

DESIGN BRIEF

THE STARS' LAW

Master's Degree Program in
DIGITAL HUMANITIES AND DIGITAL KNOWLEDGE

Course Examination
MUSEOLOGY, MUSEOGRAPHY AND VIRTUAL ENVIRONMENTS

Maria Chiara Giorgi

Eliza Stuglik

Introduction

Our project work is called "*The stars' law*". What inspired this name was the etymology of the word "astronomy" that is: from the Latin *astron* "star" + *noms* "arranging, regulating; rule, law", literally "star-regulating".

Its main aim is to raise interest about the Astronomic world in the young generation. This field concerns the study of everything in the universe beyond Earth's atmosphere, it is one of the most mysterious disciplines and for this reason complicated as well. This characteristic confers to her fascination, fundamental trait in the development of a creative project. The idea was born after visiting the *Museo della Specola* of Bologna. The value of the cultural heritage objects present in its permanent collection is glaring and that is what makes the visit interesting. However, the staticity of the guided tour does not fully exploit the potentiality of this museum. It is evident that a great lack can be found in the absence of digital features.

Linked to this matter, what the museum staff told us, reinforced our thesis; teenagers are the generation that currently frequents the *Museo della Specola* the least. As a matter of fact, people in the age range 13-19 struggle to spontaneously approach to this museum. Most of visits including teenagers are organized by high schools. For this reason our main goal is to get attention and make them come voluntarily. Hence our choice fell on this museum, for which the whole project is intended.

Moreover, consulting the thesis of Simona Caraceni: "*Designing a taxonomy for virtual museums for the use of AVICOM professionals*" we have been inspired from an example cited in the paper. The project "Story behind the paintings" organized by the *Sukiennice Museum* in Poland brought lots of new visitors to the gallery, thanks to the engaging digital activity.

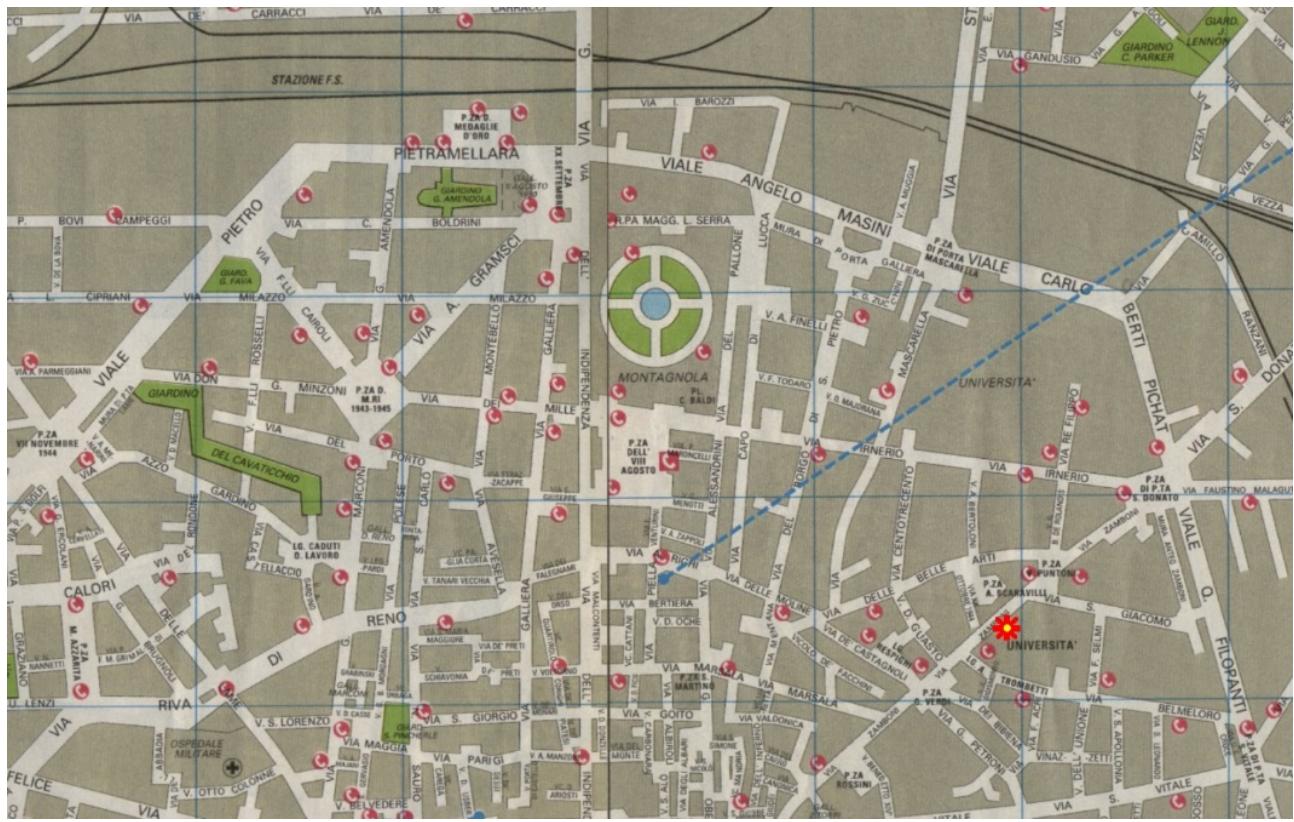
Logo of The Stars Law Project:



CONTEXT

The museum

The *Museo della Specola* is located in Bologna in Via Zamboni, 33. It is housed in some of the rooms of the 18th-century tower, built onto Palazzo Poggi, present seat of the University of Bologna - which in the 18th and 19th centuries were mainly given over to astronomical observation.



Map showing the position of the *Museo della Specola* in Bologna, Italy

The museum is today subdivided in four rooms: the *Guido Horn D'Arturo Room*, the *Sundial Room*, the *Globe Room*, and the *Turret Room*, situated on the first, third and fourth floor of the tower respectively. The same tower also houses the Department of Astronomy of the University and the Astronomical Observatory.



The Specola tower photographed by Paolo Monti (1974)

Construction work on the *Specola* tower began in 1712 designed by architect Giuseppe Antonio Torri. Bologna's astronomical observatory was to be built on the 16th-century Palazzo Poggi, where the Institute of Sciences was founded by Luigi Ferdinando Marsili in 1711. The building was completed in 1726 by Carlo Francesco Dotti and in the same year observations began by Eustachio Manfredi, the first scientist to conduct astronomical research, commissioned by Marsili. Since 1979, the astronomical tower has housed the *Museo della Specola* where it is possible to see the ancient instruments in the same rooms where they were used by Bolognese astronomers in previous centuries.

Among the most striking rooms is the *Sundial Room*, built in 1727 to observe the stars at their highest point on the horizon. The current floor dates to 1742 when the artist Ercole Lelli created the brass sundial, which was used until the mid-20th century to signal noon to citizens every day. Right above this room was the astronomer's study and living quarters. In the *Guido Horn D'Arturo Room* there is the Dowel Telescope designed by Guido Horn D'Arturo and built in 1952: this invention by Horn is considered today to be a forerunner of modern multi-mirror telescopes. In addition to instruments for studying and observing the sky, the museum also houses ancient globes, armillary spheres, maps and two rare Chinese maps dating back to the early 17th century. A helicoidal staircase leads to the *Specola* terrace, from where there is a splendid and unusual view of the city. An interesting detail is

about the structure of the tower, the top of has the function of a compass. Each corner points to a cardinal point, useful for the scientist during night observations.

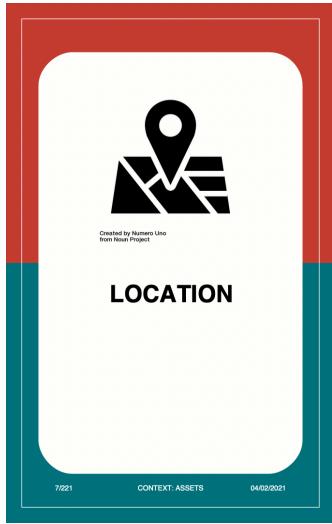


View from the Specola tower

The institution

The first step for the development of our project is the definition of goals, assets and features of the museum under consideration. From our analysis and interview of the museum's employee, we recognized as the main goal the illustration of the development and evolution of astronomical instruments over a period of more than a century from the early 18th century to the late 19th century, spreading their importance in the scientific field. In fact, the institutional belief is that historians must be persuaded to accept that there could have been no science without instruments, and that in the historical context they provide the concrete referent to the development of scientific theory. In conclusion, we can state that the main goal of the *Museo della Specola* is an historical-scientific one.

Assets

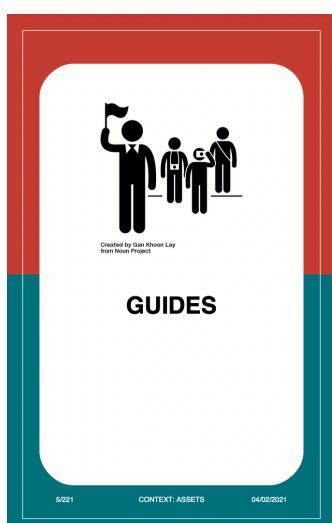


The main assets of the *Museo della Specola* that we identified are: **location, guides** and **price**. In the past they have also organized some learning activities for schools and families but currently they are not available hence it cannot be considered as one of the main assets.

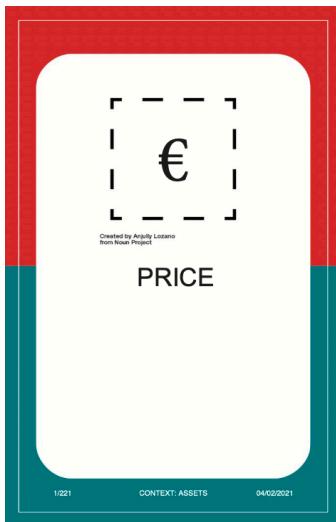
The museum is located in the centre of Bologna, in Via Zamboni, 33 build onto *Palazzo Poggi*. This facilitates the affluence of foreign tourists but also of a lot of university students of the University *Alma Mater Studiorum*. The building has also a relevant historical importance for several reasons:

- It is the first public astronomic observatory;
- It represents the historical site of the Astronomy Department of Alma Mater Studiorum and the Science Institute;
- It has housed astronomic experiments of Horn and Guglielmini;

In addition, on the top of the tower there is a fascinating view of the city of Bologna from a unique point of view.



Every ticket includes automatically a guided tour made by young students or recent graduates. This youthful and passionate approach is very appreciated from the audience as evidenced by the museum's reviews.



The standard ticket is not so expensive (5 euros) and several categories benefit from a free admission: students of the University of Bologna, personnel of the University of Bologna, accompanying visitors with disabilities, Card Cultura holders, Ukrainian citizens. Reductions are also made for guided tours for school groups.

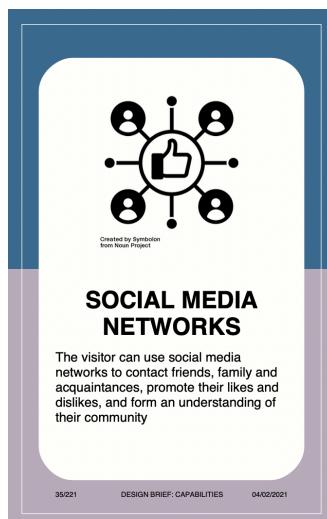
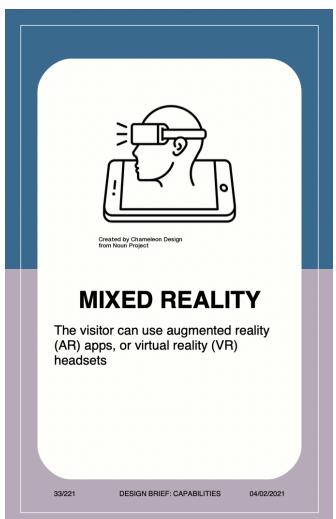
Target audience

During our visit we have been able to ask some questions about the target audience of the museum. As the personnel stated, the principal clients of the museum are adults from 25 years old, foreign tourists, university students and school groups.

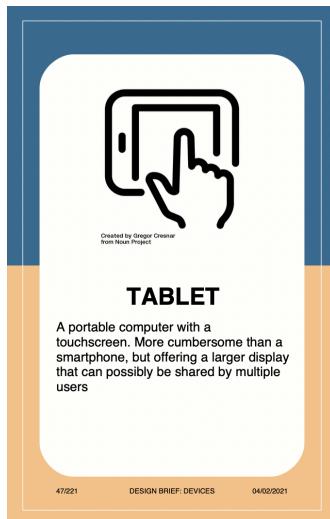
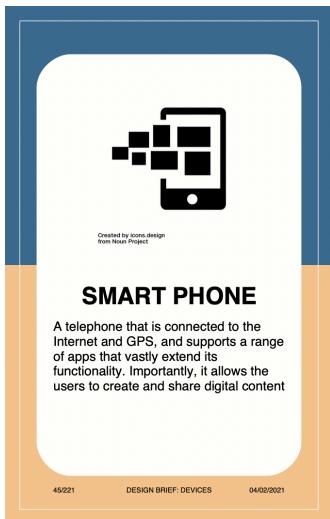
Having all these information we decided to choose as target audience of our project the young generation (13-19 years old) since the guide told us that their presence is mostly due to school organized trips. Moreover, we thought to add some features also for citizens who are part of the other category not often visiting the gallery. Supporting this, the guide added that the majority of citizens do not even know about the museum's existence.

Capabilities, devices and motivations

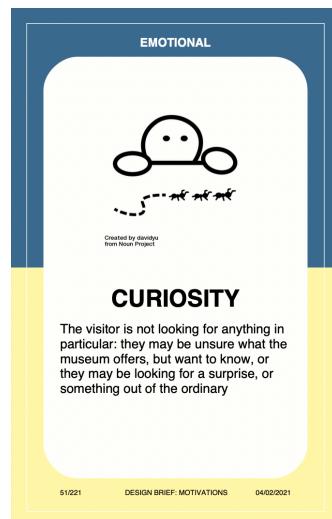
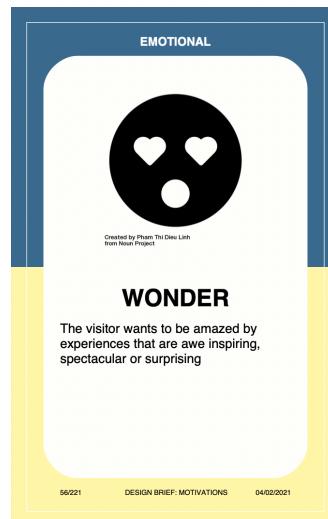
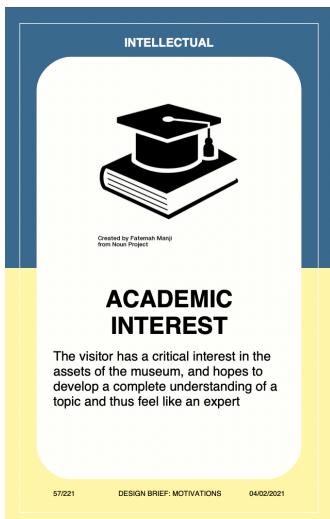
We detected three main capabilities of our visitors that are **computer gaming**, **media creation** and **websites** that we used as a starting point for the development of different activities.



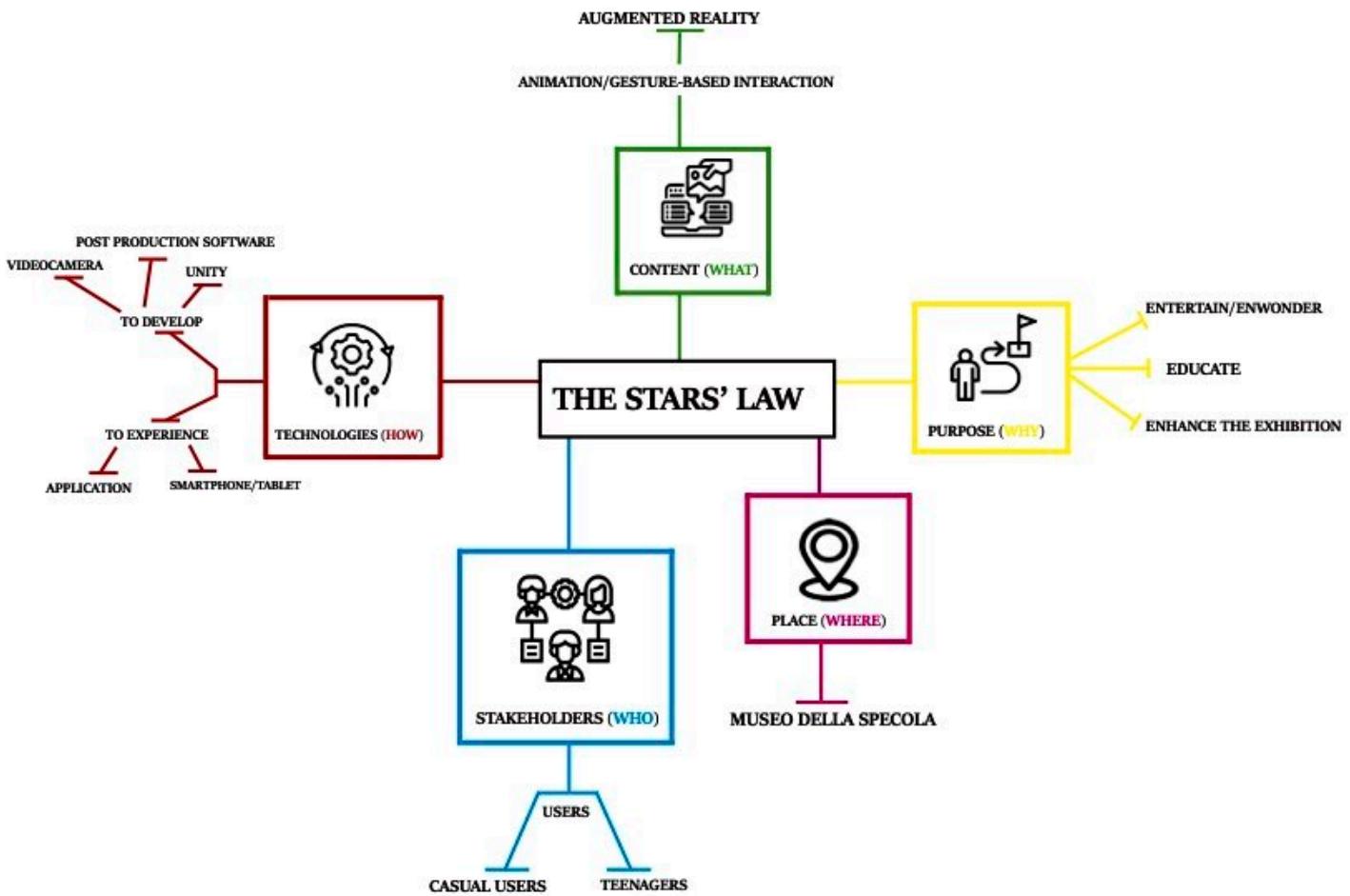
In addition, we have also chosen three already known devices that we could exploit, that are: **smartphones**, **gaming consoles** and **tablets**.



Finally, we defined also the **motivations** that could push visitors to come to the museum:



CONCEPT



Conceptual Map

"A non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment.". In this definition of museum stated by the ICOM, we can find its standard goals that are to **educate** and **entertain**. These last, match perfectly the aim of our project. In order to achieve these goals, we made extensive use of digital technologies, for this reason we can say that we are facing a virtual museum. Consulting the "*Taxonomy for virtual museums for the use of AVICOM professionals*" written by professor Simona Caraceni we recognized our museum as being part of the category "C", that is a virtual museum that enhances museum **exhibition** with **open interaction** in a **closed space** showing **selected objects** from the museum collection, **not allowing visitor contributions**.

NEED	EXHIBITION
INTERACTION	OPEN ('gesture based') inside the galleries
SPACE	Closed
CONTENT	Selected objects
VIRTUAL/REAL	Real with virtual
VISITORS	NOT ALLOWED
CONTRIBUTIONS	

Starting from this sample we created our own table.

NEED	EXHIBITION
EXAMPLE	INTERACTIVE BROWSING (GESTURE-BASED)
TECHNOLOGY	INSIDE/OUTSIDE THE GALLERY POINTING A DEVICE INTERACTION
CONTENT	VIDEOS, TEXTS, 3D RECONSTRUCTIONS
VIRTUAL/REAL	REAL WITH VIRTUAL
VISITORS EXPERIENCE	"STUNNING" BOTH FOR THE CASUAL AND FOR THE GREEDY VISITOR

As written in the taxonomy, this virtual museum includes all exhibition using on-site gesture-based technology inside the actual rooms of the museum. However, this latter should not allow any interaction between the object/information on display and the user, but we decided to add a minimal interaction in order to capture more the target audience attention. The space and interaction are closed and that means that the experience follows a precise pattern. This is also due to the structure of the building which is organized in four floors. The guided tour starts from the first and follows the natural shape of the tower. For what concerns the content, we selected few of the cultural heritage objects of the *Museo della Specola*. This is directly linked with the intersection between the virtual and real. The technologies used are touch-screens and interactive projections activated by natural human gestures.

Cognitive goals

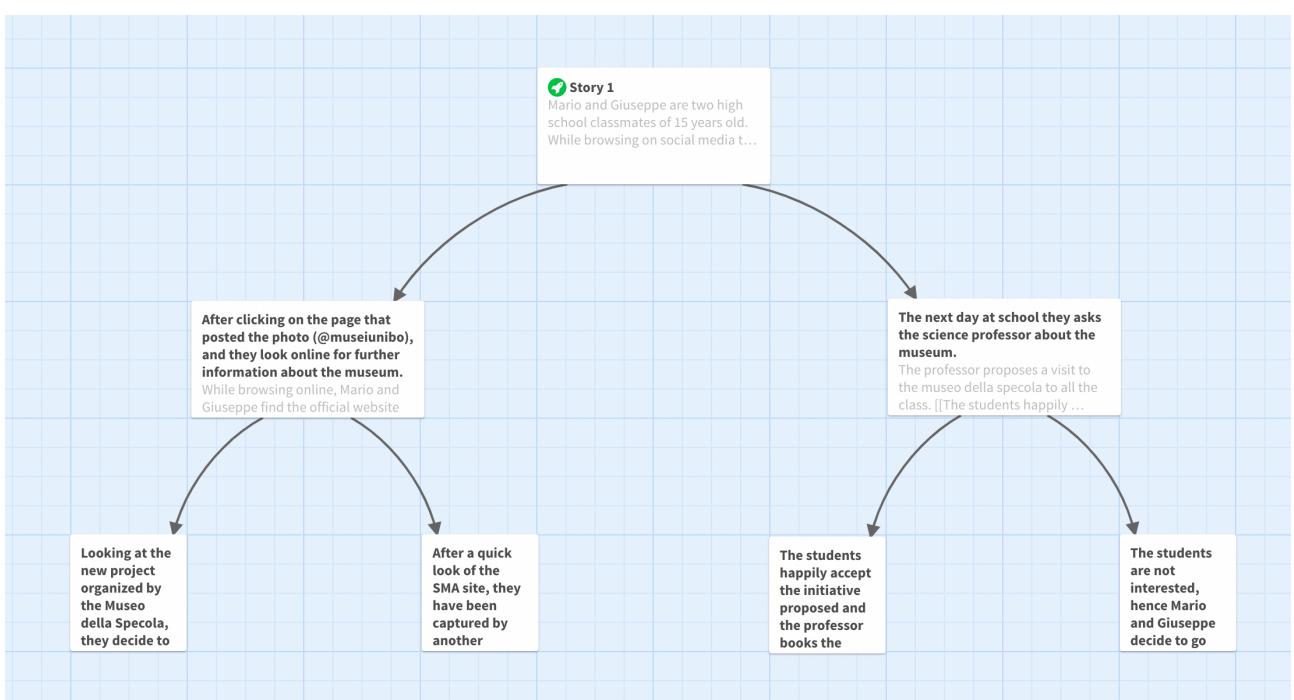
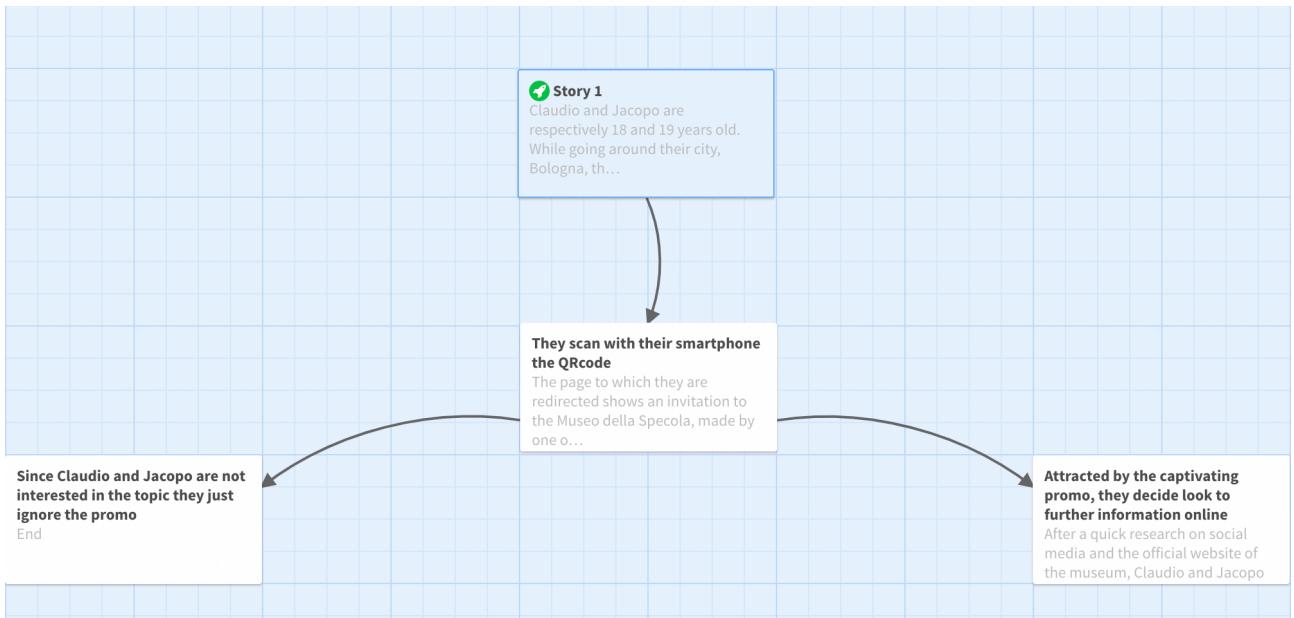
Since our main goal is to attract young people to astronomy enhancing the exhibition, we chose as our leading cognitive focus **Meaningfulness-Emotions-Empathy**. The idea is to entertain the visitor giving him/her a more digital and amusing experience of the museum. An important stress is given to historical empathy, that is the process of cognitive and affective engagement with historical figures to better understand and contextualize their lived experiences. This is achieved by the “digital presence” of some of the historic characters that explain part of the visit “directly” giving the visitor the feeling of crossing temporal boundaries. This permits to create in the user a state of wonder that is also called enchantment and that entails surprise and pleasure. Enchantment is also generated by emotive engagement that requires action-oriented activities that pushes to do things, embodied meaning-making and inspirations that lead to doing. There are several modalities in order to generate inspiration. Among these, in the activities we designed we exploited humour. As a matter of fact, the speech part of our characters was written with an entertaining aim other than educational, for this reason we decided to give to it a comic streak.

Cultural and economic goals

The primarily goal of *The stars' law* to bring teenagers closer to astronomy and in particular to the *Museo della Specola*. The aim is therefore to educate them in a field that is actually not deeply analyzed in schools and at the same time entertain them. In fact, the main idea is to let them live an inspiring and surprising experience that will increase their cultural background in an amusing way. Our project did not start with an economic intent. However, if it achieves all previous goals the financial benefit will be unavoidable.

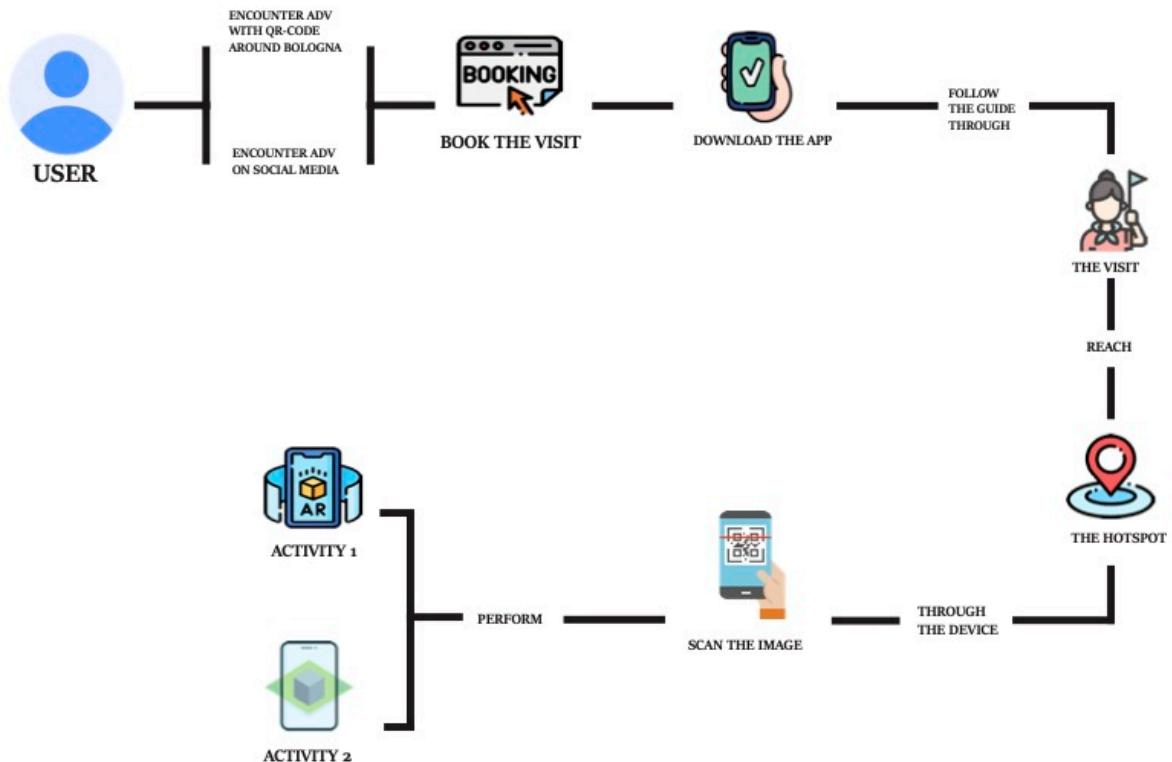
DEVELOPMENT

Twine Story



Story 2

User experience diagram

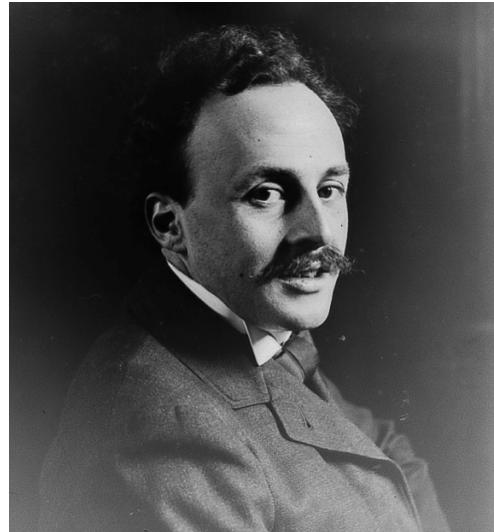


We developed a project in order to enhance the exhibition of the *Museo della Specola* in Bologna. Since the teenagers are the target audience that less spontaneously visit the museum, we designed some digital features that could engage them. The standard visit organized by the museum include a guided tour through all the rooms; we decided not to revolutionize totally the already existent organization. In fact, we simply added some activities in the typical exhibit.

ACTIVITY 1. The first activity consists in an augmented reality (AR) application in which an historical character (meaningful for the topic) narrates a brief humoristic biography that gives to the visitor an historical overview. To start the experience the visitor will be asked to bring his own earphones in order to see the video on his/her own, without disturbing other people. However, the museum will also have head phones to provide.

After visiting the museum, we identified three fundamental figures: *Guido Horn D'Arturo*, *Giovanni Battista Guglielmini* and *Maria Clara Eimmart*. Each character can be seen in a specific room:

A. Guido Horn D'Arturo: Guido Horn D'arturo Room;



B. Giovanni Battista Guglielmini: Turret Room ;



C. Maria Clara Eimmart: Globe Room;
(Since there are no photos of Maria Clara Eimmart we decided to put this poster that should represent her considering that is dating back to 1693)



The user will see each character by pointing his/her device (smartphone/tablet) to the chosen spot told by the guide. The character will appear on the screen.

ACTIVITY 2. Since the evolution of the scientific instruments through the 18th and 19th century is the main topic of the museum, the second activity we designed is focused on these last. We selected three cultural heritage objects: the multi-mirror telescope by Guido Horn D'Arturo (**A**), the astrolabe (**B**) and the map of Matteo Ricci (**C**). Using the same application, visitors point the camera of their device on the target image present near the instrument and for each object something appears:

A. In the standard guided tour when this hotspot is reached the guide shows a picture of the HET telescope, currently the largest in the world with mosaic optics. This technology is the one ideated by Guido Horn. In fact, he predicts in the latest articles published on his magazine "Column" the possible further applications of his mirrors. For this reason, we decided to digitalize this part of the guided tour by showing virtually the image of the modern employment of the invention.

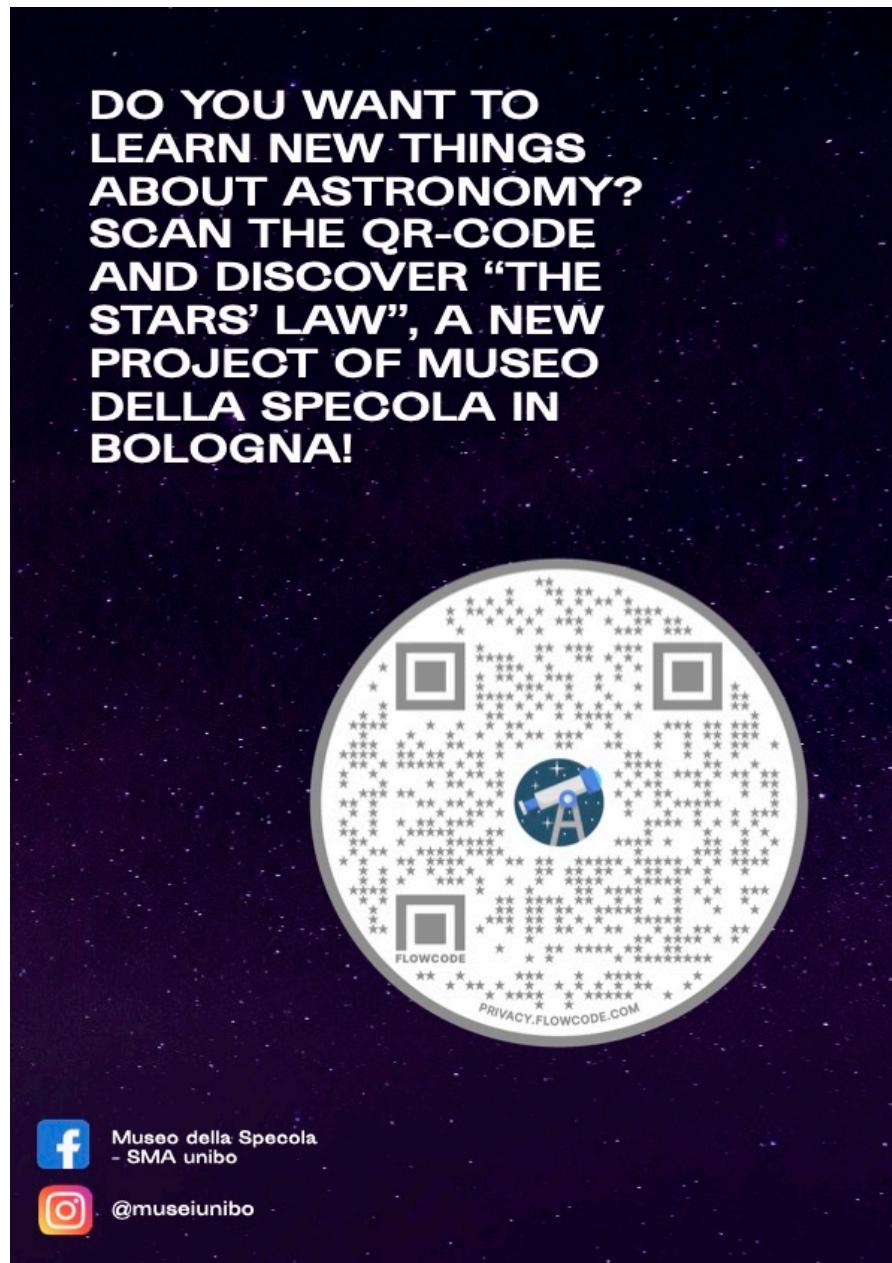
B. The astrolabe is an ancient astronomical instrument that was a handled model of the universe. It was used in order to observe and calculate the position of celestial bodies in a specific date and time. This gave us the inspiration for this activity. In fact, after the scanning of the photo in the hotspot the user by clicking on a button will be redirected to this [NASA](#) page. This initiative of NASA permits to the user to select a precise date and month and shows him/her a picture of the universe in that moment. This picture is captured by the Hubble Space Telescope that was launched into orbit on April 24th of 1990 and since then it explores the universe 24 hours per day taking sharp pictures of stars, planets and galaxies.

C. The map of Matteo Ricci, called "*Mappa geografica completa di tutti i regni del mondo*", is a geographic map of the world. It was drawn up in 1602 in Peking for the Japanese court. Since this map was created before the setting of the prime or Greenwich meridian we can see at the centre of Ricci's map the Asia. Obviously, this was not the right structure of the globe map also because Australia was not discovered yet. For this reason we thought it would have been interesting to show the comparison with the updated one.

Promo

In order to promote our project, we thought to place all around the city of Bologna advertising posters containing a QRcode that redirects to a captivating invitation to go visit and have the pleasure of meeting our three characters. This idea came to our minds for two reasons:

- The first was after knowing from the personnel of the museum that lot of citizens does not even know the existence of this museum.
- The second was because the young generation spends a lot of time hanging around the city so this is an easy way to reach them.



Flyer that will be positioned in different places of the city of Bologna.



Interactive pdf the user will download after the scanning of the QRcode that will redirect him/her to the website of the museum.

The image above is just a prototype of the actual pdf, in fact the human shape that we add will be replaced with the one of the three historical figures pictures. This is a sample of the Guido Horn D'Arturo, all the other personalities' related pdf will be based on this example.

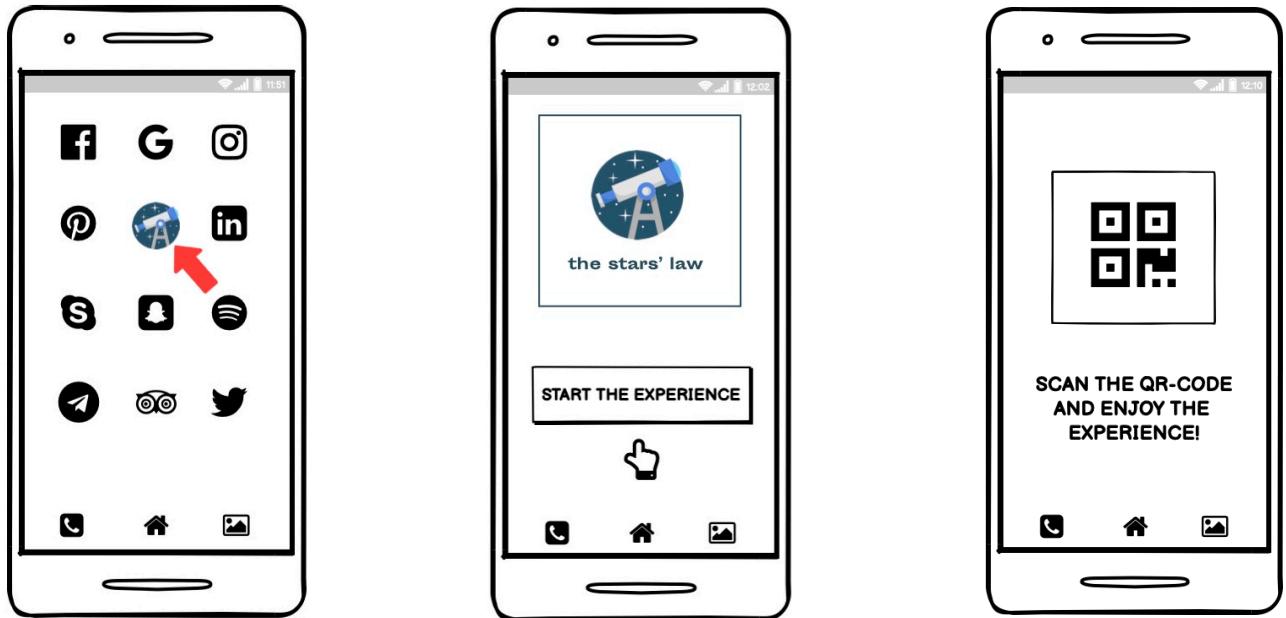
Foreseen workflow

ACTIVITY 1: As we said before this is an augmented reality (AR) activity; for AR is meant the phenomenon of adding virtual elements into our physical reality. In other words, it is the process of overlapping images, texts or sound on top of a real object. The devices needed could be smartphones or tablets that thanks to an app show the altered version of reality. We decided to use AR instead of Virtual reality (VR) because we thought it was the most creative modality to express the contrast between the ancient and the modern world and give an historic contextualization. Moreover, VR requires advanced instruments, such as headsets, controllers and sensors that are much more expensive than a smartphone and a tablet.

The first step is the making of the application. The development of an application for mobile phones or tablets should be designed for all the different operating systems. Examples of cross-platform AR development software are Unity, Wikitude, and ViroReact. There are two broad classes of AR apps: marker-based and marker less. The first uses a designated marker to activate the experience such as QR-codes, logos, or product packaging. These last must be distinctive and recognizable for the camera to be easily identified in any environment. The second instead of being tied to a marker is based on geometry. The AR scans the real environment and places digital elements on a recognizable feature; this is often used in gaming or live events. In our project we decided to use a marker-based approach using specific marker images. The AR softwares mentioned above permit to create directly an application as we have done with Unity for the Activity 2. It is clear that the more advanced is the application the more knowledge is needed so for this task it could be useful to hire an application developer. Typically, the implementation takes around 200 hours and 5000/10000 euros depending on how it is advanced, the scope, team and timeline involved. There are two main paths to follow for the development of an application that are:

- hiring a development team that implies high costs, troubleshooting, low expertise and additional HR strings attached;
- hiring an AR development App company;

Application prototype



For what concerns the videos showed to visitors we opted for the employment of real actors. This choice was made in order to emphasize even more the ambivalence between virtual and real. In addition, this gives the illusion to be in authentic contact with the historical figure accentuating the historical empathy. Green-screen method is used in which a green screen represents a backdrop against which footage is shot to later be superimposed over a separately filmed background in a visual effects process called “chroma keying”. The green-screen is usually made of synthetic stretchable nylon spandex but any bright green fabric can be used although with varying results. A fundamental advantage of this method is that it is not so expensive; it is easy to find a green screen for any kind of budget from the most professional to the costless one made by your own. Another necessary instrument would be a videocamera; even in this case everything depends on the budget and the effect needed but it is possible to have a good result even without the most professional tools. Finally, there is the post production work that can be made with a lot of different applications that are often for free. Some of them are: Adobe After Effects, Camtasia or Movavi. Below the photos of the three environments, we chose for our characters.



Hotspot Guido Horn d'Arturo



Hotspot Maria Clara Eimmart



Hotspot Giovanni Battista Guglielmini

This activity was not implemented by us for the lack of the necessary instruments and professionals.

Speeches

As we stated previously, we wanted to add a humanistic trait to each character. For Guido Horn D'Arturo we decided to give him a conceited and confident attitude. As you can see he seems to be in a rush and to underestimate the knowledge of the public in front of him. On the contrary, for what concerns Giovani Battista Guglielmini he is more a bashful and insicure personality. Finally, we decided to "draw" Maria Clara Eimmart as a daydreamer character, that seems to be lost in her own world made by astronomy and art.

A. Guido Horn D'arturo:

"Benvenuti! Per gli ignoranti di voi che non lo sapranno, mi chiamo Guido Horn D'Arturo. Il perché di questo nome? Andiamo veloci... Guido piaceva a mia madre, Horn cognome ebreo che mi causerà non pochi problemi, ma di questo parleremo più avanti e D'Arturo, gli storici direbbero che nel 1921 l'ho aggiunto in onore di mio padre ma dal mio egocentrismo vi svelo che deriva dal nome della stella più luminosa della costellazione del Boote. Il mio curriculum

è di tutto rispetto. Sono nato a Trieste e dopo aver studiato a Graz e Vienna matematica, fisica, astronomia ho conseguito la laurea in filosofia con una tesi sullo studio dell'orbita della cometa 1889 IV. Poi vi ho allietati in Italia di nuovo con la mia presenza nel 1903; qui ho lavorato in diverse città da Trieste, Catania, Torino, Roma fino ad arrivare a Bologna dove ho ottenuto l'incarico di direttore dell'Osservatorio e non solo, ho ottenuto anche la cattedra di insegnamento di Astronomia. Come vi ho anticipato prima però, le mie origini ebraiche negli anni '40 non erano esattamente ben viste, sono comunque stato più fortunato di molti altri. Il mio incarico è stato retrocesso per circa cinque anni, poi sono tornato a lavorare qui ma ammetto che ormai la mia passione per l'Astronomia era stata fortemente intaccata. Spero che la guida sarà abbastanza preparata per potervi dire il perché, vi anticipo solo che gli Americani hanno praticamente rubato una delle mie intuizioni più brillanti. Vi lascio ora, sono stanco di ripetere sempre le stesse cose, vi lascio alle mie incredibili creazioni che parleranno per me!“

English version:

Welcome! For those of you who do not know me, my name is Guido Horn D'Arturo. Why this name? Let's go fast.... My mother liked the name Guido, Horn is a Jewish surname that will cause me several problems but we will talk about this later and D'Arturo, historians would say that in 1921 I added this surname in honour of my father but I will reveal you that it derives from the name of the brightest star in the Boote constellation. My resume is respectable. I was born in Trieste and after having studied mathematics, physics and astronomy in Graz and Vienna I graduated in philosophy with a thesis on the study of the comet 1889 IV's orbit. Then I have gladdened you again with my presence in 1903; I worked in Trieste, Catania, Turin, Rome until I arrived here in Bologna. Here I got the position of director of the Observatory, and I became a full professor of astronomy. But... as I have told you my Jewish origins were not well seen in the forties. My position was demoted for about five years, then I came back here to work but I admit that by then my passion for astronomy had been severely affected. I hope the guide will be prepared enough to tell you why, I just anticipate that the Americans have practically stolen one of my brightest insights. I leave you now, I am tired of repeating the same things repeatedly, I am sure that my incredible inventions will speak for me!"

B. Maria Clara Eimmart

"Bentrovati amici delle stelle, io sono Maria Clara Eimmart sono una disegnatrice e astronoma tedesca. Devo tutte le mie infinite conoscenze sull'astronomia e sull'arte a mio padre... grande uomo.... Ma torniamo a noi. Dall'osservatorio privato che proprio lui.... uomo magnifico... fece costruire ho iniziato le mie osservazioni del cielo e poi, sola soletta con la mia candela, riproducevo su questi cartoncini blu ciò che i miei occhi vedevano e la mia mente registrava. Quanto sarebbe stato più facile avere uno di quegli aggeggi che avete in mano voi ma ai miei tempi i pastelli erano lo strumento più avanzato di cui potevo disporre. Tra il 1693 e il 1698 ho realizzato 350 disegni delle fasi lunari, una delle mie più ricche raccolte

intitolate "Micrographia stellare phase lunar ultra 300". Ho deciso di donarne 12 al mio grande amico, Luigi Ferdinando Marsili, che ne ha poi donate 10 a questo meraviglioso museo. Ora che ci penso, chissà dove avrà messo le altre due, devo chiederglielo...a presto amici stellari, ora devo andare...finirà di raccontarvi la vostra guida"

English version:

"Welcome friends of the stars, I am Maria Clara Eimmart, I am a German designer and astronomer. I owe all my infinite knowledge on astronomy and art to my father....a great man...but let's get back to us. From the private observatory that he...magnificent man...had built on his own, I began my observations of the sky and then, alone with my candle, I reproduced on these blue cards what my eyes saw and my mind recorded. How much easier would it have been with one of those contraptions you have today but in my time, crayons were the most advanced tool I could have. Between the 1693 and the 1698 I made 350 drawings of the phases of the moon, one of my richest collections entitled "Micrographia stellare phase lunar ultra-300." I decided to donate 12 of them to my great friend, Luigi Ferdinando Marsili, who then donated 10 to this wonderful museum. Now that I am thinking about it, I am curious of knowing where he has put the other two, I must ask him....see you soon, stars friends, now I have to go.... Your guide will finish to tell you about it."

C. Giovanni Battista Guglielmini

"Benvenuti, sono Giovanni Battista Guglielmini cercherò di non annoiarvi troppo ma mi è stato detto di presentarmi. Sono Giovanni Battista....ah no l'ho già detto, andiamo avanti, che dire sono un fisico e religioso famoso per...beh famoso...comunque ciò che mi ha portato qui è stato il mio esperimento svolto nel 1790 che fu una delle prime prove meccaniche della rotazione terrestre. Il primo tentativo è stato eseguito proprio qui, in questa torre. Alla base dei 272 scalini che immagino con fatica avete percorso feci praticare un'apertura per prolungare fino a 29 m la caduta di un grave dalla sommità di questa torre. Non so se ne siete a conoscenza, ma del resto perché dovreste, ma lo effettuai nottetempo per evitare che il passaggio di carri interferisse nella caduta dei gravi. Non so se fu proprio grazie a questo esperimento, ma a quanto pare così dicono, questo provò la rotazione della Terra intorno al proprio asse. Cos'altro dirvi...non so... ah ho ripetuto l'esperimento anche dalla Torre degli Asinelli e la maggiore altezza di quest'ultima ha confermato ancor di più ciò che volevo dimostrare. Adesso, credo di avervi annoiato abbastanza... vi lascio alla bellissima vista della mia amata Bologna"



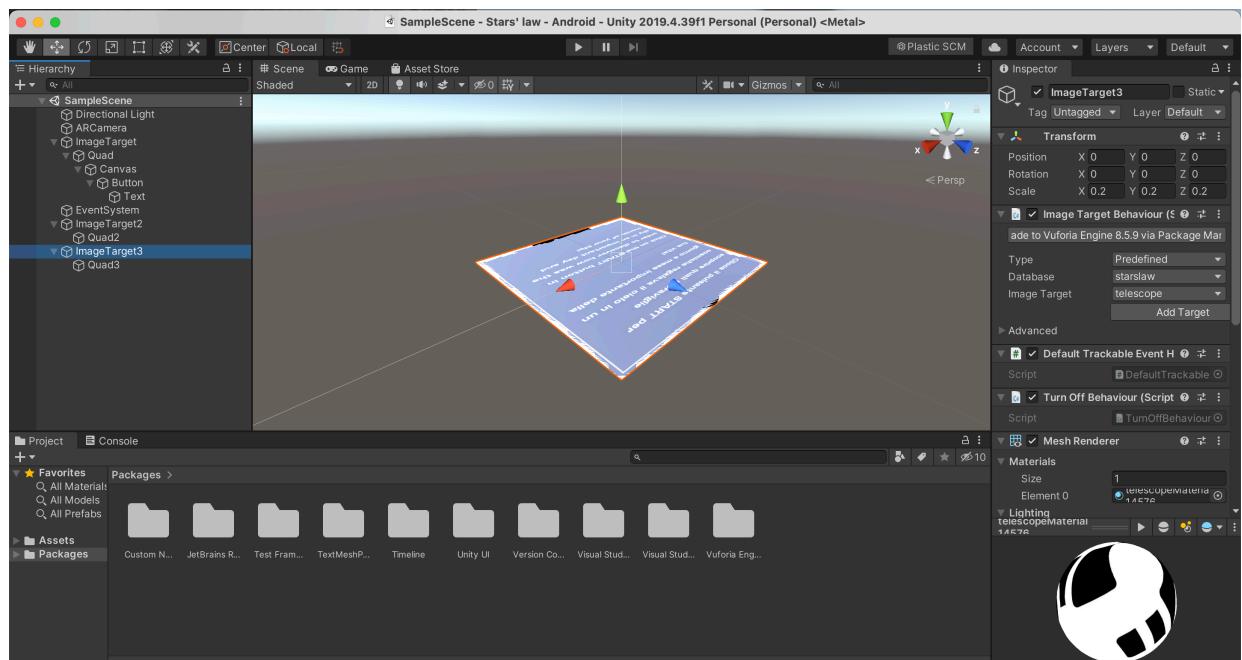
English version:

"Welcome everyone, I am Giovanni Battista Guglielmini. I will try not to bore you, but I was told to introduce myself. I am Giovanni Battista... oh no I've already said it, let's go ahead, I am a physicist and religious famous for...well famous.... however, what brought me here was my experiment carried out in 1790 which was one of the first mechanical tests of the earth's

rotation. The first attempt was made right here, on this tower. At the bottom of the 272 steps that I imagine you walked with difficulty. I had a hole drilled to extend to 29m the fall of a grave from the top of this tower. I do not know if you are aware of it, but then again why should you, but I did it during the night to prevent the interference of wagon's passage on the falling bodies. I am not sure if it was thanks to my experiment, but apparently scientist say so, it proved the rotation of the Earth around its own axis. What else to tell you, I don't know... ah, I also repeated the experiment from the "Torre degli Asinelli". The greater height of this latter confirmed even more my thesis. Now, I think I have bored you enough.... I leave you to the beautiful view of my beloved Bologna."

In order to make more clear the concept of humor we wanted to give to the personality characters we created a demo of the Maria Clara Eimmart speech that is present in the drive we attached.

ACTIVITY 2: As well as the first we are facing an augmented reality activity. The resources needed in order to develop this work were more reachable so we actually implemented it using Unity software. We created a virtual scene in which we put three different objects. For each object created we defined a target image and a “quad”. The target image is the one the visitor will scan with his/her device while the quad is the image that will appear after scanning. For the astrolabe activity we had to add a “canvas” containing a button that redirects the user to our chosen link. Then we finalized our work with the creation of the application. As we stated before, Unity permits to create applications for any operating system. In our case the implementation was just for the android one.



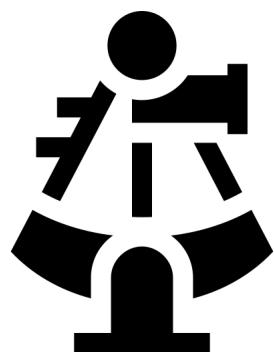
Screenshot of Unity Software

Target image for the multi mirror telescope:



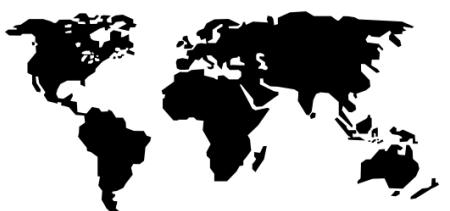
A.

Target image for the astrolabe:

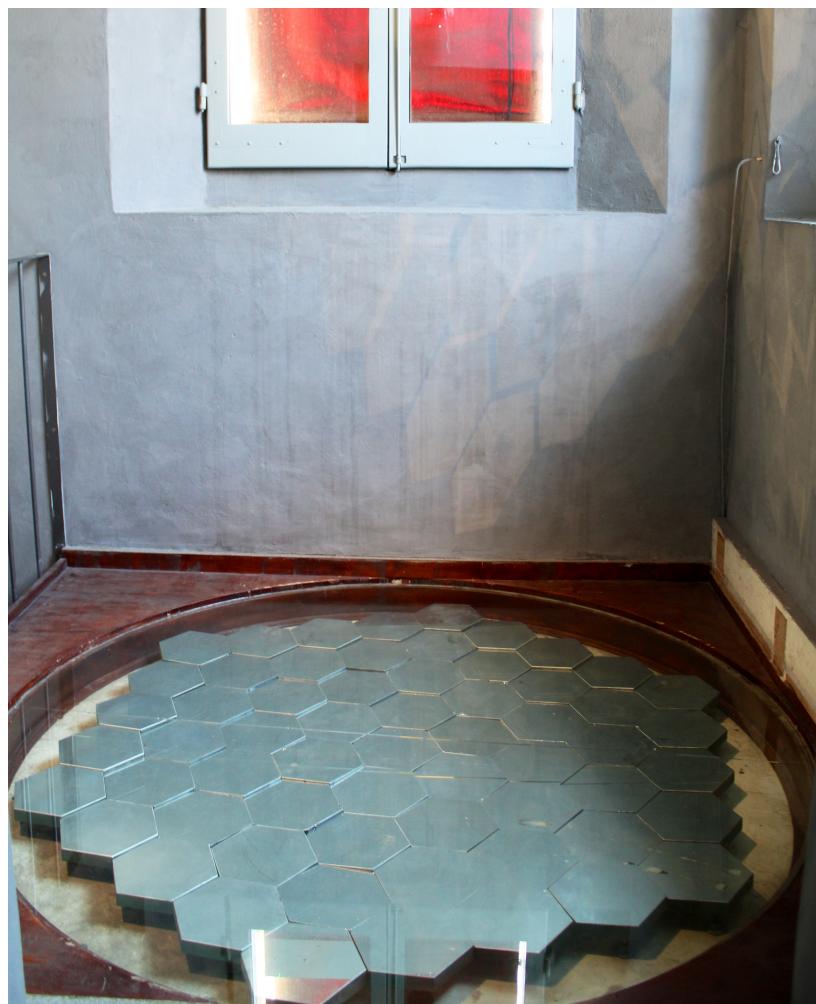


B.

Target image for the Matteo Ricci's map:



C.



A. Hotspot Multi-Mirror Telescope activity

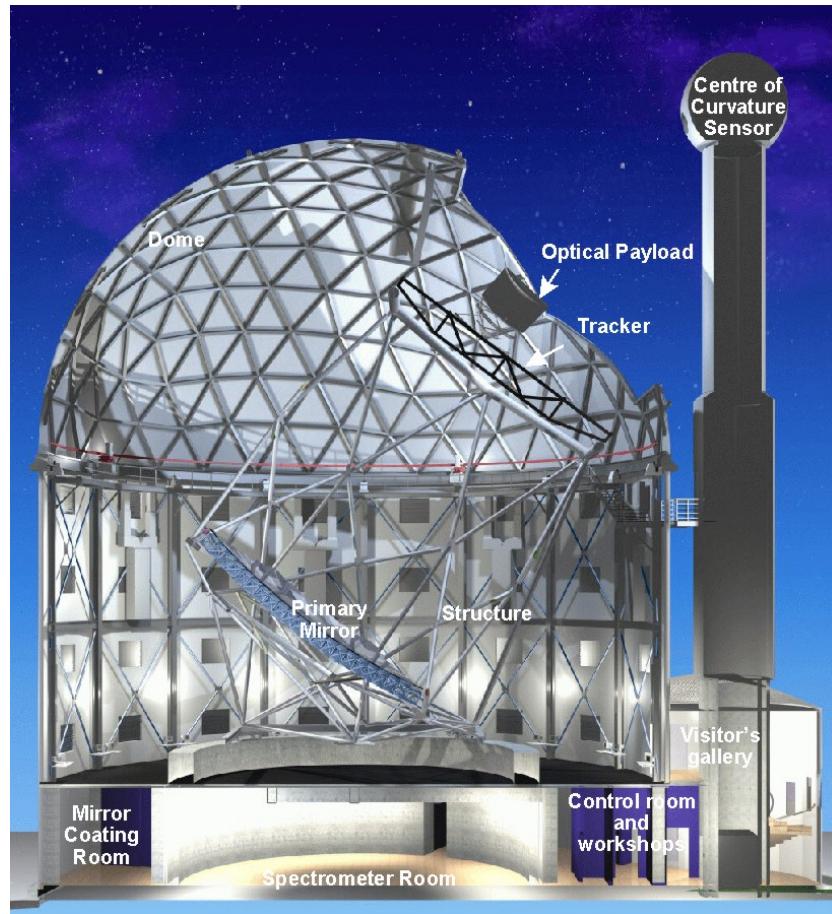


B. Hotspot Astrolabe Activity



C. Hotspot Matteo Ricci's Map activity

What the user will see after scanning the target image in the specific hotspot:



A.



B.



C.

Further development and maintenance issues

The *Stars'Law* project could be enriched in many ways, in order to maintain the work in line with the times. What can be added could be the presence of 3D model of the cultural heritage object selected for the Activity 2, instead of the 2D representation. This kind of technology is way more advanced and for this reason it requires a higher budget and a greater amount of time.

For what concerns the Activity 1 a further improvement could be the interaction between the characters; for example Guido Horn D'Arturo could have a conversation with Newton about the intuition of the reflecting telescope that gives birth to the modern instrument. The insertion of the figure of Luigi Fernando Marsili could be an interesting addition not only because of the importance of the scientist in the history of the museum but also because of the connection with Marie Claire Eimmart, with whom he could interact.

Another improvement that could be developed in the future came up while visiting the Museo della Specola, the matter is the accessibility. As a matter of fact, the building is composed of a stairs of 272 steps, this characteristic does not permit to disabled, heart sufferers and claustrophobic people to access to the museum. In order to solve this limitation the creation of a virtual museum is the only chance to not exclude any social group.

Team Roles

Our team is made up of two students: Maria Chiara Giorgi, Eliza Stuglik. Our project work is a result of our collaboration. As a matter of fact, the work was not split between the two of us but hence it was continuous team work.

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