Application of new interfaces in museum environments: the Virtual Showcase

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1. What is Mixed Reality?

Nowadays, the concepts of Virtual Reality and Augmented Reality [1] can be considered as a whole unit. In a virtual environment, the user gets immersed in a completely artificial world, which can exceed physical laws creating a world where concepts of gravity or time do not exist. On the other hand, the real world is completely defined and constrained by physical laws. Instead of considering these two concepts as antonyms, they can be thought of as the extremes of a continuous process that mixes reality with virtuality. Inside this framework, it is necessary to define a generic Mixed Reality environment as an environment in which virtual and real objects coexist in the same space [2].

2. Basic configuration

The Virtual Showcase [4] has the same form factor as a conventional showcase. Inside the Virtual Showcase, real artefacts of cultural or scientific interest can be placed. They can be enhanced or augmented by projecting computer-generated 3D stereoscopic graphics and animations. Thus, real artefacts and virtual projections share the same space inside the Virtual Showcase, creating an Augmented Reality system. The interface of the Virtual Showcase is intuitive and familiar to a visitor of an exhibition.

As shown in Figure 1, the Virtual Showcase consist of two main parts (numbers in brackets correspond to the numbers in Figure 1): a convex assembly of half-silvered mirrors (1), usually a truncated pyramid or cone, which rests on a flat projection screen used to project 3D stereoscopic graphics (2) using a (retro)projection device. Real artefacts inside the Virtual Showcase are illuminated by a controllable light source (3), whereas graphics are visualized with the use of special polarized glasses for stereoscopic vision (5). Head movements from the

different users are tracked by a tracking system (6), which uses mostly magnetic or optical sensors. Computer generated graphics are projected on the screen and reflected in the semi-transparent mirrors.

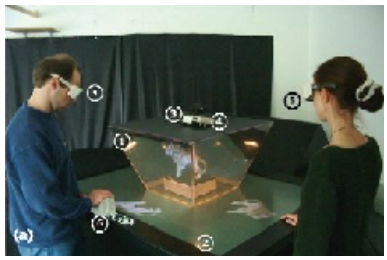

Figure 1 Virtual Showcase pyramid-shaped prototype (Courtesy of O. Bimber).

3. Virtual Showcase prototype in San Telmo Museum

3.1 Event definition

The first worldwide application of this type of Virtual Showcase technology in a museum has been implemented in the context of the exhibition *FERRUM. Burdina Gipuzkoan. El hierro en Guipúzcoa* at the Museum of San Telmo in Donostia-San Sebastián. The Virtual Showcase prototype has been used as a Virtual Reality display in which 3D reconstructions of historical and archaeological artefacts are exhibited (Figure 2).

3.2 Features of the prototype

3.2.1 Visualization system

Among all possible configurations of Virtual Showcase using these technologies, a convex volume with the shape of a truncated square pyramid has been chosen for the current event. The graphic visualization system uses retroprojection techniques by means of projectors to display the images. The stereoscopic system makes use of passive stereo for the first time in a Virtual Showcase application.

Images are displayed with dual projectors, one for each eye, equipped with polarization filters. Glasses are equipped with corresponding polarization filters. Projectors are calibrated in such a way that both projected images overlap, forming a stereoscopic pair. These images are reflected on a mirror placed under the

projection screen with an angle of 45º and thus resulting in an undistorted image in the projection screen the Virtual Showcase lies on. The graphics system collects the tracking data and generates three views for each image of the stereoscopic pair that display the adequate view for each of the users.

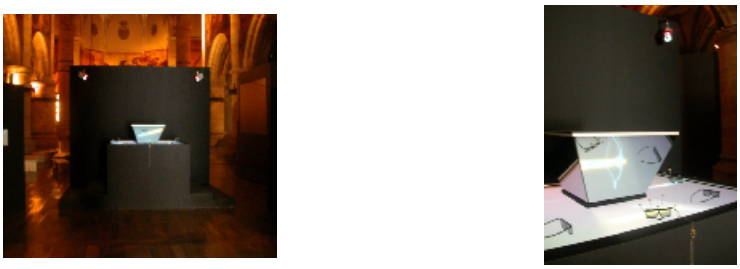

Figure 2 Virtual Showcase Prototype in San Telmo Museum.

3.2.2 Tracking system

For this application, an optical tracking system has been used. It consists of two infrared cameras, which register the movement of some reflective markers attached to the passive glasses for stereo viewing. There are three tracked glasses equipped with markers, one for each of the three available sides of the Virtual Showcase. The configuration of the markers for each pair of glasses has been chosen in such a way that occlusion is avoided as much as possible. The information of the position of the user is sent to a computer, which deals with the acquisition of the tracking system data. These data are sent through a network connection to the computer that generates the graphics, so it renders the adequate view for each user position.

3.3 Differences with the laboratory prototype

The installation of the prototype in the museum has arisen a series of problems not found in the laboratory prototype. One of the main problems is the possible decalibration of the tracking system and the projectors due to movements or shaking. Due to the impossibility of hanging the cameras from the ceiling of the museum, it was necessary to build a large support structure which allows hanging the cameras from it. Finally, some stairs have been placed in two sides of the projection table, so that they make it possible for everyone to look at the virtual artefacts from an optimal height.

4. Conclusions and future work

The implementation of the first worldwide prototype of a Virtual Showcase of this kind in a museum environment will make possible to evaluate the impact of new technologies in the diffusion of cultural heritage. Future work will depend to a great extent on the evaluation of the response of the public. This work will be oriented towards an improvement of current prototypes and an integration of new elements, which provide more information and in a more intuitive manner (like anthropomorphic conversational avatars). Among the improvements already in study phase, we could mention the implementation of prototypes with more resolution, smaller size and more versatile and robust tracking systems.

5. Acknowledgments

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6. References

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