

# **Gesture Based AR Interaction Research at the HIT Lab NZ**

Mark Billinghurst

[mark.billinghurst@hitlabnz.org](mailto:mark.billinghurst@hitlabnz.org)

The HIT Lab NZ, University of Canterbury

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2012 – Iron Man 2

# To Make the Vision Real..

- **Hardware/software requirements**
  - Contact lens displays
  - Free space hand/body tracking
  - Speech/gesture recognition
  - Scanning real world
  - Etc..
- **Most importantly**
  - Usability/User Experience

# Environmental Awareness

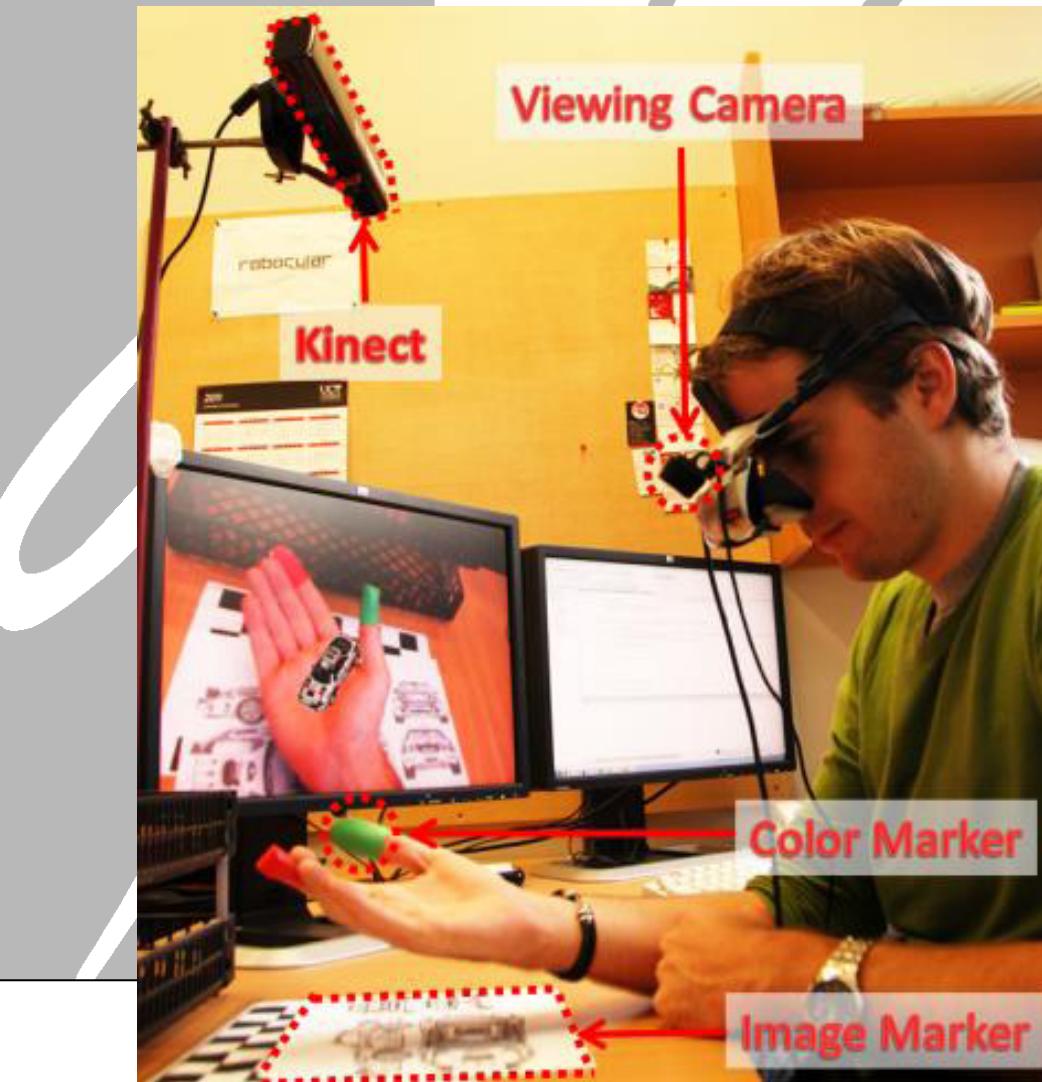
# AR MicroMachines

- AR experience with environment awareness and physically-based interaction
  - Based on MS Kinect RGB-D sensor
- Augmented environment supports
  - occlusion, shadows
  - physically-based interaction between real and virtual objects

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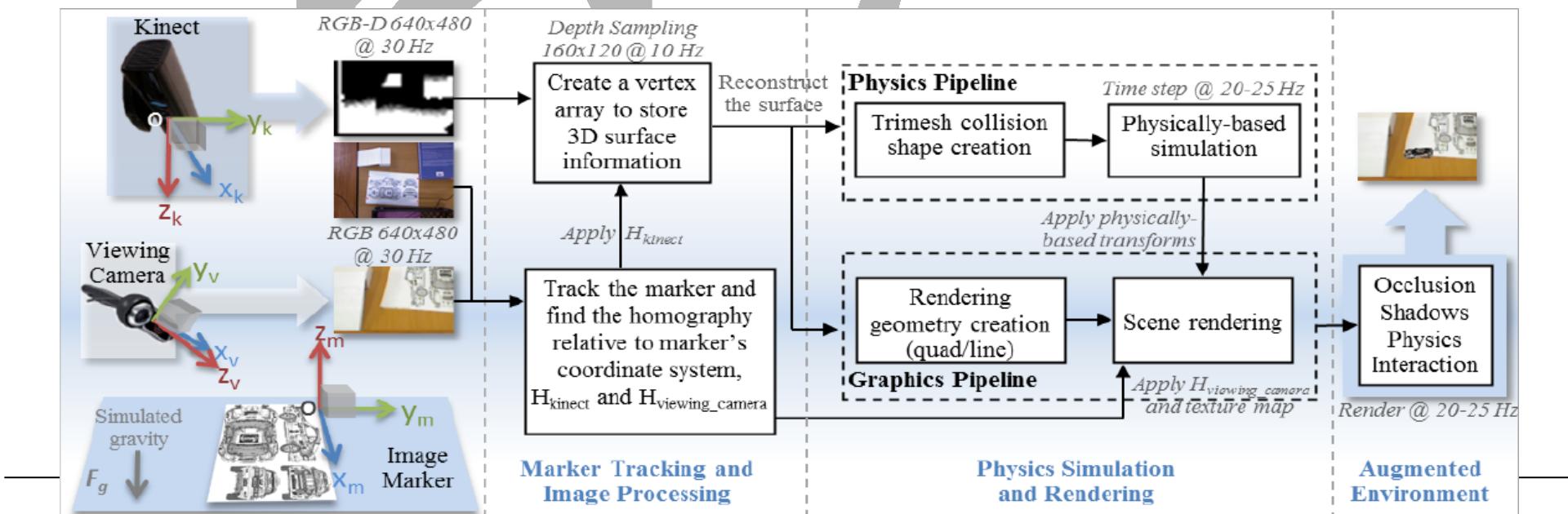
Clark, A., & Piumsomboon, T. (2011). A realistic augmented reality racing game using a depth-sensing camera. In *Proceedings of the 10th International Conference on Virtual Reality Continuum and Its Applications in Industry* (pp. 499-502). ACM.

# Operating Environment

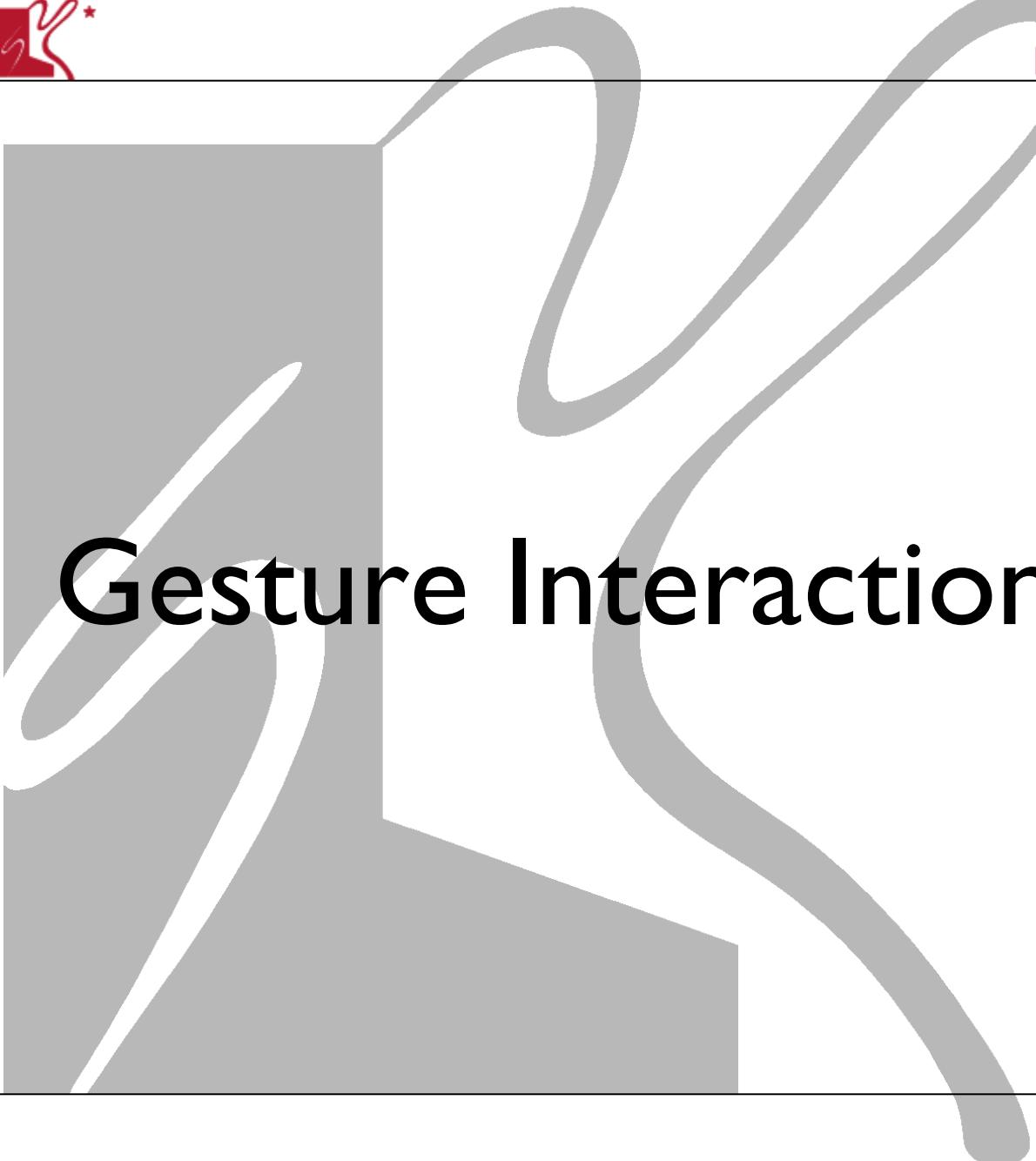


# System Flow

- The system flow consists of three sections:
  - Image Processing and Marker Tracking
  - Physics Simulation
  - Rendering



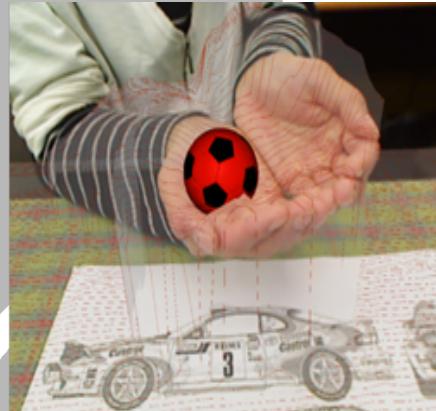
# Gesture Interaction



# Natural Hand Interaction



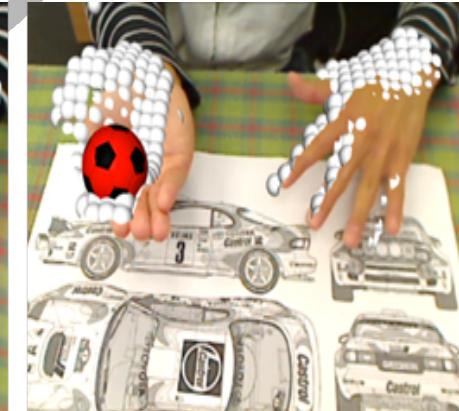
(a)



(b)



(c)



(d)

- **Using bare hands to interact with AR content**
  - MS Kinect depth sensing
  - Real time hand tracking
  - Physics based simulation model

# Multi-Layered Approach

## 5. Gesture Recognition

- Static Gestures
- Dynamic Gestures
- Context based Gestures

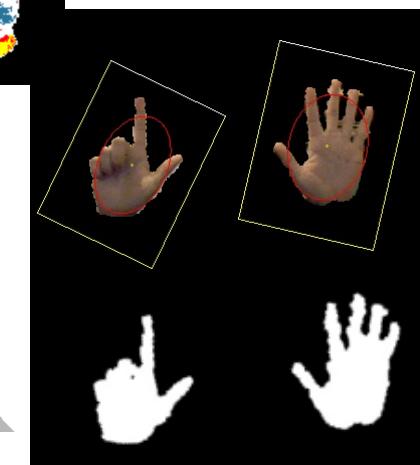
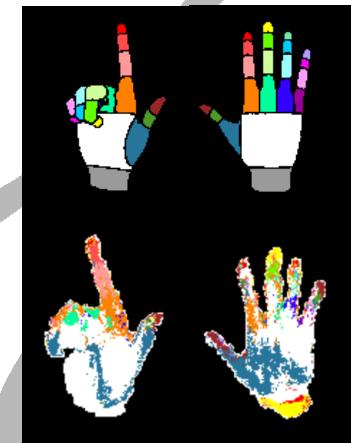
## 4. Modeling

- Hand recognition/modeling
- Rigid-body modeling

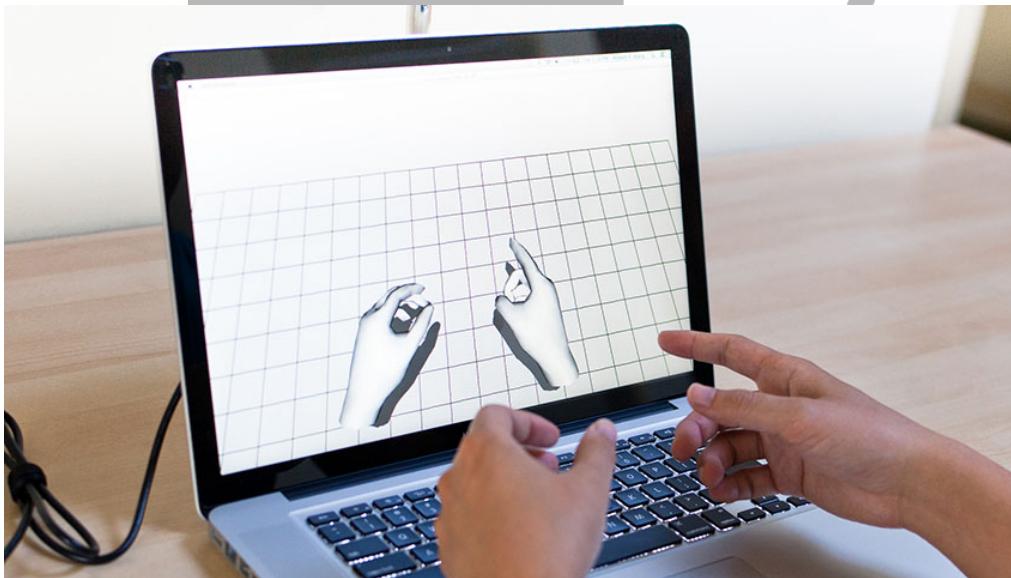
## 3. Classification/Tracking

## 2. Segmentation

## 1. Hardware Interface



# Skeleton Based Interaction

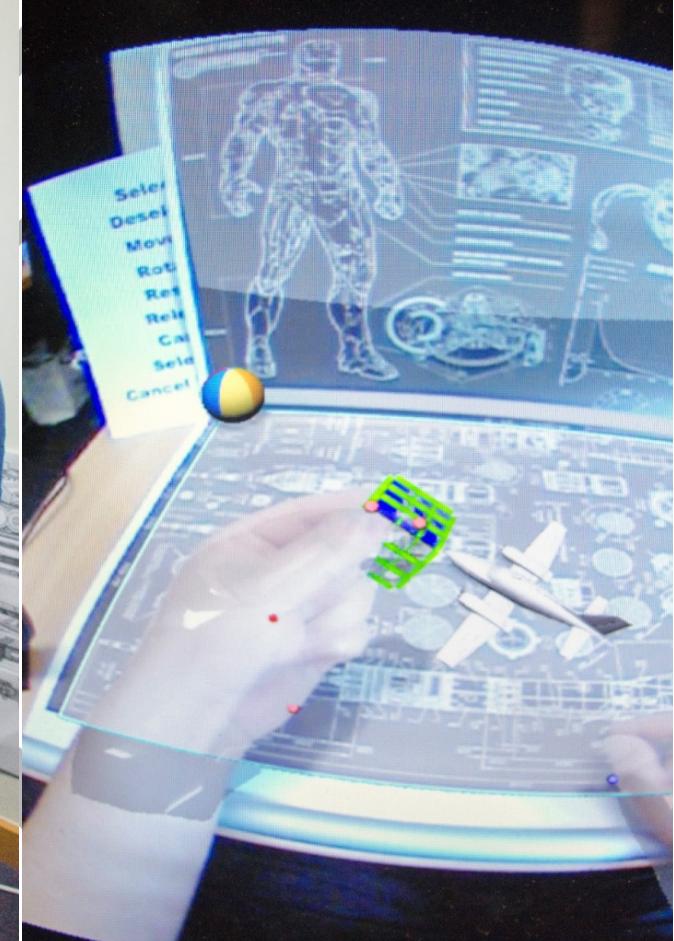


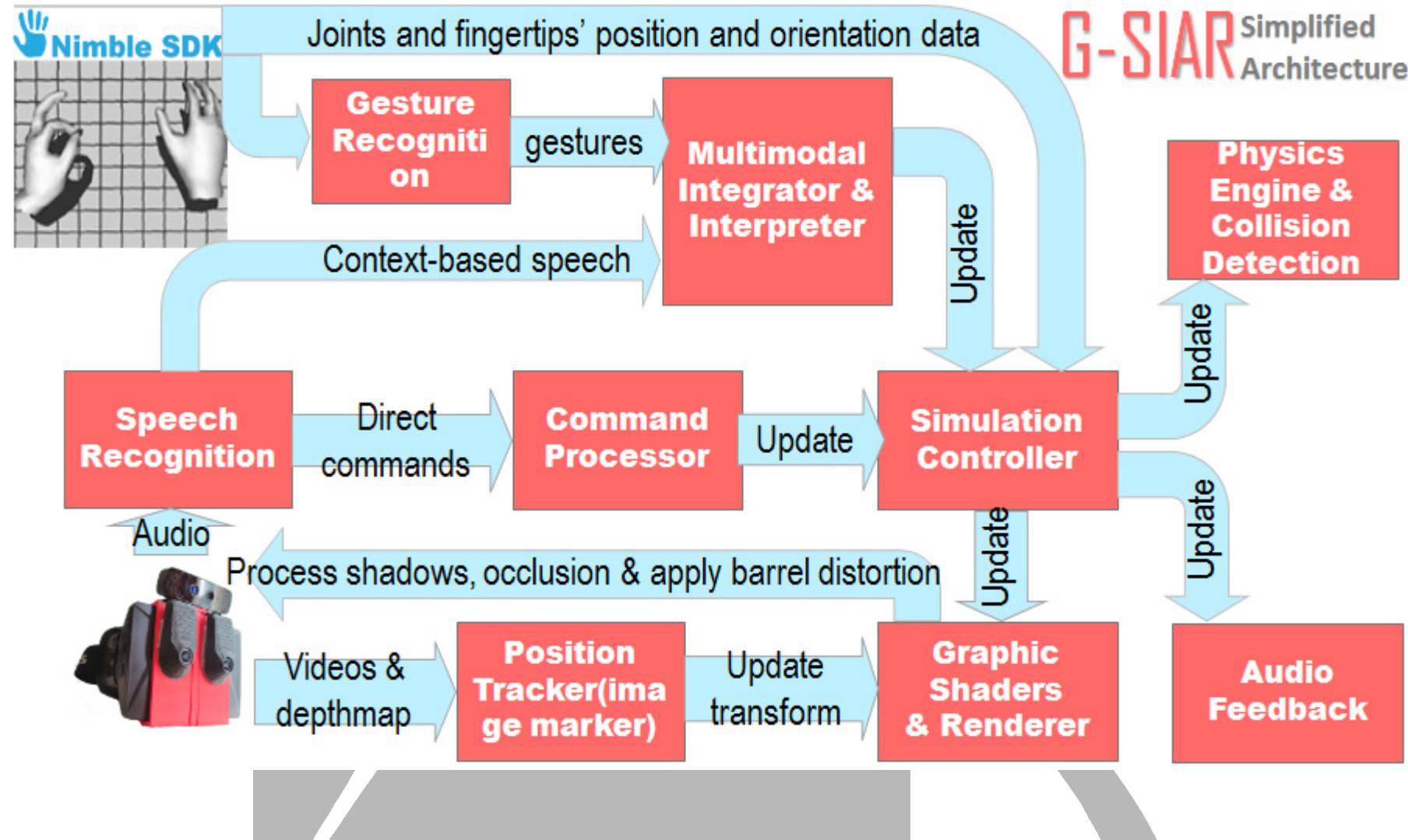
- **3 Gear Systems**
  - Kinect/Primesense Sensor
  - Two hand tracking
  - <http://www.threegear.com>



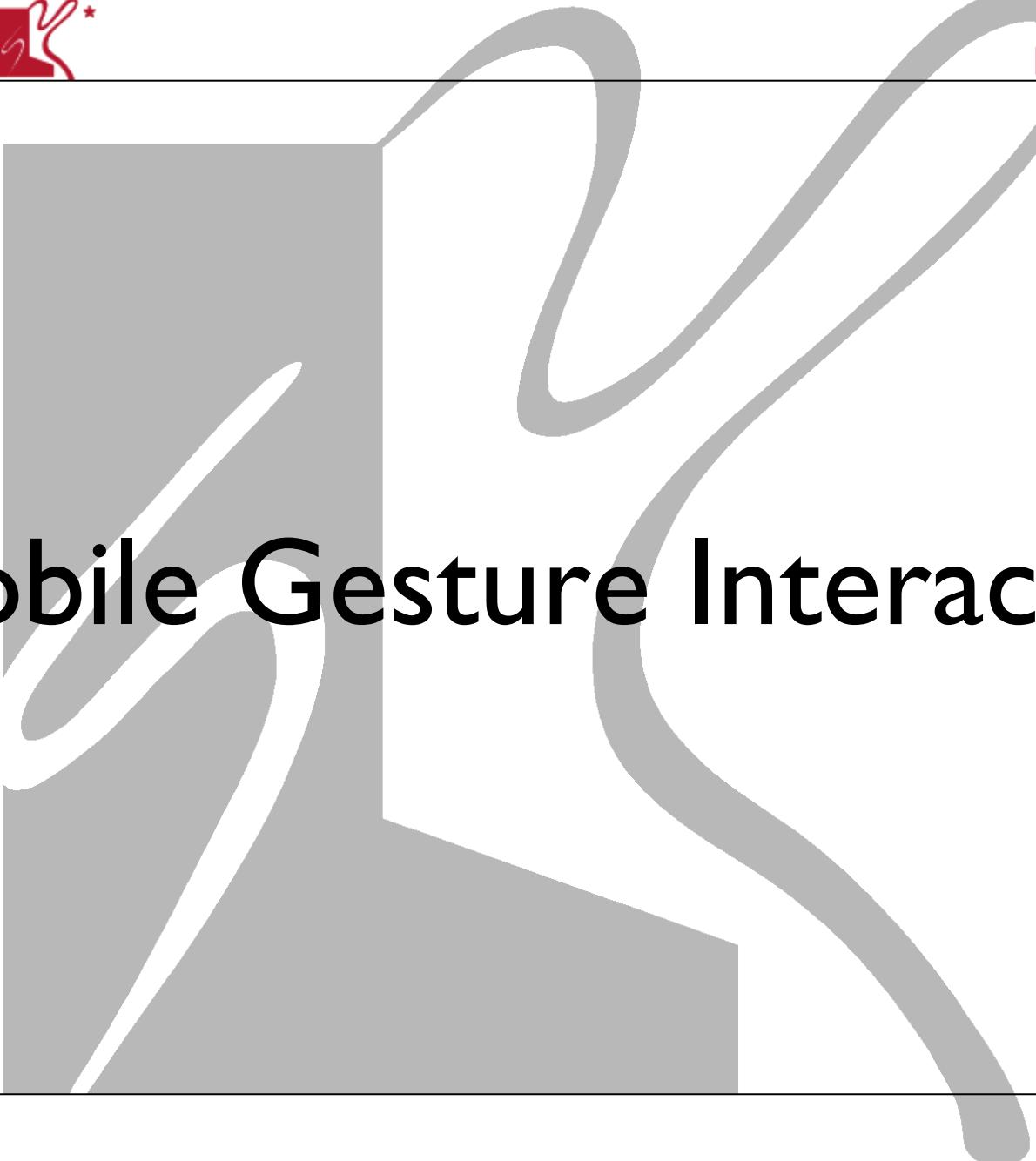
# AR Rift Display







# Mobile Gesture Interaction



# Mobile Gesture Interaction

## ■ Motivation

- Richer interaction with handheld devices
- Natural interaction with handheld AR

## ■ 2D tracking

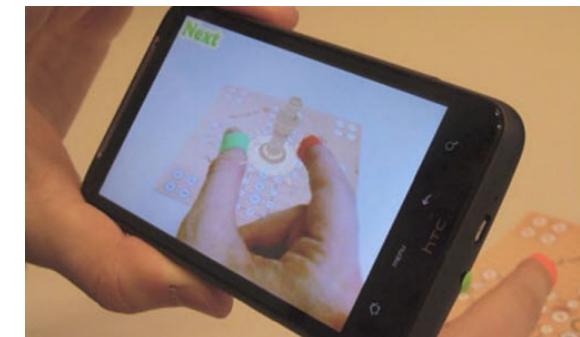
- Finger tip tracking

## ■ 3D tracking

- Hand tracking



[Henrysson et al. 2007]

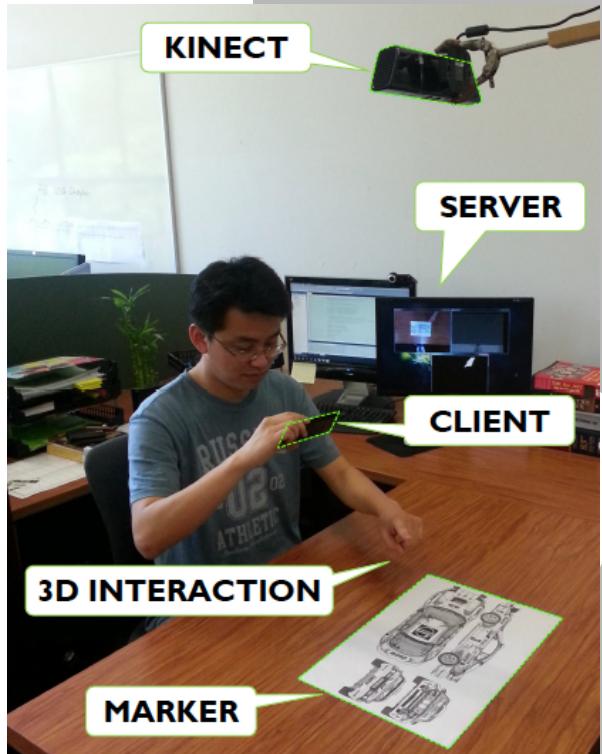


[Hurst and Wezel 2013]

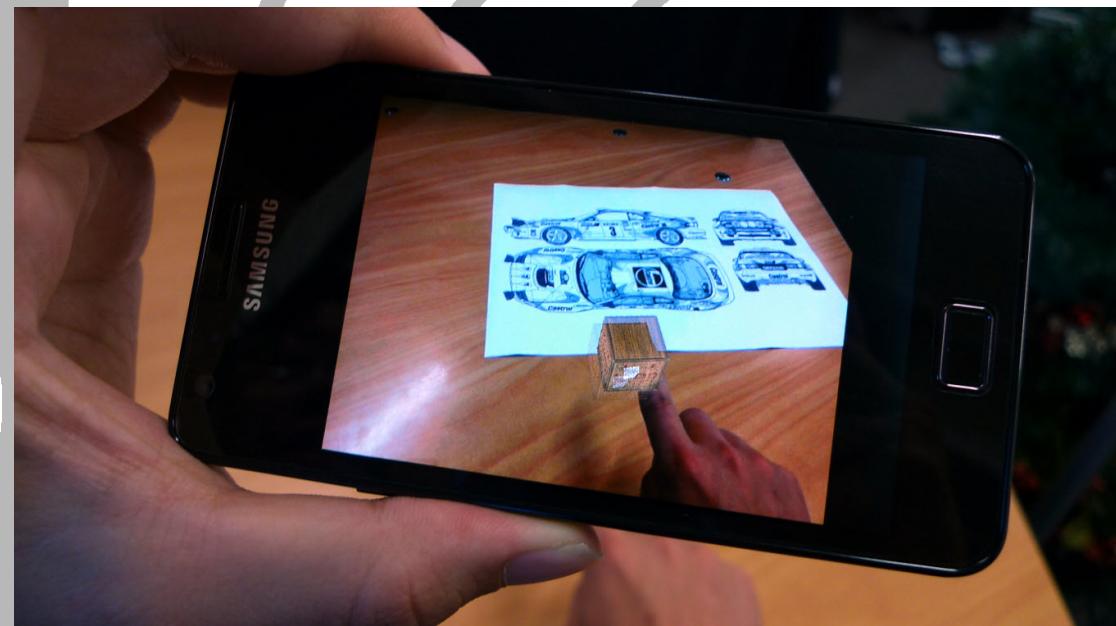
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Henrysson, A., Marshall, J., & Billinghurst, M. (2007). Experiments in 3D interaction for mobile phone AR. In *Proceedings of the 5th international conference on Computer graphics and interactive techniques in Australia and Southeast Asia* (pp. 187-194). ACM.

# Fingertip Based Interaction



System Setup



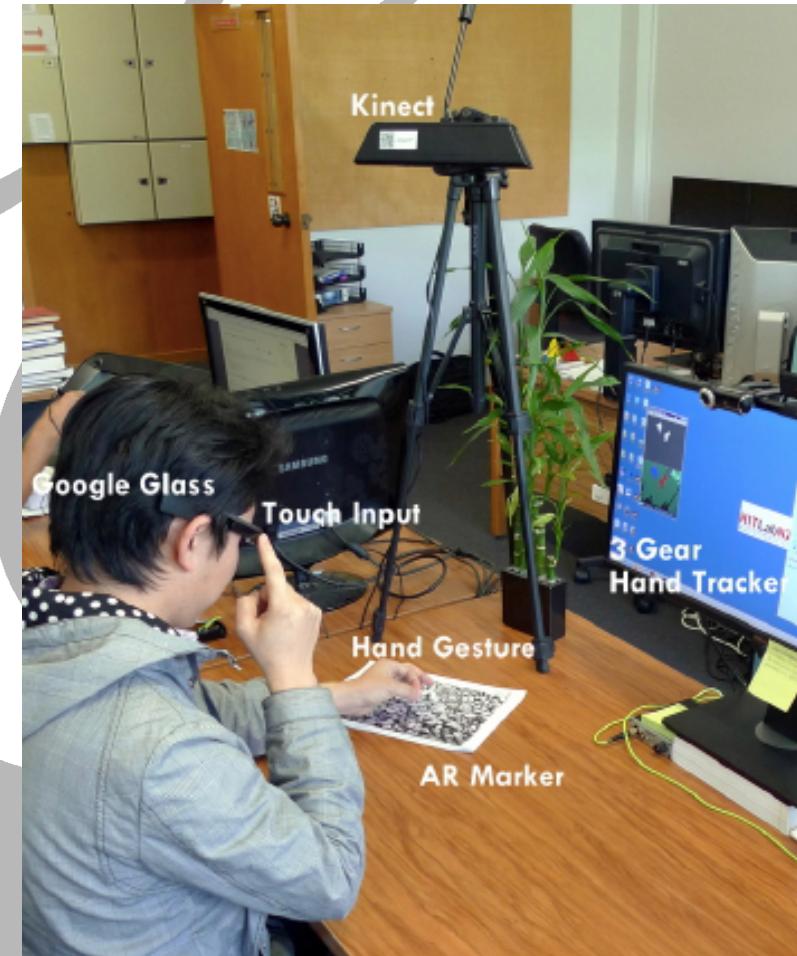
Running System

Mobile Client + PC Server

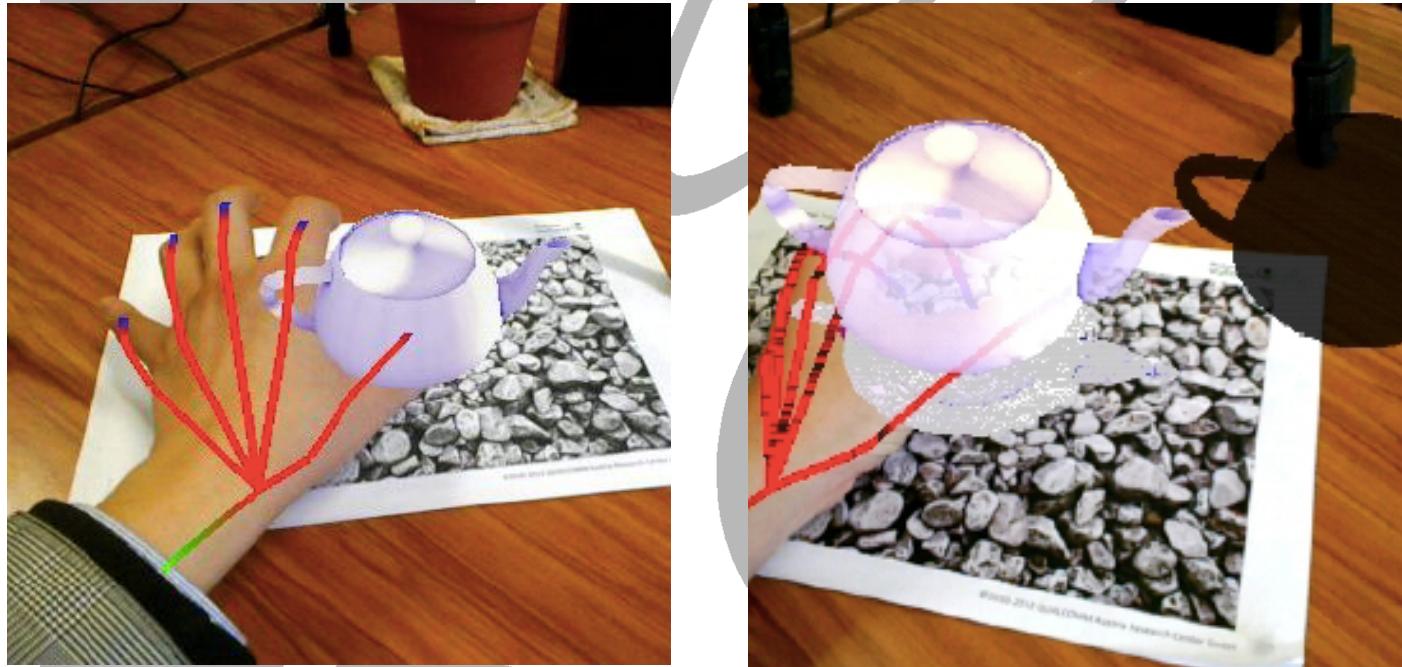
Bai, H., Gao, L., El-Sana, J., & Billinghurst, M. (2013). Markerless 3D gesture-based interaction for handheld augmented reality interfaces. In *SIGGRAPH Asia 2013 Symposium on Mobile Graphics and Interactive Applications* (p. 22). ACM.

# Gesture Interaction With Glass

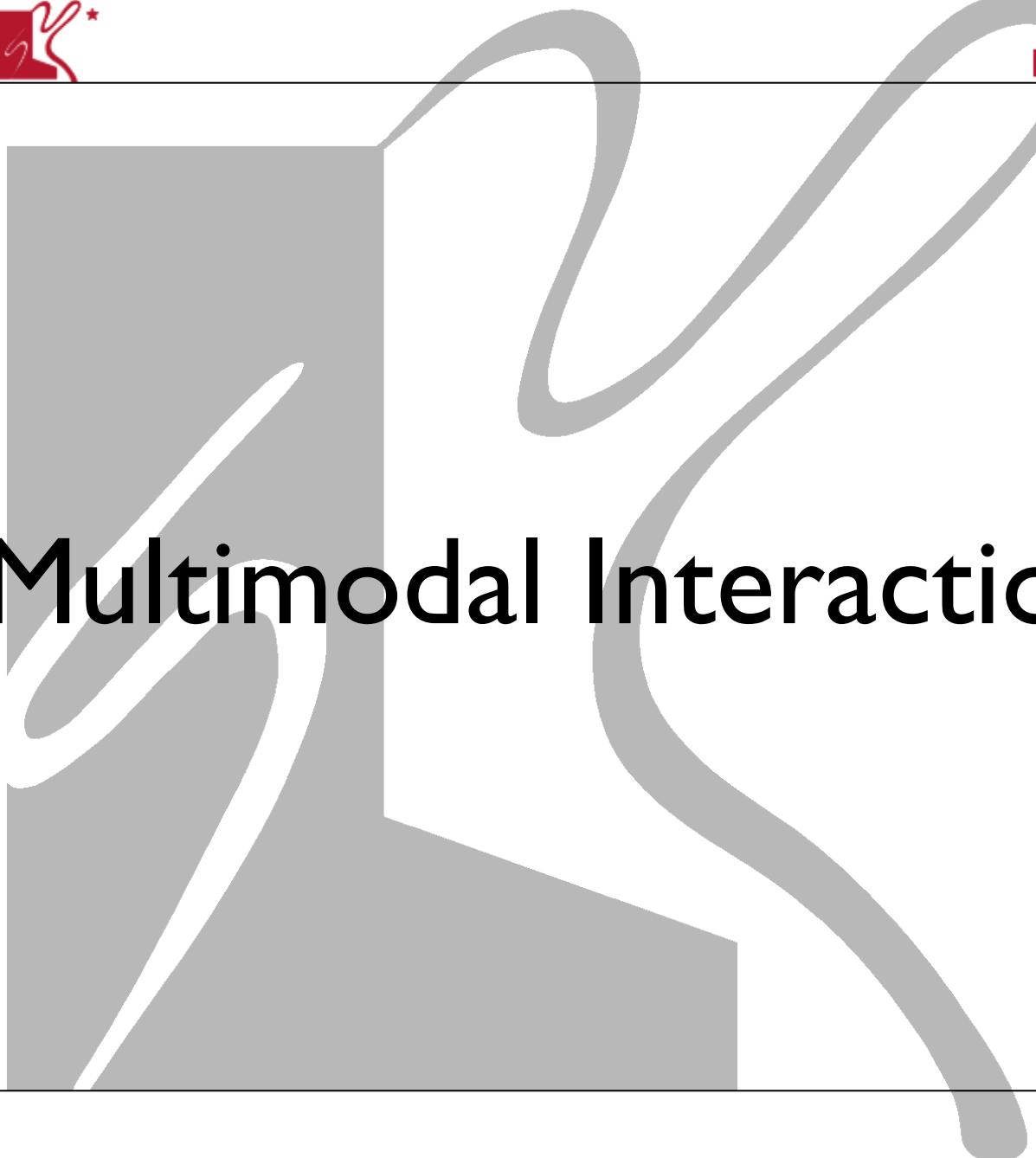
- **3 Gear Systems**
  - Hand tracking
- **Hand data sent to glass**
  - Wifi networking
  - Hand joint position
  - AR application rendering
  - Vuforia tracking



# Performance



- Full 3d hand model input
  - 10 - 15 fps tracking, 1 cm fingertip resolution

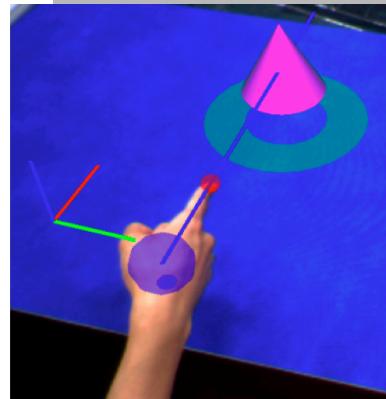


# Multimodal Interaction

# Multimodal Interaction

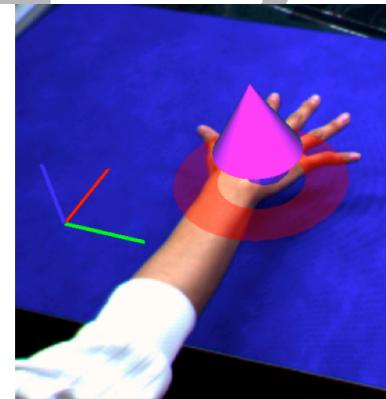
- Combined speech and gesture input
- Gesture and Speech complimentary
  - Speech: modal commands, quantities
  - Gesture: selection, motion, qualities
- Previous work found multimodal interfaces intuitive for 2D/3D graphics interaction
  - However, few multimodal AR interfaces

# Free Hand Multimodal Input



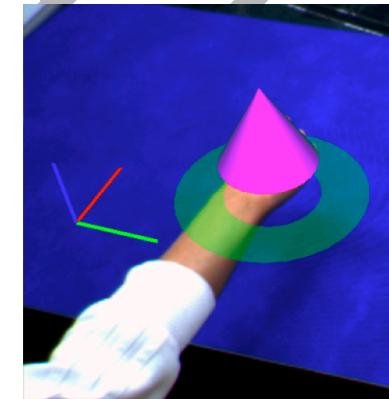
(a)

**Point**



(b)

**Move**

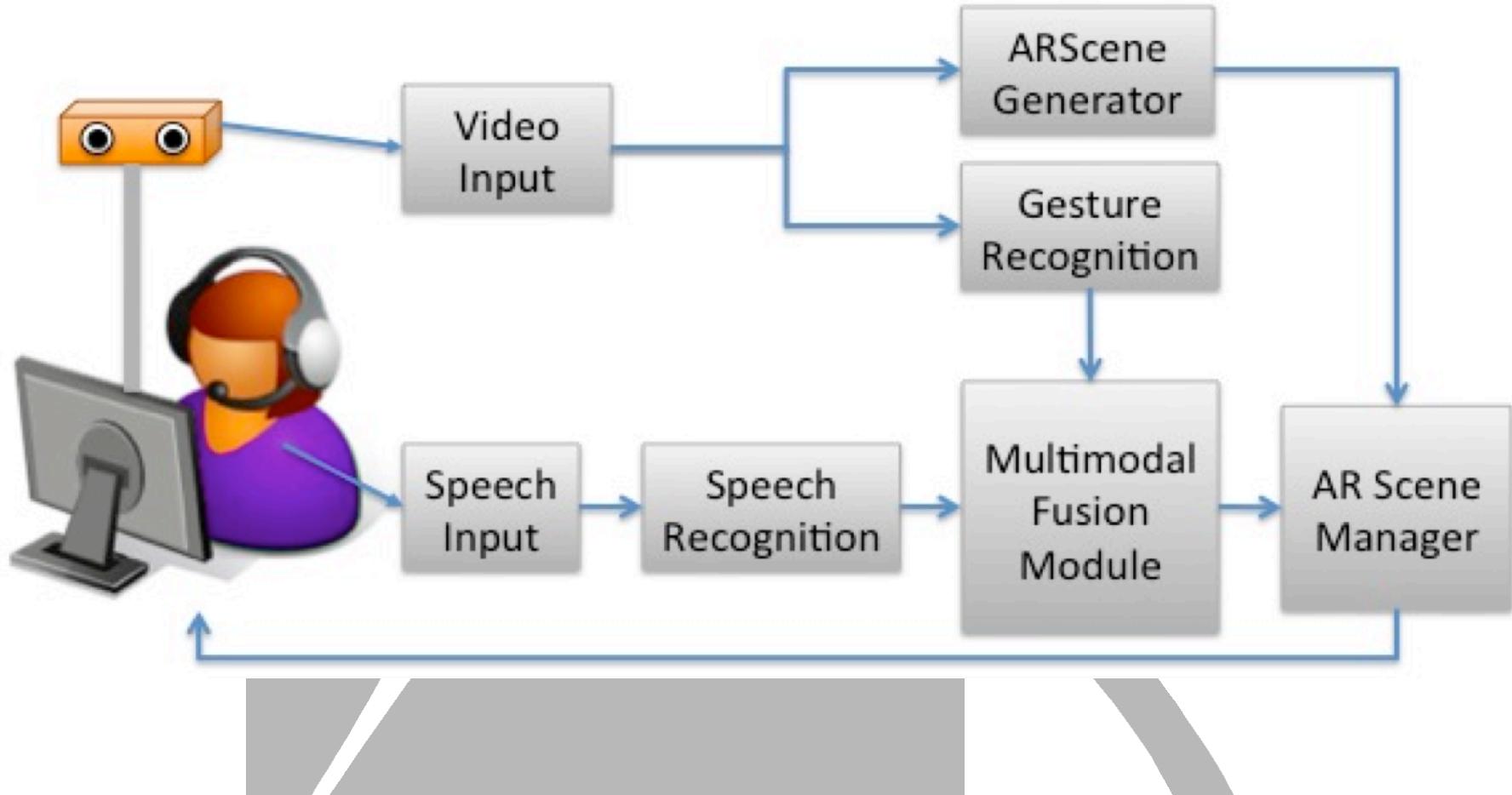


(c)

**Pick/Drop**

- Use free hand to interact with AR content
- Recognize simple gestures
  - Open hand, closed hand, pointing

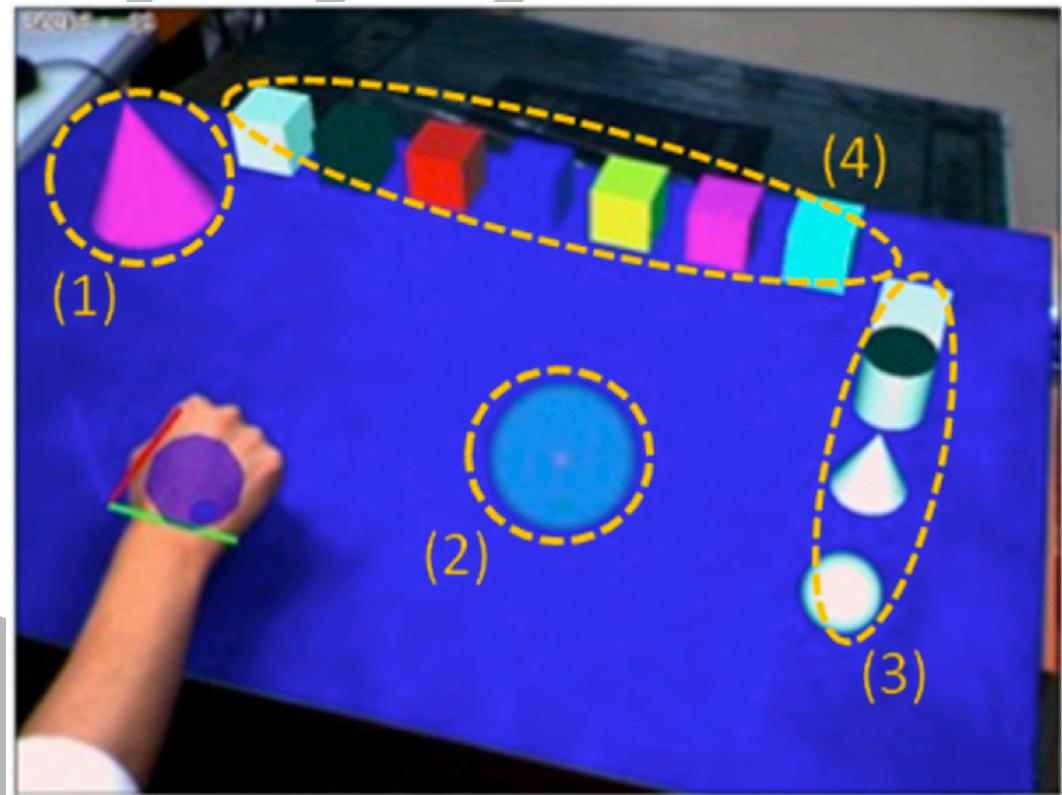
# Multimodal Architecture



# Experimental Setup



Change object shape  
and colour





# Next Steps

# Project Research

- **Providing intuitive gesture interaction**
  - Improved hand tracking/gesture interaction (Korea)
  - Novel methods for volume based interaction (Ewha)
  - Providing visuo/haptic feedback (Korea, Ewha)
- **Multimodal input**
  - Integrating speech, gesture, gaze, etc
- **User evaluation studies**
  - User presence, interaction efficiency, etc

# Coming Soon



## ■ Meta Space Glasses



# More Information

- **Mark Billinghurst**
  - [mark.billinghurst@hitlabnz.org](mailto:mark.billinghurst@hitlabnz.org)
  - [@marknb00](https://twitter.com/marknb00)
- **Website**
  - [www.hitlabnz.org](http://www.hitlabnz.org)

