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Blue-c: A Spatially Immersive Display and 3D Video Portal for Telepresence

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Keynote

We present the blue-c, a new generation immersive projection and 3D video acquisition environment for telepresence and collaboration. It combines simultaneous acquisition of multiple life video streams with advanced 3D projection technology in a CAVE™-like environment creating the impression of total immersion. The blue-c portal currently consists of three rectangular projection screens which are built from glass panels containing liquid crystal layers. These screens can be switched from a whitish opaque state to a transparent state allowing the video cameras to “look through the walls". Our projection technology is based on active stereo using two LCD projectors per screen. The projectors are synchronously shuttered along with the screens, the stereo glasses, active illumination devices, and the acquisition hardware. From multiple video streams, we compute a 3D video representation of the user in real-time. The thus created video inlays can be transmitted progressively through networked virtual environments.

Within the blue-c project a variety of novel technical concepts were developed:

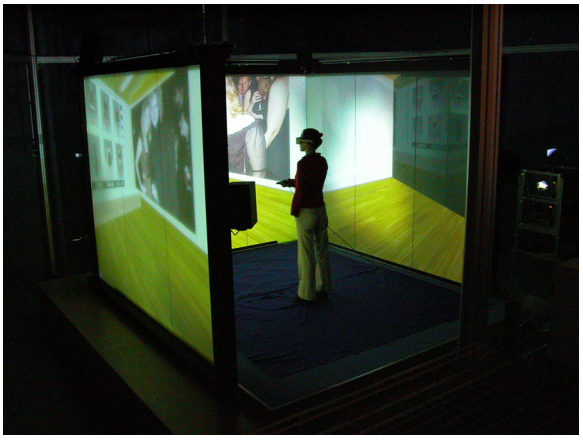
1. We designed new projection technology that uses active screens with liquid crystal layers inside. Additional, pulsed LED illumination improves the image quality and facilitates the 3D acquisition.

2. We developed specialized controller hardware which synchronizes all critical hardware components, such as projectors, LC panels, shutter glasses, cameras, and active illumination.

3. We devised a novel 3D video format and processing pipeline tailored to our needs. It is based on 3D video fragments using irregular point samples as video primitives. This technology combines the simplicity of 2D video processing with the power of 3D video representations. It allows for highly effective encoding, progressive transmission, and supports a multitude of visual effects.

4. We designed a network communication architecture for the blue-c. It offers various services for managing the nodes of the distributed blue-c system and implements communication channels for real-time streaming of 3D video, audio, and synchronization data.

5. We provide an API which allows programmers to readily use specific hard- and software features of our system for rapid application development.



While the blue-c is primarily intended for high end collaborative SID and for telepresence, our setup is highly scalable enabling users to adapt the number of cameras and projectors to the needs of the application.

The blue-c is the largest internally funded research project at ETH. It required expertise from computer graphics, computer vision, communication engineering, mechanical engineering, and physics. It took us 3 years and the effort of 20 researchers to bring this project to completion.