Museo Digitale Diffuso
di Leonardo da Vinci

Leonardo da Vinci
Widespread Digital Museum

Catalogue
Introduction

The digital open-air museum dedicated to Leonardo’s artistic-scientific experiments is intended to enhance the eclectic aspects of Leonardo’s activity. His brilliance is manifested in many fields, where every action he took arose from that creative process and experiential learning, which makes Leonardo still today a reference model for scientific investigation.

The digital museum in Gradisca d’Isonzo, inaugurated on the 18th of October 2019, is dedicated to some of Leonardo’s artistic-scientific experiments. The museum is a homage to da Vinci’s eclecticism and at the same time is an attempt to compare his cleverness with the tools of today’s technology. The innovative nature of Leonardo’s thoughts was the starting point and the source of inspiration for his projects. Their development, stored in his manuscript archives, was also inspired and supported by his polyhydric team: it is manifested in many fields, where every action he took arose from that creative process and experiential learning, which makes Leonardo still today a reference model for scientific investigation.

What emerges from the museum’s path were seven projects, located through the perimeter of the city, which at the time allowed him to develop cutting-edge ideas about collective
development, enhancing the urbanistic, engineering and robotic sciences of our contemporaneity.

The proposed itinerary aims at exploring Leonardo’s thinking. Given the drawings that can be admired within the city, the museum focuses on the combination of artistic imagination, visionary creativity and science that supported the birth of his inventions.

da Vinci’s projects, used in stages of an enthralling journey through the most beautiful parts of Gradisca d’Isonzo, have been chosen to touch the most disparate aspects of da Vinci’s activity: its multiple interests are applied in many sectors, from that military to engineering, passing through the most visionary, the human flight.

What brings these very different ideas together, for periods and purposes, is their design character, which is well presented within the museum’s modality. In fact, the possibility of recreating Leonardo’s drawings in a virtual way – pursued through a compromise between philological reasoning and contextual application – is an innovative way to give life to those models that were only sketched on paper.

The design aspect of Leonardo’s mentality is what allows his ideas to be alive even in our contemporary world. The ability to look at things with a critical spirit and to seek solutions to problems with an innovative approach free from conventional patterns, is more stimulating than the basis of a modern and effective method.
The museum tries to expose the challenge of achieving harmony between practical solutions and the affect of the context.

The root of all da Vinci’s intuitions is the constant studying of the natural world.

Through his life, Leonardo observed the environment, tried to intimate essence of each phenomena, there progress and the effects that follow. He reads nature as if it were a book, with great confidence in its ability to find adaptable and efficient solutions: he tries to imitate the mechanism and characteristics of animals by imitating them in his flying machines, he tries to exploit the power of water by designing dams, or to overcome it by measuring monumental bridges.

However, Leonardo’s attention is not only attracted by natural dynamics, but also by those that are more purely human, especially about war. The museum attends to represent Leonardo’s knowledge about books, which influenced significantly his way of thinking. His education allowed him to use classical models as starting point examples in order to idealize advanced military devices.

The museum, thanks to the innovation of the digital dimension, allows a real immersion in da Vinci’s world, transporting its original and avantgarde features in the contemporary world through augmented reality.

The choice of the multimedia structure of the museum updates the form of transmission of the contents, which remain faithful to Leonardo’s teachings and, at the same time, make...
the visitor an active protagonist because, as da Vinci said «the experience is the only teacher in which we can trust».

Going through the particular museum itinerary to discover the machines also grants the possibility to know the city that hosts it. Each stage is placed with mathematical exactitude in the most suggestive view of Gradisca d’isonzo, a city that perfectly embodies another of the cornerstones of Leonardo’s reflection: the binomial centre-periphery.

Gradisca and, more generally, the entire Friuli-Venezia Giulia region are by definition recognized as frontier/boarder places. Leonardo visited this area for geo-political purposes, in order to comprehend how to protect the central cities, for example Venice, using the territorial characteristics.

The power with which this binomial re-emerges in contemporary reflection, marked by the different relations between centres and outside cities, makes the discussion of current interest a useful one in the historical reading of the Leonardo panorama.

Performing this project in Gradisca allows us to highlight the dynamism that characterises the border areas and the energy and vitality that identifies them, their fundamental function for the centres and their being in all respects center, from the point of view of relationships and exchanges with the diversity that is beyond the border.

Suburbs that became centres, centres of cultural and artistic interest, places where they can compare themselves by stimulating interesting and constructive experiences for the individual citizen and for the entire community: this are the objectives of the digital museum of Leonardo da Vinci.
Leonardo in Gradisca

It is in the spring of 1500 when the Senate of the Serenissima invited Leonardo on the Gradisca territory to find a solution to the threat of Turkish incursions. From the year 1400 on, the Ottoman Empire appeared at the boarder of Friuli Venezia Giulia: since they took advantage of the control, they had over the Balcan, they started to send the cavalry on a regular basis, each time of a bigger dimension. Venice was hoping that Leonardo would think of an innovative and original solution that could develop a defense system, which would prevent the enemy’s troops of invading the territory from the eastern border.

Leonardo, even before developing the concrete idea of what could physically stop the Turks, first identifies the most suitable area on which to act: convinced that the most effective result would have been intervening in the narrowest point of the plain to exploit the surrounding natural reliefs, goes up to Gorizia conducting numerous inspections of the territory.

Leonardo was not only studying the structure of the area, but he was also interacting with its inhabitants, who were the first ones in experiencing and suffer the enemy’s invasion. The sketches of the report made for the Serenissima senate, which manuscripts are still conserved, were giving the idea of
the scheme in different layers. The project was settled to utilize both natural and human strength.

Professors Silvia Bosa, Domenico Visintini and Daniele Zucchaccia, from the university of Udine, were explaining Leonardo’s reconstruction plan during the event named “Leonardo da Vinci: il progetto del lago a Gradisca D'Isonzo contro le invasioni turche” (Leonardo da Vinci: the Gradisca’s lake project against the Turkish invasions). They emphasized Leonardo’s prediction that the Turkish cavalry would have to come across the river Isonzo and the tributary Vipacco. Da Vinci understood that this could be a strategic point in order to create an obstacle that could stop the Turkish threat.

Leonardo’s genius is not denied even on this occasion and his inventive talent is fully demonstrated in a complex and articulated project, which takes advantage of the conformation of the landscape that surrounds it. The proposal is to block the course of the two rivers with a mobile dam to allow the flooding of the Gradiscan plain.

The artificial lake would have stopped the passage of enemy cavalry, forcing it to move in a column between the hills and becoming an easy target for the artillery of the Serenissima.

In the project that Leonardo studies for the defence against enemy entry through the Balkan entrance and Eastern entrance, identifiable is the inventiveness and originality that characterises his attitude in solving problems.

Collected in the Codex Atlanticus (the most extensive collection of Da Vinci manuscripts kept in the Ambrosian Library in Milan) there are drawings and notes that testify to da Vinci’s plan. They are all concentrated in sheet 638 v, divided into six
panels, of which four collect the texts and the remaining two sketches.

Beyond the concrete feasibility of the project, what emerges from the study conducted by Leonardo is not only his great ability as a civil engineer and designer of large hydraulic and mechanical works, but also the attention and respect for the whole context that surrounds us, that nature whose laws, if interpreted with finesse, offer solutions that can be replicated in infinite contexts.

What characterises Leonardo’s genius is the transversality of his desire to know, which allows him to cross the boundaries between the disciplines by facing studies with a more extended approach. The words of the Maestro, five hundred years after his death, sound still extremely current:

*Per sviluppare una mente completa studia la scienza dell’arte, studia l’arte della scienza. Sviluppa i tuoi sensi, impara soprattutto a vedere. Comprendi che tutto è connesso.*

*To develop a complete mind study the science of art, study the art of science. Develop your senses, learn how to see. Understand that everything is connected.*

*Leonardo da Vinci*
The museum

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The museum enables to lead an immersive experience in Leonardo’s world, thanks to the innovation in the digital dimension. That allowed to maintain in the contemporaneity the original character and Avantgarde of Leonardo da Vinci’s projects.
Glider and parachute

Potrai conoscere l'uomo colle sue congegnate e grandi ale, facendo forza contro alla resistente aria, vincendo, poterla soggiogare e levarsi sopra di lei.

You will get to know the man who made his own big wings, who was trying to resist the wind in order to dominate and fly.

Codex Atlanticus, f. 1058v

Leonardo wanted the human kind to fly with the glider he constructed inspired by bats and other bigger birds wings. He was observing their structure and he reported it in his drawings from 1495-1496, which are now gathered in the Codex Atlanticus, f. 846v. Also the glider’s wings are fixed in the interior so it assures support and agile in the exterior so it produces traction, which can be bended if the pilot pulls a cable.

The project found its perfect corner on the Unità square, Leone per I Gradiscani, which became an open space after the walls were bombed in the 1800.

Approximately 10 years before the constructing of the glider, he got the idea from the birds wings structure: Leonardo understood that they can fly due to their aerodynamic strength, which sustained their bodies. This allowed the development of the parachute, he drew the prototype and took note of the
measurements, structure and materials needed: a quadrangular base which is equivalent to approximately 7 meters per side and the same height, looking like a canvas pyramid that can offer resistance to the air.

*Se un uomo ha un padiglione di pannolino intasato, che sia di 12 braccia per faccia e alto 12, potrà gittarsi d'ogni grande altezza senza danno di sè.*

*If a man has a densely woven linen pavilion, which is 12 arms per face and 12 feet tall, he will be able to throw himself over all great heights without injury.*

*Codex Atlanticus, f. 1058v*

The sign of the old wall perimeter, which can be seen nowadays in Leone square, displays the signing of the track for the da Vinci’s parachute landing.
Aerial screw

The diameter, almost 5 meters long is the dimension that Leonardo notes on the side of the Vite aerea drawing found in the French manuscript B. The big flax propeller was supposed to be activated by the strength of 4 men positioned on a wooden base.

The air movement based on the functioning of the object is nowadays used on modern helicopters: this is why the vite aerea it is considered to be the anticipating idea. Leonardo’s intuition was too modern for that time (1486-1487) and he was aware of it: manpower would not be strong enough to make the machine fly.

Spinata park, with the characteristic elliptical sign in the centre, is the perfect location to re-invoke the Vite aerea icon.
The Gradisca’s Bombard

As if it were in a real battlefield, the bombard is perfectly placed in the Parco della Rotonda, just outside the perimeter of the walls. In the suggestions he gave for “Gradisca in Frigoli” (f. 822v, *Codex Atlanticus*), Leonardo probably thinks of using this project from 1485, which is interesting from many points of view.

The drawing shows the in-depth study of the ballistics laws and the attention to the parabolic bullet path. The latter are hand-sewn and contain small bullets of gunpowder which, held together by special iron elements, are released after the explosion. The only adjustable element of the bombard is the height of the shot, which is only possible thanks to a crank which activates a screw. The drawing (*Codex Atlanticus* f. 33r) testifies to Leonardo’s ability to find a balance between art and science by giving an aesthetic presentation to a war machine.
The Porta Nuova glimpse is one of the most suggestive places in Gradisca, it allows the entrance to the village through the old walls and it stimulates the imagination of those who passes through them. Stopping at the bridge that leads to the entrance it is possible to admire the beauty of the landscape and being able to dive into a charming history. Imagination is needed when looking at the hat but also when trying to recreate the context. Its design (f 710r, *Codex atlanticus*) was always interpreted in different ways, from the attribution of links with the world of platonic solids and of esotericism as a simple representation of the typical Florentine renaissance headdress.

It is certain that da Vinci’s capacity to reproduce with great meticulousness the perspective view of the figure, charging it with a wealth of precise and accurate details. Leonardo da Vinci’s brilliance is shown in the search of a perfect representation: he drew only half of the hat and traced the other half, this way he obtained a precise final result, which was helpful for the solid construction he planned, from wax or lead.
Galata Bridge

Ponte da Pera a Costantinopoli.  
Largo 40 braccia, alto dall’acqua braccia 70 lungo braccia 600, cioè 400 sopra del mare e 200 posa in terra, facendo spalle a se medesimo.

The bridge from Pera to Constantinopoli. 
Wide 40 arms, long 600 arms, 400 arms above the water and 200 arms lied on the floor, sustaining the whole structure.

Biblioteca Institute de France, MS. L., f. 65 v

This way Leonardo thought to answer the desire of the sultan Ottoman bajazet II to build a bridge on Corno d’oro, nowadays Istanbul. The peculiarities of the structure made by Leonardo are the dimensions of the unique span (in modern measures L 240m, I 23m, H 40m) and the support of the extremities which have a swallow’s tail shape, in order to guarantee major stability.

A monumental project full of charm, an original and an innovative idea, an utopistic but pioneering architecture that is still used in modern bridges, which shows prove of Leonardo da Vinci’s brilliance.
Gorizia
Gorica
Görz
Vipacco
Vipava
Wippach
Gradisca
Isonzo
Soća
Sontig
Mar Adriatico
Jadransko morje
Adria
Gradisca’s plan

Gradisca’s fortress was ready when, during spring in 1500, Leonardo was called to study the consolidation of the defensive front at the Balcan and east entrance. In this context da Vinci developed a system that takes advantage of the Isonzo river as a defensive natural barrier in order to counteract the Turkish threat.

The study of the territorial conformation and the study of Carso were allowing to da Vinci to elaborate a plan that involves Gradisca too. Taking advantage of the river Isonzo and Vipacco, he proposed to build a mobile dam that will, once closed, allow the flooding of the gradisca’s plain, and subsequently force the fortress to position the artillery when needed. Inventiveness and design skills are the highlighting characteristics of this project, showing the original approach Leonardo da Vinci had in finding solutions to problems.
Mobile siege bridge and siege ladder

Leonardo da Vinci was not only a creatively talented but also intellectual, he thought and invented his own machines, having a solid theoretical foundation gained by investigating and learning from the past. The mobile siege bridge, designed between 1478 and 1480 and preserved in the Codex Atlanticus (f.1048r), was constructed as a war machine for the assault on the walls. Looking at the walls of the castle it is easy to imagine the movable bridge in action: the covered walkway, lowered with the help of the ropes, that leaned against the enemy walls, allowing the passing of the troops to the shelter.

About this invention, Leonardo wrote to Ludovico known as “Moro”:

*Item, farò carri coperti, securi e inoffensibili, e quali intrando intra li inimici con sue artiglierie, non è si grande multitudine di gente d’arme che non rompessino. E dietro a questi poteranno seguire fanterie assai, illese e senza alcuno impedimento.*

*I will make covered wagons, safe and inoffensive, and which intros enter the enemies with his artillery, it is not great multitude of people of arms that do not break. And behind these they will be able to follow very, literate infantry without any impediment.*

_Codex Atlanticus, f. 391 recto-a_
The Gradišca walls, erected in the second half of the 1400s by the Venetians, have seen another da Vinci’s invention: the siege ladder, whose drawings are kept inside the Codex Forster (1487-1505).

Taking advantage of the mechanism of the toothed-worm wheel to which it is connected, the ladder can be easily hoisted by soldiers to reach the enemy walls overcoming the ditch that surrounded them. The separable elements for which it is formed, ensured that the staircase can be lengthened and shortened, making it adjustable incase of any offensive fortification.
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