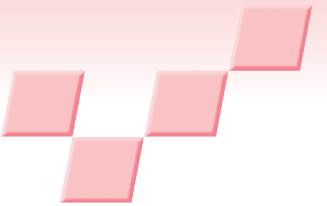

Virtual Reality Software and Technology

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In recent years, VR has benefited tremendously from computer graphics advances, ranging from computing platforms, display technology, and software techniques to the understanding of human perception. The results of this progress are evident in the increasing number of VR-based training systems, immersive visualization systems, and visually realistic video games.

The ACM Symposium on Virtual Reality Software and Technology (VRST) serves as a major forum for the dissemination of cutting-edge technical advances. This special issue features significantly expanded versions of the four best short papers from the VRST 2007 proceedings.[1] It also contains an introductory survey on 3D user interfaces (3D UIs) by leading VR authorities. We express our sincere gratitude to the many reviewers who diligently helped attain the highest quality standards for this special issue.

Surveying 3D UIs

The VR field has recently seen the advent of novel commodity 3D UIs that have led to not only a revolution in video game interaction but also new possibilities for other VR applications. To provide background, Doug Bowman, Sabine Coquillart, Bernd Froehlich, Michitaka Hirose, Yoshifumi Kitamura, Kiyoshi Kiyokawa, and Wolfgang Stuerzlinger present the timely survey, "3D User Interfaces: New Directions and Perspectives." They discuss four major research trends:

- novel combinations of sensors for 3D input device design,
- biosignals such as brain activity as input mechanisms,
- haptic (touch) feedback through pseudohaptic interfaces, and
- 3D UIs for multidisplay interfaces.

The survey also proposes guidelines for the design of next-generation 3D interaction techniques, particularly multiuser, collaborative user interfaces.

The Featured Articles

The explosion of computing power in computer graphics has extended the number of tractable virtual characters in virtual environments from just a few to several hundred. The inclusion of virtual crowds in interactive applications poses novel technical problems, one of them being crowd control. Xiaogang Jin, Jiayi Xu, Charlie Wang, Shengsheng Huang, and Jun Zhang tackle this problem in "Interactive Control of Large-Crowd Navigation in Virtual Environments Using Vector Fields." They present a simple but effective technique that successfully combines global and autonomous control. The global-control component is derived from a user-specified vector field, whereas the autonomous component includes velocity proportional control and the influence of anchor points. The authors have enhanced the control algorithm with editing tools that allow on-the-fly modifications of crowd behavior without hurting real-time performance.

The problem of wayfinding in VR is clearly important, but first-person navigation differs from that of large virtual crowds. In first-person virtual

 Published by the IEEE Computer Society

environments, the view of the virtual world must capture the maximum degree of realism. Visual realism might be critical in determining the end user's response and, ultimately, the VR application's success. In "Depth-of-Field Blur Effects for First-Person Navigation in Virtual Environments," Sébastien Hillaire, Anatole Lécuyer, Rémi Cozot, and Géry Casiez enhance the realism of first-person navigation by introducing depth-of-field blur effects. Their technique automatically computes the focal distance and a temporal accommodation of the blur effect. They also evaluate blur effects in terms of performance and subjective preference.

Another factor influencing the visual realism of virtual environments is global-illumination effects, such as soft shadows or smooth shading due to reflected lighting. In recent years, computer graphics has seen a rapid growth in global illumination, with many techniques that enable highly accurate yet interactive lighting of complex scenes. Such growth has affected VR applications, as exemplified by "Real-Time Global Illumination for VR Applications," by Jesper Mortensen, Insu Yu, Pankaj Khanna, Franco Tecchia, Bernhard Spanlang, Giuseppe Marino, and Mel Slater. The authors present Virtual Light Field rendering, which achieves real-time rendering that's independent of illumination complexity and largely independent of geometric complexity. A key problem in real-time global illumination is how to handle dynamic scene changes; the authors present a method to support a virtual character's motion with appropriate shadows and reflections. They also apply the method to immersive displays.

VR extends the frontier of human communication by enabling communication with or through virtual agents. However, human communication is far from simple and is influenced by subtle perceptual and emotional effects. A good understanding of these effects is crucial for successfully communicating with virtual agents. In "Virtual Human versus Human Administration of Photographic Lineups," Brent Daugherty, Sabarish Babu, Lori Van Wallendael, Brian Cutler, and Larry Hodges evaluate a virtual human interface for a social collaborative task. In particular, they compare communication with virtual and real humans conducting a photographic lineup. They conclude that a virtual human can conduct such lineups just as well as a human; they base this conclusion on measures of identification accuracy, the procedure's ease of use, and the witness's affect.

This special issue compiles exciting novel contributions to VR, which we expect will serve as an inspiration for future research and applications. We hope that you enjoy this issue.

Reference

1. *Proc. 2007 ACM Symp. Virtual Reality Software and Technology* (VRST 07), ACM Press, 2007.

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