UNIVERSITY OF OSLO
Department of informatics

Our World

A Project for the Oslo Barnemuseum

By Marie Mjåseth, Miran Damjanovic, Jostein F. Malde, and Siril Bolstad

mariemj@student.matnat.uio.no, mirand@student.matnat.uio.no, josteifm@ifi.uio.no, sirilbo@ifi.uio.no

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Table of Contents

1. Introduction

Our report is based on the main three components in interaction design: understanding users, design, prototyping, construction, and evaluation. These subjects cover a typical design process, as described in the book *Interaction Design: Beyond Human-Computer Interaction* (Preece, Rogers, Sharp, 2007).

Interaction Design is not a linear design process. The process is neither identical nor equal for various products. Depending on what we are designing, it will be necessary to study different chapters in the book.

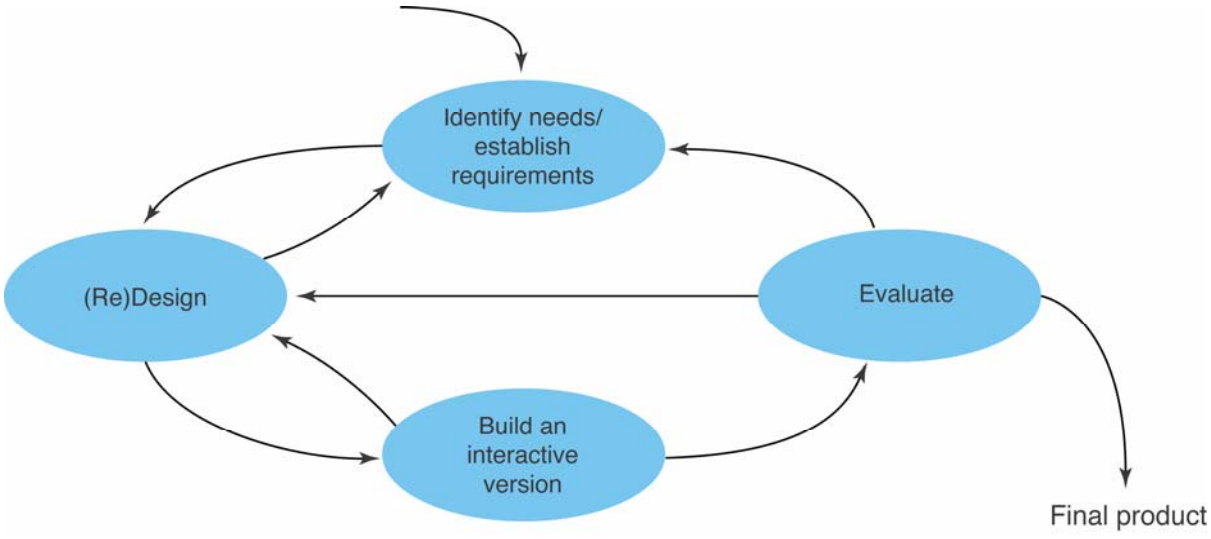
Three of four group members mainly have an IT background. The reason for choosing the project for Oslo Barnemuseum was that we had to think in quite another way than we are used to. Beside, it would also be the most challenging project to be working on, since it involves children; no one on the group has particular experience with this user group. Since financing the project was not an assumption, we could really challenge our self and be creative and not worrying about the costs.

We intend to create a visual simulator for children. The simulator will let the children explore the world, presented by a big globe; it will be a kind of a world tour. The surface of the globe will consist of a touch surface in order for the children to be able to select a country or an ocean. Each country and ocean will be represented with symbols associated with that particular area of the world. When selecting a country or an ocean a video will be played; together with sound and smell this will make the experience for the children more real.

1.1 The Process of Interaction Design

There are four basic activities in interaction design: (1) Identifying needs and establishing requirements for the user experience, (2) Developing alternative designs that meet those requirements, (3) Building interactive versions of the design so that they can be communicated and assessed, and (4) Evaluating what is being built throughout the process and the user experience it offers (Preece, Rogers, Sharp, 2007, page 17). We have used these activities working with Our World.

All the mentioned activities above can be summarized in the lifecycle model (Preece, Rogers, Sharp, 2007, page 448).



2. Understanding Users

2.1 Understanding How to Design for Children

As mentioned earlier, our focus group is children between six and 12 years of age. Before moving on in developing our system, we have to gain an extensive understanding of what lies beneath the development of a system which purpose is to interact with children. Through our project – Our World – we wish, in a different and funnier way, to provide the children with insight and education about the world in which they live in. We wish to develop an application that will give away a different learning experience than those found in a classroom setting. In this accomplishment we (as interaction designers) have to acquire an understanding of how the chosen group of users experience and learn new things. We need to gain a certain insight in how the children will react and interact in meeting the system in addition to put to life a "world" that respond to our goals and expectations.

According to cognitive theories of learning, the individual is actively engaged with all of its intellectual property, through interpreting what is happening, developing hypothesizes about which connections that exist and what is leading to what (Kaufmann & Kaufmann, 2005, page 188). Emphasizing that humans are not passively, acquiring beings receiving sense impressions from their surroundings, but that they through their activities, and by themselves, are constructing their understanding of the world around them (Säljö, 2003, page 57). "Å utvikle seg kognitivt er å gjøre erfaringer som korrigerer ens verdensbilde og dermed utvikler intellektet" (Säljö, 2003, page 61).

The book *Interaction Design: Beyond Human-Computer Interaction* also (Preece, Rogers, Sharp, 2007) emphasizes the importance of knowing the cognitive aspects of your users in making good design, underlining such concepts as attention, perception and recognition, memory and learning (Preece, Rogers, Sharp, 2007, pages 94-111). One shall develop a design and an interface that evoke the attention of the user and that direct it towards the right things. When it comes to children, their attention and interest, especially during learning purposes, can be difficult to get a hold on. Stimulating the children's different senses, through extensive use of color, sound, smell and so on will make this easier. One should still be careful of exaggerating (Preece, Rogers, Sharp, 2007, page 95). By providing the system with a "clean" interface with understandable symbols collected from the real world, we wish to make interacting with the system as easy as possible for the children (Preece, Rogers, Sharp, 2007, page 99). Through this we have made our way in to attention and the fact that the context in which the children is harvesting new experiences and learning, is very crucial for their learning benefit in the given situation. The context is very important in affecting our memory. It is easier for the human brain to recall rather than remembering things. As humans, we are very good at storing visual hints from a given situation, then later on being able to feel familiar in a similar situation (Preece, Rogers, Sharp, 2007, pages 101).

Concerning children, these things are additionally intensified. Therefore, our wish is to use our system to stimulate several of the children's senses, in this way provide them with hints that will support them in later and perhaps similar occasions. To make this process of recalling easier, we want to make Our World as real as possible. It is important for us to provide the children with a place in which they can feel familiar. We also want them to be able to see parallels between the world they meet in the Oslo Barnemuseum and the world they know (and will meet) outside, and in this way learn through their interaction with Our World. This is also similar to the cognitive perspective of learning, where one regard learning as an active process of construction where the child receive information, interpret it, add or supplement it (and possibly reorganizes) to its mental models, and conform to new experience (Preece, Rogers, Sharp, 2007, page 101; Säljö, 2003, pages 59-60). "Å utvikle seg kognitivt er (…) å gjøre erfaringer som korrigerer ens verdensbilde og dermed utvikler intellektet" (Säljö, 2003, page 60).

Another very important perspective within theories of learning is the sosiocultural perspective of learning. In this perspective one regard learning as a collective social process (Erstad, 2003, page 4). Our fellow-beings help us, often unconsciously, to understand how the world works and how it is supposed to be understood; the world around us is interpreted in corporate and collective human enterprises (Säljö, 2003, page 67). Thus, humans learn in interaction with others. Through the cognitive theory of learning we learn that children shall be allowed to be active, to discover things on their own and they shall be allowed to be directed by their own curiosity – exploration lay down the foundation for understanding (Säljö, 2003, pages 59-60). In the sociocultural perspective of learning it is added to the cognitive comprehension, a perception that learning primarily is social and that participation, interactions and collaboration with other children and adults is formative for learning to take place. The child learns through interaction with others – through, among other things, see how others "do it" (Säljö, 2003, page 67).

Anna Sfard presents these two perspectives of learning in a slightly different manner; through two metaphors of learning. Respectively, she calls them "the acquisition metaphor" and "the participation metaphor". The participation metaphor describes the situated perspective and sociocultural learning; in this metaphor the focus lies on contextualized practice – community, solidarity and collaboration – instead of regarding knowledge as private property that is within the mind of each individual. The acquisition metaphor, which represents the cognitive perspective, does on the other hand just that. In this metaphor, learning is understood as the individual is acquiring something (knowledge), which thereafter becomes the property of the individual (skills) (Bråten, 2002, pages 17-18). Sfard is saying that a combination between the two would be an advantage. She suggests that we have to regard the cognitive and the situated perspective as two complementary perspectives that together will provide a more complete picture of human learning (Bråten, 2002, page 19).

2.2 Defining the User

Beneath we have defined our user, the person intended to use our interactive product. With the term "children" we, of course, mean both boys and girls.

Our user will be:

- A child in the age of six to12 years old.
- A child from Norway with a Norwegian background.
- A child from Norway with a multi cultural background.
- A child from abroad on holidays in Norway (not understanding Norwegian).
- A functionally disabled child. With the term "functionally disabled" we mean a child that need to use a wheel chair or walk on crutches.
- A child that have reduced sight, are blind, partially hearing, and deaf.
- A child with psychical disablements as for instance, Down's syndrome and autism.

2.3 Our Assumptions

Beneath we have defined our assumptions. Unfortunately, it is necessary to restrict our project due to the limited time to the delivery of the Mid Term Report.

Our assumptions will be:

- Children from abroad will recognise their place of birth in the way that their country's flag will be displayed on the globe.
- We claim that the majority of the children will be from Norway; therefore the countries and oceans on the globe will be written in Norwegian.
- The functionally disabled children need to have with them a parent.
- The children with reduced sight or that are blind need to have with them a parent.
- Children younger than the age of six are recommended to have with them a parent.
- Children that are afraid of loud sounds will have the possibility to wear headphones.
- Children that are reacting on awful smells are not recommended trying out the simulator.

2.4 Usability Goals

Usability is regarded as ensuring that interactive products are easy to learn, effective to use, and enjoyable from the user's perspective. Usability is broken down into the following goals: (1) Effective to use (effectiveness), (2) Efficient to use (efficiency), (3) Safe to use (safety), (4) Having good utility (utility), (5) Easy to learn (learnability), and (6) Easy to remember how to use (memorability) (Preece, Rogers, Sharp, 2007, page 20).

2.4.1 Effectiveness

- Will the product be inspiring and educational for children to use?
- Will the product help make children understanding the world around them?
- Will the product be fun for children to play with?
- Will the product help children developing their creative thinking and self-confidence?

2.4.2 Efficiency

- Will the product be easy for children to learn?
- Will the product be educational for children?

2.4.3 Safety

- Are there any possibilities for children to cause errors?
- What kind of feedback will the product give to help children if they are doing something wrong?
- Are there any chances that the product could be moved or overturned so children can be injured or hurt?
- Are there any chances that any part of the product could start a fire or something due to electronic equipment as part of the product?

2.4.4 Utility

- Does the product provide an appropriate set of functions that will enable children to carry out their tasks in the way they want to?

2.4.5 Learnability

- Is it possible for children to work out how to use the product by exploring the interface and trying out actions?
- How hard will it be for children to learn the whole set of functions in this way?

2.4.6 Memorability

- Will it be easy for children remember how to use the system from time to time?
- Will some kind of interface support be provided to help children remember how to carry out tasks?

3. Design

3.1 Design Principles

Design principles are used in interaction design to aid the interaction designers thinking when designing for the user experience. Design principles are derived from a mix of theory-based knowledge, experience, and common sense. They are, however, not intended to specify how to design an actual interface, but act more like triggers to designers; ensuring that they have provided certain features at an interface (Preece, Rogers, Sharp, 2007, page 29).

The best known are concerned with how to determine what users see and when carrying out their tasks using an interactive product. We have focused on the most common ones: visibility, feedback, constraints, consistency, and affordance (Preece, Rogers, Sharp, 2007, page 29).

3.1.1 Visibility

The visualization of the globe is the most powerful aspect of our project. It is the centre for interaction and communication with the system. Making the globe with a touch surface and inserting projectors inside make it truly a vision in itself. With the movement of the seas and graphical effects of the mainland it is very easy for the users to understand what they have to do i.e. touch the big globe! Having in mind that we are designing this globe for children, the visual effects are very important, or otherwise it will soon be boring for the intended users. In this way we achieve a highly visible controlling device which is intuitive to use. The interaction parts of the globe are not visible for the user, but the main purpose of the installation is for children to explore and play. A sign with a simple symbol like a hand touching the globe may be enough for the users to understand how to interact with it and trigger the videos and so on.

3.1.2 Feedback

The problem with feedback is here not very clear. The problem would arise if a user pressed on an area on the globe which is not associated with any video. We have worked out the following solution: a circle around the users' finger, indicating that what he does is recognized. When the finger slides across the surface, and hits a hotspot, the circle could change colour, the area could be highlighted or a sound could be played. The simulator is constructed in a way that when the user doesn't do anything, either nothing will happen.

The whole idea behind the simulator is for it to be exploratory, thereby encouraging the users to explore whole new and remote areas to "see how it is up there". When the system has been idle for a period of time, a "screensaver" is displayed to indicate that it is ready for interaction.

3.1.3 Constraints

In our design of this simulator we have had a number of constraints. The first problem was that we wanted to use projectors instead of screens to display the videos. This solution is much cheaper, but since we have the globe in the middle of the room, it would create shadows; places on the screen where nothing shows. The projectors could also be positioned outside the room, making a "cave", but this way the space needed would triple.

Another constraint was which videos we would be able to display. The facts about economy or war scenarios we meant would not be appropriate for our audience. We settled with more cultural and educational consistency.

We also designed the system to only show one video at any given moment. Imagine the chaos if the video changed immediately someone touched the screen.

As described in the feedback section, the indicator around the users' finger has a different colour when the user is touching an area which has an action. The globe may also get a different colour scheme when an action is performed, which indicates that the system is doing something else, but also lets the users continue to play with the globe. Turning the globe dark or something else that would make the children loose interest is an unwanted reaction.

3.1.4 Consistency

Taking our user group in mind, we wanted to create the system in a way that the users easily feel familiar with. We try to reflect actions that they perform in their everyday lives. What better to use than a lot of colours, sounds, smell and shapes? The children, aged from six to 12 surely like to touch and explore, here the touch surface play a central role in our design of the globe. Making the operation of the globe as easy as possible, the only interaction is touch the globe, navigate your finger across the surface to the desired point, tap or hold the finger for a moment, and the action associated with the spot starts playing. Other modes require other interactions, but it all comes down to point and click interface which is very intuitive. After a few minutes of play everyone could be a champion.

Also very important here are the symbols and names associated with each country or area. Taking the youngest users in mind, we have provided symbols especially for the country they represent. In this way we hope the children will associate the symbols with countries, and learn about it from videos displayed. For the bit older users, who probably can read, there are the true names provided.

3.1.5 Affordance

We assume that the affordance of our globe is perceptually obvious. We strongly believe that the users will know what to do with it once they approach the globe. Since our globe is physical, it has a **real affordance**, even if the logic behind it mostly virtual. It is the globe the users will interact with, and not the underlying software. On the other hand we can also argue that our globe has a **perceived affordance**, learned conventions, since it has a screen-based interface.

3.2 Designing the Visual User Interface

The simulator will provide an experience for the children, a kind of a world tour. The globe will consist of a touch surface in order for the children to be able to make their choices; select an area of interest. This action will trigger an event that will play a video, associated with the selected area. Together with sound and smell this will make the experience real.

3.2.1 The Globe

Each country will be represented in a real-life colour; that is, mountain ranges will be brown, deserts will be yellow-brown, and forests will be green. The oceans will, of course, be coloured blue, likewise seas and rivers, and the Poles white.

Countries, oceans and the Poles will be identified with animals, products, or other symbols associated with the area. Also, countries, oceans and the Poles will be identified with their name, written in Norwegian, and their respective flag. All major cities in the world's countries will be displayed on the globe, also them written in Norwegian. For an overview of selected symbols, see Appendix C.

It has been challenging finding symbols that could identify countries, oceans and the Poles. While working, we discovered a book called Barnas Verdensatlas (Weldon Owen Pty Limited, 1998). In this book, intended for children in the age of six to 12 years old, we found symbols and maps of the world. In Norway, the book is published by Gyldendal Norsk Forlag AS – Gyldendal Barn &

Ungdom. In order for us to save time drawing some examples of maps our self, we wrote an e-mail to the publisher, kindly requesting if we could use pictures from the book. Examples of how these symbols will look like on the globe are also shown in Appendix C. Here we have displayed maps for some selected countries and areas.

3.2.2 Video

The globe will consist of a touch surface in order for the children to be able to make their choices; select an area of interest. This action will trigger an event that will play a video, around 30 seconds long, associated with the selected area. Before the video is played, the name of the selected area is displayed on the screens in the oval-like room, written and spoken in Norwegian.

We are aware of that children are easily frightened, so it's necessary to show a kind of a fairytale view of the world; that is not showing war situations, animals eating each other, and other things that children can be offended of. Still, it is not quite academic correct to just show the "friendly" side of the world. Particularly, the elder children know that there are "problems" and "conflicts" around in the world. However, we have decided to e.g., show pictures of destroyed houses, people running from their homes, animals hunting other animals, starvation, and flooding but this will not be displayed for more than a few seconds.

3.2.3 Sound

Together with the videos we will also have sound. The sound will be used to make the experience more real. The only spoken sound we intend to have is the moment just before the video is started and the name of the selected area is spoken. For example, sound can be the roar of a lion, or the sound from the savannah in the early morning.

Regarding the sound, this will be implemented by putting small speakers between the screens to provide a surrounding effect

3.2.4 Smell

To make the experience even more real, we will also implement smell. It is a little bit tricky to implement this feature, we have to get the smell out from the oval-like room quickly and fast enough before the next video is played. It is not possible to implement smell throughout the whole movie. We have decided to go for one or two "smells" per video, one at the start and one at the end at the movie. Then it is possible to get the smell out of the oval-like room fast enough.

Regarding the smell, this will be implemented by putting four small boxes between the screens at the bottom at the wall. These boxes are connected to the computer running the video. When the sequence is played where the smell is implemented, these boxes will lounge the smell just as "smoke" on a stage. For instance, the movie running is from Tanzania, showing the Serengeti savannah. Then we will have the smell of the savannah (grass, acacia trees, and animals) spread into the oval-like room.

3.2.5 Screensaver

If the simulator has been inactive for a short while e.g. 30 seconds, this will trigger a "screensaver". The screensaver will display the night sky where stars are visual. We will implement this in a way so the stars and star pictures that are visual on the sky at the northern and southern hemisphere swap in a way, displaying both skies. We will also, respectively, show the Aurora borealis and the Aurora australis.

3.2.6 Time Travel through the Earth's History

Every hour a special video showing a time travel through the Earth's history; from the beginning of time up to today will be displayed. This video will be longer than the ordinary ones, approximately 3 minutes.

The video will start showing the "Big Bang", going through the geologic time scale e.g. Precambrian, splitting of the super continent Pangaea, the period of the dinosaurs, evolution of mammals, the Ice Age, the first human, civilizations like the Egyptian Empire, the Roman Empire, emperors like Napoleon, flashes from World War II, and up to present day; a very short story of the Earth's 4.5 milliard year old history.

3.3 Data Gathering

Data gathering is an important part of designing an interactive application. We are just doing the design phase for our interactive product; it will (probably not) be produced. Also, we haven't got much time with the assignment, it is therefore necessary to restrict our self. To gather data we have used some of the techniques described in the book *Interaction Design: Beyond Human-Computer Interaction* (Preece, Rogers, Sharp, 2007, page 292 - 346).

3.3.1 Setting Goals and Collect Data

We have mainly been focusing within three subjects where we meant it was necessary to actively collect data: understanding the user group, technical aspects and details, and making low-fidelity prototypes as good as possible.

Designing for children is not easy. They think, interpret, and react to situations differently than adults. Understanding how children are reacting to different kinds of aspects to our simulator will be very important. Also, understanding how they are playing and learning new things will be necessary to design a good product. Our intended user group is roughly in the age of six to12 years old; obviously the six year old will react to situations differently than the 12 year old. One of the group members has another background than just IT; fortunately she has knowledge in for instance psychology and pedagogy.

Due to our background, it was quite easy to write about the technology we intend to use. The technology is "out there", it is not necessary to invent something new.

We will try to make the low-fidelity prototypes as good as possible, since it will be impossible for us to make a high-fidelity prototype of the simulator; it will be too expensive. Therefore, we will only be making sketches and a small physical model.

3.3.2 Interviews

We thought it would be important to really talk to representatives for our user group. One of the group members has a brother that is eight years old. A meeting with the brother's class mate and, of course also the brother himself was arranged. The challenge will be, since these are small children, having them understand what the simulator does only looking at the low-fidelity prototype.

This section will be ready for the delivering of the Final Report.

3.4 Requirements

3.4.1 Functional Requirements

Functional requirements capture what the product should do (Preece, Rogers, Sharp, 2007, page 478).

The Globe

We see before us a globe of dimensions three meter in diameter. The surface of the globe is supposed to be made touch sensitive. Inside the globe we are to put two projectors opposite of each other in the centre, which are to project a virtual image of the world. When the projectors are on, they project a picture of the world on the two hemispheres. The reason we are using projectors is that we can easily change what is being shown on the surface. In this way we can easily simulate the time line mode of the simulator. The surface is being mapped in coordinates; in this way each region has its own coordinates, which makes it easy to connect a region with the corresponding action.

With use of the projectors inside the globe, we can achieve great visual effects on the surface of the globe. One of the cool things is that the oceans will be made to look moveable. Also one side of the globe will be darker than the other, creating an absence of day/night effect.

Inside the globe there will be a computer with a small client handling the picture display and the touch sensitive surfaces. The main task of the client is to get the coordinates from the surface and transmit them to an external mainframe holding the database.

The Surroundings

The hemisphere will consist of 16:9 format screens, of size 0.9 meter x 1.6 meter. We imagine that we can put small speakers behind the screens to provide a surrounding effect for the sound. Since the room is so big, the audience will not notice that the screens themselves are not bent. With these dimensions of the screens, and a diameter of 13 meters for the room, we will need approximately 184 screens.

The Floor

The floor will be covered of protecting glass. Underneath the glass there will be many screens. These screens will project an image of the surface of the corresponding active region of which the video is being shown at the given time.

Under the screens we will put low frequency subwoofers. This will create a more realistic experience of the video, since they will create vibrations in the floor.

With a diameter of 13 meters the floor will have an area of 133 square meters. The floor will consist of 16:9 format screens, of size 0.9 meter x 1.6 meter. In this context the floor will approximately consist of 92 screens.

The Mainframe

The mainframe is basically a server, a central control unit. It will get its inputs from the client placed inside the globe. The control unit is responsible for outputting the correct video associated with the given coordinates. This has to be a powerful machine, de-multiplexing the video on the screens. It will also hold a database which contains the videos.

3.4.2 Data Requirements

We are formulating our data requirements based on the user needs. In practice these requirements may develop and evolve as the users interact with the system. Data requirements capture the type, volatility, size/amount, persistence, accuracy, and value of the required data (Preece, Rogers, Sharp, 2007, page 479).

Data needed for the Globe

We need the following: images of the Earth, data for simulating the movements of the oceans when a person touches it, videos from each country or area, images for each country, different images for the floor from the continents. We also need data for the screensaver and other possible modes, such as the time travel.

Type of Data

For the videos we will use hi definition mpeg. The pictures will be in jpeg. The programs, for controlling all of the actions, will be written in C or C++. The data is stored on a server, with a backup in case of a system crash. We will also need to have a relation database.

Data Volatility

We will use a second database for backup, containing a mirrored version of the main database. Using this, we will make the data persistent.

Data Size and Amount

The duration of the videos will be approximately 30 seconds each. We wish to provide the best quality using H.264 encoding and lossless audio. With videos for approximately 200 countries and each video about 30Mb, the space required for the videos will be about 60 GB. The time travel mode, with a video on the globe and the surrounding screens will require 1 GB. We also need space for additional modes and the screensaver. The screensaver will be a looping video of about 1-2 minutes and will therefore require 1-2 GB of space.

Data Accuracy

To guaranty the most accurate set of date, we will create all the necessary media presented. This provides the accuracy of the data we want.

Data Value

The information the videos present are of great educational value to the users, and the videos are the main feature of the system, and thereby having great value for the system as well.

3.4.3 Environmental Requirements

Environmental requirements or context of use refer to the circumstances in which the interactive product will be expected to operate (Preece, Rogers, Sharp, 2007, page 479).

Physical Environment

The room in which the globe will be placed will be slightly dark and not much illuminated. The only source of light will be the globe, unless there is a video playing in which case the lightening depends on the video itself. This use of light is to give the audience the most realistic experience possible. We think that this will not present a problem since the globe will light up enough so that the children that are afraid of the dark will not be uncomfortable.

The noise level will be at a normal level. The bass will be noticeable, since we want to create a realistic environment.

The dust level will be tolerable, even if smells are used. We will have filters in the room to circulate the air at all times.

With these requirements we think that all children will be able to participate, even if they have minor illnesses such as asthma, bad hearing, and lowered vision and so on.

Social Environment

Since our data is static, we feel that this aspect is of little interest for our project. The data is not distributed, nor is it shared. There is also only one user at any given time, namely the system itself.

Organizational Environment

Since the simulator will be a part of a children museum, there will be people responsible for interacting and working with/on the system. These people will have to have the knowledge needed to support the users in their interaction with the system, if this would be necessary. There will probably be one person who is the administrative user, taking care of the technical aspects and maintenance of the system, and several staff personnel who will assist the users; thereby we do not expect a hierarchy in the organisation.

Technical Environment

The database will be Oracle, a relational database. The software needs to be custom written for efficiency, probably in the programming language C. The globe is an optical touch interface, having a client which sends requests to the server based upon the coordinates for the region. Inside the server we will need to have hardware able to display video over multiple screens, a multiplexer. We need a fair amount of hardware to display the videos, and software to manage the logic behind.

3.5 Task Description

3.5.1 Scenarios

If the interview with the children is successful, we find these results to be a lot more interesting than have to use fictive users. First, we have to gather the results from the interview before making any decisions. If the interview wasn't a success, then we will have to write more in this section before the delivering of the Final Report.

4. Prototyping and Construction

Prototyping is the process of (quickly) putting together a working model in order to test various aspects of an illustrated idea and gather early user feedback. Prototyping is often treated as an integrated part of the design process, where it is believed to reduce project risk and cost. When the prototype is sufficiently refined and meets the functionality, robustness, and other design goals, the product is ready for production (http://en.wikipedia.org/wiki/Prototyping).

4.1 Low-Fidelity Prototyping

A low-fidelity prototype is one that doesn't look very much like the final product. These kinds of prototypes are useful because they are simple, cheap, and quick to produce. Examples of low-fidelity prototypes are storyboarding and sketching (Preece, Rogers, Sharp, 2007, page 531).

The advantages of using a low-fidelity prototype are e.g. low development costs, proof-of-concept, and easy to make. The disadvantages are e.g. limited error checking, limited usefulness for usability test, and since we are working with a product for children; difficult for children to test our interactive product with only sketches to look at (Preece, Rogers, Sharp, 2007, page 536). For sketches, see Appendix D.

We intend to make a small model of the simulator; something like architects do when they are building houses. Pictures of the model will be displayed in Appendix D.

4.2 Evaluating Our Prototypes

This section will be presented in the Final Report.

5. The Evaluation Process

This section will be presented in the Final Report.

5.1 DECIDE: A Framework to Guide Evaluation

We have used the DECIDE framework to evaluate the project. The DECIDE framework has the following six items: (1) Determine the goals, (2) Explore the questions, (3) Choose the evaluation approach and methods, (4) Identify the practical issues, (5) Decide how to deal with the ethical issues, and (6) Evaluate, analyze, interpret, and present the data (Preece, Rogers, Sharp, 2007, page 626).

5.1.1 Determine

5.1.2 Explore

5.1.3 Choose

5.1.4 Identify

5.1.5 Decide

5.1.6 Evaluate

6. Heuristic Evaluation

This section will be presented in the Final Report.

7. Future Improvements of Our World

More within this section will be presented in the Final Report.

If we had had more time to finishing the project a lot of improvements and other design decisions would have been taken. Here we have mentioned some of the possibilities that exist in improving the simulator.

7.1 Understanding Users

7.2 Design

Countries, oceans and the Poles could be identified with their name, written both in Norwegian and in the native language. Likewise, when selecting a country, the name could also be spoken both in Norwegian and in the native language before the video is shown.

For blind children, it could be a possibility to implement a kind of a Braille display on the touch surface. Sadly enough, they are not able to see the video, but they can enjoy the sound and the smell.

Alma gave us an idea that we in this project didn't have time to follow up. It's a good idea, it's doable and therefore, we have mentioned it here as a suggestion for updates to the simulator. She suggests that the children could put their own information at the Globe, e.g. a photo of where they live, relatives in other part of the world and so on.

7.3 Prototyping and Construction

More information about price, lifetime for the technical equipment, alternative to touch surface, less expensive solutions, other technical solutions (projector vs. screens).

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8.1 Agreement with Gyldendal Norsk Forlag AS

While working, we discovered a book called Barnas Verdensatlas. In this book, we found symbols and maps of the world. In Norway, the book is published by Gyldendal Norsk Forlag AS – Gyldendal Barn & Ungdom. In order for us to save time drawing some examples of maps our self, we wrote an e-mail to the publisher, kindly requesting if we could use some pictures from the book. The agreement with the publisher and the editor Gerd Hjelmtveit is that these pictures must not be used in any, what so ever, commercial circumstances.

Appendix

A. Project Description

We want to create a visual simulator for children, roughly in the age of 6 to12. The simulator will let the children explore the world, presented by a big globe. The globe will be placed in an oval-like room, in the center of the room, where the walls will consist of screens. The floor in the room will also be made of screens, covered by protecting glass.

The globe has to be maneuverable in all directions, placed on a stand. The axes, which are the North and the South Pole, there will be placed a red button, which will stall the simulator. The surface of the globe has to consist of touch-pads in order for the children to be able to make their choices. Each country will be represented in a real-life color and with animals, products, or people associated with the different areas of the globe. The oceans will, of course, be colored blue and the Poles white.

We would like to have, together with a video associated with the selected country or area on the globe, sound and – if possible – smell. Regarding the sound, this can be done by putting small speakers between the screens to provide a surrounding effect. The smell will probably be a little bit trickier to implement; then we also have to think about how to get the smell out from the oval-like room quickly and fast enough.

B. Conceptual Model

The simulator will provide an experience for the children, a kind of a world tour. The globe will be big enough for multiple participants; excluding the queue which may occur if there are many children present.

The children may move the globe to a selected continent and touch a country or an ocean. This action will trigger an event that will play of a video, around 30 second long, associated with the selected country. The video will be played on all the screens creating 3D experience; the children will feel that they are present in the video. Each video will have elements associated with the country in question. The sound and smell will make the experience more real.

In order to stop an ongoing video, they have to press one of the two red buttons, which will trigger a “screensaver”, may be implemented by a night where stars are visual.

The children do not need any experience with similar simulators since the design is well explaining in itself; they only approach the globe and touch something.

C. Selected Symbols for the World

North America	Symbols
Canada	The mountain range Rocky Mountains, animals like Beaver, White Whale, Musk Ox, Polar Bear, Artic Fox, Artic Hare, Wolf, Greenland Seal, Grizzly Bear, the Caribou, Killer Whale, Blue Whale, and Canada Goose, sports like skiing and ice hockey, Royal Canadian Mounted Police, Inuit's, Niagara Falls, minerals like gold, silver, uranium, copper, oil, and gas, industry like timber and paper, iceberg, and icebreaker
United States, including Alaska and Hawaii	Animals like the Bald Eagle, Grizzly Bear, Walrus, Kodiak Bear, and American Bison, minerals like gold, industry like timber, oil and gas, Trans-Alaska Pipeline, Yukon River, Iditarod Trail Sled Dog Race, the mountain range Rocky Mountains, animals like Swordfish, Northern Minke Whale, various species of fish, Niagara Falls, Kentucky Derby, New York City, Statue of Liberty, The White House in Washington D.C, industry like gold, oil, gas, iron, steel, and coal, producer of cars, computers, and aeroplanes, sports like skiing, ice hockey, base ball, and American football, cowboys, rodeo, tourism, country music, Mississippi River, Kennedy Space Center, Cape Canaveral, Epcot Center and Disney World, Everglades and alligators, Mount Rushmore, native American tribes like the Sioux, the Cherokee, and the Apache, Grand Canyon, Death Valley, Nevada Desert, Redwood Tree, Hollywood, Golden Gate Bridge, Las Vegas, pineapples, Aloha shirt, Waikiki Beach, surfing, and tourism

Central America	Symbols
Mexico/Guatemala	Mexico City, traditional Mexican costumes, Mariachi Musicians, folk dance, sport like football, industry like gold, iron, oil, and maize (corn), Mt. Orizaba (5700 metres), Chichen Itza, the Yucatan Peninsula, animals like Great White Shark, Dolphins, Monarch Butterfly, various species fish, Mexican Jaguar, and Red-and-green Macaw, ruins from the Aztec and Maya Civilizations, food like tacos and enchiladas, Tical National Park, ruins from the Maya Civilization, and tourism
Belize/Honduras/El Salvador/Nicaragua/ Costa Rica/Panama	Industry like bananas, coffee, and meat production, The Panama Canal, animals like Howler monkey, the Kuna people, and tourism

The Caribbean, including Cuba and Bermuda	Animals like various species of tropical fish and turtles, lobsters, coral reefs, producer of sugar and tobacco, palm trees, coconuts, sport like cricket, snorkelling and free-diving, and tourism

Europe	Symbols
Ireland	Production of potatoes, peat, ale, sugar, and beef, sports like football and hurling, animals like lobster, sheep, cows, and Kingfisher, Newgrange – one of the passage tombs of the Brú na Bóinne complex in County Meath, Blarney Castle, Waterford Crystal, King John's Castle in Limerick, and tourism
United Kingdom (Scotland, Whales, England, Northern Ireland)	The Shetland Pony, production of textiles, wool, whisky, sugar, ale, potatoes, electronics, and cars, animals like Wolf, Reindeer, West European Hedgehog, Capercaillie, and Highland Cow, industry like coal, oil, and gas, sports like golf, football, cricket, and rugby, Great Highland Bagpipe, The Loch Ness Monster Nessie, Glamis Castle, Iona Nunnery, Caernarfon Castle, the village Llanfairpwllgwyngyllgogerychwyrndrob-wllllantysiliogogogoch, The Palace of Westminster, London bus, Stonehenge, Royal Pavilion in Brighton, Narrowboat, Chatsworth House and Gardens in Derbyshire, the Tudor style, The Stormont Castle, The Giant's Causeway, and tourism
Spain, including the Balearic Islands and the Canary Islands	Production of cigars, olive oil, textiles, wine, oranges, saffron, and cars, animals like Camel, Brown Bear, and Wild Boar, the running of the bulls in Pamplona, the Mezquita Mosque in Córdoba, the Alhambra in Granada, the Sagrada Família in Barcelona, the Guggenheim Museum in Bilbao, Bullfighting, Flamenco Dance, the Historic City of Toledo, paella, sports like sailing and football, and tourism
Portugal, including the Azores and Madeira	Production of wine, apples, potatoes, port, and textiles, animals like various species of fish, farming, the Castle of Guimarães, Oak Tree, Vasco da Gama Bridge, Tower of Belem in Lisbon, and tourism

France, including Corsica and Monaco	Sports like skiing and football, Tour De France, production of cheese, champagne, wine, mustard, textiles, fashion, perfume, cars and planes, industry like oil, gas, iron, and coal, the TGV Atlantique high speed train, the Channel tunnel, Mont Saint Michel, Palece of the Popes, the Eiffel Tower, The Royal Palace in Versailles, Château de Chambord, the Walled city of Carcassonne, Mt. Blanc (4807 metres), animals like Chamois and Capricornus, the Film Festival in Cannes, Monte Carlo Casino, statue of Napoleon Bonaparte, and tourism
Netherlands/Belgium/Luxembourg	Windmills, clogs (wooden shoes), dikes, the International Court of Justice in The Hague, the City of Amsterdam, the Sint Jans Kathedraal in Hertogenbosch, sports like skating, cycling, the Historical Centre of Ghent, production of cheese, chocolate, tulips, textiles, wine, beer, sugar, and vegetables, industry like fishing, diamantes, crystal, iron, and steel, the City of Luxembourg, the EU Capital Brussels, and tourism
Germany	Production of cars, textiles, electronics, beer, and wine, industry like oil, coal, and gas, the City of Berlin, Brandenburg Gate, the Reichstag, Sächsische Staatsoper Dresden, Heidelberg Castle, Neuschwanstein Castle, sports like football, and tourism
Austria/Switzerland/Liechtenstein	The mountain range The Alps, industry like iron and steal, production of Wiener Schnitzel, cheese, Sachertorte and Apfelstrudel, sport like ski-jumping, banking, pharmaceuticals, watch making, the City of Vienna, Mt. Matterhorn (4478 metres), the Belvedere Palace in Vienna, and tourism
Italy, including San Marino and the Vatican City	The mountain range The Alps, industry like fishing, oil, and iron, production of cars, fashion, wine, olive oil, oranges, and walnuts, sports like skiing, palio, and football, animals like Marmot and Chamois, Mt. Etna (3323 metres), Duome di Milano, Leaning Tower of Pisa, the City of Rome, Colosseum, St. Peter's Basilica, Duomo of Florence, Venice, gondolas, Swiss Guard, the ruins of the ancient City of Pompeii, and tourism

Albania/ Bosnia and Herzegovina/Bulgaria/ Jugoslavia/Croatia/Macedonia/Romania/ Slovenia/Serbia/Montenegro	Animals like Black Kite, Wild Hog, industry like copper, timber, iron, folk dance, the Cathedral of Sofia, production of tobacco, roses, wine, and Soya bean, sports like skiing, the Kalemegdan Fortress and the monument Pobednik (Victor), The Parliament of Serbia in Belgrade, National Public Library in Priština, Croatian National Theatre in Zagreb, Bran Castle (Dracula's Castle), Transylvania – historical region, Peleş Castle, Diocletian's Palace in Split, and tourism
Greece, including Create	The Parthenon in Athens, Mt. Olympus (2918 metres), Delphi with the Temple of Apollo and the Delphi Sanctuary, the Archaeological Site of Olympia, production of wine, olive oil and cotton, industry like coal and shipping, and tourism
Estonia/Latvia/Lithuania	The Old City of Tallinn, the Old City of Riga, Trakai Island Castle, animals like Cattle, Deer, Pig, and various species of fish, production of amber, industry like farming and timber, and tourism
Belarus/Ukraine/Poland/Czech Republic/ Slovakia/Moldova/Hungary	The Castle of Brest, the Cathedral of Sofia, animals like Wolf, Wild Hog, Gees, Fish Eagle, the European Wildcat, Wisent, and the Eurasian Lynx, folk music and national dresses, industry like timber, gas, chemicals, iron and steel, production of wine, sugar, textiles, tobacco, caviar , crystal, and cars, the Historic Centre of Warsaw with the Royal Castle Square, Oleśnica Castle, the mountain range Karkonosza, the City of Prague, the City of Budapest, Parliament Building in Budapest, Buda Castle, and tourism
Iceland	Volcanoes like Hekla and Eldfjell, Strokkur Geyser, animals like Icelandic Horse and Icelandic Sheep, Vatnajökull, Dettifoss, and Church of Hallgrimur
Norway	Industry like oil and gas, coal, minerals, timber, and fish, production of Jarlsberg Cheese, Sámi people, sports like skiing and snowboard, animals like the Norwegian Moose, Reindeer, Artic Fox, Killer Whale, and Atlantic Puffin, Urnes Stave church in Luster, Mt. Galdhøpiggen (2469 metres), the Polar Circle Statue at Saltfjellet, Bryggen in Bergen, folk costumes, and tourism
Sweden	Sámi people, industry like iron, timber, and steel, traditional Swedish costumes, folk dance, producer of cars, clothes, and furniture, sports like skiing and ice hockey, the Sankta Lucia feast day, the Drottningholm Castle in Stockholm, and the Kalmar Castle in Kalmar

Finland	Sámi people, Sauna, various design products like clothes, furniture, and mobile phones, animals like Mouse, Wolfe, and Wolverine, industry like timber and paper, sports like skiing and ice hockey, and the Helsinki Cathedral
Denmark	Legoland, traditional Danish costumes, Egeskov Castle, the statue Little Mermaid, various species of fish

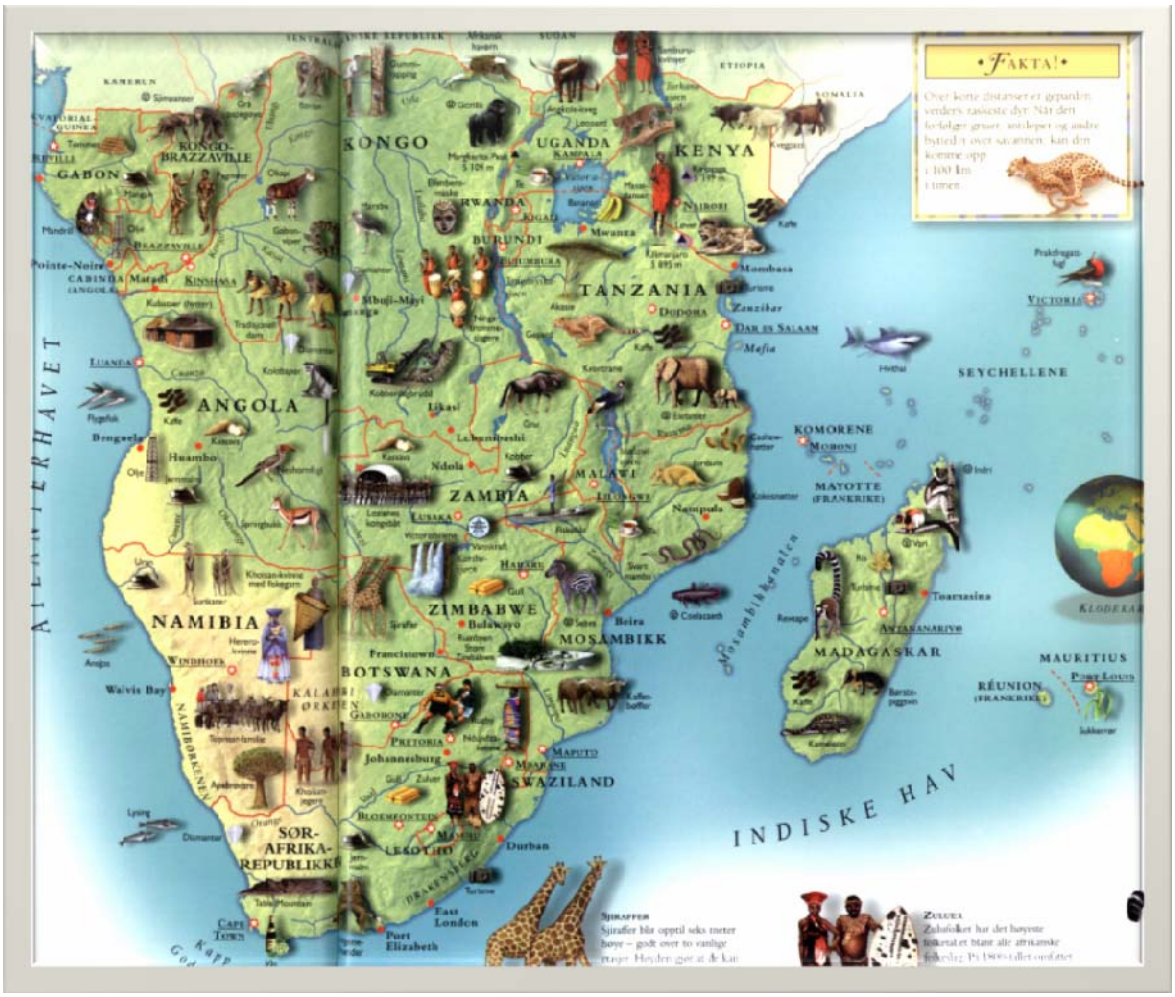
Africa	**Symbols**
Morocco/Algeria/ Tunisia/ Libya/Mauritania/ Mali/ Niger/ Chad/ Sudan/ Western Sahara	Sahara - the world's second largest desert, the mountain range Atlas Mountains, animals like Dromedary, Sheep, Goat, Hippopotamus, and the Nile Crocodile, the nomadic Berber and Tuareg people, spices like saffron and mint, industry like oil and gas, ruins from The Roman Empire – the City of Leptis Magna, The Old Mosque of Khartoum, The Blue Nile Falls, production of cotton, and tourism
Egypt	The Nile River, Cairo, The Great Pyramid of Giza, the Great Sphinx, the Valley of the Kings, the Suez Canal, production of cotton, Bibliotheca Alexandrina, industry like oil, the Red Sea, and tourism
Senegal/Gambia/Guinea-Bissau/Guinea/ Sierra Leone/Ivory Coast/ Liberia/Burkina Faso/Ghana/Benin/ Togo/Nigeria/Cameroon/ Equatorial Guinea/Central African Republic/	Industry like aluminium, diamantes, cotton, oil, and rubber, production of coffee, bananas, cacao, sweet potato, peanuts, animals like the Elephant, Black Rhinoceros, the Abuja National Mosque, and Rubber Tree
Eritrea/Djibouti/Ethiopia/Somalia	Mt. Ras Dashen (4620 metres), the city of Gondar with the Fasilides Castle, the Dinka tribe, animals like the Lion and Zebra, and production of bananas
Gabon/ Congo-Brazzaville/ Congo/ Uganda/ Angola/ Rwanda/ Burundi/ Malawi/ Zambia/ Zimbabwe/ Mozambique	Industry like timber, oil and gas, gold, and diamantes, Pygmy group, animals like Mandrill, Baboon, Okapi, Gorilla, Leopard, various species of monkeys and birds, Wildebeest, and Zebra, Victoria Falls, Great Zimbabwe (a complex of ruins), production of tea, coffee, cashew nuts, coconuts, and tourism
Namibia/ Botswana/ Swaziland/ Lesotho	Industry like uranium and diamantes, animals like the Suricate, Giraffe, and Zebra, various tribes as the Herero, and the Khoisan, the Monkey Bread Tree, and tourism

Kenya/Tanzania	Lake Victoria, Lake Tanganyika, the ethnic group Maasai, animals like Elephant, Lion, Giraffe, Cheetah, Blue Wildebeest, Zebra, and Hippopotamus, various species of birds, production of bananas and coffee, Mt. Kilimanjaro (5895 metres), Mt. Kenya (5199 metres), Ngorongoro Crater, Serengeti National Park, and tourism
Seychellene/Madagascar/ Mauritius	Animals like the Magnificent Frigatebird, Lemur and the Fossa, production of coffee and sugar, and tourism
South Africa	The Zulu tribe, industry like coal, iron, gold, and diamantes, production of wine, Table Mountain (1086 metres), sports like rugby and cricket, animals like Lion, White Rhino, Blue Wildebeest, Impala, Hyena, and Giraffe, the Blue Train (1600 km), and tourism

Australia and Oceania	**Symbols**
Australia, including Tasmania	The Great Barrier Reef, snorkelling, various species of tropical fish, Eucalyptus, Baobab and Acacia Tree, animals like Platypus, Dromedary, wild horses, Merino Sheep, Tasmanian Devil, various birds like Emu, Kookaburra, different species of parrots, Black Swan, Saltwater Crocodile, Dingo, a host of marsupials as Koala, Wombat, Red Kangaroo, and Gray Kangaroo, various species of wallabies, Great White Shark, minerals like gold and opals, production of wine, the Wolfe Creek, the Devil's Marbles, the Uluru, the Pinnacles, the Twelve Apostles, Aborigines, the instrument Didgeridoo, Boomerang, the Sydney Opera House and Harbour Bridge, Port Arthur, and tourism
New Zealand	The Maori culture, Kauri Tree, sailing, petroleum and natural gas, animals like sheep, the flightless birds Kiwi and Tokoeka, Barracuda, Sperm Whale, Blue Whale, Southern Royal Albatross, various species of shrimps and oysters, Mt. Cook (3764 metres), the Milford Sound, skiing, the Christchurch Cathedral, and tourism
South-West Pacific Islands; the Solomon Islands, Samoa, Vanuatu, New Caledonia, Tonga, French Polynesia, the Society Islands, and Papua New Guinea	Animals like Spinner Dolphin, Whale Shark, Great White Shark, Giant Manta, Swordfish, Southern Bluefin Tuna, Magnificent Frigatebird, Tree-Kangaroo, and tropical fish, coral reefs, bananas, palm trees, coconuts, pearls, Polynesian culture, multi-hulled canoe, snorkelling, and free-diving

The Poles	Symbols
Antarctica	Iceberg, glacier, animals like Southern Right Whale, Fin Whale, Blue Whale, Killer Whale, Humpback Whale, Southern Elephant Seal, Weddell Seal, Ross Seal, Crabeater Seal, Leopard Seal, Emperor Penguin, Adelie Penguin, King Penguin, Wandering Albatross, Krill, snowmobile, icebreaker, glaciology, climatology, Mt. Erebus (3794 metres), and Aurora australis (southern light)
Arctic, including Greenland (Denmark) and Svalbard (Norway)	Iceberg, glacier, animals like Narwhal, Gray Whale, White Whale (Beluga), Bowhead Whale (Greenland Right Whale), Killer Whale, Polar Bear, Musk Ox, Greenland Seal, Ringed Seal, Walrus, Svalbard Field Mouse, various species of birds and fish, Inuit's, snowmobile, Aurora borealis (northern light), and tourism

Oceans	Symbols
Arctic Ocean	Iceberg, pack ice, glacier, animals like Narwhal, Gray Whale, White Whale (Beluga), Bowhead Whale (Greenland Right Whale), Killer Whale, Greenland Seal, Ringed Seal, Walrus, and various species of fish
Atlantic Ocean (The Equator subdivides it into the North and the South Atlantic Ocean)	The Mid-Atlantic Ridge, the Gulf Stream, animals like various species of fish, shrimps, lobsters and oysters, Northern Bluefin Tuna, Swordfish, Reef Shark, North Atlantic Right Whale, Whale Shark, and Killer Whale
Pacific Ocean (The Equator subdivides it into the North and the South Pacific Ocean)	The Mariana Trench (10 911 metres), various species of fish, Swordfish, Northern and Southern Bluefin Tuna, various species of dolphins, Humpback Whale, Great White Shark, Pygmy Sperm Whale, and Eagle Rays
Indian Ocean	Animals like various species of tropical fish, turtles, mussels, shrimps and lobsters, Dugong, Grey Nurse Shark, Giant Manta, Swordfish, Tiger Shark, and Hammerhead Shark
Antarctic Ocean (Southern Ocean)	Iceberg, pack ice, glacier, animals like Southern Right Whale, Fin Whale, Blue Whale, Killer Whale, Humpback Whale, Southern Elephant Seal, Weddell Seal, Ross Seal, Crabeater Seal, Leopard Seal, Emperor Penguin, Adelie Penguin, King Penguin, various species of squid, and Krill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SEYCHELLENE
KOMORENE
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MAURITIUS
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ATLANTERHAVET
Mosambikkanalen
FAKTA!


North Island
South Island
NEW ZEALAND
Whangarei
Great Barrier Island
Auckland
Hamilton
Rotorua
New Plymouth
Napier
Hastings
Wanganui
Palmerston North
Nelson
WELLINGTON
Greymouth
Christchurch
Timaru
Queenstown
Dunedin
Invercargill
Stewart Island
Tasmanhavet
STILLE-HAVET
Bay of Plenty
Cookstredet
Foveauxstredet
Maori-krigsdans
Før de gikk i strid, framførte maori-krigere en krigsdans kalt haka. Under dansen rakte de tunge og laget skremmende grimaser.
Hvalhai
Hvalhaien er den største fisken som lever i dag. Den spiser ved å svømme av sted med åpen munn. Den spiser bare plankton og småfisk og er ufarlig for mennesker.

D. Prototype Drawings and Model

The picture below shows the first version of Our World. Here it is easy to see the globe and the winding stairs the children have to use to move around the globe.

The pictures below show Our World with countries and oceans. We have only made sketches with use of a map from the southern parts of Africa.


SAHARA