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Our World

A Project for Oslo Barnemuseum

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3rd of December 2007

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Abstract

This paper is the design document for a visual simulator, called Our World. The simulator is made for Oslo Barnemuseum; therefore Our World is designed and intended for children. Our World will provide a kind of a tour around the world for children, perhaps adults as well.

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. Also, we think this will be a funny, encouraging, and educational way for children to learn about e.g. geography, and cultural differences in the world.

1. Introduction

Three of four group members mainly have an IT background. One of the group members has another background than just IT; fortunately she has knowledge in for instance psychology and pedagogy. 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 ourself and be creative and not worrying about the costs.

Our challenge was to make the world available for children in a way that they could understand and from which they could learn; also in a way in which they could be engaged. Children learn through interaction – through playing and exploring. They quickly loose their patience, and does not like to be bored. To see that they can have an influence at their surroundings engages them; then they think its fun to learn new things and this motivates them to learn and participate more in the activities. Children see the world and other cultures as exiting; they are interested in things that are different.

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, pages 17-19). 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).

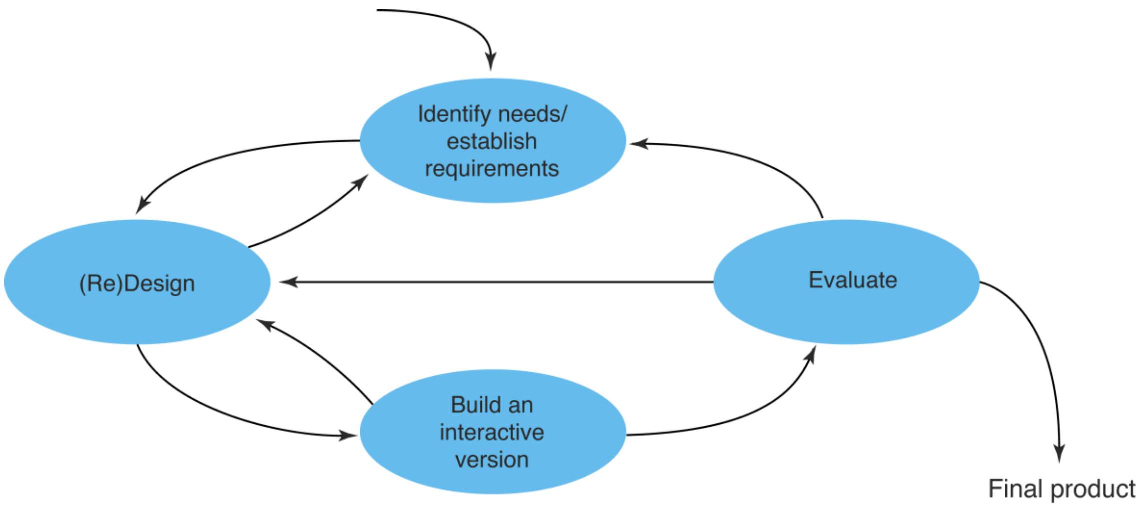

Figure 1.1: The Lifecycle Model

2. Understanding Users

2.1 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 to twelve 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.

Our user can be a child from anywhere in the world; therefore we have chosen to design a system without speech and text. Only guided by symbols, all the users will understand what to do.

The wide age span in our user group will not be a problem. We think our project can provide videos of interest to all ages. The youngest will perhaps find videos from Africa and South America with exotic animals and nature very interesting; the elder children may find other places in the world more interesting. Our hope is to make all the videos as educational as possible, although they will be without a narrator or text.

2.2 Understanding How to Design for Children

Our focus group is children between six and twelve years of age. Before moving on in developing our system, we had to gain an extensive understanding of what lies beneath the development of a system which purpose is to interact with children. Through our project 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* (Preece, Rogers, Sharp, 2007) also 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 colour, 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, page 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 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).

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).

2.3 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 project.

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.
- 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 smells are not recommended trying out the simulator.

2.4 Interview

Our goal is to get as much information as possible on how our user group would respond and react to the technology used in Our World.

The relationship between the interviewer and the interviewees was done in an appropriate manner. This was especially important since the interviewees were children. They were assured that the questions asked would not be threatening or inappropriate, and also that the data would not be used to any other purposes. We did not find it necessary to undertake a pilot study, nor did we have the time to do so.

Since we already had specific goals and questions prepared, we found it natural to conduct a **structured interview** (Preece, Rogers, Sharp, 2007, pages 299-301, 307). In this type of interview the interviewer asks a predetermined set of questions (listed below), similar to a questionnaire. The results were not chosen from a set of options; rather we wanted to see what the users’ natural response was.

Since we interviewed children, we had to make a child friendly atmosphere. Luckily, one of us has a brother that is eight years old. We took advantage of this, and interviewed him and his four friends while playing around the house.

We found it easiest to interview them as a group, hoping that they would relax more and in this way contribute with more information. To illustrate how the simulator would work in real life we used a laptop with an image of the world, exact in details on how it would look being placed in the oval room. The globe had all the entities, such as colour, symbols, names and the stairway going around it. To illustrate as close as possible how it would feel to touch it, we used an iPhone with a touch screen.

The goal of this session was exploratory, hence we used open questions. Before we started the interview we tried to explain the purpose of the questions and did our best to make the interviewees feel comfortable. The group interviewed consisted of two eight year old boys, one nine year old girl, and two seven year old girls.

Introduction

Here we represented our selves, in this case as an older brother that was going to ask them some simple questions. We explained loosely what we were going to ask, and that it was nothing dangerous, only that we wanted their strait answers.

Warm-up

Here we asked them some questions about what they knew of geography and if they had ever been in a simulator before. We also asked about where they live, their other interests; in short terms we tried to loosen things up.

Main Session

In the main session we displayed the globe image on the laptop in front of the interviewees. Then we asked the following questions (the answers of the interviewees are listed underneath each question):

1. Do you have trouble recognizing the countries using only symbols and flags, or would you prefer names in form of letters?
No trouble recognizing symbols. A little harder recognizing flags, it would make it much easier if we had names as well.

2. Would you be comfortable in exploring the simulator yourselves the first time; or would you prefer to go with an adult?
Prefer to go with an adult, unless there are other children that we know there.

3. Would you be comfortable in using the simulator, touch the globe, going up the stairway and use the "time travel" functions?
Yes, when we know how it works, how high is the globe?

4. Would you be afraid being in the dark room where the globe is placed?
Yes, a little frightening; no problem if there are other children there.

5. Does sound and smell together frighten you?
The sound would, it should not be too loud. The smells are very funny.

6. Would you be afraid to touch the touch sensitive surface of the globe?
No, when we know how it works and that it is safe to touch.

7. Would you use the simulator to learn about geography, how other cultures are and so on?
Yes, would like to see Egypt...

8. Do you understand the features of the “time travel” function, would you be afraid to press the red button?
No, we have not learned that in school yet.

Closing

After we had asked all the questions, we gave the soda and cookies we had brought with us and thanked them for their contribution.

Evaluation

Question 1
Here we see that names in combination with symbols and flags would be the best way to go. In this way it will make it easier to explore the globe for the users.

Question 2
The children interviewed are very young, and naturally they prefer adults close by. We could ask for some staff on the floor to make them feel safer.

Question 3
They first did not understand the purpose of the globe, but after some additional explaining they were all nodding. We see that it will take some time to make them experienced users of the system.

Question 4
A dark room seemed frightening, but they said that they would not be afraid if they all went together. Again, some people on the floor to make them feel safer seem preferable.

Question 5
They did not like too much sound/volume in this context, but the smell was funny to them and it seems that it would be a very attractive feature.

Question 6
When we showed how the touch screen on the iPhone works, they soon felt comfortable touching it, naturally since children like to play with everything. We feel that this will not be a problem.

Question 7
They all asked about Egypt... We think that they will learn to explore all of the functions as soon as they see the system in use. From this they will automatically gain knowledge about distant places in our world.

Question 8
This question could have been saved for older children, but we have no insight in how much geography is taught in the third grade. They obviously did not know much about the movement of continents and such things. We still feel that the time travel function is an exciting feature, especially for a bit older users.

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, pages 29-33).

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, pages 29-33).

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. 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 twelve 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 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 as well.

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. To present an even more realistic representation of the globe, we want to add clouds, volcanoes, tropical storms and important ocean currents. A nice feature will be that clouds and oceans will react to the users touch, creating ripples or waves in the ocean and dissolving clouds in a natural way. The latter will be especially useful if clouds cover an area of interest.

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 A.

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 twelve 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 ourself, 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 A. 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 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, animals hunting other animals, 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 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 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 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 ourself. To gather data we have used some of the techniques described in the book *Interaction Design: Beyond Human-Computer Interaction* (Preece, Rogers, Sharp, 2007, pages 292 - 346).

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 to twelve years old; obviously the six year old will react to situations differently than the twelve year old. Also, we thought it would be important to really talk to representatives for our user group. Please refer to interview in section 2.4.

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.

3.4 Requirements

3.4.1 Functional Requirements

Functional requirements capture what the product should do (Preece, Rogers, Sharp, 2007, pages 477-479).

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.

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. Since the wall is completely covered with screens, we will divide the room in two, showing the same video on both parts. This will create a feeling of being at the actual location.

The roof of the room will naturally represent the sky. The sky will be projected from the top of the globe, and can change according to the video.

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, for instance sand as desert or water as ocean. 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.

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.

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, pages 531-535).

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 B.

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 B.

5. The Evaluation Process

Users want interactive products to be easy to learn, effective, efficient, safe, and satisfying to use. Evaluation is needed to check that users can use the product and that they like it, particularly if the design concept is new (Preece, Rogers, Sharp, 2007, page 586).

As mentioned before, we have used the lifecycle model (Preece, Rogers, Sharp, 2007, page 448) working with Our World. As Figure 1.1: The Lifecycle Model above shows we have continuously improved Our World by redesigning and re-sketching. The final activity is evaluating what has been designed.

We have chosen to perform two types of evaluating: (1) Evaluating our low-fidelity prototype, and (2) Heuristic evaluation. In both cases, experts and users should have been invited to do the evaluating; with us as observers. Due to limited time we have chosen to do both the evaluations ourselves.

5.1 Evaluating Our Prototype

Due to the projects complexity it was only possible for us to make sketches and a low-fidelity prototype. It was challenging making a prototype due to our budget and the materials used.

Aesthetically, the prototype could have been better. The picture on the wall could have been made as a puzzle, illustrating screens and the winding stairs around the globe is a little bit to steep. After all, we have been able to show the proportions between the globe and the oval room.

All over, we are pleased with the result, the prototype illustrates what we had in mind.

5.2 Heuristic Evaluation

Heuristic evaluation is a usability inspection technique, in which experts, guided by a set of usability principles known as heuristics, evaluate whether user-interface elements conform to the principles (Preece, Rogers, Sharp, 2007, page 686).

The heuristics that we will use analyzing interactive products (Preece, Rogers, Sharp, 2007, pages 686-687, 699-700) are: (1) Sufficient information design, (2) Consistent and intuitive mapping, (3) Match between system and the real world, (4) Visibility of state, (5) Aesthetic and pleasing design, (6) Useful and relevant information, (7) Visibility of system status, (8) User control and freedom, (9) Easy transition to more in-depth information, (10) Peripherality of display, (11) Error prevention, and (12) Flexibility and efficiency to use.

Heuristic evaluation has three stages: The briefing session, the evaluation period, and the debriefing session (Preece, Rogers, Sharp, 2007, pages 700-701). We have not invited any experts to do the evaluation for or with us. Of course, this could have been very useful, but due to limited time we chose to do the evaluation ourself.

Sufficient Information Design

We think we have designed a pleasurable user interface. At the globe, each country is represented in a real-life colour; that is, mountain ranges are brown, deserts are yellow-brown, and forests are green. Likewise, oceans, seas and rivers are coloured blue, and the Poles are white.

All parts of the world are identified with animals, places of interest or other symbols associated with the different areas. Also, countries, oceans and the Poles are identified with their name, written in Norwegian. Likewise, all countries are identified by their respective flag, and all the major cities are displayed, also them written in Norwegian.

The globe is quite big, approximately three meter in diameter. Therefore, there are place enough for symbols, flags, name of countries, oceans, and major cities. There are “just enough” information presented on the globe; it is neither too much nor too little.

Consistent and Intuitive Mapping/Useful and Relevant Information

The globe is made up of a touch surface. With the movements of the oceans and the graphical effects of the mainland it is easy for the user to understand what to do – touch the globe. A sign with a symbol like a hand touching the globe is displayed when the user enters the oval room before start playing with the simulator. We think this is enough for the user to understand how to interact with the simulator.

Some of the countries and islands haven’t got their own video associated with them, so if the user is pressing on one of these areas nothing will happen. The solution for this problem: a circle around the user’s finger, indicating that what he does is recognized.

Match Between System and the Real World

To satisfy all of our users, we have decided to make an interactive product without spoken or written information. The reason for this decision is that some of the users may be from abroad and will not be able to understand Norwegian. Some of the users could be deaf, therefore not able to "understand" spoken information. Also, the youngest in our user group can probably not read. Letting the user know what to do and that the things he is doing is correct we have used signs, symbols, changing of colours and beeping.

Visibility of State/Aesthetic and Pleasing Design

The globe consists of a touch surface in order for the user to be able to make his choice; select an area of interest. This action triggers an event that plays a video associated with the selected area. Before the video is played, the name of the selected area is displayed on the screens in the oval room, written and spoken in Norwegian.

Together with the video there are sound. The only spoken sound is the moment just before the video is started and the name of the selected area is spoken. Sound can be the roar of a lion, or the sound from the savannah in the early morning.

Together with the video there also are smells. For instance, the movie running is from Tanzania, showing the Serengeti savannah. Then the smell of the savannah (grass, acacia trees, and animals) is spread into the oval room.

If the simulator has been inactive for a short while this triggers a "screensaver". The screensaver displays the night sky where stars are visual. It is implemented so the stars and star pictures which are visual on the sky at the northern and southern hemisphere swap, displaying both skies.

Every hour a special video showing a time travel through the Earth's history; from the beginning of time up to today is displayed.

Summing up, we think we have designed a pleasurable user interface. We claim that the simulator is funny and encouraging for the user to use; that the user learns new things about the world and other cultures and that the user found this exiting.

Visibility of System Status

In an active state the globe will display "normal" bright colours. When the system is inactive, this will be indicated with a darker colour of the globe.

The simulator is constructed in a way that when the user doesn't do anything, either nothing will happen. If the simulator has been inactive for a short while this triggers a "screensaver".

User Control and Freedom

When the video is being played, it is still possible to play with the globe. Still, the system is designed to only show one video at any given moment. The reason for this decision is the chaos that will occur if the video changed immediately someone else touched the screen.

The simulator is constructed in a way that when the user doesn't do anything, either nothing will happen. If the simulator has been inactive for a short while this will trigger a "screensaver".

Easy Transition to More In-depth Information

The simulator is constructed only with one-levelled information.

Peripherality of Display

Not applicable.

Error Prevention

It is not possible for the users to make any errors.

Flexibility and Efficiency of Use

We have designed an interactive product that will not separate inexperienced and experienced users; all the users will be at the same level of experience. Still, a novice and young user will feel insecure start using the simulator; other users present will make them feel more secure. Also, some staff personnel present on the floor will make the user feel safer.

6. What Have Others Done

After searching the web, we could not find any systems with similar design or functionality. This, however, does not mean that there can not be found systems that may resemble our idea.

7. Future Improvements of Our World

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 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.

7.2 Prototyping and Construction

The cost of the system could be substantially cheaper if projectors will be used instead of LCD/plasma panels. We discussed some issues about this earlier, and concluded that using screens will be the best technical solution as of today. There are some projectors today that can project large images at short range, but not big enough that they can reduce the number needed to cover the area.

8. Conclusion

First of all, this has been a funny project to work with, though it has been challenging mainly because of the topic chosen. Three of four group members mainly have an IT background so it was quite necessary to think in another way than we were used to. Also, the user group chosen was challenging. None of the group members has particular experience with children as a user group, therefore it was necessary to find out how children learn, react to things and so one.

Since financing the project was not an assumption, we could really challenge ourself and be creative and not worrying about the costs. The disadvantage chosing this kind of project was that it would not be possible to make a high-fidelity prototype; difficult to explain for others how the simulator would look like and work.

Working in group has not been any problem, all four group members have worked very well together. We have had group meetings once a week, discussing the “topic” of the week and dividing job tasks between us. The group has had a team leader who has been responsible for putting the reports together. We have actively used the book *Interaction Design: Beyond Human-Computer Interaction* (Preece, Rogers, Sharp, 2007) to structure our work and the reports.

9. References

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9.1 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 ourself, 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. Selected Symbols for the World

The tables below show an overview of selected symbols for the world.

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

Table A.1: Europe

Europe	Symbols
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), the Film Festival in Cannes, Monte Carlo Casino, 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, 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, Venice, gondolas, 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, The Parliament of Serbia in Belgrade, National Public Library in Priština, Croatian, Bran Castle, Transylvania, Peleş Castle, Diocletian’s Palace in Split, and tourism

Europe	Symbols
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

Table A.1: Europe

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

Table A.2: Africa

Africa	Symbols
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

Table A.2: Africa

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

Table A.3: Australia and Oceania

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

Table A.4: The Poles

Examples of how these symbols will look like on the globe. Here we have displayed maps for some selected countries and areas.

Figure A.1: Scandinavia

Figure A.2: The Southern parts of Africa

Figure A.3: New Zealand

Figure A.4: Arctic

B. 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.

Figure B.1: Our World

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.

Figure B.2: Our World with Map

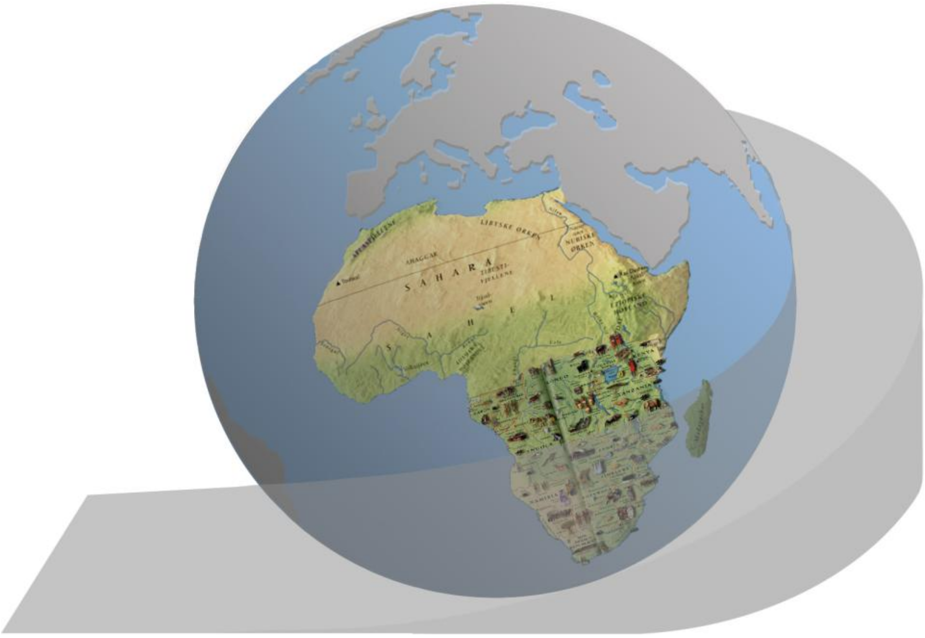

Figure B.3: Our World with Map

The picture below show Our World with the globe, the winding stairs, and the oval room with screens.

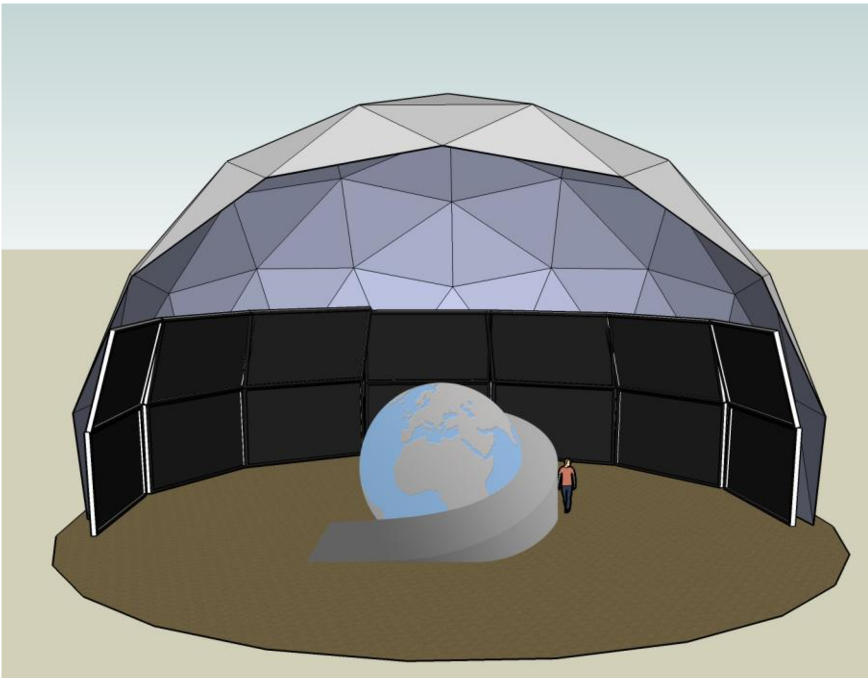

Figure B.4: Low-Fidelity Prototype (sketch)

The pictures below show the low-fidelity prototype of Our World.

Figure B.5: Low-Fidelity Prototype

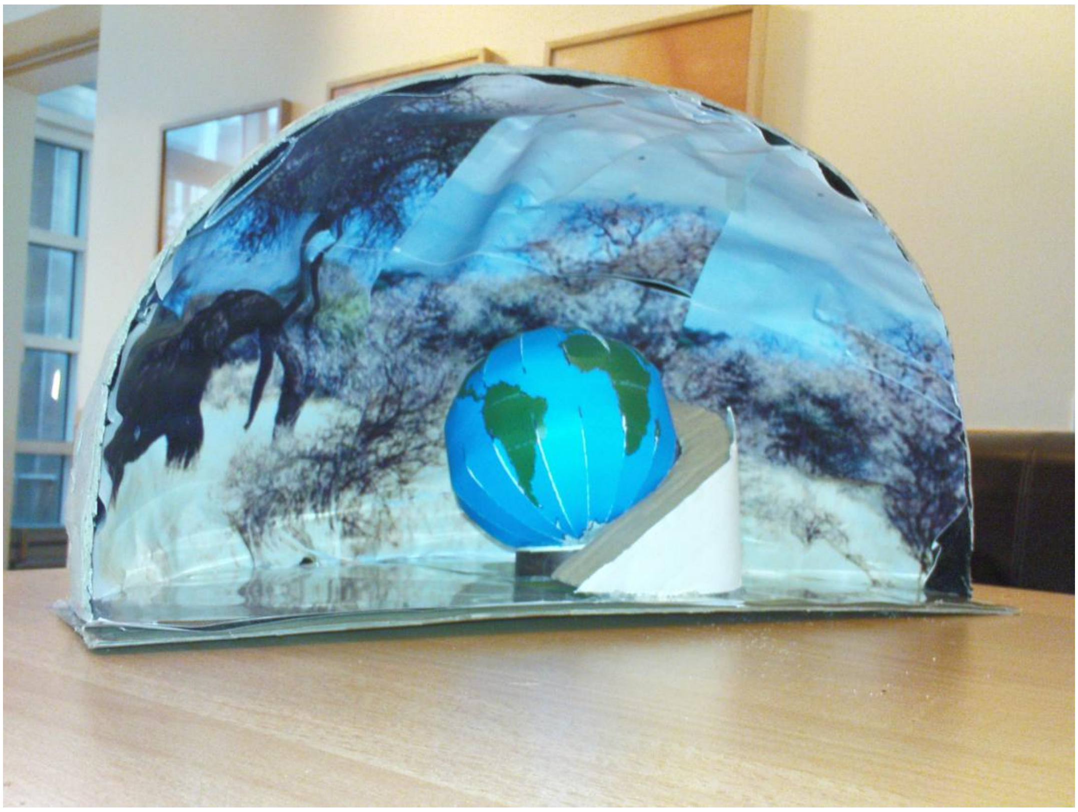

Figure B.6: Low-Fidelity Prototype