Analysis of the Realism of 3D Computer Animations in the Context of The Human Visual Perception

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Abstract - A first study is presented in which parameters want to be found and verified which correspond in a virtual scene to the perception of the human so that they feel realistic. It is based on the physiological-psychological knowledge about the visual perception of the human (Helmholz 1866, Kempter, G. & Bente, G., 2004) and from the knowledge about the possibilities of VR Systems (Dontschewa, Kempter et al. 2005) and already known parameters, which influence the realistic impression of a virtual scene (Flemming 1999). The analysis serves as a basis to find parameters which are important for the realistic impact and to empirically prove them. Primarily the paper wants to examine, what the perception of a viewer influences. For this purpose a scene selection, the reference to the human visual perception and its reflection to the possibility of VR Systems are analyzed and adequately considered and included.

Keywords **– 3D - Computeranimation, Perception, Virtual Reality**

I. INTRODUCTION

Normally, if you want to show someone something which does not exist, where the look and the impression is most important, you may model the product with cardboards (Bartenbach – Lichtlabor, Innsbruck) or you use other representation techniques like diagrams, drawings or verbal descriptions. But with such representation techniques you will soon get to a border because it is very difficult to maintain a good impression. For example the modeling with clipboards has big disadvantages if the main objective lies in illuminating the object. You cannot work photogametrically and geometrically correct because for a geometrically scaled object you cannot use the real light sources with their light properties but will have to use smaller lights for example. Today virtual prototypes replace the traditional physical prototypes because they have many advantages. It is not only possible to look at a virtual prototype but it is also possible to interact with it, manipulate it. Also flexible light and material simulations can be done with virtual prototypes which are not possible with physical representations (Dontschewa, Künz et al. 2007).

Also a big advantage is the financial benefit in the development process. Virtual prototypes can also be used in the selling process to give the customer a much better view of the product.

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II. SELECTION OF A SCENE

Axiomatically, the content of an image plays a big role if the image looks real or not. Therefore is the selection of the scene very important. We describe our thoughts bellow.

- Artificial and non artificial objects

Generally one might distinguish between artificial and non artificial objects. Artificial objects are objects made by human. These can further be classified into simple objects (used in daily life) and complex scenarios (architecture, scenes, complex products etc.). Non artificial objects have a natural root like trees, plants, complex landscapes, animals or humans. Both those object groups get modeled with computer animation systems (CAS) very differently. The objects created by human mostly base on geometrical basic shapes and can therefore be modeled much faster and more accurate. Artificial objects have the advantage that they most often have today a digital source and therefore they look in a 3d scene much more realistic as organic shapes.

- Existing scenes or not existing scenes

An important aspect in the selection of a scene is the necessity of the accessibility. This necessity comes from the try not to compare 2d images (like photos) but visual impressions which come from looking at a real or virtual scene. Therefore we searched for real scenarios to be able to compare the visual impressions. We selected the foyer of a building of the Fachhochschule Vorarlberg, because it is a public location and therefore we have test persons. Also it is possible to take photos of the scene every time or to measure certain objects or to create drafts for the development process. The selected scene contains objects (chairs, tables, bar stool, bar etc) which rarely have potential to look unreliable.

III. REFERENCE TO VISUAL HUMAN CONCEPTIONS AND IT'S REFLECTION TO THE POSSIBILITIES WITH VR SYSTEMS

Some physiologic factors have to be followed that a virtual scene seems realistic. On the one hand the presentation has to be in stereoscopic form to get a depth

perception (Collewijn, H. & Erkelens, C. J. 1990). On the other hand we have to use a "moving camera" because we do not only see single images. Although we only work with one image we respect the fact that the human can move his head. To imitate this "moving camera" an experiment design with sensors for the "tracking" of the head movement was developed. In this study the VR labor (http://www.fhv.at/uct) of the FH Vorarlberg was used.

- Stereo vision
- Field of vision
- Head movements

IV. Tested Reality Parameters

Not much studies exist about „Realism" in the 3d area and even less under the aspect of the human visual conception, therefore we use the ten principles of photorealism in 3d (Fleming, B. 1999) in this study as basis.

➢ *Lightfields*

At the beginning of this analysis we expected that the lighting in the scene plays a big role in the concentration of the viewer of the scene. This assumption was not approved by the eye tracking results.

➢ *Order, Disorder*

A big problem in computer generated images is that the scenes and objects often look very sterile. Each scene, artificial or non artificial, consists of at least a bit of disorder and chaos, figure 1.

Fig. 1: Two figures of the analysis. The aspect of disorder between a ordered and a chaotic scene gets analyzed.

➢ *Detailed information*

The way to tenability of a 3d scene goes over the fluency of the objects in a scene. The more detailed the elements are the more realistic a scene seems.

Fig. 2: All objects have been modeled as detailed as possible to feel as realistic as possible.

Fig. 3: The objects are placed as disordered as possible

V. Verifying Parameter Selection Through the Eye Tracking Analysis

For the analysis an animated illustration of 32 images was created. It consists of synthetic images of the bar and of the foyer, their real archetypes and more synthetic environments. In the self generated images some parameters like order, the detail of the objects and light properties get changed within the same images.

In the eye tracking analysis a camera is set onto the pupils of the eyes to find out the location to which the test person looks at on the 2d monitor. First a calibration is done by telling the camera if the person looks to the left, right, up, down and so on. Then the images are presented onto the screen.

Fig. 4: Eye-Tracking results

VI. DISCUSSION

In this paper a first study on the basis of really existing scenarios was done to find the parameters and criteria for a realistically seeming scene. VR technologies were used to offer stereo viewing, handling the view problematic and the head movement. Now the first analysis was done. More 3d studies have to be done, the scene has to be improved and it is necessary to use comparing studies in real size and with HMD.

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