

Digital Heritage and Multimedia

Course: Design Brief

Capellini in your pocket

Dippy Design

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1. The Context

a) The museum, its content and collections

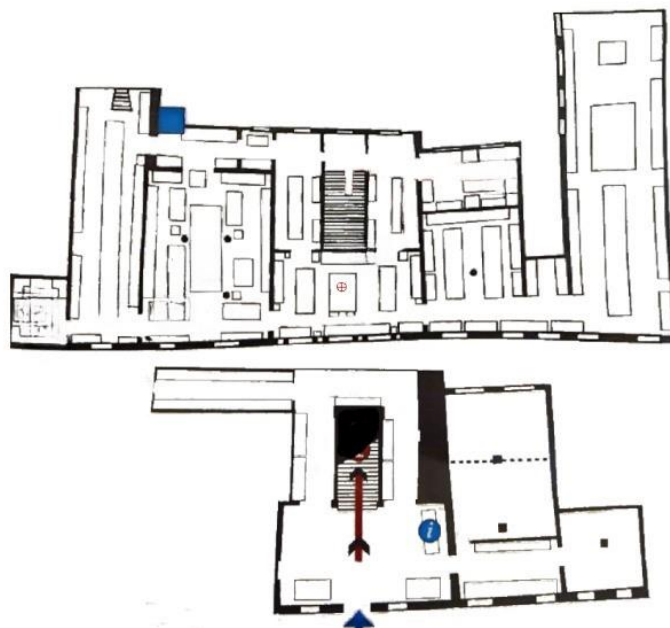
Capellini Museum is the biggest and richest 19th century geological and paleontological museum in Europe with over 1 million pieces. Its primary purpose is preserving and enhancing the collections, promoting education and research, and guaranteeing access for scholars worldwide. The museum is unique because it faithfully preserves the founder's vision of a 19th-century scientific museum while incorporating modern technologies for non-invasive enjoyment. It is located at Via Zamboni 63 in a crucial position within the city, offering great potential for visibility.

The Museum in Bologna has illustrious precursors who are the founders of scientific and naturalistic museology altogether, such as Ulisse Aldrovandi, who established the first natural history museum open to the public in 1547. Ferdinando Cospi and Luigi Ferdinando Marsili later donated collections to the museum, which became the Museum of Natural History of the Institute of Sciences of Bologna. In 1796, the museum was looted by Napoleon and its collections were scattered by the university reform of 1803, but many geological collections were saved by Camillo Ranzani. After the death of Ranzani in 1841, Gian Giuseppe Bianconi became the new Professor of Natural Sciences and the curator of the new Museum of Natural History in Bologna. In 1859, teaching of Natural History became divided into three new disciplines: Geology, Mineralogy, and Zoology, which led to the dispersion of the ancient

collections. With the arrival of Giovanni Capellini in Bologna, the government wanted to renew the old university, and Capellini aimed to create a great museum devoted to Geology and Palaeontology as an instrument of national progress. He aimed to recover and incorporate the natural history collections from the past three centuries and inaugurated the museum in 1881.

b) The location and the Museum's map

The ground floor includes the Archive, packed with unexhibited documents and collections, the Rocce Room, the Atrium of Tombstones, the Viali Room, and the Sancta Sanctorum, as well as the internal garden and the large Capellini garden. This part of the Museum is dedicated to the history of science, geological education and outreach, and offers spaces for temporary exhibitions. The first floor is the main exhibition area of the Museum's collections. Capellini himself curated the furniture setup: display cases, wardrobes, niches, drawers, stands, protected by blown glass, and a large corner clock with weights and an external bell that chimes the hours. The exhibition architecture is largely original or arranged by Capellini. Unfortunately, in the 1960s, the length of the Diplodocus room was reduced to make room for the new Institute of Geology and Palaeontology, designed by Giovanni Michelucci (1891-1990) and wanted by Raimondo Selli (1916-1983). The recent bright mirrored cladding of the back wall (2003, 2007) has happily restored space and view to the large dinosaur.



Capellini Museum's map of the ground floor (below) and the first floor (above)

Unlike the Scarabelli Museum in Imola (1857), which initially characterized itself with an expressed stratigraphic architecture, the Capellini Museum has ambitions of globality and grandeur such that only an eclectic criterion can be followed, which allows for very interchangeable margins in content and arrangement.

c) Institutional Goals

The primary goal of the Capellini Museum is to serve as an educational institution, continuing the legacy of its founder, scientist Giovanni Capellini. The museum provides a rich and immersive learning environment for students, researchers, and the general public. It aims to showcase the interdependence between palaeontology and geology, highlighting the importance of understanding Earth's history and the processes that have shaped our planet.

Education is a fundamental aspect of the museum's mission. Through its extensive collections and Capellini Museum strives to engage visitors of all ages and backgrounds in the wonders of the natural world. The museum offers guided tours, workshops, and educational programs that cater to different levels of knowledge and interests. These initiatives provide valuable opportunities for students to learn about Earth's history, evolution, and the scientific methods used in palaeontology and geology.

The Capellini Museum is committed to preserving and expanding its collections, ensuring their accessibility to scholars worldwide. With over 1 million pieces, the museum holds a wealth of geological and paleontological specimens that are invaluable for scientific research and discovery. The preservation and cataloguing of these collections are of utmost importance, and the museum employs specialized staff and conservation techniques to maintain their integrity.

d) Cognitive and Emotional Goals

The cognitive goal for our project on Museum Capellini is to promote scientific literacy and understanding among its visitors. The museum aims to enhance visitors' knowledge and comprehension of palaeontology, geology, and the interconnectedness of these fields. The project strives to foster a deeper appreciation and understanding of the Earth's geological history and the importance of scientific research in these areas.

The museum seeks to spark curiosity in visitors, prompting them to ask questions, seek answers, and explore further.

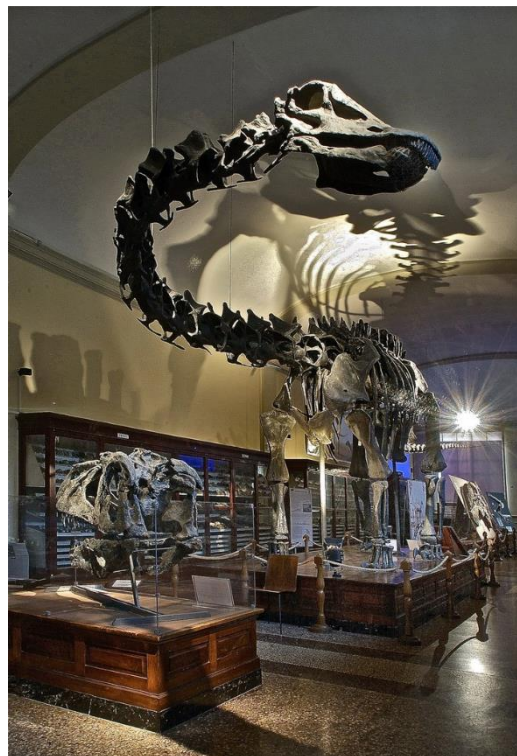
By presenting the immense diversity of ancient life forms and geological processes, the museum aims to create a sense of wonder and awe, captivating visitors and inspiring them to delve deeper into the subject matter. Visitors are encouraged to marvel at the complexity and beauty of the natural world, fostering a connection to the past and a desire to protect and preserve our planet for future generations.

By promoting scientific literacy, inspiring wonder, and fostering curiosity and care, the museum aims to leave a lasting impression on its visitors, encouraging lifelong learning and a deeper appreciation for the Earth's geological and paleontological heritage.

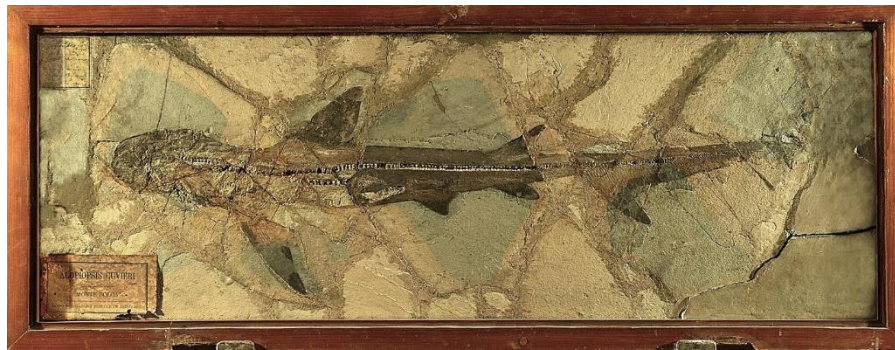
e) Star Assets

For our project we decided to select three relevant artifacts of Cappellini Museum:

- Diplodocus, replica of a sauropod dinosaur, represents a remarkable specimen in the fossil record. This specimen arrived as a generous donation from Scottish entrepreneur Andrew Carnegie to Vittorio Emanuele II in 1909, subsequently finding its place in the museum in Bologna. Characterized by its colossal size, Diplodocus measures an impressive 26 meters in length and stands approximately 4 meters tall, occupying an extensive part of the room: for this reason, it generates astonishment in every visitor that enters the room.



- Another important specimen is *Alopiopsi Cuvieri*. It is a shark lucky discovered by archaeologists in Monte Bolca. Both front and back impressions are stored in Cappellini Museum and they show not only the cartilaginous skeleton, but also the soft tissue, which is very rare. Notably, within the lower portion of the specimen, a smaller skeleton is discernible, leading scientists to hypothesize that it represents a fish that was ingested by the shark prior to its demise.



- Fossilised egg of the *Eormis Maximus*, extinct predator from Madagascar that could reach three meters of height. Capellini was very fascinated by this specimen and made a hole on the surface that allowed him to find the embryo inside of it.



f) Target Audience

Capellini Museum attracts schools, tourists, and local residents, but for our project, we have focused on the latter group. Our intention is to raise awareness among the citizens about the existence of the museum and pique their curiosity about its collections by enhancing its website. We want also to raise awareness among the citizens about the museum's significance for the city of Bologna. This virtual component will be especially valuable for those who are unable to visit the museum physically, whether due to time constraints or physical limitations. It will provide an opportunity for everyone to access the museum's treasures and knowledge.

2. The audience

a) Motivations

1. Educational interest: Citizens may visit the Capellini Museum to expand their knowledge and understanding of geological and paleontological history. The museum offers a wealth of information and exhibits that cater to individuals seeking to learn about these scientific fields. From fossils to geological formations, visitors can satisfy their thirst for knowledge and deepen their understanding of the Earth's history.
2. Cultural curiosity: People with a general interest in science, history, and culture may be motivated to explore the museum and its collections. The Capellini Museum offers a unique opportunity to explore the natural world and its evolution over time. It allows visitors to appreciate the beauty and intricacies of geological formations, as well as the diversity of ancient life forms preserved in fossils.
3. Local pride: Citizens of Bologna may visit the museum to appreciate and celebrate the rich cultural heritage of their city. The Capellini Museum stands as a testament to Bologna's scientific and historical contributions, highlighting the city's importance in the field of geology and palaeontology. Visiting the museum can evoke a sense of pride in the local community and foster a connection to their city's legacy.

b) Barriers

1. Lack of awareness: Some citizens may be unaware of the existence or significance of the Capellini Museum due to insufficient promotion or limited visibility.
2. Time constraints: Busy schedules and other commitments may hinder citizens from allocating time to visit the museum.
3. Perceived relevance: Some individuals may not see the museum as personally relevant to their interests, leading to a lack of motivation to visit.
4. Accessibility: Physical barriers, such as limited mobility, may prevent some citizens from easily accessing the museum.

c) Capabilities

1. Surfing internet and consulting websites: Citizens have the capability to access information about the Capellini Museum by surfing the internet and visiting its website.

This digital platform can serve as a virtual gateway, attracting potential visitors and providing a preview of the museum's offerings.

d) Devices

1. Smartphones: Visitors can use their smartphones to access information about the museum, view digital exhibits, and enhance their overall museum experience through an interactive website. The museum's website will be optimized for mobile devices, providing a seamless and engaging browsing experience for smartphone users.

2. Personal computers: Citizens can explore the museum's website on their personal computers before or after their visit to gather information, plan their visit, or engage in virtual experiences. The website can offer detailed descriptions, high-resolution images, and interactive features to captivate users and encourage them to visit the museum.

3. Concept

a) The challenges our project faces and how we will address them

The museum lacks a modern way to visualize the items inside it: our project aims to create one, which would have a prominent space on the museum's website. The most important and interesting pieces, particularly for non-specialists, will be showcased as “digital cards” first and accompanied by accessible and captivating information suitable for public dissemination.



Diplodocus reproduction

3D model

Skeleton structure reconstruction
26 x 4 m.

Mesozoic (Late Jurassic)

The Diplodocus

It was a widespread species during the late Jurassic, the name derives from the shape of its tailbones, doubled at the end. It's an herbivore, the teeth on the front are thin and small, on the rear there are none. You could find the diplodocus mostly in North America. It's the longest and slowest dinosaur ever existed. They weight between 20 and 25 tons and they could walk just on all fours, being the rear legs unable to sustain that great bulk.

The Story

This diplodocus arrived here through a donation of Andrew Carnegio, a scottish entrepreneur who gave it to Vittorio Emanuele II in 1909. Then it was assigned to this museum. It's the copy of a fossil that was Carnegio's property (the original was found in Wyoming), other ones were given to other capitals such as Berlin, Wien and Paris.

Did you know?

The 2016 Emilia's earthquake broke the tail of our diplodocus.

If you want to know more about the diplodocus check out our research gate.

[Description of the palate and lower jaw of the Sauropod dinosaur Diplodocus \(Reptilia; saurischia\) with remarks on the nature of the skull of Apatosaurus](#)

[Cranial biomechanics of Diplodocus \(Dinosauria, Sauropoda\): testing hypotheses of feeding behaviour in an extinct megaherbivore](#)

Ask a question to the staff

[Contacts](#)

Ask a question here

Submit

Example of a digital card dedicated to a Star Asset exhibit, the Diplodocus, available using the tool “Capellini in your pocket”

By creating this tool, the museum can make its collection more accessible to a wider audience. Visitors, whether they are physically present or exploring the website remotely, can delve into the museum's treasures and gain a deeper understanding of their significance. This approach promotes inclusivity and enables citizens to engage with the museum's content on their terms.

Citizens often have limited knowledge about the museum, its exhibits, and their importance. By improving the website and incorporating the aforementioned information, we can stimulate citizens' curiosity and provide them with a preview of the museum's wonders without requiring them to purchase a museum ticket.

Through engaging and informative content on the website, citizens can discover the fascinating world of geological and paleontological collections. They can learn about the historical context, scientific discoveries, and the relevance of the museum's exhibits to the city of Bologna. This knowledge instils a sense of appreciation and pride among citizens, encouraging them to further explore the museum in person.

By providing virtual access to the museum, individuals with limitations can still explore the collection and develop a connection to its significance. This inclusive approach ensures that everyone, regardless of their circumstances, can benefit from the educational and cultural offerings of Capellini Museum.

Chaotic collection and limited staff: The museum's collection, due to various interventions over time, appears rather chaotic. To truly appreciate Capellini Museum, a guided tour is necessary. To facilitate visitor experience and help them follow a coherent narrative, the website will include a museum map showcasing curated itineraries suggested by the museum's curators.

With a clear and structured map of the museum, visitors can navigate through the collection with ease. The suggested itineraries will guide them through key highlights and thematic areas, ensuring a more immersive and meaningful visit. This approach helps overcome the challenges posed by the collection's chaotic nature, making it accessible and enjoyable for all.

Limited budget: The museum's revenue primarily relies on school visits, resulting in limited financial resources. With few visitors and limited funds available for investment, improving the website poses a challenge. However, once the initial infrastructure is created, gradually updating the archive would be relatively less costly (with only a limited number of important artifacts required for the map interfaces).

Our project aims to leverage the available budget strategically. By prioritizing essential features and gradually expanding the website's content, we can make the most of the limited resources. Additionally, the website serves as a cost-effective platform to reach a wider audience beyond physical visitors, allowing for greater exposure and potentially attracting new sources of funding.

Preserving Capellini labels: One of the unique aspects of Capellini Museum is its historical significance and the preservation of the original Capellini labels. These labels serve as valuable artifacts in themselves, representing the vision and curation of the museum's founder. However, as technology advances and interactive elements become more prevalent in museums, there is a challenge in finding a balance between enhancing the visitor experience and respecting the authenticity of the original labels.

On the one hand we will preserve the original Capellini labels on the other we will incorporate modern technologies to enrich the museum experience. The website will play a crucial role in achieving this balance. Rather than replacing the physical labels, the website will serve as a complementary platform that expands upon the information provided by the labels.

Through the website, visitors can access detailed information about each exhibit, including its historical context, scientific significance, and relevance to the city of Bologna. The goal is to provide a comprehensive understanding of the collection while maintaining the integrity of the original labels.

The project recognizes the importance of visitor preferences and diverse levels of engagement. The website will offer various resources and features that allow visitors to choose their desired level of depth and interaction. Some visitors may prefer a quick overview of the exhibits, while others may want to delve deeper into specific topics. By providing flexibility in exploring the museum's subject matter, the project aims to cater to a wide range of interests and learning styles. Additionally, the website will serve as an educational resource, providing supplementary materials and resources for teachers, students, and researchers. This further promotes the educational mission of the museum and facilitates access to its collections for scholars worldwide.

c) Museological approach

Museology is the study and practice of museums and their role in society.

It encompasses the theory and methods involved in the establishment, development, management, and interpretation of museums. Museology seeks to explore the multifaceted aspects of museums, including their historical, cultural, educational, and social significance.

Our museological approach for the Museo Cappellini is characterized by a commitment to preserving and enhancing the collections, promoting education and research, and ensuring access for scholars worldwide. We aim to create a museum experience that is both rooted in

the vision of a 19th-century scientific museum while incorporating modern technologies for non-invasive enjoyment.

One of the key elements of our museological approach is the preservation of the founder's vision. We strive to faithfully maintain the original intent of Giovanni Capellini, who envisioned the museum as a tool for national progress, devoted to geology and palaeontology. This commitment to preserving the founder's vision provides a strong historical and cultural foundation for the museum, allowing visitors to appreciate the rich heritage of scientific discovery.

In addition to preservation, our approach emphasizes the importance of education and research. The Museo Cappellini aims to be a hub of knowledge, offering opportunities for scholars to study and delve into the extensive collections. By facilitating research and promoting scholarly engagement, we contribute to the advancement of geological and paleontological understanding.

Furthermore, our museological approach embraces accessibility and inclusivity. We recognize the importance of making the museum accessible to a wide range of audiences. Using modern technologies, such as an enriched website, we aim to engage and educate visitors, regardless of their prior knowledge or expertise in the field. By providing engaging and informative content, we hope to spark curiosity and foster a deeper understanding and appreciation of geological and paleontological sciences.

d) Specific themes and topics selected as case study for our Project Work

As a case study for our project, we have decided to focus on the processes of fossilization¹.

The chemical and physical processes that enable the preservation of fossils are diverse. Petrification is a phenomenon through which the lithification of organic remains occurs, particularly bones, shells, wood, and sometimes even feces. Petrification can occur through two distinct processes: mineralization and replacement. After the death of an organism, the soft parts are typically attacked by bacteria and decomposing organisms. The empty shell or skeleton remains buried in sediment, which simultaneously begins the slow process of lithification. The circulating water impregnating the sediment often carries dissolved silica, calcium carbonate, or iron. These substances can precipitate into the originally occupied

¹ https://www.youtube.com/watch?v=-MSgHkvy2Z4&ab_channel=Universit%C3%A0diBologna

cavities of blood vessels, canals, nerves, or tissues. In this way, the shell or skeleton is extensively mineralized, becoming harder and more resistant. This addition of chemically precipitated substances in porous spaces is called mineralization. Petrification can also occur through a molecular exchange of the original substance, molecule by molecule, replaced by minerals of different composition (silica, calcium carbonate, sulfides, and iron oxides). This process, called replacement, results in a fossil with a completely different chemical composition from the original, while retaining the most minute details. A classic example is that of silicified tree trunks, which distinctly preserve growth rings as well as the intricate architecture of woody fibers.

Carbonization is another fossilization process that exclusively affects tissues composed entirely of organic matter. After the organism is buried in sediment, in the absence of oxygen, the tissues undergo slow destructive distillation, releasing carbon dioxide (CO₂) and water (H₂O), while leaving behind free carbon as residue. In the rock, a carbonaceous imprint of the animal or leaf remains, and sometimes even the perfect outline of the soft body.

Organisms from the past can also be preserved as molds and impressions. An external mold occurs when sediment consolidates around an organic remnant that may subsequently be destroyed. A negative image of the external surface is thus left on the surrounding sediment. The term impression refers to external molds of thin parts of an organism. An internal mold occurs when sediment fills the cavity of an organic remnant, such as the interior of a mollusk shell, and solidifies, faithfully reproducing the internal morphological features.

Fossil traces can provide valuable information about the size, shape, and living environment of the animals that produced them. For example, footprints can reveal whether a dinosaur was quadrupedal or bipedal, heavy and slow-moving, or agile and fast. The activities of organisms that lived on the seafloor have also left countless traces found as tracks and burrows in sedimentary rocks.

4. Requirements

a) Characteristics that our Project Work must have in order to reach the goals

Our project, as previously stated, aims to enhance the visitor experience at the Capellini Museum, both virtually and in person. Our primary goal is to raise awareness about the value and significance of the museum's collections. To achieve this, we have designed a user-friendly website that provides visitors with additional information about specific exhibits through digital cards accessible on their phones. These cards feature exhibits' images, captivating graphics and interactive widgets that allow users to intuitively place fossils or rocks on a timeline. Furthermore, a trivia section presents intriguing anecdotes to spark the curiosity of users.

We have taken great care to make the cards as interactive as possible. In a 2014 study conducted by Federico Fanti and Dante Abate², 3D models of selected objects from the collections were created. In our designed cards, we will include an option to view a 3D model of the particular fossil or rock alongside its image. This interactive feature enables users to engage with the exhibits in a more immersive and dynamic manner.

Moreover, our project aims to bridge the gap between the general public and the academic world. Within the cards, visitors will find links to academic papers that allow them to deepen their knowledge about specific exhibits or relevant themes. This inclusion highlights how the museum's collections have been and continue to be subjects of extensive research. By showcasing the scientific importance of these exhibits, we hope to raise awareness among the citizens, our chosen audience, and emphasize the value of the Capellini Museum as a valuable scientific resource for the city.

b) Characteristics that our Project Work should and could have in order to reach the goals

We envision the possibility of incorporating a Q&A tool into the interactive cards. This tool would allow users to leave comments and ask questions to museum staff and even the researchers involved in the studies. This interactive feature would extend the visitor's experience beyond the museum visit, providing inspiration for further exploration and expanding their knowledge of paleology and geology.

² Dante Abate and Federico Fanti, "La valorizzazione digitale del Museo Geologico Giovanni Capellini di Bologna", *Archeomatica*, (January 2014):1-4.

c) Characteristics that won't be developed our Project Work but may be developed in the future

The creation of the interactive cards not only benefits the public but also serves as an essential foundation for the future development of a digital archive of the Capellini Museum.

Although our Project Work does not address this aspect in the initial phase, it represents a crucial step for the institution's digital preservation and accessibility in the future.

Creating a digital archive of a museum offers several benefits that concern a lot of different aspects. Firstly, the level of accessibility would increase: the digital archive would allow the museum to make its collections available to a global audience, overcoming geographical limitations, thus widening the reach of the museum and promoting greater public engagement. In addition, with a digital archive, museums can extend their outreach efforts and engage with a broader audience. Online exhibitions, virtual tours, and interactive multimedia experiences can be created to captivate visitors and offer immersive educational content. Another great advantage is the higher level of flexibility in presenting and organizing collections. Curators can update and expand content over time, incorporating new research findings or contextual information. Moreover, they can easily organize theme-specific paths within the museum with the help of our QR codes and digital cards containing specific information about exhibits, gaining the possibility to focus each time on a different theme. On a more practical note, digitizing the museum's collections helps preserve and protect valuable artifacts and documents, that in this way don't have to be physically handled as much. Most importantly, a digital archive provides researchers, scholars, students, and educators with convenient access to primary sources and valuable reference materials. It enables them to conduct in-depth research, analysis, and comparative studies, fostering new discoveries and insights. Digital archives can also support educational initiatives, serving as valuable resources for online courses, virtual exhibits, and interactive learning experiences.

Lastly, a very useful implication would concern Linked Open Data. In fact, digital archives can be linked to other cultural heritage institutions, libraries, and databases through Linked Data or similar technologies. This interconnectedness allows for the exploration of broader contexts and connections between different collections and disciplines. Archives and Linked Data have gained increasing interest and recognition in recent years, particularly within the archival and digital humanities sectors. The adoption of Linked Data principles and technologies has shown

great potential for enhancing the accessibility, integration, and analysis of archival collections³. In 2011, reports highlighting the benefits of Linked Data for libraries, archives, and museums started to emerge. Projects such as the LOCAH (Linked Open COPAC and Archives Hub) project and the British Library's British National Bibliography showcased the use of Linked Data in archives and bibliographic data. These projects emphasized the advantages of Linked Data, such as integration with other data sources, serendipitous search, and flexible access points to archival data. Over the past decade, numerous case studies have been published in the field of Archival Linked Data. Some of them, in particular, involve enhancing existing collections of archival metadata and publishing them as Linked Data. This approach allows for the integration and enrichment of archival data and has been applied to collections such as the Historical Archive of the European Commission, the Zeri Photo Archive⁴, and the Getulio Vargas Foundation's Archives. Another prominent example of the digitization of archives is the online collection of the Met's Museum in New York⁵, which contains more than 450,000 digitized records. Surveys demonstrate that the online collection is browsed by a wide public (around 600,000 people per month), that has the possibility to collect information about artworks, downloading high-quality pictures, listening to audio guides and having easier access to related content. Further analysis show that the majority of this public is represented by people who declare to browse the online collection for research purposes⁶. This may lead to think that a digital archive only interests specialists of the field, however a lot of these researchers state that they only have a general knowledge of the topics they are investigating, because the kind of research they are conducting is not necessarily academic but could also serve different purposes (e.g. verifying some information about an exhibit or collecting information for a fictional story). Another common reason that brings users to the online archives is to plan their visit in the museum in the future. Overall, the public of the digital collection can be divided into the main categories of researchers, inspiration seekers and visit planners. These surveys demonstrate that digitizing the archive of a museum can be a very precious resource, both for museum's staff and other specialists but also for the general audience.

³ Ashleigh Hawkins, "Archives, linked data and the digital humanities: increasing access to digitised and born-digital archives via the semantic web", *Archival Science* 22, (September 2022):319–344

⁴ <https://fondazionezeri.unibo.it/en/photo-archive>

⁵ <https://www.metmuseum.org/art/the-collection>

⁶ Elena Villaespesa, "Who Are the Users of The Met's Online Collection?", Met Museum, https://www.metmuseum.org/blogs/collection-insights/2017/online-collection-user-research?utm_source=pocket_saves.

5. Ideation

a) Experience (from the users' perspective)

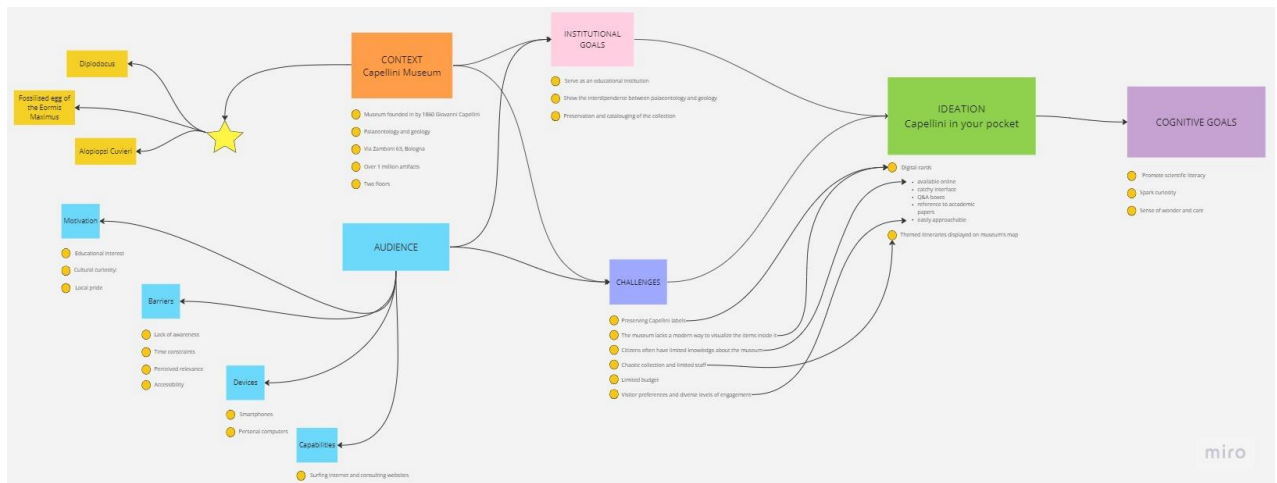
Our potential user, a citizen of the city of Bologna, may have learned about the renovation of the Capellini Museum through advertisements or word-of-mouth. Intrigued, they decide to visit the museum in person. Upon arrival, a staff member greets them and provides details about "Capellini in your pocket," an enhanced visit experience. This concept offers curated routes designed by the museum's curator, guiding visitors through a sequence of exhibits marked by QR codes.

By scanning the QR codes, the visitor gains access to a digital card specific to each fossil or rock they encounter. These cards provide additional information and media, such as studies conducted on the exhibit, its discovery story, and its significance in the field of paleontology. Through various forms of media, including articles, pictures, and videos, the user can understand the importance of each item and its contribution to scientific progress. Alternatively, the citizen has the option to freely explore the museum's collections, scanning QR codes whenever they encounter one to learn more details.

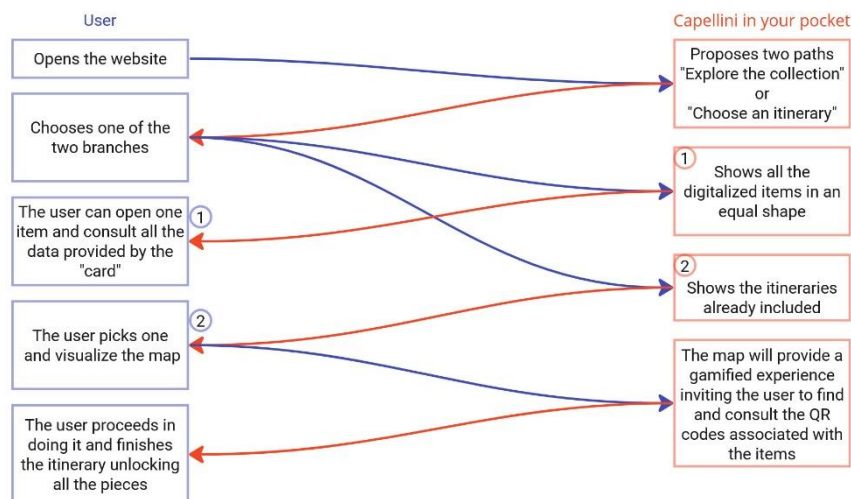
Let's imagine the citizen decides to embark on a particular itinerary focused on the process of mineralization. They open the website, select the itinerary, and are presented with a map that reveals only the first item. Scanning the first QR code unveils the digital card associated with that artifact. The user will see a picture of the item, a 3D model (if available), a widget displaying the era it belongs to, and an informative text outlining its specifics and story. At the end of the card, an invitation to continue the path and discover the next item appears, unlocking the subsequent segment of the itinerary. This gamified approach engages the visitor physically, guiding them through the museum, while also providing an educational journey that teaches them about the fossilization process through various examples in the museum's collection.

Furthermore, this visit experience can be enjoyed in a similar way from home. By visiting the Capellini Museum website and accessing the "Capellini in your pocket" section, users can choose predefined virtual routes or freely browse the online collection. Even when connected remotely, the citizen retains the opportunity to interact with the museum's staff through the Q&A tool. The questions submitted by online visitors are collected and examined by the museum's staff, allowing experts to provide answers and further enrich the virtual experience. By offering both physical and virtual visit options, as well as opportunities for interaction with the museum's staff, we aim to provide an engaging and informative experience that connects citizens with the collections preserved at the Capellini Museum.

b) Conceptual map



f) Description of the interaction between the application and the users (include Interaction Diagram)



Interaction diagram created with Miro

g) Foreseen workflow

One of the biggest challenges for this kind of project is conceiving a functional workflow, to set up an efficient and fruitful cooperation with the museum staff and experts working on the actual collection.

Our idea is to act with an exact workflow that will allow us to quickly implement our concept and deploy it as soon as possible, the main goals of our foreseen workflow will be:

- Getting enough knowledge of the museum collection and highlights to work independently on their digitisation and abstraction inside our website system.

- Realizing a functional template that can be easily implemented and duplicated by anyone having basic computer literacy.

The first step will be instantiating the communication with the staff, we will acquire all the meaningful information about the items they evaluate as most important and crucial for the museum image and outreach, this set of items will be the first to be digitised and inserted inside the system. We will try to identify through this phase also the most interesting facts and info about rocks and geology, to create a website that is truly geo-palaeontology oriented and involving in both fields. In this phase we will also try to stress about the importance of retrieving scientific and educational data about the item, making it more interesting to the means of scientific popularization that should be, in our concept, one of the empowered aspects of this institution. When the staff will not be able to supply enough information about an item it will be necessary to reach out and consult also other experts in the relative field.

The second step is the one in which we collect all the raw data that will be finally pushed inside the website. This is a difficult moment because it is necessary to decide between many potential standards and practices and stick to them. To do that we decided to do some research and take as an example the museal institutions that realized the best digital collections in terms of modern UI and UX, accessibility and transparency in their practice, this research phase was followed by another in which we benchmarked Natural History museums that carry some similarities to the uniqueness of Capellini Museum.

It appears clear to us that some institution looks like in a hurry when building their online archives, such the Louvre's one, which shows some low-quality standards and a choice oriented to archive as much as possible in a little due time, probably driven by the huge collection and archives. This is the opposite approach from the one we intend to adopt for Capellini's Museum in which we intend to take the right time to produce some high-quality results in terms of aesthetic pleasure when browsing the digital archive and accuracy in terms of expected use for research that, as we've shown before through the Met's Museum data report, it's an important aspect of the online presence of a museum nowadays.

We intend to achieve this through the construction of an image and metadata archive at the service of the website that will use the most recent standards in terms of digital photography. The collected images will be of three types, and they will require different equipment:

Big items: this category includes all the big fossils and unmovable display cabinets, ideally unmovable and so it will be necessary to create the right conditions for a documenting photo shoot, being unable to move the item to a prepared set. Supposedly the right conditions will be achieved by the means of the right equipment, that will include:

- a high quality (hopefully full frame) camera:
- An adjustable tripod
- Movable lights to achieve the right exposition condition
- Some specialized software that will take care of the postproduction adjustments when necessary.

Small items: include all the easier to move items (rocks, small fossils), these items can be photographed in ideal conditions, a usual feature of these kind of shoots include the presence beside the item itself of useful markers that are used for colours and dimensions references as in the shown example from the Smithsonian Paleobiology archive.



CC0- <https://collections.nmnh.si.edu/search/paleo/?v=g0>

For this kind of photo shoots should be necessary to create a small reusable set, with neutral background and soft box lights to cast as less shadow as possible over the items and acquire some useful files to share for the means of research and casual browsing on the foreseen website or using the Guided Tour functionalities.

Panoramas: High quality 360° shots can be easily achieved with modern equipment; they are useful to show the insides of a museum and communicate an idea of coherence and high institutional standards, they also suggest how the embodiment of the institution takes place, through this kind of pictures a visitor can have a preview and image himself as someone seeing the place from the inside. To achieve this effect, it is needed to realize good 360° photo files,

that show detail and good lighting. The perfect conditions are like the others, good exposition and soft lighting to avoid shadows and reflections, the use of a specialized camera would be better to obtain them easily inside the cramped spaces of the museum.

For every item of the three categories would be better to obtain raw images and have more than one file, to have a rich and interchangeable archive. Reusable and reliable.

Starting from these assets it will be possible to work on the graphics and interactive part of the website. The realization of a simple pipeline to realize the cards is fundamental in this phase, they will use a shared template and jpeg versions of the raw images to improve the experience in terms of responsiveness and quick access.

Obtained all the cards, populated with images and data, it becomes finally possible to realize a working website and use the cards in various ways, one of them, already designed and shown in this brief is the possibility of visualizing a virtual map of the museum with some suggested path to follow to obtain different experiences based on your interests and expectations.

h) Set-up: Foreseen hardware, software and Media (digital asset needed)

The fundamental set-up that we'll need for the foreseen workflow consists of a few item that are usually found in every photographer equipment, plus a specialized camera for panoramas would be ideal given the peculiar conditions of the Capellini Museum.

For the realization of the website will be used computers that can support code editing and graphic software for prototyping the final gui of the website. All the main items of the museum will be provided of customized QR codes that will track the distinction between palaeontology and geology in a highly readable way, for them used <https://www.qrcode-monkey.com/> a simple site that allows you to customize your QRs.



QRs realized using qrcode-monkey

i) Further development and maintenance issues

Building up from these grounds it's possible to expand the website in various ways, always consulting with the museum direction board and according to their requests and requirements. Some proposals, by the way, look natural to us and we want to include some of the foreseen potential developments:

- Creating a database for the museum, containing all the items, feasible for open research and consultation. The image will ideally included in a IIIF image server that will make them accessible for API calls and usage in other contexts.
- Deepening the links between the museal items and research, the website will become a useful tool for consulting papers and research related to the items.
- Implementation of a 'kid area' of the website, including some infotainment small application that will help the kids learn more and be engaged with the things they saw or they're going to see during a visit. We were thinking about a tamagotchi-like app, in which they can collect dinosaurs and objects they saw at the museum answering some basic questions about them, this one would be completed with a pokédex-like interface from which they can visualize their collected dinos with flashy and simplified versions of our main cards.

6. Disruption

Our project is based on the concept of utilizing visitors' personal cell phones to access informational online cards during their in-person museum experience. This approach offers undeniable advantages by reducing project costs and addressing future maintenance concerns. However, relying on cell phones also exposes the project to certain risks and challenges.

Firstly, there may be instances where visitors wish to enjoy the enhanced tour but do not possess a phone or do not have one with them at the time. This situation can particularly arise among elderly visitors who may own a phone but not a smartphone. To overcome this issue, a portion of the budget could be allocated to provide a limited number of devices, such as tablets, that would be available for those without smartphones. Alternatively, visitors without phones could be paired up with individuals who have one, creating an opportunity to share the experience with others, whether they are known acquaintances or strangers. This arrangement would also facilitate the exchange of opinions and curiosities.

Another potential concern is that relying on phone-based media may distract visitors from their surroundings and the actual exhibits. Our primary objective is to maintain the focus on the real exhibits, even while providing additional information on the phone. To mitigate this risk, we propose adding references on the website that direct visitors to related exhibits within the museum. These connections can be based on similarities or differences between the exhibits. This approach could also introduce an element of gamification, encouraging visitors to complete thematic paths by unlocking one item after another. By doing so, we would encourage visitors to actively explore the museum and seek out fossils and rocks, while simultaneously gaining a deeper understanding of the interconnections among different items in the collection. Another concern revolves around internet connectivity. To ensure the proper functioning of the digital cards, internet access is required. To address this issue, a portion of the budget could be allocated to installing a Wi-Fi network specifically for the Capellini Museum. Visitors would be provided with the necessary credentials at the beginning of their visit, enabling seamless access to the online content.

Lastly, one potential drawback is that providing visitors with additional information may discourage them from booking guided tours, as they may perceive the two experiences as equivalent. To mitigate this concern, we would actively encourage visitors to engage with museum guides by asking additional questions. Furthermore, we would highlight the guides' expertise and share details about their research on the museum exhibits, emphasizing the unique insights they can provide based on their extensive studies.

When it comes to the possibility of browsing the digital cards of the museum exhibits on the museum's website from the comfort of one's home, there is a potential concern regarding the limited availability of items in the online collection. Creating a substantial number of digital cards requires time, which means that initially, potential visitors may not be able to gain a satisfying impression of what the Capellini Museum truly offers.

To address this initial limitation, we will take great care in presenting the virtual tour as a mere glimpse or teaser of the immersive experience that awaits visitors at the Capellini Museum in person. The virtual tour aims to inspire individuals to explore the entire collection, discover the different thematic paths, and fully engage with the enhanced experiences that can only be encountered during an in-person visit.

By framing the virtual tour as an enticing introduction, we encourage individuals to go beyond the digital realm and personally witness the richness and diversity of the Capellini Museum's collection. It is through this direct encounter that visitors will have the opportunity to delve deeper into the various exhibits, appreciate the context, and immerse themselves fully in the captivating ambiance that the museum offers.

By addressing these potential challenges and risks, we aim to create an enhanced museum experience that maximizes the benefits of digital access while ensuring the preservation of the visitors' connection with the physical exhibits and the value of guided tours.

7. Team's roles and work

Francesco Alaimo

Graphic UI designer, workflow designer and photographic expert. Curator of the design brief (ideation, concept, future developments)

Chiara Parravicini

Workflow designer, curator of the research regarding possible developments of the project (digital archive and Linked Open Data), curator of the Design Brief (deation, requirements, disruption).

Nicole Liggeri

Workflow designer, curator of the research regarding possible developments of the project (digital archive and Linked Open Data), curator of the Design Brief (context, audience, concept, ideation).

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