



# My Players are Monkeys

## Building Games for Animal Research

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# Blanket Fort Games

- Small Independent Developer
- Upstate NY
- Broad Platform Experience
  - Arcade
  - PC
  - Web
  - Zune





# The Scientists



- University of Rochester
  - Department of Brain and Cognitive Sciences
    - Hayden Lab
- Motivated by knowledge-seeking





# The Monkeys

- Rhesus Monkeys
  - *Macaca mulatta*
- Motivated by cherry juice





# The Game

- 3D Maze
- First-person
- Joystick driven
- Display stretched over three monitors in landscape
  - Nearly 180 degree field-of-view
- Collect fruit
  - Detect when a patch of fruit is exhausted
  - Decide to move to another area of the maze
  - Navigate to new patch





# The Experiment

- Scientists monitoring in real time
  - In the next room
- 3 Displays
  - Repeater of Monkey's display
  - Top-down view of maze
  - Configuration window
- Configures maze in advance
  - Builds walls
  - Sets up triggers
    - Wall creation/deletion
    - Fruit spawning
- Adjusts maze in real time
  - Adds/removes walls
  - Adds fruit





# The Tools

- Analog USB I/O Board
  - Actuates juice dispenser
- Digital USB I/O Board
  - Synchronizes game logs with neurological data
- Custom Joystick
  - Reinforced to withstand harsh treatment
- Neurological Data Recorder





# The Logs

- Monkey position, facing, speed
- Position of each fruit
- Visibility of each fruit
  - Which of 3 monkey monitors
  - Occlusion
- Fruit collected
- Visibility of each landmark
  - Which of 3 monkey monitors
- Monkey collision status
  - Collided with wall
  - Scraping along wall
  - Free
- Logs saved twice
  - Machine readable, for replays
  - CSV, for data analysis





# The Challenges





# Teach The Monkeys

- Already knew how to play a 2D game with a joystick
- First iteration was easier
  - Open field – no maze
  - Fruit ran away
- Monkeys would watch replays with rewards enabled
  - Monkey see, Monkey do
- Understanding joystick control in 3D was easy
- Understanding maze navigation is hard





# Teach The Scientists

- Scientists are not gamers
  - “Virtual Environment” meant 3D
- Throw out 10 years of game design convention
  - Build a new set of jargon from scratch
  - Words like trigger, spawn, event were unfamiliar
- Build a level editor out of a text editor
  - Scientists are accustomed to tedious processes
  - Much less comfortable with ‘standard’ level editing tools
  - Access to cheap labor
- Understanding what is possible





# Interface with the Hardware

- Two different USB I/O boards
  - From different manufacturers
  - With different libraries
- Custom Joystick
  - Just a normal joystick, reinforced
- Single lab computer
  - 'Works on my machine' really is good enough
  - Once driver versions matched between lab and office





# Two Games in One

- Monkeys and Scientists playing simultaneously
  - Different games with different goals
  - Monkey wants fruit
  - Scientists want data
  - Neither goal is entertainment





# Development is Ongoing

- Changes for new experiments
- More advanced triggers
- Custom head rotation tracker
- Eye tracking camera





# Questions?

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