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# IMGD 3xxx - HCI for Real, Virtual, and Teleoperated Environments: Introduction

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# Motivation

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- Some interesting recent developments
  - Mobile computer systems are cheap, powerful, and everywhere
  - Wireless connections are everywhere
    - Cellular, WiFi, Bluetooth, ...
  - Sensors and actuators are cheap
  - Accessible robot systems are emerging
    - Roomba, MANY kits
  - Wild popularity of new games and platforms
    - Rockband, Wii, iPhone/iPod/iPad, Android

## Motivation (cont.)

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- I've been working on 3D User Interfaces for Virtual Reality for a loooooong time
  - About 15 years
- VR and gaming are very related
  - But games sell!
- Games have gotten a little stale
  - How many more FPSs can you make?
- Graphics are pretty good now!
- Sound is also pretty good!
- So, what's the next big thing?

# Questions

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- ❑ Why are car navigation systems so popular?
- ❑ Why are the iPhone/iPad so popular?
- ❑ Why is the DS so popular?
- ❑ Why is the Wii so popular?
- ❑ What games are popular on the Wii?
- ❑ What are Sony and MS doing to catch up?
- ❑ What can Nintendo do to stay ahead?

# HCI in Real Environments

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- Mobile devices
  - Car Navigation
  - GeoCaching
  - FriendFinder
  - Medical monitoring
  
- Multi-person coordination
  - Military operations
  - Search-and-Rescue
  - Fire fighting
  
- Stuff we don't know about yet!

# HCI in Virtual Environments

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- Layouts for user interfaces
  - Heads-Up Displays (HUDs)
  - Chat windows
  - State
- Spatialized audio/voice
- Haptic (touch) displays
  - Hit by weapons fire
  - Virtual surgery training
  - Steering wheels
- Smell?
- Taste?
- What about input?

# HCI in Teleoperated Environments

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- Teleoperated robot systems are used more and more
  - Disaster areas
  - Medical micro-robots
  - Space exploration
  - UXVs (UAV, UGV, UUV)
  
- Operator relies on remote sensors
  - Limited fidelity
  - Communication delays
  
- Remote actuators change the physical world

# Common Problems

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- All three environments require the user to:
  1. Sense something
    - Limited fidelity (screen space, etc.)
  2. Make a decision
    - Draw on new and existing knowledge
  3. Carryout actions
    - Limited expressiveness (mouse, gamepad, etc.)
- Errors can be made at each step
- In this course, we will focus on **1** & **3**
  - Also known as Input/Output



# What to Expect

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- This course is about
  - How to build new interfaces for these environments
  - How to design applications (e.g., games) that take advantage of these devices
- This is really a **Chicken & Egg** proposition
  - Devices constrain the application
  - Application constrains the devices
  - User constrains both
  - Environment constrains both

## What to Expect (cont.)

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- The groundwork to do this stuff right requires
  - A good understanding of the human sensory system
  - A good understanding of building devices
  - A good understanding of the application domain
  
- The projects you do in this course will help you learn all of this

# Summary of Syllabus

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- Lectures and in-class work
  - Exercises designed to drive home concepts, or to get you thinking about projects
- 1 Application Design Report (33%)
  - Research a potential application (Real/Virtual/Tele)
  - Design (not build) a novel user interface for it
- ~4 "Smaller" Projects (33%)
  - Individual projects
  - Use the Arduino and Android to build stuff
- 1 Final Project (34%)
  - Team-based
  - Use Arduino/Android, plus other software you choose (Unity, Flash, C4, XNA, etc.)
- All material on class website  
([www.cs.wpi.edu/~gogo/courses/imgd3xxx/](http://www.cs.wpi.edu/~gogo/courses/imgd3xxx/))

# Readings for the Course

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- There will be material from several eBooks:
  - ***Programming Interactivity***, 1st Edition, Joshua Noble, O'Reilly.
  - ***Getting Started with Arduino***, 1st Edition, Massimo Banzi, O'Reilly.
  - eBooks can be accessed from any WPI computer:
    - <http://proquest.safaribooksonline.com:80/home>  
Enter "Arduino" in the search box
- And also material from the Web:
  - Arduino/Android communities
  - Electrical engineering help
  - Project ideas
- Excerpts from:
  - 3D User Interfaces: Theory and Practice, Bowman, Kruijff, LaViola, Poupyrev, 2005, Addison Wesley, ISBN: 0-201-75867-9

# More About the Projects

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- One of the goals of this course is for you to feel confident to build devices
  - Find sensors to measure what you want to measure
  - Find interesting ways of getting input to the system
  - And output to the real world (e.g., the user)
    - Pinwheels for network traffic
  
- You can find stuff easily these days
  - Sparkfun ([www.sparkfun.com](http://www.sparkfun.com))
  - Digikey ([www.digikey.com](http://www.digikey.com))
  - Jameco ([www.jameco.com](http://www.jameco.com))
  - Allelectronics ([www.allelectronics.com](http://www.allelectronics.com))
  - RadioShack ([www.radioshack.com](http://www.radioshack.com))

# Engineering vs. Science

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- Scientific Method
  - Define a hypothesis, test it, and make laws
- Engineering Approach
  - Come up with an idea, build it, refine
- Both of these require solid foundations!
  - You need to do your homework
- Software people are reluctant to mess with hardware
  - Might break something

# Arduino Development

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- There are Arduino Development Kits for this course in the bookstore
- The kits work in the lab
  - And you can work at home too
- Cross-platform
  - Mac, Linux, Windows
- LOTS of help on the Web:
  - <http://www.arduino.cc/>

# Android Development

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- Google gave us phones!
- The Android development environment is eclipse based
  - Java is main language
  - Emulator for testing
- Eclipse has been configured in the lab
  - And you can work at home too
- Cross-platform
  - Mac, Linux, Windows
- LOTS of help on the Web:
  - <http://developer.android.com/>



# Final Project

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- ❑ Two- or three-person teams
- ❑ Choose an application area
- ❑ Define a set of interface devices and techniques that support the app
- ❑ Interim status demos in class
- ❑ Presentations will be done the last week of this course, where you will show your stuff
- ❑ More on this later!

# Course Support

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- TA
  - Paulo de Barros (pgb at wpi.edu)
- Please come to office hours (or other times)
- There is a GDC Forum for this course
  - <http://forums.gdc.wpi.edu/>
  - All project discussions should be posted there
  - You are encouraged to post screen-shots of your progress

# Expected Outcomes

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- Think beyond the gamepad
  - Alternative I/O to support a particular application
- Feel comfortable building new things
- Know how best to provide output to humans
  - All the senses
- Build up your portfolio

# Final Thoughts

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- This is an experimental course!
- I don't know which parts of this course will give you problems
  - We need to work together to tweak the content, presentation, etc.
- I welcome any and all feedback and suggestions on how to make the course better
- We have some flexibility to re-order/change topics
- Be playful!
- Be ambitious!