DTU Compute
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Pond of Illusion: Interacting through Mixed Reality

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Pond of Illusion is an installation allowing users to feed fish in a virtual world. The virtual world is injected between two real spaces using Microsoft Kinect cameras and screens. The virtual world has two windows, which allows users to see through the virtual world and into the other real space.

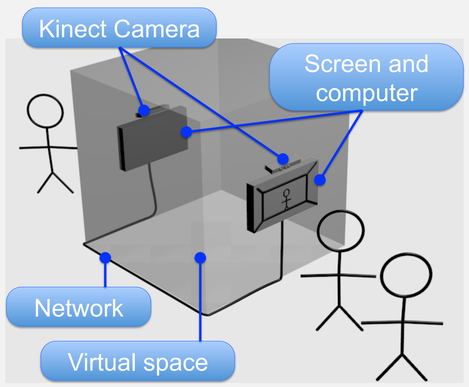
Mixed Reality

The term ‘mixed reality’ was coined by Milgram and Kishino [1994] and describes the merging of real and virtual worlds. Mixed reality covers usages ranging from augmented reality to augmented virtuality.

Our installation is an example of fairly unexplored part of mixed reality where you interact with both the virtual environment and people in the real environment.
Compared to related works, such as the telepresence system by Beck et al [2013], our approach is simple to implement and with few artifacts.

Setup

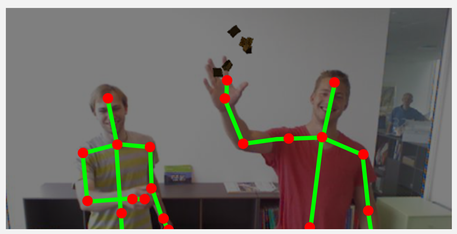
The installation uses two computer systems each with its own display and Kinect camera. A video stream and skeleton data is captured by the Kinect camera.



The data is compressed and sent over a network cable and displayed on the opposite system.

Tracking

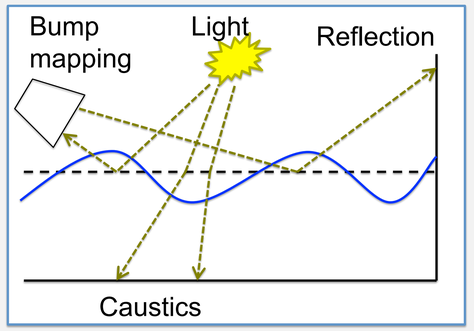
Skeletons tracked by the Kinect are used for detecting throw gestures, simply by looking at the velocity and acceleration of the skeleton hands. A velocity above a certain threshold with an oppositely directed acceleration will trigger breadcrumbs to be thrown into the virtual room from the hand position.



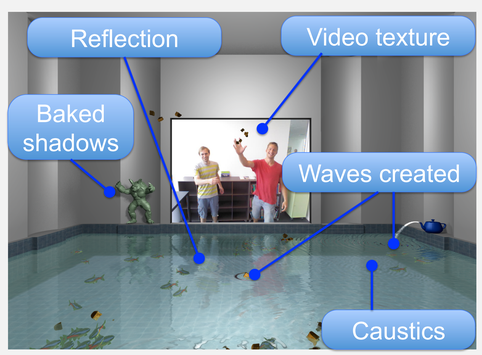
When only a single person is detected in the camera field of view, the head is tracked and the view into the virtual room is adjusted to achieve head-coupled perspective [Francone and Nigay 2011]. This allows people to see more of the environment.

Rendering

The room in the scene has diffuse light baked into a lightmap, which gives soft shadows. The water is simulated using the wave equation. A heightmap texture is updated using a semi-implicit Euler method running on the GPU. Waves are generated by both a small fountain and by breadcrumbs colliding with the water.

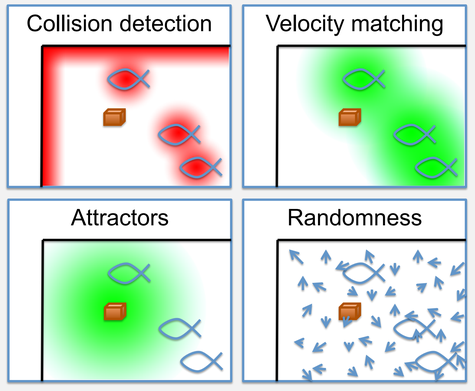


The gradient of the heightmap texture is used both for lighting and reflection when the water surface is rendered. Caustics are rendered by tracing light particles through the surface to the first intersection with the basin.



Flocking Simulation

The fish behavior is simulated on the GPU using flocking [Reynolds 1987]. Fish movement is based on:



Breadcrumbs attract the fish while the breadcrumbs flow on the surface, but the attraction goes away when the breadcrumbs dissolve as they sink toward the bottom. The fish are animated on the GPU procedurally.

Supplemental material

A video is available here:
http://youtu.be/iK2M6jPD_Vc

References

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