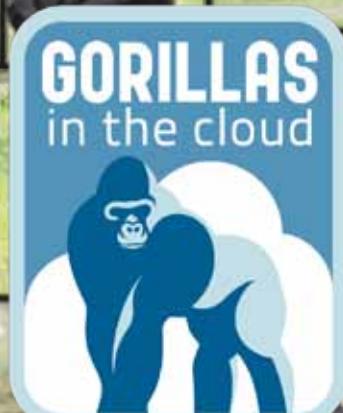
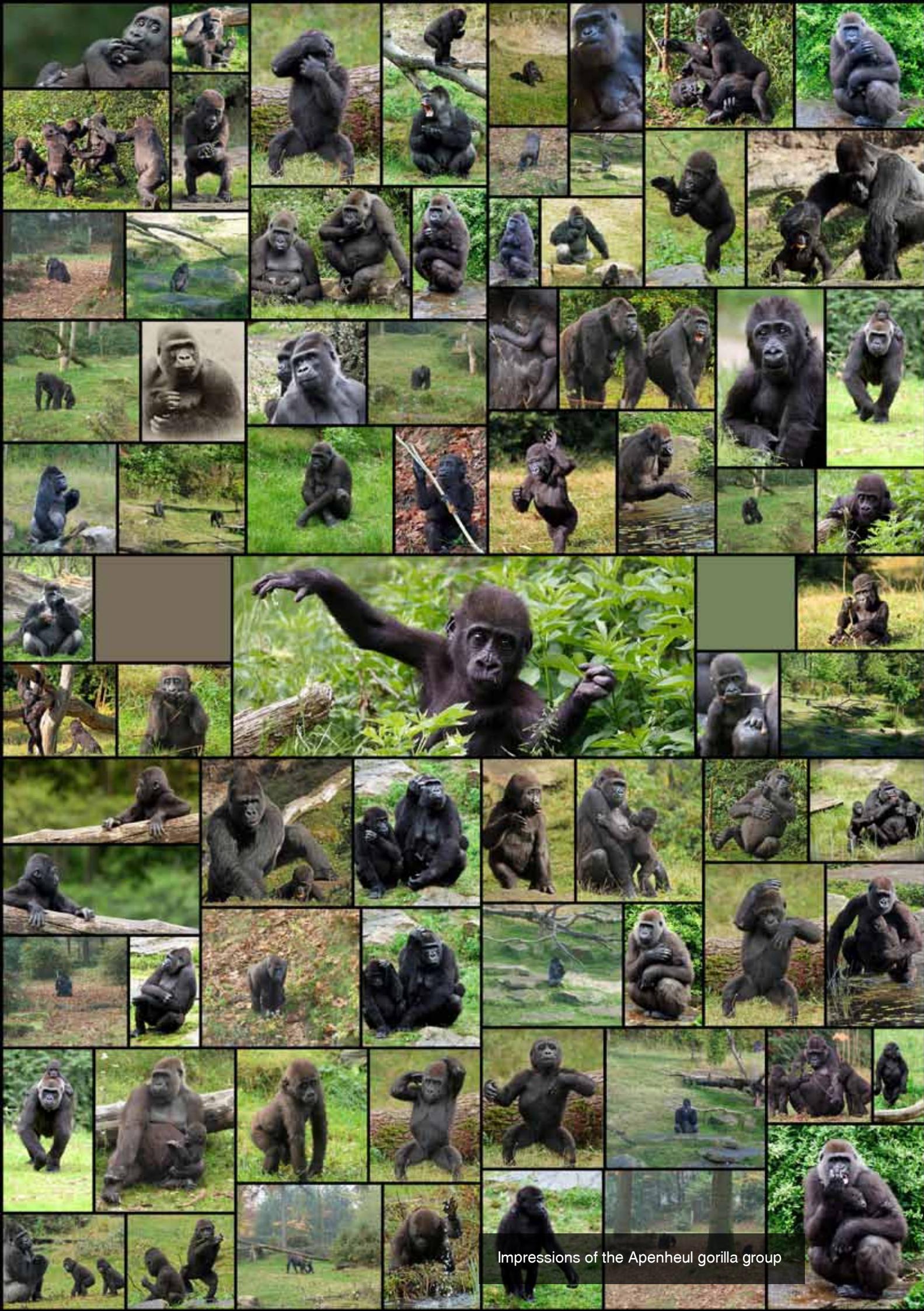


Experiencing gorillas in the cloud

GRADUATION THESIS

By Erik Groenenberg

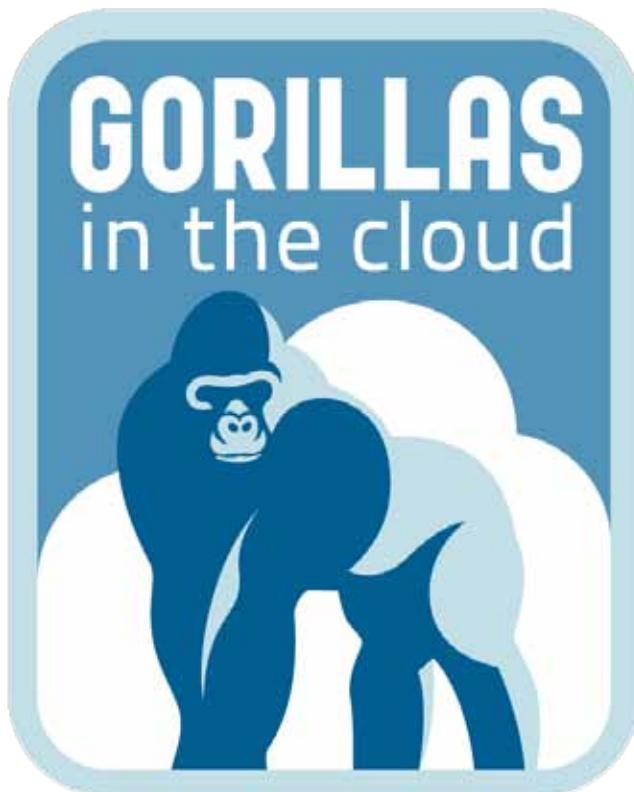




Impressions of the Apenheul gorilla group

GORILLAS IN THE CLOUD

“EXPERIENCING GORILLAS IN THE CLOUD”



The official gorillas in the cloud logo

*Master Thesis Design for Interaction
Industrial Design Engineering
Delft University of Technology
May 2013*

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Young toddlers playing with each other
-Photo by Joke Kok

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Erik

Executive summary

The Project

Experiencing gorillas in the cloud is a graduation project that aims '*to create a product for the Apenheul that enhances the user experience of a visit to the park using sensor data*'. In Apenheul a network of sensors has been placed around the gorilla island, constantly gathering data about the gorillas. Gorillas In the Cloud was created by TNO and Apenheul and other partners with the goal to stimulate innovation. The island of the gorillas serves as a sensor network field lab where professionals can test their sensor hardware and software on a live 'human like' environment. It offers TNO the opportunity to conduct research and to test and develop technologies with (new) research partners. It offers Apenheul the opportunity to differentiate their zoo through new and unique products affecting user experience, marketing and primate knowledge.

In this thesis a description is given of the technology applied, of the users of the park Apenheul and of the design explorations made. One concept has been further developed. Its use is described via scenarios and the designed interactions and interface have been tested with an interactive prototype. Conclusions and recommendations about '*how to experience gorillas in the cloud*' are given.

The brief

A product has to be designed that uses sensor data to create a rich and meaningful user experience for the visitors of Apenheul. The design targets families with young children. TNO wants to raise awareness about their (sensor) technology in order to interest business partners for collaboration. Apenheul received almost 500.000 visitors last year, who could have been potential users of the technology. Currently there are no products yet with which visitors can experience what GITC means and how it works. Products have to be developed that demonstrate the capabilities of the installed sensor network while giving Apenheul and their visitors extra value. People visit Apenheul to see animals and to have a fun day out. The product has to provide the right user experience in order to accommodate visitors during their journey. This graduation assignment explores products that make use of the data captured by current and future sensor technology installed in Apenheul.

The approach

The Network Focused Design (NFD) approach was chosen because it was developed to create networked products with digital content. NFD has been applied on this design case and has been evaluated through summarizing the learnings of the design process. The approach introduces three key terms; data, touchpoints and metadata. During the whole process the skills and approaches taught at the Design For Interaction (DFI) masters programme were used. A technology study mapped the relevant and applicable technologies and trends that are applied and that could be applied in this project. A user centered design approach was chosen to

create designs meaningful to the visitors. User centered design aims to map needs and wishes of end users and to create products that are meaningful to those users. User research was performed in order to map the aspirations, needs and wishes of Apenheul visitors. The research has generated insights which have been used as requirements for the design process. The user studies were done in a qualitative, quick and iterative way to quickly gather important insights. The studies were focussed on collecting valuable insights for the design phase.

The design

The design goal of this assignment was "*To create a product in the park of Apenheul that enhances a 7 year old child's user experience during his/her visit to the park using data from the GITC sensor system*", while providing an *engaging, educating, involving, fun, bonding, relating and reflecting* user experience. The design explorations resulted in 130 sketches, 25 ideas 6 concepts and 1 product prototype. The gorilla mirror concept, based on the skeleton tracking principle of the Microsoft Kinect, has been prototyped and tested. During the design phases the possible data, touchpoints and metadata available and applicable in this project have been mapped and put in sheets.

Test results

User testing with children was done to evaluate the product prototype and the interactions. The tests indicate that children enjoy the product and that the product would be feasible for implementation in the park. First a number of issues resulting from the test would have to be solved and a redesign has to be developed.

Conclusions

The designed product meets the formulated requirements and can be placed in Apenheul to make GITC experiential.

Recommendations

Placing a number of interactive installations in Apenheul would communicate the efforts of the gorillas in the cloud project while enhancing the visitor experience. Once gorillas in the cloud is experiential, the technology and the learnings can be applied for other customers and other markets.

Keywords:

User experience design, Meta products, Innovative zoos, Sensor systems, Data communication, User research, Interactive prototyping, Motion controlled interfaces.

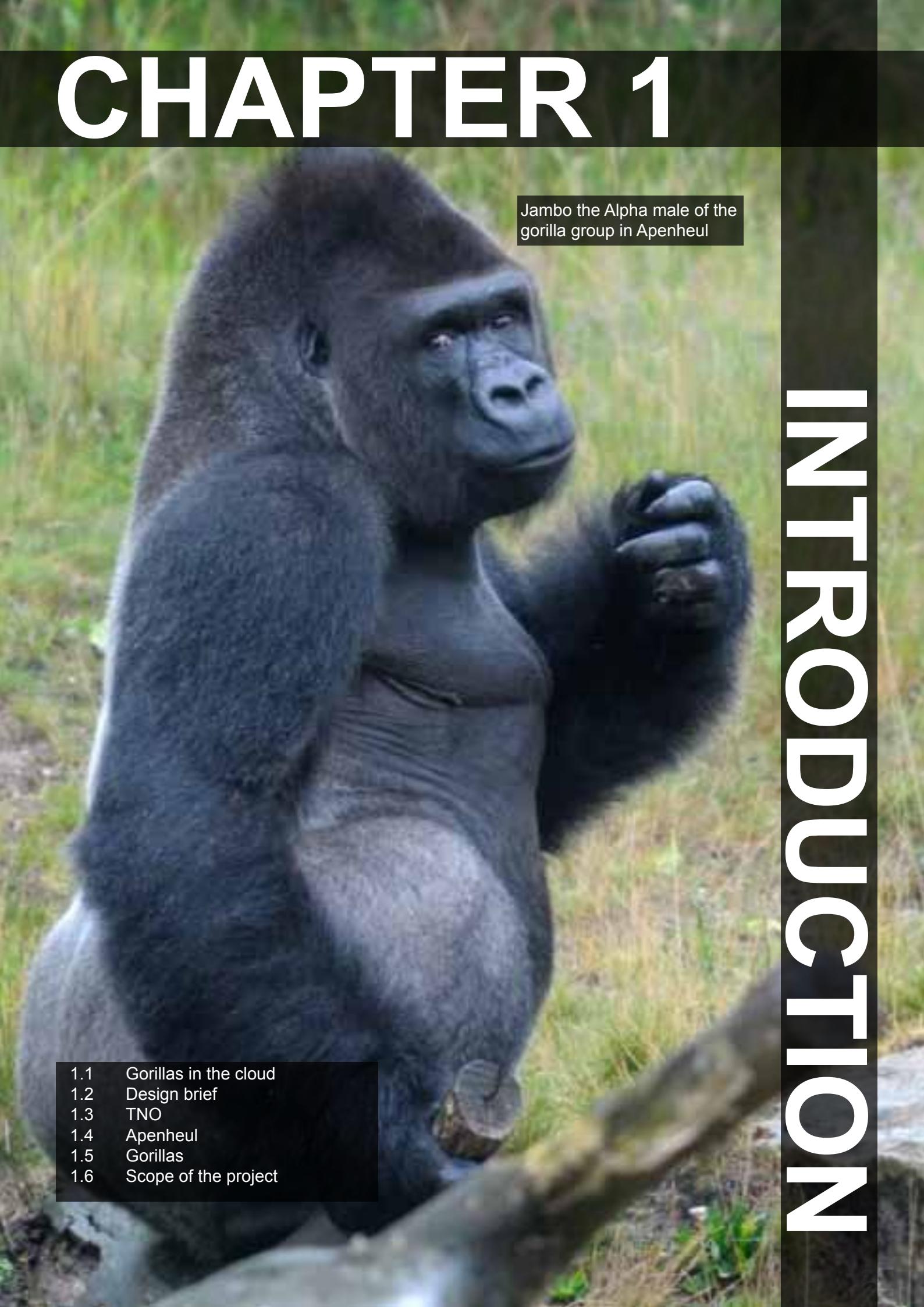


A young gorilla playing with a stick
- Photo by Joke Kok

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CHAPTER 1



Jambo the Alpha male of the
gorilla group in Apenheul

INTRODUCTION

- 1.1 Gorillas in the cloud
- 1.2 Design brief
- 1.3 TNO
- 1.4 Apenheul
- 1.5 Gorillas
- 1.6 Scope of the project

1.1 Gorillas in the cloud (GITC)

Gorillas in the cloud is a research and innovation project that aims to test and innovate sensor technology.

In 2011 TNO was searching for a live ‘human like’ location to test and experiment with sensor networks. Collecting, analyzing and sharing data about humans is bound to strict rules and regulations. That is not the case when collecting data about animals. When TNO came across Apenheul and the gorilla island, it seemed they had found a perfect location. The island is a closed environment with a fixed number of inhabitants. The location is still challenging enough, because of the complex (group) behaviour of the apes. TNO and Apenheul entered into an agreement and chose to name their project ‘Gorillas in the cloud’. Local companies were involved and together a new infrastructure was built.

Gorillas in the cloud as an eco system

TNO aims to facilitate research, innovation and education through gorillas in the cloud by creating an eco system that invites new partners to join the project. The current eco system is visualized in figure 1.1.

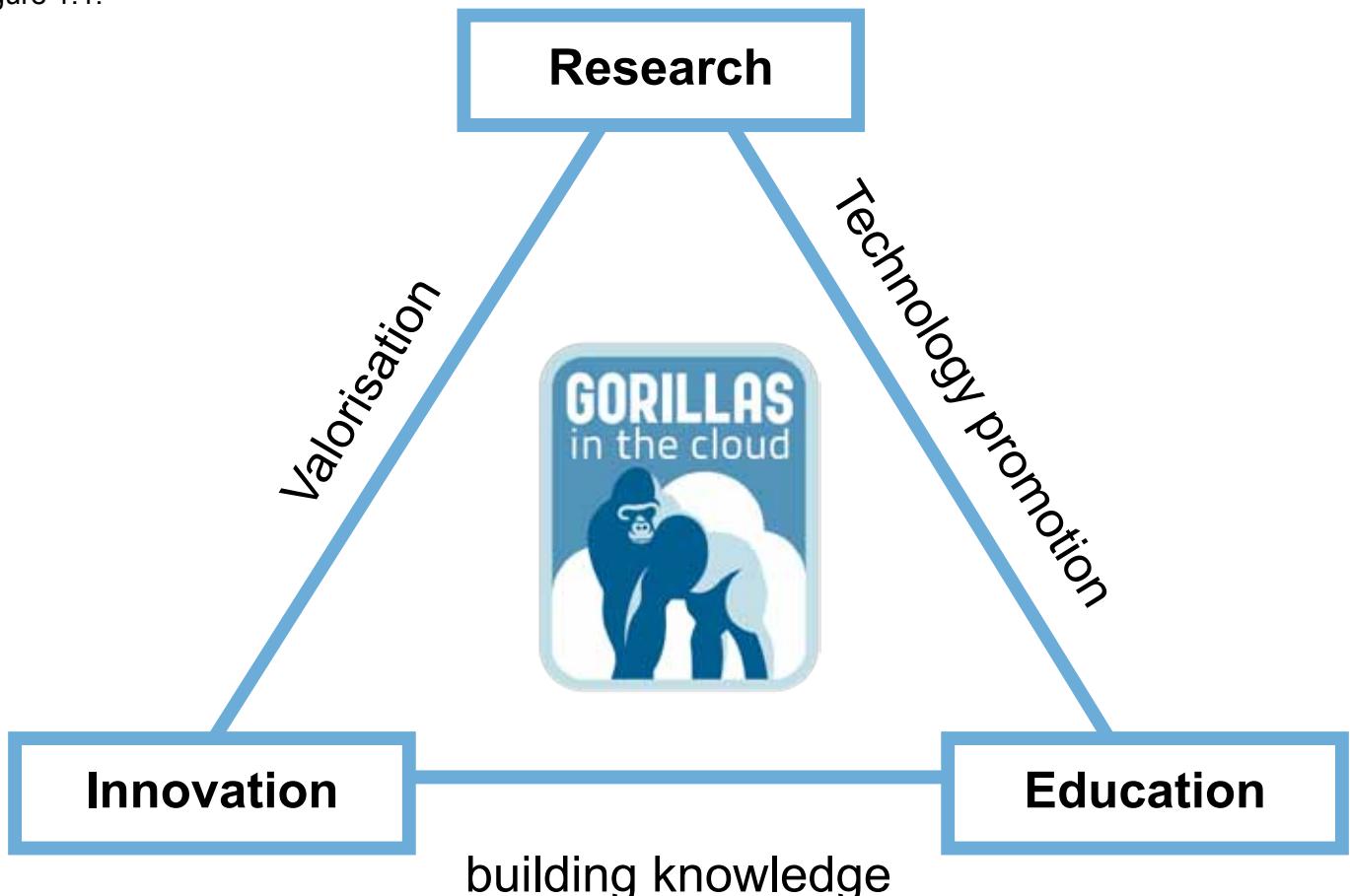


Figure 1.1 - The gorillas in the cloud eco system, envisioned by TNO

1.2 Design brief

Introduction

The main question this thesis tries to answer is "How to create a rich and meaningful user experience using sensor network technology?" This question is applied on the case of GITC, trying to use the sensor network build in Apenheul to create meaningful user experiences for park visitors and gorilla enthusiasts. The gorilla island inside of the Apenheul is currently fitted with a sensor system, containing 11 HD cameras. Software is able to detect the gorillas and to extract more data from the video files. The data is being streamed into 'the cloud' where it has to be filtered and interpreted to gain meaning. Technical systems will process the data and deliver input for a product. A product and a user interface have to be designed in order to communicate the interpreted data, according to the right target group, business model and user experience. TNO has set up a development track for the coming years to implement new technologies and products for GITC.

Problem definition

TNO and Apenheul have invested in the Gorillas In The Cloud (GITC) project by installing sensors around the gorilla island and by developing smart analysis software. TNO is looking for ways to make the data collected by the sensor technology accessible to users. At Apenheul they have set up a field lab. By showcasing the technology, they can attract attention to the sensor systems work field. Apenheul has the opportunity to enrich the visitor's user experience. A study will be done to explore the possible product solutions, to evaluate the potential of these solutions and to prototype and assess a final solution.

Assignment

The challenge in this project is to create a rich and meaningful user experience using the data generated by the sensors. A user interface will be designed and prototyped, using the Network Focused Design (NFD) method. The NFD method was developed with a focus to create 'connected products'. The design will be showing interpreted data and visualizations about (individual) gorillas, extracted from sensor output. The design will try to actively involve its end users. The end users will be visitors of the zoo. The design should be engaging, educating, involving and fun. Design iterations and user research are done to optimize and finalize the design. After the design process the Network Focussed Design approach and the potential of sensor systems within the context of the internet of things will be evaluated through this case.

Parties

There are multiple parties involved in this project. The parties and their role are listed below.

- TNO – Contractor of the project. They study sensor networks and internet of things. TNO is hosting the student in the department of Distributed Sensor Systems (DSS) in The Hague. The student is expected to work individually on the project, but with guidance & expertise from TNO.
- Apenheul – Zoo and host of the test location at the gorilla island. Their goal is to educate their visitors about primates and to let them empathize with the animals.
- Booreiland, design studio – Creators of the Network Focussed Design (NFD) approach. (Inspiration of the project)
- TU Delft – Graduation project. Student project demonstrating the possibilities of the applied methods & techniques to show what (interaction) design can do through product design & prototyping.

Results/deliverables

The project should result in a product, an experiential prototype and user feedback, demonstrating and evaluating the designed interactions. Conclusions and recommendations will be given about the product, the design process and about technical feasibility and priority. The results are being communicated through in between presentations, a final presentation, a final prototype, a design workbook, a poster and in this thesis.

Design discipline

In the work field of design there are many different disciplines, approaches and specializations to explore. All types of design have a slightly different focus. The design principles of this assignment are based upon interaction design, user centered design and user experience design, as taught in the masters programme of Design For Interaction by the faculty of Industrial Design Engineering by the TU Delft. An infographic about User Experience design has been posted by Design blog Fastcodesign.com [w1] , showing the different disciplines merging in Interaction Design, as a part of User Experience Design (see figure 1.2). The illustration is not an exact representation of the work field, but it demonstrates how diverse interaction design is.

Personal interest

Looking at current developments in digital technology, it appears that the boundaries between the physical and the digital world are dissolving. Blending analog and digital experiences together is a big challenge for interaction designers and that is where good interaction design can make a difference.

The Disciplines of User Experience Design

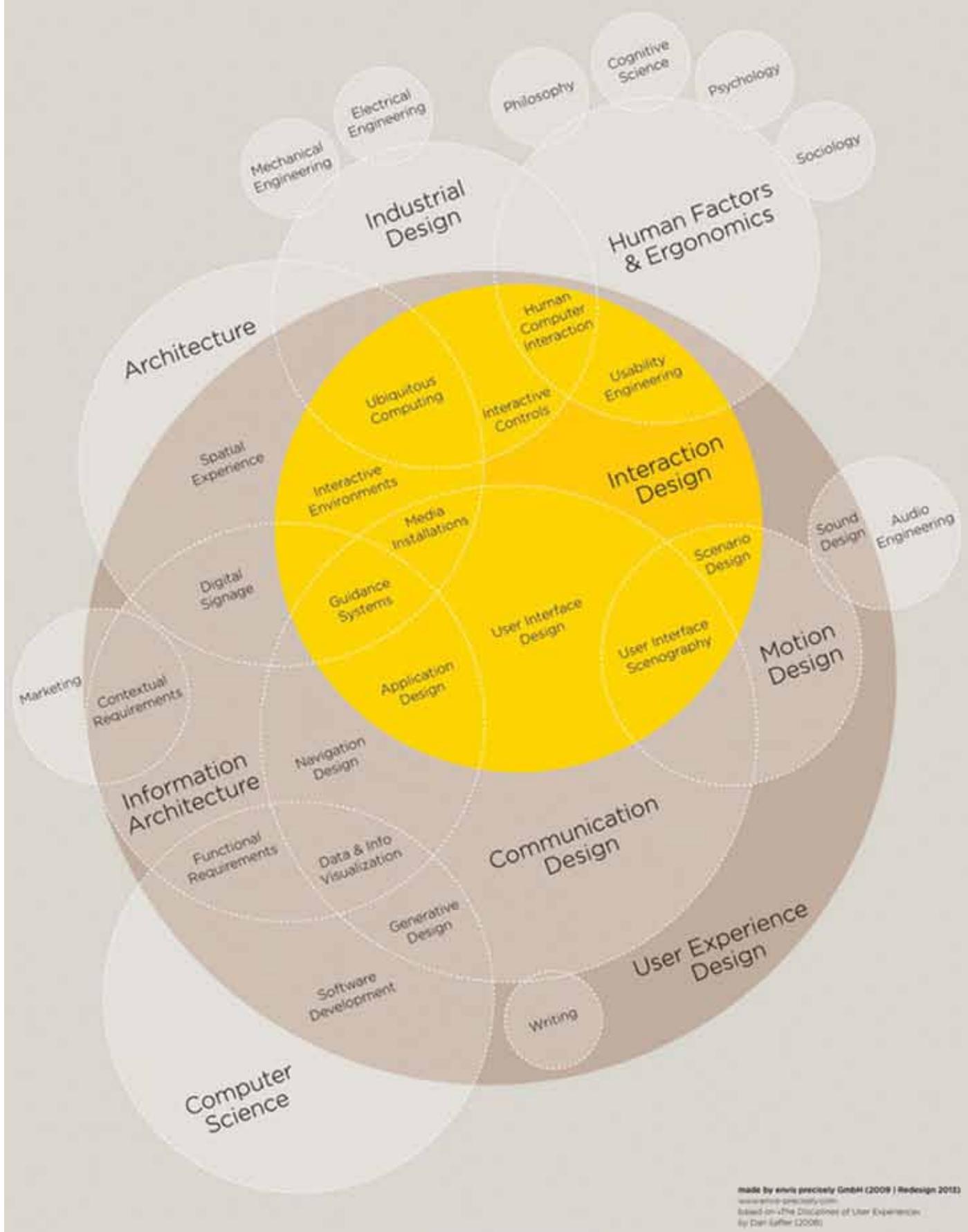


Figure 1.2 - The disciplines of User Experience Design - an insight in the complexity of interaction design & UX design

1.3 TNO

TNO is the main client in this graduation assignment and therefore it is important to understand their organization.

The company

TNO has a number of aims for the Gorillas In The Cloud (GITC) project; to research & innovate, to attract business partners and to showcase and test sensor system technologies in a field lab. Eventually, the developed technologies should lead to big impact and meaningful innovations for society. The knowledge gained should be applicable to new projects, markets and research.

TNO is an independent research organization that tries to use its research and expertise to make important contributions to the competitiveness of companies and organizations, to the economy and to the quality of society as a whole. It is a large organization, hosting 3,900 employees and has a turnover of 577 million euros (2011). According to their website [w2] the company as a whole has the following mission:

“TNO connects people and knowledge to create innovations that boost the sustainable competitive strength of industry and well-being of society.”

Innovation with purpose is what TNO stands for. They want to have an impact on society with the innovations they achieve, making life more pleasurable and helping companies to be innovative, finding new answers for problems found in modern society. As a knowledge broker, TNO tries to advise its customers, ranging from SME's to larger companies to governments, on finding the optimum solutions that are geared precisely to

the questions that they have. The company tries to build a bridge between inventions and theoretical research and tries to support innovations that meet the market demands. During his speech at the TNO winter school 2012 [s1], Jan Mengelers, member of the board of directors, talked about the key features that differentiate TNO. Features such as that TNO is non-profit, that it is commissioned by the Dutch law and that it wants to generate impact.

In order to understand where inside TNO the GITC project fits you would have to look at their organizational structure, which consists of a larger functional matrix, containing 7 themes and 3 expertise areas. Outside of this matrix TNO works with different expertise groups, projects and with TNO companies. The gorillas in the cloud project is positioned within the Technical Sciences expertise area and the information society theme. The project is positioned in the Distributed Sensor Systems expertise group, see figure 1.3.

TNO – Technical Sciences

The Technical Sciences expertise area has a staff of over 1500 high degree employees with the ambition of working together on crucial technological breakthroughs for the societal challenges we face today and tomorrow. The areas of expertise range from material science and mechatronics, physics and electronics, fluid mechanics and chemistry to civil engineering and ICT. Technical sciences work closely together with knowledge partners and with industry.

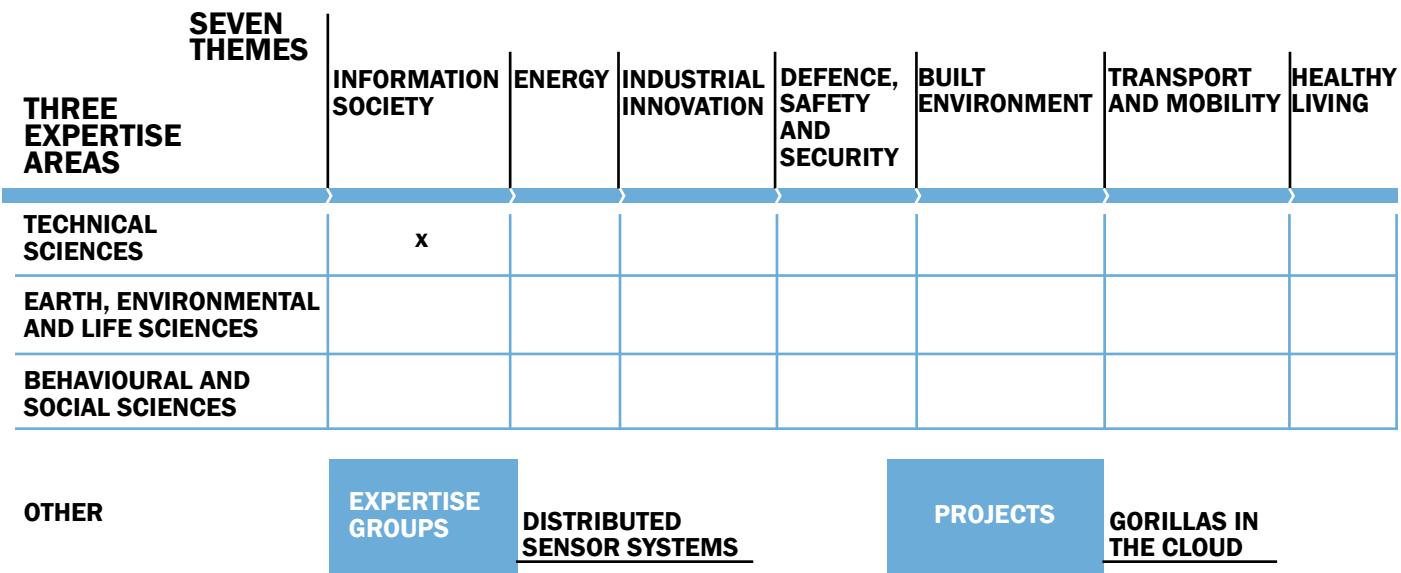


Figure 1.3 - The positioning of the gorillas in the cloud project inside the TNO company structure

TNO - Theme Information society

According to the information society theme, ICT, media and space technology are essential to our society. A new information infrastructure is emerging whereby citizens, industry and government will communicate with each other in new ways and will fully employ open data. The impact of this on many societal and economic processes will be considerable, though as yet unknown. TNO investigates and stimulates the introduction of new applications of media, supporting government and industry in identifying and applying new communication possibilities. The main challenge is to enable the information society to develop in such a way that it is not only sustainable but can also boost productivity as well as solve a number of social problems without any loss of confidence in ICT. The innovating power of ICT enables us to do things differently: more efficiently, better, faster, smarter and more sustainable. Smart ICT innovations can help solve complex societal issues like climate change, demographic ageing, scarcity, education, mobility, care and safety. In fact, the smart application of ICT is a precondition for this.

TNO researchers have been/ are working on the project, depending on the time and money available. The project is funded by subsidies, by TNO, by the Apenheul and by business partners.

TNO - other

Other TNO expertise groups involved in the Gorillas in the cloud project are Intelligent Imaging, perceptual and cognitive systems and Media & Network Services.

TNO - Expertise group - Distributed Sensor Systems

Within each expertise area there are different expertise groups. During the graduation project Martin van Rijn and other members of the Distributed Sensor Systems (DSS) group were involved in developing the technology for GITC. Integrated Systems bridge the gap between sensor research and sensor application. Distributed Sensor Systems focuses on distributed observation systems that deliver enhanced situation awareness.

This expertise group distinguishes itself by their thorough domain knowledge for heterogeneous sensor systems and their determinative expertise in processing and architectures. The delivered output ranges from innovative concepts to operational systems. The expertise group is able to integrate subsystems and modules, to define innovative architectures and to design and build complete operational systems ready for series production by partners. The multidisciplinary approach includes technologies as sensor fusion, sensor networks, multi- agent systems, cognitive systems and human machine interaction.

TNO - project - Gorillas In The Cloud

GITC is a project initiated by TNO to further develop sensor technology & detections and to create a live field lab where TNO, partners, universities, researchers, artist and businesses can work with sensors. The goal has been to experiment with measuring and processing live situations close to those which can occur in human life. A handful of

1.4 Apenheul

Apenheul is a zoo specialized in primates. The park is located on the edge of the Veluwe in the city of Apeldoorn.

Apenheul foundation

Apenheul is a foundation. They are not subsidized and are completely dependent on visitors for their income. To achieve their goals Apenheul employs more than 60 permanent members of staff. During the season in which Apenheul is open to the public, April - October, they are assisted by many seasonal and part-time employees. Apenheul has served 487.000 visitors in 2012 [w3.1].

History

Apenheul has been founded in the sixties by Wim Mager, a photographer from Rotterdam. He decided to build a park for his pet monkeys. The concept Wim envisioned was simple; people enjoy primates most when the primates are enjoying themselves and behave naturally. The animals no longer lived in cages with bars, but in large, natural enclosures in the forest. Apenheul opened in 1971 as a small but revolutionary zoo. It is the first and only zoo in the world where primates live free in the forest and where they can also walk around the visitors. The freedom given to the animals allowed them to form ideal social groups and to reproduce perfectly, as opposed to the conventional zoos where small cages disallowed the animals to behave naturally. Soon the concept was proven to be successful for both animals and visitors. [w3.2]

Mission

The Apenheul foundation is an idealistic organization, with a dedication to serve their visitors while taking care of their animals in the best possible way. The advertisement slogan of Apenheul is '*Herken jezelf*' or in English '*Recognize yourself*'. They try to show their visitors the commonalities between humans and primates and their behavior. By literally bringing people in touch with primates, Apenheul hopes to educate people about the animals and the beauty of nature. The animals in the park are 'ambassadors' for their own species in the wild.

A sustainable message

Apenheul tries to be sustainable in many different ways. They want to have the best care for their own animals, support care for animals worldwide, support primate research and conserve and protect nature including endangered species. The buildings of the park are designed to be sustainable and have low environmental impact. Even the coffee served in the park is specially made for Apenheul, so that coffee farmers won't threaten the natural

habitat of certain kind of monkeys. Apenheul has their own conservation fund, the Apenheul Primate Conservation Trust (APCT).

Knowledge centre

Apenheul is a specialized zoo and has a good reputation as experts on primates. Years of experience and research at the zoo have provided a wealth of information. Apenheul is always willing to share that information with other zoos and researchers.

Collaborations

Apenheul collaborates closely with a number of national and international partners. The goal is to exchange knowledge about animals, education, research and nature preservation. Some of the partners of Apenheul [w3.3]:

- Nederlandse Vereniging van Dierentuinen (NVD)
- The European association for Zoo's and Aquaria (EAZA)
- EAZA Zuidoost-Azië campagne
- World Association for Zoos and Aquaria (WAZA)
- International Union for Conservation of Nature (IUCN)

Apenheul - Goal GITC

Through investing in the GITC project, Apenheul aims to build an innovative system providing added value by improving the visitor experience, the branding & image and the knowledge about gorillas. As an effect Apenheul aims to increase their visitor numbers, the perceived quality of their zoo, their gorillas expertise and their revenue streams.

Animal welfare

To Apenheul, the welfare of their animals is their primary concern. Apenheul has joined the GITC project, but only under the condition that there will be no harm to their animals. For this reason, physical sensors and/or devices attached to the gorillas is out of the scope!



1.5 Gorillas

Gorillas belong to the group of greater apes. They are very similar to humans. Up to 98% (estimation) they are genetically the same as humans. Their brain is estimated to be up to 70% similar (though their brains weigh only 40% of that of a human). They are ranked third or fourth when it comes to the closest relatives to humans in nature. A Gorilla can grow to be 45 to 50 years old. An adult gorilla is about 200kg if it is a male and 100kg if it is female. They grow to be about 1.70-1.80 meters tall. Gorillas are vegetarians. They eat 12-15 kg a day (in Apenheul) or in nature even up to 25-30 kg. Because of their diet (plants, fruits, vegetables) they spend a lot of time processing their food. Therefore, gorillas are considered to be very quiet and relaxed animals. Gorillas are also considered to be very smart, but apparently they lack the ambition and motivation in their lives (as far as we know) to do something truly different than finding & processing food. Figure 1.3 shows how gorillas are classified as great apes and as primates [w4].

Apenheul has 15 Gorillas; 5 males, 10 females, ranging from .3 months to 38 years in age, see figure 1.4. The group is quite special, since it was the first group of gorillas in captivity that successfully managed to raise their babies. This success has brought primatologists from all around the world to see the group.

Behavior Gorillas

Gorillas show similar kinds of complex behavior as humans. Only professionals that have worked with gorillas for a longer time, or to some extend behavioral scientists, can understand their personalities. Gorillas can communicate mainly nonverbal by using expressions, gestures, and postures. They can also communicate verbally. They have a few ways of making sound, such as grunting or coughing. Ronald van der Beek, gorilla care taker

from Apenheul [s2], said "Gorillas have about 5 words they can say in 100.000 different ways" (as an illustrative statement). Gorillas also experience complex emotions. They behave differently according to those emotions, but it is very hard to detect what those emotions are, even for a trained professional.

Social dynamics

Gorillas live in groups with a harem structure. They are social animals, much like their human relatives. In the group there is a hierarchy, they all have their positions. There is usually 1 adult male which is the great leader, but sometimes there can be up to 5 or 6 males (also depending on gorillas in the wild/in the zoo). The most powerful male is the one on top of the hierarchy. Power comes not only with physical strength but also with factors like leadership capabilities, trust and experience. Depending on a number of factors, gorillas are higher or lower in ranking. How they are ranked manifests in closeness to and favour of the leader. The ranking is a dynamic process. Some influencing factors are; age, character, having babies or not, family/friends within the group and personality, amongst many others.

Sensory detections

Biologists and observers usually have a pre defined research question which they will analyze in the wild. Through observations they can tell the relation between apes by looking at individual distance between gorillas, gestures and the number of positive/negative encounters. If sensors could automatically annotate and record that data and if it would be possible to ask a research question using the recorded data, it would be a revolutionary system. Saving just raw data is one thing, but you would also have to consider external, social and anthropological influences (for gorillas). Table 1.1 shows some key factors, but there are still plenty

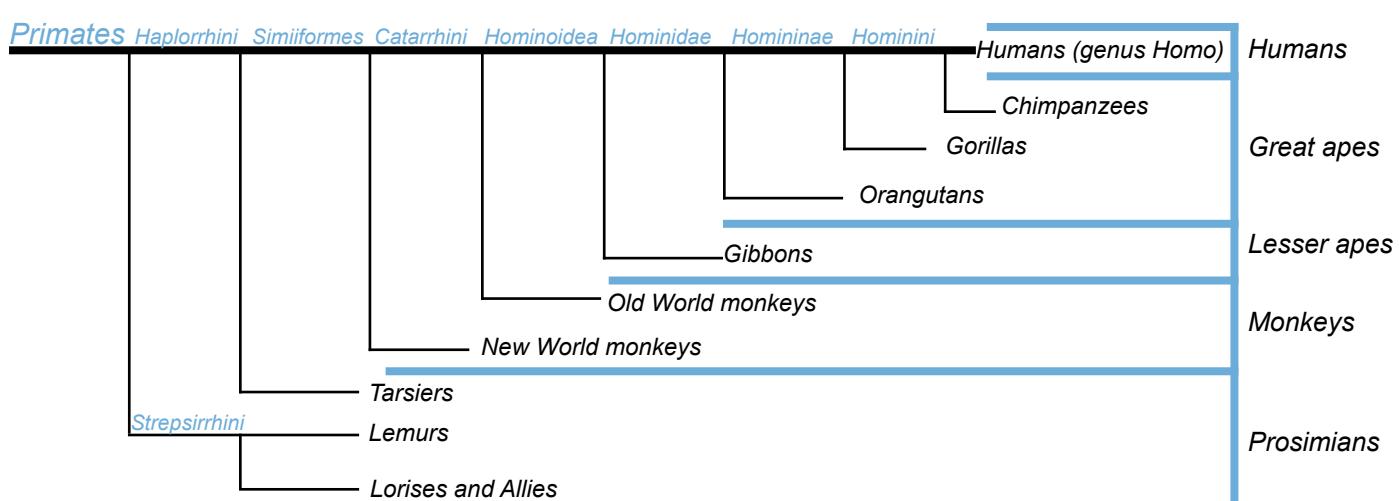


Figure 1.3 - Classification of primate species (image based on wikipedia)

WIE IS WIE BIJ DE GORILLA'S?

Op het eerste gezicht zijn alle gorilla's zwart en op een enkele na groot. Toch lijken ze zuivel qua uiterlijk als qua karakter beslist niet op elkaar! Dit zijn de gorilla's van Apenheul:



Figure 1.4 - Profiles of the gorillas in Apenheul (provided by Apenheul). Jabari was added to the image

more to be added. If you look for example at the external factor 'do nuts fall from the tree', then you could explain why gorillas like to sit close to the trees for a few weeks a year. If you forget to annotate this external factor, wrong interpretations might be made about the reason why they sit near the trees.

Datasets

Capturing a complete dataset will tell more about the gorillas.

External data feeds

External information can be downloaded and added to the database, such as weather information, to make the dataset more complete.

Length of the recording

The datasets will improve with a longer length of the recordings. The longer the time frame, the more data, the better the data spread, the more valid the patterns & conclusions identified. It can take up to 10 or 15 years before enough data is captured about the gorillas. Think about the development of

a young baby into an adult. According to all phases in his/her life the behavior of the gorilla will be very different.

The accuracy of the detections

Improving the certainty of detections and decreasing the number of false detections will improve the datasets.

The amount of detectable 'things'

Sensors can capture almost anything, from objects to behavioural patterns. Increasing the list of detectable things would give a more complete image of the captured moment of real world. For example, capturing neck bites would show a lot more about who is in charge.

Conclusions

There is enough interesting material to capture of gorillas. Datasets should be as complete and accurate as possible, to learn the most about gorillas.

External influences	Social	Anthropological	Actions
Weather & season (sun/rain/temperature)	Personality of Gorilla	Hierarchy	Neck bite
Inside/Outside	Mood of the gorilla	Raising children	Touch
Feeding session yes/no	Emotion at that moment	Family	Eating
Employees present?	Stress	Confrontations	Sleeping
Do nuts fall from the trees?	Relationship status	Conflicts	Playing
Etc.	Phase in life of gorilla	Phase of the group	Fighting

Table 1.1 - Examples of thing possible to detect from gorillas

1.6 Scope of the project

This project covers three main topics; technology, users and design. In chapter 2 the technologies that apply to this project are discussed. In chapter 3 zoo visitors and their behaviour will be studied. Chapter 4 explores the design possibilities for GITC and connected products. Chapter 5 describes the final product, bringing the technology, the user and the design together. User testing is done to refine the designed product, as described in chapter 6. Final conclusions and recommendations about the product and '*how to experience gorillas in the cloud*' are given in chapter 7. As a timeframe, the product should be feasible to implement in 2015.

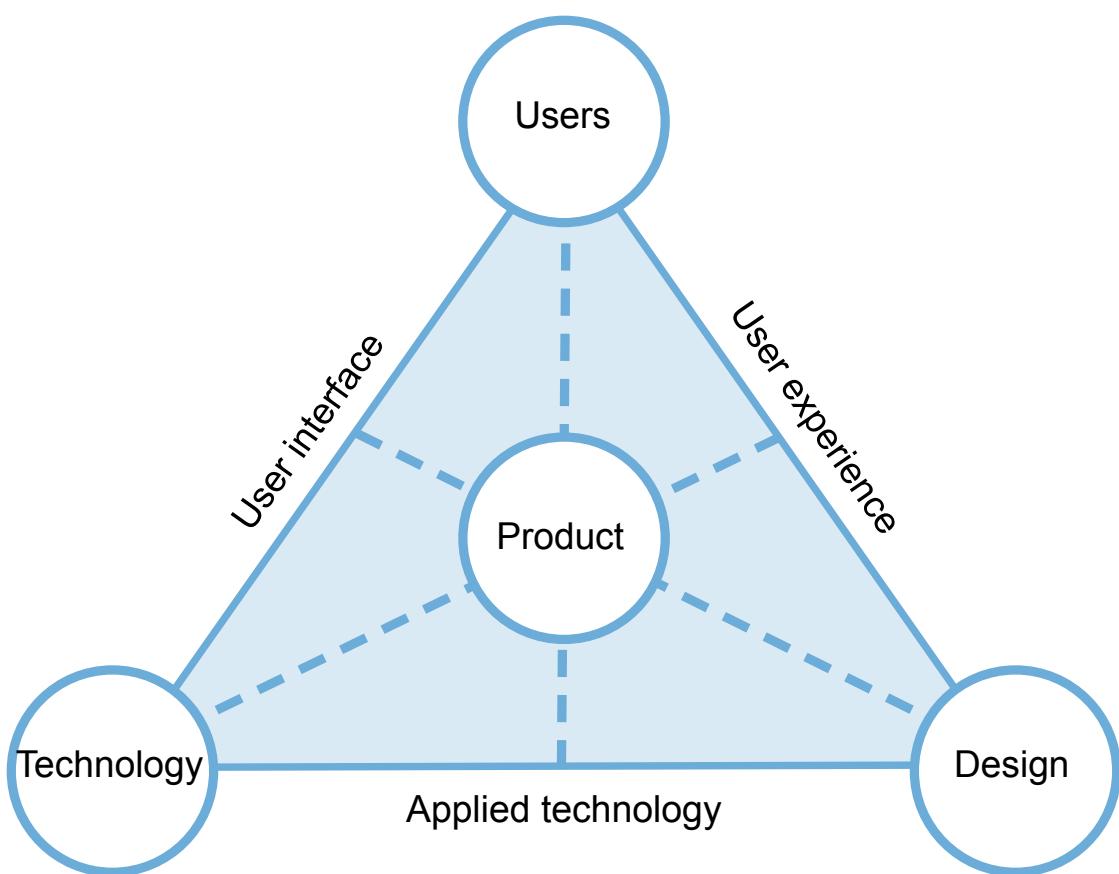


Figure 1.5 - The scope of the assignment

TECHNOLOGY ANALYSIS

CHAPTER 2

The server running above the gorilla habitat



- 2.1 Data collection infrastructure
- 2.2 Detection methods
- 2.3 Data processing technologies
- 2.4 Trends to consider
- 2.5 Interactive parks
- 2.6 Markets
- 2.7 Conclusions

2.1 Data collection infrastructure

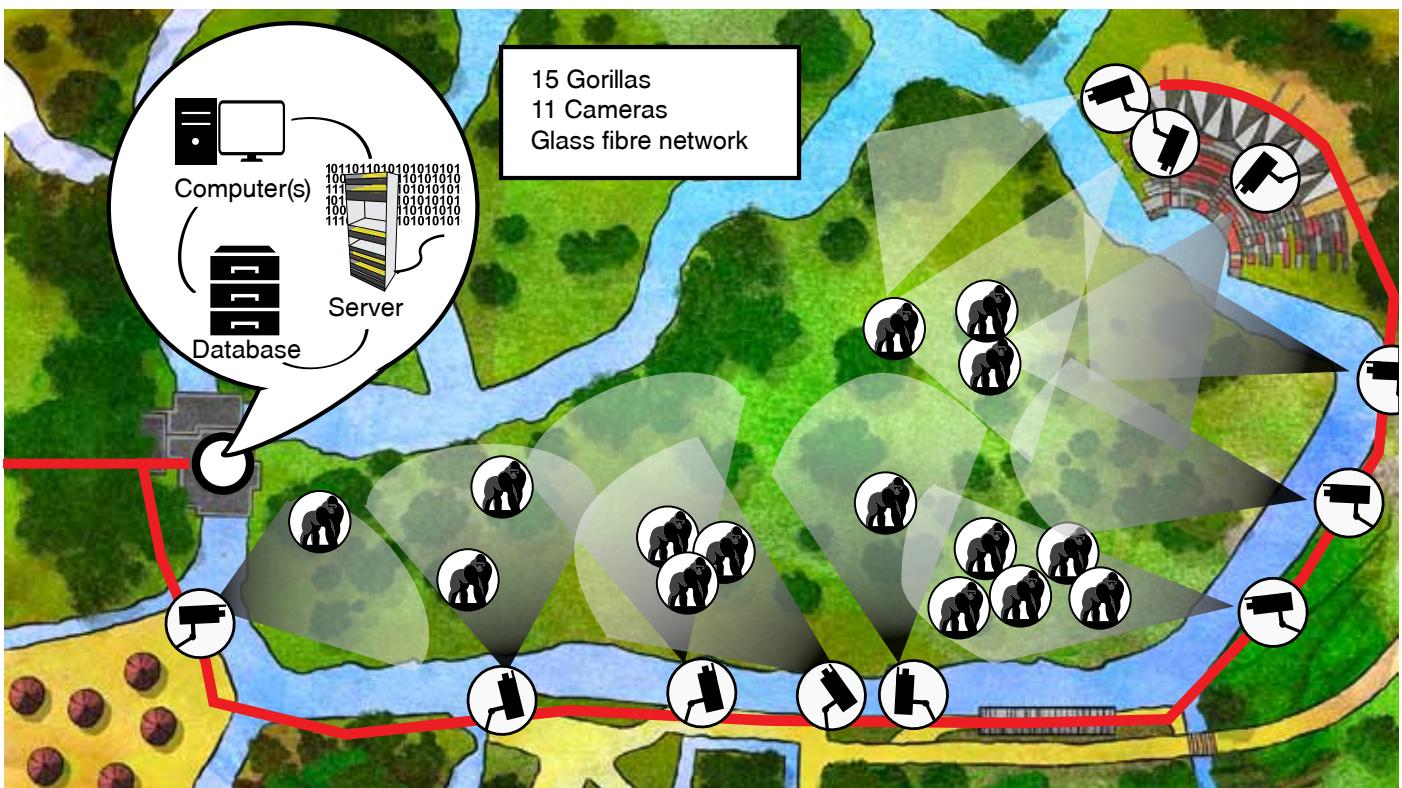


Figure 2.1 - A schematic overview of the gorilla island

Technical set-up

The technology currently implemented around the gorilla island is visualized in figure 2.1. Eleven cameras capture video files of the Fifteen gorillas living on the island. Through the glass fibre cables the content is sent to the server, which then distributes the files to various places in the network. Computers in the server room analyze the captured data and extract extra information, writing it to a database. The server can distribute the database and datasets to computers all over the world via the internet.

Raw Data

The installed cameras around the island have their own IP address and their video streams and can be accessed through the internet. They can communicate their time, image files and video files.

Web feeds

External data can be downloaded by the servers and added to a database. For example the weather data from Apeldoorn can be saved in the database.

**TNO has the ambition to add more and different types of sensors*



Figure 2.2 - Images captured from the video streams by the cameras around the gorilla island

2.2 Detection methods

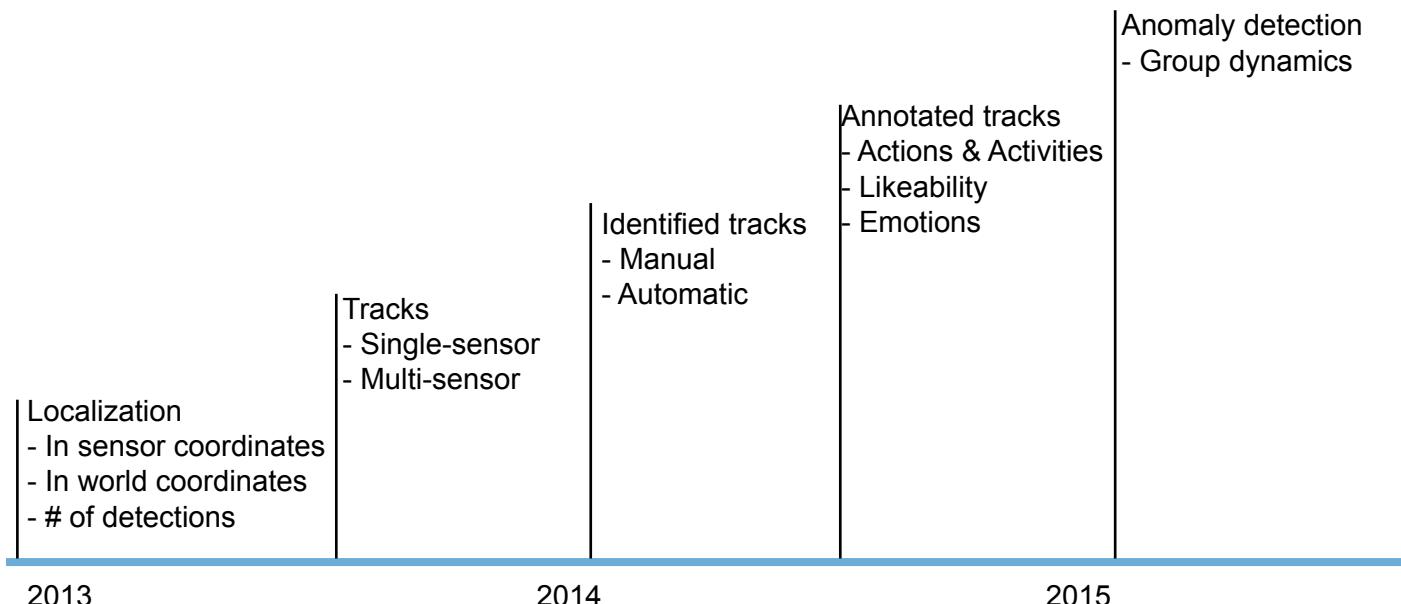


Figure 2.3 - The technical development roadmap for the GITC project. Image adapted from a TNO powerpoint slide

Development roadmap

TNO has sketched out a road map for 2015 to further develop their technical framework, see figure 2.3. The way those detections will be implemented depends on the numbers and types of applications that will use the output.

Localization

TNO has developed detection software; when a gorilla is spotted by a camera, an x and y coordinate on the island are calibrated and will be projected as a dot on the map. From the x & y coordinates and the location of the camera, also a Geo-coordinate can be determined. Figure 2.4 shows the calibration interface of a similar system developed by G4S.



Figure 2.4 - A camera calibration interface developed by G4S

Bleep

Apenheul and TNO are currently working on the prototype of a localization system they call Bleep; real time localization of gorillas projected on a map.



Figure 2.5 - Screenshot from the early prototypes of the gorilla Bleep localization software

Tracks

Developers within TNO are currently working on optimizing the location and tracking algorithms. The dots in figure 2.6 show where the camera has spotted a gorilla and it has plotted the location over time on a static image. As a result the tracks of gorillas are clearly visible. By calculating the time and distance between two detections, an estimation can be made if the detection was made of the same gorilla, see figure 2.7. If so, a Trackid will be given to a series of detections, indicating the path of an individual gorilla. The tracks of multiple sensors can be compared and integrated into a single model.



Figure 2.6 - Camera detections of gorillas displayed as dots on the screen.

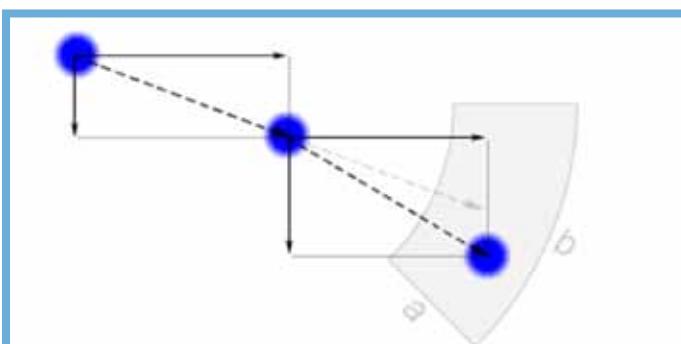


Figure 2.7 - Analyzing the location and speed between two detections, returning a trackID

Identified tracks

Detection of individual gorillas is possible. The Fraunhofer institute in Germany has developed face recognition software for primates in their SAISBECO project. TNO is trying to collaborate with the institute to develop a software package that is able to identify gorillas individually, based on their face, but also on different attributes such as size of the gorilla.

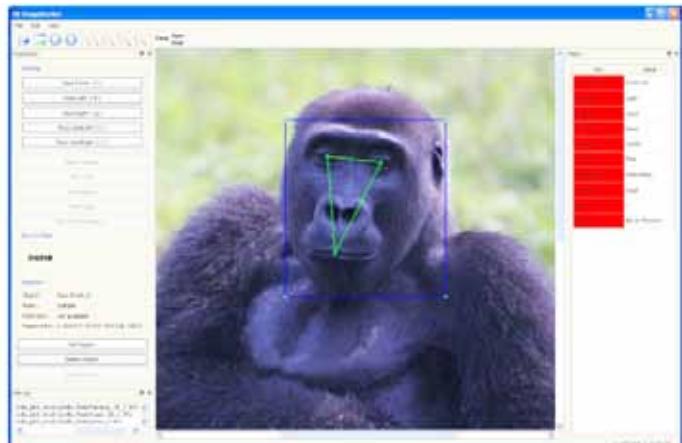


Figure 2.8 - A screenshot of primate face recognition software, developed by the Fraunhofer institute

Annotated tracks

When analytics software is able to recognize the actions, interactions and emotions of the individual gorillas and as a group, more information can be extracted from the sensor data and be saved in a database. This step is challenging state of the art video analyzing technology and other sensor technology. A number of annotations can be made, shortly explained below.

Actions & Activities

An action is a registration of a single event; an activity is a registration of an event over a period of time. Analytic software could detect a number of predefined actions & activities. Figure 2.9 gives an example of interpretations of actions & activities shown by gorillas and serves as inspiration to select which types of activities to pre-define.

Likeability

A judgement can be made if a video clip is relevant for the users or not, based on different parameters. Through crowdsourcing dynamics, users could vote on the likeability of a video clip, giving subjective scores by liking or rating.

Emotions

Gorillas are expressive and emotional animals. Will it be possible to read the emotions of gorillas through sensors? Emotions could also be derived as an effect of another measurement, such as heart beat fluctuation. Companies such as Vicar Vision are developing face recognition software which can also detect expressions and other characteristics.

Activities & Actions



Figure 2.9 - Examples of actions & activities that could be detected by computer software

Anomaly detection

Once enough entries have been registered in to a database, algorithms can detect patterns and things that usually occur. If detections differ from the usual pattern, they can be classified as anomalies. Once anomalies are detected, users, observers or caretakers can automatically get a notification when an anomaly happens. An example could be a gorilla that climbs a tree, which has never been climbed before.

Interactions & group dynamics

Within gorilla groups complex group dynamics exists, such as a hierarchy tree, family relations, sexual relations and so on. By measuring the distance between gorillas and by counting the types and the number of interactions between gorillas, claims can be made about a gorilla's position in the group.

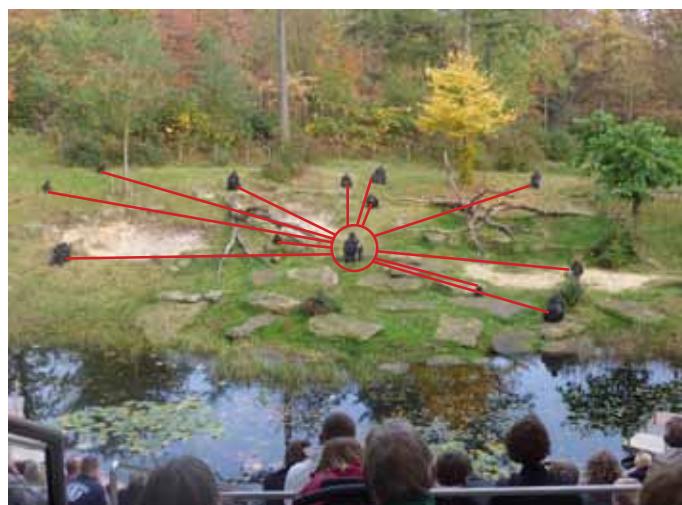


Figure 2.9 - The distance to the leader clearly manifests itself during the feeding presentations

External sources

Extra input for the database can be collected from external sources.

Time & date

The time and date can be captured from computer clocks.

Weather data

Using data from weather update services.

Manual input data

Data that is manually entered by a person in to a database. This could be the names and the birthdays of the gorillas.

Social media

Data collected through social media feeds, such as facebook posts and twitter messages

User generated content

Content uploaded by users, for example pictures of gorillas doing an unusual action send by visitors.

2.3 Data processing technologies

The technologies that apply to GITC have been analyzed. Three technologies that are in the current project are intelligent imaging, cloud computing and big data. Six more technologies that could be applied to GITC have been selected and analyzed, being data visualization, quantified self, Internet of Things, crowdsourcing, digital signage and augmented reality. A description of each technology will be given and possible implementations in GITC are discussed.

1 Intelligent imaging

Smart algorithms and software are capable of analysing the content video images. The input can be picture or video files. With current image and processing technology, it is possible to identify objects, people and even to some extend actions and emotions. TNO is developing and applying imaging software to localize and track the apes on the gorilla island. By further developing the software, more advanced features and precise results should become possible. The Fraunhofer institute has developed facial recognition software for apes, which could be integrated in the detection software running in Apenheul, resulting in identified and annotated tracks.

Challenges

There are several challenges for intelligent imaging to address;

- To optimize software performance to gain the highest level of certainty and precision in the detections with the least amount of resources.
- To develop generalized software that can also be applied in everyday situations.
- To experiment and research with new topics in imaging such as animal detections, activity detections and emotion recognition.

The knowledge and experience gained during the development of these imaging algorithms can be applied for other projects.

2 Cloud computing

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). [w5] Because more devices will be connected to the GITC infrastructure, cloud computing is applied to control the data streams of GITC. The National Institute of Standards and Technology (NIST), of the U.S. department of commerce has identified 5 essential characteristics of cloud computing, 3 different service models and 4 different deployment models [p1]. The characteristics and models that apply to the gorillas in the cloud project have been

described.

Essential Characteristics

- On-demand self-service

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

- Broad network access

Capabilities are available over the network and accessed through standard mechanisms (e.g., mobile phones, tablets, laptops, and workstations).

- Resource pooling

The provider's computing resources are pooled to serve multiple consumers. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

- Rapid elasticity

Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

- Measured service

Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Service models

- Software as a Service (SaaS)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user specific application configuration settings.

- Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Deployment Model

- Community cloud

The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g.,

mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

3 Big Data

On the gorilla island computers continuously collect, analyse and save large amounts of data, building an extensive database. Eleven cameras are feeding computers with high definition video images. Those computers apply data analytics to extract the most valuable information from the raw data. The video clips and the extracted data are stored in the cloud. If every day 12 hours of video content from all 11 cameras would be stored using the H.264 codec, 8Mbit/s, approximately 475.2 GB of data storage room would be needed per day. The H.264 codec is currently one of the most commonly used formats for the recording, compression and distribution of high definition video and is being used by streaming internet sites such as Youtube and Vimeo [w6]. Smart solutions need to be applied in order to filter, analyse, store and distribute the data generated with the GITC sensor system.

More value can be derived from raw or processed data when analytics will recognize patterns &

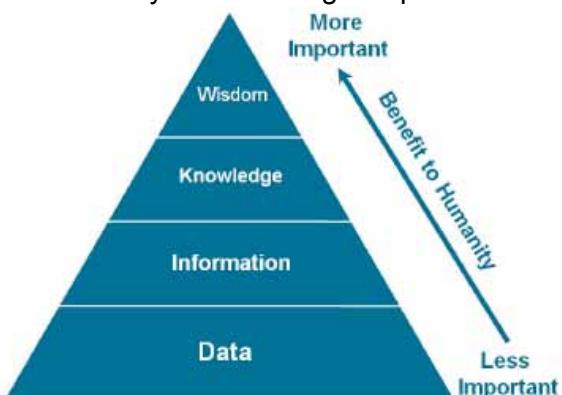


Figure 2.10 - The data, information, knowledge, wisdom pyramid, by Ericsson

anomalies in data. That information can lead to new insights, knowledge and wisdom, see figure 2.10 [p2]

According to Philips Design, “*the biggest revenue streams will not come purely from technical solutions. Instead, the key to making dollars out of data lies in finding the insights among the chaos and white noise by moving from data mining to data meaning. Companies which manage to turn complex data into seemingly simple services and platforms that make sense to people – improving their relationships, health, happiness, and connection to the world – will create strong bonds and enduring connections to their customers.*” [p3]

Market

The amount of globally stored data is expected to grow with big numbers. Computer Sciences Corporation (CSC) predicts that data production will be 44 times greater in 2020 than it was in 2009 [w7]. Cisco systems has reports about current mobile data usage increasing rapidly. “Global mobile data traffic grew 2.3-fold in 2011, more than doubling for the fourth year in a row.” [p4]. These numbers indicate that being able to mine, analyze and save big data will offer opportunities for the future. One case of a company successfully applying big data technology is IBM with their supercomputer ‘Watson’. The Watson was able to beat two of the best Jeopardy! players searching through big amounts of data. In a video by IBM they say *“Most of the data available today is unstructured data; it is text. Written words, spoken words. Just consider a human who can read essentially an unlimited number of documents and understands those documents and can completely retain all the information that is in there.”* [v1] Watson demonstrates that practically anything can be seen as data and that computing has the power to find the right information. IBM recognizes that data is only valuable to the end user if it has meaning. In the video they pose the following question; *“How do I present that data to the end user in a way that they can use it and can find new value?”* According to IBM, systems like Watson, that analyse huge databases, play a role in bridging that gap. *“This is the age of big data. When you have the data and the tools to make sense of that data, you can begin to make things better”*

Challenges

- Smart filtering needs to be applied so that only clips of gorillas will be analyzed and stored.
- Develop the system in such a way that it is also applicable for other big data cases.

4 Data visualization

According to Friedman, the main goal of data visualization is to communicate information clearly and effectively through graphical means. It does not mean that data visualization needs to look boring to be functional or extremely sophisticated to look beautiful. To convey ideas effectively, both aesthetic form and functionality need to go hand in hand, providing insights into a rather sparse and complex data set by communicating its key-aspects in a more intuitive way [p5].

Data visualizations can range from static analog infographics to digital dynamic interactive data visualizations. Software can import different datasets and allows users to play with the parameters, making personalized and customized visualizations.

The current GITC system is able to capture and interpret data, but does not yet communicate it in a visual way. Data visualizations can be used to communicate the data to the end users in a clear and insightful way. When making the data visualization interactive, it gives users the opportunity to explore datasets by themselves. Maps can be used as a canvas for creating visualizations, such as visualizations showing the most commonly used places on the island or showing tracks of where the gorillas have been, see figure 2.11.



Figure 2.11 - Data visualizations of the gorilla island. Above; island usage intensity map. Below; tracks by individual gorillas

Challenges

- Communicating the captured data to the users in a clear and insightful way
- Making the data visualizations dynamic, so that users can play with the different parameters
- Making visualizations that can be used with different datasets and in different cases

5 Quantified self

Quantified self can best be explained as a movement of early adopters of self-measuring technologies, supported by a community of people sharing experiences. They try to measure aspects of their daily life through sensors, devices and prototypes. Measuring anything ranging from physical work outs, diets, music listened to, amount of time spent on activities, etc. 'quantifiers' try to build data-bases with personal data. When examining their data, patterns can be found and correlations can be made,

so that quantifiers can gain better insights and learn about the way they live their life.

GITC offers a unique chance to monitor a group of human-like animals around the clock, where as many of the self quantifying projects only take measurements of an individual on a moment in time. Because GITC quantifies gorillas, rules and legislation and confidentiality around personal data for humans do not apply. The gorilla quantifications can be presented as data visualizations to visitors of the park. For example, the amount of steps taken or the distance walked can be tracked. The amount of actions can be counted and the length of the activities can be noted.

Quantified gorilla

Steps: 2000	Play: 25 min
Distance walked: 3.5 km	Sit: 310 minutes
Eating: 93 min	Cuddle: 25 min
Fights: 3	



Timeline of today

	First step outside	Cuddling	Eating
Woke up	Eating	Eating	Playing
06.30	08.00	10.00	14.00

Figure 2.12 - Examples of quantified data presented in a visual way

Market

Several companies are experimenting with self tracking services. According to an article in the Economist [p6] the first enthusiasts will soon be followed by the masses. Quantified self currently is a research topic which has the potential to grow into a mature consumer field with services and products that can be beneficial to both the individual and society. The GITC ecosystem would be a good place to research and experiment with self quantifying.

6 Internet of Things (IoT)

By the year 2020 it is said that there will be between 20 to 50 billion connected devices. These devices will be smart, meaning that they are able to collect, analyse and communicate data amongst each other and to users. The Cisco Internet Business Solutions Group (IBSG) states that “IoT is simply the point in time when more “things or objects” were connected to the Internet than people.” [p2]

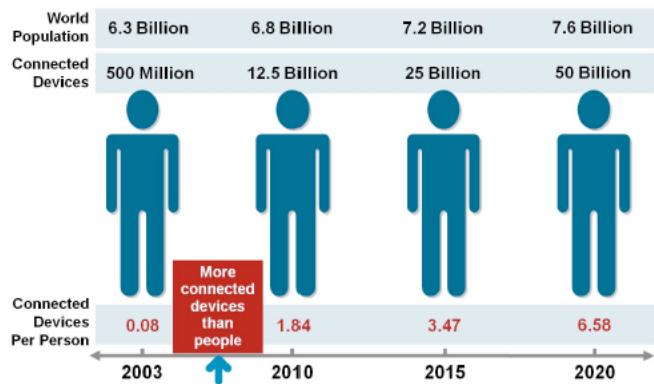


Figure 2.13 - The projected world population and the predicted number of connected devices (image by Cisco)

According to Cisco, IoT is the first evolution of the Internet, with new communication protocols and standards. We now have web 3.0, or the semantic web as it is often referred to, with social networking and big digital service providers. The next evolution of the web is making the internet sensory and extending its reach to devices, space and even into humans.

In the Cisco Systems whitepaper ‘The Internet of Things; How the Next Evolution of the Internet Is Changing Everything’, they state that IoT will change our lives: *‘The Internet of Things (IoT) will change everything—including ourselves. This may seem like a bold statement, but consider the impact the Internet already has had on education, communication, business, science, government, and humanity. Clearly, the Internet is one of the most important and powerful creations in all of human history.’*

The main reasons for IoT technologies to emerge are:

- Ubiquitous connectivity and low connection costs
- Cheaper, better & wider available sensors, actuators and energy sources
- A mature data infrastructure with open standards
- Large potential benefits for companies and customers

The white paper ‘More than 50 billion connected devices’ by Ericsson [p7] describes that the IoT will come in three waves; 1. Networked consumer

electronics, 2. Networked industries and 3.

Networked society, see figureX. The first wave is already starting, with networked smartphones, game consoles, TV’s, home automation, etc. GITC provides an opportunity to further develop IoT knowledge for networked products, the networked industry and the networked society.

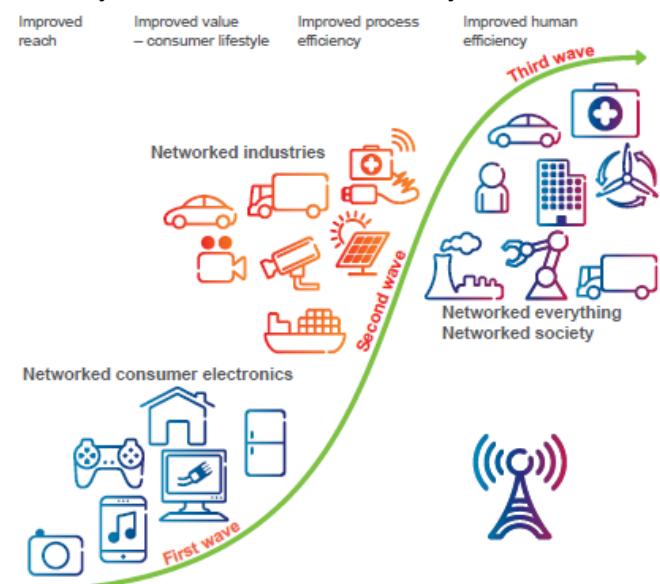


Figure 2.14 - Three waves of IoT implementation (image by Ericsson)

GITC has connected sensors, which can be remotely accessed and controlled. They can send information over the network to any kind of device. There are possibilities to create connected products, such as connected souvenirs, statues or avatars of a gorilla. These products can react on recorded actions of the real gorillas. For example; when a gorilla makes a sound, a sensor can record that sound and the avatar can play back the recorded audio, notifying the user that the gorilla is actively making sounds. The knowledge gained from IoT in GITC can be applied in industry and society.

Markets

A study called “building value from Visibility: 2012 Enterprise Internet of Things Adoption Outlook” has investigated current business interest in the internet of things amongst global IT companies [p8]. When the respondents were questioned if they were ‘planning to deploy IoT solutions and applications’, 15% responded that they already have an IoT solution in place, 53% responded that they were planning to implement IoT technologies within the next 24 months. An additional 14% of the firms plan to implement IoT solutions in the next two to five years.

7 Crowdsourcing

Crowdsourcing is a process that involves outsourcing tasks to a distributed group of people. The difference between crowdsourcing and ordinary

outsourcing is that a task or problem is outsourced to an undefined public rather than a specific body, such as paid employees. There are several strategies for crowdsourcing, such as crowdvoting, wisdom of the crowd, crowdfunding, microwork, creative crowdsourcing, prize contests and more. TNO is developing crowdsourcing mechanisms for automated sports summaries, showing the 'most interesting' moments of a sports game in a short video clip. A similar system can be developed by TNO to select and compile the most interesting gorilla video clips.

Rating or annotating video clips of gorillas is a job very well suitable for crowdsourcing to the visitors of Apenheul. Users can give their subjective judgement over video clips, assessing the 'likeability' of the data and/or adding annotations. It can be done in series or in parallel with automatic content analysis software and in different degrees of detail. Because Apenheul has nearly .5 million visitors a year, enough participants can interact with the system, generating rich sets of data.

8 Digital signage

A system that allows moderators to manage content flows over a number of digital devices and displays, via a central control point. A moderator has the freedom to customize what information he/she wants to show on which place. The content is digital and can be fed in via various streams, for example twitter messages with #GITC. Messages can be customized and targeted to a specific location or audience. The technology can also be referred to as narrowcasting; the dissemination of information to a narrow audience. Companies like 1080dots offer digital signage software solutions, allowing their users to create and manage on-screen messages to one or more screens on multiple locations [w8].

The park of Apenheul would be a good place to apply digital signage on the different (existing/future) digitally connected displays. Via a central control system and a person moderating the content information can be communicated to the visitors. Screens close to the feeding presentations could alert people that the presentations are starting in x minutes. Content can change, displaying promotions of the coffee corner first and live images of the gorillas playing later.

9 Augmented reality

Augmented reality is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data. The sensor data captured by the GITC ecosystem could be used to overlay information on

live captured images. Using information such as the gorilla identity and the location, displays could show live gorillas with their names and the distance to the gorilla projected over the image.

Data processing technologies conclusions

Intelligent imaging is used to analyse & process data, extracting detections from video content. Big data solutions are needed to select, process and save only the most meaningful data. Cloud computing needs to be applied in order to facilitate and communicate the data. Data visualizations can help to communicate rich & insightful figures in a quick and effective way. The project offers the opportunity to research self quantification by quantifying the group of gorillas. Connected products can be developed, giving new knowledge about Internet of Things solutions. Crowdsourcing mechanism, outsourcing tagging and annotating content, can be developed. Through digital signage the content flows of digital devices can be managed. Using data, reality can be augmented, showing digital information over live images.

2.4 Trends to consider

Current technical developments have an impact on the way society functions today. Six trends that apply to GITC have been analyzed, being service oriented products, sensor network availability, social media, analog to digital, business models and privacy. A description of the trends will be given and possible implementations in GITC are discussed.

Service oriented products

Interacting with customers via digital channels gives companies opportunities to develop new products and to create new bonds with their customers.

Rather than only sending information, companies can also receive information, actively participating in a dialog with their customers, offering services.

A GITC product can be developed using a service oriented approach, where the user gets value in return for a (periodical) fee. One example could be to adopt a gorilla. When the user sees a gorilla in the park and they bond with the animal, they can decide to buy a subscription to online (extra) content of the gorilla. Users can look up the information themselves (pull) or they can choose to subscribe to a newsletter, sending weekly information to them (push). As a part of the service a selection will be made tailored to the user his/her preferences with digital materials such as videos, photos, sounds, etc.

Sensor network availability

Current developments in consumer electronics have pushed the development of sensors and has made them smaller, cheaper and wider available. Many sensor products are entering the consumer market. Products such as smart phones or cameras are now available to the masses. The sensors they house could be used to contribute to the GITC sensor network. One example would be to let users tag moments with their own mobile phone, by uploading user generated content. If time & location are shared, software could match the user 'captured' content with content captured by the sensor system on the island.

Social media

Communication to users can be done in new ways via social media. Apenheul is active with their social media communication, posting facebook updates and tweeting messages. TNO can operate servers and develop an API that releases the sensordata for other collaborators. Applications such as automatically generated social media can be developed. For example when Jambo is spotted on coordinate x,y, then send a twitter message. A combination of automatically generated post and user generated post will provide new communication streams, online marketing and promotion for free.

Analog to digital

In society the focus is gradually shifting from printed media to digital and interactive content. Magazines and newspapers loose popularity while apps and websites gain a lot attention. Digital content can easily be changed and updated and can display dynamic content, such as embedded videos. In Apenheul there is a lot of printed media, which could gradually be replaced by digital media. For example developing apps or changing the information displays to (touch)screens.

Serious games

Learning through playing is a new approach in education which is upcoming. By playing games with a real life context users can experiment with the best solutions in certain situations. Information about gorillas can be presented during games.

Business models

Generating value for companies can be done in new and innovative ways. The business model canvas is a tool which is used map how businesses can use their resources to gain a better position. The canvas consists of 9 building blocks:

1. Customer segments
2. Value propositions
3. Channels
4. Customer relationships
5. Revenue streams
6. Key resources
7. Key activities
8. Key partnerships
9. Cost structure

Value can be returned by reaching (new) customer segments, by improving the value proposition, by strengthening the channels, by improving customer relationships and by increasing the revenue stream. If new value can be gained depends on the key resources, the key activities, the key partnerships and the costs structure.

The business model canvas is explored during the design process for gorillas in the cloud, mapping the costs and benefits of different groups of ideas (see chapter 4).

Privacy

Monitoring gorillas might raise ethical questions and could feed in to the privacy debate in the Netherlands. Gorillas are close relatives to humans, but they don't have human rights. In to what extend is it okay to monitor the animals? What will their data be used for? What if the same thing would happen to you? Are you aware that you are already being monitored by camera surveillance systems in stations and city centers? GITC can be an open platform giving users a look inside the surveillance world.

2.5 Interactive parks

An increasing number of opportunities present themselves to parks, musea and zoos to add an interactive experience to their main attractions. The core business of Apenheul is to run the zoo and to attract visitors. A digital system might give them a number of benefits, such as an increased user experience, innovative marketing, new customer (segments), improved knowledge and new revenue streams. The possible benefits are briefly discussed.

User experience

Visitors of zoos come to see live animals. Parks apply strategies to give the customer the best experience during his/her day. The parks are investing in exhibition design, in their park layout, in their routes and in their attractions in order to facilitate their visitors the best way they can. By adding a digital, interactive layer on top of the normal one, current experiences might be enriched.

Innovative marketing

Susan Fledderus, marketing manager at the Apenheul, mentioned two successful cases of other zoos which successfully generated a lot of media attention and therefore an increased number of visitors [s3]. In Amersfoort zoo a baby rhinoceros was born and in Antwerpen zoo a baby elephant, see figure 2.18. Both zoos developed a website to keep customers and media informed and involved with the birth of their animal. Both campaigns proved to be a big success, resulting in the zoos reaching into the living rooms and the daily lives of potential customers and as a result of that they had a lot of extra visitors coming to their zoos.

Apps

Different zoos in the Netherlands have developed apps and mobile websites for their visitors. Apenheul has the <http://m.apenheul.nl> website optimized for viewing on mobile devices. Diergaarde blijdorp has a twoppy app (<http://m.twoppy.com/blijdorp>) and Artis has an app with a special route you can walk through the park.

The main functionalities of these apps are to inform users with practical info, such as opening times, parking info and more detailed information of the park and the activities, such as overview maps and feeding times. There is also the potential to add extra functionalities, such as the 'forgotten animals route' by the artis app, which shows a new route to walk through Artis and contains extra information and small movies about 'the forgotten animals' that live in Artis.

Webcams

Several Zoos have installed webcams in and around the habitats of different animals. Current systems only seem to offer a live video feed of one of the installed cameras. Diergaarde blijdorp has developed an app for their elephant webcams. In a Czech zoo there is already a number of webcams running around their gorilla habitat.



Figure 2.17 - Screenshot from the Czech zoo's website (<http://hobby.idnes.ca/gorily-kamery.aspx?kam=1>, visited 07-03-13)

Webcams offer the opportunity to look at animals from a distance from anywhere in the world. Still, they don't seem to be very commonly used. The experience of looking at webcam images of animals isn't great yet and seems to have room for improvement. For example through automatic zooming, recognizing actions, selecting the 'best' feed of the moment or by giving an overview of multiple cameras, the experience could be improved.

Knowledge centre

Apenheul has years of experience and a good name when it comes to their expertise about primates. By studying their animals even more with a new and advanced systems, new learnings can be shared, improving the position of the Apenheul as a knowledge centre about primates.

Gorillas in the cloud

Apenheul can use the GITC ecosystem to become an interactive park. Through exhibition design current user experiences can be enhanced. Apps can be developed to provide additional (practical) information. Video images can be used in webstreams, reaching for visitors and new customers in their homes. Innovative marketing strategies can be applied using dynamic gorilla content. Using the GITC infrastructure to research gorilla behaviour is a very new and innovative approach and it could help Apenheul reinforce their knowledge position about gorillas and primates.

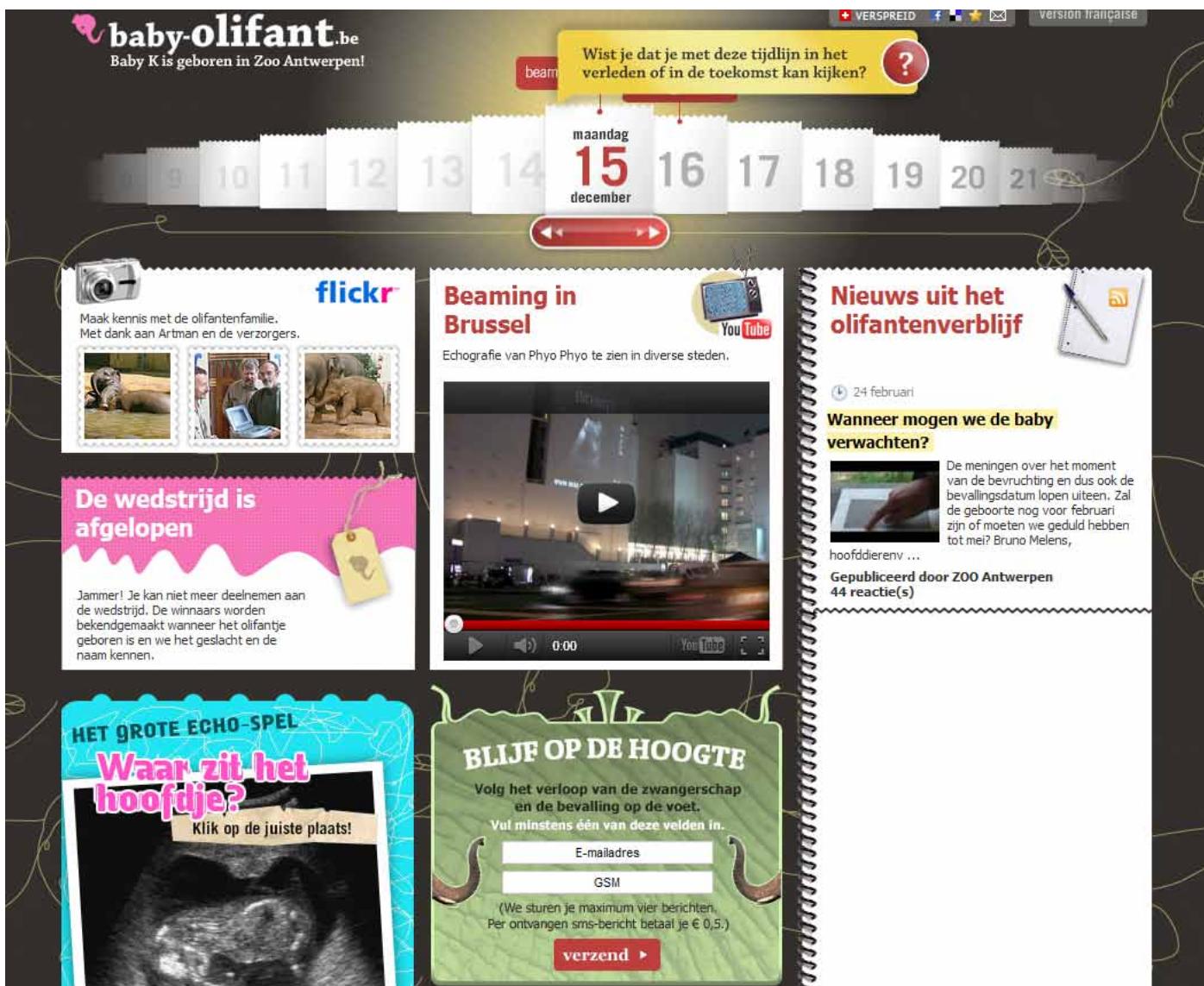


Figure 2.18 - A screenshot of the campaign website of the baby elephant (visited 11-11-12)



Figure 2.19 - Left; The Artis app, displaying the 'forgotten animal route'. Middle; the Apenheul mobile website, showing practical info. Right; the Twoppy app menu interface by Blijdorp.

2.6 Markets

The set up of the gorillas in the cloud project might have some spin-offs into other market segments. The ones considered to be most promising are discussed briefly

Security & safety

In the field of security a lot of cameras are being applied in stores, offices, parking places, city centres, borders etc. Observation & surveillance systems could benefit from the technologies applied at the GITC project.

Sensors research field lab

The gorilla island is becoming a field lab, where developers can test their sensor systems. The field lab opens new possibilities to cooperate with industry, universities and partners to further develop sensor technology.

Primate research

The data captured at the Gorilla island can be valuable to biologists/primatologists and might give new insights in primate behaviour

Health care

With an aging society researchers are looking towards technology solutions to provide good health care. The GITC project monitors the condition of the apes and possibly similar kind of projects

could be done to monitor the condition of patients. Quantifying life patterns could give new insights in personal health.

Zoos & parks

Zoos, attraction and amusement parks all try to deliver a good and unique user experience to their customers, while trying to keep up a good revenue stream. The developed systems and they key learnings could possibly also be applied in different parks.

Smart planet

If you consider the predictions that there will be 20-50 billion connected devices in 2020 and that it is being said that "anything that can benefit from a connection will have one", the market potential is huge and spreads across all domains. IBM with their smarter planet vision [w9] has identified over 30 interesting market domains, categorized in capabilities, industries and smart cities, see figure 2.16.

Other

There are many possible spin-off markets, that will manifest themselves later on in the project. Figure 2.15 shows some initial explorations done by TNO.

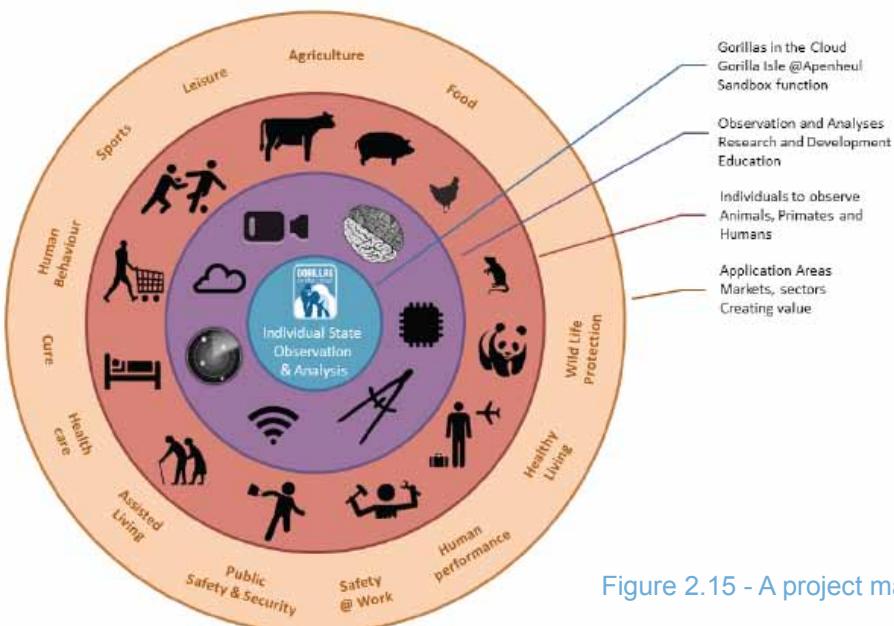


Figure 2.15 - A project market analysis of GITC made by TNO

All Smart Planet topics –



Capabilities

- Analytics
- Business agility
- Cloud computing
- Commerce
- Computing
- Marketing
- Mobile enterprise
- Products and services
- Security and resilience
- Social business
- Sustainability

Industries

- Banking
- Communications
- Education
- Electronics
- Energy
- Food
- Government
- Healthcare
- Insurance
- Media
- Oil and gas
- Retail
- Transportation systems

Smarter Cities

- Buildings
- Cities
- Energy
- Public safety
- Rail
- Traffic
- Water

Figure 2.16 - The identified smart planet markets according to IBM

2.7 Conclusions

- Ten detection methods have been identified (see figure 2.20) (2.2)

→ Through design explorations the importance of the detection methods has been mapped. A roadmap is developed, giving recommendations which detections should be developed and how the detections should function (See chapter 7).
- Nine data processing technologies have been identified as important and applicable to the project (see figure 2.20) (2.3)

→ Through design explorations the importance of the data processing technologies are examined. Conclusions are given about the importance of the technologies and how they should be applied (see chapter 7).
- Seven trends have been identified as important and applicable to the project (see figure 2.20) (2.4)

→ The trends serve as inspiration during the design phase. They give a fresh look on current developments in society. Possible business models have been mapped, exploring how to generate value.
- There is potential for zoos, musea, theme parks, etc. to add digital layers upon new and current experiences they offer. (2.5)

→ Apenheul can use the GITC system to enrich the current user experience, to generate additional marketing, to offer extra information, to reach (new) customer segments at home and to reinforce their primate knowledge position.
- The gained knowledge from the GITC project can be used in other markets such as security & safety, primate research, health care, smarter planet and zoos & parks. (2.6)

→ Technologies applied and learnings gained from GITC can later on be used in spin off markets. Chapter 7 will give examples of possible spin off markets and products for both TNO and Apenheul.

Detection methods	Technologies	Trends
Localization	intelligent imaging	Service oriented products
Tracks	Cloud computing	Sensor network availability
Identified tracks	Big data	Social media
Annotated tracks	Data visualization	Analog to digital
Actions & Activities	Quantified self	Serious games
Emotions	Internet of Things	Business models
Likeability	Crowdsourcing	Privacy
Group dynamics	Digital signage	
Anomaly detection	Augmented reality	
External sources		

Figure 2.20 - 10 Working principles, 9 Technologies and 7 trends available for GITC

CHAPTER 3

Park visitors in the Bongo bonde theatre during the gorilla feeding sessions

USER STUDIES

- 3.1 User analysis
- 3.2 Family persona
- 3.3 User research
- 3.4 Results user research
- 3.5 Child persona
- 3.6 Conclusions

3.1 User analysis

Studying users is essential for creating user centered designs. The users of zoos in general and the users of Apenheul have been analyzed through literature studies and user research, to gain more insights about their behaviour and profiles.

Zoo visitor behaviour

A number of studies describe why visitors visit zoos, how exhibits influence the experience the user has, and how people can learn about animals.

Zoo visitors profile

The paper 'Visitor behaviour in zoos: A review' by Gareth Davey [p9] describes why studying zoos and their visitors is valuable. "Studies of zoo visitors are invaluable for several reasons. They help to understand how visitors engage with the zoo environment and interact with animals, identify people's needs, aid planners in developing and evaluating appealing exhibits, understand and promote utilization of exhibit areas, attract a broad representation of audiences, enable people to gain maximum benefits, provide adequate amenities, and also investigate the visitor market to aid the development of business and marketing strategies." The paper states that: "there is no "typical" zoo-visitor as such. The words of Morgan and Hodgkinson (1999, p. 227) are perhaps very fitting; "attempting to profile the average zoo visitor is probably futile."

The study indicates that there is no 'average' zoo visitor; people all behave different. User research is needed to investigate and describe what it means for people to visit Apenheul, to see gorillas and how they perceive zoos. The paper 'The public face of zoos' [p10] describes that modern zoos are now days perceived and identified by the public as sites of conservation, research, education, and entertainment.

Exhibit design

Through the design of exhibits the perception of visitors about zoos & animals can be influenced. In the paper 'Animal–visitor interactions in the modern zoo' [p11] they conclude that "To attract visitors, modern zoo exhibits should be both entertaining and educational. Naturalistic exhibits of active animals appear to be more effective in fulfilling both aims. Naturalistic exhibits, interactive demonstrations, and signs effectively educate visitors about animals and the importance of conservation."

Through exhibit design higher visitor numbers and longer viewing times can be achieved, resulting in visitors staying in the park longer and being more likely to spend money. Exhibit location also can play a role in visitor attendance. Through signage, visitor

awareness and the way they interact with an exhibit can be affected. Studies indicate that significantly more visitors stay at exhibits when they can observe active animals as opposed to inactive animals.

Animal knowledge

Zoos try to educate their visitors about the animals. Gareth Davey describes in his paper that "*Visitors' long- and short-term perceptions can be altered by the presentation of an exhibit, including education and enrichment.*" The study also suggests that visitors become more conservation-focussed after visiting exhibits that have interactive elements linked to conservation issues. The paper 'Urban park visitors and their knowledge of animal species' describes that park visitors score significantly better in their knowledge of animal species compared with a control group. Species knowledge increases with age, with number of park visits, and with educational level.

Museum fatigue

The attention span of zoo visitors seems to drop the more time visitors spend in the zoo. Davey observed visitors at a primate exhibit and found that visit durations, viewing periods, and the proportions of people that stopped, all markedly decreased as the day progressed. Museum fatigue seems a likely explanation.

Visitor profiles Apenheul

Apenheul has a range of different visitors, all with specific needs and wishes. They range from young to old and from singles to groups and families.

The following user groups have been identified;

- children
- adults
- elderly
- singles
- couples
- families with children
- Large groups of family & friends
- Schools
- Business users
- Employees
- Researchers

All of these users could experience the Gorillas In The Cloud product. A specific target user group was chosen to address the specific needs and wishes of that group.

Target user group

Apenheul has served 487.000 visitors in 2012. In order to be able to design something for 'park visitors', a closer look is needed to understand the types of visitors. There is a large variation in visitor profiles. Apenheul owns a research report by McKinsey & company [p12]. The report contains figures with statistics of the Apenheul and Apenheul in comparison to other zoos in the Netherlands. Figure 3.1 - 3.4 are taken from the research report.

When you look at figure 3.1, it is interesting to see that Apenheul draws a lot of families with their children still in primary school. They have almost triple that number of visitors, compared to the average zoo. When you look at figure 3.2, you can see that 45% of the visitors come with their household and another 25% with family relatives. It seems that Apenheul is a typical family activity. Families with children are a very large and important user group for Apenheul. By far the most common group size is 3-5 people, see figure 3.3 & 3.4.

Conclusions

Parents with (young) children prove to be an interesting group to design for. Besides that they are a large and 'outstanding' user group of Apenheul, they also pose challenges in designing for young & old, in finding the right balance in complexity and in making the design meaningful for them.

Group composition

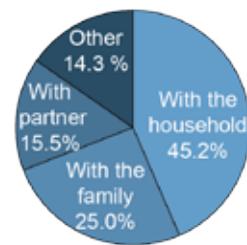


Figure 3.2 - Percentage of different group compositions of Apenheul visitors

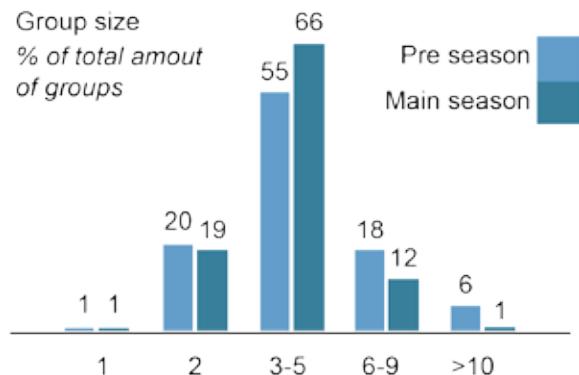


Figure 3.3 - The average group size of Apenheul visitors

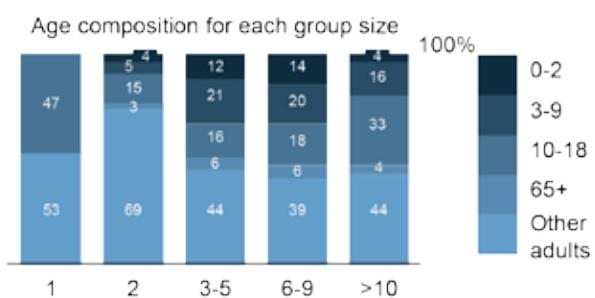


Figure 3.4 - The age composition per group size of Apenheul visitors

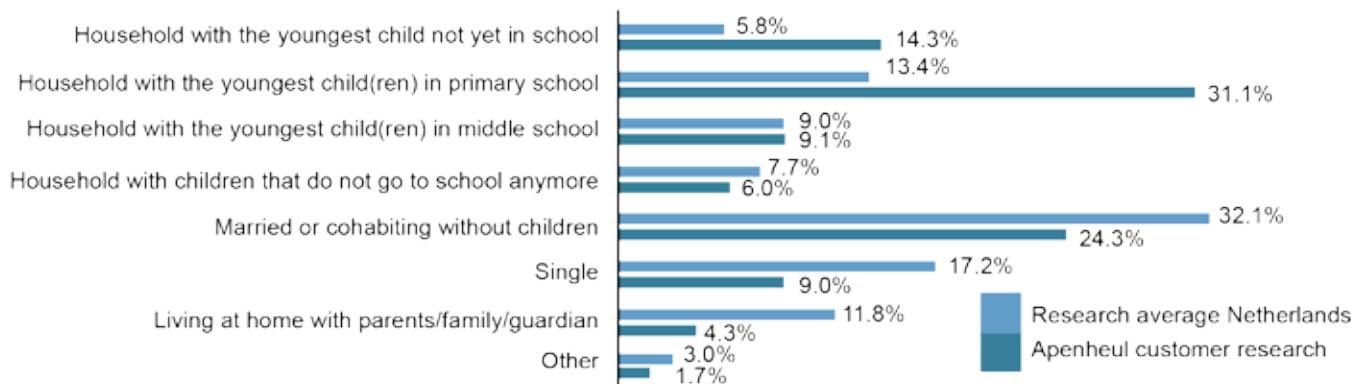


Figure 3.1 - Visitor profiles of Apenheul

3.2 Family persona

A model family has been chosen to represent the target user group. The family persona embodies, personalizes and details the chosen target group.

Persona - Young parents with children



Marscha, Imre & Yente

Marscha (42y) and Imre (41y) are both working parents; Marscha works at the ANWB office and Imre works for an insurance company. Whenever they have free time they like take their daughter Yente (7y) out on fun family activities. She is their only child and her parents spent as much time with her as they can.

Marscha is more of a city girl but she likes the peacefulness of days out. She works at the ANWB so she often gets free tickets for all kinds of places and parks, which she gladly visits. Whenever Marscha has free time she enjoys the nature and being outside. Marscha likes to collect small items and she keeps them as memories.

Imre grew up on the countryside so he is used to being close to animals. His favorite TV channel is national geographic. Imre likes to build stuff in his workshop whenever he has spare time.

Yenthe is a bright little girl that enjoys school and likes to do things neatly and according to the rules. She's a daddy-girl and likes to show him everything. Yenthe used to visit Artis (Amsterdam zoo) weekly with her grandmother, but she grew kind of tired of it lately.

Technology

Marscha and Imre both have a smart phone, which they use daily. They know a bit about apps and different ways of using the technology but they are amazed how quickly young children are able to handle the technology. Yenthe is really clever with the devices. She often plays games on their devices. Because of Imre's building hobby, he knows a little bit about house hold appliances and basic electronics.

A day out

Whenever the family does a day out, they are usually very relaxed, but well prepared. Their motto is 'Do it as you like it'. They leave whenever they feel ready and they go back home whenever they've had enough. Before they go somewhere, they do have some kind of idea about where to go and what they want to see, although it is not too strict.

Profile

	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	<input type="checkbox"/>		<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>		<input type="checkbox"/>
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	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	<input checked="" type="checkbox"/>		<input type="checkbox"/>

Figure 3.5 - The family persona embodies and personalizes the chosen target group

3.3 User research

User research was conducted to gain more insights in zoo visitor values and aspirations.

Research method

Several user tests have been done to gain deeper insight in the users of this product and to improve the final design. The research is of a qualitative nature and is aimed at improving the design process, rather than producing a large quantitative scientific study. A number of research techniques have been used in the studies, which are described shortly.

User observations

Observing the behaviour of users without giving instructions or interfering with their activity gives the researcher insights in the everyday usage of existing products. During the observations pictures were taken and notes were made.

Visitor journey analysis

Graduate student at Apenheul, Rosalie Stone, has performed a user journey mapping study. Following 5 families during their visit, she has captured the most important insights on what Sanders & Stappers [p13] call statement cards. Together with Rosalie Stone, during one whole day an ‘on-the-wall’ analysis of the qualitative research has been done.

Probes

According to Bill Gaver “*Cultural probes were designed to provoke inspirational responses*” [p14]. Three probes have been designed to evoke the users initial experiences with gorillas, before the user interviews, see figure 3.6. Another probe has been used to research which topics about gorillas are appealing to the participants.

Interviews

The interview technique has been applied to gather user insights. Three different questionnaires have been used for a family day out study, a gorilla

Dit weet ik al over gorillas:

(gebruik pijltjes en steekwoorden)



Welke activiteiten zou je de gorillas willen zien doen?

(Denk in werkwoorden)

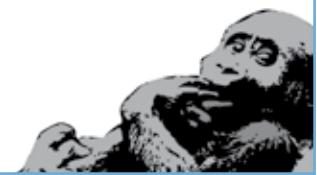


Figure 3.6 - Examples of probing materials used during the user research

expert interview and a study about gorilla enthusiast communities. The interviews aim to ask participants about their relevant experiences with topics such as gorillas, family life, zoos, a day out, amongst others. The questionnaires have been composed in a way that they ask open questions without directing the answers. During the interviews the answers by the participants were questioned by the researcher with the ‘why?’ question, aiming to reveal the underlying values. The summaries of the interviewss can be found in the appendix

Data, Information, Knowledge, Wisdom (DIKW)

Context mapping studies aim to gain new insights in all levels of knowledge. In the context mapping paper by Sleeswijk-Visser, they say that “*Designers and researchers use these techniques to gain deeper insight into the needs and dreams of prospective users of new products*” [p15]. Figure 3.7 shows the different research techniques and the types of knowledge that is uncovered. “*Tacit knowledge is knowledge that people can act upon, but cannot readily express in word. Latent needs are those that people are not yet aware of. They are needs that become realized in the future.*” The user studies aim to gather insights across all levels of knowledge.

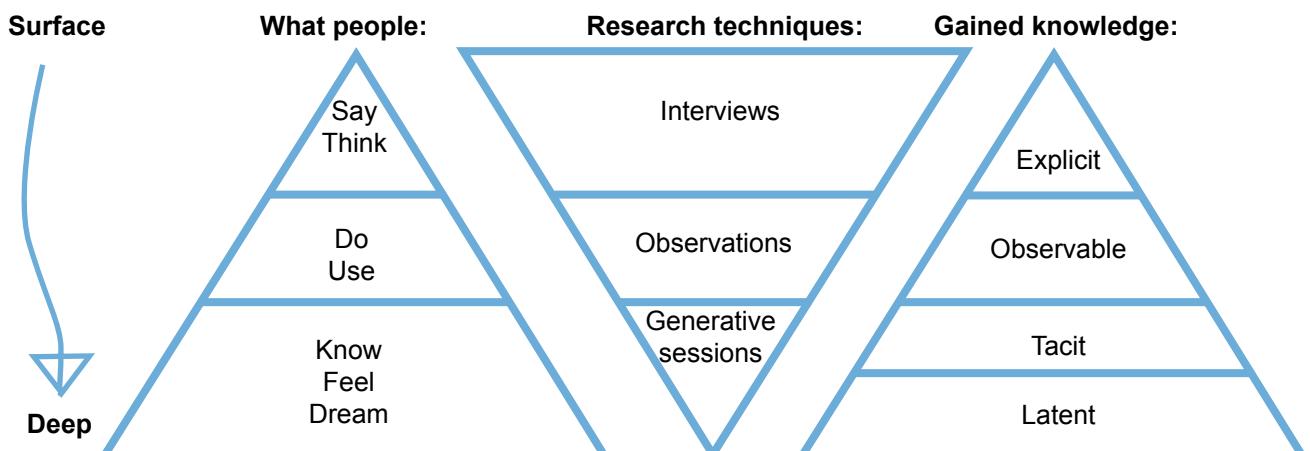


Figure 3.7 - Adapted from a model of Sanders. Different levels of knowledge about experience are accessed by different techniques

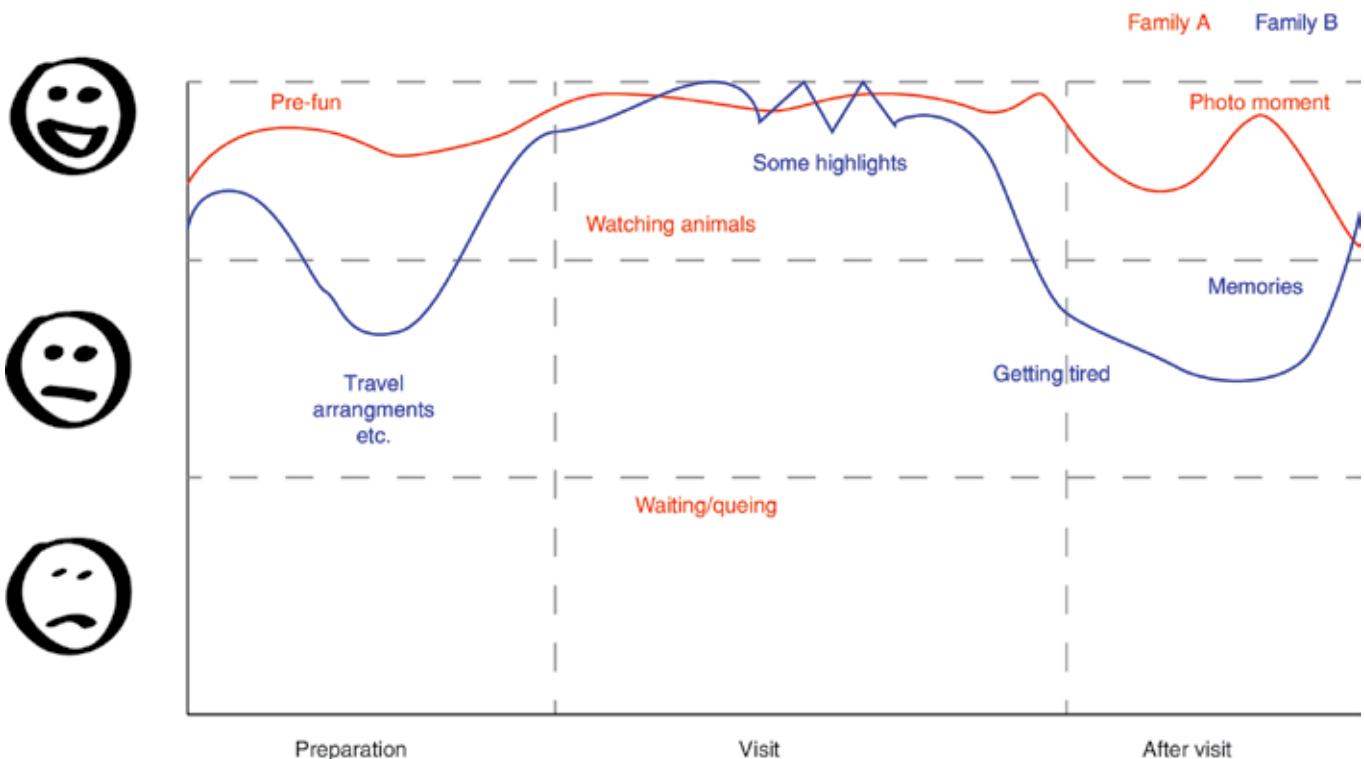


Figure 3.8 - Example of an experience mapping exercise done with families

Generative sessions

During the family interviews the participants were asked to map out their negative, neutral and positive experiences during different phases of their day out. The participants were asked to draw their own 'experience curve' and optionally to add some keywords to the map, see figure 3.8.

Participants were presented with product ideas and were given the opportunity to comment, discuss and elaborate upon the ideas. In some extend the participants were co-creating.

Extensive generative sessions have been done with design students and sensor experts during the design & ideation process (see Chapter 4)

Analysis

The raw data from the user studies have been collected. Based upon subjective judgement the most insightful observations and comments have been presented as results. Insights from various levels of the abstraction hierarchy [p16] have been taken along and form the basis of the conclusions.

Results

The user studies have resulted in to various insights and infographics. The results have been taken along in to the design process and the form the basis for some of the key design decisions during different iterations in the design process.



Figure 3.9 - A schematic visualization of the user research process

Research process

Eight user studies have been conducted in order to gain good insights in the user centered design values. The process of conducting these studies has been more or less linear, with some overlap during the user studies, see figure 3.9.

Literature studies

Literature was studied to learn more about zoo and visitor behaviour.

Park observations

In the parks Apenheul and Blijdorp unobtrusive observations have been made of typical user behaviour.

Statement card analysis

During an on the wall analysis of the statement cards statement cards about visitor behaviour, created by Rosalie Stone, the gathered user insights were made tangible and three themes became apparent. A full description of the study can be found in the graduation thesis of Rosalie stone [p17].

Gorilla expert interview

Ronald van der Beek is ICT manager at Apenheul and is closely involved with the Gorillas In The Cloud project. He has worked with the gorillas inside Apenheul for over 15 years and knows the gorillas by name and personality. During the interview the gorillas were visited and the following topics were discussed.

- General questions about Gorillas
- The gorilla population of Apenheul
- Behaviour & personalities of gorillas
- Social & group dynamics
- Detection using sensors

Community investigation

Online and offline there are zoo enthusiast gathering to exchange experiences, pictures, information, etc. One of these enthusiasts is Joke Kok. She is active on Flickr (profile J.A. Kok) and member of a number of groups. Joke has been interviewed in diergaarde Blijdorp about her experiences with zoos, online communities, photography, animals and gorillas. During the meeting probing materials were filled out, an interview was conducted and ideas were discussed.

Family day out interviews

Two families with young children have been visited in their house. During the visit, the parents were asked to reflect upon their recent experiences with a day out, while the children were at home playing. Five main topics have been discussed; their (last) visitor journey, the group dynamics during the visit, digital usage during the journey, what is interesting about a gorilla and the product ideas. During the visit probing materials, experience maps and a questionnaire have been used.

Gorilla topics mapping

A figure displaying clustered topics about gorillas has been used as probing material during the park visit to Blijdorp, during the community investigation, and during family day out interviews. In total eleven participants discussed the most relevant topics to them.

Children development research

An interview was conducted with a childrens teacher in training. At the PABO, school for teachers, students use the book 'het verhaal van het kind' [p18] to understand the development of children during different phases. After the interview the book was studied. The book describes different aspects of children behaviour during the age period of 6-9.

3.4 Results user studies



Figure 3.10 - A developed onion model, explaining the observations and the derived values

User values

During multiple visits to the Apenheul the visitors have been closely observed. By asking the questions 'Who are these visitors?' 'What are they doing?' 'How do they do it?' and 'Why do they do it?' values can be derived. The results have been processed in a specially developed onion model, see figure 3.10. An onion model refers to something which has multiple layers and which has a core in the middle. The keywords inside are based upon observations and the values are abstractions derived from noticed behaviour.

There are 10 values given in the onion model.

Below is a description of their meaning.

- **Basic needs**: Users in the park have to fulfil their primary needs, such as eating/drinking.
- **Society**: Users behave according to social patterns and what is expected of them, for example queuing.
- **Memories**: Via pictures and/or souvenirs users keep (and cherish) memories of their day in the park.
- **Sharing**: Through various means users share information with their friends and/or family.
- **Education**: Users (try to) educate themselves by

- reading signs or listening to presentations.
- Curiosity: (Some) users are curious to explore unknowns and to discover (new) insights.
- Entertainment: In the park users want to have fun and want to be entertained.
- Sense of belonging: Users relate to, emphasize with and mimic primates in various degrees.
- Safety: Several precautions have been taken to keep the users and their belongings safe

The values derived from the observations show something about the character of the day out in Apenheul. The words/values underlined in red are the ones considered useful for the design process.

Visitor behaviour

The most insightful observed visitor behaviour has resulted in key insights to be used during the design phase. The insights are shortly described.

'People like to see active gorillas'

During one of the feeding presentations (for an impression see figure 3.11) there was a very good atmosphere in the crowd. There was a gorilla which climbed upon the tree in front and started clapping and doing chest beats. The crowd responded with an 'ahhh', 'laughing' and 'clapping'. One of the gorilla toddlers was playing with some grass and was the favourite of all the spectators. During other presentations the gorillas were less active and so the spectators didn't get to see as much of the gorillas as they would have liked.

'There is a big difference in quality of presentation'
Even though the format of the presentation is more or less the same, the 'perceived quality' of the presentation still differs a lot, because the gorillas don't always put on a show.



Figure 3.11 - The bongo bonde theatre where the gorilla feeding presentations take place

'Size and status of gorillas'

The visitors are very much intrigued by the size and status of Jambo, the big leader of the group. But also the gorilla toddlers are being liked. The mother-child relation is also one that intrigues the crowds.

'Movie screen'

During the feeding session the care taker has a remote with which he can switch on/off some movies about gorilla behaviour. The video shows some typical gorilla behaviour, such as chest beats and playing gorillas and also contains an ethical message. The response of the crowd is positive.

Park lay out & facilities

These observations give some insights in to what kind of extend park infrastructure and facilities are used.

1. Users make use of the directional signs and paper maps.
2. Users make stops at the parks facilities, such as the playgrounds and eateries.
3. Users have to wait in ques on some points.
4. Users make use of the installations, statues and artworks in the park.
5. The photo booths are well visited and perceived to be fun (see figure 3.12)
6. Information displays are often overlooked by the visitors.



Figure 3.12 - Some impressions of a photobooth inside of Apenheul

'The way around'

The road signs are being used by the visitors. On various places in the parks, there are directional signs pointing in the direction of the animals. Besides the directions, there also a number of routes through the park. If the visitors follow them all, they will have seen all the animals in the park. The visitors are free to decide their own route.

'A lot of Information displays'

On almost every corner of the zoos there are

information displays. For a regular family there are too many information displays to read in one day. The information displays are often overlooked. If they are being read, most users only read small snippets of information

'The screen effect'

All installations in the park with interactive features such as buttons or touchscreens had a magical appeal to the users, specially the children. One installation in Blijdorp in particular caught the attention; the device by Greenpeace in the North Sea exposition where users could make their own fish. In a very simple interface users could make their own fish, which would then 'swim' with the other fishes in the application. Via email users could send their own fish to an email address, spreading the message of Greenpeace.

'Relative measure/ The human dimension'

Installations helped the children to visualize the dimension, see figure 3.13. For children it appears to be easier to understand facts and figures if they can relate them to the human dimension.



Figure 3.13 - An installation showing the length of the arms of the primates compared to your own arms.

Statement card clusters

The statement cards have been grouped, clustered and summarized in three main themes, as described in the thesis of Rosalie Stone. An example of a statement card is shown in figure 3.14.

Observation Smartphones, facebook, whatsapp... The adults spend half the time sharing the experience of the day. They put a lot of effort in getting the right picture. They say as memories, show to others later, as background picture, etc. And social media because it's so easy and funny to make jokes about monkeys.	Who? Lot, Danielle, Rafaella
Photo/Quote/Note 	

Figure 3.14 - An example of a statement card.

In to the wild (Beleef)

Going to Apenheul is fun, exciting, connecting, an adventure! Unexpected things happen, just like in the wild. Every experience is unique and natural, making it extra special to be a part of it. Apenheul is a way to experience a primate from up close, really close! This can be scary, but that's what makes it exciting and fun. This excitement catches your attention and provides enough food for conversation to last all day.

Discussing experiences (Bewonder)

Going to Apenheul is a day out, together with family. A day to spend time with each other and maybe bond a bit. The dialogue and sharing experiences of that day are a very important aspect of that. By talking about everything seen or experienced during the day, you reflect on what happened. This dialogue can lead to admiration, understanding, nice memories, etc. of the different animals seen. This can give a lasting impression of an animal, creating more awareness of its existence, importance, extinction, etc.

Recognition (Bewaar)

When looking at primates long enough, almost everybody recognizes a bit of himself. Primates look like humans, act like humans and sometimes even smell like humans. Since humans are the only thing we truly understand, this is fascinating. Children and adults can all talk about it, because, of course, we are all humans. Because of this recognition, empathy can form. We feel sorry for a primate, or we see it do something we could do ourselves. We talk about the animal as if it has emotions. Equality forms, with a gaining of respect towards the animal as a result.

Community

There is a community of people who are very active in visiting zoos and talking about their experiences both online and offline. These users are an interesting group for GITC to consider designing products for. The gorilla enthusiast already, share, tag and comment upon gorilla content. It could be very beneficial for the GITC system if the community would also monitor and tag content. Some members of the community can also help in the development of products and are willing to cooperate if contacted.

A family day out

The most insightful quotes from the user interviews are presented visually and give insights in the way a family experiences a day out. The text in blue gives conclusions taken from the families. The full description of the interviews can be found in the Appendix.

Family A: "Just by talking to the girls about going to visit a zoo or a park, the pre-fun already begins."

The visitor journey

The visitor journey has three phases; pre-visit, visit and after-visit.

Family B: "The excitement during the visit differs from time to time. Generally, it is a fun and relaxing experience, with some highlights, such as feeding presentations or finally reaching that special animal you wanted to see all day."

Family A: "We go and visit a park for our children. That they have fun is our most important concern..."

Group dynamics during the visit

Children are leading factors during the park visits

Family B: "As a parent you can determine the route, the things you want to see and the time you want to spend in a park, but the children determine the pace."

Family B: "When the children really don't like a place, you can't really force them to stay and have fun, so you walk along with them."

Family A: "I like to post one or two nice pictures of my day out on facebook, so my friends know what I've been doing."

Digital usage during the journey

Visitors make pictures for visual memories

Mainly practical information is looked up

Family B: "Before we go we look up some information on the website. When we are behind a computer we visit the website or when we sit on the couch we use our iPad. Maybe when we are on the go we would look up extra information we haven't checked before on our smart phones."

Family A: "Photos with your mobile device are for keeping visual memories. Photos with a DSLR camera are for portraits. But you don't want to carry that around all day..."

What is interesting about a gorilla

Small and funny snippets of information about gorillas should be presented to the families

Family A: "Sometimes I read some information on a sign and then later I pretend that I've known that information for a long time."

Family B: "You don't really want to know everything. You just want to read or hear something funny which you then can discuss."

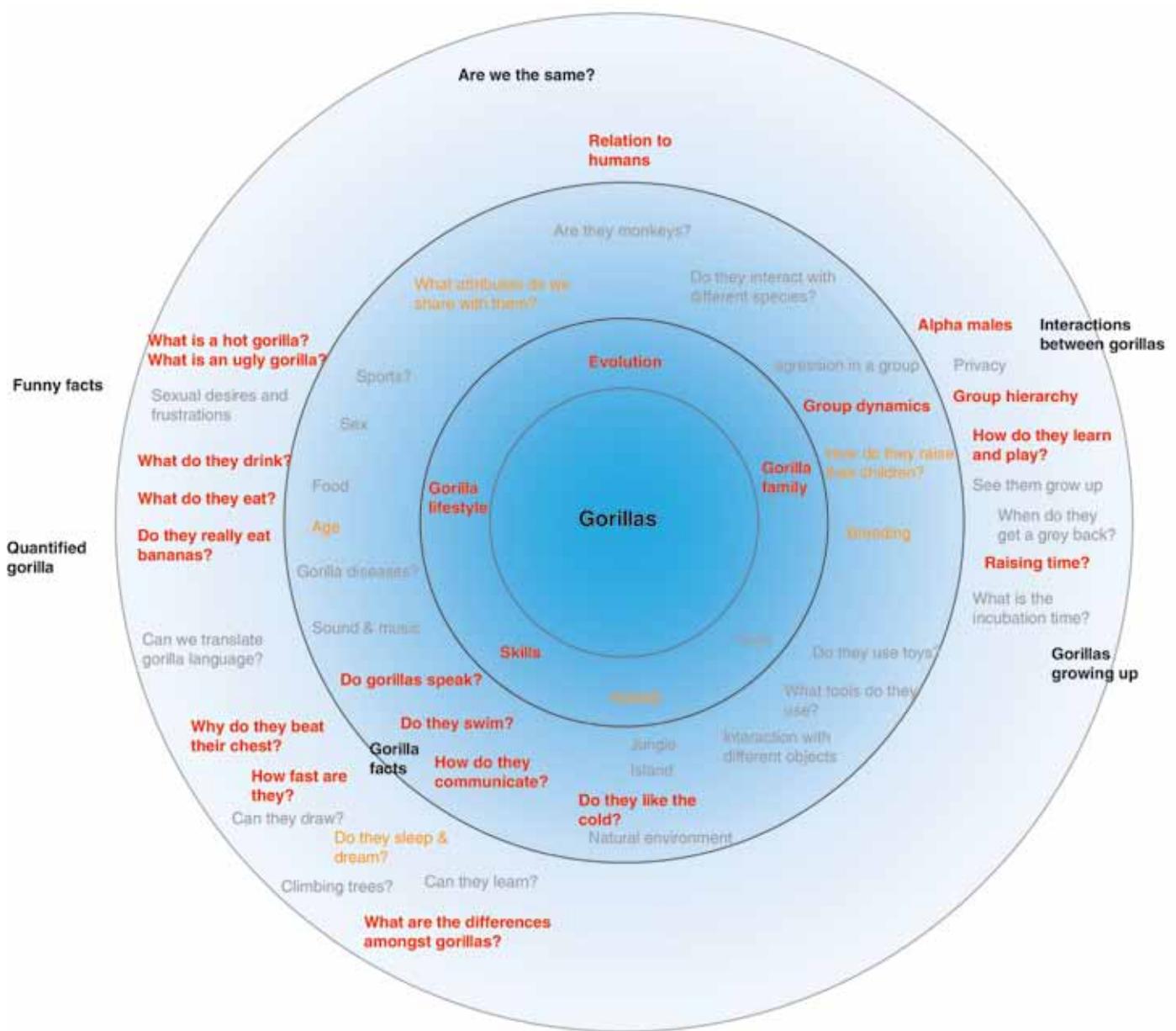


Figure 3.15 - The most liked gorilla topics

Gorilla topics

Insights about what topics of gorillas appeal to the eleven respondents have been visualized in figure 3.15. The topics in red are the ones mentioned two or more times, the ones in orange are the ones mentioned one time, the ones in gray weren't mentioned. In total 6 comments in black have been added, because they were mentioned extra.

The comments in black and their explanation:

- *Are we the same* - In to what extend is a gorilla the same as a human? Related to the person.
- *Funny facts* - Participants indicated that they mostly like to read funny facts about gorillas.
- *Quantified gorilla* - Besides knowing what the gorillas eat, participants wanted to know how much they eat/drink/walk etc.
- *Gorilla facts* - Some questions can be answered with yes or no, like can gorillas swim. Gorilla facts might give extra topics to discuss stating things gorillas can/can't do.

- *Gorillas growing up* - There was a special interest amongst participants to how gorillas grow up.
- *Interactions between gorillas* - There were some questions about how individual gorillas interact between each other. Can gorilla A like gorilla B but dislike gorilla C?

In the center of the onion, 4 main themes have been mentioned to be most interesting, being evolution, gorilla family, skills and gorilla lifestyle. In the outer layer of the onion, the more concrete options have been circled the most times, indicating that the participants like the more clear topics. Providing 'funny facts' was mentioned multiple times, as a means to present information in a short, quick and fun way.

The figure has mapped the key topics to be presented to users through a product design.

Child development

Children are still developing their physical and their mental skills. The way they behave and how they perceive the world around them changes with age. Because children are leading factors during park visits, it is important to understand the way they behave. The most important behavioural attributes are described below per topic, based on the topics from the book 'het verhaal van het kind'.

Physical

The child is physically maturing. His/her senses have been developed. During this phase the control the child has over their senses is being refined.

Motoric

The children will actively develop both their fine and their coarse motoric skills through practising a lot. They have a good sense of control over their body.

Emotional

The bigger world is opening up to the children. They have the desire to explore the world that is out there. If the children are in a safe environment they can explore autonomously. They start to distinguish the boundaries between reality and fantasy better. They start to ask a lot of questions. Children are eager to learn during this age

Identity

The children are able to reflect upon their own personalities. They are exploring their personality and through interacting with other children they learn about their skills and weaknesses. Their empathic ability increases. The children learn a lot from modelling (imitating) other persons behaviours.

Cognitive development

During this age period children are very receptive for taking up new knowledge and skills. They develop a wide interest in many topics. To learn something new, it takes practice. The children have a good understanding of language, all though they have some difficulties with exceptional words.

Social

The children increasingly start to focus upon behaviours of others. They start to explore social and moral principles.

Moral

The children are looking for strict and clear rules and are starting to formulate their own ones. They start to copy and imitate behaviour of others.

These factors are to be considered during the design process and in the final design.

3.5 Child persona



Yenthe

*7 year old city girl
from the Amsterdam
area.*

Yenthe used to go to the zoo more often with her grandmother, but now she is a first time visitor to the Apenheul together with her parents. She is a very curious girl, ready to explore whatever comes on her way.

Yenthe likes to play



Yenthe is a little explorer



Yenthe likes animals

Yenthe likes to touch everything

Figure 3.16 - The persona of Yenthe, a little girl visiting Apenheul

A persona of the little girl Yenthe displays the main user group of the GITC products. The child persona embodies, personalizes and details the end user. The persona is a tool to be used during the design phase. The product design has to be tailored to her needs, so that she will have an optimal user experience.

3.6 Conclusions

The insights gathered during the user studies form a basis for some of the design decisions made during the user centered design process. The design process will be described in chapter 4 and the final design in chapter 5. The most important conclusions from the user study are summarized and listed below

Target user profile

- There is no “typical” zoo-visitor as such. (3.1)
- There is a gorilla and zoo community that is enthusiastic and willing to contribute to GITC. (3.4)
- Families with young children are chosen as the target user group (3.2)
- The family persona of Marscha, Imre & Yenthe represents the target user group (3.3)
- Children are leading during the park visit (3.4)
- The child persona of Yenthe represents the main user of the GITC product. (3.5)
- Children from the age of 6 - 9 years old have good physical control over their bodies (3.4)
- Children from the age of 6 - 9 year old start to discover the world by asking a lot of questions. They are eager to learn (3.4)
- Children from the age of 6 - 9 years old learn from others by immitating their behaviour and their empathic abilities increase (3.4)

Description

Parents with young children that visit the park have been identified as the most important group to focus on. People such as Marscha, Imre and Yenthe. The group dynamics cause the children, such as Yenthe, to become the leading factors during the visit. Children from the age of 6-9 have good physical control over their body, they ask a lot of questions, they are curious to learn and they learn by immitating. The GITC product has to be designed for the children, addressing their needs and desires.

Visitor Activities

There is a need for sharing and keeping memories (3.4)

- Users like to see active gorillas (3.4)
- Information displays often overlooked (3.4)
- Photo booths are popular (3.4)
- ‘The screen effect’ (3.4)
- ‘The human dimension’ (3.4)
- Discussing experiences (Bewonder) - Bonding with the family, making conversation and sharing experiences. (3.4)

Description

Visitors of Apenheul go for a family day out, where they bond with the family while looking at animals and discussing their experiences. The visitors are enthusiastic for a longer period of time when the animals are active and when there is

something special to see. Installations can enhance their experiences. Using ‘*the screen effect*’ and ‘*the human dimension*’ visitors can be drawn to installations where they can see information in relation to themselves. The activity has to stimulate interacting with installations and sharing experiences and memories.

Gorilla topics

- Species knowledge increases with age, with number of park visits, and with educational level. (3.1)
- The 4 main themes perceived to be most interesting are evolution, gorilla family, skills and gorilla lifestyle. (3.4)
- People are mostly interested in clear & concrete information about gorillas (3.4)
- Funny facts are a good way to present information in a quick, short and fun way (3.4)
- Recognition (Bewaar) - The primates in Apenheul relate in a lot of ways to humans and thus children and adults can emphasize with the individual animals. (3.4)

Description

The product has to present information about gorillas in a quick and fun way. Themes that should be addressed are evolution, family relations, skills and lifestyle. Knowing more about (individual) animals helps visitors empathize with the animals. By interacting with the installations the visitor knowledge should increase.

Park exhibits

- ‘visitors’ long- and short-term perceptions can be altered by the presentation of an exhibit, including education and enrichment. (3.1)
- zoos are, today, identified as sites of conservation, research, education, and entertainment (3.1)
- Museum fatigue causes visitors to drop interest, decreasing their visit duration, viewing period, and the amount of times visitors stop at exhibitions (3.1)
- In to the wild (Beleef) - Experience the animals from up close. Scary, exciting, fun. (3.4)

Description

Zoos are seen as sites of nature conservation, research, education and entertainment. Experiencing the animals from up close in Apenheul is a key feature of the park. The user experience can be changed through exhibition design.

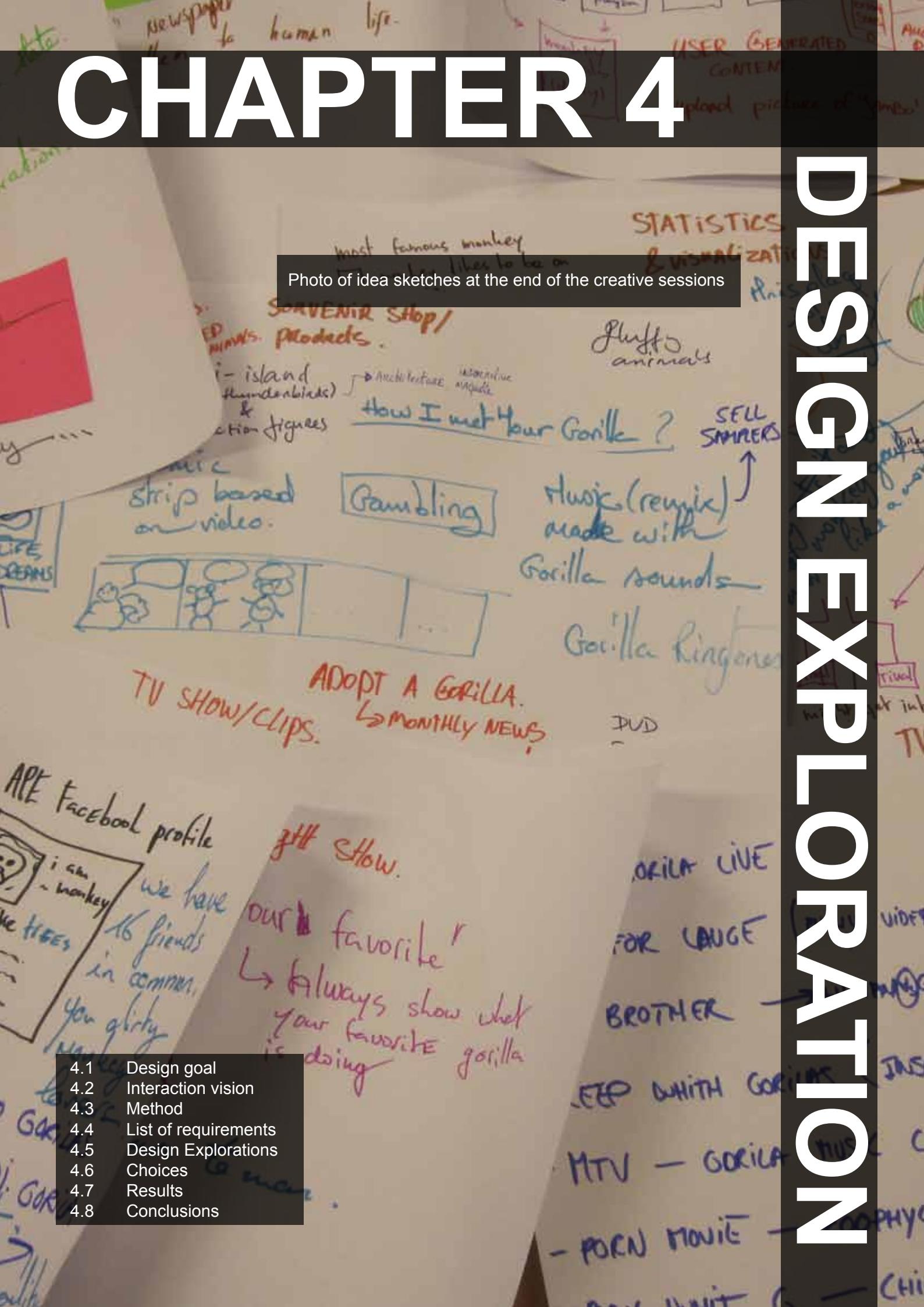
Overall conclusion

The insights from the user studies have been translated to product requirements (see chapter 4.4). The family persona and the child persona can be used for design explorations.

DESIGN EXPLORATION

CHAPTER 4

Photo of idea sketches at the end of the creative sessions



- 4.1 Design goal
- 4.2 Interaction vision
- 4.3 Method
- 4.4 List of requirements
- 4.5 Design Explorations
- 4.6 Choices
- 4.7 Results
- 4.8 Conclusions

4.1 DESIGN GOAL

At the starting point of the graduation project, the design goal still had to be defined. During the design process in different iterations, the design goal has been re-adjusted and narrowed down. The starting point was:

'To create a product for the Apenheul that enhances the user experience of a visit to the park using sensor data.'

User experience; Engaging, Educating, Involving, Fun.

Design goal iterations

- Based on the mission of the Apenheul (see chapter 1.4) 'Herken jezelf' a choice was made to add the user experiences of 'bonding, relating and reflecting'.
- Based on the insights from the user research the target users have been defined as 'a family with (a) young child(ren)' with a main focus on 'a 7 year old child' (see chapter 3).
- Based on the design iterations a choice was made to 'enhance the user experience through a product in the park'.



Figure 4.1 - The final design goal

Specifying the design goal

A product

- A physical installation in the park, displaying digital information. The product design will consist of the information architecture, the interactions and the user interface.

Enhances user experience

- Giving the end user something extra on top of their current experience in Apenheul. Creating an attraction that gives the users a new and unique experience.

7 year old child

- Boy and/or girls of the age 5 - 12 should be targeted as the main users of the product. The presentation style, the storytelling and the level of complexity have to be tuned in such a way that they are targeted at these children.

Visit to the park

- The visit to the park is described in the customer journey and consists of 3 phases; the pre-visit, the visit and the after-visit. The product can target to enhance the visitor experience during one, two or all three of these phases.

Data

- All raw data and/or processed sensor detections captured by the GITC sensor system. This can be the raw video streams or interpreted data from any of the working principles (localization, tracks, identified tracks, Annotated tracks, Action & activities, emotions, group dynamics, likability and pattern/anomaly detection).

GITC sensor system

- The 11 cameras currently installed around the island with their server and the glass fibre network.

Specifying the user experience

Engaging

The product has to invite users to come and engage with it. Once the users are 'engaged', the product has to keep the users interested long enough without getting boring. A well balanced level of complexity needs to be chosen to challenge the user enough to explore the product further without the product being too difficult.

Educating

The product has to teach its users new insights about the gorillas that live in Apenheul and about their species. The more visitors will learn about gorillas, the more likely they are to admire them and to empathize with them.

Involving

The product has to invite people to learn more about GITC and should stimulate the user to get deeper involved in the project. It has to give the user the feeling that they can make a contribution to GITC.

Fun

The product has to be perceived as fun in order to facilitate people in their day out. Exploring and interacting with GITC has to be a pleasurable experience for the visitors.

Bonding

The product has to stimulate and facilitate the process of people bonding with nature, animals and the individual gorillas living in Apenheul.

Relating

The product has to give the users the feeling that they relate to the gorillas in a biological, physical and a behavioural sense.

Reflecting

The product has to trigger visitors to reflect upon their own experiences, to get a sense of responsibility over nature and sensor technology

4.2 INTERACTION VISION

During the analysis families with young children were chosen as a user target group. As a result of the user studies, it became clear that children are leading during park visits. Parents visit the zoo for their children and when they are happy, the parents are happy (see chapter 3). That insight forms the basis of the chosen interaction vision, see figure 4.2.

Finding Nemo is a movie by the animation studio Pixar. The movie puts forward a lot of recognizable stories, themes and characters for both children and adults, making it a fun experience for the whole family. The movie has a layer for children, with an easy to understand storyline, basic characters and themes. For the adults there is a more difficult layer, with sophisticated jokes and references to real world characters and situations. The '*to be designed product*' has to contain both layers.

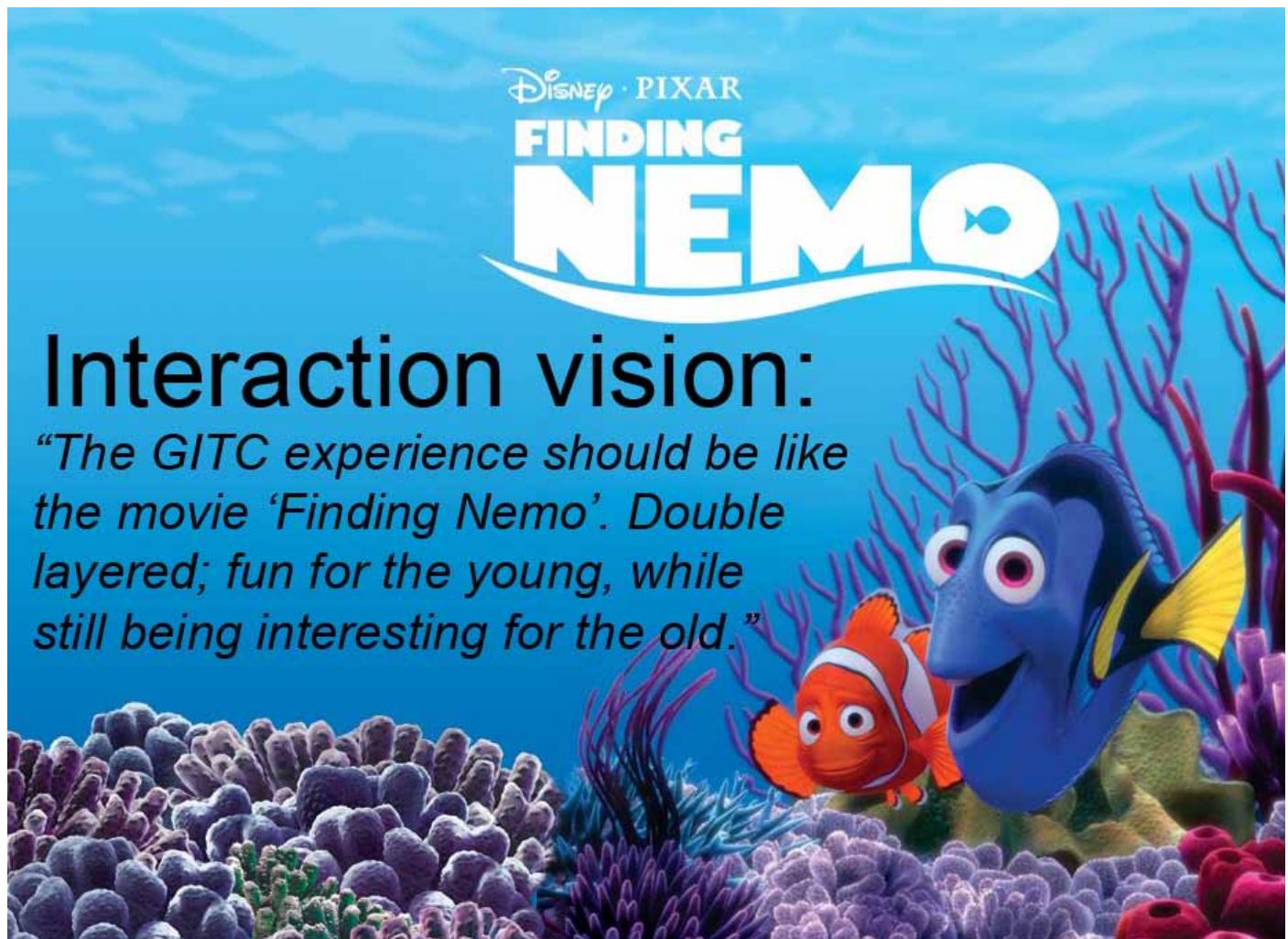


Figure 4.2 - The chosen interaction vision

4.3 METHOD

Network Focused Design

During this project the Network Focused Design (NFD) approach was chosen as a guideline to a final product, because of its focus on networked products. NFD originally was the result of the master thesis of Sara Córdoba Rubino [p19], who researched the strategic implications of designing products for the internet of things. When she started working with the Design studio Booreiland, they developed a book called Meta Products [p20], which explains the phenomenon of meta products and which introduces the Network Focussed Design approach.

The book states that “*Meta products are dedicated networks of services, products, people and environments fed by the information flows made possible by the web and other ubiquitous technologies*”. The gorillas in the cloud project can also be seen as a meta product. The illustration in figure 4.3 shows a schematic representation of some of the basic functionalities of a meta product.



Figure 4.3 - The main functionalities of a Meta product

The Network Focused Design (NFD) approach consists of 3 phases, containing 3 steps each. The first phase dedicates itself to identifying the network and to visualizing all the actors and the actions. The second phase aims to find new relations of value exchange and tries to identify the design opportunities. In the third phase a selection needs to be made about what kind of data, metadata and touchpoints have to be developed. Figure 4.4 shows the the phases and the individual steps of NFD. A full description of the approach can be found in on www.metaproducts.nl. As a part of the project deliverables, the NFD process will be evaluated. (See chapter 7.5)

The NFD approach introduces three terms which are important during the whole design process; data, touchpoints and metadata. To get a better perception of what these terms exactly mean, Booreiland has defined the exact meaning of these words.

Data

Almost anything that can be measured: it does not have meaning, it has to be collected, combined and interpreted in order to have meaning.

E.g. type of food, temperature of the fridge, movements

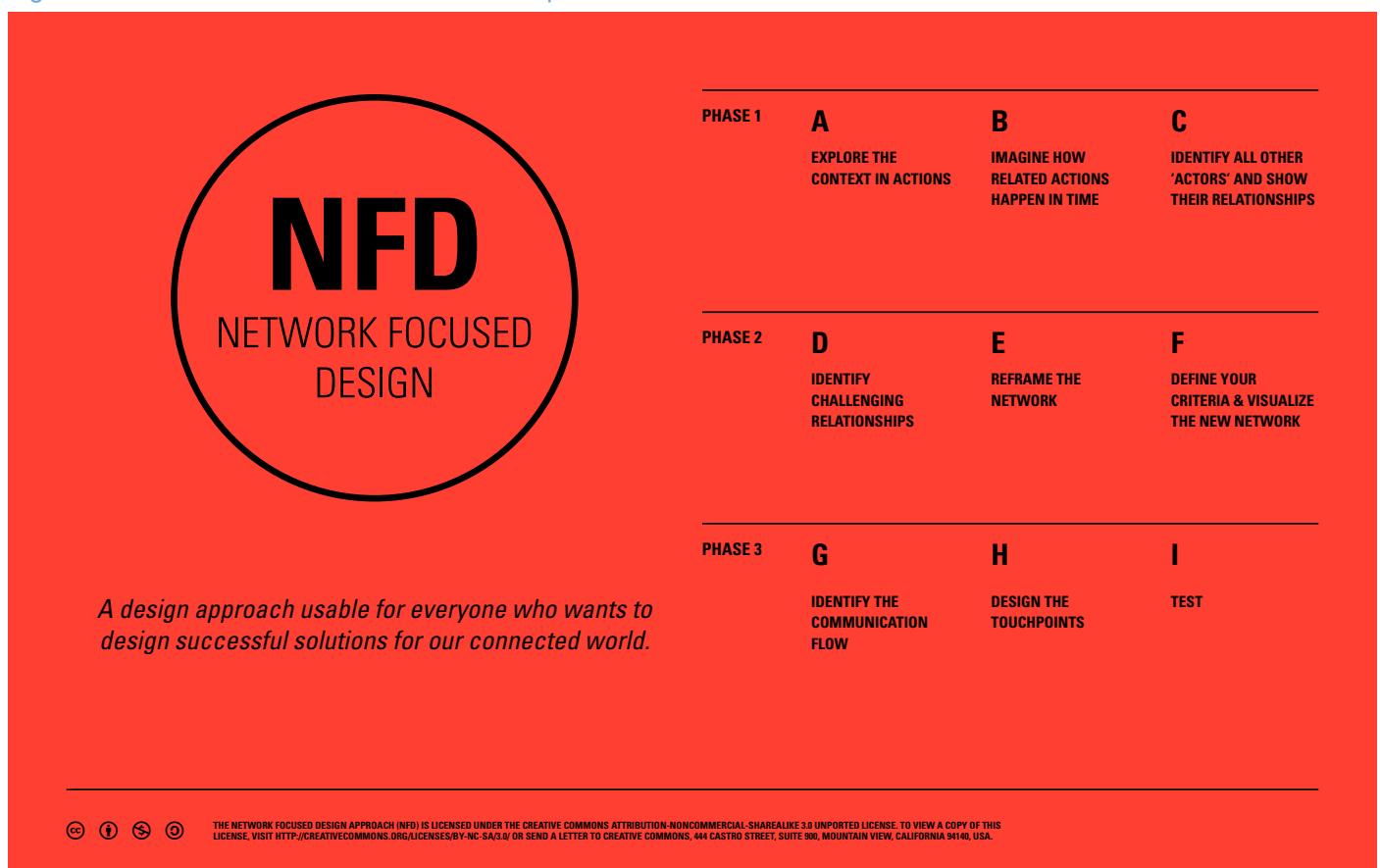


Figure 4.4 - The three phases and the 9 steps of the Network Focussed Design approach (illustration from www.metaproducts.nl)

Touchpoints

all the processes and hardware that are dedicated to collect, manipulate and direct the data.

E.g. monitors, software, sensors

Meta data

The interpreted data: the information that actually has meaning so that other devices and people can act upon that information correspondently.

E.g. it is communicated to turn on the fan because the temperature is too high

User centered design

During the design process user research has been conducted, as described in chapter 3. The insights of the user studies have been used in the design process to gain a feeling about the user experience of the ideas and concepts and to create a final product that fits the needs of the end users.

7 Commandments of Experience design

Dutch design studio Northernlight specializes in exhibition and experience design for (interactive) environments, such as musea, theaters and airports. Northernlight has composed seven commandments for good experience design [w10]. A vision about the user experience in the park has been framed using the seven commandments of experience design. During the design process, the commandments have been used for inspiration while creating the ideas, concepts and the final product.

1 - Storytelling

A challenge in the product design will be to communicate the total story around GITC and not just a part of it.

2 - Authenticity - Real stuff

The users in Apenheul go to the park to see the animals live. The GITC product should be an enhancement of their live experience, instead of a replacement.

3 - Action

The product has to be appealing to visitors and it has to stimulate and activate visitors to interact with it"

4 - Focus

The communication towards the user needs to be sharp, clear and adjusted to the user.

5 - Being together

Visiting a zoo as a group is a bonding experience. The group bonding process should be supported and stimulated by the product.

6 - Sparking inspiration

To communicate information about gorillas in such a way that people learn something new while having an enjoyable experience.

7 - Passion

Expressing the beauty and magic of the gorillas as they are wonderful creations of nature.



Figure 4.5 - Designing a product for GITC using the 7 commandments of experience design by Northernlight

4.4 Program of requirements

The final design has to meet the conditions formulated during the project. The product will be digital, interactive and connected to a network. The definitions of product and system are specified to clarify their differences.

Product

Consists of both a physical appearance and digital content.

System

The complete network build in Apenheul consisting of the sensors, the infrastructure, the servers and the touchpoints.

Product

- The product has to be used in Apenheul
- A physical product will be placed inside Apenheul to display data & information about gorillas
- The product delivers the user information about the gorillas in Apenheul and as a species
- The product has to present information within 5 minutes
- The visitor's knowledge should increase by interacting with the product
- The product gives the option to share your experiences. Sharing can be done through multiple services (such as email, social media, etc.)
- It is desirable if the product also encourages interaction before and/or after the park visit

Technology

- The Gorillas will not be physically equipped or chipped with sensors. No harm to the gorillas!
- The product will be connected to a network
- The product will process and select the most feasible information to the user, filtering data
- The product should be feasible to implement in 2015
- The product uses the (meta)data collected by the sensors on the gorilla island

Data

- The processed (meta)data is presented to the visitors in a clear, understandable and useful way.
- The added annotations and metadata can be both automatically generated or manually put in by visitors, care takers or researchers
- The 'mature' database can be used to analyze patterns and to find interesting correlations and insights
- It is desirable if the users contribute in a valuable way to the GITC ecosystem, through data input, data processing or data validation
- The product has to be able to customize the output by processing input from the user. The displayed information will be dynamic rather than static.

Users

- The main user group of the product is parents with young children who visit the park. The product will target the children.
- The product has to contain enough depth for the parents who are using the product with their children
- The product has to be clear and understandable to use for children
- The scenario of the use of the product 'A nice family day out' or in Dutch is 'een gezellig dagje uit met het gezin'
- The product can be used by other user groups
- On the following moments the product can/will be used
 - Children that want to play with the product
 - Parents who are watching over their children
 - On a rainy day, visitors can still use the product to view the park

User experience

- The product has to enhance the visitor experience. The average perception of the users should be rated as 'positive' 'pleasant' or 'valuable' (or synonyms of these words).
- The users should reflect upon their experience with the product as; fun, involving, engaging, educating, bonding, relating & reflecting
- The presentation of the information has to be perceived as fun

Awareness

- The applied sensor & data processing technologies have to be understandable and usable for park visitors
- The park visitors can be participants and/or contributors to the GITC research
- It is desirable if the product triggers other people to visit the park or the GITC ecosystem

4.5 Design explorations

Design is an iterative and explorative process. Figure 4.6 visualizes the followed design process and the exercises done, from brief to product prototype, during three different phases.

Figures 4.7, 4.8, 4.9 and 4.10 give an impression of the path taken and the exercises done during each phase. For a detailed description of the design exercises the design workbook can be referred to, as a second deliverable of this thesis.

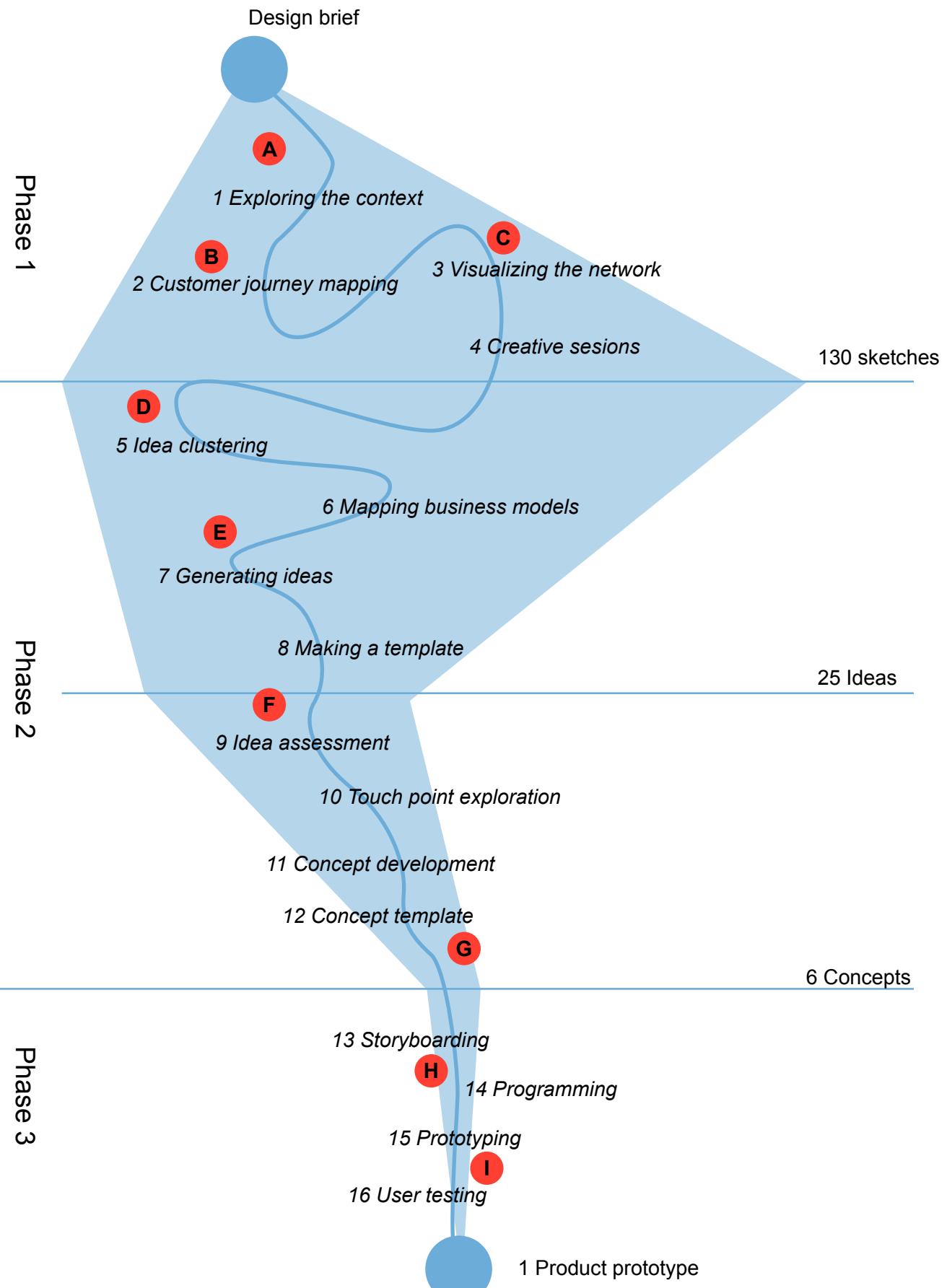


Figure 4.6 - A schematic representation of the followed design process and the exercises done.

1 Exploring the context

Design brief



A - Exploring the context in actions



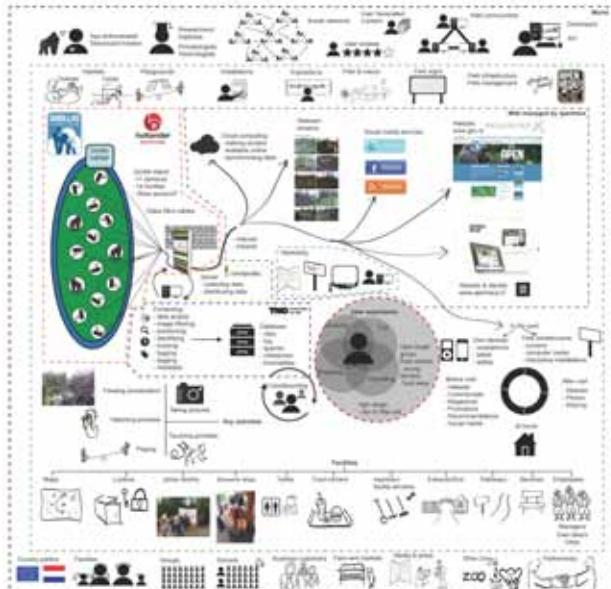
B - Imagine how related actions happen in time

C - Identify all other 'actors' and show their relationships

User phases	Trigger			Preparation			Visit			After visit		User phases
User journey	Motivation	Orientisation	Decision	Planning	Packing	Traveling	Entering	Visit	Exit	Traveling	Home	User journey
Experience curve	Previous experiences / Recommendations	Information about the destination	Decided	Check parking permit / Book tickets online	Pack food and drink / Check clothing / Take photo equipment	Get ticket / Check-in	Enter park / Pay fee	Visit attraction / Enjoying in the park	Leave park / Security	Proceeding the way home	Arriving home	Exploring next destination
What?	What do I want to experience?	Where can I go?	When?	How?	Why?	How?	What?	What?	When?	What?	When?	What?
Where?	Where can I go?	Where can I go?	When?	How?	Why?	How?	What?	What?	When?	What?	When?	What?
Why?	Why?	Why?	When?	How?	Why?	How?	What?	What?	When?	What?	When?	Why?
How?	How?	How?	When?	How?	How?	How?	What?	What?	When?	What?	When?	How?
When?	When?	When?	When?	When?	When?	When?	When?	When?	When?	When?	When?	When?
Timeline	Weeks before / Week before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Days before / Days before visit	Weeks after / Weeks after visit
Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media	Reading news / Social media
Touch points	Marketing / Advertisement	Marketing / Advertisement	Marketing / Advertisement	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service	Marketing / Customer service
Company perspective	Provide information / Customer service			Cashing			Deliver park quality			After visit		Company perspective

2 Customer journey mapping (see Appendix A)

3 Visualizing the network (see Appendix B)

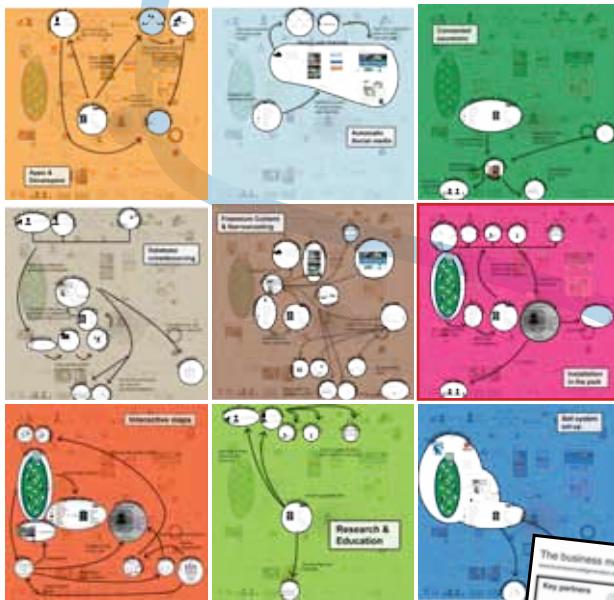


4 Creative sessions



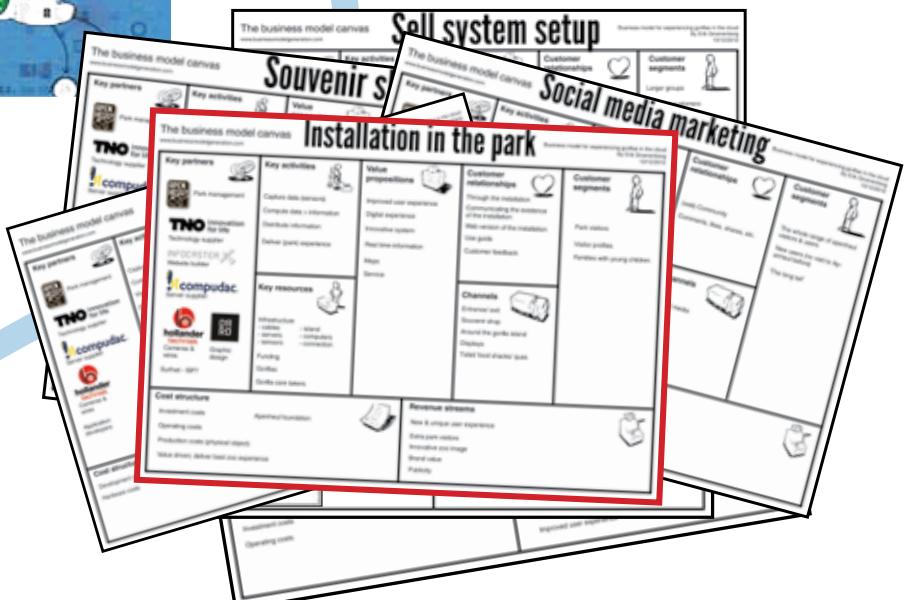
Figure 4.7 - Impressions of the exercises and the design process during phase 1

5 Idea clustering



D - Identify challenging relationships

6 Mapping business models



E - Reframe the network

7 Generating ideas



8 Making a template



Figure 4.8 - Impressions of the exercises and the design process during the beginning of phase 2

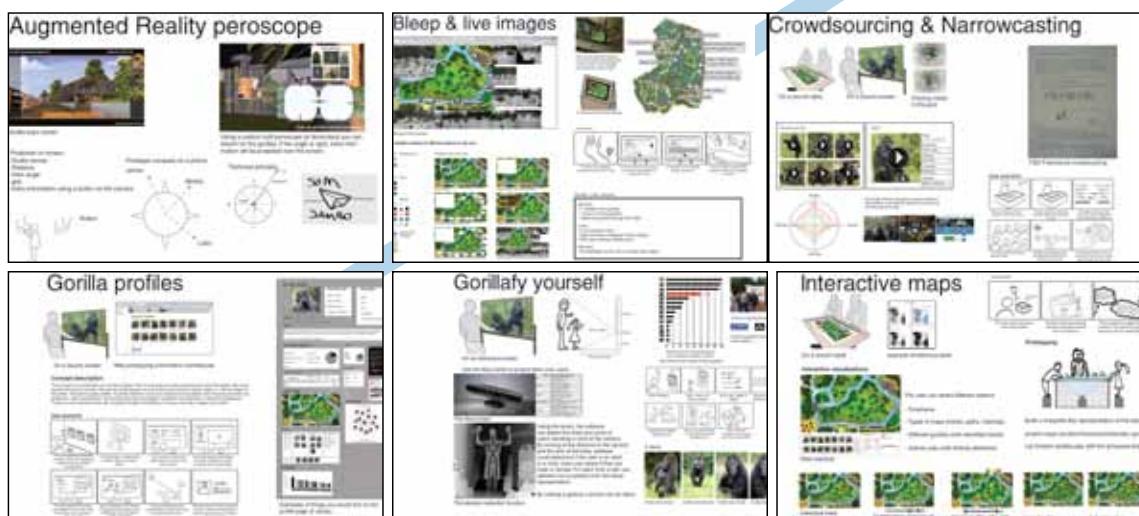
9 Idea assessment



Mode	Assessing touchpoints									
	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Smartphone	High	None	Low	Medium	High	Medium	Low	Medium	High	Medium
Tablet	None	None	Low	Medium	High	Medium	Low	Medium	High	Medium
PC	None	None	Low	Medium	High	Medium	Low	Medium	High	Medium
Smart display	High	Medium	Low	Medium	High	Medium	Low	Medium	High	Medium
Touch screen	High	Medium	Low	Medium	High	Medium	Low	Medium	High	Medium
Touch-table	High	Medium	Low	Medium	High	Medium	Low	Medium	High	Medium
Infrared ziel	None	None	Low	Medium	High	Medium	Low	Medium	High	Medium
Existing displays	None	None	Low	Medium	High	Medium	Low	Medium	High	Medium
Custom-built QSR extension service	Medium	None	Low	Medium	High	Medium	Low	Medium	High	Medium

F - Define your criteria & visualize the new network

10 Touch point exploration



12 Concept template

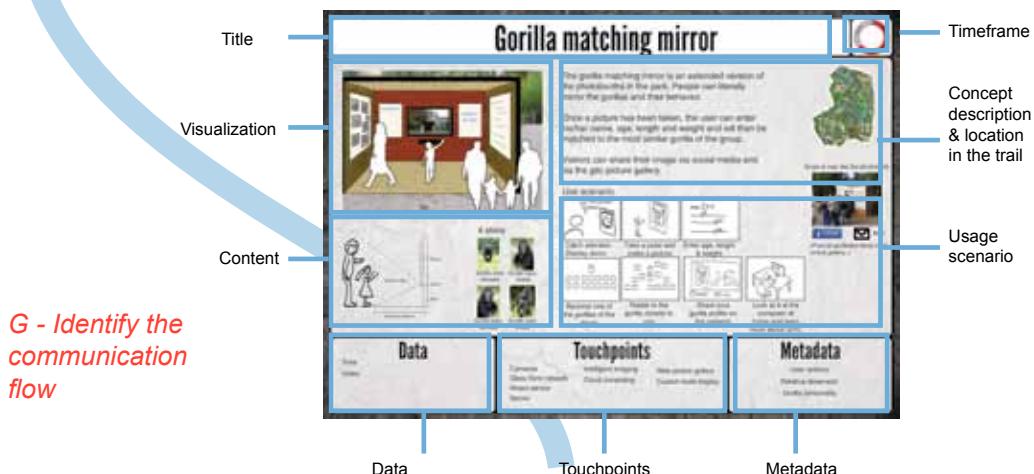


Figure 4.9 - Impressions of the exercises and the design process during the end of phase 2

13 Storyboarding



14 Programming



15 Prototyping



I - Test



16 User testing



1 Product prototype

Figure 4.10 - Impressions of the exercises and the design process during phase 3

Process description

A brief description is given of the results of each exercise is given below. The capital letters indicate during which phase of NFD the exercises were done.

A Exploring the context in actions

1 Exploring the context

The context has been explored through direct observations, user research and contextmapping.

B Imagine how related actions happen in time

2 Customer journey mapping

Mapping the customer journey defined three phases; pre-visit, during visit and after visit and helped to understand the user actions over time. It identified possible moments to target when creating a user experience. See appendix A.

C identify all other actors and show their relationship

3 Visualize the network

The network visualization shows the main user, the GITC set up, different aspects of the park and external factors in the world. The network visualization can be seen as a summary of all the actors that (can possibly get) involved in the network. See Appendix B.

4 Creative sessions

Two creative sessions started the ideation process with the goal to diverge and resulted in a large set of useful product sketches.

D Identify challenging relationships

5 Clustering ideas

The sketches have been clustered in 9 different groups. The challenging relations of the clusters have been mapped using the network visualization.

6 Mapping business models

The different ways the idea clusters generate value have been explored through the business model canvas. 9 Business models have been mapped based on the idea clusters.

E - Reframe the network

7 Generating ideas

The sketches of the chosen cluster have been further developed and detailed.

8 Putting ideas in templates

The ideas have been put in a standardized canvas to equalize the ideas. The ideas have been assessed

and the data, the touchpoints and the metadata has been mapped.

G - Define your criteria and visualize the network

9 Idea assessment

A decision has been made which ideas are the most promising ones to further develop into concepts.

10 Touch point exploration

The possible display touch points and which ideas could be displayed on those touchpoints has been explored.

11 Concept development

The chosen ideas have been further developed and detailed into concepts.

12 Concept templates

The concepts have been standardized in a canvas to equalize the concepts. The data, the touchpoints and the metadata per concept has been mapped.

G - Identify the communication flow

13 Storyboarding

A use scenario of how the user will interact with the product has been sketched.

14 Programming

The way the program should work has been determined and the code to add functionalities to the program has been written.

H - Design the touchpoints

15 Prototyping

A prototype of the physical space, the intended interactions and the digital content has been prototyped.

I - Test

16 User testing

A questionnaire for the users to test the product prototype and to assess its viability and its qualities

* The in between results from the design process can be consulted via the design workbook.

4.6 Choices

The arguments for the most important choices during the design process will briefly be explained below.

Sketches to Ideas

Based upon the 9 idea clusters, different business cases have been mapped using the business model canvas, exploring what value groups of ideas can bring. The 9 business models are;

- Apps
- Mature database
- Feemium content
- Installation in the park
- Visualizations
- Research & Education
- Social media marketing
- Souvenir shop
- Sell system set up

The installation in the park case has been chosen, to serve as a starting point of the GITC project and to increase the awareness of the project.

Ideas to concepts

The ideas have to meet the requirements formulated. They can only further be developed if they are within the framed boundaries of the product, the technology, the data used and the users targeted. The ideas can differentiate themselves on expected user experience and awareness. The product has to be appealing to all stakeholders in this project.

An assessment of the quality of each idea has been made based upon 5 criteria;

- The assumed fit with the User Experience, based upon user studies
- The awareness of the product (as framed in section 4.4)
- The product fit with the mission of Apenheul
- The product fit with the goals of TNO
- The product fit with the competences of an interaction design student at the TU Delft

In total 6 ideas were selected and further developed into concepts

Concept to prototype

The concepts are based upon the best scoring ideas and/or combinations of those ideas. Each concept consists of a concept visualization, a concept description, the content to be displayed and a use scenario. Six concepts have been developed;

- Gorilla bleep & live images
- Gorilla matching mirror
- Gorilla profile wall
- Interactive maquette visualization
- Augmented binoculars
- GITC control center

The gorilla matching mirror has been chosen to prototype, based upon a number of arguments;

- The matching mirror is designed to be an introduction to GITC. It can serve to introduce other installations
- The installation aims to connect users to real gorilla individuals, letting users explore more about that individual later.
- The matching mirror provides enough challenges for prototyping, such as the gesture control interface. Both physical product and digital content can be developed.
- The matching mirror does not rely on technology and/or sensor detection methods still to be developed.
- The gorilla bleep is currently being tested and implemented while other concepts rely on technologies yet to be implemented

4.7 Results

Product exploration

The design process has produced 130 sketches, 25 product ideas, 6 concepts and 1 product prototype. The final design will be described in chapter 5. Recommendations about the concepts will be given in chapter 7.

NFD sheets

As a result of the design process, all the data, touchpoints and metadata usable in GITC have been mapped. Three 'NFD sheets' have been created, giving a short and quick summary of the available and applicable data, touchpoints and metadata, see appendix C, D & E. The sheets can be seen as the raw ingredients of a cook book. The ideas and concepts are the recipes, combining ingredients to a delicious dish (meaningful product).

Design workbook

All design exercises have been collected in the design workbook. Descriptions of the exercises are given and all ideas and concepts are presented. The workbook can be used as inspiration when developing future products for GITC.

4.8 Conclusions

Conclusions Data

The available raw data is captured by the cameras and is communicated as image or video files with a timestamp.

Detection methods have to be applied to extract more information from the raw data. What information to extract depends on which concept to be developed. Location, tracks and annotated tracks are most useful when visual representations of the island are made. The # detections is useful for selecting the live images of the camera with the most gorillas in sight. Individual detections enable a lot more functionalities in ideas. Recognizing actions & activities enables triggers and is useful for logging and quantifying data. Group dynamics can be used for logging and experimenting with family/hierarchy visualizations. The likeability score is mainly used for video clip assessment and crowdsourcing dynamics. Detecting emotions is not a primary concern and could be added as an extra.

Per idea the data has been mapped in 'must have', 'should have', 'could have' or 'no need'. The development roadmap in chapter 7 describes the information in the final product and what information is needed per concept.

A large database will be built, saving the time, the raw data and the extracted information. More information can still be added manually or via external sources, such as weather data. For research purposes, it is beneficial to have a complete database, with as many parameters as possible. The precision of the detections needs to be above a level of certainty, in order for the data to be useful and scientific.

Patterns and anomalies can be detected analysing the database entries. When patterns/anomalies are detected, it can start a sequence of events.

Experimental datasets, containing raw data and processed data, can be given to developers to experiment with new installations & applications. Those datasets can be from a moment in the past, say the 1st day of March, and do not require to be live.

Conclusions Touchpoints

All the ideas rely on the infrastructure in Apenheul; the sensors and installations need to be connected via a (glass fibre) network to a server.

Data processing technologies that are essential for GITC are intelligent imaging, cloud computing and big data. Almost all ideas and concepts rely on those technologies. Data visualization does not apply to all ideas and/or concepts, but is very important in the communication of the data. Quantified self, Internet of Things, Crowdsourcing, Digital signage and augmented reality are not essential data processing technologies, but applying their principles will enable more products (and features).

Different display touchpoints have been explored. Most of the ideas and concepts use custom placed touchpoints in the park, such as touchscreens. The best display touchpoint should be considered per idea. An official website, supporting the installations in the park, needs to be developed.

Currently cameras are the only sensors on the island, making the data very dependant of intelligent imaging solutions. Placing more sensors and matching the output with that of the cameras will increase performance and will decrease dependency of imaging processes. Adding audio sensors can increase the richness of the datasets and allow for new ideas to be developed.

Conclusions Metadata

Installations in the park can help to give data meaning to users. Deciding which metadata to present is essential when developing concepts with meaning to users. The metadata can be completely different for different ideas.

CHAPTER 5

The product prototype during the greenlight meeting



- 5.1 Final product design
- 5.2 Use scenario
- 5.3 Prototype

FINAL PRODUCT

5.1 Final product design

The chosen product is the gorilla matching mirror.

The gorilla matching mirror is an extended version of the currently existing photobooths in the park. Visitors can literally mirror the gorillas and their behavior, using sensor technology themselves, see figure 5.1. Users can stand in front of a kinect sensor, which is recording the user actions, see figure 5.2. On the screen, a gorilla skin will be projected over the user. The user can change the gorilla skin and background he or she wants to be displayed. Figure 5.3 gives an impression of how the matching mirror can be placed as a booth in the park.

Once a picture has been taken (see figure 5.4) the user can enter his/her name, age, length and weight on a touch screen and will then be matched to the most similar gorilla of the group, see figure 5.5. Visitors can share their image via social media and via an online gtc picture gallery.

Data

The product will process the video and depth image captured by the Kinect sensor. It will record user actions. Personal information can be entered through manual input. A database containing information about the gorillas will be consulted.

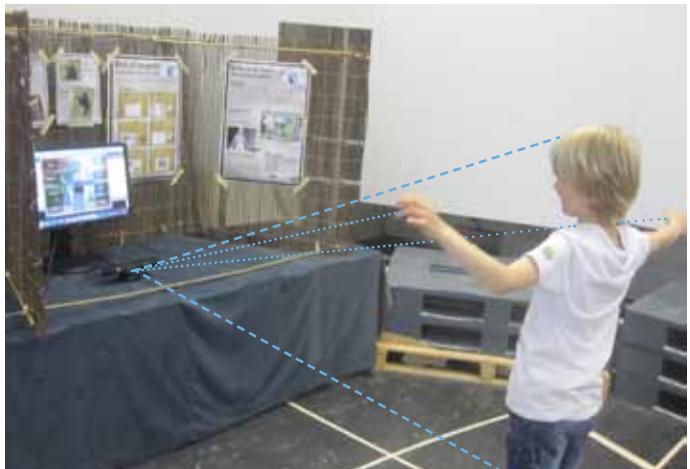


Figure 5.2 - A user being recorded by the Kinect sensor

Touchpoints

A glass fibre network and a server connect the product to the intranet. Pictures can be shared via email and/or social media and by uploading them to a web gallery on the internet. The product uses a Kinect sensor, processing software, a display screen and a touch screen.

Metadata

The interpreted data this product shows are what the user is doing, the dimensions of the user compared to a gorilla and what gorilla from Apenheul is most like the user.

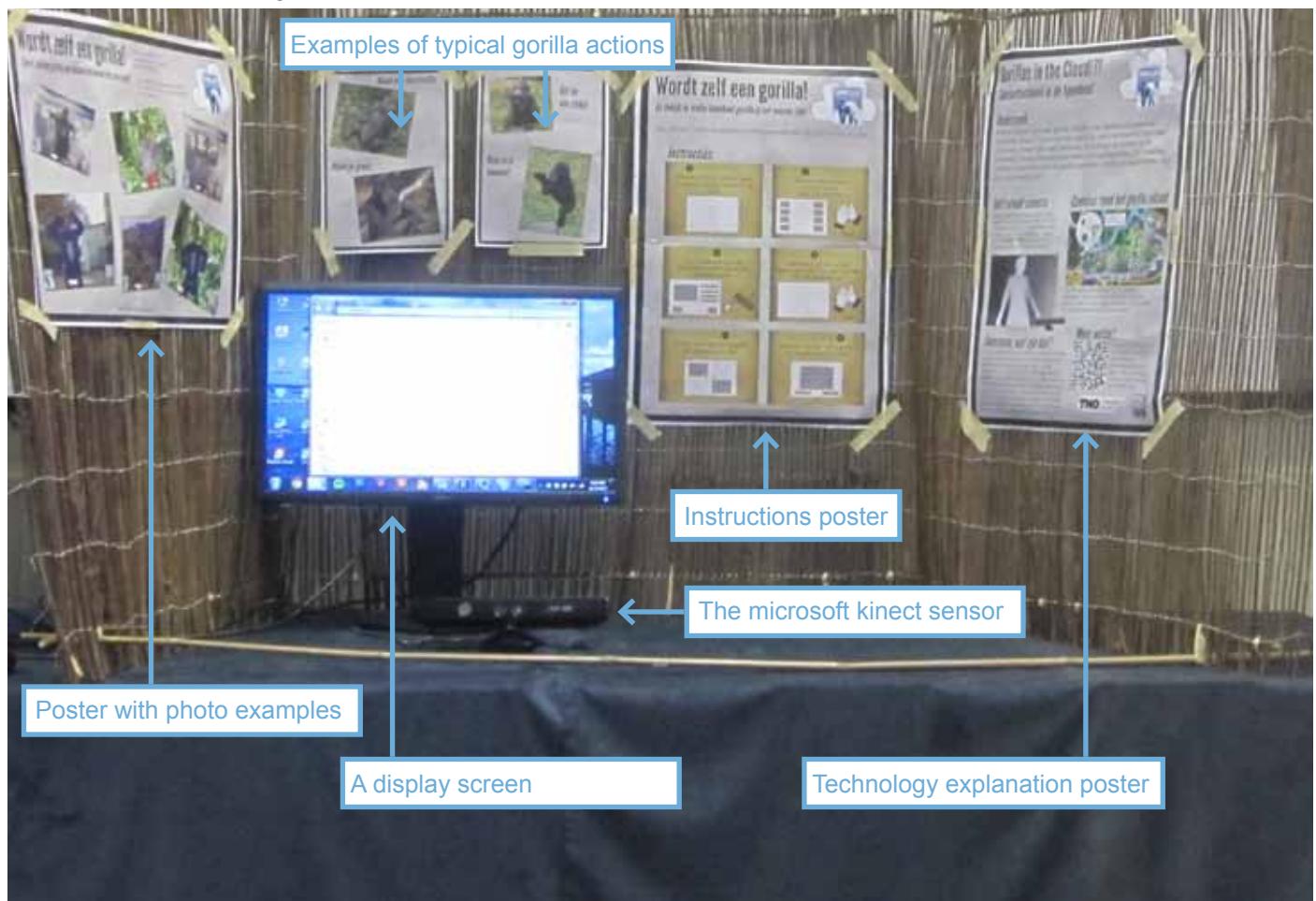


Figure 5.1 - A mock up of the gorilla matching mirror.



figure 5.3 - An impression of the gorilla matching mirror booth placed in the park.



Figure 5.4 - A picture taken of a user with a gorilla skin projected over him

Angaza ()
24 jaar
74 kilo
154 centimer

De Apenheul gorilla die het meest op je lijkt is:

Jambo
25 jaar
200 kilo
180 centimer

Vorige Volgende

figure 5.5 - A user is being matched to a gorilla.

Concept principles

The product embodies a number of principles encountered during user research, technology analysis and design explorations. The main principles of the concept are described below.

Bringing the sensors to the visitors

The mirror makes the concept of ‘being sensed’ very understandable and experiential for the users. Through this product, the story about sensors, gorillas and technology can be told. It has been designed to introduce GITC, so that in a later stage more products and installations can be developed.

‘The screen effect’

Being an interactive display with moving objects and images, the screen is expected to draw a lot of attention from the users.

Mirroring behaviour

Children learn by mirroring behaviour. Apenheul has the concept ‘herken jezelf’ (recognize yourself), where they encourage people to relate to gorillas and to behave like gorillas. In multiple places in the park children are encouraged ‘to climb like a primate’ or to mirror behaviour in other ways. The product responds to the gestures of the user and encourages simulating gorilla behaviour. When users ‘clap like a gorilla’, they control the interface, enabling them to pose and make a picture of themselves.

The human dimension

The product presents data on a understandable scale to users. It makes the connection between what is normal for humans and what is normal for gorillas. After entering your personal information, the application will translate it to a gorilla dimension. The average life expectancy at birth in the Netherlands is 80.20 years [w11]. For gorillas in captivity the life expectancy is estimated around 40 years. If a user enters an age, say 26, his/her gorilla age would be 13. The same applies for length and weight. All gorillas have a Swahili name, so the user randomly gets assigned one.

Being matched with a gorilla

Matching users with gorillas in Apenheul can increase their curiosity and empathy for that animal. Users get to see which gorilla ‘is most similar to them’, based on name, age, length and weight. A gorilla profile wall can be placed, allowing visitors to explore more about their gorilla match.

Keeping memories and Sharing experiences

Making a picture of yourself as a gorilla can serve as a lasting memory about your visit to Apenheul. It lets users remember and cherish their experiences

of a day in Apenheul. The picture can be shared via social media and/or via email, sharing your experiences digitally. The picture can serve as a conversational object.

Add an online part to the experience

Before users visit they can browse an image gallery on the gorillas in the cloud website, looking at photos of friends or ‘random’ visitors who have uploaded their gorilla photo. During the visit the user can make a picture and share it online. After the visit users get a link to their photo and are invited to read more about GITC on the website.

Presenting information in a fun way

While interacting and playing with the product, users get to know some information about the gorillas. They get to see some differences between male and female and between young and old gorillas. The backgrounds the user can choose tell something about where the gorillas live; inside Apenheul, in the Jungle, in the Rwanda mountains or even in the cloud. Getting a name learns users that Gorilla names are given in Swahili. By being matched to a gorilla the user is tempted to explore more details about one particular gorilla.

5.2 Product prototype

A product prototype has been developed in order to make the designed interactions experiential.

Prototyping technology

The gorilla matching mirror has been prototyped using the Microsoft XBox Kinect sensor and a computer with a USB port. The Kinect has a RGB (Red, Green, Blue) camera and it uses an infrared projector and an infrared camera to make so called 'depth images' of the sensed surroundings, see figure 5.6.

In the Java based software development environment (SDE) called 'Processing' an application has been written demonstrating the intended visitor interactions. It makes use of the open source SimpleOpenNI libraries, developed for the Kinect. Much of the code originates from the book 'Making things see' by O'Reilly, see figure 5.7. The book describes how the SimpleOpenNI libraries can be used to do skeleton tracking. Skeleton tracking calculates the positions of your joints and draws lines between them to visualize limbs, see figure 5.8

Interactive Prototype

The interactive prototype makes the designed interactions experienceable. The prototype is based upon 9 phases;

1. Demo movie
2. User Calibration
3. Menu; choosing skin & background
4. Posing & imitating as if a gorilla
5. Countdown and taking picture
6. Checking picture
7. Entering user name, age, length & weight
8. Translation to gorilla name, age, length & weight. Match with most similar real gorilla
9. Save & share picture

The interactive prototype can be controlled via gestures and invites users to immitate gorilla behaviour. The current applied gestures are left hand positioning, right hand positioning and a hand clap.

Future possibilities

More gestures and control functions can be added in a more advanced version of the prototype. There are plenty of ways to further detail the prototype. A number of suggestions;

- Add sounds
- Create highly detailed character animations
- Recognize additional poses and gestures, such as chest beats, scratching the head, etc.
- If user behaviour is recognized, additional animations can be started.
- Add interactive elements, such as a baby gorilla on your shoulder
- Program, prototype & test the application for (small) groups of people



Figure 5.6 - A kinect with its plastic casing removed, revealing (from left to right) its IR projector, RGB camera and IR camera. Picture taken from the book 'Making things see'.



Figure 5.7 - The cover of the book 'making things see'. Much of the code of the interactive prototype comes from the book.

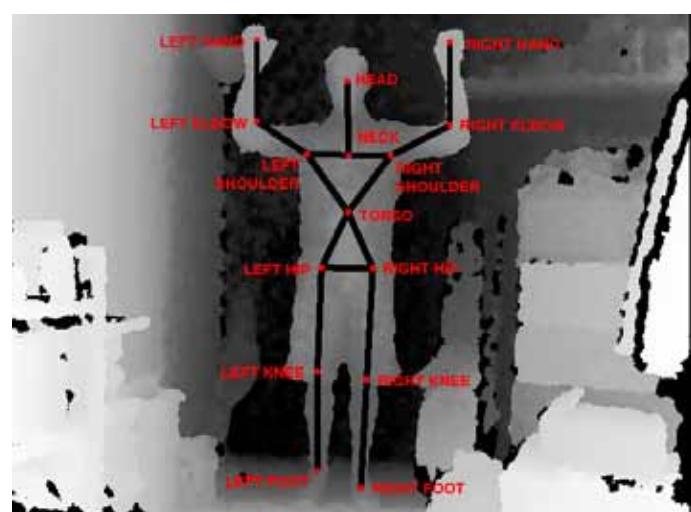


Figure 5.8 - Skeleton tracking calculates the position of the user his/her joints.

5.3 Use scenario

These screenshots from the prototype describe the different actions users have to perform and the different phases the users encounter when using the prototype.



Phase 1 & 2; Watch the instructions. Stand in front of the camera with your hands up, so the software can calibrate your bodyparts.



Phase 3; In a menu choose a background and a gorilla skin with respectively your right and left hand. Clap your hands to go to the posing phase.



Phase 4 & 5; The user is free to immitate a gorilla and to experiment with poses. Once the user claps, the countdown timer starts and a photo will be made.



Phase 6 & 7; Check your photograph, if satisfied, save it, if not, make another one. Once saved the user is asked to fill out his/her name, age, length and weight.



Phase 8; The personal information is translated to gorilla dimensions. The user is being matched to a gorilla in Apenheul most similar to him/her.



Phase 9; The user can choose to email the picture or share it via social media, with a standard text or a personalized message entered by the user.

CHAPTER 6

USER TESTING



- 6.1. Research questions
- 6.2. Test set up
- 6.2. Results
- 6.4. Conclusions
- 6.5. Redesign suggestions

A child and his grandfather filling in a questionnaire evaluating the prototype

The interactive product prototype has been tested in order to test if the product enables the intended interactions and if it meets the formulated requirements. The user test is of a quick and qualitative nature, aimed to gather further insights for design improvements.

6.1 Research questions

The user test has to answer a number of key questions to give insights in the user's perception and the performance of the product. The questions have been grouped in to five topics;

Concept

Does the prototyped product and interaction appeal to the target user group?

Usability

How well do the users understand the motion controlled interface? Is the menu structure understandable and usable?

Perception

Is the perception of the installation positive in the eyes of the users? Do the users think the installation is fun? Do the users reflect upon the user experience as engaging, educating, involving, fun, bonding, relating and/or reflecting?

Relation

Does the installation cause people to be more interested in gorillas? Does the installation help the users to relate and reflect upon their relationship with primates? Does the installation help to bond with an individual animal?

Technology

Does the installation cause people to be more interested in sensor technology?

6.2 Test set-up

The prototype has to test the most critical interactions of the product. It has been built in such a way that it tries to test most of the user experiences and interactions with the least amount of effort, see figure 6.1. The test is aimed at the main target group of the product, children in primary school (5-12 years old). The prototype has been placed in the science centre of the TU Delft, a visitor centre bringing people in contact with technology, often visited by children, see figure 6.2. A 'photo booth like' demo was placed around the prototype in a room of the science centre, see figure 6.3.

Children were recruited and asked to participate in a test by themselves.

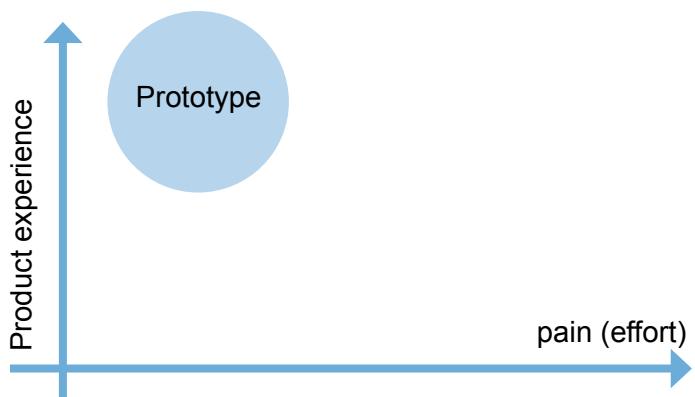


Figure 6.1 - User testing most of the product experience with the least amount of pain



Figure 6.2 - The science centre of TU Delft, hosting an interactive exhibition of technology.



Figure 6.3 - The photobooth like demo placed in the science centre

The following instructions were given to the children;

- 1 Watch the prototype instructions
 - 2 Operate the prototype
 - 3 Evaluate the prototype through a questionnaire
- During the test the participants were recorded via screen capture software, photos and videos. This enabled tracking the real time user experience (TRUE) [p21] and allowed reviewing of the test and making annotations of the user behaviour during the test.

After finishing using the prototype the participants were asked to fill out a small questionnaire specially designed for children. The questionnaire uses the 'smiley-o-meter' and the again-and-again

table from the fun toolkit, as described J. C. Read and S. MacFarlane. [p22]. In child centred game development children's enjoyment is the most important goal. If the children do not enjoy the game, they will not play it. [p23] Using the 'Smiley-o-meter' & the Self-Assessment Method (SAM), the children were asked to assess their experience with a number of topics. The children were then asked to select the words most fitting with their experience using paired comparison. In addition the children were asked a number of open questions. The whole questionnaire can be found in the Appendix.

6.3 Results

Visitors of the science centre were invited to use the prototype and to evaluate their experiences afterwards. Ten children ranging from 5 to 12 years old, fitting the target user group, filled out the questionnaire after the test, see figure 6.4.

Quantitative results

Looking at the results from the SAM-scales (see figure 6.5), the product is considered to be highly pleasurable. The arousal and the dominance scales score in the middle with a high deviation, indicating that the users had a medium level of arousal and dominance, with high differences in scores between subjects.

Nine out of ten participants would use the prototype again, one might do so. The scores from the smiley-o-meter are shown in figure 6.6. Five aspects of the prototype scored from very fun to quite fun on the scale. The most valued aspect was being a gorilla or seeing what you like as a gorilla. Knowing your gorilla age was the least valued feature, closely followed by the feature of 'acting like a gorilla', though still being evaluated as fun. Making a photo of yourself and knowing which gorilla you look like are evaluated to be very fun.

Figure 6.7 shows the answers to the open questions at the end of the study. Only three participants were curious to know more about gorillas. Four participants felt more like a gorilla. Seven participants were curious about the technology and eight participants would like to share their photo with others.

Character of the prototype

The character of the prototype can be described by the words shown in figure 6.8. The participants were asked to circle one word out of two antipodes.

n	Male/Female	Average age
10	7/3	8.8

Figure 6.4 - The composition of the participant group

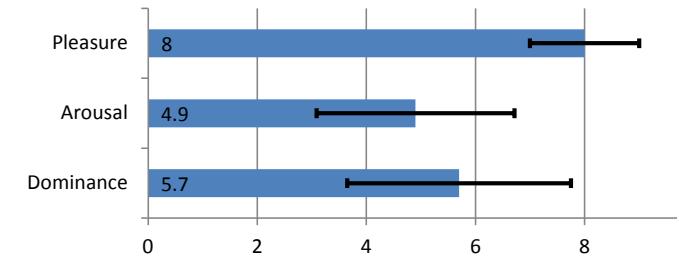


Figure 6.5 - The average Self Assessment scores

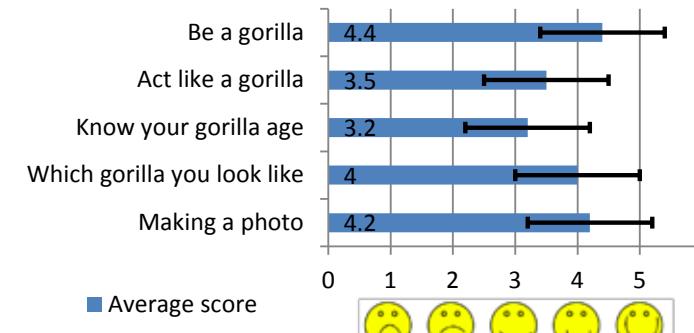


Figure 6.6 - The average fun scores of the Smiley-O-Meter

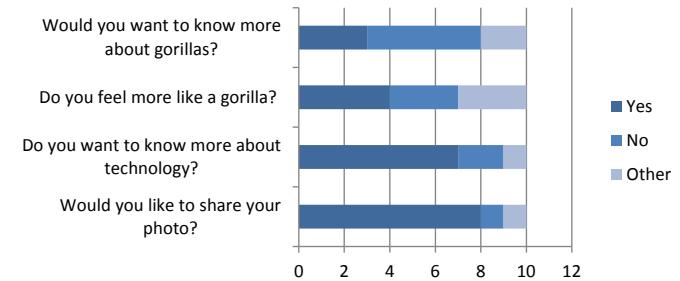


Figure 6.7 - Answers to the questions



Figure 6.8 - The words chosen by the participants to describe the character of the prototype

Comments

Twenty responses were given to the questions which aspects were liked most, the least and if there were any suggestions. Some of the responses have been illustrated by quotes. The ones in green are positive, the ones in red are negative and the ones in blue are suggestive, see figure 6.9.

Usability

About 25 annotations were made from analyzing the video files. They have been grouped in three categories; Menu & Control, phases and other.

Menu & control

- The gesture control was hard for some users
- It was not always clear when to clap
- The menu structure has a number of issues
 - Some participants could not reach the top buttons
 - When reaching for the buttons, other ones were touched
 - Some users had troubles reading the letters

Phases

- Users forgot to fill in their names. There were no clear usecues where to fill in the name.
- Users had troubles using the sliders to indicate their age/length/weight.
- Not all users knew their weight/length or were comfortable filling it in.
- The countdown timer was not always noticed in time, causing people to take their pose too late
- After making a picture, the picture is shown for a few seconds after which it disappears in the background. It was a bit confusing for the users

Other

- Participants asked if it was possible to have multiple users on screen
- The introduction demo screen was too elaborate for a number of users
- Many of the participants needed extra instructions from the researcher
- Not all user calibrations succeeded, some miscalibrations occurred
- Users wearing cameras/backpacks/dresses/etc can cause the kinect to miscalibrate joints.
- Some users controlled the interface by accident when holding hands together instead of clapping

Not all participants were familiar with gesture controlled interfaces. However, most children do pick up quickly. The more practice the users have/will have with motion control, the easier it will become for them to use these kinds of interfaces.

"The prototype is for somewhat larger people" – Jacob, 5 year



*"It was very fun to see myself as a gorilla!"
- Moreno, 8 year*



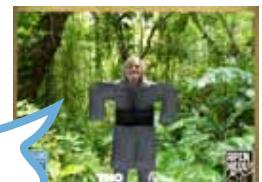
*"Maybe you could add a fun music tune?"
- Natasja, 7 year*



"It was fun to see myself on the screen. It is a bit like a mirror." - Eline, 8 year



*"Look daddy, I am an ape!"
- Tom, 10 year*



*"I would like to control a better looking gorilla..."
- Ruud, 7 year*



*"Sometimes I did not completely understand what I was supposed to do..."
- Thijs, 12 year*



Figure 6.9 - Visualized quotes from the user testing.

Discussion

The test results give insights about the product and how people perceive it. The self-assessment scores and the smiley-o-meter give quantified results about the performance of the product, while the open questions and the observations give qualitative results. The test was done with a small user group, meaning the scores can easily be influenced by incidental high or low scores by people. The scores do give an indication of what could be expected when performing the study with more participants.

The context of the science centre probably has influenced the test results. For example, more participants indicated to be interested in the technology used than to be interested in the animals. To test users in the real context they would be in when visiting Apenheul would increase the reliability of the test results. It would also be interesting to test how the product performs as a stand-alone product, without the intervention of a researcher.

To know if the product evokes the desired user experiences as described in the design goal could not be completely tested, as these experiences occur over time. To gather further insights about the user experiences requires more testing and a more advanced prototype.

Having a medium score on arousal and dominance can be a good thing. To keep users engaged, the installation should be designed to be a bit challenging, yet doable. The product is meant to evoke more interest and empathy for the gorillas, but the prototype didn't achieve that result with all users. In future prototypes more emphasis could be put on teaching about gorillas.

6.4 Conclusions

The user study resulted in a lot of hands on feedback on how to improve the design. Watching the participants, talking to them and evaluating their experiences gave a lot of insight in the user interactions with the prototype, giving insights in the performance of a fully developed product.

Concept

The concept has been evaluated positively by the participants. It is regarded to be fun, one of the most important aspects for children-computer interactions.

Usability

The user study showed several issues with the application, that can be improved in future redesigns.

Perception

All users perceived the prototype to be fun, new and pleasant. Most users indicated the prototype to be easy, special, funny and surprising. It is perceived as a game more than an educational tool.

Relation

The installation intended to bring the users in closer contact with the animals, but did not succeed to do so. In further design more emphasis should be placed on 'your' relation with the gorillas.

Technology

Most users responded that they would like to know more about the technology after being asked. It seems that the installation succeeds in making people curious about (sensor) technology. The posters placed on the demo were carefully read by some of the visitors, teaching them more about technology.

The test results have indicated the product to be feasible to apply as an installation in Apenheul, because of many enthusiastic reactions and good evaluation scores. The product does have to be further developed and some usability issues need to be solved before implementing a final design. More user testing during further development of the concepts is advised.

6.5 Redesign suggestions

This section proposes redesign solutions to improve the performance of the product (prototype). Based upon the insights from the user study the following changes are to be implemented in future prototypes;

Add audio & visual feedback.

- Add feedback for (un)successful calibrations of the user
- Add feedback for starting and counting down the countdown timer
- Make users clap twice and show animations for successful claps
- Add visual hints for instructions if the users take a long time to go through the menu. Support these visual hints by spoken instructions
- Play a 'gorillas in the cloud' background tune

Automatically calculate length & weight

Minimize the amount of information users need to fill in, so that he/she can move through the phases quick and easy. Make the Kinect estimate how long a user is and use pressure sensors to estimate the weight of a user. The length and the width of the gorilla skins could automatically scale along with the measured values.

Change the buttons & menu structure

Change the menu so that it will be easier for (small) people to reach the buttons. Make it so that users won't accidentally touch one of the other buttons. Increase the text size of the buttons for better readability.

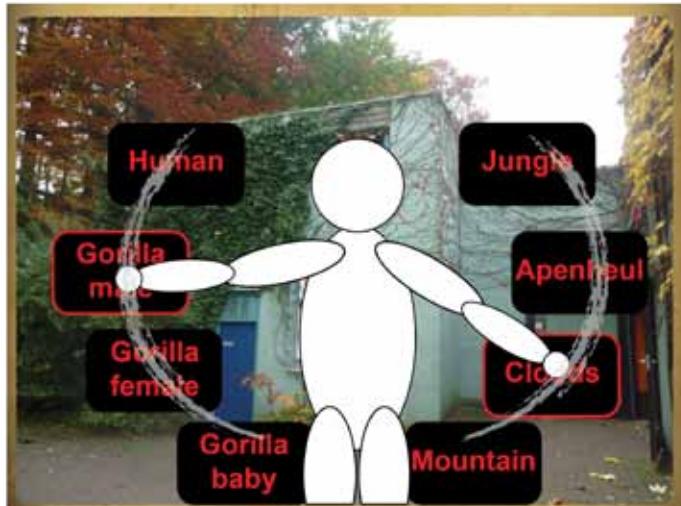


Figure 6.10 - A redesigned skin & background menu

Fade away the photo taken gradually

When users have taken their picture, it will be displayed on the screen, gradually fading away. After some time, the picture will be placed in the top right corner and the user will re-appear. The user can choose if he/she wants to save the photo with one of the buttons on the bottom.



Figure 6.11 - Your photo gradually fades away

Entering name and controlling the slider

Provide usecues on how to enter your name and imply a clearer slider to select your age.



Figure 6.12 - An easier information input screen

Relation with the animals

Present the information in a different way, teaching the users a bit more about the gorillas while using the product. The redesign shows how this can be done. It shows a screen which uses more storytelling and which tells something about the background of the gorillas. For example, it explains that all gorillas have a Swahili name, so you should have one too.



Figure 6.13 - Storytelling your 'gorilla information'

Multiple users

Consult a programmer to see if it would be possible to pose as a gorilla with multiple users at the same time. If it is possible, design the booth to work with multiple users. Otherwise, choose to focus on single users.

Improve gorilla skins

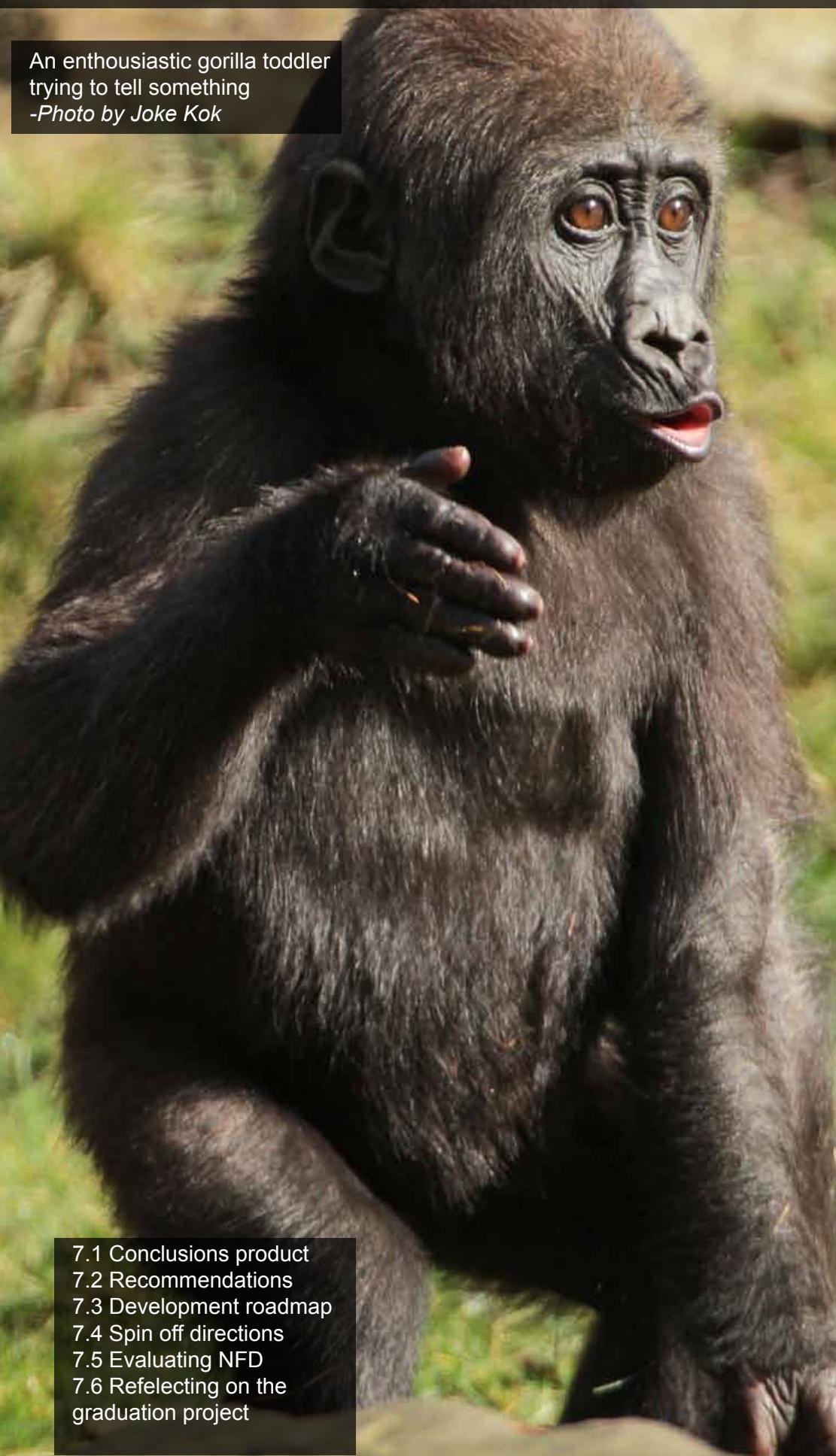
A professional 3D computer artist can be hired to create computer models based on the gorillas in Apenheul. An adult male, an adult female and a gorilla toddler can be modelled. An impression of a detailed 3D gorilla is shown below.



Figure 6.14 - A rendered 3D gorilla (Image taken from Turbosquid.com)

CHAPTER 7

An enthusiastic gorilla toddler
trying to tell something
-Photo by Joke Kok



- 7.1 Conclusions product
- 7.2 Recommendations
- 7.3 Development roadmap
- 7.4 Spin off directions
- 7.5 Evaluating NFD
- 7.6 Refelected on the graduation project

RECOMMENDATIONS & EVALUATION

7.1. Conclusions product

A product for ‘experiencing gorillas in the cloud’ has been designed, prototyped and tested. The test results indicate that the product is liked by children and is feasible to implement in Apenheul.

Looking at the program of requirements, the product fits within the formulated boundaries. A product with a physical appearance and digital content can be placed in Apeheul using viable technology. It presents the target users data from sensor systems, providing an extra user experience and increasing the awareness of GITC in the park. Some questions remain about the user experience and the awareness of the product, because they require more thorough user testing.

The gorilla matching mirror is meant to connect Apenheul visitors to gorillas through technology. It only makes limited use of the data captured by the GITC system, but this installation serves as a first step to introduce GITC and to open up the way for more complex installations showing data about gorillas.

7.2 Recommendations

Product

A decision needs to be made if Apenheul and TNO want to place this product. A go/ no-go moment needs to be planned with TNO and Apenheul to decide whether or not to develop and place this installation. If so, further developments and testing is needed. User testing with a more advanced prototype in Apenheul will give the most accurate insights in the performance. During the winter break, the product can be installed in the park. It is advisable to wait for the release of the Kinect 2 (expected November 2013) [v3], which has more accurate tracking algorithms and a much higher resolution, resulting in better pictures.

Costs

The estimated costs for such one installation have been calculated on €6000,- including professional software development and installation, see table 7.1. This price excludes further design explorations and user testing.

Costs	Estimated price
Booth materials	1000
Hardware for the installation	2000
Display screen	600
Kinect	250
Touchscreen/keyboard/mouse	150
PC	1000
Interface development	2000
Hire a professional programmer 40 hrs (25E/hr)	1000
Hire a professional 3D artist 40 hrs (25E/hr)	1000
Installation of the booth	500
Unforeseen	500
Total	6000

Table 7.1 - Estimated project development costs

Project development TNO - GITC

TNO should further develop the technical back end of the network, providing accurate data via cloud computing solutions. The processed data should be presented in an API (Applicable Programmable Interface), so third parties can develop applications with the detections.

TNO has to try to involve many external parties, as the network will grow larger and the project will become richer.

For TNO the field lab offers an excellent opportunity to further test and develop products and to perform more research in a number of fields. Different departments within TNO can be contacted, such as Multimedia and Network Services and the Perceptual and Cognitive Systems department.

TNO has to consider which metadata is most important for the end users and has to develop the sensor network detections accordingly. By placing interactive installations in the park the awareness of the project will increase.

If TNO wants to further develop installations and services for Gorillas in the cloud, a user centered design approach with a lot of (small) user tests and design iterations is advised. Apenheul offers an excellent opportunity to go out there and to talk to the end users of the products. Talking and validating with end users will be beneficial for the quality of the eventual product.

Apenheul

Through the gorillas in the cloud project Apenheul has the chance to experiment with more digital content, starting with a slow shift from analogue to digital media. If Apenheul wishes to place interactive installations, a number of steps need to be made:

- 1: Choose which ideas/installations appeal
- 2: Make spatial decisions; which installations can be placed where?
- 3: Make an inventory of what hardware to buy, to

place and to decorate

4; Get the content for the installations to be developed

5; Facilitate & maintain the products in the park.

If Apenheul decides to place connected hardware, it would be wise to have a content moderator.

Using digital signage solutions, messages can be spread from a central point to currently existing and to be placed display touchpoints. By placing new installations in the park, Apenheul will generate extra value for their visitors, enriching the user experience during the different phases of the customer journey. The installations will also generate extra value for Apenheul through social marketing and more web traffic.

Experiencing gorillas in the cloud

As a first step to making GITC experiential, installations in the park such as the gorilla matching mirror, need to be developed to exhibit collected sensor data to the park visitors. Having (a number of) interactive installations in the park has a number of benefits. It allows developers to test and fine-tune their (detection) software settings. It gives awareness towards the users in the park, through live demonstrations of the capabilities of sensor technology. It also creates more of a field lab atmosphere, where researchers and visitors can use a number of instruments to analyse the data.

The first installations should allow the database and the system to quickly mature, with precise and well annotated data. Once matured, more products can be developed, for example a research & education program using the data. More products can be developed according to the mapped business models.

The digital content displayed on the installations can be improved over time. Once invested in hardware materials, digital connectivity allows for the (re) development of program features and moderation over distance. External data can be imported and provide a continuous stream of fresh data. Generated content can be exported.

Gorilla exhibition trail

Based on the six concepts developed during the design process, a gorillas in the cloud exhibition trail can be build. The trail is a conceptual route visitors can walk, interacting with the content generated by the GITC sensor system. The trail starts at the Bongo Bonde theatre, after users watched a gorilla feeding session. When walking the trail, users will see multiple 'bleep' live maps, where they can pick and decide the best way to walk to see the gorillas from up close. Walking down the path, parents

and children will pass by a number of interactive installations. Users can mirror a gorilla, explore gorilla profiles, look at interactive maps and look through augmented binoculars. Both for parent and child there is enough to do and to explore.

The path ends at the gorilla habitat. There will be a special GITC control room, where visitors can spend as much time as they would like to, watching the gorillas through captured data content, see figure 7.1.



1. 'Bleep' shows users their location relative to the gorillas and shows live images what the gorillas are doing.



2. Users can walk past the gorilla matching mirror, where they can play & immitate gorillas. Visitors can find out which gorilla is most similar to them.



3. Users pass 'The gorilla profile wall', an interactive screen where they can explore the personalities, relations and activities of the individual gorillas.



4. Users can walk up to the interactive maquette visualization, showing the usage patterns of the island.



5. Users can use augmented binoculars to look at the gorillas and to identify their names and the distance to the gorillas.



6. Users can watch gorilla clips and rate and annotate them in the GITC control center. The movie of the day will be composed using their input.

Figure 7.1 - Impressions of a Gorillas in the cloud exhibition trail

7.3 Development roadmap

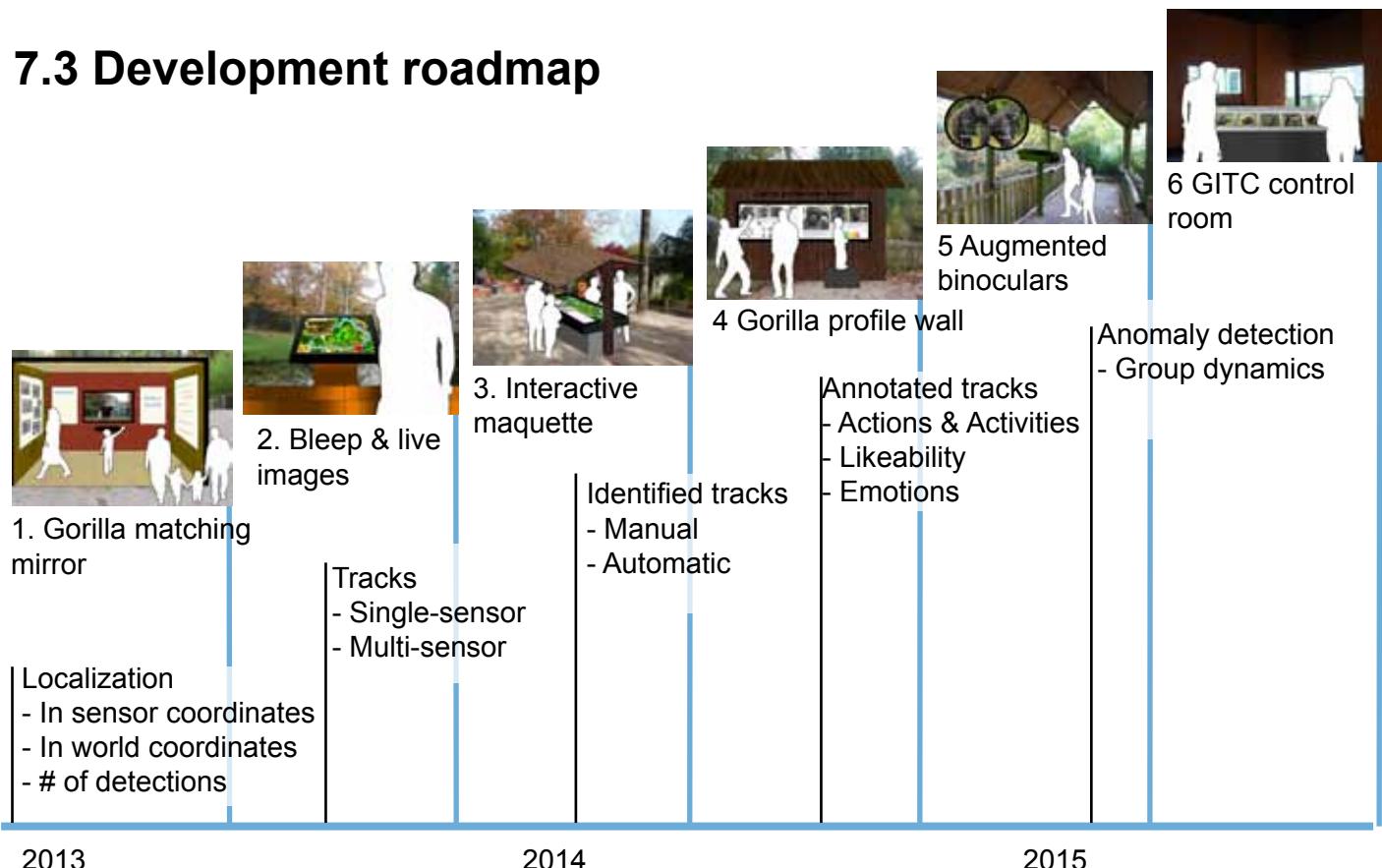


Figure 7.2 - The development roadmap

A technical framework has been developed by TNO, to further develop the sensor detection methods (see chapter 2.2). In order to make that data experiential, more installations to the park can be added. The development roadmap shows how the sensor detection methods and the park installations can be developed in parallel. By building installations, the sensor data can be tested and experienced, creating more of a field lab

atmosphere. If the sensor technology detections are improved, it should directly show different (better) results on the installations.

The installations are digital, so that the detection methods and the content of the installations can easily be updated and improved.

Table 7.2 shows what detections the installations must have, should have or could have.

Time	Raw data	Processed detections	GITC control room
Images			Augmented binoculars
Video			Gorilla profile wall
# detections			Interactive maquette visualizations
Localization			Bleep & live images
Tracks			Gorilla matching mirror
Individual detection			
Actions & Activities			
Emotions			
Likeability			
Pattern/anomaly			

Legend:

- 'Must have'
- 'Should have'
- 'Could have'
- 'No need'

Table 7.2 - What data the installations must have, could have and should have

7.4 Spin off directions

TNO

The TNO department of DSS has to find more 'civil' projects. Apenheul demonstrates that it is possible for TNO to reach new markets with their sensor technology. There are many more possible applications that could be developed. The most promising opportunities for new projects like GITC are discussed below.

Interactive parks

The same kind of concepts and functionalities used in GITC can be applied in other parks. Because of their 'closed environments', parks are easier to monitor. Other zoos could install similar products for different animals.

Data visualizations for public space

Visualizing data can make data insightful for end users. Visualizations applied at the gorilla island can also be applied on public spaces. For example, routes and walking paths could be visualized of shopping malls, of the main square in Delft or the central station of Utrecht. The city of Melbourne has developed an interactive map, displaying the usage of the streets in the city center. The map is available to the public and tells the public if the pedestrian count during a period of time in the city is average or not, see figure 7.3 [w12].

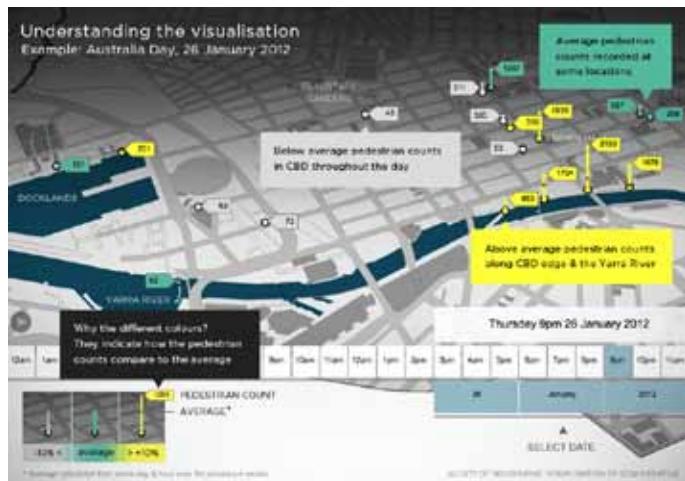


Figure 7.3 - an interactive data visualization of the city of Melbourne, available to the public

Safety

The safety market will benefit from anomaly and pattern recognition. Using surveillance cameras, imaging techniques, action & activity detections and individual detection can be applied. Automatic alerts when 'something' happens can be triggered.

Quantified self / Health care

By monitoring the gorillas all day, learning can be made about the life patterns of gorillas. Similar principles can be applied in health care, monitoring

personal data of patients. Looking at that data, doctors can focus on illness prevention rather than curing.

Primate & behaviour research

This project gives an unique opportunity to research gorilla behaviour. Running the GITC sensor system will generate a large and unique set of data. As much relevant data as possible should be collected. Primatologists and biologists can study gorillas through analyzing this data. The animals at Apenheul can be seen as ambassadors for their wild species. What is learned in Apenheul could also be used in the wild.

Sports

Monitoring sports can be done through sensor systems. Just like in GITC it is possible to count actions & activities, to visualise statistics and to project tracks on maps. Automatic match summaries can be made, providing the sportspeople insights in their performance.

Festivals & events

At festivals and events it can be very valuable to generate insights in user patterns, identifying possible bottlenecks and dangerous situations.

Apenheul

Gorillas in the cloud offers a number of opportunities for Apenheul that can be further explored and developed.

Marketing & communication

GITC offers the potential to spread more 'visual information' on the social networks of their visitors. Increasing online traffic to their website can be beneficial for the park. Offering new services, such as live images, data or knowledge, even new customers can be reached.

Technology

Apenheul can differentiate themselves from other zoos by their technology systems. A gorilla activity database will increase their knowledge and will reinforce their position as a primate knowledge center.

User experience

Technology can be used to enhance the user experience of visitors. Installations in the park can be used to add new experiences. It can target better education, more fun or more visitor convenience. Apps and websites can support the park experience and can target the whole customer journey (before, during, after).

7.5. Network Focused Design evaluation

NFD was chosen at the start of the project as a guideline to use. NFD supports project management and planning, because of its clear division in 3 phases and 9 steps.

Besides being a design approach, NFD is very much a mindset to design for connected products. It introduces three key terms; data, touchpoints and metadata. Understanding and working with these terms proved to be key to successfully applying NFD.

The method is clearly divided in three phases with three steps each. NFD provides a lot of possible exercises per step, but it does not visualize the output of the steps. Giving examples and/or developing templates would clarify the result of each step/phase. During NFD workshops such templates were available, giving a guideline of the intended way to follow NFD. During this thesis an ideation template and a concept template were developed, see figure 7.4. This allowed mapping all the possible data, touchpoints and metadata in sheets.

The method presents itself as a very linear process, but in reality design activities are often non-linear. During the project it often occurred that steps forward or backward had to be taken. The time spent per step and per phase was not equally divided. The

second phase was the longest one, because in that phase three iterations were done. At the start of phase two, creative sessions were hosted to start the ideation process.

The Meta products book has been a great source of inspiration for this project. This case shows that NFD can be used for connected user experience design and exhibition design.

Critical notes

Some critical notes about the method:

- step E - reframe the network - lacks some depth. The step has been interpreted as an ideation step.
- NFD makes prototyping appear to only happen in step H, but in reality prototyping sketches and strategies have to be explored earlier on in the process. The method should emphasize to start early with prototyping.
- NFD should provide templates as a standardized means to do design exercises. For example idea/concept sheets with boxes to write down what the data/touchpoints/metadata are.
- More emphasis could be placed on the importance of data, touchpoints and metadata.

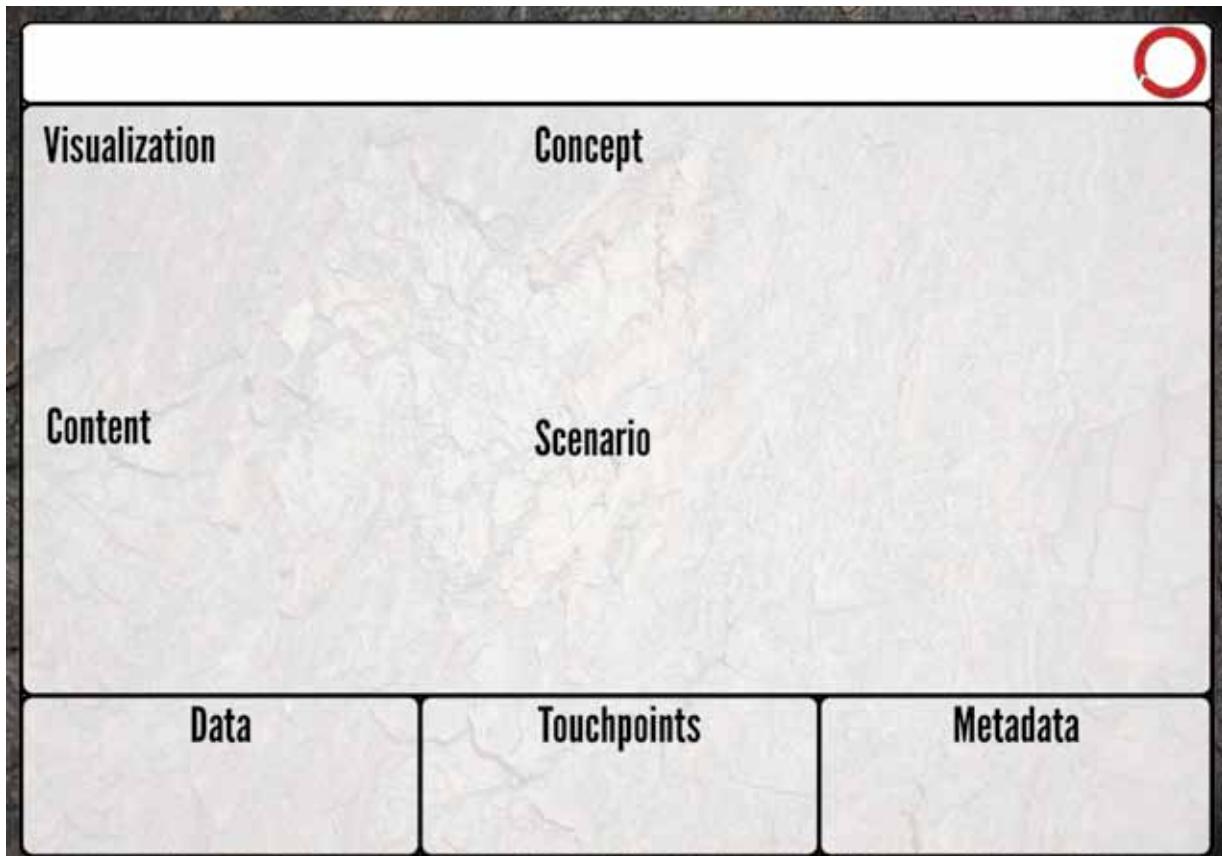


Figure 7.4 - An empty concept template

7.6. Reflection on the graduation project

In this section personal experiences with this graduation project will be discussed.

Research

With all my enthusiasm for technology I can start to research almost anything I find interesting. Through various sources, such as papers, the internet, videos and seminars I have collected a lot of insights in the technical principles of Gorillas in the Cloud. Visiting seminars works really inspiring for me and gives a good understanding of what is possible with state of the art technologies. The user research was iterative; it really builds upon insights, towards a point where the target user became very understandable and touchable. Translating the research insights in product ideas and requirements was a big challenge. The program of requirements helped to formulate boundaries and to converge during ideation processes.

Goal finding

Along with the project, the design goal developed as well. At the beginning, the challenge was to identify an interesting product to develop for GITC. Because this was rather wide, choices needed to be made about the scope of the graduation project. During the project a number of iterations were needed to formulate the eventual design goal. Making choices was an essential part of moving towards a final design.

Network focused design

At the beginning of the project I was enthusiastic about NFD and wanted to test it. NFD was very useful for the project management. It gave good guidelines in setting up a project in three phases and estimating what kind of activities were to be expected. Actually working through the steps I would have liked a bit more concrete examples of the expected output. NFD is also a mind-set and it helps to keep the mind focused towards making connected products.

Prototyping

For this project I had to learn coding for JavaScript. Being relatively new to programming, that was quite a challenge. Reading, understanding and copying code is a lot easier than writing code yourself. I had a very good guide book to help me write the Kinect code. Programming takes a lot of pain and effort, but it is very rewarding when your program finally does what you want it to do. I believe a basic level of programming to be a very important skill for interaction designers.

Testing

User testing really helped identifying issues with in the prototype. During prototype development several small test were done with friends and colleagues. They gave usefull feedback and were good sparring partners. The actual user testing with children took a lot more time to prepare and to perform, but resulted in very good feedback and tangible points for improvement. In further development I would defenitly like to do more quick design validations through user testing.

Time management

Making a clear planning with determined deadlines helps to keep focus. It takes a lot of personal discipline to keep to that planning. My planning was readjusted a number of times, because of lack of time, holidays, and setbacks. Everybody experiences ups and downs during their graduation. What I've learned from it is not to stop when you're stuck, but instead to ask for help and to keep doing activities. Working towards deadlines can be stressful but helps to set boundaries. Those boundaries can help to close phases and objectives.

A good experience

The graduation project has been a valuable learning experience. Being an individual project, you are confronted with your own personality, your own strong and weak points and your way of working. The project gave me a lot of freedom to select a personally appealing subject. I really believe in a connected future and this project helped me explore that future further. Working with gorillas keeps everything light and fun. During this project I've really began to understand and appreciate the animals. They are truly amazing! Working as an intern at TNO was an interesting and good experience. I've enjoyed working with the sensor professionals and to experience the working life at TNO.

CHAPTER 8

Photos of different users posing and behaving like gorillas

- 8.1 References
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- B - Touchpoint sheet
- C - Metadata sheet
- D - NFD Process visualization
- E - Summary family day out interviews
- F - Summary community investigation
- G - Gorilla interview

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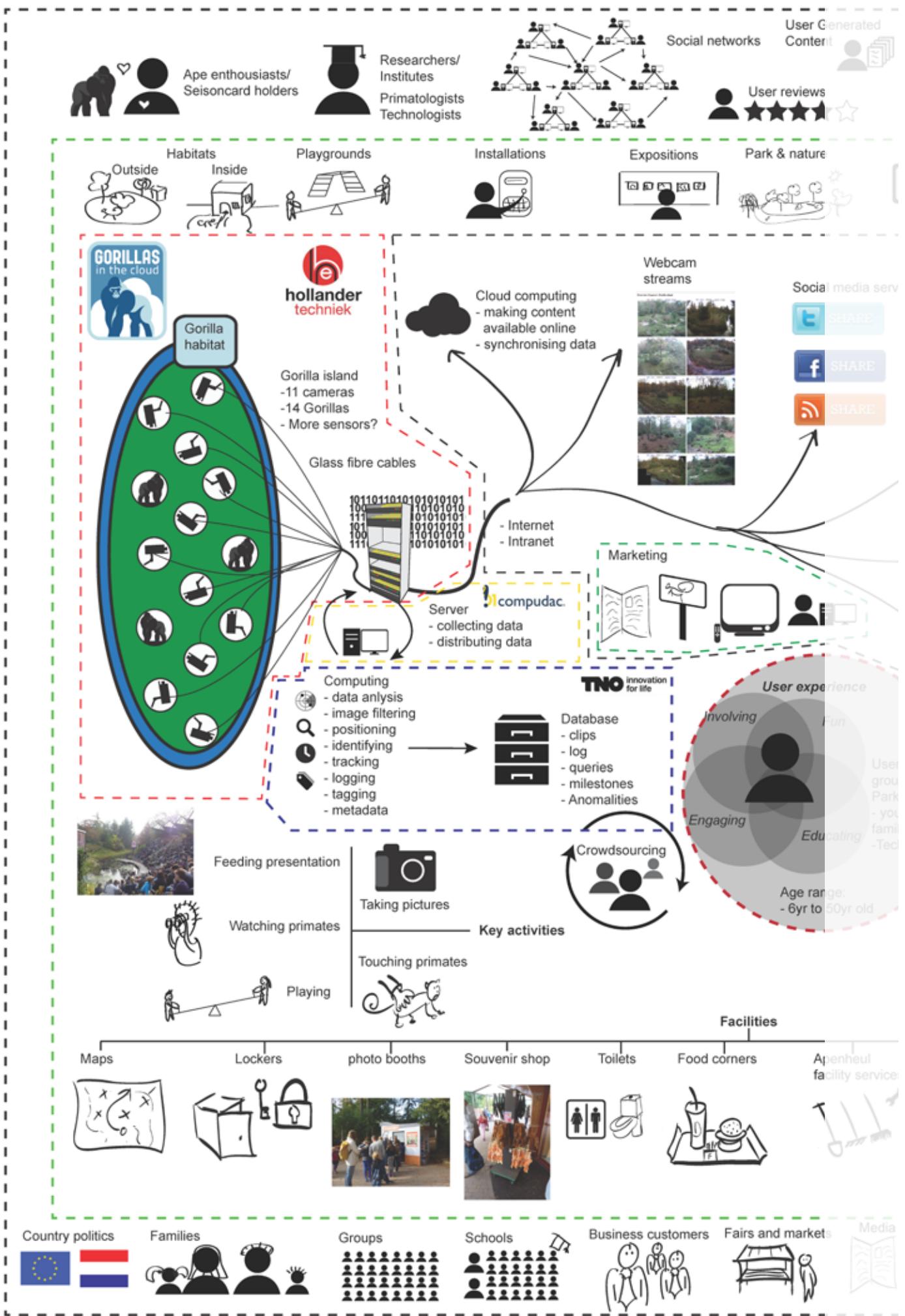
8.2 Appendices

- A - Customer journey
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- H - Gorilla interview
- I - User test questionnaire

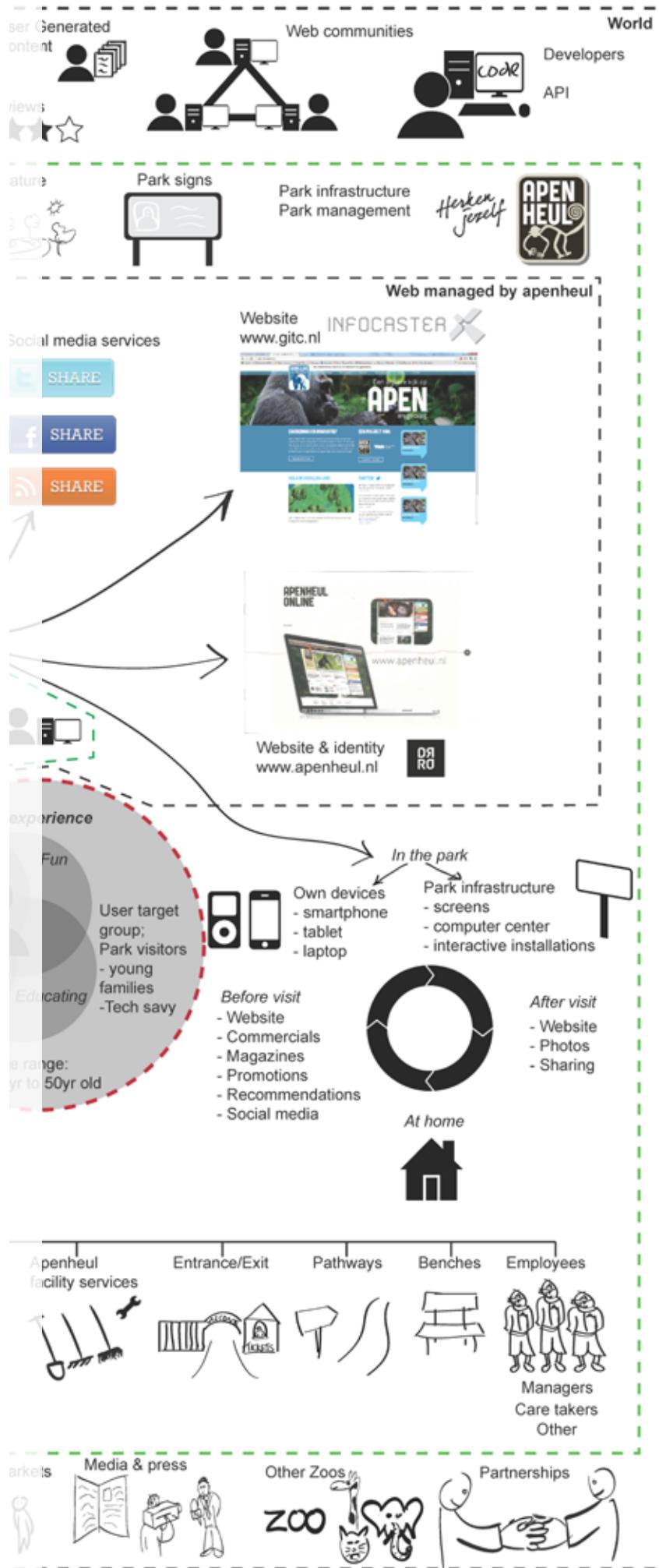
A - Customer journey

User phases	Trigger			Preparation		
User journey	Motivation	Orientation	Decision	Planning	Packing	travelling
Experience curve						
What?	Promotions Commercials <u>Recommendations</u>	Information Price/weather/things to see	Choice	Data picking guests / route time schedule	Pack food/ clothes/ toys/ camera/ stuff <u>Pre-fun</u>	get excited parking
Where?	Promotions TV/Web/papers/posters/etc.	Park website <u>Promotion websites</u> Comparison sites magazines	In the mind	At home Websites	At home	between house & park
Why?	Getting an impuls/trigger Getting an idea about the experience	Family activity Convincing people to go See nature/monkeys Adventures / day out	Price/quality Mood/timing Distance Coupon	Find the right day to go	Preparation	need to get from A to B
How?	TV/ website Friend chats <u>Social web</u> Personal experience	Reading Talking Discussing	Making a choice	Agendas shared calendars School calanders	Gathering the stuff you need for the visit	Car/ public transport car park
When? Timeline		Monts / weeks / days before visit			Days/ hours before visit	Hours/minutes before visit
Social media	<u>Reading posts/</u> Seeing photos <u>Recommendations</u>	<u>Reviews</u> <u>Crowd wisdom</u> Apenheul website	Sharing buying tickets Posting 'who joins?'	Maps Trafic info	Posts Sharing packaging lists	Location Route services
Touch points	<u>Advertisements</u> <u>Social web</u> <u>Visitors sharing experiences</u>	<u>Website</u>	Price Coupons	Providing the links to the right info as a service	Informing what to bring	Parking Route information
Company perspective	Marketing Advertisement	Provide information Customer service				

	Visit			After visit		User phases
travelling	Entering	Visit	Exit	Travelling	Home	User journey
						+ Experience curve
get excited parking	Queing Paying Ape bag	Ape watching/touching Interacting in the park	Leaving <u>Souvenirs</u>	Evaluating the day Going home	Evaluating visit Charishing memories <u>Talking about experience</u>	What?
between house & park	Entrance of the park	Anywhere in Apenheul	Exit of the park	Between park & house	At home/ work/ school	Where?
need to get from A to B	Personal value Societal behaviour	Fun Activity	Tired, done with the visit <u>Memories</u>	<u>processing memories</u>	processing memories	Why?
Car/ public transport car park	behaviour	Park of the Apenheul <u>Park Experience</u>	Exiting the park	Discussions sharing experiences	Remembering Discussing Sharing experiences	How?
Hours/minutes before visit	Start of visit	Halfway visit	End of visit	Hours/minutes after visit	Days/weeks/months after visit	When? Timeline
Location Route services	Tickets Check-in Sharing your location	Status updates <u>Shoot & upload pictures</u> <u>Photobooths</u> <u>Calling/messaging/mail</u>	Checking next events	Checking notifications <u>Sharing experiences</u>	<u>Sharing experiences</u> <u>Reviewing</u> <u>Liking</u>	Social media
Parking Route information	<u>Customer service</u> -Duration, help, clear instructions etc.	Quality of ... (attractions) <u>Service to customer</u> <u>Shows</u>	<u>Souvenirs</u>	Something for on the go? (music/food/magazine..)	Community Newsletters	Touch points
	Cashing	Deliver park quality		After care		Company perspective



B - Visualizing the network



C - Data Sheet

Raw data

Raw data is directly captured by the sensor systems.

- Time

The time is captured through the internal computer clock and is returned to the database in a *timestamp* with the format 'yyyy-MM-ddThh:mm:ss:zzz'.

- Image

A single picture frame captured by the camera.

- Video

A sequence of picture frames over time compiled to a video file.

Sensor detection methods

Data extracted and computed after analyzing the raw data from the sensor.

- # detections

The number of detections in an image/video, representing the number of gorillas spotted by the sensor system.

- Location

The camera can calibrate the distance from the camera to the detection. The location detection calculates an *x* and *y* coordinate on the island. These coordinates can also be transformed to *geo-coordinates*.

- Tracks

Tracks represent the travelled paths by the gorillas. A *trackID* is assigned if a series of location detections with a small interval between location and/or time is detected.

- Individual detection

A *gorillaID* is assigned if the identity of a gorilla is determined. This can be achieved through facial recognition.

- Annotated tracks

The x and y location of the gorilla on the island gets saved when a detection (actions, activities, emotions, group dynamics) is made, showing where on the island things happen.

- Actions & Activities

An action is a single event noticed and an activity is an event noticed over time. A pre-defined list of actions and activities could be detected through video analysis.

- Emotions

Through smart analysis, manual input and behaviour simulation, emotions can be recorded.

- Group dynamics

Detections of behaviour between (a group of) gorillas. Things such as:

- # of interactions between gorillas
- the measured distance between gorillas
- simulated hierarchy points, based upon recorded data.

- Likeability

A score based upon computer and/or human appreciation of the recorded data.

- Pattern/anomaly recognition

Through analyzing a dataset (data over time), smart algorithms can detect patterns (things that usually occur) and anomalies (things that usually do not occur).

External data

Data which can be added to the database which is fed in via external sources.

- Social media

Data collected through social media feeds, such as facebook posts and twitter messages.

- User generated content

Content uploaded by users.

- External feeds

Data that can be downloaded via other (web) services (E.G. weather data).

- Manual input data

Data that is manually entered by a person in to a database.

- Signage feeds

Data that is transferred by a moderator operating a number of devices.

D - Touchpoint sheet

Collecting touchpoints

The touchpoints that collect and distribute the raw data.

Cameras

11 security video cameras are operational along side the gorilla island.

Glass fibre network

A glass fibre cable infrastructure has been constructed inside Apenheul.

Server

A server has been installed gathering the camera data and distributing it over the network.

Web feeds

Through the internet web feeds from external sources can be accessed.

Other sensors

More sensors can be placed on the gorilla island

Data processing touch points

Technologies and software that can be applied to analyze and alter the collected data.

Intelligent imaging

Via smart algorithms software is able to analyze video images, making estimations and assumptions about the content of the video images.

Cloud computing

Hosting the data online and offering it as a software service or a platform service, with a hybrid model giving an operator control over the content and giving users the freedom to access the content.

Big Data

The technical challenge to capture, process, analyze and store only the relevant data with the least amount of resources.

Data visualization

Visualizing large datasets in a clear and understandable way for the end user.

Quantified self

Measuring, storing and quantifying data in order to gain insight in personal or group behaviour.

Internet of Things

Connecting physical products to the internet and making the products interact both physical and digital.

Crowdsourcing

The process of outsourcing tasks to a distributed group of people.

Digital signage

Moderating content flows and display solutions on different touchpoints all over the park.

Augmented reality

Enhancing reality through computer-generated sensory input such as sound, video, graphics or GPS data.

Display touch points

Touch points that are used to communicate with the end user.

User owned touch points

Touch points that are in the possession of the users themselves, such as;

- Smartphones
- Tablets
- Desktop computers
- Laptops

Web touch points

Touch points accessible by the end user via the web, such as

- Official websites (www.apenheul.nl / www.gitc.net)
- Social media channels (@apenheul twitter profile)
- RSS feeds
- Video streams

Park touch points

Touch points currently available in the park of Apenheul

- Screens at the eateries
- Screens at the bongo bonde

Exhibition touch points

Touch points to be placed in Apenheul to display content about GITC according to the designed interactions and experiences.

- Passive screen
- Touch screen
- Touch table
- Information kiosk
- Custom build touch point

Physical touch points

Products with actuators that react to digital content, messages and impulses, such as:

- Avatars
- Connected souvenirs
- Printers

Rest of World

Any external device able to connect to and use the data from the GITC database.

E - Metadata sheet

Position relative to the gorilla(s)

The relative position shows the distance and direction of you or the device to the gorilla(s).

Live images

Real time display and information about what the gorillas are doing right at that moment.

Identification of gorillas

Matching a gorilla with his/her name.

Gorilla personality

Information that tells something about the personality and the personal history of a gorilla.

Alerts when...

Send messages and notifications when a specific detection is made.

Activity logbook

Shows in an automatically generated overview what (specific action) the gorilla(s) did (when and where).

User actions

Recordings of what the end users do, what functions they use, etc.

Relative dimension

Show data as if it was done by a gorilla (e.g. your human age: 25, your gorilla age: 13).

Island usage

Show which parts of the island are used most and map what kind of activities take place there. This can be done both for the group and for individuals.

Gorilla tracks

Gives information where the gorilla(s) have walked the past period of time.

Gorilla paths

Shows where the gorillas walk most often, identifying the commonly used walkways.

Favourite spots

Mapping the amount of time gorillas spend on certain parts of the island, heat maps or place intensity maps can be made showing the 'favourite spots' on the island.

Family relations

Shows how gorillas are related to each other. This information can be displayed in a personal way, saying Kisiwa is the girlfriend of Jambo, or Mintha is the mother of Wimbe.

Quantified gorillas

Being able to give numbers to gorilla behaviour. This could be calculating the average distance an Apenheul gorilla walks per day.

Gorilla timeline

Shows and quantifies what a gorilla does over a period of time.

Life patterns

Expresses the common elements in a gorilla his/her daily life. For instance the time they wake up every day.

Place in hierarchy

Expressing the position of gorillas and their place in the group.

The best moments

Using the likeability score the best moments over a period of time can be quantified.

F - family day out interviews



Figure 3.19 - Family A; Ellen, Arthur, Wende & Lola. (Picture taken in the park 'de Efteling' with grandmother instead of Arthur).



Figure 3.20 - Family B; Moniek (mom), Eva, Anne and Fleur. Rob (dad) is not on the picture.

Two families with young children have been visited in their house. During the visit, the parents were asked to reflect upon their recent experiences with a day out, while the children were at home playing. Five main topics have been discussed; their (last) visitor journey, the group dynamics during the visit, digital usage during the journey, what is interesting about a gorilla and the product ideas. During the visit probing materials, experience maps and a questionnaire have been used.

The visitor journey,

A visit to the park is mostly a social occasion. The families go to the zoo when a special (family) activity is coming up or when there are school hollidays. A visit to the zoo is something mostly planned beforehand, because of the long time spent at a zoo (as opposed to a spontanious visit to for example a petting zoo). Both families don't really experience 'getting triggered' to go to a zoo, they decide to go because of intrinsic motivation and arguments like "*where I have not been for a long time*" or "*what is closeby*" or other more rational arguments. In general, the last zoo visists were perceived very positive, without any negative feelings or emotions, except for getting tired at the end of the day, having to wait for a long time in ques or getting hungry. The parents prepare the trip by looking up the practical information such as opening times, prices, route information and parking. Before leaving, the parents make sure they pack all the necessities for their children and some food and drinks. After the visit the families come home and they remember their

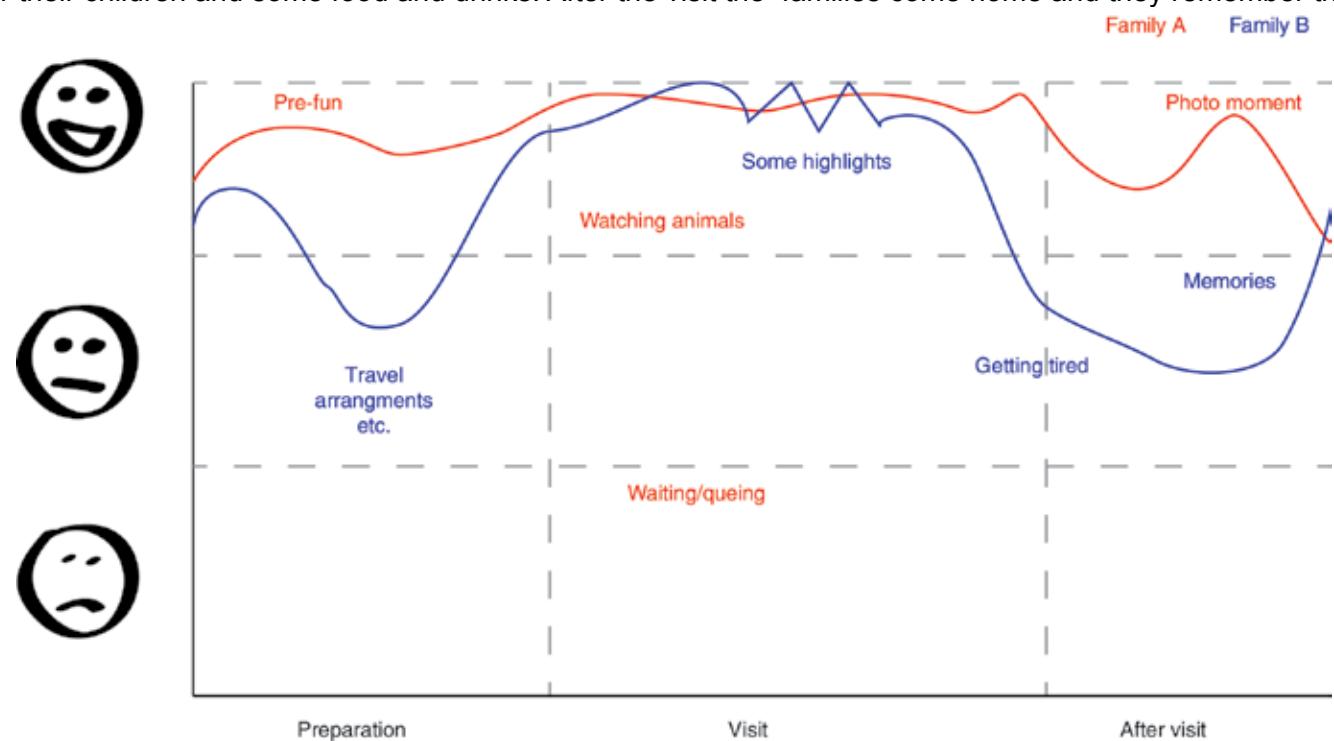


Figure 3.21 - The experience curves of Family A & B.

experiences by looking at photos or talking about memories.

Illustrative quotes:

Family A: "Just by talking to the girls about going to visit a zoo or a park, the pre-fun already begins."

Family B: "The excitement during the visit differs from time to time. Generally, it is a fun and relaxing experience, with some highlights, such as feeding presentations or finally reaching that special animal you wanted to see all day."

Group dynamics during the visit

Normally families stick together as a group. It can occur that they split up when in a bigger group with different ages and with different levels of thrill seekers, but that accounts mostly for amusement parks. **Children are leading during the park visit.** They have physical limitations, you have to keep close to them all the time, they amplify the mood of the group and they are often the main reason the adults are there. While the parents can steer the visit by picking the route and attractions to visit, the children determine the pace. For families with small children, playgrounds are important, as they are a place where the kids can play free for a bit and the parents can take the time to rest for a bit.

Illustrative quotes:

Family A: "We go and visit a park for our children. That they have fun is our most important concern..."

Family B: "When the children really don't like a place, you can't really force them to stay and have fun, so you walk along with them."

Family B: "As a parent you can determine the route, the things you want to see and the time you want to spend in a park, but the children determine the pace."

Digital usage during the journey

Before the park visit, mostly the practical information is looked for. When on holidays this can be the local VVV offices, but when at home the internet is used. While browsing, things such as opening times, route information, parking information, entry fees and so on are looked up. Sometimes, while looking at the information, family A browses the website a bit, not reading everything, but more searching for headlines and looking for special attractions. The information is accessed through their laptop (behind the desk) or tablet (on the couch) and occasionally on the mobile phone (on the move), when they have to look up something extra. When going to the park both families take their mobile phones with them. Sometimes family A likes to take their DSLR camera with them, to make high quality photos, but they don't like carrying it around all day. For just keeping

a visual memory, the cameras on the smartphones are good enough. The parents use their phones in the park to keep in touch with family and friends through calling/SMS/WhatsApp. Ellen from Family A also likes to share pictures of her children through facebook.

Illustrative quotes:

Family A: "Photos with your mobile device are for keeping visual memories. Photos with a DSLR camera are for portraits. But you don't want to carry that around all day..."

Family B: "Before we go we look up some information on the website. When we are behind a computer we visit the website or when we sit on the couch we use our iPad. Maybe when we are on the go we would look up extra information we haven't checked before on our smart phones."

Family A: "I like to post one or two nice pictures of my day out on facebook, so my friends know what I've been doing."

What is interesting about a gorilla

Both families had no specific knowledge about gorillas. To them, gorillas are just like any other animal, but because they are so big and very human like, they are more special to look at. Arthur from family A sometimes picks out some information from a sign which he then can read out to his little girls. When reading signs, the families rather look for funny facts and interesting insights than to look for exact stories about gorilla, their DNA, where they are from, etc. It is nice if the information provided can evoke additional discussion and/or jokes.

Illustrative quotes:

Family A: "Sometimes I read some information on a sign and then later I pretend that I've known that information for a long time."

Family B: "You don't really want to know everything. You just want to read or hear something funny which you then can discuss."

Product ideas

When presenting and discussing the ideas from the ideation process (See chapter 4.8), reactions were generally positive. Talking about these ideas gave some insight in the likeability and the feasibility of the ideas by the target group.

G - Gorilla community investigation



Figure 3.18 - Joke Kok and her camera during the interview in Blijdorp

Online and offline there are zoo enthusiast gathering to exchange experiences, pictures, information, etc. One of these enthusiasts is Joke Kok. After examining her Flickr profile (J.A. Kok) and contacting her, she has been interviewed in diergaarde Blijdorp about her experiences with zoos, online communities, photography, animals and gorillas. During the meeting probing materials were filled out, an interview was conducted and ideas were discussed. The main insights will be briefly discussed

- *Online communities*

Through various (online) platforms groups of gorilla enthusiasts exchange photos and discuss news and information. In the Netherlands there are between 25 and 50 very active members of these communities, according to Joke Kok. Internationally, there are many more people, including some true 'gorilla watchers', who know everything about gorillas. For example, in Austria there is a man who gathers information about all Gorillas living in the European continent. They often comment on pictures and share details such as names and age, etc. These people would definitely be interested in using the GITC ecosystem.

Through Flickr, a large photo sharing community, users upload their (gorilla) photos and their followers & friends can comment upon the photos. On facebook, there is a special gorilla group page. Regularly, people from that group meet up in zoos across the Netherlands.

Zoos

Through newsletters, facebook and contacts inside the zoos Joke stays informed about what is happening at the different zoos. Mainly for practical reasons zoos closeby are most often visited and further away zoos are visited occasionally. In different zoos live different groups of animals and the level of involvement with those groups differ based on how often a group is visited or how special a group is to Joke. If there are special events or meetings at zoos, it can be a good reason to go to that specific one. Apenheul really differentiates itself because of the primates, their park and the beautiful groups that live there in large habitats.

Photography

To make a really good photograph of a gorilla the conditions have to be right. You have to be at the right place at the right time and even then you are still dependant on a number of conditions, such as the weather, the gorilla activity and so on. It is a time demanding process and photographers should be happy if only a few of their shots turn out to be nice. You have to be extremely patient. A continuous monitoring system could be used to capture the special moments, but Joke questions the quality of the picture.

Animals

According to Joke, people should take more time to learn about the species and to really get to know an individual animal. "The more you know about the animal, the more fun it becomes". This accounts even more for gorillas, because they have a bad name, because of publicity like the incident with Bokito.

Gorillas

Because of their human like appearance and behaviour, Joke adores the gorillas. What a lot of people don't know, is that gorillas are really peace-loving. They are really interesting animals to follow, because of their group dynamics. The most special bond to see is the relationship between mother and child. But also to be able to notice which female has more favor with the leader. The most special moment for Joke is when the dad, is playing with his children, because of the big contrast between tenderness and protection. The babies and/or toddlers are just super cute to watch.

Ideas

A number of ideas have been generated during the ideation process (see chapter 4.X) and were presented during the interview. When the ideas were presented, Joke Kok gave a positive response. She thinks the community could also get involved in some of these ideas. When possible, she can ask the community to test some of the ideas. She hopes the product will make people understand the animals better and make them care for animals more.

H - Summary gorilla expert interview

Present: Ronald van der Beek, Erik Groenenberg

Subject: What kind of behaviour do Gorillas show and how can sensors detect it?

Location: Apenheul



Picture taken from facebook

Ronald has worked with the Gorillas in Apenheul for over 15 years. He has been with them for a long time and he has seen all important milestones, such as the birth of the gorilla babies. Ronald knows the gorillas personally and he has learned a lot about their behaviour. Ronald currently is ICT manager at Apenheul and he is closely involved in the Gorillas in the Cloud project.

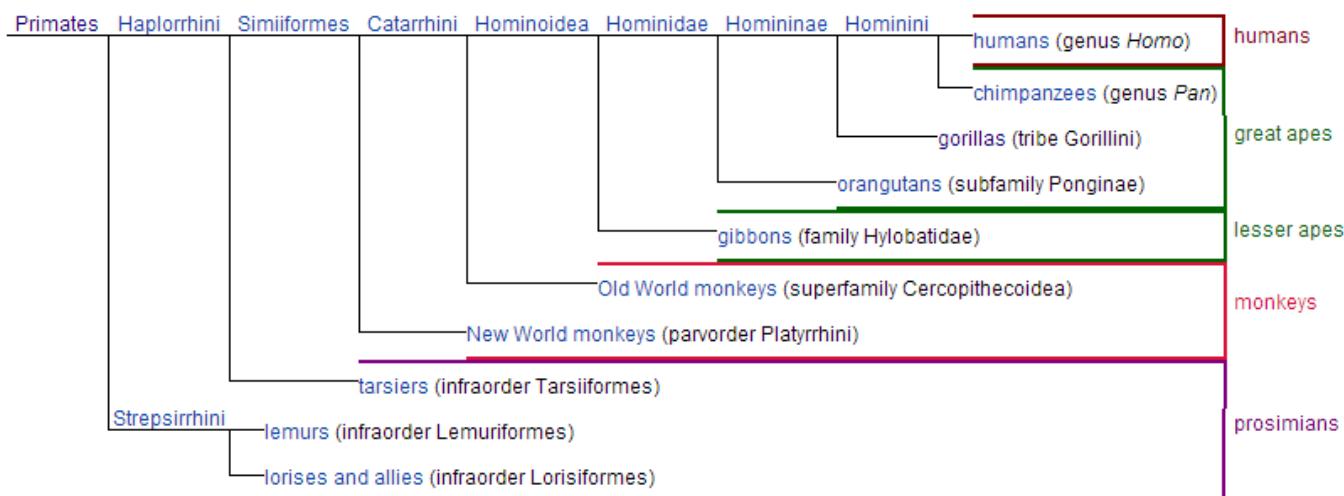
During the meeting the gorillas were visited and the following topics were discussed;

- General questions about Gorillas
- The gorilla population of Apenheul
- Behaviour & personalities of gorillas
- Social & group dynamics
- Detection using sensors

The most interesting results, quotes and comments are listed here. For the results of the whole meeting I would like to refer to the recorded audio files I have on my computer.

General

Gorillas belong to the group of greater apes. They are very similar to humans. Up to 98% (estimation) they are genetically the same as humans. Their brain is estimated to be up to 70% similar (though their brains weigh only 40% of that of a human). They are on the third or fourth spot when it comes to the closest relatives to humans in nature. A Gorilla can grow to be 45 to 50 years old. An adult gorilla is about 200kg if it is a male and 100kg if it is female. They grow to be about 1.70-1.80 meters tall. Gorillas are vegetarians. They eat 12-15 kg a day (in Apenheul) or in nature even up to 25-30 kg. Because of their diet (plants, fruits, vegetables) they spend a lot of time processing their food. Therefore, gorillas are very quiet and relaxed animals. Gorillas are very smart animals, but most of them lack ambition and motivation in their lives (because they have to spend so much time finding & processing food). Figure 3.3 shows how gorillas are classified as great apes and as primates.¹



Apenheul has 14 Gorillas; 4 Males, 10 Females, ranging from 1.5 years to 38 years in age. The group is quite special, since it was the first group of gorillas in captivity that successfully managed to raise their babies. This success has brought primatologists from all around the world to see the group.

Behaviour Gorillas

1 <http://en.wikipedia.org/wiki/Primate>

can communicate mainly nonverbal by using expressions, gestures, and postures. They can also communicate verbally. They have a few ways of making sound, such as grunting or coughing. Ronald¹ said "Gorillas have about 5 words they can say in 100.000 different ways" (illustrative statement). Gorillas also experience complex emotions. They behave differently according to those emotions, but it is very hard to detect what those emotions are, even for a trained professional.

Social dynamics

Gorillas live in groups with a harem structure. They are social animals, just like we are. In the group there is a hierarchy, they all have their positions. There is usually 1 adult male which is the great leader, but sometimes there can be up to 5 or 6 males (also depending on gorillas in the wild/in the zoo). The most powerful male is the one on top of the hierarchy. Power comes not only with physical strength but also with factors like leadership capabilities, trust and experience. Depending on a number of factors, gorillas are higher or lower in ranking. How they are ranked manifests in closeness to and favour of the leader. The ranking is a dynamic process. Some influencing factors are; age, character, having babies or not, family/friends within the group and personality, amongst many others.

Sensory detections

Usually biologists and observers have a research question which they then will analyse in the wild. They can tell the relation between apes for example by looking at individual distance between gorillas, gestures and the number of positive/negative encounters. If sensors could automatically annotate and record that data and if it would be possible to ask a research question using the recorded data, it would be a **revolutionary system**. Saving just raw data is one thing, but you would also have to consider external, social and anthropological influences (for gorillas). Table 3.1 shows some key factors, but there are still plenty more to be added. If you look for example at the external factor 'do nuts fall from the tree', then you could explain why gorillas like to sit close to the trees for a few weeks a year. If you forget to annotate this external factor, wrong interpretations might be made about the reason why they sit near the trees.

Another possibility is to capture certain activities gorillas do. For example, to show who is in charge, gorillas put their teeth in the neck of another gorilla. Normally this doesn't happen often, maybe just a few times a year, but when there is a large tension between individuals or in the group, it might occur more often. The same action also happens when gorillas are playing. It is important to see if it is playing or if it is fighting. This difference is hard to identify for layman and still sometimes for professionals. You could ask layman to identify behaviour, but Ronald recommends keeping that data separate from the scientific data. The 'law of big numbers' applies here (more participants means a better result).

External influences	Social	Anthropological	Actions
Weather & season (sun/rain/temperature)	Personality of Gorilla	Hierarchy	Neck bite
Inside/Outside	Mood of the gorilla	Raising children	Touch
Feeding session yes/no	Emotion at that moment	Family	Eating
Employees present?	Stress	Confrontations	Sleeping
Do nuts fall from the trees?	Relationship status	Conflicts	Playing
Etc.	Phase in life of gorilla	Phase of the group	Fighting

In order to capture the right data to come to show interesting patterns, the lists of external, social and anthropological factors should be as well described as possible.

Just by using the location of the gorillas already a lot can be learned. Even more can be learned about the individual locations of the gorillas. If also the external, social and anthropological factors and the activities done by the gorillas can be captured, it would become possible to see patterns and correlations between data to come to proper conclusions. However, these conclusions would just be based upon one moment in life of a gorilla. The longer the time frame, the more data, the better the data spread, the more valid the patterns & conclusions identified. It can take up to 10 or 15 years before enough data is captured about the gorilla. Think about the development of a young baby into an adolescent into an adult. According to all those phases in life the behaviour of the gorilla will be very different.

¹ Ronald van de Beek, gorilla expert Apenheul.

Gorillas in the cloud

Apenheul wants to be the best zoo and in order to do so they have seen a strategic opportunity in innovation. With the gorillas in the cloud project Apenheul wants to innovate the zoo and improve the user experience. As a result of the gorillas in the cloud project Apenheul hopes to generate extra value for the zoo and to continue to be the best at what they do. Extra value for the zoo can be multiple things. Some examples:

- Gorilla Welfare & health
- Improved knowledge
- Research projects and funding
- Extra income streams
- Marketing exposure

Apenheul loves their gorillas and they would never hurt them. One of the primary conditions of the whole project is that the gorillas won't be harmed in any way. Physical sensors are out of the scope!

WIE IS WIE BIJ DE GORILLA'S?

Op het eerste gezicht zijn alle gorilla's zwart en op een enkele na groot. Toch lijken ze zowel qua uiterlijk als qua karakter beslist niet op elkaar! Dit zijn de gorilla's van Apenheul:

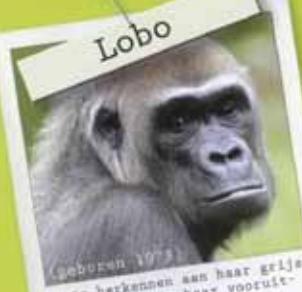
68

Jambo

(geboren 1993)
Als harsleider en enige volwassen man is hij moeilijk te vergeten aan zijn formaat en herkennen aan zijn silvery-grey rug. Eind 2006 kwam hij naar Apenheul.

Mandji

(geboren 1975)
Is de moeder van Nemsi en Iriki en pleegmoeder van Mapasa. Haar vacht en gezicht zijn grijs. Ze is een vrij forse dame.

Lobo

(geboren 1977)
Is te herkennen aan haar grijze wakkebaarden en haar vooruit springende snoot. Het is de oudste gorilla van de groep en heeft een vriendelijk en zachtzaardig karakter.

Wimbe

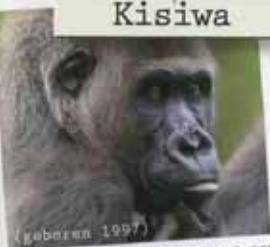
(geboren april 2008)
Zoon van Lobo. Dit kleintje is vernoemd naar Wim B. Mager, de oprichter van Apenheul. Wimbe is erg enthousiast en onderhoudend.

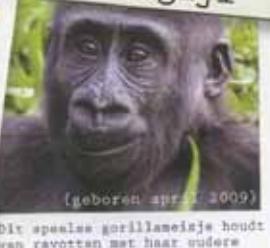
Mintha

(geboren 1974)
Moeder van M'Fugaji. Ze is gemakkelijk te herkennen aan haar grijze vacht. Lange gezicht en bolle buik. Mintha houdt zich niet erg bezig met de rangorde.

Nemsi

(geboren 2001)
Licht qua uiterlijk erg op haar moeder Mandji. Ze is immiddels in de puisherjaren uitgegroeid en in 2011 voor het eerst zelf moeder geworden.

Kisiwa

(geboren 1997)
Een jongvolwassen vrouw met een plat gezicht. Zus van Gyasi. Ze is de lieveling van Jambo en heeft daardoor een hoge positie binnen de groep. Hiervan maakt ze dan ook dankbaar gebruik.

M'Fugaji

(geboren april 2009)
Dit speelse gorillameisje houdt van ravotten met haar andere halfbroers. Ze is te herkennen aan de roze duim van haar rechterhand.

Mapasa

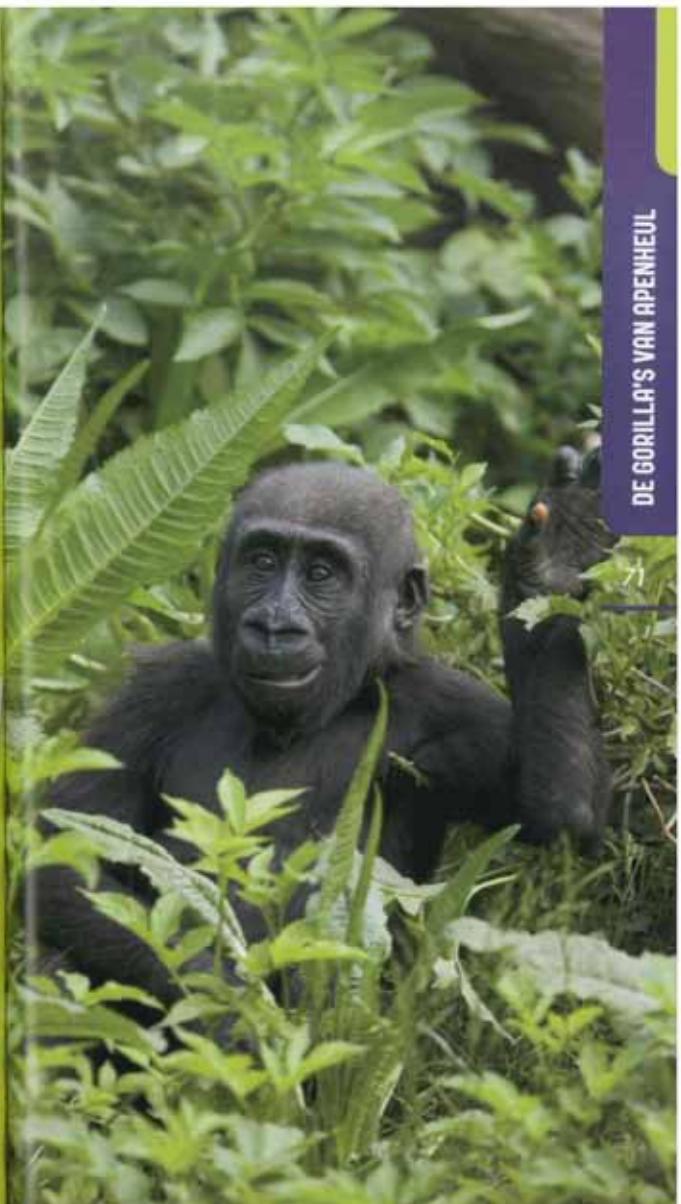
(geboren oktober 2007)
Mapasa is de eerstegeborene van Jambo! Volgens DNA-onderzoek is hij de zoon van Kisawa, maar Mandji nam hem opgevoed.

Gyasi

(geboren 2002)
Moeder van Tayari. Ze behoort niet tot de lievelingen van Jambo, maar is een uitstekende moeder.

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DE GORILLA'S VAN APENHEUL



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Chama
(geboren 2011)
Dochter van Lissiva en de laatste geborene van de baby-boom in 2011.

M'Zungu
(geboren 2011)
Enige jongen van de gorillababyboom in 2011. Dit is nu al duidelijk te zien aan zijn grote bouw ten opzichte van de gorillamamajes.

Tayari
(geboren 2011)
Het eerste kind van Oyani en meisje Tayari betekent 'bijdehandje' in het Swahili.

Iriki
(geboren 2011)
Een onderaardig meisje, is alweer het negende kind van Mandji.

GORILLABABYBOOM
In 2011 vond in Apenheul een echte 'gorillababyboom' plaats! Er werden maar liefst 5 gorillababy's in één jaar geboren! Een absoluut unicum in de dierentuinwereld. Helaas is de dochter van Lobo op een leeftijd van vier maanden overleden. Met de overige gorilla-ukkies gaat het uitstekend.

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I - The user test questionnaire

Beste deelnemer,

Voor een onderzoek naar de gebruikers ervaring van het gorillas in the cloud prototype wordt gevraagd of je het prototype wilt uitproberen en of je naderhand een aantal vragen wilt invullen. Tijdens de test zullen de beelden op het scherm worden opgenomen en kunnen er een aantal fotos worden genomen. Door onderstaande gegevens in te vullen ga je hiermee akkoord.

Naam: _____

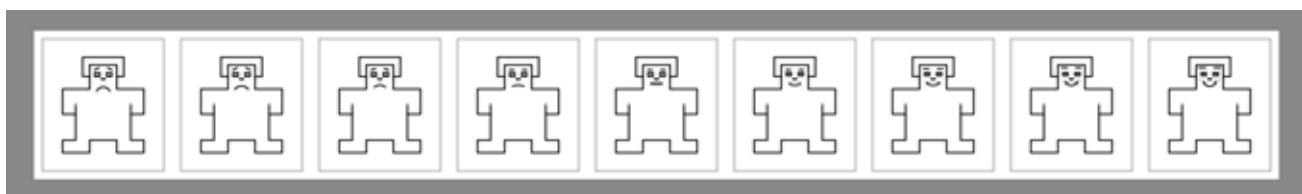
Leeftijd: _____

Datum: _____

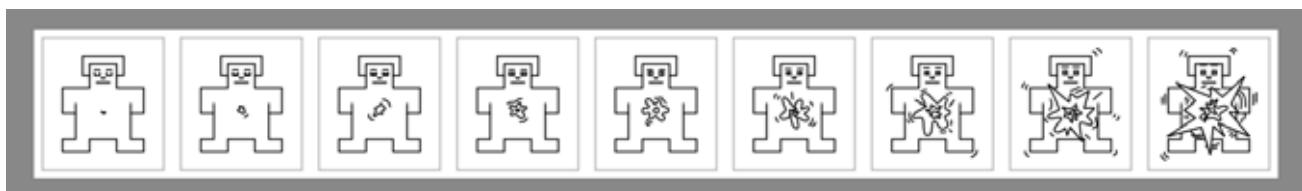
Handtekening: _____

Email adres: _____

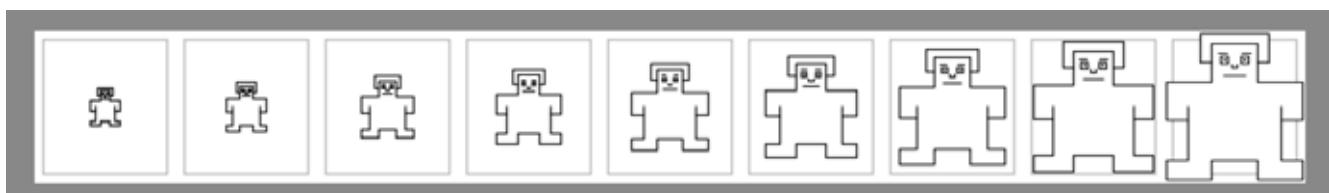
Geef aan hoe leuk je het vond



Geef aan hoe opwindend je het vond



Geef aan hoe veel controle je had. Vond je het makkelijk?



Zou je het apparaat nog een keer willen gebruiken? Kruis het juiste hokje aan.

Ja	Misschien	Nee

- Vond je het leuk om een gorilla te zijn?



- Vond je het leuk om een gorilla na te doen?



- Vond je het leuk om te weten hoe oud jij bent als gorilla?



- Vond je het leuk om te weten op welke gorilla jij lijkt?



- Vond je het leuk om een foto van jezelf te maken?



Kies welk woord het beste past bij jou ervaring

Geef aan welke van deze woorden het beste bij de installatie past

Leuk	Saai
Makkelijk	Moeilijk
Gewoon	Speciaal
Leerzaam	Leuk
Nieuw	Bekend
Aangenaam	Vervelend
Verrassend	Normaal

Maak de zin af...

Het leukste aan de installatie vond ik

Het minst leuke aan de installatie vond ik...

Als ik iets zou mogen toevoegen of veranderen dan zou ik ...

Vragen

Zou je nu meer over gorillas willen weten? Waarom?

Voel je jezelf nu meer een gorilla? Waarom?

Ben je nieuwsgierig naar hoe het prototype werkt?

Zou je meer willen weten over sensor techniek?

Zou je je foto graag aan andere mensen laten zien?

Notes

Notes