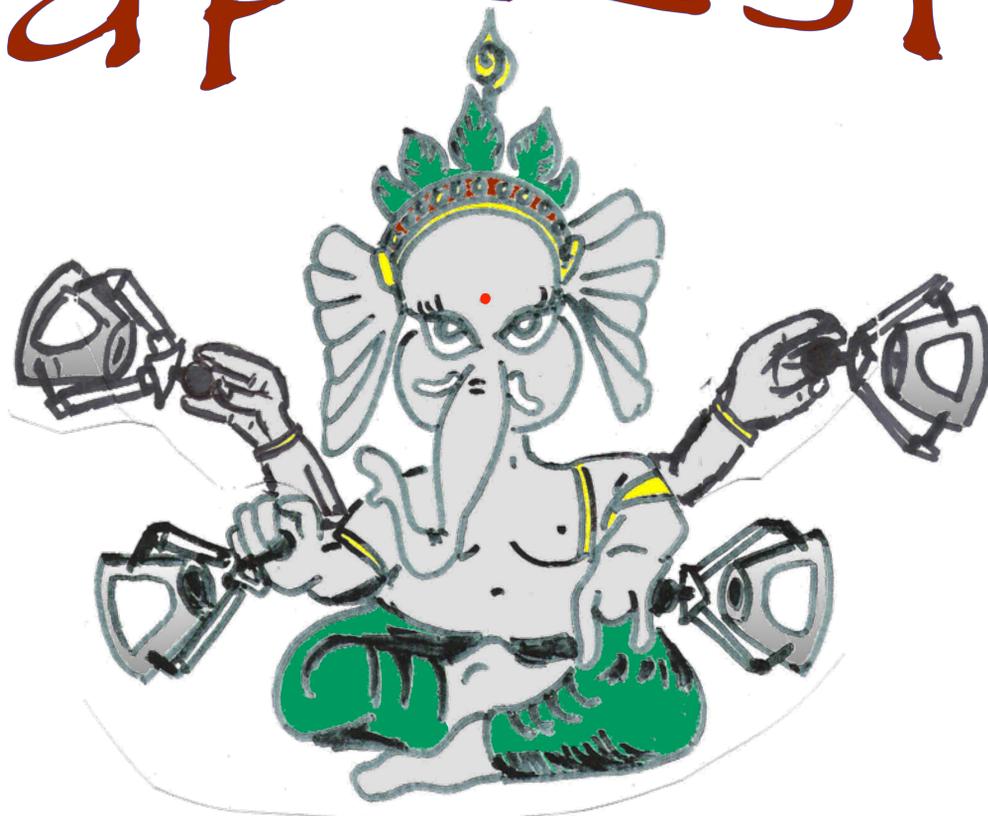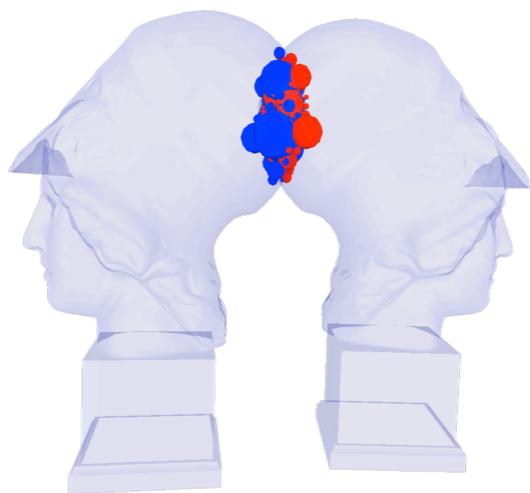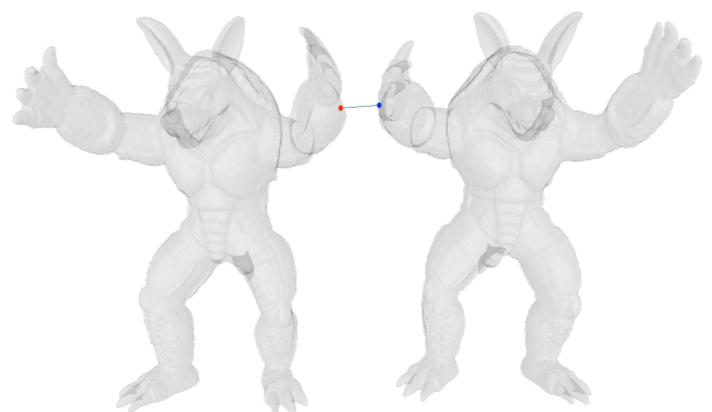# Haptesha

A Collaborative Multi-User Haptic Workspace

by René Weller, Gabriel Zachmann, Clausthal University, Germany

The Challenge

- **Common** workspace for
  - **Physically based simulations**
  - High fidelity 6-DOF **haptic rendering**
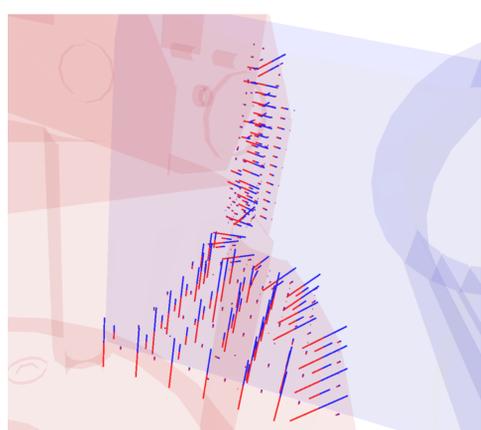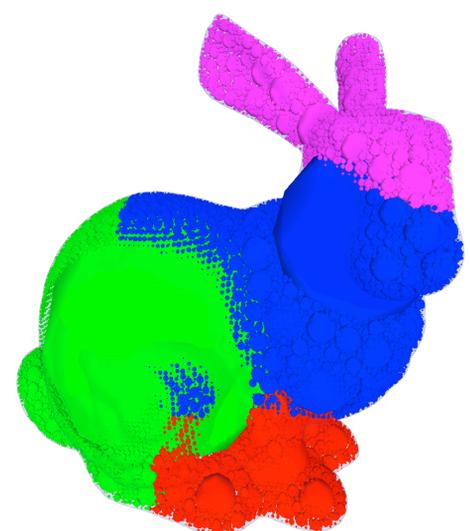- Two-handed multi-user interactions
- Haptic **refresh rates** (1 KHz)

Collision Detection

- **Uniform** algorithm supporting
  - **Proximity queries** and
  - **Penetration volume**
- Memory consumption like BVH based approaches

Force Rendering

- Based on **penetration volume**
  - Related to water displacement
  - Yields **physically motivated** forces
- Stable and **continuous** forces / torques

Inner Sphere Trees

- Approach: bound objects densely from the **inside**
- With a set of **non-overlapping** spheres
- Construct an **"inner bounding volume hierarchy"**