IMGD 4000
Technical Game Development II
Interaction and Immersion

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What *is* Immersion?

- ☐ "Being There"

- ☐ Being in *Flow*

- ☐ Natural interaction that recedes into the background

- ☐ Tapping into personal experience

Being There: Virtual Environment

- ☐ Video game
- ☐ Immersive learning environment
  - ■ Immersive chemistry
- ☐ Surgical simulation
- ☐ MMO

Being There: Real Environment

- ☐ Hand-held mobile device
  - ■ iPhone/iPad/Android
  - ■ DS/PSP

- ☐ In-vehicle system
  - ■ Navigation
  - ■ Traffic

- ☐ Augmented Reality (AR)

Being There:
Described Environment

- ☐ Books
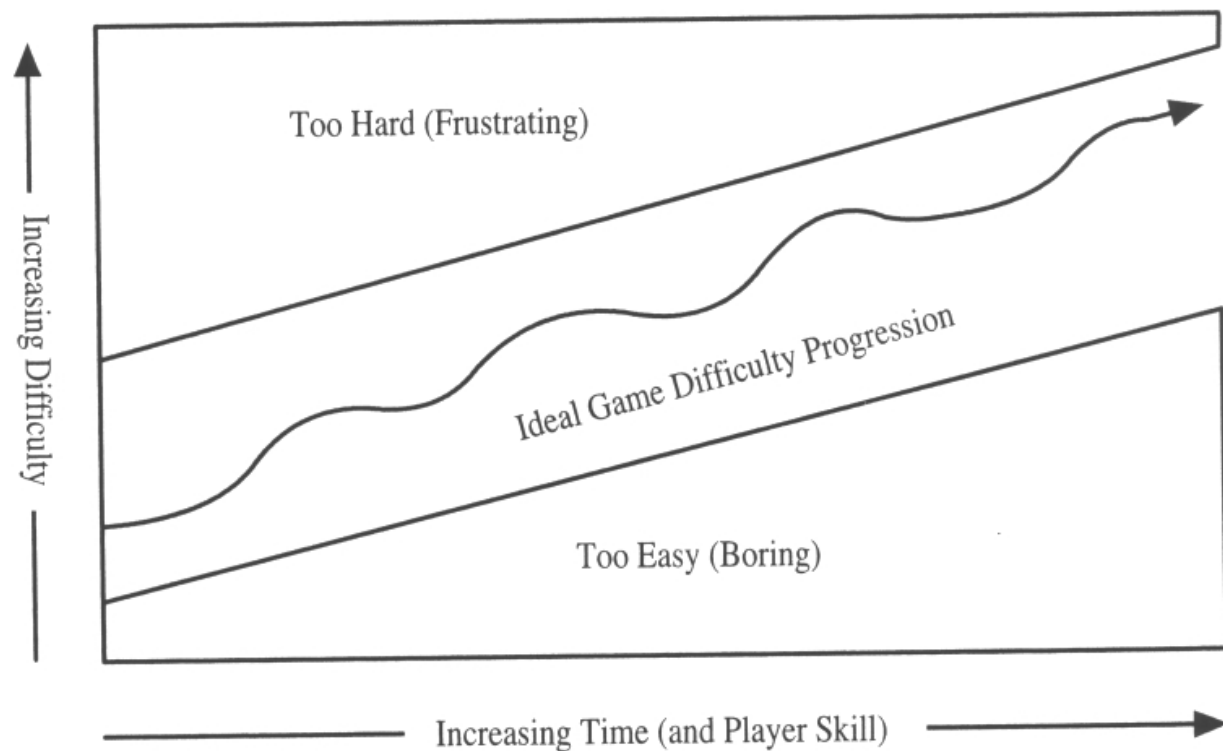- ☐ Movies
- ☐ Phone Sex

Being in Flow

- Introduced by Mihály Csíkszentmihályi
  - *Flow: the Psychology of Optimal Experience*. Harper Perennial, 1990
  - Heightened sense of perception
  - Highly focused on primary task
  - In the "sweet spot" between frustration and boredom
- Athletes often report this
- Video gamers too

Flow

- Getting the balance right is the key to success

Increasing Difficulty

Too Hard (Frustrating)

Ideal Game Difficulty Progression

Too Easy (Boring)

Increasing Time (and Player Skill)

FIGURE 2.1.8 *A better flow.*

M. Csikszentmihalyi, "Flow, The Psychology of Optimal Experience"

Chapter 2.1, *Introduction to Game Development*

Flow: Sample Game

- flOw

- Game written by Jenova Chen

- Research into adaptive difficulty
  - How can we keep people in flow?
  - Player doing poorly, make it easier
  - Player doing well, make it harder

- Play Demo

- http://www.jenovachen.com/

Characterizing Flow

- ☐ A challenge activity that requires skills
- ☐ The merging of action and awareness
- ☐ Clear goals
- ☐ Direct feedback
- ☐ Concentration on the task at hand
- ☐ The sense of control
- ☐ The loss of self-consciousness
- ☐ The transformation of time

Natural Interaction

☐ Recedes into the background
- Low cognitive load for interaction techniques
- Visual (and other) feedback can be easily digested
- Low cumber

The Role of Personal Experience

- We all filter our senses

- Variations in sight, hearing, etc.

- My childhood versus yours

- My mood

- Can we harness this?

Motivation

- The mouse and keyboard are good for general desktop UI tasks
  - Text entry, selection, drag and drop, scrolling, rubber banding, …
  - Fixed computing environment
  - 2D mouse for 2D windows

- How can we design effective techniques for 3D?
  - Use a 2D device?
  - Use multiple n-D devices?
  - Use new devices?
  - Use 2D interface widgets?
  - Need new interaction techniques!

Motivation (cont.)

- Gaming and Virtual Reality
    - Tight coupling between *action* and *reaction*
    - Need for precision

- VR can give *real* first-person experiences, not just views
    - Head-mounted Display
        - In order to look behind you, turn your head!
    - Selecting/manipulating an object
        - Reach your hand out and grab it!
    - Travel
        - Just walk (well, not quite)!

- Doing things that have no physical analog is more problematic

Common Input Devices

Mouse

Keyboard

Joystick

TrackBall

TrackPoint

TrackPad

Tablet

MightyMouse

Multi-Touch
TrackPad

Game Controllers

Atari 2600
(1977)

Intellivision
(1980)

PlayStation2
(2000)

Xbox 360
(2005)

PlayStation3
(2008)

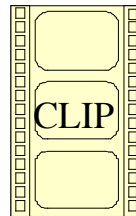# "Natural" Motion Controllers

WiiMote
(2007)

WiiMotionPlus
(2009)

Microsoft
Kinect (2010?)

PlayStation
Move (2010)
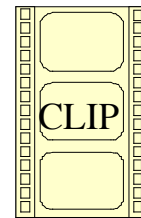
Multi-Touch Surfaces

☐ High resolution

☐ Co-located interaction

http://www.ted.com/talks/jeff_han_demos_his_breakthrough_touchscreen.html

Prototypes of Controllers

Nintendo "Revolution"
Controller (prototype)

CLIP

Nintendo Wii + Nunchuck
(released)

Prototypes of Controllers (cont.)

PlayStation3 Controller
(prototype)

PlayStation3 SIXAXIS
(released)

Hand-Held Devices

☐ Becoming interesting!

Apple iPhone 4
(2010)

Apple iPad
(2010)

Motorola DROID
(2009)

Nintendo DS Lite
(2006)

Sony PlayStation
Portable (2004)

Classification Schemes

- Relative vs. Absolute movement
- Integrated vs. Separable degrees of freedom
- Digital vs. Analog devices
- Isometric vs. Isotonic devices
- Rate control vs. Position control
- Special-purpose vs. General-purpose devices
- Direct vs. Indirect manipulation

More on Classifications

- ☐ Relative vs. Absolute movement
  - ■ Mouse vs.Tablet

- ☐ Integrated vs. Separable degrees of freedom
  - ■ Mouse has integrated X, Y control
  - ■ Etch-a-sketch has separate X, Y control
    - ☐ Motions that are easy with one are hard with the other

- ☐ Analog devices allow more sensitivity
  - ■ For example, analog game controllers

Isometric vs. Isotonic Input Devices (Zhai)

WPI

☐ No motion vs. No resistance

☐ Actually a continuum of elasticity
- TrackPoint (mostly isometric) vs. mouse (mostly isotonic)
- Many devices are re-centering (*e.g.*, joysticks)

Rate Control vs. Position Control (Zhai)

WPI

- Mouse is normally used for position control
- Mouse scroll-wheel
  - Position control
  - Click-drag for rate controlled scrolling
- Trackballs typically use position control
- Joysticks: Control position (cross-hair), or Control velocity (aircraft)
- Rate control eliminates need for clutching/ratcheting
- **Isotonic-rate control and isometric-position control tend to produce poor performance** (Zhai)

Special-Purpose vs. General-Purpose Input Devices (Buxton)

□ Game controllers are designed to support many types of games
  ■ Game developer decides on mapping
  ■ No "standard" mappings -> each game different

□ Some special-purpose devices exist
  ■ Light guns
  ■ Steering wheels
  ■ RPG keyboard/joystick
  ■ Drum kits, dance pads, bongos, *etc.*

Direct vs. Indirect Manipulation

- ☐ Direct
  - ■ Clutch and drag an icon with mouse or stylus
  - ■ Touch screens, PDAs use direct manipulation
  - ■ Works well for things that have a physical analog

- ☐ Indirect
  - ■ Use some widget to indirectly change something

- ☐ Problems with direct manipulation
  - ■ Some things do not have a physical analog
  - ■ Precision may be lacking
  - ■ Selection/de-selection may be messy
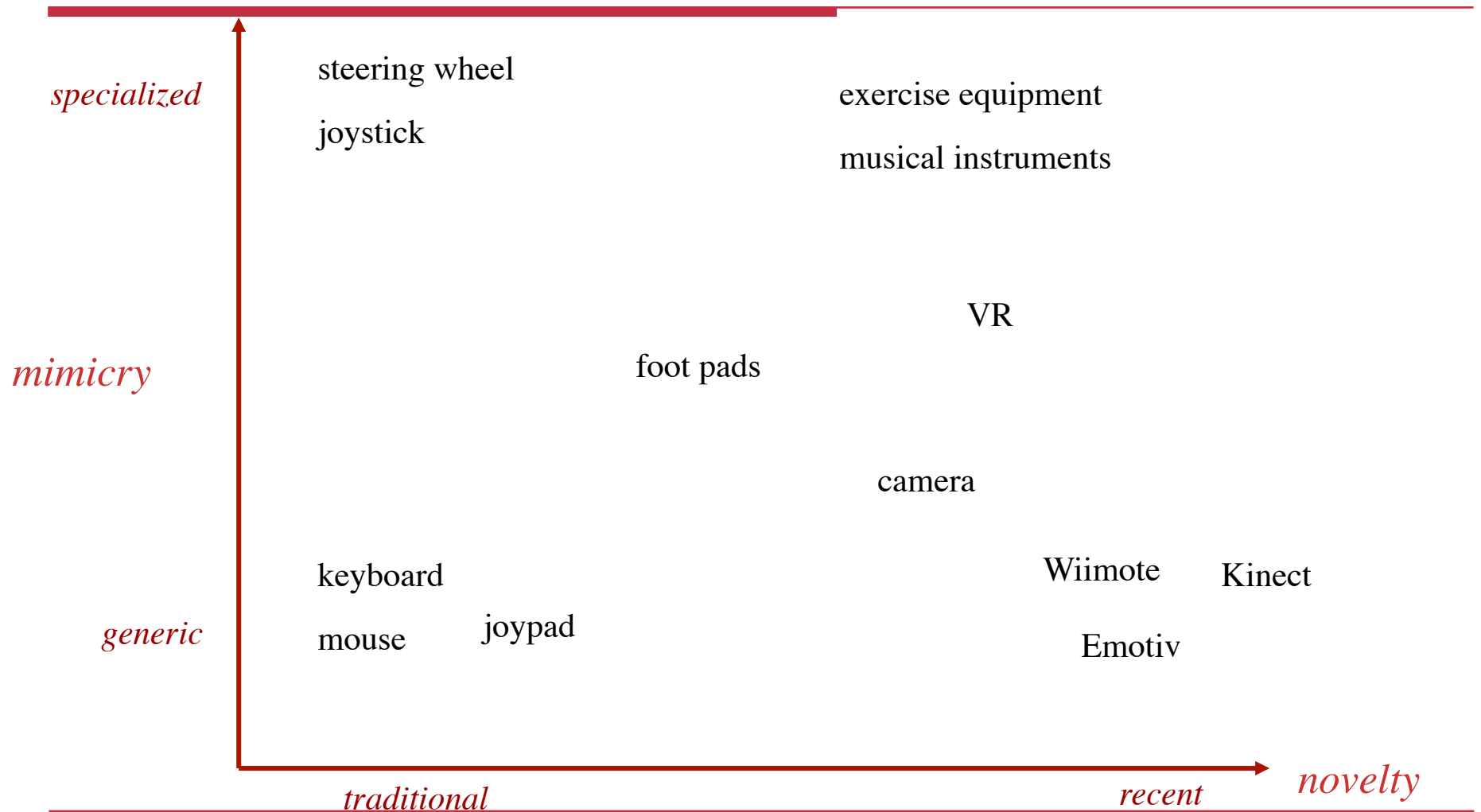
3D Input Devices

SpaceBall

SpaceMouse

CyberGlove II

HMD with
3-DOF tracker

Tracked Paddle for 2D Interaction

PHANTOM Omni
Haptic Device

steering wheel

joystick

exercise equipment

musical instruments

specialized

mimicry

VR

foot pads

camera

generic

keyboard

mouse

joypad

Wiimote

Kinect

Emotiv

traditional

recent

novelty

Think about…

Which of these ideas you could apply to <u>your new game</u> !

Embrace alternative controllers

[From Harmonix presentation]

Harmonix hasn't made a joypad game since 2003

Camera   Guitar   Microphone
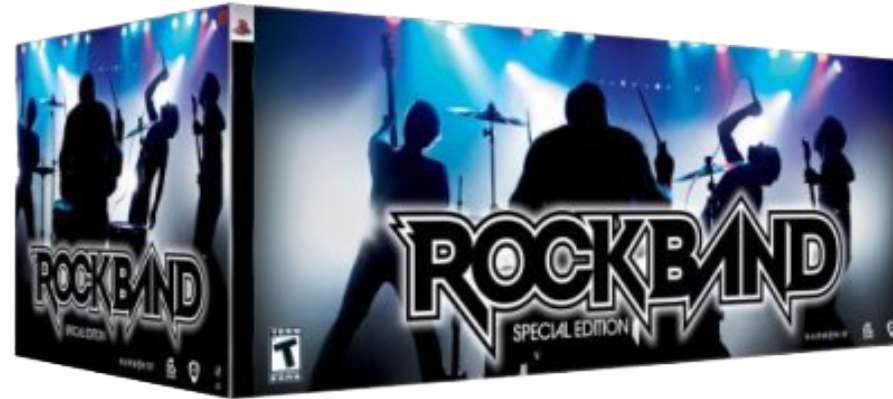
Guitar + Drums + Microphone!

We've noticed some big user benefits...

[From Harmonix presentation]

They look like what they do

[From Harmonix presentation,]

It's obvious how to use them

[From Harmonix presentation]

In Contrast… Joypads

☐ Generic by design
- So <u>can't</u> "look like what it does"
- No mental model for how to use it

[From Harmonix presentation]

Today's joypads are intimidating

N/A

Handbrake

Radio station

Steering/ weapon targeting

NA

Accelerate

Menu

Fire secondary weapon

Fire primary weapon

Look back

Nitrous boost

Accelerate/ sniper zoom in

Brake/reverse/ sniper zoom out

SONY

SELECT   START

ANALOG
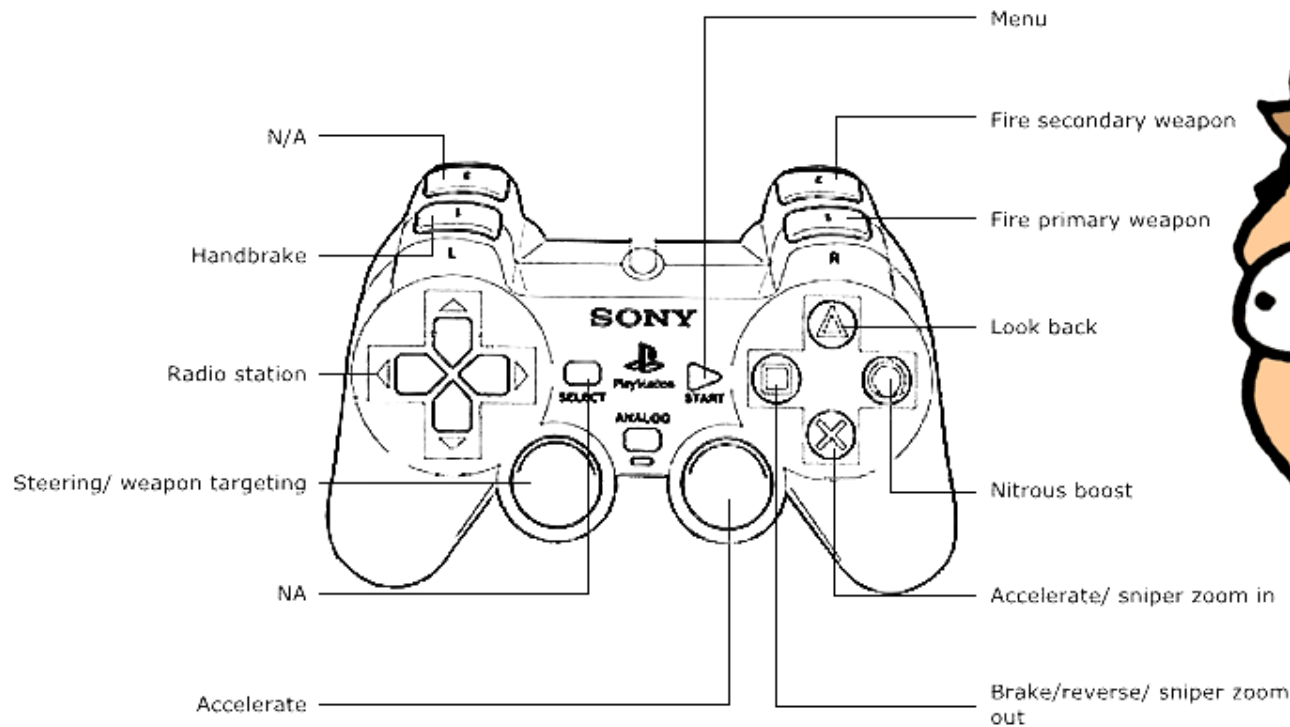
[From Harmonix presentation]

These controllers are inviting

[From Harmonix presentation]

They also "level the playing field"

[From Harmonix presentation]

The design principle:

Ensure intuitive controls

[From Harmonix presentation]

Intuitive Controls

- ☐ It just works
- ☐ This is our responsibility
- ☐ Employ usability principles

Spatial relationship between control and result is consistent
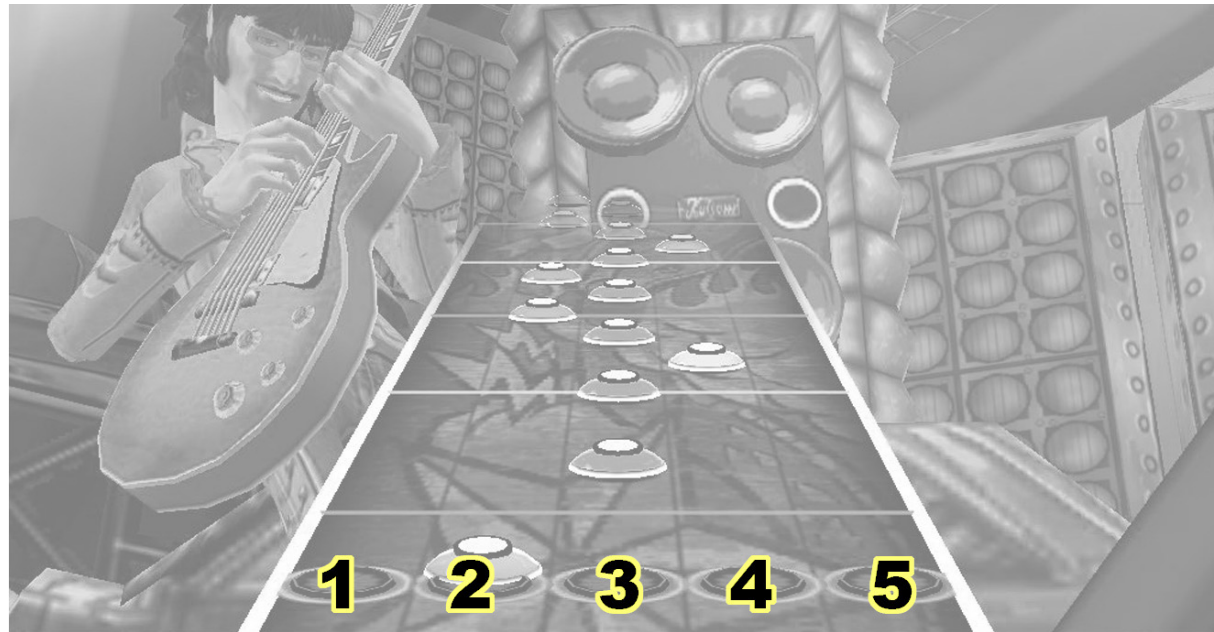
[From Harmonix presentation]

Unnatural Mapping
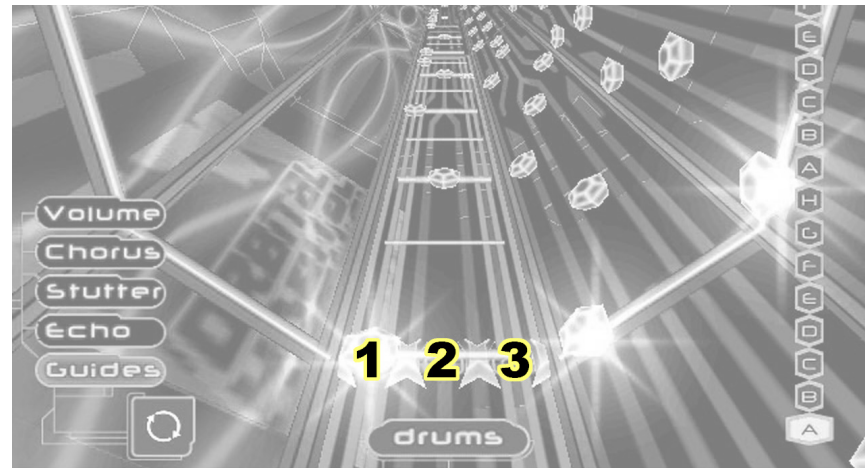
Dance Pad

Diamond Park

Inertial and IR Sensing

□ Wiimote

- ■ finger tracking *[video]*

- ■ head tracking *[video]*

Wii Finger Tracking
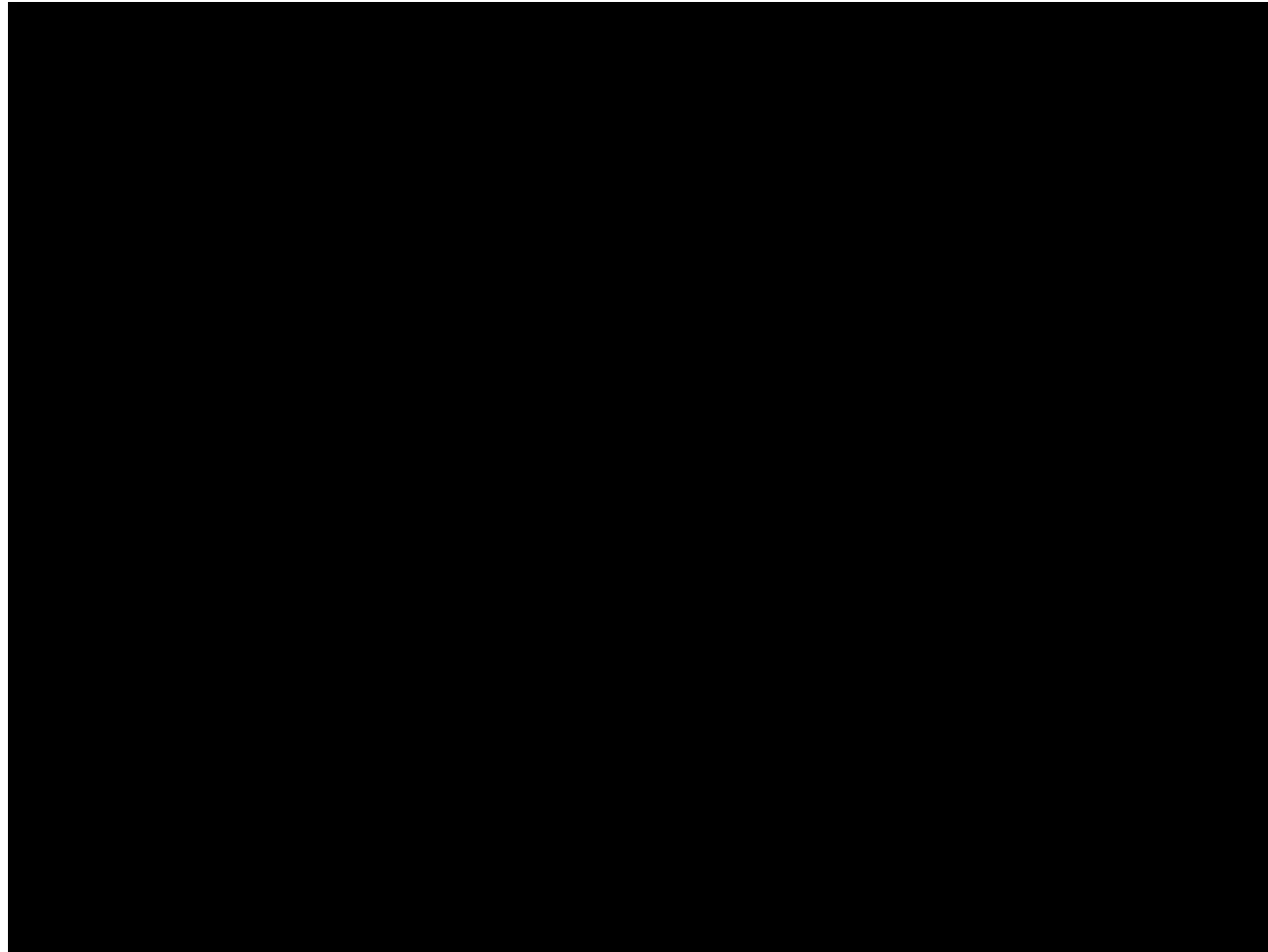
Wii Head Tracking

Head Tracking for
Desktop Virtual Reality Displays
using the Wii Remote

Johnny Chung Lee
Human-Computer Interaction Institute
Carnegie Mellon University

Using Cameras and Computer Vision

☐ Kinect (for Microsoft XBox 360)
- RGB camera
- infrared depth sensor (IR laser projector +sensor)
- microphone array

Augmented Reality
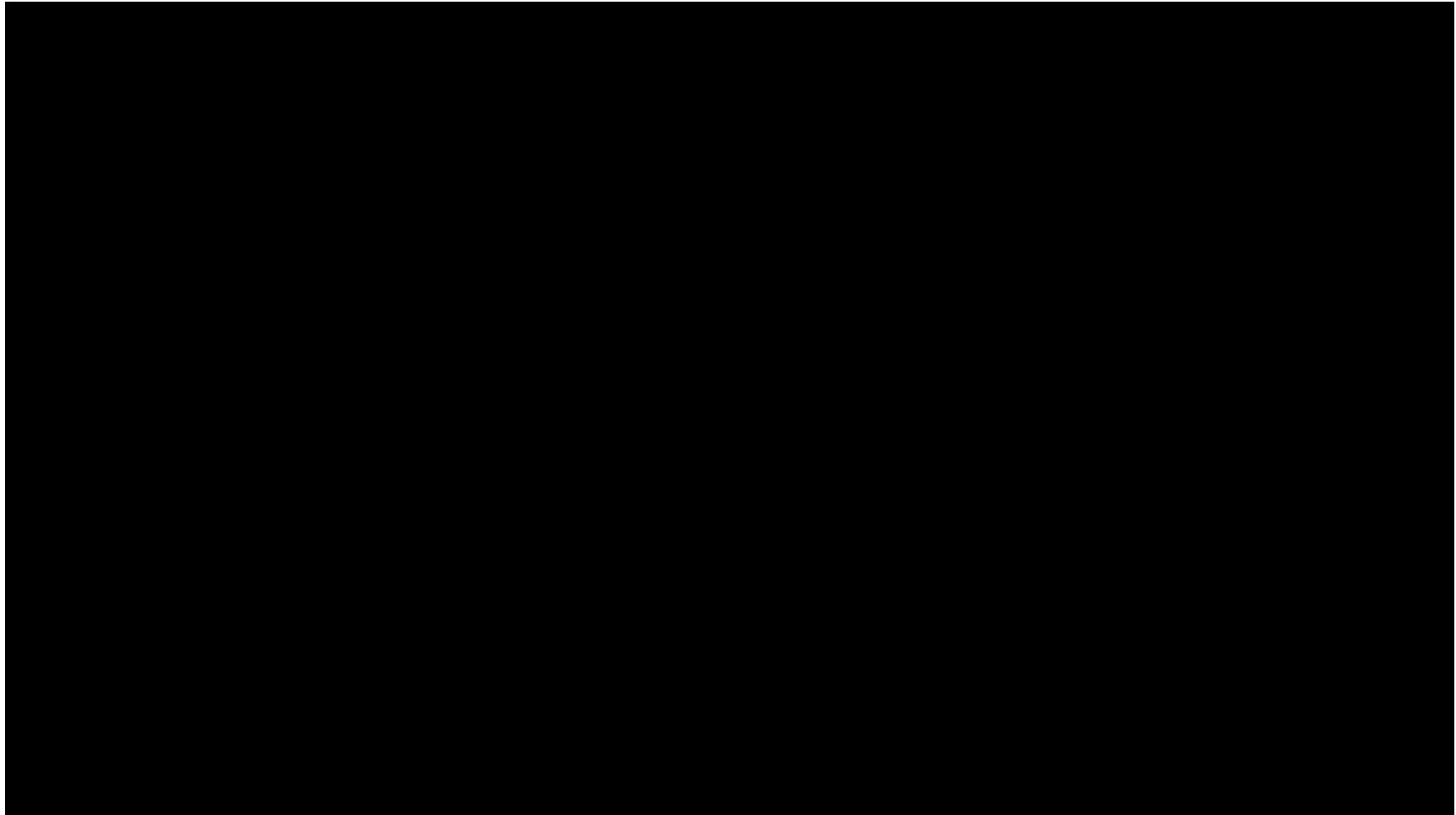
- ☐ Eye of Judgement *[video]*

- ☐ Lab Demos *[2 videos]*
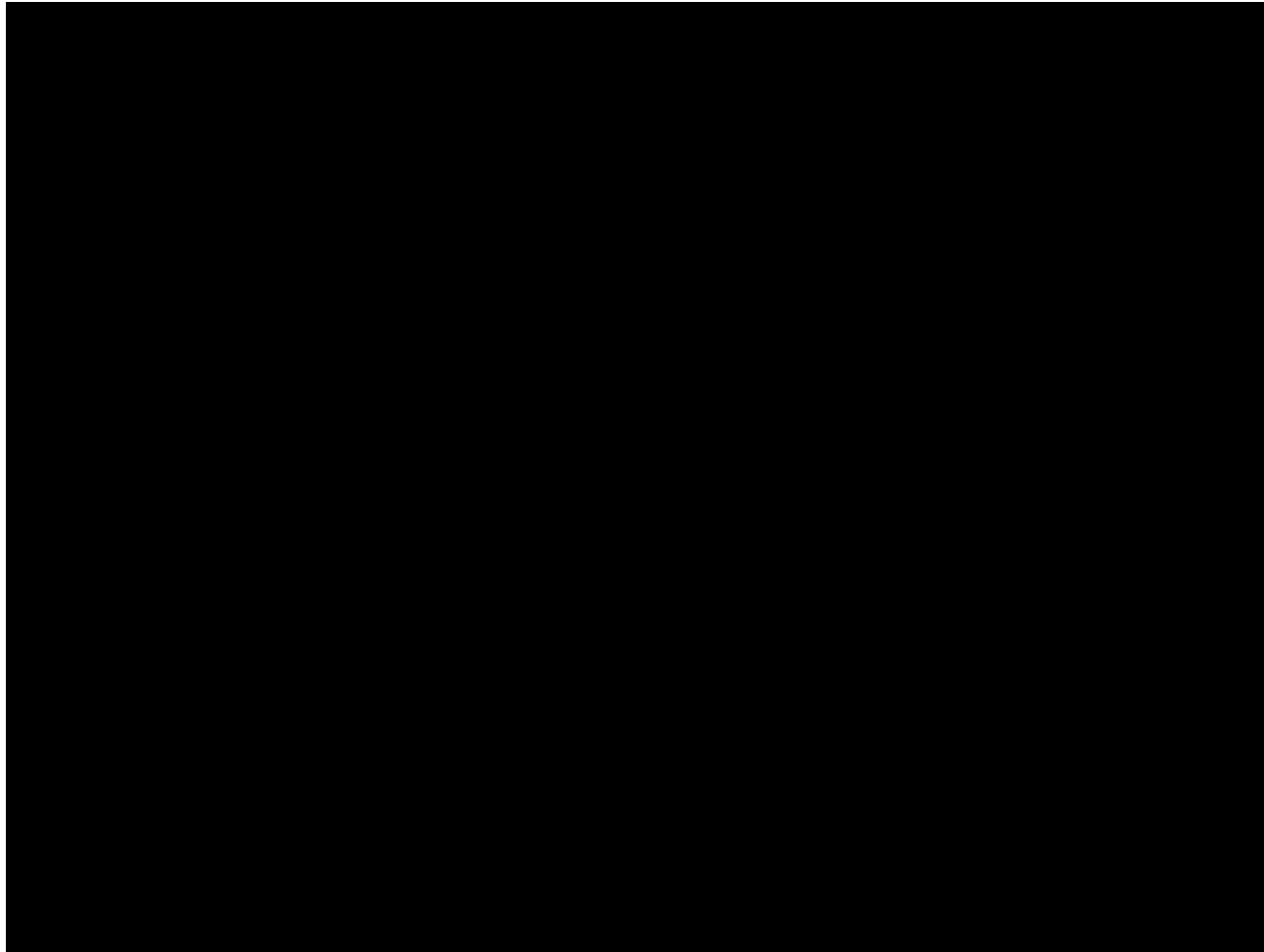
Eye of Judgement

Augmented Reality

Virtual Reality

☐ Prof. Lindeman's TactaVest *[video]*

part of the "Playstation 6"

TactaVest

Neural and Bio Feedback

□ Heart rate and skin conductance

- Wild Divine IOM *[video]*

  □ http://www.meditations-uk.com/products/wilddivine.html

□ Neural activity (EEG)

- EmotivEPOC

  □ http://www.emotiv.com

Wild Divine IOM
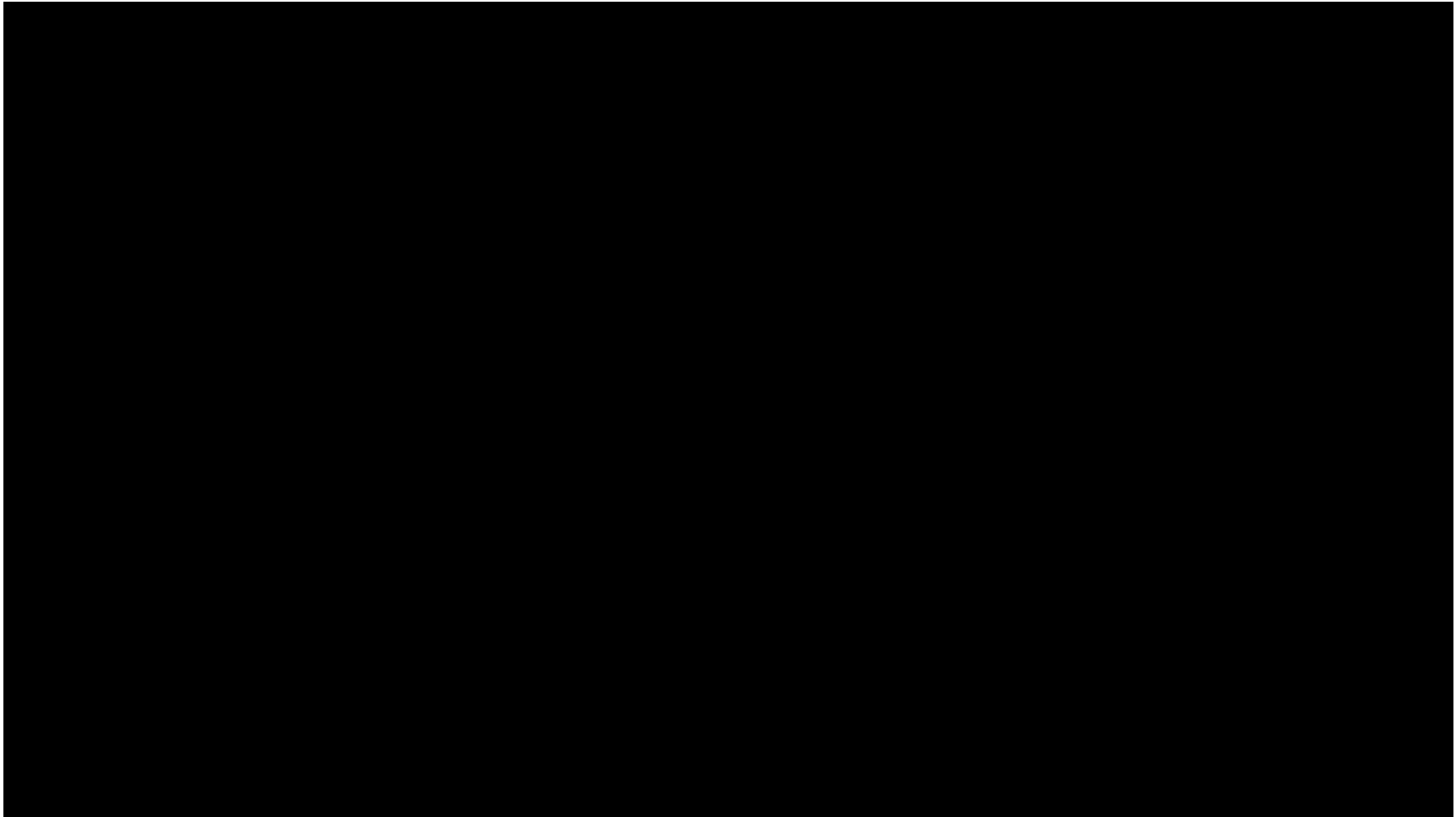
Other Input Control Ideas

- Speech
  - cheap, easy to get
  - slow, unreliable (esp. in noisy env.)

- "Embodied Gaming"
  - e.g., robosoccer with Sony Aibos

Input Controls Summary

☐ What can you do with _____ that you **couldn't do** before?

☐ What's **more fun** with _____ than with previous technologies?

☐ Does _____ **enhance** game play, rather than replacing traditional controller?

[From Z. Drake, GDC'08]