Extreme Interactions

Camille Moussette, July 2011

Umeå Institute of Design
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Me

Canada, physics, IBM, industrial design, freelance,
Sweden, interaction design, teaching, PhD, MSR

Umeå Institute of Design (Sweden)

UMEÅ INSTITUTE OF DESIGN

STARTED PHD IN 2007, ETA 2012

40% TEACHING FOR VARIOUS IXD COURSES

PHD PROJECT

SIMPLE HAPTICS, SKETCHING TOOLS FOR HAPTIC INTERACTION DESIGN

DANIEL FÄLLMAN, INTERACTIVE INSTITUTE UMEÅ

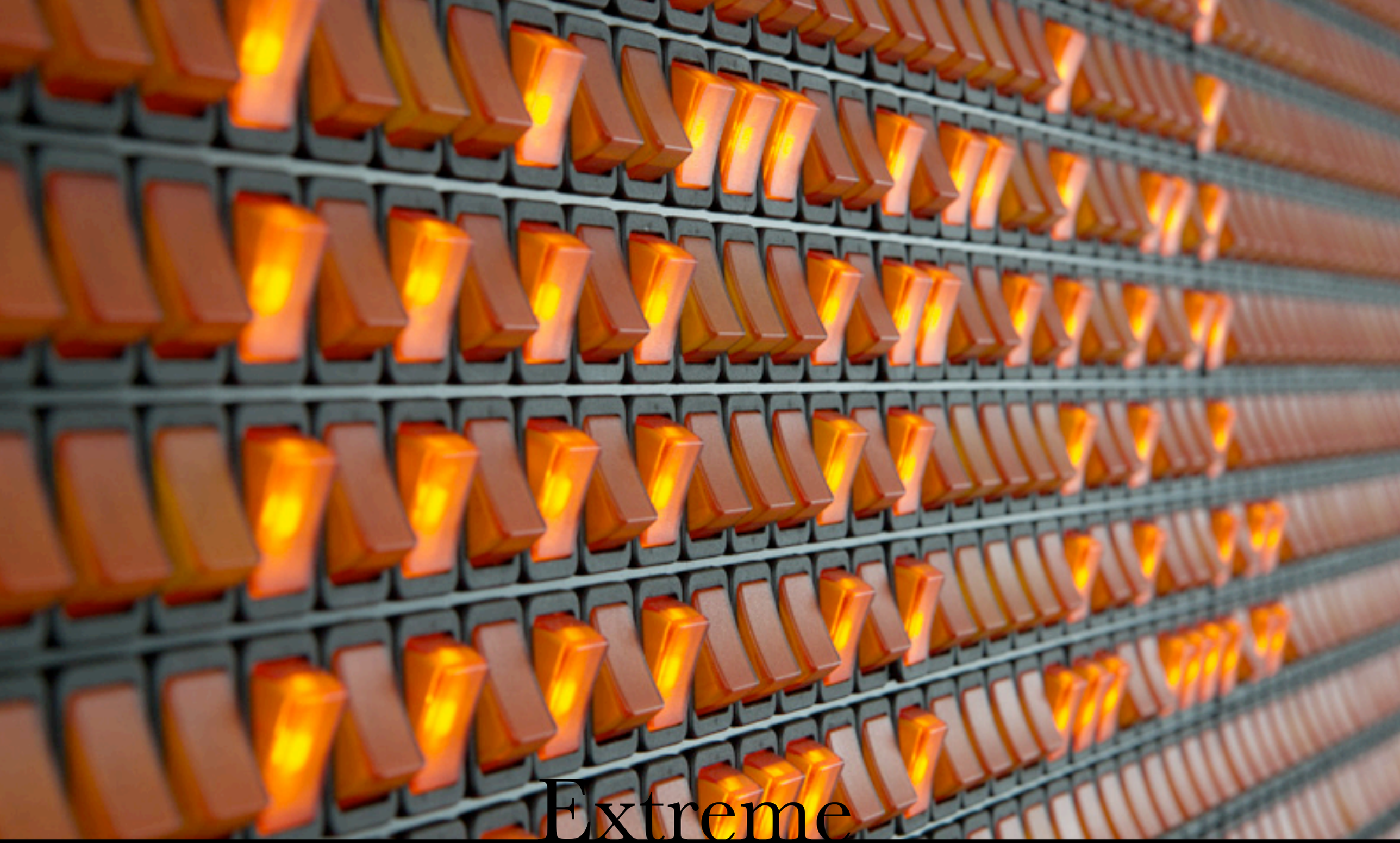
BILL BUXTON, MICROSOFT RESEARCH

Extreme Interactions ???

Extreme Interactions

Extreme

intentionally explore orders of magnitude (Powers of Ten)
beyond common boundaries
extreme/lead user (Von Hippel)
recognizing limitations
learning from failures
new perspectives for learning
exploring/expanding a design space



Extreme

relative to context, experience, perspective
relates to complexity (a collection on simple things)

Valentin Ruhry http://ruhry.artfolder.net/untitled-hello-world.html

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Teaching

easy to make one
difficult to integrate two, ten

unconscious incompetence
conscious incompetence
conscious competence

Typical issues

going mobile
wireless communication
multiplying # of nodes/units
scaling up in power
scaling up/down in size
integration of hardware and software

scaling challenges

number

power

size

price

time

beyond the common &
extreme cases
as learning vectors

light

on/off

1 10 100 1000 10000

light

on/off	*switch/uC*	*uC*	*multiplex*	*multiplex*	*APIs*
	1	10	100	1000	10000

light

pwm	*uC*		*multiplex*	*custom hardware*	*???*
on/off	*switch/uC*	*uC*	*multiplex*	*multiplex*	*APIs*
	1	10	100	1000	10000

light

power	*transistor*	*relay board*	*DMX*	*???*	*???*
pwm	*uC*	*multiplex*	*custom hardware*		*???*
on/off	*switch/uC*	*uC*	*multiplex*	*multiplex*	*APIs*
	1	10	100	1000	10000

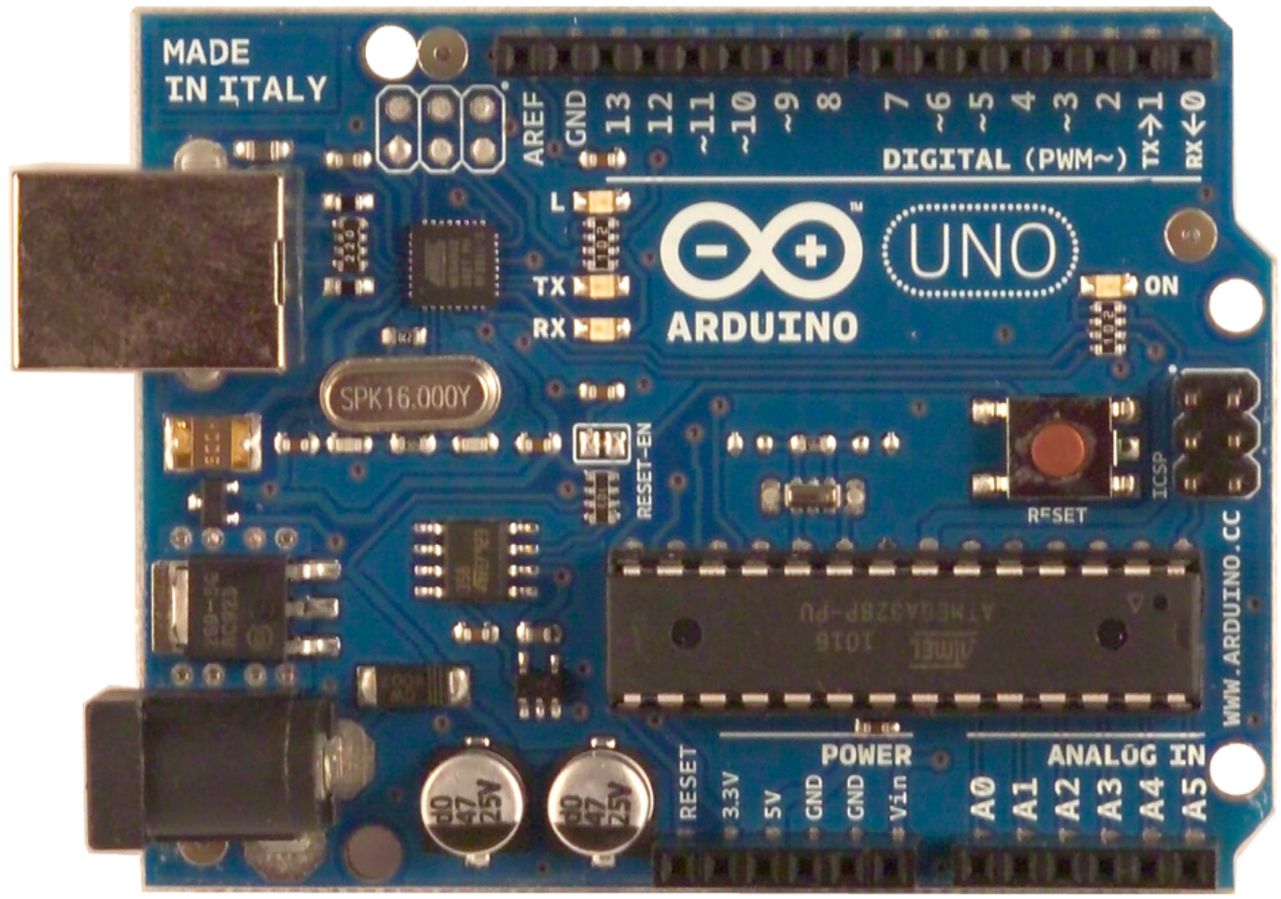
light

power	*transistor*	*relay board*	*DMX*	*???*	*???*
pwm	*uC*	*multiplex*	*custom hardware*		*???*
on/off	*switch/uC*	*uC*	*multiplex*	*multiplex*	*APIs*
	1	10	100	1000	10000

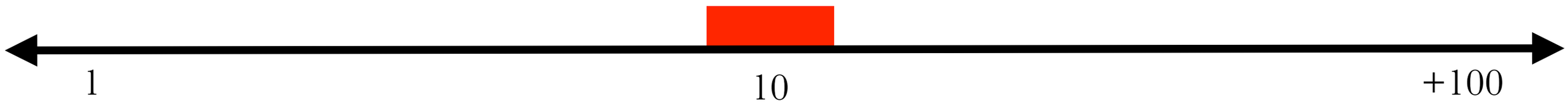
inherent qualities and limitations for each

light

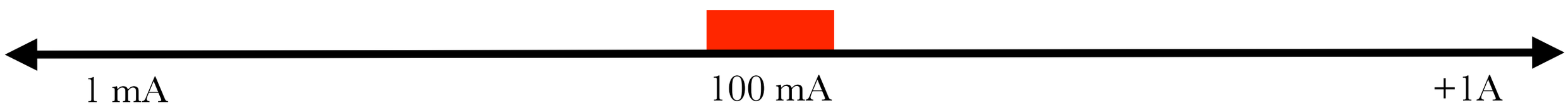
power	*transistor*	*relay board*	*DMX*	*???*	*???*
pwm	*uC*	*multiplex*	*custom hardware*		*???*
on/off	*switch/uC*	*uC*	*multiplex*	*multiplex*	*APIs*
	1	10	100	1000	10000


MADE
IN ITALY
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
L
TX
RX
ARDUINO
UNO
ON
SPK16.000Y
RESET-EN
RESET
ICSP
WWW.ARDUINO.CC
POWER
ANALOG IN
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

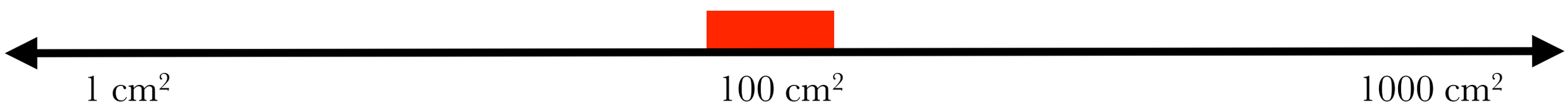
number (IOs, n)



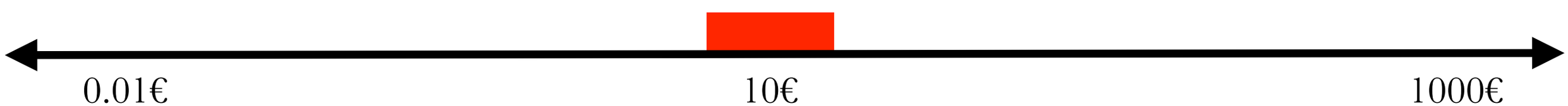
power (memory, energy, speed)

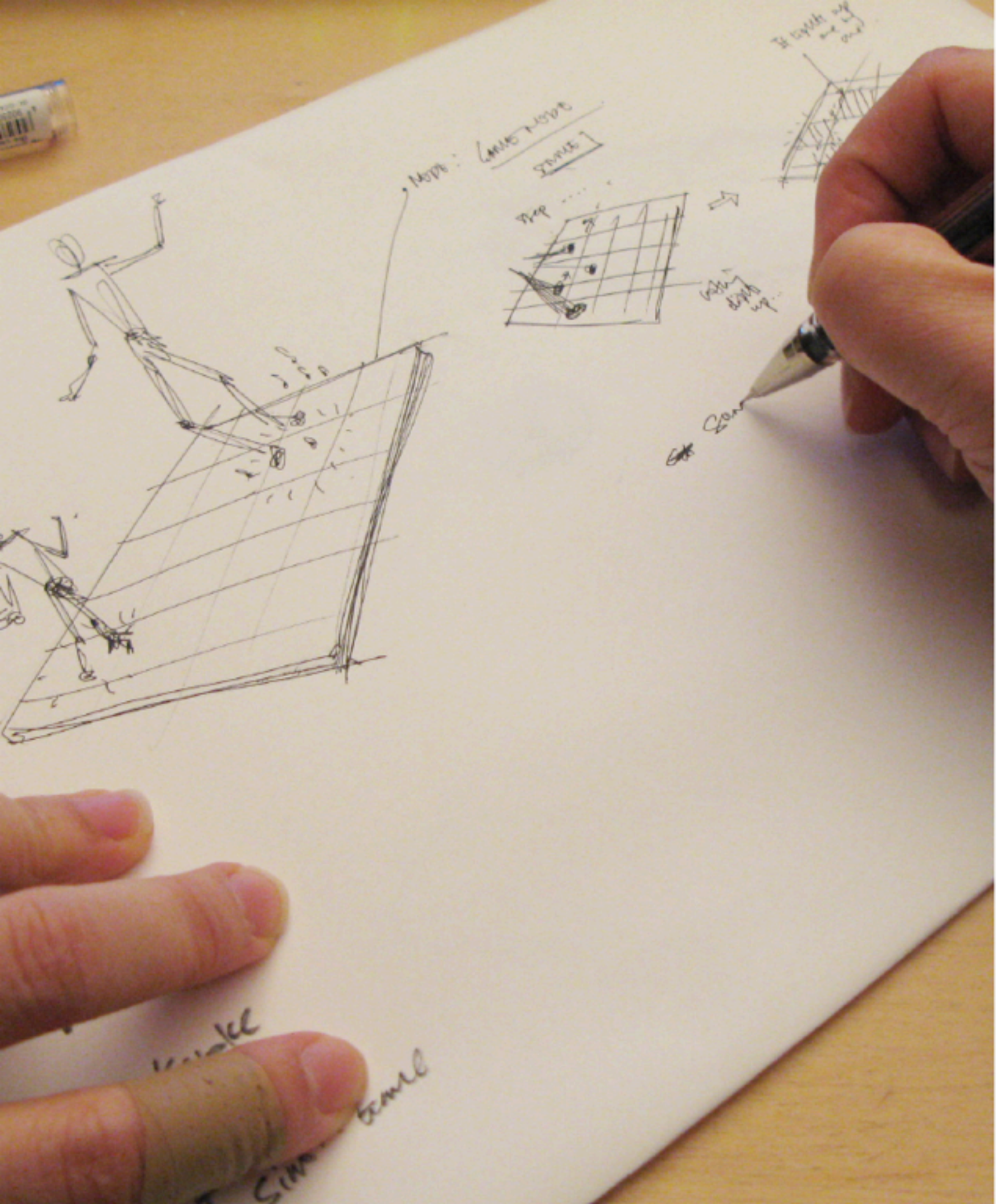


size

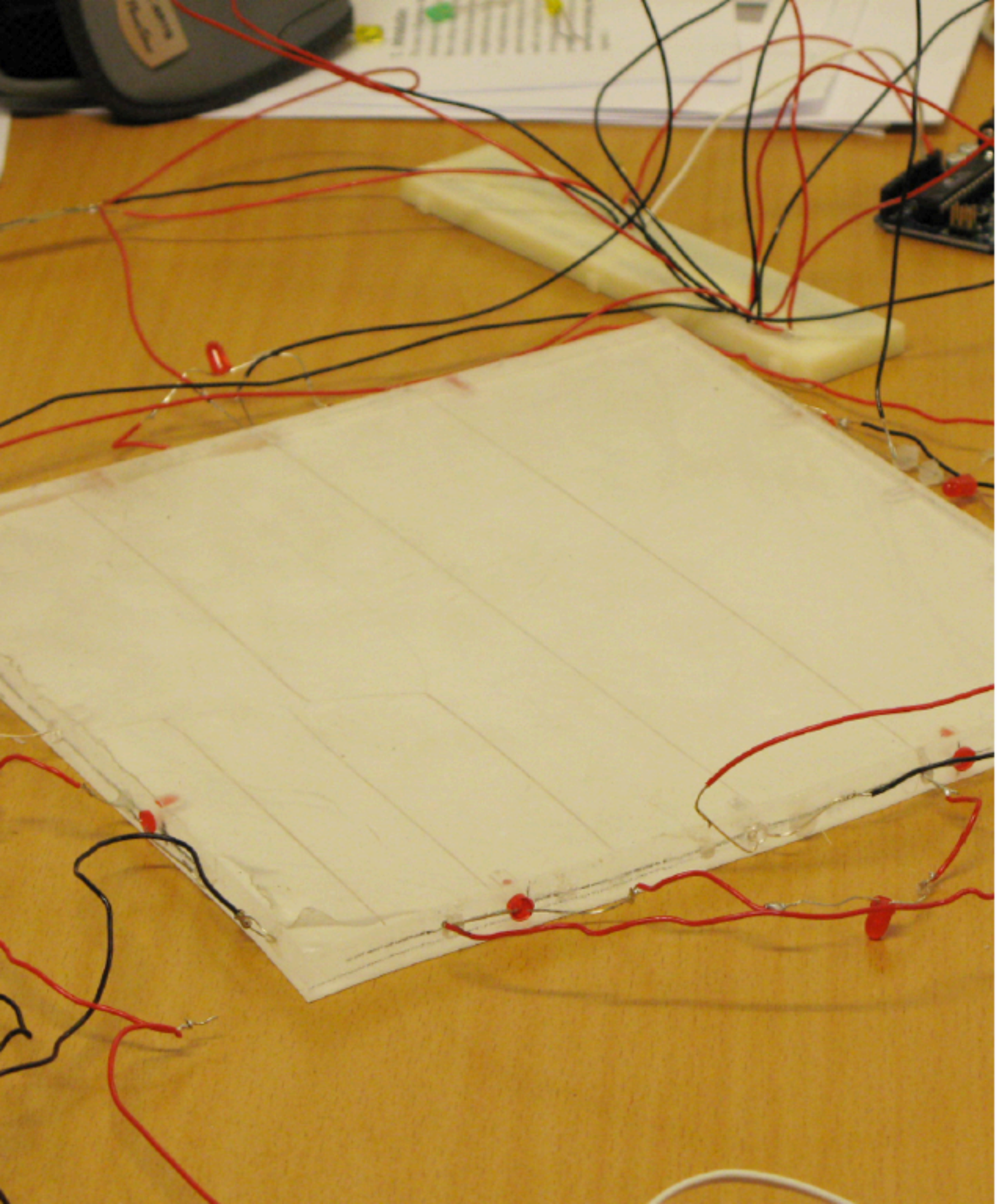


price

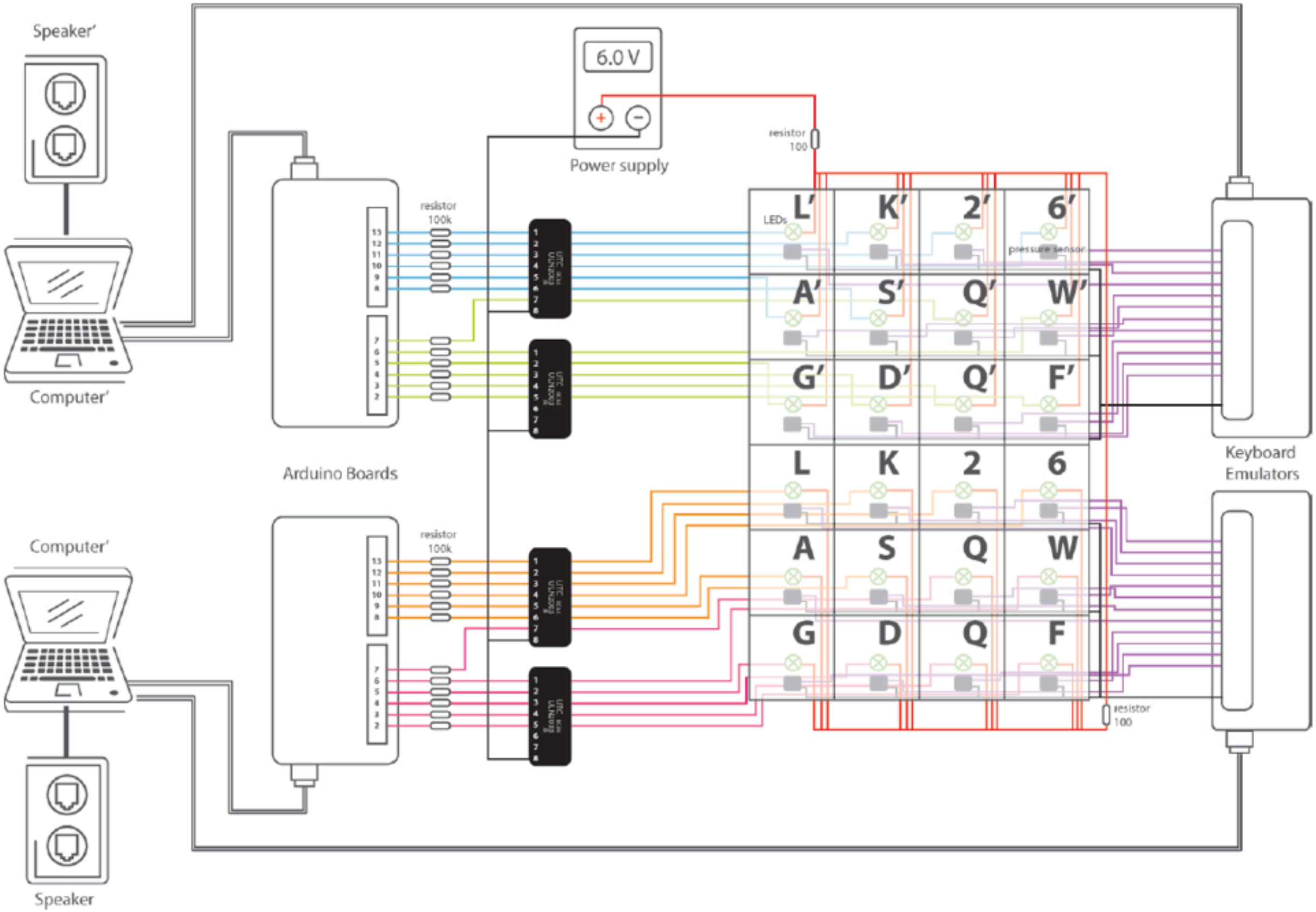




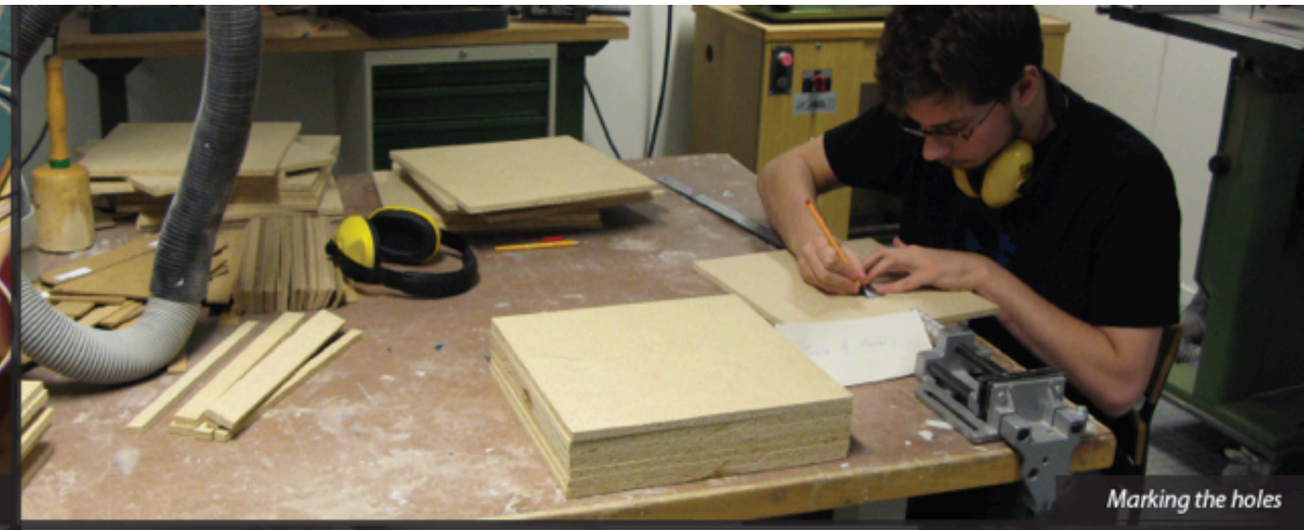
happy feet

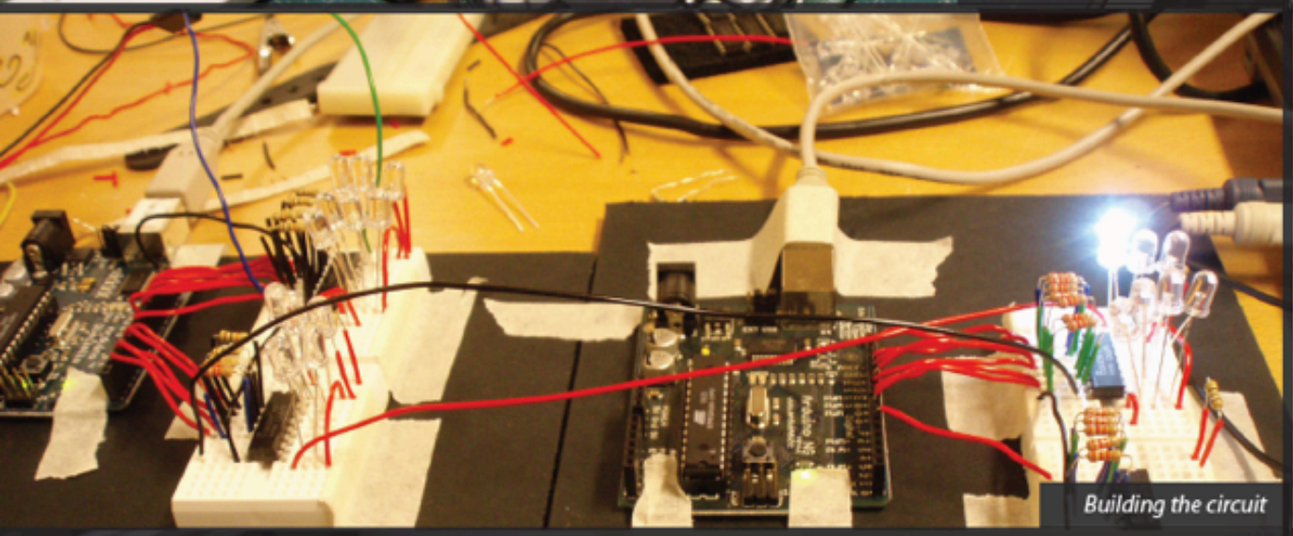


happy feet


Speaker'
Computer'
6.0 V
Power supply
resistor
100
resistor
100k
Arduino Boards
LEDs
pressure sensor
L'
K'
2'
6'
A'
S'
Q'
W'
G'
D'
Q'
F'
L
K
2
6
A
S
Q
W
G
D
Q
F
Keyboard
Emulators
Computer'
Speaker


Labeling Keyboard Emulator


Marking the holes


Building the circuit


Drilling holes


Wood cutting


Feet making

"Happy Feet"
The Design Construction

"Happy Feet" is programmed using flash acti
talking to Arduino. Below each tile, there is a
The pressure sensor is connected to a keybo
which will be recognised by Flash as an inpu
keyboard.

The sounds are controlled by Flash using act
lights are controlled by Arduino.

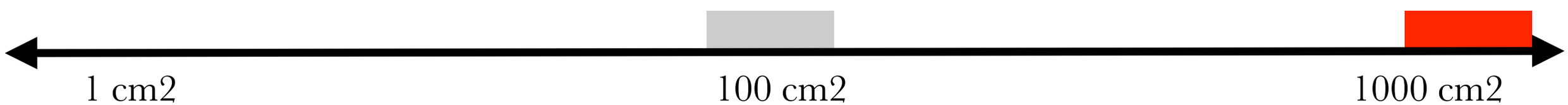
Once pressed, the pressure sensor triggers a
keyboard emulator. Then Flash (code) catch
(key strike), plays the corresponding sound a
signal to Arduino board. Arduino will then sw
corresponding light accordingly.

The lights are powered by an external power
using the ULN2003 chip. The sounds are play
speakers from the computer (flash animatio

number (inputs)

number (LEDs)

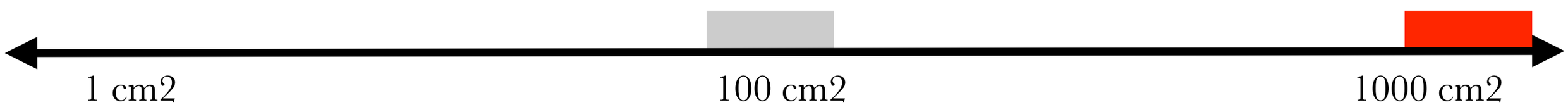
size



number (inputs)

number (LEDs)

size



learning: robust connections, keyboards emu., human power

Figure 82. Visually impaired people using the device.

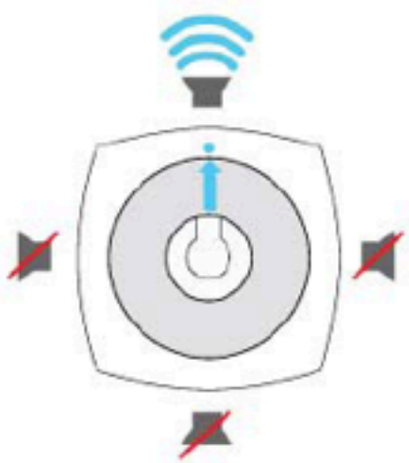
3.1.10.B. Navigation pad, sound output and visual feedback

1. Starting point. All the speaker play at the same time on the same volume level. All LED are lit up.

2. Pushing up the navigation pad. The speaker on the bottom starts decreasing its volume. The LED that are opposite to where the user presses tun off

3. Keep pushing up. The speaker on the bottom is muted, the speakers on the sides start decreasing their volume level. LEDs keep turning off from the bottom-top.

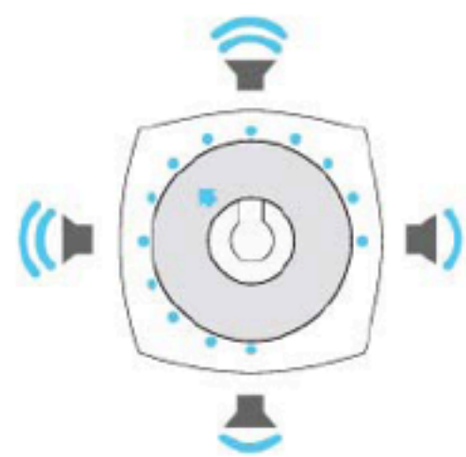
4. Close to the limit on the top. The speaker on the top increases its volume and the speaker on the side keep decreasing their own. plays Polar array of LEDs keep shrinking down.



5. Limit on the top. The speaker on the top plays in solo, the other speakers are muted. Just one LED is lit up.

6. Pushing top-left. Both the top and left speakers play at the same time at the same volume. LED follows the movement on the control.

7. Limit on the left. The speaker on the left plays in solo, the other speakers are muted.



8. Going back to the middle. Speakers on the side start playing and it goes back to the starting point (frame 1).

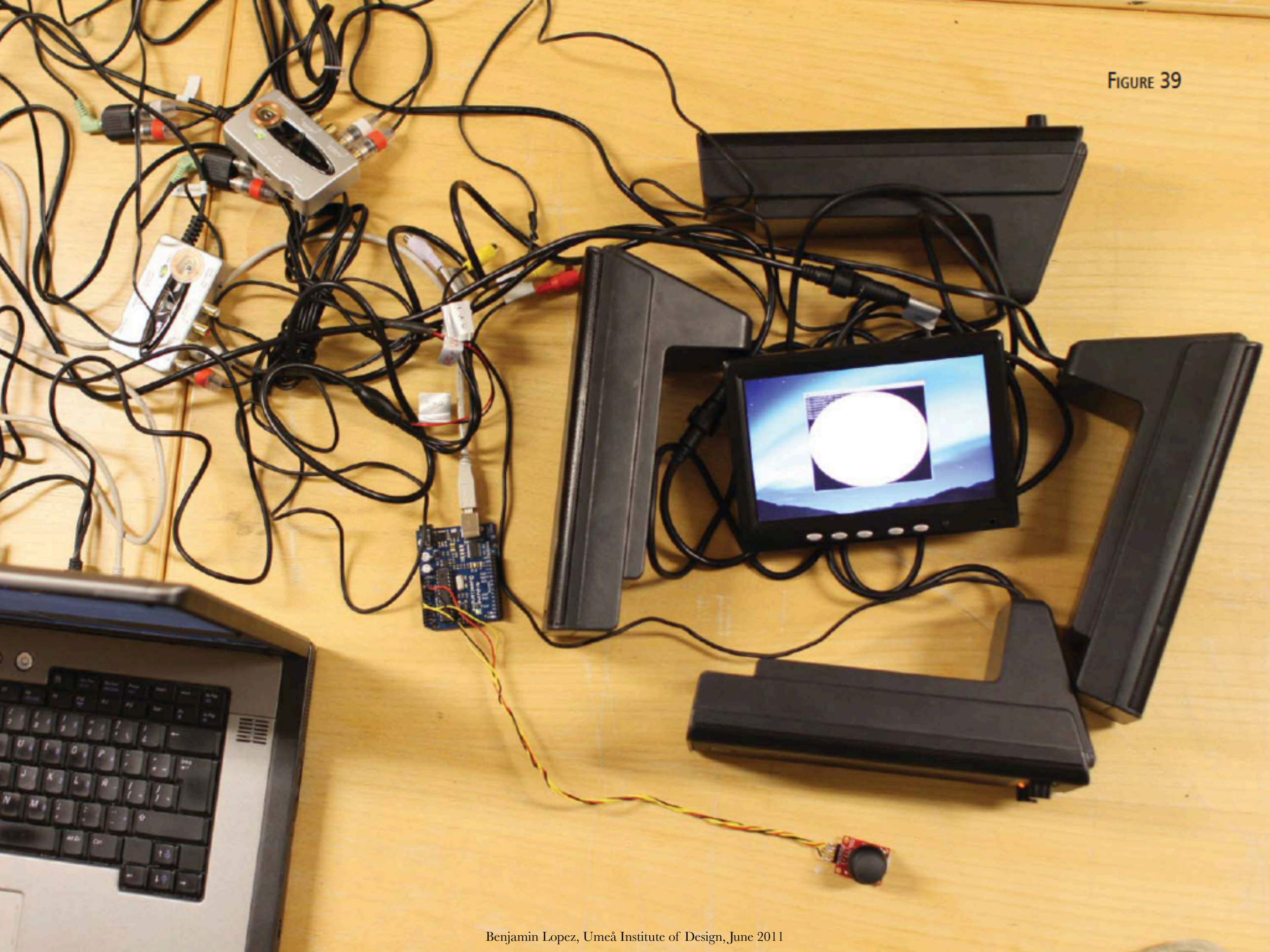


Figure 39

3.1.10. PLAYBACK

After confirming the sound to play, the complete sound start playing. The user can decide whether if he/she wants to listen to the sound as it is (four channels playing at the same time) or if he/she wants to navigate through it

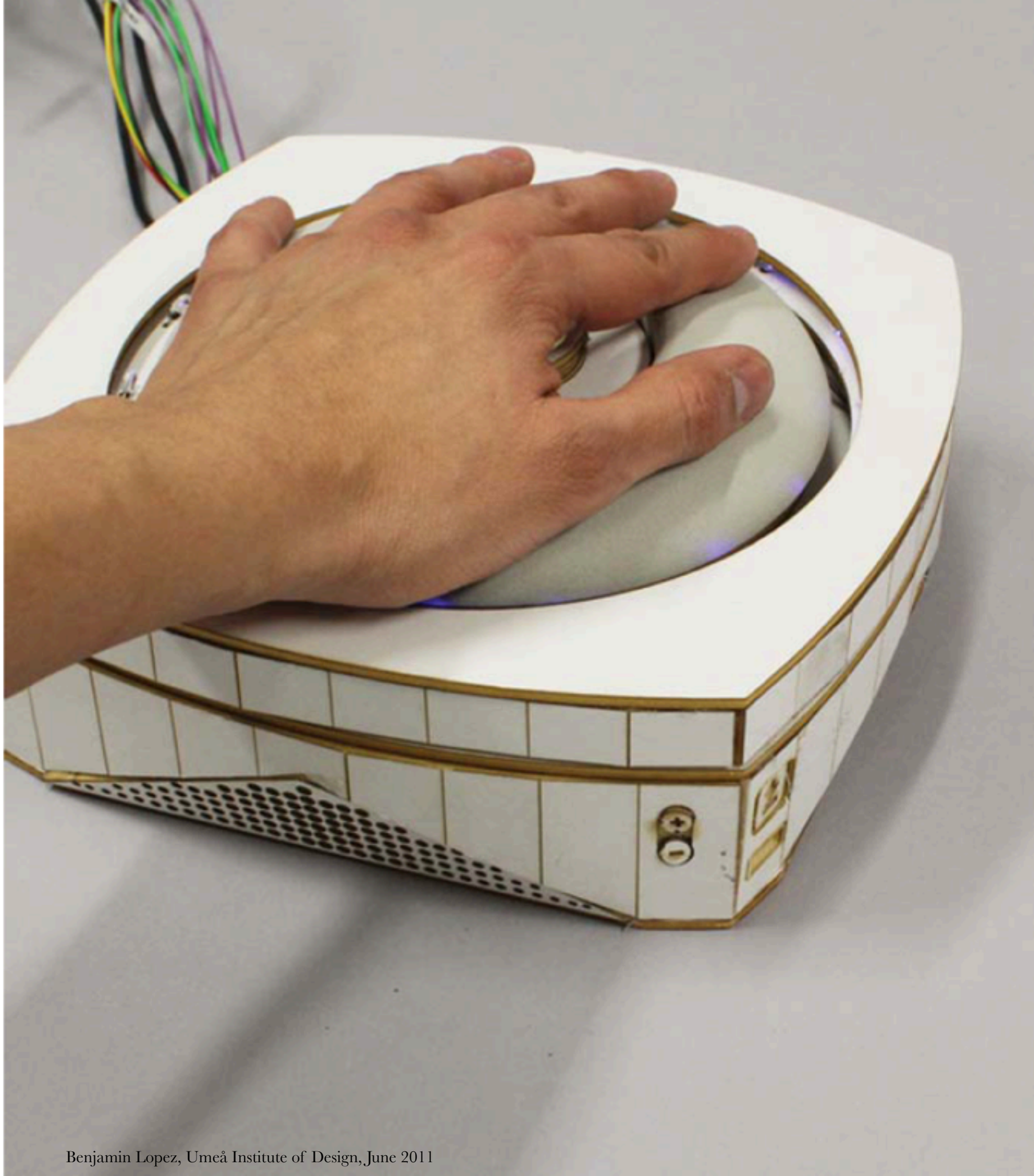
By navigating through the sound, the user is able to zoom in in certain positions in the space to get some details clearer.

The tangible interface for navigating through the sounds is a navigation pad that is placed around the sound album.

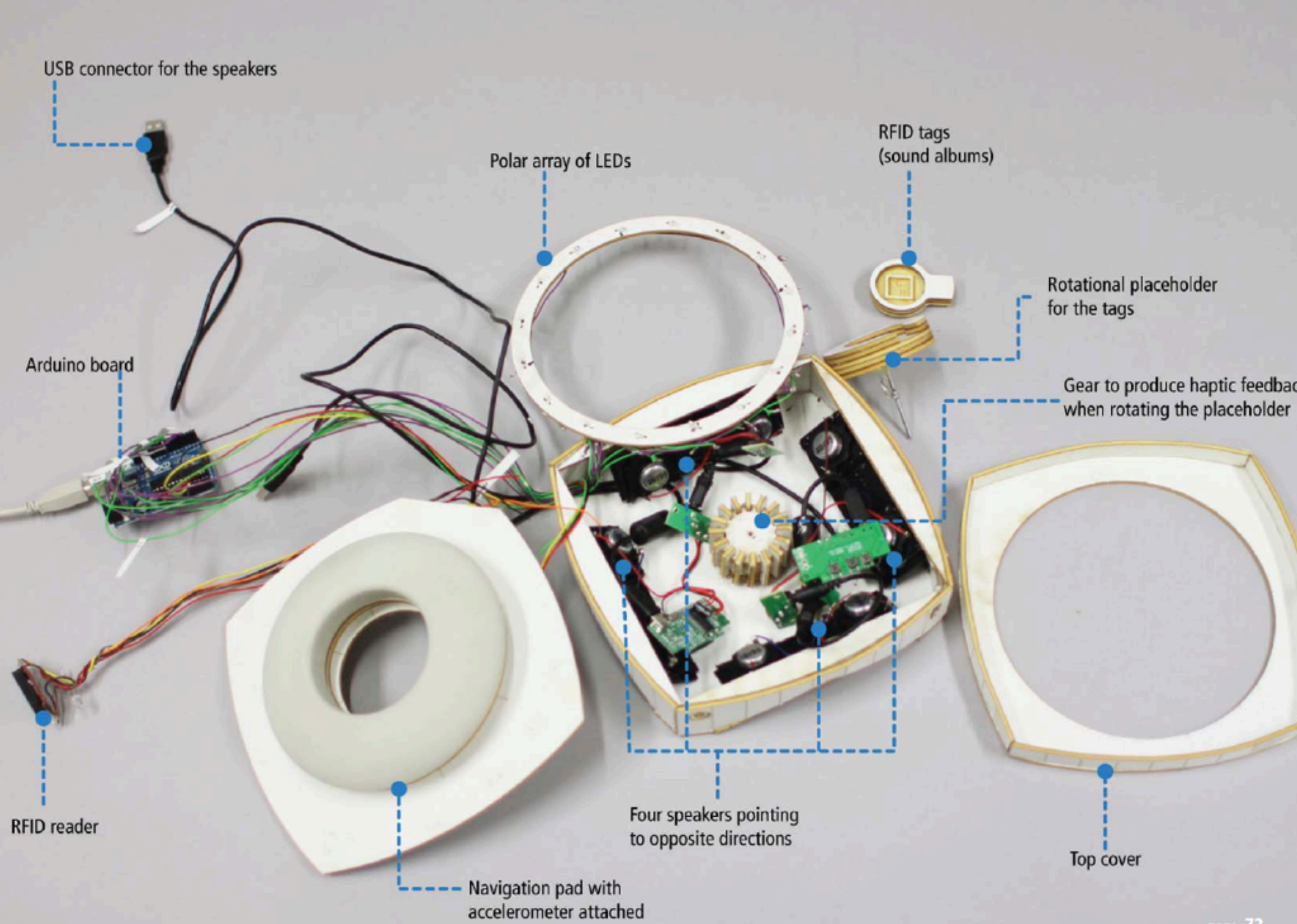
The user can place his/her palm over the pad and use the whole hand to control it physically. The pad can be moved in all directions.

The haptic feedback when moving the pad is different. The movement to the top, left, right and left positions offer lest resistance than moving to the rest of the positions.

Although the sound output has four reference points in the top, bottom, left and right positions.



Benjamin Lopez, Umeå Institute of Design, June 2011



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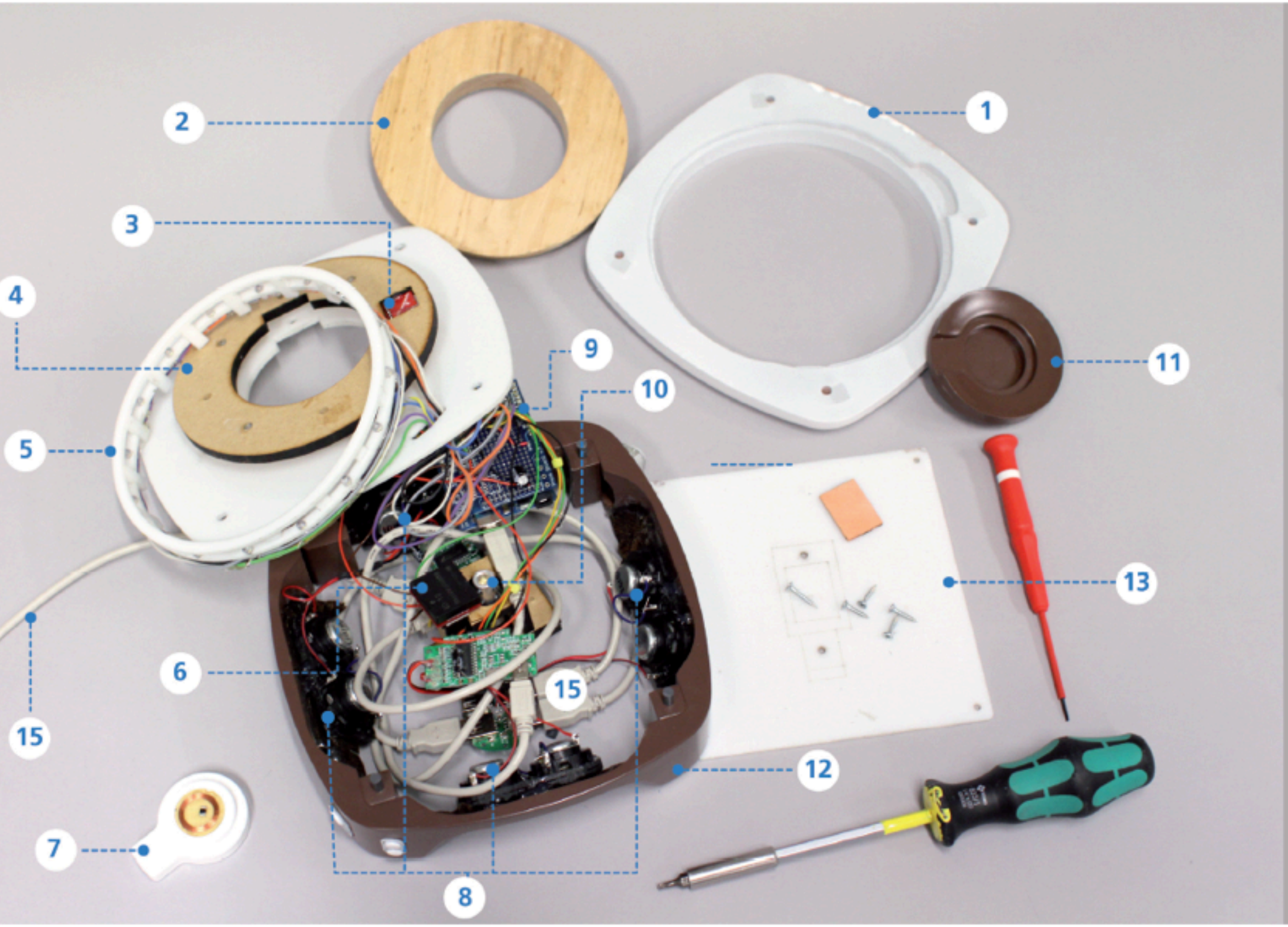


FINAL PROTOTYPE

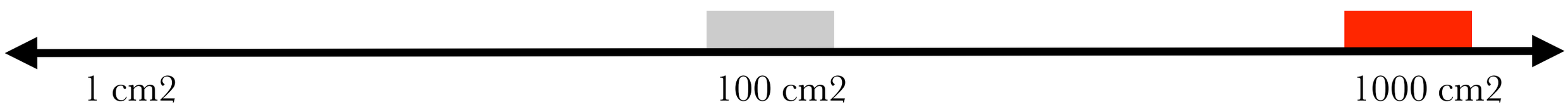
MAIN COMPONENTS

1. Top cover
2. Navigation pad
3. Accelerometer
4. Pushing mechanism
5. Polar array of LEDs
6. RFID reader
7. RFID tag
8. Four speakers
9. Arduino board
10. Digital enconder
11. Placeholder for tags
12. Main body
13. Bottom cover
14. USB hub
15. USB cable

number (audio channels)

number (fading LEDs)

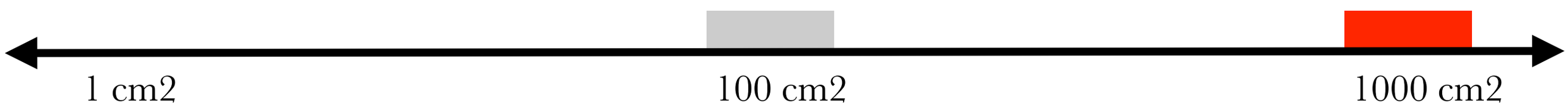
size



number (audio channels)

number (fading LEDs)

size

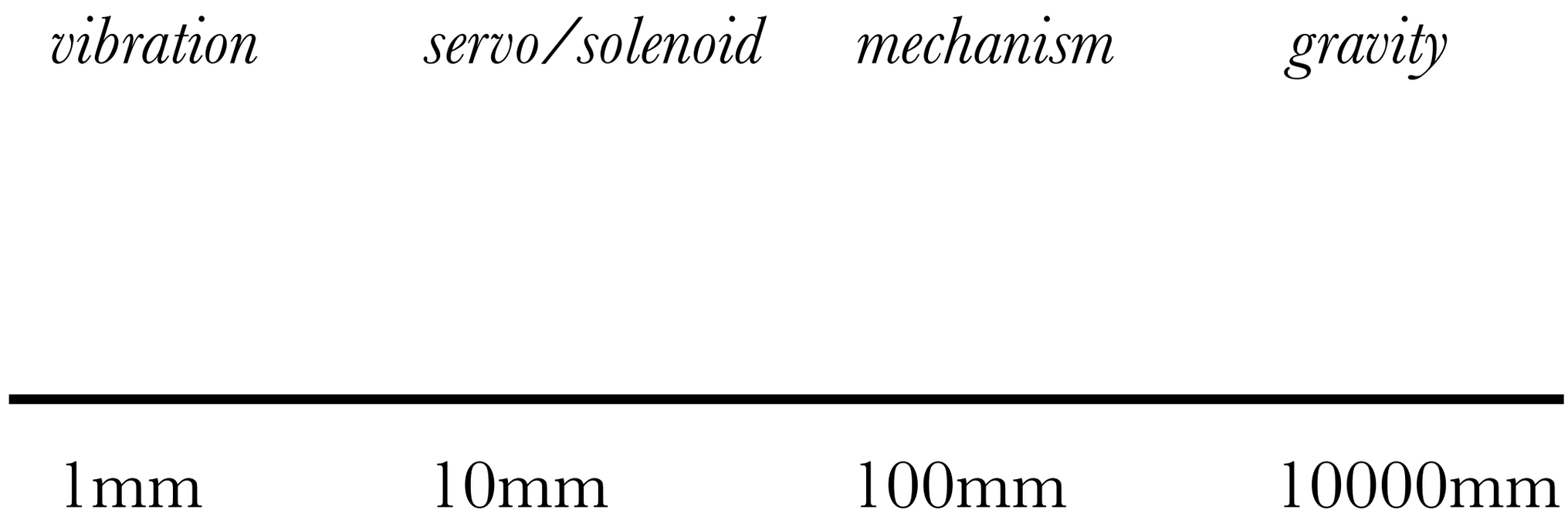


learning: multichannel audio, row-col scanning, OOP

haptics/actuation

1mm 10mm 100mm 10000mm

haptics/actuation

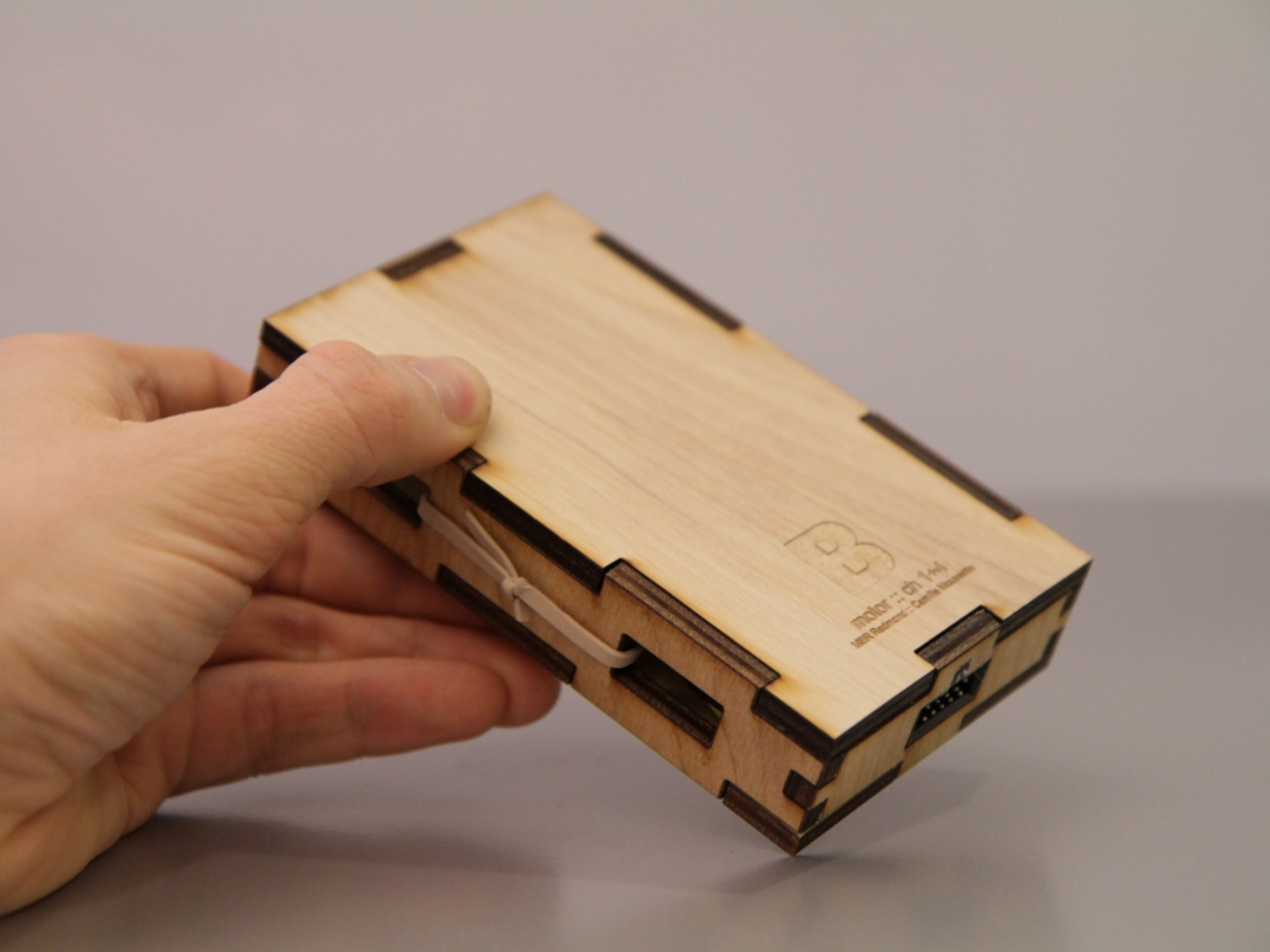


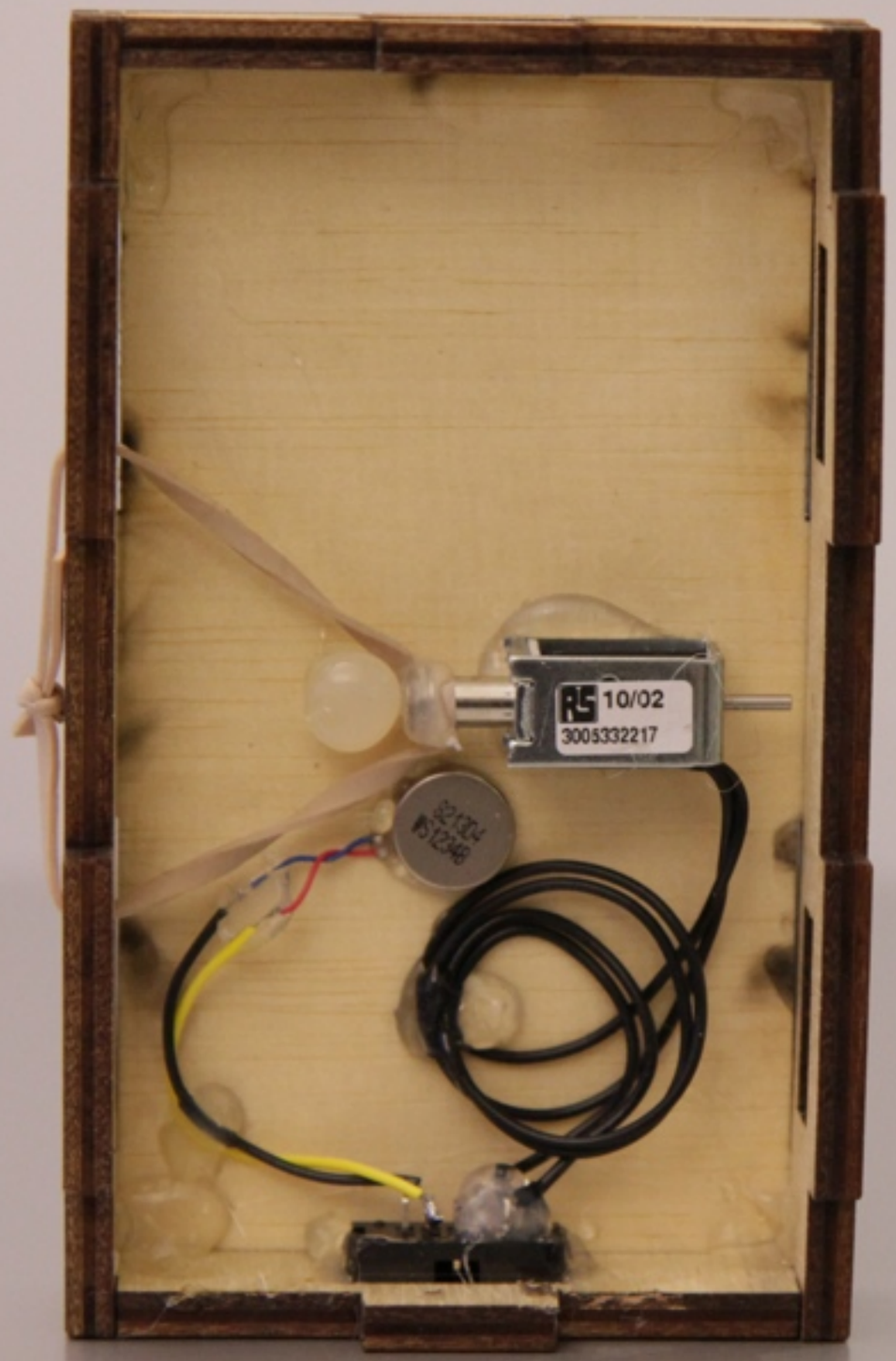
haptics/actuation

1s	*vibration*	*servo/solenoid*	*mechanism*	*gravity*
0.001s	*piezo*	*EAP*	*???*	*???*
	1mm	10mm	100mm	10000mm

haptics/actuation

1000s	*mechanism*	*organic growth*	*???*	*???*
1s	*vibration*	*servo/solenoid*	*mechanism*	*gravity*
0.001s	*piezo*	*EAP*	*???*	*???*
	1mm	10mm	100mm	10000mm


motor :: ch 1+4
MSR Reference :: Camilla Hansen


RS 10/02
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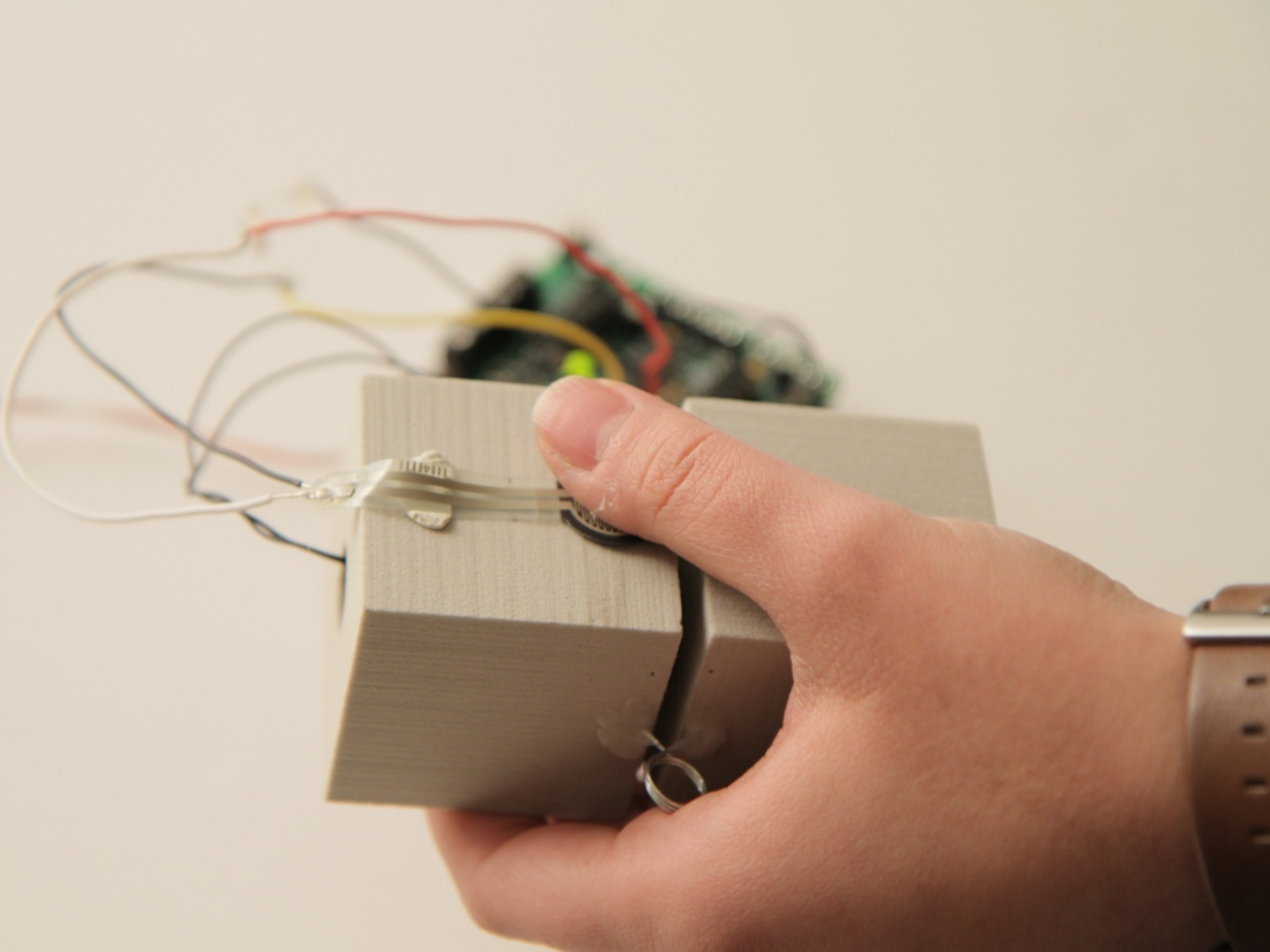

scaling challenges

number

power

size

price

time

unscientific complexity gamut

n	2n	n^x
large	compact	micro
ephemeral/transient		robust/permanent
wall powered		battery powered
3-5V	12V	110-220V
wired		wireless
binary output		PWM
binary input	ADC	SPI/I^2C
self-contained	one-way comm.	duplex comm.

Thanks - merci - tack

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