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3D Virtual Museums

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Summary

- what is a 3D Virtual Museum
- some of the benefits of using 3D graphics to present cultural information
- main shortcomings, open issues and research problems
- enabling technologies
- main EU projects in this area
- a practical example: the 3D computer science museum



3D Virtual Museums

- virtual museums that employ 3D graphical representations of objects (e.g., artifacts) and 3D virtual spaces (or environments) for purposes such as preservation, study, communication and exhibition
- exist both as a special sections of real-world museums (e.g., Virtual Reality Theater rooms), and as purely virtual museums, e.g. to be visited on the Web



Mummy: The Inside Story



- visitors enter a 3D immersive Virtual Reality Theater where they experience "virtual unwrapping" and exploration of a 3,000 old mummy
- the mummy 3D model has been built using medical scanning techniques









Leonardo:the ideal city



museo nazionale della scienza e della tecnologia **leonardo da vinci**

- 3D reconstruction of an "ideal city" that Leonardo could have projected assembling buildings and machines he designed
- can be visited on the Web, and visitors can see and talk with each other

http://www.museoscienza.org/museovr/Default.htm









Why using 3D graphics for cultural information?

- digital collections are useful if they support the needs of those who access them (e.g. for study)
 - (good quality) 2D images can be sufficiently good for "flat" collections (e.g., manuscripts, photographs)
 - less effective as surrogates for three-dimensional collections (e.g., sculptures), since much spatial information is lost
 - multiple 2D views (e.g., Quicktime VR) can simulate a 3D experience, but only provide limited navigation, and the physical form and material of the object is not digitally captured in detail



Basics of 3D graphics

- objects are geometrically modeled in 3D and positioned in the scene (a 3D space)
- objects materials are modeled or photographs are "attached" to 3D geometrical models
- lights and a view point are added to the 3D space
- the computer calculates and display an image that visualizes the scene from the view point







Advantages of 3D Graphics (1)

- 3D models of objects allow for detailed inspection capabilities:
 - see objects from any point of view
 - zoom to explore details
 - objects can be programmed with behaviors, so that the user can interact with them in ways that are limited only by the imagination of the model builder





Advantages of 3D Graphics (2)

- one can construct complex virtual worlds that contain representations of both objects and their contextual environment, e.g. to:
 - convey the "cultural settings" of museum items by inserting them in their original place and historical context
 - virtually reconstruct objects, structures and environments that have been destroyed or damaged in the past
 - build environments that do not exist physically, but provide an appropriate conceptual or architectural environment



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Example



• The Museum of Reconstruction uses 3D graphics to develop accurate and complete reconstructions of buildings, artworks, artifacts, and sites







• The Virtual Museum of Arts El Pais places digital images of contemporary Uruguayan art in a virtual museum that was designed by professional architects, but will never actually be constructed due to prohibitive cost







• The Philadelphia Museum of Art has created an online exhibition in 3D that places sculptures in an ethereal gallery space without visible walls, and allows visitors to walk around 3D models of the sculptures



Advantages of 3D Graphics (3)

- while the visit to a 2D virtual museum is typically a single user experience, multiple users visiting the same 3D worlds can see each other, talk, and interact (e.g. guide other users)
- moreover, animated characters (e.g. virtual humans) can substitute real users, e.g. to:
 - guide visitors
 - play as actors in virtual reconstructions



Example



• CVE-VM is a museum focusing on the historical origins and concepts (e.g., musical instruments, dance gestures,...) of the capoeira, a sort of dance/martial art that is rooted in brazilian culture. Visitors can collaborate to extend the virtual world and learn.



Disadvantages (1)

- acquiring 3D models is still a relatively costly and complex process. There are two techniques:
 - building them from scratch using 3D authoring software products
 - using a 3D scanner, but resulting models often need transformations (e.g., simplification) to be practically used







Disadvantages (2)

- 3D interfaces are scarcely usable, if not designed properly:
 - many users have difficulties in effectively moving in a 3D virtual space, e.g. they get stuck in corners
 - many users have difficulties in orienting themselves, with the result of getting lost, leaving before reaching their targets of interest, or with the feeling of not having adequately explored the virtual environment
- viewing 3D content typically requires to download additional software (e.g., Web browser plug-ins)
 - not all users are willing to do it



Technologies



• VR systems and hardware



Arco (IST-2000-28336)









- The Augmented Representation of Cultural Objects project is aimed at developing technologies for:
 - digitize museum artifacts.
 - create photo-realistic 3D models from the digitized artifacts.
 - build and manage collections of these 3D models and supporting multimedia data.
 - build highly visual virtual museums that exhibit these 3D collections, and publish them on the Web







- The project objectives are to:
 - create a distributed multimedia digital library for storing, searching and retrieving diverse multimedia types, including 3D objects;
 - develop a semantic layer for distributed multimedia information management and a knowledge structure linking low and high-level multimedia representations;
 - populate the semantic layer using automated tools using classifying agents and web search agents











- 3D MURALE aims at creating a set of low-cost multimedia tools for recording, reconstructing, encoding, and visualising archaeological artefacts and sites
- shapes and object types, range from landscapes, over buildings, to ornamental structures, statues, pottery sherds and stratigraphic layers













- ViHAP3D aims at preserving, presenting, accessing and promoting cultural heritage by means of interactive, high-quality 3D graphics
- ViHAP3D uses 3D scanning technologies to acquire accurate and visually rich 3D models. Post-processing, data representation, and efficient rendering techniques enable detailed interactive display and inspection of such models even on low cost platforms







LifePLUS



- LIFEPLUS proposes an innovative 3D reconstruction of ancient frescos-paintings through the real-time revival of their fauna and flora featuring groups of virtual animated characters with artificial life, and dramaturgical behaviours in an immersive AR environment
- LIFEPLUS aims at developing, real-time realistic virtual life in AR environments, automatic real-time camera tracking in unknown environments, design of successful character-based installations, and expressive autonomous cinematography for interactive virtual environments









- the goal of the Augmented Reality-based Cultural Heritage on-site Guide project is to provide:
 - personalized tours to the visitors according to their individual preferences,
 - virtual reconstruction of selected monuments through Augmented Reality techniques.





Archeoguide [2]

- visitors receives at the site a wearable computer with:lightweight portable computer, Head Mounted Display (glasses, earphone, speaker, camera), batteries etc.
- visitors enter personal preferences, then proceed to walk through a tour the system customizes for them
- visitor "sees" reconstructed ancient monument placed where the ruins lie.
- visitor listens to the information the system provides, and may interact with the system: request more info or interrupt the info coming from the system.







A practical example

The 3D Computer Science Museum



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