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LEONARDO: SHAPING THE FUTURE ...

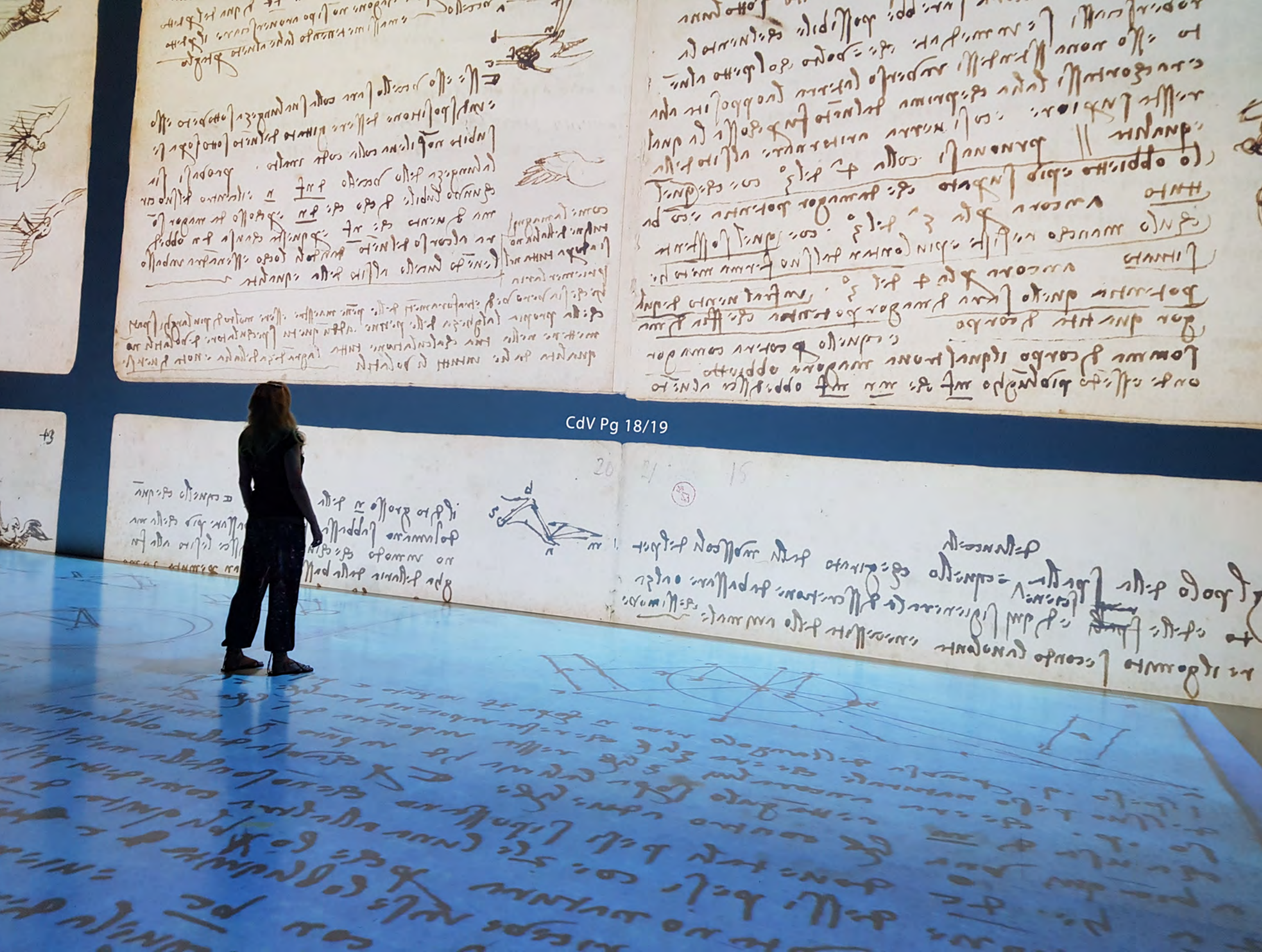
500 Years of vision (LSF-500)

*Exhibit within the framework of the
500th anniversary of Leonardos da
Vinci death (2019)*

Immersive digital exhibit, showcasing Gigapixel images in 8K, up to 28350×40160 pixels, made of over fourteen of Leonardo da Vinci's works comprising among others: the universally renowned "Portrait of an Old Man" (also known as the Self Portrait of Leonardo), the "Head of a Young Woman" (Study for the Angel in the "Virgin of the Rocks"), often described as the "Mona Lisa of drawings," the notable manuscript, "Codex on the Flight of Birds" (18 pages with studies and 167 drawings), donated by Theodor Sabachnikov to King Humbert I in 1893, containing Leonardo's drawings of flying machines, including the ornithopter, a flying machine with flapping wings, and the Hidden Portrait, Leonardo da Vinci's alleged self-portrait discovered under one of the pages of the "Codex on the Flight of Birds".



LEONARDO: SHAPING THE FUTURE ... 500 Years of vision (LSF-500 Project)
Exhibits within the framework of the 500th anniversary of Leonardos da Vinci death (2019)



CdV Pg 18/19

First presentation took place in the Deep Space of ARS Electronica Center (AEC) on the occasion of the quincentenary of Leonardo da Vinci's death and the celebration of the 40th anniversary of the Festival of Ars Electronica Center, Linz, Austria.

Project Credits: Content Design: visual narrative structure and storytelling and; Project Production Manager for the Developer & Author: Franz Fischnaller./ Project Partners and collaborators: Ministero dei beni e delle attività culturali, Istituto Centrale per il Restauro e la Conservazione del Patrimonio Archivistico e Librario (ICRCPAL), Rome, Italy; Musei Reali - Biblioteca Reale, Torino, Italy.

STORYTELLING | GIGApixel

Generating new forms of storytelling for Immersive Gigapixel Exhibits, innovative knowledge creation across the field of Art, design, science, technology, humanity with the use of advanced visualization.



8K versus
Leonardo da Vinci
Self-portrait
Orig. Size: 333 x
21mm



LEONARDO: SHAPING THE FUTURE ... 500 Years of vision

LEONARDO SHAPING THE FUTURE (LSF-500-YV Project)

Immersive gigapixel exhibit

artps_121s1

ABSTRACT

This paper presents the LSF-500-YV Project, an immersive gigapixel exhibit conceived for large scale multi viewer immersive spaces and visualization display environments, showcasing scientific macro imaging, multi-spectral acquisition and digital reproduction in scale 8K up to 1.3 billion pixel resolution never made before, of fourteen works of Leonardo da Vinci, including the Portrait of a Man in Red Chalk, also known as the Self Portrait of Leonardo, the Head of a Young Woman and the Codex on the Flight of Birds containing Leonardo's drawings of flying machines and the Hidden Portrait, Leonardo's alleged self-portrait, discovered under one of its pages.

KEYWORDS

Leonardo da Vinci, gigapixel exhibit, immersive narrative, storytelling, multi viewer immersive spaces, science, technology, arts, humanities and heritage

INTRODUCTION

<1> Project overview

An Immersive gigapixel exhibit that offers users access to a spectacular experience inside an original collection of extraordinary autograph works by Leonardo, rarely shown to the public, dating from the period between 1488 to 1515 that includes masterpieces in the form of manuscripts, drawings, studies and preparatory works, with a variety of subjects of different inspiration, that illustrates Leonardo's activity, research and visions from his youth to his full maturity in the field of the art, science and engineering.

<2> Leonardo da Vinci Collection - Historical Background - Cultural Heritage Context

The collection comprises thirteen drawings purchased by King Charles Albert on 1840 that includes the universally renowned Portrait of a Man in Red Chalk [1], also known as the Self Portrait of Leonardo, sold to the King [2] by the collector Giovanni Volpato [3], the Head of a

Young Woman [4] (Study for the Angel in the Virgin of the Rocks), often described as the “Mona Lisa of drawings” and the notable manuscript: the Codex on the Flight of Birds [5] (18 sheets with studies and 167 drawings), donated by Theodor Sabachnikov (Son of a rich Siberian merchant, and older brother of two important Moscow publishers interested in the study of Leonardo da Vinci's codes) to King Humbert I [6] in 1893, containing the Leonardo's drawings of flying machines, including the ornithopter - a flapping winged flying machine conceived by Leonardo. The collection now preserved is kept together in an underground section in the Royal Library of Turin [7], based in the Palazzo Reale complex in Turin [8], one of the most important cultural institutions of the city and part of the site of UNESCO Residenze Sabaude registered on the World Heritage List since 1997. The library currently holds around 200,000 printed volumes, 4500 manuscripts, 3055 drawings, 187 incunabula, 5019 cinquecentine, 20987 booklets, 1500 pergamene, 1112 periodicals, 400 photoalbums, and numerous recordings and maps.

<3> PROJECT DESCRIPTION - Vision, Goals, Aims

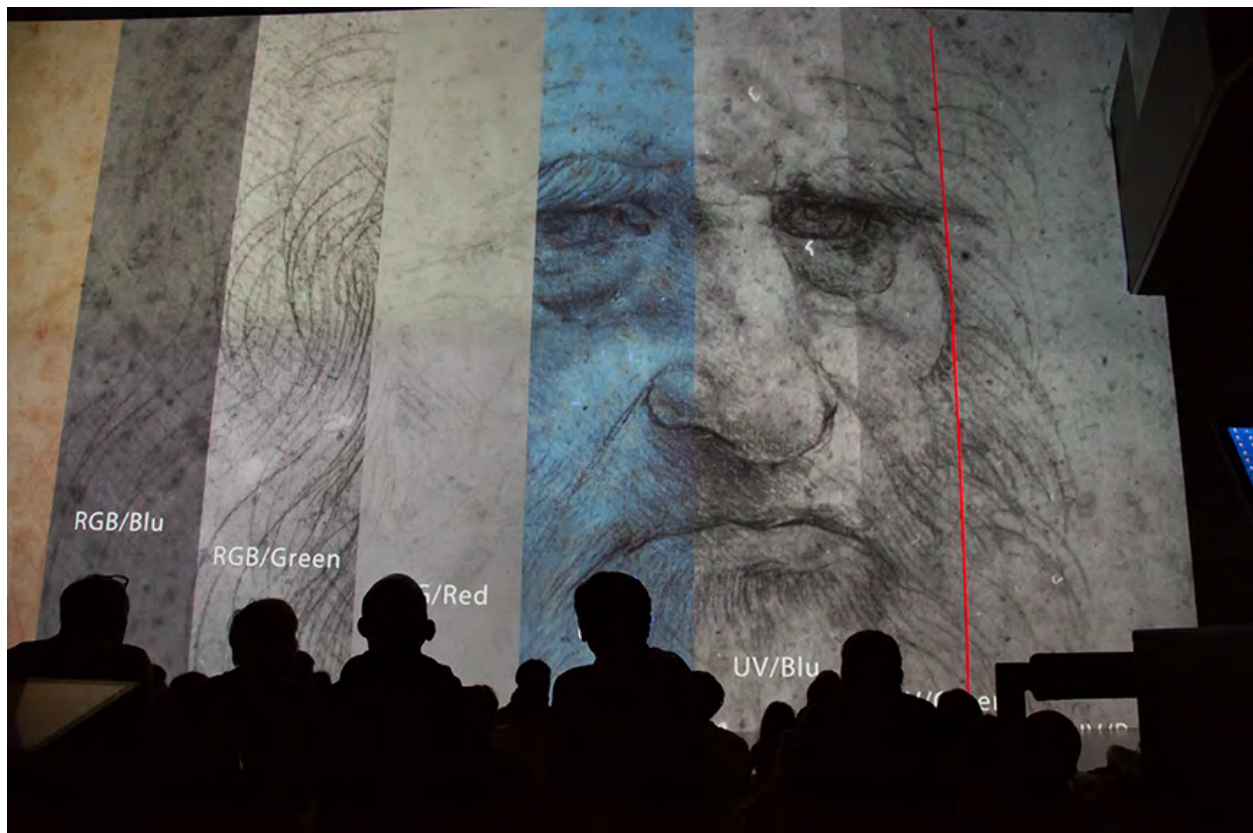


Figure 2. LSF-500-YV experience in Deep Space 8K, ARS Electronica Festival 2019. ©

F.Fischnaller. Photo: Magdalena Sick-Leitner.

A major goal of the LSF-500-YV Project is to take the visitor into a micro-macro multi perspective, an immersive journey of Leonardo's prodigious polymath's research, his style and techniques in the art, his visions, passion and curiosity for nature, his scientific studies and his driven engineering vision that has shaped our future, allowing to enter inside "one of the greatest minds in history", and bringing life to his visions after more than 500 years of his death.

The vision behind the project to empowering thrilling experimental approaches in the design and creation of novel forms of immersive narrative and storytelling (based on emotional involvement and driven engagement) in the field of the arts and digital heritage. Furthermore the author aims to stimulate users' learning and curiosity to go beyond the picture and to explore the story in/behind and around the vision of an iconic figure of the Italian Renaissance as Leonardo da Vinci.

Immersive Storytelling and Sound Art

Through LSF-500-YV visitors can embark in an immersive journey in fourteen works of Leonardo including the world's highest-resolution photograph (1,2 billion pixels) taken of the stunning Portrait of a Man in Red Chalk (original drawing size: 33,3x21,3 cm), the Head of a Young Woman, the Codex on the Flight of Birds containing Leonardo's drawings of flying machines and the polemic Hidden Portrait of Leonardo discovered under the writing on page 10 (verso), the Codex on the Flight of Birds [9], enhanced with surround sound design and specially created soundtracks. In LSF-500-YV immersive narrative, content visualization and musical composition are central elements to knit an Ariadne's thread along the narrative structure and the storytelling generating a multi-leveled flow of confluences, enhancing the user's feeling of immersion, motion and perception

Premiere exhibit and viewing format experience

The LSF-500-YV world premiere went on display on the occasion of the year 2019 that marks the quincentenary of Leonardo da Vinci's death and in concomitance with the celebration of the 40th anniversary of the Festival of Ars Electronica Center in Linz that took place in September 2019 [10]. The presentation took place in the Deep Space of the Ars Electronica Center, an exhibit space of 16 x 9 meter wall- and 16 x 9 meters floor projection, with laser tracking and 3D 8K resolution images,

User Experience Highlights

Through LSF-500-YV in the Deep Space at the museum the audience had the opportunity to see Leonardo's famous drawings and manuscripts stitched into tree, 3.6 billion gigapixel images, combined with scientific macro imaging and multispectral high definition images, ever seen of this works, with zoom-in capabilities, enabling to enlarge and observe any portion and detail of the works (zoom-in levels) for close-up examination with high brilliance and brightness, of each detail of the works.

The experience was enriched with overlays and integration of the multispectral acquisitions, RGB and ultraviolet images macro photography and X-radiography in high resolution, combined with the presentation of Leonardo's works, techniques, thoughts, vision and intriguing highlights gravitating around several of these pieces and the story of the work and the story behind the collection itself.



<4> LEONARDO'S ARTWORK

Art, science and engineering

The Portrait of an Old Man, is one the 10 famous artworks by Leonardo da Vinci [11], one of the most discussed works of Leonardo, also known as the Self Portrait of Leonardo. An icon of the history of art to which the collective imagination traces the figure of the Renaissance genius [12].

Figure 1. Leonardo da Vinci, Autoritratto, c. 1515-16 (sanguigna su carta bianca). ©Musei Reali. Photo: Alfredo Corrao. MiBAC- ICRCPAL

The Head of a Young Woman, defined by the art historian Bernard Berenson [13] as "the most beautiful drawing in the world", datable around the years 1483-1485; it is probably a preparatory study for the angel of the Virgin of the Rocks [14], a pictorial work of Leonardo whose first version is kept at the Louvre in Paris, the second at the National Gallery in London. The drawing was also identified with Cecilia Gallerani, the young

woman loved by Ludovico Sforza and represented in the painting in Cracow, Lady with an Ermine [15] (Italian:Dama con l'ermellino a painting by Italian artist Leonardo da Vinci from around 1489–1490 and one of Poland's national treasures.



Figure 3. LSF-500-YV experience in Deep Space 8K, ARS Electronica Festival 2019. © F.Fischnaller. Photo: Melinda File. Leonardo da Vinci, Busto di fanciulla.

The Codex on the Flight of Birds is a fragile document that comprises 18 folios and measures 21 × 15 centimetres created between 1505 and 1506 while he was also working on the Mona Lisa [16]. Written in specular writing, begins with an examination of the flight behaviour of birds and proposes mechanisms for flight by machines. Leonardo constructed a number of these machines, and attempted to launch them from a hill near Florence. However, his efforts failed [17]. In the codex, Leonardo notes for the first time that the center of gravity of a flying bird does not coincide with its center of pressure. The texts, the drawings, commented and exceptionally abundant, hides the project of the most advanced flying machine of Leonardo, it indicates the dimensions, the materials used in the construction, the position of the pilot, the establishment of the center of gravity, which is an indispensable element in the construction of a flying object

[18].The Leonardo da Vinci's alleged self-portrait, Hidden Portrait in the Code on the Flight of Birds, when the artist was a young man unearthed, in 2009 .The Italian scientific journalist, Piero Angela, was struck by similarities to The Portrait, in red chalk, Piero Angela, enlisted the help of art historians, Carabinieri, forensic experts and graphic artists to tease out more detail from the ghostly image. The research team used criminal investigation techniques to digitally correlate the newly-discovered sketch with the well-known portrait. They employed facial reconfiguration technology to age the drawing [19]. Carlo Pedretti [20] (1928-2018) Italian art historian considered one of the leading experts in the life and works of Leonardo, Professor of Italian art history and holder of the chair of studies in University of California , where he directed the Armand Hammer Center for Leonardo Studies , described the sketch as “one of the most important acquisitions in the study of Leonardo [21].



Figure 4. LSF-500-YV experience in Deep Space 8K I 2019. © F.Fischnaller. Photo: F.Fischnaller. Image courtesy: Elena Console T.E.A. Italy.

The others works of the collection [22] showcased in LSF-500-YV Project are: Nude studies for The Battle of Anghiari, (<https://www.gettyimages.fr/detail/photo-d'actualit%C3%A9/nude->

studies-for-the-battle-of-anghiari-c1503-1505-photo-dactualit%C3%A9/463977467), The Battle of Anghiari (1505) is a lost painting by Leonardo da Vinci, at times referred to as *The Lost Leonardo*, which some commentators believe to be still hidden beneath one of the later frescoes in the Salone dei Cinquecento

(https://en.wikipedia.org/wiki/Palazzo_Vecchio#Salone_dei_Cinquecento) in the Palazzo Vecchio, (https://en.wikipedia.org/wiki/Palazzo_Vecchio) the town hall of Florence, Italy that overlooks the Piazza della Signoria (https://en.wikipedia.org/wiki/Piazza_della_Signoria), which holds a copy of Michelangelo's David statue, and the gallery of statues in the adjacent Loggia dei Lanzi. And finally another ther works which are part of the collection and thereof integral part of the LSF-500-YV Project are : *Three Views of Bearded Head*, presumed portrait of Cesare Borgia;

(http://sauvage27.blogspot.com/2014_06_24_archive.html); *Hercules with the Nemean Lion* (http://sauvage27.blogspot.com/2014_06_24_archive.html), probably a project for a statue of Ercole ever made, twinned with that of the David that Michelangelo created around 1500); *Study of Assault Tanks Equipped with Scythes*, the terrible falcati Wagons, the war machines correspond to the unbeatable weapons promised by Leonardo in his letter to Ludovico il Moro (https://it.wikipedia.org/wiki/Carro_falcato#/media/File:Leonardo_da_vinci,_Assault_chariot_with_scythes.jpg), (ie. Ludovico Maria Sforza), Duke of Milan from 1494, famed as a patron of Leonardo da Vinci and other artists, and presided over the final and most productive stage of the Milanese Renaissance (https://en.wikipedia.org/wiki/Ludovico_SforzaAlso known as the man who commissioned the Last Supper).In addition to: *Studies of the hind legs of the horse* three studies of horses, one of which is a *studi delle gambe posteriori del cavallo*, probably preparatory work for the *Monument to Francesco Sforza* (Probably done by Melzi, his favorite student (https://en.wikipedia.org/wiki/Francesco_Melzi); *Studi di gambe virili*, studies on the front legs of a horse, *Study of the musculature of the front limbs of the horse*, *Insect studies* and *Figure at the fire and flying butterflies, with poetic commentary* and *The Virile Head of Crowned Laurel Profile*.

<5> IMAGE ACQUISITION - RESEARCH FRAMEWORK - TECHNIQUES AND METHODS

The imaging used in the LSF-500-YV Project is articulated by a complete set of high-resolution digitized images, composting, scientific macro imaging and multi-spectral acquisition, which

have been acquired and released as a result of a non invasive multi-technique investigation, an expertise and scientific analysis of an multi-disciplinary research entitled: *Leonardo and his secrets. Study, Research, Restoration*, performed by ICRCPAL's labs (Central Institute for the Restoration and Conservation of Archival and Book Heritage) <http://www.icpal.beniculturali.it/>. The research conducted by ICRCPAL' within their labs and interdisciplinary team of experts worked in synergy with diverse European institutions, research centres, scientific laboratories, universities, museums, companies, scholars, researchers and practitioners working across the field of arts, humanities and cultural heritage. In addition to experts in the field of science, operating with leading edge technologies, innovative tools, methodologies and emerging techniques for the inquiry and diagnostic of ancient heritage work, data documentation, analysis, methodologies and solutions to the problems of art history conservation. Although the studies began in February 2018 on the drawings preserved at the Biblioteca Reale di Torino and on the Codex on the Flight of Birds, the main research took place in ICRCPAL on the occasion of the 500th anniversary of the death of Leonardo da Vinci, and the 80th anniversary of its institution (June 1938) within the framework of project valorisation (studies, analysis and restoration) and the investigation was performed in works previous to restoration in agreement with the Royal Museum and Library of Turin.

Project research framework, notes and future work

Initially the LSF-500-YV Project was conceived to deliver the design of a permanent exhibit, that can also travel as an itinerant exhibit, based on Leonardo's art collection, described in this paper, which is rarely exhibited due to their fragility and the high cost to display them as per consequence. The expected outcome of this first phase was successfully accomplished. The most important direction for future development of this project (currently in progress) is to deliver the final content creation. Subsequently, in order to fulfill the ultimate goal, we plan to implement the content in the appropriate immersive viewing format and display systems for an optimal user fruition.



Figure 5. LSF-500-YV experience in Deep Space 8K, 2019. © F.Fischnaller. Photo: Magdalena Sick-Leitner. Leonardo da Vinci, Studio di insetti.