Assessing Language Accessibility for Foreign Visitors at the National Technical Museum

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Assessing Language Accessibility for Foreign Visitors at the National Technical Museum

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degree of Bachelor of Science

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Jan Duda
National Technical Museum

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Abstract

The goal of this project was to aid the National Technical Museum in Prague in improving the museum experience through language accessibility for foreign visitors. After assessment of the current accommodations through participant observations, direct observations, and survey distribution, the team concluded the museum implements effective language accommodations. This was assessed regarding readability, comprehension, and enhancement of the museum experience. The team identified some areas of improvement and developed a list of recommendations presented in conjunction with demographic information on museum visitors as a deliverable to the sponsor. These recommendations and demographic information can further guide the NTM in accommodating foreign visitors.

Acknowledgements

We would like to thank the following individuals for their support and contributions throughout this project:

- Our project advisors Melissa Butler and Kim Hollan for their assistance throughout the entire project, giving important feedback and critique, assisting in improving our presentation skills, and overall support throughout both ID2050 and IQP.
- Our project sponsor Jan Duda and the staff at the National Technical Museum for providing guidance throughout the project, distributing surveys to staff, and overall hospitality. We greatly appreciated the offers of coffee at every sponsor meeting and the Jawa car ride he gave to us as a gift will be a great memory for years to come.
- To all those who participated in our surveys, providing valuable data on their experiences with the NTM's language accommodations.

Meet the Team

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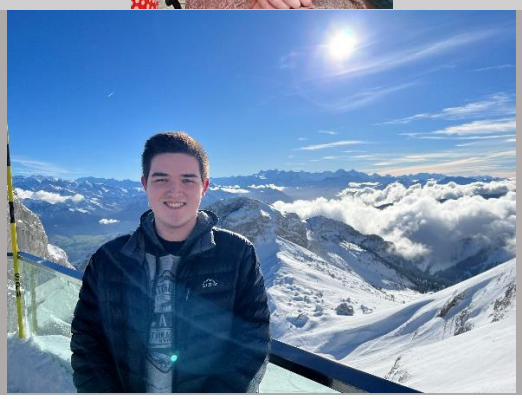

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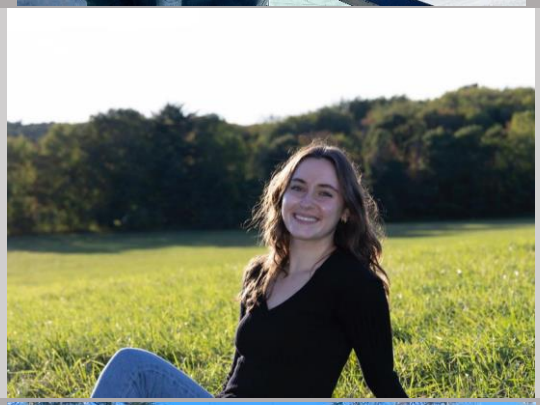

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Executive Summary

Background

Preserving culture and teaching history are important aspects of museums. Not only does a museum teach people about history and culture but it presents information in a more engaging way than done in a typical classroom. Due to this importance, there is a need for language accommodations and an enhanced visitor experience (Yalowitz, 2015).

Figure 0.1 The original building of the NTM, The Schwarzenberg Palace c. 1910 (Archives, 1960-)

Prague showcases its history through museums, such as the NTM which displays the technical history from the Czech Republic. The NTM was first established in 1908 and open to the public in 1910 in the Schwarzenberg Palace as a collection of machine parts and industrial products and eventually nationalized in 1951 (Figure 0.1). Due to The Czech Republic's rich technical history full of innovations and technological development, (NTM) has strived to showcase this development.

Figure 0.2 View of the Transport exhibit

Today the NTM features sixteen permanent exhibits and attracts visitors from across Europe and around the globe. Standout exhibits include the Transport Hall (Figure 0.2) and the Mining exhibit, both of which feature significant advancements in Czech history. Transportation was an important factor to society because it represented the Czech Republic's advanced technology. By the 1940's transport vehicles progressed into the production of Jawa motorcycles and T-3 trams to overcome spatial barriers due to social integration. Today, these features are still prevalent with technology constantly growing.

The Czech Republic also has an important history with coal mining, and it continues to play a significant role as an energy resource today. Coal reserves are found throughout the country with both Brown coal and Hard coal. This geography is seen throughout the Czech Republic, which is why mining is so popular and plays such an important role in history. Additionally, coal plays an important factor in natural resources for energy while still remaining as an important resource with regards to energy and economics. Due to this, the Mining exhibit is important to share the technical history of the Czech Republic.

Because of these important exhibits and history, the NTM attracts visitors from all around the world. This brings the museum with a variety of languages and creates a need for effective language

accommodations. Effective museum language accommodations come in many forms and include but are not limited to multilingual staff, translated museum text, and universal signs. Language accommodations have been shown to improve the museum experience and provide visitors with a higher degree of comfort in the museum space (Tempel, 2012. Chivarov, 2013. Huerta, 2015. Martin, 2015. Yalowitz, 2015. Chasapis, 2020).

Project Goal and Methodology

The goal of this project was to aid the National Technical Museum in Prague in improving the museum experience through language accessibility for foreign visitors. To achieve our goal, the team developed three objectives to guide research:

1. To identify the current barriers facing foreign visitors attending the National Technical Museum.
2. To evaluate the current language accommodations at the National Technical Museum.
3. To propose improved methods of language and cultural accommodations for foreign visitors.

These objectives built off each other, starting with the identification of current barriers, moving to an evaluation of these barriers, and from this, the accommodations that could be improved/implemented.

To understand the current effectiveness of language accommodations, the team focused on the readability, comprehension, and importance of text-based language accommodations provided within the museum. The team conducted participant and direct observations throughout the museum to identify and assess the language accommodations provided by the museum from a personal and outside perspective. Participant observations consisted of the team personally experiencing the museum and recording if translated text was available, language barriers that exist, and the navigation experience. The team conducted direct observations in popular exhibitions (Transport, Chemistry Around Us, InterCamera, Mining Exhibit), where team members identified visitor demographics and how they interacted with the museum. Additionally, the team developed a visitor survey to collect demographic information, such as gender, country of origin, and languages spoken, as well as gauging the visitor museum experience (Figure 0.3). The team developed a staff survey to understand visitor-staff interactions and identify the staff members' spoken languages.

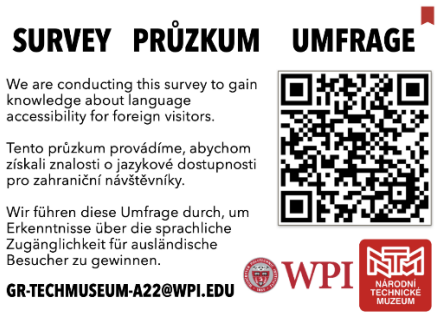

Figure 0.3 Survey flier with QR created to distribute to visitors

Findings

The team concluded that the museum has effective language accommodations based on participant observations, direct observations, and survey distribution. One example of this is found through the museum map which was offered in Czech, English, and German. The team found the map to be clear and easy to use, making it an effective navigation tool. However, 15% of visitors indicated difficulty with navigation, which could be due to the maps not being distributed with tickets and are often not picked up. The museum also contained

universal signage throughout the museum that helped indicate travel direction and what is or is not allowed. The team counted the number of universal signs in the most popular exhibits and found to be an adequately distributed number of signs to be understood by anyone no matter what language they speak. Additionally, the team found that almost all the text on labels, plaques and wall text was translated in Czech and English throughout the exhibits. The Transport exhibit contained 99.3% of text in both Czech and English, with the Chemistry exhibit having 98.3%, and the InterCamera exhibit having 98.5%. These statistics emphasize how there is effective readability and comprehension for the reader leading to an enhanced visitor experience. Based on surveys, the respondents that did not speak Czech or English as their primary language, 25.8% spoke Czech, and 83.9% spoke English as secondary languages, showing that having both translations accounts for a large majority of visitors.

Areas lacking accommodations included the café, with non-translated menus and mini displays, the transport exhibit, with a large wall about a displayed train, the cloakroom, with a lack of informational signage leading to confusing with locker usage, and various interactive elements throughout, such as computer terminals with games or speakers that play only Czech audio. The team also found that when distributing visitor surveys via QR codes, the NTM Wi-Fi had very low strength, making it impossible to load websites such as Qualtrics for our survey and Google Translate for possible exhibit translations.

Conclusion and Recommendations

From these findings, the team synthesized a list of recommendations and improvements the NTM can implement to enhance the museum experience for non-Czech speakers. These recommendations included:

- A list of areas and exhibits that would benefit from English translations
- Distribution of the museum maps with tickets to aid in visitor navigation
- Adding instructional signage in the cloak room to reduce confusion of locker usage
- Boosting Wi-fi throughout the museum providing internet access to all visitors

This project aimed to assist the NTM to assess and improve language accommodations. The report details the steps the team took to present the NTM with a set of recommendations with regards to text readability, comprehension, and visitor enhancement. In addition to recommendations, the team provided the NTM with demographics about the visitors for the museum to further their understanding of the language's visitors speak. Overall, this project provided the NTM with key information on several ways to further improve language accommodations and enhance the visitor experience.

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Meet the Team	Spencer	Team
Executive Summary	Team	Team
1.0 Introduction	Team	Team
2.0 Background	Jennifer	Team
2.1 Progression of the Czech Republic into a Nation	Jennifer	Team
2.2 History of Technology in Prague, Czech Republic	Jennifer, Aidan	Team
2.3 Historical Significance of Museums and the NTM in Prague	Jennifer, Aidan	Team
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2.3.2 Transport Exhibit	Aidan	Team
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2.5 Current Accommodations at the National Technical Museum	Spencer	Team
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3.0 Methodology	Team	Team
3.1 Observational Research	Spencer	Team
3.1.1 Participant Observation of Language Accommodations	Aidan, Jennifer	Team
3.1.2 Direct Observations of Museum Visitors	Aidan, Jennifer	Team
3.2 Surveys	Spencer Aidan	Team
3.2.1 Survey Development	Aidan	Team
3.2.2 Survey Distribution	Spencer	Imogen
3.3 Recommendations Report	Spencer	Spencer
4.0 Findings and Discussion	The team all contributed equally to the creation of the ‘Findings and Discussion’ section.	Team
5.0 Conclusion and Recommendations	Imogen	Team
5.1 Conclusion	Jennifer	Team
5.2 Recommendations	Imogen + Team	Team
Formatting	Aidan	Aidan

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1.0 Introduction

Museums play an essential role in preserving local culture. Vladimir Sucha, the Director for Culture and Media at the Directorate General for Education and Culture of the European Commission, states "[museums] teach us many things about our history, including the wonderful diversity found in various cultures both past and present" (The Value of Museums, 2011). In addition to teaching people about local history, "museums possess what a classroom may not," meaning they provide a physical connection to the subject that leaves visitors with memories, social impact, and inspiration (Exhibit Concepts, 2021). Because museums attract people from all over the world there is a demonstrated need for language accommodations to improve and enhance the museum experience (Yalowitz, 2015).

Since 1908, the National Technical Museum (NTM) in Prague has documented the historical advancements in "technical fields, natural and exact sciences, and industry" in the Czech Republic (*The Official Tourist Website for Prague*, 2022). The museum exists as a location for education and cultural appreciation where visitors come to learn about the significance of technological development and advancements in the Czech Republic and worldwide. The NTM engages visitors with sixteen permanent exhibits and rotating temporary exhibits relating to Czech cultural and technical history. The NTM's goal is to provide visitors with a full understanding and appreciation for Czech technical history, yet without proper language accommodations foreign visitors may not receive this experience.

NTM staff estimate that approximately 30% of visitors are foreign and do not speak the Czech language (J. Duda, personal communication, September 21st, 2022). Currently, the NTM offers signage throughout the museum in Czech with most exhibits featuring English translations. While the NTM also features a few multilingual staff members versed in Czech, English, German, and Italian, they have limited availability to visitors. The lack of language accommodations for foreign guests may lead to an inhibited understanding and appreciation of Czech technical history and a diminished museum experience.

The goal of this project was to aid the NTM in Prague in improving the museum experience through language accessibility for foreign visitors. The team achieved this goal through the following objectives:

1. To identify the current barriers facing foreign visitors attending the National Technical Museum.
2. To evaluate the current language accommodations at the National Technical Museum.
3. To propose improved methods of language and cultural accommodations for foreign visitors.

A literature review of museums and language accessibility revealed a dearth of research surrounding best practices to accommodate foreign visitors in technical and scientific museums. To augment the literature review and supplement the gap in research, the team performed observational research and surveyed visitors of the NTM to understand the foreign visitor experience. From these findings, the team synthesized a list of recommendations and improvements the NTM can implement to enhance the museum experience for non-Czech speakers.

2.0 Background

This chapter begins with a summary of the history of technology in Prague, Czech Republic. Next, the chapter discusses the historical and cultural importance of the National Technical Museum (NTM). Finally, the chapter compares visitor accommodations in museums around the world with the accommodations at the NTM. These topics are essential to understanding the historical importance of technology in Prague, and the language accessibility of the National Technical Museum.

2.1 Progression of the Czech Republic into a Nation

The Czech Republic is in central Europe (Figure 2.1) surrounded by Slovakia, Poland, Germany, and Austria. Due to its ideal geographic location, Prague, the capital of the Czech Republic, is a popular major city to visit in Central Europe and features decades of rich technical history.

Figure 2.1 Map of the Czech Republic and the surrounding countries in Central Europe (*General map of Czech Republic, 2000)*

Figure 2.2 Map of the territory occupied by the Austrian Hungarian Empire 1914 (Encyclopædia Britannica)

From 1867 to 1918, the Austrian Hungarian Empire occupied what is now the Czech Republic and surrounding territories (Figure 2.2). Austria-Hungary was the largest political entity in mainland Europe while being technologically and industrially advanced in comparison to the rest of Western Europe. Manufacturing and industrialization increased rapidly as Austria-Hungary became the world's third largest manufacturer and exporter of electrical appliances. Other advancements included railway infrastructure, trade modernization, general improvement of living standards, and increased employment (Alpha History, 2017). After World War I ended in 1918, the Austrian Hungarian Empire collapsed, leading to Czechoslovakia becoming an independent state while obtaining about two-thirds of Austria-Hungary's economic and technological industry. In 1920, Czechoslovakia adopted the constitutional document which allowed the country to become a democratic republic giving people control of the power and starting their socially, politically, and technological progressive era. From that point forward, Czechoslovakia had a complicated sociopolitical history marked by Nazi and soviet occupation, communism, and the Velvet Revolution. This led to their eventual peaceful split into two new countries known as the Czech Republic and Slovakia in 1993.

2.2 History of Technology in Prague, Czech Republic

Following WWI, Czechoslovakia developed into one of the world's top ten industrialized states and economies. This advancement allowed Czechoslovakia to produce progressive technology including guns and television sets.

Figure 2.3 Image of experimental television broadcaster in the 1930s (*A history of Czechoslovak industry in seven objects, 2021)*

Starting in the 1930s, Czechoslovakia was one of five countries to test experimental television broadcasters due to technological developments (Figure 2.3). The Czechoslovakian engineers created the first European television set that stands as a unique development of technological history in the Czech Republic today. By the 1940s, transport vehicle manufacturing appeared as another aspect of advanced technology. This included innovations such as the Jawa 250/353 motorcycle and the T-3 tram. Transport infrastructure was a way to promote social integration to overcome spatial barriers and increase interactions between locations. When Czechoslovakia was established, the road systems were reoriented away from Budapest and toward the newly established capital, Prague, which quickly emerged as the seat of political and economic power. Thus, the T-3 tram was designed and integrated as public transportation (Encyclopédie d'histoire numérique de l'Europe, n.d.). Today, visitors can still see the T-3 tram in use and learn more about its history at museums like the National Technical

Museum (Radio Prague International, 2018). In 2018, The National Technical Museum (NTM) displayed an exhibit called “Made in Czechoslovakia - the Industry that Ruled the World” to celebrate their great industrial heritage (Radio Prague International, 2018). According to Hynek Stříteský, the director of the building’s Electrotechnical and Media Museum, the museum illustrates the technological advancement of Czechoslovakia from 1918 to the present.

The Czech Republic has an extensive history with coal mining and it continues to play a significant role as an energy resource today. Coal reserves throughout the country are estimated to contain a total of 705 million tonnes of coal. Brown coal, which makes up more than 95% of their reserves, is mostly produced in Bohemia while hard coal is produced more in northern Moravia (Figure 2.4). Brown coal contains less carbon and moisture, providing less chemical potential energy than hard coal and making it worse for the environment. Hard coal is a higher quality more dense coal, leading to a higher fuel value than brown coal. The foothills of the Krušné hory mountains in Northern Bohemia contains coal seams which are underground layers of rock with coal deposits inside. This geography is seen throughout the Czech Republic, which is why mining is so popular.

During the Communist regime and after the war, there were labor shortages which negatively impacted job accessibility and war reconstruction. Therefore, the hard work of miners and importance of the coal industry increased as an illustration for rebuilding the state. Additionally, there were environmental issues in the 1960’s including toxic smog and chemicals which decreased the life expectancy for coal mining in Bohemia by three to five years. By 1980, the increased industrial output due to the Communist regime steadily increased coal production and built new basins in Bohemia (Glassheim 2004).

Although their energy imports have been increasing slightly over the past few years – 32.7% of energy was imported in 2017 – coal has always been a significant natural resource to the Czech Republic. In 2018, coal amounted to 49.5% of the Czech Republic’s gross energy production, which is the largest sector of their energy industry. Comparatively, nuclear energy makes up 34%, renewable energy provides 11.8%, and fossil fuels provide only 4.3%. Today, coal mining remains important as an energy resource, but the country is focused on improving sustainable coal use and economic prosperities (Euracoal, 2022).

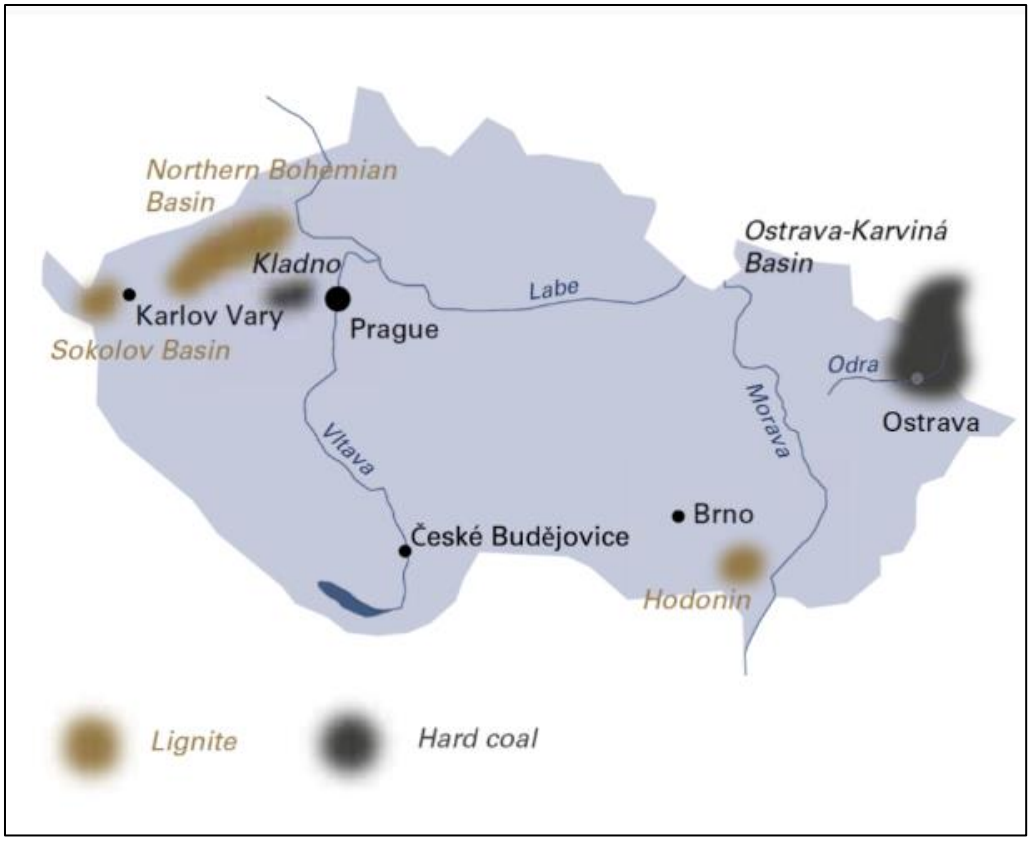

Figure 2.4 Geographical map displaying where brown coal and hard coal is mined

Today, the Czech Republic is still known for technological advancement with technically skilled workers and education in the science fields. In recent years, partnerships with scientists have established connections in new fields including information technology (IT), biotechnology, cyber security, aerospace science, and other branching-off fields. This growth has led to investment in research and development (R&D) with intentions of a growing industry. According to the Organization for Economic Cooperation and Development (OECD), "Within the last seven years the number of R&D staff in companies and universities has grown by 50% and R&D funding has exceeded 2% of GDP" (OECD). In 2017, the Czech Republic invested over 65 billion crowns in domestic and foreign companies where one-third of the investments were considered "high tech projects" (CzechInvest, 2018). Some of the largest investment projects include IT and software development and Praha vaccines to fight against infectious diseases.

2.3 Historical Significance of Museums and the NTM in Prague

Prague is well known for prioritizing the Czech Republic's history and culture through attractions and exhibits. Museums are popular tourist attractions that educate visitors while providing fun, interactive experiences, serving as an effective way to display the historical and cultural aspects of Prague while making it accessible, affordable, and diverse.

Prague showcases its history through museums, such as The National Museum – a collection of buildings which contain all types of exhibits related to Czech political, historical, and natural history – and The Museum of Communism which shares the experience of what it was like to live in Communist-era Czechoslovakia. Alongside these museums, famous historical buildings like Prague Castle are now museum-like attractions where visitors can learn more about the history of Czech dynasties and architecture.

Initial efforts to expand technical work and industry in the Czech lands began in the 19th century when a group of businessmen created an organization whose goal was to spread education in the technical fields through lectures, literature, industrial goods, and products. These businessmen and professors from local technical universities created an association for new technical products called the "Association of the Technical Museum of the Czech Kingdom." Eventually, the association fulfilled educational awareness and support which inspired the development of the National Technical Museum (Hozák, n.d.). In 1874 during the Industrial Revolution, Vojtěch Náprstek, a Czech patriot, collected parts of machines and industrial products responsible for the technological boom. His collection became the basis for the original collection displayed during the 1910 opening of the NTM.

Figure 2.5 The original building of the NTM, The Schwarzenberg Palace c. 1910 (Archives, 1960-)

In 1910, the museum opened to the public in the Schwarzenberg Palace (Figure 2.5), but during the First World War the museum and the collection process stopped. After the war in 1918, the shift to a democratic state improved support of technological development and preservation, leading to a state of growth for the museum and its collections. Following the creation of the Czechoslovakian Republic, it received a new name called “Czechoslovakian Technical Museum” and the area of the museum collection increased to include the entirety of the Czechoslovakian lands. Construction for the current NTM building began in 1938 (Figure 2.6).

Figure 2.6 Construction of the transportation hall in the new museum building, 1940 (Archives, 1960-)

In 1941, during the Nazi occupation of the Czechoslovak Republic, construction of the new museum building concluded but it was swiftly taken over by the occupying administration, preventing the museum from using the building. The Nazi administration also removed all collection items from the Schwarzenberg Palace building. Despite the lack of space, the collection of technical artifacts continued with the help of donations from enterprises, clubs, corporations, and individuals. The war signified a deep setback in the museum's activity, but the museum did not close during the war. In 1945, the state offered financial assistance, collections, and artifacts that allowed the museum to finally move into the current location in the Letná district. However, in 1948, the communist regime took over the Technical Museum Association and placed it in state ownership. In 1951, the government nationalized the museum as the National Technical Museum making it a scientific and educational institute for the history of technology. After this, the number of exhibitions increased with special attention paid to the coal mining exhibition as it attracted thousands of visitors looking to gain an authentic mining experience.

Today, The National Technical Museum, one of the oldest museums in Europe, is an institution dedicated to preserving a diverse collection of historical knowledge and technology of

the Czech Republic through exhibits and attractions. Since 1910, the number of employees, exhibits, and variety of exhibits have collectively increased and the museum currently offers sixteen permanent exhibits and various temporary exhibits covering topics including but not limited to architecture, engineering, photo cinema, astronomy, transportation, chemistry, space, and mining (See Appendix B). The NTM, as a tourist attraction, offers a wide variety of historical and cultural knowledge for visitors.

2.3.1 Mining Exhibit

One of the signature exhibits important to the history the Czech Republic is the Mining Exhibit. The exhibit is located on the bottom floor of the museum and offers a tour of an ore and coal mine replica. The exhibit originally served as propaganda while under communist rule, as the soviets expanded the mining industry to fuel their economy through the Czech Republic's vast reserves of coal. The exhibit details the economic development of the territory of the Czech Republic through the centuries, along with general mining techniques and information. The geography of the Czech Republic provides valuable ore deposits that have helped aid the development of technology throughout the centuries. Some notable locations where coal mining was predominant are Kutná Hora and its importance to the revival of silver mining in the 13th century and Jáchymov and its development of Saxon technology in the 16th century. Mining gained state support in in the second half of the 18th century which resulted in deeper mines revealing more excavations of ores such as "colored metals, cobalt, arsenic, bismuth, antimony, and uranium". After WWII, Czechoslovakia focused on supporting their declining coal mining economy by nationalizing all mines into one company. The mining economy began increasing again with the nationalization of their mines and their shared technological developments with the Soviet Union (*Mining*, 1960-).

2.3.2 Transport Exhibit

The transport exhibit is the largest exhibition hall within the NTM. It contains four floors, each focusing on different transportation methods (Figure 2.6). Floor zero displays various automobiles, railway history, and fire engines. Floor one displays all types of foreign and domestic motorcycles that were once sold and manufactured within the Czech Republic. Floor two contains aviation models and the descriptions of aerial vehicles hanging from the ceiling. Finally, floor three contains the NTM's large collection of historical bicycles and the history of

water transport within the Czech Republic. These collections display the Czech Republic's rich history in transportation production and use from the late 19th century and beyond.

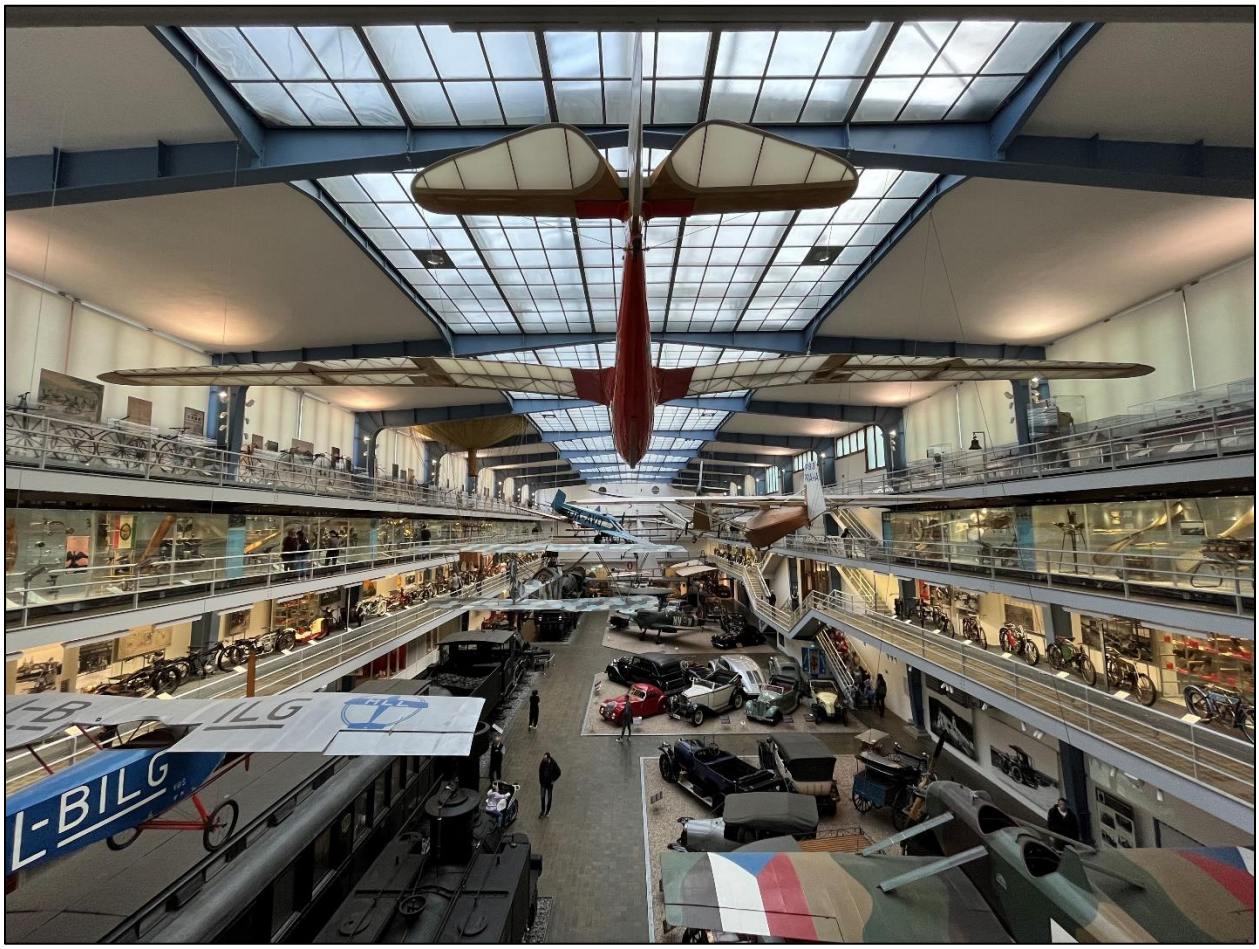

Figure 2.7 The NTM's Transportation Exhibit

Automobiles were a large part of the Czech Republic's history. The exhibit details the Czech Republic as one of ten countries that can be regarded as "the cradle of motoring". In the late 18th and early 19th centuries, Prague was the third place in the world, just after Paris and London, where road motor vehicles, using steam engines, were demonstrably driven by a human crew. However, these vehicles were not successful in past trials or demonstrations until late into the 19th century. In 1897, the railway wagon plant, Nessels-dorfer Wagenbau-Fabriks-Gesselchaft A.G. (known later as the Tatra car plant) in North Moravia produced the motor car Präsident. The Präsident was driven from Koprivnice to Vienna over May 21-22, 1898, immediately after its completion, demonstrating its success. The NW Präsident car, the first car made in the Czech Republic, is part of the NTM's collection (*Transport*, 1960-).

In addition to automobiles, motorcycles served as a common means of transportation in the Czech Republic's history. In 1899, Czech motorcycles were some of the most modern in the world, but it did not stay that way for long. By the 1920s, foreign motorcycle producers, such as Indian from America, had more sophisticated vehicles that were imported, advertised, and sold in the Czech Republic. Due to the marketing done by foreign and domestic producers, motorcycles became a trusted and common method of transportation during the early 20th century. These motorcycles stayed on top of the market until the mid-1930s, when Jawa motorcycles became both sufficiently advanced and progressively cheaper. Jawa remained prevalent in the Czech Republic until the mid-1990s, when it went bankrupt, and the producer Praga took its place. Unfortunately, by this time demand for motorcycles had greatly decreased, and Praga was discontinued after just a few years. Overall, the Czech Republic played a large part in the improvement of vehicles and transportation in the 19th and 20th centuries (*Transport*, 1960-).

2.4 Common Museum Language Accommodations

The international success of the NTM and the important exhibits contained within it have underscored the need to ensure proper accommodations for foreign visitors. Museums around the world offer language-based accommodations to cater to foreign and multilingual audiences and create a fulfilling museum experience for everyone. Museums provide visitors with information through exhibit labels on walls, plaques, physical artifacts, video, and audio. Examples of best practices for improving the foreign visitor's experience include audio tours, universal symbols, translated navigation signs and exhibit descriptions, multilingual staff, mobile applications, and implementation of QR codes for ease of access (Tempel, 2012. Chivarov, 2013. Huerta, 2015. Martin, 2015. Yalowitz, 2015. Chasapis, 2020.) Audio tours provide a recorded explanation of museum exhibits and offer narration in different languages. When used effectively, audio tours can also animate an exhibit by establishing a new auditory means of interaction with the information, provide additional information, and "can have an important added value in the strategy to increase accessibility of cultural heritage" (Tempel, 2012). For example, The Louvre in Paris offers pamphlets in seven languages and audio tours in eleven languages through the museum's mobile app and the new Nintendo 3DS (Chasapis, 2020. *Visitor*) while The Salvador Dalí Museum in St. Petersburg, Florida utilizes a mobile application to provide audio tours in six languages (Chasapis, 2020. *The Dalí*).

The Children's Discovery Museum of San Jose also underwent significant efforts to create an inclusive environment for their multicultural community by incorporating trilingual (English, Spanish, Vietnamese) signage and translations throughout the museum (Martin, 2015). Additionally, the museum hired a bilingual receptionist to perform calls in Spanish and recorded visitor information on a Vietnamese line thereby creating a welcoming and comfortable environment for visitors (Martin, 2015). The Children's Discovery Museum's efforts improved operational success and provided a more accurate demographic representation of the community within five years of implementation (Huerta, 2015. Martin, 2015).

Multilingual approaches to museum exhibits can improve visitor experience by providing basic services including orientation and wayfinding. A study examining the effect of English-Spanish exhibit labeling across four United States museums, discovered that the presence of multiple languages lent itself to an improved visitor experience (Yalowitz, 2015). Respondents indicated that signage was easier to understand in their language of choice while allowing a deeper understanding across generational groups. Younger visitors often read the English text while older generations focused on the Spanish text. This allowed museum visitors to consume both versions of the text and more easily share understanding amongst each other. Respondents also indicated the presence of one's native language throughout the museum improved comfort and created a more welcoming space (Yalowitz, 2015).

Universal symbols such as arrows indicating navigation to restroom designations are also an easily implementable and effective accommodation that is found in nearly every public space. A standardized array of symbols for the world does not exist but symbol similarity from location to location often allows institutions to bypass language barriers (Molina, 2012). The presence of universal symbols allows an institution to convey an idea or message without the need for both parties to understand the same language. Museum usage of universal symbols to improve visitor experience is common, often featuring arrows indicating direction or symbols conveying the message "Do not touch" as illustrated in Figure 2.8.

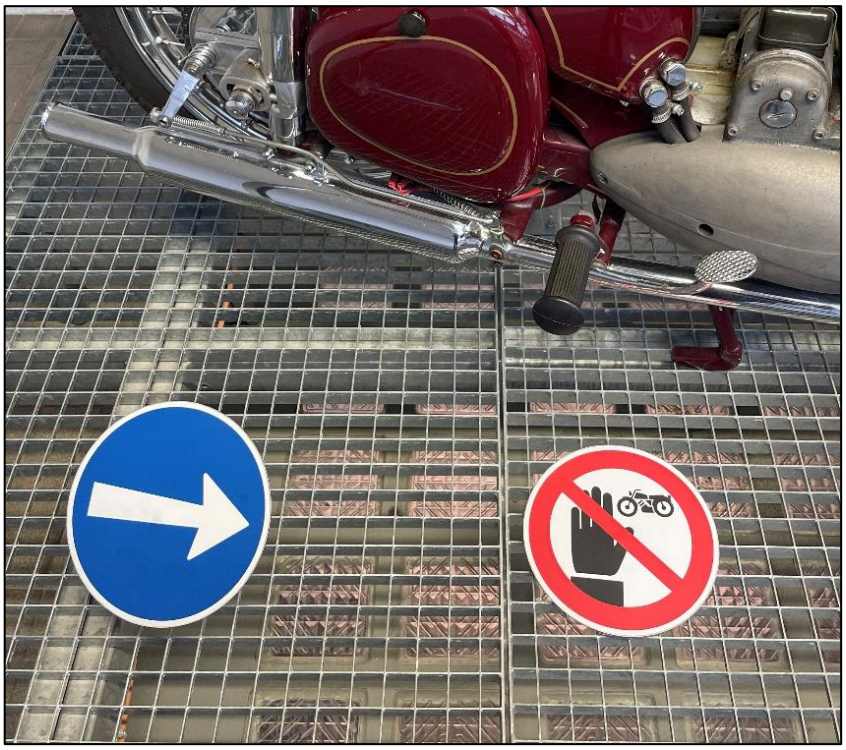

Figure 2.8 Example of universal signage at the National Technical Museum of Prague, Czech Republic

In Prague, museums have varying degrees of accommodations for foreign visitors. For instance, the Museum of Communism provides guided tours in Czech, English, and German, though you must schedule these in advance. Prague Castle also offers guided tours in several languages with options in Czech, English, French, German, Italian, Spanish and Russian. The National Museum recently developed a mobile app with guided tours, museum navigation, and augmented reality to bring their exhibits to life. Currently, the app only supports Czech and English, but the National Museum plans to implement other languages in the future (Johnston, 2022).

2.5 Current Accommodations at The National Technical Museum

Currently, the National Technical Museum offers a guided tour of the Ore and Coal Mine Exhibition in Czech. (National Technical Museum, 2016). Additionally, the NTM can provide non-Czech speaking visitors with a booklet containing a transcribed version of the spoken tour in English, German, Italian and Russian. The rest of the museum is self-guided, with most titles and text descriptions of exhibits in Czech and English. Additionally, a handful of tourist companies – such as Discover Prague Tours – offer twenty-minute introductions to the museum in Czech or English. The ticket booth also offers physical and digital maps of the museum in Czech, German,

and English. The combination of translated maps and universal signage help clarify navigation throughout the museum for non-Czech speaking visitors.

To engage visitors, the NTM has interactive elements such as touchscreen computer games, touchable artifacts, and audio/lighting effects. Some of the touchscreen games give the option to translate between Czech or English, while audio effects are only offered in Czech. The touchable artifacts are accessible across all languages.

Although the NTM has varying methods of presenting their exhibits, generally "[museums] also struggle with actually engaging *all* members of [their] communities regardless of class, gender, age, race/ethnicity, or even linguistic background" (Garibay, 2015). It is essential to examine the language accommodations available at the NTM as approximately 30 percent of the visitors are foreign and do not speak Czech (J. Duda, personal communication, September 21st, 2022). By providing sufficient language accommodations, any visitor can experience the museum to its full extent but without proper language accommodations many visitors will be left with an incomplete experience.

2.6 Summary

This chapter summarized the historical and cultural aspects of Prague, Czech Republic, the importance of the NTM, and examined the common language accommodations provided at other museums in Prague and across the globe. Museums implement various strategies like audio tours, universal symbols, translated signs, multilingual staff, mobile applications, and QR codes to break language barriers. Understanding the history and the current state of the NTM is essential to assessing language accessibility and working to improve the visitor experience.

3.0 Methodology

The goal of this project was to aid the National Technical Museum (NTM) in Prague, Czech Republic in improving the museum experience through language accessibility for foreign visitors. The team determined three objectives to achieve this goal:

1. Identify current language barriers facing visitors at the museum
2. Evaluate effectiveness of current language accommodations
3. Propose improved methods of language accommodations

The team completed this work at the NTM between October 24th and December 16th, 2022. The team performed participant observations and direct observations of museum visitors including Czech citizens and foreign visitors, to examine how visitors navigate and experience the museum. The team also distributed surveys to collect demographic and visitor experience data such as spoken languages and exhibit comprehension. This allowed the team to gain an understanding of the visitor experience and how language accessibility affects the museum experience. The team measured effectiveness of language accommodations based on three criteria: visitor readability of text, comprehension of content, and if the accommodation enhanced the visitor experience. Readability refers to if the visitor was able to read the text, comprehension being if the visitor was able to understand the content provided by the museum, and enhancement being if this accommodation was a key element for the visitor's experience. The team assessed these three criteria through observations and the visitor survey. Additionally, the team distributed a survey to NTM staff members to determine areas of improvement surrounding interactions with visitors. Together these methods provided the team with an understanding of the current accommodations, their effectiveness, and how to best improve the foreign visitor experience.

3.1 Observational Research

Observations allowed the team to gather crucial information about the current state of language accommodations and identify possible improvements to the visitor experience. The two major types of observations include participant observation where researchers become a part of the study and direct observation where researchers observe without being part of the study

(Kawulich, 2012, 2). Participant observations allowed the team to collect information as foreign visitors, while direct observation allowed the team to study other foreign visitors to identify current barriers (objective one) and evaluate current accommodations (objective two).

3.1.1 Participant Observation of Language Accommodations

The team's first objective was to identify current language barriers to ensure visitors can fully understand navigational directions and content at the museum. To achieve this goal, the team first visited the museum in the role of foreign visitors, which allowed the team to observe what it was like to experience the museum as a visitor. During the first visit, team members immersed themselves in the museum experience and took notes on their comprehension and museum accommodations individually. At the conclusion of their visit, team members reflected on their personal experiences, discussed with teammates, and recorded their struggles and experiences related to the understanding of the exhibits. Team members coded reflection notes using axial coding which is categorizing by groups, themes, and similar words/phrasing. There were six categories used to group similar concepts: staff members, text at exhibits not in English, universal signs, text in more than one language, map helped navigation, and general confusion or comments. The team assigned a highlighted color to each of these categories and then read through the qualitative data while highlighting accordingly. By actively engaging in the museum as a visitor, the team was able to better understand the visitor experience and evaluate current barriers firsthand and locations where accommodations were lacking.

3.1.2 Direct Observations

Direct observation removed the team from the museum experience and instead allowed the team to solely focus on other museum visitors. The team conducted the first direct observational research for a 30-minute session on Friday October 28th, from 12:45-13:15. The team chose this date to achieve a greater quantity of observations because October 28th is the Czechoslovakian National Independence Day, which meant reduced admission fees and a larger crowd than normal visiting the NTM. Team members split observations during this day with one team member observing at each of the following exhibits: Transportation exhibit, the temporary Müller Maps of Bohemia exhibit, the InterCamera exhibit, and the Chemistry exhibit. During participant observations, team members observed that the Transportation, InterCamera, and Chemistry exhibits experienced greater visitation due to the natural flow of the museum. From

the ticket office, the museum guides you either to the Transport exhibit through the large atrium leading to two sets of doors into the large exhibit, or towards the cloakroom. The cloakroom leads visitors through the Time, Chemistry, InterCamera, and Photographic studio, before leading into the atrium. Team members recorded field notes on body language, facial expressions, interaction with others, navigation patterns, and time spent at each exhibit. After completion of the first direct observation period, the team contemplated abandoning this method as direct observation did not appear to yield practical results due to difficulties interpreting visitor behavior. For example, the team was unable to identify the language the visitor was reading on the plaque or whether the visitor was reading it at all.

Following discussions with advisors and the lack of data from the first set of observations, the team conducted a second set of observations focusing on exhibit layout, established accommodation options, observing both visitors and staff members, counting exhibit attendance, seeing how visitors interacted with the museum as well as how staff members interacted with visitors. Through these discussions, the team developed an improved approach for taking observations within the museum. The team individually observed the Café, Chemistry Around Us, Mining, InterCamera, Measurement of Time, Photographic Studio, Müller Maps of Bohemia, and Transportation, with each team member observing two exhibits. The team performed these direct observations from November 29 through December 1. On November 29 the team observed from 2:30 pm to 3:00 pm. During this period the team placed an emphasis on counting the number of labels, plaques, large wall text, and interactive items in each exhibit observed. The team was able to quantify the level of readability of the observed exhibits for English speakers. The team found the percentage of text in English and Czech compared to text only in Czech. The team then moved focus to observing visitor exhibit interactions, visitor attendance, and staff interactions with visitors. On November 29, the team observed the exhibits from 3:00 pm to 3:30 pm. On November 30, the team observed the exhibits from 1:40 pm to 2:10 pm and 2:10 pm to 2:40 pm. On December 1, the team observed from 11:00 am to 12:00 pm. The team chose the times of morning, early afternoon, and late afternoon to experience the museum at different rush periods throughout the day. On December 11, two team members counted the types and number of universal signs throughout each exhibit mentioned above. The team looked for areas that may benefit from additional signage, along with areas that had adequate signage. Upon completion of the observation periods, the team met to discuss their

observations and systematically analyze findings to organize research from the multiple days. The team collected all observation notes and coded based on categories that led us to major findings. These categories included interactions with staff members, interactions with text, interactions or viewing artifacts, devices, or audio, socialization with others, and number of people who visited the exhibit (Appendix H). These categories allowed the team to determine which aspects of the museum needed more attention and further emphasized the team's initial participant observations. This information helped the team to evaluate the current language accommodations, understand visitor interactions with these accommodations and aided in the identification of current language barriers.

3.2 Surveys

Surveys gather broad numerical data on people and their opinions, which made it an effective tool for collecting information from the visitors at the NTM (Guyette, 1983). The team created two surveys, one for visitors and one for staff members. The team created the surveys using Qualtrics, a web-based software "that allows the user to create surveys and generate reports without having any previous programming knowledge" (*Qualtrics*). Qualtrics also has its own machine translation tool that gives the option to translate the survey questions into a multitude of languages, which allowed for easy distribution to foreign visitors. Additionally, native Czech speakers proofread the surveys, ensuring correct translations into Czech.

The visitor survey had three distinct sections: demographic information, general visitor experience and accommodations, and exhibit specific questions (Appendix D), while the staff survey focused on interactions between staff and visitors (Appendix E). Both surveys consisted of Likert scales, frequency sliders, multiple choice, and open-ended response questions. Cross-sectional surveying allowed the team to collect information of museum visitors during a specific period: between November 1st and December 2nd (Guyette, 1983). Surveying museum visitors and staff helped the team determine the demographics of visitors, their opinions regarding their visit to the NTM, and the quality of staff interactions. These results assisted in the identification of current barriers (objective 1) and evaluation of current museum language accommodation effectiveness (objective 2).

3.2.1 Survey Development

The first section of the visitor survey (Appendix D) focuses on the demographics of NTM visitors. The team asked questions about gender, age range, country of origin, primary and additional languages, and education level of the visitor. Additional questions inquired about their visit such as their reason for visiting, if they had visited before, and if they attended the museum with children. Understanding the background of visitors who attend the museum will allow the NTM to cater future exhibitions towards the average visitor, as well as make accommodation changes to fit the demographic profile of visitors. The demographic information on country of origin and understood languages also allowed the team to determine what common languages are spoken by NTM visitors so additional language accommodations and aided in the development of the recommendations. Since the exhibits are only offered in Czech and English, it is pertinent to understand what other common languages are not accounted for and accommodate accordingly.

The next section of the survey asked questions about difficulty regarding buying tickets, navigating the museum, and generally being able to understand the exhibits. These were "to what extent do you agree with the following statement" questions. Using a scale of strongly agree to strongly disagree, the team was able to gauge the extent of barriers within the NTM. This section also featured key questions regarding visitors' comprehension, readability, and enhancement of the visitor experience. Using these questions, the team was able to directly gauge the effectiveness of the current accommodations.

The final section of the visitor survey focused on exhibits that allowed the team to understand participants' experiences and thoughts on specific exhibits. This section began by asking whether exhibits were offered in their primary language and if they were able to understand the content provided. Participants selected the exhibits they visited and then could choose to answer more in-depth questions for each. These questions centered on the extent to which participants were able to gain a comprehensive understanding of the specific exhibit's content, how important text was to the exhibit, and an opportunity for the respondent to share any other thoughts or recommendations.

In addition to the visitor survey, the team developed a second survey (Appendix E) for staff members to take. The survey began with questions about the staff member's first spoken

language, along with any additional spoken languages. This allowed the team to understand any miscommunications between staff and visitors due to spoken language barriers. To understand the level of interaction that staff members have with museum visitors, the survey asked questions regarding how often the staff member is approached and whether they are asked questions on navigation, exhibits, or general F.A.Q.s. The survey included an open-ended question asking if there are specific questions the visitors frequently ask the staff. Lastly, the survey asked a general yes or no about whether there was any difficulty communicating with visitors.

3.2.2 Survey Distribution

The team administered surveys using four methods with various levels of effectiveness. First, team members attempted to survey visitors as they exited the museum by setting up a table near the exit of the NTM with flyers featuring a QR code of the visitor survey and description of the project in three languages, Czech, German, and English. This method proved ineffective as visitors were not willing to approach the table, so the team decided to place a team member near the exit who could approach visitors as they left the museum. The team member greeted the visitor in Czech and communicated as effectively as possible the nature of the survey. The member held three versions (Czech, English, German) of a flyer featuring a short description of the project and the survey QR code. If the team member was unable to communicate with the visitor verbally due to language differences, the translations allowed the visitor to read about the survey. The ineffectiveness of these distribution methods led to a discussion with our sponsor about low survey response rates and culminated in the team creating A6 sized flyers featuring a QR code that staff could distribute with visitor tickets from the ticket office. This gave more validity to the survey since it was coming from the ticket office, but still resulted in zero responses, most likely due to the survey being distributed prior to visitors having experienced the museum. Additionally, team members handed the A6 sized fliers out at the exit. These fliers allowed visitors to have access to the survey after leaving the museum so they could respond at their leisure. After repeated attempts to find a distribution method that would yield responses, the team decided to laminate and place the A6 sized flyers on tables throughout the café for visitors to read while taking a break from the exhibits and getting food. This distribution method allowed the team to passively gather survey responses and was more effective with improved survey response rate. Lastly, the team's sponsor administered the staff survey directly to permanent NTM staff members through email.

3.3 Recommendations Report

The team utilized the data collected and analyzed to develop a short series of recommendations for the NTM that the team believes will improve the visitor experience. These recommendations can be found in Chapter 5.0: Recommendations. Additionally, the team included with this report the raw data survey data for the NTM to access. This includes visitor demographic information and visitor experience information (Appendices I and J).

4.0 Findings and Discussion

This chapter displays and discusses the key findings from the data the team collected from the implemented methods. The synthesis of this data, analysis, and discussion led to accommodation recommendations for the NTM in Chapter 5. The team determined three factors to assess the effectiveness of the language accommodations. This included readability, comprehension, and enhancement. The team collected observational and survey data at the NTM to draw conclusions on the effectiveness of the language accessibility of the museum. Team members conducted participant and direct observations concurrently with a visitor and staff survey. This mixed methods approach to data collection led to the following results.

4.1 Overview of Museum Language Accommodations

Overall, the team found that the museum contained effective language accommodations. Czech and English text was found throughout the museum and easily distinguishable with use of fonts, colors, and size (Figure 4.1). This allowed the team to fully engage and understand the content within each exhibit.

Figure 4.1 An example of translated text in the Photographic Studio

Readability

In terms of readability, 46.2% of visitors strongly agreed that they were able to read the text within the museum, with an additional 46.2% slightly agreeing. Only a small portion of visitors stated that they had difficulty reading the text, with a little over 10% of respondents claiming difficulty or inability to read (Figure 4.2). Having a vast majority of visitors able to read the text is particularly good for the museum. Due to this, the team concluded that the text offered within the museum works as valuable accommodations.

Comprehension

Visitors strongly indicated that they were able to understand the content of the museum. With over 44.2% of visitors strongly agreeing, many visitors can understand the museum. Additionally, 46.2% slightly agreed that the museum displayed their content in an understandable manner. There was a small portion of visitors who were neutral (7.7%) on the matter, and a minimal amount strongly disagreeing (1.9%) (Figure 4.2). Being able to understand the content within a museum is key to the museum experience, as there would be minimal value in attending if visitors could not comprehend what the museum offers. The museum conveys the information within their exhibits in a strong manner.

Necessity of Text

Responses varied on how important text was to a visitor's museum experience. Respondents who indicated neutral or slightly agreed each represented around a quarter (28.9%) of visitor responses on the importance of text, therefore it can be said that text may be important for a visitor's museum experience, but not as important as the readability or comprehension of the content as a larger proportion of visitors were neutral or disagreeing to some extent compared to the other measures of effectiveness. The variety of responses for this question is comparatively wide as seen in Figure 4.2, and likely depends on the type of visitor you are. Overall, the importance of text within the NTM relies on the interests of the visitor.

Based on the responses received, the team concluded that the language accommodations within the museum are effective and beneficial to a substantial proportion of visitors. The significant percentage of positive responses for content comprehension and readability back this point. The variety of responses regarding the importance of text indicate that text can be beneficial to a visitor's experience, however not every visitor considers text a key element for their museum experience.

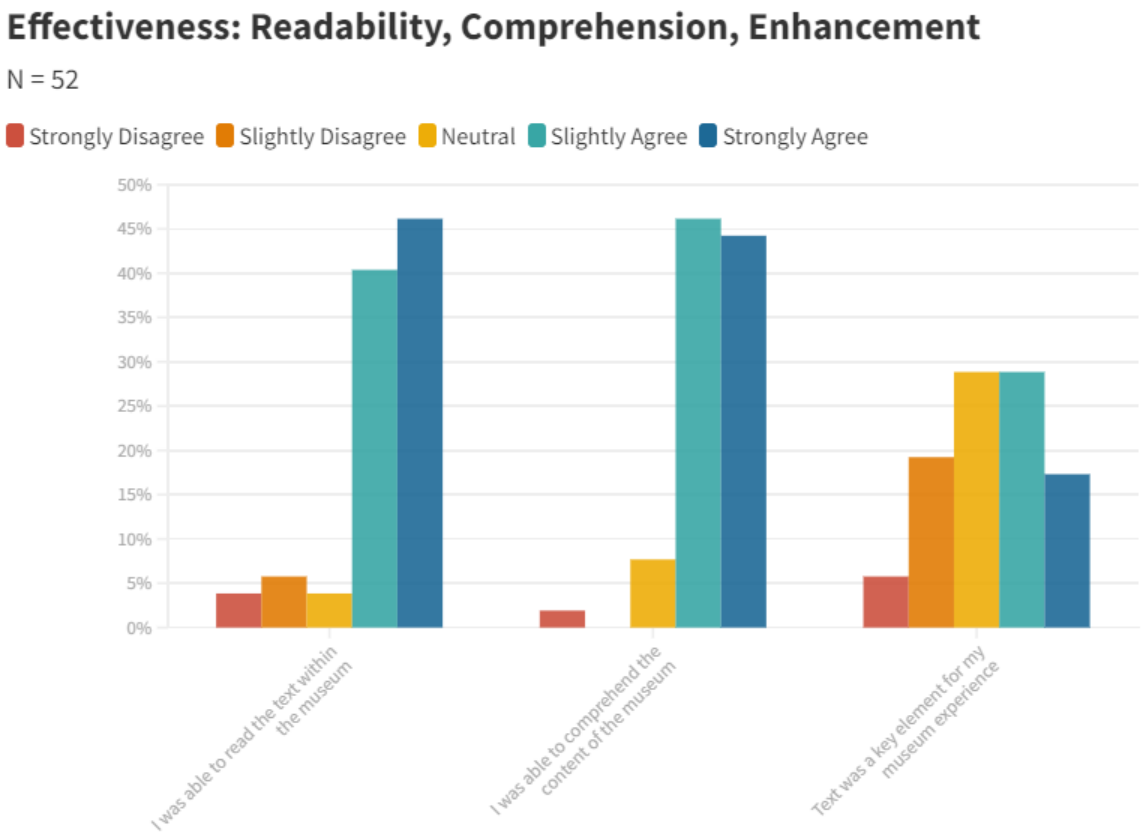

Figure 4.2 Museum Experience and Comprehension Agree Statement Responses

Throughout the museum there are common universal signage such as the one shown in Figure 4.3, which allowed the team to understand simple notions such as ‘do not touch,’ ‘social distance,’ and ‘exit.’

Figure 4.3 Universal emergency exit sign found in the model coal mine

Additionally, there was a paper map of the museum layout and an online version offered through a QR code (Figure 4.4). This map was available in three languages: Czech, German, and English, and was clear in displaying the location of each exhibit in the museum. This allowed for both the team and visitors to fully comprehend the museum layout without asking for help.

Figure 4.4 Multilingual map access

Navigating the museum is key to the museum experience, as being able to find locations of interest or necessity is important. Survey responses displayed a variety of opinions on the

helpfulness of the map, with 41.4% of respondents strongly agreeing that the map was helpful, but nearly a third responding neutral (29.3%). Additionally, a little more than 15% indicated difficulty with the map (Figure 4.5). Visitors not having a map may have led to a high level of neutrality in survey responses.

Being able to find necessary locations like bathrooms or emergency exits is also important for the comfort and safety of visitors. A large majority of respondents indicated that it was easy to find the toilet (45.8%), however 8.5% of respondents had some difficulty (Figure 4.5). The map marks bathrooms, but that is not enough. As mentioned previously, some visitors may not have received the map. It is important to ensure visitors can find their way to the restrooms if necessary, and the map should mark them in a way that everyone would be able to find them. Emergency exits are extremely important in the case that visitors need to evacuate the building. While a little over half of visitors believed that they could locate emergency exits, more than a third of visitors were neutral on whether they could find emergency exits (35.1%) (Figure 4.5). Additionally, there was also a small portion of visitors who were not aware of the emergency exits, which could be detrimental in the case of an emergency. Overall, most visitors indicated that they had little difficulty navigating the museum, with a small percentage struggling in specific cases, like using the map, finding bathrooms, and understanding where emergency exits are located (Figure 4.5).

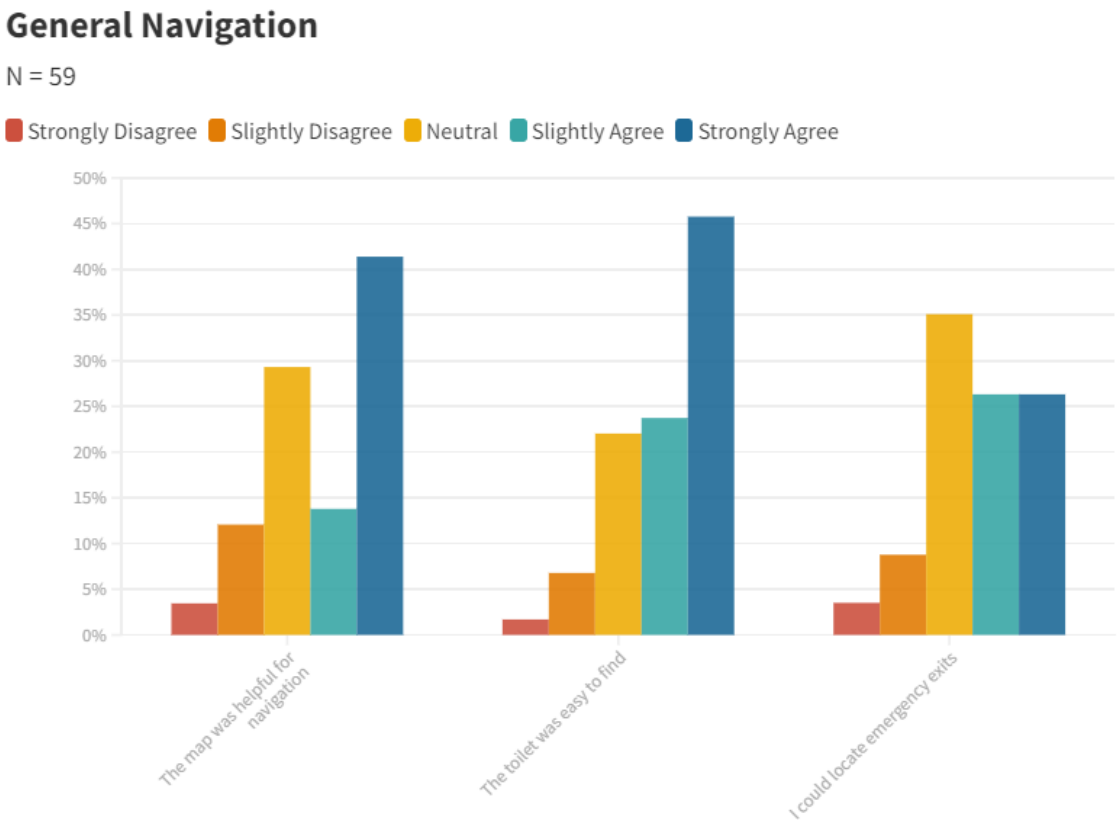

Figure 4.5 Understanding Visitor Sentiments on Navigation Throughout the Museum

Many respondents strongly agreed that purchasing tickets was easy (59.7%), and no respondents indicated difficulty (Figure 4.6). As the ticket office is close to the entrance, visitors have minimal difficulty navigating to where they can purchase tickets. Additionally, visitors also indicated that staff members were helpful, with a sizable portion of visitors strongly agreeing (46.6%), assisting with the ease of purchasing tickets. However, more than a third of responses were neutral (37.9%), indicating that these visitors had minimal interactions with staff at all (Figure 4.6).

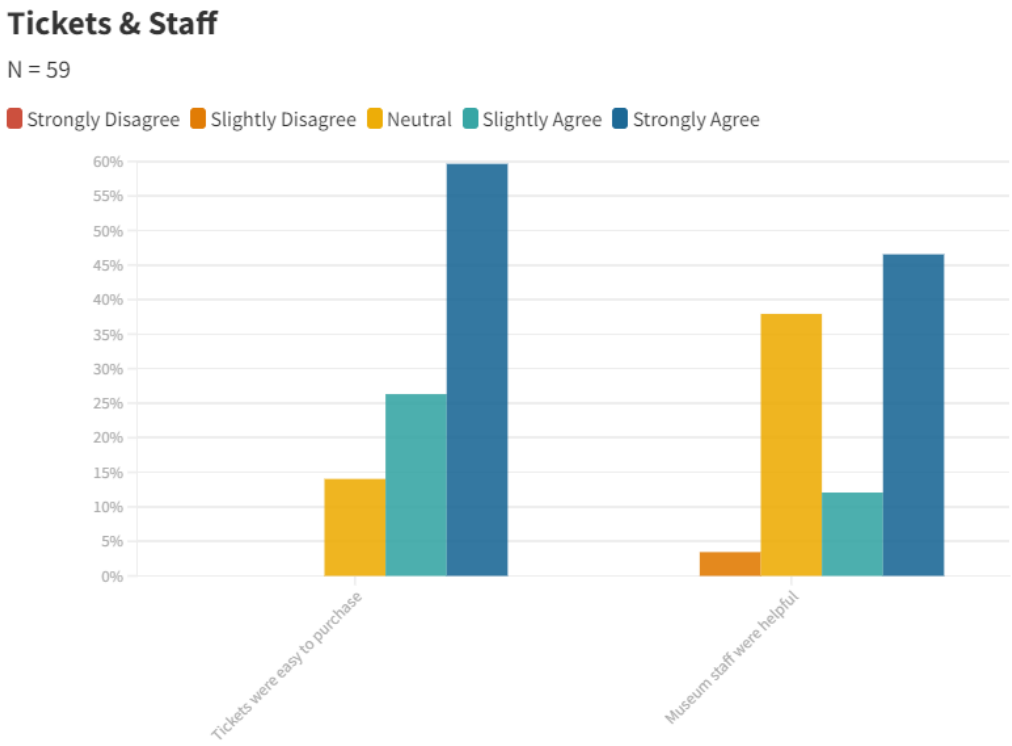

Figure 4.6 Visitor Responses on Purchasing Tickets and Staff Helpfulness

4.2 Language Accessibility Within Exhibits

The following section presents and discusses the language accessibility of seven museum exhibits, the café, and the cloakroom. The team found that accessibility trends were consistent in these specific locations. Figure 4.7 shows the average number of visitors in each exhibit as observed during the observational periods between November 29th and December 1st. This graph emphasizes that the Transportation exhibit is the most popular with 40 visitors followed by the Measurement of Time (16). This information helped the team identify higher traffic areas of the museum and evaluated their language accommodations.

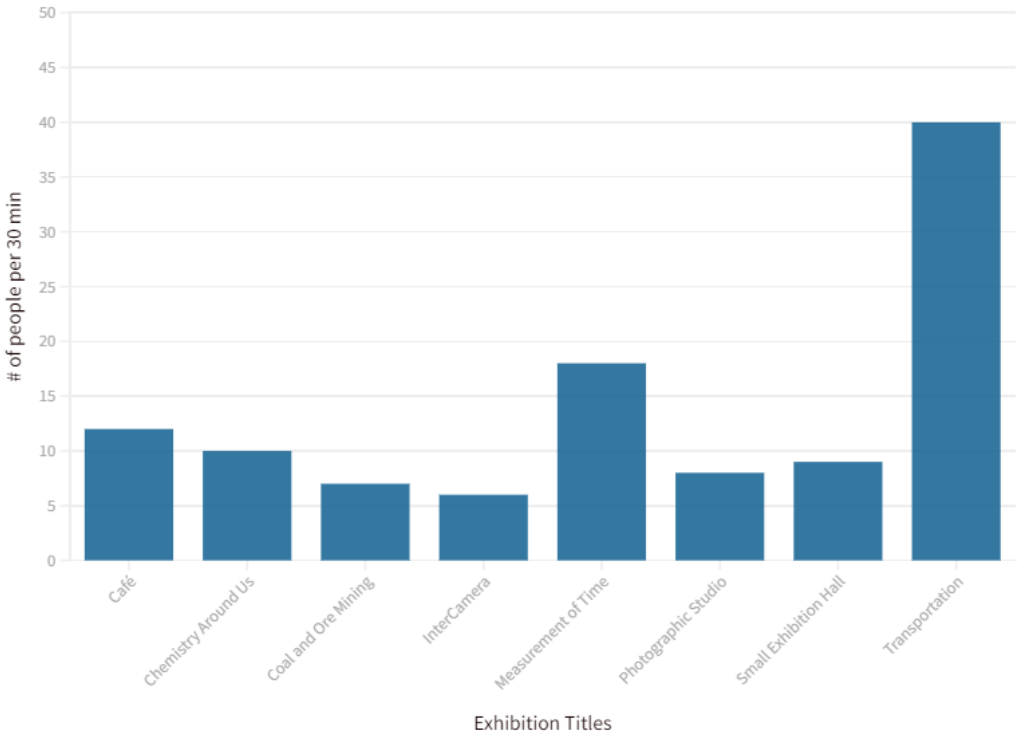

Figure 4.7 Average number of people in each exhibit per 30 minutes

4.2.1 Transport

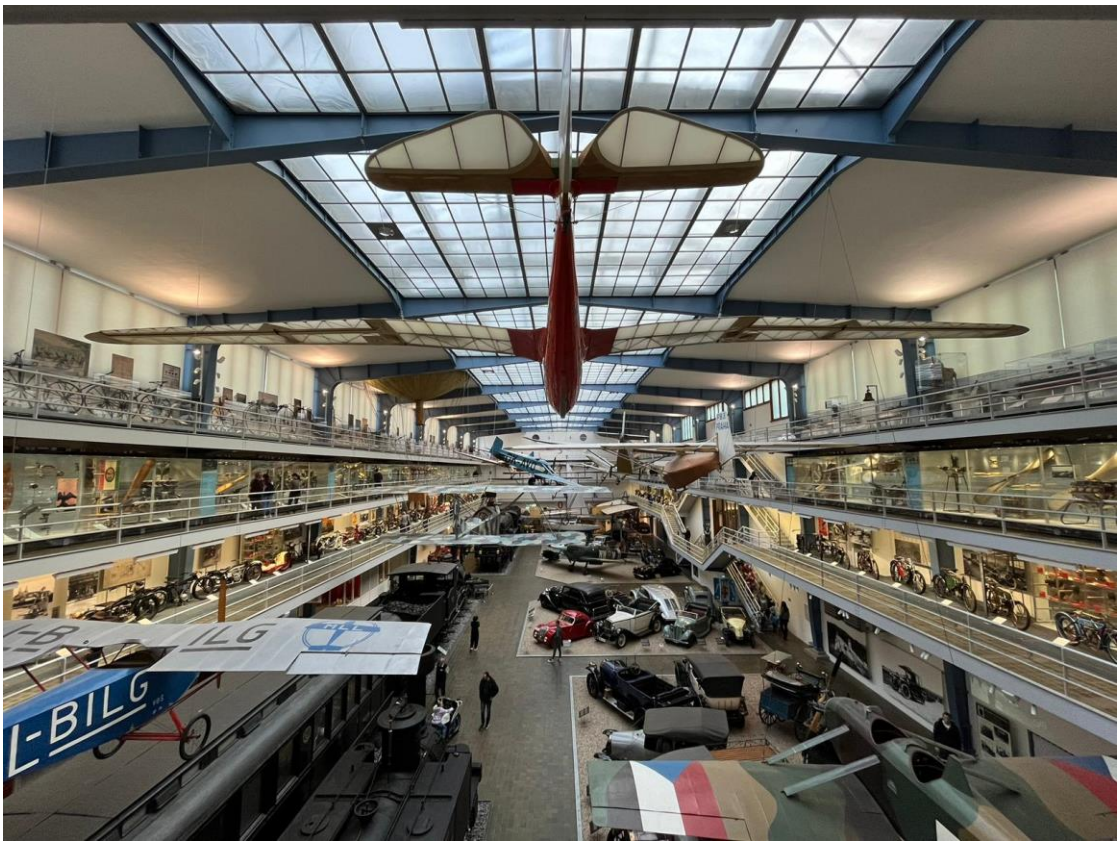

Figure 4.8 The Transportation Exhibit

The transportation exhibit is one of the first exhibits visitors see coming into the museum. It is located through two sets of large double doors on the ground floor and has four floors dedicated to the artifacts. The bottom floor displays many cars, two trains, and a plane. The second, third, and fourth floor all wrap around the entire room acting like balconies, with each floor displaying a different transportation. The second floor consists of motorcycles, the third floor is dedicated to planes and various plane equipment, and the fourth floor is dedicated to bicycles and aquatic transportation. The ceiling hangs many planes and a hot air balloon basket (Figure 4.8). The exhibit has three interactive elements, with a motorcycle on the bottom floor upon which guests can sit (Figure 4.9) and two touchscreen info-kiosks with information about the museum.

Figure 4.9 The interactive motorcycle in the Transportation exhibit.

Direct observations conducted by the team revealed that the transportation exhibit has high language accessibility, with 99.3% of text translated from Czech to English. There is a variety of universal signage throughout this exhibit. All 12 staircases in the Transport exhibit have social distance signs and exit signs with more of these signs throughout the floors. There are a total of 16 social distance signs, 18 exit signs, 26 directional signs, and 37 ‘do not touch’ signs present. As this is the largest exhibit, it contains the most universal signage spread evenly throughout, assisting visitors in understanding navigational flow with directional signs and object interaction, such as ‘do not touch.’

However, the team identified three areas within the exhibit that did not include translated text. First, an entire wall dedicated to the history of the court train of František Josef (Figure 4.10).

Figure 4.10 The non-translated wall behind the train in the Transport Exhibit

Second, a plaque in front of the interactive motorcycle had the words 'Take a Picture' but the rest of the text was in Czech with no English translation (Figure 4.11). Third, one of the touchscreen info-kiosk did not have the option to translate to English.

Figure 4.11 The Czech-only plaque in front of the motorcycle.

Responses from the visitor survey revealed that most respondents felt Transport (62.5%) was a very object focused exhibit (Figure 4.12) which was consistent with the team's participant observations.

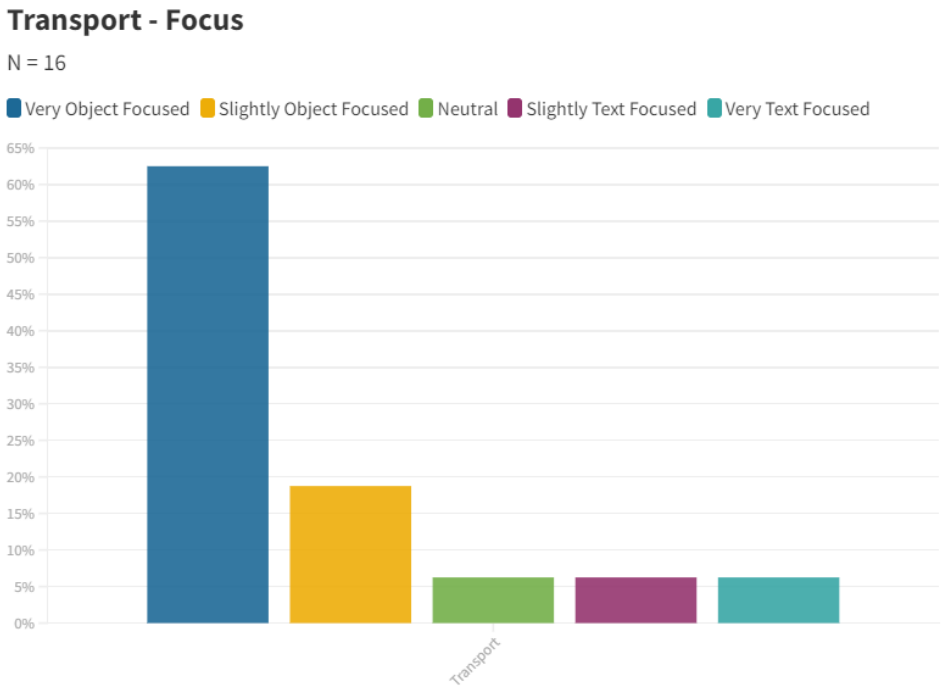

Figure 4.12 Visitor Responses on Focus in the Transport Exhibit

Around half of Transport (57%) strongly agreed they could read the text with an additional 31% slightly agreeing. Even with the areas in need of translation mentioned above, the visitor survey suggests that there is a high level of accessibility in this exhibit, with three quarters (75%) of Transport respondents strongly agreeing they could understand the content while 19% of respondents slightly agreed (Figure 4.13).

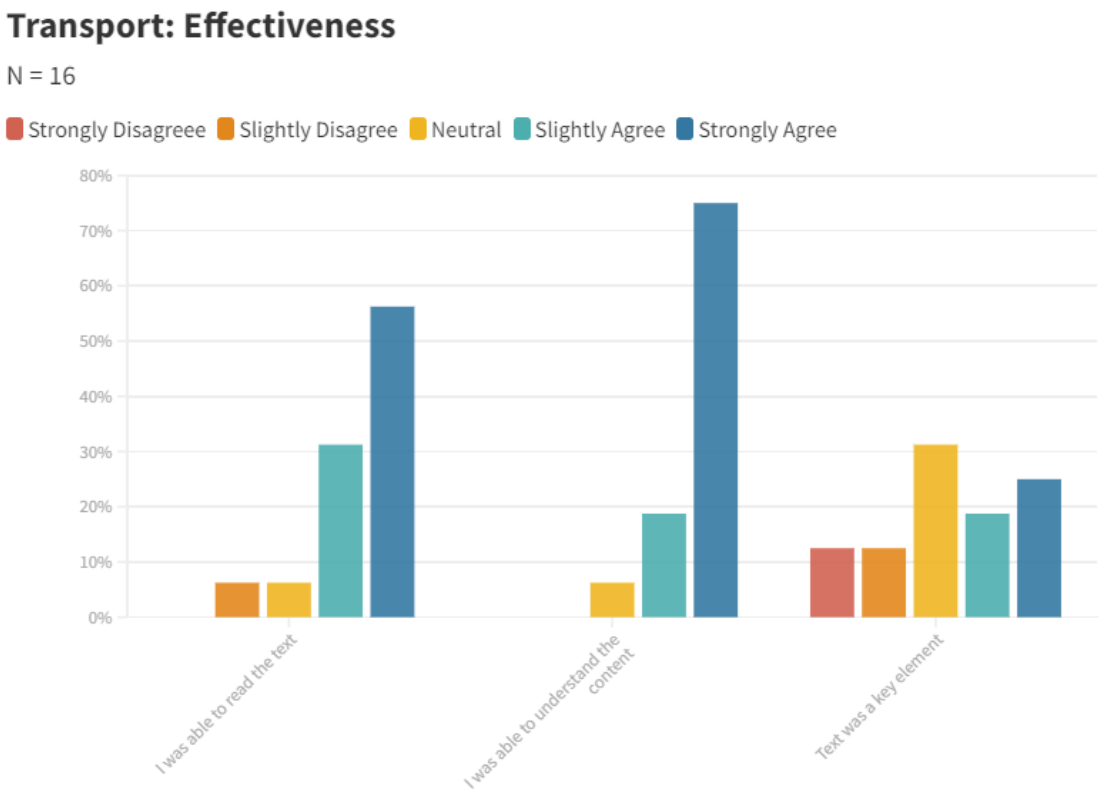

Figure 4.13 Visitor Responses on Effectiveness of Accommodations in the Transport Exhibit

4.2.2 Measurement of Time

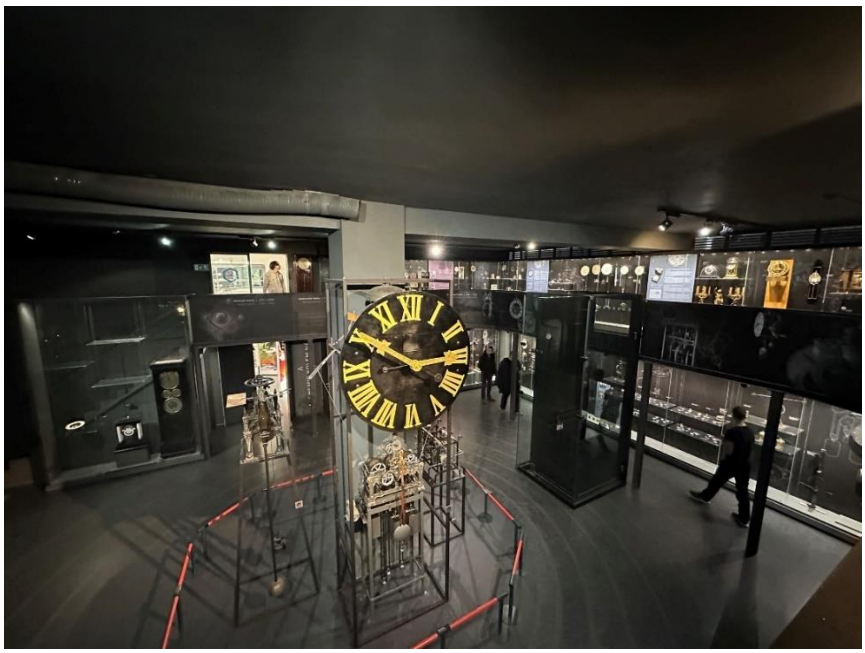

Figure 4.14 The Measurement of Time Exhibit

The Measurement of Time exhibition is located on the main floor of the museum and is a dark room with a large clock in the center that constantly ticks and chimes every 15 minutes (Figure 4.14). There is a second floor wrapping half of the top floor and glass cases lining the perimeter of the room with various clock items inside. To indicate not to touch the items, there are seven universal signs of a hand with a cross through it, one for every exhibit not behind glass. There are also five universal exit signs distributed through the exhibit. The sufficient presence of these signs creates an environment where any visitor can understand navigation and the level of interaction in the exhibit. Due to this the team concluded the signs in this exhibit create an accessible environment. After conducting direct observations, the team concluded that this exhibition is one of the most popular exhibits (Figure 4.7), in part due to its location on the main floor. All 261 text plaques in this room contain Czech and English translations emphasizing presence of language accommodations in this area (Appendix H). Consistent with this finding, most visitors strongly (55.6%) or slightly (22.2%) agreed they could read the exhibit text. Similarly, most visitors strongly (44.4%) or slightly (44.4%) agreed they could comprehend exhibit content (Figure 4.15). The high degrees of readability and comprehension indicate effective language accommodations in this exhibit.

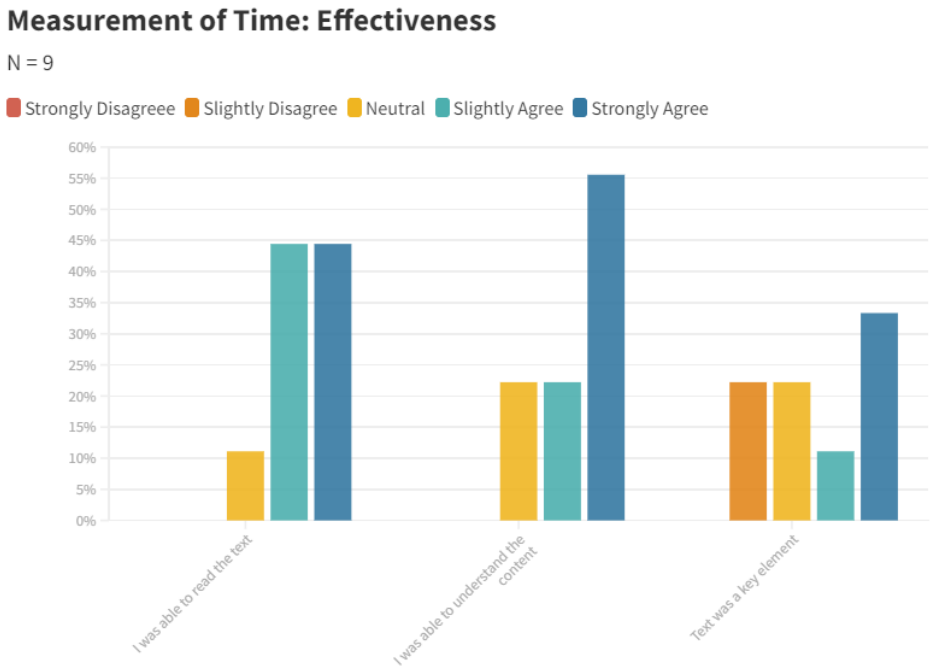

Figure 4.15 Visitor Responses on Effectiveness of Accommodations in the Time Exhibit

4.2.3 Chemistry Around Us

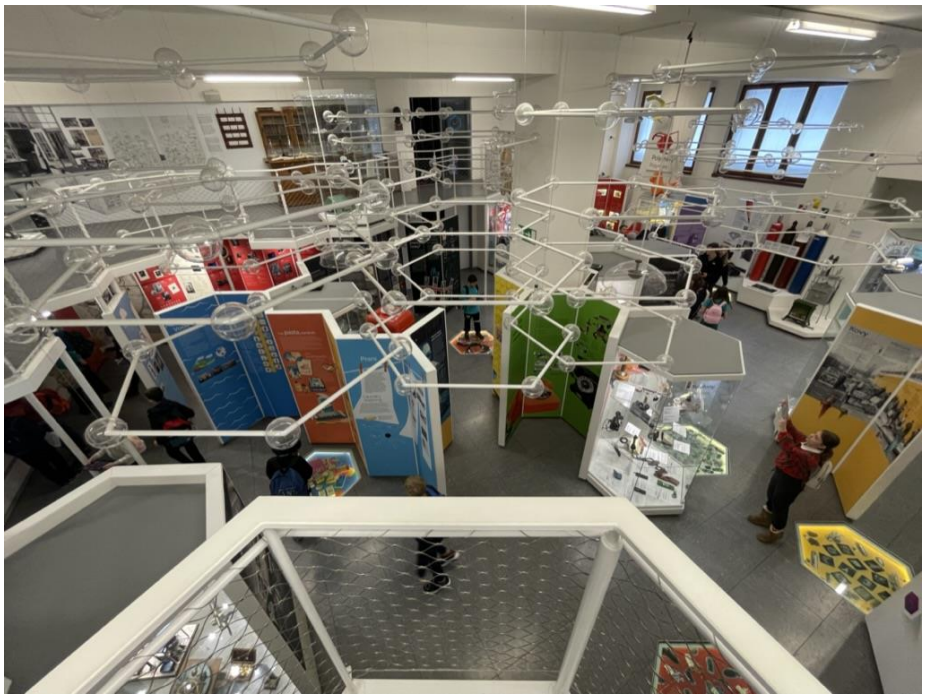

Figure 4.16 The Chemistry Around Us Exhibit

The Chemistry exhibit is on the main floor of the museum. It is an intricate room made up of an upstairs balcony and a downstairs area divided up by hexagonal walls (Figure 4.16). There are two blocks of hexagonal walls that wrap around the inner area of the room. The front and back of these walls and the outer surrounding walls hold plaques and artifacts explaining different areas of chemistry such as metals, water, polymers, and paper. Upstairs on the balcony there are two classrooms filled with science instruments for school group demonstrations. There are six interactive elements in the exhibit: two computers, two videos with audio, and two videos without audio.

The exhibit has a high percentage of English accessibility, with 98.3% of text offering Czech and English captioning (288 out of 293 plaques, labels, and interactive elements combined). As seen in Figure 4.17 half (50%) of visitors strongly felt they were able to understand the content and read the text of the Chemistry exhibit with an additional 30% slightly agreeing. The high readability and comprehension of visitors suggests efficient language accommodations within the Chemistry exhibit.

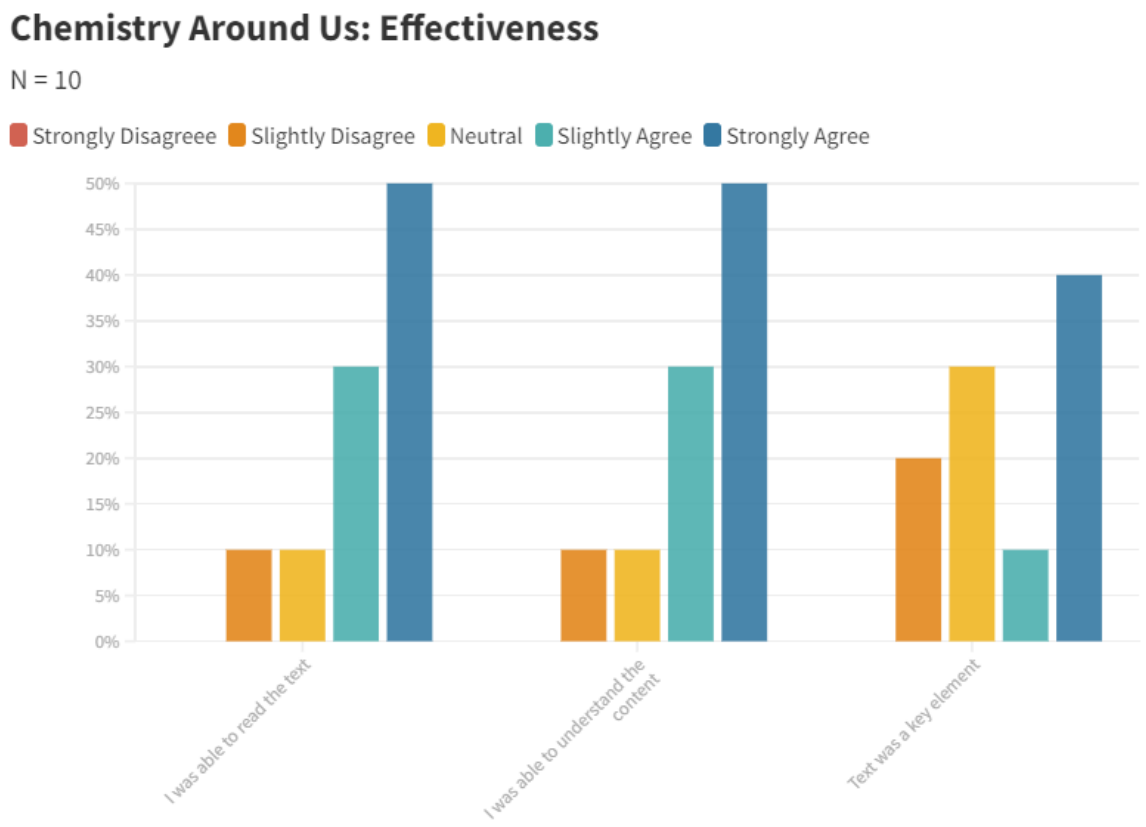

Figure 4.17 Visitor Responses on Effectiveness of Accommodations in the Chemistry Exhibit

However, within the interactive elements, the two computers only have Czech text, while the two videos with Czech audio do not have English captions (Appendix H). This exhibit also features four ‘do not touch’ signs on objects not behind glass. The universal nature of these signs ensures all visitors understand the exhibit is not interactive. A visitor can understand this without the need for language, suggesting the signs in the Chemistry exhibit are sufficient for an accommodating environment.

4.2.4 InterCamera and Photographic Studio

The team considered InterCamera and Photographic Studio as one exhibit due to the homogeneity of the exhibition halls and the ease with which visitors often navigate (Figure 4.18). Additionally, survey responses and observation results for these exhibits were consistent and displayed similar trends.

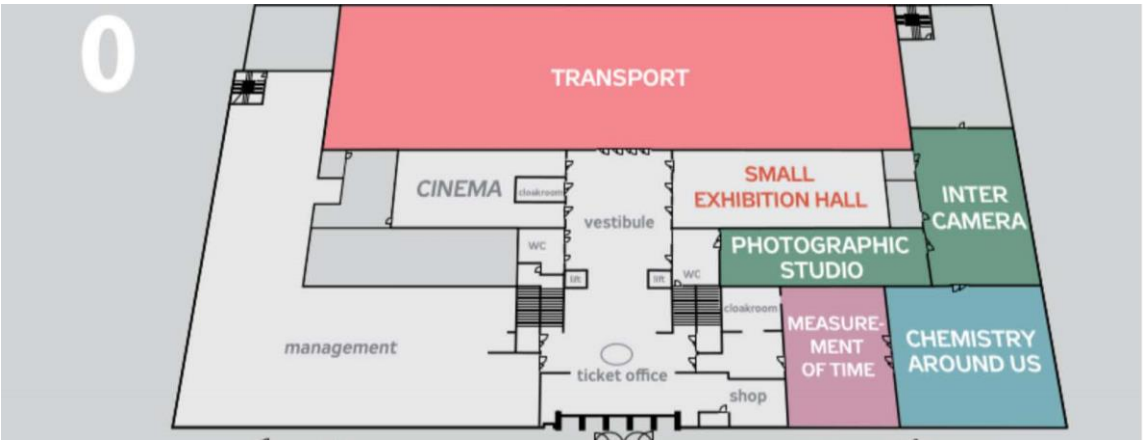

Figure 4.18 Excerpt of the museum map showing the natural grouping of InterCamera and Photographic Studio

Figure 4.19 The InterCamera Exhibit

The InterCamera exhibit is located on the main floor and is a dark room with an upstairs balcony area (Figure 4.19). Entering from the Chemistry exhibit the visitor is greeted by a holographic display of an old camera. The exhibit is filled with display cabinets and interactive devices demonstrating the history of image capture and display. Within the exhibit there are five

exit signs and two directional signs to assist visitors with navigation. Additionally, there are no ‘do not touch’ signs, as everything not behind glass cases serve as interactive elements of the exhibit.

Figure 4.20 The Photographic Studio Exhibit

The photographic studio is a long dark hallway adjoined to the InterCamera exhibit. Along the right-hand wall is a display case featuring cameras and photographs on a timeline. On the left is a lower level showing a life-sized reconstruction of a photographic studio and a photographic laboratory from the early 20th century (Figure 4.20). Due to the straightforwardness and size of the exhibit, there are few universal signs present. There is one social distance sign, two exit signs, and two ‘do not touch’ signs. Additionally, there is one ‘no flash photography’ sign and one ‘no food and drink’ sign. These signs are important for the preservation of the photographs displayed, as flash photography, food, or drinks could damage

the presented objects. It is key that these ideas are presented to all visitors across all languages and these signs ensure that this is the case.

In the InterCamera exhibit, four of the interactive screens were text-based with only Czech and another one was a documentary-style video in Czech without English subtitles. In the Photographic exhibit, all except one plaque – the Samsung NX 210 – have English translations. Together, the InterCamera and Photographic exhibits indicated a high percentage of English accessibility, with 98.9% of text available in Czech and English (Appendix H). Consistent with these findings, about half of the InterCamera and Photographic exhibit (47%) respondents strongly agreed they could read the text with an additional 17% of respondents slightly agreeing. The high degree of accessibility is also supported by more than a third (35%) of InterCamera and Photographic respondents strongly agreeing they could understand the content while 35% of respondents slightly agreed (Figure 4.21).

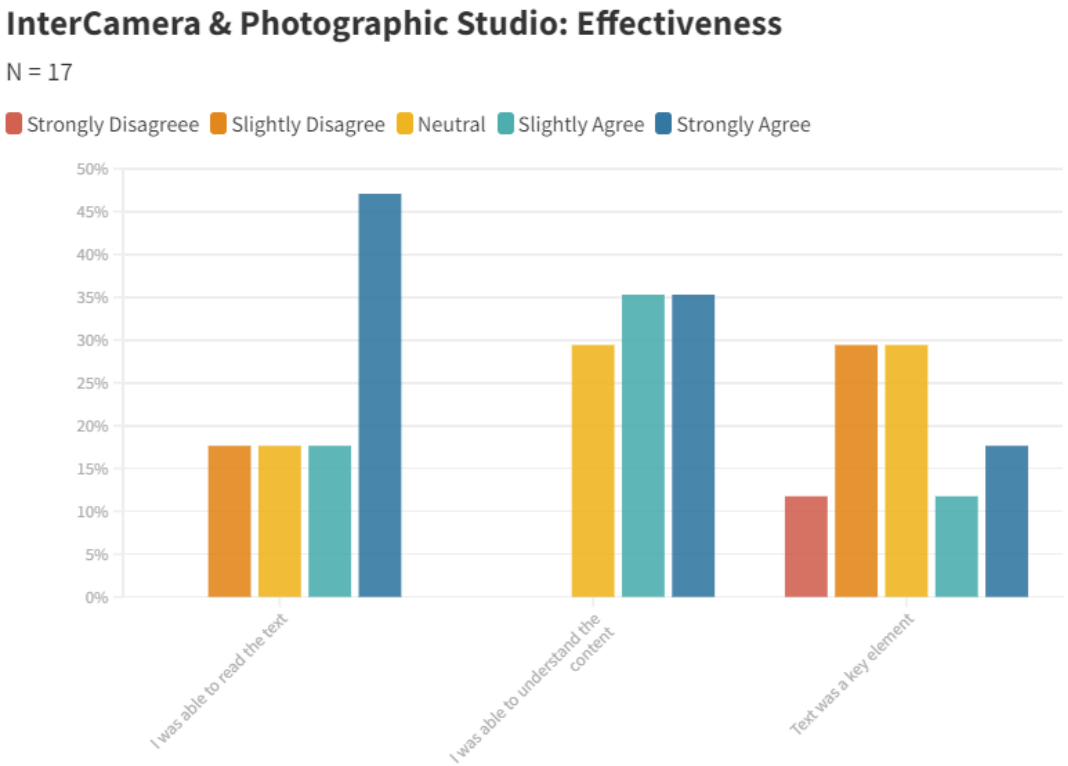

Figure 4.21 Visitor Responses on Effectiveness of Accommodations in the InterCamera and Photographic Studio Exhibits

4.2.5 Mining

Figure 4.22 The Mining Exhibit

The mining exhibit is located on floor –3 of the museum. It begins in a large, dimly lit room with a low ceiling and large wall plaques along the outer walls. There is a large drilling machine in the middle of the room, along with many dioramas of mines and mining technology (Figure 4.22). In this exhibit, there are nine items not in glass cases, and only two of them have ‘do not touch’ signs. Due to this dichotomy, there is no clear indication on whether the visitors can touch the objects without these signs present. Additionally, there is one social distance sign and three exit signs. There are many interactive elements throughout this exhibit, all of them being touchscreen televisions that show short clips of information on mining. These short clips have no audio but have English-caption narration. All 311 of the reading and audio materials within the exhibit are in Czech and English (Appendix H). At the end of the room there is an entrance to the museum mining tour. Most visitors strongly agreed they could read the text (71.4%) and comprehend the content (71.4%) of the Mining exhibit with (Figure 4.23). This indicates the Mining exhibit implemented highly effective language accommodations.

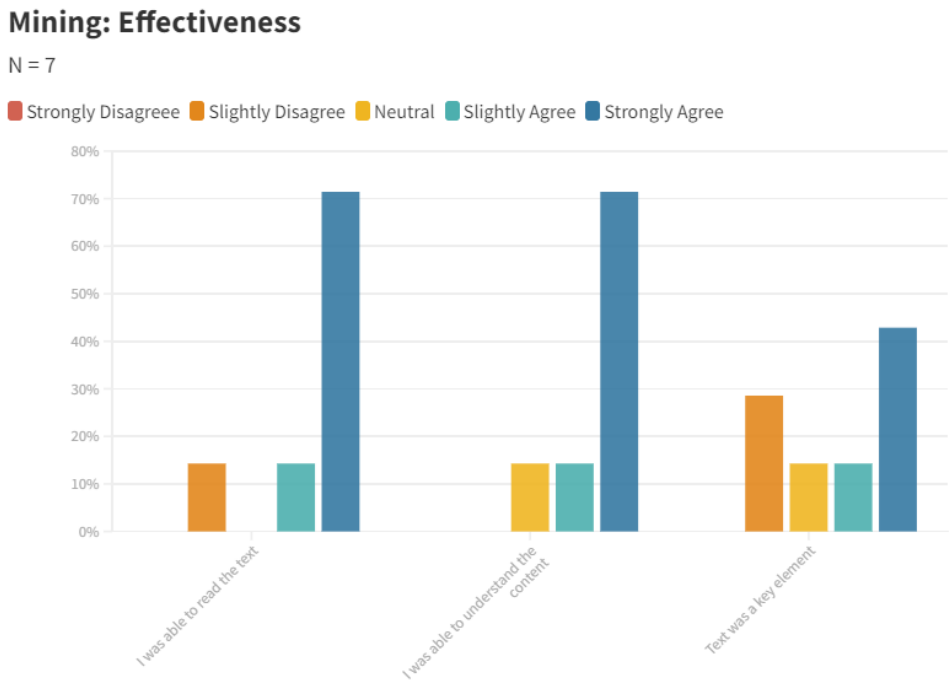

Figure 4.23 Visitor Responses on Effectiveness of Accommodations in the Mining Exhibit

4.2.6 Coal and Ore Mine Tour

The mining tour is a guided experience that replicates the feeling of being in a mine. The tour is in Czech and the guide can provide a paper based translated transcript of the tour in English, German, Italian, or Russian. The guide takes the visitors through a dark tunnel with wax figures of miners using the museum's historic mining machines. To follow along, there are numbers at intervals throughout the tour that correspond with the sections in the pamphlet. The team observed that while an English speaker could utilize the pamphlet, the text contained a multitude of grammatical errors and missing words that would improve readability. The team was unable to collect quantitative data on the quality of translation. Additionally, the team noted more direction on the pamphlet such as the map or images of the discussed item could be beneficial. The team discussed this with the sponsor as a potential deliverable. This is discussed in limitations.

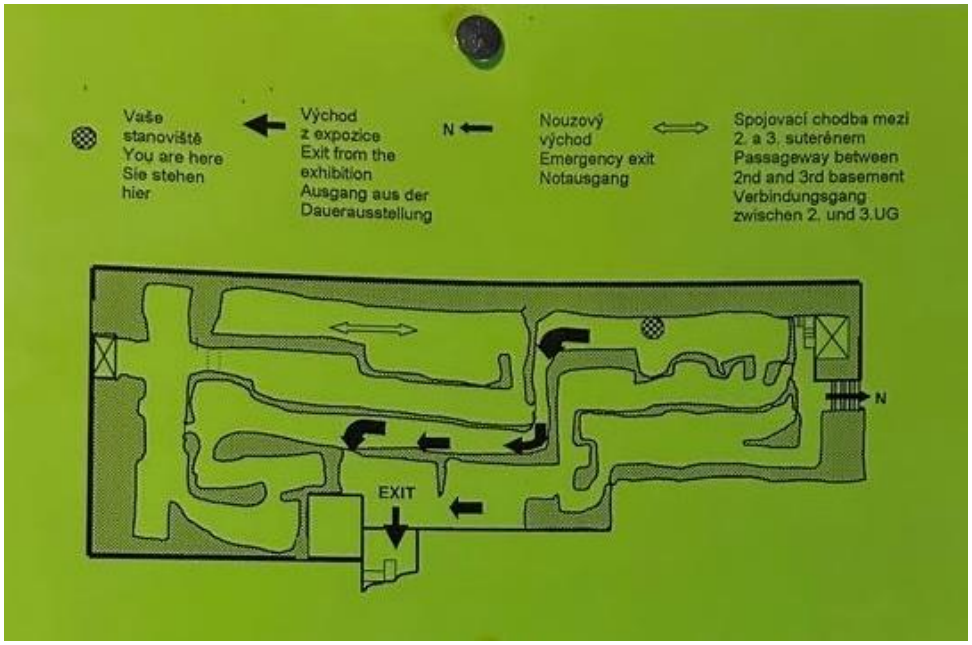

Figure 4.24 Map of Coal and Ore Mining tour route of nearest emergency exit with Czech and English, and German translations.

The mine had safety measures in place, including ten maps of the tour route at different intervals throughout along with fire extinguishers and emergency exits (Figure 4.24). The text on these maps is in English, German, and Czech. These translations provide readability and the pictorial nature of the map ensured easy comprehension leading to effective language accommodations.

Figure 4.25 Sign in Coal and Ore Mining tour that has no English translation.

There are 19 signs on the walls throughout the tour that are not in English. These signs are an immersive part of the experience, designating various aspects that would have been present in a mine. For example, the sign as shown in Figure 4.25 contains important safety information stating, "touching the trolley or the pickup is dangerous to life even when the locomotive is standing, therefore it is prohibited." The lack of translation of these signs prevents a non-Czech speaker from understanding their impact and purpose in the mine. Despite this, the team felt a direct translation within the mine would detract from the authentic experience as the sign is a recreation of a sign found within Czech mines. The team also identified 31 universal signs for emergency exits throughout the mining tour. The heavy presence and even distribution of these signs creates a safe and effectively accessible environment in the event a non-Czech speaker encounters an emergency in the Ore and Coal Mine exhibit.

4.2.7 Small Exhibition Hall (Müller's Maps of Bohemia)

Figure 4.26 The Müller's Maps of Bohemia Exhibits

The maps exhibit is currently one of two temporary exhibits in the NTM. Located off the main atrium, the exhibit is in a small, minimalist room with historic maps lining all four walls (Figure 4.26). There are eight glass cases containing maps and map-making tools in the middle of the room. There is a lot of empty space around cases and a portion of the backroom houses large maps that span the width of the room. There was a total of 56 text-based plaques accompanying the artifacts, all of which were accessible in Czech and English. This is most likely due to the size of the exhibit, that it is a temporary exhibit that travels between museums, and that there are no interactive elements within this exhibit. Due to the size of the exhibit, there is a low presence of universal signage. There is one social distance sign, one exit sign, and two ‘do not touch’ signs. Additionally, there is a ‘no phones’ sign as well, indicating that visitors should not be on phone calls in this room.

4.2.7 Café

Figure 4.27 Café

The café is on the –1 floor of the museum. There are two entrances to the café at either end of the room leading down from staircases. The room is an open area with 13 tables and old tram chairs that are either red or grey (Figure 4.8). On one side of the café, there are counters with food and menus on the walls. There are four small menus on the front side of the food station in Czech and English (Figure 4.28). Despite the English translations, the team still encountered confusion with these menu types as it was unclear if these menus featured the same information as the large menu.

Figure 4.28 Café menu boards featuring English translations

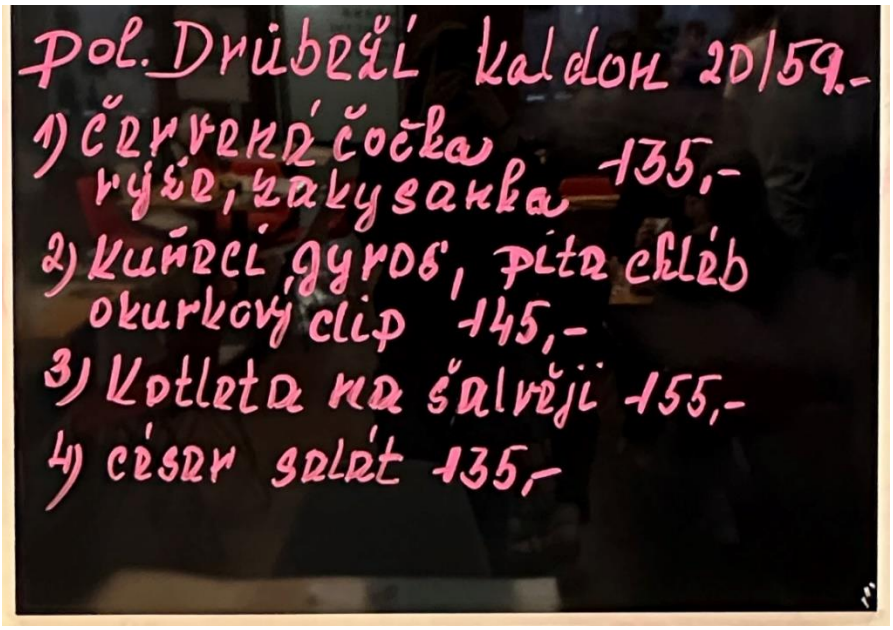

Figure 4.29 Large café menu without English translations

On the left side of the food station there are three small menus above the counter on the wall with about 98% of the writing being in Czech and English (Appendix H). There is also a larger menu on the wall handwritten in Czech with zero English translations (Figure 4.29). This makes it difficult and confusing for an English speaker to understand what is available on the menu for lunch. There is a fridge with water and other drinks to the right of the food station. The fridge has a universal sign that indicates not to touch the fridge. There are also carts where you can drop off your tray so the employees can roll it away and take care of the trash. Additionally, there are four text plaques of technical history information in the café but 75% of them are in

Czech leaving the café's exhibition information largely inaccessible to people who do not speak Czech (Appendix H). However, there is universal signage present in the café to assist with accessibility. There are nine social distance signs, six exit signs, seven directional signs, and two ‘do not touch’ signs. While not helping with ordering food, they improve the visitor’s navigation experience in and out of the café.

4.2.8 Cloakroom

Figure 4.30 Cloakroom near entrance of museum

The cloakroom is located on the main floor of the museum to the right of the entrance. It is a small room with 118 lockers available for use along with a desk with an attendant available for a coat check (Figure 4.30). The current attendant does not speak English and there are no signs describing how to use the coat check or the lockers. Therefore, the cloakroom was noticeably confusing with lack of signs with language accommodations. However, the cloak

room has a universal sign for each: social distancing, navigation, ‘do not touch,’ and emergency exit. These signs are sufficient language accommodation due to the small nature of this room.

The cloakroom is near the entrance of the museum, to the right of the ticket office. Many visitors indicated that the cloakroom was easy to find, with more than half agreeing to some capacity. However, there was a small portion of visitors who showed slight difficulty in finding the cloakroom. In terms of using the cloakroom, visitors either found the cloakroom very easy to use (38.6%) or neutral in difficulty (38.6%) (Figure 4.31). These neutral responses indicate that they most likely did not use the cloakroom or had minimal difficulty storing their jackets or bags.

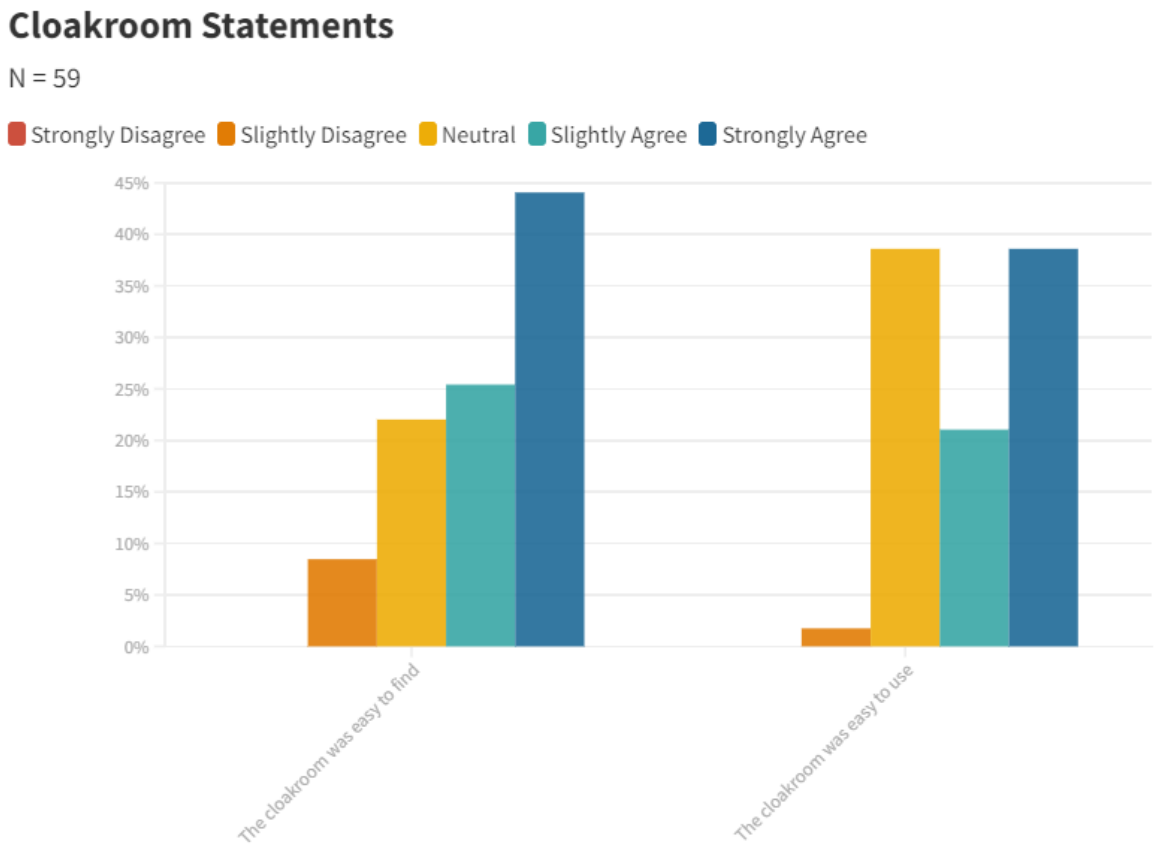

Figure 4.31 Visitor responses on the cloakroom

4.3 Reported Demographics

Understanding visitor and staff demographics, such as spoken languages, country of origin, and gender can assist with potential accommodation improvements for the NTM. The team provided the NTM with a list of these demographics so the museum can better understand the visitors attending the museum and how best to accommodate them in the future.

4.3.1 Staff Languages

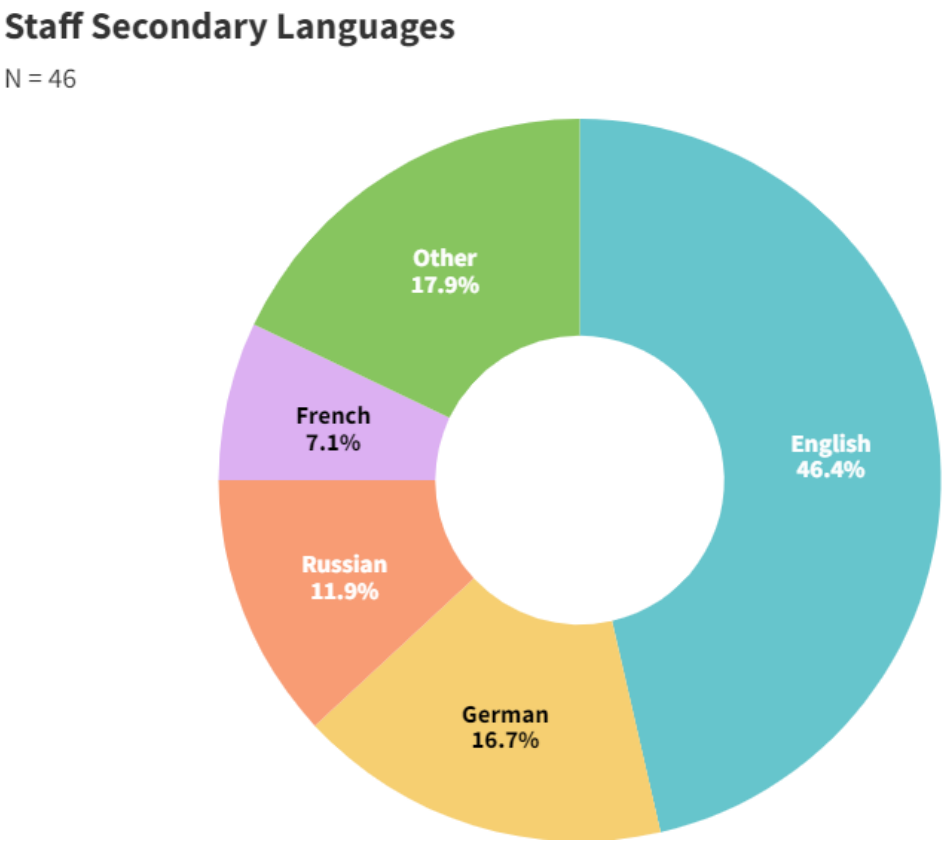

Figure 4.32 Breakdown of additional staff languages

The staff survey reported that all respondents that answered the first question spoke Czech as their primary language. There was also high number of staff who reported ability to speak additional languages, English (46.4%), German (16.7%), and Russian (11.9%) (Figure 4.32). Having diverse staff should improve the foreign visitor experience through the ability to interact and help a larger number of visitors. The report revealed that staff are approached an average

number of three times a day by visitors, and that it is usually just general questions about the museum.

There was a high percentage of English speakers present in the staff. This survey data was inconsistent with what our sponsor indicated to the team. This is also inconsistent with the team's observations as the team encountered only a small number of staff members versed in English, although there is no hard data from observations. The high percentage of English identified from the staff survey suggests effective language accommodations, but this may be misleading. The team believes this is due to higher level staff members who do dot interact with visitors daily being fluent in English. The team was unable to confirm this, and more research may be necessary.

4.3.2 Visitor Demographics

Of the 67 respondents who took the survey, approximately two thirds (67.7%) identified as male, less than one third (29.2%) as female, and the remaining preferred not to answer (Figure 4.33).

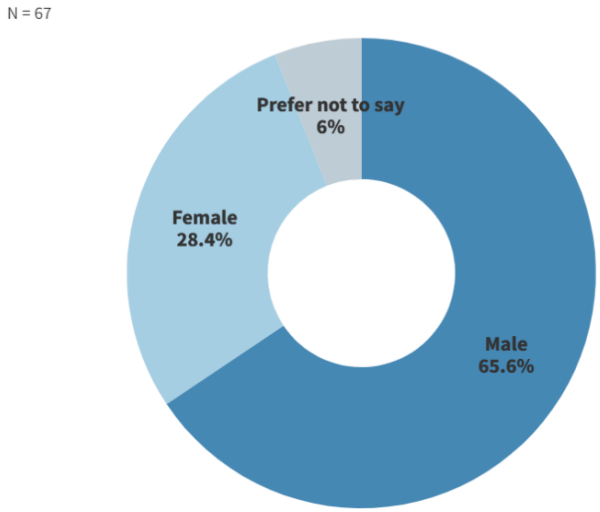

Figure 4.33 Gender breakdown of visitors

The age range also varied, with a significant portion of respondents (40.9%) between the ages of 35-54 and 24.2% between the ages of 18-24. These results follow the approximation that the sponsor mentioned in previous meetings, as a larger portion of visitors are expected to be middle-aged to older men (J. Duda, personal communication, September 21st, 2022). The content

of the museum caters more towards middle aged (35-54) men, as the museum focuses on technological advancements in various fields. Observations within the Transport exhibit showed that most visitors who were not children or a part of school groups were male (66.7%). Of these visitors, it was observed nearly every visitor that visited alone was male (91.7%) and spent long periods of time reading the plaques within the exhibit. Female visitors often came with a male partner (72.2%), and or as a mother bringing children to the museum (22.2%) (Appendix H). They spent less time reading plaques, more time looking at the objects, as well as moving more quickly throughout the exhibit. Additionally, if there was a family with both mother, father, and children, the mothers spent more time bringing the children around, while the fathers tended to spend more time looking at the exhibits.

Survey respondents came from 21 different countries. Of the responses, 76.3% originated in Europe, with 25.4% from the Czech Republic. Non-Czech Republic countries with the most visitation included the United States (13.6%), Germany (13.6%), Slovakia (8.5%), Slovenia (6.8%), and Hungary (5.1%). The NTM received visitation from various other countries, in much smaller counts (Figure 4.34) (Appendix K). Figure 4.35 shows a closer view of the visitors from Europe.

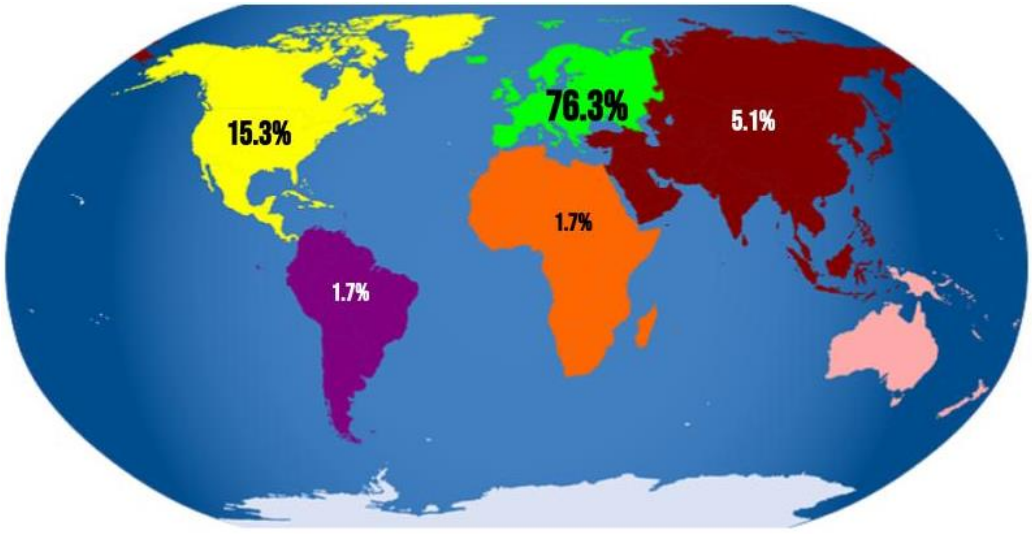

Figure 4.34 Percentages of NTM Survey Respondents from Each Continent

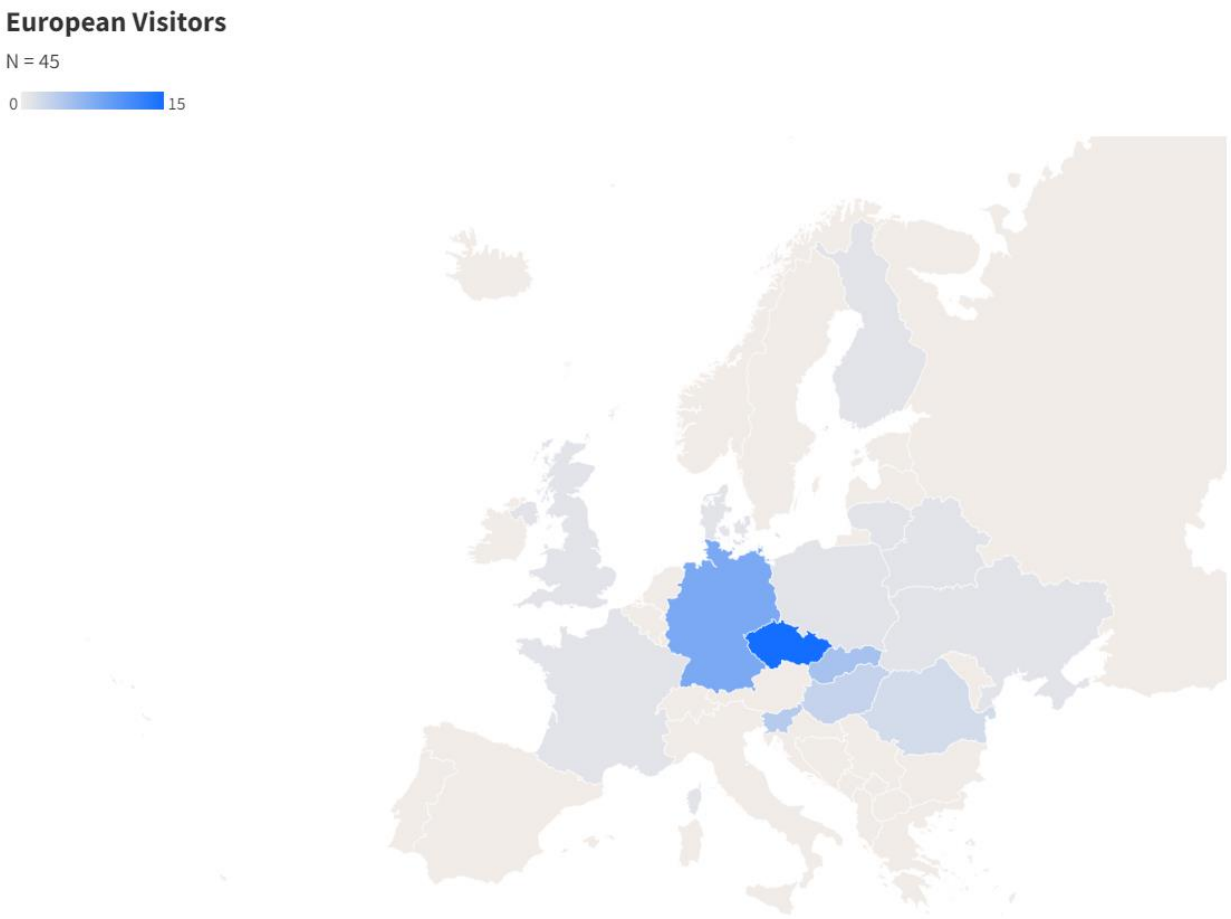

Figure 4.35 Survey Respondents from European Nations

Primary languages of visitors are consistent with the national languages of these countries, with Czech (33.3%), English (16.7%), German (12.1%), and Slovenian (7.6%) appearing as the most prominent languages (Figure 4.36).

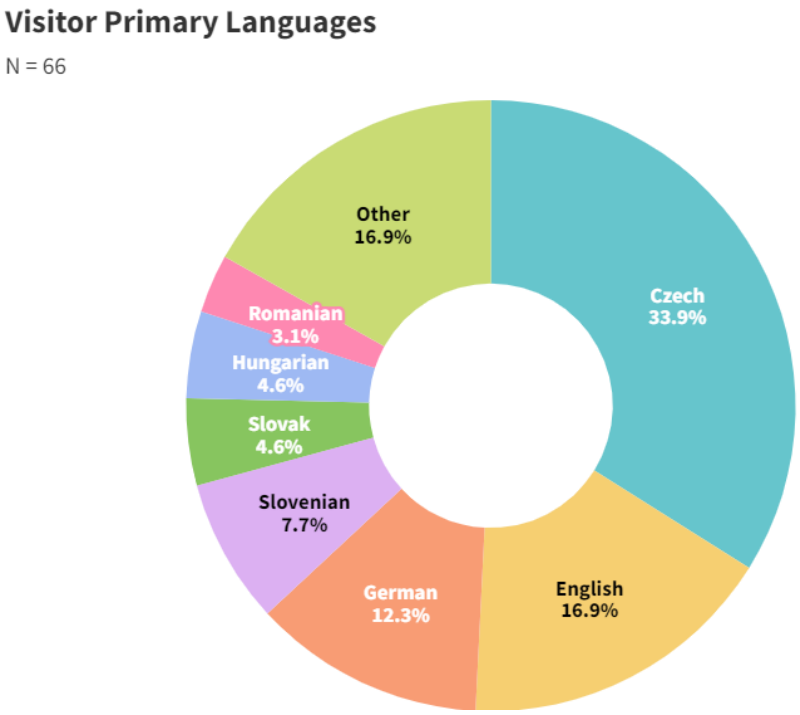

Figure 4.36 Primary Language Breakdown of Survey Responses

In addition to this, of the respondents that do not speak Czech or English (50%) as a primary language, 83.9% speak English and 25.8% speak Czech as secondary languages. With a large portion of responses having Czech or English as a primary or secondary language, it is likely that a vast majority of the survey respondents were able to access and understand the museum's exhibits.

4.4 Limitations

The following section discusses limitations pertinent to the presented findings. Limitations include general limitations as well as methodological limitations the team experienced in the completion of the project.

4.4.1 General Limitations

General limitations are broad limitations that affected various aspects of the project process not related to any methodological approach. One major limiting factor the team encountered was the quality of internet access present at the NTM. While the building has wireless network access, it is outdated. The wireless network was often not sufficient to scan QR

codes present in the museum. Network issues could prevent visitors from interacting with any QR codes the team implemented for surveys and may have negatively impacted response rates. Additionally, it limited the scope of the team's potential deliverables of creating QR codes featuring translated text as they are not feasible. Unfortunately, the sponsor reported that the museum cannot easily update the internet in the future due to budget restrictions (J. Duda, personal communication, November 9th, 2022).

The limited budget of the NTM was another challenge while attempting to develop deliverables and discuss recommendations. The Ministry of Culture of the Czech Republic funds the NTM, but the museum does not receive substantial funds beyond the necessary operational budget. The team proposed recommendations to the sponsor throughout the research period such as implementing multilingual audio tours, however the sponsor preemptively declined them due to a lack of funding necessary to implement the expensive accessibility feature. This limited the potential scope of the project and its final deliverables. The team discussed improvement of the mining tour pamphlet with the sponsor as a deliverable, but the team learned that the NTM was already working on an improvement to the Czech tour. As this improvement did not come to fruition before the project period concluded, the team was unable to work on relevant English updates to the tour. This also limited the scope of the project deliverables. The language barrier was also a persistent problem as the team initially intended to interview NTM staff members to understand their experience with language accessibility in the museum but had to abandon this method when the team learned from the sponsor that the vast majority of staff members were not fluent enough in English to effectively conduct an interview. Unfortunately, the team was unable to find someone who could work as a consistent translator within the museum, and instead opted for other methods.

4.4.2 Observational Limitations

Observations performed by the team consistently encountered issues. The biggest and most prominent problem with usage of the observational method is the nature of the project topic. Reading and language interpretation is an inherently internal process and identification of a visitor's language preference or difficulties with understanding were found to be nearly impossible. This led to initially fruitless direct observation periods and a lack of useful data

collection. The team was unable to alleviate this problem fully and instead revised the observational guide to return focus to the physical layout of specific exhibits and how equipped certain exhibits are for foreign visitors. In this process the team observed the Coal Mining Tour but had difficult conducting in depth observations. Each time the team took the tour, team members were the only visitors present. Additionally, guides must accompany visitors during the tour. This limited the time the team had access to both the exhibit and the pamphlet. The inability to identify individual language experience was also compounded by low visitor density. The NTM resides in a large seven floor building and experiences around 500 visitors per day on a normal weekday in November. Split across opening hours of 9:00 – 18:00 and seven floors, exhibits can go for extended periods of time only seeing a handful of visitors. This decreased the potential observations regarding visitors in these exhibits. Visitor density not only affected observations but was a consistent limitation in survey distribution.

4.4.3 Survey Limitations

The visitor survey remained open from November 1st, 2022, through December 2nd, 2022. In this time, it garnered 67 valid responses. The team changed and revised distribution methods repeatedly in a search for an effective method. Survey distribution at the exit door was limited by low and high visitor density. During periods of low visitor density, the team members distributing surveys could spend two hours at the door and only could speak to 10 total visitors, most of whom had no interest in taking a survey. Opposite to low visitor density, high visitor density also hindered survey distribution. Team members aimed to utilize the Czech Struggle for Freedom and Democracy Day (November 17th, 2022) to distribute large volumes of surveys due to expected increased museum visitation. The prediction of increased museum visitation was correct and led to a large line and often congestion of visitors at the entrance and exit. This created an environment where visitors wished to leave quickly, and it was difficult to distribute surveys to uninterested visitors. This along with other factors contributed to a low survey response rate. On November 11th, the team had the NTM ticket office begin survey distribution in conjunction with tickets. This ensured each visitor to the museum received the survey pamphlet. On November 11th the museum experienced 370 total visitors and the survey received two valid responses, despite every visitor receiving the survey. Resulting in a 0.54% response rate for the date of November 11th. This was not an isolated trend as the survey saw a 0% response rate for the weekend of November 12th and 13th despite seeing 1,967 visitors. One of

the greatest limitations on meaningful survey responses was the ever-present language barrier. Team members found visitors most receptive to taking the survey were those engaged by team members in English as it was the easiest to explain the nature of the project. Visitors who were unable to communicate effectively with team members consistently turned down the survey. Unfortunately for the survey results, the most important survey respondents were those who did not speak Czech or English, and these were the hardest responses to receive. The team identified a limitation in reporting of survey responses. The survey indicated “slightly” or “strongly” agree and disagree statements. The team did not include a “moderately” answer option. The large disparity between the two options limited visitor responses and prevented the team from reporting the values together.

The team also collected responses from individuals under the age of eighteen. Initially, this was not the intention of the team, and the team indicated to the WPI Institutional Review Board that surveys would not include individuals under the age of eighteen. Survey distribution methods unintentionally made it possible for individuals under the age of eighteen to respond to the survey. However, this ended up not being a limitation because the Czech Republic law limits parental consent to individuals under the age of fourteen. Therefore, these survey results are valid and included in the sample.

5.0 Conclusion and Recommendations

This chapter discusses the conclusion and recommendations that have come together throughout this project. It includes an overview of the project and recommendations that the team believed is best for improving accommodations within the NTM. Through the team's work within the NTM, it was found that the museum had a large amount of strong language accommodations, but some specific areas were lacking. To remedy this, the team's extensive research regarding effective accommodations helped to create a list of recommendations for the museum. It is the team's hope that these recommendations will improve the museum experience for foreign visitors in the future.

5.1 Conclusion

The goal of this project was to identify the current barriers facing foreign visitors attending the National Technical Museum while evaluating and proposing improved methods for the NTM to implement. After researching effective methods for language accommodations and working with the museum to prepare in person research, the team created a plan to understand the effectiveness of language accommodations through observations and surveys. This information rendered the team's ability to make informed recommendations to the NTM. The team concluded the NTM implements effective language accommodations throughout while recommending minor recommendations. By considering these recommendations and continuing their efforts to improve language accommodations for foreign visitors, the NTM can help improve the visitors' experience while at the museum.

5.2 Recommendations

Our recommendations to the NTM include:

- **Exhibits/areas that would benefit from additional English translations:**
    - The Chemistry exhibit's two interactive computers in the corner under the real-element periodic table needs an option to translate to English, as well as two areas that use audio without English captions/subtitles.

- The wall text about ‘Composition of Wood’ has a screen without subtitles and audio speaker that is only Czech.
- The wall text about ‘Fuel’ has a screen without subtitles and audio speaker that is only Czech.

- The InterCamera exhibit has four interactive text-based devices that need an option to translate to English.
  - Three touchscreen info-kiosks – under the stairs of the ‘Space’ side of the exhibit, downstairs in the middle of the ‘Colour’ side of the exhibit, and near the entrance to the Photographic exhibit (Figure 5.1).
  - Projector video in back-right corner of exhibit had no English subtitles for audio (Figure 5.1).

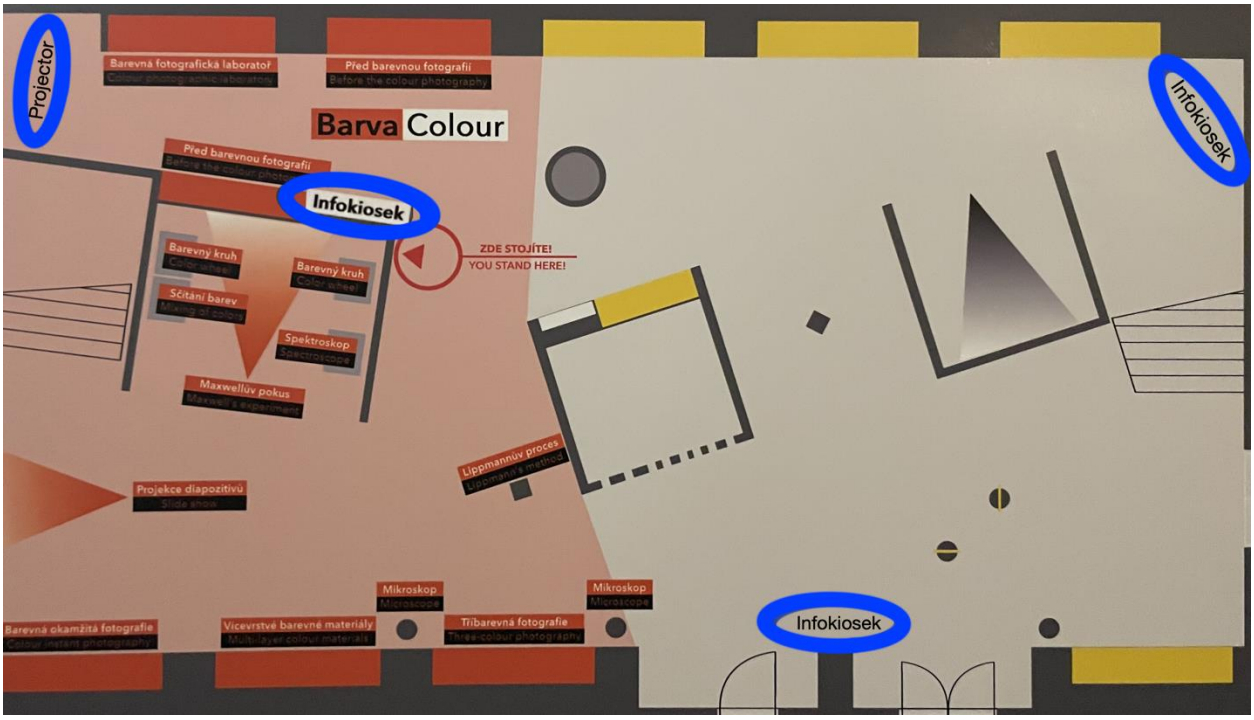

Figure 5.1 Map of the InterCamera exhibit with locations of the kiosks

- The Photographic exhibit has one plaque that needs English translations located on the right of the exhibit coming from the InterCamera exhibit.

- Samsung NX 210 is missing English translation (Figure 5.2).

Figure 5.2 Czech-only plaque in Photographic exhibit.

- The Transportation exhibit has a touchscreen info-kiosk located on the ground floor against the far-left wall that needs an option to translate to English. There is also a large wall of text behind the left train that needs to have English translations. There is also a motorcycle on the bottom floor in front of the left train that has a sign in front of it without English translation.
- The café needs English translations for the menu, especially for the handwritten menu board that is unable to be translated by Google Translate Lens feature. There is also wall plaques titled “Železniční depozitář NTM” and “Muzeum Železnice a elektrotechniky NTM” located under the stairs near the ‘Hardtmuth: from Charcoal to a Pencil Empire' exhibit that needs English translations.
- The Coal and Ore Mining tour had signage throughout the mine regarding safety that need English translations. These translations should be implemented in the

translated guidebook given to visitors taking the tour in a language that is not Czech.

- **Handing out maps with tickets**
    - The museum could mitigate visitor navigational issues by handing out maps with tickets. Some visitors were not aware that paper maps were provided in the main lobby and on the touchscreen boards throughout the museum.
- **Signage in cloakroom**
    - The museum could benefit from a sign in Czech and English detailing how the cloakroom works. This may include the price to use a locker, that the coin is returned, and any other general information.
- **Boosting Wi-Fi throughout the museum.**
    - The sponsor is aware of Wi-Fi limitations. It would benefit the visitor to have access to Wi-Fi, especially if there is text that isn't translated, the visitor could use the Google Translate Lens feature for translations.

6.0 Team Reflection

Through the past 14 weeks, the team has grown as students and individuals. The strong group dynamic established in ID2050 and carried throughout the project allowed for productive work and a positive experience abroad. A variety of different working styles allowed the team to thrive in work both as a group and independently. The team is thankful to have had the opportunity to work with the National Technical Museum, and we would like to extend our gratitude to our sponsor for their hospitality, encouragement, and sincerity.

The team was challenged with a different problem than we first expected, and we had to adapt our project accordingly. Our initial belief was that the National Technical Museum had minimal language accommodations and we would be assisting them with improving their support for foreign visitors. Upon arrival, we found that the museum had translated a majority of their text into English and had support for a variety of visitors. As a team, we had to change our focus to evaluating their offered accommodations and provide recommendations on how they can improve. Another issue was the scope of the project, and what the museum had the capability of implementing. The scope shifted many times throughout the process. Many ideas the team wanted to bring forward ended up not coming to fruition for a variety of reasons. The team learned to change and adapt often due to the shifting scope to ultimately meet the final goal of the project. Shifting scope was influenced by a multitude of stakeholders in the project. The team, advisors, and sponsor all had different visions for the project at various points and it pushed the team to compromise to meet the needs of all stakeholders. We found ourselves often getting frustrated with the process of development and constructive feedback. By working through advisor comments the team eventually created a more developed and cohesive project but it took until the completion to see the final product. We hope the work we have done has provided the NTM with the means to improve the visitor experience. In doing so more visitors will be able to appreciate the rich technical history of the Czech Republic.

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