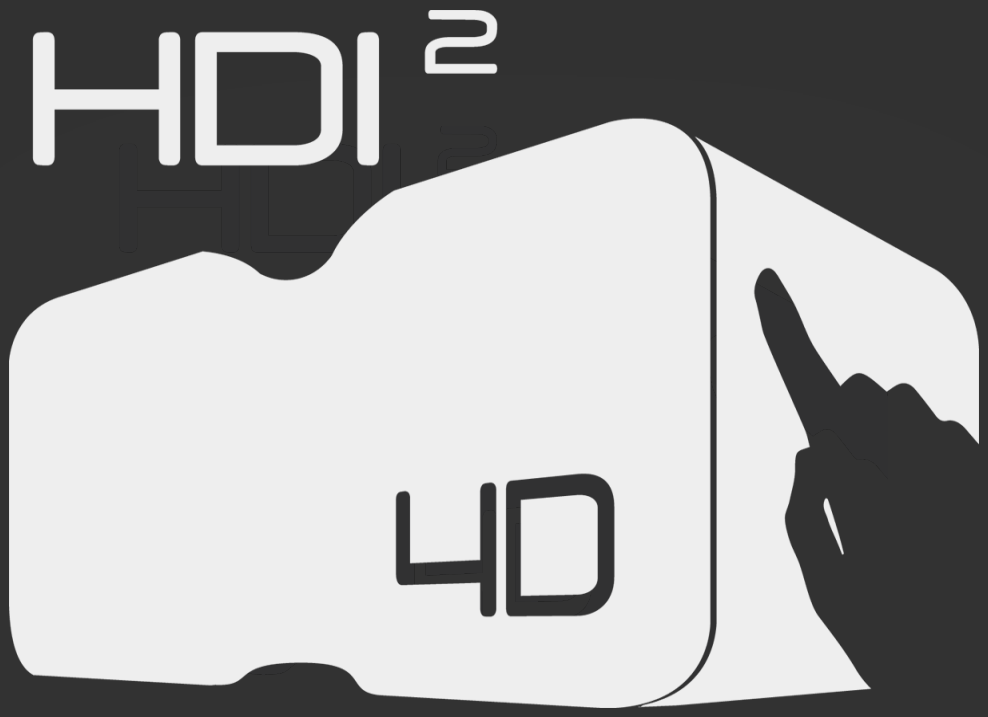


Human-Digital Content Interaction for Immersive 4D Home Entertainment
The 1st New Zealand-Korea Strategic Research Partnership Workshop

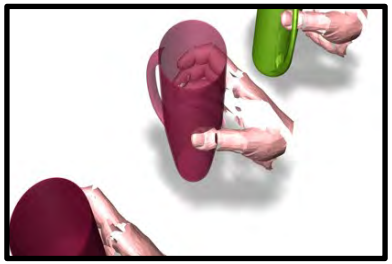
Human-Digital Content Interaction for Immersive 4D Home Entertainment 2015

Research Activities of NZ team

Taehyun rhee (VUW), Mark Billinghurst (HitLabNZ)

Research Activities

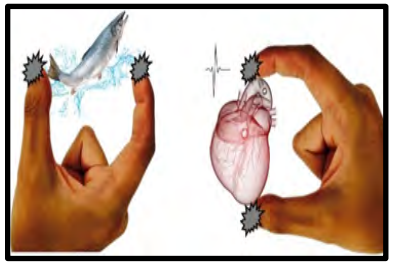
Ewha W. Univ.



Hand Animation and Force Feedback

- Interference-free Hand Modeling
- Grasp Planning and Synthesis
- Haptic Rendering

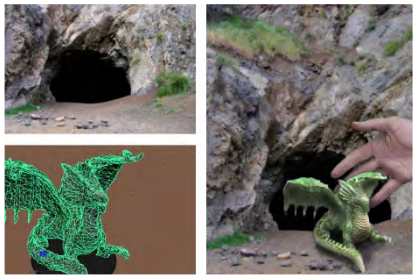
Korea Univ.



Interaction Techniques using Wearable Devices

- Pinch-based Interaction
- Vibro-tactile Pseudo-haptic Feedback
- Full-body Interaction using Wearable Sensors

Victoria Univ.



Perception-based Rendering

- Perceptually optimized rendering for reducing simulator discomfort in HMD
- Perceptually optimized rendering for seamless composites

U. of Canterbury

Augmented Hand Interaction

- Augmenting immersive movie scene with user's body and environment
- Physical simulation-based natural hand gesture interaction in immersive movie

Victoria University

Interactive & Immersive

- Provide a visualisation solution for immersive presentation in interactive applications

Challenge: human friendly immersive visualisation

- Maximise immersive filling
  - A stereo visualisation covering a wide field of view
- Minimise visual discomfort
  - reducing simulator sickness in HMD
    → Nausea, eye fatigue, headache

Research Aim 1

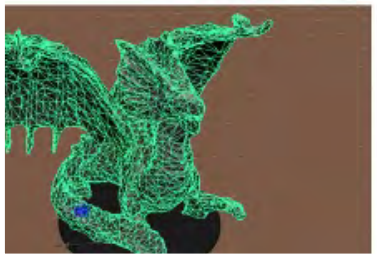
- "Perceptually optimised rendering for reducing visual discomfort in HMD"

Research Activities

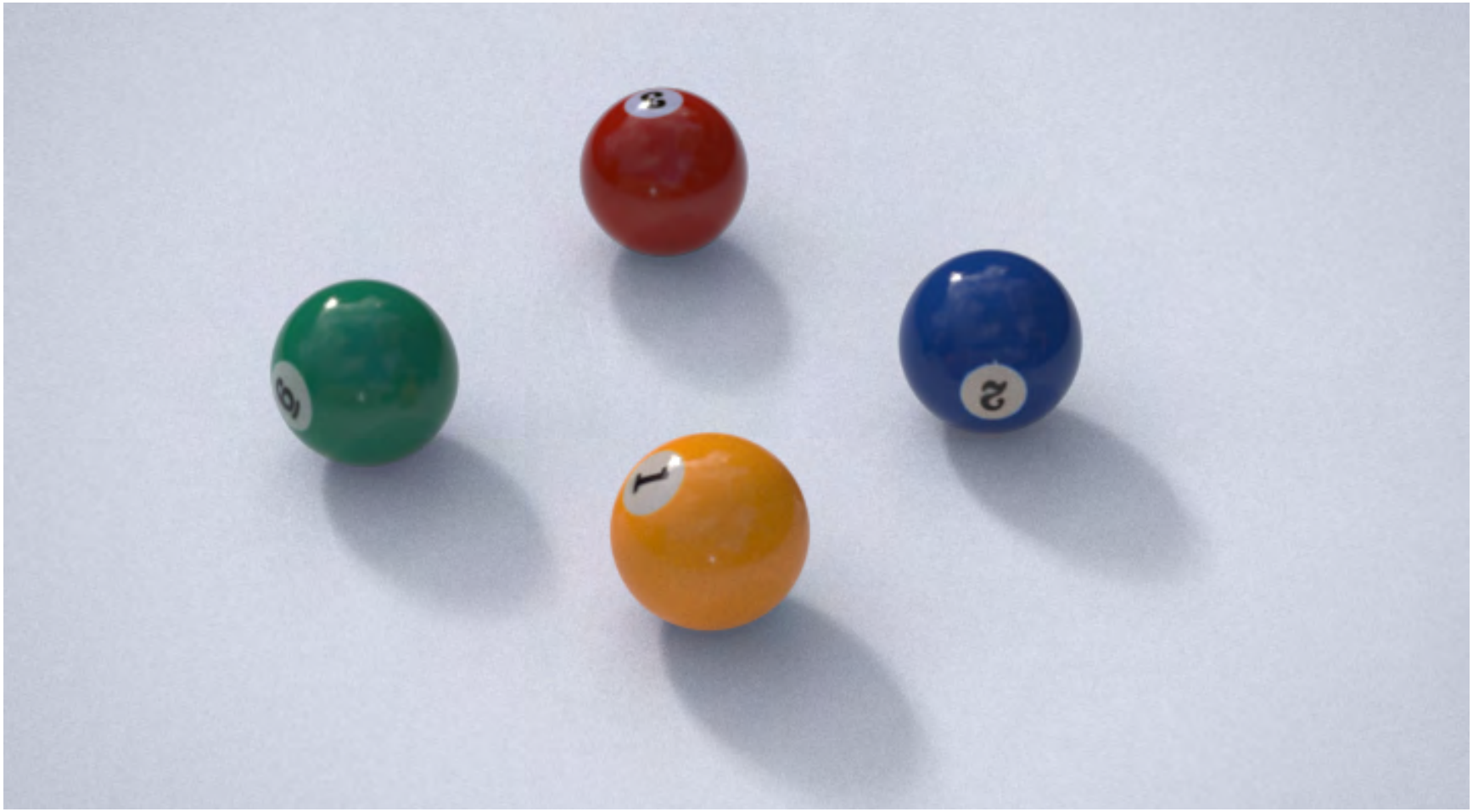
- Investigating human discomfort factors in HMD
- Develop rendering solution to minimise the discomfort factors
- Perceptually optimise the rendering parameters

Challenge: interactive seamless composites

- Maximise visual quality
  - Seamless blending btw virtual objects and the background cinematic scene
- Minimise computing time
  - Real-time rendering to support interactions

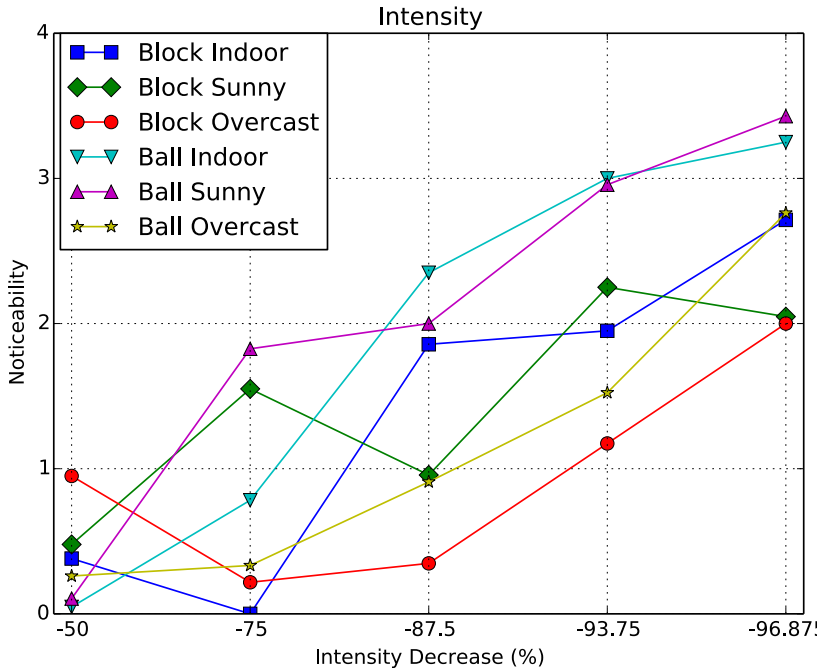


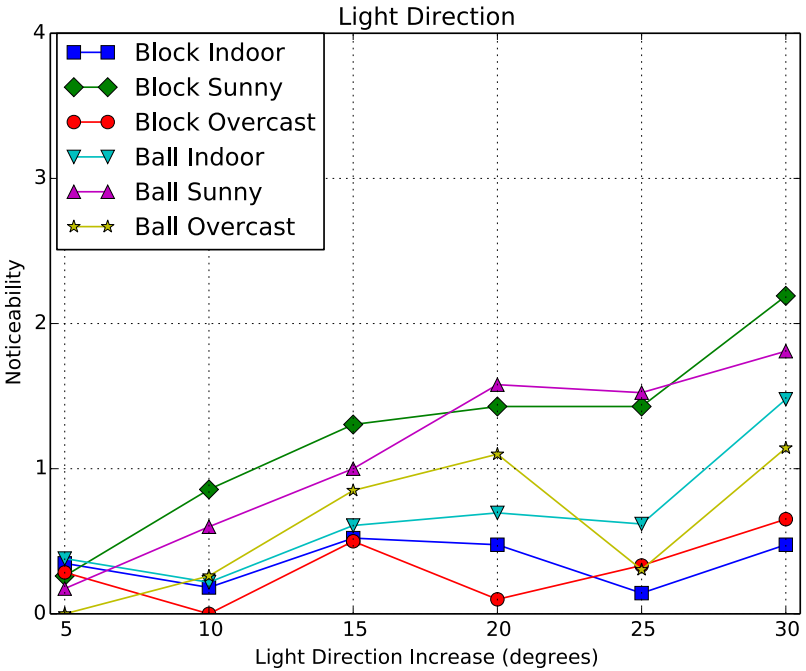
TEST



Observations

- Human visual system is not sensitive to perceive local illumination changes





Research Aim 2

- “Perceptually optimised rendering for seamless composites”

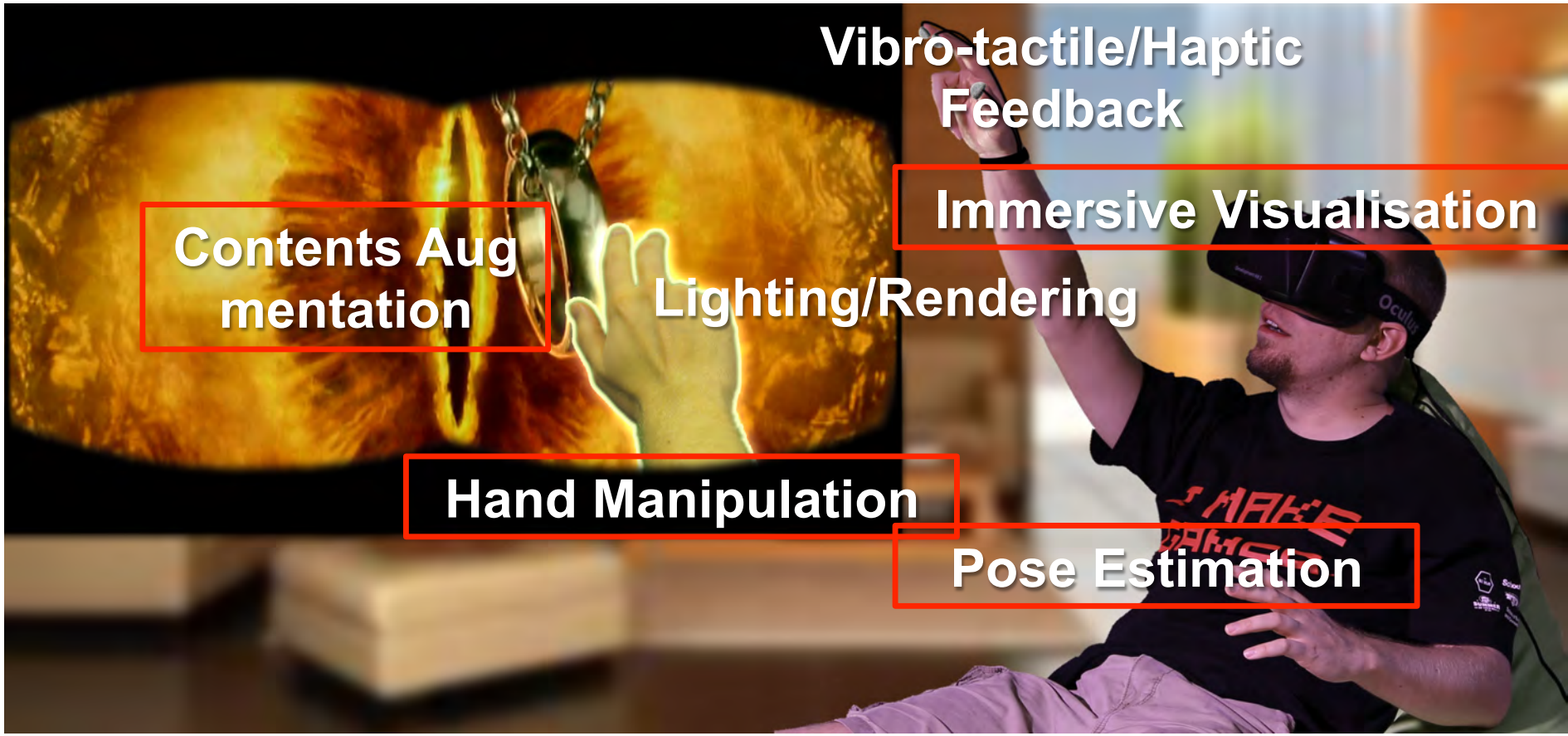
Research Activities

- Interactive IBL rendering using perceptually optimised HDR radiance map
- Illumination composites from virtual to real world scene
  - Interactive differential rendering
- Mutual global illumination btw real and virtual objects

Example


D&D
ENCOUNTERS
D&D
PLAYER'S HANDBOOK
DUNGEONS & DRAGONS
D&D
MONSTER MANUAL
DUNGEONS & DRAGONS

University of Canterbury



Challenge: compelling experience of *being* in the cinematic scene

- HMD based immersive movies
  - 360 view of the movie (virtual) scene
- But,
  - Where did my body go?
  - Can I interact with the scene, as I do in the real world?

Research Aims

- Where did my body go?
  ➔ Augmenting user's body into the cinematic scene

- Can I interact with the scene, as I do in the real world?
  ➔ Physically based human hand interaction

Research Aim 1

- Augmenting the user's body and environment into the cinematic scene
  - Augmented Virtuality
    - ✓Augmenting the virtual (cinematic) scene with live real world imagery

Vision

Seamless blending of the user's body and environment into cinematic experience

Research Activities for Aim 1

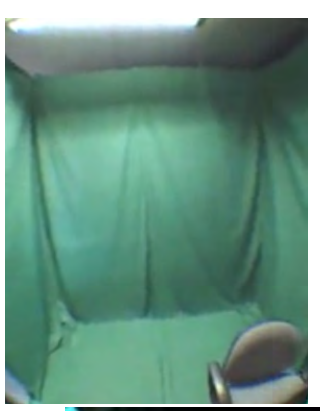
- Hardware setup and keying based user's body augmentation
- Physical environment reconstruction and augmentation
- Realistic rendering integration and user evaluation

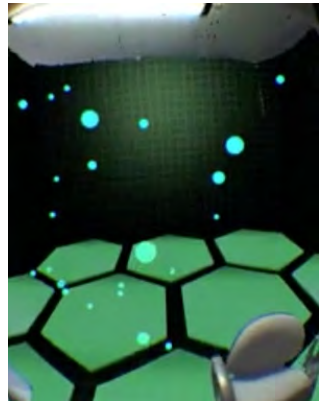
Setup to Capture the Real World

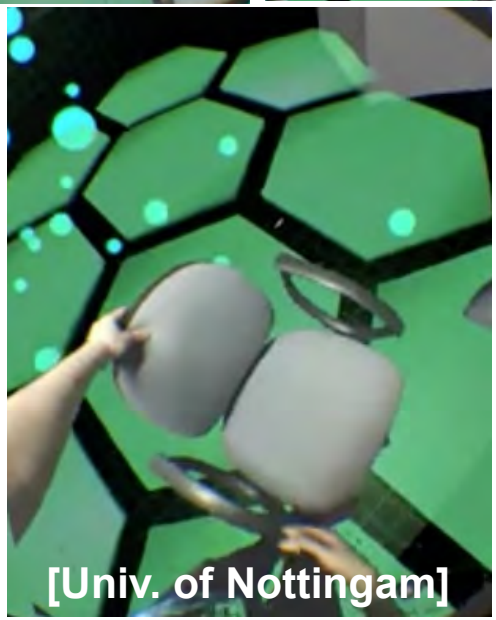
- AR Rift

Mixing User's Body into Movie

- Chroma Keying
  - Skin colour
  - Green or Blue background
- Depth Keying
  - Depth camera

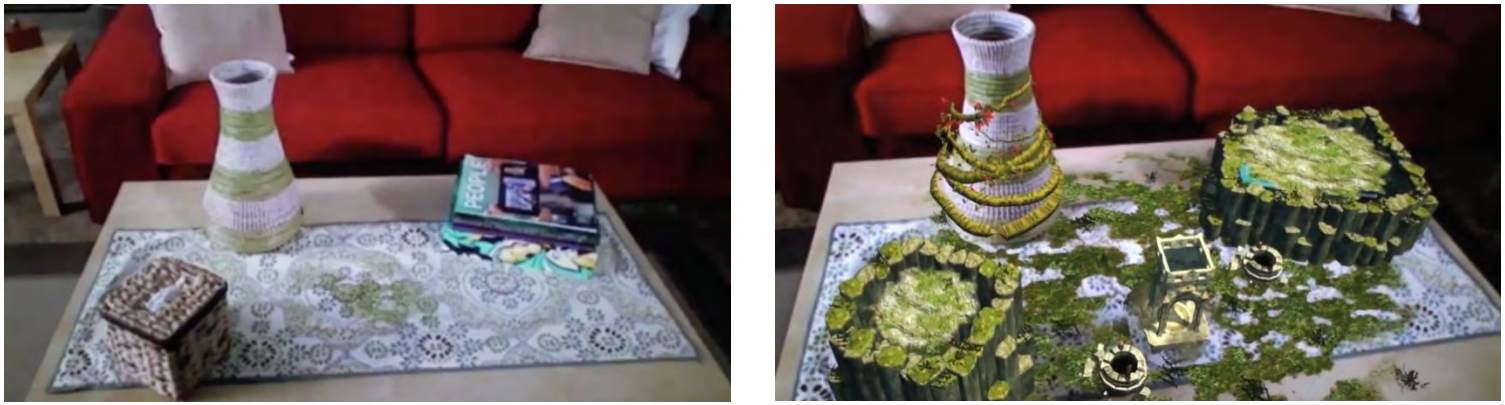






Mixing User's Environment

- Reconstruction and tracking of physi cal objects in user's environment
- Use of physical objects in user's envi ronment as Tangible interfaces



[Vuforia]

Integrate Realistic Rendering and User Evaluation

- Integration of Realistic Image Based Rendering Methods
  - Collaboration with VUW & Ewha Univ.
- User Evaluation
  - Assess how user experience / presence is improved with introducing user's body and other physical objects into the movie scene

Research Aim 2

- Physically based human hand interaction

- Normal free-hand input natural for AR/VR interaction
  - Unencumbered, bi-manual
  - Supports rich interaction

Vision

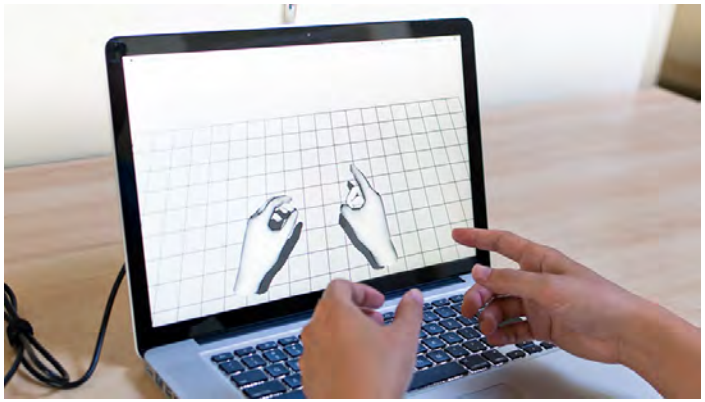
Interacting with cinematic content as naturally as with real world objects

Research Activities for Aim 2

- Skeletal motion tracking for gesture interaction
- Hand volume based physical interaction
- Haptic feedback integration and user evaluation

Skeletal Motion Tracking

- Track hand motion
  - Depth camera input
- Create skeleton
  - Multi-layered approach
- Gesture recognition



Multi-Layered Approach

5. Gesture Recognition

- Static Gestures
- Dynamic Gestures
- Context based Gestures

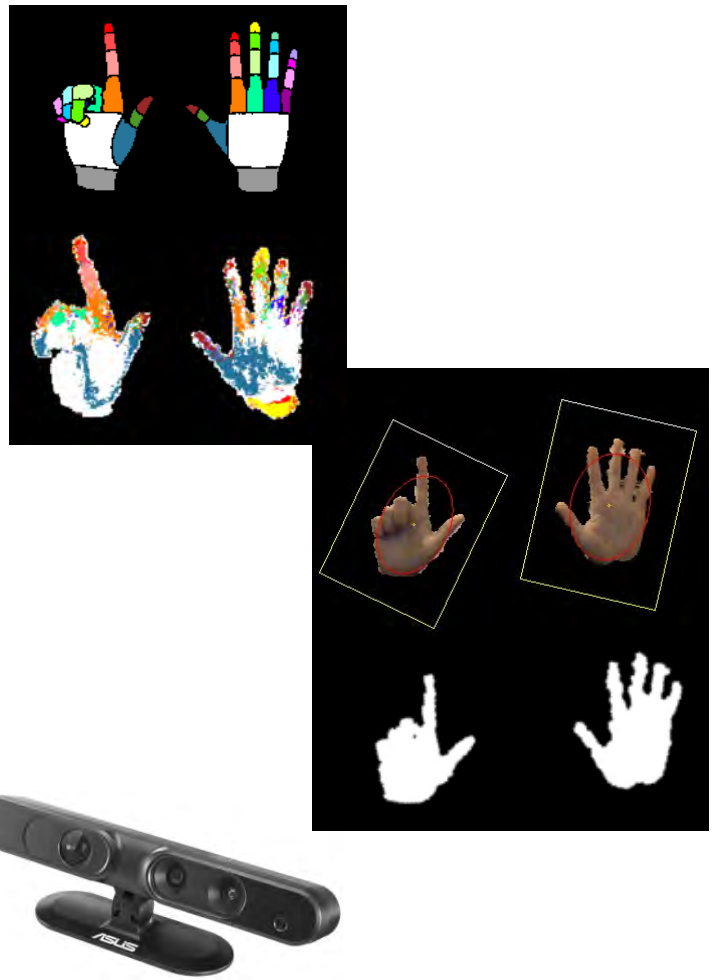
4. Modeling

- Hand recognition/modeling
- Rigid-body modeling

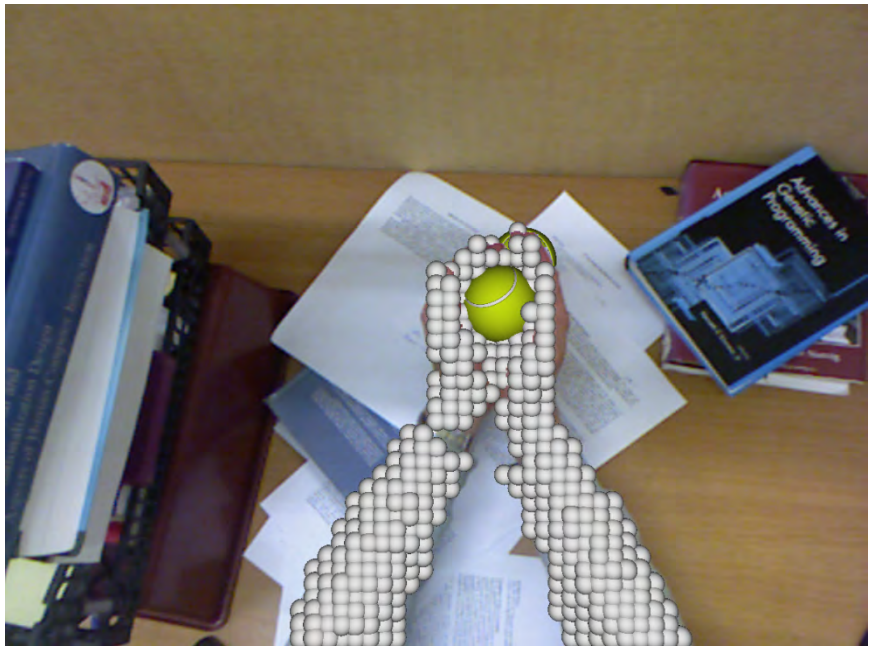
3. Classification/Tracking

2. Segmentation

1. Hardware Interface



Hand Volume Based Interaction

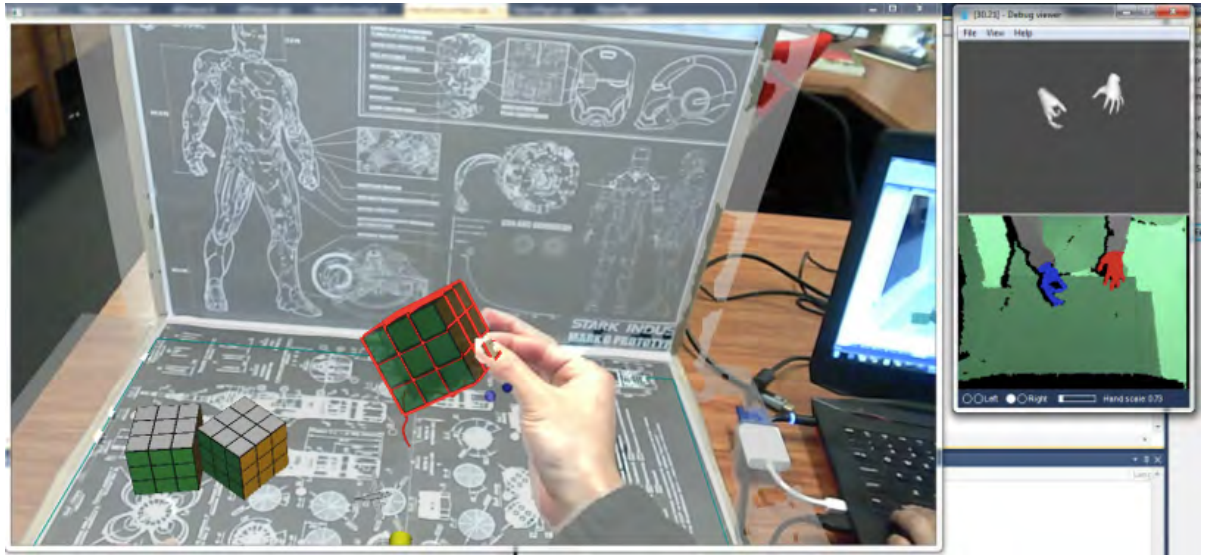


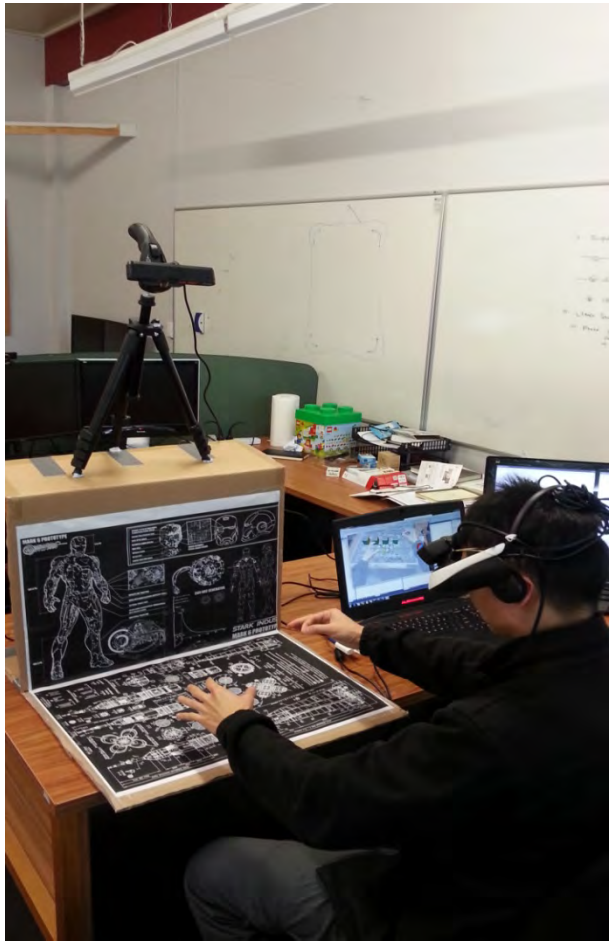
- Represent hands as collections of spheres
- Physics engine for real world interaction

Haptic Feedback Integration

- Explore haptic feedback
  - Vibro-tactile, force feedback
  - Collaboration with Korea Univ. & Ewha Univ.
- User evaluation
  - With and without haptics

Early Results





- HMD AR View
  - Viewpoint tracking
- Two hand input
  - Skeleton interaction, occlusion

TEAM New Zealand

- Project Leader
  - Taehyun Rhee, Victoria University of Wellington
- Co-Leader
  - Mark Billinghurst, University of Canterbury
- Key Researcher
  - Gun Lee, University of Canterbury
  - J.P. Lewis, Victoria University of Wellington (Weta Digital)
  - Gina Grimshaow, Victoria University of Wellington
- Students
  - 1 PhD, 3 Master per year (+ other researcher)