Making I/O

making **human interface devices (HIDs)** for
audio / visual performances

Introduction Projectweek IMD

Niki Scheijen & Marijn Brussel

What will you **learn & make** this project week?
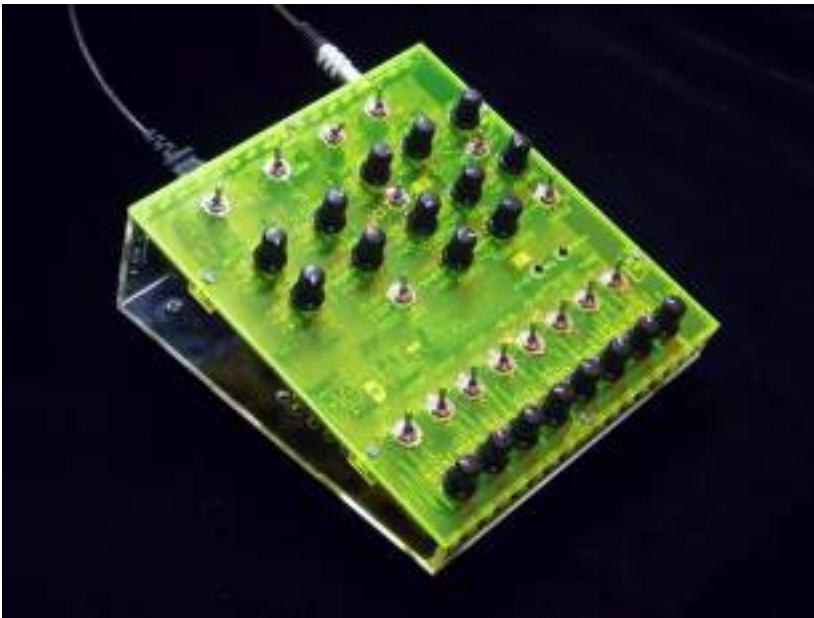
Your own **HID midi/usb controller**!
That you take home with you!

Use it in your own **audio / visual** performance!

What are **human interface devices (HIDs)**?

gamepad

mouse

keyboard

microphone

midi keyboard

webcam

devices that allow humans to interact with c o m p u t e r s

What is inside a **human interface device (HID)**?

sensor

microcontroller
& software
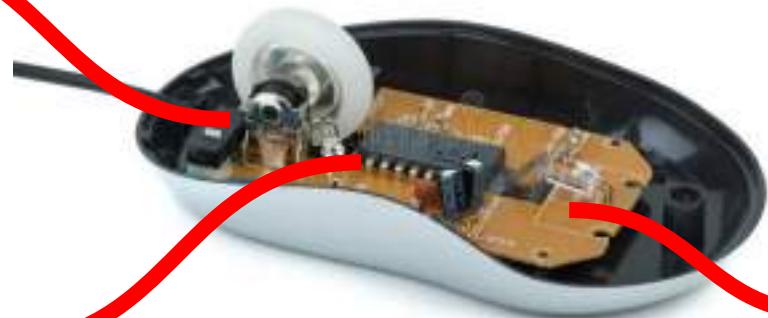
mouse

pcb

Making your own **human interface device (HID)**


sensors
(input)

arduino

(keyboard,
mouse, midi,
etc.)

computer
(output)

Making your own **human interface device (HID)**

breadboard

software

circuit board

enclosure
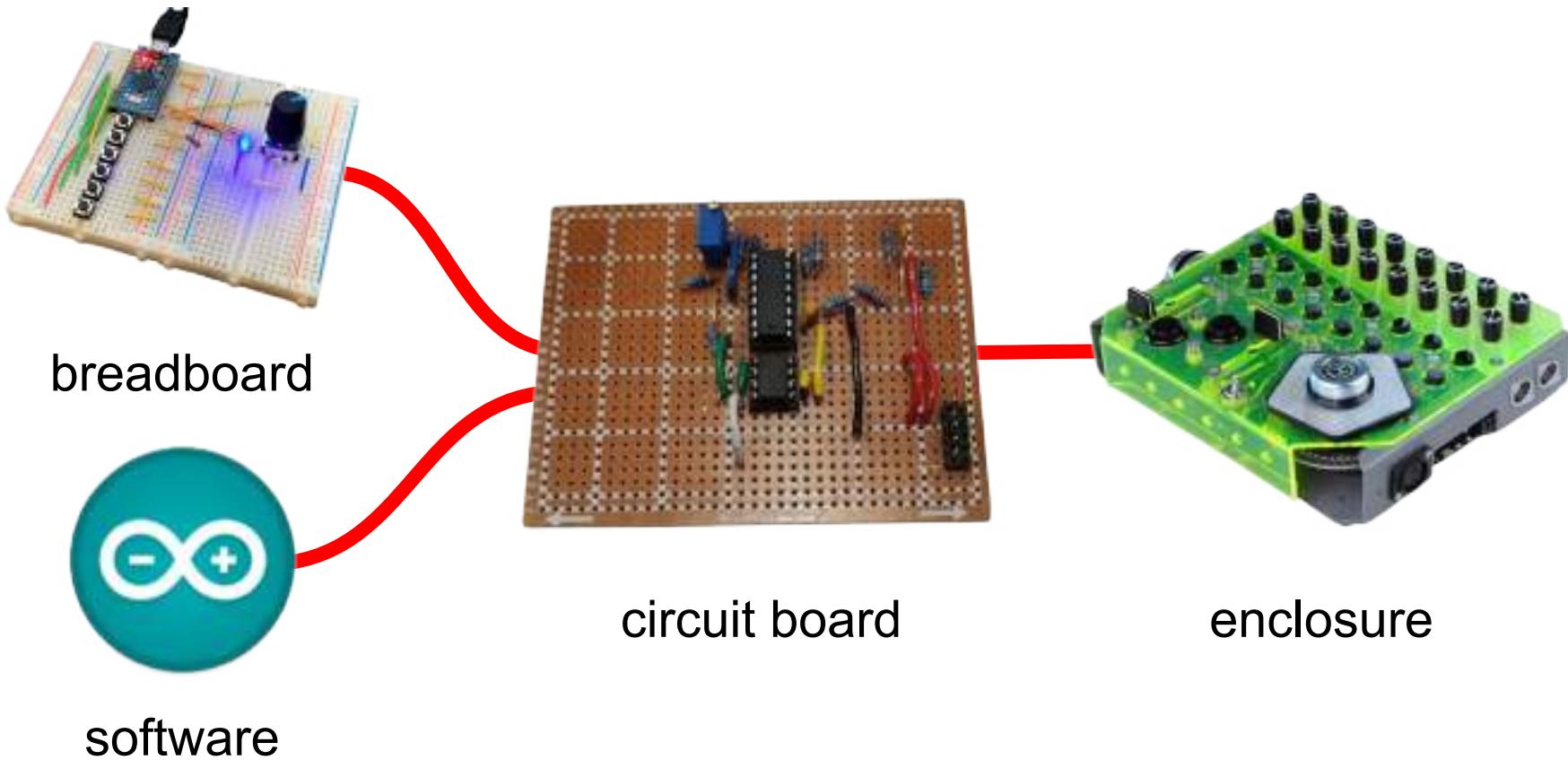
What **inputs**/**sensors** are available for **free***?

switches

sliders

buttons

knobs

* you can keep everything you use! Thanks Janine!

Extra: **touch sensor** with 12 inputs!
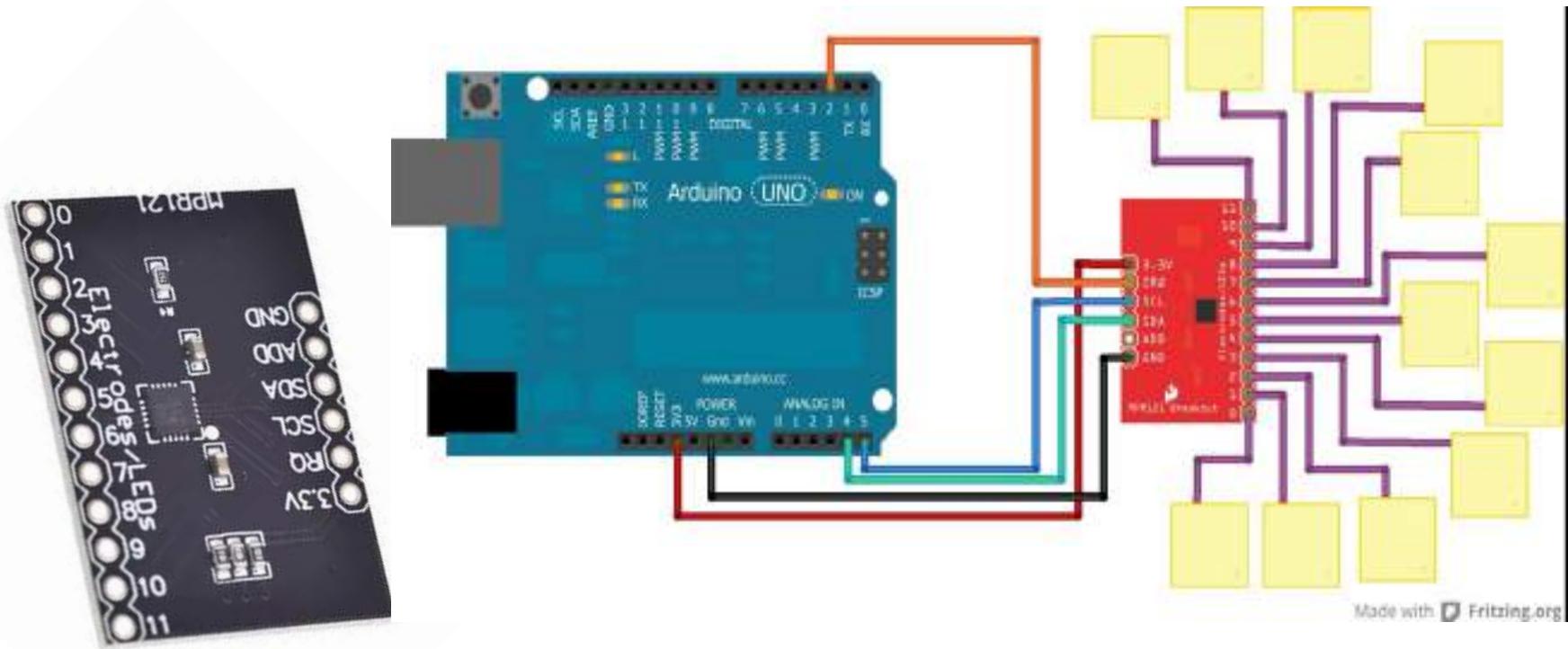
Some **sensors/inputs** you can **rent/buy** from **Hacklab**:

distance sensor

sound sensor

temperature sensor

heartbeat sensor
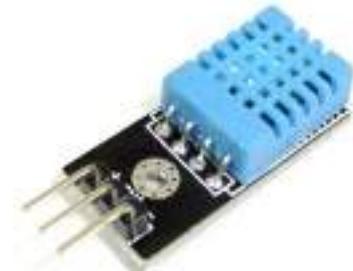
gyroscope sensor

Recycle and repurpose old electronics!

- IMD basement
- Secondhand store
- Using multimeter

Get retro electronics @ **Radio Twenthe!**

What Marijn can help you with/teach you:

- Woodworking   Cutting, Sanding, Drilling, etc.
- Metalworking   Bending, Cutting, Drilling, etc.
- Metalcasting   Aluminium mold making & casting.
- Stained Glass   Cutting, Soldering, Patina, etc.
- Game Development   Unity, Unreal, Godot, etc.
- Lasering, CNC and 3D printing   Designing & getting appointments
- Software & Coding   All programming languages
- Hardware & Electronics   Arduino, Soldering, Circuits
- PCB & CAD Design   KiCad, Fusion 360, AutoCAD
- 3D modelling   Blender
- Illustration & Photography   Adobe & Printing
- Website Development & Design   Hosting, CMS (Wordpress), Databases

Some projects from last year.

A Traveler's Magic Survival Kit
stained glass, touch/heat sensors, leds
(Kate, Mimo, Aurora, Olessya, Milos)

A Maluism Pyramid Scheme
*accelerator sensor & nokia LCD display
metal forming/hammering*
(Tijmen, Lisa, Jelena, Iva, Min Jae Kim)

A Childlike Joy Unit
*multiple arduino's, motors and
sensor, crazy stuff*
(Sterre, Audrey, Tama, Jonas)

Some projects from last year.

Wifi Collapse
esp32, LED's, MP3 Module
(Ko, Theo, Thijs, Ingrid)

Emotional Armor
touch sensor/button & LED strips
(Jet Jiang, Beverly, Anabel, Daniela)

Self Help Tarot
tilt sensor and Nokia LCD display
(Gizem, Rubing, Mads, Luka)

Learn **a new technique** that you can keep **using in your personal practice**. We can help you with this!

I'm always available for help.
Find me on Discord or Instagram (quickest):

@ietsnut

Or send an email:

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Show us your screen
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Niki Scheijen

CRASH COURSE
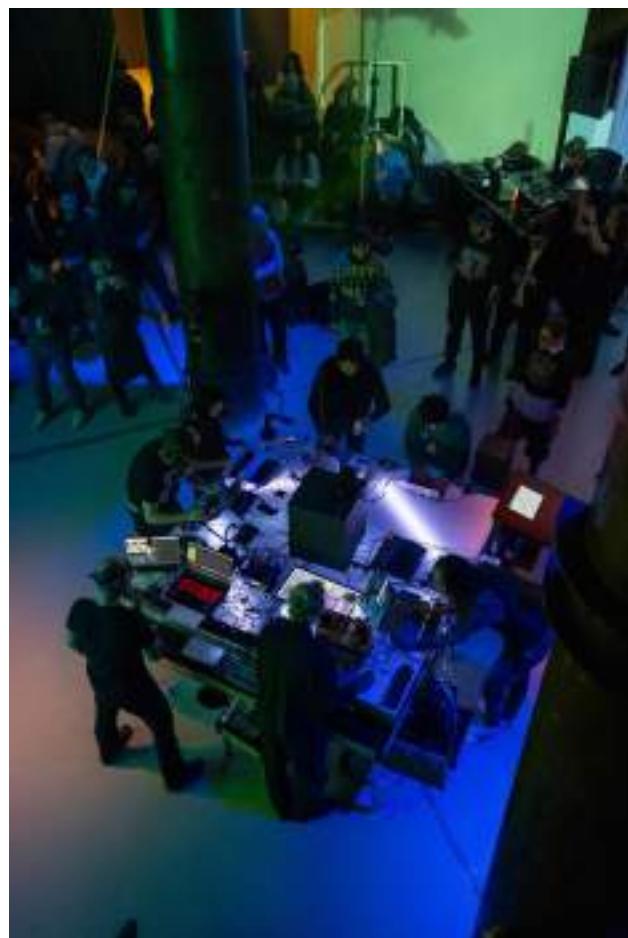
Liveness & immediacy

- Pre rendered vs realtime
- Risk -> things can go wrong!
- The process matters more
- Not repeatable
- Interaction with visitor, crowd, space or other artists

Exploring hardware interface design (HID)


Dieter Rams with Braun

Teenage Engineering

Exercise (30 minutes)
Interface archeology

Find a device and map the diagram of interaction

- What inputs does it have? (buttons, sliders, knobs, joysticks, sensors)
- What outputs? (screen, LEDs, sound, vibration)
- How does it feel? (Texture, weight, button resistance)
- How does this input constrain you?
- Think about how could these inputs modify sound or visual?

Concept spatial layout
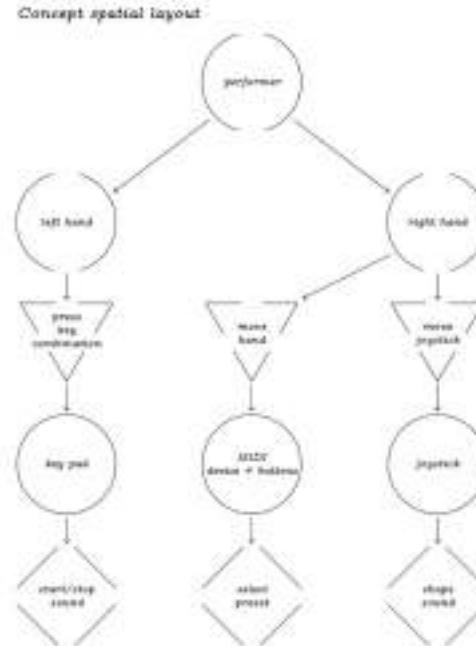
Interfaces and interaction

- Not neutral: Interfaces influence interaction.
- Decides what choices and inputs are possible
- Tactile feedback changes how the body experiences it
- Every design choice has consequences: it can make an experience smooth (aligns with goal) or cause friction

HIDs in audio/visual performances

- Allow to play and modify parameters live
- Every interface is a translation system between body and media
- Should be fast and intuitive
- Should feel like the interface disappears and you're directly manipulating media itself
- manipulating variables rather than fixed outcomes

Interface as instrument (not tool)

- Before computers, instruments were directly interacting with the body's movement: breathing into flute, bow on string, hands on drum
- Interface as translator
- Constraints and familiarity shape the result

Embodied interaction

- Digital media is usually mediated (processing, rendering, delay) But live performance demands immediacy.
- The direct manipulation of parameters creates a different relationship between performer, instrument, and audience than pre-composed work.
- Flow state and the risk/payoff balance of improvisation. studio work hides latency, live performance makes it visible

Artist examples

DANSER SUR L'ALGO-RYTHME
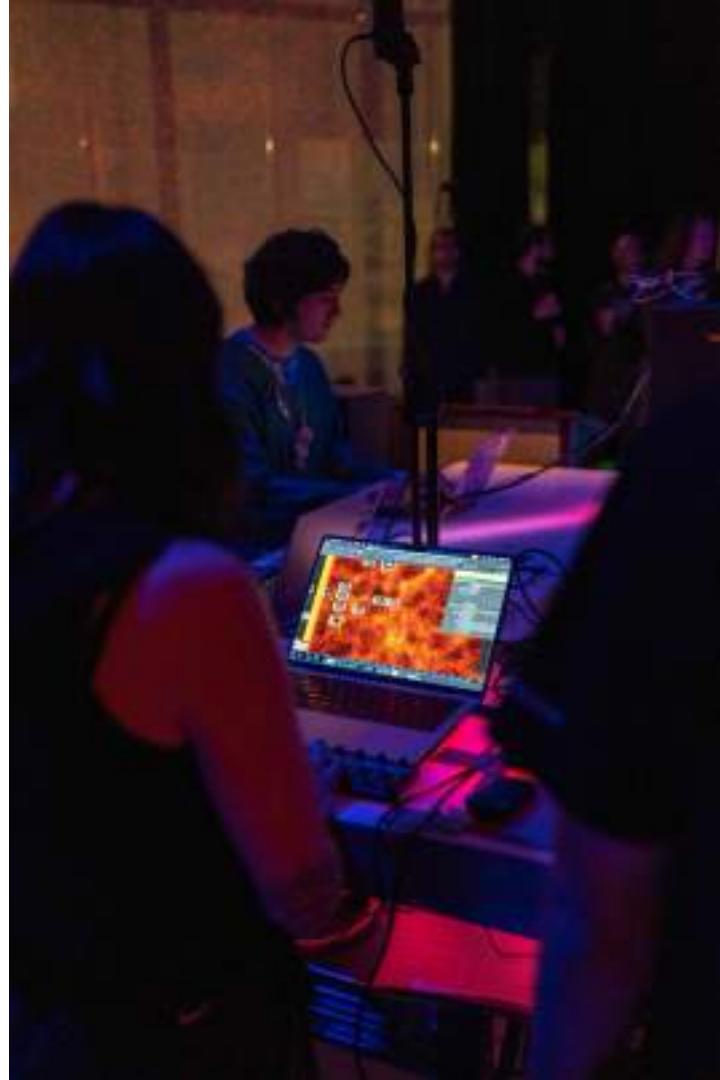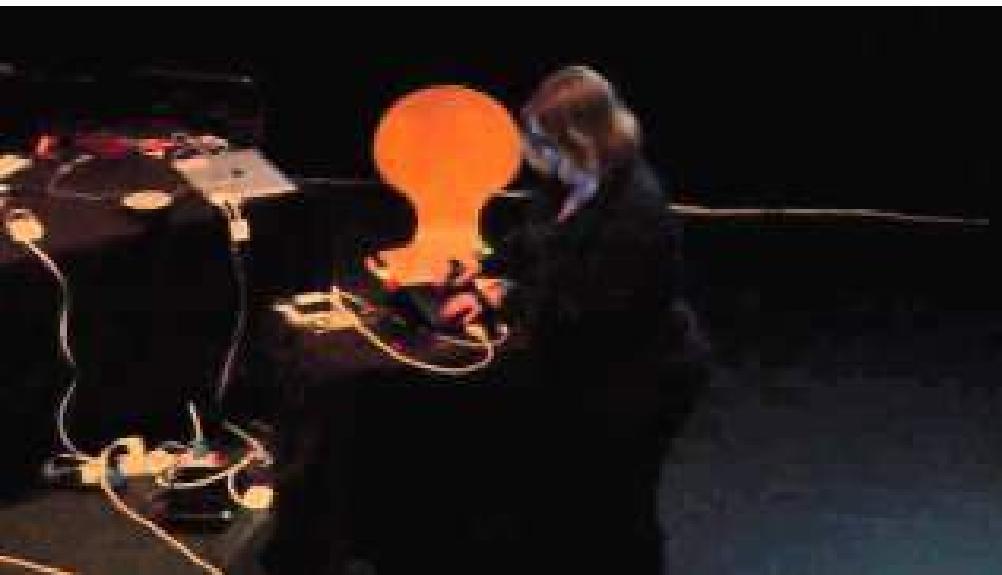
Examples embodied interfaces
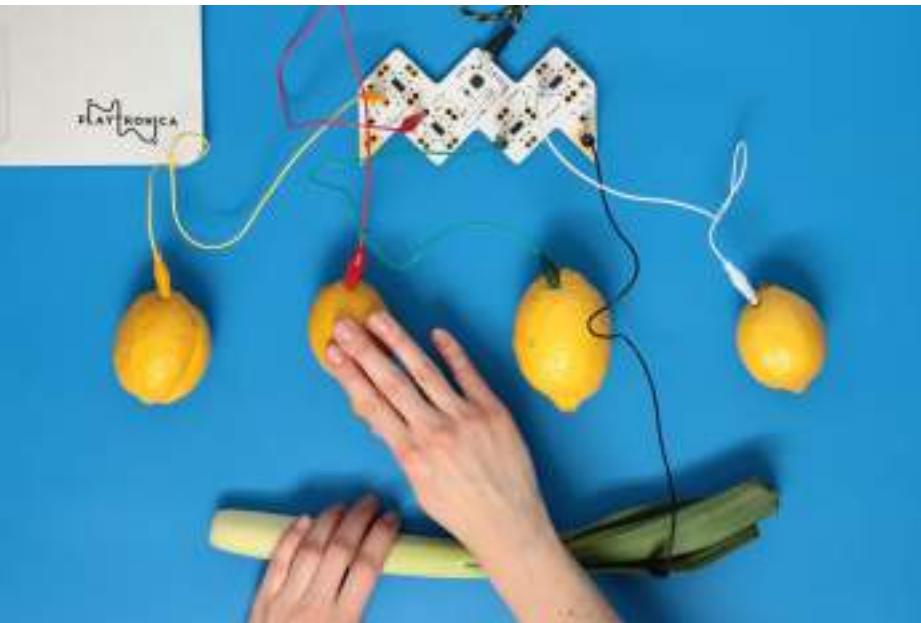
Playtronica touch sensor

Stem player

MIDI messages

```
(9.661) CC 6 value 121 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.493) CC 22 value 58 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.518) CC 22 value 57 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.536) CC 22 value 56 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.549) CC 22 value 55 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.567) CC 22 value 54 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.580) CC 22 value 53 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.596) CC 22 value 52 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.614) CC 22 value 51 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.639) CC 22 value 50 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.655) CC 22 value 49 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.676) CC 22 value 48 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.697) CC 22 value 47 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(10.751) CC 22 value 46 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(14.950) CC 39 value 127 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
(15.624) CC 39 value 0 (ch 1) [nanoKONTROL2 SLIDER/KNOB]
```

Pause MIDI log

Brief history of MIDI

- the Musical Instrument Digital Interface
- Protocal that sends instructions, not sounds
- Syncing instruments
- Latency 1-5ms
- MIDI cable(5pin DIN), USB, web
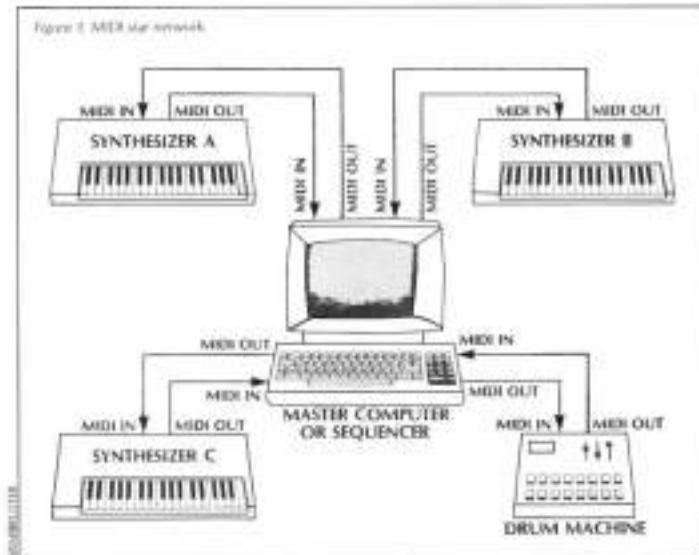
MIDI star network diagram, from July 1983
Keyboard Magazine article by Bob Moog

- Note on/off
- Note velocity (how hard)
- CC = Control changes (knobs) 1-127
- Pitch bend
- Program changes
- Timing/sync

MIDI CONTROLLER

```
Press key
[C4]



Release key
```

Note On: 60
Velocity: 100

Note Off: 60

COMPUTER/SYNTH

```
"Play note
C4, loud"

[SOUND!]

"Stop note"
```

MIDI CONTROLLER

```
Turn knob
[clockwise]
```

CC 1: 90

SOFTWARE

```
Map to:
- Filter
- Reverb
- Anything!
```
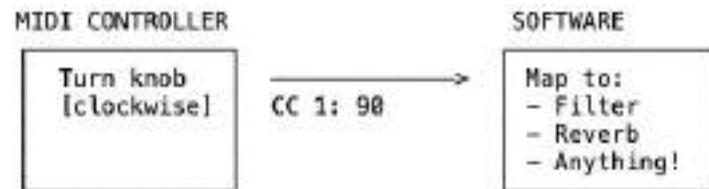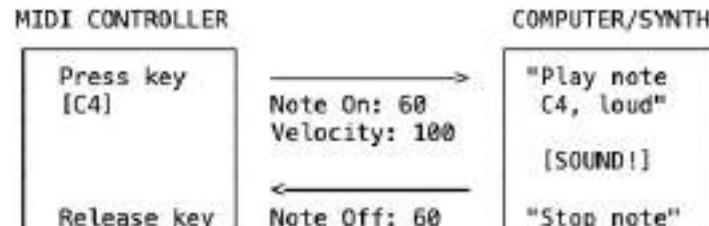
Final assignment

Create a HID

Control something with it (light, visual, audio etc.)

Perform it.

Goals

- Each interface becomes a unique instrument with its own possibilities and constraints that shape what's possible to create.
- Find new ways to control and use the software you use everyday
- translating signals to influence various parameters
- finding intuitive connection in the translation of body input to audio/visual output
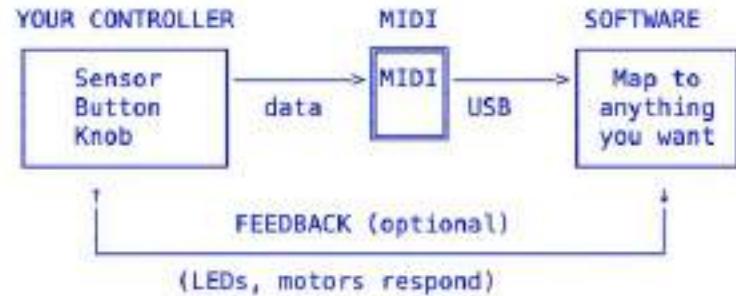
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