



PA201 Virtual Environments

Lecture 3
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.allm.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 inefficient



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?



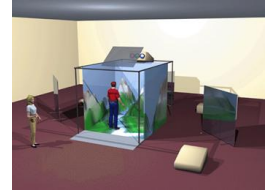
- Use of immersive virtual reality for collaboration
- Feel present somewhere else
 - With someone far away
 - Within the same local space
- Less distractions of real world
 - Better self-discipline?



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. 1991. Surround-screen projection based virtual reality: the design and implementation of the CAVE. In Proceedings of SIGGRAPH '91. ACM, New York, NY, USA, 135-142. DOI=http://dx.doi.org/10.1145/146117.146134



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



Rodfem, 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?



Development Challenges



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

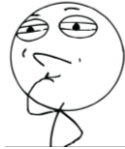




Development Challenges



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



Development Challenges



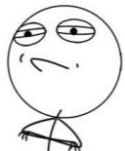
- Motion and other kind of sickness
 - ???
- Communication
 - ???
- How to visualize others
 - ???



Development Challenges



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



User Visualization



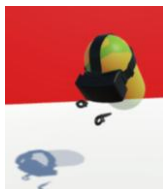
- Why:
 - Users should see each other in CVE
 - To amplify the immersion
 - To help the communication



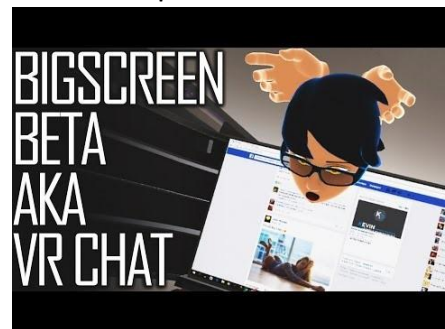
User Visualization



- 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



<https://youtu.be/GC8U2v28E1I>



Avatars with IK Hands



<https://youtu.be/52w9w480K4>

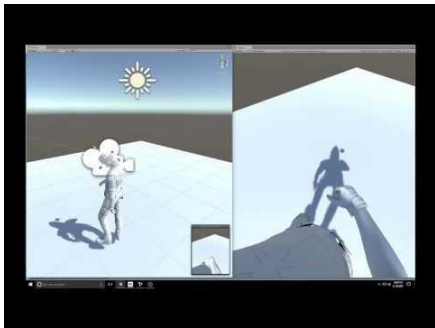


Full-body Visualization

- 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/Mn0155Kt0o>



IK with ground



<https://youtu.be/0Q3R0w9yV>



Treadmills



<https://youtu.be/MFSqFFEG0>



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



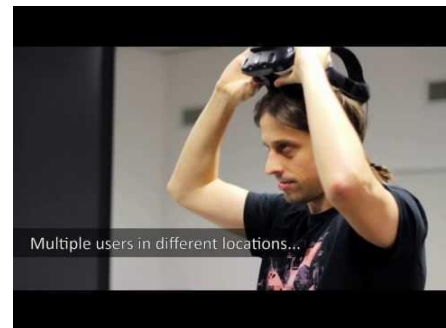
Possible Future Applications



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



Collaborative VR - GAMU



<https://youtu.be/RVj09Ww07A>



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

