Evaluating Interactives at the Postal Museum and Mail Rail

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The Postal Museum

Evaluating Interactives at the Postal Museum and Mail Rail

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Abstract

The goal of this research project was to evaluate interactive exhibits at the Postal Museum and Mail Rail and suggest improvement strategies to the Museum through four objectives: identifying current and best practices, soliciting Postal Museum staff's knowledge of the exhibits, assessing visitor experiences with the interactive exhibits, and conducting in-depth evaluations of selected exhibits. In terms of deliverables, the team compiled the ratings of each exhibit in four main categories: attraction, placement, engagement, and learning. The team also presented a set of long and short-term recommendations for existing exhibits, new interactive ideas, and the museum as a whole.

Acknowledgements

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- The Postal Museum
  - Hannah Smith
  - Yatin Patel
  - Sally Sculthorpe
  - Joshua Henning
  - Ian Tolley
  - Martin Devereux
  - Davide Avanzo
- KCA London
  - Joe Martin
- Museum of London
  - Felicity Paynter
  - Elpiniki Psalti
- London Transport Museum
  - Martin Pugh
- National Maritime Museum
  - Katherine Biggs
- National Army Museum
  - Dominique Bouchard

Executive Summary

The Project

The team's goal in this project was to evaluate the interactive exhibits at the Postal Museum in London. Since the Postal Museum only opened at their new location on July 28, 2017, less than a year before the project began, and because the staff was still busy with finishing off the tasks that came with a change in location, the museum had not performed any thorough evaluation on the interactive exhibits. Such an evaluation is needed for the Postal Museum in order to determine the extent to which the interactive exhibits fulfilled their intended purpose: to attract visitors of all types and showcase stories and collections in an engaging, interactive, educational, accessible and fun way. To fulfill the goal of evaluating the interactives and providing helpful recommendations, the team established four objectives:

1. Determine the current and best practices involving interactive exhibits among other museums.
2. Solicit the knowledge of staff at the Postal Museum concerning their expectations and perception of the interactives in the gallery.
3. Assess the visitors' experience of the interactives in the gallery.
4. Perform a more in-depth evaluation of specific interactive exhibits to determine their strengths and shortcomings.

Methodology

The data gathered from these four objectives allowed the team to benchmark the interactives at the Postal Museum, as well as establish suggestions for improvements. To best determine how the practices at the Postal Museum compare to those at other museums, the team conducted interviews with staff at the Museum of London, the Museum of Science, the National Maritime Museum, the National Army Museum, and the London Transport Museum. These interviews focused on the staffs' experience with interactives, regarding their development, implementation, maintenance, and any past evaluation. The team also visited these museums on their own in order to understand how a visitor might feel after using these interactives.

To understand exactly what the Postal Museum expected from its interactives, the team interviewed several staff members, including the heads of the departments of exhibitions,

community and school learning, and visitor experience, as well as the IT manager, an engineer, and a contractor with whom the Postal Museum worked to develop the interactives. These interviews focused on what each staff member expected out of the interactives, whether they were working as intended, and what problems they had noticed already. The interviews with the contractors focused more of the developmental process of interactive exhibits, how they went about designing an interactive to fit its goals, and any problems they have experienced in the past with designing interactive exhibits.

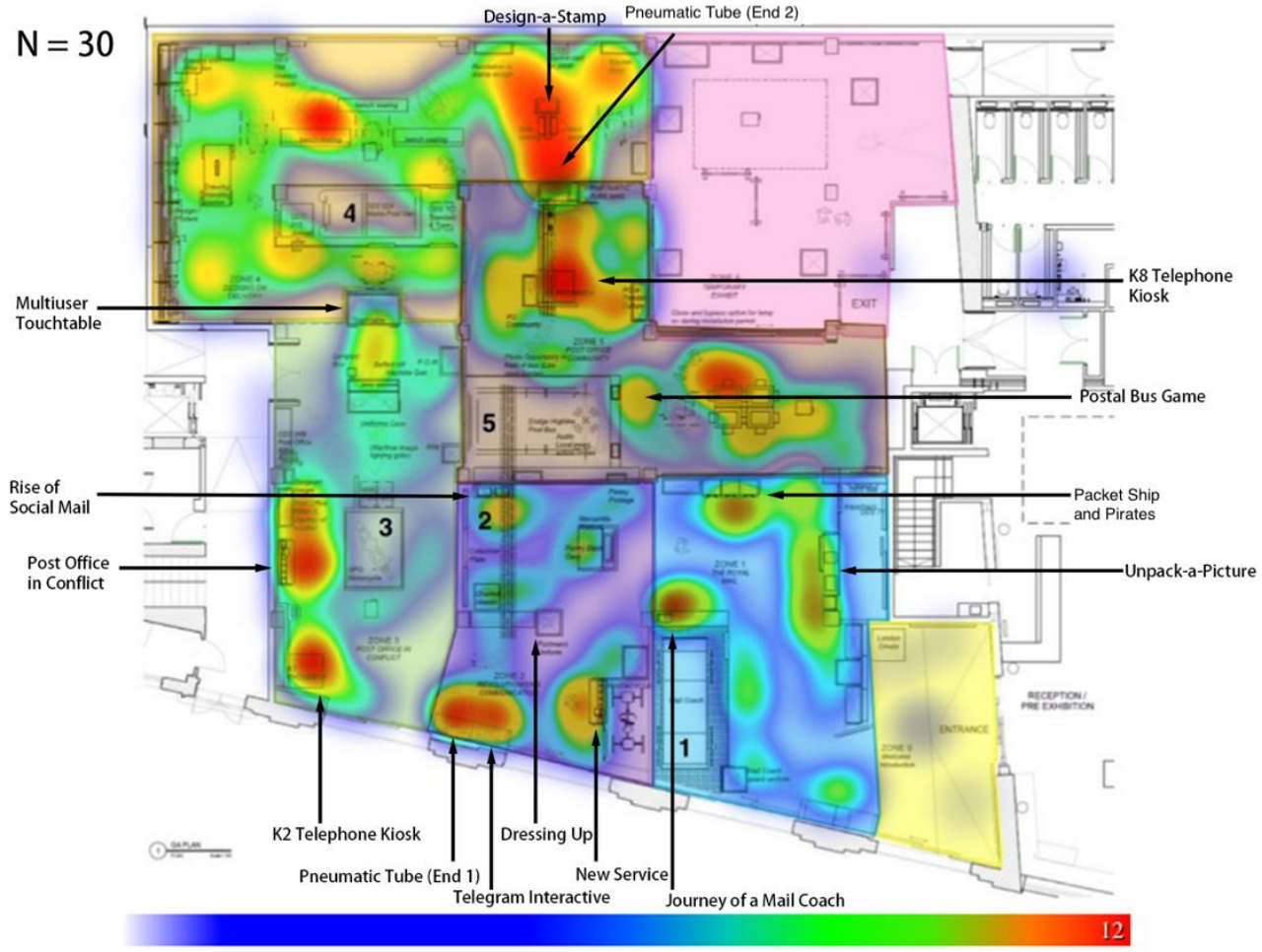
To determine in general how visitors acted in the museum gallery and gain more data to base the next objective on, the team observed visitors in the museum gallery and interviewed them as they exited the gallery. These observations included tracking their path through the gallery, recording the dwell time, and how much they interacted with each interactive (the degree of interaction). The degree of interaction included whether the exhibit was broken, the visitors didn't notice it, if it was occupied when they reached it, they used it but did not complete the main objective of the interactive, or completely finished using the interactive. The interviews included asking for the visitor's age as a basic demographic, which interactives they felt were the most memorable, which ones they learned from, and which ones they liked or disliked.

Following the completion of this objective, the team performed a more in-depth survey focusing on particular interactives. This survey focused on three aspects of each interactive, its intuitiveness, the level of engagement it prompted, and how effectively it transmitted learning outcome(s) to visitors. The team interviewed visitors just after they moved on from an interactive, with the questions focusing on how easy they thought the interactive was to use or understand, how long or deeply they interacted with it, and asked them to relay as much of what they learned from using the interactive as they could (figure on the right is the word cloud generated of 'what visitor learned' from one of the Mail Rail exhibit - Switchframe).

E.S. Figure 1: Switchframe - Word Cloud for Learning Outcomes

Findings

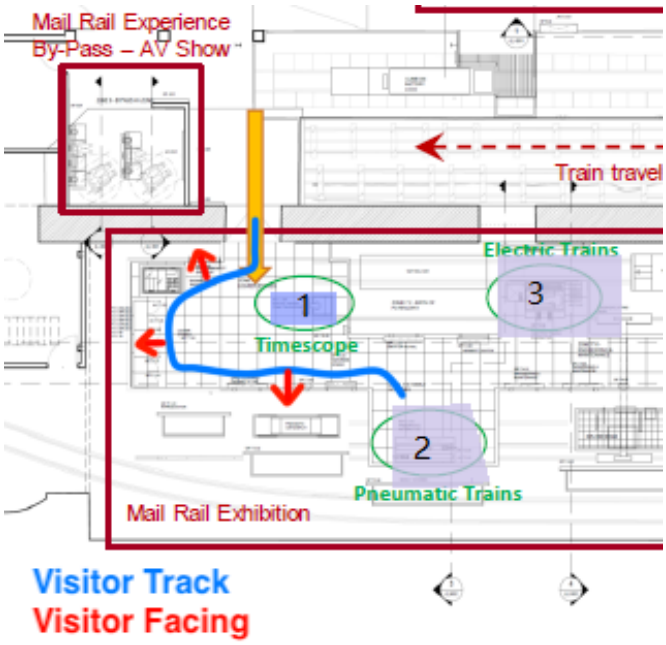
Following the completion of these four objectives, the team analyzed all the data it had received. A common trend noticed with all museums studied in the first objective as well as the Postal Museum in the second objective is that maintenance is the most critical aspect of an interactive exhibit. Additionally, some museums use their interactives for different purposes; The Museum of London uses their interactives to support nearby objects, describing them in a more compact or thorough manner than a physical display would allow, while the National Maritime Museum readily uses interactives as standalone exhibits, to explain concepts or tell a story that is difficult to portray using a static object or display.



E.S. Figure 2: Heat-map of the Postal Museum

E.S. Figure 3: Trace-map of the Postal Museum

The heat map and trace map the team created for the Postal Museum can be found here. Through the visitor study portion of the project, the team discovered that some interactives are not used as frequently as the others, mostly because of their placement; as shown in the figure below, the Timescope interactive in the Mail Rail gallery, for example, is placed in such a manner that visitors often walk around it to see other exhibits, passing it by in the process. Additionally, some interactives are easier to use than others, so visitors will frequently be able to complete all the learning objectives at these interactives, while they may become bored or frustrated with others and pass them by too quickly, missing some of the intended learning objectives.



E.S. Figure 4: Route usually taken by visitors who neglected the Timescope

Recommendations

For deliverables, to help existing interactives to improve, the team composed Report Cards of each interactive exhibit that summarizes all the findings about its advantages and shortcomings, as well as any short and long-term recommendations about improving it. The cards also visualize each exhibit's performance with a radar chart on four aspects: Attraction, Placement, Engagement, and Recollection. Based on how well each interactive did in these aspects, we gave recommendations that ranged from simple changes that could be done quickly but nonetheless had a large effect, to more long-term changes that would have a similar or greater effect but at a higher cost.

The team also pointed out potential interactive ideas (from similar museums) that the Postal Museum may experiment in its second-year renovation. On top of that, the team gave more general suggestions regarding interactive instructions, live interpreters, and the museum as a whole.

Authorship

The document is equally authored and edited by all project team members. This following table contains detailed authorships of all non-trivial sections.

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Chapter 1. Introduction

Museums have three major roles: collections, research, and education. With the explosive increase of entertainment and "edutainment" venues, it becomes harder for museums to maintain visitation. Based on visitor figures collected by Association of Leading Visitor Attractions (ALVA, 2017), museums in England have continued facing a slow increase or even declining visitor numbers in the 21st century (ALVA, 2017). In response, museums have been devoted to promoting the exhibits and programs to attract target audiences. They have done this by employing visitor evaluation studies to understand and enhance visitor experience, and guided by these visitor studies, many museums have produced physical and digital interactive elements to attract, entertain and educate their visitors.

The Postal Museum opened on July 28, 2017, with its accompanying exhibition, the Mail Rail, opening on September 4, 2017. Based on their own and other's research showing the value of interactives in learning, particularly with children under 11 years old, the Postal Museum decided to integrate numerous physical and digital interactive exhibits in the new galleries. Because it only opened recently, the Postal Museum had yet to conduct an in-depth examination of how well its interactives are performing. At approximately one year after the official opening, the Postal Museum wanted to know how visitors were using the interactive exhibits, what they liked or disliked about them, what they learned using the interactives, and how they compared with interactives at other museums.

The goal of this project was to evaluate interactive exhibits at the Postal Museum and the Mail Rail and identify possible improvements. Branching from this overarching goal, the team derived the following four objectives:

- Identify current and best practices for the design, development, and implementation of interactive exhibits;
- Solicit Postal Museum and Mail Rail staff opinions about the design, implementation and performance of the galleries and interactives;
- Assess visitor experience with the interactive exhibits at the Postal Museum and the Mail Rail;
- Conduct in-depth evaluation of selected interactive exhibits.

To achieve these objectives, the team interviewed staff members and other experts, both in the Postal Museum and at other leading interactive museums in London. The team also conducted visitor studies at the Postal Museum including tracking, observation, and exit surveys. In a later phase, the team supplemented these studies with a more in-depth assessment of particular interactive exhibits, selected from data from preliminary studies of success.

Chapter 2. Literature Review

To gain some background in this area for the team's project, the team consulted published research on the purposes of museums in general, followed by the learning behavior occurring in a museum context. The team then narrowed down the studies, focusing on interactive exhibits, including their advantages, design principles, and the methods to evaluate them. The team concluded the research with a study on the Postal Museum and the Mail Rail, covering their identity, goal, and layout.

2.1. Museum Overview

The word "museum", as defined by the International Council of Museums (ICOM), refers to "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates, and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" (ICOM, 2007). Thus, museums have the following major roles: maintaining collections, conducting research, and educating the public. By analyzing the nature of their collections, Geoffrey D. Lewis (1996), President of the International Council of Museums, categorizes museums in the following five categories based on the nature of their collections: general, natural history and natural science, science and technology, history, and art museums. Museums may also be categorized based on the type of their collections, whether they are local or nationally recognized, and many other more specific features, such as if they are a historical site or a working museum. This being said, museums often do not fall into just one category; the boundaries between the categories are flexible and allow museums to be unique in how they are represented.

Brief History of Museums

Since museums first came about, their purposes and approach to education have changed significantly. The first museums began as exhibitions of private collections of wealthy individuals and were only shared with other members of the elite. The art or historical artifacts on display in these early museums could only be accessed by those with significant financial and social power, and the exhibitions of these objects were more of an embodiment of the collector's wealth and eminence rather than a display for public benefit (Andrews John, 2010). As sources

of education, these museums could only serve scholars with social and financial importance; their full potential as locations to provide knowledge to the public would not be achieved until much later. During the 18th century, public visitors began to be admitted to the Royal European collections held in palaces —still an activity for the advantaged. In this manner, museums began shifting from private to public access. This transition was followed, in the late 19th century, by museums becoming centers of learning and banks of knowledge (Hein, 1998).

In today's world, with the inauguration of a new museology, increasing consumer demand and heightened competition, museums recognize the need to adopt new ways to achieve their educational mission. Three key factors are:

1. Recognizing visitors' capacity to make meaning for themselves;
2. Collaborating with visitors to discover what they personally want from the museum experience;
3. Mobilizing the museum's resources to meet these needs.

Realizing the importance of these circumstances has led museums to shift from didactic to more interactive and visitor-centric approaches to the design and implementation of exhibits and programs.

One of the best ways that modern museums are switching to a more visitor-centric exhibition is by switching from a didactic approach, presenting static displays with plaques explaining the exhibit in a way only those knowledgeable in the topic would understand, to a **constructivist approach**, which enables visitors to construct their own knowledge structures from the exhibition. In this way, museums can appeal to a variety of learning styles and visitor types (Hein, 1998). Olds (1990) contends that a visitor-centric museum should provide their visitor with:

- Freedom of movement: Museums should not confine the movement of visitors, know and have their needs met and let visitors know their location in navigating the galleries.
- Comfort: Museums should create an environmental setting that maximizes visitor comfort through lighting, furnishings, and comprehensible exhibit designs.

- Competence: Museums should present objects and information that does not overwhelm the visitors but enables them to connect their own knowledge and experiences.
- Control: Visitors want to feel safe when navigating through the galleries.

2.2. Learning at Museums

A museum is a place of **informal learning**, which is a term used to describe the education that happens in out-of-school contexts such as zoos, aquariums, and museums (Diamond, Luke, & Uttal, 2016). In contrast with traditional learning environments, informal learning accentuates a process of learning that is uncertified, flexible, unstructured, and spontaneous. It is a type of learning devoid of the structured learning environment such as would be provided by lectures in a classroom. Museums may hold programs and activities that imply formal learning. However, in most museum contexts, visitors acquire an understanding or appreciation of a subject without feeling someone is teaching them (Foster, 2008).

Informal learning advocates a personal and individualized learning atmosphere where it is the visitors that decide what knowledge they want and how to gain that knowledge. Moreover, museums propagate informal learning because it is similar to learning in everyday life; museums can initiate and promote this way of learning. Interactive exhibits are widely employed at museums to promote informal learning, inspiring people to learn for learning's sake and it can be both fun and exciting (Diamond, Luke, & Uttal, 2016).

Although a place of informal learning, museums designers still expect their visitors to attain certain **learning outcomes** like in formal learning institutions. Inspiring Learning for All (ILFA) is a framework developed by the England Arts Council aiming for practitioners to improve the learning at public knowledge banks. Namely, it populates the definition of generic learning outcomes (GLOs) as listed below (Foster, 2008):

- Knowledge and understanding
- Skills
- Attitudes and values
- Enjoyment, inspiration and creativity
- Action, behavior and progression.

Informal learning also asks museums to serve all manner of **learning styles** to reach defined learning outcomes. Based on how museums present their content and how they apply a specific learning theory to the audience, they can be categorized into four types: the systematic museum, the discovery museum, the orderly museum, and the constructivist museum (Hooper-Greenhill, 1999).

Figure 1: Museums and Learning Types (Hein, 1998)

Figure 1 shows different types of museums based on the learning style they represent. The old-fashioned systematic museum exhibits the content so that it reflects the 'true' structure of the subject matter, and the content should be presented to the visitor in a manner that makes it easy to comprehend. It is common for exhibits to present material in a single, orderly manner deemed by the exhibit designers to be best suited for visitors to learn the message of the exhibit.

In modern settings, museums adopt a constructivist approach where the viewer constructs personal knowledge from the exhibit, and the exhibits allow the visitor to draw their own conclusion about the meaning of the exhibition. In fact, instead of systematically and passively feeding a visitor with information, the constructivist museum acknowledges that knowledge is created in the mind of the learner using their own personal learning methods.

It is clear that constructivist museums accommodate all ages and types of learning (Hein, 2012) and demonstrate the idea of informal learning. Different from the didactic approach given by traditional museums or schools (formal learning), museums are trying to combine education and entertainment (informal learning). To accomplish these missions, museums have been increasingly incorporating interactive exhibits. However, balancing between 'just for fun' and 'learning while having fun' can be challenging.

2.3. Museum Interactives

Interactive exhibits have been defined as "those in which visitors can conduct activities, gather evidence, select options, form conclusions, test skills, provide input, and actually alter a situation based on input" by McLean (1993). The core value for an interactive exhibit is the reciprocity of action. Users are allowed to act on the exhibits and the exhibits provide a reaction back to the user. The development of museum's exhibits started with non-interactive exhibits, followed by interactive exhibits, which have separated into digital and physical interactives with the growing power of technology,

Non-interactive vs. Interactive

The idea of having interactive exhibits in museums began in the latter half of the 20th century. Before that, museums acted as collections of artifacts, which visitors could only use their eyes to look at the exhibits. Visitors were educated through short and basic introductions on the printed labels around the exhibit (Hawkey, 2004).

A study by Hein and Heald (1988) showed multisensory interactive exhibits promote engagement, understanding, and content recollection of exhibits in museum. The idea that interactivity can improve a visitor's learning at museum exhibits also has roots in the philosophies of experiential education (Dewey, 1938/1997). An interactive exhibit's emphasis on the physical input of visitors to encourage the participation and the outcome brings engagement

and accomplishment to visitors (Andrew, 2002). Interactive exhibits encouraged users either to assimilate new knowledge into their existing conceptual structure or to accommodate new, conflicting ideas by restructuring their previous understanding. These two strategies both provide a process of learning and allow users to strengthen or rebuild their memory.

Interactive exhibits can be further subdivided into **physical and digital interactives**. The development of technologies began to introduce significant changes into exhibits in museums, and digital interactive exhibits offer a greater concentration of information than physical interactive exhibits, due to the properties of digital storage and retrieval. Compared with physical interactive exhibits, digital exhibits take less space to provide more information, respond quicker and are easier to update. However, physical interactive exhibits are still useful for especially tactile learners, due to the ability to hold or manipulate the object with your own hands. A computer image of a knight in armor will work well for some people but being able to see the same armor from multiple angles and possibly even wear a replica often provides a much better experience.

Interactive exhibits are completely different from non-interactive exhibits, requiring no input from the visitor. For example, a non-interactive exhibit displaying Archimedes' screw would simply be a replica of the object, or an archeological artifact. However, an interactive exhibit displaying Archimedes' screw would allow a visitor to crank the screw themselves, allowing them to see the water being moved uphill.

Design of Interactives

Since the creation of interactive exhibits in the late 20th century, museums have been constantly innovating their interactive exhibits. During the process, they have learned a lot about the design of interactives. For instance, interactives should be family-friendly because a significant proportion of museum visitors are families with children. It is also beneficial to create a free-choice learning environment that is distinct from schools for young visitors. Albeit having these standards, museums need to avoid interactive design pitfalls, such as being overwhelming to visitors, or not having clearly defined learning outcomes.

Family-friendly design is a major subject in museum exhibit settings because family & children occupy a large percentage of visitor demographics in museums. As indicated by an

evaluation at the London Postal Museum (2017), 16% of the parties visiting the museum have children (ALVA, 2017). Therefore, their needs must be addressed in the design of museum interactives. Borun and Dritsas (1997) pointed out that family-friendly exhibits should have the following characteristics:

- Multi-Sided: Interactive should allow family members to cluster around;
- Multi-User: Interaction allows multiple user to collaborate at the same time;
- Accessible: Comfortably used by people of all age range;
- Multi-outcome: the interaction and observation are sophisticated enough to spur discussion;
- Multi-modal: invite involvement of individuals with different learning styles and knowledge backgrounds;
- Relevant: link to visitor's existing context of knowledge or experience.

Although the last two characteristics reiterate ideas from ILFA in Section 2.1, they again accentuate these consistent themes guiding the design of interactives.

Bourque, in her literature review for the National Park Service (2014), emphasized that museums should have **free-choice settings** because family members' identities would affect family dynamics and in turn result in different motivations, needs, and learning styles. Furthermore, while a formal learning environment relies heavily on the learning part of the learning-fun spectrum, free-choice at museums allow visitors to experience the fun end of the spectrum. For instance, Bourque pointed out that a parent would not always lead or mediate their children's experience at a free-choice setting.

Museums may also get carried away by these guidelines and, sometimes, adopt the idea that 'more is better'. Gutwill (2004) listed some of the most common pitfalls in science museum interactive designs:

1. Museums need to avoid having too many features aggregated at one interactive, where visitors are presented with an obvious priority of the elements or labels. Visitors are likely to be overwhelmed by the mounting input of information and may be confused by an exhibit with no clearly defined output area or outcome. In this case, museums should clearly understand what visitors may expect to get though interacting.

2. As mentioned previously, family-friendly design calls for multi-user capacity. However, without good coordinative design or guidelines, users may just disrupt each other by interacting simultaneously.
3. When an interactive exhibit has a single, powerful feature, accompanied by some marginal or peripheral features, users may be misled to consider the secondary feature as the dominant one. If some secondary interactive feature eclipses the primary one, the learning outcome for the interactive exhibit would change.

A common solution for these issues is to create a hierarchy of functionalities. Some of the features can be repurposed so that they appear more or less obvious to visitors. Sometimes, if it is determined that features are too concentrated on one exhibit, segmenting the functionalities by creating a new interactive is also a solution (Gutwill, 2004). Identifying and deciding what to do with problematic interactives requires evaluation, which will be covered in the next section.

2.4. Evaluation of Interactives

As museums are adopting more interactive galleries, it becomes increasingly important for them to know how the exhibits are performing. One way to do this is through monitoring and evaluation. Monitoring provides a quantified information such as traffic flow and visitor demographics, and a museum may use these data to know whether the visitor figure has increased. On top of that, to help a museum to interpret visitation data, a museum can conduct such evaluations as visitor surveys and focus groups to allow a more in-depth understanding than simple visitation demographics alone can provide (Foster, 2008).

Additionally, museum visitors have now come to expect a high level of interactivity when going to museums. However, the design for interactive exhibits are still very open-ended without a standardized design in practice. Evaluating museum interactives is challenging because of the broad base (Pekarik, 2002). Given the open-endedness of interactive designs and valuable data an evaluation can produce, museums and their patrons can reap rewards from conducting well-organized evaluations.

Types of Evaluation

The following are the three major types of evaluation that can help improve the design and implementation of interactive exhibits. They are front-end, formative, and summative evaluations.

Front-end evaluation is used when a museum is in the planning stage or redesigning exhibits. It helps to assess whether the project is worth running and, if so, how the budget or other resources should be deployed to ensure a final, high-quality project delivery. In particular, when conducting a front-end evaluation, the evaluators are interested to learn what visitors want to experience in the museum.

Objectives for front-end evaluations incline towards a study of the visitors. Identifying visitor demographics that may include factors such as gender, age, general education level, and ethnicity can give developers ideas about what people would be their main target group and what flavor an interactive should embody to satisfy all kinds of participants and reflect visitor expectations. Lastly, it is important to know the target's current knowledge scope so that visitors will not be overwhelmed by the amount of information in the gallery or feel discontent by the lack of new information (Foster, 2008).

Formative evaluation is somewhat similar to front-end evaluation in that they are both aimed towards gathering qualitative data (Slover Linett Audience Research Inc, 2013). Formative evaluation usually takes place after front-end evaluation. It is conducted during the development phase of a program (or during a redevelopment), or in other words, while the program is still forming. It typically involves testing of exhibit prototypes or mock-ups. These activities can give developers quick feedback on whether the prototype meets the project aim and how the final product could be further refined.

The formative evaluation can have objectives such as determining whether the exhibits work mechanically. At the first glance, this kind of question does not really ask for visitor participation. But it may induce some potential design issue including non-intuitive controls or short life-span. These problems can be critical if carried towards the actual deployment. In museums, especially those that are interactively-focused, a sign saying "under maintenance" will

be highly disappointing to visitors and resource-consuming for staff. Secondly, the evaluation is centered around whether the visitors are getting the right message from the exhibitions.

Summative evaluation happens when an exhibit is deployed. At this stage, museums want to learn about the impact of the exhibit and if the product is performing as they planned. In addition, evaluation should also assess whether the data collected by the front-end and formative evaluation was successfully incorporated into the deliverables (Foster, 2008). Once the exhibit is opened to public, thus establishing a broader base for data, evaluators can conduct visitor studies about what they think of the exhibits as well as interview the staff to compare if visitors are achieving the outcome planned by the developers.

A summative evaluation is different from the other two evaluation types; its objectives congregate more on the results rather than the proceedings. For example, if a new gallery is opened, evaluators find that, on average, a total of 500 visitors attend the exhibition every day and evaluators tracked the visitor footprint. Doing so would not be a complete summative exercise. Rather, the evaluators need to answer questions such as why visitors tend to concentrate more near a specific object, and what visitors learn from interacting.

Overall, museum curators, educators, designers etc. use formative and front-end evaluation to identify the learning outcomes and shape the design of exhibits; they use summative evaluation to determine if the exhibits and programs have met the learning outcomes.

Evaluate Learning

Measuring learning for visitors is often challenging at museums where one's learning outcomes can be impacted by numerous factors such as the visitor's personal background, the interaction with other persons, handbooks and instructions, etc. One effective way of measurement is to hand visitors questionnaires at the end of an exhibition. Doing so is referred to as self-report measures, where people evaluate their own learning experience. The result is not reliable for formal learning outcome studies because people do not always accurately recognize how much they have learned (Robert A. BJork & Judith F. Kroll, 2015).

In the following table, Borun et al. (1998) categorized different indicators of learning, which other evaluators and researchers have adopted and adapted to measure learning from museums.

One Identifying	• One-word statements • Little direct association to exhibit content • Connections to content miss the point of the exhibit
Two Describing	• Direct connection to visible exhibit characteristics • Connections to personal experience based on visible exhibit characteristics, not concepts
Three Interpreting and Applying	• Descriptive statement of concepts behind exhibits • Connection to personal experience based on exhibit concepts

Table 1: Learning Level Measures (Borun, 1998)

2.5. The Postal Museum: Interactives and Evaluation

In its current form, the Postal Museum opened in July 2017. The Postal Museum has, however, existed in some form since 1966, where its collections were housed in the basement of the General Post Office headquarters. These collections began as little more than postage stamps but have expanded in the modern day into historical letters, traditional transportation, and postal antiques. The Postal Museum's goal is to showcase the stories and collections of the United Kingdom's postal heritage in an engaging, interactive, and educational way. For this purpose, the Postal Museum uses both digital and physical interactive exhibits, based on previous research about the value of interactives in the museum setting, which found that interactive exhibits engage most visitors regardless of age.

The main floor of the Postal Museum is made up of seven zones, as seen in Appendix A, with Zone 0 acting as a welcome space and Zone 6 being used for temporary exhibits. Zones 1 through 5 each focus on a particular aspect of the post in the past, and are, respectively, The Royal Mail, Mail for Everyone, Post Office in Conflict, Designs on Delivery, and Communication and Change. Spread among these five zones are five digital and ten physical interactive exhibits, described in more detail in Appendices 4 and 5; their locations are labeled in Appendix B.

The Mail Rail portion of the Postal Museum, housed in a separate building, has four physical and two digital interactive exhibits, described in more detail in Appendix C. In total, the Postal Museum and Mail Rail hold seven digital interactives and fourteen physical interactives.

Evaluate Interactives at the Postal Museum and Mail Rail

Because its interactives are so new, the Postal Museum requested the team's help to evaluate whether their interactive exhibits accomplish their goals and provide suggestions to improve them.

Chapter 3. Methodologies

The overarching goal of this project was to evaluate the interactive exhibits at the London Postal Museum and Mail Rail and recommend ways to improve them. The methods are organized under four objectives as listed below:

- Identify current and best practices for the design, development, and implementation of interactive exhibits;
- Solicit Postal Museum and Mail Rail staff opinions about the design, implementation and performance of the galleries and interactives;
- Assess visitor experience with the interactive exhibits at the Postal Museum and the Mail Rail;
- Conduct in-depth evaluation of selected interactive exhibits.

Table 2 is the timeline for the execution of the methods as described below. These methods were executed over a period of approximately 7 weeks in London, England, at the Postal Museum, with further research into interactive exhibits completed at other museums in the area. Figure 2 is a map for the goal, objectives, tasks, and data that the team planned, gathered and/or produced. The timeline and map were subject to modification as the team proceeded, as the project map was used to guide the team's research and evaluation of the interactive exhibits.

Table 2: Project Timeline

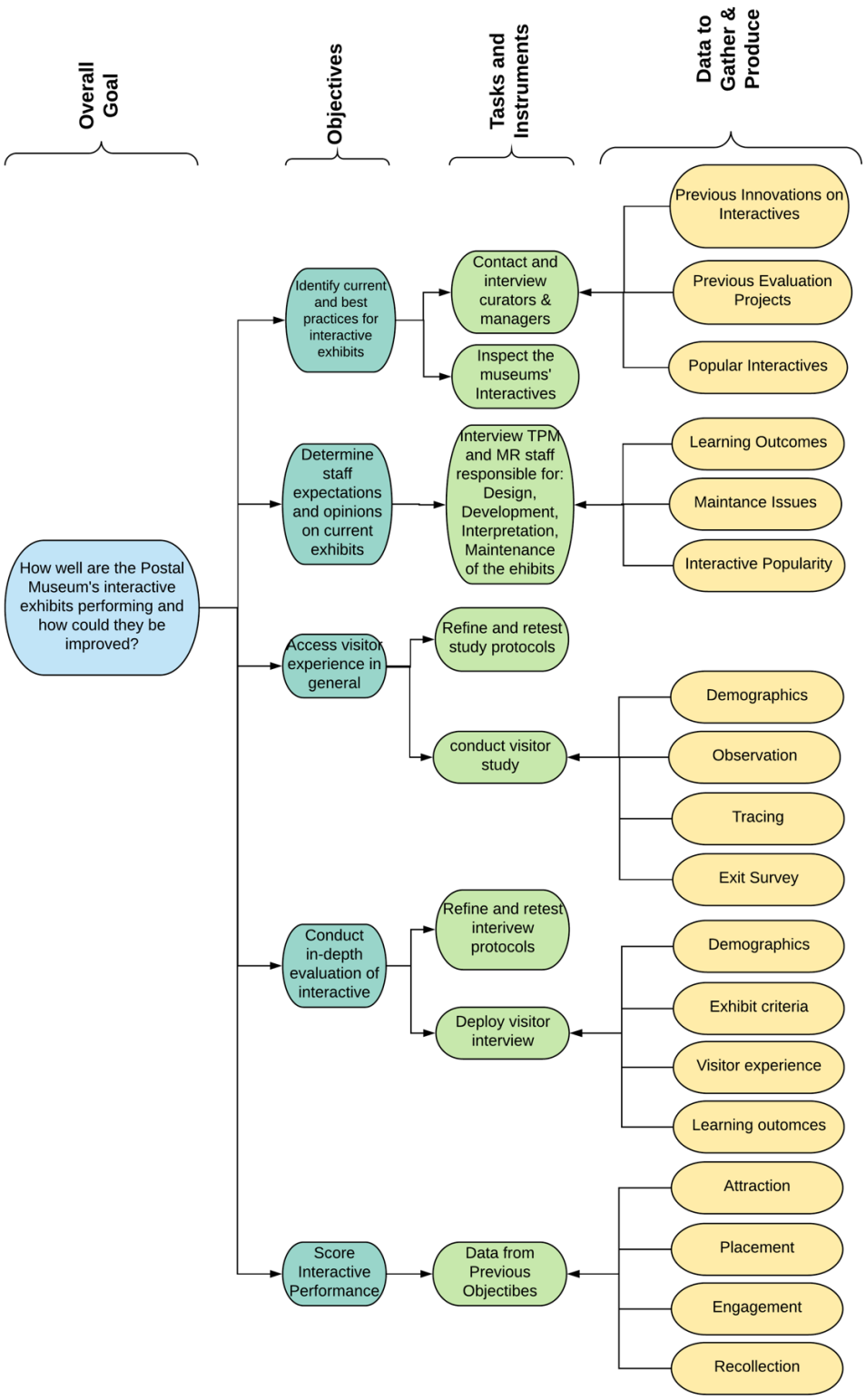

Figure 2: Method Map

3.1. Objective 1: Identify Current and Best Practices

First, the team visited the selected museums, engaged their interactives, and conducted informal observation of visitors using these interactives. the team focused on which types of interactive exhibits were popular, and if any lesson could translate well at the Postal Museum. After visit, the team summarized the team's thoughts as note for each museum. The notes are supplement for next step interviewing staff at the selected museum and also provide inspiration for improve the interactives at the Postal Museum.

Secondly, the team conducted in-person, semi-structured interviews with curators of selected museums. The team contacted the staff at these museums within the first few weeks of the team's arrival in London and agreed to a meeting time in the earlier phase of the team's study. The information guided the team's information-gathering methods later. The preamble to the team's interview and full preliminary interview script are in Appendix F; the team also modified the interview scripts for each museum based on what the team observed in each museum. The curators the team were able to meet with are from (in order of meeting time): The Museum of London, the London Transport Museum, the National Maritime Museum, and the National Army Museum.

While interviewing the staff at the Postal Museum, the team also explored successful practices of interactives of other museums. Doing so supplemented the team's background research on the best practices in the design, development, and implementation of interactives. The team's sponsors at the Postal Museum suggested several museums leading in interactive usage. These museums included the London Science Museum, Museum of London, National Maritime Museum, National Army Museum, and Imperial War Museum.

3.2. Objective 2: Solicit Postal Museum and Mail Rail Staff Knowledge

We started with the opinions of people that have experience working at the Postal Museum and may have witnessed any trends or changes that have occurred since the museum opened. One of the best groups of people that could provide us this information were the staff members at the Postal Museum. They not only knew what happened at the museum daily, they could also provide information on how the intended use of the exhibits may have been different

from how the visitors were actually interacting with them and how the impact differed from the expectations since the opening of the museum.

We conducted interviews with a variety of staff at the museum, receiving information from staff members that are in charge of the following four areas of the exhibits: design, development, interpretation, and maintenance. The team scheduled interviews with eleven people that currently work with, or have worked in, the development of the interactives of the Postal Museum.

Two of the contractors that were heavily involved with the design and construction of the interactives were able to provide us with information on how to design successful interactive exhibits.

The head engineer and head of the IT team provided us with information on the maintenance and repair of the exhibits, both physical and digital, respectively.

We also interviewed a variety of staff that oversaw the development of the interactive exhibits and programs for school groups. These staff members were able to provide us some most essential information, such as the intended learning objectives and purposes for the interactives to achieve. The team were able to compare the information that the team gathered about what the staff intended for the interactives to achieve to what the team learned about the actual success of the interactives from the interviews that the team had with some of the visitor experience managers.

Each of these groups provided us with different perspectives on how well the exhibits are performing. While the general staff of the museum may have had more firsthand knowledge of what goes on in the exhibits, the managers were ultimately those that received this information from the general staff and had a broader idea of any issues with the exhibits. The list of staff members the team interviewed is in Appendix E.

Through the team's interviews with the staff of the Postal Museum, the team gained information on which exhibits they saw as popular and the most engaging, if there were any exhibits that were repeatedly broken, and if staff had any suggestions for improving the interactive exhibits in the museum. It was important to ask these questions of the staff prior to asking similar questions of the visitors in order to get a broader idea of what issues to ask about

specifically and get a general idea of what answers the team might expect to receive from the visitors.

The team conducted the interviews face-to-face during the first few of weeks at the project site; following the best practices from Objective #1. The preamble and full preliminary interview script are in Appendix G. The team edited and modified the script to fit the type of staff member the team were interviewing each time to best fit the interviewee's duty at the Postal Museum.

3.3. Objective 3: Assess Visitor Experience

This objective marked the beginning of visitor studies. The goal was to study visitors' attitude towards the current implementation of interactive exhibits. The team decided to approach this objective through a typical museum study method taken from "The Use of Digital Technologies for Learning at the Victoria and Albert Museum" (Andrews John, 2010): visitor tracking, observation and exit interviews. The preliminary protocol was first developed before the project commencement at London. It was then further developed during first three weeks aided by the information gathered from the previous two objectives.

Sampling and Preparation

On each data collection day, the team was divided into groups of two, with one at the Postal Museum and the other at Mail Rail.

The team employed systematic sampling of visitors at the entrance of both Postal Museum and Mail Rail. The team chose every second visitors / group of visitors that entered to the main galleries. After each study, the team would go back to the entrance and repeat the process. During tracking and observation, depending on the target's position in the gallery or which interactive the target was engaging, the team would observe from chosen vantage points.

The visitors enter at the far-left side of the gallery (close to the **Timescope**), while the observers would be stationed near the **Electric Train** while the subject was interacting with the first three exhibits or in their vicinity. Similarly, the observers would wait at the end of the gallery to cover the **Switchframe**, **TPO Carriage**, **MR Network Explorer**, and their vicinity. This location is also a good place to wait for the subjects to leave the gallery for the exit survey.

The layout at the Postal Museum is more complicated and the exhibit (interactives & non-interactives) are more packed than in the Mail Rail. Other visitors could block the view of the target, especially during rush hours, so the observers would stand in any free place they could that still offered a vantage of the subjects, while ensuring that these locations were not in the way of other exhibits.

Tracking and Observation

The team developed tracking & observation protocols for both sites (see Appendix H). One major guideline for designing the tracking sheet was to minimize the subjective differences when the sheet is recorded by different team members. One of the two team members on a tracking group would be observing visitor behaviors while the other noted the areas in which they spent a disproportionate amount of time, as well as the dwell time at each exhibit. The survey software Qualtrics is licensed to WPI and it offers a variety of data visualization. Hence, the team chose Qualtrics for observation and Apple Notes for tracing.

The data the team collected includes:

- **Time of day and day of the week:** The recording of data helped us segment visitor demographics, as they were likely to be different for weekends and workdays.
- **Visitor types:** individuals, adults without children, family with children, school groups.
- **Hotspot (heat map):** the team put a hotspot on the heat map if the target spent more than 10 seconds (best data threshold to generate an informative heat map discovered in pretesting) or took any photos at a spot. The color on the heat map would represent how many hotspots have been put there. In addition, the hotspot placement was segmented by zones. For instance, Mail Rail's exhibition had two zones, so the heat map for these two zones was separated during the observations but recombined later for data analysis.
- **Observation data:** for each interactive exhibit, the team noted:
    - Degree of interaction: In total the team have seven interaction degrees and each degree counted from 1 to 7 for future data analysis. The higher

number degree assigned represents higher engagement which the visitor had with the interactive. From less engaged to more engaged, the team separated the degree of interaction into the exhibits as: broken (1), occupied (2), visitor ignored (3), noticed (4), entered (5), interacted (6) or completed (7) with the exhibit.

  - Read Instruction: whether the target read the written instruction at the exhibit.
  - Discussion: if the target talked with others during their engagement with the exhibit.

- **Dwell time:** the duration between when the target first showed signs of interaction with the exhibit and when they removed their attention from the exhibit. The units the team used were minutes and seconds.
- **Tracking footprints:** the team would record the path a visitor took on the floor plan. The tracked footprint will eventually be combined into a single trace-map that represents the traffic follow in the gallery.
- **Comment:** The last section of tracking & observation was for the recorder to quickly write down any distinct behavior or other noteworthy observations that can possibly aid future improvement.

For group visitors, if the target group split up during the session, the team would randomly pick an individual from the group and continue the protocol.

Exit Interview

The team would ask the target if they would be willing to take a exit survey on their way out. The exit interview could supplement the observation and tracking data by learning the reason for target's behaviors back in the gallery. the team continued to use Qualtrics for this section, to keep data gathering consistent. To refresh visitors' memory about the interactives, the team developed posters with photos (the photos were taken by the team before opening hours to ensure quality) of the exhibits in the order that visitors would encounter them going through the gallery (see appendix J). the team collected the following information through the exit survey:

- Age cohort of the person being surveyed

- Group composition: the group composition was of interest because family-friendliness is a crucial design principle for a large portion of the interactive exhibits.
- Short answers:
    - Which one of the following interactive exhibits was the most memorable to you?
    - Among the interactive exhibits, is there any one where you feel you learned something important?
    - Could you tell us about why you skipped certain exhibits (the other team member would show interviewee photos of the exhibits they seemed to have ignored)?
    - Could you tell us why you spent a relatively long time at certain exhibits (the other team member would show interviewee photos of the exhibits where they had long dwell time)?
    - Lastly, do you specifically like/dislike any of the interactive exhibits?

The exit interview is mainly focused all of the interactive exhibits together, while the team turned its attention to specific interactive exhibits and did an in-depth interview on them in objective #4.

3.4. Objective 4: Conduct In-depth Evaluation of Selected Interactive Exhibits

After grasping a visitor's general attitude from the last objective, the research carried us into conducting an in-depth evaluation of selected interactive exhibits, using visitor interviews. The team selected a few exhibits each day where the studies would take place and targeted visitors as interviewees.

The interview protocols were developed from data collected from the three previous objectives and assessing criteria for museum interactives in the literature review section. The interview covered:

- Visitor demographics;
- Checking if the exhibit criteria are met by the interactive exhibit;

- Visitor experience;
- Visitor learning outcomes;
- Exhibit characteristics found in Objective #3.

(see Appendix K: Visitor Interview Guide)

Sampling and Preparation

The sampling was similar to that in Objective #3. The team divided into two groups that stood beside the two targeted interactive exhibits during each data collection day. The location of the interview depended on the recommendations of the team's sponsor liaisons and other relevant staff at the Postal Museum. The location for each day was at a place with high exit traffic flow but which did not impede visitor experience.

The interviewee sampling method was stratified sampling because the team's goal is to identify how different types of visitors like the interactives and not to draw general visitor demographics (demographics data was analyzed, however, for the difference in behaviors at each interactive exhibit). Furthermore, visitor demographics of a specific period would also affect the sampling. For instance, if the team learned from previous studies that groups such as families and school groups are present more frequently on weekends than on weekdays, the team would try to interview more of these types to reconcile the imbalance in sampling.

For families, the evaluator would ask the parents to solicit their child's opinions. When faced with school groups, because the person in charge may not be with the students that engaged the interactive and attaining the permission to interview the student may be time-consuming, the team only observed students from school groups but did not interview school group leaders.

Before interviewing a visitor, the evaluator would fill out basic information on the interview form including the target Interactive Exhibit and the Visitor Type. The interview guide in Appendix K and the data collected for the previous three objectives helped us develop and refine the final interview protocols.

Data Collection

The interview includes three sections: preamble, visitor experience assessment, and learning outcome. In the preamble, the team informed the potential participant about the nature of the study and let them know the personal information the team would collect, that is, their age range and the composition of their group. Similar to objective #3, the team applied the same demographic division as other evaluations done at the Postal Museum and Mail Rail.

The second section is the first feedback the team needed to collect, to see whether the interactive met the exhibit criteria from the literature reviewed. The evaluator would have the device to the target to have them fill in this part (See Appendix K for details). Besides assessing visitors' experience, the purpose of this section was to refresh the visitors' memory of the exhibit they just engaged to prepare them for the following open-ended questions.

The fourth section was to assess the learning outcome solicited from staff interviews. The questions are entirely open-ended where the visitors were asked about the subject of the expected learning outcome. The team listened to the demonstration made by the visitor of the subject and marked their level of understanding (see Section 2.3.2 for developing a qualitative measure for learning). The lowest level was identifying when the interviewees were only able to give fragmentary statements and unable to associate the subject with the exhibit content. In the second level, the participant should be able to link the subject with visible exhibit features correctly and connect their personal experience based on these features. The highest learning level was when the visitors could interpret the concept behind the exhibit and competently interpret the subject.

After the interview, the interviewer thanked the participant and finished the post-interview comment section. In this section, the team promoted visitor responses to the exhibit's symptoms (see Appendix K for a list of symptoms) noted from previous studies. For instance, if the team had learned that Exhibit #9 usually incurred a relatively longer dwell time than expected, and the visitor remarked that they need to refer back to the instruction several times during interactive, the evaluator would then document that the prolonged dwell time could be due to unclear instructions.

The team spent three days to **refine and pretest the interview protocols**. Based on the data the team gathered from previous objectives, the refinement included more design guidelines

in Section 2 of the interview, a more comprehensive list of visitor behaviors for Section 3 or elaborating on the qualitative learning measurement for Section 4 based on staff expectation. Moreover, the team worked on further distinguishing what question to ask when faced with different visitor types as well as considering the phrasing of the questions.

3.5. Objective 5: Score Interactive Performance

This section covers how to summarize the exhibits' performance by giving them a score in the following aspects: Attraction, Placement, Usability/Intuitiveness, Engagement, and Recollection. The scoring is using a 100-point-scale.

Attraction Scores are derived from the heat map from objective #2. In block mode, the heat map shows the hotness in a certain square space. The score would be a summation of the heat of the squares near each exhibit (see figure 3).

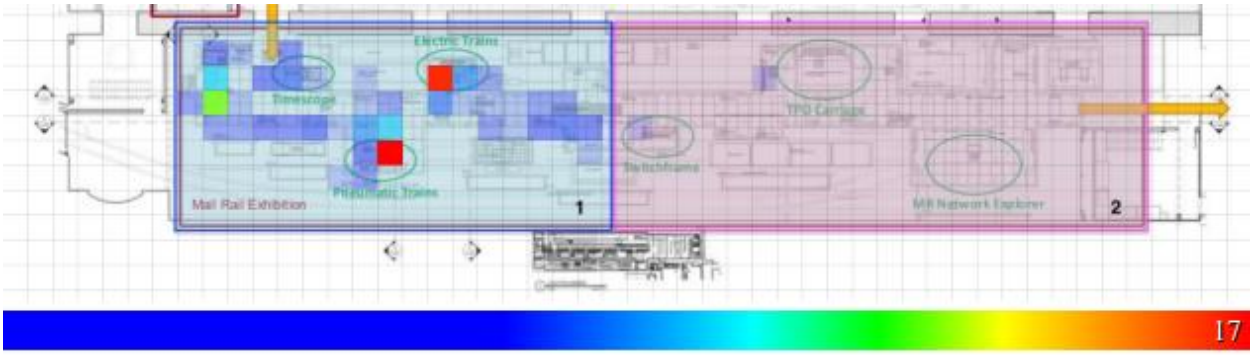

*Figure 3: Mail Rail Zone 1 Heat Map (Block Mode, squares are 26*26 px)*

For example, the attraction for the Pneumatic Trains (second green circle from the left) would be:

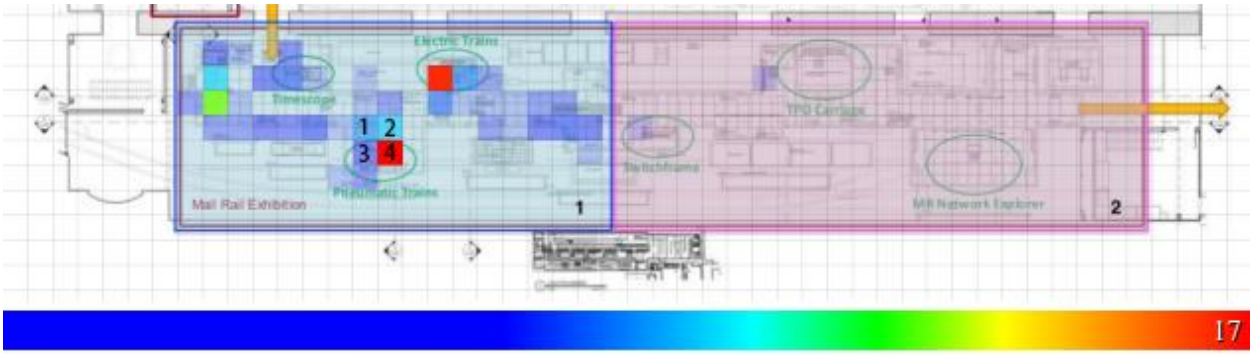

Figure 4: Example, Pneumatic Train Attraction Score

Pneumatic Trains Attraction Score		
Pixel	RGB Value (Actual Value – Background Color)	Corresponding Hotness Count
1	#68AFF5-#D1E5EE	10
2	#5AD3F5-#D1E5EE	11
3	#8B9AF3-#D1E5EE	8
4	#FF0200-#D1E5EE	17
		Total: 46

Table 3: Example, Pneumatic Train Attraction Score

Furthermore, to keep the scoring in a 100-point-scale base, the final attraction score for each interactive are normalized so that the highest score would be 100, and the rest would be a fraction of it (round up).

The **Placement Score** represents the traffic flow of the exhibits– how many people pass through the vicinity of each exhibit (not necessarily engage with it). Similar to attraction score, it is derived from the number of passes near an interactive and the count is normalized to yield a 100-point-scale.

The **Intuitiveness Score** is based on the team's in-depth survey data; the average result of the questions "You find this exhibit easy to use" and "You understand the purpose of this exhibit" for all surveys taken at a particular exhibit, plus the average of the question "Did you read the instructions for this exhibit" acts as the final "raw score" in this category. The maximum raw score possible is equal to 100 points on the final scale, with lower raw scores giving a proportionally lower final score.

The **Engagement Score** represent how deeply visitors interact with the interactives. The score depends on two aspects: degree of interaction (80%) and dwell time (20%). The raw data for these two aspects were collected in visitor study stage one (Objective #3). The team expect visitor to have higher degree of interaction and relatively longer dwell time at each exhibit.

As mentioned in the methodology 3.3, the team had seven levels of interaction. In data analysis, the team encoded five of the seven levels into numbers, which "ignored" as zero, "noticed" as one, "entered" as two, "interacted" as three, and "accomplished" as five. The degree of interaction score is the average number of those five levels. To calculate the engagement

score, the team scales the highest degree of interaction score into 100. For the dwell time score, the team scale the highest average dwell time at certain interactive into 100. The Engagement Score = 0.8 * Degree of Interaction Score (scale) + 0.2 * Dwell Time Score.

In order to determine the **Recollection Score** of each exhibit for the team's final deliverable, the team considered the highest score of 100 to correlate with whichever exhibit in each exhibition space, separately, has the most visitors consider it their most memorable exhibit. Exhibits with no visitors claiming it to be the most memorable were given a score of 0 in this category. Exhibits that fall in between are calculated using the percentage calculated by dividing the number of visitors that chose them as most memorable by the number of visitors belonging to the highest exhibit.

3.6. Ethics Notes

Before each visitor study session, the team let the hosts at the reception area know that the team had started operating, so the hosts, in turn, would let the visitors know as they enter the gallery that they might be observed, tracked, and surveyed. For personal information, the team only collected data on a visitors' age cohort and their group composition. All the data found is kept completely anonymous and no data collected can be used to trace answers back to a specific visitor.

Chapter 4. Data Analysis and Findings

Following the data collection phase, the team analyzed the information gathered, in two main groups, opinions and facts. The opinion data came from the first two objectives, concerning the current and best practices and the opinions of staff at the Postal Museum, thus providing context and common trends in the subjects of interactive exhibits and the Postal Museum. The factual data came from the last two objectives, and contains data gathered from visitor observation and visitor interviews gathered from visitors to the Postal Museum and Mail Rail.

4.1. Trends found from Museum Studies

Data gathered in this section supplemented the team's literature review. Exploring the museums leading in interactive implementations and interviewing the curators from these museums granted us further insight into the trends of interactive design, development, implementation, maintenance, and ideas that may lend to the Postal Museum's future expansion.

Museum Tours

To identify current and best practices, the team first visited other museums that had a reputation for effective interactives. As visitors, the team observed what features popular interactives have and what defects their interactives have that can be improved. The team completed these visits following the initial tours of the Postal Museum and Mail Rail so that the team could compare and analyze the interactives against each other for reference. The team completed the visits before interviewing the curators of each museum as they felt it was important to have a basic understanding of what each museum has to offer in terms of interactive exhibits and what specific questions should be asked in the interview.

Trait	Interactive at other Museums	Comparable Interactive at the Postal Museum/Mail Rail	Explanation
Multi-user design	Science Museum Atmosphere Gallery	Pneumatic Train	Multiple users at one time; competitiveness
Usability design	Museum of London child exhibits	Step-stools present at all higher-up exhibits	Built lower to the ground, allows easier access for children
Immersion	Museum of London's Pleasure Garden, Victorian Walk	Mail Rail Traveling Post Office Carriage	Make visitors feel as if they are in a specific time era or environment

Table 4: Common Museum Traits

In the **Science Museum**, there are interactives that allow multiple users to cooperate and compete with each other. In the Wonder Lab, a gallery room in the Science Museum full of interactives for school children to explore, staff at the Science museum that hold demonstrations every hour to explain the information behind the interactives to visitors. The interactives are positioned relative to the information provided by the interactives, with all the interactives focusing on electricity grouped together. Additionally, interactives designed for younger children are specifically built lower to the ground, so that they are easier to reach.

The team also found a similar idea of position design in the **Museum of London**. Some of the physical interactives that are designed to attract kids' attention are built lower down to the floor. This design may be a good idea to apply to the Postal Museum in the future, as many interactives required step-stools to be accessible to children. Related to the positioning of interactives, designers also need to be aware of the ambient lighting. When a projector is under sunlight, it will be difficult for visitors to see what it is projecting. On the other hand, when the lighting of the museum is too dark, it is hard for visitors to see written instructions beside the exhibits, so a difficult balance must be struck. During visiting at this museum, we also observed there are interpreters from the museum divided up the large school group into small groups of 10 to 15 children and explain the background of exhibits to them. The museum designed with room

left for children to sit down and listen to the interpreter. The interpreter also gave quiz to children to encourage them learning and having fun at the same time.

The **Imperial War Museum** was specialized for building the atmosphere of battle for visitors to experience and immerse themselves in. The "dress up" section is popular in this museum and people of all age ranges like to try it; the Postal Museum also has a few similar "dress up" sections. The Imperial War Museum also has a model of a trench similar to those that would have been used during World War I. Inside the trench, speakers play background noises of bombs and shots, and projectors show shadows of soldiers walking past, to increase the ambience and make the visitor feel like they really are in a trench.

The **National Maritime Museum** uses interactives to support concepts, rather than tying them to any particular object. Interactive digital maps show how historic naval battles played out, allowing visitors to grasp every facet of what was happening back then, while quizzes compare a visitor's answers to the answers of every other visitor, enforcing the idea of just how widespread and necessary trade is. There is even a ship's bridge simulator, so visitors can pretend to be the captain of a modern vessel.

Figure 5: A child using a multi-user interactive in the Science Museum (Photo taken Huaxin Yang, one of the project team member)

Curator Interviews

While interviewing staff at other museums, the team learned of a few common trends among interactives. The **Museum of London** focuses heavily on immersion, attempting to remove the approach of using mostly digital screens. They, along with the **London Transport Museum**, mostly use screens to support the message that an object is supposed to convey; physical interactives are frequently designed to enhance the immersion, such as dressing up in period clothing and uniforms. The **National Maritime Museum** takes a different approach, using screens as stand-alone exhibits designed to convey a concept that cannot easily be explained using a physical object. For example, one screen shows different mapping methods, and how they all have their own strengths and weaknesses in projecting a three-dimensional spherical object onto a two-dimensional image.

Among the staff interviewed at other museums, they all agreed that the most difficult part of creating, implementing, and maintaining an interactive exhibit was the maintenance portion. Each museum admitted that they often have at least one interactive exhibit in non-functioning order at any one time, and interactives go out of date quickly, as the Docklands portion of the Museum of London has difficulty finding replacement parts for some of its older interactives. Each of the museums also do extensive testing before implementing their interactives, both to ensure that the learning outcomes are as the developers intended, and that the interactives themselves can withstand daily use. Evaluations are surprisingly infrequent among museums; even when a museum performs an evaluation, it tends to be limited in scope, as the most recent evaluation for the Museum of London only concerned itself with audio media, and the National Maritime Museum only performs evaluations after opening a new gallery.

4.2. Opinions from Postal Museum Staff

Data in this section was gathered from individuals that work at the Postal Museum or worked on the development of some of the interactives at the Postal Museum. This information supplements that which the team received during the team's project briefing, giving the team a better idea of the day-to-day operations at the Postal Museum, and any preliminary observations the staff have made. The data also provided an updated version of the initial exhibit briefings the team received early in its research, covering all the interactives in the museum.

Interactive Audiences / Learning Outcomes

Being the main goal of soliciting staff opinions, the team identified the primary audiences and learning outcomes of each interactive exhibit, which was further evaluated by the second stage of visitor study (Objective #4). Summarized from reviewing various internal documents and interview notes, this information is in Appendix C-D. Furthermore, the learning goals are reorganized into a hierarchy of information (suggested by Katherine Biggs of the National Maritime Museum), that was evaluated in relation to the degree of interaction (Objective #3).

Observations / Known Issues

The team interviewed the staff of the Postal Museum about the performance of the exhibits, to determine which age range or types of visitors the exhibit tends to appeal to (Figure 6), and to ascertain known problems from their observation.

	Name of Exhibit	Type	Rank	Visitor type	Problem Facing
TPM	Unpack-a-Picture – Mail Coach and Lioness Attack	Physical			
TPM	Packet Ships and Pirates	Physical			
TPM	Journey of a Mail Coach Game	Digital	3	older	long story
TPM	Rise of Social Mail	Digital			miss zone two
TPM	Lantern Slide Viewer – New Services	Physical			
TPM	Telegram Interactive	Physical			
TPM	Pneumatic Tube (End 1)	Physical	1	all, family, school	
TPM	Have You Got What it Takes – Dressing Up	Physical	2	all, family, school	
TPM	K2 Telephone Kiosk – Oral Histories – Post Office in Conflict	Physical			
TPM	Lantern Slide Viewer – Post Office in Conflict	Physical			
TPM	Multiuser Touchtable	Digital			
TPM	Design-a-Stamp	Digital	2	younger, family	
TPM	Pneumatic Tube (End 2)	Physical	1		
TPM	K8 Telephone Kiosk – Oral Histories – Post Office Communities	Physical			
TPM	Post Bus Game	Digital			
MR	Timescope	Digital			lack of context
MR	Pneumatic Trains	Physical	3	all	
MR	Electric Trains	Physical			poor instruction
MR	Switchframe	Physical	3	all	poor instruction
MR	TPO Carriage	Physical	2	all	
MR	Mail Rail Network Explorer	Digital			lack of context

Figure 6: Staff View of the Interactive Exhibits

From the maintenance managers that the team interviewed at the Postal Museum, the team learned that the physical interactives tend to break mainly due to children misusing them. The three interactive exhibits that most often to break are the **Pneumatic Tube**, the electric trains, and the traveling post office. These are some of the most popular interactive exhibits, which shows how the exhibits that become broken may be damaged more frequently due to a greater amount of wear and tear. The digital interactives in the exhibitions are much harder for

visitors to break, with the most common cause of malfunction due to software errors causing the screen to simply not respond to being used. The Postal Museum does not have any immediate plans for renovation of the digital interactives, but they do plan to change some existing exhibits and add new digital interactives next year.

4.3. Interactive Performance

This section focuses on how well the interactive performs and is divided into four aspects: attraction/placement, usability/intuitiveness, engagement, and learning. The analysis is organized in a progressive fashion, so each aspect is the predecessor of the next (i.e. the team cannot assess what visitor has learned from the interactive if they do not engage with it in the first place). The measurements of each aspect are as follows:

- Attraction/Placement: heat map, trace map, visitor interview (Stage 2)
- Usability & Intuitiveness: dwell, time, observation, visitor interview (Stage 2).
- Engagement: dwell time, observation, visitor interview (Stages 1 & 2).
- Learning: visitor-interview (Stage 2).

Attraction & Placement

The first attribute of a successful interactive is whether or not it is eye-catching; in other words, it should appeal to its intended audience at first glance. This section presents the trace and heat-map for both the Postal Museum and Mail Rail, a few notable problems identified from the maps, and the scoring for all interactive exhibits regarding attraction and placement.

The heat map shows where visitors tend to linger, in other words, the attractiveness of different areas of the exhibitions are (see section 3.3: Objective #3 Assess Visitor Experience for the protocol that generates the heat map). The spectrum at the bottom shows the degree of attraction (heat) on the map. The number at the rightmost side of the spectrum is the number of hotspots counted for the hottest area. The heat-maps presented here have the location of all the interactive exhibits labeled, for un-labeled heatmap, see Appendix M.

The trace-map combines all the sample's track to produce a comprehensive view of the traffic flow (see section 3.3: Objective #3 Assess Visitor Experience for the protocol that

generates the trace map). In the diagram, the darker areas speak for more massive traffic and the lighter ones represents fewer passes.

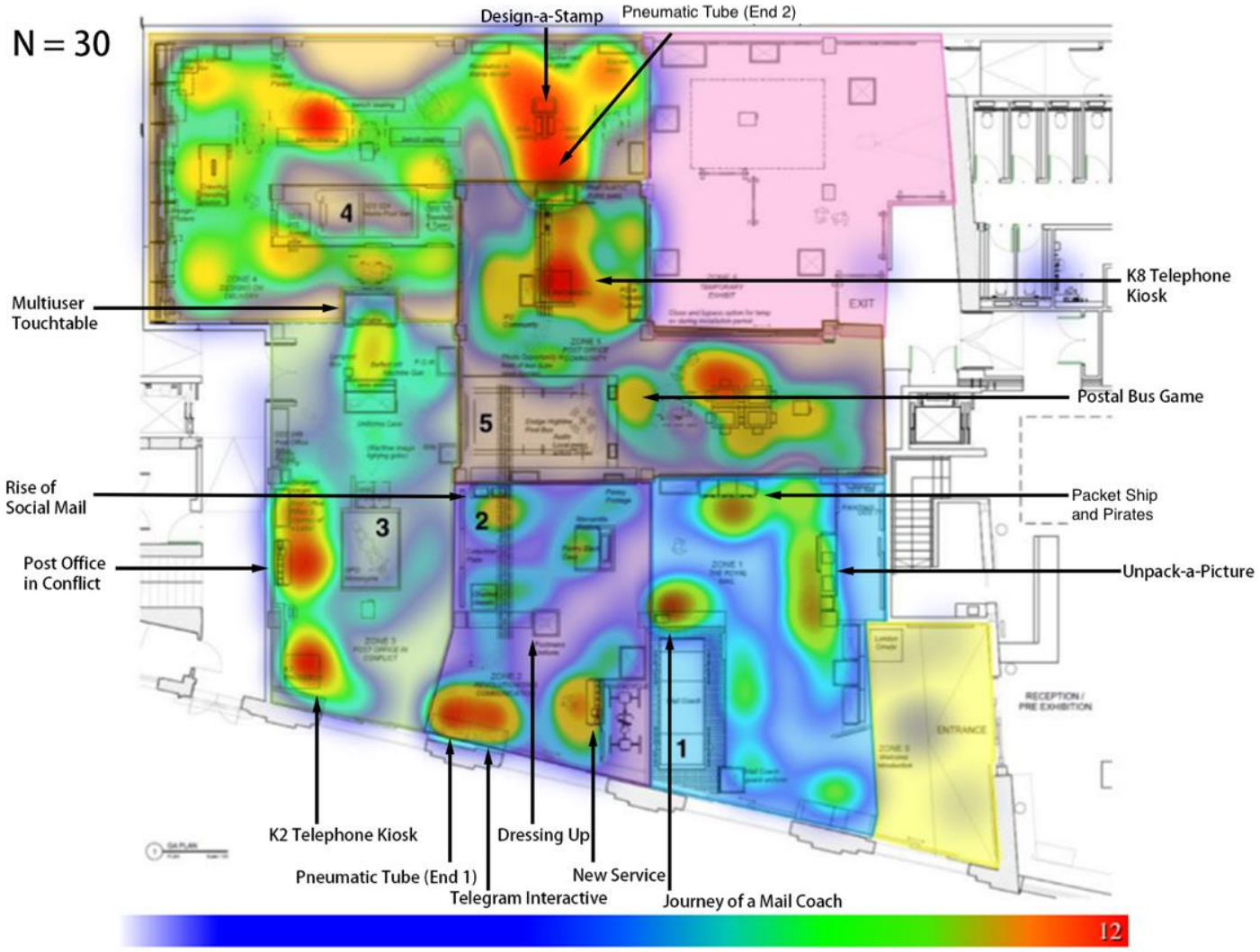

Figure 7: Postal Museum Heat-map

Figure 8: Postal Museum Trace-map

Analyzing the two maps, the team have noticed a series of issues. They are: cornered interactive, face-to-face interactives, and interactive orientation.

Cornered Interactive

As shown in figure 8, the **Rise of Social Mail** incurs a relatively low traffic flow, albeit its fair hotness in the heat-map. In the Postal Museum, the team had observed that visitors are usually more appealed to digital interactives in open pathway or corridors such as the **Design-a-Stamp** and the **Multiuser Touchtable**. Because digital screens may not stand out as much compared with a physical interactive, a cornered digital interactive would most likely exert less impact due to low traffic flow. The team had devised a possible solution: the museum could

relocate the Rise of Social Mail to a more opened area (without the exhibit losing touch with its related non-interactives) and add a physical interactive exhibit in its place to boost the traffic flow in this area.

Face-to-face Interactives

When placed in a narrow passage facing each other, one exhibit or the other would have an increased chance of being neglected by the visitors. The Mail Rail exhibition is designed more linearly with interactives well-separated from each other horizontally, therefore, does not present this problem. However, some of the Postal Museum exhibits do suffer from being put face-to-face. A notable example is the **Dressing up** vs. **Telegram Interactive/Pneumatic Tube (End 1).** Dressing up has always been a popular attraction in museums as noted in Objective #1. However, the Postal Museum's Dressing Up area is not nearly as successful as the one at Mail Rail **TPO Carriage** (figure below reveals the difference in attraction of these two dressing up space).

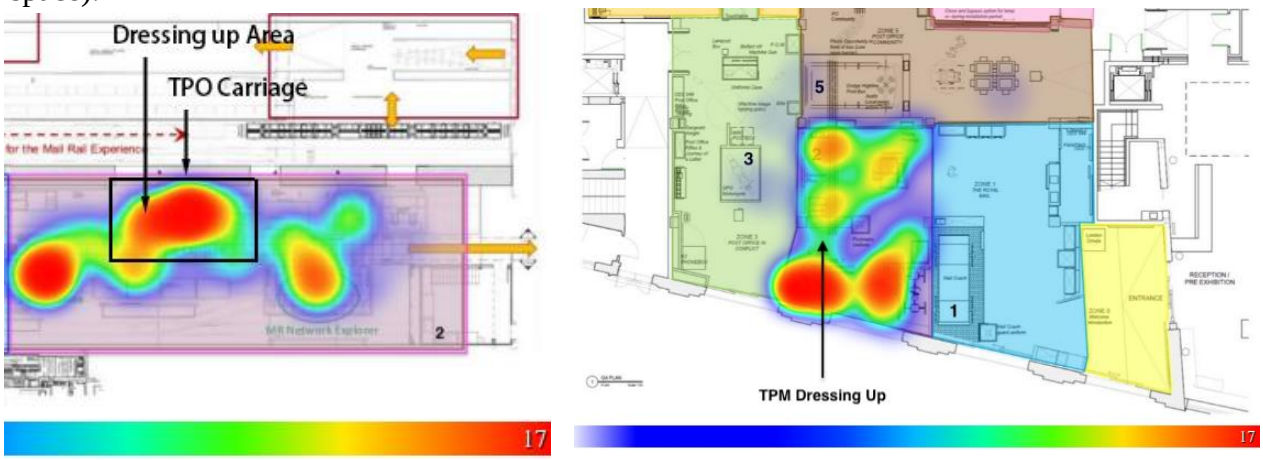

Figure 9: (left) TPO Carriage Dress Up; (right) TPM Dressing Up

Figure 10: The Route Usually Taken by Visitors at the Across Point

The Postal Museum Dressing Up is placed right across from one of the most popular interactives – the **Pneumatic Tube**. As shown in the route map on the left (Figure 10), most visitors would take to the **Lantern Slider View – New Service** or to the **Telephone Interactive** & **Pneumatic Tube**,

and few visitors would turn their face backward to notice the Dressing Up after using the **Pneumatic Tube**.

Moreover, when entering this portion of the museum, visitors are usually oriented in one of the directions shown above because of the presence of the non-interactives. Doing so would typically result in the visitor following the blue arrow on the right and go **Lantern Slider Viewer** -> New Service non-interactive -> **Telegram Interactive** and the **Pneumatic Tube**, causing them not to notice the **Dressing Up** in the first place.

Interactive Orientation

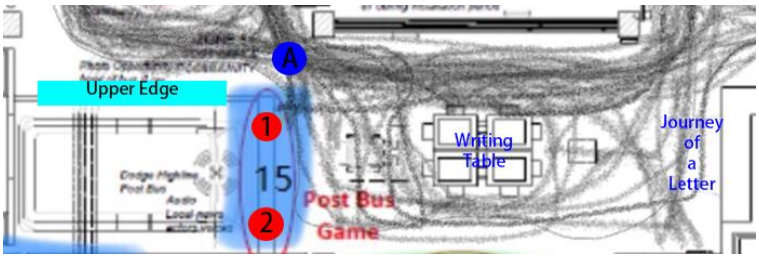

Figure 11: Postal Bus Game Traffic Flow

A fair amount of heat and traffic congregates at the upper edge of the **Postal Bus Game** (Figure 11), whereas the actual interactive experience is at the right side (the two interactive consoles are the right dot 1 and 2). On top of that, none of the visitors that the team tracked turn to interactive at point 2, as it can be seen in the figure above. The team had observed a likely reason being that once the visitors had passed point A (blue dot), they usually would generally orient themselves to face the newly open-up area where the writing table and 'Journey of a Mail' is located. Albeit the low traffic flow on the interactive side, the problem could be solved by replacing the consoles at the upper edge of the Postal Bus Game where there is heavier traffic as shown in the figure above.

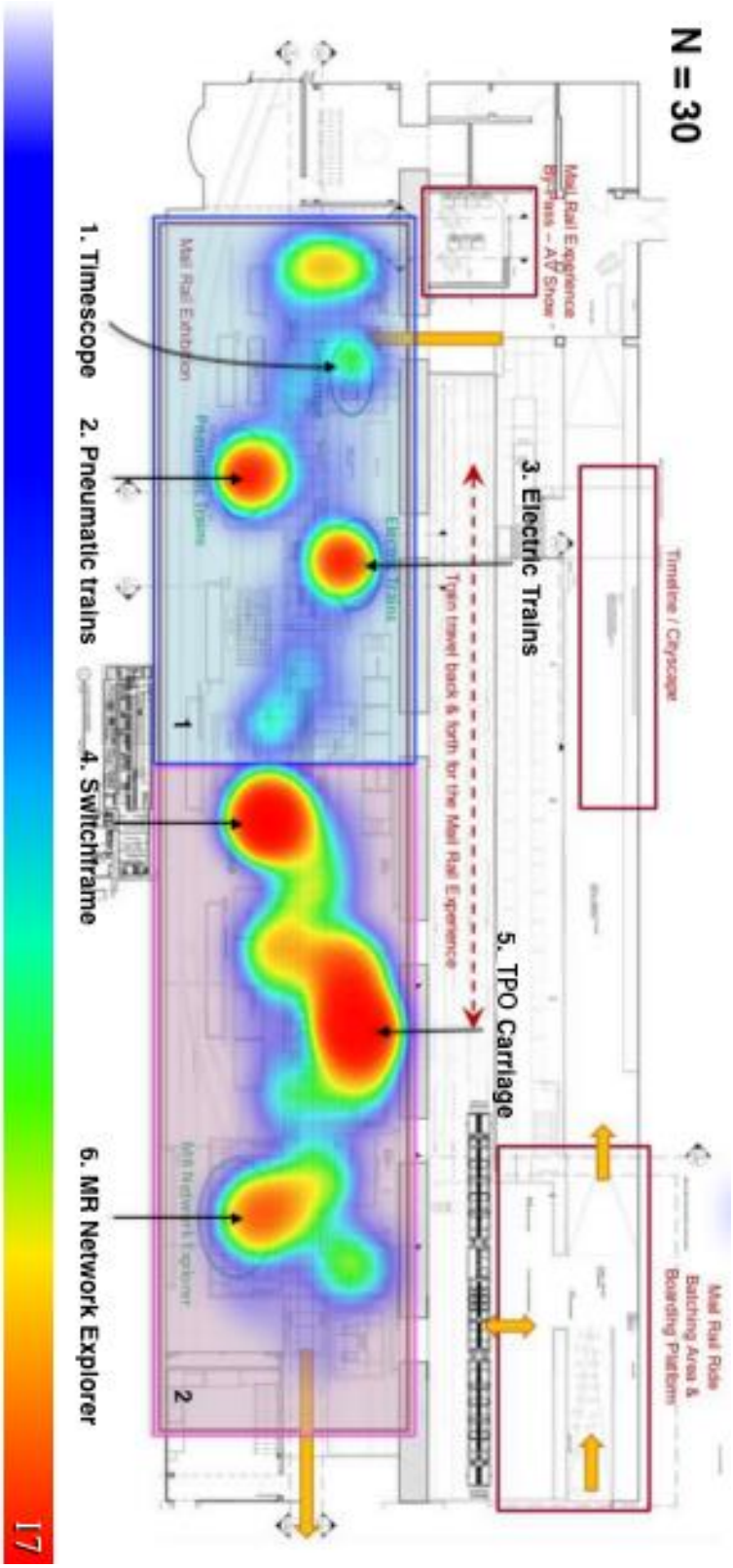

Figure 12: Mail Rail Heat Map

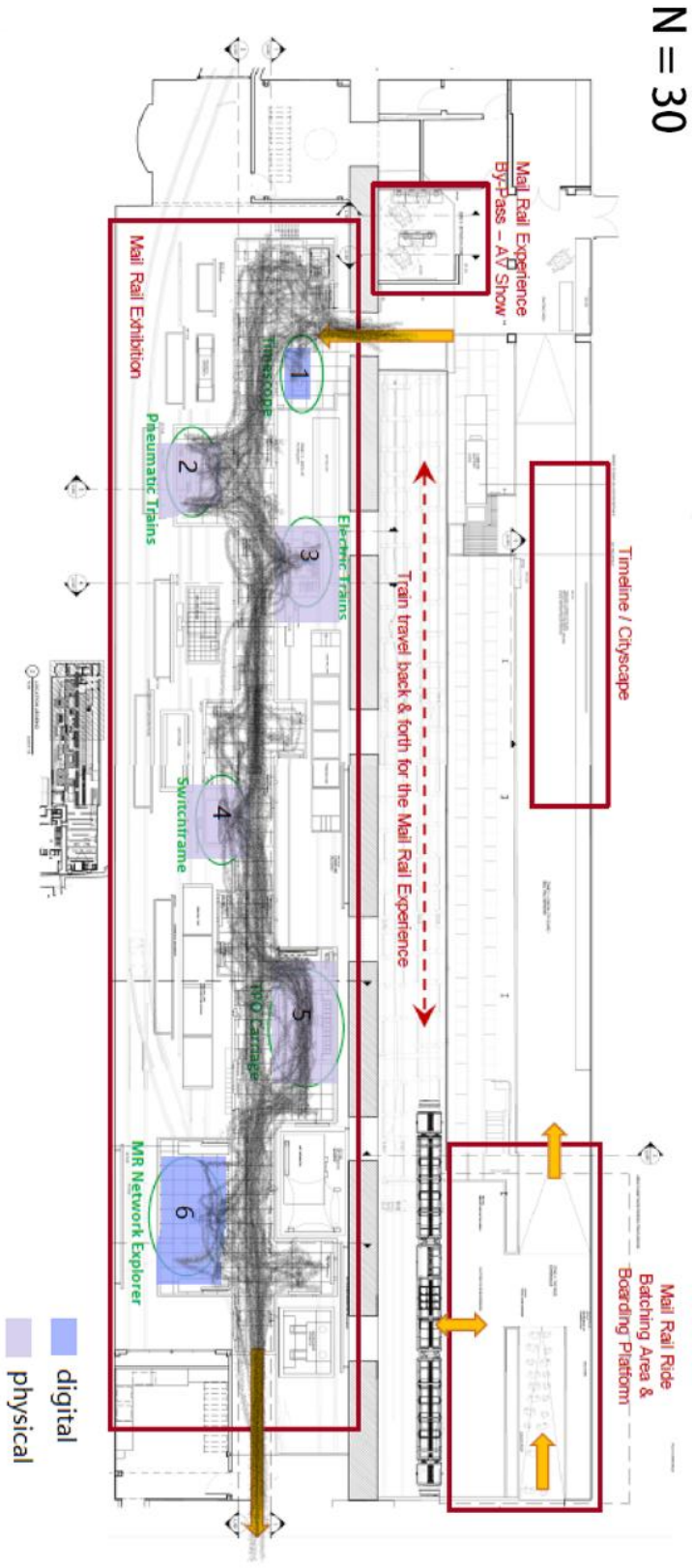

Figure 13: Mail Rail Trace Map

As might be expected, the heat map shows that the main attraction in the gallery are the interactive exhibits, with some exceptions.

Interactive vs. Nearby Non-interactive

The section on the left of the **Timescope** is the most popular non-interactive area containing a dress-up area with uniforms of maintenance workers. Unfortunately, this popularity may be the primary cause of the relatively low attraction to the Timescope. From observations and visitor interviews, the team has made out the route usually taken by visitors who missed the Timescope: after visitors had entered from the main entrance, they would notice that most of the exhibition lays to their left. A common reaction was to explore the area on the right first, then head left. Doing so would result in the visitor proceeding along the edge of the exhibition; facing away from the Timescope (see trace illustration on the right).

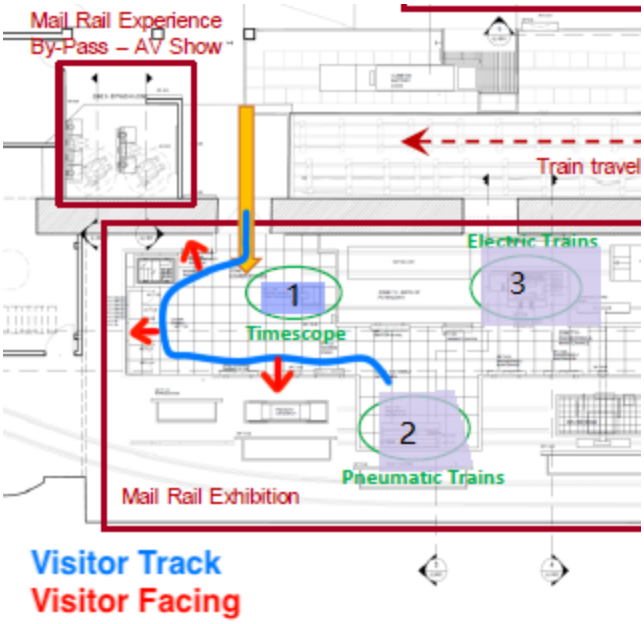

Figure 14: The route usually taken by visitors who did not interact with the Timescope

At the end of the trace above, they would arrive at the Pneumatic Trains exhibit and proceed onward, usually passing over the Timescope entirely. Additionally, the exhibit to the right is more visually attractive compared to the Timescope, with more direct and physical parts to interact with, while the Timescope has a simple screen that does not appear to change.

A similar issue occurred for the **Mail Rail Network Explorer**. Although less significant comparing to the Timescope, the problem is still noteworthy that visitors' tracks tend to diverge after the **TPO Carriage**.

Attraction & Placement Scoring

The following figure shows how each interactive scored in attraction and placement (see *Objective #3 Assess Visitor Experience* for the scoring protocol).

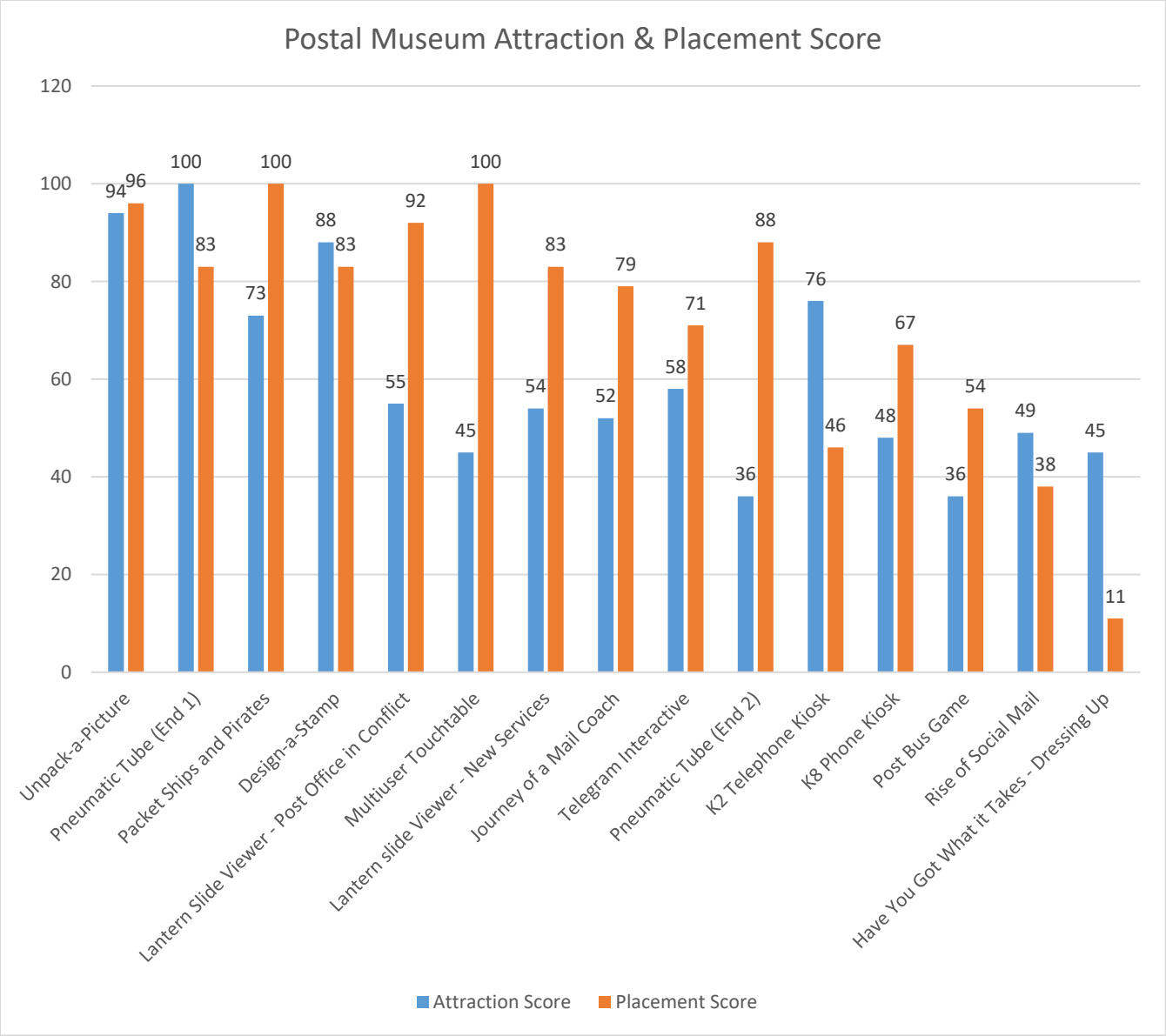

Figure 15: TPM Attraction & Placement Score (sorted by sum of the two scores)

The chart is sorted by the sum of the attraction and placement scores. As noted in previous, it is **Dressing Up, Rise of the Social Mail** and **The Postal Bus Game** at the Postal Museum requires special consideration to their underperformance.

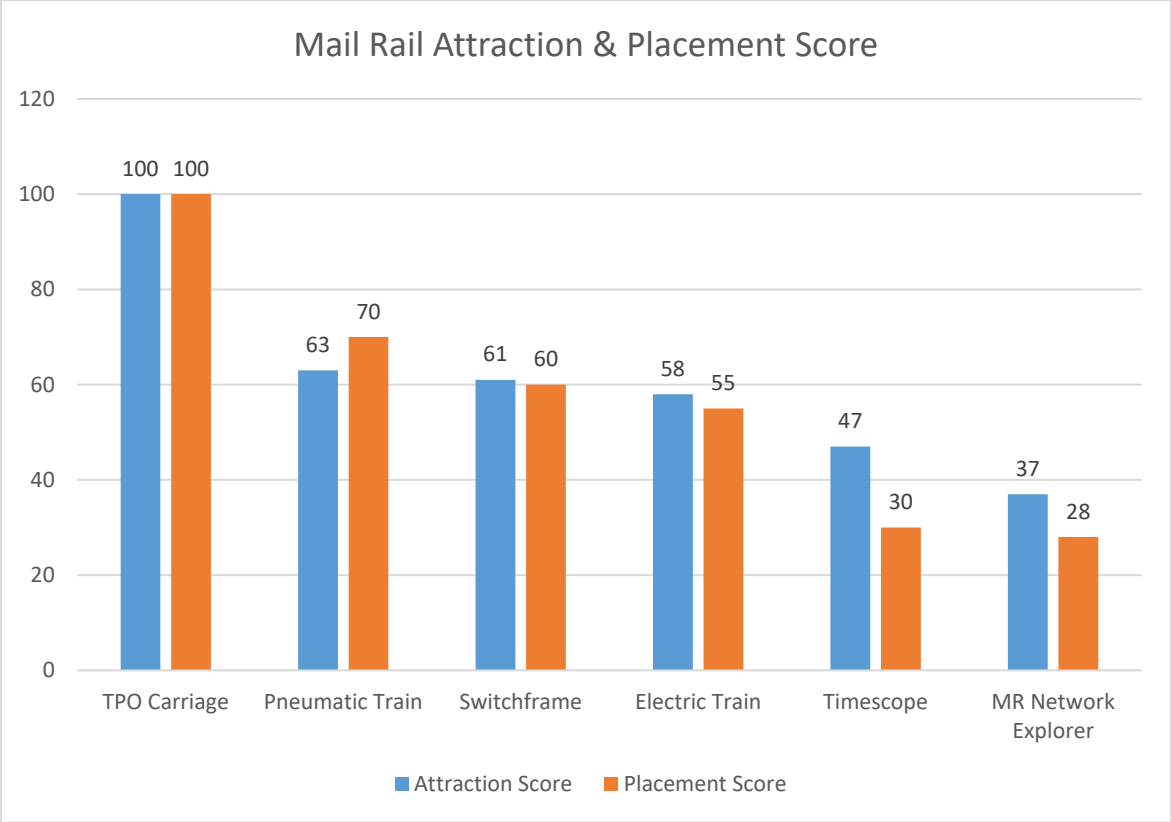

Figure 16: MR Exhibit Attraction & Placement Score (sorted by sum of the two scores)

Different from TPM, at the Mail Rail, the attraction and placement score correlate more closely. A likely cause is that the exhibition at Mail Rail is arranged linearly thus the relation between attraction and placement is more predictable. Nevertheless, the team would call attention to the two digital interactives – **Timescope** and **MR Network Explorer** due to their falling below the average regarding Attraction and Placement.

Engagement & Interaction

Dwell Time

How long visitors stay is a crucial measurement of a visitor's engagement. Dwell time is subjective, and it partially reflects the engagement of the visitor. If the dwell time is 0, then it convincingly demonstrates visitor doesn't engage with this interactive. To show visitors' dwell

time at each interactive, the team decided to use whisker chart. Figure 17 explains the structure of a whisker chart.

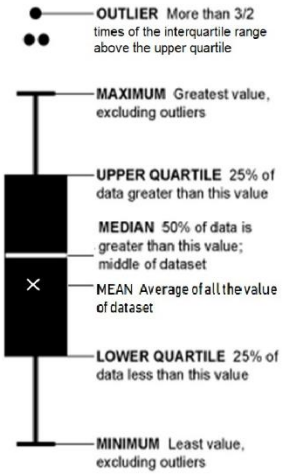

Figure 17: Explanation of Whisker Chart (modified from Flowingdata, 2008)

Figure 18 and 19 are whisker charts for visitors' dwell time at each interactive in the Postal Museum and Mail Rail. The X-axis is the interactives in the Postal Museum/Mail Rail. The Y axis is the dwell time in seconds. The sample size for each interactive is different because the team would not take zero dwell time into account.

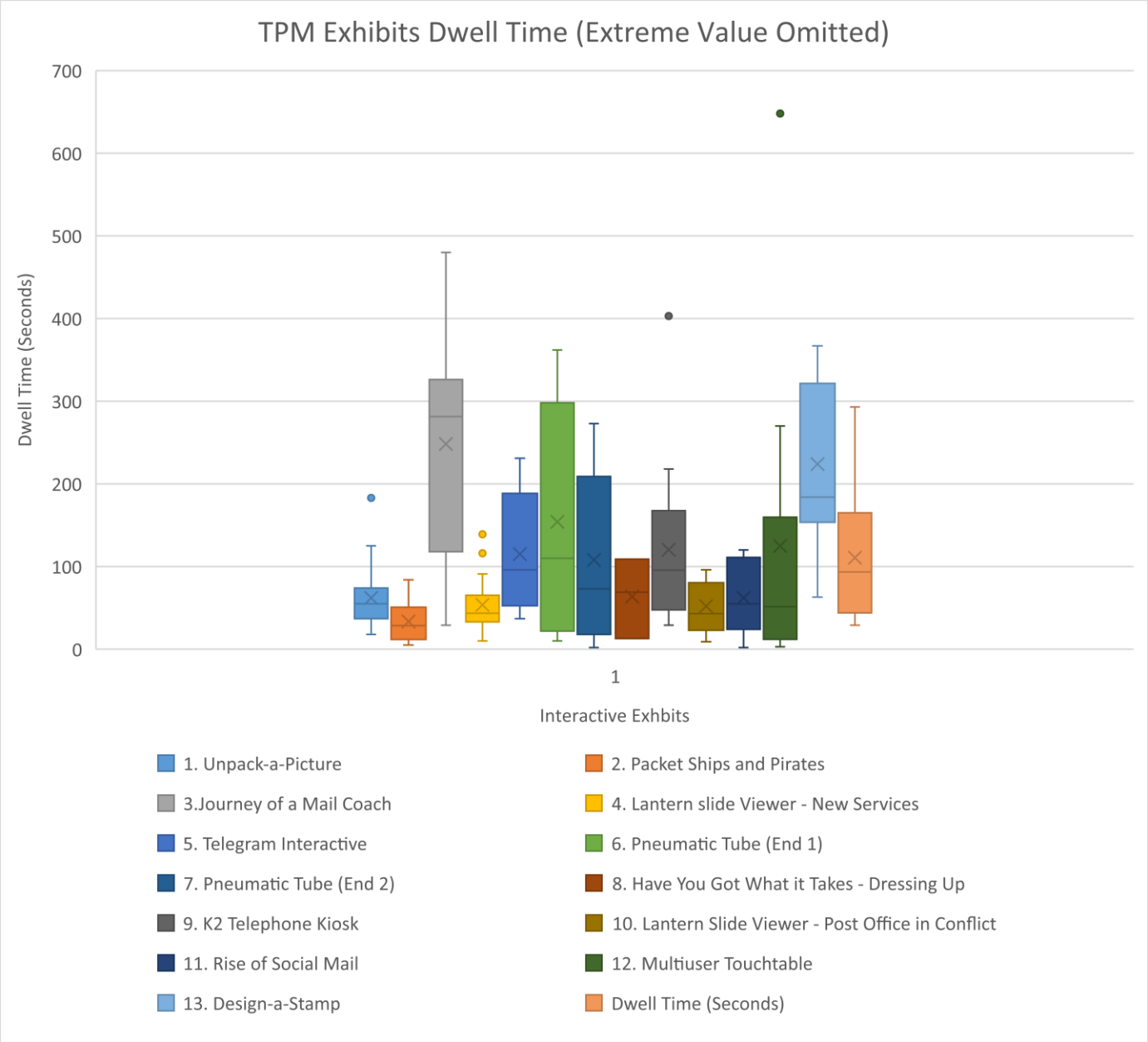

Figure 18: Visitor Dwell Time at Postal Museum without extreme value

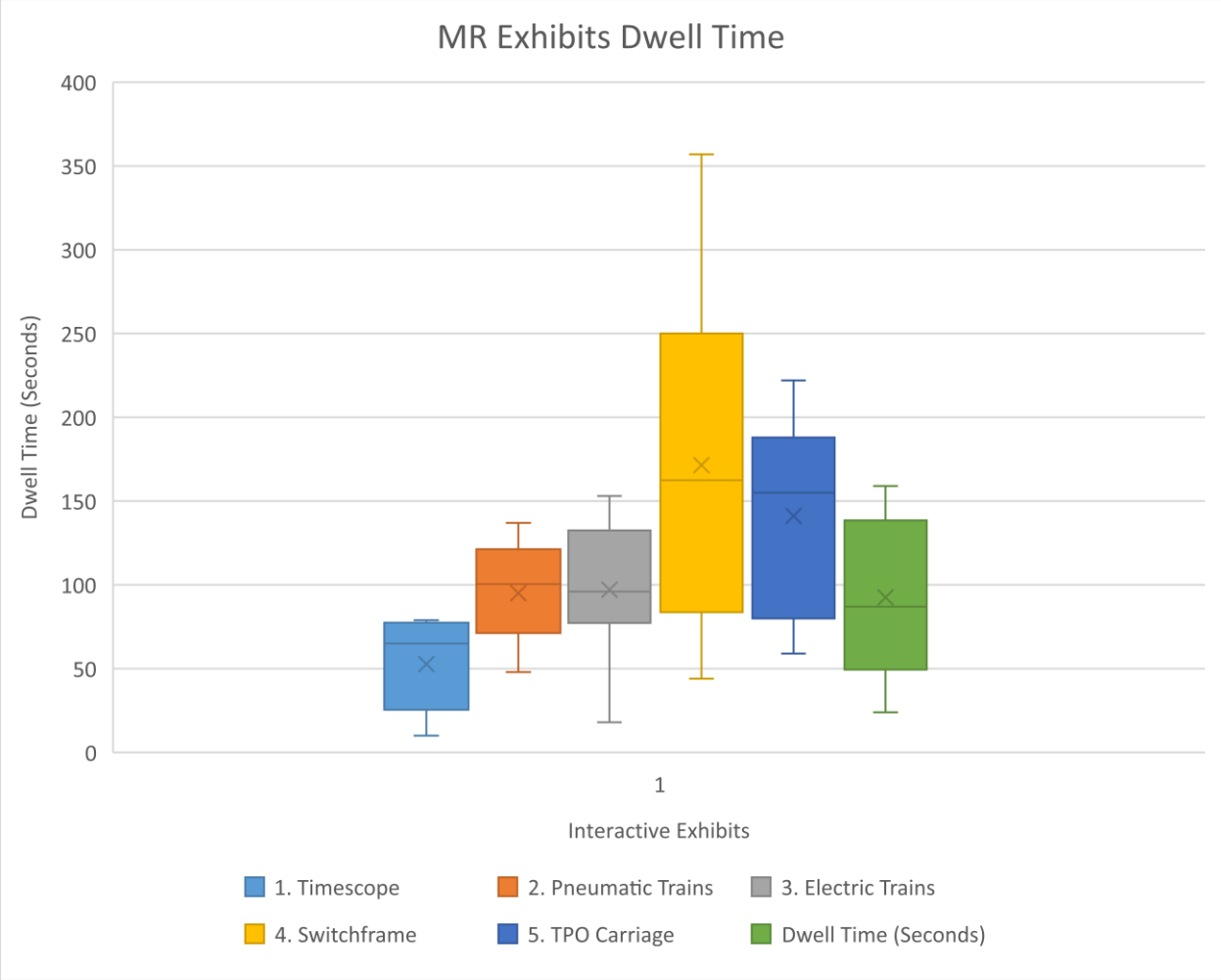

Figure 19: Visitor Dwell Time at Mail Rail

Figure 19 shows the **Journey of a Mail Coach Game** has a broad range of visitor dwell time, which means visitors have polarized attitude toward it. Some visitors only stay and try it for two minutes, and other stay there for more than five minutes. These facts indicate that the game is in suitable length for some of the visitors but not for all. A similar situation happened for Switchframe at the Mail Rail which visitors have a relatively significant difference in dwell time. Those two interactives are designed to require relatively long time to finish the whole process.

The **Pneumatic Tube** (End 1 & 2) at the Postal Museum also has a substantial difference in visitor dwell time. The time takes to send one message through the tube is shorter than one minute. For most of the family groups we observed, the children tend to run back and forth between the two ends and prolong the dwell time at this interactive.

Degree of Interaction

As mentioned in the methodology, the team had seven possible levels of interaction. In data analysis, the team encoded five of the seven levels into numbers, with "ignored" as zero, "noticed" as one, "entered" as two, "interacted" as three, and "accomplished" as five. Interactives that were broken or occupied will be discussed in separate sections.

In this section, the average degree of interaction at the Postal Museum and Mail Rail are calculated by the sample size times the encoded number for each level of interaction. The team's sample size for the Postal Museum and Mail Rail are both 30.

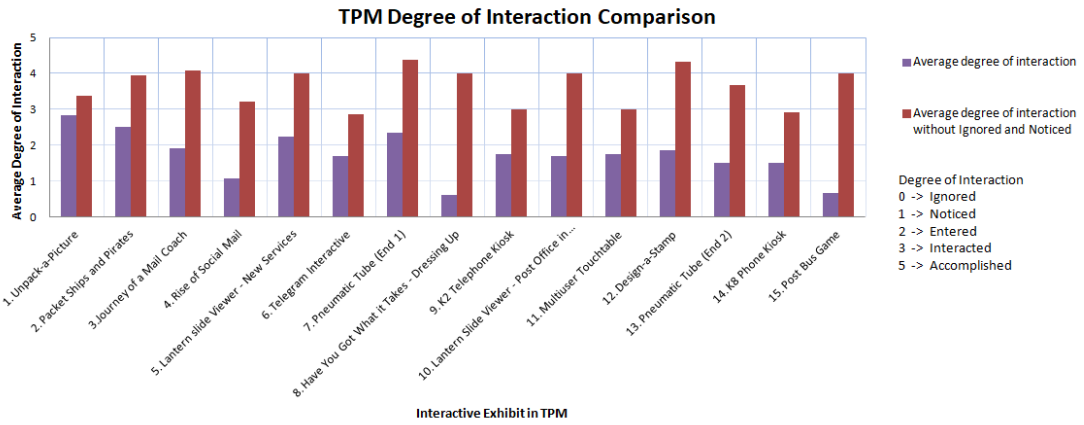

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Figure 20: Visitor Degree of Interaction Comparison at Postal Museum

In Figure 20, the red bars show the average degree of interaction, while the purple bars indicate the average degree of interaction without the "ignored" and "noticed" responses, thereby only showing the data from visitors that interacted with the exhibit. Based on figure 20, the **Dressing Up**, **Post Bus Game**, and **Rise of Social Mail** are the three interactives that visitors are most likely to ignore. However, the **Dressing Up** and **Post Bus Game** both have a much higher degree of interaction than dwell time. The major issue for these two interactives is not that visitors dislike interacting with them, but that they never started engaging in the first place. For the **Rise of Social Mail**, the gap between the red and purple bars is relatively small, so this

interactive needs to improve the content to attract visitors and achieve the learning outcome from the visitors that do use it.

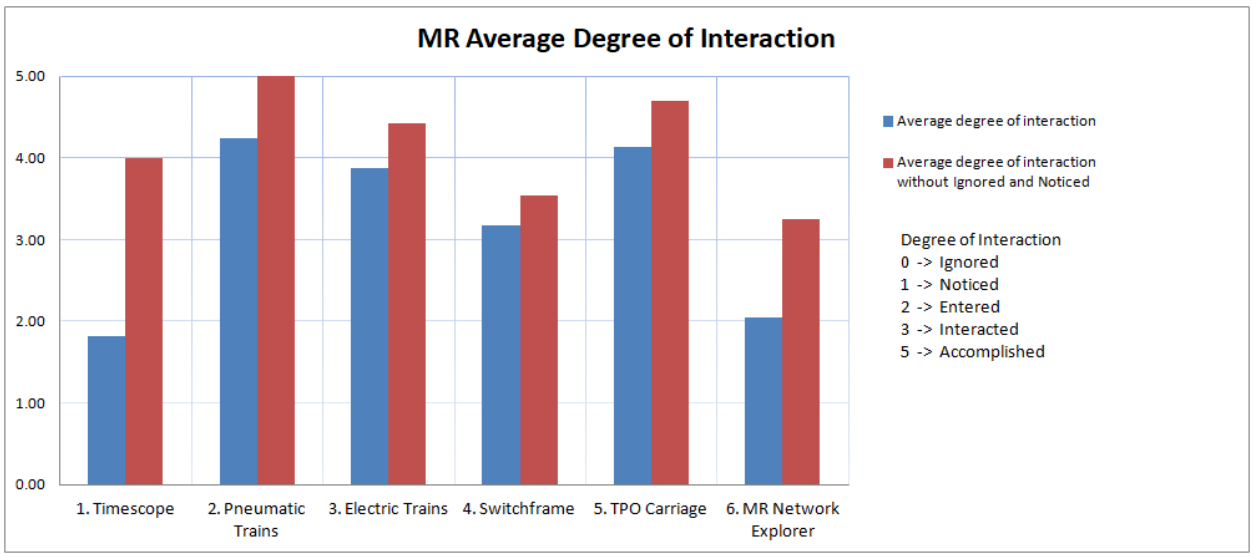

Figure 21: Visitor Degree of Interaction Comparison at Mail Rail

Figure 21 shows the average degree of interaction of interactive exhibits at in the Mail Rail. Comparing the red bars and blue bars, the first interactive at Mail Rail, it is clear that the **Timescope** has a vast difference between these two averages. The fact shows visitors tend to ignore the first interactive, but if they start to use that interactive, they tend to finish the whole process of it. The two interactives visitors most likely to ignore at the Mail Rail are the **Timescope** and the **MR Network Explorer**.

Degree of Interactive & Dwell Time

Dwell time represents the breadth of engagement, and the degree of interaction reflect the depth of engagement. In this section, the team tried to find the correlation between visitors' dwell time and degree of interaction and the meaning behind it.

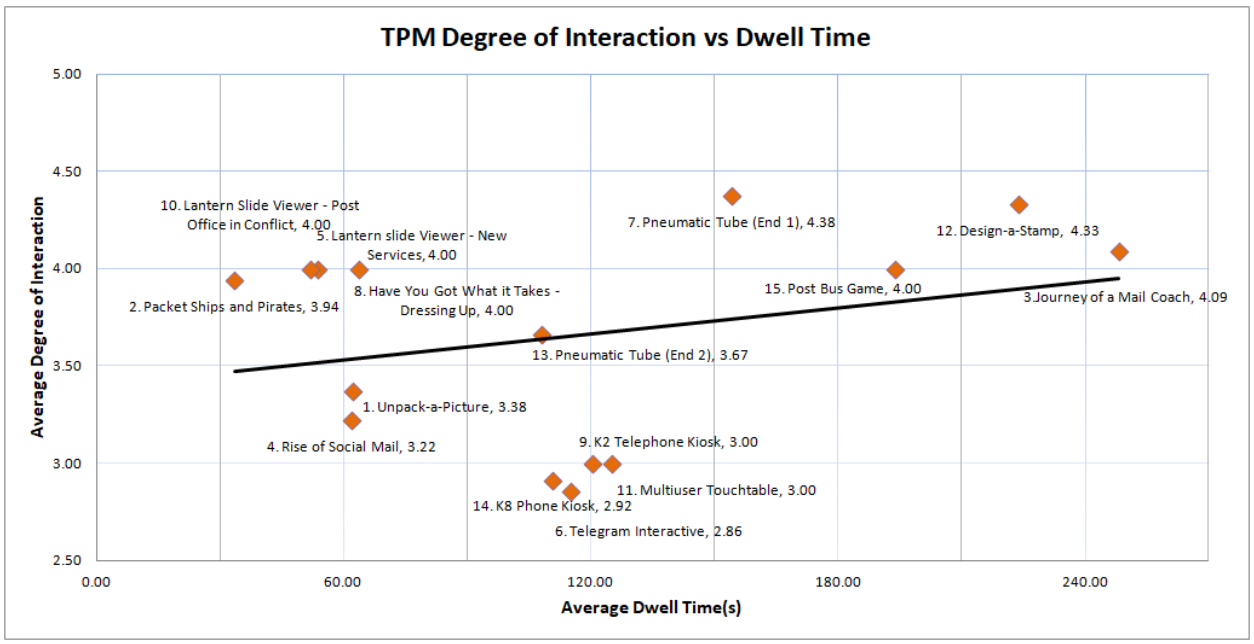

Figure 22: Visitor Degree of Interaction vs Dwell Time at Postal Museum

Figure 22 is the dwell time verse degree of interaction at the Postal Museum. The x-axis is the average dwell time in second without extreme value. The y-axis is the average degree of interaction without ignored and noticed. Therefore, the degree of interaction on y-axis only captures situations when visitors enter the interactive. The team's expectation is after the museum applied the team's recommendations, the trend line will move upper.

The trend line shows at the Postal Museum, for interactives that visitors spend a long time on average, they also have higher degrees of interaction with them. The dots above the trend line means those are the interactives that have higher degrees of interactive compared to the average at the amount of dwell time. On the contrary, the dots below the trend line are the interactives to which the team needed to pay more attention. There are four dots far below the trend line which the team expects to improve these four interactives to increase their score for degree of interaction. Those four interactives are **Telegram Interactive**, **K2 Telephone Kiosk**, **Multiuser Touchtable** and **K8 Phone Kiosk**. The main problem for these four interactives is they are not as attractive as other interactives, and also visitors don't engage enough with the content.

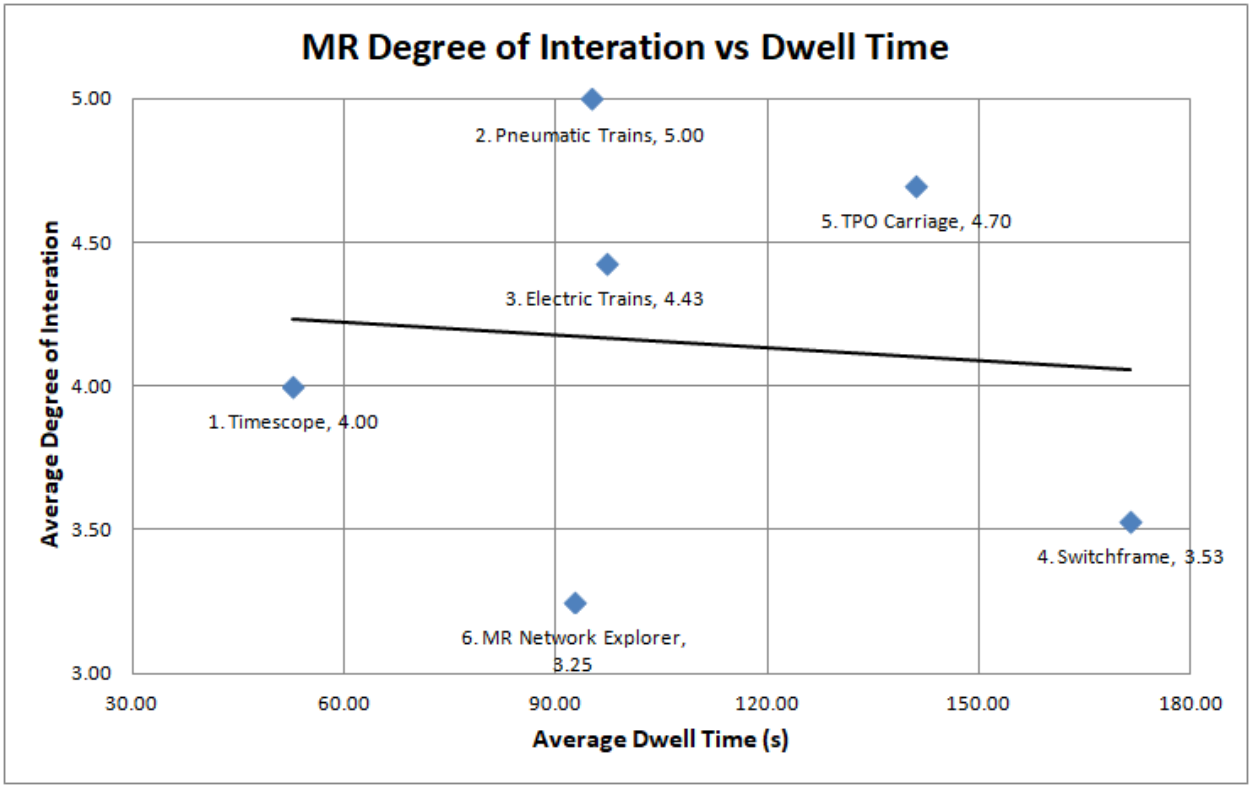

Figure 23: Visitor Degree of Interaction vs Dwell Time at MAIL RAIL

Figure 23 is the dwell time verse degree of interaction at the Mail Rail. Similar with the figure for the Postal Museum, the x-axis is the average dwell time in second. The y-axis is the average degree of interaction without ignored and noticed.

The trend line shows at Mail Rail, for interactives that visitors spend longer time in average, they have lower degree of interaction with them. This result may cause by the Mail Rail is not as a serious gallery as Postal Museum. Most people go the Mail Rail before Postal Museum to take the train and then busy to go to the Postal Museum to see the exhibits. So, visitors have lower patient then when they are in Postal Museum.

There are also two dots far below the trend line that needed special concern. Those two interactives are the **Switchframe** and **Mail Rail Network Explorer**. The common problem for these two interactives is they both include lots of content and visitors tend to have low patient to finish them.

Under Maintenance

The interactive that breaks the most is the **Pneumatic Tube** in the Postal Museum. In a sample size of 30, between both ends of the pneumatic tube, it was broken 15 times in total, meaning that nearly half of the time the **Pneumatic Tube** is not working as it supposed to. Based on the team's results from interviewing the staff at the Postal Museum, the **Pneumatic Tube** is one of the most popular interactives at Postal Museum and Mail Rail, so it is important to keep it working. The **Packet Ships and Pirates** was reported broken twice, and **Multiuser Touchtable** was reported broken once.

Occupied

In this section, the team will discuss the relationship between times of occupation, dwell time of interactives and degree of interaction. figure 24 and 25 shows the times of occupation versus dwell time at the Postal Museum and the Mail Rail.

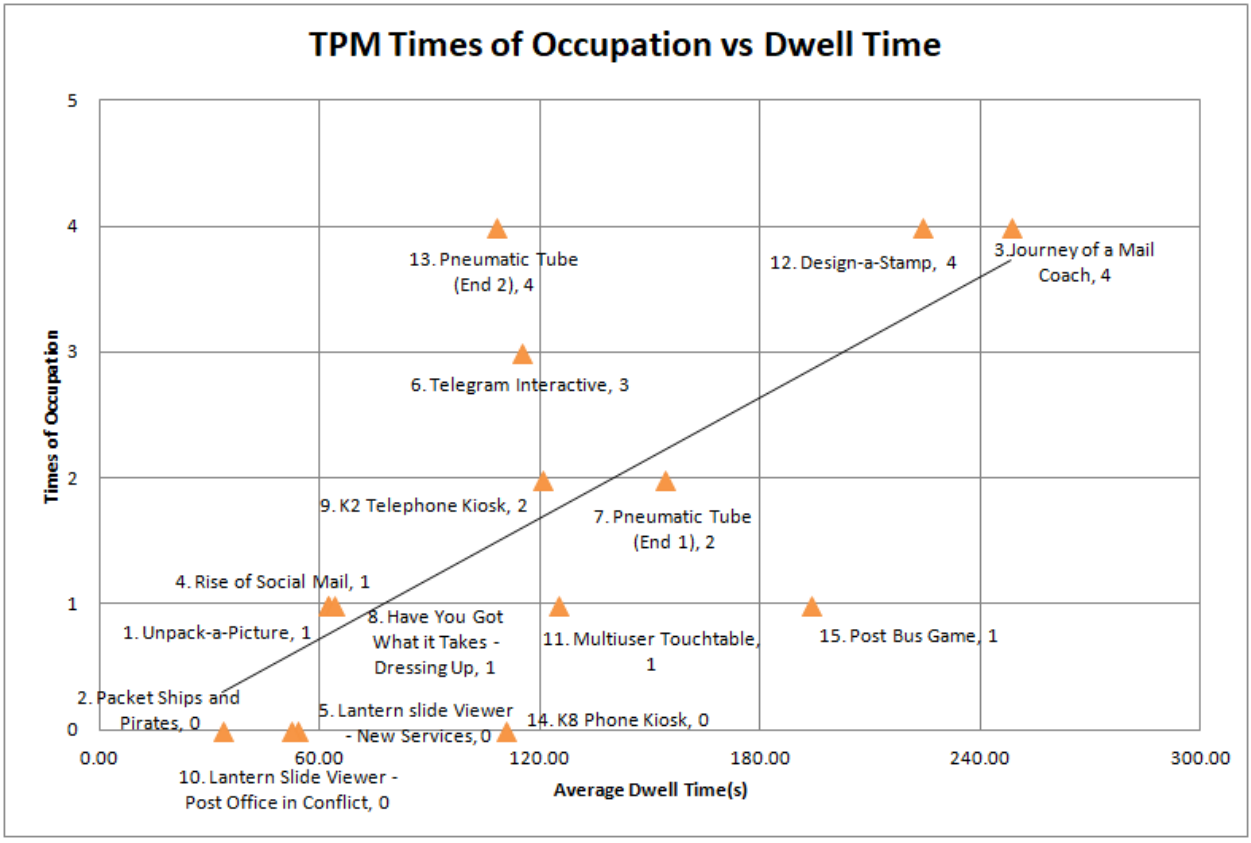

Figure 24: Times of Occupation vs Dwell time at the Postal Museum

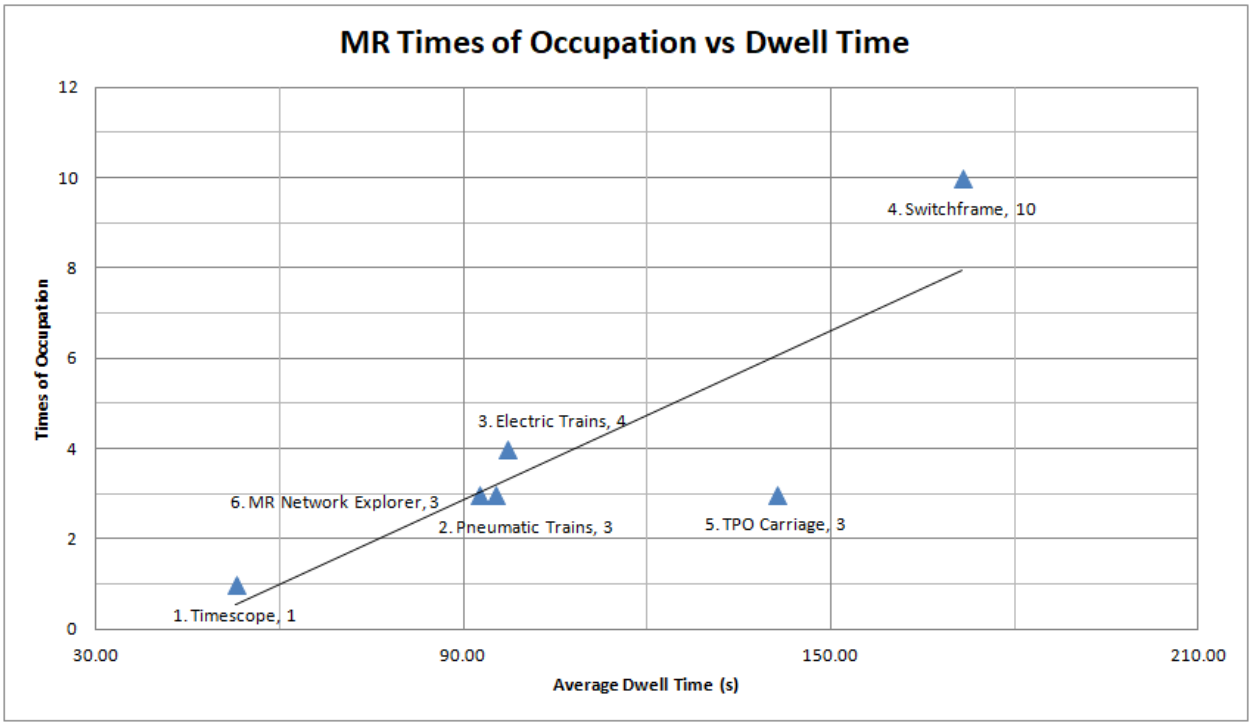

Figure 25: Times of Occupation vs Dwell time at Mail Rail

The black lines in these figures show the tendency of interactives with high dwell time to be interacted with more fully. The interactive exhibits that visitors interacted with the most at the Postal Museum were the **Journey of a Mail Coach, Design a Stamp** and **Pneumatic Tube**. Comparing the results with the degree of interaction, the team concluded these three interactives have a relatively high degree of interaction. These extended times of occupation, long dwell times and high degrees of interaction shows that these three interactives are popular with visitors and visitors engage with them a lot. Thus, the main problem for the three interactives is lots of time these interactives are occupied, and other visitors don't have a chance to try it.

For the Mail Rail, the Switchframe interactive has significantly more times of occupation than other interactives. The Switchframe interactive has a relatively low degree of interaction, but a relatively high dwell time. The fact reflects that visitors spend a relatively long time at this exhibit, but most of them didn't accomplish the full process. Thus, the main problem with this interactive is the design of content is too long for a visitor to keep paying attention to this interactive. Also, the long time required to finish the whole game means that other visitors have a decreased chance to be able to use this interactive, as another visitor may be using it.

Engagement & Interaction Scoring

The following figure 26 and 27 show how interactives scored in engagement and interaction accepts (see *Objective 3.5 Score Interactive Performances* for the scoring protocol).

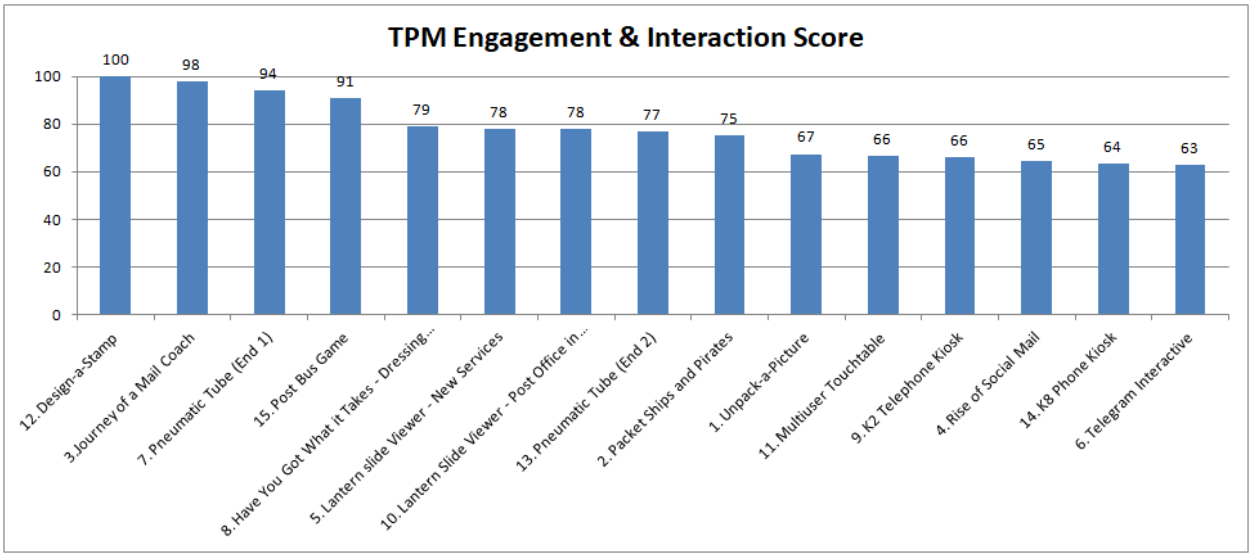

Figure 26: TPM Engagement & Interaction Score

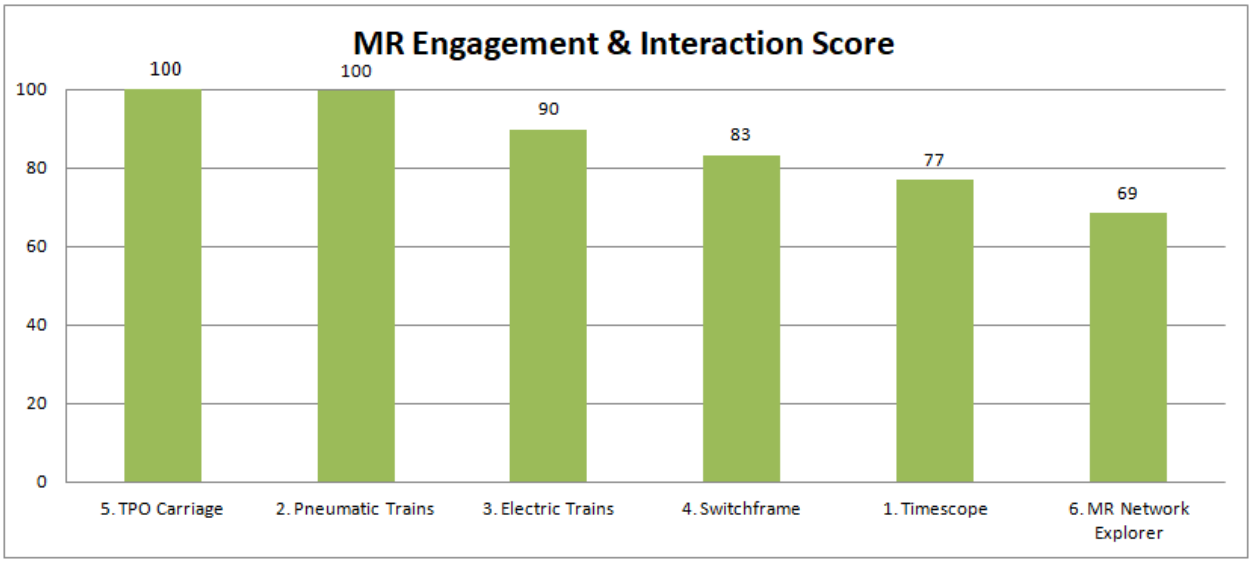

Figure 27: MR Engagement & Interaction Score

As a summation of the results of the analysis in this section, the **K2 Telephone Kiosk**, **Rise of Social Mail**, **K8 Phone Kiosk and Telegram Interactive** at the Postal Museum and **Timescope and MR Network Explorer** at Mail Rail are the interactives that most need to be improved on.

Recollection & Learning

An important aspect of developing an effective interactive exhibit is making sure that it is memorable to all visitors, especially the intended audience. In the survey given to all visitors, the team asked visitors which of the interactive exhibits in the corresponding exhibition, Mail Rail or the Postal Museum, was most memorable to them. As it may be difficult to distinguish why a certain exhibit is memorable to a visitor, the team also asked visitors why the exhibit that they selected was the most memorable. Almost all visitors that were asked gave the answer that the exhibit they enjoyed most and had the most fun with was the most memorable to them. From the data that was collected, the team was able to generate the charts below. In Figures 28 and 29, the team compared which interactives at the Mail Rail were most memorable to families and other groups that did not include children, respectively. This correlates very well with the most popular exhibits that the team learned from the team's interviews with the museum staff and have observed in the team's studies. The Electric Trains and Network Explorer exhibits have not been very engaging, according to the team's data, and may require some modifications to increase how engaging they are and have more visitors remember them fondly. In the team's final objective, the team will be able to focus on the exhibits that do not perform well and determine what changes the team can determine will be most effective.

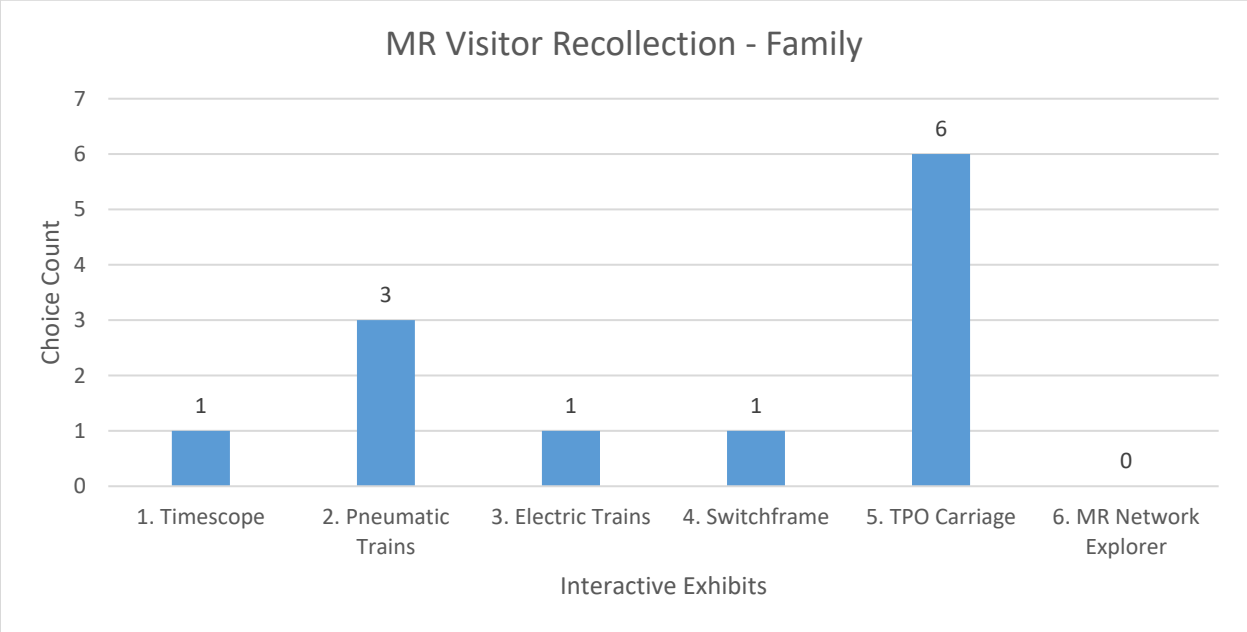

Figure 28: Visitor Recollection: Mail Rail – Family (N = 12)

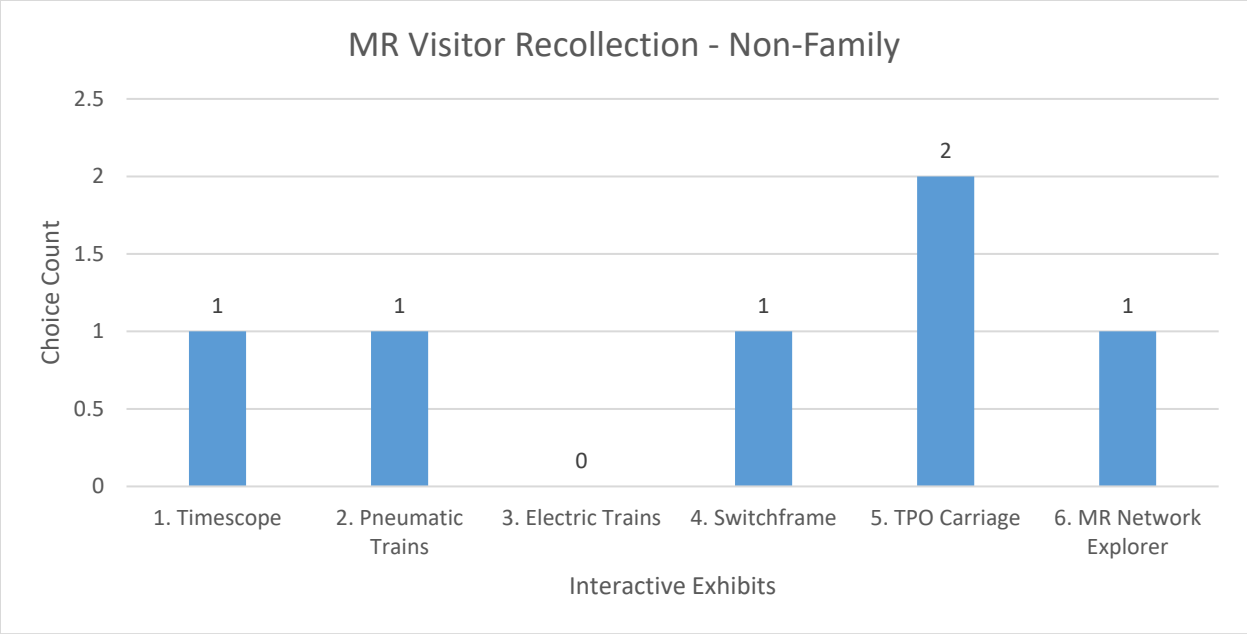

Figure 29: Visitor Recollection: Mail Rail - Non-family (N = 6)

In Figures 30 and 31**, the team** compared the engagement of the interactive exhibits in the Postal Museum. From these data, the team can gather that the **Pneumatic Tube** exhibit is very memorable to both demographics, families that include children and groups of adults or individual adults. However, the Design-a-Stamp exhibit turned out to be the most memorable to family groups, but not very memorable at all with adult groups and individuals. This also correlates from what the team have found to be some of the most liked exhibits by visitors. With all visitors, the team have found that five out of the fourteen interactive exhibits at the Postal Museum are not the most memorable compared with each other, as they have not been considered by any visitors that the team have surveyed. the team can focus on these specific exhibits in the team's final objective to determine what may improve this, as the team would like visitors to remember all of the exhibits in the exhibition.

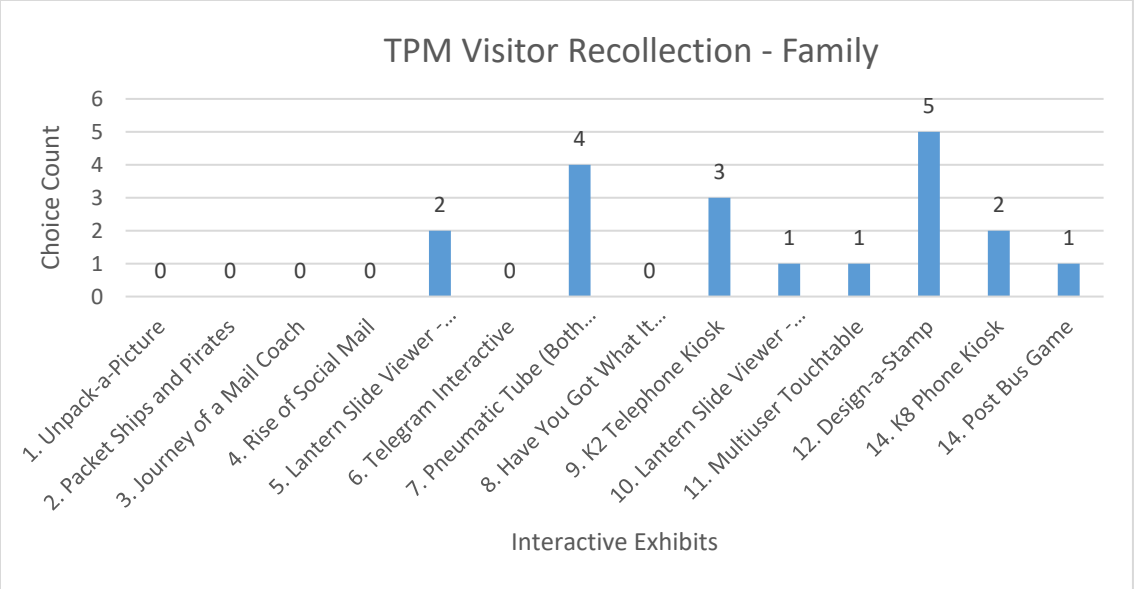

Figure 30: Visitor Recollection: The Postal Museum - Family (N = 19)

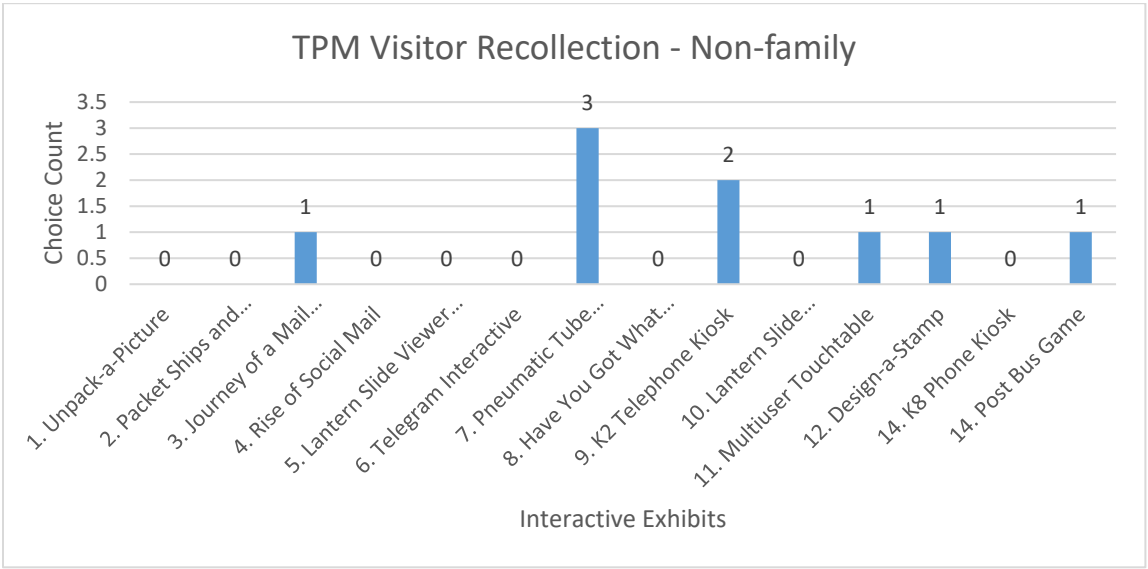

Figure 31: Visitor Recollection: The Postal Museum - Non-family (N = 9)

As it is very important for visitors to gain knowledge when visiting the Postal Museum and Mail Rail, the team found it necessary to ask visitors if they feel that they have learned something from the interactive exhibits in the exhibitions. This does not give us too much information on what they learned and if they are meeting the learning objectives set up during the design of the interactives, however it will provide insight into which exhibits to research further.

As the last question of the interview that makes up the final objective, the team asked visitors what they can tell us about the topic that a specific exhibit represents and is trying to teach users about. On the team's iPads, the team compared the answers to the learning objectives provided by the initial briefs given to us by the team's sponsor-liaisons. The team also determined the level of learning achieved to determine how effective the exhibit's teaching potential is.

Chapter 5. Conclusions and Recommendations

The overarching goal of the project was to provide the Postal Museum and Mail Rail with suggestions for improvement through evaluating the existing interactive exhibits. In this section, the team has collected the key findings, as well as sets of recommendations for the museum to proceed further with offering interactive experiences.

5.1. Conclusions

Based on the data collected, the team concluded that there were two main patterns among the interactives at the Postal Museum and Mail Rail.

First, some interactives convey their learning objectives well after they have the visitor's attention but have difficulty in gaining that attention in the first place. For instance, the "Have You Got What It Takes – Dressing Up" is highly enjoyable for all visitors that use it but this interactive is placed opposite to the very popular **Pneumatic Tube**. The end result is that visitors tend to bypass the **Dressing Up** interactive in order to use the **Pneumatic Tube**.

The second pattern is that some interactives easily catch a visitor's attention but are difficult to use or understand. The primary example of this pattern is the **Switchframe** interactive in the Mail Rail, which is large and easily within a visitor's sight, but requires several minutes to complete, and relatively poor instruction designed. While there is an audio component explaining how the **Switchframe** works, many visitors have trouble understanding how to use the **Switchframe**, tried to answer the ornamental phone and may leave partway through using it. Based on these patterns, we have devised some recommendations for changes that could be made to the existing interactives.

5.2. Recommendations

In this section, the team summarized the findings gained under each objective and provided ideas on how to improve the interactives at the Postal Museum and Mail Rail.

Recommendation for Interactives

Existing Interactives

Detailed recommendations for all interactives are on the Report Cards in Appendix N. This following table is a summary of the team's recommendation for existing interactives.

The Postal Museum Exhibition			
Zone	**Name of Exhibit**	**Type of Interactive**	**Recommendations**
1	**Unpack-a-Picture – Mail Coach and Lioness Attack**	Physical	Our observation shows a higher satisfaction with hands-on interaction. Multi-stage and multi-sensory interaction, such as having visitors blow into the horn rather than pressing a button, can increase visitor engagement and especially recollection with this exhibit.
1	**Packet Ships and Pirates**	Physical	Modify the appearance of the buttons to those that are easier to distinguish as buttons. Light-up arcade-style buttons would work well to attract attention and can withstand extensive usage.
1	**Journey of a Mail Coach Game**	Digital	Make the area around the screen more attractive and eye-catching. Doing so could get visitors more interested.
2	**Rise of Social Mail**	Digital	To increase traffic flow in this area, add arrows on floor, add physical interactivity
2	**Lantern Slide Viewer – New Services**	Physical	find some way to make the slider a little bit easier to move. Solutions may consist solely of adding oil or a lubricant to the slider rails on a regular basis to improve ease of sliding.
2	**Telegram Interactive**	Physical	Make the controls more obvious, can be multi-user
2	**Pneumatic Tube (End 1)**	Physical	Add a sign that instructs visitors clearly that the tube will end up at another machine towards the end of the exhibition and that they can send messages back and forth between the two ends. Additionally, it would be very beneficial to determine precisely why the interactive will stop working.
3	**Have You Got What It Takes – Dressing Up**	Physical	Change its facing so that it's further from pneumatic tube
3	**K2 Telephone Kiosk – Oral Histories – Post Office in Conflict**	Physical	Attach the yellow card to the wall so visitors can see and use it

3	**Lantern Slide Viewer – Post Office in Conflict**	Physical	Add more content to the exhibit, such as stories or information about each slide. It may also be interesting to change up the slides every once in a while, so visitors can have something new to look at if they return to the museum.
3	**Multiuser Touchtable**	Digital	Adjust the environmental lighting; need to be more colorful and eye-catching
4	**Design-a-Stamp**	Digital	Add more cartoon stickers in
5	**K8 Telephone Kiosk – Oral Histories – Post Office Communities**	Physical	Attach the yellow card to the wall so visitors can see and use it
5	**Post Bus Game**	Digital	Move this exhibit so that it faces zone 4 (the K8 telephone interactive) where there is a heavier traffic flow.

Table 5: Recommendation for the Postal Museum Interactive Exhibits

Mail Rail Exhibition		
Name of Exhibit	**Type of Interactive**	**Recommendation**
Timescope	Digital	Add arrows to the floor, make buttons more obvious, add an animated “screen-saver” so visitors know how to use it
Pneumatic Trains	Physical	Reduce the noise of rotating the handle, increase speed of resetting
Electric Trains	Physical	Add a visual component to the instructions, showing how the two levers should be positioned to use the exhibit.
Switchframe	Physical	Make this interactive more appealing while it is in use, to keep visitors from leaving partway through. One suggestion is to add some sound effect to keep visitors interested while the “trains” are moving
TPO Carriage	Physical	Reduce the noise when ‘letters’ are sliding down
Mail Rail Network Explorer	Digital	Adjust lighting to make the big screen more visible

Table 6: Recommendation for the Mail Rail Interactive Exhibits

New Interactives Ideas

From visitor interviews, the team has gathered that people indeed feel the Postal Museum is ‘quite interactive.’ Moreover, given the spatial limitations of the building, the balance between traditional displays and interactive experience needed to be kept when introducing new cases.

Therefore, without asserting the necessity of enlarging the museum's interactive collection, the team would like to point out a few popular exhibits at other museums whom the interactive-design trends embody. Through this research, the team believes that these examples may be beneficial if appropriately imported.

- Collaborative & Multiuser designs (three or more if space permits): the following figure is a **digital** interactive at the Science Museum that allows more than two users to work together while retaining the competitive elements (scores).

Figure 32: Collaborative Interactive at the Science Museum

- Innovative controls: The Science Museum has quite a few interactives that react to body motion, whereas the Imperial War Museum projects words on a book-shaped Touchtable. Visitor can turn the pages by clicking the arrows on the bottom. The war event is shown on a dynamic map tabletop. The team observed children are more interested in these, but they essentially function as reading consoles.

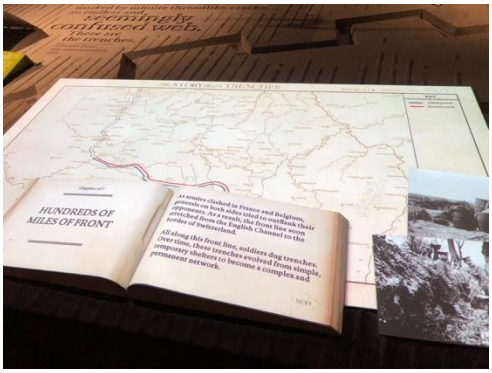

Figure 33: (Left) Body-motion-capturing exhibit at the Science Museum; (Right) Interactive reading consoles at the Imperial War Museum

Other Recommendations

Prevent Misusage & Over-usage

During observation, the team found that one of the reasons visitors have a longer dwell time than needed to accomplish the use of the interactive from beginning to end is that visitors often take time to learn how to use the interactive. Additionally, as mentioned in section 4.3.2, the **Pneumatic tube** at the Postal Museum is under maintenance often. The two main reasons behind this are that visitors tried to send a message without the canister, leading to the letters getting caught and jamming the tube, and sending messages too often so that the mechanical part of the interactive suffers from overuse. In section 5.2.1, the team discussed the possible ways to improve the instructions of interactive exhibits. To solve the problem of visitors misusing or overusing some of the interactives, the team also provides potential ideas on how to reduce the possibility of misusage and over usage.

Instruction Videos

One recommendation is to post a short video including clips of using interactives on the Postal Museum website. During the interview with Senior Visitor Experience Manager, the team came up with the idea of adding short videos of interactives on websites to let parents know how to use interactives correctly. The Postal Museum is facing a problem that there are not enough staff members in the gallery to prevent visitors from misusing the interactives. The museum expects to let adults (parents in family and teachers in school group) read the intrusions and lead children to use the interactive correctly. From staff interviews the team also learned that most of the visitors visit the website of the Postal Museum to book their ticket before they come to the Postal Museum, making this a viable option.

After discussing the idea with the project sponsors, they stated that the museum doesn't want to give away all of what it has to offer before visitors come to explore themselves. From the staff member we interviewed, it is essential to keep the video short; therefore, we recommend these videos should be between 30 seconds to 1 minute. The interactives the team suggests putting in these videos include: **Unpack-a-Picture** (graph of lion), **Packet Ships and Pirates** (push the "touch" button), **Telegram Interactive** (push the white button), **Pneumatic Tube** (put

message into container and send it), **Telephone Kiosk** (call number on the yellow card) and **Multiuser Touchtable** (drag images into specific position).

Live Interpreters

Another recommendation is to have staff volunteers dress up as live interpreters to guide children in how to use interactives correctly, preventing the interactives from being broken through misuse.

As a part of Objective #1, the team visited the Museum of London and observed that there are interpreters from the museum to teach school group children the knowledge contained within the exhibits. During our interview with the Schools Learning Manager at the Postal Museum, the team discussed the possibility of applying what the same system to the Postal Museum and Mail Rail. The manager had a positive attitude toward our suggestion and also provided information about difficulties the Postal Museum has. The primary challenge with this suggestion is that the Postal Museum lacks the staff members to be interpreters and the lack of room in the gallery for children to gather around exhibits; since the same system cannot be applied, the Postal Museum will have to use a modified version.

There are two advantages for the Postal Museum to have live interpreters. The first is that there would be volunteers in the gallery that know how to use all of the interactives. Employing volunteers as a workforce, the museum wouldn't have to hire and train new staff. The other advantage is that the Postal Museum has already had facilitators dress up as postal workers in workshops for school groups. When the school groups finish the workshop, they will have built a relationship between themselves and the "postmen," providing a familiar face when they enter the gallery that is willing to give direction and advice.

5.3. Deliverables

The deliverables of this project include this report, the Report Card for each interactive exhibit (see Appendix O), protocols used for collecting data (see Appendices H, I, and K), and the raw data of visitor surveys (contained in a separate document).

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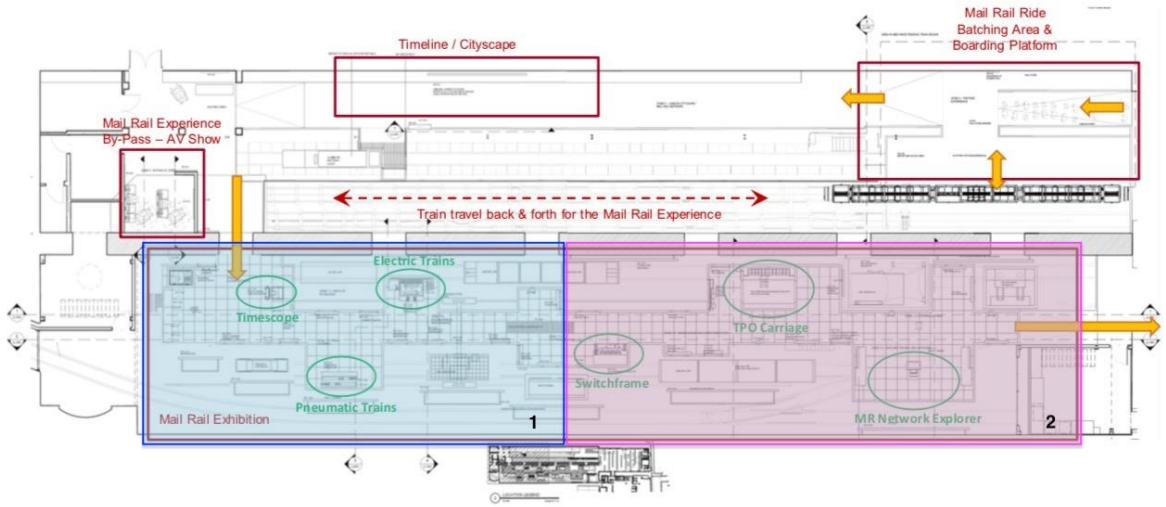
Appendices

Appendix A: Postal Museum and Mail Rail Zone Map

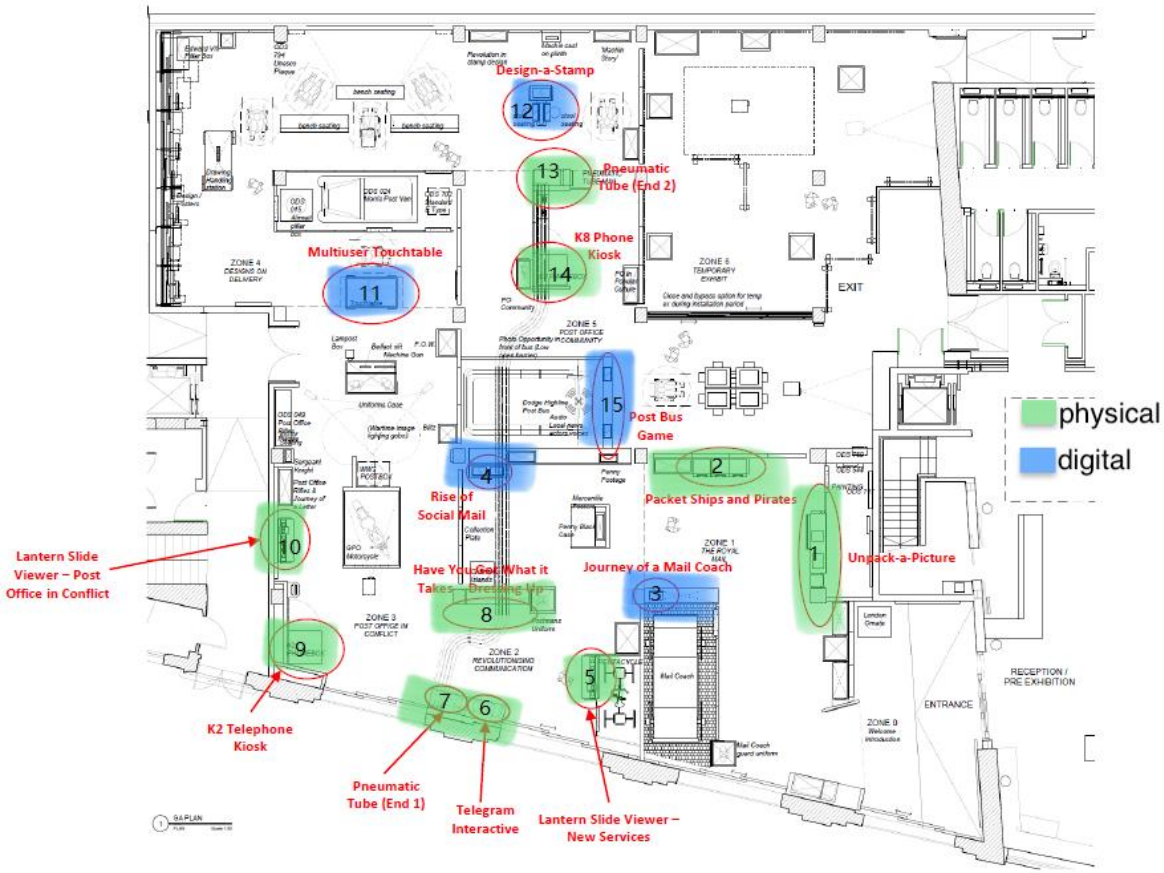
Postal Museum

Mail Rail

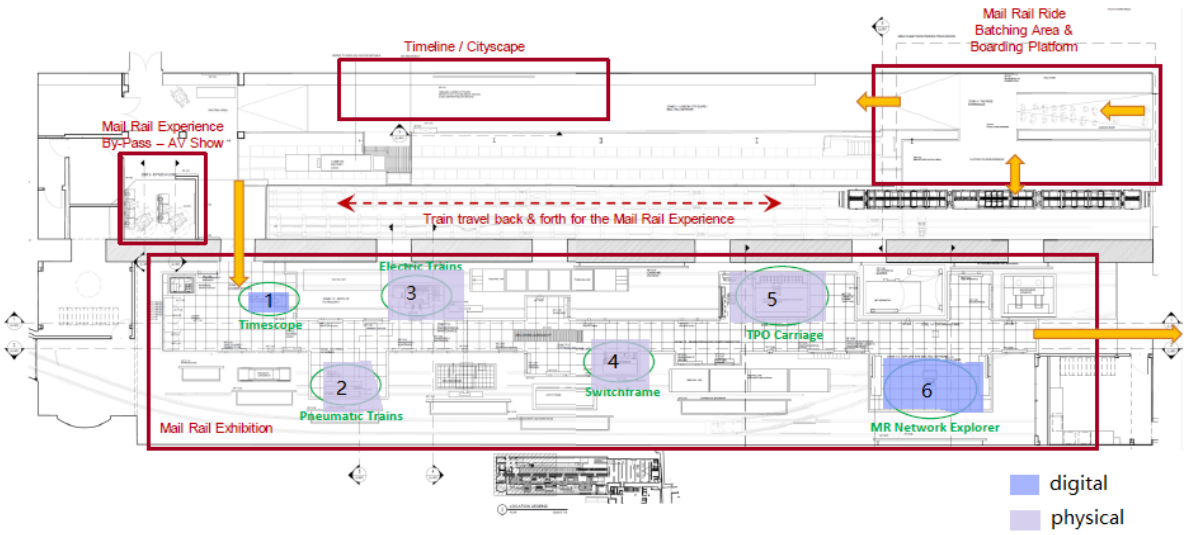


Appendix B: Postal Museum and Mail Rail Trace Map with Marked Interactive Exhibits

Postal Museum



Mail Rail


Mail Rail Ride
Batching Area &
Boarding Platform
Timeline / Cityscape
Mail Rail Experience
By-Pass – AV Show
Train travel back & forth for the Mail Rail Experience
Electric Trains
1
Timescope
3
5
TPO Carriage
4
Switchframe
2
Pneumatic Trains
6
MR Network Explorer
Mail Rail Exhibition
digital
physical

Appendix C: Postal Museum Interactive Exhibits Information

The Postal Museum Exhibition					
Zone	**Name of Exhibit**	**Type of Interactive**	**Brief Description**	**Primary Audiences**	**Learning Outcomes / Key Messages**
1	**Unpack-a-Picture – Mail Coach and Lioness Attack**	Physical	Explore the story of the lioness attack on the Exeter Mail Coach in 1816. Press a button to hear Post Horn calls; flick through a period newspaper story describing the event; view a lenticular image of the lioness attacking the lead horse; and reach inside a feely box to feel the lioness' teeth and hear it roar.	Families with under 7s (primarily 5-7-year olds)	• 1816 Lioness attack on mail coach. • The story happened long time ago and was only represented in drawings, paintings or engravings • The history of the postal service is full of unexpected and quirky stories.
1	**Packet Ships and Pirates**	Physical	Explore three scenes of Packet Ships in peril. Peer into portholes to see reconstructions of famous packet ship paintings. Press a button to trigger sound and lighting effects which bring the layered scenes to life.	Families with children aged 7-11, Independent adults	• Packet ships gave the Post Office a global reach • Mail delivery could be treacherous in early days
1	**Journey of a Mail Coach Game**	Digital	Take on the role of Mail Coach Guard's apprentice in this digital game. Follow the journey of the Mail Coach from Exeter to London and make some difficult decisions along the way.	Families with children aged 7-11	• Mail coaches were the most efficient way to deliver mail in 18th and 19th centuries • Delivery my mail coach was often dangerous and difficult • Still often punctual despite issues
2	**Rise of Social Mail**	Digital	Explore digital scans of social mail from the Museum's collections, including early examples of Birthday cards, Easter cards, Valentine cards, and Christmas cards.	Independent adults and families with older children (11+)	• History of post reflects history of people and their communication • The postal service is still relevant even today through sending social mail

2	**Lantern Slide Viewer – New Services**	Physical	Use a sliding magnifier and back-lights to view original lantern slides from the Museum collection.	Independent adults and families with older children (11+)	• How lantern slides were used in the past • Lantern slides allowed images to be seen by large audiences (ancestor of modern projector) • Document early forms of transportation developed, may have been used to train Post Office staff
2	**Telegram Interactive**	Physical	Use the headset to listen to three Morse Code recordings and try to decipher the messages.	Families with children aged 7-11	• Revolutionary way to send quick messages • Example of both Victorian spirit of invention and innovation and Post Office's willingness to use new technology • Morse code is used to send and receive messages
2	**Pneumatic Tube (End 1)**	Physical	Write a message on a piece of paper, pop it in the canister, and send it whizzing to the other side of the exhibition (Zone 5) via the pneumatic tube.	Families with children aged 7-11	• Pneumatic tubes send cylindrical containers through network of tubes using air • Post Office used to carry mail within and between buildings • Example of both Victorian spirit of invention and innovation and Post Office's willingness to use new technology • Still relevant technology today
3	**Have You Got What It Takes – Dressing Up**	Physical	Dress up as post person from the past, including a Mail Coach Guard, First World War Postwoman, Telegram Boy, and Edwardian Postman.	Families with children aged 7-11, Families with Under 7s	• Post Office uniforms have changed a lot over the years • Different jobs had different uniforms • Uniforms reflected styles of the time, practicality, Post Office brand, etc.

3	**K2 Telephone Kiosk – Oral Histories – Post Office in Conflict**	Physical	Step inside an original 1920s red telephone kiosk, dial the numbers, and use the handset to listen to oral history recordings of postal workers. An additional phone unit outside the kiosk allows wheelchair user to listen to the same content.	Independent adults	• Communication provides a lifeline for people during times of conflict • Delivering the mail in times of conflict is a theme with human stories of home and inspiration at its heart
3	**Lantern Slide Viewer – Post Office in Conflict**	Physical	Use a sliding magnifier and back-lights to view original lantern slides from the Museum collection.	Independent adults and families with older children (11+)	• Post Office played a key role in times of conflict • How lantern slides were used in the past • Lantern slides allowed images to be seen by large audiences (ancestor of modern projector)
3	**Multiuser Touchtable**	Digital	Use the large digital touch table to explore stories from the team's collections, including: Postcodes; Animals in the Post Office; and The Great Train Robbery. Drag the objects towards you, watch the animation, and then scroll through text and images related to each topic.	Independent adults and families with older children (11+)	• Our collections contain unexpected stories linked to objects and materials • History of the post is one of the people that worked for it and those that used it
4	**Design-a-Stamp**	Digital	Pose for a picture and then design a stamp around your photo. Choose a template, add accessories, and then email the results to yourself.	Families with children aged 7-11	• A commemorative stamp is a stamp that marks a certain event/date • Modern stamps are designed on computers • Smilers are customized stamps that include one's own photo

5	**K8 Telephone Kiosk – Oral Histories – Post Office Communities**	Physical	Step inside an original 1960s red telephone kiosk, dial the numbers, and use the handset to listen to oral history recordings of postal workers. An additional two phone units outside the kiosk allows wheelchair user to listen to the same content.	Independent adults	• Post Office have always played a key role in the lives of people in Britain • Working for the Post Office often includes funny/challenging memories and experiences • The Post Office is important in the community it serves
5	**Pneumatic Tube (End 2)**	Physical	Write a message on a piece of paper, pop it in the canister, and send it whizzing to the other side of the exhibition (Zone 2) via the pneumatic tube.	Families with children aged 7-11	• Pneumatic tubes send cylindrical containers through network of tubes using air • Post Office used to carry mail within and between buildings • Example of both Victorian spirit of invention and innovation and Post Office's willingness to use new technology • Still relevant technology today
5	**Post Bus Game**	Digital	Take on the role of a Post Bus driver in this digital game. Plot your journey through the countryside, picking up mail and passengers, and doing good deeds for bonus points. Make sure you reach the end of the route before the train arrives to pick up the mail!	Families with children aged 7-11	• Post buses played an important role in rural communities, transporting both mail and passengers • Delivering the mail involves route planning and dealing with changing situations

Appendix D: Mail Rail Interactive Exhibits Information

Mail Rail Exhibition				
Name of Exhibit	**Type of Interactive**	**Description**	**Primary Audiences**	**Learning Outcomes / Key Messages**
Timescope	Digital	Use the Timescope digital viewer to peel back the layers of time and view the Mail Rail Depot as it was before the exhibition was installed.	Families and independent adults	• To feel the industrial roots of the gallery spaces – a working environment. • To feel closer to the people that worked in those spaces.
Pneumatic Trains	Physical	Race your pneumatic car against a friend – first to the top of the slope wins. Turn the handles to power the fans, pushing the cars through the tubes by pneumatic power.	Families with children aged 7-11	• Before the Postal Office Underground Railway, there was the London Pneumatic Dispatch Railway • Carriages were propelled through underground tunnels by air compressed by giant fans • Innovative trial taken out of service because it did not meet aim of delivery times
Electric Trains	Physical	Train as a Mail Rail engineer, using the levers to move the model train around a loop of track, including tunnels and platform areas.	Families with children aged 7-11	• First driverless electric railway in the world • Carriages powered by electricity from the rails • Track approaching each platform was designed on an incline to slow down trains • Track leaving platform designed on decline to speed up train

Switchframe	Physical	Use the levers in the Switchframe unit to move trains across the Mount Pleasant station, keeping track of their positions with the help of the LED map.	Independent adults and families with children aged 7-11	• Routes of trains controlled from 1927-1990s by a Mail Rail worker that sat in a cabin at each platform • A Switchframe is a series of levers that would be pulled to control trains arriving and leaving each platform • As a final check, the train could only leave the platform once a postal worker pressed a button to show it was safe
TPO Carriage	Physical	Dress up as a worker on the Travelling Post Office (TPO) train carriage – as featured in the famous 1936 film *Night Mail.* Step inside the reconstructed carriage and sort the letters into the correct pigeon holes – but watch out for the wobbly floor!	Families with children aged 7-11	• TPOs are trains in which the mail was sorted and transported at the same tome during the journey • Saved the Post Office time • Dropped off and received mail while in motion • Workers had to move quickly and keep balanced on moving train
Mail Rail Network Explorer	Digital	Explore 3D scans of the Mail Rail Tunnels and Depot before the exhibition and ride were installed.	Adults, children aged 11+	• Emphasize the historical and current outward journey of the mail to the rest of the UK and abroad • Post has an impact on everyday lives • Evidence of the post is all around us, the team just need to take a look

Appendix E: Persons Interviewed and Dates (both of the Postal Museum and of other museums)

The table is in order of the time being interviewed)

Name	Association	Role (if available)	Time of Interview	Duty (if available)
Yatin Patel	Postal Museum	Engineer (Bouygues)	11am-12pm, May 14, 2018	One of the engineers that works for Bouygues, the Museum's Facilities Management Company. The engineers deal with day-to-day repair and maintenance of the physical interactives
Sally Sculthorpe	Postal Museum	Schools Learning Manager	2pm- 3pm, May 15, 2018	Manages the development and delivery of the program for school groups
Joe Martin	KCA London	Exhibit Design Manager	2pm-3pm, May 16, 2018	Designed "Sorted", an under 8s postal-themed play space at the Mail Rail
Joshua Henning	Postal Museum	Visitor Experience Manager	12pm-1pm, May 17, 2018	Manages the team of Duty Managers and Hosts that run front of house operations day-to-day
Ian Tolley	Postal Museum	IT Manager	2pm-3pm, May 17, 2018	Manages the team that looks after day-to-day maintenance of the digital interactive exhibits

Hannah Smith	Postal Museum	Community Learning Officer	11am-12pm, May 21, 2018	Helped develop the briefs for the physical interactives, especially those aimed at families
Martin Devereux	Postal Museum	Head of Digital	3pm-4pm, May 21, 2018	Oversaw development of all of the digital interactive exhibits
Andy Richmond	Postal Museum	Head of Exhibitions, Access and Learning	11am-12pm, May 22, 2018	Oversaw development of all the physical and digital interactive exhibits, from concept through to installation and operation.
Emma Harper	Postal Museum	Exhibitions Officer	11am-12pm, May 22, 2018	Oversaw development of all the physical and digital interactive exhibits, from concept through to installation and operation.
Davide Avanzo	Postal Museum	Senior Visitor Experience Manager –	2am-3pm, May 22, 2018	Manages the team of Duty Managers and Hosts that run front of house operations day-to-day.
Felicity Paynter & Elpiniki Psalti	Museum of London	Major Exhibitions Project Manager	2pm-3pm, May 23, 2018	N/A
Martin Pugh	London Transport Museum	Operations Support Manager	2pm-3pm, May 24, 2018	N/A
Katherine Biggs	National Maritime Museum	Lead Digital Project Manager	3pm-4pm, May 24, 2018	N/A

Dominique Bouchard	National Army Museum	Head of Learning and Participation	(TBD) June 6, 2018	N/A

Appendix F: Preliminary Script for Interviews of Other Museums' Staff

Thank you for agreeing to this interview with us. The aim of this interview is to identify well-used and refined methods for designing, developing, implementing, and evaluating interactive exhibits in museums, for the purposes of obtaining a more accurate evaluation of the interactive exhibits at the Postal Museum. This interview is entirely voluntary, and you may call it to an end at any time. the team may wish to quote your responses in the team's research; if the team do, you will be given an opportunity to review the team's statements before publication. Do you wish to continue? Do the team have your permission to quote your responses in the team's research?

- When the interactives were implemented, what were the staff expectations? How well are these interactives living up to expectations?
- What is the process for selecting interactives? What learning outcomes were they intended to promote?
- Do you have any personal experiences with implementing or evaluating interactive exhibits that you have taken as lessons for future evaluations? What are they?
- Have you performed any evaluations, such as surveys, of interactives recently?
    - Are you willing to share the results of those evaluations?
- In your experience, which type of interactive exhibit tends to work best? Physical or digital? Individual or group?
- What are some of the biggest problems you have encountered in the design, implementation, and maintenance of interactives?

Appendix G: Preliminary Script for Interviews of Postal Museum Staff

Thank you for agreeing to this interview with us. The aim of this interview is to identify the expectations of the interactive exhibits in the Postal Museum and Mail Rail and determine preliminary information about the interactive exhibits that could assist in guiding the team's visitor studies as the team continue the team's evaluation. This interview is voluntary, and you may call it to an end at any time. the team may wish to quote your responses in the team's research; if the team do, you will be given an opportunity to review the team's statements before publication. Do you wish to continue? Do the team have your permission to quote your responses in the team's research?

When the interactive exhibits were implemented, what were the intended audience demographics for the exhibits? Which are catered more toward children or adults? Which are designed to accommodate multiple users at a time or are meant for one person only to use? How are these expectations similar or different from the actual audiences?

- What learning outcomes did the museum intend for each exhibit? What did you want children to learn from the exhibits? How are visitors able to learn from the exhibits? Do visitors seem to gain the knowledge or interest intended? How do these expectations differ from what was intended?
- In what you have seen in the Postal Museum, which exhibits, or types of exhibits tend to perform well? Why do you think these exhibits perform well?
- Which exhibits in the Postal Museum have you seen to be not performing as well as intended? Why might these exhibits not be performing well?
- In what you have seen in the Mail Rail, which exhibits, or types of exhibits tend to perform well? Why do you think these exhibits perform well?
- Which exhibits in the Mail Rail have you seen to be not performing as well as intended? Why might these exhibits not be performing well?
- Have you noticed any variation in success of exhibits with different group types, such as families, school groups, or individuals? Why has the success changed? What made the exhibit more/less successful?

- As someone that may determine visitor reactions yourself, do you have any recommendations for how to determine these reactions (if they like an exhibit or not) through observation?
- Are there any exhibits in particular that tend to be broken/damaged often? Why do you think these exhibits are repeatedly broken (i.e. poorly made, used incorrectly due to poor instructions, users too rough)? Do you have any suggestions on how these issues could be solved, apart from routinely replacing/fixing broken parts?

Appendix H: Tracking & Observation Protocol for Postal Museum and Mail Rail

(Note the Postal Museum and Mail Rail surveys are actually separated but combined in this report to save space)

Q1. Survey Code Number (put DDMMNU) _____

e.g. the 15th survey done on the day 30 May 2018 would be 200515.

Q2. Recorders _____

Q3. Day of a week

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

Q4. Time of a day

- 10:00-11:00
- 11:00-12:00
- 12:00-13:00
- 13:00-14:00
- 14:00-15:00
- 15:00-16:00
- 16:00-17:00

Q5. Visitor Type

- Individual
- Adults without children
- family with children

- school group

Q6. (Postal Museum) Observations

Interactive Exhibit	Degree of Interaction							Read Instruction			Discussion	
	Broken	Ignored	Noticed	Occupied	Entered	Interacted	Accomplished	Y	N	Not Sure	Y	N
Unpack-a-Picture												
Packet Ships and Pirates												
Journey of a Mail Coach												
Rise of Social Mail												
New Services												
Telegram Interactive												
Pneumatic Tube (End 1)												
Dressing Up												
K2 Telephone Kiosk												
Post Office in Conflict												

Multiuser Touchtable												
Design-a-Stamp												
Pneumatic Tube (End 2)												
K8 Phone Kiosk												
Post Bus Game												

Q6. (Mail Rail) Observations

Interactive Exhibit	Degree of Interaction							Read Instruction			Discussion	
	Broken	Ignored	Noticed	Occupied	Entered	Interacted	Accomplished	Y	N	Not Sure	Y	N
Timescope												
Pneumatic Trains												
Electric Trains												
Switchframe												
TPO Carriage												
MR Network Explorer												

Q7. (Postal Museum) Dwell Time

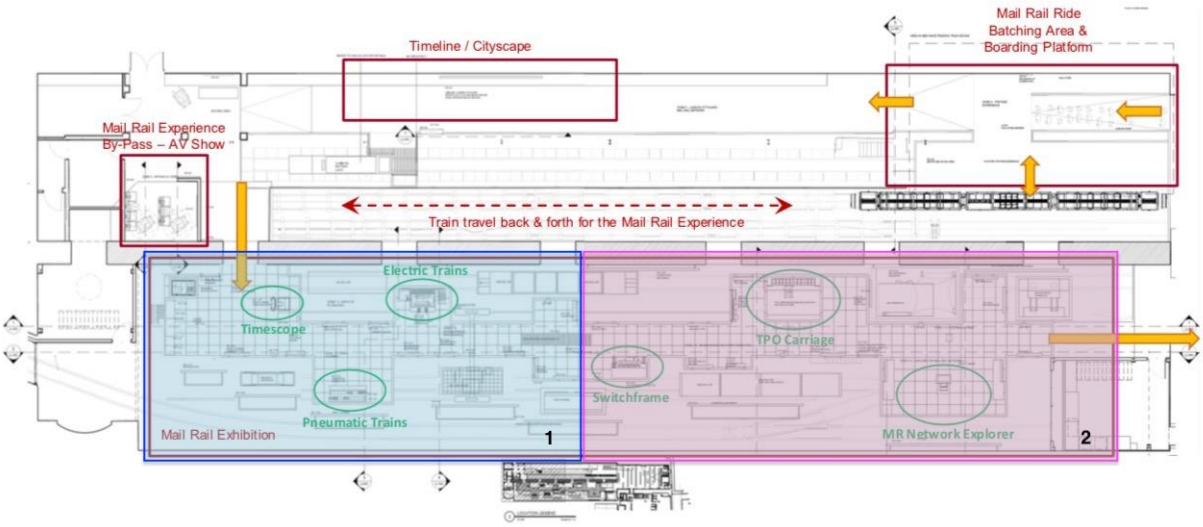
Interactive Exhibit	Dwell Time (H: MM: SS)
Unpack-a-Picture	
Packet Ships and Pirates	
Journey of a Mail Coach	
Rise of Social Mail	
New Services	
Telegram Interactive	
Pneumatic Tube (End 1)	
Dressing Up	
K2 Telephone Kiosk	
Post Office	
Multiuser Touchtable	
Design-a-Stamp	
Pneumatic Tube (End 2)	
K8 Phone Kiosk	
Post Bus Game	

Q7. (Mail Rail) Dwell Time

Interactive Exhibit	Dwell Time (H: MM: SS)
Timescope	
Pneumatic Trains	
Electric Trains	
Switchframe	
TPO Carriage	
MR Network Explorer	

Q8 – Q12. (Postal Museum) Zone Tracking Heat Map (5 zones)

Q8 – Q9. (Mail Rail) Zone Tracking Heat Map (2 zones)



Q13. (Postal Museum) Comment _____

Q10. (Mail Rail) Comment _____

Appendix I: Exit Interview Protocol for Objective #3

(Question number continued from Appendix H)

Q14. Preamble:

Hello, my name is _____ and I'm from Worcester Polytechnic Institute in the US. My team and I are conducting an evaluation of the interactive exhibits for the Postal Museum / Mail Rail as you were told by the hosts at the entrance. the team would love to hear opinions from visitors like you. Would you like to take a survey that's about 4 minutes?

- This interview is completely anonymous, and your response won't be used to trace to you in any way.
- Your response will only be published after analysis and aggregate without any personal identifying information.
- Participation is voluntary.
- Interviewee has right to end the interview at any time.
- Interviewee need not answer every question being asked.

Q15. Please choose your age range

Under 16	16-19	20-24	25-29	30-34	35-39	40-44	45-49
50-54	55-59	60-64	65-69	70-74	80-84	85+	

Q16. The group composition

Age range	Children aged under 5	Children aged 5-11	Children aged 12-16	Adults (16+)
Number of person				

Q17. Which one of the following interactive exhibit is the most memorable to you (show visitor the Exit Interview Poster, see appendix J)? _____

Q18. Among the interactive exhibits, is there anyone that you feel you learn something from it (show visitor the Exit Interview Poster, see appendix J)? _____

Q19. Could you tell us about why you skipped this exhibit (the other team member will show one of the exhibits they have ignored)? _____

Q20. Could you tell us about why you spent a relatively long time at this exhibit (the other team member will show the photo of one exhibit where they had long dwell time)? _____

Q21. Lastly, do you specifically like/dislike any of the interactive exhibits? _____

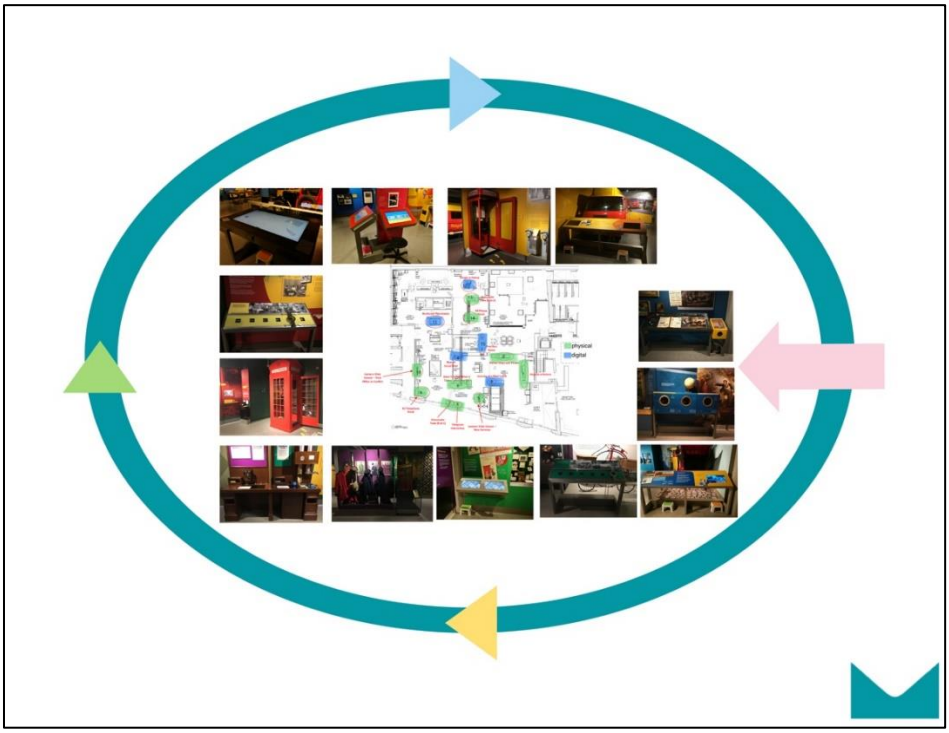
Q22. Thank you very much for taking all the time with us. Everything you remarked will help guide us to make the museum better – Do you have any question for us?

Interviewee questions write ‘no question’ if no question asked _____

Q24. Thank you again and hope you had a nice day at the Museum.

Appendix J: Exit Interview Posters

Postal Museum Poster:



Mail Rail Poster:

Appendix K: Visitor Interview Guide for Objective #4

(The Preamble information is the same as in Appendix H)

Interview form should include the data, time, location, interviewer initials.

Identify target visitor or visitor groups upon their entrance of the exhibit.

Approach target visitor or visitor groups exiting the interactive exhibit (the target should not appear to be in a hurry).

If the group is a school group, only observe and note the behaviors

Section 1: Preamble

1. "(Hello, my name is _____ and I'm from Worcester Polytechnic Institute in the US). My team and I are conducting an evaluation on the interactive exhibits for the *Postal Museum / Mail Rail*. The survey is completely anonymous, and …"
   A. *If adult(s) without children*: "… the only personal information we'll collect is your age range and the age of your group. Would you be willing to speak with us for a few minutes and share your thoughts about the exhibit you just used?"
   B. *If family group*: "… the only personal information we'll collect is your age range and the age of your group. Would you be willing to speak with us for a few minutes and share your and your family's thoughts about the exhibit you just used?"
2. A. *If no*: "That's not a problem, thank you very much for your time anyway. Have a nice day."
   B. *If yes*: "Excellent, thank you very much! the team would love to hear your opinion to make the *Postal Museum / Mail Rail* a better place to have fun and learn. It should take about five minutes"
   C. *If uncertain*: "We would appreciate to hear your opinion. It won't take more than five minutes and you can quit at any time. Would you like to participate?" (proceed to "yes" or "no")

Section 2: Visitor Experience Assessment

3. Please choose your age range

Under 16	16-19	20-24	25-29	30-34	35-39	40-44	45-49
50-54	55-59	60-64	65-69	70-74	80-84	85+	

1. Did you read the instruction for this exhibit? Yes/No
2. Did you use the exhibit as a group? Yes/No
3. Did you discuss while using the exhibit? Yes/No
4. About your experience (interactive criteria) [Response in five-point scale: Strongly disagree -> Disagree -> Neither agree nor disagree -> Agree -> Strongly Agree]

Criteria	Question statement	Responses
Intuitiveness: an exhibit should offer intuitive way of controls that does not require an extended period to learn.	You find this exhibit easy to use	
Concentration: an exhibit should have limited number of features with obvious priority of the elements.	You understand the purpose of the exhibit	
Competence/relevant: an exhibit should let viewers to construct new information on their background and not overwhelm them with new information.	You learned something new from the exhibit	

If group visitors: Multi-sidedness/user: an interactive should allow a group to gather around and multiple user should be able to collaborate without hindering each other.

Criteria	Question Statement	Responses
Multi-Sided: Interactive should allow family members to cluster around and let multiple user to collaborate at the same time.	You and your group can easily cluster around the exhibit	

5. What caught your eye about this interactive? (You can choose more than one option)
    a. It appeals to you visually
    b. The subject interests you
    c. Other people are using it

   d. It attracted a member in your group (which member of your group)
   e. Other (please specify)
   f. No specific reasons
6. What did you enjoy the most about this exhibit?
7. What could you suggest to make the exhibit better?

Section 3: Learning Outcome

1. Pre-interview: This section is unique for every exhibit. The team had identified the learning outcome of each exhibit from staff interview and prepared a picture to remind visitor of the subject matter.
2. During interview: ask the visitor what they can tell of the subject and mark the level of their understanding. The levels are:
   a. Identifying
      i. One-word statements
      ii. Few association to exhibit content
      iii. Connections to content miss the point of the exhibit
   b. Describing
      i. Correct connection to visible exhibit characteristics
      ii. Connections to personal experience based on visible exhibit characteristics, not concepts
   c. Interpreting and applying
      i. Correct statement of concepts behind exhibits
      ii. Connection to personal experience based on exhibit concepts

End of interview

3. "Thank you very much for taking all the time with us. Everything you remarked will help guide the improvement of the interactive exhibits – Do you have any question for us?"
   If no: "Thank you again and enjoy your day at the *Postal Museum / Mail Rail*."
   If yes: record and answer
4. Post-Interview Reflection
   a. After each interview, identify if any of the response can be related towards the characteristics noticed from previous studies that may include:

i. This interactive often breaks / requires maintenance.
ii. Visitors tend to spend more/less time with this interactive exhibit.
iii. This interactive exhibit appeals more to certain type of visitors (adult without children, family, school group)
iv. Visitor spend particularly long time reading the instructions and usually refer back to them during usage.

b. Additionally, please use the comment space to record any thoughts or concerns the evaluators may have.

THIS INTERVIEW GUIDE WAS TAKEN FROM "SCIENCE ON THE MOVE: FRONT-END EVALUATION REPORT" BY CARDIEL, C., & PATTISON, S. (2015) AS A TEMPLATE.

Appendix L: Sponsor Description

The London Postal Museum

The postal service has been going for more than five hundred years since Henry VIII tasked Sir Brian Tuke with establishing a national postal network to serve his Court. While it was opened to the public by Charles I as far back as 1635, becoming the General Post Office under Oliver Cromwell and then Charles II in 1660, it was not until the early 1800s that the first steps towards organizing and safeguarding its records were taken. Figure on the left was a commercial painting at that time showing the royal mail service. Following the passing of the first Public Records Act in 1839, the General Post Office put record-keeping front and center and created the Record Room in the General Post Office Headquarters in St. Martin's Le Grand, Central London in the 1890s (Postal Museum: the team's History, 2018). The Record Room was the archive of the institution that could be studied by historian and other interested researchers. The Public Records Acts of 1958 and 1967 demanded that the Post Office make its archives more readily available to the public (National Archives).

Figure 34: The Postal Service Only for the King and the Court (Taylor Ian, 2016)

Established in 1966 the National Postal Museum opened to the public on February 19, 1969 in the King Edward Building. The museum house the archive and an award-winning collection of British Victorian stamps donated by Reginald Phillips in 1965. Figure to the right is a Victorian stamp in the collection. This museum provided public access to the collections of the postal service like never before. Over the years, the collection grew to include a wide array of postal equipment, uniforms, vehicles and many more items exceeding the capacity of the existing building. Following the sale of the King Edward Building in 1998, smaller objects of the collections and museum staff moved to Freeling House at Mount Pleasant, the home of the Royal Mail archive since 1992. Larger objects were put into storage away from Central London. After six years as part of Royal Mail, in 2004, all collections were transferred to a new independent charity, the Postal Heritage Trust

Figure 35: British Victorian Stamp (Taylor Ian, 2016)

Figure 36: The New Postal Museum (Postal Museum: the team's History, 2018)

that was created to look after and grow them for the enjoyment of all. The museum in charge of the collections was known as the British Postal Museum & Archive, or BPMA. At the year of 2017, the Postal Heritage Trust rebranded and launched the BPMA as The Postal Museum. In July of the same year, they opened a new facility to house the archive and to display and interpret items from the collections. Since that time, the Postal Museum has been actively engaging the public, revealing the fascinating story behind the first social network. Figure above is the newly opened Postal Museum at Phoenix Place, London near the Mount Pleasant sorting office in Clerkenwell.

The Mail Rail

In 1855, Rowland Hill, then Secretary to the Post Office, submitted a report to the Postmaster General on a system for conveying mail in underground tubes (The story of mail rail.2018). The plan was the predecessor of underground mail rail but was up off due to financial difficulties. At the opening of 20th century, the Mail Rail plan was revived as a countermeasure against London's increasingly congested traffic.

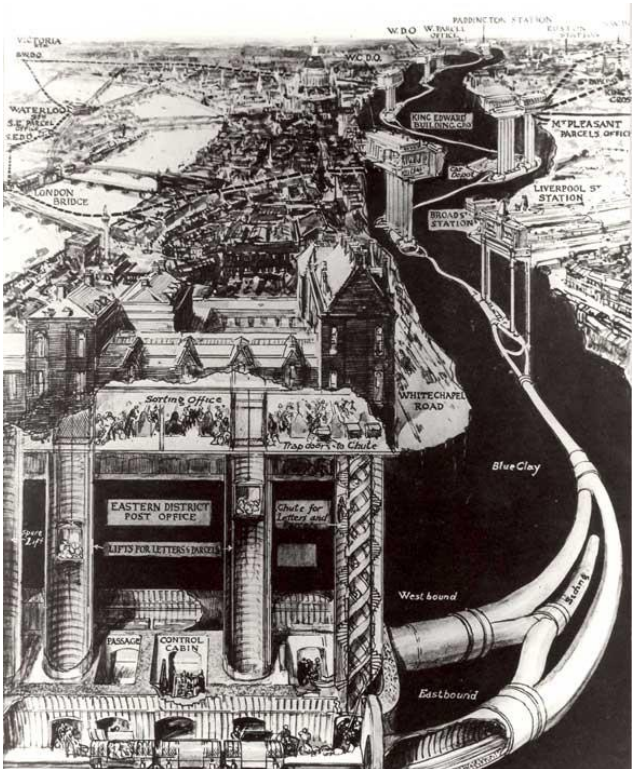


Figure 37: Mail Rail Diagram, 1926 (The Story of Mail Rail, 2018)

The railway was to consist of six and a half miles of tunnels at an average of 70 feet below ground. It would connect the West and East ends of London, with eight stations situated at Paddington District Office; Western Parcels Office; Western District

Office; Western Central District Office; Mount Pleasant; King Edward Building; Liverpool Street railway station and Eastern District Office. The construction of the tunnels began in 1914, completed in 1917 and officially put into use in 1927 (The story of mail rail, 2018). See figure 37 for a complete map of the mail rail.

Figure 38; Mail Rail in Operation: Loading Containers (The Story of Mail Rail, 2018)

The Post Office (London) Railway played a pivotal role in the transportation of mail in London. Its continued, rarely interrupted, service is testament to the skilled engineering and maintenance teams that kept the system running. Figure 38 shows workers loading mails on the train for transferring. The network even had its own underground workshop beneath Mount Pleasant. Through declining use and closure of the above ground offices, the system eventually became un-economical to run. In 2003, the system was suspended (The story of mail rail.2018).

In July 2017, the 6.4-mile (10.5 km) long route was opened to the public by Postal Heritage Trust with a whole set of Mail Rail related exhibitions. Figure below shows an interactive exhibit where the visitors can control a model of railway pneumatic trains. Furthermore, as the major display for Mail Rail, Riding the Mail Rail (shown in figure below) allows visitors to ride on the mail trains and explore the immersive underground interlink which had been the core of London's social network for nearly 100 years.

Figure 40: Mail Rail Exhibition - Pneumatic Trains (Mail Rail Exhibition)

Figure 39: Riding the Mail Rail (Ride Mail Rail)

The Museum Today

The Postal Museum and the Mail Rail are parts of the Postal Heritage Trust, a registered charity, whose board of trustees is its principal governing body. The nine trustees have dedicated subcommittees that focus on the specific issues of audit and finance, HR and remuneration, museum collections, fundraising, marketing, and the Postal Museum/ Mail Rail project (Postal Museum: Governance & Trustees, 2018). Around 186,000 visitors and 10,000 school groups were expected to visit the museum annually before its opening in July 2017 (Evening Standard, 2016). The museum was built at a cost of £26 million (The National, 2016).

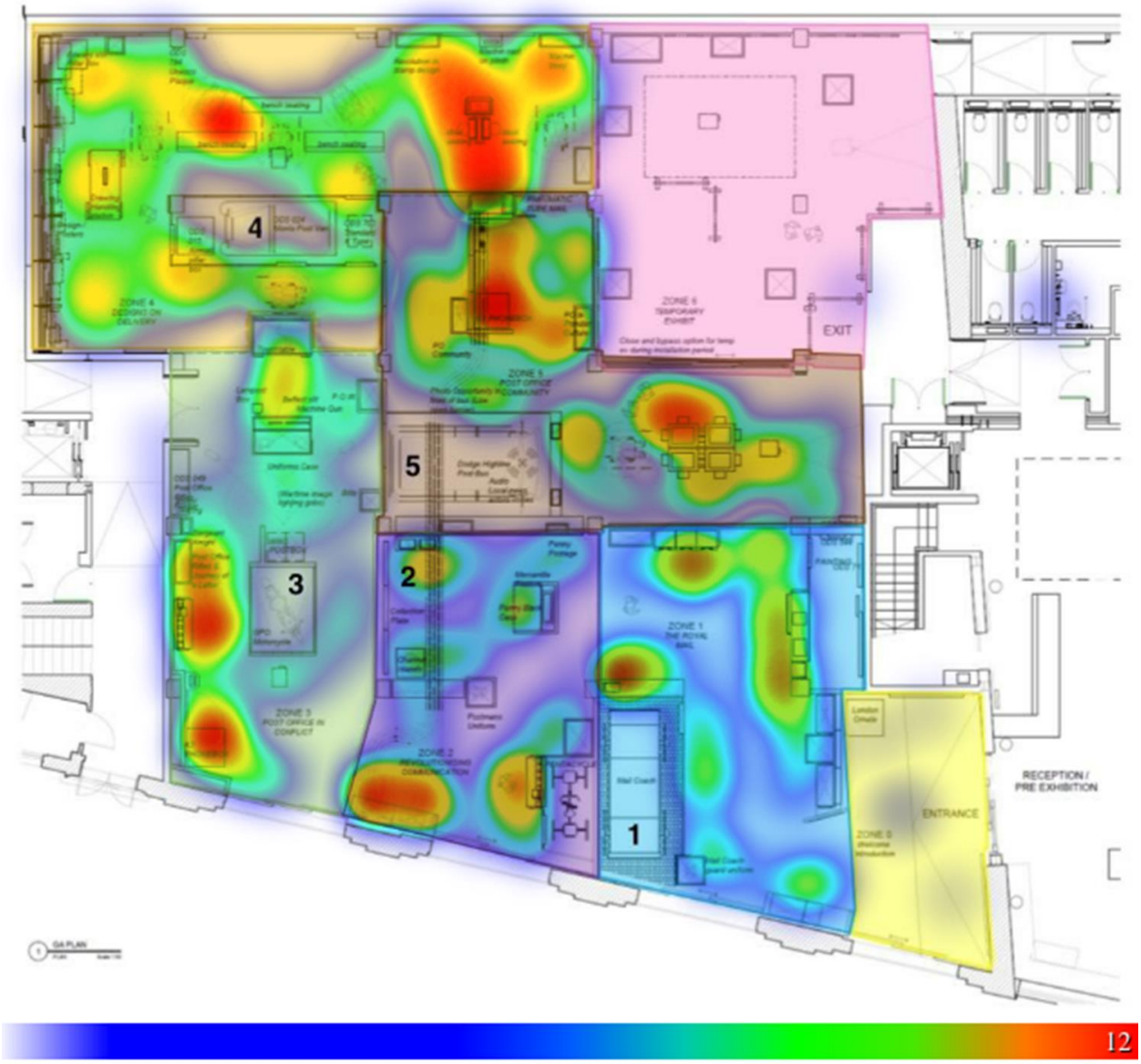
The new museum was designed with a large number of physical and digital interactives because previous research in museum studies by the BPMA indicated that interactives are essential in attracting and engaging visitors, especially school groups and families with children. Each interactive tells some story behind the postal service, such as "Have You Got What It takes – Dressing Up" where visitors are able to dress up as a post person from the past, including a Mail Coach Guard, First World War Postwoman, Telegram Boy, and Edwardian Postman (Figure 46).

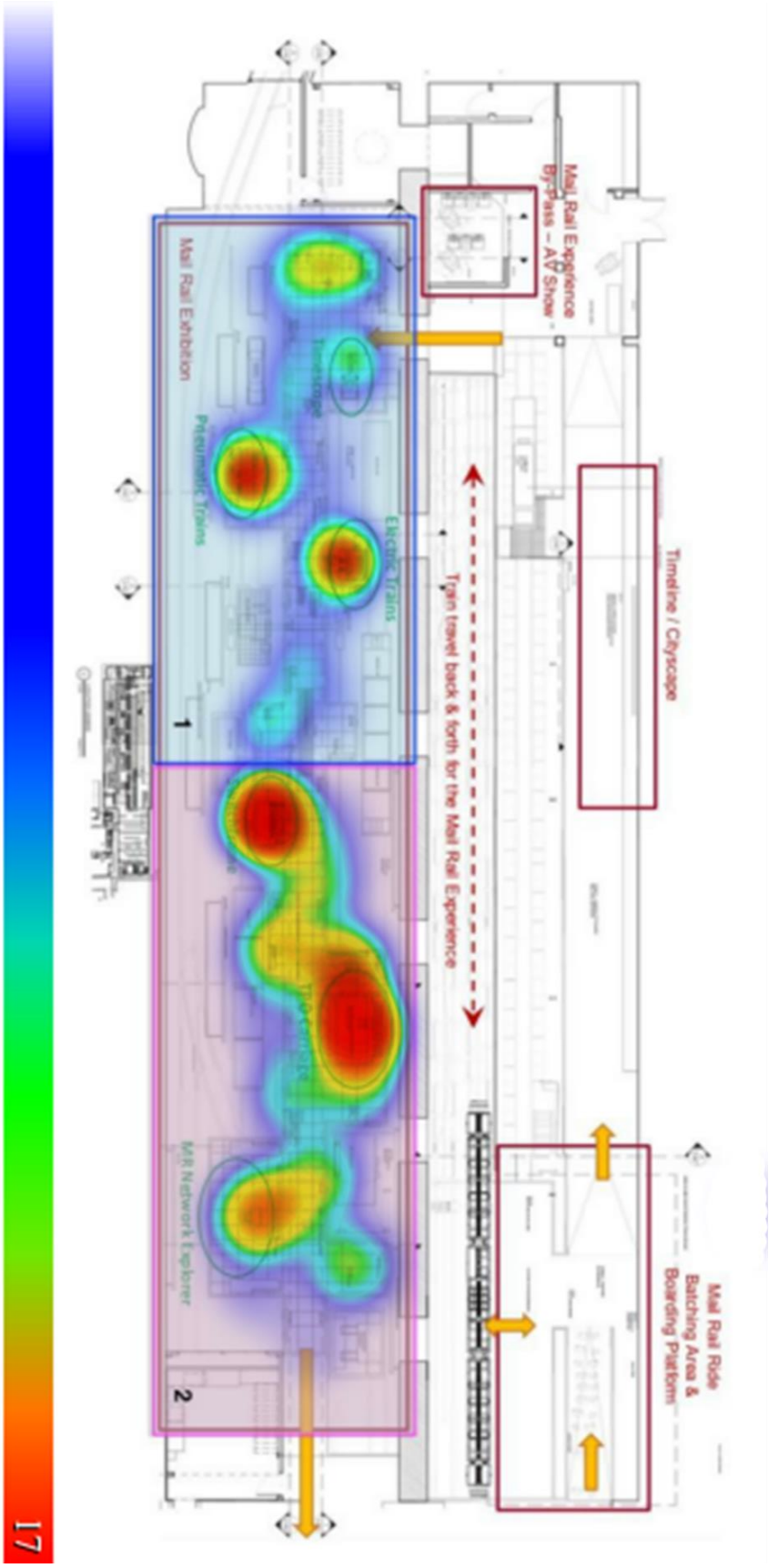
Figure 41: "Have You Got What It Takes" (The Postal Museum Exhibition.)

The museum aims to attract people of all ages. For older adults, the museum and its archive provide for them the memory of how they used mail services in the old days. In addition, the museum conducts a variety of activities for families and their children. Last August, the Mail Rail Science Show illustrated the early attempts to use pneumatic power in Mail Rail, and allowed children to take part in live experiments, learn engineering skills, and explore the scientific principles behind the world's first driverless electric railway. Figure to the right shows a group of children that participated in the "Make Your Own Hard Hat" at the science show.

Figure 42: Make Your Own Hard Hat (Mail Rail Science Show)

Appendix M: Raw Heat Maps




17
Mail Rail Experience By-Pass – AV Show
Mail Rail Exhibition
Timeline / Cityscape
Train travel back & forth for the Mail Rail Experience
Mail Rail Ride Batching Area & Boarding Platform
1
2

Appendix N: Report Cards

In the cards, the scales (i.e., good, poor, low, not) for the four aspects (attraction, placement, engagement, and recollection) reflects an exhibit's one aspect against other three aspects; in other words, no comparison between interactives was made. This report is also available in a separate file.

UNPACK-A-PICTURE

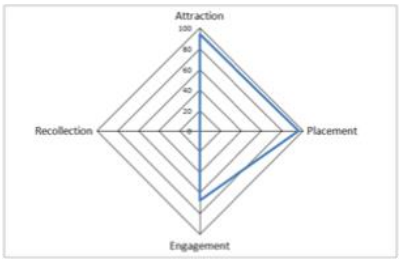
TPM Physical

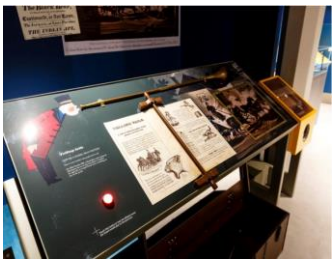
Good at:

- ✓ Fair attractiveness
  - ✓ Multiple assess point for visitors to interactive with the exhibit
- ✓ Good location
  - ✓ Visitors are more likely to try more interactives early in exhibition

Improvement Needed:

- ○ Low dwell time
  - ○ The physical part of the interactive can be completed quickly. People don't always stay and read
- ○ Not memorable
  - ○ Visitors tend to forget early exhibits that don't immediately "wow" them or may due the fact that this is the first exhibit the visitors encounter





Conclusion and Recommendation

This exhibit receives a lot of attention and traffic flow. However, visitors do not tend to remember interacting with it. Visitors are also able to complete only individual parts of the interactive very easily.

For long-term modification, our observation shows a higher satisfaction with hands-on interaction. Multi-stage and multi-sensory interaction, such as having visitors blow into the horn rather than pressing a button, can increase visitor engagement and especially recollection with this exhibit.

PACKET SHIPS AND PIRATES

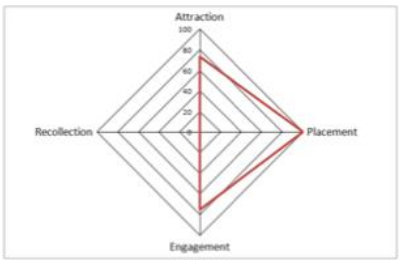
TPM Physical

Good at:

- ✓ Great placement
  - ✓ Located in open area where visitors tend to walk directly towards or follow along outside
- ✓ Fair engagement
  - ✓ Visitors tend to complete all three portholes once they start

Improvement Needed:

- ○ Not intuitive
  - ○ Buttons are sometimes neglected and visitors will try to look in without the being lit up which causes confusion
- ○ Poor accessibility
  - ○ Height of portholes is too short for adults



Conclusion and Recommendation

This exhibit suffers from unclear instruction. Using written instructions for use may not be unnecessary. However, the intention of using the buttons is not obvious.

For immediate changes, we recommend modifying the appearance of the buttons to those that are easier to distinguish as buttons. Light-up arcade-style buttons would work well to attract attention and can withstand extensive usage.

As for long-term changes, we would recommend further study to determine if the learning objectives can be met with how the interactive is currently set up.

JOURNEY OF A MAIL COACH GAME

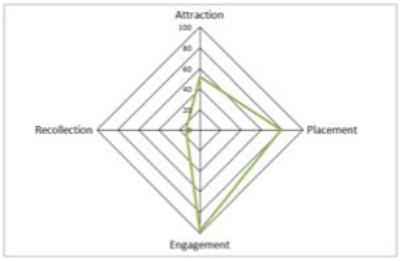
TPM Digital

Good at:

- ✓ Good informative potency
  - ✓ Visitors are able to learn a lot from going through entire journey
- ✓ Good engagement
  - ✓ Visitors tend to be willing to finish it once they interacted

Improvement Needed:

- Poor attraction
  - Visitors would rather have a more physical or hands-on experience
- Poor location
  - Visitors sometimes miss the exhibit due to it being more to their side when they walk through the exhibition



Conclusion and Recommendation

This exhibit mainly suffers from the long story that users must go through using only touching a screen. As it is not too exciting, visitors do not flock to the exhibit too much and often skip by it entirely as they do not face it head-on.

For immediate changes, we recommend making the area around the screen more attractive and eye-catching. Doing so could get visitors more interested.

For a long-term modification, we would recommend adding a more tactile way for visitors to make the choices in the game. This could include things like buttons, rather than touching the screen. Arcade-style buttons have repeatedly been recommended in being robust options for use in museum exhibits.

RISE OF SOCIAL MAIL

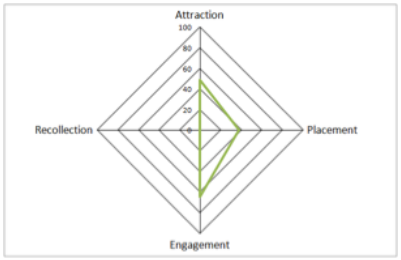
TPM Digital

Good at:

- ✓ Fair attractiveness
  - ✓ Only interactive in often-skipped section in Zone 2 and has bright screens
- ✓ Good engagement
  - ✓ Visitors tend to look at multiple pieces of mail on the screens once they start engaging

Improvement Needed:

- Poorly located
  - Visitors often tend to miss this section of the exhibition entirely and walk towards the bicycle once they finish Zone 1
- Not memorable
  - visitors tend to recall less on Digital Interactives in general



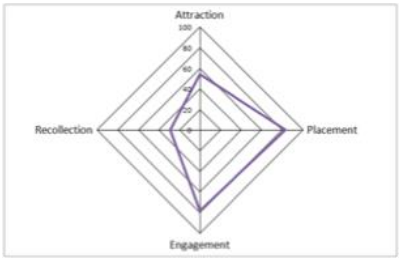
Conclusion and Recommendation

This exhibit mainly suffers from its poor placement; it resides in an area where most visitors pass by and are seeming not to notice it is a part of the gallery

For immediate changes, we recommend adding arrows on the floor, or similar method, to get more visitors entering this "hidden" area.

For a long-term modification, we recommend adding some physical elements to the exhibit. Doing so can include, for example, buttons around the screens to be the method in which visitors can choose the type of social mail about which they would like to look at and learn more. After pressing the desired button, they can use the touchscreen to look at the different examples.

LSV – NEW SERVICES



TPM Physical

Good at:

- ✓ Good placement
  - ✓ Locating near a across point increases use as visitors are more willing to interact
- ✓ Fair Engagement
  - ✓ Visitors tend to look at all slides once they start

Improvement Needed :

- Poor attraction
  - Visitors sometimes skip this exhibit to go directly to the pneumatic tube as it nearby and is more attractive
- Lack of content
  - This exhibit has potential to tell more extensive stories

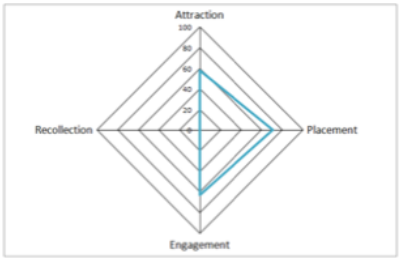
Conclusion and Recommendation

This exhibit mainly suffers from poor recollection. Not many people remember this exhibit fondly as it contains little content relative to other displays and does not get them too involved.

For immediate changes, we recommend finding some way to make the slider a little bit easier to move. Solutions may consist solely of adding oil or a lubricant to the slider rails on a regular basis to improve ease of sliding.

For a long-term fix, we recommend adding more content to the exhibit, such as incorporate stories or information as audio about each slide. It may also be interesting to renew slides regularly a while so visitors can have something new to look at if they return to the museum.

TELEGRAM INTERACTIVE



TPM Physical

Good at:

- ✓ Fair attractiveness
  - ✓ Visitors find it generally interesting to look at
- ✓ Fair Engagement
  - ✓ visitor tend to be willing to finish it once they interacted

Improvement Needed :

- Accessibility
  - People may not be able to collaborate well with one telephone receiver
- Not memorable
  - Visitors tend to remember the pneumatic tube better out of the two that are together

Conclusion and Recommendation

One main drawback to this interactive is that it tends to "reset" while visitors are still using it, and they seem to believe it is nonfunctional if they take too long between listening to the first code and hearing the answer.

For immediate changes, we recommend lengthening the interval between when a visitor presses the button and the interactive "resets," so that they can push the answer button freely.

For a long-term modification, we recommend relocating this exhibit away from the pneumatic tube. Visitors seem interested in using this exhibit, yet tend to be more interested in the exhibit directly next to it.

PNEUMATIC TUBE

TPM Physical

Good at:

- ✓ Great recollection
  - ✓ Visitors remember using the pneumatic tube fondly
- ✓ Good engagement
  - ✓ Visitors tend to try to finish sending the tube, trying multiple ways to get it to send

Improvement Needed :

- Breaks often
  - Visitors are often unable to use the interactive, and sometimes unable to tell if it's under maintenance.
- Poor attraction (End 2)
  - Visitors tend to send messages only from End 1

Conclusion and Recommendation

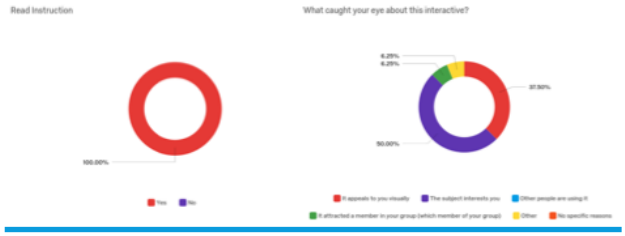
This exhibit mainly suffers from being broken very often and having little attraction to End 2. Visitors do not usually use the pneumatic tube towards the end of the exhibition.

For immediate changes, we recommend adding a sign that instructs visitors clearly that the tube will end up at another machine towards the end of the exhibition and that they can send messages back and forth between the two ends. Additionally, it would be very beneficial to determine precisely why the interactive will stop working.

For a long-term fix, we recommend adding light indicators along the lengths of the tubes to show all visitors when a message is being sent.

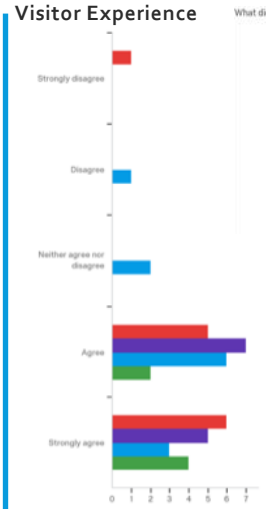
IN-DEPTH – PNEUMATIC TUBE

General



Learning Outcomes

Visitor Experience



N = 12

HAVE YOU GOT WHAT IT TAKES – DRESSING UP

TPM Physical

Good at:

- ✓ Fair attractiveness
  - ✓ Mostly younger visitors enjoy being able to dress up
- ✓ Fair Engagement
  - ✓ Visitors tend to enjoy dressing up and often will walk through the exhibition dressed up

Improvement Needed :

- Poorly located
  - Visitors often miss the exhibit as they interact with the exhibit on the opposite wall
- Not memorable
  - Not many visitors remember this exhibit as very few interact with it

Conclusion and Recommendation

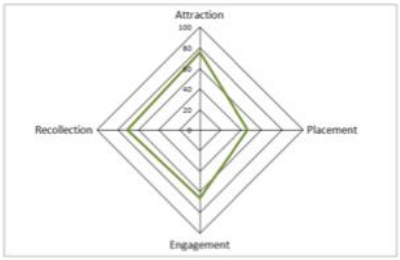
This exhibit mainly suffers from its poor placement; it is placed opposite to the Pneumatic Tube, the most popular exhibit in the gallery, and just around a corner, so many visitors do not even notice it is there.

For immediate changes, we recommend something more flashy around the display to catch visitors' attention more.

For a long-term fix, we recommend moving the dress up area to somewhere away from such a popular exhibit, such as the pneumatic tube. Having clothes to dress up seems to work well and be well-received, yet the exhibit does not get much attention as it is across from the most popular interactive in the exhibition.

K2 TELEPHONE KIOSK

TPM Physical



Good at:

- ✓ Fair attractiveness
  - ✓ visitors seem to be attracted by the antique-looking phone
- ✓ Fair Engagement
  - ✓ visitors tend to spend time figuring out how to work the phone
- ✓ Memorable
  - ✓ Visitors, especially elders and children remembers this interactive well

Improvement Needed :

- Poor location
  - Entrance in opposite direction of general travel does not encourage usage

Conclusion and Recommendation

This exhibit mainly suffers from lack of understanding. Most adult visitors have an idea how to dial the phone inside, but few of them look at the card containing the numbers the produce a response. Additionally, the telephone placed off to the side is used far more frequently than the one inside the box. Visitors are now well informed regarding how they can interact with the kiosk. Despite the footprint sticker on the ground, visitors also often skip entering the booth, as they see its side and move on, assuming it is just a static exhibit.

For immediate changes, we recommend making the list of numbers more visible, so that visitors are aware the exhibit will respond to use. Making instruction for use much clearer. An attractive sign simulating the general use of a phone kiosk that can instruct visitors on how they can use it would likely increase visitor use.

For a long-term fix, we recommend making the telephone box itself more attractive, as visitors are more likely to use the other telephone. A potential solution is to rotate the kiosk 90 degrees to face the walking path to guide more visitors into it since the visitors currently must move in the opposite direction of their travel to enter the kiosk.

LSV – POST OFFICE IN CONFLICT

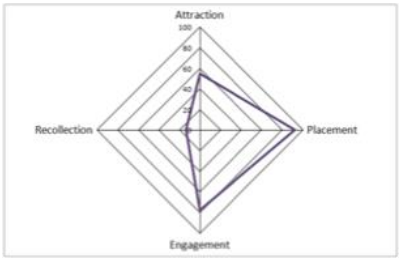
TPM Physical

Good at:

- ✓ Good Placement
  - ✓ Placed in a high traffic area where visitor tend to drift after the Telephone Kiosk and Pneumatic Tube
- ✓ Fair Engagement
  - ✓ visitor tend to be willing to finish it once they interacted

Improvement Needed :

- o Medium attractiveness
  - o Being one of the two lantern slide viewer. Some visitors may loss interest on the second one.
- o Lack of Content
  - o This exhibit has potential to tell more extensive stories



Conclusion and Recommendation

This exhibit mainly suffers from poor recollection. Not many people remember this exhibit fondly as it contains little content relative to other exhibits and does not get them too involved.

For immediate changes, we recommend finding some way to make the slider a little bit easier to move. This may consist solely of adding oil or a lubricant to the slider rails on a regular basis to improve ease of sliding.

For a long-term fix, we recommend adding more content to the exhibit, such as stories or information about each slide. It may also be interesting to change up the slides every once in a while so visitors can have something new to look at if they return to the museum.

MULTIUSER TOUCHTABLE

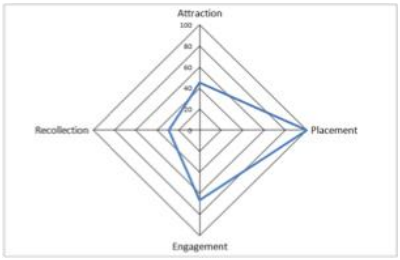
TPM Digital

Good at:

- ✓ Great location
  - ✓ Located in the middle of a corridor that all visitors must walk past
- ✓ Fair engagement
  - ✓ Visitors tend to look at multiple items on the screen once they begin

Improvement Needed :

- o Poor attraction
  - o Visitors often skip the exhibit because it is not too colorful and eye-catching
- o Not memorable
  - o visitors tend to recall less on digital interactives in general



Conclusion and Recommendation

This exhibit is prone to visitors not being attracted to the screen itself. All visitors must walk past the exhibit, and will often walk past multiple sides if they take the far route, but very few attempt to use it.

For a long-term modification, we recommend adding more eye-catching content to the touchtable. There are relatively few items on the screen, and they are static until users move them. It would help, according to our research, to have the background of the display more colorful and put dynamic elements in before visitors start interacting. Additionally, consider reorganizing the lighting nearby because they can blur the screen.

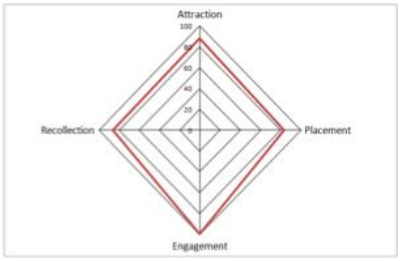
DESIGN-A-STAMP

Good at:

- ✓ Good attractiveness
  - ✓ Parents with children are very interested in creating something together
- ✓ Great engagement
  - ✓ Visitors always finish creating at least one stamp once they begin
- ✓ Great recollection
  - ✓ Visitor recall more involving interactives such as this one better

Improvement Needed :

- Placement affecting other exhibits
  - Visitors often will skip End 2 of the pneumatic tube after using



Conclusion and Recommendation

This exhibit performs very well but suffers slightly from the amount of time required to use the exhibit to its fullest extent (dwell time), which increases the occupied time and prevents other visitors from using it, Additionally, its proximity to the second end of the pneumatic tube causes some visitors to ignore one interactive in favor of the other.

For this exhibit, we recommend looking for a way to increase the number of visitors that can use this interactive in a given period; this may be reducing the amount of time taken to complete use or adding more screens to allow more visitors to use it at once.

Moreover, to prevent popular interactives from affecting each other negatively, we recommend the museum takes the special relationship between popular exhibits into account when redesigning the gallery.

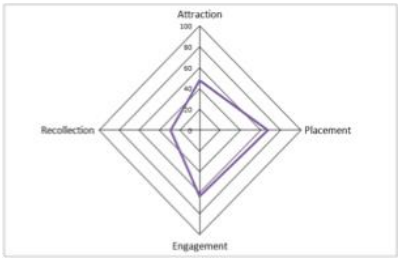
K8 TELEPHONE KIOSK

Good at:

- ✓ Fair Placement
  - ✓ The footprint at this interactive prove to be more effective, possibly due to the fact that K8's entrance is along visitor's path whereas K2's is against it
- ✓ Fair Engagement
  - ✓ Visitors are willing to invest their time to work out the telephones

Improvement Needed :

- Neither attractive nor memorable
  - Visitor seem to not appreciate the design improvement between the two models of Telephone kiosk in the gallery, causing this one to be neglected



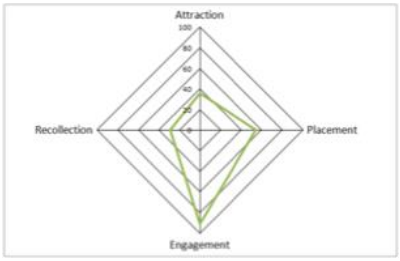
Conclusion and Recommendation

Similar to its predecessor - K2 Kiosk. This exhibit mainly suffers from lack of understanding.

Additionally, it seems that visitors do not realize the changes between these two models.

We recommend the museum show information about the update in designs near the kiosks or provide pictures of earlier models so that visitors can identify the difference. Additionally, it may be helpful to state at the K2 booth 'you will encounter an later model in the gallery, see if you can find the difference.' Doing so could prevent visitors getting the impression of this interactive as 'just another telephone stand.'

POST BUS GAME



TPM Digital

Good at:

- ✓ Fair attractiveness
  - ✓ visitors tend to stay once they get into it
- ✓ Fair Engagement
  - ✓ Visitors tend to be willing to finish it once they interacted

Improvement Needed :

- Poorly located
  - visitors often do not notice it until they have passed it already
- Not memorable
  - visitors tend to recall less on Digital Interactives in general

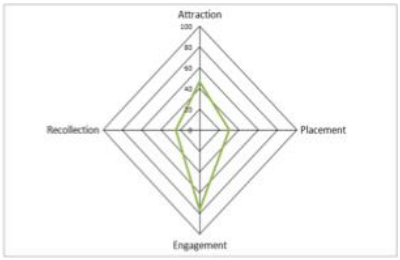
Conclusion and Recommendation

This exhibit mainly suffers from its poor placement; it directly faces an open area with other attractions and visitors do not always orient themselves where to notice what is behind them (see *Report* section 4.3.1 for more detail).

For immediate changes, the core of this interactive is well-designed and does not require extensive changes.

For a long-term modification, we recommend moving this exhibit so that it faces zone 4 (the K8 telephone interactive) where there is a heavier traffic flow.

TIMESCOPE



MR Digital

Good at:

- ✓ Fair Engagement
  - ✓ Visitors are willing to try the controls

Improvement Needed :

- Poorly located
  - Visitors tend to completely miss the exhibit as they turn right and navigate facing away this exhibit
- Poor attractiveness
  - Visitors sometimes don't notice that the screen is interactive
- Not Immediately Intuitive
  - Visitor may mistaken the screen as a touchscreen and try to tap on it, and not everyone would have the patients to try different controls after the first few failed attempts

Conclusion and Recommendation

This exhibit mainly suffers from its poor location and confusion because there is no room for instruction. The visitors that notice the screen often will not realize that it is interactive or will try to use it as a touchscreen, and leave when they find out that it is not.

For immediate changes, we recommend adding direction pointers, on the floor of the exhibition to guide more visitors toward the Timescope when first entering.

For a long-term fix, we recommend modifying the inactive state of this exhibit. One potential change is to let the default screen show up before interaction to show instructions on the use of the interactive.

PNEUMATIC TRAINS

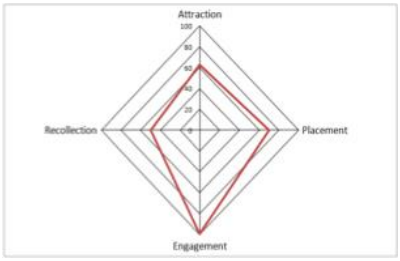
MR Physical

Good at:

- ✓ Good placement and attractiveness
  - ✓ As an early exhibit that is both competitive and colorful, this interactive attracts visitor well (and surprisingly effective on older visitors)
- ✓ Great engagement
  - ✓ Visitors almost always complete the race once they begin

Improvement Needed :

- o Not memorable
  - o Visitors seem to not recall this exhibit well despite its remarkable performance on other aspects



Conclusion and Recommendation

This exhibit is very engaging, but with certain flaws; the crank wheels are very loud and squeaky when turning. Also, the trains' speed is limited to a certain extent, so visitors could be turning the wheel quickly without the train moving any faster, and the trains take a relatively long time to reset to their default position. Additionally, we've noticed more than once that a member in a group would try to turn the wheel to see what it does first and then realizing it is supposed to be a race, they would wait until one side to reset to race each other. This fact may induce unwanted waiting time.

For immediate changes, we recommend the museum consider a way to reduce the noise made by the crank wheels, unless the exhibit is designed to emit such sounds.

For a long-term fix, we recommend modifying the trains so that they increase speed in relation to the speed of the crank wheel, and reset to their default state more quickly.

ELECTRIC TRAINS

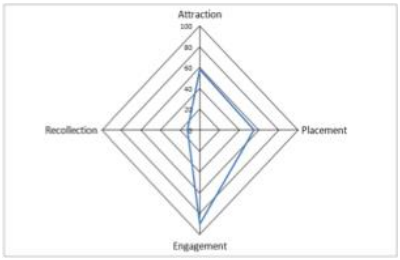
MR Physical

Good at:

- ✓ Fair attractiveness
  - ✓ visitors tend to stay once they get into it
- ✓ Great Engagement
  - ✓ visitor tend to be willing to finish it once they interacted
- ✓ Fair Placement
  - ✓ Since the middle four exhibits at MR (all but Timescope and MR Network Explorer) are placed linearly, they all receive a fairly good traffic flow

Improvement Needed :

- o Not memorable
  - o Visitor tend to recall more involving interactives such as the Switchframe or the TPO Carriage



Conclusion and Recommendation

This exhibit mainly suffers from difficulty understanding and abuse by visitors, especially younger ones. Most visitors take several seconds reading the instructions to understand how to use the two control levers, while many children merely slam them back and forth, potentially damaging the mechanism within, as in the case of the 'Frankenstein Lever', and since the power switch is constantly active, visitors seldom get the chance to use it when a "power outage" happens.

For immediate changes, we recommend adding a visual component to the instructions, showing how the two levers should be positioned to use the exhibit.

For a long-term fix, we recommend modifying the power switch so that it sets itself into the "off" position so that visitors can use it when a "power outage" does occur.

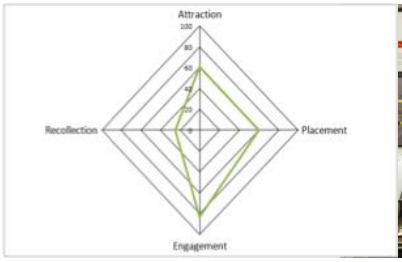
SWITCHFRAME

Good at:

- ✓ Fair attractiveness
  - ✓ The design reflects the real Switchframe which is on a poster to the right. Therefore it attracts visitors visually
- ✓ Fair Engagement
  - ✓ Most visitor would choose to complete the tasks
- ✓ Fair Placement
  - ✓ Since the middle four exhibits at MR (all but Timescope and MR Network Explorer) are placed linearly, they all receive a fairly good traffic flow.

Improvement Needed :

- Long dwell time
  - Visitors must spend a long time to complete the interactive



Conclusion and Recommendation

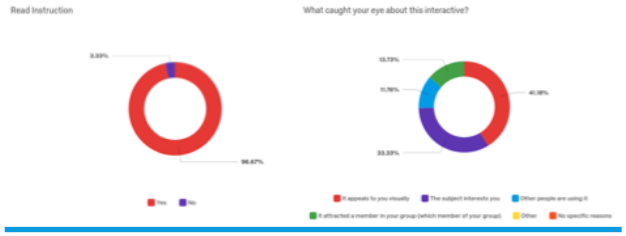
This exhibit mainly suffers from the difficulty in getting started (initial understanding). Visitors who first approach this exhibit often try to use the telephone on the right-hand side first, without noticing the "start" button on the left-hand side. Once visitors begin using the interactive and understand how to use the levers, the length of time required to fully complete all three stages of the interactive prevents other visitors from being able to use it.

For immediate changes, we recommend making this interactive more appealing while it is in use, to keep visitors from leaving partway through. One suggestion is to add some sound effect to keep visitors interested while the "trains" are moving.

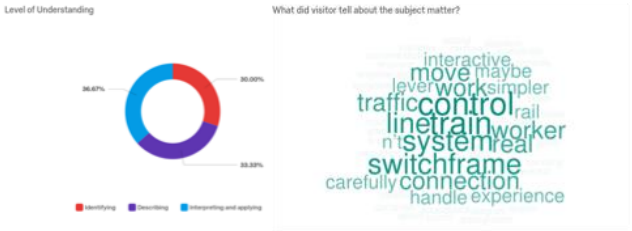
For a long-term fix, we recommend switching the locations of the telephone and the "start" button, as most visitors approach this interactive from the right.

IN-DEPTH – SWITCHFRAME

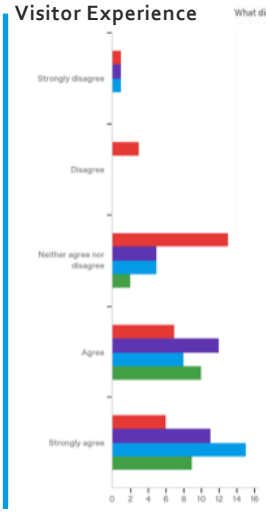
General



Learning Outcomes



Visitor Experience



N = 30

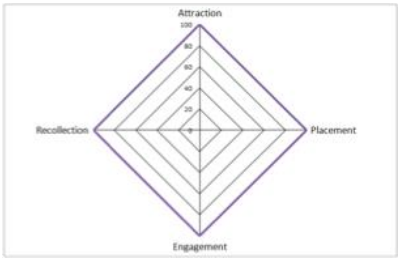
TPO CARRIAGE

Good at:

- ✓ Great attraction
  - ✓ Visitors are very interested in entering the carriage
- ✓ Great engagement
  - ✓ Visitors almost always complete the entire interactive as it is competition and there is something for them to complete
- ✓ Great recollection
  - ✓ Visitors tend to remember the carriage as it is often the last thing they use and they enjoy it

Improvement Needed :

- Loud letter drop
  - Visitors may not enjoy how loud the letters are when they drop. They also may hit visitors hands if they are in the trays



Conclusion and Recommendation

This exhibit is the best-performing interactive of both locations, according to the standards set in our data analysis. Visitors seem to enjoy the hands-on activity and competition, and the Carriage is definitely engaging enough to encourage visitors to enter and interact

For immediate changes, we recommend using softer objects for the letters or placing a more elastic material in the bottom trays. When the letters drop, it is loud having the hard 'planks' hit each other. Doing so can also reduce the amount of damage caused by hard objects hitting each other.

For a long-term modification, the only thing that we can recommend is to place it as the final interactive. Doing so can ensure further that a more significant number of the interactives will get used as it seems no one wants to skip the TPO Carriage, yet many look past the Network Explorer as it is not extremely attractive as the final exhibit.

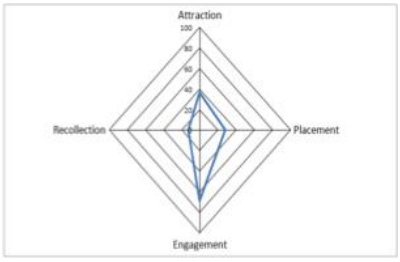
MR NETWORK EXPLORER

Good at:

- ✓ Fair Engagement
  - ✓ Visitors tend to look at multiple areas once they get past the rather long introduction

Improvement Needed :

- Partial completion
  - A good portion of visitors tend to neglect the projected screen, sometimes even when they are aware of its presence
- Poorly located
  - Visitors tend to skip the last exhibit, especially if it is not as visually attractive as a more physical interactive
- Not memorable
  - Visitors tend to recall less on Digital Interactives in general



Conclusion and Recommendation

This exhibit mainly suffers from its poor placement; it is located on the side of an open area, which may contribute to visitors' inability to notice it well. However, it also suffers from the occasional error where the touchscreen stops being responsive (possibly due to memory shortage).

For immediate changes, we recommend increasing the brightness of the projection on the wall and dimming the lights slightly more. Doing so can increase the visibility of the screen and projection.

For a long-term fix, we recommend adding some audio response such as narratives or sound effects to the 3D models to make it more attractive and engaging, as multi-sensory exhibits have mostly proven to be more effective.