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

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VEs in education

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

Menu lists

Beam: Steel w3x10
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 are 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