Efficient, Intuitive User Interfaces for Classroom-Based Immersive Virtual Environments

Doug A. Bowman, Matthew Gracey, and John Lucas
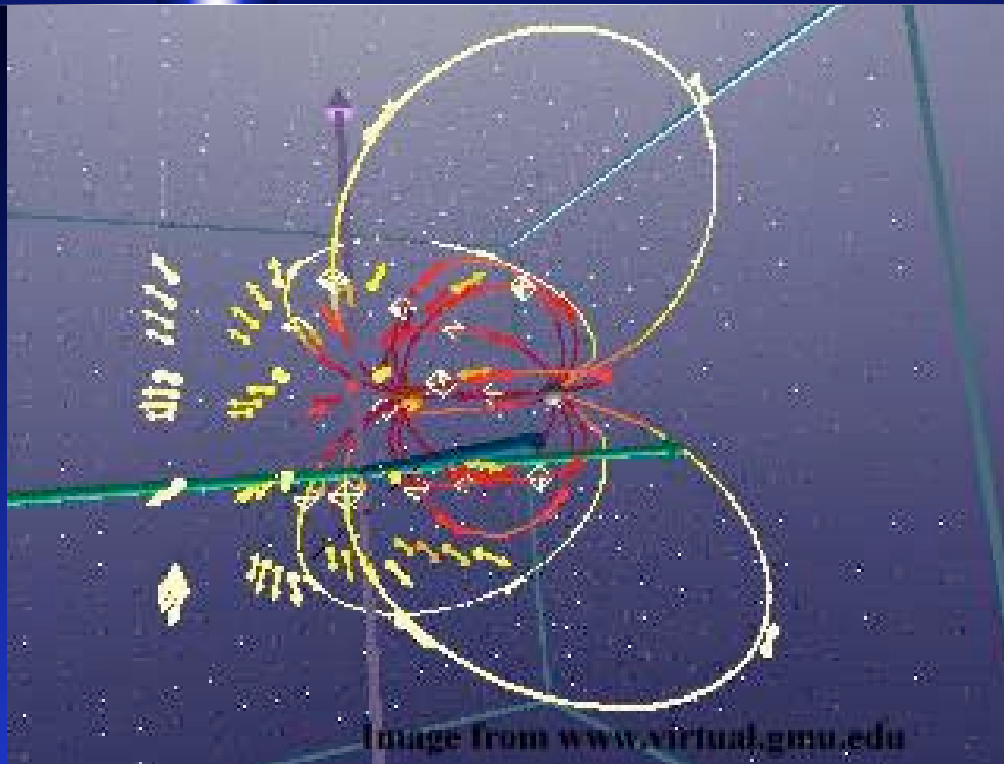
Dept. of Computer Science

Center for Human-Computer Interaction

Virginia Tech

VEs in education

Image from www.virtual.gmu.edu

ScienceSpace (Dede et al.)

- HMD, trackers
- Research prototype
- Tested in laboratories, not in classrooms

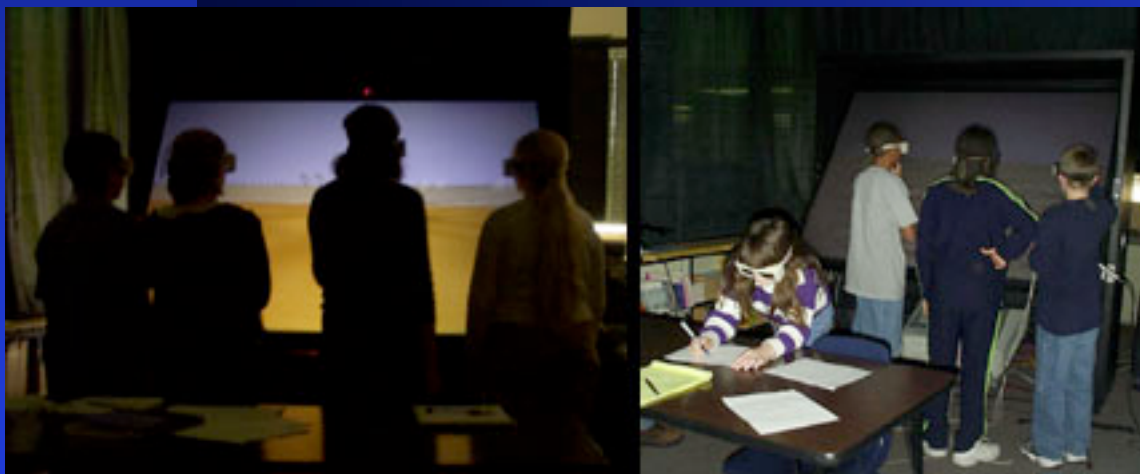# VEs in education

NICE: Roussou et al.

- CAVE *and* VRML / Web
- Research prototype
- Tested with real students

VEs in education


Virtual Ambients: Moher et al.

- Immersadesk or Plasma screen
- Tested with real students
- Tested in real classrooms

Our goals and challenges

- **Goals**:
    - Develop an immersive system that could easily be used in real classrooms
    - Develop interactive, information-rich applications that supported real learning by complementing existing teaching methods
- **Challenges**:
    - Cost
    - Portability
    - Usability

Applications
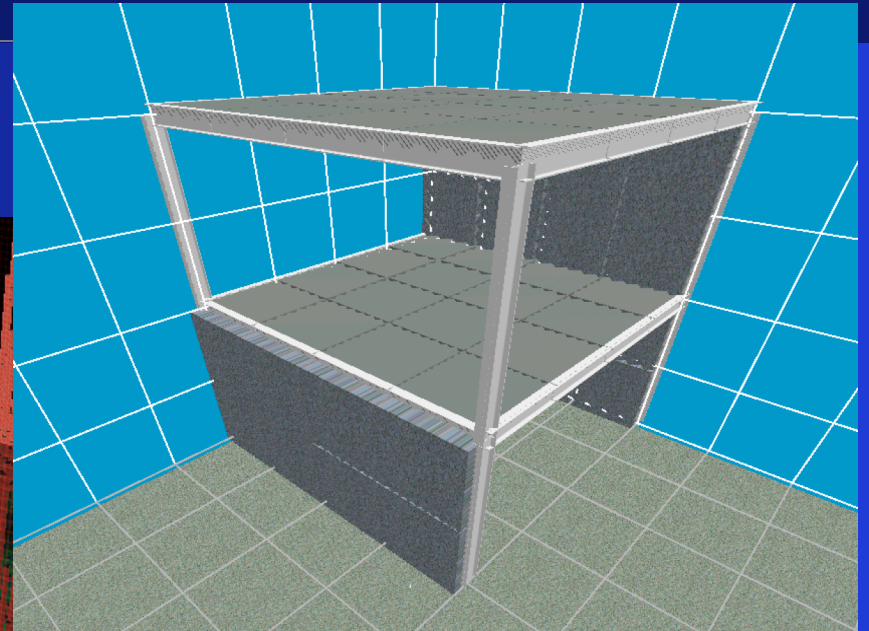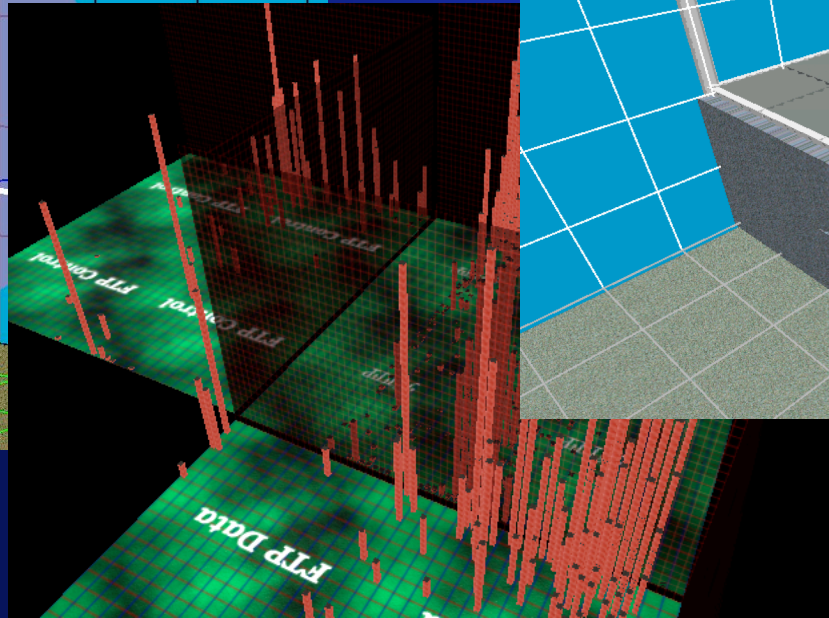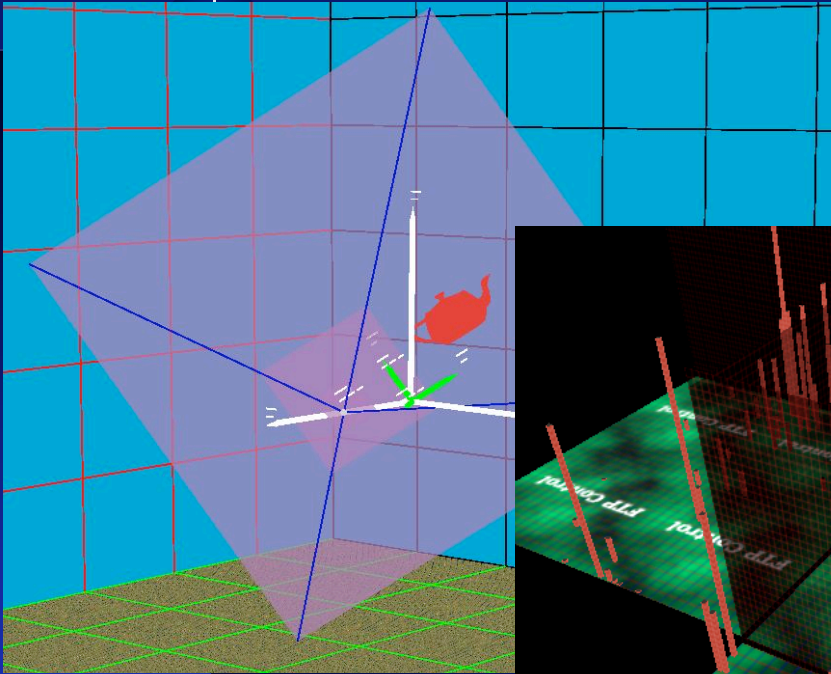
Addressing cost and portability

- Portable, low-cost, immersive, multi-viewer VE system:
    - A/V cart
    - PC
    - i-visor HMD
    - Intertrax2 3DOF tracker
    - Twiddler input device
    - LCD projector
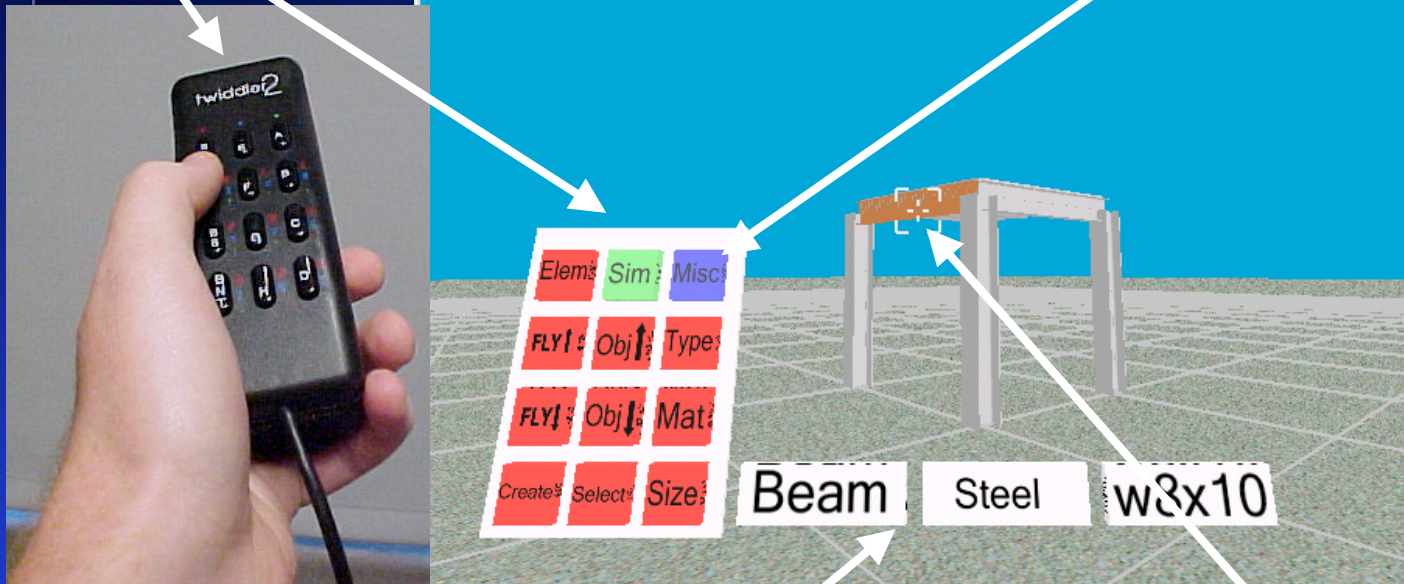   - Video splitter
- Total cost: < $7000

Addressing usability

- We needed a usable UI within the constraints of this set of hardware devices
- Usability requirements:
  - Learnability
  - Efficiency
  - Multiple student use
  - Whole class benefits
  - Ease of use for instructors

UI components

Remote control metaphor

Button overloading

View management

Menu lists

Gaze-based interaction

Real-world use

- 6 different undergrad and grad classes at VT
- Real classrooms, not in research lab
- Instructors, not researchers, were in charge
- Classes ranged from 7 to 45 students
- Observations, surveys, interviews with instructors and students

Successes

- Remote control metaphor, gaze-based interaction intuitive, easy to learn

- High ratings for usability

- Non-immersed students did understand what they saw on the screen, and benefited

- View management critical to teacher's use of the VE applications

Less-than successes

- Low-cost HMD uncomfortable, low FOV led to disorientation
- Low-cost tracker not designed for extreme viewing angles

  => Most usability problems disappeared with use of high-end HMD and tracker

- 12 buttons is too many
- Instructors need to be able to point to objects/locations in the VE

Conclusions
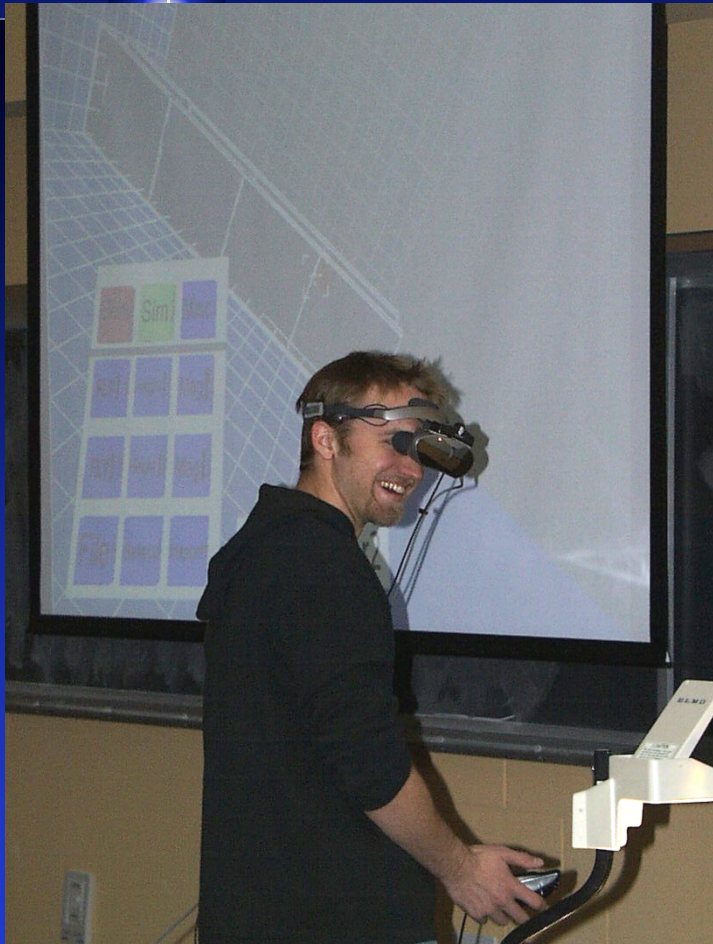
- Immersive VEs <u>are</u> possible in the classroom

- Low-cost devices are available, but less than desirable for student use

- Good UI design is necessary to make learning possible