



IMGD 3xxx - HCI for Real, Virtual, and Teleoperated Environments: Physical Input

by

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Overview

- Manipulating Physical controls is different from manipulating virtual controls
 - “Handling” them is different
 - Brain activity is different
 - Uses may be different

- We need to design to best suit the application, user, and environment
 - Tap into previous experience
 - Support adequate expressiveness
 - Automate what we can
 - Provide multi-modal redundancy

Physical vs. Virtual Controls

- ❑ In the past, physical controls were more common
- ❑ Now, virtual controls are as common
- ❑ Examples?
- ❑ Many virtual tools mimicked physical tools
- ❑ However, since physical manipulation requires touching, virtual versions are often flawed



The Brain/Hand Connection

- Every interface has to be learned
 - Could be a short learning time though
- Over time, some people master an interface to the point where they don't really think about it anymore
 - Guitar/piano players
 - Remembering phone numbers
- Goal of Interaction Design
 - To allow users to perform actions instinctively and without the need to consider each action but to instead consider its larger consequence.
- Make so your users can develop habits

A Button is Much More than just a Button

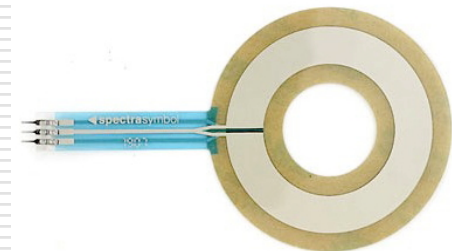
- An electrical object
 - Pushing it closes the circuit, alerting the Arduino

- An interactive object
 - More common than knobs today, because many things we control are digital
 - Thermostat, mp3 players, phones
 - Buttons are quick too

- A state in program code
 - We address the button using the state of a pin

A Knob is Much More than just a Knob

- Buttons are digital (ON/OFF)
- Analog gives us more expressiveness
- Knob as Interactive Object
 - Represents a range of values
 - Less precise than a button
 - Some knobs change the values in fixed increments
- Implemented as a potentiometer for us
 - Could be "soft potentiometers"
 - http://www.spectrasymbol.com/typo3/site/en/softpot_splash/softpot.html



Lights

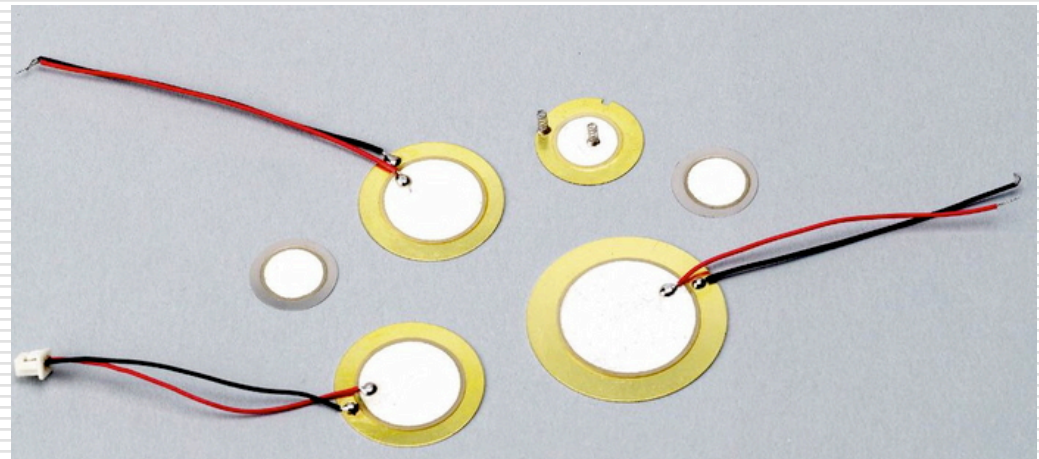
- Tell us the state of something
 - Charging state of a battery
 - Progress of an activity
 - State of a larger device

Touch and Vibration

□ Piezoelectric sensors (or just *piezo*)

□ Use for sensing

- Pressure
- Acceleration
- Strain
- Force



□ Crystals generate an electric potential in response to stress

- More current is returned when bent

Detecting Motion

- Easy and fun
 - Use when someone approaches your installation

- Passive Infrared (PIR) sensor
 - Senses rapid changes in the presence of IR energy
 - Caused by people coming into the scene
 - 9 or 10 micrometer wavelength

Reading Distance

- Two main technologies
 - Ultrasonic (range finders)
 - How long it takes a wave to return
 - Magnitude is proportional to distance
 - Infrared
 - Two parts: emitter and receiver
 - Angle of beam returning is measured to estimate distance
 - Used in digital cameras

Detecting Forces and Tilt

□ Accelerometers

- Measure the change in angle between a pendulum and gravity

Binary Numbers

- Decimal vs. Hexadecimal vs. Binary

Further Reading

□ Interface Hall of Shame

- <http://homepage.mac.com/bradster/iarchitect/shame.htm>