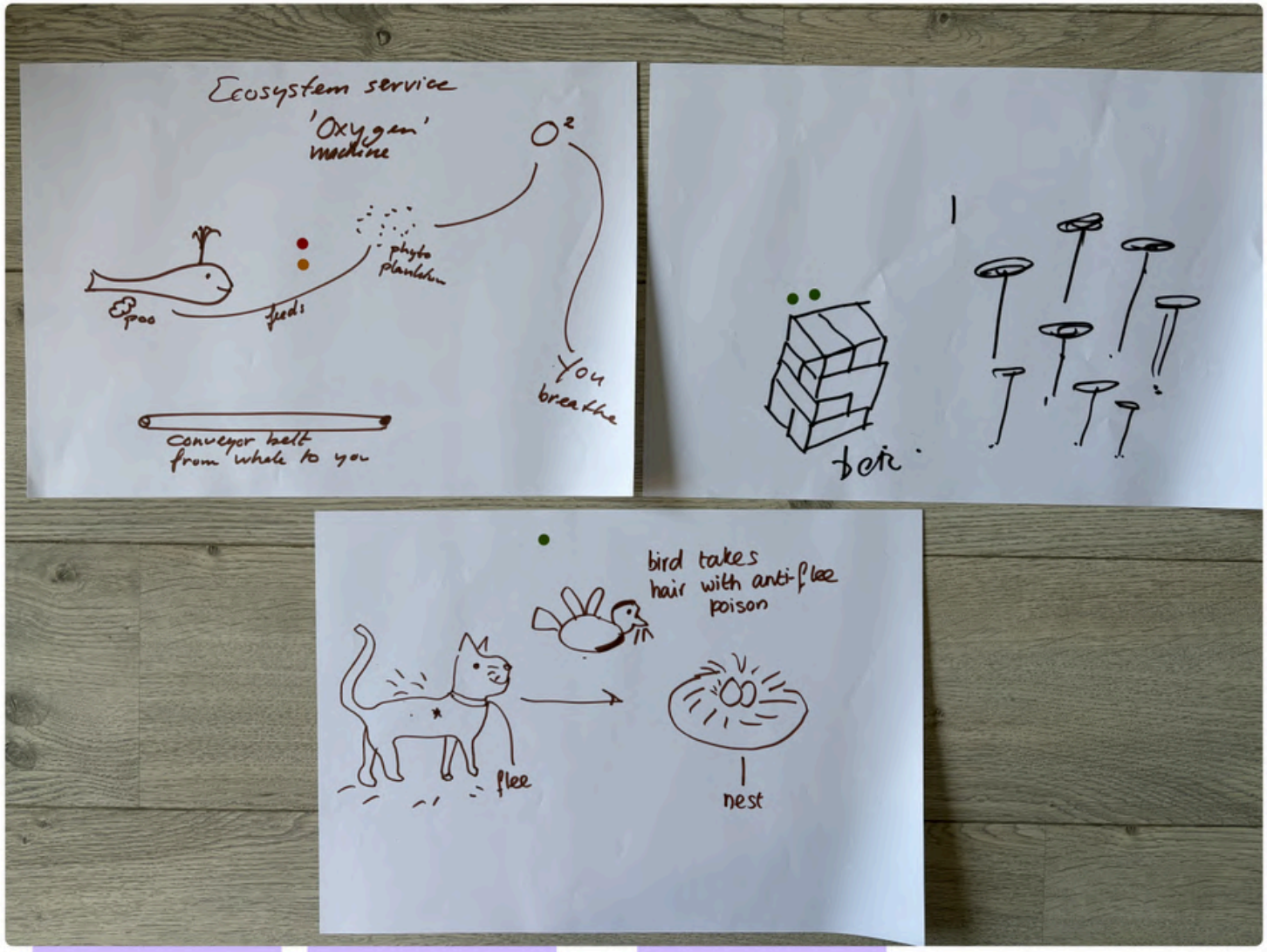
Loss of habitat

* raising of temperature
* agricultural poison
* melting polar ice
* ~~no~~ urbanisation / industrialisation / ~~decline of nature~~ agriculture
* fossile fuels
* Trump / politics
* more people
* acidic oceans
* invasive species
* waste

loss of species

* extinction
* decrease of biomass
* poison
* lack of knowledge about small creatures
* disbalance in ecosystem





Spinning wheels of ecosystem service

- see the whale poops
- algae eat it
- produce o2
- you have to spin fast enough to keep it working otherwise you die

Boss

plate spinning stick

- you have to spin to keep it working otherwise it falls down and break

Boss

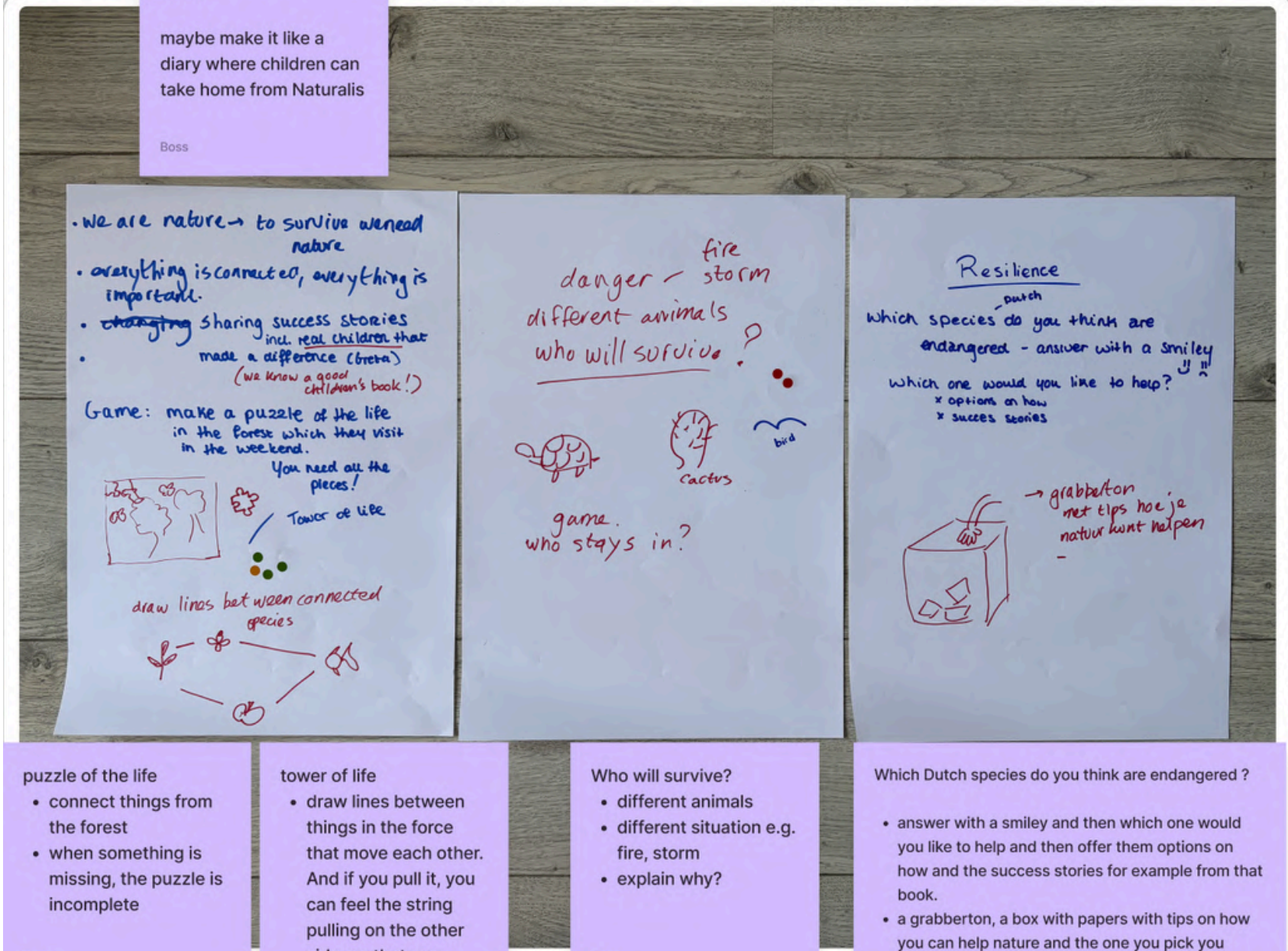
Unexpected changes and negative impacts on nature due to human interventions

- people use flea to protect pet from insects
- birds use the contaminate feather to build nest
- birds die because of poison

sharing success stories book

maybe make it like a diary where children can take home from Naturalis

Boss



puzzle of the life

- connect things from the forest
- when something is missing, the puzzle is incomplete

Boss

tower of life

- draw lines between things in the force that move each other. And if you pull it, you can feel the string pulling on the other side, so that you know you're connected to that person or that animal, which it represents.

Boss

Who will survive?

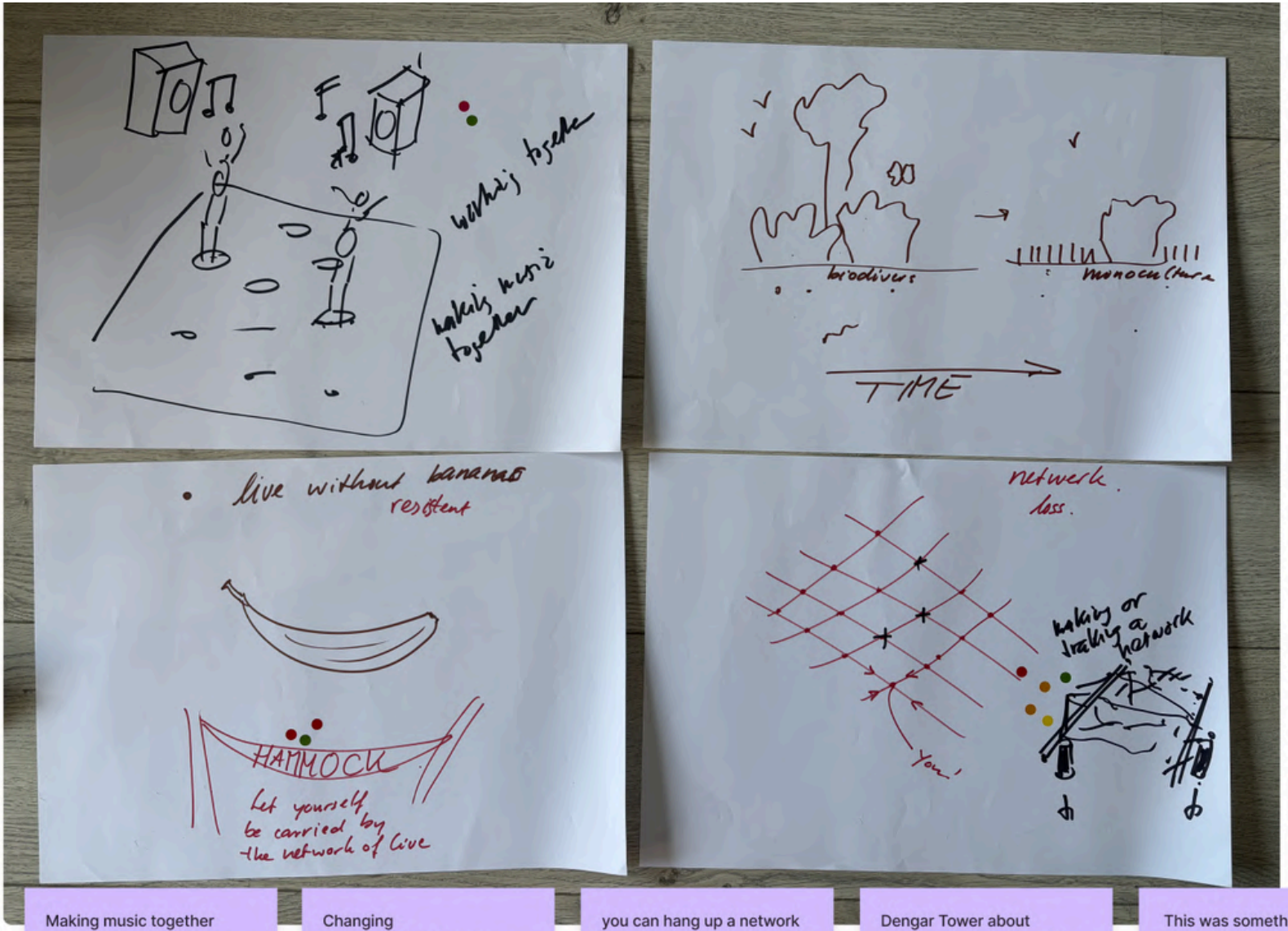
- different animals
- different situation e.g. fire, storm
- explain why?

Boss

Which Dutch species do you think are endangered ?

- answer with a smiley and then which one would you like to help and then offer them options on how and the success stories for example from that book.
- a grabberton, a box with papers with tips on how you can help nature and the one you pick you actually have to do or you can give it away for a challenge to someone else

Boss



Making music together

- stand on the sensitive plates on the floor and working together to get a nice music or orchestra or sound of the forest

Boss

Changing

- time slider to see how the biodiversity has changed during each time

Boss

you can hang up a network hammock in naturalis and say let yourself be carried by the web of life and then if you pull out too much strings you will fall out.

Boss

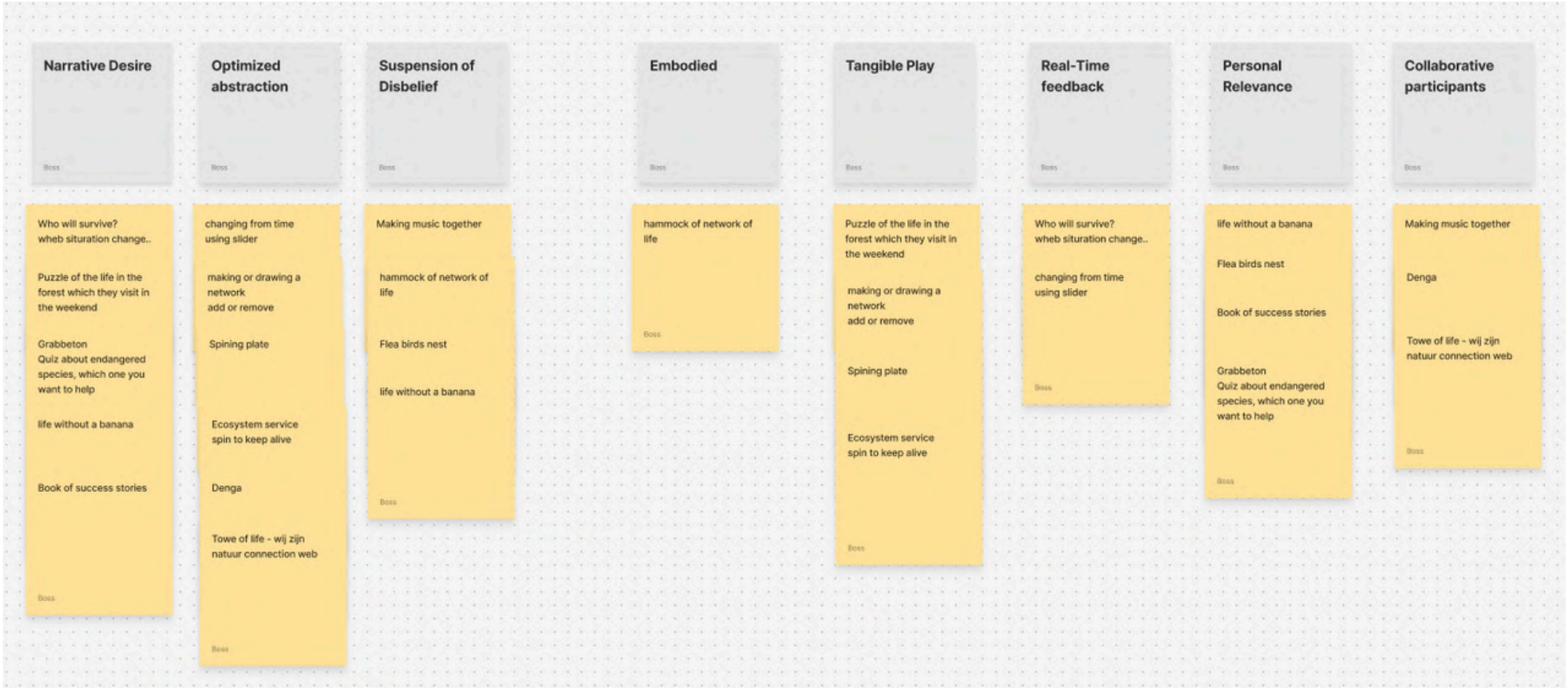
Dengar Tower about biodiversity if you change one element maybe that this thing the thing will still stand up straight but after a while if you if you put out too much it will collapse.

Boss

This was something about a network a network how everything is connected to each other and this is something like also a network and then with weights on it so there's a lot of fragile lines between it and you can add one you can add a few or you can remove few but after a while the the the wave will fall down and will fall on your feet and then shit happens.

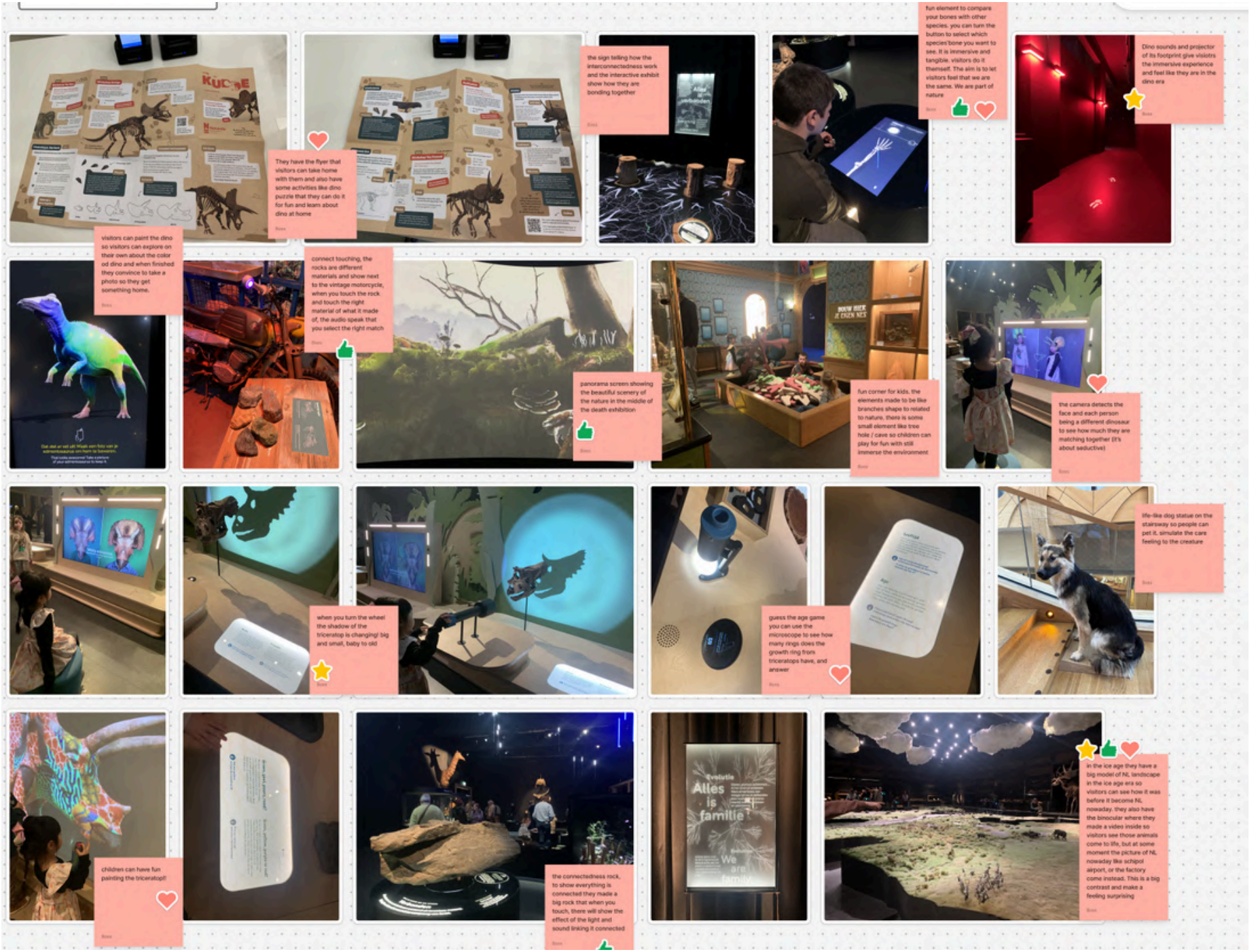
- Endangers species

Ideas clustering based on framework

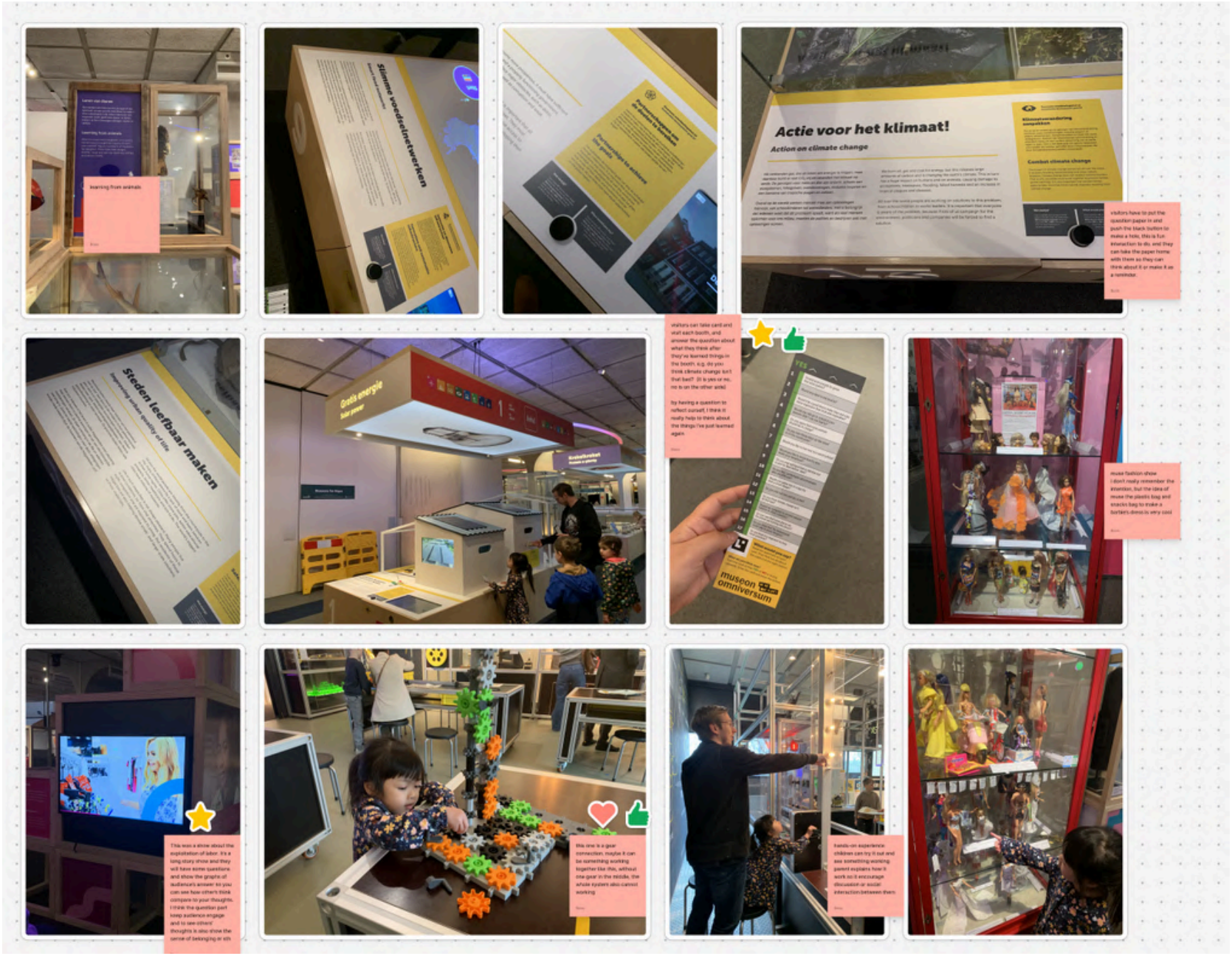


Appendix G

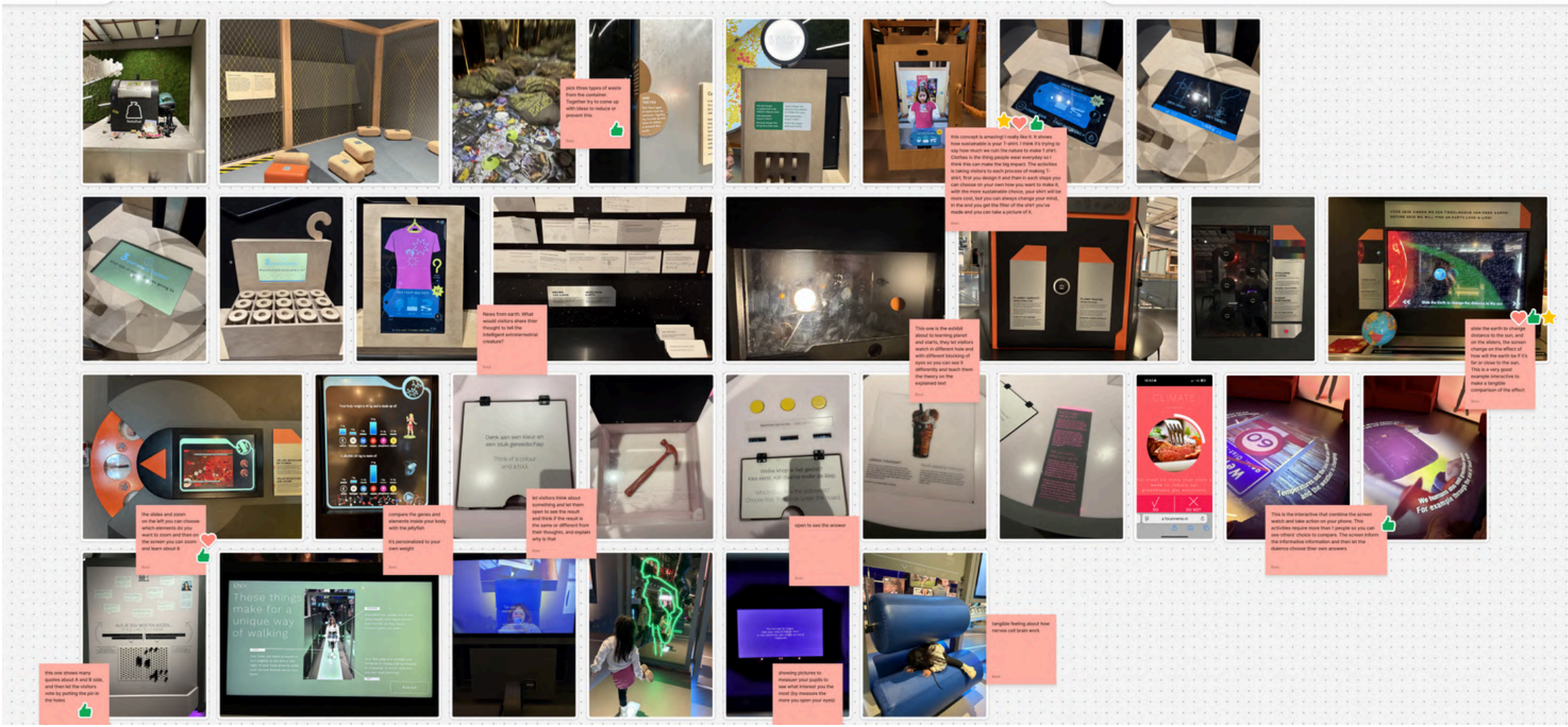
Museum Visit – Naturalis



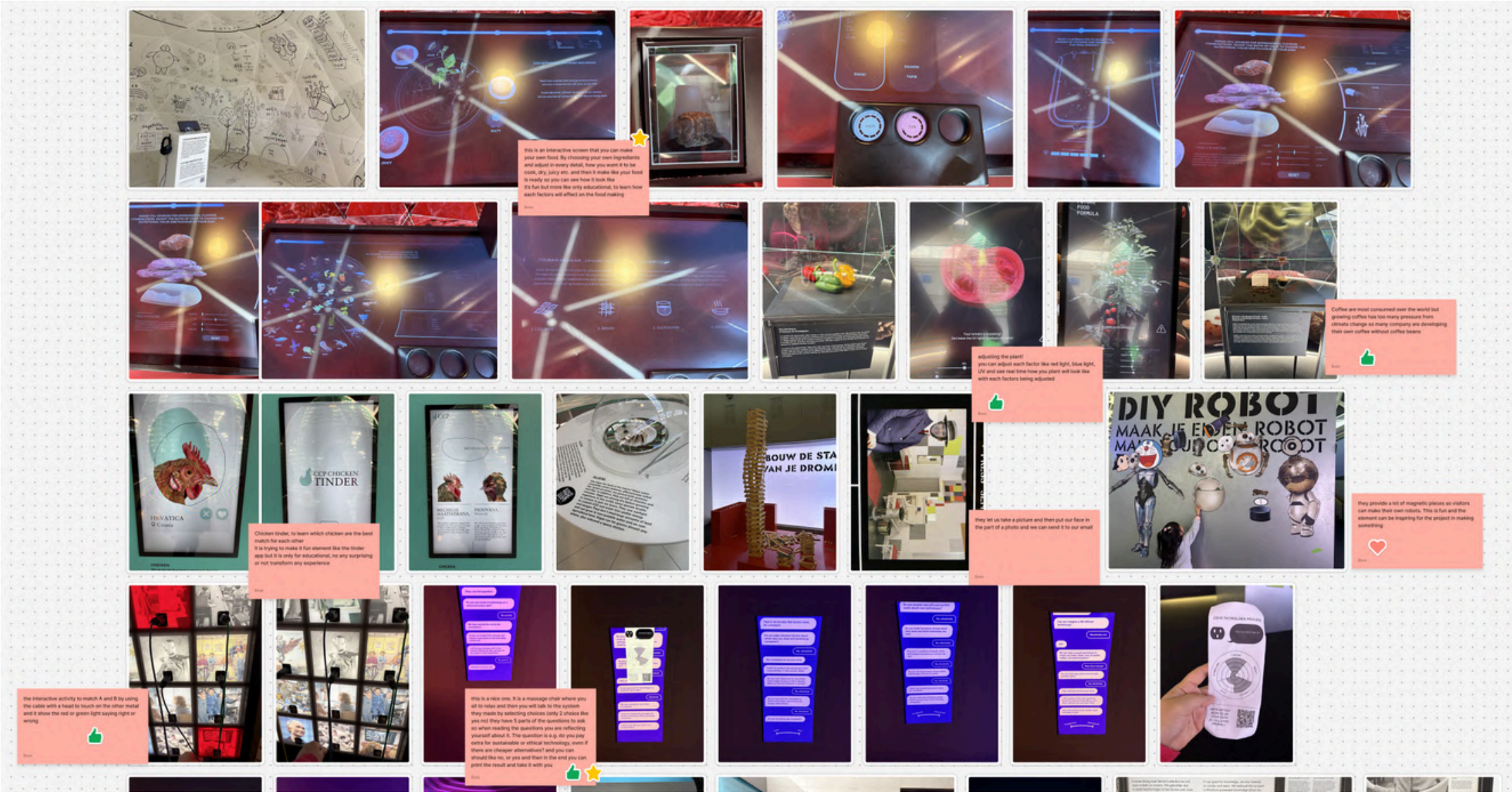
Museon


learning from animals
Slimme voedselnetwerken
Actie voor het klimaat!
Action on climate change
Steden leefbaar maken
Gratis energie
museon omniversum

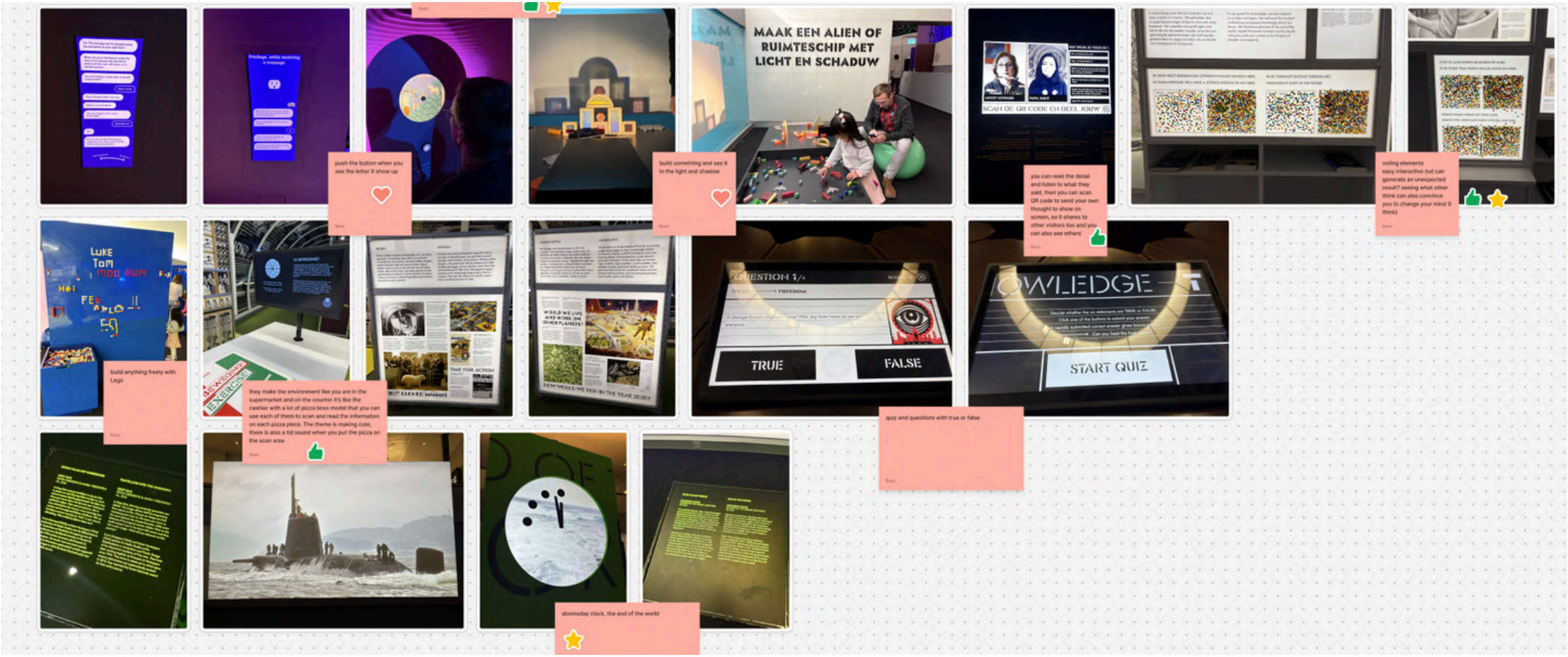
Nemo Museum


pick three types of waste from the container. Together try to come up with ideas to reduce or prevent this
this concept is amazing! I really like it. It shows how sustainable is your T-shirt. I think it's trying to say how much we ruin the nature to make 1 shirt. Clothes is the thing people wear everyday so I think this can make the big impact. The activities is taking visitors to each process of making T-shirt, first you design it and then in each steps you can choose on your own how you want to make it, with the more sustainable choice, your shirt will be more cost, but you can always change your mind, in the end you get the fitter of the shirt you've made and you can take a picture of it.
News from earth. What would visitors share their thought to tell the intelligent extraterrestrial creature?
This one is the exhibit about to learning planet and starts, they let visitors watch in different hole and with different blocking of eyes so you can see it differently and teach them the theory on the explained text
slide the earth to change distance to the sun, and on the sliders, the screen change on the effect of how will the earth be if it's far or close to the sun. This is a very good example interactive to make a tangible comparison of the effect
the slides and zoom on the left you can choose which elements do you want to zoom and then on the screen you can zoom and learn about it
compare the genes and elements inside your body with the jellyfish
it's personalized to your own weight
Denk aan een kleur en een stuk gereedschap
Think of a colour and a tool
let visitors think about something and let them open to see the result and think if the result is the same or different from their thoughts, and explain why is that
open to see the answer
CLIMATE
This is the interactive that combine the screen watch and take action on your phone. This activities require more than 1 people so you can see others' choice to compare. The screen inform the informative information and then let the dulence choose thier own answers
these things make for a unique way of walking
this one shows many quotes about A and B side, and then let the visitors vote by putting the pin in the holes
showing pictures to measuer your pupils to see what interest you the most (by measure the more you open your eyes)
tangible feeling about how nerves cell brain work

The Next Nature



The Next Nature



Beeld en Geluid