

Leonardo da Vinci's Last Supper

Storytelling and enjoyment in new ways

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Abstract: The year 2019 marks the 500th anniversary of the death of Leonardo da Vinci, a man of genius and universal talent who lived during the Renaissance period and who is universally recognized as the complete embodiment of the spirit of his era. This is the reason why ETT S.p.A. (International Creative and Digital Industry) created the new mobile App dedicated to an undisputed masterpiece, Leonardo da Vinci's Last Supper, for the *Polo Museale Regionale della Lombardia* (Museums of the Lombardy Region). This mobile App has been designed to increase engagement with various types of audience; ETT's approach focuses on the use of innovative edutainment tools such as augmented reality. The experience offers increasing levels of information, revealing curiosities and anecdotes on the origin of the painting and its characters. The application is a visit support tool providing information directly to smartphones during every stage of the experience: before, during and after. With this instrument, visitors can really discover the secrets hidden in the Last Supper, one of humanity's undisputed masterpieces. In addition, the app offers a tourist route through 15 POIs (Point on Interest) to discover locations bounded to Leonardo all around the city of Milan and its neighbouring areas.

Keywords: *augmented reality—mobile app—innovation—history—digital storytelling*

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Introduction

The Leonardo da Vinci's Last Supper app, created by ETT S.p.A. for the *Polo Museale Regionale della Lombardia* is a software platform offering a new way to engage multiple audiences through innovative edutainment (educational entertainment) tools as AR (augmented reality). The aim of this app is to deliver information about the painting, the characters and the experimental techniques Leonardo used to create one of his undisputed masterpieces. The application is a visit support tool providing information directly to smartphones (see Fig.1), with this instrument visitors can really discover the secrets hidden in the Last Supper.



Fig. 1. Visitor scanning a painting with AR (© ETT).

Visitors cannot stand in the paintings area for more than 15 minutes due conservation reasons, so the app is designed to provide information during every stage of the experience: before, during and after.

Approach

The project aim was to develop an app that included different routes inside and outside the museum. Outside the museum users can explore Milan and the places bounded to Leonardo's life thanks to a route composed by 15 POIs (Point of Interest) scattered all around the city.

Inside the museum is where AR technology played an important role. As mentioned in the introduction visitors cannot stand in the paintings area for more than fifteen minutes due conservatives and guest's flow reasons. Besides this location cannot host informative panels so, contents needed to be delivered in some other ways.

App development stages

- Study of UI and UX
- Content analysis and elements definition (Routes, POI, Content, etc)
- Content Structure Design
- CMS Development
- Models and elements development inside the mobile app
- Flow and interactions development

- Graphic UI design and implementation
- iOS and Android Application Tests
- App release on different platform (App Store & Google Play Store)

AR integration in the native App

The application core is the possibility to discover how the Last Supper paintings were made, with this aim AR was integrated inside an iOS/Android native app.

To allow this integration several piece of software was used:

Unity: Unity is a cross-platform game engine developed by Unity Technologies, first announced and released in June 2005 at Apple Inc.'s Worldwide Developers Conference as a Mac OS X-exclusive game engine. As of 2018, the engine was extended to support more than 25 platforms. The engine could be used to create three-dimensional, two-dimensional, virtual reality, and augmented reality games, as well as simulations and other experiences. The engine was adopted by industries outside video gaming, such as film, automotive, architecture, engineering and construction.

AR Foundation: AR Foundation allows you to work with augmented reality platforms in a multi-platform way within Unity.

ARKit: ARKit allows developers to build high-detail AR experiences for iPad and iPhone. Environments captured through the device can have animated 3D virtual text, objects and characters added to them. AR scenes made by one individual are persistent and can be seen by others visiting the location later.

ARCore: ARCore is a software development kit developed by Google that allows for augmented reality applications to be built. ARCore uses three key technologies to integrate virtual content with the real world as seen through your phone's camera.

Once the software system had been defined, the painting had to be identified as a marker to allow to trigger the AR once the visitors headed the smartphone to it. Using Adobe Illustrator prospective lines and painting out lines has been drawn and importing them into Adobe After Effects it was possible to create a video that superimposed the lines on the image of the painting. AR has been used in other ways inside the app routes described below.

The history of the „Last Supper” and the app routes

In 1494, Ludovico il Moro commissioned Leonardo to decorate the refectory of the Church of Santa Maria delle Grazie, a Sforza family religious place. Traditional decorations were chosen for two walls, epitomising the Crucifixion and the Last Supper. Donato Montorfano worked on the Crucifixion, using a traditional setting. On the opposite wall, Leonardo began work on the Last Supper. The artist did not like the fresco technique, as the speed of execution was incompatible with his *modus operandi*. Colours had to be applied before the plaster dried and fixed them, but Leonardo had continuous second thoughts and was always making additions and small changes. He chose, therefore, to paint on the wall as though it were a tablet, first putting down a rather rough layer of plaster. This experimental technique proved to be unsuitable for the room's humidity and, for this reason, the painting

was in a poor state of conservation for centuries. It was restored, as much as possible, during one of the longest renovations in history, lasting from 1978 to 1999 and employing the most advanced techniques in the sector.

The Last Supper mobile App consists of a series of structured routes, diversified depending on various types of target, as described below:

Perspective and compositional choices

During the latest restoration, a hole was found in Jesus's temple. This links to the nail used by Leonardo as a vanishing point for lines of perspective (Fig. 2). Thanks to augmented reality, we can visually retrace the way the artist set perspective and compositional choices. The lines of perspective converge at the point where the hole was found, revealing how the head of Jesus is the fulcrum of the entire composition. Visitors can thus understand how Leonardo used this illusion to make real architecture coincide with a painted one.

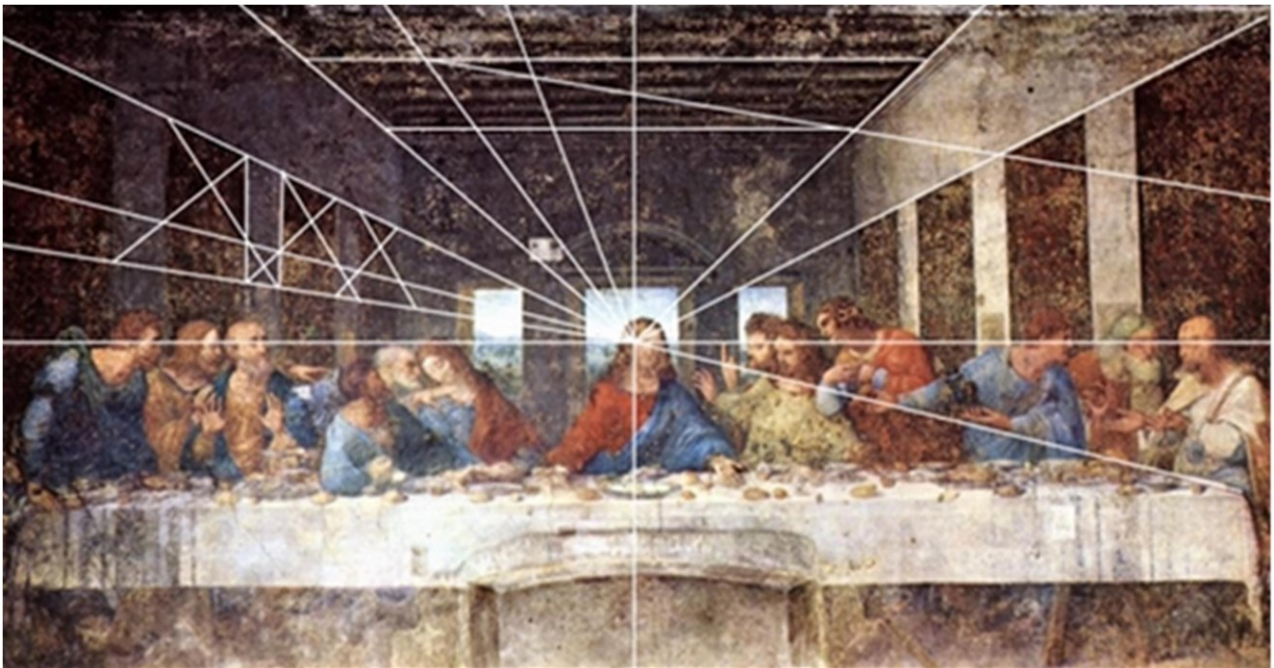


Fig. 2. *The Last Supper's lines of perspective* (public domain image [https://it.m.wikipedia.org/wiki/Ultima_Cena_\(Leonardo\)](https://it.m.wikipedia.org/wiki/Ultima_Cena_(Leonardo))).

Restorations and tormented conservation

Augmented reality takes visitors through the conservation history of the work over the centuries. Images appear gradually and are attenuated, giving a sort of Last Supper chronicle in pictures (Fig. 3)

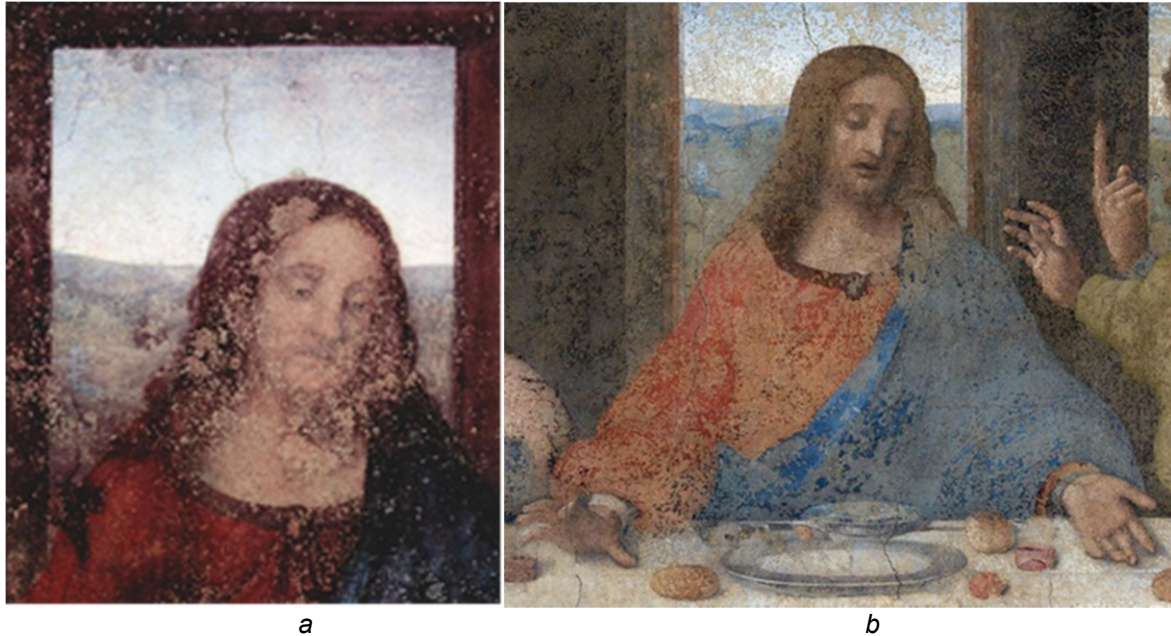


Fig. 3. a) Christ before and b) after the restoration (public domain image, [https://it.m.wikipedia.org/wiki/Ultima_Cena_\(Leonardo\)](https://it.m.wikipedia.org/wiki/Ultima_Cena_(Leonardo))).

Leonardo's studies for the Last Supper

The multimedia application shows the preparations for the Last Supper in an interactive way. Starting from the high-resolution image of the painting, touch-screen scrolling enables the user to discover the preparatory drawings of the mural painting.

The great iconographic innovation

An audio track recites the famous Gospel passage in which Jesus announces his betrayal, with an explanation of the meaning of some of the details, e.g. Judas's money bag and Peter's knife. A gallery with some pictures relating to other famous fifteenth-century last suppers helps us understand the innovative advances of Leonardo's work.



Fig. 4. Details explained through Augmented Reality (© ETT).

Leonardo's operational technique and the conservation problems

The audio/video track explains the fresco process, emphasizing the differences from the experimental technique used by Leonardo and revealing the reasons behind its precarious state of conservation.

As well as the normal visit routes, the App also includes a route for visitors with accessibility issues and another one for families with children. An audio track, automatically activated by a beacon located near a tactile model of the Last Supper, supplies a narrative for the visually impaired, increasing inclusion.

The route for families with children is of a more playful kind, with gaming to stimulate their curiosity and imagination, such as the one with which a work of art may be created by choosing the technique (fresco, tempera or oil painting) and the colours to be used. Another game leads to the discovery of the colours of the Last Supper, starting from a black and white version of the painting.

Designed this way, the application is a versatile tool involving various categories of the general public. Visitors are provided with further information also before and after the tour. Routes are diversified, taking into account different user targets and people with accessibility issues, and the multi-language content helps international visitors. Information-gathering profiles collect visitor feedback and strengthen the use of social networks as a sharing and promotional tool.

By using this tool, visitors will be able to discover curiosities and the anecdotes that lie behind one of the undisputed masterpieces in the history of art, which is included in the list of UNESCO World Heritage Sites.

Multiple Routes for Different Audiences

Alongside the main routes just described, the app is designed to deliver more content to a more extended audience. Developing the app have been identified four categories:

- Casual Visitors
- Art/History Enthusiasts
- Children
- City Breakers

Interactive Guide for everyone

As mentioned in the previous section one of the identified categories is the „casual users” one. All those users who approach the museum without a particular preparation in the historical / artistic field belong to this category. Through the interactive guide, they can learn all they need to understand this masterpiece before, during and after the visit. So the core route is design mainly for this kind of users, inviting them to discover all the others app section to know more about historical context, art techniques and the city where the painting is hosted.

“Stories” for Art Enthusiasts

For art and history enthusiasts has been created the “stories” section, this can be consulted before and after the visit to the museum and allows to deepen the historical and social context in which “The Last Supper” was created. This section is composed of 12 POIs and explores Leonardo’s relationship with the Sforza family; the methods of preparation and creation of the painting; the restoration of the work and the history of the museum. Keeping the application installed on their devices and browsing inside it, even casual visitors can approach these contents and turn into enthusiasts.

Gamification and Edutainment for Children

For children, a parallel path to the main one has been designed, which is divided into 6 POIs:

- A bit of History! Is where Leonardo in first person talks to children. He presents himself, his work and his biography in a simple and “kids friendly” way.
- Let’s discover the Last Supper! Is a section with video content that explains the masterpiece to children in a simple and funny way
- Colour Me! is the first video game in which the child will find himself having to recolour faded parts of the “Last Supper”, therefore having to observe the work carefully during the visit to find the missing colours
- Guess Who is the second videogame in this section: the works displayed at the museum will appear and the user will have the task of recognizing which ones are by Leonardo, and which from other authors.
- At the Studio allows the user to identify himself in the artist’s shoes by placing all his tools at disposal to create his own piece of art
- Puzzle is a game in which several works of art by Leonardo will be placed in front of the user, who will have to reassemble them in order to know the title.

Leonardo's Itineraries for City Breakers

In the design of the application routes, the category of city breakers was also taken into consideration: those who visit cities of art and culture around the world. Thinking above all of these, the section dedicated to the Leonardo's Itineraries were created. This function allows users to cover 15 POIs related to Leonardo's history in Milan, passing through places outside the mainstream routes of mass tourism. Obviously, this sort of guide for the city of Milan can be interesting even for the occasional user who will be able to get to know the city and its wonders. The "Leonardo Itineraries POIs are:

- Sforza Castle
- Monument to Leonardo, Piazza della Scala
- Ambrosiana Library
- San Siro Racecourse
- "Leonardo Da Vinci" Science and Technology Museum
- Mora Bassa Mill, Vigevano
- State Archive
- Cascina Bolla in via Paris Bordo
- Leonardo's Ferry Boat, Imbersa
- Leonardo's Vineyards, Casa degli Atellani
- Trivulziana Library
- Conca dell'Incoronata
- Villa Melzi, Vaprio d'Adda
- Pinacoteca Ambrosiana (picture gallery)
- Pinacoteca di Brera (picture gallery)

Using screenwriting techniques to engage the audience

The application was designed following the structure typical of cinematic narratives. Above all, Syd Field's paradigm was used, which divides the narration in three acts within each of which hooks are identified narratives that will be a pretext for the plot points.

The narration also takes shape thanks to the use of some of the narrative functions of Vladimir Propp, which the anthropologist schematized as basic elements common to many fairy tales in different cultures.

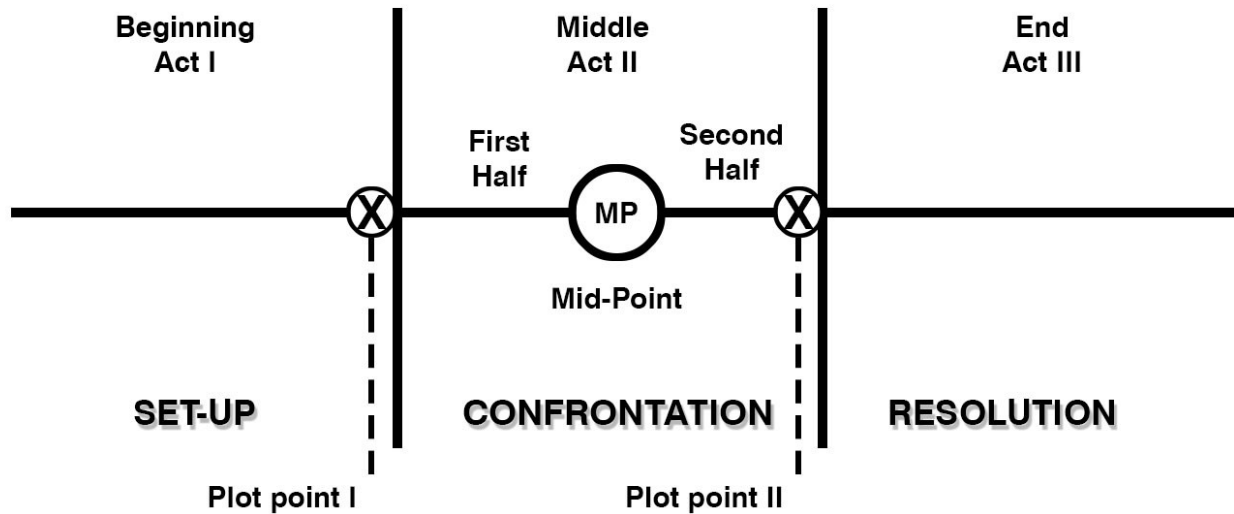


Fig. 5. The Syd Field Paradigm.

The pre-visit itinerary is therefore configured as the first act of the narration. The planning of the itinerary therefore outlines the characters of the story: Leonardo and Ludovico il Moro. The story then begins with Leonardo's arrival in Milan at Ludovico's court, at his work as a military engineer and the artist's relationship with the city.

Now to the user is offered the history of the commissioning of the work and also of the place where it was made. This is used as a narrative hook for the second act: the visit to the museum.

As mentioned, the in-museum visit route is the act II of this storytelling. When the visitor enters the Museums, they already know the historical and cultural context. During the visit visitors can discover the real main character of this narration: The Last Supper.

Once the visitor has known the man, the context and the works, he is ready to discover the impact of his work on the history of the city. Thus, the Leonardeschi itineraries serve as the third act of the narrative.

Conclusion

The challenge was to develop an information architecture that was able to deliver contents just at the right time. Allowing visitors to reach this masterpiece with awareness but at the same time, showing its secrets in the very moment they stand in front of it. The analysis tools had to be serviceable and intuitive to make visitors able to prepare for the visit wherever they are. Moreover, being the work of Leonardo universal, the app's user experience had to be able to talk to visitors from all around the world, of all ages, education level and backgrounds. ETT conceived a product that guides the visitors, before meeting the painting, into the Leonardo's world.

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