

# Reactive Virtual Human with Multimodal Interaction

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## What is Reactive Motion ?



## Background

### Recent Virtual Human ...

- realistic
- intelligent
- interactive

not reactive !

## Reactive Virtual Human

- What is Reactive Virtual Human ?



## Basic Components for Reactive VH

- life-sized -- Immersive Display
- direct interaction -- Haptic Interface
- reactive motion -- Real-time Motion Generation

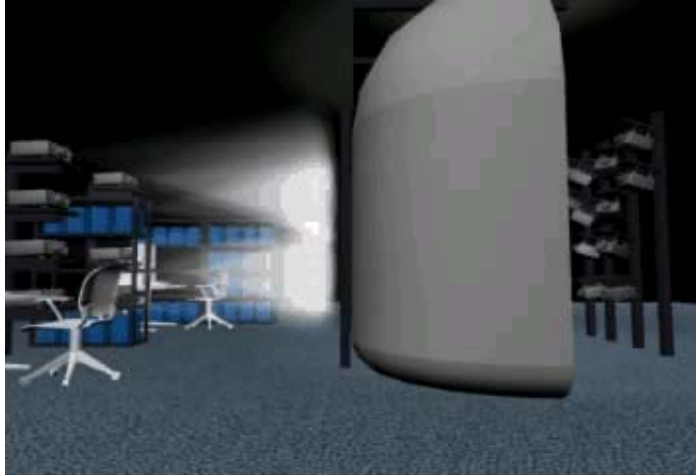
## Immersive Display

### D-vision

- immersive
- large screen  
(6.3m x 4.0m x 1.5m)
- multi-projection
- multi-PC
- multi-user



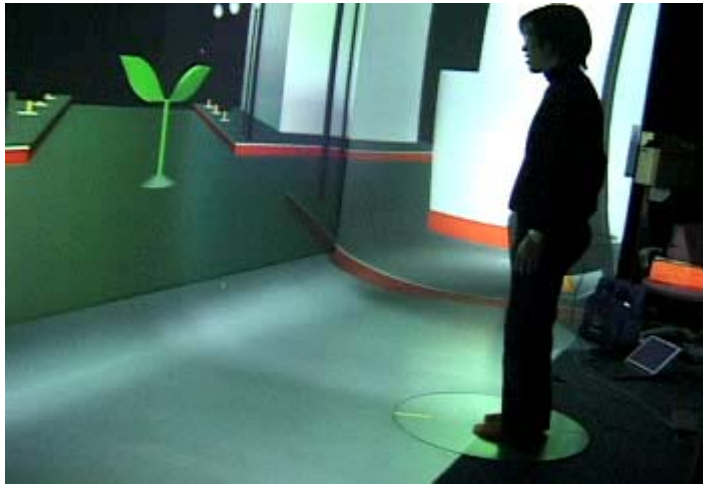
# D-vision



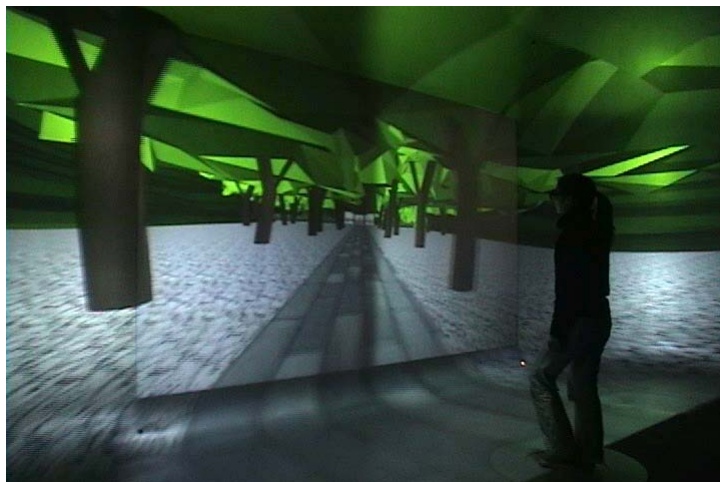
# D-vision



## Locomotion Interface for D-vision



## D-vision



## Human-scale Haptic Interface

### SPIDAR-H

- human-scale
- string-based
- smooth & safe

Size	2.5 × 2.5 × 2.5m
Accuracy	$\epsilon \leq 1.2\text{cm}$
Max Force	Max.30N



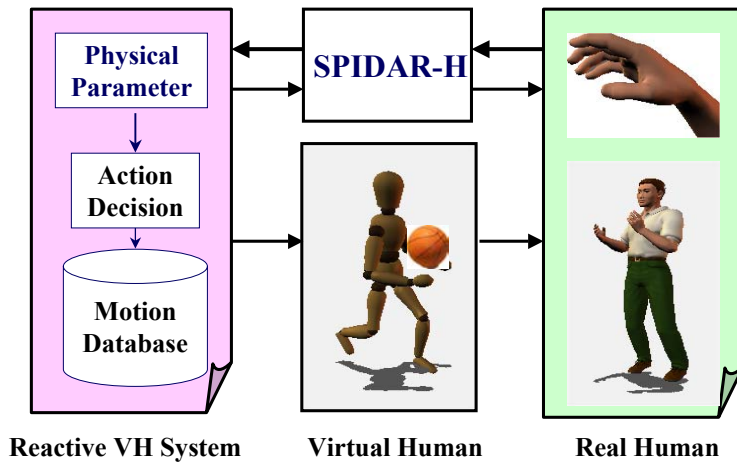
Tokyo Institute of Technology P&I Lab 1997

## Human-scale Haptic Interface

### SPIDAR-H

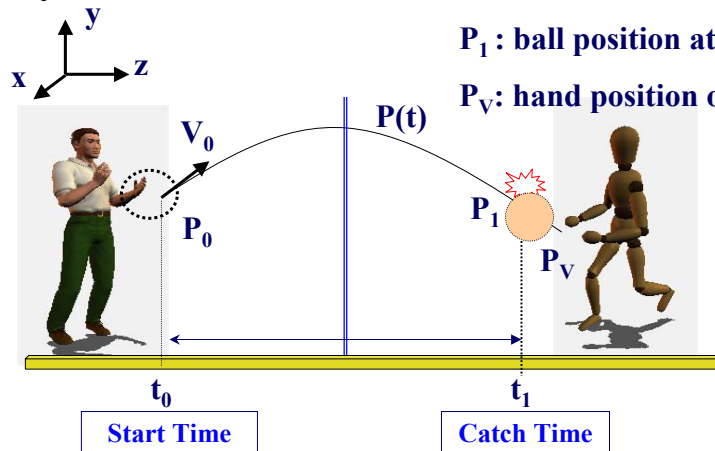


## Reactive VH System



## Motion Data Retrieval

### Physical based Retrieval



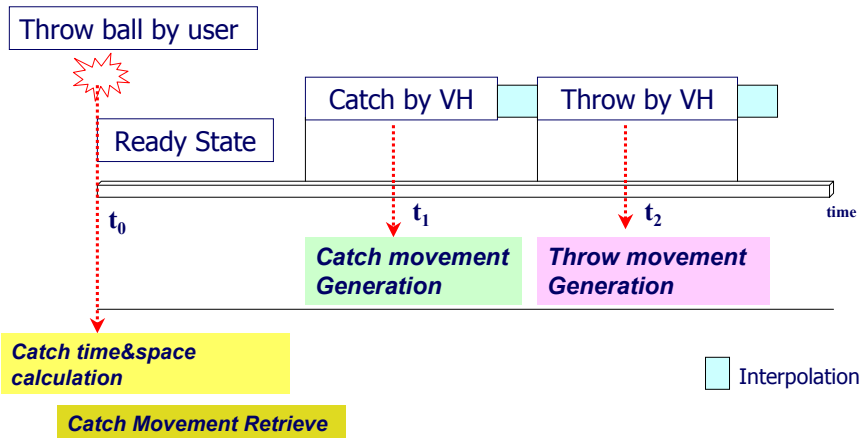
$P_0$ : initial ball position

$P_1$ : ball position at  $t_1$

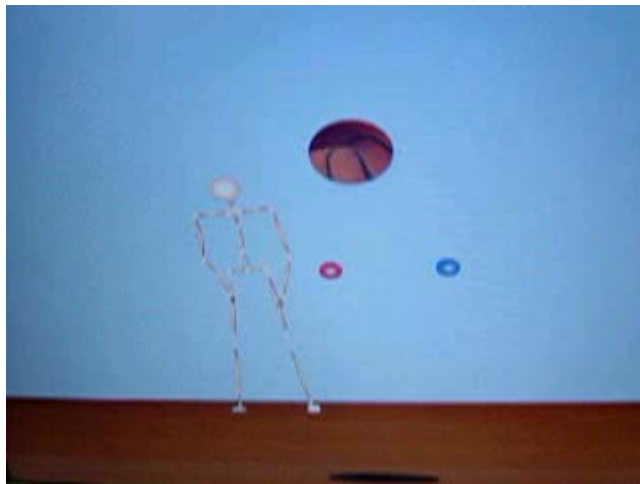
$P_V$ : hand position of VH

## Control Flow of Reactive VH

### Control flow by time-line



## Motion of Virtual Human





## Reactive Virtual Human



## Reactive Virtual Human



## Reactive Virtual Human



## Conclusions

- Propose “Reactive Virtual Human”
- Reactive VH System is composed of:
  1. D-vision
  2. SPIDAR-H
  3. Reactive Motion Generation