Large digital screen as a corporate communication channel

Enhancing the dissemination of information, administration and interaction

Tove Bäckström

18 January, 2018
Master's Thesis in Interaction Technology and Design, 30 credits
Supervisor at UmU: Shafiq Urréhman
Supervisor at CGI Östersund: Björn Otterberg

Examiner: Thomas Mejtoft

Umeå University
Department of Applied Physics and Electronics
SE-901 87 UMEÅ
SWEDEN

Abstract

Public areas are more and more equipped with digital screens that are used to inform or promote a particular product. This is a way to communicate with the people on that area. The idea is to get people's attention, make them read and take in information and possibly buy the product that is marketed. This type of digital display is called digital signage and can also be used as an information channel of a company where information directed to employees and visitors is displayed. CGI Östersund has a screen placed in their office that works as such an information channel.

This thesis is about investigating and analyzing the current presentation and creating a new solution with a custom interface that will be more effective and engage more people.

The new solution is interactive and clickable with the help of a mouse. A user study has been done using a Kinect sensor to see how many people are watching the screen, how long they look at the screen and from what distance. This data was also supplemented by a survey sent to the employees at CGI Östersund. The result of the user study shows that there was no significant difference between the previous solution and the new one. This may be due to two main reasons: the lack of time in which the experiment was performed and the location of the digital screen that is not currently optimal.

Contents

List of Figures

Chapter 1

Introduction

Large public displays are devices that we are all observing lately. They appear in places frequently, because it is an effective way to reach out with information towards audience at a specific location [1]. The purpose is to get peoples' attention and deliver targeted information to a group of people. It can appear in shopping centers, out on the streets, on different kinds of stations, buses, trains, and so on. Public displays often have a purpose to market a product or service to increase the value. This type of advertising is called digital signage, they could be non-interactive or interactive [1].

Large displays also appear in other environments such as offices and thereby act like a communication channel to visitors and employees by distributing information. This is an eminent way to reach out to all the employees and visitors at the office. This is a way to make the employees feel identified with the organization and leads to involvement and motivation to make a good job, provided that the audience are receiving and remember the information [2]. Varied and relevant information is provided to achieve this.

A known phenomena called display blindness, was first mentioned 2008 in a study conducted by Huang et al. [3] when it became clear that peoples attention to public displays was low, glances at displays lasted in 1-2 seconds and there were a few persons that looked at the display. This phenomena was a springboard for further studies about audience behavior towards public displays.

This thesis is about developing a new digital solution for CGI Östersund's large digital screen located in their coffee room. The project comprises content design, an appropriate interface adapted to CGI Östersund's requisites and an interactive solution. The digital screen in their coffee room is displaying information about new members, upcoming events, contacts to responsible for work environment, in case of emergency, information about cleaners and janitors and

also information about projects with employees working towards different customers.

1.1 Objective

The objective of this study is to analyze the current digital presentations effectiveness, and create a new solution for the digital screen for the members of CGI Östersund and their visitors that will engage the audience and make the administration more effective. The challenges in this thesis are to create a digital solution that is more effective and engage more people than the current presentation.

- How to create a more effective solution that engage more people?
- What is relevant information to distribute in a digital solution in the coffee room?
- Can a solution with interactive interface make the audience more interested and engaged?
- How to create an effective solution to administer the content on the digital screen?

1.2 Limitations

The time limit to do this thesis is 20 weeks. Therefore, the focus have been on the content, the design and functionality of a new solution. The administration is not designed and implemented.

1.3 Thesis outline

The structure of this report is as follows. Chapter one contains an introduction to the subject, problem description and objective. Chapter two describes the background about the subject and current solution. Chapter three is about understanding relevant information about public displays, engagement, content and earlier work. Chapter four describes the used method for this thesis, including the user study. Chapter five presents the results from user study and the final prototype. Chapter six contains discussions about all states in this project. Chapter eight conclusions from result and lifts future work about this area.

Chapter 2

Background

This chapter introduces CGI and the current solution of their internal digital screen. This chapter also introduces earlier work concerning experiments with public displays and user engagement.

2.1 About CGI

CGI is one of the largest independent IT and business process services company with 70 000 members and exists in 40 countries. The employees on CGI are globally called members. CGI Östersund have about 140 members and is a global delivery center (GDC) and operates like a "cost center" to assure that the business is transparent and competitively neutral between all regions. The regional unit is business owner and GDC deliver parts of or throughout the service that have been agreed. Their business idea is to deliver cost effective and qualitative services in application management and application development. The members on CGI Östersund are consultants but all of the consultants are working in the same house, and do not work at customer level.

2.2 Problem statement

The digital screen located on the way into CGI Östersunds coffee room shows a PowerPoint presentation. The quantity of content is different every week, but the standard is about 40 different slides. Each slide is displayed for about ten seconds. The digital screen is a complement to information that is available in other information sources like the company intranet, news letters to the members of the company and in the internal mail. The main purpose of the

digital screen is to remind members about important information. The presentation have white background with texts and graphics from CGIs graphic profile.

The content is largely the same every week, there are about 3-5 slides that are updated or changed every week. Much of the static content is available on other sources in the internal network. The administration of the screen is not so productive, the presentation is modified on a computer and uploaded to dropbox, then the administrator needs to go to the screen and start the presentation on the Minix Android player connected to the screen. The screen is located on the way into the coffee room by some armchairs in a corner. The office has two entrances on each side of the coffee room. Therefore, the digital screens location is not optimal. The ones that have their work space on the other side of the office maybe not pass by the digital screen regularly.

2.3 Earlier work

When creating a digital signage solution it is important to consider the audience. There have been a lot of studies about user attention, engagement and behavior towards public displays. The evaluating methods varies, the location have been in real-world and in lab. Alt et al. [4] have created guidelines for evaluating public displays and they are based on a literature study. The emphases of the guidelines lays on the importance of content, audience and common problems. Testing a display with different content would be a good idea. It is important to analyze how people behave in different locations where public displays appear. A common problem with public displays are peoples expectation towards the content and that people does not understand whether a public display are interactive or not [4].

Different stages of engagement of interactions was evaluated using a public display in a train station. The display was showing a campaign with purpose to make people more aware of Cardio-Pulmonary Resuscitation (CPR) and cardiac arrests. The goal was to make people notice the interactivity, interact with the public display and the final state was to visit a website, embedded in the public display. The experiment was made with a Kinect camera to get quantitative data and interviews to get qualitative data. To get the audience attention a mirror-prototype were used. When people passed by, the screen showed a silhouette of the passers-by. The conclusions were that interactive displays are effective at capture attention, but may not always make the audience stay to the final state, in this case: to visit a website [5].

An experiment where information on a public display is personalized when interacting was conducted in a study by Kurdyukova et al. [6]. Three interacting techniques where used when collecting data: Mobile-interaction, body-interaction and direct-interaction. The study presents some critical aspects to

consider when designing for personalized information on public displays. Some of the findings were that users prefer mobile-interaction because they do not want to show their interaction in public and they were able to choose their position. Body-interaction and direct-interaction made the users uncomfortable because they needed to show their interaction and stand close to the screen.

James She, et al. [7] proposes a model for more effective advertising through public displays. The model is split in three key decisions: Attraction, interaction and conation. Attraction is the stage when users become aware of the display and the actions that they perform before interacting with the display. Interaction is when a user gives an input to explore available content on the display. Conation are the actions the user perform after interacting with the display, if the goal is to sell a product, the conation is that a user actually by the product. The research concludes that a smart phone interaction enhance the effectiveness in advertising through public displays.

Chapter 3

Theoretical Framework

This chapter is about understanding public displays, user engagement and the power of content.

3.1 User Experience and Engagement

In human-computer interaction the term user experience (UX) have become more common. User experience can be defined as: users consequence of their expectations, needs, motivation and mood, the usability, complexity, functionality of the designed system and the context where the interaction happen [8]. Engagement in the context of digital media is a concept which is hard to explain. There exists many different definitions. O'brien at al. [9] have defined engagement as: the quality of user experiences with technology that characterizes challenge, interactivity, aesthetic and sensory appeal, novelty, feedback, awareness, perceived control and time, motivation, interest and affect. This means that user engagement can be defined as the quality of UX, therefore the concepts are closely related. O'briens et al. definition emerged through literature study combined with exploratory about online shopping, game applications and web searching. O'brien, at al. [10] did a survey to measure user engagement. They were testing the reliability and validity in online shopping and the relationships among six attributes: perceived usability, aesthetics, focused attention, felt involvement, novelty and endurability. In conclusion, they find that attributes of engagement are closely related as interaction variables.

We can think of engagement as consequence of how a person feel about a magazine/TV program/Mobile app that he or she consume, does he or she recommend it to others and what are the feelings when it does not exists anymore? Engagement is about feeling connected and involved to something. In this case,

the engagement is about feeling connected to the content on the digital screen [11].

Engagement towards digital screens in public spaces can be divided into passive engagement, active engagement and discovery [12]. Passive engagement is about observing the environment and what others do, a more relaxed way of engagement. Active engagement is about challenging people in the public environment, this can lead to social interaction between people. The discovery state is about collecting new experiences through new features.

3.2 Digital Signage

There exists a lot of different definitions of digital signage (DS). To describe DS we can think of a digital screen that can be thin, and come in many sizes that are displaying digital content that are changing constantly and provides refreshed content. DS is often connected to the internet and a PC to be able to deliver up-to-date information. Lyle Bunn[1] a sign industry expert have defined digital signage as

> A network of digital, electronic displays that are centrally managed and individually addressable for display of text, animated or video messages for advertising, information, entertainment and merchandising to target audiences [1].

DS is used to deliver targeted information to persons in a specific location at a specific time. The most common DS are used for advertising a product or a service. Newman, et al. [13] examines how consumer behavior in shopping malls could be improved by DS. The qualitative research was made in three different countries and the result was that DS with relevant information, pleasant sounds and scenes can be useful for consumers. The negatives were very few. In another study Dennis et al. [14] found out that DS affect the customer experience and strengthen the customers process route. It is important to generate loyalty due to the effect of advertisements on DS is stronger for persons that discover the advertise for the first time. The conclusions comes from a survey based field experiment [14].

The non-commercial DS could also be called digital display and the purpose can be different than the commercial DS, for example to provide people with travel information, educative information for students or inform employees on a company [1].

Display blindness is a known challenge where people pay a little or no attention at all when passing by a public display. Studies have been made in different locations such as banks, libraries, museum, coffee shops, grocery stores, universities, travel stations etc. The content on the displays have varied between important

[1] http://www.lylebunn.com/digital-signage-strategy.php

information related to specific location, but also entertaining information such as fun facts. The result have showed that not many people are looking at the display at all and that only a small amount of passersby are glancing at the display, and only for a very short time [3, 15, 16]. The expectations from the creators of DS assume that the screen will get the audience attention. But because of the high amount of public displays today the audience have an ability to ignore the digital screens. This is because of the low expectations of content. The creators of the screen and the environment the screen is placed in is crucial when it comes to expectations [16]. Therefore, the audience expectations about the content is important when creating a DS system. If the audience do not have any expectations they will not even look at the display. One way of making the audience pay more attention to public displays is to make them interactive and invite the audience to interact with the display.

3.2.1 Administration of Digital Signage System

A lot of DS systems are administrated through a content management system (CMS). The most famous content management system is WordPress[2] and could be used for a lot of different web based pages. There exists a lot of other CMS-solutions for DS systems, but the most of them are available for a monthly purchase and they are not easy to adapt to specific requests for administration.

3.3 Interactive digital signage

There have been studies that interactive DS engage people more than non-interactive DS . Interactive DS is more useful, than the traditional DS, because interactivity increases users ability to remember [17]. Different types of interactions are through smart phone, buttons, touch-screen, user gestures through camera and multimodal interaction.

Touch screen is an effective way to let the audience interact with the DS. Touch screens are now almost more obvious than non-touch screens. However, the challenge is yet to create a creative solution to invite the audience to touch the screen, otherwise the touch screen is worthless. Multi-touch is is to prefer for large screens in public places, to let multiple users use the display at the same time. Multi-touch does also give a more intuitive and more natural interaction [18].

To navigate a DS by using a smart phone is a way to invite the audience to interact with the screen. To interact with a digital screen by using a smart phone the users can scan a QR-code to connect to a website. Another way is to use their smart phone like a remote where the users can navigate through

[2]https://wordpress.org/

the content on the screen with their smart phone. This type of interactive DS is used in a study by Masuko et al. [19]. They let users read and save favorite products in a shop, where multiple screens could be found on the wall and the purpose was to give the users a novel shopping experience. Smart phones can also be used to update the content on a DS, by creating a real-time application for controlling and updating the content [20, 21].

Multimodal interaction is interaction through natural modes of communication for both input and output. Users can be more flexible and free to use their five senses to interact with automated systems, such as voice, handwriting, body gestures. Multimodal interfaces have two major groups of input. One that have alternate input methods and one that combine input/output. The most common input method that combine input is the traditional mouse, keyboard and a display.

3.4 Content Design

To create an effective solution of a digital communication channel, relevant content is important. To create relevant content, the most important thing to consider is the audience [22]. The location of the display is important, and to identify if the audience are passing-by, waiting or actively reading. The distance and height of the screen is also important. The content has to be up-to-date otherwise the screen could lose interested audience [23].

Huang at al. [3] made a summary of recommendations for designing large public displays. The findings are as follows: the time for receivers to determine whether the screen is interesting is very short. Informative content that is most important should be determined in 2-3 seconds. Two or three sentences are not likely to be read, therefore it is good to use minimal text. The position of the display should be close to eye-height, they are then easier to detect for passersby. About the content it is important to have dynamic content, to keep the audience attention. Give the audience some control over what information that is showed and do not change content abruptly. To catch the audience eyes consider the environment, is there other objects in the area that draw attention instead of the display? Also consider the audience behavior: direction and movement of people in the environment.

3.4.1 Information overload

Internet consists of a huge network of information and it have been increased in relation with the digitization. The internet exists around us, in our phones, laptops and tablets and are very easy to access. The availability of information on the internet have increased humans ability to sort out important information, because as the relevant information have increased the non relevant information

also have increased. The growth of available information is called information overload. It can be a risk that the receivers does not perceive the important information due to the large amount of information and it can produce stress at the receiver if the person always become a target for large amount of information[24].

3.5 Corporate communication

Corporate communication is important for building strong relationships among employees. Strong relationships is crucial for employees to feel motivated and involved in the organization. Engaging employees elevate the loyalty and productivity. By connecting people via internal communication channels, sharing knowledge and spread information employees can feel engaged with the company, and the process of management decisions [25].

Chapter 4

Method

This chapter describes the method that was used to develop a new communication concept for the digital display at CGI Östersund.

4.1 Design process

The design process that was used in this thesis is based on UX process life cycle from The UX book [26]. It contains four activities: analyze, design, prototype and evaluate, see figure 4.1. This life cycle does not need to be used strict, and the activities can be iterative.

Analyze - is about to understand the user behavior and user needs. This phase consists of contextual inquiry, contextual analysis, user needs and requirements and design-informing models. Contextual inquiry is an activity to gather information of user behavior for the purpose to understand how users work in a specific context. Contextual inquiry contains interviews and observations of users in a real-world scenario. Contextual analysis is about interpret, consolidate and communicate the gathered data in previous step. This can be done by building a flow model, synthesizing notes or Work Activity Affinity Diagram. User needs and requirements are about bridging the gap between analysis of existing system and a new design of a new system. Design-informing models are used to inspire the design, for example persona, scenarios, story boards [26].

Design - the design phase consists of design thinking, conceptual design and design production. Which includes ideation, sketching and describing what a system is, what it does and how it works?

Prototype/Implement - this phase is about getting an early and easily changed model for the interaction design. A prototype can be made in lo-fidelity,

medium-fidelity and high-fidelity prototype.

Evaluate - evaluation is a way of testing the solutions UX. This is valuable for refining the prototype as soon as possible. UX-testing is about measuring the user experience by collecting data that is both quantitative and qualitative. To collect quantitative data counting clicks, errors or time can be good parameters to use.

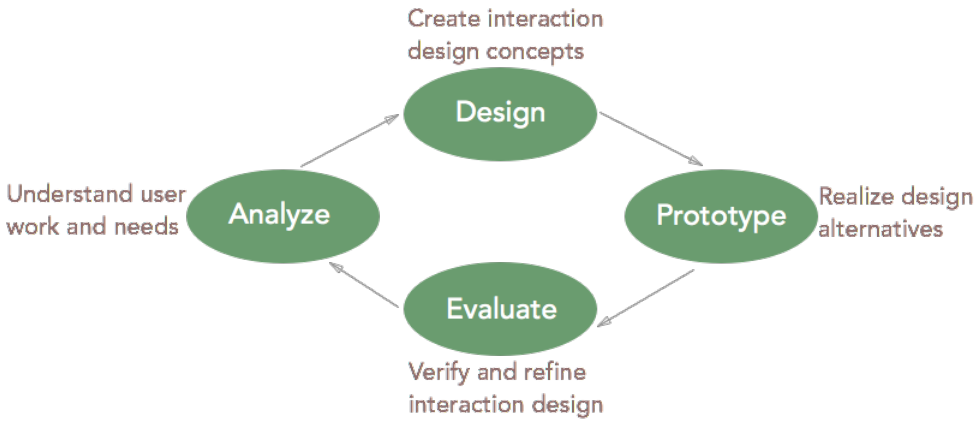

Figure 4.1: Description of the used design process [26].

4.2 Analysis state

This state is about understanding users behaviors and needs. During this thesis the analysis method was made with literature study, interviews with content providers and a card sorting session with a post-survey among possible users.

4.2.1 Literature study

A literature study was conducted to get more knowledge about public display. That includes advertisement, like DS, user engagement against public displays, how user engagement can be measured and different technical opportunities to create a DS system and content management systems (CMS) as a tool for administrate the digital signage. Literature about content design, corporate

communication and what is important when creating such a solution was also used in the literature study.

4.2.2 Interviews

Interviews were conducted to get some qualitative data to understand the information running on the screen today. Interviews are a good method for understanding peoples experiences, attitudes and opinions [27]. Much of the content in today's presentation in also available from other sources like internal website, mail, meetings and also paper on walls in the office. The purpose with the interviews was to understand the strategy of selected content for the digital screen. The interviews were individual with an administrator and an consultant manager on CGI Östersund. The administrator is responsible for updating the content on the screen and the consultant manager, together with other managers, are responsible for the information shown on the digital screen.

Interviews can be structured, semi-structured and unstructured. Structured interviews is similar to questionnaires. The questions are read exactly as constructed, to every participant. The answers should be comparable among participants and can possibly be quantified. To conduct qualitative interviews it is better to not use structured interviews, because not structured interviews are more flexible [28]. Semi-structured interviews does not have as structured questions as structured interviews. The questions could have supplementary questions, where the interviewer could steer the dialogue depending on the answers. Unstructured interviews have a little structured questions. The method for the interviews in this project was semi-structured interviews because the questions was not read exactly as structured and not the same to both of the participants.

4.2.3 Card sorting

Card sorting is a method where participants can sort, categorize and label information. It is a good method for example structure information on a website. As a constructor you have topics on cards either on post-it or using an online tool. Participants can help you to cull relevant information, label categories and build the structure of content. It will help you to understand the audience expectations and understanding of the content.[1] There exists three types of card sorting: Open card sorting, closed card sorting and hybrid card sorting[2].

Open card sorting - which means that the participants can create their own categories and cards, and label them. It is flexible for the participants, new

[1] Card Sorting https://www.usability.gov/how-to-and-tools/methods/card-sorting.html

[2] Different types of card sort https://medium.com/design-ibm/card-sorting-a-powerful-simple-research-method-9d1566be9b62

terms can appear and you can understand the participants relationship to the topics, but it is harder for the constructor to evaluate the result.

Closed card sorting - means that the cards and groups already exists and they are labeled. The participant are not allowed to modify the cards, groups or labels. This method is good for evaluating when the concepts already have been established. With this method it is easier to see a grouping pattern in the results.

Hybrid card sorting - starts with closed card sorting, but the participants are allowed to modify labels and groups by changing label or creating new categories. As a constructor you can decide whether the participants should be able to create new cards or suggest missing content.

The chosen method in this thesis was hybrid card sorting, where the participants were not allowed to create new cards, but they were able to create new categories/groups, and label them or modify the existing categories. The investigation had a post-survey where the participants could comment if there was something that was difficult or easy to sort and why. The card sorting session was made with a card sort online tool called Proven by Users[3]. The participants was eight employees of CGI Östersund with different roles.

4.3 Design and prototype state

This state is about design thinking and how the system works, in this state the sketching and idea generation was founded [26]. The ideas was generated from the interviews with the administrator and the consultant executive, the card sorting session with members on CGI and the literature study.

Design and prototype state contains sketching with pen and paper, low-fidelity (lo-fi) prototype and high-fidelity (hi-fi) prototype. The chosen tool for a hi-fi prototype was Framer[4]. This tool is for creating interactive prototypes and was chosen because it has a large amount of documentation and it has a design state and code state. The code state have great descriptions about how to create animations and events. The prototype was used in the half-way presentation on CGI Östersund. The colors and fonts that are used in the prototype is from the CGI brand guide, see figure 4.2.

4.3.1 Presentation

Just over halfway through this thesis a presentation was held for a few members on CGI Östersund. The presentation had a purpose to involve more people in the project and it was an opportunity to get feedback on the new solution. The

[3]https://www.provenbyusers.com
[4]https://framer.com/

Figure 4.2: CGI color palette used when designing the new solution.

presentation was made with a PowerPoint presentation containing information about what has been done so far. At the end of the presentation, a demonstration of an interactive prototype was made. The feedback from the presentation was used when implementing the final prototype.

4.3.2 Tools

Reveal.js[5] and Webslides.tv[6] are two open source web based presentation tools that have different built-in functions. Both tools could be extended with custom functions. Slides.com[7] is a tool that is powered on the Reveal.js framework. Slides.com is for editing themes, sharing presentations and so on. It has its own interface for creating and editing the slides. In Slides.com it is also possible to edit HTML and CSS.

Prezi is another presentation tool that is supposed to be more engaging, persuasive and more effective than PowerPoint.[8] Prezi was something that CGI Östersund already had tried for their digital screen and it was not that appreciated as believed.

There exists a lot of different presentation tools and DS tools. Most of the tools requires subscriptions with monthly payment.

[5] http://revealjs.com/
[6] https://webslides.tv/
[7] https://slides.com/
[8] https://prezi.com/the-science/

4.3.3 Implementation

The final solution was implemented with a framework based on HTML called Reveal.js. This framework has embedded functions as auto-slide, progress bar, controls for navigating, nested slides and more. This framework was chosen because of open source, much documentation, could be integrated with Slides.com and could be used with Django-CMS and Wordpress. Django-CMS is a content management built with Django that is a web framework based on Python.

4.4 User study

To evaluate the suggested solution a user study was conducted for measuring the audience engagement and efficiency against the digital screen. The parameters that were used in the experiment were users that are watching the digital screen, for how long time, and the distance from the reader to the screen. The parameters time and persons watching the screen were also used in a questionnaire, to compare the two results. This method was chosen for evaluating the prototype because the interesting thing to investigate is how the audience behave towards the digital screen in the wild. If the digital screen is catching the users attention, for how long time they are reading on the screen, and see if the audience feel motivated to interact with the digital screen.

The user study contained a questionnaire and a measurement conducted two different times with two different solutions on the digital screen. So the first measurement was with the current solution and a questionnaire was sent out by email when the experiment started. This measurement lasted for a week. When a new solution was finished an email was sent out when the experiment started and after one week an almost similar questionnaire was sent out again. The purpose of the questionnaires was to complement the Kinect data.

Engagement is how a user feel about a product or system. Motivation, interest, attention and time are central concepts for engagement [9]. They are parameters that could be used in the user study. The time and attention is measured by a Kinect sensor. In the questionnaire questions about remembering information from the screen were questioned, also if the digital screen was opening up for discussions between other members or visitors.

4.4.1 Current solution

The study began with the current solution made with PowerPoint. A questionnaire was sent out to the employees on CGI Östersund where the questions were about, how often they watch the screen, for how long time, when they were watching the screen and what the last they read on the screen were? The

questions can be found in Appendix A. At the same time a Kinect sensor was set by the screen to measure the audience behavior.

4.4.2 New solution

A new interactive solution was created, to measure the difference between the current solution and a new solution. The new solution was implemented with a presentation framework based on HTML called Reveal.js[9]. This framework has embedded functions as auto-slide, progress bar, controls for navigating, nested slides and more.

4.4.3 Kinect sensor

To measure the audience engagement a 360 Kinect sensor was used. The Kinect was implemented with an openCV library[10] and the language chosen was Python[11]. The program did measure the audience that watched the digital screen, for how long time and the distance from the person to the Kinect. The library contains algorithms for face detection, track movements and more. The sensor was placed under the digital screen and was connected to a computer that saved the data in a comma separated values file. The log file saved a timestamp, detected face, and distance. The data was later analyzed by a small script.

4.4.4 Participants

The users in this study were members on CGI Östersund and also visitors on the office. The questionnaire was only sent to the members on CGI Östersund. The members are about between 24-65 years old and about 1/6 women. The participants of the Kinect sensor experiment were all persons that moved inside of CGI Östersunds premises at the time.

4.4.5 Questionnaire

A questionnaire was conducted during the experiment. This was to measure the difference between the audience expected behavior and the real behavior, to prevent any bias. The questionnaire created with Google form was sent to the employees by mail. The questionnaire can be found in the appendix A.

[9] http://revealjs.com/
[10] https://opencv.org/
[11] https://www.python.org/

4.4.6 Limitations User Study

During the experiment the Kinect sensor was visible and the members of CGI Östersund knew about the measurement, this is because the members needed to know that an experiment took place, and that their behavior was saved in a file. This is a factor that could affect the result. The Kinect sensor does not recognize if the same person watches the screen again, every face detection was unique.

The time the experiment took place was limited. The new solution should be measured for a longer time to get better results due to that users might be interested just because of a new solution. But this was not possible due to the time limit.

Another limitation of the user study was the location of the Kinect sensor. It was placed under the screen and there are armchairs placed by the screen. This means that persons that have been sitting in the armchairs might have looked at the screen but not been detected by the sensor.

Chapter 5

Results

In this chapter the results from the analysis including the interviews, card-sort session, the design state and the resulting implementation is stated. The results from the user study is also included in this chapter.

5.1 Results Interviews

The interviews gave information about the content on the screen today and gave understanding of the strategy for the information on the digital screen.

5.1.1 Interview Administrator

The findings from the interview with the administrator were that the content on the current digital screen is updated every week, and the time spent for updates are approximately fifteen minutes. The time every slide is shown are ten seconds and it is the administrator that chose the time for the slides. The information on the screen is also sent out on e-mail to the members except the information about project and members. Certain information is also on the walls on the office. The administrator decides partially what content that is shown on the digital screen, she is a part of the management group and participate in meetings where upcoming events and meetings are scheduled. After meetings she decides what information is appropriate to show on the screen. When there for example starts new members she gets help from a consultant manager. Every time the content is updated the new presentation is uploaded to Dropbox and she must go to the screen and start the presentation there.

5.1.2 Interview Consultant Manager

The result from the interview with a consultant manager was that they do not talk about the content on the digital screen, except from when there are new members' that are going to be placed in different projects. The content strategy in his opinion is to reflect what is important locally on the office, special events, spread knowledge and spread information about members in different projects. Much of the information on the digital screen also exists on the internal web and email. But he says that there is no easy way to find information about different projects and members except for the managers. When showing information of different projects is important to consider if there are any security-classified information.

5.1.3 Summary Interviews

To summarize the interviews there are not so much time spent on the digital screen today. Discussions about the content happens rarely. Much of the information on the screen exists in other channels such as email, internal web and on walls on the office. The only information that the members do not access to is information about current projects and the projects members. The description of every project is vague but this is because the managers do not discuss what information is safe to show and not.

5.2 Results Card sorting

The result from the Card sorting session collected both quantitative data and qualitative data from possible users.

5.2.1 Quantitative data

Hybrid card sorting method was used in this investigation. The created groups had the labels: Welcome to CGI, News, Upcoming events, Workplace information and social but translated to Swedish. These groups' were made considering the content that exists on the digital screen today and the cards that were used in the card sorting was also from the existing content on the screen of the CGI office. There were eight participants that participated in the card sorting and the post-survey via a URL-link to an online tool for card sorting, called Proven By Users[1]. The result of the card sorting session is shown in figure 5.1. This result was used when creating the new solution for the digital screen.

[1] https://www.provenbyusers.com

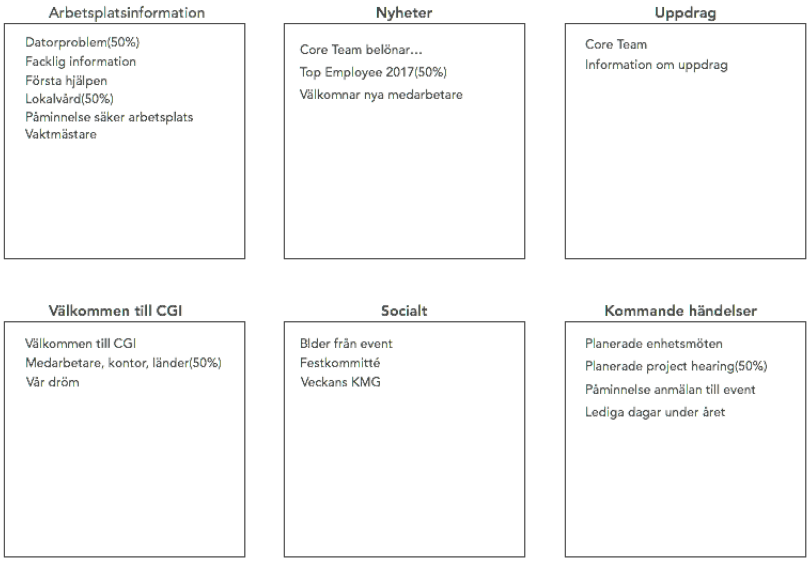

Figure 5.1: Result from card sorting session: What the majority chose to categorize and in which group

5.2.2 Qualitative data

The card sorting session had a post survey where the participants could answer questions about cards that was hard to categorize and easy to categorize and why it was hard or easy to place in groups. This was also a opportunity for the participants to comment the cards and groups. One finding was that the card project hearing seems to be an event that only comprises a small part of the members of CGI Östersund. The labels on the groups was not changed and the comments were that the labels already was good. One comment from the card sorting session was:

" *What I was confused about was the distribution of information between internal network and the digital screen. I landed in prioritizing information that is currently relevant (meeting this week etc.) as well as information aimed for new members and guests.*"

The used content for the final prototype was information that more than 50 percent of the participants chose. And information that could be interesting for visitors. The participants in this research were members of CGI Östersund and did not contain visitors.

5.3 Result design and prototype

The first sketches to the new solution had a fixed navigation menu to the left, and the content associated to each page was supposed to be to the right. The idea was also to make a solution where a user could search for specific information. In figure 5.2 the first sketches is shown.

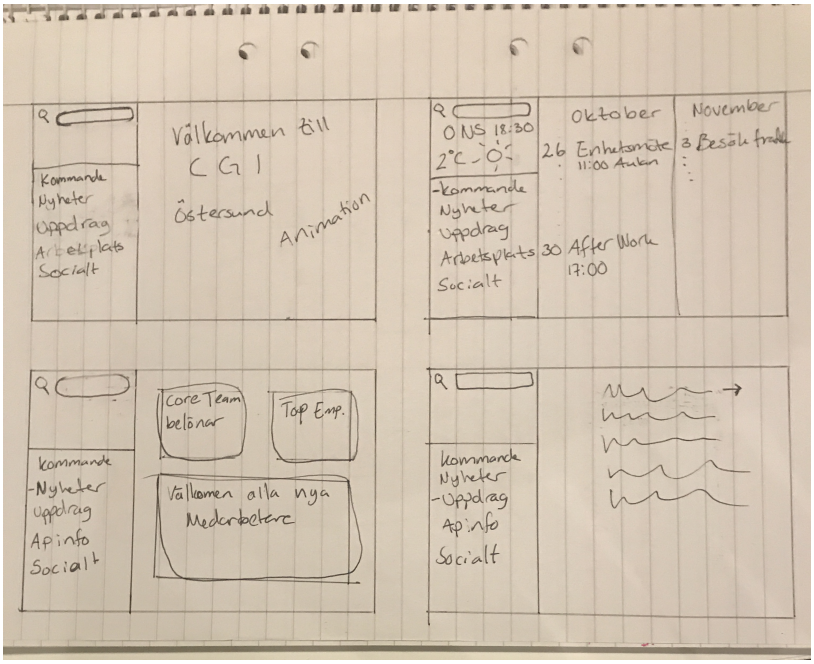

Figure 5.2: Sketch of a new solution for a digital screen at CGI Östersund, where the menu is to the left and the content to the right.

The design of the prototype emerged through the card sorting session, interviews and literature study. The prototype was made interactive because interactive solutions should make the audience remember the content better which leads to a more effective communication channel. The Hi-fi prototype design contain a menu with navigation, two level hierarchy with top pages and subpages. The menu is place at the bottom of the screen instead of the left as in the sketches. This was changed because the content did not look as collapsed as in the sketches, and the menu was placed in the bottom because if this solution will be used on a touch screen in the future, the users do not need to obscure the screen when navigating.

The prototype contain six pages with the titles: Welcome, Events, News, Projects, Workplace and Social, translated into Swedish. These six pages comes from the card sorting session with the audience. Some pages have clickable options to read more on a subpage. The prototype have a hierarchy with two levels. Figure

5.3 shows the structure of the navigation in the new solution. Each page has different variety of subpages. For example the page of projects has about 15 subpages at the time but the amount could change over the time.

The figures 5.4, 5.5, 5.6, 5.7 and 5.8 shows some pages from the Hi-fi prototype created with the tool Framer.

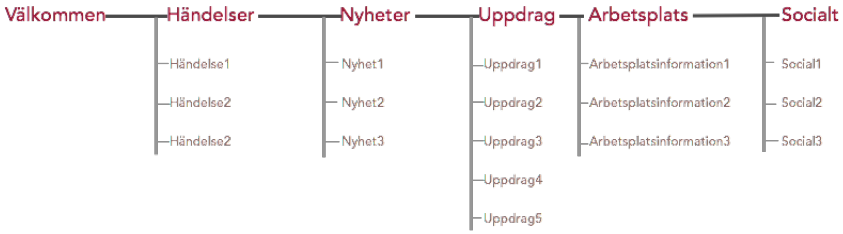

Figure 5.3: A visualization of the resulting solution navigation structure in Swedish.

Figure 5.4: Prototype of the welcome page.

Figure 5.5: Prototype of the upcoming events page. Where the orange cards are clickable to read more about each event.

Figure 5.6: Prototype of news page. Where the orange cards are clickable to navigate to a separate slide with more information.

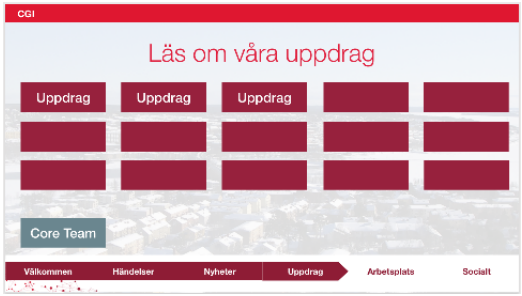

Figure 5.7: The page with projects where the projects are listed. Each project is clickable to read more about a project and its members.

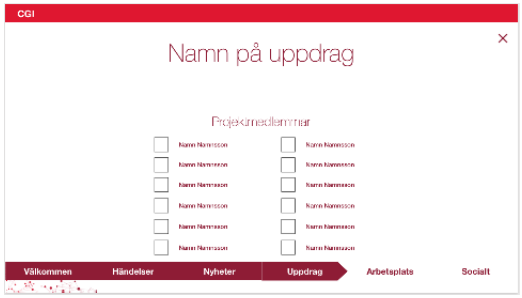

Figure 5.8: One subpage from a project where all the members in the project are listed.

5.4 Result Implemented Solution

The implemented solution is a little bit different from the prototype. One thing is that the navigation arrow is removed in the final implemented version. This was because of the feedback from the halfway presentation on CGI Östersund. The arrow could be confusing because it looks like breadcrumbs that have a

main purpose to display a hierarchy, which was not the purpose in this case. Some colors on element and texts was changed. The implemented solution was submitted with help of the administration on CGI Östersund to know that the information on the new solution was up to date. This also changed the implemented solution, due to the news for example. The time the new solution was set up on the office, there was no relevant news up to date. The figures and text used on the implemented version was also created with the administrator. All the top-pages had the same background and it is an image of Östersund with a white filter. All the subpages had white background.

The functionality is that the solution is running from page to subpages then to the next page. The time set on the implementation is for ten seconds, but this is a configuration that easy can be changed and also adapting the time for specific slides. Some pages does not show all the subpages. This is a configuration in Reveal.js and some implementation in JavaScript. This solution is to satisfy both active and passive users. When a user starts navigating with the mouse the presentation stop the auto-sliding. This is because the presentation should not continue when a user interacts with the presentation. When a user stops navigating on the presentation, the auto-sliding starts again after an amount of seconds chosen by the administrator. The way the presentation is running can be changed depending on which information is important for the nonce. For example, the workplace information does not run through the subpages, this is because these subpages is static, always the same information. If someone wants to read about the subjects the option is to navigate there.

The idea is that the solution should be easy to adapt to changes, dependent on the information that is relevant at a specific time. Also the time for auto-sliding and which slides that is going to show in the auto-slide and which slides that only shows when user clicks. The prototype contains links to different pages in the menu at the bottom, each subpage have a cross in the upper right corner and if a user clicks on the cross it navigates back to the top page. The prototype also have a play and pause button and arrow controls. The arrow controls are built in function from the framework Reveal.js and let the user navigate both horizontal and vertical. The horizontal navigation navigates through the pages in the menu, and the vertical navigation navigates between the subpages. If the page does not have a subpage, the arrow is not clickable and the color is changed. Another built in function in the implemented version is a time line in the bottom so that the users can see how long time it is left before the presentation starts over. Instead of the arrow in the menu in the bottom, the top page is highlighted by a lighter color when each top page are active.

5.4.1 Welcome page

The resulting welcome page shows a header with a welcome text in Swedish, a text with CGI's dream, the amount of members, offices, countries and customers globally, see figure 5.9. It also contains an image with a world map, where the

countries are highlighted in red. This page is to make the visitors and members feel welcome, and also get a feeling of how big the company is. The welcome page does not have any subpages.

Figure 5.9: The final prototypes welcome page.

5.4.2 Event page

The event page is listing all relevant future events for the members on CGI Östersund, see figure 5.10. It can be meetings, lectures and other events on the office or outside the office like after work, or Christmas dinner. Each clickable event on the page show the date and time, for more information the user can click on each event. The information in the subpage is similar to the information that is sent out in an email and provides more information about the event.

Figure 5.10: The final prototypes event page, here are relevant meetings and happenings listed.

Figure 5.11 shows an example from a subpage. This subpage belongs to the event page and shows information about an upcoming meeting.

Figure 5.11: Social page of the final prototype, containing three clickable choices that navigates to subpages.

5.4.3 Project page

The project page shows all the current projects on CGI Östersund, see figure 5.12. Every project have a subpage that shows a short description and the members in each project. From the project page it is possible to use the mouse to navigate to a specific project. Otherwise the presentation is running through all the projects on CGI Östersund. This information is not easy accessible on the intranet, therefore it is important to show it on the digital screen. This is a feature that also could be interesting not just for members, for visitors and new members as well. Each subpage contain a short description about the project, a list with pictures, names and roles on each member in the specific project.

5.4.4 Workplace page

Here are useful information showed concerning the workplace, like safety information about leaving security classed documents on the desk, information about responsible persons in case of fire, safety representatives and union information, see figure 5.13. This information is updated rarely therefore this page does not auto-slide to the subpages.

Figure 5.12: The project page where all current projects are showed. All the projects are clickable and navigates to a subpage where more information of each project is shown.

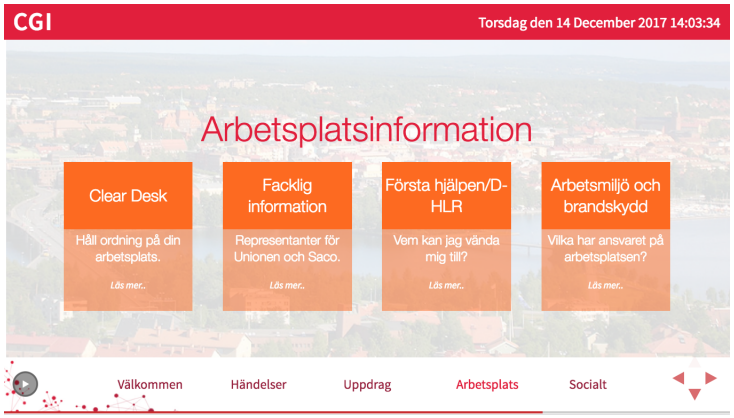

Figure 5.13: The work place page that have four clickable options, that navigates to four subpages.

5.4.5 Social page

This page is for showing information and/or pictures from events, here are also the persons in the party committee presented, see figure 5.14. A list with the different groups responsible for the kitchen the current week are shown in a sup page of the social page. In the final solution the auto-slide is running through the subpages, this is because these pages are updated more often.

Figure 5.14: Social page of the final prototype, containing three clickable choices that navigates to subpages.

5.5 Result User Study

The user study was divided in two parts, one part for measuring the current solution and one part for measuring the new solution. A comparison was made between the two parts. Each part consists of a questionnaire and data from the Kinect sensor.

5.5.1 Current solution

This section presents the result from the experiment while the ordinary PowerPoint presentation was running. The experiment was running for five days, Monday to Friday.

User questionnaire

There was 57 persons that participated in the questionnaire about the current solution on the digital screen. Average time a person watches the Digital screen according to the questionnaire is 11 seconds. And the maximum time is over 60 seconds. The time the participants were looking at the screen according to the questionnaire is shown in figure 5.15.

The questionnaire also gave some qualitative data. Questions about discussing the content with colleagues and visitors, when the audience is watching the screen, what the last they read on the screen and other comments. There was 15 of 43 that did not remember the last thing they read on the digital screen. The ”other comments” field provided much information about the content on

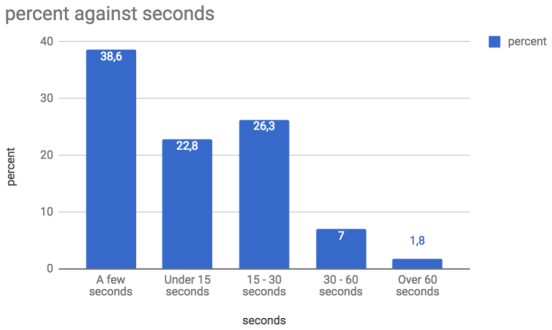

Figure 5.15: The time in seconds users watching the screen according to the questionnaire.

the screen and also suggestions about location and quantity of screens. Some of the comments are listed as follows:

"*The text is running too fast, or i might read slow.*"

"*I use to glance it when a pass by, it is only when I see something new I stop and read, therefore I do not watch so often.*"

"*It feels like an unnecessary feature, the information could lay on the internal network instead.*"

"*The screen is not placed on a natural place. Usually you just pass by, if you stop right there it feels like you standing in the way.*"

"*It is a good information channel, but the "cycle" has to be short, you do not want to wait to long to see all slides.*"

"*If the screen was moved inside the coffee room, i think more should watch. And also if there was multiple screen, one in each corridor.*"

"*Relatively uninteresting right now. Could be more interesting with more current items, but it costs work and support for the worker, to provide information while it is still interesting. The workers does already have much to do in their projects.*"

"*The level of the content. Which are include in which project can be on the intranet. Better to provide information about routines in the office - today's kitchen managers and upcoming events. I would like if it acted like a rolling news update with short information about what is going to happen.*"

User behavior

The average time for the audience watching the screen according to the Kinect sensor was 1,85 seconds. And the maximum time was 33 seconds during a time span of five days and the amount of detected faces was 660. It is about 132 persons each day. Figure 5.16, shows the time the audience watched the screen according to the Kinect sensor. The stack "a few seconds" is counted as 5 seconds or less. "Under 15 seconds" is between five and 15 seconds. In table 5.1, the resulting data from the Kinect sensor is stated.

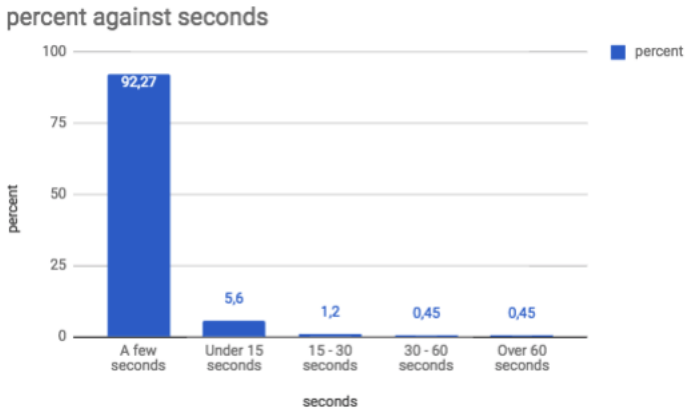

Figure 5.16: The time users are watching the digital screen according to the Kinect sensor.

Table 5.1: Result from the face detection on the current solution.

Parameters	Detected faces	Average	Median	Max	Min
time	660	2,937879s	1s	208s	1s
distance	660	926,8mm	1020mm	1026mm	571mm

5.5.2 New solution

This section presents the results from the new solution on the digital screen. The new solution did detect 494 faces in 5 days.

User questionnaire

Almost the same questionnaire as for the current solution was sent out to the members on CGI to compare the results. One additional question was added,

and it was if the users had used the mouse to navigate to different slides in the new solution. There was 38 persons that participated in this questionnaire. The average time looking at the new solution on the screen was about 15 seconds according to the questionnaire. Figure 5.17, shows the time the participants are watching the screen with the new solution according to the new questionnaire.

22,9 percent had used the mouse to navigate in the new solution. There were 3 of 21 that did not remember the last thing they have read on the digital screen.

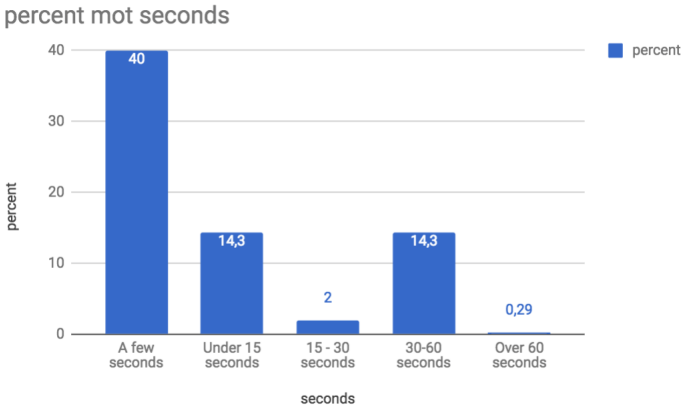

Figure 5.17: The time users are watching the digital screen according to the new questionnaire.

The questionnaire for the new solution did also came with some comments:

"*The location of the digital screen could be reviewed. The ones that works in the other corridor do not pass the digital screen so often. If the digital screen was visible from the coffee station the screen would get more viewings.*"

"*It would be interesting to see how many slides there is in the loop and which slide that is showed.*"

"*The location of the screen is not optimal. As long as you do not sit in the armchairs, you only pass by for 1 second and see it in the periphery.*"

"*Nice layout*"

"*Faster slides with further short text would be good.*"

"*It is running too fast between the slides.*"

"*Feels still like an unnecessary feature, information could lay on the internal network instead. But also a bad location of the screen it is hidden and obscured. It would be better to move it to the coffee room.*"

User behavior

The average time the audience was watching the screen on the new solution was 3,02 seconds and the maximun time was 118 seconds. The Kinect detected 494 faces in 5 days, about 99 persons each day. Figure 5.18, shows the time the audience were watching the new solution on the digital screen according to the Kinect sensor. Table 5.2, shows the result of time and distance in the new solution.

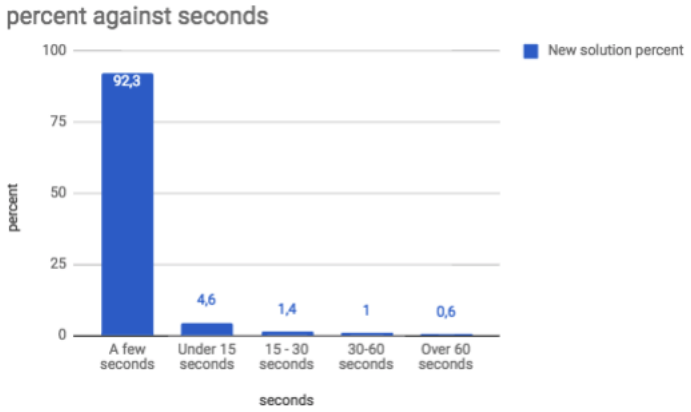

Figure 5.18: The time users are watching the new solution on the digital screen according to the Kinect sensor.

Table 5.2: Result from the face detection on the new solution.

Parameters	Detected faces	Average	Median	Max	Min
time	494	3,028340s	1s	118s	1s
distance	494	893,184211mm	950,00mm	1023mm	413mm

5.5.3 Comparing the solutions

The expectations between the current solution and the new solution was that users spent longer time by the new solution and that the distance was supposed to be shorter than in the current solution. The result showed that there was not such a difference between the two solutions.

A T-test was conducted to see if there was a significant difference between the watched time in each measurement. When conducting a t-test the zero hypothesis is that there is no difference between the two tests and an alternative hypothesis is that the new solution was more popular. If the new solution is

more popular is depending on the time. If the time users are watching the screen are longer the solution is more popular. This means that if the p-value is lower than 0.05 the zero hypothesis is rejected and the alternative hypothesis is more probable.

The outcome was that the p-value was not lower than 0.005, this means that the zero hypothesis can not be rejected. Thus the new solution is not more popular the the current solution. The outcome was that the p-value was 0.5609.

As seen in figure 5.19, the PowerPoint solution (blue) and the new solution (red) does not show a noticeable difference in time.

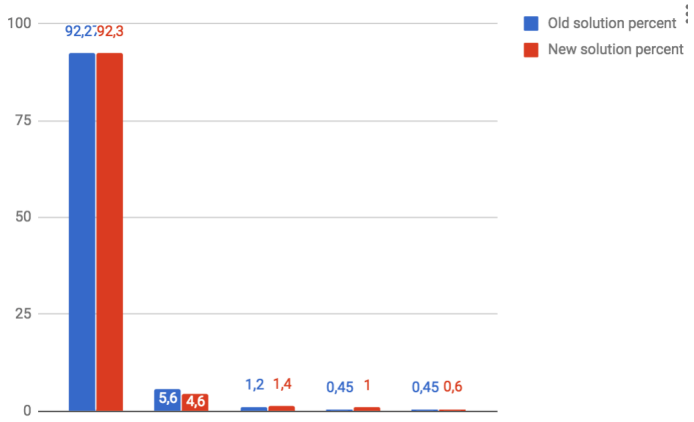

Figure 5.19: The time users are watching the PowerPoint solution and the new custom solution.

Chapter 6

Discussion

This chapter contains a discussion about the project and result.

6.1 Introduction

The objective of this study was to analyze the current DS solution and create a new effective design concept for the DS that engage more people. Also finding what information is relevant to distribute on CGI's office in Östersund and see if an interactive solution would engage more people. The last research question was aimed at the administration of the digital screen. This was made with an analysis of the current solution, a new solution was developed and a user study on audience behavior towards the digital screen was conducted.

6.2 Analysis

The interviews and card sorting session was an opportunity to find out what content is relevant, and what information that is possible to show on the digital screen, also what information was displayed at the time. The interviews gave clear answers about the content and the digital screen. The digital screen provided with information on CGI Östersund have been there for a long time and have also shown a lot of static information. It does not exist a plan or strategy for the content on the digital screen. It seemed like the digital screen have looked the same in several years and the content that was updated each week was one to three pages of about 40. The main purpose for the screen was to mediate and disseminate important information to members and visitors on CGI Östersund. Much of the information on the previous solution does also exist on the internal web and internal email. The only information that is not easy to

find anywhere else was the information about current projects and the member of each project and a description. Therefore the information about the project and members became prioritized when creating a new solution. The choice of the rest of the information that was the basis for a new solution came from the card sorting session. That session was an opportunity for some members on CGI Östersund to influence what they wanted to be displayed on the digital screen. Since the card sorting session only contained participants that was members of CGI, some content aimed for visitors also was chosen for the new solution, even if the majority of the participants did not ranked that information as important.

6.3 Design/Implementation

The design of the new solution began by brainstorming during the analysis state. Some sketches were made and a lo-fi prototype to get an idea of how the information was presented. Here the solution was limited into a hierarchy of two levels. Because the solution should work as a running presentation, it is not effective with clicks in multiple levels of navigation, this would only make the presentation more advanced and troublesome to learn and understand.

The tool chosen for the implementation was based on a comparison of similar frameworks. Reveal.js, the chosen tool is open source and had a lot of documentation, and easy to manipulate to a solution that meets the requirements. It also exists plugins to WordPress and DjangoCMS[1] to create Reveal.js presentations. Therefore it might be easier to create a solution with a content management system for the administration of the content.

The time for providing the implemented version with information was longer than expected. Some projects had a large amount of members or much information, therefore a lot of small changes was made.

6.3.1 Hardware

The hardware used in this thesis is the current hardware that is used on CGI Östersund, a TV-screen, a Minix android player and a mouse and keyboard. It would be interesting to do the same study using a touch screen to see if there would be any changes. Also put additional screens on the office.

[1] https://www.django-cms.org/en/

6.4 User Study

The result from the user study was that there was no significant difference between the two solutions. However, the screen is not placed optimal for such a solution. The opinions from the questionnaire were that most of the participants thought that the screen is misplaced and that there would exist multiple screens on the office. It is not a natural place to stop and read, it is a location where you just pass by. Another possible reason for this result is that the time the experiment was measured was too short and it was just before Christmas holiday. This means that there are less persons at the office during the time. The optimal solution would be if the measurement could go on in several weeks to get more fair results.

The result of the questionnaires gave a lot of different opinions about the digital screen, where there was no pattern about a specific subject except location, some said that the presentation was running too fast and some said that the presentation was too slow. A supplementary questionnaire with more specific questions about different things, such as amount of slides, time for the presentation to start over, could affect the conclusions.

6.5 Administration

One intent with the project was to create a more effective administration of the digital screen. This part of the project has not been prioritized and this is because of the time limit, and also because the administration is dependent of the chosen solution. The final solution (Reveal.js) was chosen about halfway through this project. This means that the final solution is based on HTML[2] and is lying on a web server. The most effective and easy way to administrate the solution for an administrator that is inexperienced in HTML, CSS[3] and JavaScript[4] is to create an CMS for the administration to update the content. The time did not cover this part of the project. The priority was instead on the implementation of a new solution that was actually working, with information up to date and the user study. During the thesis, there have been a continuous discussion with the administrator about the new solution and the content. The administrator is positive to have a solution were she is possible to update the content on her computer without being forced to go to the screen and start a new presentation.

[2] https://www.w3.org/html/
[3] https://www.w3.org/Style/CSS/
[4] https://www.w3.org/standards/webdesign/script

Chapter 7

Conclusions

This chapter contains the conclusions of the results and future work about public displays in general and for CGI Östersund.

According to the theory and earlier work, the challenges when working with public displays is to get the audience attention and make them read and remember.

7.1 User study

The new solution detected less faces, the users watched the screen almost the same time as in the previous solution, and the distance was also about the same. The expected result was that the users would be more, spend more time by the screen, and that the distance would be closer than before. According to the results from the user study the new solution is not more effective than the previous solution. The content and design of the new solution could be more analyzed and evaluated. The content on the new solution is almost the same. Some information have been removed, but there are almost nothing that have been added. This is because the loop was going to be short but also keep the information about the projects, which is a large part of the presentation.

There was only one person that described the digital screen as a unnecessary feature, otherwise the comments were positive but a lot of people commented on the location of the screen.

7.2 Future Work

In general there are much future work that can be done. Not just considering the interface or presentation. To create a better experience and more engagement among the audience or users, one screen with a bad location with navigation with a mouse is not enough.

About the content there are also more research that can be done with the members of CGI Östersund. If there are some information that is desirable and not showing on the screen today. So that the presentation on the screen faces the audience expectations.

An interactive solution that will engage more people need to invite users to interact with the screen. Some ideas that came up when conducting the literature study was to make the content more fun by creating internal polls, if there is something that could be voted about. Where the mobile phones could be the tool to use when voting. Also signing up for different events like group activities, instead of answering an email, the digital screen could provide a opportunity to sign up. QR-codes for example lunch guides could also be possible for the digital screen. Another improvement of the content is to connect personal meetings or schedule for each member on CGI Östersund and also a search function. Then the users would be able to search for a member to see if he or she are available and where they have their workplace. This is something that have been discovered during the time on the office. A lot of members do ask about other members, where they have their work place and/or where they are, or for example if they are out for lunch or in a meeting.

Social Media feed from Twitter or Facebook could also be an opportunity to make the members feel like they are a part of a large company and see what is going on in other CGI offices around the world. Connect smart phone and navigate through that could be a possible solution for not standing in the way when interacting with the screen.

7.2.1 Administration

There is some possibilities to implement CMS for the administration of the presentation. In the new solution all the information is coded in HTML, but it is possible to connect it to a CMS. Or try to connect to Slides.com that is based on Reveal.js and have an interface for editing the presentation.

7.3 Summary

Overall the work with this digital screen have made the members on CGI more aware of what they show on the screen. They have got many new ideas on how

they can make it better. Not just the content on the screen but also the location of the screen, and the hardware. Interacting with a mouse and keyboard might not be the most optimal way. The location of the screen is also not optimal. Users should not feel like they are standing in the way when interacting with the screen. The solution created should also work with a touchscreen, there was something that was in mind when choosing the tool for implementing the solution. Since Reveal.js also have a function for touch navigation and swiping on a touch device.

Acknowledgements

I want to thank all the members on CGI Östersund for helping me with the interviews, questionnaire, card-sort session and experiments. A special thanks to Björn Otterberg for helping me with all the parts during this thesis. And a special thanks to the administrator for helping me with the content of the final solution. I also want to thank Shafiq Urréman from Umeå Universitet for supporting me in my work and helping me out with the thesis and user study.

Finally, I want to thank my friends and family for all support during this thesis.

Bibliography

[1] J. Schaeffler. *Digital Signage: Software, Networks, Advertising, and Displays: A Primer for Understanding the Business*. Taylor & Francis, 2012. ISBN: 9781136031540. URL: https://books.google.se/books?id=5%5C_Z4AgAAQBAJ.

[2] Eleonora Mencarini, Leonardo Giusti, and Massimo Zancanaro. "An Investigation on Acceptance and Rejection of Public Displays in a Knowledge Company". In: *Proceedings of the 2012 International Symposium on Pervasive Displays*. Porto, Portugal: ACM, 2012, 16:1–16:6. ISBN: 978-1-4503-1414-5. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2307798.2307814.

[3] Elaine M. Huang, Anna Koster, and Jan Borchers. "Overcoming Assumptions and Uncovering Practices: When Does the Public Really Look at Public Displays?" In: *Pervasive Computing: 6th International Conference, Pervasive 2008 Sydney, Australia, May 19-22, 2008 Proceedings*. Berlin, Heidelberg: Springer Berlin Heidelberg, 2008, pp. 228–243. ISBN: 978-3-540-79576-6. URL: https://doi.org/10.1007/978-3-540-79576-6_14.

[4] Florian Alt et al. "How to Evaluate Public Displays". In: *Proceedings of the 2012 International Symposium on Pervasive Displays*. 2012, 17:1–17:6. ISBN: 978-1-4503-1414-5. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2307798.2307815.

[5] Gonzalo Parra, Joris Klerkx, and Erik Duval. "Understanding Engagement with Interactive Public Displays: An Awareness Campaign in the Wild". In: *Proceedings of The International Symposium on Pervasive Displays*. Copenhagen, Denmark, 2014, 180:180–180:185. ISBN: 978-1-4503-2952-1. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2611009.2611020.

[6] Ekaterina Kurdyukova, Mohammad Obaid, and Elisabeth André. "Direct, Bodily or Mobile Interaction?: Comparing Interaction Techniques for Personalized Public Displays". In: *Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia*. Ulm, Germany, 2012, 44:1–44:9. ISBN: 978-1-4503-1815-0. URL: http://doi.acm.org/10.1145/2406367.2406421.

[7] James She et al. "Convergence of Interactive Displays with Smart Mobile Devices for Effective Advertising: A Survey". In: *ACM Trans. Multimedia Comput. Commun. Appl.* 10.2 (2014), 17:1–17:16. ISSN: 1551-6857. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2557450.

[8] Marc Hassenzahl and Noam Tractinsky. "User experience - a research agenda". In: *Behaviour & Information Technology* 25.2 (2006), pp. 91–97. URL: http://dx.doi.org/10.1080/01449290500330331.

[9] Heather L. O'Brien and Elaine G. Toms. "What is user engagement? A conceptual framework for defining user engagement with technology". In: *Journal of the American Society for Information Science and Technology* 59.6 (2008), pp. 938–955. URL: http://dx.doi.org/10.1002/asi.20801.

[10] Heather L. O'Brien and Elaine G. Toms. "The development and evaluation of a survey to measure user engagement". In: *Journal of the American Society for Information Science and Technology* 61.1 (2010), pp. 50–69. URL: http://dx.doi.org/10.1002/asi.21229.

[11] Bobby J Calder and Edward C Malthouse. "Media engagement and advertising effectiveness". In: *Kellogg on advertising and media* (2008), pp. 1–36.

[12] Nemanja Memarovic et al. "Using Public Displays to Stimulate Passive Engagement, Active Engagement, and Discovery in Public Spaces". In: *Proceedings of the 4th Media Architecture Biennale Conference: Participation*. Aarhus, Denmark, 2012, pp. 55–64. ISBN: 978-1-4503-1792-4. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2421076.2421086.

[13] Andrew Newman et al. "Shoppers' Experiences of Digital Signage-a Cross-National Qualitative Study." In: 4 (Oct. 2010), pp. 50–57.

[14] Charles Dennis et al. "The effect of digital signage on shoppers' behavior: The role of the evoked experience". In: *Journal of Business Research* 67.11 (2014), pp. 2250–2257. URL: http://www.sciencedirect.com/science/article/pii/S0148296314002100.

[15] Nemanja Memarovic, Sarah Clinch, and Florian Alt. "Understanding Display Blindness in Future Display Deployments". In: *Proceedings of the 4th International Symposium on Pervasive Displays*. Saarbruecken, Germany, 2015, pp. 7–14. ISBN: 978-1-4503-3608-6. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2757710.2757719.

[16] Jörg Müller et al. "Display Blindness: The Effect of Expectations on Attention towards Digital Signage". In: *Pervasive Computing: 7th International Conference, Pervasive 2009, Nara, Japan, May 11-14, 2009. Proceedings*. Ed. by Hideyuki Tokuda et al. 2009, pp. 1–8. ISBN: 978-3-642-01516-8. URL: https://doi.org/10.1007/978-3-642-01516-8_1.

[17] Florian Alt et al. "Cognitive Effects of Interactive Public Display Applications". In: 2013, pp. 13–18. ISBN: 978-1-4503-2096-2. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2491568.2491572.

[18] C. H. Chen, K. H. Nien, and H. M. Hung. "The user interactive behavior model for a large multi-touch display in public space". In: *2013 1st International Conference on Orange Technologies (ICOT)*. 2013, pp. 256–259.

[19] Soh Masuko et al. "WallSHOP: Multiuser Interaction with Public Digital Signage Using Mobile Devices for Personalized Shopping". In: *Proceedings of the 20th International Conference on Intelligent User Interfaces Companion*. IUI Companion '15. Atlanta, Georgia, USA, 2015, pp. 37–40. ISBN: 978-1-4503-3308-5. URL: http://doi.acm.org.proxy.ub.umu.se/10.1145/2732158.2732179.

[20] N. M. Hung et al. "Design of instant digital Signage System based on smartphone". In: *2016 International Conference on Information and Communication Technology Convergence (ICTC)*. 2016, pp. 825–830.

[21] JungSoo Lee et al. "Smart digital signage using smartphone". In: *2013 15th International Conference on Advanced Communications Technology (ICACT)*. 2013, pp. 978–981.

[22] Keith Kelsen. *Unleashing the Power of Digital Signage: Content Strategies for the 5th Screen*. CRC Press, 2012. ISBN: 9781136023866.

[23] Alessandro Bendinelli and Fabio Paternò. "Design Criteria for Public Display User Interfaces". In: ed. by Masaaki Kurosu. Springer International Publishing, 2014, pp. 623–630.

[24] Anna Landby. *Intranät uppifrån och nedifrån : Skillnader i åsikter mellan ledning och personal – en fallstudie*. 2014.

[25] Holger Sievert and Christina Scholz. "Engaging employees in (at least partly) disengaged companies. Results of an interview survey within about 500 German corporations on the growing importance of digital engagement via internal social media". In: *Public Relations Review* (2017). URL: http://www.sciencedirect.com/science/article/pii/S0363811116303800.

[26] Rex Hartson and Pardha Pyla. *The UX Book: Process and Guidelines for Ensuring a Quality User Experience*. 1st. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc., 2012.

[27] Jennifer Rowley. "Conducting research interviews". In: *Management Research Review* 35.3/4 (2012), pp. 260–271. DOI: 10.1108/01409171211210154. URL: https://doi.org/10.1108/01409171211210%20154.

[28] Svend Brinkmann. *Qualitative Interviewing*. New York: Oxford University Press, 2013. URL: http://www.oxfordscholarship.com/10.1093/acprof:osobl/9780199861392.001.0001/acprof-9780199861392.

Appendix A

Interview questions

This is the interview questions used for the admnistrator and a consultant manager.

1. When and why did the idea about a digital screen came up?

2. How much time do you lay on deciding the content on the screen?

a. How many occasions per month? how often?

3. Is there a strategy for the content on the digital screen?

a. Is the digital screen a complement to email/internal web/meetings or how do you chose the information shown?

b. Is there any information that is only showed on the digital screen?

c. How have you choosen the time for every slide? Is there a limit for how many slides that is showed?

4. Have you got any feedback on the digital screen? Positive/negative?

5. Have you got suggestions of new information that can be shown?

6. Have you changed some information based on any feedback?

7. Today, information is shown about each project, do you know if there are some information that not is aloud to show in the projects?

8. How do you think about that there are other people than those who work here that sees the information on the digital screen?

a. How do you think about the content because of that?

Appendix B

Questionnaire about the digital presentation

This is the questions about the current digital screen on the office on CGI Östersund. The questions are in Swedish while they also were asked in Swedish.

Hur ofta tittar du på Intern TVn?

- Flera gånger om dagen
- Några gånger i veckan
- Några gånger i månaden
- Mer sällan
- Aldrig

När du tittar på intern TVn, hur lång tid tittar du?

- Jag tittar inte på intern TVn
- Några sekunder
- Kortare än 15 sekunder
- 15 - 30 sekunder
- 30 - 60 sekunder
- Mer än 60 sekunder
- Annat..

När tittar du på Intern TVn?

- När jag går förbi

- När jag fikar/lunchar
- När jag är i närheten
- När jag söker efter information
- Jag tittar inte på internTVn
- Annat..

Jag diskuterar innehållet på intern TVn med kollegor eller besökare.

- Håller inte med alls
- 1
- 2
- 3
- 4
- 5
- Håller helt med

Vad var det senaste du läste på Intern TVn?

Övrig kommentar