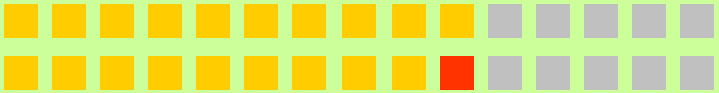
week
10



Synthesis

Mapping between the input and output space

Physical Computing

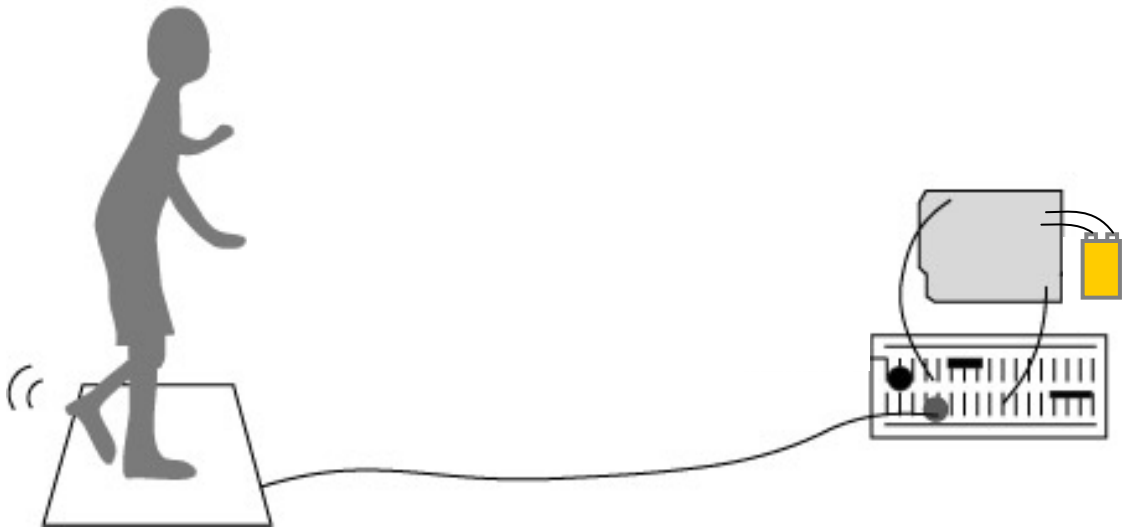


Illustration adapted and modified from O'Sullivan and Igoe

Physical Computing

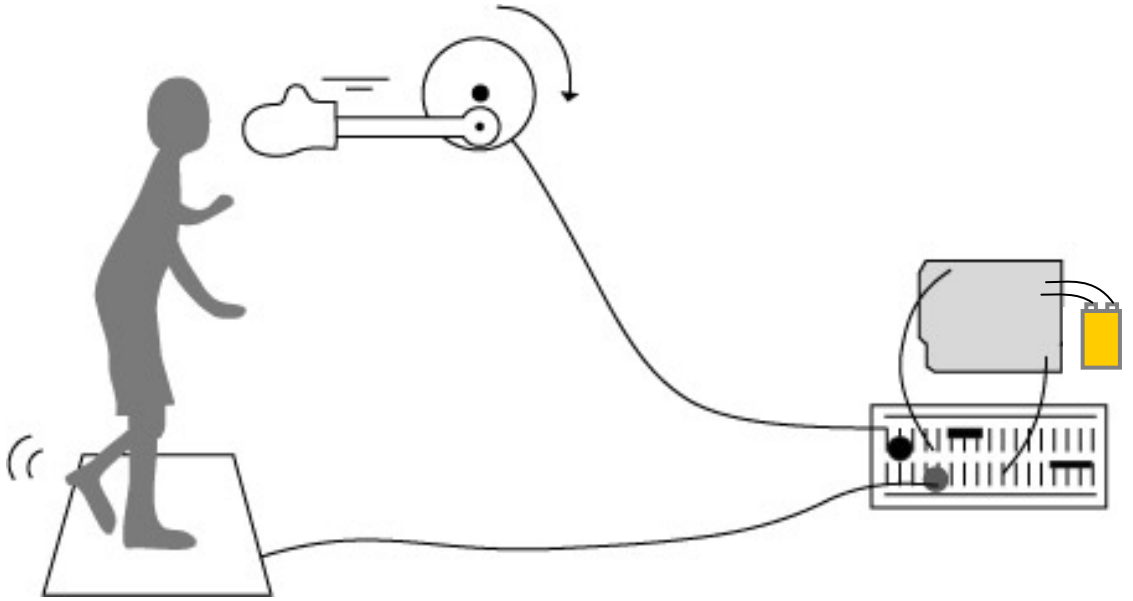
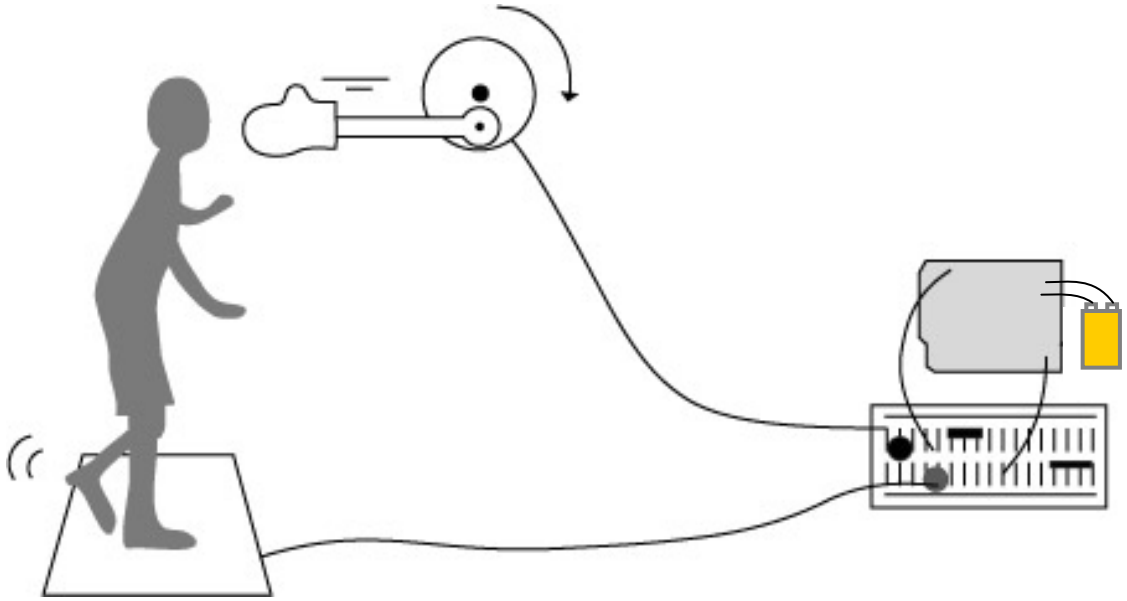


Illustration adapted and modified from O'Sullivan and Igoe

Transducers

Output Transducers
Actuators (e.g., motors, piezo, etc.)



Input Transducers
Sensors (e.g., pot, FSR, photo sensor, etc.)

Illustration adapted and modified from O'Sullivan and Igoe

Designing Tangible UI

Designing meaningful interaction loop that takes advantage of your hands and body to manipulate digital information.

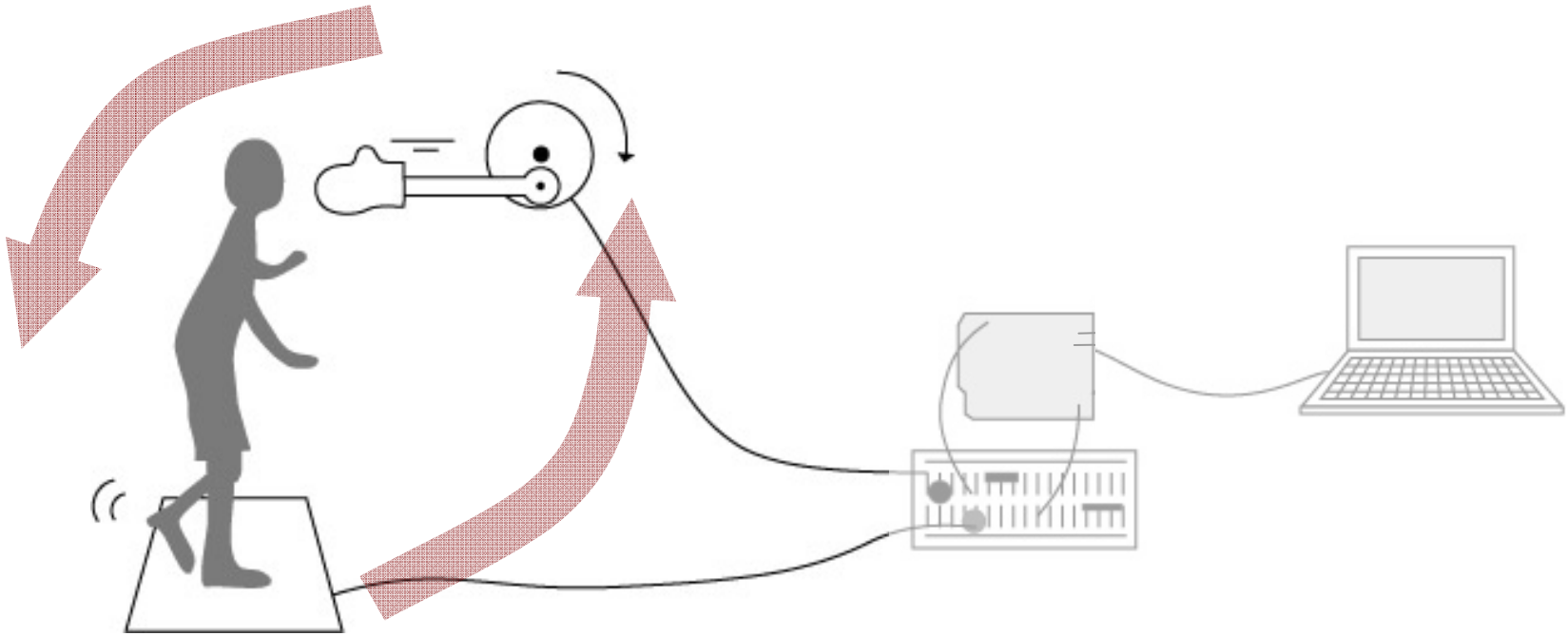
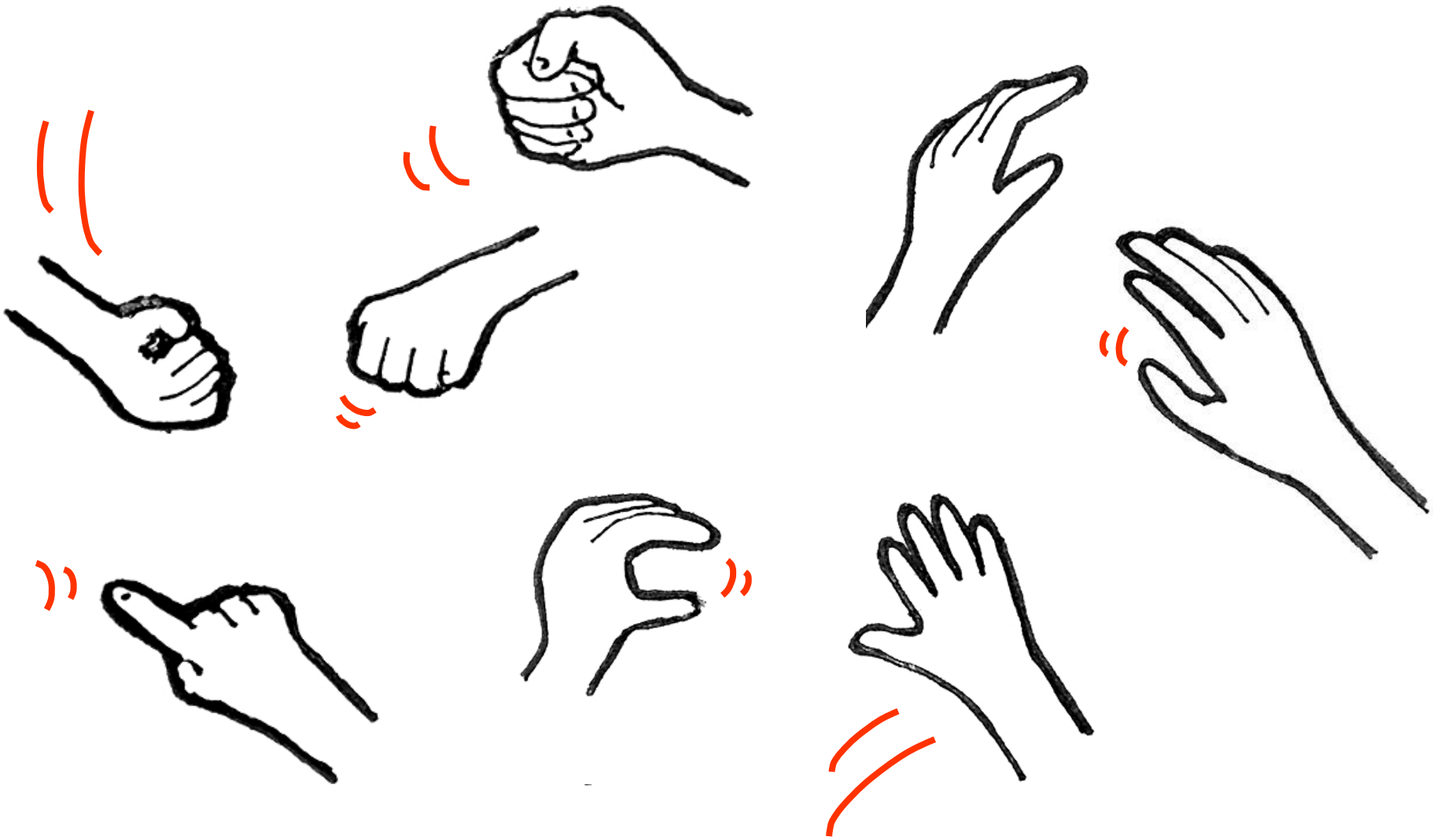


Illustration adapted and modified from O'Sullivan and Igoe



Come a Little Bit Closer Bench [droog, 2001]

Do Hit [van der Poll, 2001]

Input

Output

Input

Output

What We Do	What We Feel
Press	Light
Twist	Sound
Turn	Motion
Shake	Vibration
Kick	Balance
Stretch	Heat
Squeeze	Cold
Pound	Smell
Scratch	. . . . .
. . . . .	

Input

Input Transducers	What We Do
FSR	Press
Potentiometer	Twist
Switch	Turn
Photo sensor	Shake
Accelerometer	Kick
Tilt sensor	Stretch
IR sensor	Squeeze
. . . . .	Pound
	Scratch
	. . . . .

Output

What We Feel	Output Transducers
Light	LED
Sound	Piezo speaker
Motion	DC motor
Vibration	Servo motor
Balance	Pager motor
Heat	LCD display
Cold	Projector
Smell	. . . . .
. . . . .	

Input

Output

Input Transducers	What We Do	What We Feel	Output Transducers
FSR	Press	Light	LED
Potentiometer	Twist	Sound	Piezo speaker
Switch	Turn	Motion	DC motor
Photo sensor	Shake	Vibration	Servo motor
Accelerometer	Kick	Balance	Pager motor
Tilt sensor	Stretch	Heat	LCD display
IR sensor	Squeeze	Cold	Projector
. . . . .	Pound	Smell	. . . . .
	Scratch	. . . . .	
	. . . . .		

Input

Output

Input Transducers	What We Do	What We Feel	Output Transducers
FSR	Press	Light	LED
Potentiometer	Twist	Sound	Piezo speaker
Switch	Turn	Motion	DC motor
Photo sensor	Shake	Vibration	Servo motor
Accelerometer	Kick	Balance	Pager motor
Tilt sensor	Stretch	Heat	LCD display
IR sensor	Squeeze	Cold	Projector
. . . . .	Pound	Smell	. . . . .
	Scratch	. . . . .	
	. . . . .		

Input

Output

Input Transducers	What We Do	What We Feel	Output Transducers
FSR	Press	Light	LED
Potentiometer	Twist	Sound	Piezo speaker
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Tilt sensor	Stretch	Heat	LCD display
IR sensor	Squeeze	Cold	Projector
. . . . .	Pound	Smell	. . . . .
	Scratch	. . . . .	
	. . . . .		

In Class Exercise

In Class Exercise

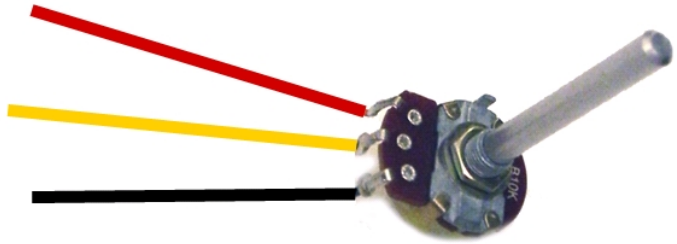
Build an instrument that produces sound in response to physical manipulation.

Blue Man Group

Guideline

1. Work in teams of four.
2. The instrument should use at least **4 input devices.** The devices can be all the same, all different, or any combination in between.
3. Consider your instrument to be **collaborative** (or even competitive).
4. Think critically about the **mapping** between the input and output space.

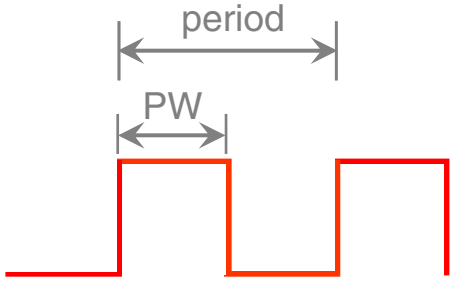
Input Transducers

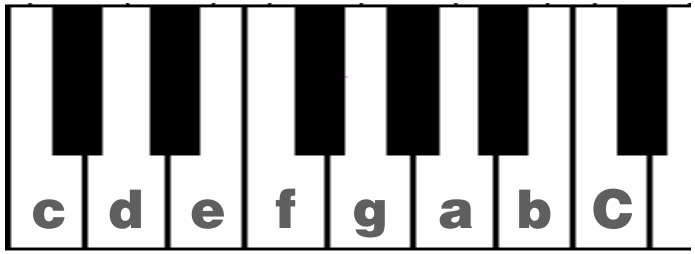


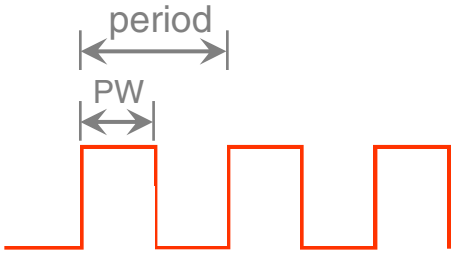
Output Transducers

Output 1

Piezo Speaker








```
byte names[] = {'c', 'd', 'e', 'f', 'g', 'a', 'b', 'C'};
int tones[] = {1915, 1700, 1519, 1432, 1275, 1136, 1014, 956};
byte melody[] = "2d2a1f2c2d2a2d2c2f2d2a2c2d2a1f2c2d2a2a2g2p8p8p8p";
// count length: 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
//                                   10                  20
```

Output 2

Sound Library

Introduction
Download

Examples

MP3 Import
Signed Applets

Credits

Classes
Ess

AudioChannel
AudioStream
AudioInput

AudioFile

Subclasses of AudioFilter
Subclasses of AudioGenerator

FFT

Analysis (uses MP3 import): Plays an MP3 while displaying an oscilloscope and performing real-time spectrum analysis. Click to start/stop

Input FFT (requires microphone): Showcase for new FFT processing options in Ess v2. Clicking and dragging changes FFT damping

MP3 Stream (uses MP3 streaming): Plays a stream from an Internet radio station in real-time

Pan and Volume: Generates a looping sine wave and pink noise. Pan and volume are controlled by mouse position

Ping Pong (requires Internet connection): Loads a sound from the Web. Uses the audioOutputPan event to pan back and forth

Pitch Shift: Plays generated sound in two AudioChannels, adjusting pitch over time. Left channel maintains tempo, right does not

Reverb: Applies reverb 10 times to the first sentence of Alvin Lucier's seminal electroacoustic piece "I am Sitting in a Room"

Scrub: Loads a sample that can be played/paused by clicking a button in the lower left-hand corner. Playback head can be adjusted by clicking and dragging

Spooky Stream Save: Sound is generated in realtime, with pitch and pan controlled by the mouse. Streaming of generated sound to a file can be started/stopped by pressing any key

Output 3

Actuated Sound

Animusic

STOMP

Mapping

Think critically about the mapping between the input and output space.

Homework

Post descriptions and photos (and/or video) of your instrument on the course website.

Let’s get started!