Trends and Developments from the VR2007 Conference

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Virtual Reality (VR) is not a niche but key of a larger trend in next generation Reality Based Interfaces (RBI) according to Robert J. K. Jacob from Tufts University in his keynote address at this year's 3D User Interfaces (3DUI) Symposium, which took place in conjunction with the IEEE Conference on Virtual Reality. "Use reality wherever you can, for the rest, use something different." Jacob (figure 1) encouraged researchers to continue and broaden their work towards the development of interfaces which in his opinion should be based on natural users' skills and incorporate new technologies whenever what we gain by the computers' capabilities is more than we lose by giving up familiarity in handling objects and information.

The annual IEEE Conference on Virtual Reality brings together researchers and companies involved in the field. The 2007 conference took place in Charlotte, North Carolina. It covered the whole range of VR related themes ranging from perceptual and human factors issues, technical questions and interaction research, to modeling and rendering of virtual humans, to name just a few.

Beside much in-depth research work presented during the conference, it was also the place to share opinions on future trends and developments in VR. Jim Foley from Georgia Tech opened the discussion in his keynote by claiming three big T's which will dominate Virtual Environments in future: Training, Therapy, and Theatre. As for many other technologies, Foley sees games and entertainment as the main driving factors in making VR technology affordable for consumers. This in turn could open up new markets and bring VR applications into daily life. He also drew attention to the point that complete immersion is not necessary for all tasks. While considerable immersion is achievable at relatively low costs, a full immersion system might easily inflate the budget, so it is crucial for the economic success of Virtual Environments (VEs) to keep the relationship between costs and effectiveness in mind when planning them. When asked for what comes after Virtual Reality, he speculated that

Figure 1: Rob Jacob (right), keynote speaker, and Wolfgang Stürzlinger (left), organizer of the 3DUI Symposium.

in a future evolutionary step we might lose our ability to walk and live our entire life in virtual environments, similar to the popular Second Life.

In a statement addressed to those planning an academic career and shaping the future of VR, Frederick P. Brooks from University of North Carolina, Chapel Hill, one of the fathers of VR, gave the advice to "do what makes you crazy and do it well, find your passions, and find a way you make your passion useful." Many agreed that the enthusiasm and innovations which drive the computer games industry could also be a model for developing business and industrial VR systems. Applications could be structured as serious games in order to make them more lively, usable and less tiring.

The program of the conference included several panels and sketch sessions which covered:

- Perception & Human Factors
- 3DUI & VR/AR Systems
- Scene Complexity Management
- Modeling & Simulation
- Distributed & Networked VR
- Display
- Multi-sensory Interaction
- Modeling & Rendering
- Modeling, Rendering & Virtual Humans (Sketches)

Figure 2: Infrared based optical tracking system iotracker from Vienna University of Technology.

- VR Systems & Applications (Sketches)
- Augmented & Mixed Reality (Sketches)

The talks covered the whole spectrum from basic physiological/perceptual research to core VR technology. Issues related solely to interaction were covered in the Symposium on 3D User Interfaces (3DUI), which took place two days before the conference. There were a broad range of contributions. Niklas Elmqvist from Chalmers University of Technology, Göteborg, presenting a taxonomy and design patterns for 3D occlusion management techniques, a vital step in order to help users to discover and access occluded virtual objects and find relationships between them (Elmqvist & Tsigas 2007).

Virtual mirrors were suggested as new interaction techniques for Augmented Reality (AR) systems by Nassir Navab from Technische Universität München. They are of great use when moving the head is too complicated or even impossible. Navab demonstrated the mirror in the context of laparoscopic surgery, showing impressive pictures of precisely superimposed views of real patient videos and CT images (Navab, Feuerstein, & Bichlmeier 2007). Examples like these re-emphasized what medicine can gain from using VR. “Medicine is the immediate future of VR” as participants noted during the discussion.

In a talk on Distributed Virtual Environments (DVEs), Silvia Rueda from the Universidad de Valencia presented studies underlining the benefits of peer-to-peer (P2P) networks in terms of scalability, response times and system saturation (Rueda, Morillo, Orduña & Duato 2007).

Non-isomorphic manipulation, that is non one-to-one mapping of manipulations of the input device onto the controlled virtual objects, is a common way of interacting within virtual environments. Joseph J. LaViola from Brown University presented work showing that a possibly generalizable amplification factor of three is best for non-isomorphic 3D rotation in VEs (LaViola & Katzourin 2007).

Figure 3: Tactile feedback device by VW Group Research and Bauhaus-University Weimar.

One panel was dedicated to spatial perception in immersive virtual environments. Most of the contributions were dealing with distance compression, the fact, still not entirely understood, that users in virtual environments systematically underestimate distances when acting on the space. Various related aspects were discussed, e.g. the fact that recent research in psychology has shown that visual perception is influenced by a person's purposes, psychological state, emotions, and recent activities.

Several research groups and companies presented their latest developments at a small exhibition. Among them was the low cost, four camera, infrared based optical

tracking system *iotracker* from Vienna University of Technology (see figure 2) which also astonished industrial competitors with its high accuracy and large tracking volume of up to 40 m^3. A lightweight tactile feedback device for the fingertips which could replace cumbersome data-gloves was presented by Volkswagen Group Research and Bauhaus-University Weimar (see figure 3). It enables users to feel and interact with virtual objects using two fingers and the thumbs of both hands (Scheibe, Moehring & Froehlich 2007).

Industrial exhibitors tried to attract visitors with effective demonstrations of their latest VR technology, mostly Head-Mounted-Displays (HMDs), tracking systems, and software toolkits (see figure 4). The HMDs presented featured fields of view (FOV) ranging from 40° to 80°, with varying image quality and resolutions up to 1280x1024 per channel. The prices for professional VR systems, including HMD, tracking system, visualization software, and rendering hardware, are varying among the suppliers, starting from US$ 50,000 to 80,000.

The VR community will meet again at this year's ACM Symposium on Virtual Reality Software and Technology (VRST) from November 12–14 in Newport Beach, California and ACM SIGGRAPH from 5–9 August in San Diego, California.

Figure 4: High resolution HMD and tracking technology presented at the booth of WorldViz.

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