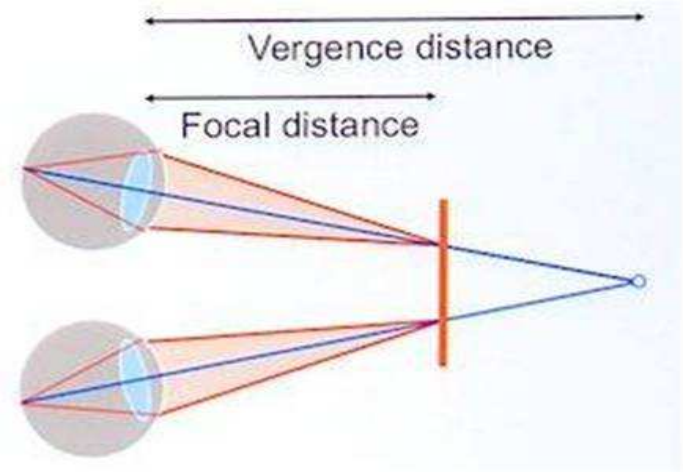
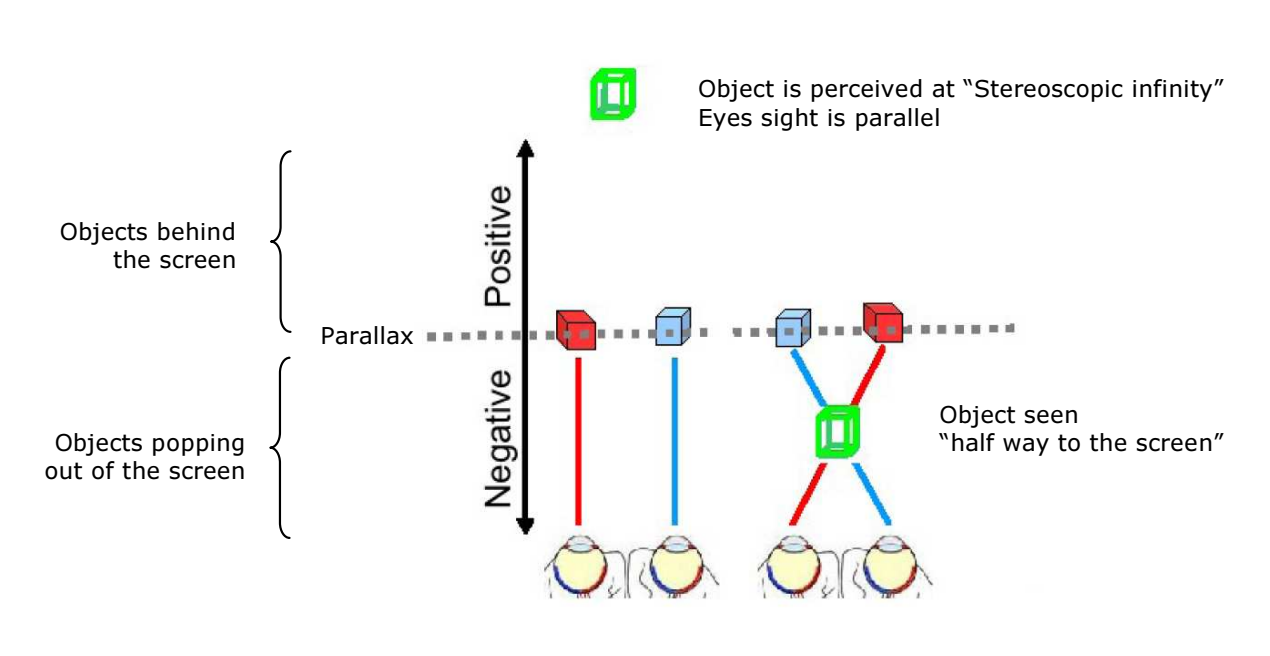
Main issues of current 3D displays

- **Focus ⇔ vergence mismatch**
  - Eye muscles vergence and accommodation are not synchronized
    => fatigue and headache



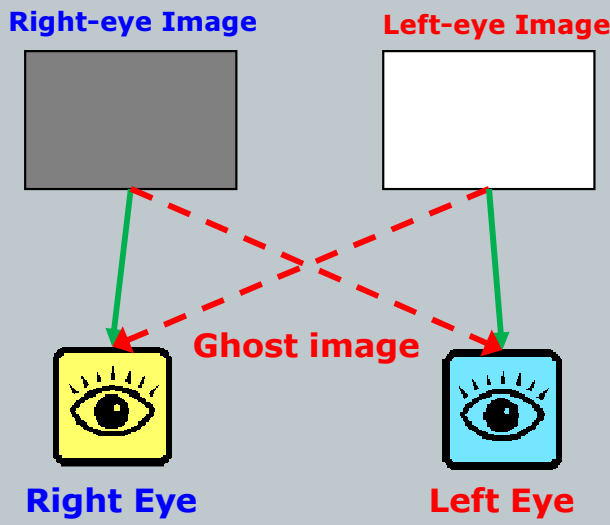


  - Tolerated mismatch depends on position of the object with respect to the screen => before/behind

Main issues of current 3D displays

2. Crosstalk

- Crosstalk = leakage of one eye image channel (view) into the other eye (view)
  => all displays except HMD's and displays with separate L,R channels



- The inverse of crosstalk is often referred to as 3D contrast or extinction ratio

3D in professional applications

Edutainment

- 3D Cinema
- Museums & expos
- Visitors' attractions

Design Engineering

- Automotive, consumer goods, architectural design
- Engineering & manufacturing
- Design studies
- Virtual prototyping
- Ergonomic studies

Oil and Gas

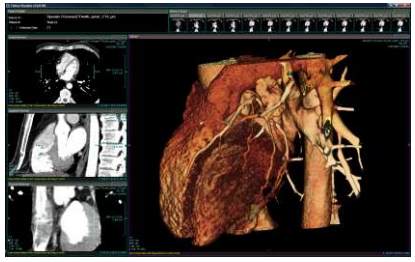
- Subsurface exploration
- Seismic research
- Drilling
- Collaboration

Universities and Scientific Research

- Medical/bio research
- Fluid and aero dynamics simulation
- Space/aerospace/climate research
- Mechanical engineering
- Urban planning

Medical

- Computer tomography (CT)
- Magnetic resonant (MR)
- Cardio-vascular
- Surgical displays

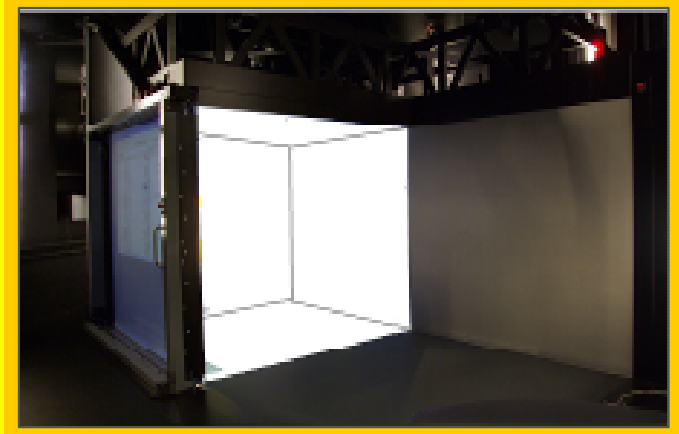


Immersive visualization solutions

Flat shape

Curved shape

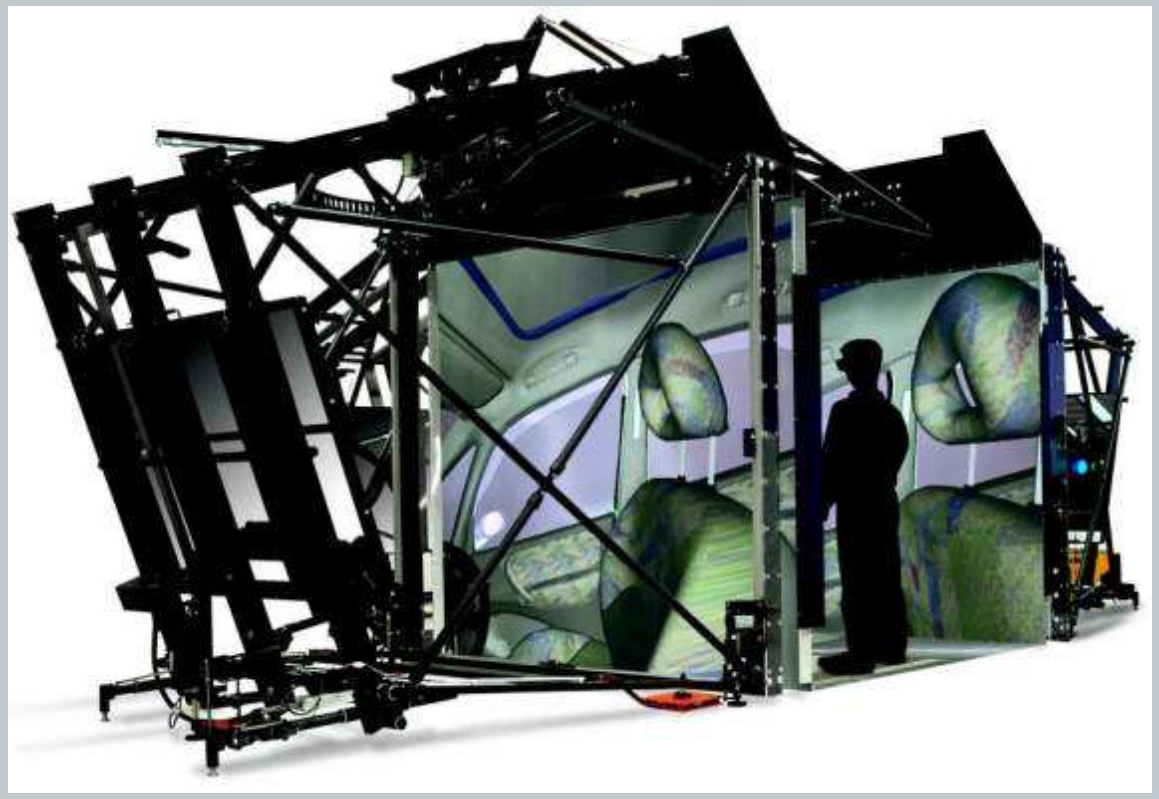
Cube shape

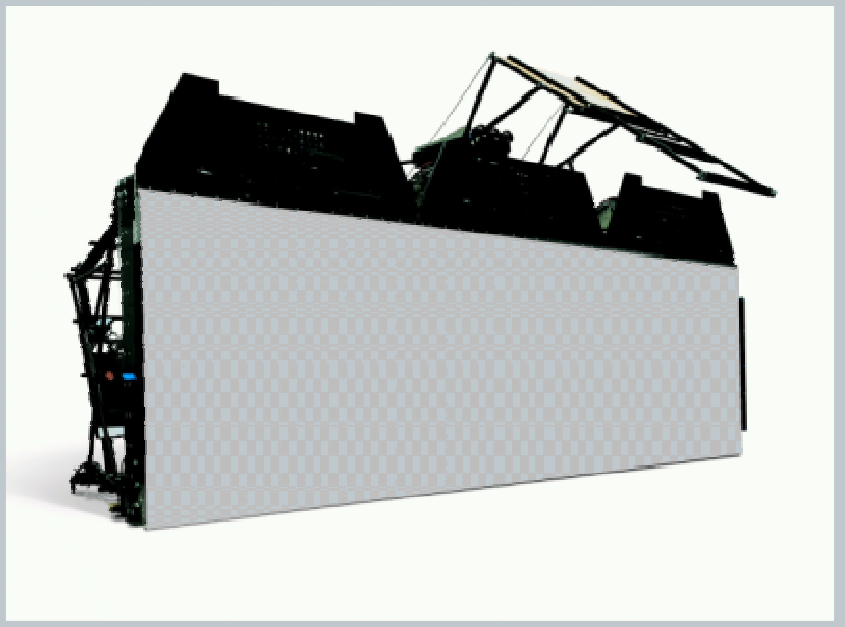


“Immersiveness”

Immersive visualization solutions

Complex optical-mechanical systems





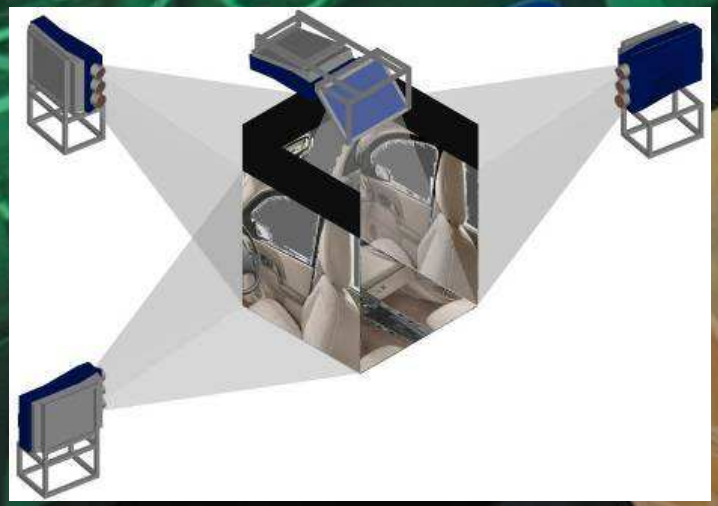
3D in professional applications

Some examples…

Digital 3D cinema

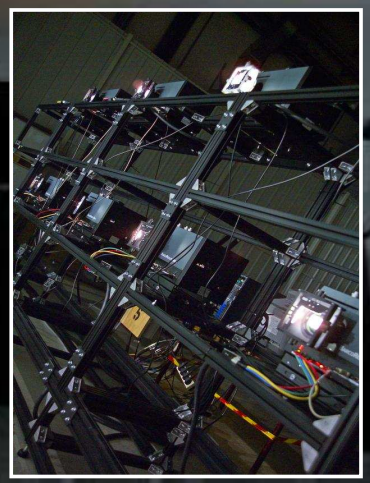
IMAX Theater Seoul, Korea

Automotive design



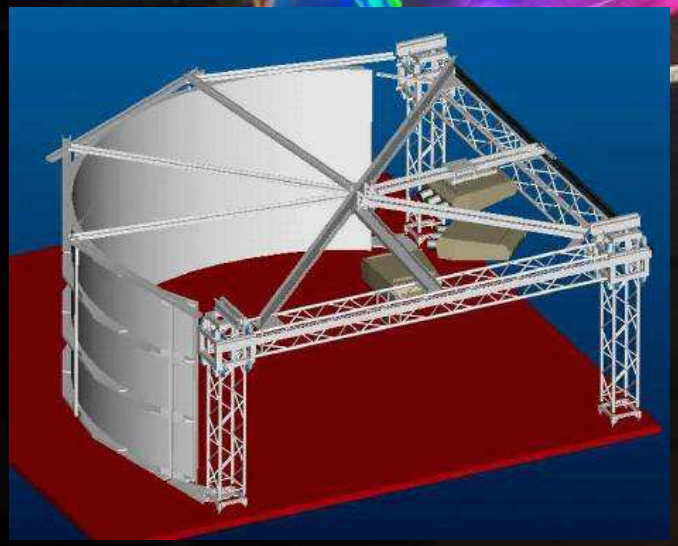
Ford Visualization Center, USA

Automotive design



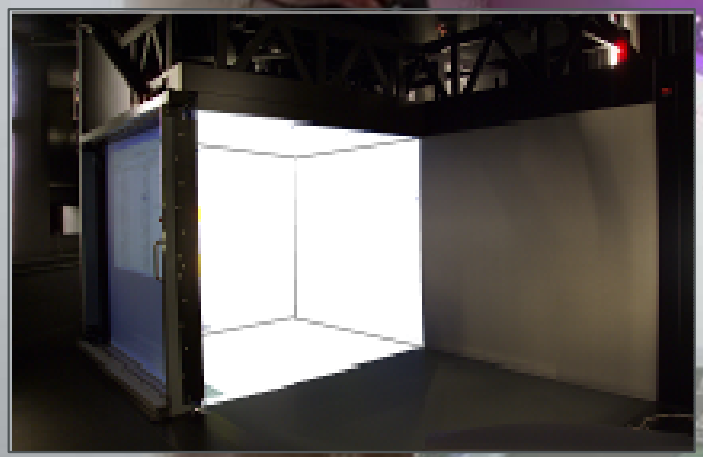
Daimler Design, Germany

Oil & gas



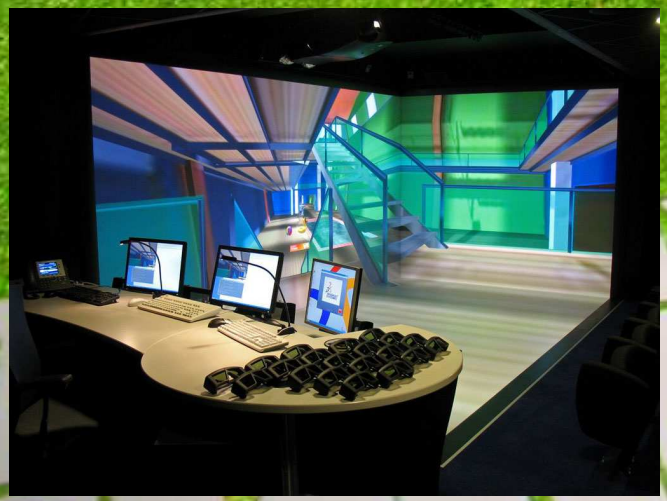
Shell ACE VR Center, Malaysia

Geo science research



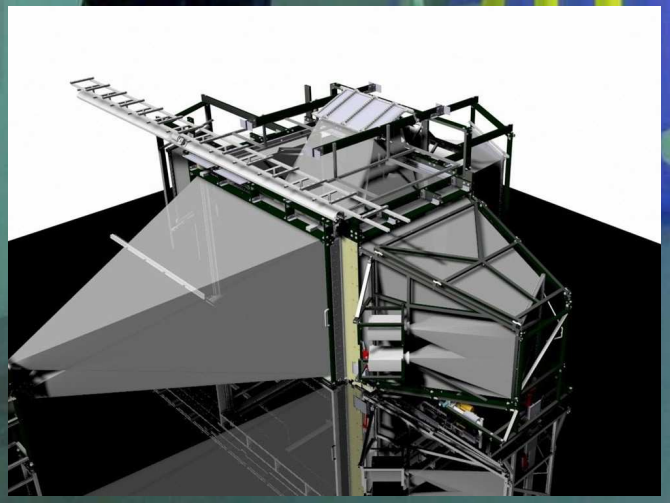
University of Potsdam, Germany

Design software showcase



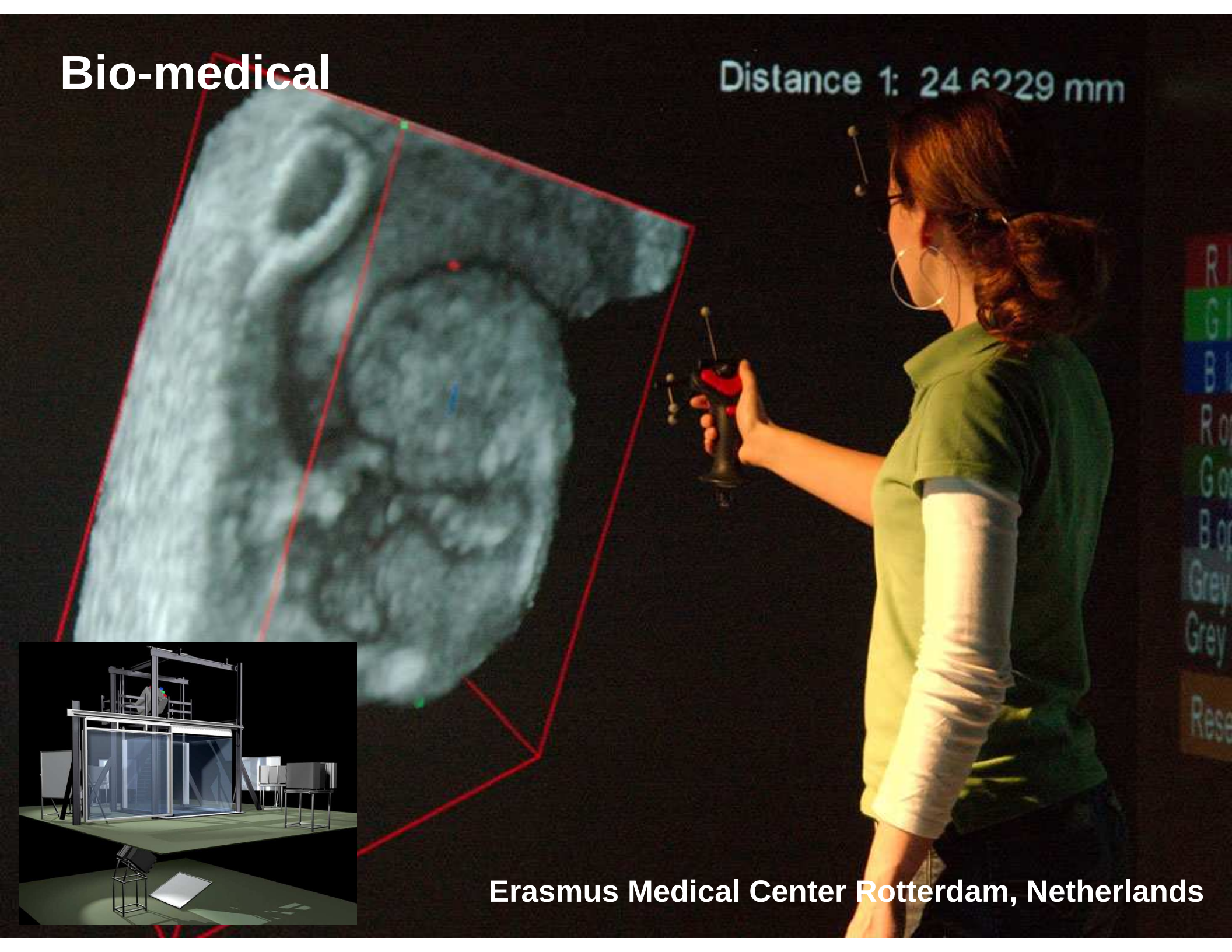
Dassault Systems, France

Scientific research



RWTH Aachen, Germany

Bio-medical



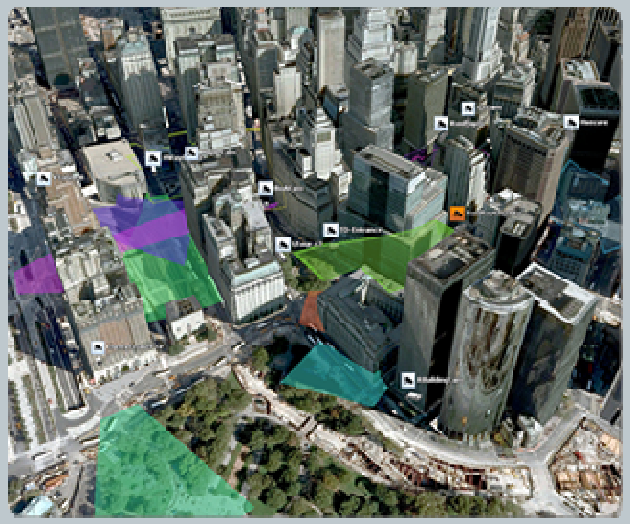
Erasmus Medical Center Rotterdam, Netherlands

3D visualization in the security control center?

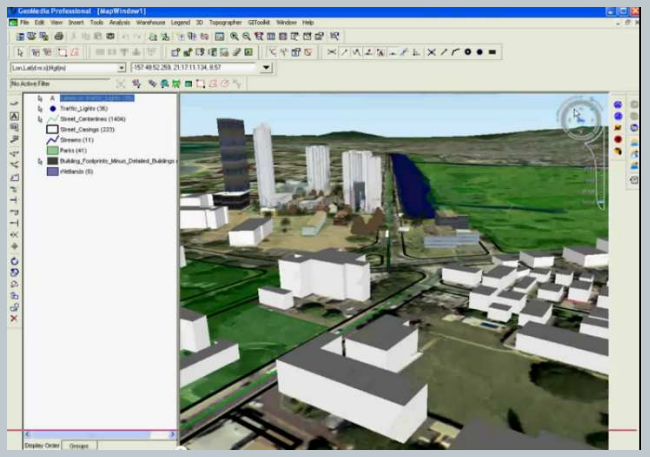
- 3D rendering on the desktop is emerging
  - As graphical UI for Physical Security Information Management (PSIM) software
  - 3D mapping of GIS information
  - CCTV camera coverage and blind spot visualization
  - Easier tracking of subjects

VCORE fourDscape

Feeling Software Omnipresence 3D



Intergraph GeoMedia 3D



Entelec SkyWalker

3D visualization on the overview display wall

- 3D rendering on mega-pixel, multi-channel display walls still a challenge
  - Resolution limitations in Operating Systems
  - Requires high computational power and accelerated graphics
  - Facilitated by high-end GPU’s becoming available (gaming industry)

Mapping CCTV video in the 3D environment

- Many cameras
- Video is displayed inside their own canvas – keyholes

⇨Position video images in the 3D map where they are captured

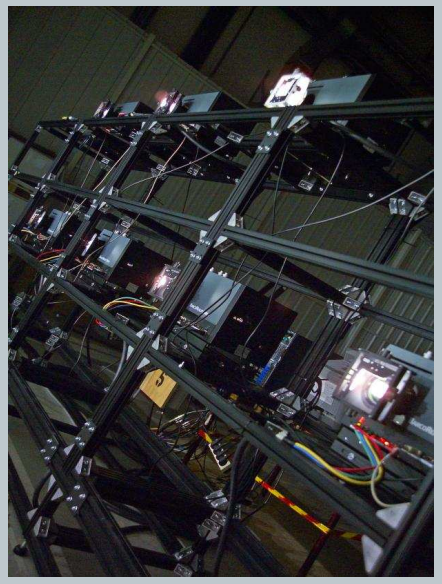
Fusion of CCTV in the 3D environment

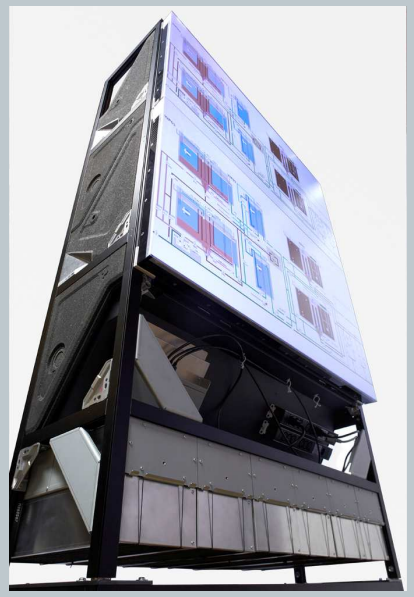
- Overlay video on top of the 3D map
- Synthetic scene visualization by adding metadata as graphical elements to the video

Stereoscopic visualization in the control center

- Benefits
  - Improved situational awareness
  - Faster decision-making in complex, dynamic environments

- Requirements
  - Displays should be capable of 24/7 operation
  - Limited floor space
  - Robust, should not require frequent re-calibration
  - Low noise level



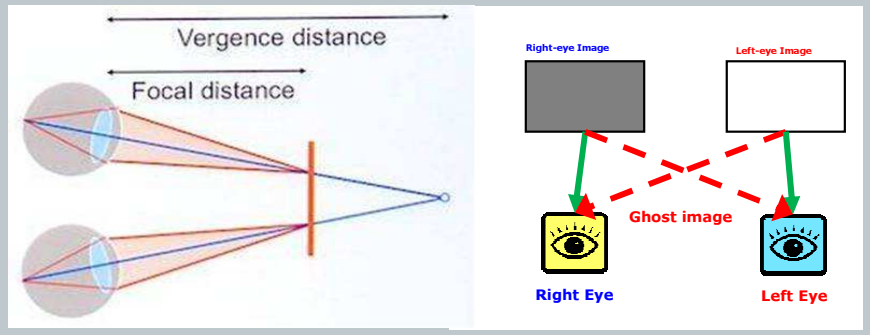


Stereoscopic projection cubes

- Available today
  - Liquid-cooled LED illumination for low TCO and long lifetime
  - Automatic color calibration
  - Time-multiplexed at 120Hz with IR emitter and active shutter glasses

Challenges

- Eye-fatigue with long-term use
  - Vergence-focus mismatch
  - Crosstalk



- Interference of the glasses with
  - Workspace lighting
  - Other displays in the operator environment

Conclusions and a forward look…

- 3D visualization technologies will become omnipresent in the control center
  - 3D rendering on 2D displays
- Stereoscopic displays start to appear in the control center
  - On the desktop
  - For the overview display wall
- 3D stereoscopic surveillance cameras may fuel the demand for stereoscopic displays

- Future **multi-view auto-stereoscopic** displays that require no eyeware will greatly improve usability and will be instrumental for general acceptance

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3D visualization in the security control center

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