IDPS - PROJECT

TITLE: A Study of Interaction Design in the Catalunya Railway Museum of Vilanova i la Geltrú

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Abstract

El Museu del Ferrocarril de Catalunya has one of the most renowned and largest train collections in Europe, more than fifty-two trains on display, including 28 locomotives, the biggest collection on the continent. It allows visitors to experience what travelling was like from the second half of the 19th through to the 20th century. The museum is located next to the train station of Vilanova i la Geltrú, a former station depot, where railway workers lived and work. It has a vast collection of trains documenting 160 years of railway history.

In order to improve visitor experience, the museum wants to offer new initiatives and services that would make the visit to the Museum a more interactive and educational resource. The aim of this project was to improve the experience, through the application of user centred design and embracing contemporary technology. In order to develop the project, various research methods were used, including questionnaires, focus groups, expert reviews, and creative sessions. Based on the outcomes of this research new interactive technologies were investigated to decide on the most suitable solutions for visitor experience enhancement. The research lead to two separated results and advises for the museum. The first one is an advice based on improved signage and way finding inside the museum changing signs with info graphics and including routing elements. The second one is a mobile application, which conveys, to a better experience for the visitors in the museum. The mobile application is replacing the audio device and the map the visitors have to carry with them during an audio tour and adds interaction to the museum, a photo application to share in social media, different tour recommendations and information addressed to both common visitors and train enthusiasts. These two end products provided answers to the main questions of the research, namely:

- How can the user experience and interaction of the museum visitors be improved?
- What is the current experience of the visitors and what are they missing?

Key word

<table>
<thead>
<tr>
<th>Creative sessions</th>
<th>Design</th>
<th>Expert review</th>
<th>Focus-group</th>
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<tbody>
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<td>Gestural Interaction</td>
<td>Guideline</td>
<td>Human Factors</td>
<td>Interaction Design</td>
</tr>
<tr>
<td>Observation</td>
<td>Railway museum</td>
<td>Smartphone</td>
<td>User experience</td>
</tr>
</tbody>
</table>
# Table of contents

ABSTRACT

1. INTRODUCTION
   1.1 BACKGROUND
   1.2 THE RAILWAY MUSEUM
   1.3 GOAL
   1.4 OBJECTIVES
   1.4.1 IMPROVING THE USER EXPERIENCE
   1.4.2 USE OF INTERACTION TECHNOLOGY
   1.4.3 MAIN QUESTION:
   1.4.4 SUB QUESTION:
   1.5 HYPOTHESIS

2. METHODS
   2.1 INSTRUMENTS
      2.1.1 QUESTIONNAIRE
      2.1.2 FOCUS GROUP
      2.1.3 OBSERVATION
      2.1.4 EXPERT REVIEW
      2.1.5 CREATIVE SESSION
   2.2 SUB-QUESTIONS
      2.2.1 WHAT IS THE CURRENT EXPERIENCE OF THE VISITORS AND WHAT ARE THEY MISSING?

3. BENCHMARKING
   3.1 WHAT OTHER MUSEUMS ARE DOING TO IMPROVE VISITOR EXPERIENCE.
   FIGURE 4. LEVIATHAN PROJECT

4. MUSEUM ELEMENTS AND INTERACTIVE APPLICATIONS
   4.1 WAY FINDING / SIGNAGE
   4.2 HAND HELD DEVICES
      4.2.1 CUSTOMISATION
      4.2.2 USERS GENERATED WEBSITES
      4.2.3 CELL PHONE AND PODCASTS
   4.3 USE OF WIRELESS COMMUNICATIONS IN A MUSEUM
      4.3.1 RFID
      4.3.2 INTERACTIVE MUSEUM GUIDE: FAST AND ROBUST RECOGNITION OF MUSEUM OBJECTS
      4.3.3 INSIDE EXPLORER
      4.3.4 mAPP
   4.4 NEW WAYS TO INTERACT
      4.4.1 LEAP MOTION
      4.4.2 KINECT
   4.5 THE IMPORTANCE OF RESEARCH IN IMPROVING THE EXPERIENCE IN MUSEUMS.
4.6 PREVIOUS STUDIES IN THE MUSEUM
   4.6.1 EXPERIMENTAL session with Kinect
   4.6.2 CONCLUSIONS OF THE EXPERIMENTAL SESSION:

5 CURRENT STUDY OF THE RAILWAY MUSEUM
   5.1 QUESTIONNAIRE
      5.1.1 OPEN QUESTIONS FROM THE THREE QUESTIONNAIRES:
      5.1.2 CONCLUSIONS OF QUESTIONNAIRES:
   5.2 EXPERTS review on current interaction
   5.3 RESULTS Focus-group
      5.3.1 MIND-map
      5.3.2 BRAIN-WRITING
      5.3.3 10.000 EURO QUESTION
   5.4 FINDINGS and usability problems

6. ANALYSIS REQUIREMENTS

7. DESIGN OUTCOMES
   7.1 INTERACTIVE Technology
      7.1.2 BENEFITS OF THE APPLICATION
   7.2 SIGNAGE
   7.4 ACHIEVABLE OUTCOMES
   7.5 PROTOTYPING

8. SMARTPHONE APPLICATION PROTOTYPE
   8.1 MUSEUM SMARTPHONE APPLICATIONS REVIEW
   8.1.2 HEURISTICS OF NIELSEN
   8.1.3 REQUIREMENTS
   8.2 THE PROTOTYPE

9. SIGNAGE AND WAY FINDING
   9.1 SIGNS AND NUMBERS
      9.1.2 METAL SIGNS
      9.1.3 PLASTIC SIGNS
      9.1.4 SPRAY PAINTED SIGNS
      9.1.5 ENVIRONMENTAL SIGNS
      9.1.6 FLOOR PAINT
   9.2 PROTOTYPING
      9.2.1 PROTOTYPING IN WAY-FINDING
   9.3 HOW THE WAY-FINDING ELEMENTS CAN IMPROVE THE USER EXPERIENCE AND INTERACTION OF THE MUSEUM VISITORS?

10. CONCLUSION

CONCLUSION
   HOW CAN THE USER EXPERIENCE AND INTERACTION OF THE MUSEUM VISITORS BE IMPROVED?
1. INTRODUCTION

1.1 Background

“Continuously improving the user experience” is a sentence one could hear in every type of museum around the world. There is a global need of continuously improving user experience based on the feedback of the customers. Since the popularity of visiting museums under the current generation is decreasing, the user experience becomes more important.

To improve the user experience the current problems will have to be defined. The majority of the museums choose to be informative on an interactive way. Plenty of museums launched their own applications to provide practical information but also interactive ways to make the visits more interesting. An example of implementing interactive technology into a museum is also leap motion and Kinect. Leap motion and Kinect are gesture-based technologies. Using these technologies will improve the experience for the users because it allows them to experience a different way of visiting a museum.

The Museums Association (MA): “Museums enable people to explore collections for inspiration, learning and enjoyment. They are institutions that collect, safeguard and make accessible artefacts and specimens, which they hold in trust for society. Museums are stepping up to the mark by installing new ways of improving the customer experience. They are installing new state of the art interactive technology such as augmented reality, multimedia installation and image recognition.”

1.2 The Railway Museum

The research has been done for ‘El Museu del Ferrocarril de Catalunya’ which is located in Vilanova i la Geltrú. It is the most important railway museum of Catalunya and one of the biggest in Europe. The museum is located next to the train station of Vilanova i la Geltrú and it is a former station depot, well known for their roundhouses, the museum is famous for their unique and historical collection of 160 years railway history.

Since 1848, the year in which the first railway was introduced, train transport has transformed the country, revolutionizing the customs and traditions of individuals and towns, alongside the urban structure, the landscape and the economy. The museum’s main aim is to open up the fascinating world of the railway and its main attractions to all. To do so, the museum acts as the guardian of an exceptional heritage, documenting it, raising awareness and building a space that actively conveys the values embodied by the railway.
The museum wants to be the benchmark cultural Centre for railways in Catalonia, and offer a unique experience that can be adapted to different types of visitors. To make this possible, they include activities for families. These include audio-visuals, exhibitions, fun areas for kids, shop, library, and the chance to explore the more than fifty-two vehicles on display, including a collection of some twenty-eight steam locomotives, the biggest collection in Europe, and so to discover what travelling was like from the second half of the 19th through to the 20th century.

The collection of movable and immovable exhibits that the Vilanova i la Geltrú Railway is considered to be the most important technical collection in Catalonia and amongst the most interesting ones for historic industrial heritage in Europe. Its vehicles are located in the original facilities of a large steam locomotive depot. This centre was where the engines had their base, workshop and the driver’s temporary homes during their working week. This closed as a production centre in 1967, reopening as a museum in 1990.

1.3 Goal
The museum wants to offer its visitors new initiatives and services that make the visit and the Museum itself as a cultural and educational resource. One of the main functions of the Museum is to preserve the guarded heritage, but also to encourage diffusion of this heritage among present and future generations. It is important to find out if there is a need for “smart technologies” like smart phone application, leap motion and Kinect or if it would be a waste of investment. The main goal of the research is to find out the best way to improve the user experience and the interaction of the railway museum.

1.4 Objectives

1.4.1 Improving the user experience
The visitors of the museum will be involved in the research to improve the user experience. It is mandatory to obtain data and opinions from the visitors about the accessibility, visibility and the overall experience of the museum.

1.4.2 Use of interaction technology
Another objective is to improve the interaction of the museum during their visit. Research will find out if there is a need for interactive technologies like a mobile application/website or Kinect/leap motion technology.

Answers from the following questions are required to come up with a solution and advice for the railway Museum:

1.4.3 Main question:
- How can the user experience and interaction of the museum visitors be improved?

1.4.4 Sub question:
- What is the current user experience of the visitors and what needs to be improved?
1.5 Hypothesis

Visitor’s experience could be improved by the use of a smartphone application; this application would replace the audio-guide and give the visitors further information, allowing them to follow specific areas that suit their interests. This application would also make the experience an interactive one.

Visitors experience could be improved by enhancing the way finding. Currently there is no clear way finding and visitors find it difficult to find their way through the museum and even walk past by the reception at the entrance. With the help of guidelines this problem could be solved.
2. METHODS

In this chapter the main research question and several sub-research questions are set put and treated. Methods are coupled to these questions to approve or disprove the expected assumption(s).

The main research question of the research is as follows: "How can the user experience of visitors and interaction in the museum be improved" the main research question is divided into several sub-research questions. By answering these sub-questions it allows the researchers to answer the main question and the predetermined hypothesis can be checked if they can be accepted or rejected.

Each method that will be used for the research is described below. In addition, a justifiable description is given why the question is formulated in that manner and which research methods will be used to answer it.

2.1 Instruments

2.1.1 Questionnaire
A questionnaire is a (digital) research instrument that can be answered fast (and remotely) by its respondents. It consists of a series of questions, often with multiple-choice, propositions and Likert scales, for the purpose of gathering information. The data from the questionnaire is quantitative and is often used to support other research methods.

2.1.2 Focus group
A focus group is a form of qualitative research wherein a homogeneous composite group consisting of 5 to 10 participants. The group will perform a carefully planned discussion about their ideas, motives, attitudes, believes, interests and way of thinking about a defined area of interest such as a product, concept or service in an interactive environment. The participants are allowed to interact freely with the other members; the discussion is guided with the help of a topic list and a facilitator.

2.1.3 Observation
Observation is a method for collecting data about processes, people in qualitative research. Observing is watching how something happens or how someone is behaving. The observations can be done by observing and participating or observing alone. Observations can have several forms; in this research a participating observation will be conducted. This means that the researchers are involved within the situation of the observation.
2.1.4 Expert review
An expert review is a flexible method to research the usability and user experience. Evaluators that are familiar with heuristic evaluation do this review. A heuristic evaluation is a usability inspection method that helps to identify usability problems. For this research the heuristics principles by Molich and Nielsen (1990) are used.

<table>
<thead>
<tr>
<th>Simple and natural dialogue</th>
<th>Speak the users’ language</th>
<th>Minimize the users’ memory load</th>
<th>Consistency</th>
<th>Feedback</th>
<th>Clearly marked exits</th>
<th>Shortcuts</th>
<th>Precise and constructive error messages</th>
<th>Prevent errors</th>
<th>Help and documentation</th>
</tr>
</thead>
</table>

Figure 1. Usability Principles by Molich and Neilsen (1990)

2.1.5 Creative session
A creative session is a group meeting that runs through the creative process in four steps that includes brainstorming. (Problem analysis, diverge, converge and realizing) Brainstorming can be used for three goals. In no particular order, these are: finding solutions to problems, promoting creative thinking or team building.

A creative workshop starts with a problem. The participants generate various brainstorming techniques and many ideas. Creative techniques like brain writing, the sticker method, negative brainstorming, Mind Mapping can be used.

The third step consists of selecting ideas. This will create a shortlist with the most interesting ideas. The final step is to develop these ideas into concepts.

The four steps

Problem analysis
The purpose of this phase is to create the best formulation that describes the problems.

Diverge
The purpose of this phase is to find as many solutions for the problem

Converge
The first step after diverge is to create a shortlist with ideas. With the help of the two criteria, originality and practicability it will create some structure.

Realizing
The last step is find solutions to realize the chosen idea(s) and create concepts.

All of these methods are used in the project with the aim to find the requirements needed to improve the visitor’s experience.
2.2 Sub-questions

2.2.1 What is the current experience of the visitors and what are they missing?

To answer the main question it is important to find out what is the current experience of the users and where the museum comes short in providing a good experience.

It is not possible to interview each visitor therefore the team has chosen a questionnaire. In chapter 5 the results of the measurement of the current experience of IDPS are showed.

Due to the difference of the visitor’s origin the questionnaire is made available in English, Catalan and Spanish. The questionnaire will provide information about how the users experience the museum, what they are missing and what improvements could be made.

To find out how the audio tour experience works, several groups of visitors will be observed when using the audio-tour device with the map. The observers will take photos and notes and the visitors will be asked to fill in the questionnaire and answer some questions afterwards.

With the use of heuristic principles the experts will review the museum on the usability and user experience.

Desk research has been conducted in the early stage of the research to find information about the current and future interaction in museums. This research includes gathering and analysing information, already available in printed, published or web media.

The focus group session will be combined with a creative session due to the time limit and to make it more effective. It will be held in the form of a discussion session combined with a creative session. This session will take approximately 1.5 hours.

In this a clear image can be determined of what the users want in a museum in general. It is important to be able to react and to comment on the various questions and their ideas, so that the visitor can say what they think is important and what their feelings and motives are here.
3. BENCHMARKING

3.1 What other museums are doing to improve visitor experience.

Museums around the world and other cultural institutions have to change the way they attract visitors to their museums. Visitors have come to expect much more activity than just passively viewing the exhibits. Visitors want more; it’s not enough to see the exhibits themselves. They want to touch and have interaction within the museum. They want to have an interactive experience as well as view the exhibits. People have become accustomed with new interactive technology and expect it in most aspects of life. When they visit a museum they expect this same technology. Museums are stepping up to the mark by installing new ways of improving the customer experience. They are installing new state of the art interactive technology such, augmented reality multimedia installation and image recognition. Signage and way finding is very important, as people want to move around the museum effortlessly.

3.2 The Altoona Railway Museum Interact With Pennsylvania History

Known as the only interactive railway museum in America below a description is provided.

The Altoona Railways Memorial Museum has duplicated life in Altoona when the Pennsylvania Railway was booming, back in the early 1950s. One can find so many places on the second floor that was once established businesses in Altoona, PA.

They have a Newsstand where a holograph of a newsboy is standing inside and tells the story of old Altoona.

Figure 2. Pennsylvania Museum

There are three floors of attractions through the museum. Each floor offers a unique Pennsylvania History that allows taking time and exploring all the aspects of what it was like to work in different areas of the Pennsylvania Railway.
On the first floor a whole different atmosphere is found. From the moment one walks through the door the feeling of stepping back in time is about to board an old steam train. The unmistakable sounds of steam engines and train whistles blowing can be heard.

Figure 3. Pennsylvania Museum

The third floor of the Altoona Railway Museum holds the children's museum, complete with model train displays. Children love playing with the many toys while parents wonder through the museum. In the grounds on the outside of The Altoona Railway Museum old train cars and equipment used by the Pennsylvania Railway are stored.
3.3 Leviathan Project
In fields like cinematography some advances and new ways of interaction have been created, one of these is the Leviathan project, an experimental leap forward in cinematic technology, is a collaboration with Intel Labs and the USC School of Cinematic Arts World Building Media Lab called "Leviathan," presented at CES 2014's Intel CEO Keynote speech. It allowed the audience to use Intel Ultrabooks and tablets to simultaneously control flying jellyfish creatures that swam alongside the eponymous augmented reality behemoth, Leviathan soared off the screen and into the crowd, yielding an as-of-yet unparalleled mixture of film and gaming experience. "Immersive storytelling" doesn't even begin to describe it.

The project integrated both the physical and digital universes by using a multimedia platform that may very well set a precedent for future Augmented Reality and immersive-narrative creativity.

3.4 Antenna International
Antenna International is an enterprice dedicated to developing audio guides, multimedia guides and tour applications for museums.

They develop smartphone applications, audiogudies, multimedia to make some explanations, download tours, and access solutions, some of the examples can be seen in their webpage.

Antenna can offer its clients a future-proof interpretation strategy through a platform agnostic approach to content distribution and is a good example for the team research.

3.5 Cultural Heritage Experience
CHESS (Cultural Heritage Experiences through Socio-personal interactions and Storytelling) is a project, co-funded by the European Commission, that aims to integrate interdisciplinary research in personalization and adaptivity, digital storytelling, interaction methodologies, and narrative-oriented mobile and mixed reality technologies, with a sound theoretical basis in museological, cognitive, and learning sciences.

Now they have an application that asks some questions that relates to you with a persona and creates a guided tour based on specific likes.
4. MUSEUM ELEMENTS AND INTERACTIVE APPLICATIONS

4.1 Way finding / Signage

In museums around the world, one of the main problems that have been found is people are not finding it easy to negotiate their way around the exhibits. Visitors find it confusing to know which way to go and are getting lost. In most museums there are many floors of galleries and public spaces. Most museums are finding that the most persistent weakness that the guests identified was signage and way finding. Museums are not alone in this. Visit any airport or shopping centre and you will encounter the same problem.

One of the problems that the design team at the Indianapolis museum of art addressed was when people were entering the museum; they were confused on which way to go. The inadequate signs left them confused and were not making their first impression a good one. The design team strategically placed the welcome desk at the entrance so that it was the first thing they seen when entering. A large welcome sign placed over the reception desk and smiling faces made the beginning of their visit effortless. (Holstine 2014)

![Figure 5. Welcome desk](image)

![Figure 6. Detail of a panel in the Indianapolis Museum](image)
4.2 Hand held devices

One of the most common solutions to assist and improve visitor’s experiences in museums around the world today is a hand held devices such as tablets and phones. Because of the availability of these devices and visitors knowledge of how to use them makes them a great first option.

![Figure 4 Phones and tablets](image)

4.2.1 Customisation

The museums website is customised to the visitor specific needs and interests. This is using technology to cater for individuals to be modified to offer users only content they are interested in receiving. Museums websites can be customised in many ways. The website can track what the customer is interested in. This is a very useful tool to improve the visitor experience in the museum.

4.2.2 Users Generated Websites

Museums are offering visitors to participate in the making of the museum. The methods they are using are user-generated websites. In this way the user can feel they are a part of the museum and have made meaningful contribution that is publically recognized.
4.2.3 Cell phone and podcasts

A great number of museums are experimenting with cell phones inviting the visitors to use their phone as a tool to enable them to guide them through the museums. The most well-known of these was created in Marymount College. The students created unofficial audio guides for the museum of modern art (MOMA) in New York. They invited the community to contribute their own podcasts as well. Both New York and San Francisco have used this approach. Many other museums have embraced this movement.

4.3 Use of wireless communications in a museum

4.3.1 RFID

RFID is a new wireless technology that uses non-contact use of radio frequency electromagnetic fields to transfer data. This data can be automatically tracked to tags attached to objects. This technology is expected to replace tourist guides to an extent. Its voice enabled device that speaks out, as the tourist is moving around the museum from place to place. When the tourist is standing near major objects and landmarks it will play an audio clip relevant to that location. How this works is the RFID receiver tag is placed in a device that visitor will carry around the museum. As soon as the device comes into the vicinity id the RF tag the microcontroller receives the RF tag unique id from the receiver and matches its own database. If the match occurs the micro controller will play an audio clip relevant to the exhibit.

Figure 5 RFID Graph
4.3.2 Interactive Museum Guide: Fast and Robust Recognition of Museum Objects

The application of Speeded Up Robust Featured SURF, an algorithm for recognition of objects of art. The problem found is that in museums the exhibits are rather passive and is hard to find the description of the object of interest, so the propose of an interactive museum guide is set. This guide is able to automatically found and retrieve information instantly about the objects of interest using a standard tablet pc with a webcam.

The visitor takes a picture from the object in any direction and a description appears on the screen.

This works with an object recognition system based on interest point correspondences between individual image pairs and it uses a standar low cost hardware. (Bay,Fasel,Gool)

4.3.3 Inside Explorer

Is an interactive visualization system that enables museum and science visitors to interactively explore subjects scanned using medical imaging systems. Today it is used at museums and science centres around the world allowing visitors to explore everything from mummies to Martian meteorites, shortening the distance between research and public outreach.

Inside Explorer was used at the Science Uncovered event at the Natural History Museum in London 2012, and is together with NHM shortlisted for the Innovations Award at the Museums +Heritage Awards 2013.

4.3.4 mApp

At start-up LabWerk's development allows museums to quickly and easily roll out iBeacon-based interactive exhibits.

The platform makes it possible for museums to add new twists on existing gaming elements, like scavenger hunts, while Passbook integration means coupons and rewards that can be issued instantly. Additionally, apps can be rolled out in a number of different languages, a boost for museums that attract large numbers of international visitors.

mApp is already in production at Tulip-themed tourist attraction Tulpenland in Sint Maartenszee, Netherlands. Visitors receive supplementary content via location-based videos and images, and can earn discounts and rebates by completing a quiz on the story of the tulip.
4.4 New ways to interact

4.4.1 Leap motion

Leap motion is a new technology designed by an American company that supports hand and finger motions. There is no physical mouse used, just hand gestures in front of the computer screen without no hand contact or touching. All control is in in the movement of the hands and fingers. This technology is been used in some museums to improve the victors experience and allowing interacting with the exhibits. The Allard Pierson museum in the Netherlands uses this technology. Leap motion was used in the exhibition Eternal Egypt experience

The leap motion Technique has made it possible to see the colours that once were used visible on Egyptian reliefs. With this technology you can use your hands by pointing at an object, the sensor makes it possible that a projection is shown the original painting on the relief. This is a way for the visitors to interact with the museum.


4.4.2 Kinect

Kinect is a new technology that some museums are using to make their exhibitions more interactive. This is a motion sensing input device that allows the user to control and interact with their console/computer without the need of a joystick or any game controller. The user moves their hands to control to activate whatever they want on the screen without any contact. Microsoft used this for Xbox 360. With this technology visitors can interact with a screen that is placed in the museum that out of physical reach, but still can operate and control what they can see with the movement of their hands.
The Louvre has been using this technology. The Antinoe veil is a furnishing fabric dating from the 4th century AD. It is decorated with scenes from the life Dionysus, the son of Zeus and the mortal Semele. But this is very delicate and difficult to read. Kinect is being used to so that the viewers can manipulate the wile without touching the actual fabric. The exhibit features videos, which can be picked by the viewer’s using Kinect to watch the history of the veil. This technology is still in its infancy and can be difficult to use and is not intuitive. The visitors have to be taught how to use it.

![Kinect used in Gaming](image)
![Kinect sensor](image)

**Figure 8. Kinect used in Gaming**  
**Figure 9. Kinect sensor**

### 4.5 The Importance of research in improving the experience in museums.

Before any technology is introduced to a museum research must first be done. The museum must find out what the visitors wants and what relevant technology will suit the museum. They must look at age, gender and various findings from the research they have compiled. It’s not much use to have state of the art technology if the needs are not being met. Sometime it’s unnecessary to have cutting edge technology when the solutions may be a lot simpler such as way finding or signage. Michael Resnick of MIT Media Laboratory99 said “you have to sit and say, what do we want our visitors to learn? The second thing you say is ‘what are the sources?’ the last thing you do is go to the technology. The biggest mistake anybody makes in technology in museums is to lead with the technology. This is where research must first be done”. All museums face the challenge of keeping the visitors entertained and wanting to come back to their museums, especially in economically challenged times.

Mitchel Resnick, MIT Media Laboratory99

### 4.6 Previous studies in the museum

This studied in which the team participated, was carried out by the UPC in conjunction with the railroad museum to develop interactive scenarios that could be used in the future to improve visitor experience.
4.6.1 Experimental session with Kinect

AIM
- The aim of the IDPS Project is develop interactive scenarios in the Railroad Museum. The aim of the Carlos final Project is develop interactive applications with the Kinect sensor.

PREVIOUS:
- The user is located in front of Kinect sensors. Distance: 3 meters for example.
- The user could use the two arms as mouse functions. Up/down the left arm is the left click mouse. Move to the right or to the left the right arm is move to the right or to the left the pointer on the screen.
- The screen is projected on the Wall. We have a Railroad virtual visit. The user can move the point of view and can choose some wagon train. (Each wagon is a button and you can access to other screen).

TRAINING
- The facilitator show how use this system.
- Training time: the use has few seconds to training the use of the system.

INSTRUCTION
- Task 1:
  - Press the Green light and select wagon train number 5. Please choose one window.
  - You can move around this screen.
  - Press again the Green button and select wagon number 1. Please: choose second window.
- Task 2:
  - Please, feel free to move inside the entire virtual visit. Duration time: 2 minutes.
If we consider that low effectiveness is 0, medium effectiveness is 0,5 and high effectiveness is 1, the final results of effectiveness are:
Figure 13. Effectiveness table

Related to efficiency, in this experimental session the duration time is fixed by the facilitators. At the end of five minutes can control the system. However, users the efficiency of user’s user4 and user8 is medium because the position of left arm is wrong and the control is difficult.

At the end of the session, the user must answer a SUS Questionnaire.

![Effectiveness Table]

Figure 14. Kinect sensor questionnaire
The mean value of SUS Score is 60.5 and the standard deviation is 11.4.

4.6.2 Conclusions of the experimental session:

- A usability testing in laboratory conditions related within the use of Kinect sensor and the Railroad virtual visit is presented. The aim of this experimental task is analyze if we can use this system inside the museum and improve the interaction with the visitors. Attending to the results, the task effectiveness must be improved: two out of nine users have high effectiveness, five out nine users have medium effectiveness and two out of nine users have low effectiveness. The reason of this low effectiveness is the use of non-appropriate gestures when the user is doing the task: in this case perhaps the system it not intuitive to use for the user.

- Related with satisfaction the SUS score is medium (the mean value is 60.5.)

- Related with the ISO 9241-9 questionnaire we have a set of comments. We must improve the accuracy: it’s necessary to improve the algorithm that allows us to move the pointer on the screen with smoothness and low operation speed. Related with the virtual visit it’s necessary to improve the feedback when the user is doing the tasks. Some graphical icons are too little and it’s very difficult to click in a graphical icon when this icon is located in a corner (at the top, at the left). One important problem is the arm fatigue: if the user is doing the right gestures there is no problem. The problem appears when the user is trying to use some gestures that the system doesn’t recognize. In this context we must improve the general comfort. For many users the system is easy to use and the experience is nice.

From the conclusions of the experimental research of this study is concluded that this technology is in its infancy and until it becomes more user friendly it’s not suitable for the museum.
5 CURRENT STUDY OF THE RAILWAY MUSEUM

5.1 Questionnaire

For research purpose a questionnaire has been made, a number of questions related to the areas and experience in the Railway Museum to have a sample of the real needs of the museum, this as an efficient way of collecting data analysis. The questionnaire keeps away from the interviewer therefore guiding and cues that could getting unbiased answers from the visitors.

The Questionnaire template is in the Annex A.

The questionnaire was made with a sample of 20 international students in the age range from 17-24 ranging from 10 different nationalities mainly European, and regular visitors of the museum in the age range of 45-54 mainly.

Three different questionnaires had been made to suit the two sample groups, International (English), Local and train enthusiast (Spanish and Catalan).

For the train enthusiasts the questionnaire was sent via e-mail to a group of 45 people in the list of Ana Grande, the responsible in the museum of the education and media part.

The following answers are the most important ones for the research; they are a sample between the 2 groups.

In the Annex A, B and C the answers to all the questions are presented, from the 3 questionnaires made in English Spanish and Catalan.

Below the most relevant parts are shown.

Train enthusiast visit the museum regularly

60% from the respondents in the train enthusiast group have visited the museum more than 5 times.

Most of the visitors make the tour by themselves; very few people make the audio-tour.
From the rating of the areas, the one with lowest ranking was the ground floor.

Comments of Signage and way finding:

- "More guiding signs"
- "Signposting is confusing"
- "The museum entrance is not very clear"
- "The chronological order of the trains is good"

What do people liked most?
Comments about the Locomotives:

- “The think I liked the most was to see all the old trains at a close distance and to go inside.”
- “I got to see engines, trains and locomotives”
- “Being inside the trains”

Negative Aspects

Comments about missing Information

- “Some boards containing the information are very small and not very attractive”
- “I would like to learn more technical facts about the trains”
- “I would like to have more information in general and from current trains too”
Comments about how could the experience been improved

- “Locomotive in motion”
- “Doing something interactive and the possibility to enter in all machines”
- “A restaurant”
- “having more than one locomotive running”

67% of all the visitors agreed on the use of smart technology to improve the visit.

5.1.1 Open questions from the three questionnaires:

What do people like the most?

Staff and guides:

- “The kindness”
- “That is very personal and surprising”

Locomotives:

62% Respondents mentioned that the thing they liked the most were the trains and specially being inside the coaches and the possibility to look at the engines from close.

Setting:

- “The outside”
- “The environment”
- “The arrangement of the exhibits”
• “The possibility of the evolution of transportation and contextualize it in different times”
• “Everything, the interior part with all the antique pieces and the exterior with the machines”
• “It is good to see how well they have progressed”
• “Everything is well cared”

Audio-visual:

• “Machines and audio-visual. It's good that you can see the visual and different languages.”

Education:

• “The pedagogical aspect”
• “The great diversity of material exposed. The pedagogical approach to materials exposed. The dark room with the audio-visual. It is a magical place!”
• “It was a good opportunity to take more knowledge about train engines”

What they didn’t like or Negative aspects:

Children area:

• “The kids area”
• “The construction material”
• “Children place everything looks heaped”

Space:

• “I think there are too many things to see in a small space, its so confusing”
• “Not enough space in the interior part”
• “Missing space”

Entrance and internal part

• “The music in the entrance hall was weird”
• “The entrance part inside of the museum”
• “I did not like the internal part”

Missing things:

• “Poor interactivity in the inside”
• “The museum does not have the facilities to support the collection of modern materials, functional motor and integrated space that allows a wider choice”

State of the locomotives:
• “The state of the electric and diesel locomotives over the entry of the museum’s rotunda”
• “Machines outdoors”
• “The state of the locomotives, while some were restored, some are still in poor condition”

How could the experience be improved?

Interaction with trains:

• “Locomotive in motion”
• “Doing something interactive and the possibility to enter in all machines”
• “A restaurant and an excellent state of preservation of the material, such as they have in other countries, even having more than one locomotive running”

Train condition:

• “Protect all the elements from the display from the inclement weather that deteriorates them”
• “With more money to put the vehicles in good conditions so they can be seen without making eye damage”
• “Restoring some machines”

Setting on specific time:

• “Maybe with characters from different times”
• “The appearance of the entrance of the museum makes you think of an exhibition of machines. It would be nicer and more impressive if it were set in the era in which it really belongs”

5.1.2 Conclusions of questionnaires:

The conclusions from this research method is that the main attraction of the museum is the locomotive collection and the possibility to have access of all the individual trains, the visitors would like to experience the different timeframes of the trains and to feel like if they were stepping back in time of the locomotive.

There is a need of a better layout or signage to guide the visitor’s trough the museum and the main exhibition areas.

The entrance and the children area has a regular impact on the visitors, it’s the first thing they see when they enter. It’s a blast of colour from the playground. Most of them would prefer to have a setting more oriented to the era when the building was used originally.
5.2 Experts review on current interaction

A cognitive walkthrough used to find the needs of the museum was to make the guided visit, the audio guide, and a regular visit to the museum and to write conclusions.

The conclusions for this research method were:

• Where to go at the entrance is not very clear, there are some arrows but they are small and the main nameplate is not located in a very visual place, some people may not notice it.

• A change in the setting of the place and the atmosphere could improve the first impression of the visitors. The music and the children area may give the impression it it’s a children focused museum, the music can be a bit loud and distracting.

• The way-finding with the audio guide can be confusing it is important to show visitors exactly how it works and make a test to the first point of the audio guide, (if you press the button more than one time and don’t wait you can get another explanation and as you don’t know what the explanation is about, get the wrong idea).

• The numbers for the audio guide must be visible and easy to find, the numbers and the route are difficult to understand, especially number 7.

• A better organization of the items could make them more attractive. There are a lot of fabulous things to see on the inside but they seem to have little space.

• Some of the signs and explanations don’t follow the same format. The sign at the entrance has a lot of colours and inside on the signs the main colours are yellow and black, it would be important to follow the same typography even for the children explanation.

• Some info graphics may help to better understand the explanations, or a new way of having information about each item. Some of the signs are very small and it may not be attractive if the visitor is not very interested, the explanation must be in different languages.

• The chronological order of the trains is well achieved. Visitors like to have order in the exposition.

• The possibility to sit on the couches is very attractive. This is a rare experience in museums where you can really interact with the exposition and be part of it.

• The collection and the distribution are very attractive to do photos. There are a lot of good sites to make photographs and the possibility to do it is also a plus compared with most museums.

• It would be important to create the atmosphere of the era when the museum was a train deposit. The sensation of being in a unique place and to see how things were then is really attractive and exiting.
5.3 Results Focus-group

The focus group was held on Thursday, April 10th at the library of the Railroad Museum. The facilitators led a group of six respondents in the content of the research. To give respondents a visual support a mood-film (film about the team to set on the mood) was shown. This film consisted of the history of the railroad in Catalonia. After seeing the film the group was asked to create a mind-map on an A4 size paper about how their perfect museum would look like and all its requirements. When everyone had finished each of them were asked to discuss what they had written down and why it was important to them. The results can be seen in figure 16.

5.3.1 Mind-map
The volunteers described their perfect museum in a mind-map. The majority of the volunteers wanted to implement a restaurant in the museum where they could eat and drink something after or during their visit. Another common aspect was to have a shop where the visitors could buy souvenirs as a remembrance to their visit. Other idea was that if the guides and other employees of the museum could wear traditional costumes, it would contribute to the overall experience of the museum.

5.3.2 Brain-writing
The second task for the respondents was the brain-writing exercise. In this task each of the respondents had a piece of paper and had to think up an idea every 3 minutes, then pass the paper to the next person and he/she would think of a new idea based on the previous one written already on the paper. This created 36 ideas within 20 minutes.

The respondents wanted to see a product that helps them with the visit and provides them information and a clear route. They suggested it in a form of augmented reality like Google glasses or with touchscreen like a smartphone.

5.3.3 10.000 euro question
This last part of the focus group consisted on asking the respondents what they would do in the museum if they had 10.000 euros.

The volunteers wanted to see a real miniature train ride at the museum. This will conduct to the total experience of the museum by making the visit more interactive and give them the feeling like they are re-living the past. To finish the bigger picture, the staff would wear costumes like the ones of the employers of the locomotives at that time. The volunteers wanted to have a place where they could relax and discuss their visit at the museum, maybe have something to drink or eat, some suggestions where a restaurant inside the trains. This place could be another source of income for the museum and would satisfy the visitors.
5.4 Findings and usability problems

With this previous research it is determined that the most significant and enjoyable part of the museum are the trains and the possibility to inter the carriages and interact within them.

Taking this in account several solutions would be proposed with the aim to improve this experience and create new experiences that are now not possible, for example the ability to drive a train, or to implement more characterization of each train.

The solutions will be discussed in creative sessions and implemented to know the strengths and weakness of them with the help of prototypes so that at the end a suitable option to implement in the museum can be given.

On the other hand for the usability problems or weaknesses (layout, atmosphere and graphic information) prototypes will also be made and tested to improve the missing experiences and to recreate a more fulfilling experience in overall.
6. ANALYSIS REQUIREMENTS

Analysis requirements are the analysis of the needs and the characteristics that the end product must have according to the different users and aspects of the museum, and will help the team to determine how the end product must be like and can be used as a checklist during the Project, they are presented in the next list.

Market

Stakeholders:

Ana:
- Improve the visitor experience
- Create an interactive smartphone app.

Pere:
- Analyse possible technologies that could improve the visitor experience

Staff from the museum:
- Clarity on the way finding of the visitors
- Avoid confrontation with the visitors because of navigation problems and confusion over entrance payment.

Local visitors
- More information
- Easy way finding
- Interactivity with trains

External visitors
- Multiple language information
- Pre-visit information

Budget:
Low to none

Design:
- Available to use in and out of the museum
- Must provide general and specific information about the museum and the exhibits
- Must be intuitive and easy to follow
- Must provide interactivity
- Must be low cost or a funding strategy must be provided
- Must be coherent with the time and context of the museum

Technical:
- Feasible to industrial designers and human technology students
- Feasible in a physical prototype
- Time: 2 months
- People: 4
Environmental:
- Durable, not aging
- Low use of energy
- Environmentally friendly
7. DESIGN OUTCOMES

The design outcomes are specific objectives that can be achieved through personal tactics. Only some outcomes are achievable depending on the resources of the project, next some possible solutions will be presented in a way of concepts to respond to the needs of the museum.

7.1 Interactive Technology

To solve some of the needs and requirements the use of interactive technology is required by the project, and to choose between a smartphone application, the use of Kinect and the use of leap motion, some research had been conducted and the use of a smartphone application is defined because it is at the moment the best choice. Looking at the number of users, Kinect; 24 million users, Leap motion; 25,000 users and the smartphone; 1.75 billion users, we can conclude the smartphone is well accepted.

A smart phone application could resolve the problem of different languages having the possibility to change the language depending on the visitor. All the information would be available in the app without the need to put large signs with all the information in different languages and affecting the aspect of the exhibition. A smartphone application is also an interactive device, which the users from different ages could use to make their visit more pleasant. The problem of the way finding could be solved by the combination of a clear map that could show where to find the different exhibits and the use of corresponding numbers and info graphic’s.

Furthermore, the use of a smartphone application will make it more accessible for more users compared to the other two products. Each user can download the app at home or at the museum and use it on their smartphone. Compared to the other products where only one user can use the product at the time. If more users want to use Leap Motion or Kinect then more devices have to be bought, otherwise visitors would have to wait in line to make use of the products. This will lead to the chance that visitors won’t use the product at all because they don’t want or can’t wait. Also more space is required to place them, space that could be used for exhibits.

7.1.2 Benefits of the application

1. The application takes less time to be adopted by the visitors that use smartphones.
2. There are more smartphones users then Kinect and Leap Motion users.
3. An application is more accessible for more users compared to Kinect and Leap Motion.
4. More information can be given to the visitor through the use of an application
5. Other museums are using applications too. Kinect and Leap Motion are rarely used.
6. An application doesn’t require any space.
7. Improves awareness of the museum with the help of social media.
7.2 Signage
One of the mayor problems that were identified in the museum was the way finding and signage. The visitors' problems with navigation made the visit confusing for example to find the entrance, pay the ticket and find the exhibits, there was lack of clarity.

A new signage approach with the use of graphics and signs is implemented so that all the public local and international visitors can understand and find the exhibitions easier. Some arrows and graphics on the floor have been tested in a way to make the way finding clearer and to avoid confusion. Making the visitors experience effortless. This will also improve the staff working experience as in not having to explain navigation to the visitors.

7.4 Achievable Outcomes

Due to the limited resources of the Project the achievable outcomes would be:
- A prototype of the Smartphone application made with the software of just in mind and that can be tested in different devices like the iPhone.
- A study and recommendation about the way finding, signage.
- The concept and requirements to develop a handcar in a possible subsequent project.

7.5 Prototyping

As a way to verify our concepts and recommendations the team made use of the prototyping method, some drafts and prototypes were generated in a way to have feedback from the visitors and the museum staff to improve the functionality and effectiveness of the end product. It would also allow the recommendations to be more precise and with a foundation.

8. SMARTPHONE APPLICATION PROTOTYPE

8.1 Museum smartphone applications review
Ten museum apps where reviewed in order to create the outline of the prototype for the Railway Museum App. A screenshot was made of each page of the application and then reviewed with the help of the 10 heuristics of Nielsen, Nielsen, J., and Molich, R. (1990) and rated in the plus and downsides. As example, language selection option in an application for a museum is seen as a plus side because the visitors of the Railway Museum come from different countries with different languages. This refers to one of the ten heuristics by Nielsen; Match between the system and real world. Which can be explained, as the system should speak the user’s language, with words, phrases and concepts familiar to the user, rather than system-oriented terms.
8.1.2 Heuristics of Nielsen

1 Visibility of system status:
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

2 Match between system and the real world:
The system should speak the user’s language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

3 User control and freedom:
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

4 Consistency and standards:
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

5 Error prevention:
Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

6 Recognition rather than recall:
Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

7 Flexibility and efficiency of use:
Accelerators—unseen by the novice user—may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

8 Aesthetic and minimalist design:
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

9 Help users recognize, diagnose, and recover from errors:
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10 Help and documentation:
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user’s task, list concrete steps to be carried out, and not be too large.
8.1.3 Requirements
This has led to the following requirements for the prototype:

- Always a system status (breadcrumbs)
- Visuals in line with the goals
- Option to change language directly from the start
- Size of buttons in line with standard guidelines
- Contrast of colours for colour-blind or reduced sight people (fonts/size)
- No learning curve
- No required additional downloads
- General information (map, opening schedule, tickets, prices)
- Buttons should be clear without explanation (learning curve)
- No useless buttons
- Outlined text and readable fonts
- Features should have an added value
- Search function
- Social media
- Support/F.A.Q/information
- Clear view of the options inside the app
- Text/visuals %
- Use cue’s

8.2 The prototype
Since the project was only for 5 months there was not enough time, knowledge and budget available to design a real working mobile application. Instead of a real working mobile application there is a high fidelity prototype made with software Justinmind. Justinmind is a program to design low or high fidelity wireframes. The advantage of using Justinmind instead of other wireframe software is the possibility to generate real working codes in case you want to develop a total functional application. Beside that Justinmind has some well-established enthusiastic customers like Google, NASA, HP and Adobe.

The prototype has been made for the IPhone 5S (IOS). The reason for making the prototyping in this operation system is that the supervisor and three members of the team make use of an IPhone and therefore a better and easier option to test the prototype. If the prototype would come to full development then also the operation system Android has to be included. The goal of the application was to improve the information, interaction and way finding of the museum in one interactive mobile application. The details about the functions and further specification of the information, interaction and way finding, are in the specification document in annex E.

The design of the application is based on heuristic analysis, the expertise and the interpretation of the project members regarding to the visitors and client’s needs and requirements. The next step in developing should be to test the prototype with the target group, unfortunately there was no time left to do it. Justinmind contributes to set up a usability test by providing QR codes to make it possible to test the application on a mobile device.
9. SIGNAGE AND WAY FINDING

One of the main problems identified in the museum was the signs for the audio tour. When doing the audio tour, visitors were losing their way. For visitors who want to do the tour by themselves, they can do the audio tour. This consists of using a device that will guide you around the museum. It looks similar to a TV remote control that speaks all the information about the different exhibits. Most of the major exhibits are numbered so the visitor starts at number 1 and move through the museum following the numbers. When the visitor arrives at an exhibit that has a number, the visitor presses the corresponding number on the audio device. The audio device speaks the information about the relevant exhibit.

While this is a good system the problems that were identified were the numbers were very small and in certain parts of the museum not in the right location. This was very frustrating for the visitor. At the beginning of the tour the visitor was given a map and the audio guide. For visitor who wishes to take pictures, carrying a camera, a map, and an audio device had their hands full, this made the tour difficult and from observation the visitor had put the map or the audio device down to take a picture. In most cases the visitor uses the phone to take pictures.

This is where the smartphone app is very convenient. The app has a search by numbers application. This will replace the audio tour device. The visitor who wants to do an independent tour will search by numbers. When the visitor views an exhibit there will be a number on it. The visitors select the number and information will be given, either it will be written or oral. But this can only be achieved if the numbers are made clear and it the right place. This will have to be solved before both works well together.

The signs that are used at the moment are a mix of plastic signs place on a vertical post. These work relatively well. These signs provide information about the exhibit. There is a number place on the signs but it’s very small. This is where the problem lies. The numbers are too small and not easily seen.
Before choosing new signs, there has to be certain factors to be taken into consideration, where they are positioned in the museum. Some exhibits are inside and some are outside. The outside signs will have to withstand different weather conditions like sun, rain and sand that are blown in from the sea. All these cause corrosive so suitable materials must be chosen.

9.1 Sings and Numbers

Stone carved signs are numbers carved out of stone by a sculptor. The process involves a sculptor finding appropriate slab of stone and carving numbers on it. These signs can be located close by the different exhibits. This option would me more expensive than the made materials such as plastic or metal, but there is no maintenance needed. As this a natural material it ages well with time, and improves with age. This option would blend in with the buildings made of brick and stone, especially the large stone exhibit that’s already there. This would be the expensive option but maybe cheapest in the long term as these signs would never have to be replaced. To make the signs be more visible the numbers can be painted as in fig 17 a sculptor can be commissioned to make these signs or they sometimes can be bought off the shelf in in quarries. The first option would be better as a design could be used to blend in the museum style.
9.1.2 Metal Signs
Metal signs could be used; these are signs that are made of different type and quality of metal from cheap metal to the more expensive stainless steel. They are usually mass produced and can be bought in most in hardware stores. Metal signs would work well in the exterior part of the museum as this would blend in with the surrounding trains. One of the problems with metal is that it corrodes except the stainless steel, it does not rust. This would be the expensive option. Another option would be aluminium signs. Aluminium is a metal that is lightweight and sturdy and doesn’t corrode this is cheaper than stainless steel.

Figure 18 stainless steel

Figure 19

9.1.3 Plastic signs
Most of the signs we see today are made of plastic. The most common one used is PVC (polyvinyl chloride), this versatile material, it is lightweight and sturdy. This material is a long-term option and cost effective. This could be an option for the museum and low cost option.
9.1.4 Spray Painted signs
The simplest and cheapest would be number templates. Number templates are templates with numbers cut out so as they can be placed on any surface, they are sprayed or painted with a brush. They are usually sprayed, and the template is removed. This very cost effective. The template can be stored and reused over the same number to retouch faded numbers. They can buy in most hardware stores or online. This is simple and cost effective option. Any colour can be used.

9.1.5 Environmental Signs
There are new biodegradable plastics on the market today and many signs are made with this material. This could be another option; this is eco-friendly material that breaks down when discarded. This is an alternative to the traditional polyurethane based plastics.
9.1.6 Floor Paint
One of the solution’s that is proposed is lines on the floor to guide visitors around the interior part of the museum effortless. From research that has been done in the museum visitors have found it easier when lines were put on the floor especially the line that led them to the exterior part when the trains are exhibited. Prototyping has been done by sticking tape to the floor. The longer term solution would be painting lines with a long lasting durable paint. This would be safer than the tape, as the tape would wear down over time.

There are many paints on the market today that are suitable for this job. They are inexpensive and could be applied easily. There is low maintenance.

9.2 Prototyping

As a way to verify our concepts and recommendations the team made use of the prototyping method, some drafts and prototypes were generated in a way to have feedback from the visitors and the museum staff to improve the functionality and effectiveness of the end product. It would also allow the recommendations to be more precise and with a foundation.

9.2.1 Prototyping in way-finding

For the way finding the use of images or info graphics instead of words is proposed, because for most of the visitors an image or a sign can be more easy to understand, signs are also international so there is no need of translations and only one sign can be used. Some examples of the signs developed are shown below. The continuity of style is important, so some changes and templates are suggested.

![Image of signs](image)

Figure 26 Actual signs and proposed

In the 1st floor there is the audio-visual, the library and part of the collection, most of it of the different hats used by the personal in the railroad, so instead of the words in Spanish some signs are suggested and also the inclusion of something to tell visitors about this second part of the exhibits.
Instead of Col.lecció de vehicles the image of a train could be more explanatory and to follow the same style the modifications of the international signs of elevator and WC are presented.

In the outside, just before the entrance the activities of the day are shown, so a template is suggested to give continuity to the style of all the signs in the museum and make the activity’s more clear, some info graphics will be given to the museum if they want to use them, because the activities change almost every week or day.

The navigation in the museum must be very clear, so the team made a mood board of different approaches from other museums to have an idea of what kind of signs and marks could work in the museum.
One of the problems found in the museum was the entrance, to enter the museum first you need to enter the building and pay your ticket in the ground floor, but the entrance is not very clear, so 2 proposals were made. One was to include a sign of the entrance in a more visual way.

The other one was to put some lines on the floor, because it must be clear were to enter, even the staff commented that some people took advantage of this “confusion” and would enter directly to the train area without paying. So to avoid any confusion this was proven with the use of colour tape.
To make a divisor line between the parking space for bikes and the entrance and make some fake corners to guide the visitors.

On the entrance of the ground floor the ticket counter is on the left side and some people don’t notice it when they enter, so they keep going into the museum, without paying and have to be called back, some of them look for the ticket counter and others think it is a free museum. Visitors looking to buy the tickets ask in the reception where they can buy and others keep going until someone of the staff has to make the awkward comment about paying the tickets before.

The design team found out that with only one line people would stop before crossing it and turning into the reception where they could buy their tickets, the response was immediately and can be created with a very simple element.
One of the most important exhibits in the museum and what the visitors look forward to is the collection of vehicles, but in the ground floor this can be a little bit hidden, visitors must go between a tunnel where they show a little animation and a green table, the staff explain this to the visitors but many times the visitors go through the tunnel instead of going to the side, to make the way clearer some black lines representing a railroad to guide visitors to one of the most important areas of exhibition.
Figure 36 and 37 Floor graphics

One exhibition that is also very nice is the signal box a green table used to control the railway traffic, it has some stairs to look at it closer but it may be good to give a sign to the visitors to encourage them to use them.

Figure 38 Green lines

Green lines were put on the stairs to encourage visitors to go up and watch closely the signal box.

Another part of the museum that is a lot of times forgotten is the 1st floor where they show a video of the railway history and where they also have another part of the exhibition, this is sometimes missed by the visitors because it is not clear if they are allowed to go upstairs or not and if there is something there, there is a sign but is only in Catalan and the location could be better so the team put a line indicating people that there was also something upstairs and a sign of the audio-visual library and part of the collection with images. The visitors reacted to it in a positive way; they noticed the arrow and follow it to see the expositions upstairs.

Figure 39 Guiding line
One of the problems noticed was finding the numbers while using the audio-guide, and as the smartphone application will also make use of the numbers on the exhibits to provide more information this numbers must be very clear. Some numbers were cut and placed next to the trains to find out the best size and colour and to make test with the visitors.

Figures A, B, C different colours and numbers

This would be a comparison between the numbers they have now and the numbers suggested.

Figure 39 Comparison of signs
For the locomotives the number on the corner seemed like the best option to have continuity with the trains that are not covered and not to interfere with the building and possible photograph enthusiast that wouldn’t like to have the number so big on their picture.

For the back part a sign like this could grab the attention and make people to look at this part as well.

For the colours the suggestion is to use the same colours that the museum already uses in their placards, a dark yellow which people is able to identify easily and gives continuity to the whole signage.
9.3 How the way-finding elements can improve the user experience and interaction of the museum visitors?

The visitors experience can be improved by enhancing the way finding. Currently there is no clear way finding and visitors find it difficult to find their way through the museum and even walk past by the reception at the entrance and possible exhibits or waste time on searching the right direction or having to ask for it. With the help of guidelines on the floor and improved signage to guide the visitors in the right direction it makes sure that the visitors won’t have those problems anymore.
10. CONCLUSION

Conclusion
The railroad museum of Vilanova I la Geltrú has been in existence since the building closed as a depot in 1990 this museum hosts a large selection of exhibits that date back to the introduction of the first trains in Spain. The museum takes you on a journey back to the beginning when the industrial revolution was in its infancy. This study looks at merging both old and new technologies to give the visitor a better and more interactive experience. To improve visitor experience an in-depth study of the museum was done by a user centered design approach. The research involved and identified user requirements. Solutions were obtained using questionnaires, expert review focus groups, concept design, user testing of prototypes, and field trials. From this research, problems were identified such as signage and way finding. There was also a need for more interaction within the museum. People are also so used to getting information at the swipe of a finger and visitors to museums are no different, they want more than just static exhibits. The first step to introducing technology to this museum is a smart phone application. This application allows the visitor to move through the museum effortlessly. It will replace the out dated audio guide. The app and the way finding will merge to give the visitor a more relaxing visit by eliminating frustrating lack of clarity in moving around and viewing exhibits. The first step to introducing technology to this museum is a smart phone application. This application allows the visitor to move through the museum effortlessly. It will replace the out dated audio guide. The app and the way finding will merge to give the visitor a more relaxing visit by eliminating frustrating lack of clarity in moving around and viewing exhibits. The introduction of a smart phone application will be the first step in nudging the railroad museum into and embracing 21st technology. This is only the beginning of the journey of introduction of new interaction technology, both old and new technology will work side by side to give the visitor an informative and enjoyable experience.

How can the user experience and interaction of the museum visitors be improved?
The Visitor’s interaction and experience can be improved by the use of a smartphone application. This application will replace the audio-guide and will provide the visitors more information in their own language besides the current audio files on the audio tape. This also allows the visitor to control how much time they want to spend in the museum and to follow his or her own path. By giving the visitor more freedom the visitor can go to specific areas that suit their interests in an interactive way.

The visitors experience can be improved by enhancing the way finding. Currently there is no clear way finding and visitors find it difficult to find their way through the museum and even walk past the reception at the entrance and possible exhibits or waste time on searching the right direction or having to ask for it. With the help of guidelines on the floor and improved signage to guide the visitors in the right direction it makes sure that the visitors won’t have those problems anymore.
11. Discussion and recommendations

The smartphone application still has to be tested with users, preferable visitors of the museum, the staff and the supervisor. The application is created on the base of the heuristics of Nielsen and a benchmark with ten different museum apps. Even though the creators of this application have experience with usability research and creating smartphone application prototypes it still has to be checked and tested by its end users.

The virtual visit is an interactive that gives the visitors the ability to go inside the trains where they normally can’t go in. The virtual visit that is used in the smartphone application is the web based version and is not optimized for the smartphone. It is recommended that if the application will be build or another prototype be made, that the virtual visit should be adjusted and tested with the end users.

For the signage we recommend to do a researcher-administered survey to test each signage icon with a few examples and ask the visitors which icon is the most suiting and understandable to communicate the message to the visitors. This is important to make sure the symbols and icons are internationally understandable.

Proposal

In the research it was find out that the thing visitors liked the most was the interaction with the trains and the feeling of going back in time, so to improve this tactile experiences and also to improve the information about new green technologies used in the railroad, the team made the following concept proposal for further development

This proposal consists in introducing a green aspect into the museum. Trains are a more efficient and environmental way of traveling than most other ways of transports and give its passengers a smaller carbon footprint than travel by car or air. The museum is missing a green aspect. This needs to be shown in the museum in some form. Children visit the museum on a regular basis; this gives the museum an opportunity to display information on the green benefits of train travel.

From research that has being carried out, one of the most important feedback from the visitors is that they want to interact with the train; this involves getting into the train. Visitors want their experience to be tactile.

Unfortunately visitors cannot be allowed to drive the trains, but there is an option that could be developed at a later stage. They could use a handcar on the existing rail tracks that are located in the external part of the museum.

This with an original or a replica handcar (cart that was used on the railway tracks for the railway workers who used it for maintenance of the trains and tracks) could be used in conjunction with new with kinetic and piezoelectric energy. This would be a bought physical and educational interactive tool. Further information in Anexx D
12. REFERENCES


http://www.gamesindustry.biz/articles/2013-08-13-leap-motion-passes-1m-app-downloads-sdk-hits-25-000-users