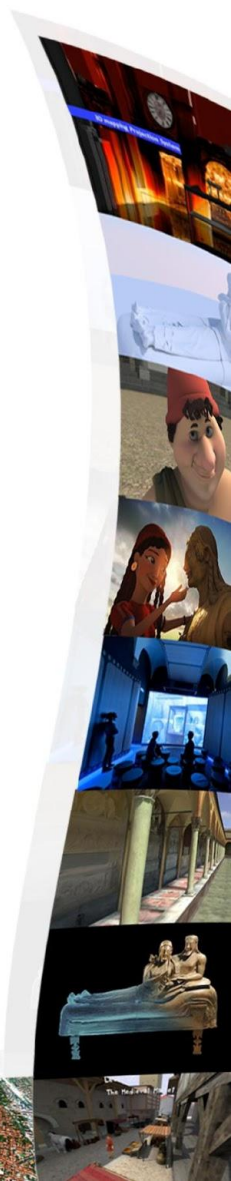


# Experiences of Cultural Heritage Digital Ecosystems between Research and Communication

**Antonella Guidazzoli**

Head of VisitLab Visual Information  
Cineca - [a.guidazzoli@cineca.it](mailto:a.guidazzoli@cineca.it)



# The Consortium



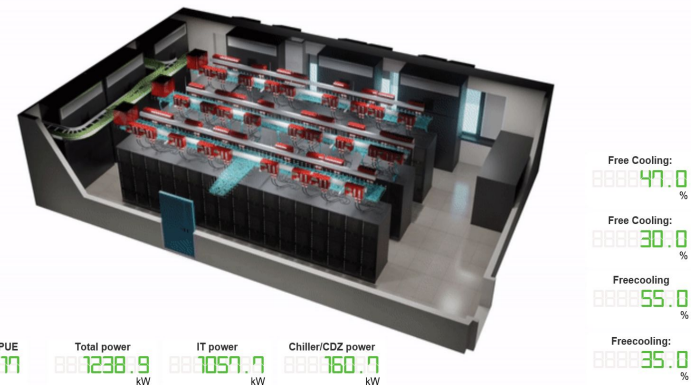
Founded in **1969**, **Cineca** is a consortium of **67 Italian Universities**

Cineca supports the whole Higher Education and Research system by **High Performance Computing systems**

Cineca provides **Information Systems** for the Italian Ministry of Education, University and Research and for the Italian academic system

**Big Data** center, **technological transfer**

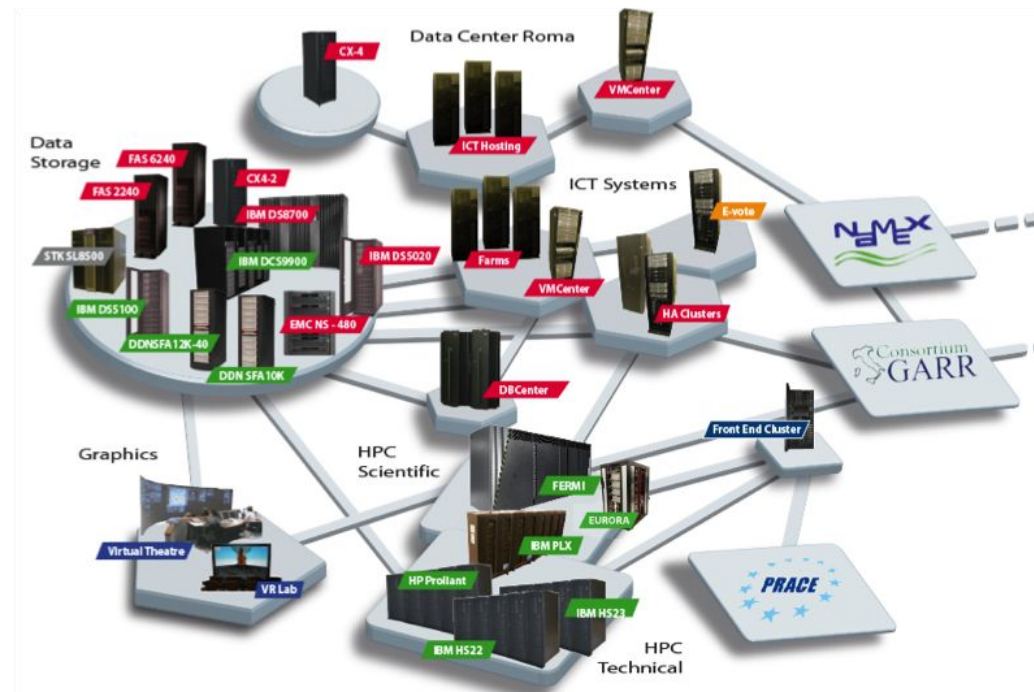
Bologna, Roma, Milano, Naples

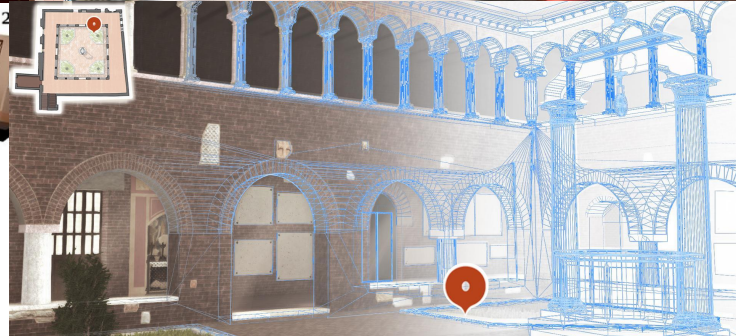
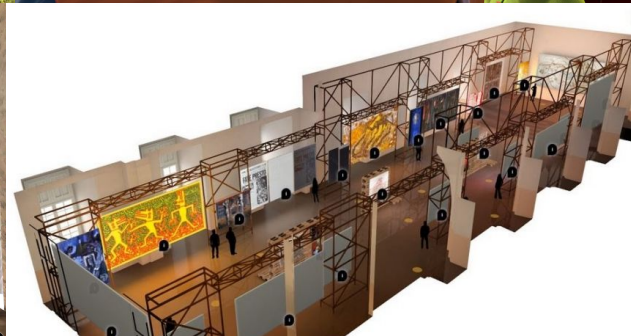
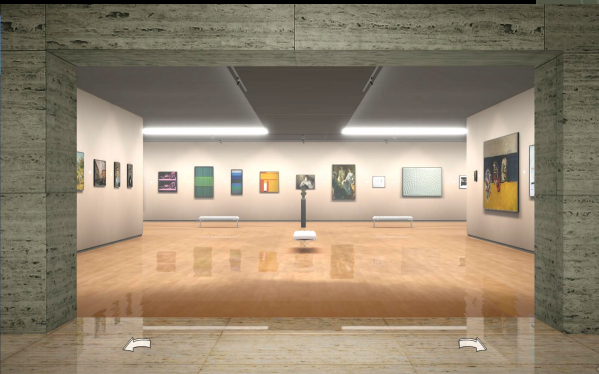


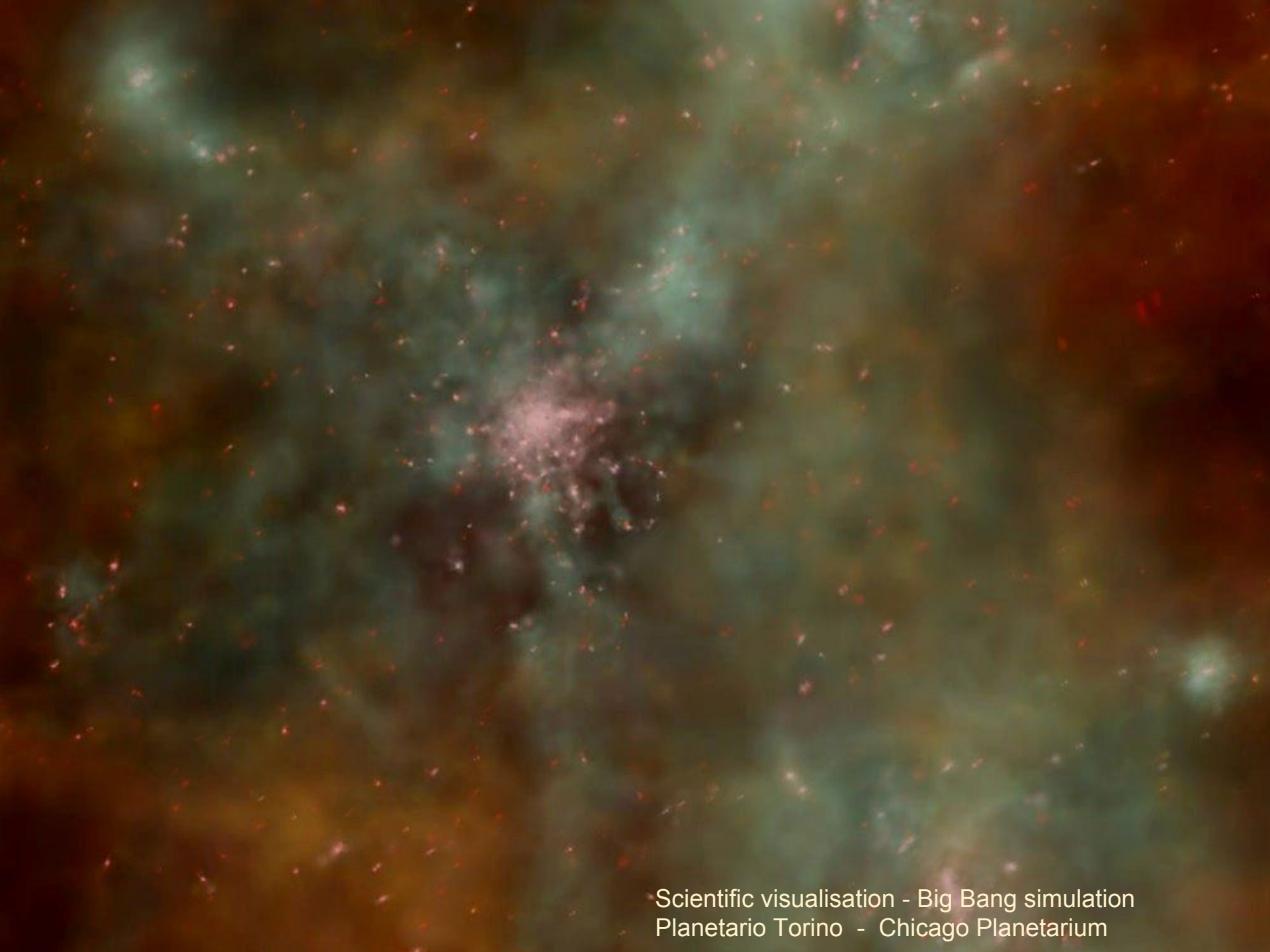
Visual Information Technology lab, [visitlab.cineca.it](http://visitlab.cineca.it)

A multidisciplinary environment grounded on **Open Source** and with **HPC Facilities**

Computer Graphics tools for Research and Communication







Scientific visualisation - Big Bang simulation  
Planetario Torino - Chicago Planetarium

# VIS.I.T. Lab mission for Cultural Heritage

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To create interactive RT applications based on 3D computers models authenticated by historians , archaeologists in order to avoid the risk of transmitting superficial or misleading cultural information

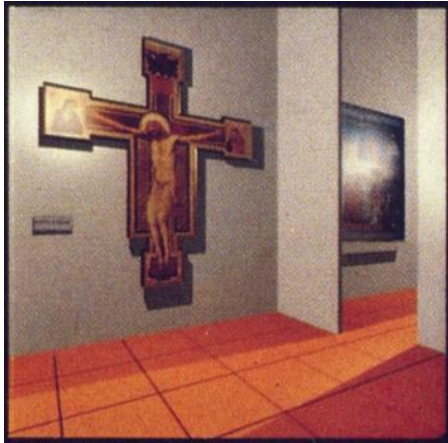
To train Phd students, architects, archaeologists, historians, computer scientists, media experts in following an interdisciplinary methodology for creating cultural VR products.



November 1999

# Giotto Crucifix 1989

---

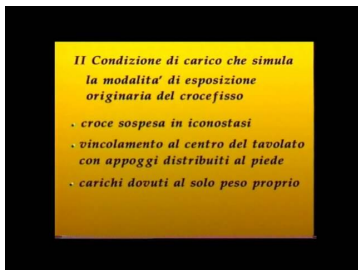


Modelling and rendering of Giotto crucifix, thanks to the first supercomputing system with vector architecture, the Cray X-MP/12

stress analysis study performed by a finite element numerical simulation

Rendering of a image simulating a possible exhibit for this artwork

## 1. ICT for Cultural Heritage



Cray User Group 1989

# Scientific Visualisation:

$$\frac{\partial}{\partial t}(\epsilon_g \rho_g) + \nabla \cdot (\epsilon_g \rho_g \mathbf{v}_g) = 0, \quad (1)$$

$$\frac{\partial}{\partial t}(\epsilon_k \rho_k) + \nabla \cdot (\epsilon_k \rho_k \mathbf{v}_k) = 0, \quad k = 1, 2, \dots, N, \quad (2)$$

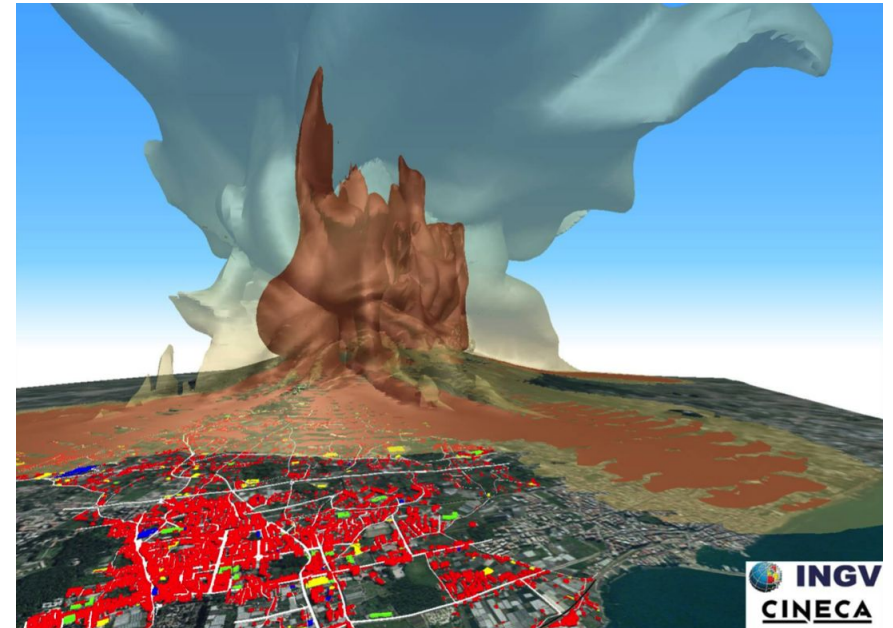
$$\frac{\partial}{\partial t}(\epsilon_g \rho_g \gamma_i) + \nabla \cdot (\epsilon_g \rho_g \gamma_i \mathbf{v}_g) = 0, \quad i = 1, 2, \dots, M, \quad (3)$$

with

$$\epsilon_g + \sum_{k=1}^N \epsilon_k = 1; \quad \sum_{i=1}^M \gamma_i = 1, \quad (4)$$

$$\begin{aligned} \frac{\partial}{\partial t}(\epsilon_g \rho_g \mathbf{v}_g) + \nabla \cdot (\epsilon_g \rho_g \mathbf{v}_g \mathbf{v}_g) = & -\epsilon_g \nabla P_g + \nabla \mathbf{T}_g + \epsilon_g \rho_g \mathbf{g} \\ & + \sum_{k=1}^N D_{g,k}(\mathbf{v}_k - \mathbf{v}_g) \end{aligned} \quad (5)$$

$$\begin{aligned} \frac{\partial}{\partial t}(\epsilon_k \rho_k \mathbf{v}_k) + \nabla \cdot (\epsilon_k \rho_k \mathbf{v}_k \mathbf{v}_k) = & -\epsilon_k \nabla P_g + \nabla \mathbf{T}_k + \epsilon_k \rho_k \mathbf{g} - D_{g,k} \\ & \cdot (\mathbf{v}_k - \mathbf{v}_g) + \sum_{j=1}^N D_{k,j} \cdot (\mathbf{v}_j - \mathbf{v}_k), \quad k, j = 1, 2, \dots, N; j \neq k, \end{aligned} \quad (6)$$



Exploris project: simulation of a subplinian eruption of the Vesuvius



# Pompeii - Casa del Centenario 2002



## 3. Research model for communication purposes

Short Paper Siggraph 2000



Poster Siggraph Asia 2011

Progettazione immersiva teatro virtuale  
Museo della storia della Citta' Genus  
Bononiae  
Rendering Apa l' Etrusco su Blender Farm  
HPC

# Parma in the Middle Ages 2007

## 4. Storytelling Emotional space, working with artists

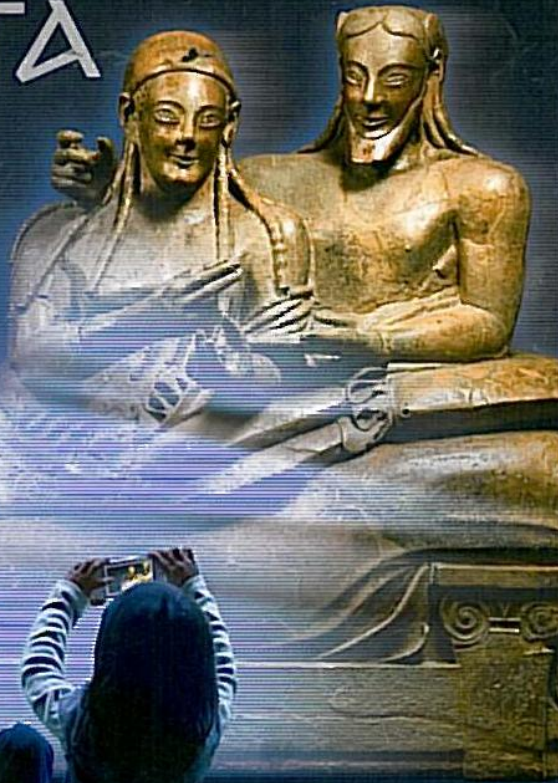


Poster Siggraph 2007

Da un'idea congiunta di Museo Nazionale Etrusco di Villa Giulia  
e Genus Bononiae Musei nella Città

# IL VIAGGIO OLTRE LA VITA

GLI ETRUSCHI  
E L'ALDILÀ  
TRA CAPOLAVORI  
E REALTÀ VIRTUALE



Palazzo Pepoli  
Museo della Storia  
di Bologna

25 ottobre 2014  
22 febbraio 2015



The twin temporary exhibition opened at  
the end of October 2014 in Bologna and  
Rome and, due to the great success, it has  
been extended until mid April 2015

more than 50.000 visitors at the Museum  
of the History of Bologna



VISIT LAB  
VISUAL INFORMATION  
TECHNOLOGY LAB  
CINECA

# Architectural video mapping and holographic system



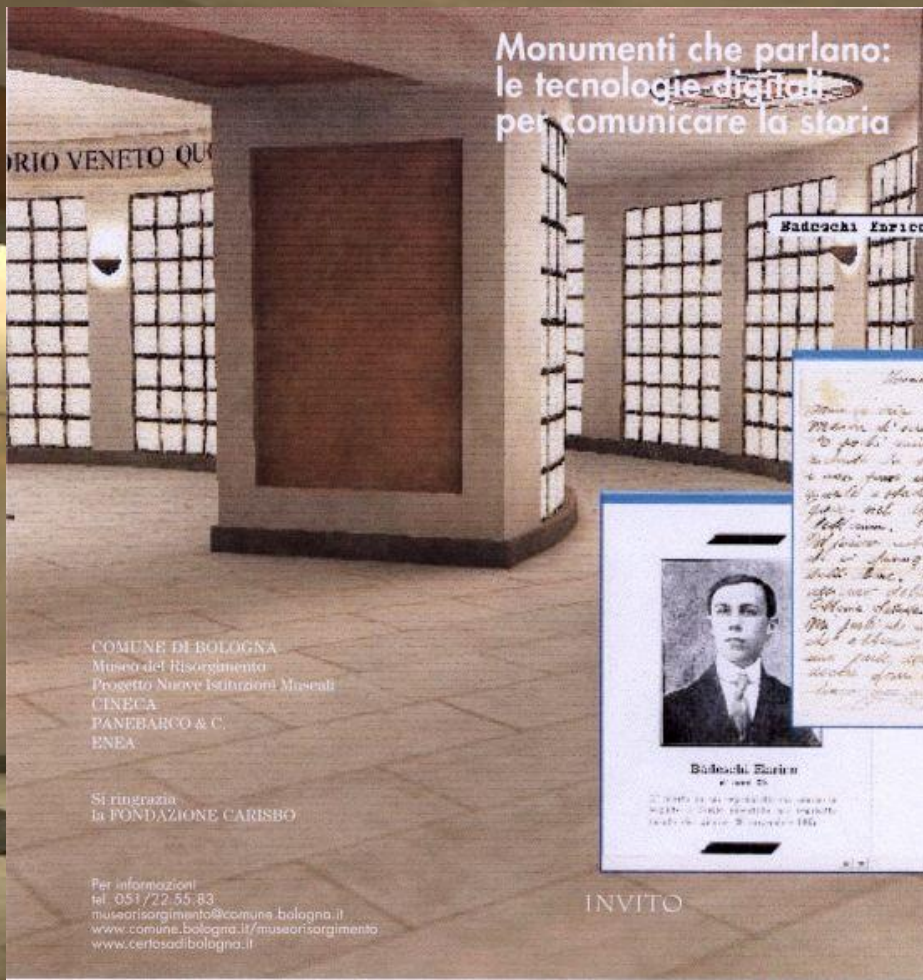






The Sarcophagus Clone by Giugiaro





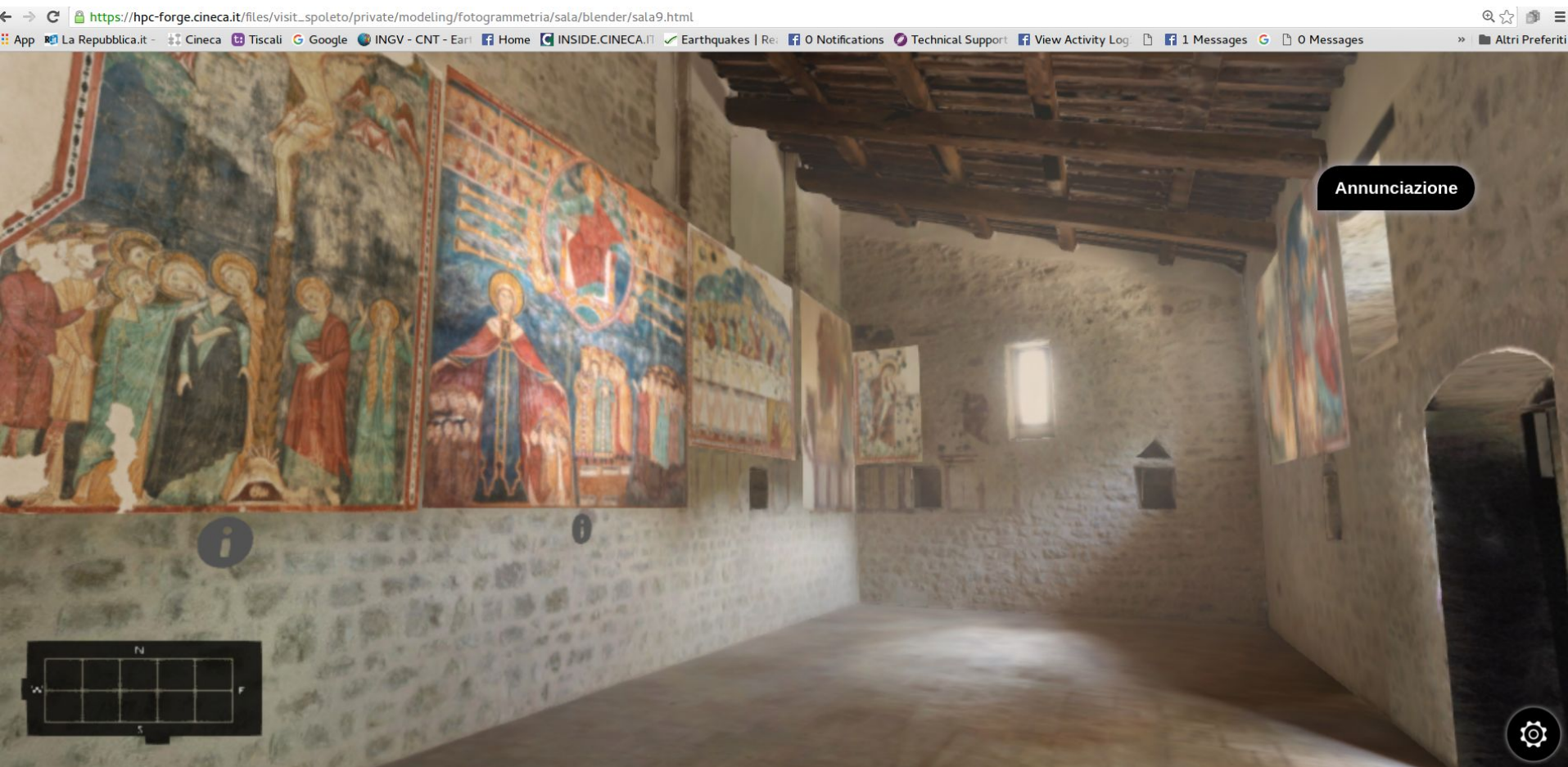
5. Databases and  
virtual environments  
a good match for  
communicating  
complex cultural sites

## Talking Monuments Certosa Virtual Museum

Siggraph Educators 2004

<http://memoriadibologna.comune.bologna.it/>

# Spoletto Le Palazze Università' Urbino



Ricostruzione navigabile su Web da fotogrammetria della sala monastero Le Palazze e ricollocamento degli affreschi attualmente conservati presso un museo di Spoletto Blend4web

[https://hpc-forge.cineca.it/files/visit\\_spoletto/private/modeling/fotogrammetria/sala/blender/sala8.html](https://hpc-forge.cineca.it/files/visit_spoletto/private/modeling/fotogrammetria/sala/blender/sala8.html)

Data Streaming Progress:

Data will be automatically updated between 14 minutes and 58 seconds

Update Now

BACK

CLP

# Browsing Historical Pompeian Watercolors through a Google Earth-based Meta Interface: Luigi Bazzani's Exhibition



6. GIS interface , cloud approach

**OPEN DATA**COMUNE  
DI BOLOGNA

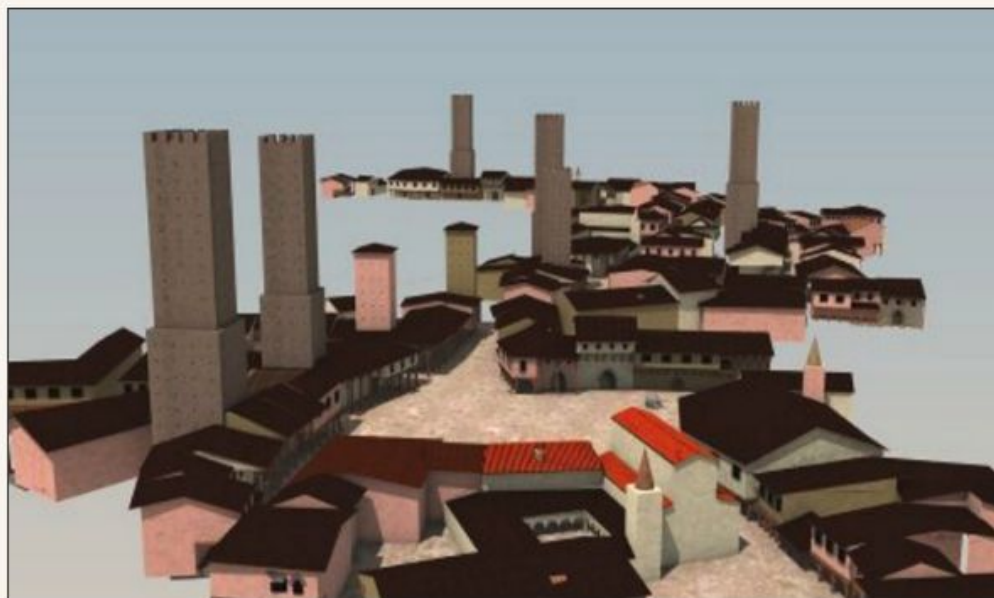
BETA

# 7. open data , digital asset re use

[Home](#)[Progetti](#)[Dati](#)[Casi d'uso](#)[Linked data](#)[Contatti](#)

Home

## Modelli 3D



Bologna 3D Open Repository è il progetto dedicato alla raccolta, condivisione e uso didattico dei modelli 3D della città e della storia di Bologna. L'iniziativa nasce dalla collaborazione tra il **CINECA** e il Comune di Bologna.

I modelli blender v.2.49b sono stati creati utilizzando il corto d'animazione "**APA l'etrusco**", il cartone animato che racconta le avventure di APA, un etrusco "doc" che nel cartone animato ha la voce e la contagiosa simpatia di Lucio Dalla.

APA l'etrusco, realizzato dal Cineca per il Museo della Storia di Bologna di Genus Bononiae, ha vinto il **premio per miglior mediometraggio** nel 2012, nella sezione audiovisivi del Festival Internazionale dell'Audiovisivo, nei Musei e nel Patrimonio Culturale (International Audiovisual Festival on Museums and Heritage - FIAMP) ed è visibile al **Museo della Storia di Bologna**.

## Progetti Open Data

- > [Open CZRM BOLOGNA](#)
- > [Bologna Open Rock](#)
- > [Bologna Open Biblioteche](#)
- > [Bologna Open Scuola: refezione scolastica](#)
- > [Bologna Open Sport](#)
- > [Bologna Open Portici](#)
- > [Bologna Open Map](#)
- > [HUB - Human Ecosystems Bologna](#)
- > [Anagrafe pubblica delle Elette e degli Eletti](#)
- > [Bilanci del Comune di Bologna](#)
- > [Modelli 3D](#)
- > [Open Welfare](#)



ACQUA



VINO E SALE



OLIO E GRANO



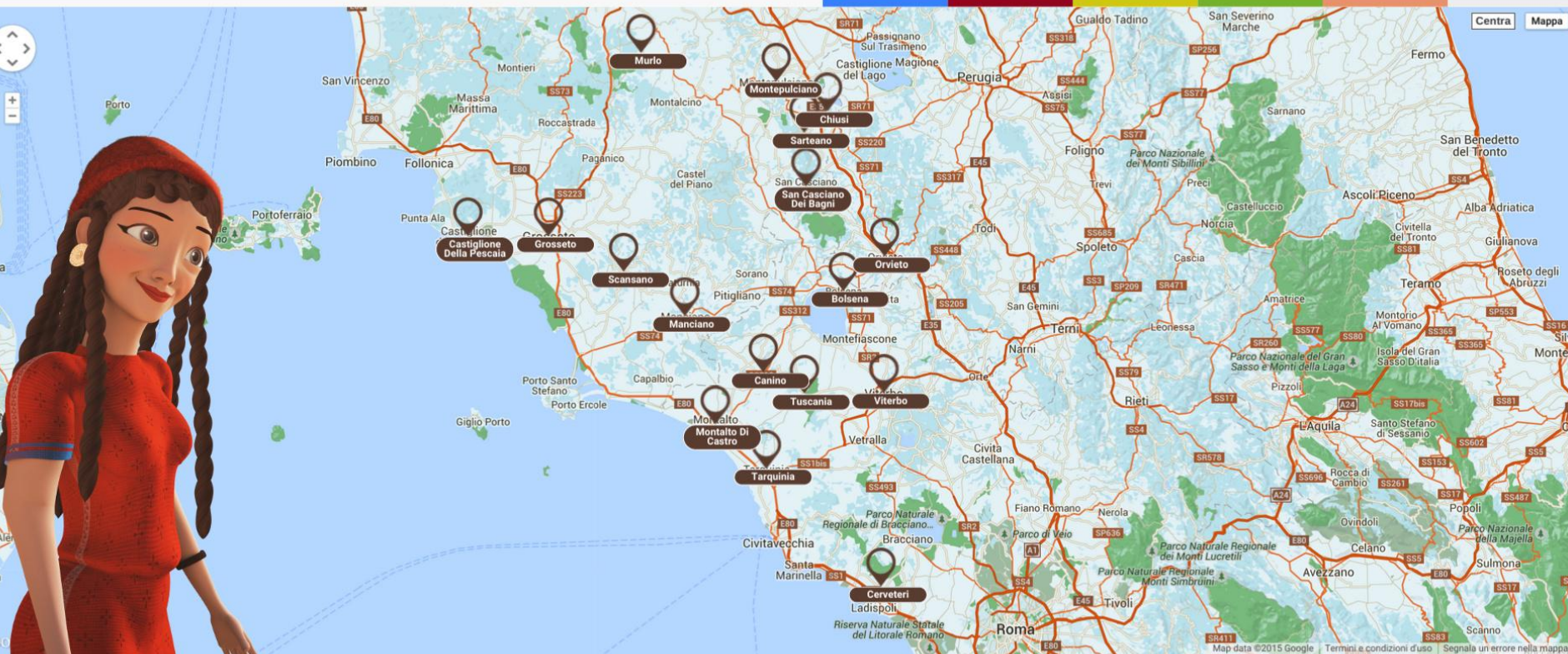
BOSCHI



LE MOSTRE



IL PROGETTO



Scopri il tuo viaggio tra gli Etruschi  
LAZIO UMBRIA TOSCANA

## 8. cross - media approach

<http://www.experiencetruria.it/>

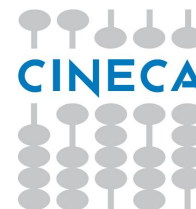
Scarica la mappa degli itinerari in PDF



VISIT LAB  
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TECHNOLOGY LAB  
CINECA



Reggia di Caserta





皇家欧洲

## 意大利卡塞塔王宫和园林 ♡

Caserta, 意大利

卡塞塔王宫和园林位于那不勒斯以北，由意大利18世纪伟大的建筑师路易吉·万维泰利依据波旁家族查理三世的意愿所建，结合了凡尔赛、罗马和托斯卡纳的建筑风格。卡塞塔被视为意大利巴洛克风格的一次胜利，而且远远走在时代的前面。在方圆11英亩范围内，宫廷花园中的水池、喷泉和瀑布排列成一条直线，向远方延伸到目力所及之处，形成“望远镜效应”。

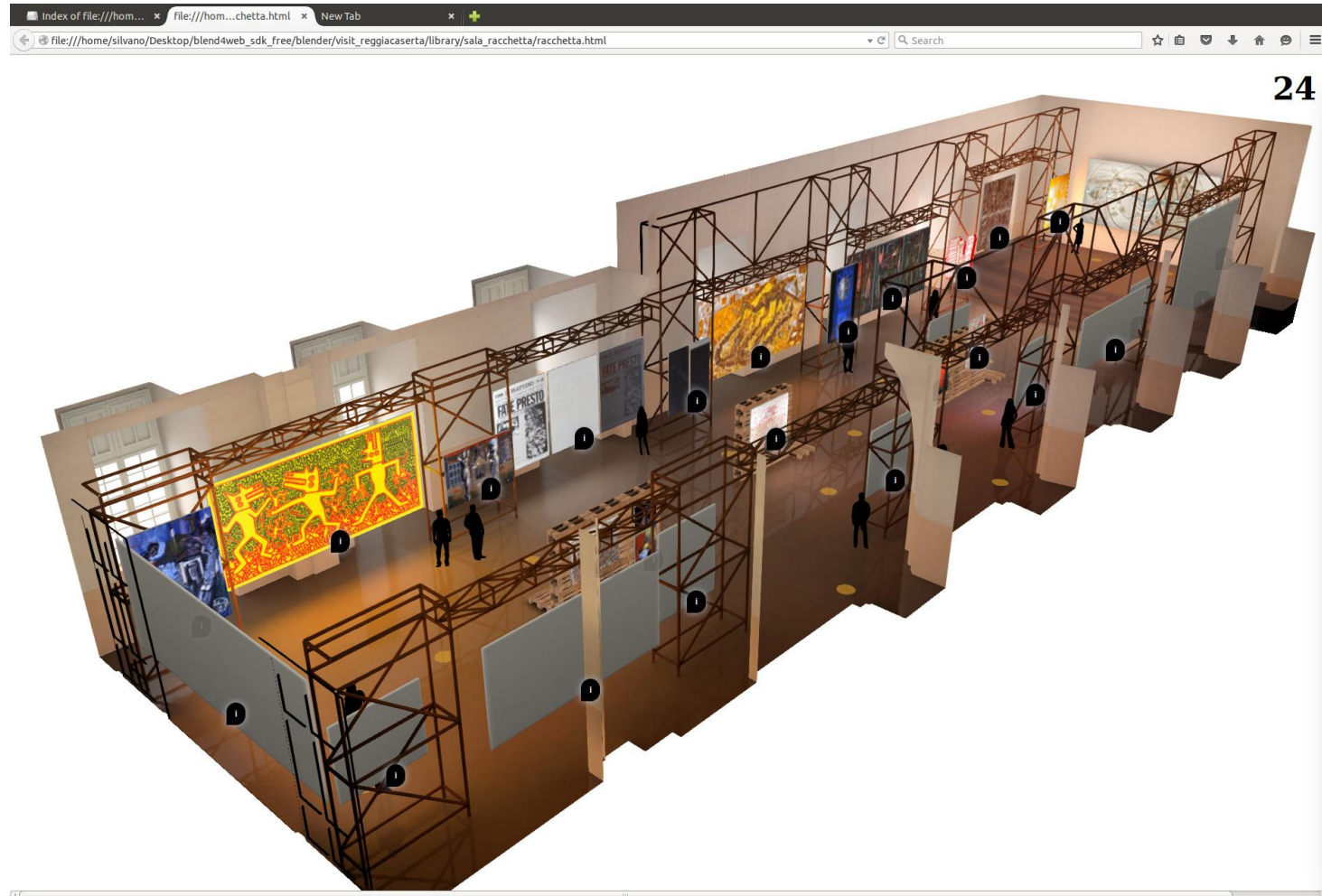
← 概览 景点 体验 传说 照片 访问

<https://visitworldheritage.com/en/eu>

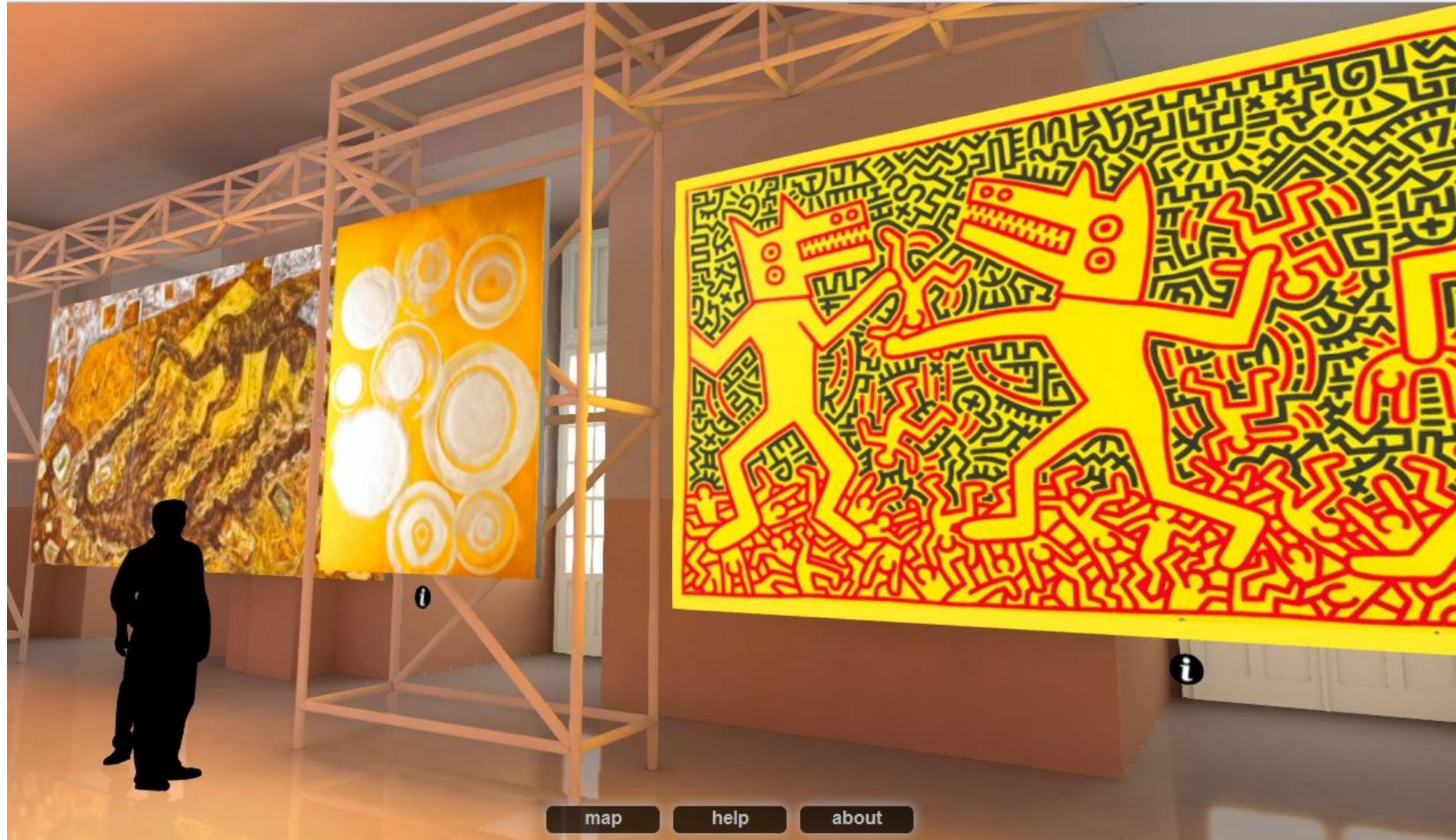
<https://visitworldheritage.com/en/eu/sites>

# Virtual Exhibitor Terrae Motus

## 3D web online



[https://hpc-forge.cineca.it/files/visit\\_reggiacaserta/public/demo\\_01/terremotus/terremotus.html](https://hpc-forge.cineca.it/files/visit_reggiacaserta/public/demo_01/terremotus/terremotus.html)



[https://hpc-forge.cineca.it/files/visit\\_reggiacaserta/public/demo\\_01/terremotus/terremotus.html](https://hpc-forge.cineca.it/files/visit_reggiacaserta/public/demo_01/terremotus/terremotus.html)

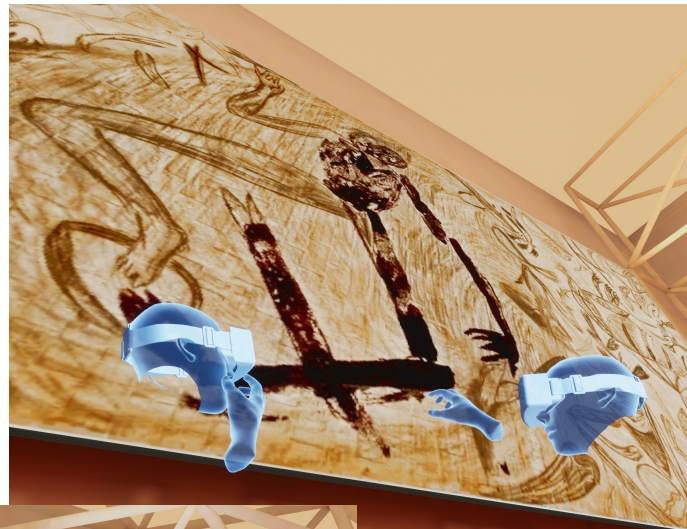


# Virtual Exhibitor Terrae motus



SOCIETY è un progetto finanziato dalla Commissione Europea nell'ambito del programma Horizon 2020. Grant agreement n. 819090





ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



# Computer Graphics for museums

Storytelling with the use of 3D animated characters is, instead, still limited for Museums, because of its high costs and challenges

The use of videos as a communicative tool in a museum context pushes the visitors in a passive stance; however, storytelling allows an emotional involvement of the viewer and can trigger the visitors' interest, empathy and imagination, leading them towards a successfully entertaining experience.

All these elements were kept well in mind while developing “Il piccolo Masaccio e le Terre Nuove”.





*Il piccolo*  
**MASACCIO**  
E LE TERRE NUOVE

# Museo delle Terre Nuove



MUSEO DELLE  
TERRE NUOVE



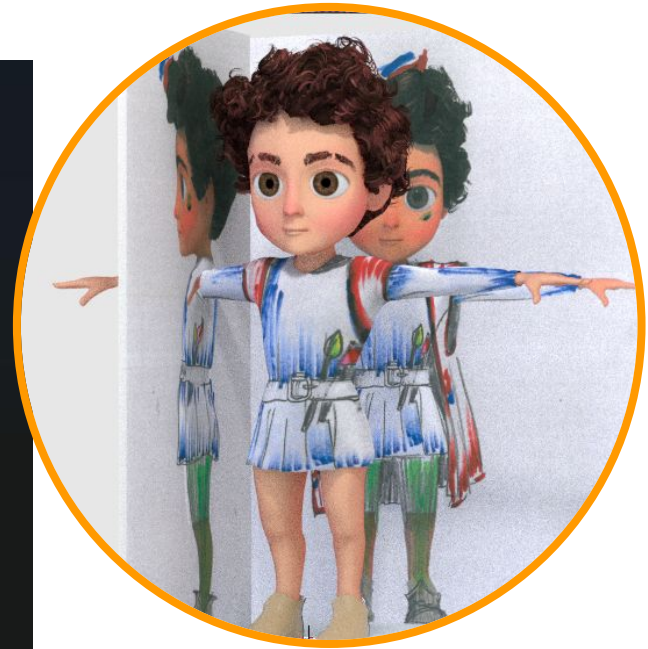
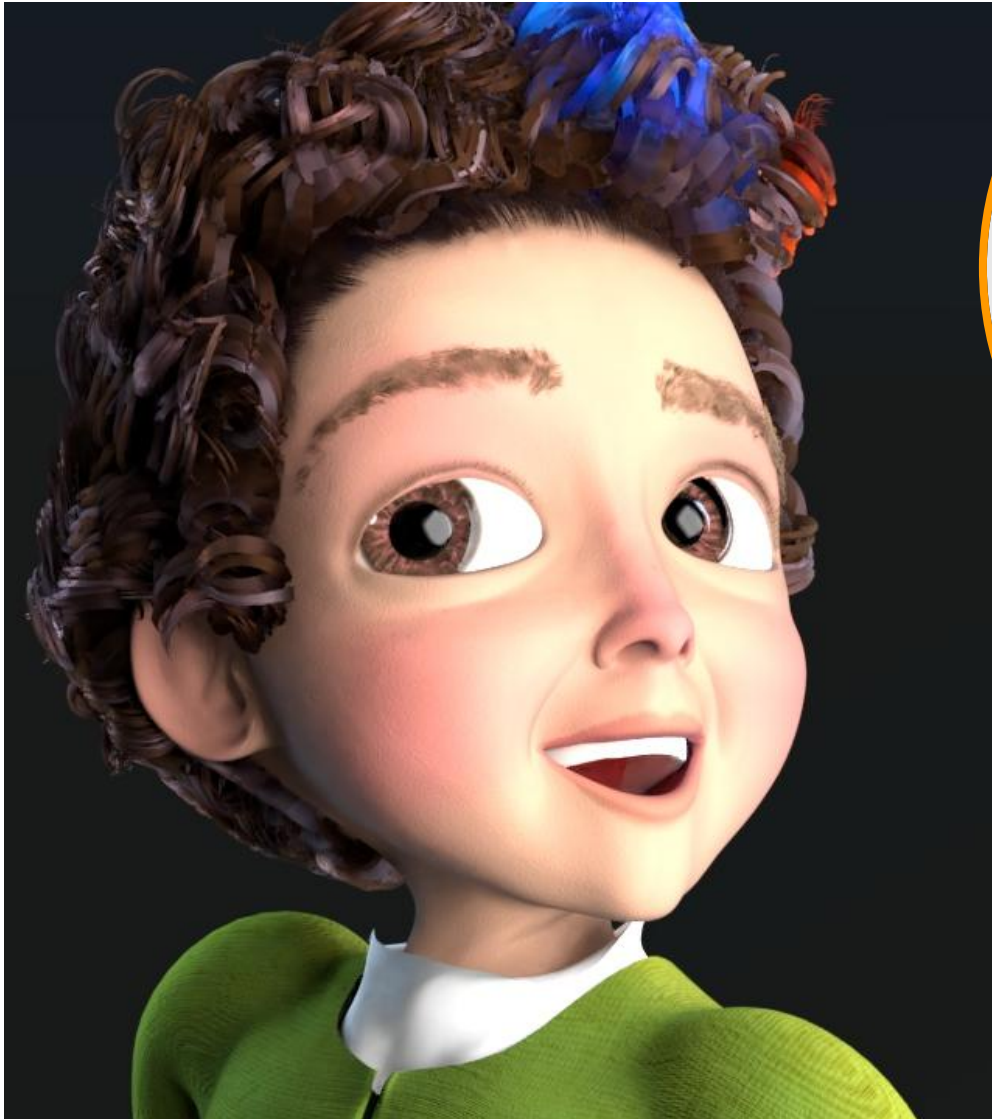
Museo delle Terre Nuove - Palazzo d'Arnolfo, San Giovanni Valdarno (AR)

<http://www.museoterrenuove.it/>

# Museo delle Terre Nuove



# Il giovane Tommaso



# Il Vicario



# Mixed Media



Live shots



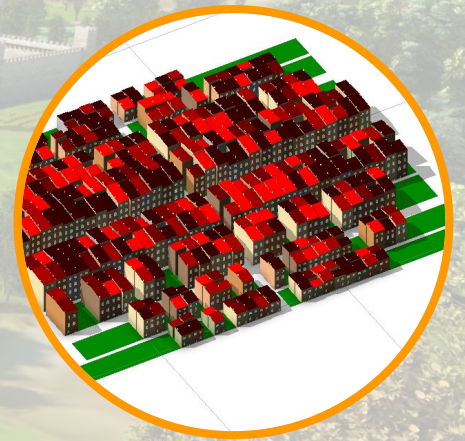
2D drawing



3D modeling



Google Earth

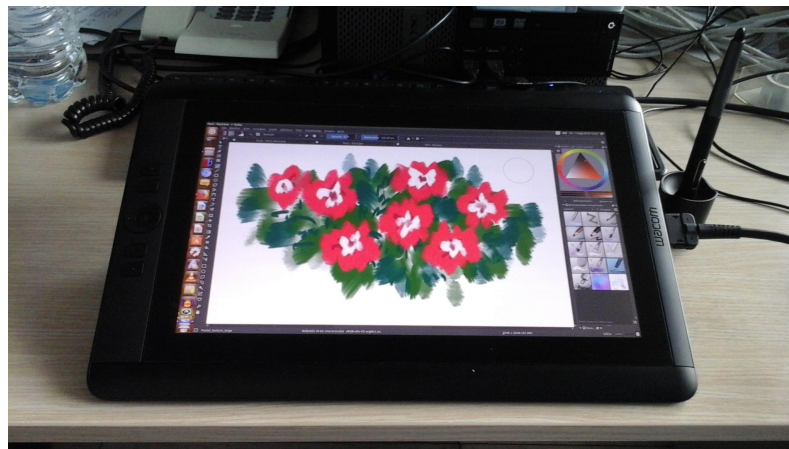


Procedural modeling

# 2D



Watercolors



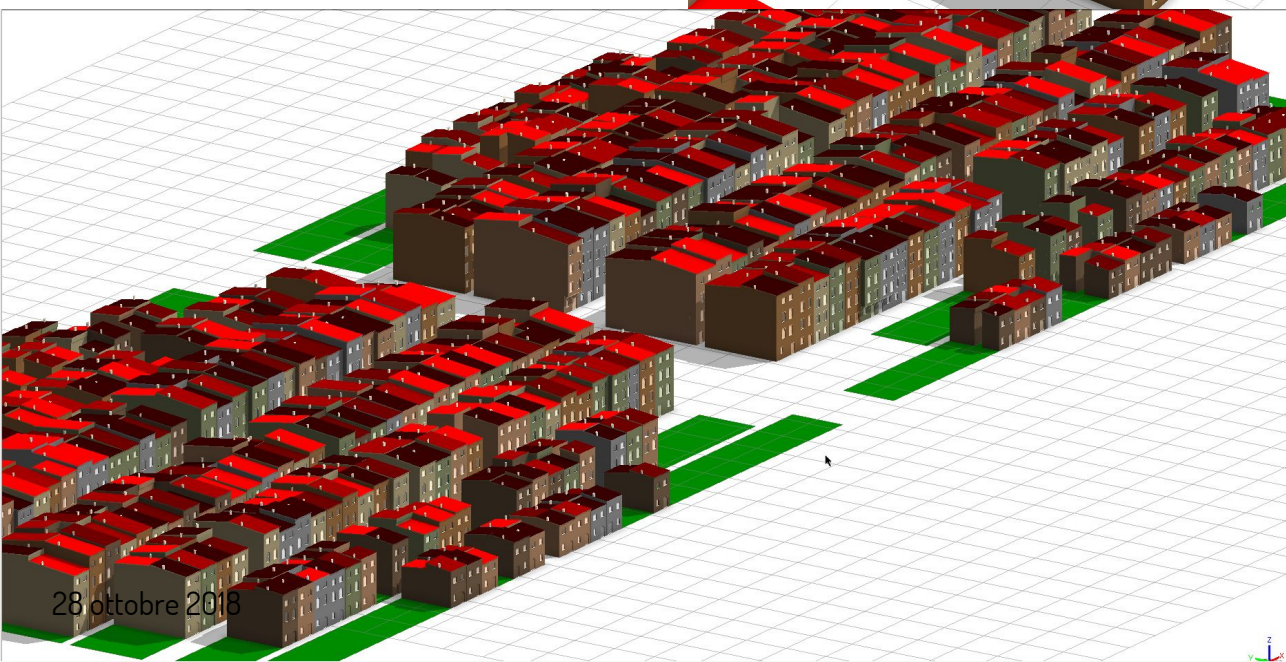
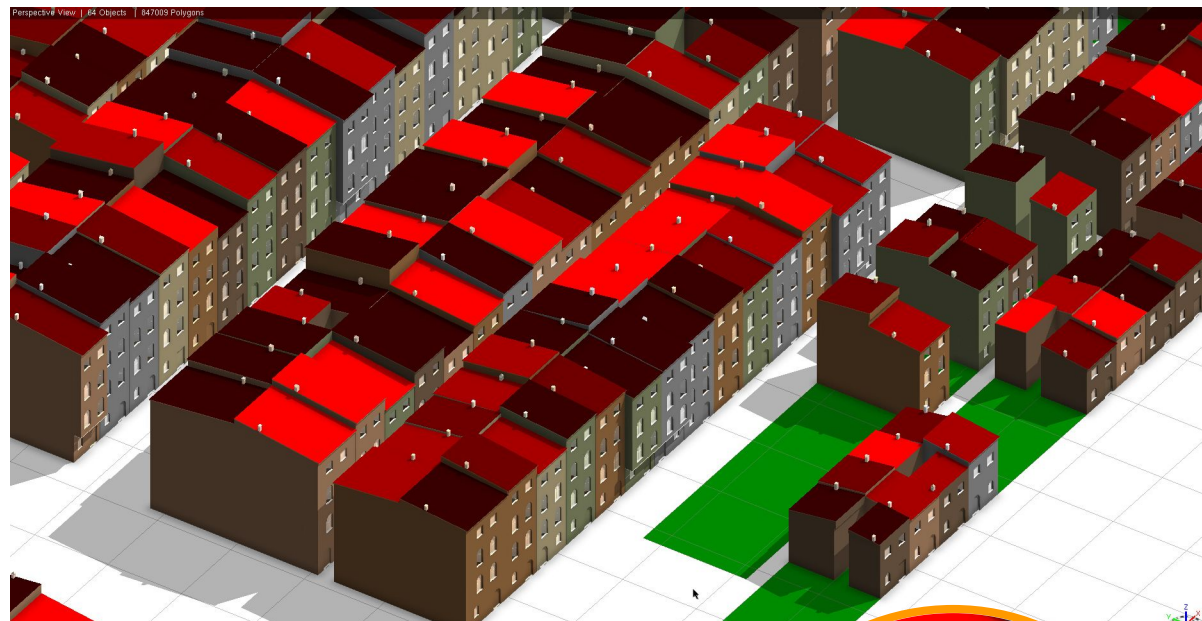
2D drawings on  
graphic tablet



# Modellazione procedurale



# Modellazione procedurale - City Engine



28 ottobre 2018

# Blender, una pipeline Open



<https://www.blender.org>

# 2D in 3D - Props



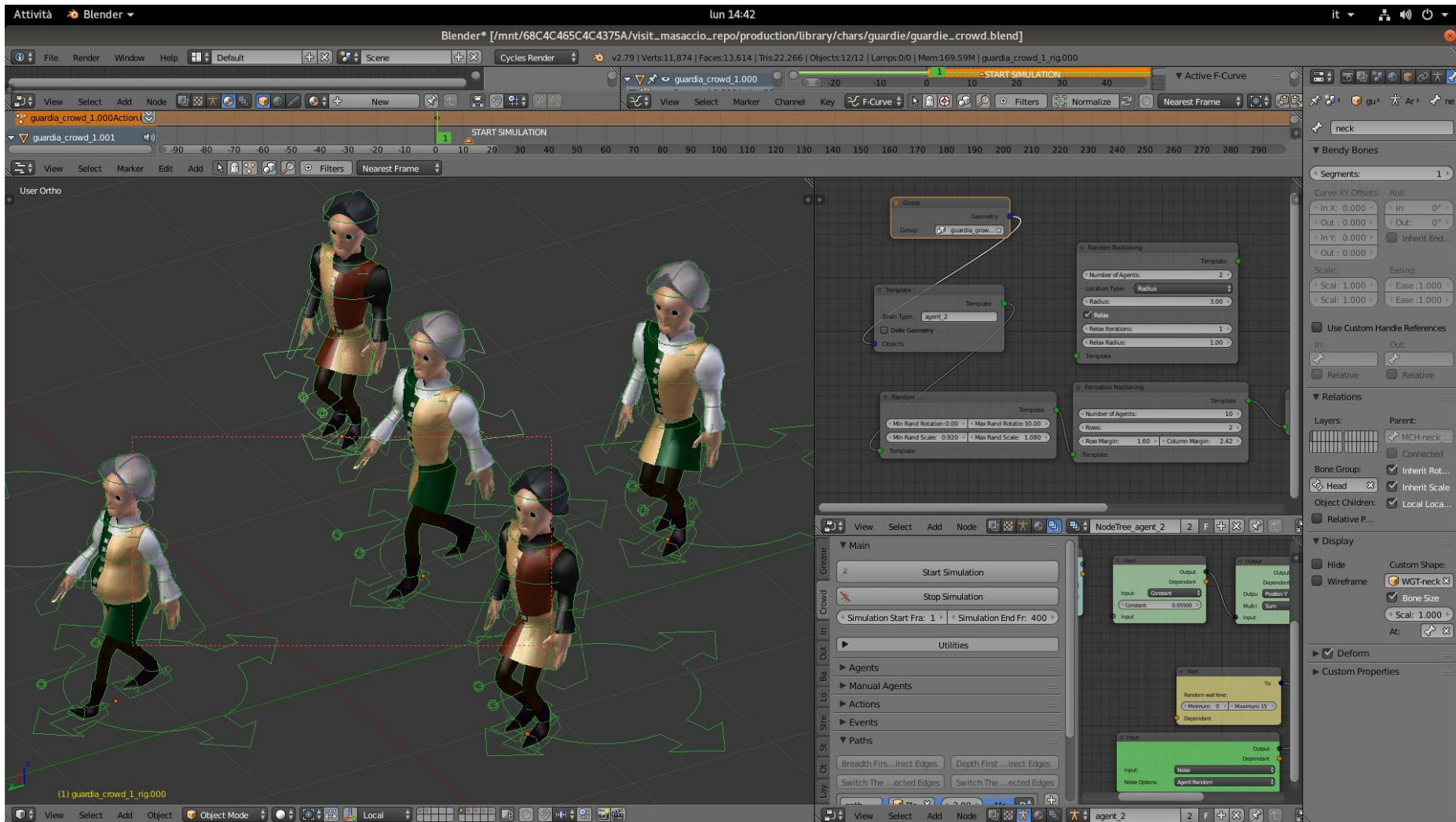
# La matrice di Arnolfo



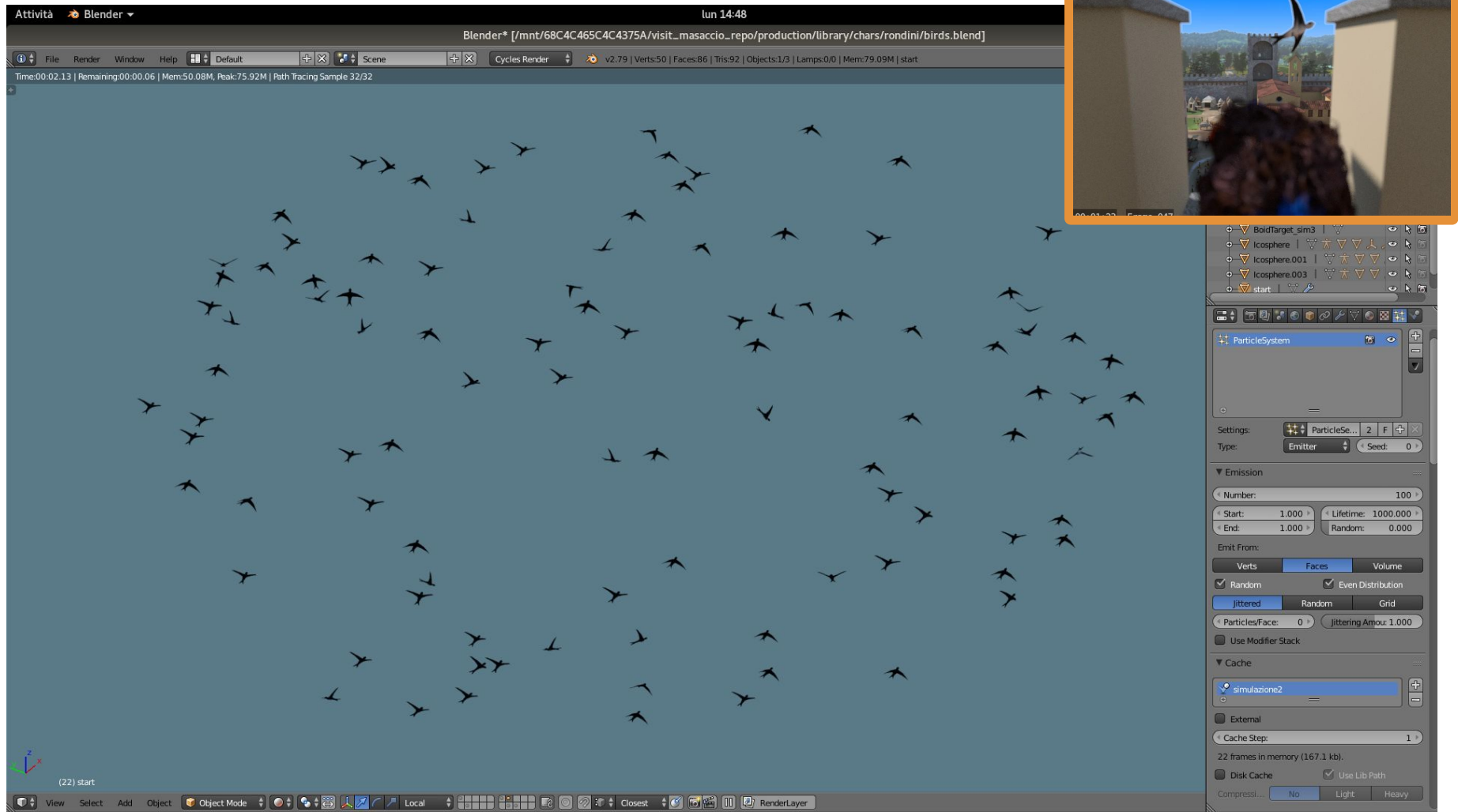
# Materiali da fotogrammetria



# Simulazione di folle



# Simulazione di volo



# Simulazione di stoffe



# 3D - Città ideali



# Google Earth



# Tempo di calcolo

- 15,3 GB Blender files and textures
- 11 GB high resolution frames
- 150,000 core hours
- Blender Render Farm on Supercomputer Galileo (360 Compute nodes (Intel Broadwell), each with 2\*18-core Intel Xeon E5-2697 v4 @ 2.30GHz - 128 GB RAM).

# Il VisitLab Cineca

Crossmedialità  
Sperimentazione  
Riutilizzo



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VISUAL INFORMATION  
TECHNOLOGY LAB  
CINECA



Maria Chiara Liguori -  
Umanista e opinionista



Giovanni Bellavia -  
Filosofo ed artista



Daniele De Luca -  
CG artist e factotum



Antonella Guidazzoli -  
Ingegnere Elettronico,  
Storica e performer



Simona Caraceni -  
Dams e Museologa



# Il VisitLab Cineca 2019



Federica Farroni -  
Ingegnere e 3D modeller



Luigi Verri - Ingegnere  
telecomunicazioni

Silvano Imboden -  
Informatico e guru



Francesca Delli Ponti -  
Ingegnere edile e  
scientific designer



Beatrice Chiavarini -  
Architetto e virtual creator