Creating New Experience for Zoo Visitors by Using Media Techniques

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Abstract

In 2008, the EU project “Digital Djurpark” (Digital Zoo) started as a cooperation between the digital media lab at the department of Applied Physics and Electronics (TFE) at Umeå University and Lycksele Zoo. The technology behind the Digital Zoo project is a wireless sensor network that is placed in the park. This wireless sensor network collects information from the park and is able to save data for the future but also send live data outside the park. The idea behind the project Digital Zoo was to give zoo-visiters new experiences during their visit and let them be able to interact with the zoo and to give the visitor a chance to get to know the animals in a more personal way.

The objective of this thesis is to create new experiences by using media techniques and the application environment is Digital Zoo. The work can be seen as applied research because of the focus on an actual case, Digital Zoo. The major scientific challenge with this work is to use media techniques so the experience for the visitor feels like a new experience. The overall research question is: How is it possible to give the zoo visitors new experience by using media techniques? This overall question is broken down into three sub-questions: (1) How is it possible to let the visitors feel involved in the experience by using media techniques?; (2) How is it possible to adapt the experience to the visitor by using media techniques?; (3) How is it possible to integrate the experience in both the digital and the physical world by using media techniques?

To create new experience for a zoo visitor it is necessary to understand the visitor better, therefore this work become interdisciplinary, touching on aspects and approaches such as interaction, media technology, social science, and marketing. To investigate different ways to enhance the visitors experience regarding the Digital Zoo interaction, the following research methods were used: case study, surveys, interviews, prototyping, and user tests. Participants in these studies were representatives from Swedish zoos, visitor in Lycksele Zoo, and children from school classes in Umeå.

It is of importance to recognize that this work will not give a general result on how to create experiences for users. However, since this work has been based on a real case, Digital Zoo, it is most certainly possible to find results that can be applied in similar cases, e.g. in the tourist attraction section. The results are practical examples on how to create experiences using media technology within a tourist attraction. The studies resulted in applications with social media, user generated content, and Proxemic dimensions in focus. These practical examples might form a basis for influencing a future concept for tourist attractions to use.

Finally a social media game concept is proposed, the concept is combining ubiquitous information, social media and a game application. This social media game concept shows how it would be possible to integrate the experience in both the
digital and the physical world involving more than one person. The participants in the game are visitors both inside and outside the zoo. The media game concept creates a new enhancing experience by using media techniques such as a wireless sensor network, social media, and applications used both on smartphones and computers.

The contribution of this work is the idea of using a game concept to create new experiences in a tourist attraction. This work shows how a game concept could combine the physical and digital worlds. The concept suggest that to create experiences for different visitors, the information should adapt to the visitors as well as letting visitors become part of the experience with, e.g., user generated content. This concept would make it possible for zoos and visitors to expand the user experience-timespan to include the time before, during, and after the visit.
1 List of Publications

This thesis consists of the following articles

I: Fahlquist, Karin, “Social Media Used in Swedish Zoos”, 2013 (manuscript)

II: Fahlquist, Karin, “Engaging the Zoo Visitors with User Generated Content Applications to be used inside and outside the zoo”, 2013 (manuscript)

III: Fahlquist, Karin, and Hortell Anna, “Adapt the experience to the zoo visitors” 2013 (manuscript)


Additional publications


2 Introduction

2.1 Background and motivation
In 2008, an EU project called “Digital Djurpark” (Digital Zoo) started. It was a cooperation between the digital media lab at the department of Applied Physics and Electronics (TFE) at Umeå University and Lycksele Zoo. Lycksele Zoo is Sweden’s most northern zoo and specialised in Nordic fauna with wildlife in Sweden. The idea behind the project was to give zoo-visitors new experiences during their visit and let them be able to interact with the zoo and to give the visitor a chance to get to know the animals in a more personal way. By making it possible for visitors to follow animals from home, the traditional way to visit the zoo would change.

The technology behind the Digital Zoo project is a wireless sensor network that is placed in the park [1]. This wireless sensor network collects information from the park and is able to save data for the future but also sends live data outside the park (Figure 1).

![Figure 1: The wireless sensor network at Lycksele Zoo.](image-url)
Depending on the type of sensor used, the data collected can be sound, temperature, vibration, picture or video, to give some examples. The project began with the use of one type of sensor - small video cameras (Figure 2). These small video cameras communicate with each other wirelessly. They are then connected with the internet through a server inside the park. The sensors are placed inside the animals’ enclosure and can broadcast live from the animals in HD quality.

Figure 2: The first wireless camera sensors (to the left) and the newer camera sensors (to the right) used in the project.

The first step for the project was to broadcast a live video stream of the animals, so that people outside the park can watch. The live video streams from the animals in the zoo were shown on both local and national newspapers’ websites (Figure 3). The animals that could be seen with live video stream at the newspapers’ websites were wolves and bears. Today there are about ten different species that can be seen live from the zoo at Lycksele Zoo’s website [2]. The whole sensor network contains about thirty video-sensors.

Figure 3: Live from animals in Lycksele Zoo at local and national newspapers websites.
By just presenting the live video stream information on a webpage or on a screen the presentation became passive information for the visitor. The motivation for the work within this thesis had its starting point from how to present the collected information for visitors in an attractive way. To make the presentation more attractive does not only mean enhancing its aesthetic impression but also how to present it in such a way as to make visitors want to do something more with it, like interacting and sharing. The natural way to present the information is to use media techniques. The challenge has been to find ways to use media techniques to present information from the zoo in an active way - to make the presentation to something active for the user. To find out how to use media techniques in a way that it would become an new experience of a tourist attraction such as the zoo. The challenge has been to make the presentation into a new experience for the visitor by using media techniques.

2.2 Objective
The objective of this work is to create new experiences by using media techniques. The application environment is Digital Zoo. Digital Zoo’s techniques will be used as a case for this work. The overall research question is: How is it possible to give the zoo visitors new experience by using media techniques? In order to create an enhancing experience, it is important to let the visitors feel that they are a part of the experience and able to influence the experience. This means that interaction, communications, contribution and visualization will become natural parts of the experience. The overall research question can be broken down into three sub-questions: (1) How is it possible to let the visitors feel involved in the experience by using media techniques?; (2) How is it possible to adapt the experience to the visitor by using media techniques?; (3) How is it possible to integrate the experience in both the digital and the physical world by using media techniques?

2.3 Challenges
The major scientific challenge with this work is to use media techniques so the experience for the visitor feels like a new experience. This challenge has the following concerns:
- How to define the experience? Is it possible to define and create an experience?
- What can be done with all the information collected with the wireless sensor network from the animals? How to present this information in a way that will make the visitor want to see and take part of the information? The presentation of the information is about the visual representation and the location it is present at.
- Since people are different, it will be a challenge how to create an experience that will appeal to everyone? The challenge is to find ways to reach out to as many people as possible.
- How to design interaction for the creation of an experience? To make the visitor interested in the information from the zoo, the interaction becomes an important part of the experience. The challenge is to make the interaction appealing to the visitor.
- A challenge is to use media technique so that the experience becomes a shared experience with other visitors. Is it possible to find ways of sharing this experience both with digital and physical visitors? Is it possible to develop a concept for the Digital Zoo that can make the digital world and the physical world become more integrated?

2.4 Related works
A tourism industry like the zoo industry has a distinct product and assignment: to inform and educate the visitors about the animals in the zoo by letting the visitors receive information about the animals, experience and meet the animals. Traditionally the zoo industry is connected to a physical place for the visitors to consume the product the zoo is offering. By comparing the tourist industry with how other businesses use internet-related applications it has been possible to come up with ideas on how to create new experiences for the zoo.

Regarding the development of the internet in the world, Sweden is ranked first by World Economics Forums when looking at networked readiness [3]. In 2012, 89% of the Swedish population had access to internet and 64% of the Swedish population was connected to social networks the same year [4]. Mobile connections and access to tablets are two areas that have increased drastically the last years in Sweden. During this time half the Swedish population had acquired access to mobile internet and 20% of the population used tablets [4]. Hence, the conditions for Swedes to use mobile social media have increased.

This increased use of the internet and social media affects different areas of society, one example is business. Businesses like the retail industry have traditionally sold products at a physical location. The physical store has been easily accessed by people when they are nearby and, therefore, been able to take part of the stores’ services. From the mid-1990s, companies have increased their on-line presence 1 2 3. This includes both on-line sales 2 3, and the use of the website such as a shopping window showing what they have and where to find the products 1. There are also examples of retail-clothing companies using social media (Facebook, YouTube,

1 http://www.ahlens.se/
2 http://www.polarnopyret.se/
3 http://www.hm.com/se/
Twitter, Instagram, Google+, mobile apps, etc.) to keep in contact with their customers 1 2 3. The use of the internet and social media has not made the physical store disappear. The actual physical visit to the store gives the customer another experience. The usage of social media and internet has become a complement to the physical store. The company now has the possibility to give customers information and prepare them before their visit. The customer can find out which store to visit to find the product, and may communicate with the business in advance. When the customer then comes to the physical store, they know what to expect. They then have the opportunity to experience the actual product and decide if the product was what they wanted. Even though many companies with a high on-line presence are strongly affected by new habits in the population, as described above, almost any industry is affected by this development.

Internet use in Sweden is wide-spread and the development in areas like mobility and social media usage are growing. These facts should influence the way Swedish tourist attractions come in to contact with their visitors. By narrowing the discussion of tourist attraction to zoos in Sweden, it is possible to get an idea of what is happening today in this field and see what would be possible in the future. The widespread use and development of mobility and social media means that it is possible to reach zoo visitors with new experiences in a positive way by using the internet and smartphone applications.

Compared with retail, it is not as natural for the zoo visitors to just pop in. More is required by the zoo industry to come into contact with its visitors. But businesses like the tourist industry could do the same as the retail industry, which is to make contact with and prepare their visitors by using the internet and social media.

Here are some examples from the tourist attraction business regarding the use of media technology in general. The Museum of Copenhagen carried out a project where they took the museum to the street by placing an interactive video wall in one of the central squares in Copenhagen [5] [6]. Here the users can explore the cultural geography and history of Copenhagen and at the same time become part of the exhibition. The user can contribute and rearrange information with different types of multimedia. Different technologies and concepts have been used within the tourism industry for a long time and studies made on different kinds of tourist attractions have revealed important values to consider. The idea of using audio guides based on wireless communication (e.g., internet-enabled devices) for visitors at tourist attractions to enable both social interaction with other visitors and at the same time get the educative value of the audio guide has been discussed by Bederson [7]. The aim of this audio guide prototype was to show the possibilities of location-based information that is not linear and pre-planned such as traditional audio guides. The educative value was also seen in studies of museums that show the importance of social activities for learning in such environments [8] [9] [10]. Research on related topics has discussed the combination of gameplay in educative
purposes in, e.g., museums [8] [9] [10] [11]. The gameplay application will offer a way to involve the visitors in different ways. To make an application more personal, the research on Proxemic dimensions together with applications [12] [13] are of interest. These developed applications displayed information to the user and interacted with the user depending on who the user was, how the user was moving in the room, where the user was located in the room, how far away the user was from the screen, and how the person was orientated in relation to the screen. In this way the screen almost became “human” like. All of the above applications have in different ways been adjusted to the user. In the work with the interactive public ambient displays, the screen displays information and interacts with the user, according to how the user is acting [14].

Another complex issue in marketing is keeping in touch with customers after they leave. Customer-centric business models [15] [16] [17] [18] [19] are often discussed in the literature and often based on customer relationship management and consequently relationship marketing [20] [21]. Within a tourist attraction, the visitors are the customers. To keep in touch with the visitor after they have left can be difficult, require a substantial amount of time and a great deal of effort from the tourist attraction. This makes media technology such as the internet and social media even more interesting to use by places such as tourist attractions.

The above mentioned examples, in different but related areas, have been an important influence and inspiration for this thesis work on creating new experiences for the visitors within the Digital Zoo. The examples from related areas show that the following are important factors to consider when creating new experiences for the zoo-visitor: letting the user contribute, adjusting the application to the visitor, making the application social, and integrating the digital and physical world.
3 Theoretical framework

To create new experiences, there are some different areas that need to be covered and defined. In this chapter the following areas are described: experience, interaction, social media, visualization, gestalt principles, and game concept.

3.1 Experience

When designing an experience, the first step is to define what an experience is. There are some models that describe this in different ways.

An experience itself will affect a person both psychologically and physiologically; a person might feel fear and get goose bumps on their arms when experiencing something scary. The effect it has in that particular situation depends on the previous experience and expectations that the person brings with them. Mäkelä and Fulton Suri [22] have defined a model of experience where it is important to look and study the following elements: past experience, motivations, context, expectations, and actions to understand what the person will experience in a particular situation (Figure 4). This particular situation where the experience is taking place is defined as the context. The context includes components such as the surroundings and location with its artefacts and people. The current experience is not an isolated event, it is affected by the past. The past in this case consists of previous experiences and expectations that the person brings to the current situation. The previous experience can be from experiences in similar situations but also experience in general.

Figure 4: Mäkelä and Fulton Suri’s model of experience [22]
The action part, in the model (Figure 4), is when a person is expected to act and do something. To know what to do in a particular situation, knowledge is important. Knowledge is something that people have to work on to receive. It is about understanding the meaning of the information on a higher and more overall level. Knowledge is very individual and relies on personal contexts, content and previous understandings. This means that it is not possible to give people knowledge, but it is possible to help build knowledge by designing the experience, so it becomes easier to understand. [23]

It is important to realize that an experience involves artefacts, environments and the relationships with other people. The artefact can be the instrument that creates an experience, but it is the universal psychological need of other human beings that creates experiences such as positive emotions and meaning [24]. According to Hassenzahl [24], “user experience is not about technology, industrial design, or interfaces. It is about creating a meaningful experience through a device”.

The discipline of interaction design focuses on the “interactivity between experience and the audience” [23]. The audience is best seen as participants; an active and involved user – not passive viewers. By letting the users become a participants, they will have a richer experience. Performing an activity will make the experience more memorable than just watching the activity. According to Nathan Shedroff [23], our memories will bind together in a subconscious way if we use our body and the outcome will become a richer experience. The next step is to give the users an opportunity to create and make something that can be used in the experience for themselves and for others. The creativity itself gives a feeling of satisfaction and accomplishment and will make the experience more memorable.

Norman [25] suggests that an experience consists of three levels of processing: visceral, behavioral, and reflective. If the experience involves some kind of artefact, the three levels can be explained in the following way. The visceral level is the simplest and primitive cognitive level that has to do with the initial reaction when experiencing something. The first reaction when experiencing a situation is mostly about the look, the sound and how an artefact feels. The next level, behavioral, has to do with the experience of using an artefact of some kind. The behavioral level is about how the artefact responds, what kind of feedback the artefact gives the user, and how the artefact reflects the human behaviour. The highest level, the reflective level, is where a person remembers the past and contemplates the future. The reflective level of an experience, involves the meaning of an artefact. The meaning of an artefact is closely related to the cultural preferences, self-image, education, and individual differences. This meaning is what affects what a person thinks is aesthetically appealing. All of these three levels interact with each other when a human is experiencing something.

Hence, when designing an experience, it is important to be aware and take into consideration the above mentioned aspects. These aspects affect the experience in
different ways depending on a person’s behaviour. By knowing the user it will be easier to design an experience that will match the user.

3.2 Interaction
One part of an experience is to be able to interact. Interaction makes the user become an active and natural part of the experience. Crawford defines interaction as “a cyclic process in which two actors alternately listen, think and speak” [26]. On a philosophical level interaction can be seen as a process of continual action and reaction between two participants [23]. Interaction in its simplest form can be seen as a “reciprocal action or influence that has effect on each other, in both directions”, with an “internal and external unbroken causal loop between the participants in the interaction” [27]. These participants can be called interactors [27] and are an active part of the interaction.

3.2.1 Ubiquitous
The way users interact with a computer system has changed. The change is from interaction with a well-defined screen at a static place to interaction with a ubiquitous computer application that can be located almost anywhere. The ubiquitous paradigm was first mentioned by Marc Weiser [28]. The computer would be around the user all the time and merge into the surroundings of the user. The idea was to put computers into the world of real objects and environment around us [29]. The computers would become “invisible” and the interaction with applications and artefacts would not be through a traditional interface. The interaction should feel and be natural. In ubiquitous computing the interaction will become everywhere [30].

Ubiquitous computing can be summarized to the following five core requirements: (1) computers need to be networked, distributed and transparently accessible, (2) human-computer interactions need to be hidden, (3) computers need to be context-aware in order to optimize their operation in the environment, (4) computers can operate autonomously, without human intervention, be self-governed, and (5) computers can handle a multiplicity of dynamic actions and interactions, governed by intelligent decision-making and intelligent organizational interactions. The first three requirements are from Weiser’s vision [28] and the other two are requirements that have emerged from others working with the ubiquitous vision [31].

With the ubiquitous paradigm, the interaction can be done at different distances between the two interactors. This resembles in some ways the interactions between two people. Edward Hall studied the way people relate and interpret distance to other people and he suggested a definition of Proxemic zones [32]. These zones correlate the physical distance with social distance. These proxemic distance zones are defined ranging from intimate (0-0.5 m), personal (0.5-1 m), social (1-4 m) to
public (>4 m). In each zone, the way a person interacts and communicate with others will differ. The interaction and communication in the public zone is more public and implicit. The interaction and communication becomes more private and explicit the closer a person comes to the intimate zone.

The proxemics zones have been used in work regarding interaction with ubiquitous computing [14]. In this work, four interaction phases [14] are the important components that help to decide how a user and a screen should interact. These interaction phases [14] are (1) ambient display, (2) implicit interaction, (3) subtle interaction, and (4) personal interaction. The interaction phases also help to decide the type of information given to the user, public or personal information. The work with the interaction phases has a connection to the proxemic zones. Example of work that had the proxemic zones as its starting point is the five dimensions of proxemics [12] [13]. The five proxemic dimensions are: distance, orientation, movement, identity, and location. These five dimensions were developed when designing a ubiquitous computing application. The idea was to let the ubiquitous application sense more of the proximity and not just the distance. The application could display and interact with the user depending on who the user was, how the user was moving in the room, where the user was located in the room, how far away the user was from the screen, and how the user was orientated in relation to the screen. In this way the screen almost became “human”.

Mobile computing is a step toward ubiquitous computing where it is possible to come in contact with information of different kinds wherever users use their mobiles. The information becomes ubiquitous with mobile computing especially when using smartphones. The interaction goes through the mobile interface. To be able to design ubiquitous systems and applications, the following three parts have to be present [31]: (1) smart devices, (2) smart environment, and (3) smart interaction. The smart part means that sensors used can communicate with each other. Smart interaction is more focused on the user’s context than the physical context. Ubiquitous application, used in the mobile marketing, requires the following to work well: ubiquitous network, constant access to the network, and mobile devices that are personal [33]. The following networks are considered to be a part of a ubiquitous network: wireless LAN, 3G and 4G, and WiMAX. The switch between these different networks should be invisible and smooth to work well for the user, in this way the user will be able to access to the ubiquitous network all the time. Today the mobile device is most often a smartphone or a tablet, items that are personal. The mobile marketing is divided into four different applications (Figure 5), based on the degree of the consumer’s knowledge and the trigger (push or pull) of communication [33].
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*Figure 5: Classification of mobile marketing applications [33]*

### 3.2.2 PACT - People, Activities, Contexts and Technologies

Since the interaction in ubiquitous computing will be present everywhere [30], it will also be important to let the interaction become human-centred and focus on the user [31]. The PACT framework helps to focus on and consider important components in the process of user-centric design. The components in the PACT frameworks are People, Activities, Contexts, and Technologies. With this framework it is possible to analyse the different parts of a system that is designed or going to be designed. The idea of this framework is to support the designing of the system making it appealing in many different ways so the system will be used and not rejected by the users. The PACT framework [34] [35] was proposed by David Benyon and is used in human computer interaction (HCI) design as well as in other areas such as health care treatment where the user and patient are important to consider [36]. Scenario based analyses that have been used frequently in HCI, are closely related to PACT [37] [38] [39]. When a person is going to interact with its surroundings, whether it is other people or artefacts, it is important that the output is understandable. Furthermore the output need to use natural mapping, be predictable and gives rich and natural signals so that the person can understand what to do, what to expect and what is happening [40]. Consequently, it is important to consider the user of the system and to define why they are using the system, how they are using the system and when they will be using the system. In the first area, People, the important part is to look at the psychological, physical and social differences between users. The psychological, physical and social differences will change for the user depending on the time and circumstances. Considering the second area, Activity, it is important to look at the overall purpose of the system, the time spent using the system, and if there is some cooperation when using the system. The third area, Contexts, is aimed at the social, physical, and organizational settings for the system. For the fourth area, Technologies, it is important to look at the content, the communication, the input and the output of the system. The PACT framework is a valuable tool to use when creating environment and applications for new experience.
3.3 Social Media

In this section the development of social media is covered starting with the prerequisite components for social media; Web 2.0, User Generated Contents, and mashups.

3.3.1 Web 2.0 with User Generated Content

There are technologies that make interaction with information on the internet possible. Web 2.0 can be seen as the framework of technologies that supports participation of users on the internet. The three important technologies for Web 2.0, to become widespread between 2004 and 2009, were Adobe Flash (animations, interactivity, and audio/video stream), RSS (Really Simple Syndication, a way of update and publish content to the user) and AJAX (Asynchronous JavaScript, a technique to retrieve data from web servers asynchronously, to update information on a webpage) [41]. These technologies gave websites and applications the ability to update quickly and let users contribute to and create websites and applications with their own information. Today Adobe Flash is on its way out in this area, and HTML5 is taking its place.

Giving users the possibility of contributing with their own information and taking part in the application will make users more engaged in the application. There is no common definition of User Generated Content in the literature [41] [42] [43]; however, OECD [43] has published a proposal of three criteria that should be fulfilled for something to be called User Generated Content:

- Publication requirement
- Creative effort
- Creation outside of professional routines and practices

With this recommendation the content has to be put in a context, e.g., the web, it has to have something creative about it, and the user shall put their own values into the work without getting paid for it. The content that users produce comes in many different shapes; text, images, audio and video; and can be expressed as: customer feedback, comments, opinions, experiences, complaints, educational content, mobile content, & virtual content [44]. The motivation for users to contribute is that they enjoy creating the content because it is fun and entertaining, that they like to distribute and share information that others might have use for, and that they have a desire to communicate and to keep in touch with others [42]. A further reason for the increased amount of User Generated Content is that tools for creating, hosting and editing content are becoming cheaper and easier to use [43].

When users are active and contribute with internet based applications, they leave footprints of their activities on the internet. Broadly speaking, there are two types of footprints: active and passive. Passive footprints are tracks left through interaction
with an infrastructure that produces entries in locational logs. These infrastructures can, for example, be mobile phone networks. Active prints come from the users, User Generated Content. The User Generated Content exposes locational data in messages, photos, and sensor measurements [45]. These footprints can be used for the application owner to get to know the users.

### 3.3.2 Mashups

When creating applications, information footprints can be used to create new applications. These applications can be called mashups. The word mashup originally comes from the world of music, when DJs mixed two or more pre-recorded songs, making a new piece of music [46] [30].

Mashups combine information, functions and devices from at least two different sources creating new services. The devices and the services might not have been intended to work together but by using open communication standards, it is possible to create something new. Depending on how the data exchange is done and how the relationship to services is, mashups can be divided in four genres - (1) mixed reality, (2) mirror world, (3) ensemble, and (4) conduit (Figure 6) [47].

![Figure 6: Classes of mashups according to Kuniavsky [47].](image)

Ensemble mashups occur when devices communicate using a local network and are physically close to each other. In conduits mashups, there is a middle device or service that translates and bridges the devices or services that are at each end of the communication. Mixed reality mashups are based on augmented reality services that put data into the environment, for example, mixing two realities visually. Mirror worlds mashups are created when the same type of data is coming from two different
kinds of sources and are displayed together in an online environment. Mashups can be a useful way to create prototypes of new ubiquitous components that can give new experience.

### 3.3.3 Social media development

One example of mashups is multimedia. Over time, multimedia has developed to include even more parts, like social media, to become social multimedia. Multimedia has even become ubiquitous, mobile social media, through the possibility to use smartphones.

As can be recognized from the term, multimedia denotes a combination of different types of digital media, which are presented together as a whole. Even though different kinds of media and a combination of them have existed for a long time, multimedia as a concept has been closely associated with improvements in computer and web technology. Vaughan [48] describes multimedia as a “combination of text, graphic art, sound, animation and video delivered to you by computers or other electronic means”. Additionally, interaction has also become a natural and integrated part of today’s multimedia. Traditionally, multimedia has been shown on a computer, delivered by the web, or previously by some storage unit like a CD or a DVD, and usually presented at a fixed location for one person at the time. However, through the increased usage of smartphones, multimedia has become more portable. When multimedia is used on a smartphone, it is possible to simultaneously interact with other people and connect socially with those people. However, the socialization with people in the physical world, around the user, is still restricted. This socialization with people in the physical world should be possible to develop further, integrating the digital world more with the physical world.

Today online social connection is very common, and social network sites (SNS), like Facebook are among the most visited sites on the web. The different SNS have different interest areas and have been an integrated part of people’s daily lives (Boyd & Ellison 2007). According to Boyd & Ellison [49], the definition of SNS is a web based service, allowing individuals to

- make a public or semi-public profile within the system
- make a list of whom they share connection with
- view other users lists within the system

Usually SNS contains different groups made by the users. Users can join groups with similar interests. Within the SNS, users leave contents to other members (“friends”) within the SNS. These contents can be both official and private messages [49].

Social media is a broad term that is frequently used to illustrate new media technology that facilitates social interaction between people. Social media can be
defined as “a group of Internet-based applications that build on the ideology and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content” [41]. Hence, social media is based around two key concepts, Web 2.0 and UGC (User Generated Content). Web 2.0 was a prerequisite for UGC.

Social multimedia denotes the hybrid of multimedia and social media letting the users interact in new ways. An example is YouTube that lets users post video comments on the video they have seen and in this way have social interaction and communicate through the video with other people. Social multimedia is a natural part of the new computer paradigm that has arisen from social computing and “involves studying and managing social behaviour and organizational dynamic to produce intelligent applications” [50]. Naaman defines social multimedia as “online media published or shared by individuals and organizations, in an environment that encourages significant individual participation and that promotes curation, discussion and re-use”. This is a basic definition that can be expanded with the following three types of interactions [50]: (1) Content interactions between multimedia, (2) Social interactions around multimedia, and (3) Social interaction captured in multimedia. The interactors in the mentioned interactions vary from pure content to the users of the social multimedia as can be seen by looking more closely at them.

Interaction between multimedia occurs increasingly since current applications consist of more than one medium. The content is distributed between for example two mediums, exchanging information depending on the input. An example of this can be a game that uses Facebook login allowing personal information from Facebook to be used in the game. Social interactions around multimedia can be seen when people form groups and use multimedia to communicate and interact with each other. An example of this would be video blogs. The social interaction captured in multimedia can be peoples’ behaviours and actions both as individuals but also as groups. From this collected data it is possible to gather information about the structure and content of different relationships [50]. All of these three different kinds of interactions are important to take into consideration to have the right outcome of the use of social multimedia.

Social media has become increasingly ubiquitous with the possibility to use artefacts such as smartphones and tablets, so called mobile social media. Mobile social media is based on the mobile marketing factors: ubiquitous network, constant access to the network, and mobile devices that are personal. Kaplan [33] defined Mobile social media as “a group of mobile marketing applications that allow the creation and exchange of User Generated Content”. Because the users have their application on a device, e.g. a smartphone, that they have with them all the time, it is possible to collect more information about the user such as current geographical position in time and space. Mobile social media applications can be divided into four
different categories depending on location-sensitivity and time-sensitivity (Figure 7): (1) quick-timers, (2) space-locators, (3) slow-timers, or (4) space-timers. Location-sensitivity means that by using technologies such as GPS, GSM, Bluetooth, and RFID it is possible to find out where the user is. Time-sensitivity makes it possible to reach the user at a specific time. By combining, or not combining, location-sensitivity and time-sensitivity it is possible to get in touch with the users in different ways (Figure 7). The most sophisticated way to come in contact with the users is space-timers. With space-timers the location of the user is known at a specific time, making it possible for the application to exchange relevant information with the user [33].

<table>
<thead>
<tr>
<th>Time-sensitivity</th>
<th>Location-sensitivity</th>
<th>Quick-timers</th>
<th>Space-timers</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>Quick-timers Transfer of traditional social media application to mobile device to increase immediacy.</td>
<td>Space-timers Exchange of messages with relevance for one specific location at one specific point-in-time</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Slow-timers Transfer of traditional social media application to mobile devices.</td>
<td>Space-locators Exchange of messages, with relevance for one specific location, which are tagged to a certain place and read later by others</td>
</tr>
</tbody>
</table>

*Figure 7: Classification of mobile social media applications [33]*

To use mobile social media it is important to consider the following four areas [33]:

- integrating the mobile social media activities into the user’s lives
- individualizing activities
- involving the user through engaging in conversation
- initiating the creation of user-generated content and word-of-mouth

### 3.3.4 Classify social media

Looking at interactions is one way of understanding social multimedia, another is to classify it. According to Kaplan and Haenlien [41], Social Media can be classified according to the degree of Social presence/Media richness and Self-presentation/Self-disclosure (Figure 8). By classifying social media, it is possible to understand how they differ. In this classification social multimedia is a part of social media. Social presence concerns the contact that two agents have in terms of acoustic contact, visual contact and physical contact when they communicate [41].
The communication can be influenced by interpersonal/mediated contact and by asynchronous/synchronous contact between the agents. The media richness is about the amount of information that is transmitted in a defined time. Self-presentation is how the agent is presented within the media, something that the agent wants to control. Depending on the presentation the self-disclosure will become high or low. The classification table (Figure 8) shows some examples of different kinds of social media. The earliest form of social media is blogs. These types of websites are managed by one person and other people interact with the blog through comments. These types of websites are examples of low social presence but high self-presentation, since only one person usually manages the website. Collaborative projects such as Wikipedia have both low social-presentation and low self-presentation, even though many people are involved. These people work together but they do not reveal who they are and they do not interact with each other. With social network sites comes social presence and high self-presentation. The users become more personal by making a profile. The users connect, interact and share information with each other. An example of specialized sharing is content communities. Here there are great amounts of sharing within specialized media content. Examples of these specialized media content communities are: video sharing at YouTube, photo sharing at Flickr, and Power Point presentation sharing at Slide Share. The social media with the highest social presence are found within the virtual worlds. Virtual social worlds like Second Life, have high social-presentation. In these social media the users interact with each other through avatars in a world that is reminiscent of the real world. Virtual games worlds such as World of Warcraft also uses avatars in order to make the users interact with each other. These avatars are more of a fantasy figure living in a fantasy world. By defining the goals for using social media, the classification helps to choose the right social media to fulfil the goals.

<table>
<thead>
<tr>
<th>Social presence / Media richness</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-presentation / Self-disclosure</strong></td>
<td>High</td>
<td>Blogs</td>
<td>Social network sites (e.g., Facebook)</td>
</tr>
<tr>
<td>Low</td>
<td>Collaborative projects (e.g., Wikipedia)</td>
<td>Content communities (e.g., YouTube)</td>
<td>Virtual game worlds (e.g., World of Warcraft)</td>
</tr>
</tbody>
</table>

*Figure 8: Classification of Social Media by social presence/media richness and self-presentation/self-disclosure [41]*
Social media can be divided into building blocks with different functionality according to a framework by Kietzmann, Hermkens, McCarthy and Silvestre [51](Figure 9). The framework explains seven different building blocks and how a business can be affected when engaging in and using social media. Different social media will have focus on some or all of these building blocks. This means that it is important for businesses to use the right social media depending on their goals and priorities regarding contact and communication with their customers.

![Figure 9: Social media functionality [51]](image)

The seven building blocks in the model [51] are: identity, conversations, sharing, presence, relationships, reputation, and groups. The identity block describes to what extent the users reveal their identities in the social media. The conversations building block views how much the users within the social media communicate with each other. Sharing is about to what extent users exchange, distribute, and receive content. This building block concerns both evaluation of what kind of objects that the users have in common and can share, and to what degree the objects can and should be shared. Presence is the knowledge users have about other users’ presence. Presence includes knowledge where others are in the physical and digital space, and if they are “available right now” or not. The relationships block is about to what extent the users have, can and need a relationship in order to use the social media. The reputation block describes how users can identify each other’s standing within the social media. Reputation concerns both people and their content within the social media. Different rating systems are usually the basis for valuing of the content. Groups are how and to what extent the users can make their own groups within the
social media. Groups can be closed or open for others. These groups can be based on a specific topic and have different permissions concerning what can be done within the group.

3.4 Visualization and Gestalt Principles

When users interact with each other through mashup applications such as social multimedia, there will be much information to present. How this information is presented to the user is important to take into consideration when creating an experience for the user. The collected data has to be presented and visualized in different ways. Visualization is closely related to the human sense of sight. Visualization is to take data of some kind and present it with a picture or diagram. By visualising the data with a picture or diagram, it will be possible to present the data in a more attractive and easy way. To make the visualization in a useful way, it is of great importance to regard the gestalt principles [52] [53] [54]. These gestalt principles regard all kinds of information that are presented in an application to the user. The presented information can be pictures, diagrams, texts, videos, etc.

The gestalt principles come from psychology but are now used in several different areas like linguistics, musicology, architectural healthcare design, sustainable design, visual communication, art, and human-computer interaction [55]. These principles were originally described around 1920 by three German psychologists: Wertheimer [52], Koffa [53] and Köhler [54]. The gestalt principles are often mentioned as gestalt laws. The word, gestalt, itself can be translated to “form, shape and pattern” or “configuration”. The essential point of these Gestalt laws is that the perception of the whole pattern is more than the sum of its parts [54]. By understanding the gestalt principles, it is possible to explain and understand the way humans perceive and recognize patterns [56]. The gestalt principles of perception are of interest when creating something visual, like art and design [55]. These laws describe how the human mind organizes visual data. Hence, it is of importance to use these principles when designing and analysing interactive media of different kinds. In total there are over 114 gestalt laws but only a dozen of the laws can be applied to visual form [57]. In their study, Chang, Dooley and Tuovinen [57] found that there are eleven gestalt laws that are relevant to use in computer screen design: (1)balance/symmetry, (2)continuation, (3)closure, (4)figure-ground, (5)focal point, (6)isomorphic correspondence, (7)prägnanz, (8)proximity, (9)similarity, (10)simplicity, and (11)unity/harmony.

Balance / symmetry: Humans feel that a visual object is incomplete if the object is not balanced or symmetrical. A simple way to obtain visual balance is to have the visual “weight” evenly around an axis [58]. If the objects around the axis are not evenly placed (asymmetric balance), balance can be accomplished by placing objects with different distances from the axis both horizontally and vertically, all depending on the size of the objects. Simplified it can be said that a larger object has to be closer
to the axis and that a smaller object can be placed farther way from the axis, both horizontally and vertically.

Continuation: The law of continuation concerns the fact that the eye wants to follow a direction derived from the visual field [59]. The reason is that the human brain seeks for relationships between the shapes that are seen. This is also true in time based experience, meaning that the brain seeks patterns not only in space, but also over time. The time pattern is especially clear when talking about sound. An example is that humans can put individual notes into music. [55]

Closure: The human mind wants to close gaps and complete forms that are unfinished in visual objects [60] [59]. This makes a picture that consist of just a few lines to become a picture or symbol that is understandable. The conclusion is that it is not necessary to give all the details in a design or a picture, the mind will fill in the details.

Figure-ground: The figure/ground law is about being able to distinguish an object from its background. The object, being a text or an image, has to have a good contrast with the background to be seen and understood. As an example, the contrast can either be in colour or in shape, making it possible to distinguish the figure. Depending on what colour the mind decides is the foreground colour, one and the same picture can be seen in two ways, with two different contents [59].

Focal point: In any visual design, a focal point will help the user to catch the essence of the design. This focal point is something in the design that stands out and gets the user’s attention to help the user know where to start registering. This starting point will help the user to understand the design as well as the message that is delivered by the design. [58]

Isomorphic correspondence: Past experience and knowledge helps the human to interpret and understand what they see. So, people with different background and experience can have different interpretations of the same image. This is especially important to consider when people come from different parts of the world.

Prägnanz: The gestalt law of prégnanz or “good form” was defined by Fultz [59]. He said “A stimulus will be organized into as good form a figure as possible”. The good form is when the design is simple or has a symmetrical design. This law is closely related to the laws of simplicity and balance/symmetry.

Proximity: One way that the human mind groups objects is when the objects are close to one another, this is the essence of the law of proximity. Objects that are nearby each other are assumed to belong together. [61] [57]

Similarity: Objects that have the same colour, size, orientation, or shape are seen as belonging together or as a group of objects [61] [57]. Hence this law is useful to help a user to understand an interface that has a large amount of information.

Simplicity: Humans that see something visual for the first time, try to simplify what they see. This simplifying is done unconsciously to better understand what is
By using these gestalt laws when designing different kinds of interfaces, it is possible to give the user interfaces that will be easier to understand. The user will better understand what to do and how to interact with the interface. These laws can be used in any interactive media design.

3.5 Game concept

One way of creating experiences within a ubiquitous environment, is to use the game concept. To use the game idea, it is important to understand what a game is. A game in itself is a form of participatory, or interactive, entertainment [62]. Rollings & Adams [62] point out how people are being entertained by actively participating in a game. The main purpose of games is to make players “addictive” and create stickiness and loyalty, a “rewarding, absorbing, challenging experience that compels the player to return for more, time and time again” [63]. When regarding the elements of a game, decisions have to be made on how a game should be constructed to fulfil the requirements for the desired environment and activity. The questions in the Game Concept Worksheet [62] can enlighten important factors to consider: the audience, gameplay, victory condition, player’s role, and type of game as some examples.

In games, in general, the players are divides into two groups: (1)casual gamers and (2)core gamers [63] [62]. Casual gamers are those playing for sheer enjoyment. The casual gamer are not interested to learn complicated rules and complex controls to play the game. They need to understand the game without so much pre-knowledge. The core gamers are the players that have game playing as a hobby and therefore can let the game be both time and money consuming.

Gameplay is the challenges a player faces in a game environment together with the action the player can take, “one or more causally linked series of challenges in a simulated environment” [62]. These activities and challenges in the game have to have goals to become meaningful for the player. The player wants to know how to win, and the victory conditions in a game are the terms that tell how the game will be won [62]. Depending on the type of game, these victory conditions could be different. If the game is a cooperative game, the players have to work together to achieve victory. In a competitive game, the focus instead lies in winning and comparing with other participants. A game where teams compete against each other is a combination of a cooperative and a competitive game. In online games, it is

viewed. [60] Knowing this law when making the visual object, will help the user to understand, by making the visual object simple and contain just what is necessary.

Unity/harmony: Objects that look alike in some way are said to belong together, according to the law of similarity. To emphasize this even more, the law of unit/harmony can be used. This law says that if the similar objects appear in the same form they really belong together. [58]
important to “provide both competitive and cooperative opportunities for play” [64]. Then the victory condition is to solve the assignment faster or just solve the assignment better than other groups that play the game and become the top playing team, rather than win some absolute game condition.

A key part in creating a game concept is to define the players’ roles. The role does not have to be simple, but it has to be understandable. If the role is difficult to describe, the player might have a hard time to understand it and this indicates that there is a problem with the game concept. If the role that the player has reminds them of something in the real world, then the player has some pre-knowledge and understands what rules are given to the role. An example of this is that if players have the role of real police, they are familiar with the fact that a real police cannot just shoot anyone. Consequently they know that the same applies in the game. The player’s role helps them to understand what they are trying to achieve and what rules to act upon. If the game takes place in a familiar world the player can even take different roles at different times during the game [62].

Games are divided into seven different genres that have focus on different patterns of challenges and activities in the game [62]. The genres are action games, strategy games, role-playing games, real-world simulations, construction and management games, adventure games, and puzzle games. Consequently, depending on the desired outcome of the game, the game concept can follow a corresponding genre’s characteristics. A combination of genres can be necessary, to achieve the desired goals with the game.
Designing experience
When designing an experience it can be of great help to know about and take into consideration the following: a conceptual model for designing experience, the factors that affect the experience, the time span for the experience, and how to adapt the experience to the user. To make the design user-centric design the PACT framework [34] [35] will be used.

4.1 Conceptual model of designing experience
Marc Hassenzahl describes a conceptual model of designing experience [24]. The experience in this conceptual model refers to an experience made through some kind of interaction with an artefact. The conceptual model has the following three levels: Why, What and How [24]. The What is the thing the user can do with the artefact: “listen to a book”, or “make a telephone call”. The What is closely connected to the technology itself. How is closely connected with the interaction. The interaction with the artefact is what How is about. The Why regards the fact that there needs to be a motivation for using a special artefact. As an example a telephone call is not only about using a telephone to speak to someone, it involves things like the need to be related to someone, a way to kill time, or to order fast food. The reason Why someone is using a telephone is about underlying needs, emotions, and associated practices according to Hassenzahl. When creating an artefact using the Hassenzahl conceptual model the focus will be on the user’s experience of the artefact. It is the order of Why, What and How that will make the artefact focus on the users experience, and not on the design of the artefact itself. The result will be that the created artefacts will not be technology-driven but human-driven.

4.1.1 Factors affecting the experience
When designing experience for interactive products or systems it is possible to talk about user experience (UX). To be more specific, UX is the experience that people have when using, interacting with, or passively being confronted to a system [65]. The factors affecting that UX [65] can be categorized in the following:

- Context
- Users
- System.

UX can change and be experienced differently depending on the context it is in. Context can be divided into [65]: (1)social context, (2)physical context, (3)task context, and (4)technical and information context.

The social context is about how users are working together with others while using the system. The physical context is more about how the physical surrounding looks like. As an example, if the system is used in a quiet place such as an office with
a desk and a computer, this will give quite a different experience than when using the system on a mobile phone on the go at a train station. Task context concerns the fact that the tasks might not be connected to the system but tasks that the user has to be aware of. The last one, technical and information context, is about how the system is connected with network services and other products. The context of the UX is often a mix of all of these four context categories. The next category that affects the UX is the user. Users differ, but also the same user can differ from time to time. A user can be said to be dynamic. The user dynamics can depend on the person’s mood, motivation to use the system, physical resources, and what expectation the user has on the system. The system itself is the last category that affects the UX. Here there are system properties such as aesthetics, functionality, responsiveness, and design infective behaviour that affect the UX. Functions that the users have changed and decided themselves, and what brand the system has, also affects the UX. By dividing UX into these categories it can be easier both to design and analyse the UX in a particular situation.

### 4.1.2 Time span the experience

Besides the factors that the UX consists of, it is important to look at the time span the UX is taking place. The time span differs between different UX depending on how often, when and where it is taking place [65]. The time span can be divided into before, during and after [65] the actual usage of the system/product or artefact. This relates to the general definition of experience (Figure 4). The UX does not have to contain all of the three time spans, but it is important to define the time when talking about UX. To be able to define the time span for the UX it is necessary to look at the different time span parts. The before is based on the existing experiences and expectations that the user has before using the system. The experiences before can be based on the users earlier experiences, but also be based on advertisements, demonstrations, opinions from others or existing experiences of similar systems and technologies [65]. The experience before the actual use of the system is called anticipated UX [65]. The actual system use is called the momentary UX [65]. The UX after using the system is called episodic UX and contains the indirect experience the user had [65]. The episodic UX is the experience that the user has shortly after the actual system use, looking back on the experience and reflecting on it [65]. When including anticipated UX, momentary UX, episodic UX together with the fact that the user has used the system repeatedly during some time, the UX is called the cumulative UX [65]. (Figure 10)

The time span is important to define, both in the process of designing the experience but also for the evaluation of the experience. Depending on what the focus will be, the evaluation can give different kinds of insights. Looking at the actual use of the artefact can give information on a user’s emotional response to details in the user’s interface. If the focus is on a longer period of use, it will be possible to see
how momentary experience will impact the cumulative UX. As an example a negative momentary experience may turn into a positive experience if the outcome of the use is positive. The cumulative UX will then be positive. So when designing an experience the time span definition is needed both for the actual experience but also for the evaluation. Even though most researchers agree that UX occurs before, during, and after interaction with an artefact, the evaluation of the UX is not done in all of the three time spans [66]. Evaluation of anticipated UX is rarely done (20 %). It is more common with evaluations of the Episodic UX (70 %). The combination of evaluation of momentary and episodic UX is the most common combination. [66]

4.2 Adapting the experience to users
The next step in designing an experience is to make it more natural by adapting the experience to the specific user of the artefact. To use the proxemics dimensions - distance, orientation, movement, identity, and location [12] [13] - will help adapting the experience to the user. To be able to adapt the experience it is essential to know who the user is and what the user would like in the particular situation with the artefact. Facts that can be of importance to know about are, e.g., the user's background, sex, age, what the user likes to do, music the user likes, animals the user likes and so on depending on the situation of the experience in the specific context. It is important to find out what kind of similar experience the users have from the same or similar situations. By making the experience adapt to the user, the experience will be more suitable for that particular person. Nathan Shedroff [23] means that the experience can either be customized or personalized. Both of these

![Diagram of user experience time spans](image-url)
expressions talk about changes of the content according to the user, but the
difference is that the personalized experience is modified to suit to just that
particular person. A customized experience is a form of adaptively to a person, but it
is based on a finite numbers of options that the person usually can choose from. One
of the most natural ways of interaction that we have in everyday life is conversation.
The two participants react and interact on what the other person says and how the
person behaves. When creating an experience we can copy this and make the
experience an interaction that will adapt according to the person, making it a
customized experience that is adapted automatically within a finite numbers of
options. This will make the experience more natural.

4.2.1 Senses as a part of the experience
When creating and adapting an experience to a user, it is important to have the
user’s attention and involvement. By studying the human senses - sight, hearing,
touch, smell and taste - and trying to understand them, it will be possible to choose
in what way to create an experience that better affects the users’ attention and how to
involve the user’s senses. When considering how the user’s senses are addressed, it
should be possible to create a new reaction to an already common experience
making it a more enhancing experience.

Out of the five human senses, sight, hearing, and touch are the senses most
frequently designed for when creating experience with interactive artefacts. When
designing for sight, 3D effects has become important. 3D makes it possible to give
the experience of depth in a picture. Movies, video- and computer-games are the
visual media that use 3D the most. [67] [68] Even though 3D has been around for
more than 100 years, it is in the 21st century that the technique made a
breakthrough. 3D films have existed since 1915, but it was not until 2009 that 3D
became really successful within film. The breakthrough came with the movie Avatar
in 2009. [68] With the video game Crysis 2 it was possible not only to see it in 3D but
also to move around in the game in 3D [69].

Designing for hearing means making use of sound in the design. Because sound is
a strong attention catcher and can convey a mood, it is important to use sound with
moderation not to annoy the user [70]. Sound helps humans to understand and
interpret the environment around them, giving important feedback of actions and
activities made by the human. While the user’s eyes are occupied elsewhere, sound
can give the user information of what can’t be seen [71]. Sound gives atmosphere
and feeling to what is seen [72]. For example, the picture of a room can be
interpreted quite differently depending on the sound complementing it (Figure 11).
Different sounds can give the picture different atmospheres and evoke different
emotions. If happy music like Spring from Vivaldi’s Four Seasons is played together
with the picture, the feeling might be pleasant and romantic. Music like Toccata
from Bach’s Toccata and Fugue in D minor will give the picture the feeling of a scary
place. The sound of steps will tell the audience that someone is walking and might soon come in sight. It is also important to realise that depending on the person, sound will affect people differently depending on their earlier experiences. An example of an area that benefits from the use of sound to create atmosphere and feeling is in the world of movies [73]. Sound can even affect a human physiologically, like heart frequency and stress hormones [74] [75]. The range for human hearing is between 20 to 20,000 hertz. Lower frequencies can be detected through the body by sensing mechanical vibration.

Of the three senses mostly used when creating experience with interactive artefacts, the touch is the least used and explored. Touch is closely associated with interaction and feedback. Touch could be used more often to simulate how different objects can feel when being touched, or to feel if the interaction made with the artefact is soft or hard. Interaction that is nonverbal and involves touch is called haptic. The use of haptic interaction can be a complement to visual impression, but can also be a way to present new information in an interactive system. Humans are capable of receiving feedback with more than one sense from an interface [76]. The

![Figure 11: A picture like this can give the audience different experiences depending on what sound it is combined with. (Picture of the mill in Vindeln, a painting by Karin Fahlquist after a photo by Bo Tannfors.)](image-url)
haptic field has much more to offer in making touch a complementary interaction possible in everything from interactive games to a learning environment in medicine. One area that haptic research is looking at is touchscreens. Interaction with a screen will not only give the user the opportunity to use their fingers to touch the screen but also be able to feel how the surface feels. A touchscreen could feel uneven even though it is flat [77]. With a haptic system it is possible to give a user feedback through touch, making it possible to sense the texture, shape, weight, friction and stiffness of an object. [78].

The senses least used with interactive artefacts are smell and taste [79]. This is probably because realistic smells and tastes still are difficult to synthesize artificially. Humans have about a thousand different kinds of receptors in the nose, each tuned to a different chemical bond [80]. A matrix representing a human nose has to have a thousand-dimension space [79]. Creating artificial taste is being done within the food laboratories. Restaurants have been able to use taste as a part of the experience they offer. There are some examples of creating experience with smell; scent films, immersive virtual reality, and museums. In 1959 the scented film, Behind the Great Wall, was released in “Aromarama”. The scents were piped through the air-condition system in the cinema theatre. The immersive virtual reality motorbike, sensorama, was an immersive experience, with fans simulating the wind, a vibration seat simulating driving over cobblestones, the aroma of flowers as passing by a flower garden, and spreading the smell of pizza when passing an Italian restaurant [81]. An example of museums using artificial scent is the Bow Street Old Whiskey Distillery in Dublin, the Natural History Museum in London, and the Jorvik Viking Museum in York [79].

Smell creates memorable experiences, so it is important to take that into consideration when designing UX. When creating an experience it is important to think of the senses smell and taste. Even if it is not possible to easily create artificial taste and smell it is important to think of how the environment might affect the experience with its smell and with objects that the user can taste.
5 Methodology
When working with applications that involve human computer interactions there are some different research methods used to study how interaction work: field studies, observation, usability test, surveys, focus groups, interviews, and controlled experiments [82]. Each method has its pros and cons, making it important to use the right method. It might even be a positive idea to use more than one research method to make a conclusion of the outcome. These research methods can be divided into three groups: descriptive investigations, relational investigations, and experimental investigations [83]. Descriptive investigations have its focus on describing what is happening as accurately as possible. With relational investigations it is possible to find and identify relations between a numbers of factors. Experimental investigations give the causal effects between two factors (Figure 12).

<table>
<thead>
<tr>
<th>Research</th>
<th>Focus</th>
<th>Claims</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive</td>
<td>Describe a situation or a set of events</td>
<td>X is happening</td>
<td>Observations, Field studies, Focus groups, Interviews</td>
</tr>
<tr>
<td>Relational</td>
<td>Identify relations between multiple variables</td>
<td>X is related to Y</td>
<td>Observations, Field studies, Surveys</td>
</tr>
<tr>
<td>Experimental</td>
<td>Identify causes of a situation or a set of events</td>
<td>X is responsible for Y</td>
<td>Controlled experiments</td>
</tr>
</tbody>
</table>

Figure 12: Describing and comparing the descriptive, relational and experimental research methods. [83]

These different research methods are ways of finding out what the user thinks, how the user reacts and what the user experiences when interacting with different artefacts, applications, and data in different kinds of environment. The following paragraphs describe the used methods in general terms of how they are performed and how the results are evaluated. The data collected during these investigations is either quantitative data or qualitative data.

5.1 Case study
If it is of interest to look at a specific situation when designing an application, a case study can be the way to do it. A case study is an in-depth study with a small group placed in a real-life context. To increase the credibility of the result in a case study, it is recommended that two or more cases are included in the study [84]. The data collected in a case study is recommended to be done by data triangulation. The idea
with data triangulation is to collect data in multiple ways, usually three, to provide corroborating evidence. The three types of collected data could be artefact, observation, and interviews. The collected data could support each other but also complement each other, to gather a better picture of the case. If the data instead reveals contradictions, it might be an indication that more or deeper studies have to be made.

The collected data is usually of qualitative and sometimes quantitative nature. The qualitative parts of the case study are to describe a situation or explain behaviours. When using quantitative components they can help to support and corroborate quantitative results. It is important to be aware of the fact that the quantitative data will probably not be representative for a larger group and therefore it will not be so easy to make statistical comparisons using the data. The result can be seen as indications of a phenomena, or at least be true for the specific situation that has been studied. So if the goal is to generalize the results, multiple cases should be used.

One part of case study is how many participants or groups will be used; another is how many units will be analysed. Units can be different tasks that are being studied. Embedded case study is when a case has multiple units being analysed. A holistic study is when one unit is studied in each case. If the units do not have any connection with each other, the units might as well be separated in multiple-case study [84].

When designing a helpful case study, the following components should be considered (this list is a modified list of Yin [84])

- Research questions – describing the goal of the study
- Hypotheses or propositions – statements of what you expect to find with the study
- Units of analysis – this defines the details of the study
- Data analysis plan – a description of how the data was structured to be analysed

The data sources that can be used in a case study are [84]:

- documentation
- archive records
- interviews
- direct observation
- participant observation
- physical artefacts

So to make a triangulation of the data, three of these data collection can be used. Depending on what the idea of the study is, the right data collection should be done. Documentation and archive records will give information about the past and current
practices and use existing tools/situations. Interviews will give information about different user reactions like perception, concerns, and needs. The direct observation made on the participants in the current situation will help understanding what people do in particular situations. If the concern is to understand complex organizational dynamics, the participant observation is a better data source to use. A positive effect of using artefacts, is an understanding of how people use these artefacts in their daily lives, how they bridge the gap between computer work and the rest of their lives.

The actual collection of the data used in the case study, can start when it is decided on what types of collection are to be made, all depending on what the goal with the collection is. To receive reliability in the case study, protocols for the different parts should be established [84]. The protocol should include all from a well formed introduction describing the way the data collection is made to how it will be performed.

The data collected from a case study then has to be analysed and interpreted. The key component in a case study is the qualitative data collected. The type of tools to use for analysing the data can be triangulation, documentation of chain of evidence, and consideration of rival theories. Compared to quantitative experiments the case study is based on a few samples. This means that the result will not apply generally. A helpful way to analyse all the data is to make a matrix with one unit of analysis per row and letting the columns in the matrix representing a specific aspect of the analysis. In this way it will be easier to compare aspects of each unit or to understand an individual unit. It will be possible to identify matching patterns between the analysed data and the theory that might have been used when designing the case study. Another comparison that can be made is between units or cases in the study. This comparison can lead to a development of a model or a framework that communicates the result of the case study. Hopefully this model or framework can be applied in similar cases helping designers understand the situation and helping them to know how to design or act in a similar designing situation.

5.2 Surveys
A way to reach and collect data from a large group of people is to use surveys.

When making the actual survey there are three different kinds of questions that can be used [85]:

- open-ended questions
- closed-ended questions with unordered response categories
- closed-ended questions with ordered response categories

If the goal with the question is to have an understanding of a phenomenon, the open-ended question should be picked. Here the participant can write more freely
about the current issue. It is important to formulate these questions well so the answer will be relevant for the subject and area that is wanted. The closed ended questions can be divided into ordered responses categories, or not. Both of them have a number of choices that can be selected as an answer. The ordered response has some kind of logical order in the used scale [86]. An example is the Likert scale with numbers from 1-7, that represents “strongly agree” to “strongly disagree” with a claim. The closed-ended question with unordered answers wants the participant to select one or more choices from a list of alternatives.

To do a well composed survey, it is important to pay attention to the actual structure. A well written introduction to the survey will inform the participant what the survey is all about. The order the questions come in is also important. Grouping questions that are similar in content together will make the cognitive load lower for the participant. Putting the more interested question in the beginning of the survey will help to receive better answer from the participant, while the participant still is motivated and has not lost interest. When the survey is developed, it should be pre-tested preferably on people that are not familiar with the subject. By doing this the actual structure and meaning of the questions will be tested in a useful way.

When choosing who will participate in the survey, the goal might not be to have an estimate of the whole population. The selection of participants depends on what questions or what conditions are to be examined. Representative participants are selected from the relevant group. To collect data from these non-probabilities based samples groups in a relevant way, there are a number of techniques to use, so the data will be valid. One way is to collect and look at the demographic data of the participants. This is a way to make sure that the participants do not represents a group that is too narrow. Another technique is to use oversampling. This means that the size of the group with participants should be considered large in proportion to the total population of interest. Another way, if the participant group is not randomly collected, is to make the sampling of usage randomized. Instead of randomizing users, it is the usage that will be randomized. This technique is known as intercept sampling [87]. Another way is to invite everyone at a certain webpage to participate by posting a link on the webpage, letting whoever wants to participate. This is called “self-selected” survey, letting the people visiting the page themselves decide if they want to participate or not. To be able to collect deeper answers with a survey, the possibility of making follow-up questions is needed. Depending on how the surveys are done, and how the participants are selected, follow-ups might not be possible. If the selection of participants is made in such a way that the participants are totally anonymous, a follow-up will not be possible.

Before analysing the data from the survey, all the surveys have to be cleaned up from obvious errors like incomplete answers, not valid answers, or repeated answers. Qualitative data from the survey has to be coded before analysing it (see Analysing qualitative data). Quantitative data is already ready to be analysed statistically.
5.3 Interviews
By doing interviews with people it is possible to go deeper into the questions, provide perspectives and receive data that might be difficult to catch with a survey. Interviews are done with one person at a time. Interviews made with more than one person at a time are called focus groups. When doing an interview it is not only the word that is said that is the answer. Both body language and the voice itself are important contributions to the answer, telling about details like how the person feels, if the person is bored and so on. In an interview the person being interviewed has the opportunity to talk more freely when answering a question. It is also easier to follow up an answer with further questions to clarify the given answer.

An interview can be structured in three different ways: (1) fully structured, (2) semi-structured, and (3) unstructured. The fully structured is the easiest to perform for a beginner. The unstructured needs more interview experience to do it correctly. With a fully structured interview there is a script presenting the questions in a well-defined ordered. The people being interviewed will have the same formulated questions in the same order. This structure will make it relatively easy to analyse afterwards. There will be no opportunity for the person being interviewed to give any other opinions that the ones asked for.

With a semi-structured interviewed there are a set of questions in the beginning that later can be completed with clarifications and additional questions. With this structure it is possible to follow up the answers in a better way, letting the interviewed person decide what to tell and which way to go in the interview. This type of interview is useful when wanting to dig deeper, looking for critical comments, design requirements, and other insights in a particular area. It is a useful way to start gathering insights from areas or users that are unfamiliar.

The unstructured interview all depends on what the interviewed person thinks is important and wants to focus on regarding topics and concerns. This kind of interview can start with one predefined question, to focus on the desired topic of the interview. The questions that follow are more of a follow-up type of question, depending on given answers. This kind of interview will be a challenge to interpret, experience of these kinds of interviews are needed to have a relevant result of the interview.

The questions asked should be simple, making them easy to be understood. It is better to have several simple questions that one complex question. A structured question could be “yes or no”, true-false multiple choice, or Likert-scale questions [88]. This structure will make it easy to analyse and apply statistical methods. An open-ended question asks for response, feedback and opinions from the person being interviewed. An example of an open-ended question is “what do you think about …?”. The question should be neutral in its structure and not affect the person answering. An example of a question that is affecting and trying to control the answer would be: “Why do you not like this …?”. This question is implying that the
person does not like a particular artefact while the person might not have expressed this at all. To avoid bad and complicated questions it is an important to do pilot-testing of the questions.

The participants of the interviews could be current users or potential users of the proposed artefact or system. But the participants could also be the artefact owners or system owners. The selection of participants depends on what the reason for the interviews is. It is important to carefully consider the reason for making the interviews, so that the answers will give a fair representation of the wanted group.

Depending on how the questions are constructed, the answers can give detailed information, general information, or trends for the future on how people use or want to use a tool or how they cannot use it in a situation to be. If the questions concerns how some artefact is used, it might be a good idea to let the person demonstrate by using the artefact, as a complement. By letting the person use the artefact or system, the answer does not entirely rely on the person’s memory of using it. The artefact or system could be an existing product or a product under construction, a prototype.

The actual interviews may be done in different ways, depending on where people are located and what financial resources there are for doing the interviews. Face-to-face, telephone/Skype, email, and chat interviews are some example of how the interview can be conducted. Face-to-face interviews are useful because then the body language and voice will be part of the interpretation of the answer. If people are located at different places the use of telephone or Skype could be a choice. By using chat or mail interviews the trouble with time differences will not become a problem.

The easiest interviews to analyse are the structured ones with closed questions. These answers can be analysed with statistical tests to determine when differences in response rates are meaningful. Tables can be made on the different answers divided into relevant categories, making it easy to have a helpful overview of the result. With open-ended questions the answers are more difficult to analyse. There are some techniques that can be used:

- qualitative data analysis method
- content analysis
- discourse analysis
- affinity diagrams

With qualitative data analysis it will be possible to identify important ideas in the interviews. With this analysis the idea is to find common structure and themes from the qualitative data. When using content analysis, things like patterns of use and frequent use of terms can be of help in finding concepts and relationships between the answers [88]. With discourse analysis, the idea is to look beyond the words and look at the structure of sentences and what words are used, trying to receive
additional understanding of the answer [89]. The use of affinity diagrams is a way to structure the answers into different categories in a visual way. The structuring is done by using different colours for different categories and placing answers under the appropriate category by using, e.g., sticky notes. A way to validate the analysis so it is correctly interpreted is to involve more than one person when doing the analysis. Letting colleagues analyse the interview data to see if they make the same analysis is one way of validating. Another way of validating is to show the result to the persons interviewed to see if they agree with the analysis. The presentation of interviews should show on the details that are possible, given that there are quantitative results. Using direct quotes without revealing exactly who said it, is also a useful way to make the reporting more concrete.

5.4 Prototyping
To be able to make tests and evaluate the idea of an application it is a useful to make some prototypes. These prototypes are applications that more or less resemble the final application. The similarity can be just the conceptual idea, the functions, the layout or more or less really look like the final application.

When designing a system it can be an idea to visualize the ideas that come up. To make a prototype is a way to visualize the application. Depending on what should be shown of the system, the degree of fidelity should be decided. Fidelity here refers to how and in what sense the prototype should be similar the final application. When choosing fidelity there are three areas to consider: visual, functional, and content fidelity [90]. Visual fidelity stretches from sketched to styled look. Functional fidelity has the scale from static to actually being interactive. Content fidelity can be content with just lorem ipsum content to actually real content that will be used in the final system.

The following types of prototypes can be used: low-fidelity prototypes and high-fidelity prototypes [91] [89] [92] [90]. Some even talk of medium-fidelity prototypes [90]. Depending on the purpose of the prototype, one of these prototypes could be selected (Figure 13). The low-fidelity prototype could be just a 2D paper sketch or a 3D paper model. Usually a low-fidelity prototype has low content and visual fidelity. This means that the prototype is static with limited functions and has no interaction possibility. The focus on this kind of prototype can be more of a conceptually idea of the system. A high-fidelity prototype usually resembles the final application both in interaction, function and appearance, and could be mistaken for being the real application. Within high-fidelity prototypes it is possible to either focus on a vertical or horizontal prototype. A vertical high-fidelity prototype is when the prototype focuses on having just some of the interactive functions fully working. The vertical high-fidelity prototype focuses instead on high-level function and skips the low-level functions of the system.
In between these two prototypes it is also possible to talk about a medium-fidelity prototype. With medium-fidelity prototypes it is possible to have the appearance of the final product but not the function. To interact with a medium-fidelity prototype a simple link or the method of Wizard of Oz might be used [93]. The Wizard of Oz method is when all the response from the user’s interaction is made by another person through a computer interface. This prototype can be useful to use when wanting to evaluate the layout of the interface before beginning with the actual programming of the application.

**Figure 13: Advantages and disadvantages for constructing low- and high-fidelity prototyping [91].**

<table>
<thead>
<tr>
<th>Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
A low-fidelity prototype is usually used in the beginning of the process of creating a new application [91]. This type of prototype is for evaluating design alternatives and describes the concept; the focus is on how the system works instead on how it looks [90].

The focus of a high-fidelity prototype on the other hand is on navigation, flow and matching the design and user models of a system. This type of prototype is done in the final phase of development. A high-fidelity prototype can be used to make function and user tests on.

5.5  User test
To test the applications that have been developed there are some users tests that can be made to help with the development.

The general description of an usability test is when representative users attempt to do representative tasks in representative environments on some kind of prototype [89] [94] [95]. The basic goal with a usability test is not about style or colour, it is to improve the quality of the artefact by finding flaws that will be problems to the majority of people [89]. The artefact can be everything from pure interfaces to actual products.

Usability testing is according to some, more close to engineering than to research [96]. Example methods used in usability testing are [89]:

- measurement of task performance
- survey to measure user satisfaction
- observation techniques
- key logging

One difference between experimental design and usability testing is that flaws that are discovered during a test will be fixed until the next person makes the test. In experimental design this will not be acceptable. The goal in experimental design is to ensure that all users in a group have the same treatment. Usability testing can be divided into three categories [85]:

- expert-based testing
- automated testing
- user-based testing

Expert-based testing is when experts are testing the artefact according to a strict set of requirements. These requirements could be of the character of some kind of official standard. If it is a user interface that is going to be tested, the experts are interface experts and not experts on the tasks that are being performed with the interface. The requirements that the interface experts use when testing the interface,
could be to look at the heuristics of the interface according to Shneiderman’s golden rules [82] of interface design (Figure 14). Some kind of heuristic review is the most common review done by the experts in HCI. Another example of requirements setup used by the expert is the Web Content Accessibility Guidelines [97]. These requirements are used when the experts are testing accessibility of a webpage for disable people.

<table>
<thead>
<tr>
<th></th>
<th>Strive for consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Cater to universal usability</td>
</tr>
<tr>
<td>3</td>
<td>Offer informative feedback</td>
</tr>
<tr>
<td>4</td>
<td>Design dialogs to yield closure</td>
</tr>
<tr>
<td>5</td>
<td>Prevent errors</td>
</tr>
<tr>
<td>6</td>
<td>Permit easy reversal of actions</td>
</tr>
<tr>
<td>7</td>
<td>Support internal locus of control</td>
</tr>
<tr>
<td>8</td>
<td>Reduce short-term memory load</td>
</tr>
</tbody>
</table>

*Figure 14: Shneiderman’s 8 Golden Rules of Interface Design [82]*

In automated usability testing, a software application is analysing, e.g., an interface to see how well the interface follows some guideline or requirements. These guidelines could be Web Content Accessibility Guidelines [97]. These kinds of testing are important ways to find out if the interface follows the desired standard, but will not be able to find out how a user will interact with the interface. To find out how the user will act and react to an artefact, the user-based testing is used. When the artefact is an interface it is important to notice that it is the interface and not the users that are being tested. The user-based test can be done on an early prototype of the artefact or later when the artefact is almost ready. The test done in the early stage of the development is a formative testing that may include low-fidelity prototypes. The low-fidelity prototypes may include wireframes or paper prototypes and have their focus on the users’ perceptions of the interface and not so much on how the users complete that actual task with the artefact [98]. The feedback on a simple prototype [99] such as a paper prototype will give more feedback and criticism than an almost fully finished artefact. Users might feel that their opinion will be taken into account when the artefact is not finished. Summative test with high-fidelity
prototypes will have the goal to evaluate a specific design choice effectiveness [98]. When a usability test is done right before an artefact is fished it is called validation test. The goal then is to compare the artefact with an old artefact, to see if the goals set up for the new interface regarding different tasks are fulfilled.

As the goal with usability testing is to find flaws in the design, the number of users to be tested is said to be five [95]. Approximately 80% of the flaws will be found by testing five users [100]. So if 80% of the flaws are acceptable for the test then five users will work. The test can take place in many different locations: a laboratory, a workplace, a user’s home, by phone or over the web. An important thing to take into account is to choose a location that will be as comfortable as possible for the user. A comfortable environment will make the user more alert on the actual assignment. The location might also depend on the kind of equipment needed to collect the testing data. Some expensive equipment might be tied to a specific location, and not be feasible to take to the home of a user. To be sure that the things wanted to be tested are tested, it is important to create a task list. The list should have a clear description and introduction of the actual test and then contain the task that the user will be doing during the test. These tasks can be typical tasks that usually are being done with the artefact, or there can be new tasks that are being evaluated.

The collected data from the usability testing can be both quantitative and qualitative data. The most common quantitative measurements are [101]:

- task performance
- time performance
- user satisfaction

Task performance is about how many of the tasks that are correctly completed. Time performance is about how long each task takes to complete. User satisfaction measures how the users feel about the artefact. Validated survey tools can be used to measure the user’s satisfaction. Other quantitative measurements can be key logging, time spent at a special function as the help menu, and so on. One qualitative measurement that is used in usability testing is “thinking aloud”. In the “thinking aloud” testing the user is encouraged to speak out aloud whatever comes to the mind while using the artefact.

The usability testing gives information on what can be made better with the design. The data analysis will not be statically, because of how few users that has been tested on. The flaws found should be reported and prioritized, so that the design can be improved. Each flaw should be described with the collected data. To be able to fix the most necessary problems, the flaws should be prioritized. Users that have been involved in the test have to be kept anonymous in the report. The users could be mentioned as Participant #1, Participant #2 and so on.
One other usability test worth mentioning is “Wizard-of-Oz testing”. This test is useful to use if the artefact, like some kind of interface, has the appearance but not the real functions. Then the user will interact with the interface as if it was working properly, but the real action is done by a person “behind the scene” changing to the right interface, according to the interaction made by the user. [93]. The idea is that the user should have the impression that it is a real computer interface being tested.

5.6 Data analysis

5.6.1 Analysing qualitative data
When interpreting qualitative data, all depends on the knowledge and experience that the person making the interpreting, has from before. Qualitative data analysis can be divided into three stages according to Corbin and Strauss [102]. The first stage is the data set that contains information about the object that is being studied. In the second stage a closer look is taken at the collected data. The properties, dimensions and relationship between the objects are studied. In the third stage the knowledge gained from studying the objects is taken into consideration when looking at and understanding the original subset and its disturbances that might be there.

Because qualitative data analysis is not objective it is important to find ways to make it valid and reliable. By having well-established and well-documented procedures for the analysis, the result will be valid [103]. The consistency of the results will make it reliable [103]. This means that if other researchers use their data set, they should come up with the same result.

5.6.1.1 Content analysis
When analysing content it can be divided into media content and audience content. Media content can be websites, printed content, TV programs, radio programs or any other recording such as photo, film or music. Audience content comes directly or indirectly from the people asked. The content from the audience can be in diaries, surveys, interviews etc. The data is collected to better understand the user and the way they interact with a particular application.

When analysing text content, the technique of coding is used and can be divided into prior coding and emergent coding. Prior coding is based on suitable established theories or frameworks. Emergent coding is used when the area does not have so much literature on the subject, so the codes have to be “invented”. The way to make these new codes is to let multiple researchers look at the data and come up with new code categories by identifying patterns, opinions and behaviour in the data. The new categories are then consolidated into the new sets of coding categories. To make the coding as objective as possible, it is important that more than one coder is doing the coding. The reliability of the data can either be how the same coder codes the data
again, or to let another coder do the coding and see if the result will be the same. It is even possible to make reliability measures. One way of measuring reliability is to measure the percentage of agreements among the coders according to this equation:

\[
\text{Agreement in } \% = \frac{\text{the number of cases coded the same way by multiple coders}}{\text{the total numbers of cases}}
\]

5.6.2 Analyzing quantitative data
Quantitative data is easier to analyse directly. The data can be displayed in tables, graphs and even be looked at statistically. To do statistical analysis on the data, it is important to have the correct numbers of participants in order to make an accurate assessment. The number of participants has to be a correct representation of the current users.

5.6.2.1 Statistical Analysis
Before doing the statistical analysis, the data has to be prepared by cleaning up the data, coding it and organizing it. Depending on how the data was collected, the cleaning up is done in different ways, but the common way is to see that the collected data has the right formatting and take away errors. If it is not possible to replace with the accurate data, the data item has to be removed; this data is seen as missing data when analyzing it statistically. It is important that the data is not manipulated in a way that it will be showing the wrong data or adding data that is not “true”. The cleaning up is all about fixing obvious errors like incomplete answers, not valid answers, or repeated answers. The Coding of data has to do with translating text information into numbers so that statistical analysis can be done. Here it is important to have translation tables of some kind, making it possible for both humans and the statistical formula to understand and use the data. The organization of the cleaned and coded data depends on the type of statistical software that is used for the analysis. The data can for example be listed in one column or in two parallel columns depending on the kind of test that is performed.

Because there is variance in the data collected it will not be possible to directly compare the means of multiple conditions or multiple groups. Statistical significance testing on the collected data will help evaluate the variance that can be explained by an independent variable and the variance that cannot be expanded by an independent variable. The statistical test will help to find out whether there is any difference between the different conditions/groups.

The following tests are available to compare the means of multiple groups: t-test or ANOVA (analyze of variance). The t-tests (independent-sample or paired-samples t-test) are simplified analyses of variance when only two groups or conditions exists. The ANOVA tests (one-way, factorial or split-plot design ANOVA) are used when there are more than 2 conditions. (Figure 15)
<table>
<thead>
<tr>
<th>Experiment design</th>
<th>Independent variables (IV)</th>
<th>Conditions for each IV</th>
<th>Types of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between-groups</td>
<td>1</td>
<td>2 or more</td>
<td>Independent-sample t-test</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2 or more</td>
<td>On-way ANOVA</td>
</tr>
<tr>
<td></td>
<td>2 or more</td>
<td>2 or more</td>
<td>Factorial ANOVA</td>
</tr>
<tr>
<td>Within-group</td>
<td>1</td>
<td>2 or more</td>
<td>Paired-samples t test</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3 or more</td>
<td>Repeated measurements ANOVA</td>
</tr>
<tr>
<td></td>
<td>2 or more</td>
<td>2 or more</td>
<td>Repeated measurements ANOVA</td>
</tr>
<tr>
<td>Between-and within-group</td>
<td>2 or more</td>
<td>2 or more</td>
<td>Split-plot ANOVA</td>
</tr>
</tbody>
</table>

*Figure 15: Commonly used significance tests for comparing means and their applications in context.* [85]

### 5.7 Methods used in this work

To investigate different ways to enhance the visitors experience regarding the Digital Zoo interaction, the following research methods were used: case study [80], surveys [80], interviews, prototyping [81], and user tests [82]. Since the Digital Zoo is connected to a physical place, Lycksele Zoo, making it a contemporary study in a real life context, a qualitative case study approach was a natural choice. In the surveys and interviews, both unordered closed-ended questions with multiple selection and open-ended question, were used. The closed-ended question was used to gather data that could be compared between different participants. The idea with using open-ended question was to let the participant speak more freely about the phenomena, making it possible for important aspects to be explored and clarified. Prototypes were made to show examples and to evaluate ideas. To make the prototypes closely connected to the real situation, personas and scenarios where used. Evaluations and user tests were performed on the prototype to see if the aim was achieved. The evaluations of the different studies were more of qualitative analysis. The number of participants was not large enough to represent the whole user group, therefore not making it possible for any general quantitative analyse. Qualitative analysis was also chosen, hence some questions and answers were more of the qualitative kind. Under the topic Research Results in this thesis, the methods are listed study by study.
6 Towards Designing Experience for Digital Zoo

The objective of this study is to find ways to create experiences using media technology with the user in focus. To be able to find out how to create new experiences for a user it was necessary to find out more information about the user. To understand the user better, this work became interdisciplinary, touching on aspects and approaches such as interaction, media technology, social science, and marketing. In the results presented in this work the creation of new experiences has been limited to the context of tourist attractions, and more specifically zoos, making Digital Zoo the case to examine. The work can be seen as applied research because of the focus on an actual case, Digital Zoo.

6.1 Digital Zoo concept from an interaction point of view

The interaction in a traditional zoo is not so rich. Visitors walk around in the zoo, looking at animals, and might here and there be able to pet an animal. When making the zoo digital the goal is to expand and enhance the experience by giving visitors richer interactions with the different parts of the environment. One of the challenges of this project is how to present all the media data that could be collected.

The information from and to the Digital Zoo can be seen as data that goes through a chain of transformation: collecting – converting – distributing. The distributing part consists of both visualization of the data and interaction with the data. In the collecting part as in the distributing part of the data transforming sequence, there will be agents. These agents will become interactors.

The general interaction in a traditional zoo environment consists of three interactors: two agents and one artefact (Figure 16). The two agents are visitors and animals. The agent visitor can be seen as an individual visitor or as a group of visitors, the same goes for the animal agent. The artefact is the physical park together with the digital parts.

Figure 16: (Left:) Traditionally concept of a zoo. (Right:) Interactions in a zoo.
with its staff. There is interaction between all these three parts, even interaction within themselves as there can be more than one of each interactor part (Figure 16).

6.1.1 Framework
By looking at Digital Zoo using the PACT framework [34] [35], the different parts will be analyzed from a user-centric point of view. User-centric will in this case not just mean people but also other agents in the Digital Zoo. So the People part in the PACT framework will be changed to Agents. With Digital Zoo the definition of the zoo-context becomes larger than it is today. With the sensor network the zoo will become a combination of a physical place in Lycksele and the digital world together with all the information and actors that can be connected with it (Figure 17). In the Digital Zoo concept the primary interactor is the visitor and the interaction is observed from the visitor’s point of view (Figure 18).

The definition of the agents in a zoo, such as animal and visitor, will also take on a wider definition than the traditional definition. An animal in Digital Zoo does not just mean a biological animal in itself, but could also be all the information connected to or associated with it. The information connected to the animal can be basic facts about the species (e.g., text material), pictures, collected sound, video sequences and live stream video of the animal. The animal agent could thus be the physical animal and some or all of the information mentioned above. The visitor of the zoo will be a physical person inside Lycksele Zoo but also someone who has a computer or a smartphone anywhere in the world where there is an internet connection. At the same time interactive information about and from the visitor, such as text, video, pictures, and so on, will also become the part of the definition of the visitor. The park could be Lycksele Zoo but also some web application on the internet or an application for a handheld artefact. The information connected to Digital Zoo and its agents could both be dynamic and static information.

![Figure 17: Digital zoo concept](image)
6.1.2 Interaction for improving experiences

An important part of the PACTs action-part in Digital Zoo is interaction. The focus now turns to the interaction that the visitor has with the two other interactors. The “visitor – animal” interaction could become more personal. For example, the visitor could build a closer relation to the animal than it has today in a traditional zoo. Information to the visitor will not just be in plain text, but could also be sound and live video so that the visitor could follow the animal during its day. The visitor can decide when to obtain the information and in what form. It should also be possible to give the visitor the ability to interact with the information given, so that the visitor can both contribute to information and influence events in the zoo. All this has to be done in a way that is appealing to the visitor, giving the visitor a sense of being a part of the zoo and being able to affect the information and the interactions. The interactions with the animals can both be at home and at Lycksele Zoo. A handheld artefact at Lycksele Zoo could give the visitor a possibility to interact both with animals that the visitor sees and with animals that are out of sight. The “visitor – park” interaction will give the visitor new ways of getting in contact with Lycksele Zoo and the information connected to it. When the visitor is at Lycksele Zoo the interaction “visitor – park” could be both static and dynamic information that at the same time could be mobile or ubiquitous [29]. The visitor would not only be able to receive answers to their traditional question like “where the toilets are”, “what time the animals are being feed”, and “where to find a cafeteria” but also gather information from the particular spot that the visitor is at right now. The information about a particular position could be something that has just happened there, who has been there, and what might happen soon.

As an example, the information from the zoo could either be information initiated by the zoo staff or automated information. The information from the zoo staff could be in real time informing about what is currently going on in the zoo. Automated information could be information about daily events such as feeding the animals.

This also means that visitor themselves will be able to give such information to the park and to other visitors, to get hold of. All the interactive information would be provided through a digital handheld artefact which will be used inside Lycksele Zoo. Here it is important to think about using cognition in such a way that the visitor feels that this is something that is easy and appealing to use [104]. The interaction for the visitor at Lycksele Zoo could both contain mobility and ubiquitous possibilities. The handheld digital artefact could display information that it holds all the time, but also specific information that it receives and displays depending on its current position.
With so much information from the wireless sensor network it is important to present the information in a way that is active. The idea is that the two agents in Digital Zoo could interact and become interactors in the digital world. Both agents should be able to take part of the Digital Zoo by contributing and have influence on the concept. Their interaction in real life should be used to influence the different kinds of information that are presented. For the technology-part of PACT the challenge is to find suitable media technology for the interaction, connection, and contribution. The media technology used should make the interaction with the Digital Zoo into a new experience.

6.2 Research Results
When creating new experiences in a zoo it is important to let the visitor becomes a participant and not a passive viewer [23]. When letting the user become a participant that is active and involved, the user’s experience will become richer. Performing some kind of activity will make the user’s experience more memorable than when the user is just watching the activity [23]. This means that it is important to give the user the opportunity to create, contribute and share information when creating an experience. These types of activities are also important to correlate to the proxemics zones [32] and proxemics dimensions [12] [13]. By choosing the right activity to the appropriate zone the activity and interaction will become more natural for the user. Some kind of communication between the visitor and the zoo should be included in the experience. The experience should also let the visitor feel involved in what is happening in the zoo and being able to influence the events. To be able to create this kind of experience it was important to find out more about zoos and their visitors.
Four studies were made to explore the creation of experience with media technology within Digital Zoo. To create the experience the PACT framework was used by considering the areas in the chapter Designing Experience; (1) the conceptual model for designing experience [24], (2) the factors that affect the experience - Context, Users, and System [65], (3) the time span for the experience [65], and (4) how to adapt the experience to the user [12] [13] [23]. By using the conceptual model for designing experience the focus was more on the user that on the technology [24]. The three levels Why, What, and How [24] from the conceptual model were used and answered in the studies. In the first study the challenge was to find out the motivation for zoos and their visitors to use media technology and social media. The study tried to answer the question Why. The motivation for the second study was to answer the question What. Here the challenge was to find examples of what the user would be able to do in the new experience. In the third study the question How was answered. The challenge here was to find ways of interaction that would give new experiences. In the fourth study the challenge was to find a concept that could answer all of the three questions at once.

Factors that affect the experience - Context, Users, and System [65]- were analysed for each study. The time span [65] for the user experience was also studied in all of the studies. In the third and the fourth study the adapting of the experience to the visitor was introduced and used as part of the experience. The adaption of the experience to the visitor was done by considering the proxemic dimensions [12] [13] [23] and the human senses [70] [71] [72] [74] [75] [76] [77] [78] [79] making the experience either personalized or customized [23].

6.2.1 Study I: Social Media Used in Swedish Zoos
The objective for Study I was to find out more about the Why in the model of designing experience [24]. This meant to find out if there were motivations and needs, common to zoo visitors and zoos as businesses, which could motivate the use of social media in an experience with a zoo. Interviews with the zoos were made, and gave information about how the zoos used and thought of media technology as well as social media.

This study was carried out with eight Swedish zoos using a qualitative case-study approach [6]. Telephone interviews were made with zoo respondents like CEOs, zoo directors, marketing managers, those responsible for communications, zoo informants, coordinators of animal department, and those responsible for animal issues and education. The questions used in the interviews were both open-ended question and unordered closed-ended questions with multiple selections [7]. The questions were mainly focused around areas concerning webpages, mobile apps and social media. The interviews showed that the social context for the connection between the zoos and their visitors is usually done on a one-to-one basis and not in a group. The connection happens in the physical context of a zoo or through the web.
where the visitor probably sits alone by the computer. This means that the task context for the visitors can differ quite a lot depending on if they are in the zoo or at home. The results from the interviews were analysed by using the social media functionality framework according to Kietzmann, Hermkens, McCarthy, and Silvestre [51] (Figure 9). The analysis showed that the following areas are dominant within Swedish zoos today: 1) conversation and 2) sharing (Figure 19). But, the potential of these areas are not fully used by the zoos.

The conversation can be between the zoo representative and the zoo visitor but also between visitors. Most of the zoo respondents mentioned communication between the zoo and the visitors as important. The visitor to visitor connection is only mentioned by some zoo respondent. The visitor to visitor conversation is not represented so much on the zoos social media.

Sharing is taking part in social media like Facebook. But the zoos need to develop a better way to use the content from the visitors. The exchanging and the receiving of the content is not really used by the zoos. One difficulty with sharing that the zoos have to handle is the visitor’s copyright of their information. Two of the zoos have solved the copyright issue by having a photo competition with rules that allow the zoos to use the photos afterwards. The photos in these examples were used on screens in the park and on the zoos’ websites. This is a step in the right direction toward using content that the visitors share.

Figure 19: Building blocks used today (dark green) and additional building blocks for the future (light green).
The two building blocks, conversation and sharing, are closely related with each other in the contact the zoo has with their visitors. As some of the visitor to visitor connection and sharing is done outside the zoos social media sites it is important for the zoos to have knowledge about and presence in these arenas. Some of the zoo respondents mentioned that they were using some kind of monitoring service to be aware of what is said about them on the internet and social media. For the zoos to be in contact with their visitors it will be increasingly important to be where their visitors are. Social media are places where the visitors will be. To meet their visitors the zoos need to be prepared to be an active part of the social media. One of the zoos has such a preparation by having accounts on different social media. Even if the zoos don’t actively use all of the social media, it is important to be aware of the fact that the zoos are a part of social media and what is being said, through their visitors, whether they like it or not.

The possibility of keeping in contact with their visitors before (anticipated experience), during (momentary experience), and after (episodic experience) the physical visit, was not a developed idea among the zoos. There was only one zoo respondent that expressed that the zoo had the before, during and after as a strategy towards their visitors. The contact the zoos have is mostly before the visit. In this contact the zoos have made their effort to inform, in different ways, about facts and activities that will prepare and attract the visitors. Social media and the web are not really used by the zoos to keep in contact with the visitors during their physical visit in the zoo. The results show that the zoos main connection to their visitor is in the physical park through the zookeepers. The contact with the visitor after the physical visit is mostly about the visitors posting comments and photos on social media.

The most important value the zoo respondent perceives in social media usage concerns marketing. If zoos found a way of using the visitors’ contributions (photos and stories) in a better way they would easily have a more personal contact with the visitors, letting the visitor become a part of the zoo. One way to develop the zoos relationship with the visitors is to find out more about the visitors and adapt to them. The zoos would benefit from letting the visitors relationship develop within their own businesses.

The system used today for connection between the zoos and their visitor were mostly the web and social media such as Facebook. For the future all of the zoo respondents regard a system such as the mobile app as something for the visitor to use during the physical visit. Most of the zoo respondents talked about the mobile app as a channel for spreading information and not as a way of sharing and keeping in contact with the visitor. Linking the use of a mobile app with zookeepers would make it possible to expand the connection with the visitor in the park. For example, having the zookeepers also communicating with the visitors through a mobile app will make the zookeepers come in contact with more visitors. Another example to make the communication more up to date would be to let the zookeepers be able to
post updates with information from the animals’ daily lives. There is a great potential for development in the use of a mobile app. By using mobile apps together with social media inside the park, blocks like presence and relationship in the social media framework [51], will become important for the zoos to think about (Figure 19). The usage of a mobile app together with social media will make it possible to create an interactive application involving more than one visitor. This kind of interactive application would require visitors to cooperate and have knowledge of each other.

Another area for the zoos to develop in the future is the usage of social media after the visit. A start is to let the visitors be able to follow the animals’ life more in real time. Here both live updates from the zookeepers and from social multimedia would let the visitors be involved in a more interactive and updated reality.

The outcome from the interviews showed that the zoos were motivated to use social media and media technology. The zoos saw the use of social media channels as a possibility to keep in contact with their visitors and to expand the time span for that contact. Social media is seen as an important channel for the marketing of the zoos. Some of their visitors were already using social media, making it a natural choice for the zoos to use it as a contact channel. These visitors also seemed willing to share information with the zoos after their visit to the zoo. To be able to build new experiences for the visitors, the interviews gave the following areas to take a further look at and develop: how to use social media in applications together with other user generated content (Study II), how to customize the experience to the zoo visitor (Study III), and how to integrate the physical and digital world into a concept for the zoo (Study IV).

6.2.2 Study II: Engaging the Zoo Visitors with User Generated Content - Applications to be used inside and outside the zoo

In Study II the objective was to look at the What in the model of designing experience [24]. This meant developing prototypes of application using social media and user generated content that the zoo visitors could use.

A case study on the interactive map (Figure 20) in Lycksele Zoo was done as background data for the UGC-applications. The case study was done by direct observation, structured interviews, and logging of touches on the interactive map on the touchscreen. Twelve observation and interviews were made during two days of the summer of 2012. The logging of the touchscreen touches was done during the whole summer 2012. The data from the case study showed that users of the interactive map were mostly children (83%). Among the children it was children under the age of six years old (58%) the used the map the most. The children between thirteen to nineteen years old (12%) used the interactive map the least.
When looking at what kind of data that was most used and seemed most interesting on the interactive map (Figure 20) the interviews and the logging data showed different results. The reason for the difference is because the interviews did not in the same way show how many times the visitor used a specific category. So the logging better reflects the actual use. The outcome of the logging was that “general zoo information” came first, second “animals”, and on a divided third place “childrens’ zoo” and “happyland” (Figure 21). The logging showed that the most popular animals to visit on the interactive map were in order: bear, muskox, lynx, seal, and wolf. Photos were preferred before text information on the interactive map. The visitors were also asked if and how they would use a smartphone app of the interactive map, if there was one (Figure 22). Only 85 said they would not use the smartphone app. The information that the visitor wanted to use the smartphone app for, was information about animal species, information on which animal was in the
closest enclosure, where the different animals were kept, and real time information from the zoo such as feeding time.

Figure 21: Result of the logging of the touchscreen touches during the summer of 2012.

Figure 22: Result from the interviews regarding the use of a mobile app use.
To be able to attract new visitors with the UGC-application, the thirteen to nineteen years olds were chosen as the target group since they were not as active using the interactive map. This target group is the group in the Swedish population that uses internet (92%) [4] and social media [4] the most. The ideas with these applications were to integrate social media connection to be included in a larger context then just the social media itself. The applications were based on the idea of creating a context and not on the social media itself. The idea was for the applications were to make UGC applications based on social media connection, to be able to distribute and share the visitors’ information. Two prototypes where developed: a Photo album application and an Individual animal page application.

6.2.2.1 Photo album application
The metaphor for this application is a physical photo album. The photo album application system is a mashup with Flickr and Facebook (Figure 24). The idea with the photo album application is to let the visitor contribute and share photos with other visitors. Together the visitors will create a dynamic photo album by using the application. The photo album is divided into the following categories: wolf, bear, muskox, and reindeer. The idea is that visitor can share photos from Lycksele zoo with each other. The visitor can choose to either create a photo album or to contribute with a picture to a photo album. In both cases the visitor chooses one of the animal categories. The contributing view is made to be used on smartphones (Figure 23), and the photo album view is made for a computer (Figure 24). To contribute the application uses Flickr API making the user log in with Flickr. To make and share comments a Facebook API together with a Facebook social plugin is used. The social media here becomes the connection to new visitors and a way to share the zoo experience with others. The context in the application is constantly changing since the latest uploaded photos are the ones shown, making it an application that the visitor have a reason to come back to.

![Figure 23: The upload application of photos to be used in a Smartphone. When uploading the photo, an animal category has to be chosen; wolf, bear, muskox or reindeer.](image)
Figure 24: Application with a mashup of Flickr and Facebook.

Figure 25: Web application with Facebook-function, video-clips, and comments from the animal. The muskox Undis is here identified and traced in the video with a green circle around it.
6.2.2.2 Individual animal page

The idea with this application is to let the visitor become friends with the animals and be able to follow the animals' daily doings. This application is a medium-fidelity prototype that has the appearance of the final application but not all the functions. The animal species chosen for this application prototype was the muskox, with the three individuals Undis, Troja and Hektor. The idea is to let the visitors of Digital Zoo be able to follow the animals and see what is happening in the muskox enclosure.

The application, being a website, is a mashup of Facebook-functions as Facebook social plugins, video clips from the wireless sensor network at Lycksele Zoo, and comments from both animals and the visitor (Figure 25). The individuals are identified and tracked in the video clips, making them clickable in the video. By clicking in the video it is possible to choose the preferred animal and come to that individual’s animal page. In the individual animal page the visitor can see more clips from the individual’s last day, read comments from the animal, and give comments back to the animal. The comments are made through a Facebook connection making it possible to easily share the information with Facebook friends and Digital Zoo friends. This way visitors interested in what is happening in the animal’s life can easily be updated.

Some of the ideas were not fully implemented in the prototype application. The clips used were not updated all the time. The identification in the video clips would in the real application be done automatically. The idea for the future is that comments from the animal should be generated automatically. To make the comments from the animal become more personal the comments should be generated from criteria such as (1) time of the day, (2) location in the enclosure, and (3) who the individual is. These generated comments should then be placed on their Facebook-page. The Facebook-comment would become the connection to the visitor, alerting the visitor to the fact that something is happening in the zoo.

6.2.3 Study III: Adapt the Experience to the Zoo Visitor

In Study III the objective was to look at the How in the model of designing experience [24]. This meant looking at how the visitor could be interacting and how to make the experience more customized [23]. The concept for this work is to create an application that could replace the traditional way of receiving information about animals in a zoo. Today a zoo has several different information signs, presenting animals in texts and pictures. The text and picture on these information signs are static and not easily changed. The new proposed application would be a large screen that adjusts its multimedia information depending on the visitor. In this way the zoo visitor will have new experiences of the animal information by using their own senses (sight and hearing) together with interaction. The idea was to use the proxemic zones, together with the interaction phases [14] and the five dimension of
proxemics [12] [13] to adjust the application to the user. The physical context for the application would be inside the zoo.

The system was a high-fidelity prototype with the technical context of Kinect sensor, a 60 inch screen, and a computer with Kinect SDK for .NET (Figure 26). This technical context made the social context into an application to be used by the user one at the time. The proxemic dimensions used with this prototype were identification and proxemics distance. The user of the prototype was identified as an adult or a child, depending of their height. Depending on the identification of the use, the information and layout of the screen was adapted to the user. The system interaction with the screen was done by moving the body and using hand movements. The user would interact with information on the screen at different proxemic distances. Information such as text, photos, video and sound at the different zones was adjusted to the distance, making the information more detailed the closer to the screen the user came. This way the experience is adapted to who the user is and what proxemic zone the user is in. This final prototype was based on personas of the target groups, scenarios, and evaluation of the interface. This prototype is mostly about the momentary experience [65] since the idea is to place it inside the zoo. The episodic experience [65] regards the memory of information from the screen and memory of the experience with the screen. A user test with the target groups was then carried out with an indoor prototype and well defined proxemic zones marked on the floor. The physical context for the prototype was indoors. The user test gave responses about what experience the user had had with the prototype application. Regarding the user experience of the application the result can be divided and discussed into the following areas: 1) interaction, 2) multimedia information, and 3) overall experience. The answers from the seven grade survey are put as mean values in parentheses in the text below.

Figure 26: The setup with the screen, Kinect and the computer.
6.2.3.1 Interaction experience

The application’s first two screens (Figure 27) gave the users information about how to interact. The first screen (Figure 27) illustrated how the user would use their hands to interact with the screen. The second screen (Figure 27) informed how the user would move between the different interactions zones.

According to the children the first screen with information about how to interact with the hands (Figure 27) was necessary information (6.8). The adults did not feel the first screen was as necessary (5.3) as the children felt. Furthermore the users thought the given information was understandable (children: 4.2; adult: 4.6) and natural. The children did not experience the layout of the first screen to be as simple as the adults experienced the screen (children: 4.6; adult: 6). The second screen (Figure 27) with the information of the interaction zones was also easy to understand for the users (children: 6.8; adult: 7). Both the adults and the children believed the second screen to be necessary for understanding how to move and use the zones (children: 6.2; adult: 6.7). They also experienced the second screen to be natural to use and that it had a simple layout. Both children and adults really enjoyed using their body when interacting, even though they did not think it was so easy (children: 4.6; adult: 4). One of the users stated that “you have to go out more to the sides, the farther away you stand from the screen, to reach some buttons.” The adult thought it was natural to use the body (6) and the children thought it was not as natural (4.8) as the adult. The experience of having interaction zones and using the body to interact with the screen was overall positive from both children and adults. One adult mentioned “I experienced that the closer I got, the better contact I had with the screen” and another said “The closer the more exciting and more easily it became”. The children also had the opinion that it was easier closer up, “It gets easier the closer to the screen I get”. These comments indicate that the information given at different proxemics distances has significance.

Figure 27: (Left:) First screen, with the text “To interact with the screen”. (Right:) Second screen, with the text “Walk closer to continue”.

För att interagera med skärmen

Gå närmare för att fortsätta
6.2.3.2  **Multimedia information experience**

In the survey done to make the personas, the adult and children listed the type of multimedia they would prefer when receiving information about animals. This result of preferred multimedia was compared with how users liked the different multimedia after using the application. The children using the application had also answered the survey for the persona, while the adults were two different groups.

The children had almost the same opinion about preferred multimedia both before and after they tested the application. The adults differed more in their preferred multimedia. The big difference within the adult group can be because they were two different groups. After using the application the children answered that photos of the animals were both the most enjoyable and the multimedia that was most necessary to have in this type of application. The adults using the application enjoyed the video most, but felt that photos were the most necessary multimedia for the application. The children liked the text about the animals more than they believed they would before testing the application. Sound in general was not as necessary and enjoyable for the children when they actually tested the application. It was the opposite for the adult group: they enjoyed the video and sound more when they had tested the application.

6.2.3.3  **Overall experience**

The experience of the actual usage of the application was also positive. The item that got the lowest ratings was the reaction time from the application (children: 4.8; adult: 4.7). The experience the users had with the application not being so quick can be related to the Kinect. The Kinect together with the software is the component that affects the response time of the system. Both groups felt the application to be pleasant (children: 6.4; adult: 5.7) to use and quite easy to understand (children: 5.4; adult: 6). When asked how they would experience using this kind of application in a zoo, they also had positive comments (Figure 28).

They thought that this type of application would be usable, natural and fun to use in a zoo, “Yes! That would be fun”. Concerning whether the application would feel personal the two user groups differed. The adults thought it would be quite personal. The children did not feel it would be as personal.
In Study IV all of the three studies were integrated into one concept where the digital and physical world would be integrated in a Social Media Game Concept. This paper is proposing a conceptual model of an educative game concept combined with the platform of social media. The paper wants to show that by integrating ubiquitous information and social media in a game idea, it is possible to create a concept for a social media game application that could be used at a tourist attraction, e.g., a zoo. The idea with the social media game concept is to indicate ways to integrate the physical and digital worlds in a way that will involve the environment around us, containing both artefacts and people. As well as become a natural part of peoples’ daily lives. The physical context can be said to contain both the physical world and the digital world. The conceptual model of the social media game builds upon the foundations of Internet of Things for the future version of a tourist attraction, such as the Digital Zoo.

The social media game application integrates of the following three areas: competition, education and cooperation (Figure 29). For the visitor to take part in and become part of the game there are two driving forces: the competition part and the cooperation part. Hence, the main goal and preferred outcome for a tourist attraction such as a zoo is to educate the visitor in a cooperative, fun and entertaining way [8] [9] [10]. The educative part is the value for the visitor and this will enhance the experience of the tourist attraction. To have a more thorough knowledge creates a richer experience of the tourist attraction visit. Consequently, the visitors will be educated about subjects that are related to the tourist attraction and its’ agents. This will create both committed visitors and a new group of potential visitors, the visitors that are at home playing the game. The game itself will have a short term entertainment value for the visitor and the educating part will have a long
term value that they will take with them. By playing the game as a team the cooperation part becomes an important driving force.

6.2.4.1 The social media game applied at Digital Zoo
To exemplify the conceptual game model, a proposed application regarding the ideas of the Digital Zoo is presented in this study. The idea with the social media game application in the zoo, is to make the visit to the zoo more social, more active, and an enhanced zoo-experience by letting the visitors cooperate, collect, and share ubiquitous information that they otherwise might not have received or experienced. The value for visitors to take part in this activity will be the fact that they will learn more about the zoo and the animals. The visitors will at the same time have an entertaining time together with a group of people. The value for the zoo will be the word-of-mouth marketing of the zoo by having loyal visitors with more knowledge. The connection to social media provides an extensive network of potential visitors for the zoo. Social media provides opportunities for sharing, cooperation, and social
interaction. The gameplay is a way of engaging people through a competitive driving force.

The participants (Figure 30) in the interaction, interactors [27], in this ubiquitous scenario will be:

- The game concept
- Visitors
- Ubiquitous information
- A smartphone (belonging to the visitor)
- Social media

The general idea is a collaborative game where a team solves an assignment by collecting and putting together information from the Digital Zoo. An important part of a social media game application involving a tourist attraction, is the actual assignments that will be performed by the players. An assignment contains activities both in the digital and the physical world like moving physical objects, collecting information and experiencing events. The activities should be dependent both of the visit inside and outside the physical zoo and finally lead to the answer of the assignment. By mixing the physical world with the digital world in a game application the game becomes pervasive or ubiquitous [105] [106] [107] [108]. The team will also be part of creating a new assignment for another team. The co-creation [16] of material in the game application is a basis for building a lasting concept that is perceived as updated.

The target group is families with children and school classes. Consequently, the common visitor at a zoo is more related to the casual gamer than to the core gamer [62]. Hence, the game design for the social media game in the Digital Zoo will be made for the casual gamer, an easy to understand game design without the need of any pre-knowledge. Teams will be created involving visitors inside and outside the zoo by connecting the application to Facebook. This means that the visitors will use their Facebook accounts to login to the game and to communicate with each other. The team consists of different roles that the different visitors will have. Some of the visitors will be at home in front of a computer and have the overall view of the game, receiving clues and assignments that the team can use. Another player’s role would be to actually visit the physical zoo. For this visitor the role will contain activities such as receiving and giving ubiquitous information, and to interact with both physical and digital artefacts at the tourist attraction. To be able to solve the assignment all of these team-members-roles are needed. The educative part of the game concept is connected to the assignment. The assignment will be set up in such a way that the team-members have to collect information about the physical environment and the agents inside the tourist attraction. New social bonds are created during the game between visitors inside and outside the zoo. The game
enhances the social experience for visitors arriving in a group to the zoo, visitors arriving on their own, and visitors outside the physical zoo. At a traditional zoo the experience of a zoo is the actual visit to the park. However, by building this application on the foundations of the Digital Zoo, it is possible to also involve visitors that are not in the actual physical zoo, but still experience the zoo. Because the players’ roles will be quite different depending on where the players are located (at the zoo or at home) the game is more of cooperative game than a competitive game. To achieve victory, the players must work together instead of one person focusing on a winning strategy.

The ubiquitous information given to the visitor in the tourist attraction will be based on the visitor’s profile. By using a social media profile, assumptions (based on statistics) can be made on how this person is and what kind of information they might want. This way the information is adjusted to the visitor. The idea of the ubiquitous information is that the visitor will receive information inside the zoo depending on where they are, who they are and what their “role” is. By using location based services (i.e. using the position of the player via, e.g., GPS, Wi-Fi etc.), the game does not have to be linear and connected to a specific route in the park, but it is possible for players to play the game at their own pace and along their own route and the game will adjust accordingly [7]. The “role” in this case can be seen as a regular visitor or a visitor playing the social media game application. When visitors, who are in the game, walk around in the physical zoo they will be able to gather information about the environment. The information will be static information about the specific physical location (e.g., what kind of animal that is nearby both in text and picture), processed live information from the cameras sensor network to know where to look for the animal in the enclosures, (e.g., through live stream of the animal) or information given by other (past) visitors for this specific place (e.g., information about the animals or some other activity related to the specific place in the zoo in both text and picture).

The communication and collecting device could be something that the visitor already has, such as a smartphone, instead of specially designed equipment [105] [107] [109]. The collected information (e.g., pictures, text, sound, and video) should be stored at a general place (e.g., a server) so that all members of the team can it. The connection between the smartphone and the ubiquitous information could use techniques like RFID, NFC, or Bluetooth. To present a large amount of location dependent information at a given point within the Digital Zoo, an augmented reality application is proposed [110]. A visitor point the smartphone camera to a region of interest to receive enhanced information about the scene which is overlaid on the screen. Since the position of individual animals can be known in the Digital Zoo system, and also the position and orientation of the user’s smartphone, it is possible to overlay extra information about animals appearing in the camera view. This information can, for example, be the animal’s name, age, and breed. It can also be in
the form of previous recorded video clips related to the specific animal. The information overlaid on the users screen can also concern other objects, both physical and digital, at the specified location.

Figure 30: The interactors in ubiquitous scenario

6.3 Discussion
The results show that Swedish zoos and their visitors appreciate the idea of using media technology as part of their experience of the zoo. The zoo representatives realise the importance of having contact with their visitors from a marketing aspect. They regard media technology and social media as an important part of their marketing. Visitors see the use of media technology as a way of receiving information about and from the zoo. These aspects together with the social media building blocks are a way of creating important steps for new experiences using media technology and social media together. The different studies have shown examples on how to create applications that use and support the different building blocks. The social media game concept becomes a concept having all of the building blocks, except for the reputation block. This shows that an idea like the social media game concept - combining ubiquitous information, social media and a game application - might be a successful way for further developing tourist attractions in these internet driven times, combining physical and digital worlds. By using technologies like sensor networks based on different kinds of sensors, smartphones and social media it is possible to build a platform for sharing experiences. This will become a ubiquitous environment where the visitors can move around in a natural way. The social media game concept should contain parts such as UGC as well as adapting information to the visitor. It is necessary to find out more about the user of
an application. The different applications developed in the two studies “Engaging the Zoo Visitors with User Generated Content - Applications to be used inside and outside the zoo“ and “Adapt the Experience to the Zoo Visitor“ could be part of the game concept. These applications are examples of both social interactions through social media, UGC, and examples of applications adapting to the visitor. The fact that a game itself is a form of participatory, or interactive, entertainment corresponds with the intention of making the experience something that will involve and make visitors more active in their experience in a tourist attraction. The visitor can be engaged in the tourist attraction any time both in time and in place through the game application. In the study “Adapt the Experience to the Zoo Visitor“, letting the visitors interact using their whole body with a big screen, showed that visitors thought this kind of application would be usable, natural, and fun to have in a place as the zoo. This kind of screen could be part of a social media game concept. By creating this kind of game, the tourist attraction will gain visitors that become more active at the physical location, feel an engagement when they are not there physically, and want to come back to visit the location again.
7 Conclusion

7.1 Goal Fulfilment

It is of importance to recognize that this work will not give a general result on how to create experiences for users. However, since this work has been based on a real case, Digital Zoo, it is most certainly possible to find results that can be applied in similar cases, e.g. in the tourist attraction section. The results are practical examples on how to create experiences using media technology within a tourist attraction. These practical examples might form a basis for influencing a future concept for tourist attractions to use.

The overall research question for this work has been: How is it possible to give the zoo visitors new experience by using media techniques? The overall research question was broken down to three sub-questions. This work has given answers to these three sub-questions:

- How is it possible to let the visitors feel involved in the experience by using media techniques?
- How is it possible to adapt the experiences to the visitor by using media techniques?
- How is it possible to integrate the experiences in both the digital and the physical world by using media techniques?

The first study, based on interviews with zoo representatives, gave an overall view of how zoos in Sweden are using social media today. These interviews indicated how to develop experience using media technology and social media. The interviews also highlighted the fact that all of the zoos wanted some kind of mobile app, but they were not clear on how to use such an app most effectively. The primary social media used by all the zoos to get in contact with their visitors is Facebook. The analysis of the result, using the social media functionality framework [51], illustrated that the zoos had their strengths in the areas of conversation and sharing (Figure 19). By finding ways of developing all of the areas in the social media functionality framework [51], the zoos could use the full potential of social media. As an example a mobile app could make the areas of presence and relationship [51] (Figure 19) become stronger.

The outcome of the study indicated the importance of further research within the following three areas: 1) find out more about the visitors, 2) make better use of the information that the visitors share, and 3) have a better contact and conversation with the visitors not only before but also during and after the visit.

The second study gave examples on how it is possible to let the visitors feel involved in the experience by using media techniques. This work has shown that one way to let the visitors feel involved in the experience is by using User Generated Content (UGC) together with social media in applications. The photo album
The prototype was an example of an application where the UGC was photos from the zoo that were shared with other visitors. Further, the individual animal page was an example of how to display and present video clips from the wireless sensor network in the zoo. Here the interaction with the different video clips together with the communication with the animals was what created the experience, making it into something more than just simply displaying the video clips.

The third study answered the question on how it is possible to adapt the experience to the visitor by using media techniques. The prototype considering of a large screen, where the multimedia information is adjusted depending on the visitor, is one example of how it is possible to customize the experience. The use of proxemic dimensions together with an interactive application and media technology made it possible to adjust to the user. The media technology used - a Kinect sensor, a 60 inch screen, and, a computer with Kinect SDK for .NET – together with the proxemic dimensions distance and identification gave the user a positive and richer experience of the information. By using human senses such as hearing and sight together with full body interacting, the users could have a richer experience [cf. 11].

It was the proxemic dimension identity that made it possible to adapt the information and content layout for the user; adult or child. The information given in the public zone could probably be even more stripped down, and become even more detailed and personal in the intimate zone. The user becomes more involved with the application the closer they are. The evaluation of the prototype also showed that the type of preferred media differed between the groups, adults and children. It is possible to say that different people prefer different media, and that is why it is important to adapt the media to the user. To make the presentation more personal more information of the visitor is needed. The type of personal information needed could be where the visitor already has been in the park and what type of media the visitor has been interested in before.

In the fourth study the social media game concept shows how it would be possible to integrate the experience in both the digital and the physical world involving more than one person. Here a media game concept created a new enhancing experience by using media techniques such as a wireless sensor network, social media and applications used both on smartphones and computers. By using the underlying mechanism of gameplay, it is possible to encourage visitors of a tourist attraction to interact with the environment and other visitors, all to facilitate learning and entertaining. The value for the visitors will be the fact that they will learn more about the zoo and the animals and at the same time have an entertaining time together with a group of people. The value for the zoo will be the word-of-mouth marketing of the zoo by having loyal visitors with more knowledge and extensive personal network around them that could attract other potential visitors. The conceptual model of the social media game builds upon the foundations of the internet of things for future versions of tourist attractions, such as the Digital Zoo. In the case of the
Digital Zoo, it will mean that a park like Lycksele Zoo can be kept open all year around. Today Lycksele Zoo has its opening season from May to the end of September, but the animals are active all year around.

7.2 Contributions by this Thesis
The contribution this work gives is of a practical nature by looking at an actual contemporary context, making it an actual case. When creating and designing an application it is necessary to find out more about the users, this is why this thesis is interdisciplinary touching aspects and approaches such as interaction, media technology, social science, and marketing. The work has centred around the Digital Zoo looking at it from different angles, making various cases to investigate the creation of experiences. This can be used in other situations and similar cases to create experiences for visitors.

The contribution is the idea of using a game concept to create new experiences in a tourist attraction. This work shows how a game concept could combine the physical and digital worlds. To create a successful game concept, the social media building blocks should be considered. The concept suggest that to create experiences for different visitors, the information should adapt to the visitors as well as letting visitors become part of the experience with, e.g., UGC. This concept would make it possible for zoos and visitors to expand the UX-timespan to include the time before, during, and after the visit.

7.2.1 Applications with its prototypes
The contact and interview with the Swedish zoos was done by the author. The prototype applications were developed in cooperation with master thesis students from the interaction and design program at Umeå University. The interactive map in Lycksele Zoo was made by Mia Petersson and Jill Jonsson in their master thesis. Then the logging, interviews, and analysis of the data were done by the author. The prototypes of different kinds of applications with UGC and social media were developed by the author. The large screen application was made by Anna Hortell for her master thesis. The development and test of the large screen application were done in collaboration between the author and the student, Anna Hortell.

7.3 Further work
Today a lot of people use mobile media technologies, as smart phone and tablets, in their daily lives. In the future the use of mobile techniques will most certainly increase and expand into new areas that we today cannot imagine. The new techniques seem to easily become adopted by the younger generation. This younger generation is also the new visitors of the future tourist attractions, as the zoo. Therefore, to keep up with its visitors, it is important for the tourist attractions to take this mobile technique into consideration for their future work. To make mobile
and ubiquitous media techniques a natural and integrated component in their activity will make a business as the tourist attraction ready for the future in a good way.

For zoos, the use of mobile and ubiquitous applications integrated with social media would be the future step in developing all the suggested applications in this thesis. The mobile application would give the zoos new ways of coming in contact with their visitors, especially during the visit but also before and after. This kind of mobile applications will give the zoo an opportunity to create an environment where visitors are being able to notice other visitors’ presence and have an opportunity to build a relationship with other visitors, by creating applications involving more than one visitor.

The first steps, of the work that has been presented in this thesis, will be to follow up the interviewed zoos to see how they have developed in the area of using social media and media technologies in their contact with their visitors. All of the prototypes made, need more participants for the evaluations so the results can be analysed in a more quantitative way. To make the application more adjustable to the visitor the technology used should be able to collect and present where the user has been in the park and what kind of media they are interested in. To strengthen the conceptual model of a social media game and verify our ideas, an evaluation of user benefits and marketing possibilities also has to be carried out. Consequently, future development and tests are needed to provide information on how visitors experience the idea of combining traditionally physical places, such as tourist attractions, with digital worlds in edutainment.
8 References


[34] D. Benyon, *Designing Interactive Systems*, Harlow, Essex: Pearson Education


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[105] S. Benford, R. Anastasi, M. Flintham, A. Drozd, Crabtree, C. Greenhalgh,


