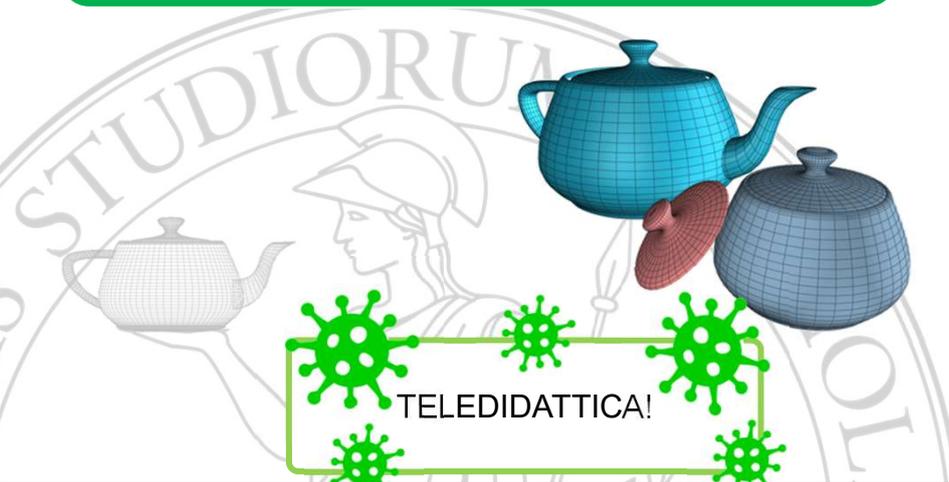


Marco Tarini - Computer Graphics 2020/2021  
Università degli Studi di Milano

Intro: cosa è e a cosa serve  
la Computer Graphics



TELEDIDATTICA!

1

## Computer Graphics: applicazioni

- ✓ Cultural heritage
  - ⇒ musei virtuali
  - ⇒ supporto al restauro
  - ⇒ supporto allo studio
- ✓ Mediche
  - ⇒ supporto alla diagnosi
  - ⇒ simulazioni, telechirurgia...
- ✓ Architeturali
  - ⇒ supporto al design
  - ⇒ previews
- ✓ Manufacturing
  - ⇒ Computer Aided Design
- ✓ Di intrattenimento
  - ⇒ Videogames
  - ⇒ Cinema
    - Visual effects,
    - CGI movies
- ✓ Scientifiche
  - ⇒ Scientific Visualization
  - ⇒ Data Visualization
- ✓ E-Commerce
  - ⇒ Product display
- ✓ Virtual Reality
  - ⇒ augmented reality
  - ⇒ telepresence



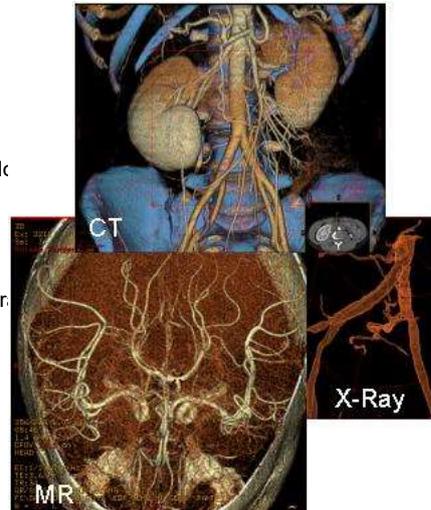
6

## Computer Graphics: applicazioni

### ✓ Visualizzazione Scientifica

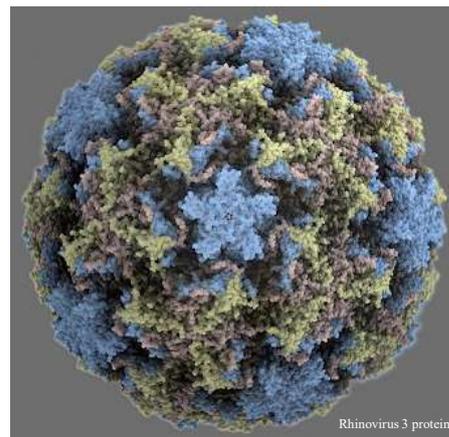
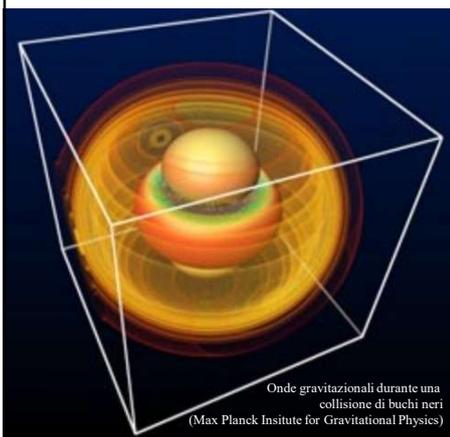
⇒ aka: SciVis , visual data

- Visualizzazione di *dati scientifici*
  - fenomeni meteorologici, medici, biol  
fisici, astrofisici,  
etc etc
- Origine dei dati:
  - l'output di una simulazione
  - *acquisiti* con qualche sistema di misur.  
Tipicamente: grandi quantità di dati



7

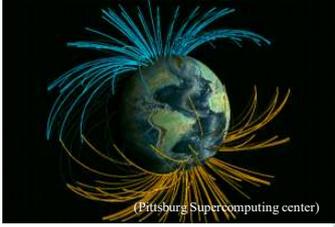
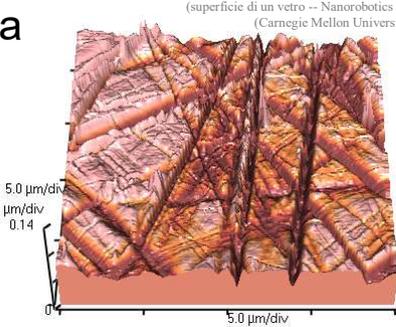
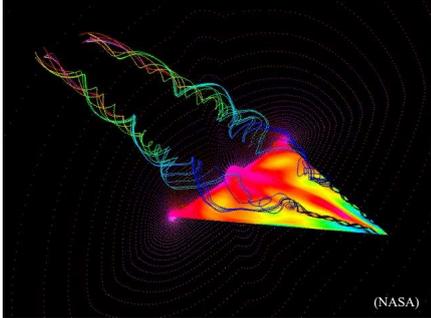
## Visualizzazione Scientifica



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## Visualizzazione Scientifica

✓ Visualizzazione Scientifica  
⇒ aka: SciVis ,  
visual data analysis ...



(NASA)

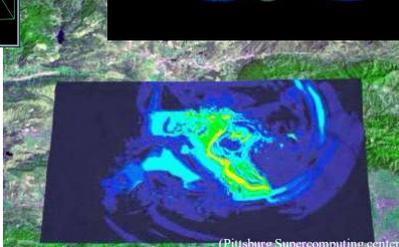
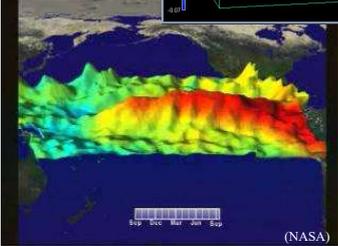
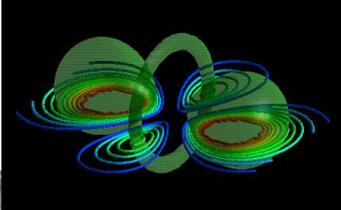
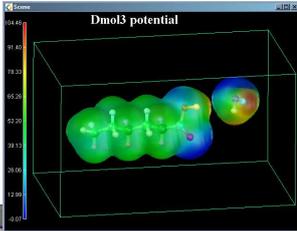
(superficie di un vetro -- Nanorobotics Lab (Carnegie Mellon University))

(Pittsburg Supercomputing center)

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## Visualizzazione Scientifica

✓ Visualizzazione Scientifica  
⇒ aka: SciVis , visual data analysis ...

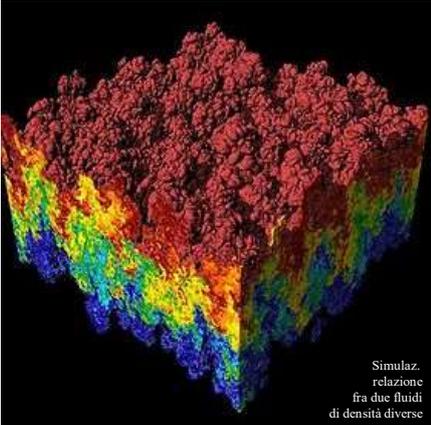


(NASA)

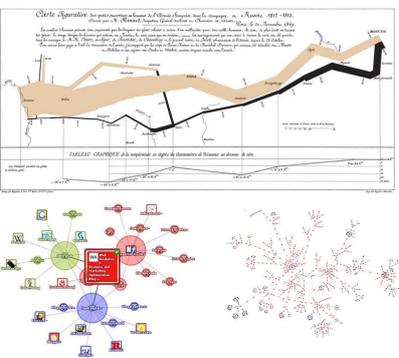
(Pittsburg Supercomputing center)

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## Scientific Visualization VS Data Visualization



Simulaz.  
relazione  
fra due fluidi  
di densità diverse

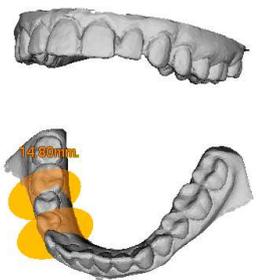


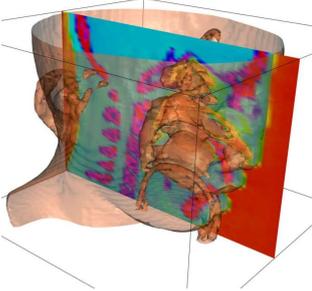


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## Computer Graphics: applicazioni

- ✓ applicazioni medicali
  - ⇒ supporto alla diagnosi
    - e.g. visualizz. CAT scans
  - ⇒ chirurgia virtuale
  - ⇒ tele-chirurgia





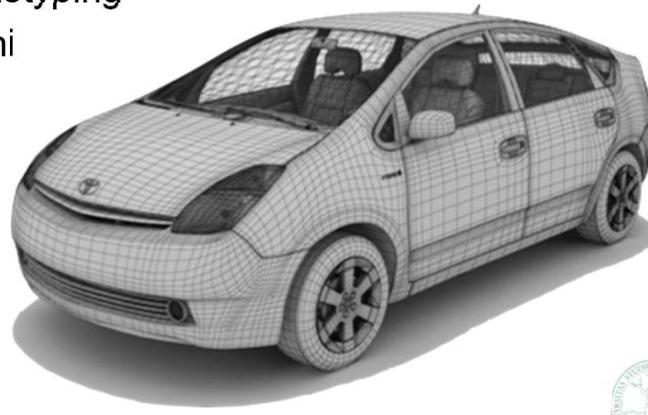


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## Computer Graphics: applicazioni

### ✓ Industria Manifatturiera

- ⇒ CAD
- ⇒ Rapid Prototyping
- ⇒ Simulazioni
- ⇒ ...

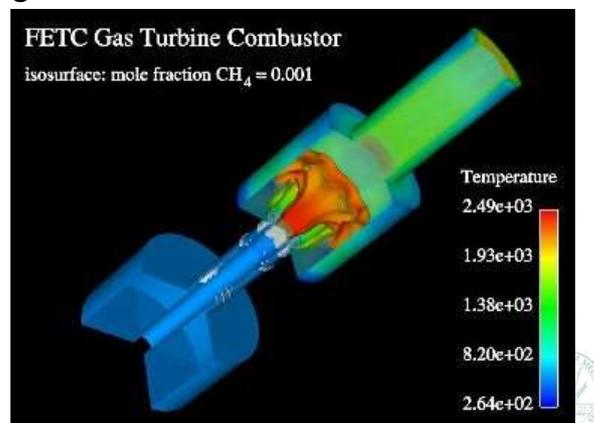


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## Computer Graphics: applicazioni

### ✓ Industria Manifatturiera

- ⇒ CAD
- ⇒ Rapid Prototyping
- ⇒ Simulazioni  
(e.g. FEM)
- ⇒ ...



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## Computer Graphics: applicazioni

### ✓ Entertainment: movie industry

⇒ visual effects (non special fx)



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Effetti *Visuali*

VS

Effetti Speciali



- (in post-produzione)



(sul set)  
(es: stuntmen, corde, esplosioni, ...)

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## Computer Graphics: applicazioni

- ✓ Entertainment: movie industry
  - ⇒ CG shorts
  - ⇒ Feature movies



Gerl's Game - Pixar 1987

Toy Story - Pixar 1995

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## Computer Graphics: applicazioni

- ✓ Entertainment: movie industry
  - ⇒ Feature movies fotorealistici

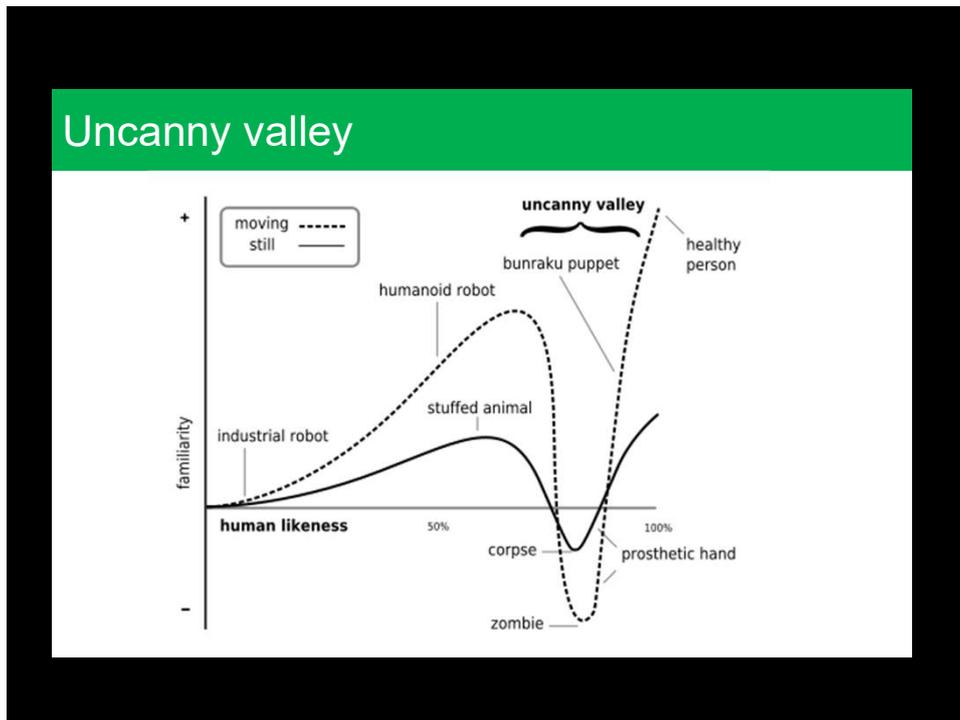


Final Flight Of the Osiris - Squaresoft 2003

Final Fantasy - Squaresoft 2001

Avatar - ILM 2009

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### Computer Graphics: applicazioni

✓ Entertainment: giochi  
⇒ forza trainante del settore (crederci o no) ...

Battlezone - Atari 1980

Tailgunner - Cinematronics 1979

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## Computer Graphics: appl

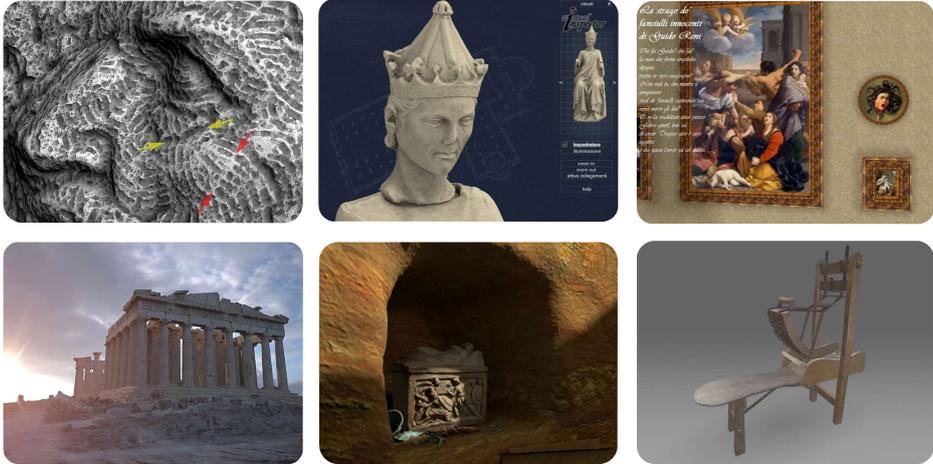
- ✓ Entertainment:  
videogames  
⇒ forza trainante  
del settore



The image displays three distinct video game environments. The top right shows a character in a green jacket in a city street from Grand Theft Auto V. The bottom left shows a grotesque alien creature in a bathroom from Doom 3. The bottom right shows a character riding a dragon in a fantasy world from World of Warcraft.

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## Computer Graphics for Cultural Heritage



The image shows a grid of six digital reconstructions of cultural heritage. Top row: a stone relief carving, a 3D model of a crown, and a digital reconstruction of a painting. Bottom row: a digital reconstruction of the Parthenon, a digital reconstruction of a cave interior, and a digital reconstruction of a wooden chair. A small circular logo is visible in the bottom right corner.

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## Uso di modelli 3D nei Beni Culturali

Uno strumento per:

✓ Supporto alla fruizione / Presentazione

⇒ esempi:

musei virtuali, chioschi interattivi in musei reali, presentazioni web, televisive...

✓ Supporto alla catalogazione:

⇒ documentazione

⇒ dominio a cui associare altre informazioni («GIS per oggetti 3D»)

✓ Supporto all'indagine / studio

⇒ supporto al restauro

⇒ rilevazione, simulazione fisica

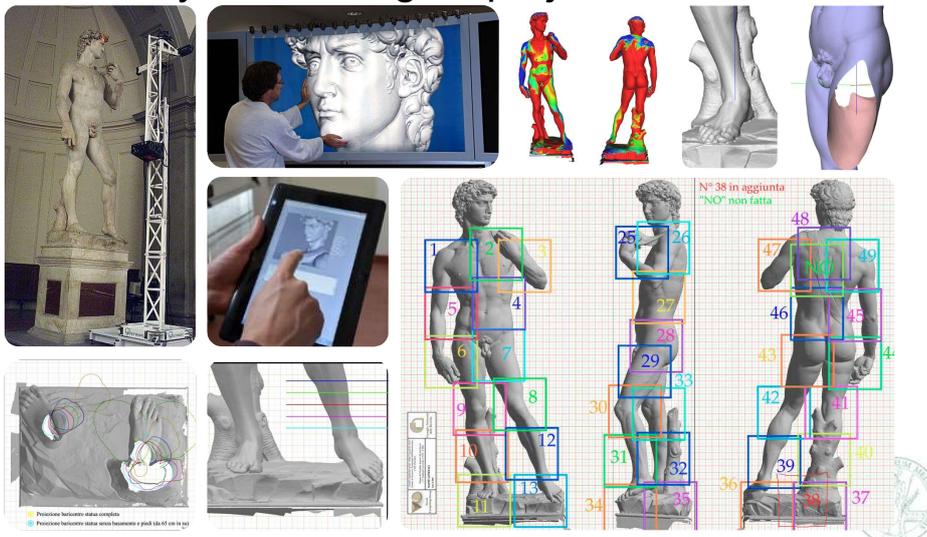
⇒ visualizzazione scientifica



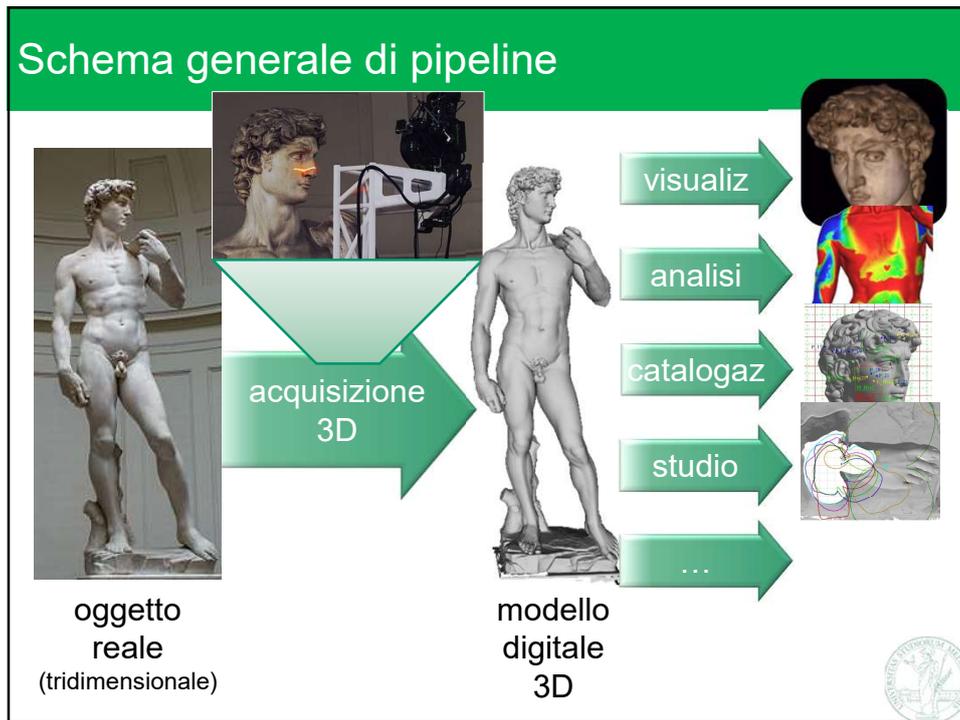
32

## CG for Cultural Heritage

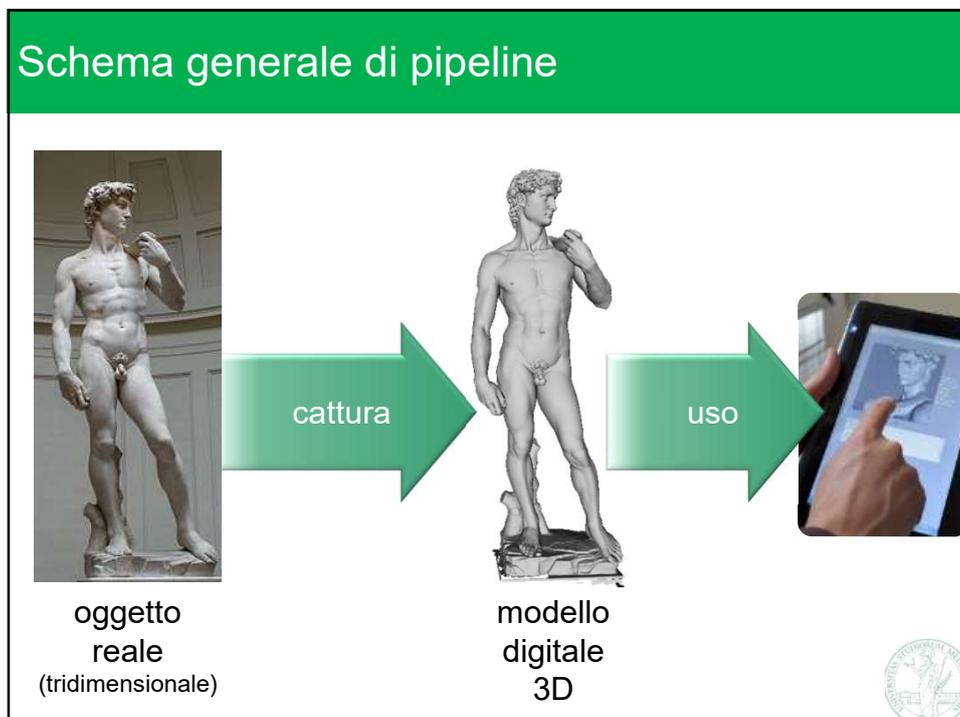
### Case study: Michelangelo project



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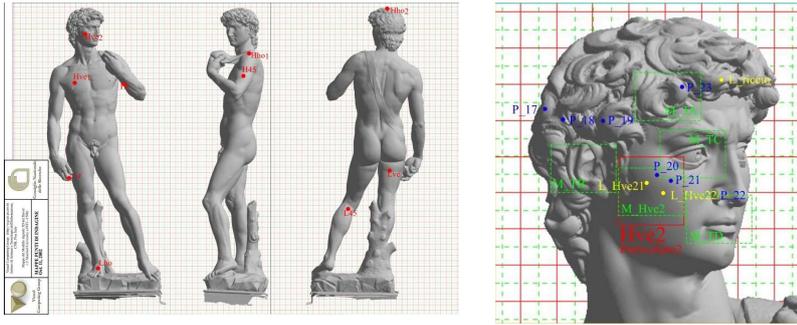
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## Beni Culturali: Restauro

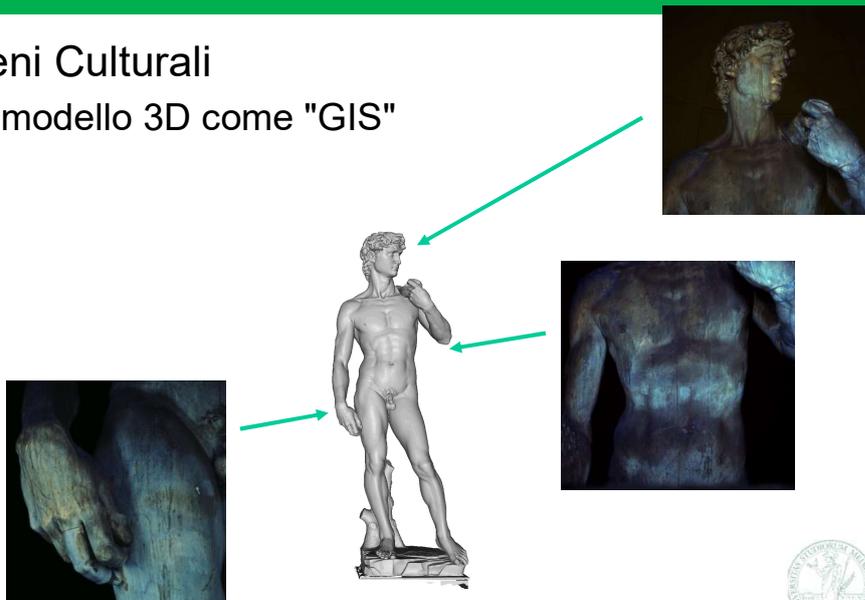
- ✓ Il restauratore si faceva fare degli schizzi su carta dell'opera da restaurare per fare una mappa degli interventi: col il modello virtuale può gestire tutto su PC
- ✓ Acquisizione dell'opera prima e dopo il restauro e confronto geometrico delle differenze



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## Computer Graphics: applicazioni

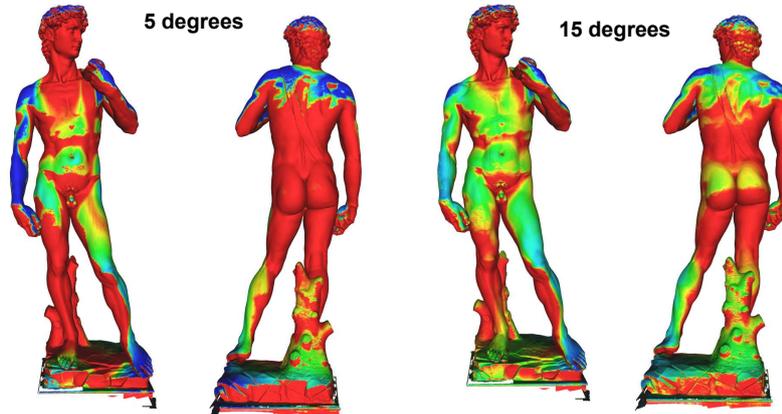
- ✓ Beni Culturali  
⇒ modello 3D come "GIS"



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## Beni Culturali: Studio

✓ ES: Simulazione caduta contaminanti



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## Beni Culturali: Monitoraggio

✓ es: monitorare nel tempo la variazioni sui materiali deformabili



foresta di Dunarobba  
<http://www.forestafossile.it/public/new/>



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## Computer Graphics: applicazioni

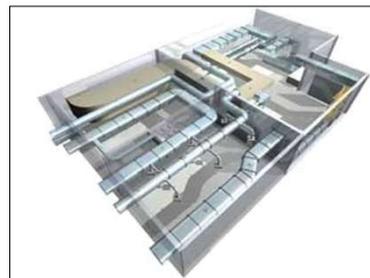
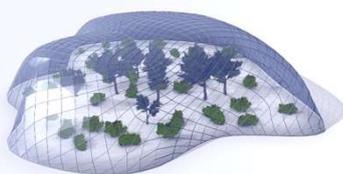
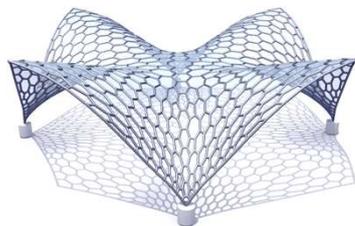
- ✓ Cultural heritage
  - ⇒ musei virtuali
  - ⇒ supporto al restauro
  - ⇒ supporto all'analisi
  - ⇒ monitoring
- ✓ Medicina
  - ⇒ supporto alla diagnosi
  - ⇒ telechirurgia
  - ⇒ simulazioni
- ✓ Architeturali
  - ⇒ Supporto al design
  - ⇒ Previews
- ✓ ...
- ✓ Videogiochi
- ✓ Cinematografia
  - ⇒ *Visual effects*
  - ⇒ Film di animazione
- ✓ Scientific Visualization
- ✓ Manufacturing industry
  - ⇒ e.g. Computer Aided Design
- ✓ Telecommunications
  - ⇒ Personalized Avatars
  - ⇒ E-commerce
- ✓ Virtual Reality
  - ⇒ e augmented reality



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## Computer Graphics: applicazioni

- ✓ Architettura:
  - ⇒ supporto al design



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## Computer Graphics: applicazioni

✓ Architettura:

⇒ preview:

- comunicazione
- assessment
- supporto al design



Brazil - SputterFish

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## Computer Graphics – applicazioni: VR



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## Summary

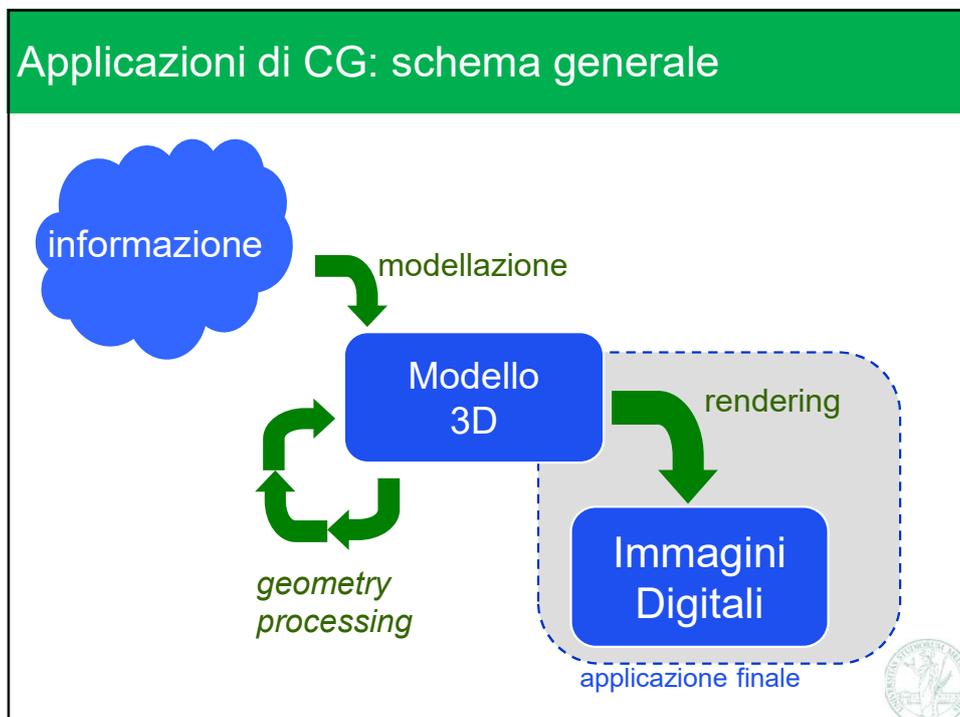
✓ Grafica Computazionale  
(Computer Graphics - CG):

⇒ molteplici applicazioni

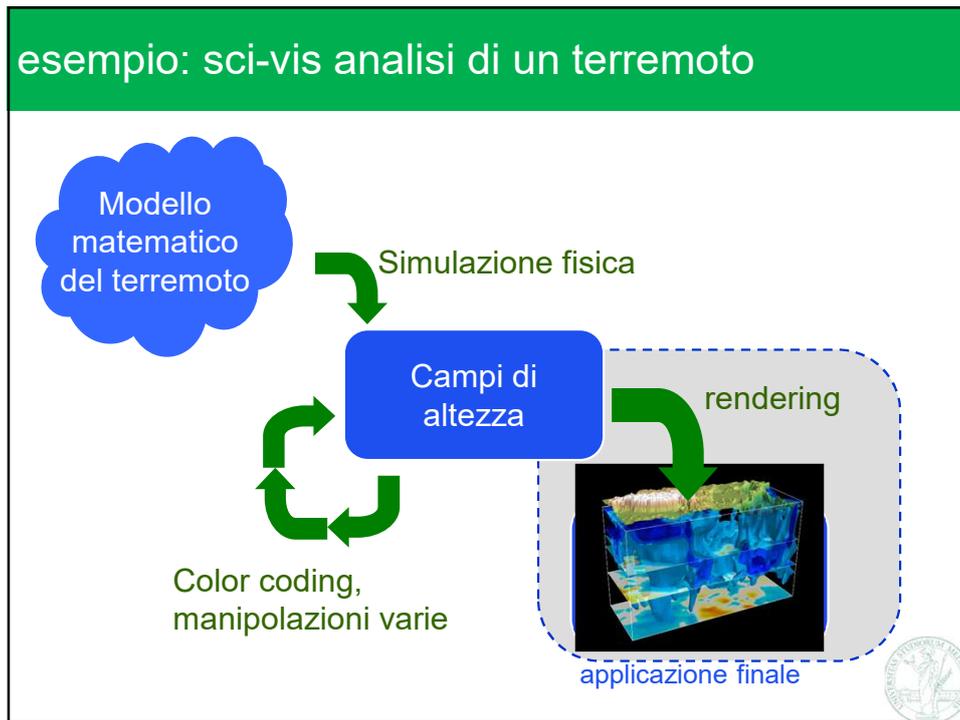
- medicali
- industriali
- beni culturali
- militari ☹
- telecomunicazioni
- commerciali
- ricerca scientifica (scivis)
- intrattenimento: games
- intrattenimento: movies
- e altro (realta' virtuale....)



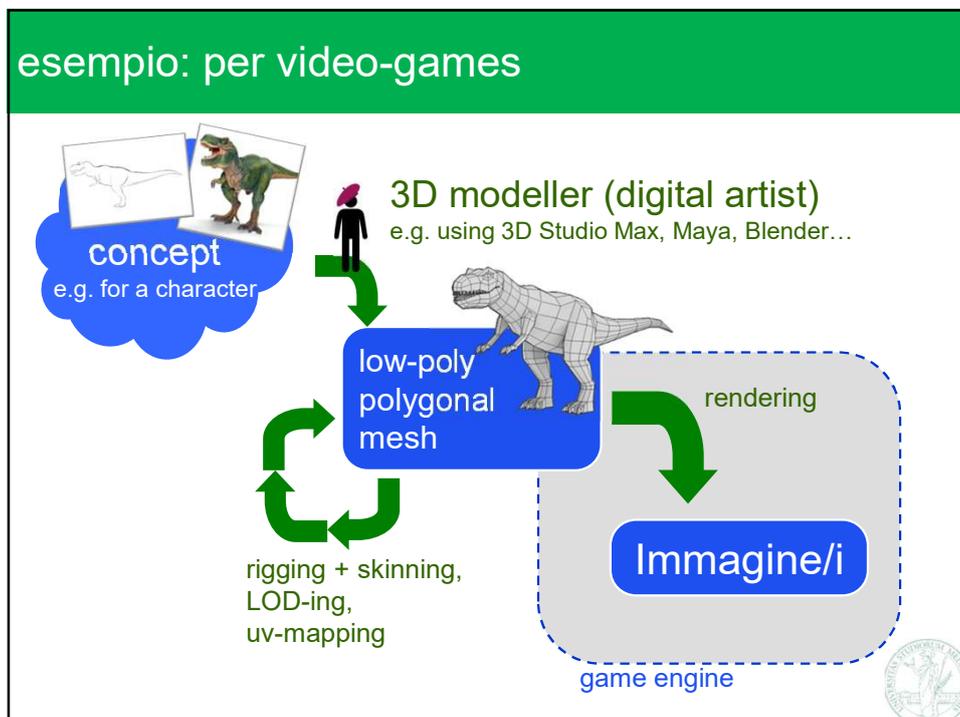
49



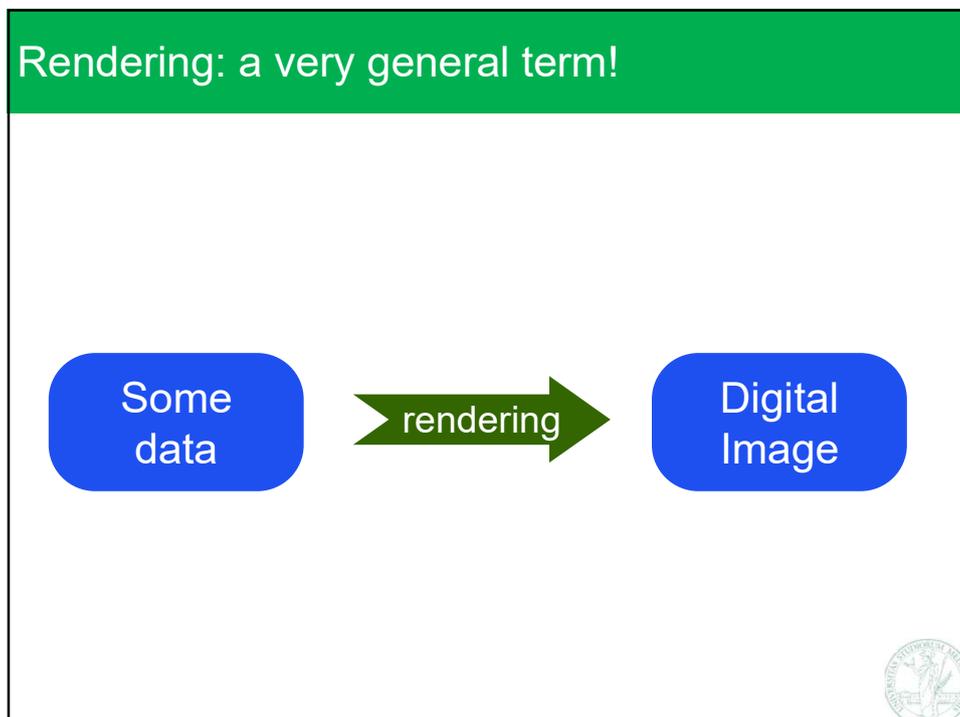
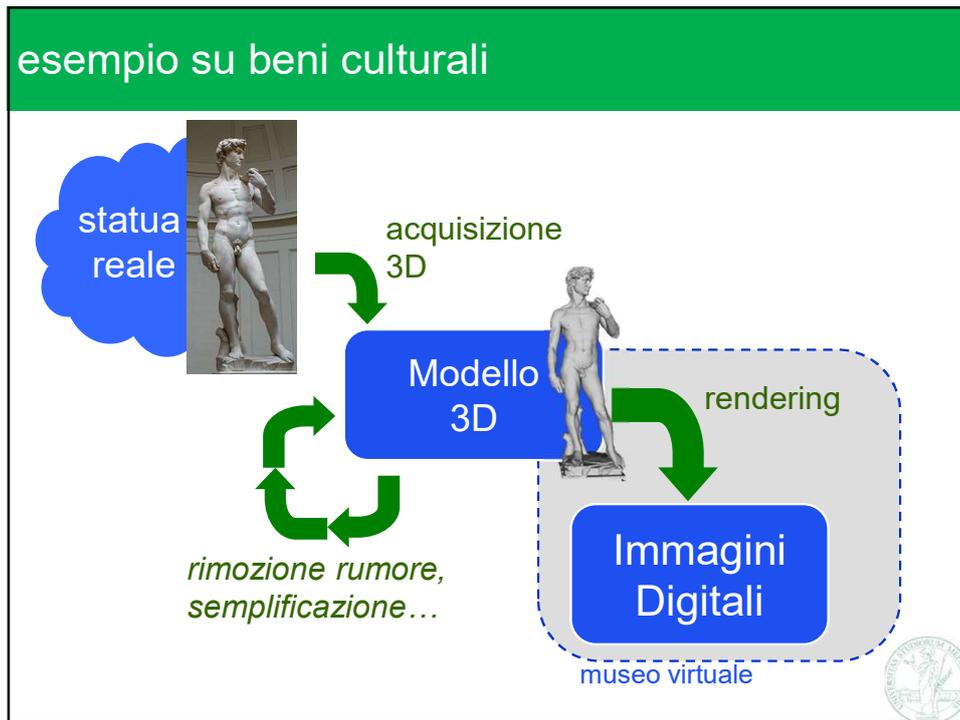
50



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## Rendering: a very general term!

✓ Example: in web browsers

```

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd"
[html xmlns="http://www.w3.org/1999/xhtml"
]
<head>
<title>SIGGRAPH 2005 | Homepage</title>
<meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
<link rel="stylesheet" href="style.css" type="text/css" />
<link rel="stylesheet" href="fontawesome.css" />
<script type="text/javascript" src="flash_detect.js"></script>
</script type="text/javascript">
</head>
<body>
<div id="wrapper">
<div id="header">
<div id="header-content">
<div id="header-image">
<img alt="SIGGRAPH 2005 Logo" />
</div>
<div id="header-text">
<h1>SIGGRAPH 2005</h1>
<h2>The 32nd International Conference on Computer Graphics and Interactive Techniques</h2>
</div>
</div>
<div id="main-content">
<div id="main-content-header">
<div id="main-content-header-text">
<h3>Conference 31 July-4 August 2005 Exhibition 2-4 August 2005 Los Angeles Convention Center</h3>
</div>
<div id="main-content-header-image">
<img alt="SIGGRAPH 2005 Exhibition Logo" />
</div>
</div>
<div id="main-content-body">
<div id="main-content-body-text">
<ul>
<li>> Design Layouts Keynote</li>
<li>> Emerging Technologies</li>
<li>> Special Sessions</li>
<li>> Special Events</li>
<li>> Online Registration</li>
<li>> Hotel Reservations</li>
</ul>
</div>
<div id="main-content-body-image">
<img alt="SIGGRAPH 2005 Exhibition Booths" />
</div>
</div>
</div>
</div>
</div>
</div>

```

→ rendering



HTML page + images, css, etc  
(which models a Web Page)

the image appearing in  
the browser



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## Rendering

✓ In our context

3D Model

→ 3D rendering

Digital Image



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Marco Tarini

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