

# Advances in Virtual Environments

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## **1. DHX - DIGITAL ARTISTIC AND ECOLOGICAL HERITAGE EXCHANGE; TRANSCONTINENTAL GUIDANCE AND EXPLORATION IN GLOBALLY SHARED CULTURAL HERITAGE.**

Intuitive access to information in everyday environments is a central concern of the new information/ communication technologies in the information age. An important question is: how can well-functioning and established everyday environments and no longer existing historical environments be communicated to the global online-community through virtual environment techniques. One of the prerequisites for both – sharing cultural heritage information with online-communities all over the globe and facilitating a further step toward the next generation of digital collections accessible for a personalized immersive experience is a well-functioning, networked information and communication technology infrastructure.

The DHX project aims to develop and establish a networked VE- infrastructure and VE-content for installation in museums, cybertheatres, and other public institutions, which allow the mutual exchange of digital cultural and natural heritage information.

Currently, a range of low-cost VR- systems is under development, which will solve the specific requirements of end-users such as museums or other public institutions. The storyboards of all research prototypes are being finalized, specific authoring-tools for automated storytelling authoring are being discussed. First attempts toward the development of computer vision methods for the collection of ecological data are being explored. Network tests to investigate the required capacity for the necessary connections are being made. Under discussion are also issues such as distributed interaction, including group interaction, standardization issues regarding the authoring of digital storytelling content, and other problems.

## **2. VIRTUAL SHOWCASE**

The Virtual Showcase project introduces a new stereoscopic display system – the Virtual Showcase. The Virtual Showcase has the same form factor as a real showcase making it compatible with traditional museum displays. Real scientific and cultural artefacts are placed inside the Virtual Showcase allowing their three-dimensional augmentation. Inside the Virtual Showcase virtual representations and real artefacts share the same space providing new ways of merging and exploring real

and virtual content. The virtual part of the showcase can react in various ways to a visitor enabling intuitive interaction with the displayed content. These interactive showcases are an important step in the direction of ambient intelligent landscapes, where the computer acts as an intelligent server in the background and visitors can focus on exploring the exhibited content rather than on operating computers.

The VS project introduces a new type of stereoscopic, multi-user display system, which allows the presentation of stereoscopic images overlaid on top of real objects to multiple users. The basis for these displays are semi-transparent, half-silvered mirrors, which allow visitors to look through them to see an illuminated, real object inside the showcase. At the same time the mirrors reflect a computer-generated, stereoscopic image, which is overlaid and registered with the real object.

## **3. LISTEN – AN EXTRAORDINARY AUDIO SYSTEM AS ARTISTIC AND EDUCATIONAL MEDIUM IN THE MUSEUM OF THE FUTURE**

LISTEN defines and explores a novel form of content: The immersive audio-augmented environment. Everyday surroundings – an exhibition space, a storage building, a public space or a living room – can become an interface to access a three-dimensional auditory information environment, experienced through motion-tracked, wireless headphones. What the user actually hears depends on his position in space, his head movements, and the direction of his walk. The environment adapts to the preferences inferred from the behavior of the individual user within the given space. The resulting auditory presentation is not only perceived as coming from within the head, as with conventional headphone stereophony, but as coming from all directions, front, back, left, right, due to an advanced binaural rendering technique that instantly adapts to the user's head motions. Thus the sound presentation augments the physical space and immerses the user into a three-dimensional augmented environment that can be explored intuitively.

LISTEN provides the visitor of a museum with an expanded and deepened perception of the actual museum space and its works of art – an option that the visitor can choose deliberately by putting on or taking off the headphones.

#### **4. THE I-CONE™ – DISPLAY SYSTEM FOR VIRTUAL ENVIRONMENTS**

I-CONE™ is a new Virtual Reality system which projects virtual environments on a wide-angled, curved, horizontal screen. The new technology eliminates the edges and corners of the CAVE™ – the cubic virtual theater widely used today. In contrast to the CAVE™, the i-CONE™ possesses an evenly curved projection surface. With corners and edges, even the typical geometric contortion and reflection effects at the walls of the CAVE™ can be avoided. At the same time, the front-projection technique used in the i-CONE™ distinguishes itself against the back projection technique of the CAVE™ by an inherently better image quality (contrast, saturation) as well as by an essentially better use of space.

With the i-CONE™ attractive Virtual Reality contents can be experienced by larger groups of visitors for the first time. An i-CONE™ with a visitor capacity of approximately 30 people takes almost the same amount of space as a CAVE™ for 5 people. In combination with the implementation of more cost-efficient and extremely potent PC-technologies, this will inspire economical solutions for the application of Virtual Reality in the entertainment and training/education fields and open up new applications for this technology. The very high visual and acoustic presentation quality of i-CONE™ presentations will result in a high acceptance of the technology for a broad targeted audience.

#### **5. PC-CLUSTER FOR ACTIVE STEREO**

The Linux PC cluster is a master-and-slave configuration, connected via gigabit Ethernet. Scene graph distribution is used, broadcasting incremental updates of the scene graph in the application master to the slaves for image generation.

The application master and the slaves are synchronized and frame locked. ATI FireGL4™ graphics cards in the four slave PCs are generating genlocked stereo video output for the projectors of the i-Cone™ display system. The resolution of the PC signal is 1600 by 1460 pixels at 94Hz for a total resolution of 6400 by 1460 pixels.

All these projects are developed at Fraunhofer IMK, in the Competence Center Virtual Environments. Head: Dr. Martin Göbel, Schloss Birlinghoven Sankt Augustin, by Ernst Kruijff, Andreas Simon, Steffi Beckhaus, Sergey Matveyev, Gerhard Eckel, Joachim Gossmann, Jan Springer a.o. with other partners.