PA201
Virtual Environments

Lecture 9
Collaborative Virtual Reality

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Collaborative Virtual Environments

Collaboration

- Users interacting with each other
  - Over the network
  - Locally (same room)
- Working together with the common goal

Definitions

- Working practice whereby individuals work together to a common purpose to achieve business benefit.
- Enables individuals to work together to achieve a defined and common business purpose. It exists in two forms:
  - **Synchronous** - everyone interacts in real time (online meetings, instant messaging, Skype,…)
  - **Asynchronous** - the interaction can be time-shifted (e.g.: uploading documents or annotations to shared workspaces, making contributions to a wiki,…)

http://www.aiim.org/What-is-Collaboration#

Collaboration in the Past

- Mostly co-located interaction, because…
- Difficult to interact on longer distances
- In form of post messaging or personal meeting
  - Later also in the form of telephony
  - Very slow paced and ineffecient

Collaboration in a Digital Age

- Simpler to interact over a large distance
- Use of modern technologies for real-time interaction (Internet)
- New place to relax

Steinkuehler, C. A. and Williams, D. (2006), Where Everybody Knows Your (Screen) Name: Online Games as "Third Places". Journal of Computer-Mediated Communication, 11: 885–909. doi:10.1111/j.1083-6101.2006.00300.x

Immersive Collaborative VR?

- Use of immersive virtual reality for collaboration
- Feel present somewhere else
  - With someone far away
  - Within the same local space
- Less distractions of real world
  - Better self-discipline?

Shared Space Collaborative VR

- CAVE (CAVE Automatic Virtual Environment)
  - Users share the virtual environment within the same real space
  - Surround projection
  - Common source
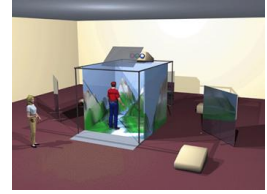
Carolina Cruz-Neira, Daniel J. Sandin, and Thomas A. DeFanti. 1993. Surround-screen projection-based virtual reality: the design and implementation of the CAVE. In Proceedings of SIGGRAPH '93. ACM, New York, NY, USA, 135-142. DOI=http://dx.doi.org/10.1145/166117.166134

Distant Collaborative VR

- Users don't have to share the real space
- Communication the over network
- Software is harder to develop
  - Networking limitations
  - Communication possibilities

Redfern, S., and Naughton, N. 2002. Journal of Information Technology Education, 1(3), 201-211. 'Collaborative Virtual Environments to Support Communication and Community in Internet-Based Distance Education'.

Development

Limitations

- How to interact?
- How to move?
- How to visualize others and the environment?
  - Realistic
  - Minimalistic
  - Stylized
- Hell, how to even communicate?

CONFUSED CAT
Meh

Development Challanges

- Network bandwidth
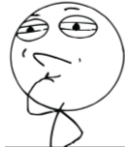 - ???
- Latency
  - ???
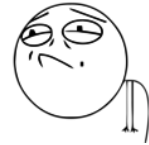- Interaction
  - ???

Development Challanges

- Network bandwidth
  - Synchronize what's really necessary
- Latency
  - Peform actions with predictions on client sides
- Interaction
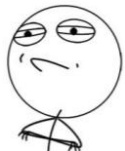 - Hardware dependend

Development Challanges

- Motion and other kind of sickness
  - ???
- Communication
  - ???
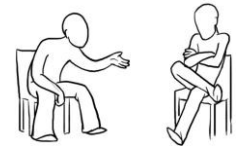- How to visualize others
  - ???

Development Challanges

- Motion and other kind of sickness
  - Use verified methods (tunelling, teleport,…)
- Communication
  - Most headsets have built-in microphone
- How to visualize others
  - Well, this one is a nut
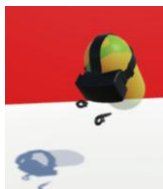
User Visualization

- Why:
  - Users should see each other in CVE
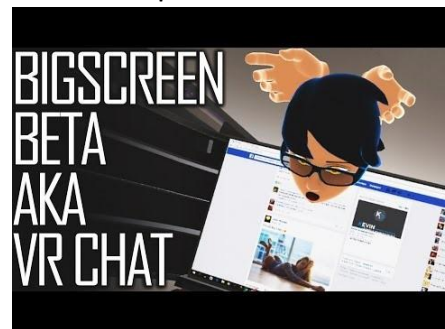 - To amplify the immersion
  - To help the communication

User Visualization

- Known is just a position and orientation of the head and occasionally hands
  - Avatars are simplified
  - In more complex cases, inverse kinematic for hands

Simplified avatars

BIGSCREEN BETA AKA VR CHAT

https://youtu.be/zCaUiJzXv8FI

Avatars with IK Hands
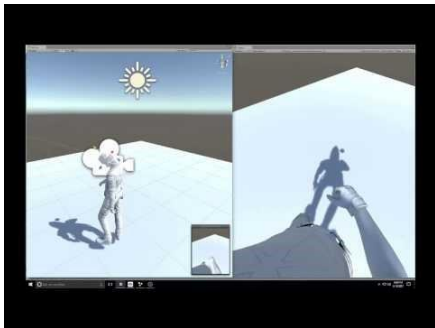

https://youtu.be/62NWu4rIDX4

Full-body Visualization

- Users often complain about missing legs
- How to visualize them?
  - IK with ground
    - Results don't look very good
  - Kinect-like sensors
    - Problems with user turning around
  - Markers
    - Additional wearable devices
    - Might be expensive
  - Treadmills
    - Bulky uncomfortable devices

Markers (with motion capture)

https://youtu.be/MnIJ5kSHXeo

IK with ground

https://youtu.be/0IQjRvvwpLY

Treadmills

https://youtu.be/MYSofTE6Sro

Applications

Current Applications

- Games
  - e.g.: Arizona Sunshine
- Social media
  - e.g.: Facebook Spaces
- Education
  - e.g.: Lifelique
- Collaborative Work
  - e.g.: Improov3

Current Applications

- Research
  - GAMU project with cartographers
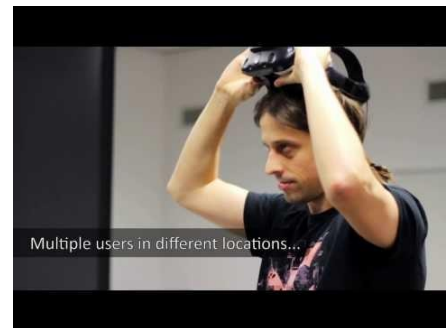 - iMareCulture, the underwater serious game
  - BCI speller chat

Possible Future Applications

- Combination with BCI
- Education
- Medical training
- Game development
- Social media

Collaborative VR - GAMU

Multiple users in different locations...

https://youtu.be/9VpQ9WvVi2A

Conclusions

- Wide range of uses
- The more people having VR, the more demand for collaborative applications will be
- Network limitations make the development harder

Questions