The Responsive Workbench –
Interactive Multimedia workplace

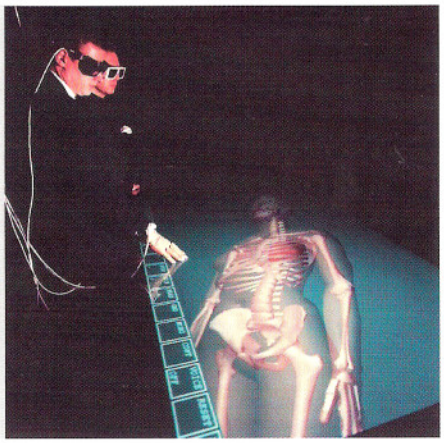
GMD IMK

Aims

The "Responsive Workbench" concept is an alternative to the multimedia and virtual reality models of the past decade. In this new concept, the user no longer experiences simulations of the world on the computer, but the computer is (invisibly) integrated into the users world. Everyday objects and activities become inputs and outputs for this environment. Computers are considered as a part of daily life and are no longer isolated on desks. The computer system can use and adapt to the rich human living environment. The project aims to transform the usual dialog concept for manmachine communication. For example adapting multi-media workstations into a more applicationoriented form for use in science, medicine and architecture. The display is designed as part of the human working environment. For instance, objects are displayed on a table in 3D. The user interacts with this virtual scenario, manipulates it as if real, and upon request obtains information from the computer in the background.

Scenario

Virtual objects and control tools are located on a real "workbench". The objects, displayed as computer-generated stereoscopic images are projected onto the surface of a table. The computer screen is changed to a horizontal, enlarged worktop version and replaces the two-dimensional flat screen. This view corresponds to the actual work situation in an architect's office, at surgery environments, on the workbench, for three-dimensional atlases, etc. The work action is virtual. A guide uses the virtual working environment while several observers can watch events through shutter glasses. The guide operates within a nonimmersive virtual reality environment. Depending on the application, various input and output modules can be integrated, such as gesture and speech recognition systems which characterize the general trend away from the classical humanmachine interface. Several guides can work together locally or use global communication networks such as broadband ISDN. "Responsive Environments", consisting of tracking systems, cameras, projectors and microphones, replaces the traditional computer workstation. Thus the computer is increasingly adapted to human needs.The control tools implement complex actions that can be easily achieved by intuitive movements of the users hand. Each control instrument is represented as a small virtual object that can be activated by grabbing it with the hand and moving it onto an object, which is to be manipulated. Rotations of objects then can be done just by turning the hand. The zoom operation is accomplished by simple up and down movements of a small virtual magnifier, which has been grabbed by the hand.



Visualization in Medicine: 3D model of a virtual patient, e.g. for surgery planning

Applications

Based on current research projects in the field of computer graphics, human computer interfaces and visualization, the following applications have been embedded in this new type of environment:

- nonsequential medical training:
  The scenario is based on a real sized model of a patient, who could be examined in any detail through the zooming operation. Especially important are the dynamic aspects, like the beating heart and the blood flow inside of it.
- surgery planning:
  Real datasets from computer tomography (CT) or magnetic resonance imaging (MRI) measurements are visualized using isosurface techniques and semitransparent rendering.
- visualization of fluid dynamics:
  An entire 3D visualization system is implemented on the Responsive Workbench. The functionality comprises particles, streamlines and a powerful cutting plane tool, which is controlled by the users hand. As the orientation and position of the plane changes, a new colorized representation of the intersected scalar volume is computed. This is done without any noticeable latency. Additionaly, isosurfaces can be generated and displayed.
- design and discussion processes in architecture and landscape planning:
  Buildings and other objects can be moved around to create variants of the current model.

Projectpartners

The "Responsive Workbench" software, which was originally implemented by the GMD is now further developed in cooperation with the Stanford University. In the area of flow visualization the GMD is doing a project together with Daimler-Benz.

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