HALF-PHD PRESENTATION

Camille Moussette, 20.09.2010

UMEÅ UNIVERSITET

CAMILLE MOUSSETTE
MONTREAL, CANADA

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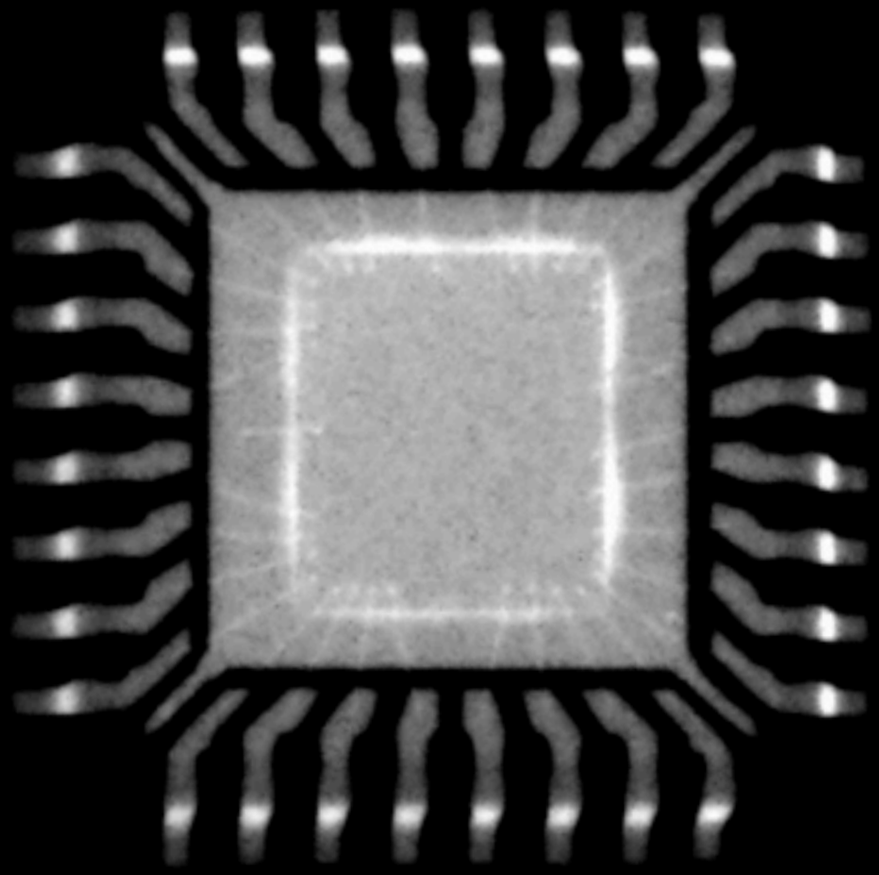
MONTREAL, CANADA



IBM

CAMILLE MOUSSETTE
MONTREAL, CANADA

MID-PHD PRESENTATION

MY PHD PROJECT

RECAP FIRST 3 YEARS

RESEARCH INQUIRIES & PERSPECTIVES

PROTOTYPING AND SKETCHING IN HARDWARE

HAPTICS

DEMOS - BREAK

THEORETICAL GROUNDS AND POSITIONING MY PHD

NEXT 2 YEARS

THE BEGINNING...

Umeå University announces...

Umeå University is the largest university in northern Sweden with more than 29,000 students. **Umeå Institute of Design** is a department within the Faculty of Science and Technology, with 5,500 students of which 350 are currently enrolled in doctoral study programs. The undergraduate curriculum at Umeå Institute of Design consists of a three-year bachelor program in industrial design, and three, two-year international Masters' Degree programs specializing in interaction design, advanced product design, and transportation design. Since 2003, as one of very few design educations in Sweden, Umeå Institute of Design also provides a doctoral study program in industrial design.

Ph.D. Student Position in Industrial Design with Focus on Multimodal Interaction Design

A Ph.D. student position is available at Umeå Institute of Design, Umeå University, Sweden. The area of study is industrial design with a particular focus on interaction design. The goal of the project is to explore, prototype, and develop new knowledge and competence in the area of multimodal interaction design with mobile devices. Particularly, we seek candidates willing to work with interaction styles that engage with users in ways that more fully embrace our senses' capabilities and which thus reach beyond the traditional buttons/display design paradigm. This project centers on design-oriented cycles of user studies, ideation, scenario-building, prototyping, testing, and assessment. Significant emphasis is also given to understanding users' experiences when exposed to such interactive technology.

In addition to the candidate's individual thesis work, he or she will participate in projects within Umeå Design Research Group, a multidisciplinary design research group that seeks to combine knowledge and competence in industrial design with interaction design and Human-Computer Interaction. Umeå Design Research Group is

INITIAL TITLE

TOWARDS MOBILE HAPTIC INTERFACES, SKETCHING MULTIMODAL INTERACTION DESIGN

DANIEL FÄLLMAN, DIRECTOR - INTERACTIVE INSTITUTE UMEÅ

BILL BUXTON, PRINCIPAL RESEARCHER - MICROSOFT RESEARCH

INITIAL STUDY PLAN (2007)

IS THERE A WAY THE TOUCH SENSE CAN BE USED IN MOBILE INTERACTION DESIGN TO PROVIDE FOR RICHER AND MORE NATURAL-LIKE INTERACTION?

WHAT QUALITIES AND CHARACTERISTICS ARE NEEDED IN MOBILE HAPTIC INTERFACES TO TRANSLATE INTO KINESTHETIC ILLUSIONS THAT ARE TOTALLY BELIEVABLE?

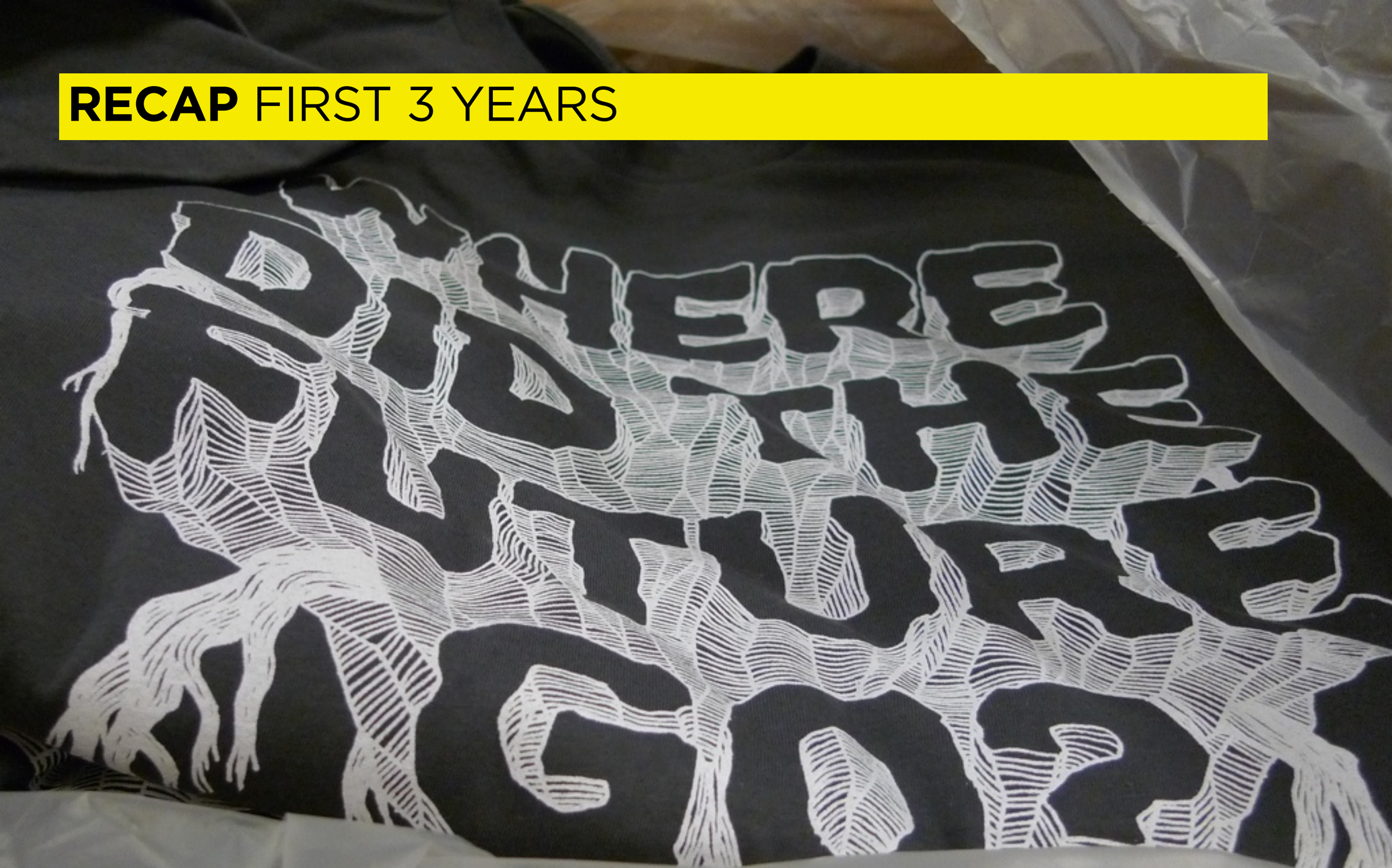
WHAT ARE THE TOOLS, PROCESSES, METHODS AND THEORIES NEEDED FOR INTERACTION DESIGNERS TO GO ABOUT DEVELOPING MEANINGFUL INPUT OR OUTPUT FORMS WITHIN A TECHNICAL DEVICE THAT FEEL NATURAL TO THE USER?

PHASE 1: UNDERSTAND THE PLAYING FIELD

PHASE 2: BUILD, SKETCH, TRY, PLAY, EXPOSE

PHASE 3: PACKAGE THESIS

RECAP FIRST 3 YEARS



3 YEARS

3 YEARS

44 CONFERENCES/EVENTS

3 YEARS

44 CONFERENCES/EVENTS

173 DAYS OF TEACHING

3 YEARS

44 CONFERENCES/EVENTS

173 DAYS OF TEACHING

5 PAPERS/ARTICLES

Sketching and prototyping haptic interfaces: design challenges and insights

Camille Moussette
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+46 90 786 7110

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ABSTRACT

This article explores and discusses some challenges of prototyping haptic (touch) interfaces early on in the design process. Using examples of prototyping activities for haptic interfaces that have strong 'sketching qualities', this paper elaborates on different prototyping levels and the consequences on fidelity, construction requirements and technical skills. It concludes by proposing various guidelines or insights relevant to the design of haptic interfaces by designers.

Categories and Subject Descriptors

and applications [4][8] have made it more accessible to build tangible and interactive systems that interact with the physical world. Can these tools help prototype and sketch non-traditional interfaces quickly and efficiently?

2. SKETCHING HAPTIC INTERFACES

The skin is a very complex, resilient and refined organ. It offers extreme sensitivity and tremendous capabilities as a medium between the external world (objects and environment) and us. The sense of touch is relatively well understood and documented

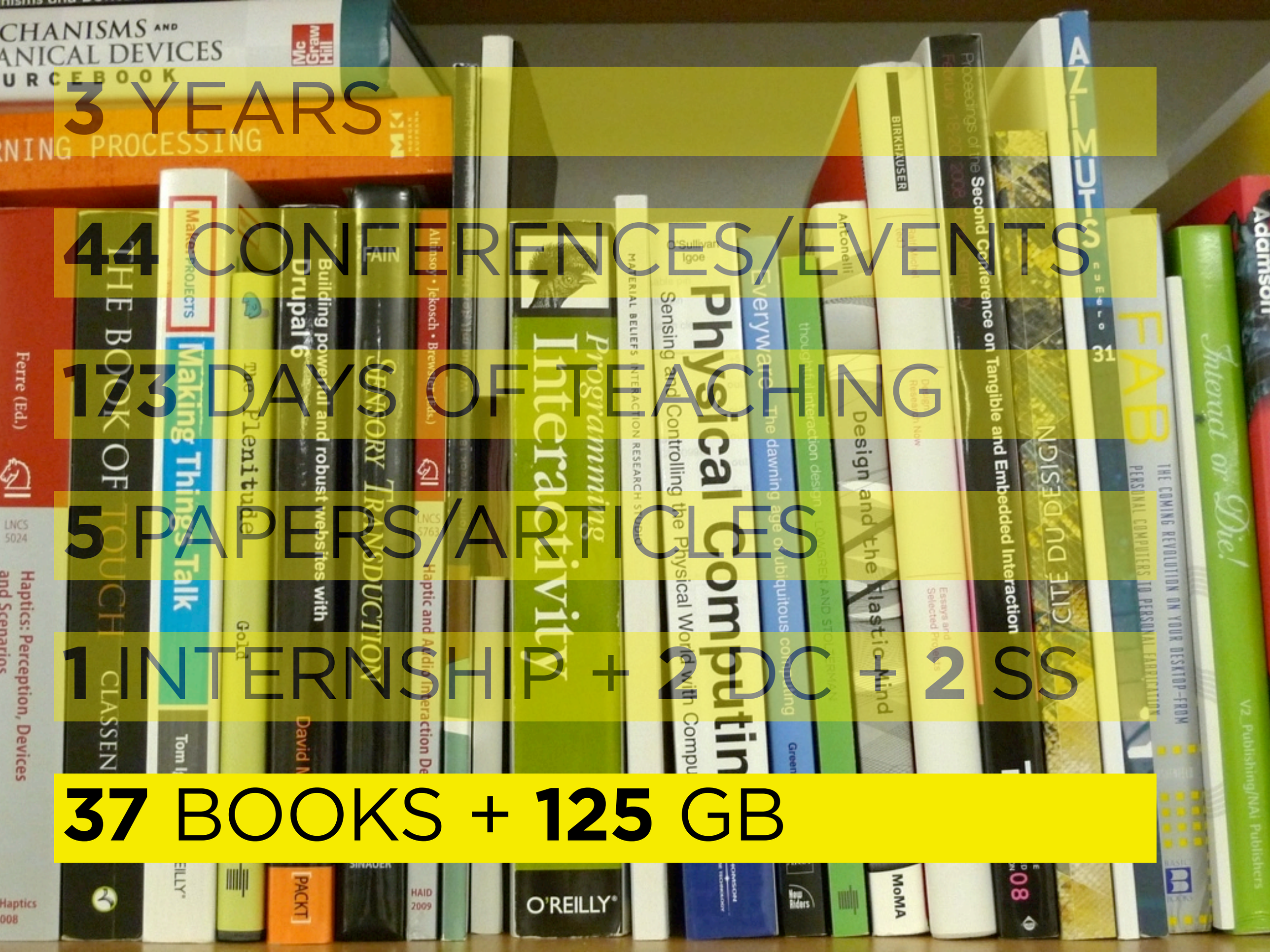
3 YEARS

44 CONFERENCES/EVENTS

173 DAYS OF TEACHING

5 PAPERS/ARTICLES

1 INTERNSHIP + **2** DC + **2** SS


3 YEARS
44 CONFERENCES/EVENTS
173 DAYS OF TEACHING
5 PAPERS/ARTICLES
1 INTERNSHIP + 2 DC + 2 SS
37 BOOKS + 125 GB

3 YEARS

44 CONFERENCES/EVENTS

173 DAYS OF TEACHING

5 PAPERS/ARTICLES

1 INTERNSHIP + **2** DC + **2** SS

37 BOOKS + **125** GB

RESEARCH INQUIRIES & PERSPECTIVES

PHD IN INDUSTRIAL DESIGN?

WHAT IS DESIGN RESEARCH?

RESEARCH AT UMEÅ INSTITUTE OF DESIGN

SCANDINAVIAN AND EUROPEAN CONTEXTS

RESEARCH INQUIRIES & PERSPECTIVES

IDENTIFYING PEERS AND COMMUNITIES

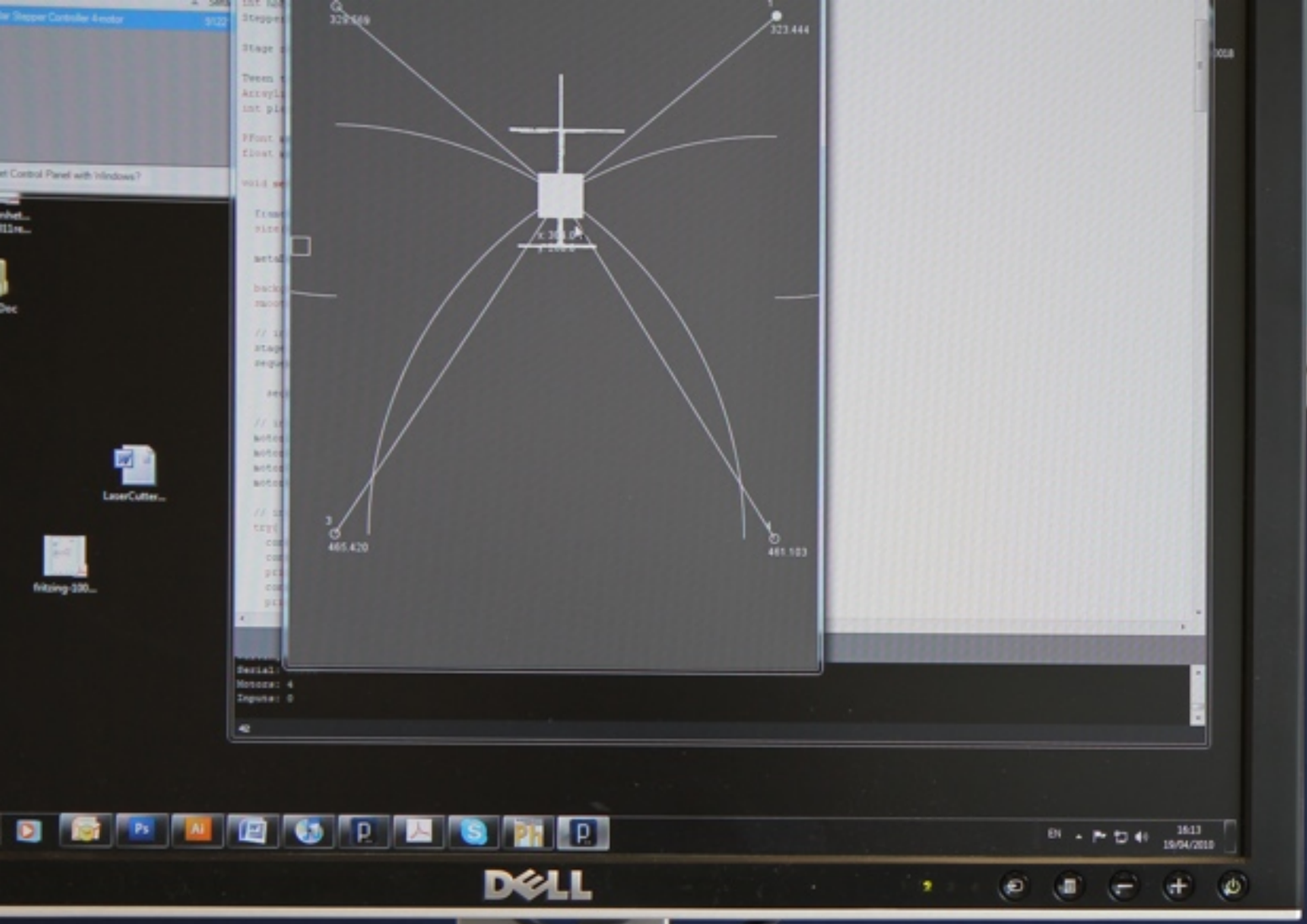
FRAMING MY PHD PROJECT

TOWARDS MOBILE HAPTIC INTERFACES, SKETCHING MULTIMODAL INTERACTION DESIGN

TOWARDS **MOBILE HAPTIC** INTERFACES, **SKETCHING** MULTIMODAL **INTERACTION DESIGN**

SKETCHING

INTERACTION DESIGN


323.444
465.420
461.103
DELL

NON-VISUAL AND BEYOND THE GUI


COPIC

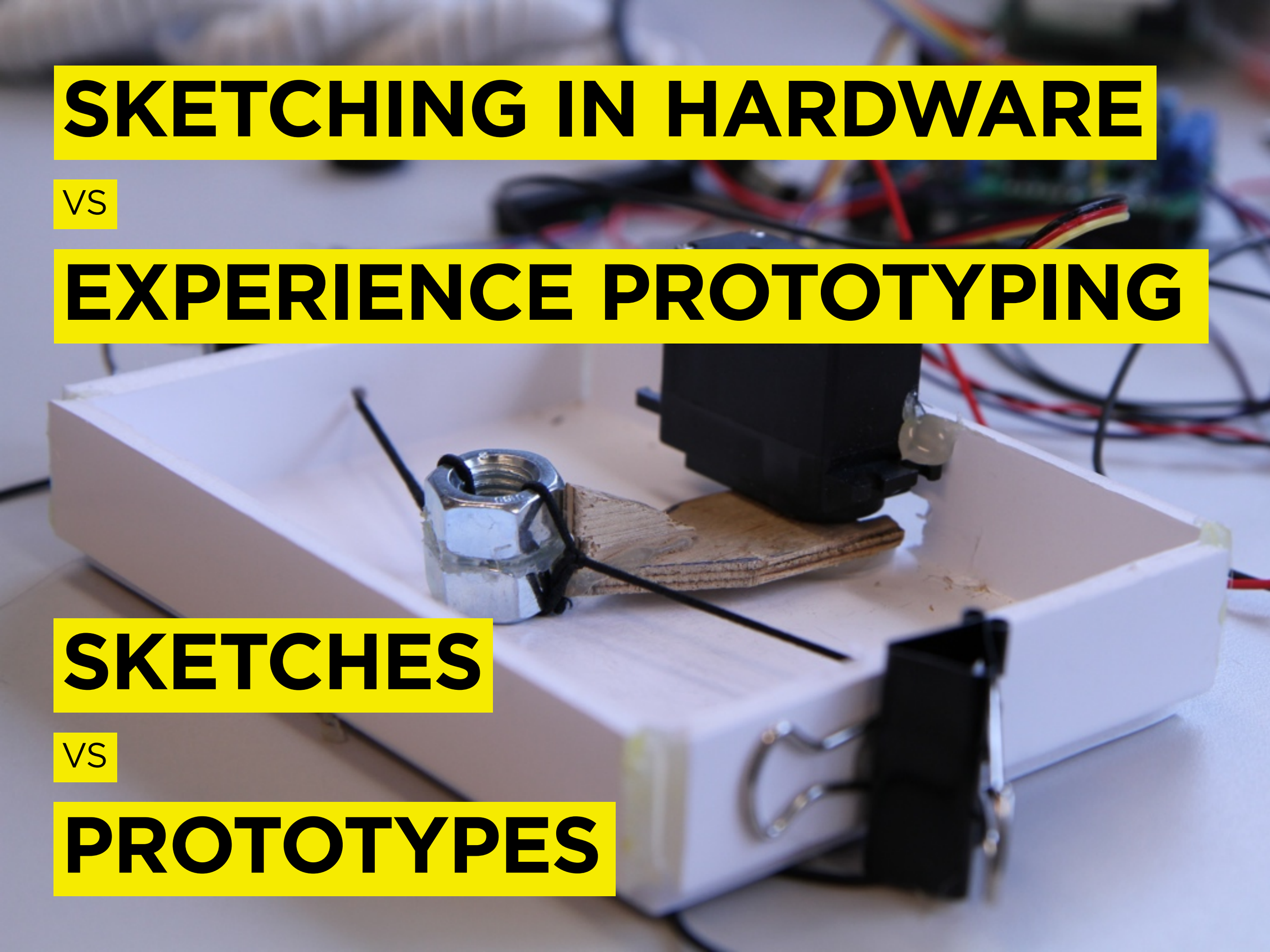

Adobe


PARALLAX
standard servo
www.parallax.com

SKETCHING IN HARDWARE

VS

EXPERIENCE PROTOTYPING



SKETCHES

VS

PROTOTYPES

SKETCHING IN HARDWARE

OR PROTOTYPING?

Controller

A. Status LCD
Two lines show current state of the input being manipulated

B. Beat Visualization
OFF and 5 levels

C. Visualization Booster
Range from -3 to +3, controlling the diameter of audio generated dots

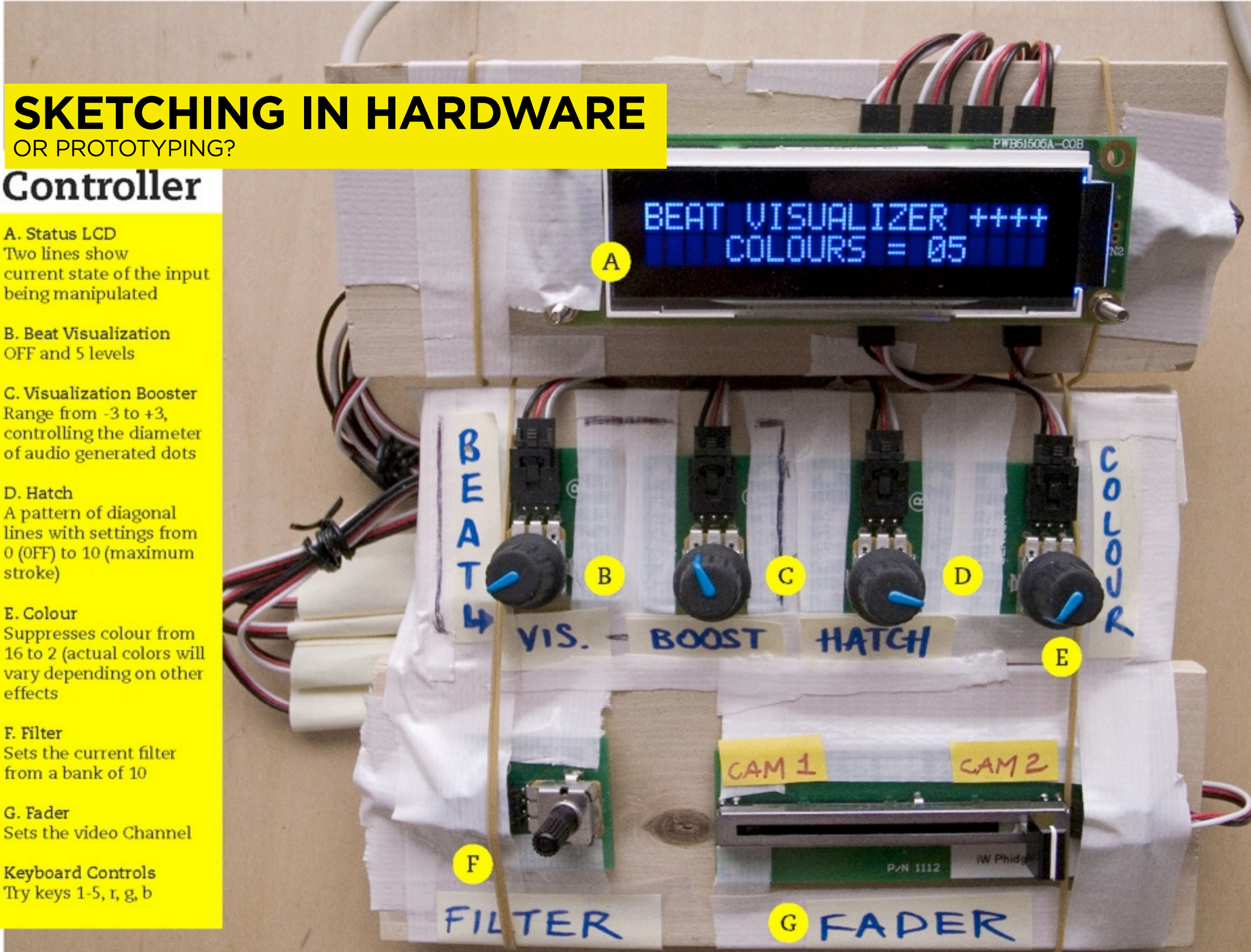
D. Hatch
A pattern of diagonal lines with settings from 0 (OFF) to 10 (maximum stroke)

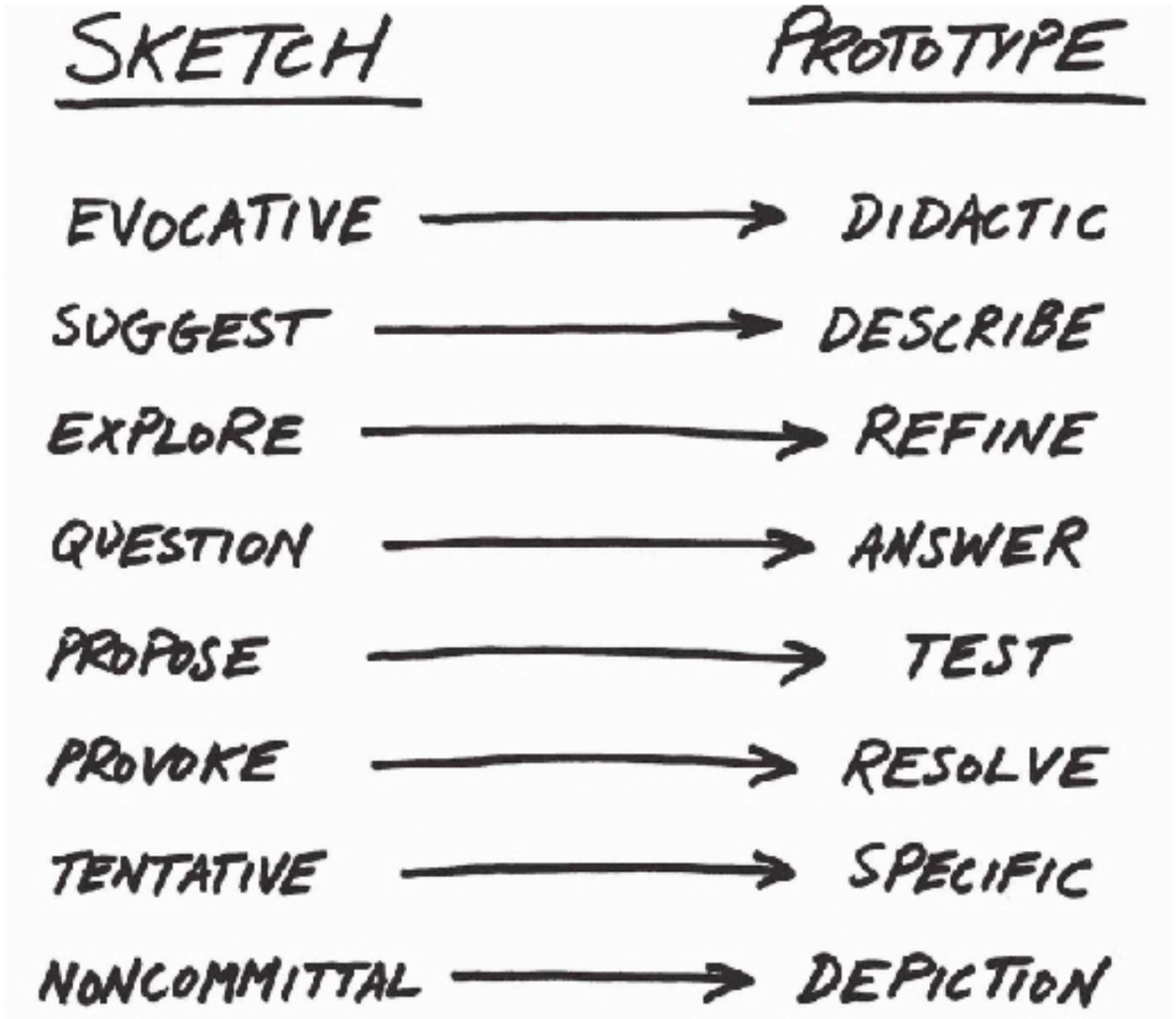
E. Colour
Suppresses colour from 16 to 2 (actual colors will vary depending on other effects

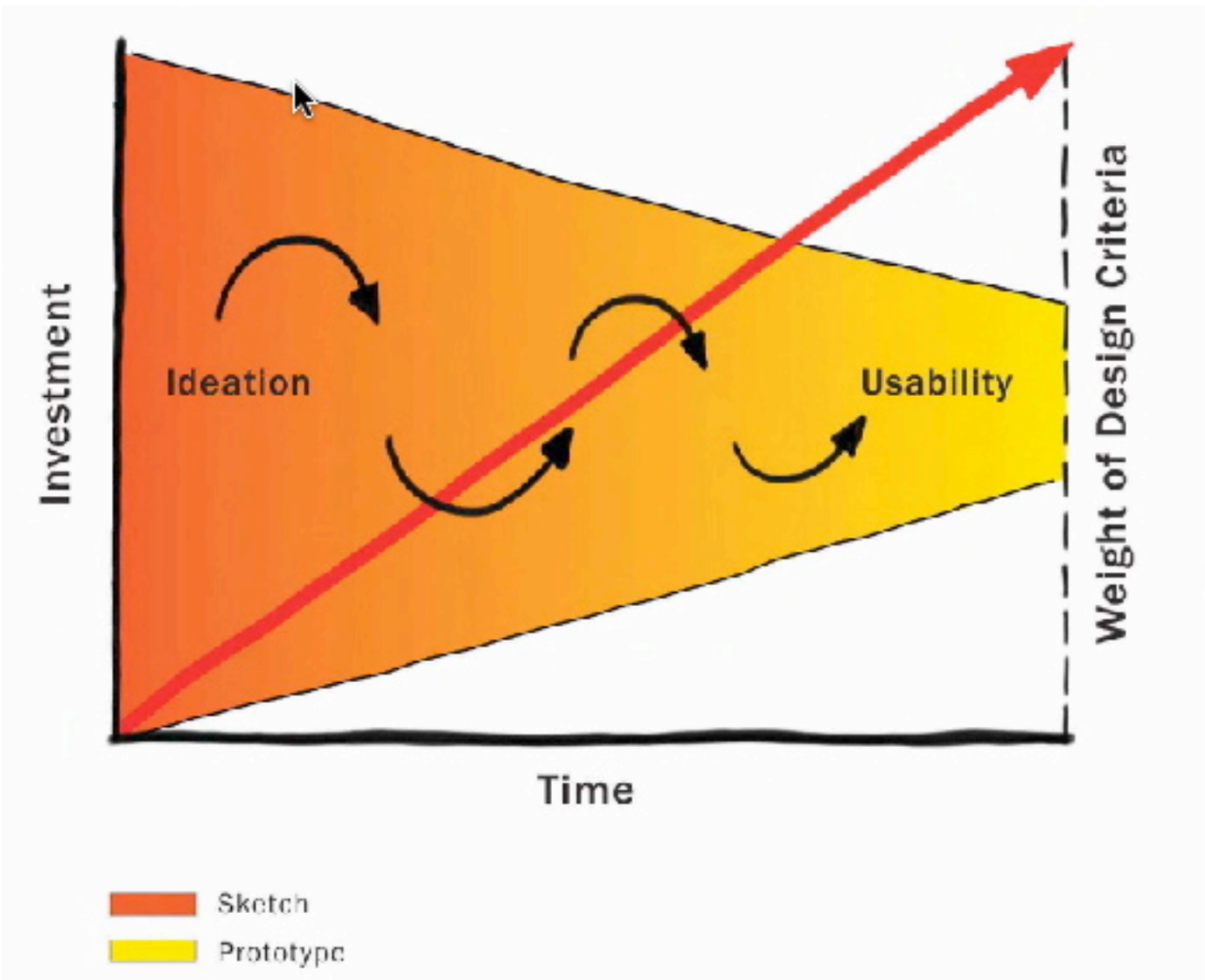
F. Filter
Sets the current filter from a bank of 10

G. Fader
Sets the video Channel

Keyboard Controls
Try keys 1-5, r, g, b




SKETCH
PROTOTYPE
EVOCATIVE → DIDACTIC
SUGGEST → DESCRIBE
EXPLORE → REFINE
QUESTION → ANSWER
PROPOSE → TEST
PROVOKE → RESOLVE
TENTATIVE → SPECIFIC
NONCOMMITTAL → DEPICTION


Ideation
Usability
Investment
Weight of Design Criteria
Time
Sketch
Prototype

Buxton, 2007

Prototypes are...

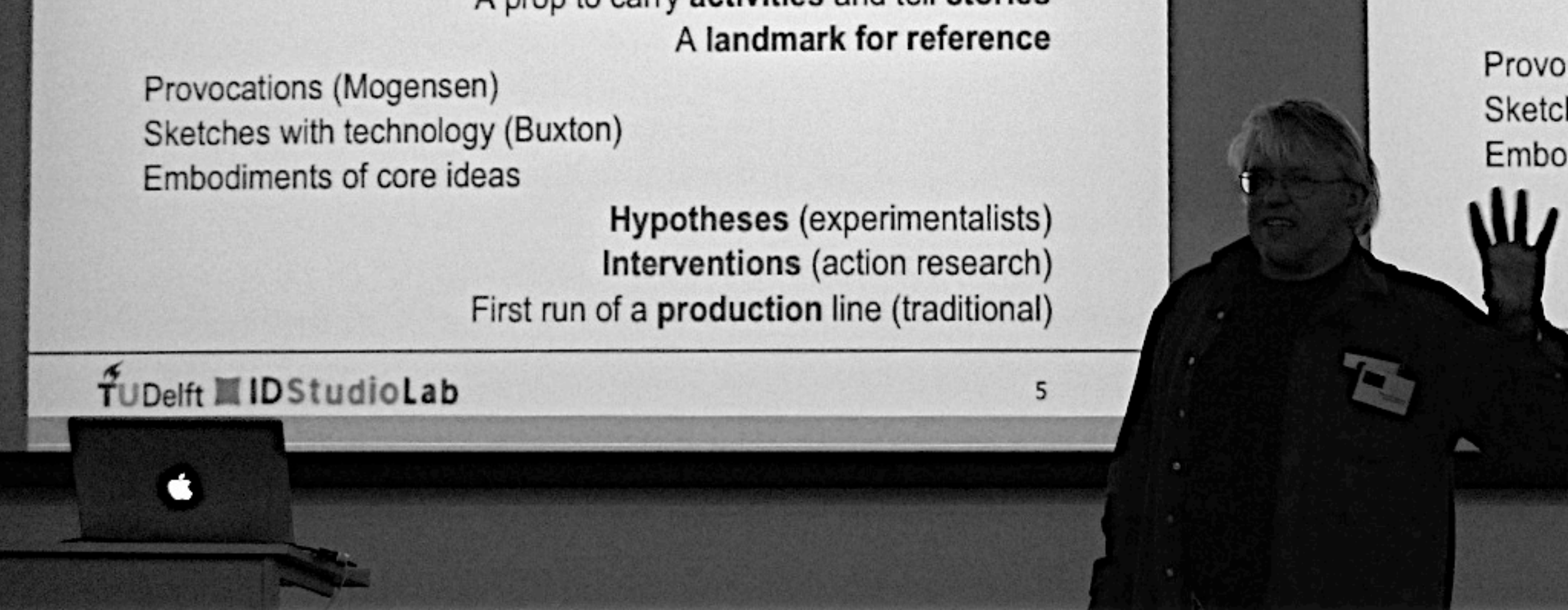
"the things we make to find out things"

How things should be
How things will be
How things can be

Unfinished, open for development
A way to **experience** a **future** situation
A way to connect **abstractions** into experience
A carrier for **discussions**
A prop to carry **activities** and tell **stories**
A **landmark for reference**

Provocations (Mogensen)
Sketches with technology (Buxton)
Embodiments of core ideas

Hypotheses (experimentalists)
Interventions (action research)
First run of a **production** line (traditional)



The Anatomy of Prototypes

Lim, Y.-K., Stolterman, E., and Tenenberg, J. 2008

Prototypes are **filters** that traverse a design space and are **manifestations** of design ideas that concretize and externalize conceptual ideas.

A “good” prototype is very dependent on what you are trying to explore, evaluate, or understand.

The Anatomy of Prototypes

Lim, Y.-K., Stolterman, E., and Tenenberg, J. 2008

The Principles of Prototyping

Fundamental prototyping principle

Prototyping is an activity with the purpose of creating a **manifestation** that, in its simplest form, **filters** the qualities in which designers are interested, without distorting the understanding of the whole.

Economic principle of prototyping

The best prototype is one that, in the **simplest** and the **most efficient way**, makes the possibilities and limitations of a design idea visible and measurable.

Experience **Prototyping**

FROM UCD/PD

NON-TECH
SERVICE/BUSINESS MINDSET

Interaction Design Programme - MA2
Autumn Term 2009
Weeks 41 - 45 (05/10 – 08/11)
Course Responsible: Camille Moussette

Umeå Institute of Design
Umeå University

FROM PHYSICAL COMPUTING

REFLECTIVE NONCOMMITTAL

EXPLORATIVE - SERIOUS PLAY

Sketching in Hardware 2

A summit on the design of/with physical computing toolkits.

SOLD OUT! Come back in December for Sketching 3 news.

...eryone who makes ...hardware. ...entally changes that ...ot. They serve as ...elp and constrain ...d new boundaries

This year's theme is Boundary Conditions

Through discussion, experience and sketching we will examine the boundaries in developing physical computing: boundaries between components, between standards, between making objects and creating experiences, between cost and sustainability, between the expected and the unorthodox, and between creator and toolkit.

Sketching in Hardware 2 will be a two day meeting of people intimately involved in this field to discuss the ideas, methods, challenges and potential of physical computing technologies.

BACKGROUND: SKETCHING IN HARDWARE 1

SPONSORS

THING M

Tellart

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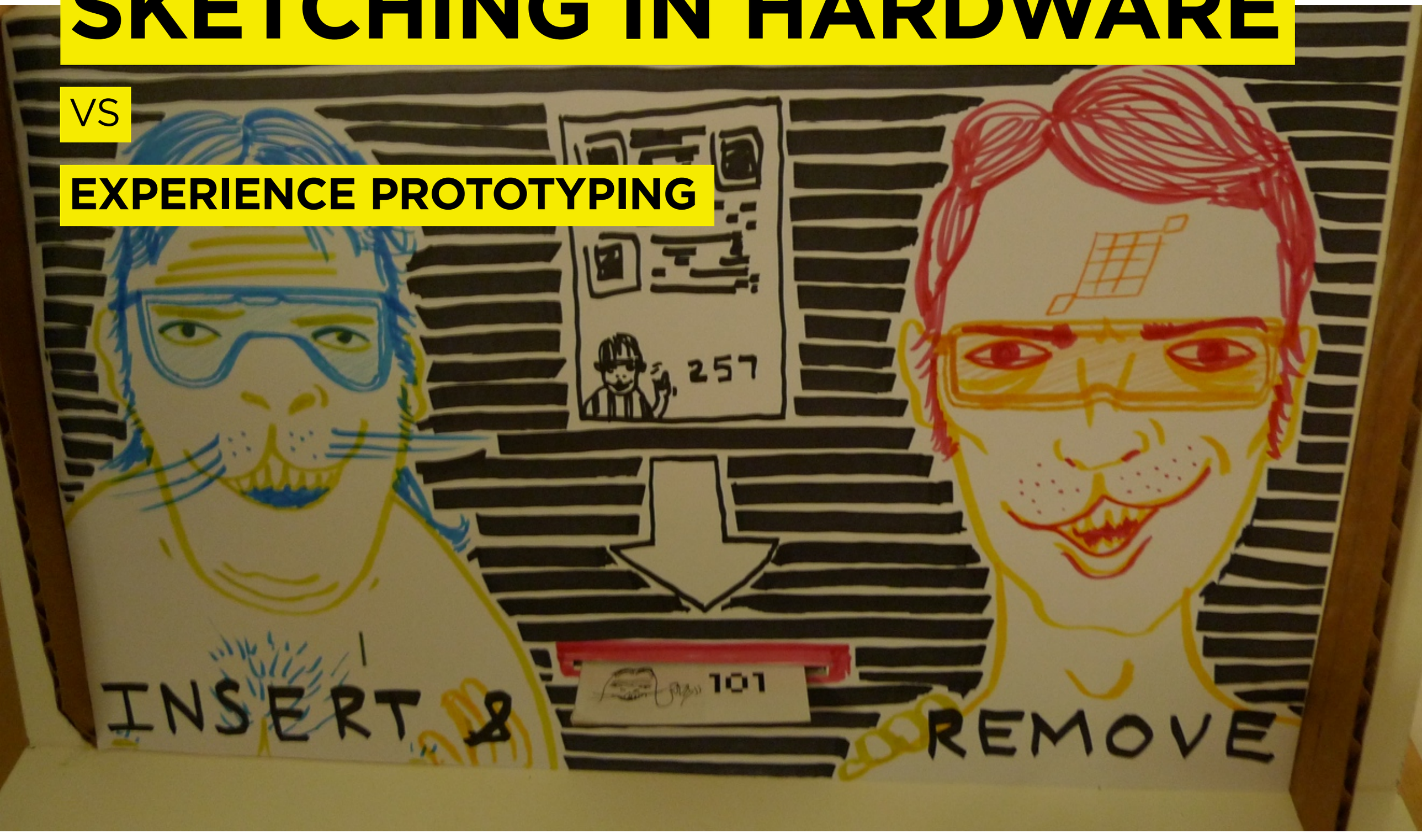
SKETCHING IN HARDWARE

VS

EXPERIENCE PROTOTYPING



Sketching in Hardware and Building Interaction Design: tools, toolkits and an attitude for Interaction Designers

Camille Moussette, Umeå Institute of Design, Umeå University, Sweden, camille.moussette@dh.umu.se

Fabricio Dore, IDEO, Munich, Germany, fdore@ideo.com

Abstract

In this paper, we present a *Sketching in Hardware* perspective to Interaction Design (IxD) education and practice. We start our discussion by highlighting the differences between *Prototypes* and *Sketches*, and explaining why we believe the term *Sketching in Hardware* is suitable and appropriate to the IxD practice. We introduce a short history of the term and its origins before relating it to Experience Prototyping activities and other related design processes/methodologies.

Our main discourse consists of observations and a critical analysis of academic activities and professional work suggesting that *Sketching in Hardware* remains quite challenging despite the recent progress in the development of new tools and toolkits. The low barrier to entry and the explosion of tools and toolkits are very welcome, but this democratization can also be misleading. The learning curve is still steep in many ways. The current sketching tools seem to have leapfrogged our design skills and our ability to deal with that avalanche of technical capabilities. Designers regularly loose a critical perspective on their sketching and prototyping activities. We noted that students and designers alike spend a lot of time mastering intricate tools and debugging technical issues when they should be developing, evolving and fine-tuning interesting experiences or sketches informing their design process.

We close our discussion with a review of various toolkits and building blocks currently available to interaction designers for designing new technology and future concepts. We ultimately

MANIFESTING IDEAS

FROM THE SKY DOWN TO EARTH , OR VICE-VERSA

DESIGNING IN THE UNKNOWN

PROBLEM-SOLVING WITH DETOURS

PRIORITIZING DESIGN OUTCOMES OVER TECHNICAL KNOW-HOW

PRIORITIZING DESIGN OUTCOMES OVER TECHNICAL KNOW-HOW

HOW DOES IT INFORM YOUR DESIGN WORK?

FIVE HIGH LEVEL CHARACTERISTICS OR QUALITIES

FOR SKETCHING IN HARDWARE TOOLS AND ACTIVITIES

1. OPENNESS AND LEVEL OF VISIBILITY/ACCESSIBILITY

2. HACKABILITY

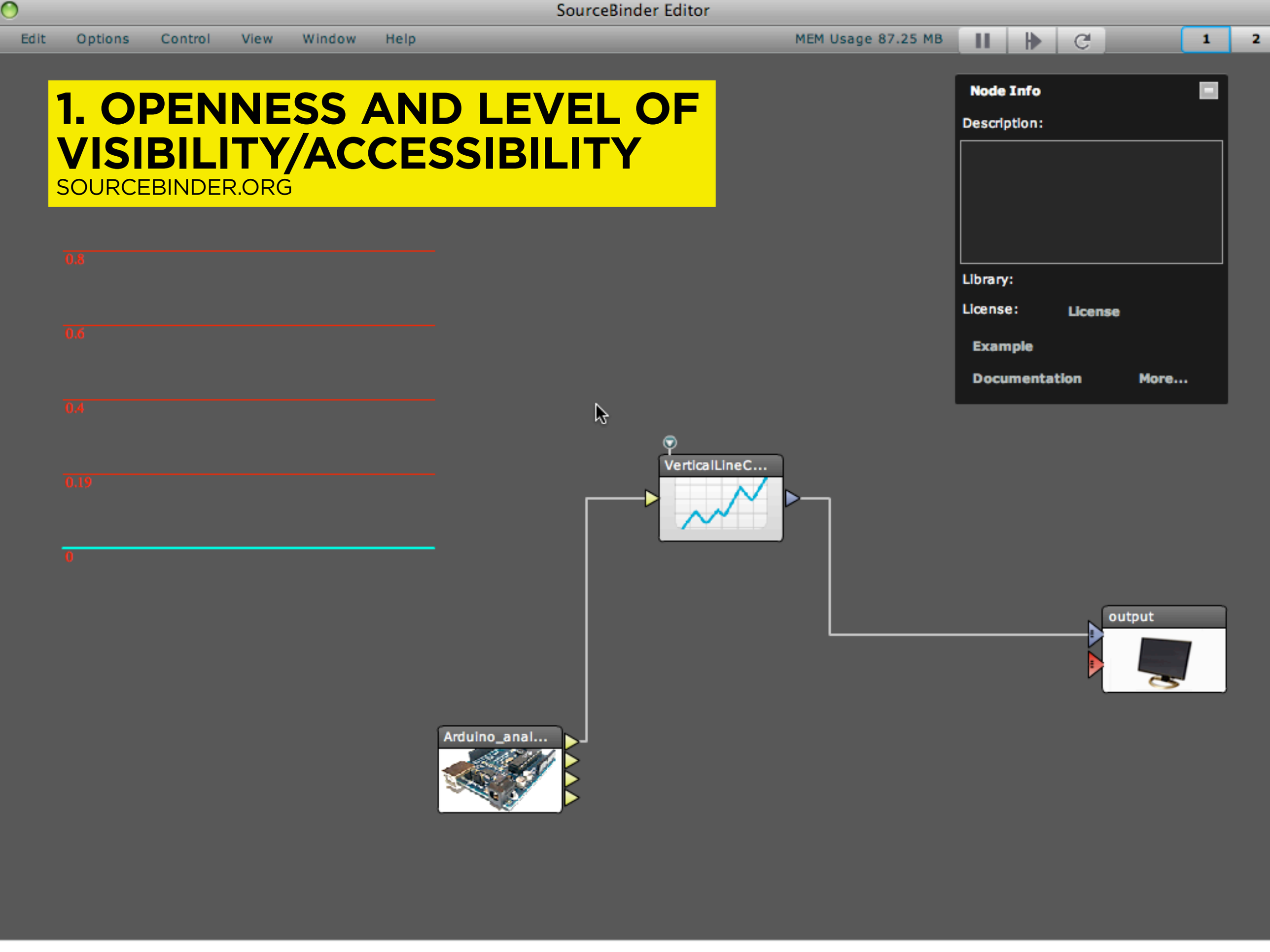
3. ADDED VALUE WHEN TIME IS LIMITED

4. VERSATILITY OR 5 WAYS OF DOING THE SAME THING

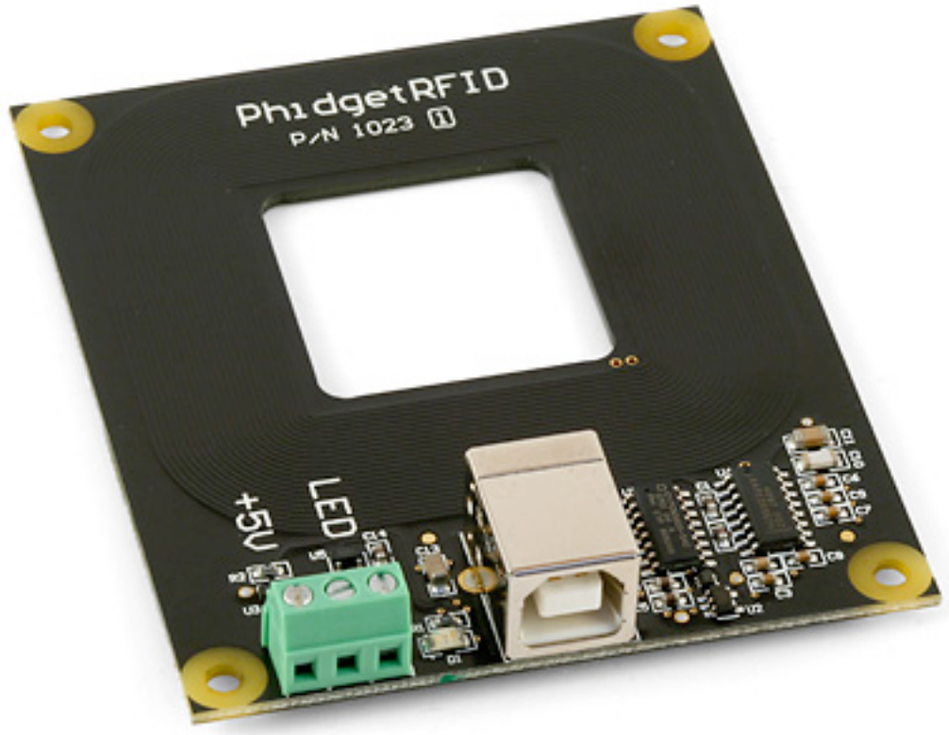
5. HUMAN FRIENDLY

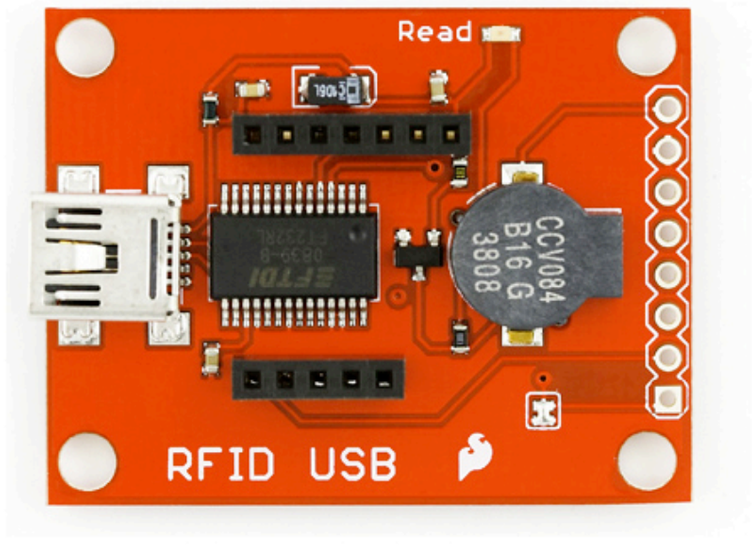
1. OPENNESS AND LEVEL OF VISIBILITY/ACCESSIBILITY

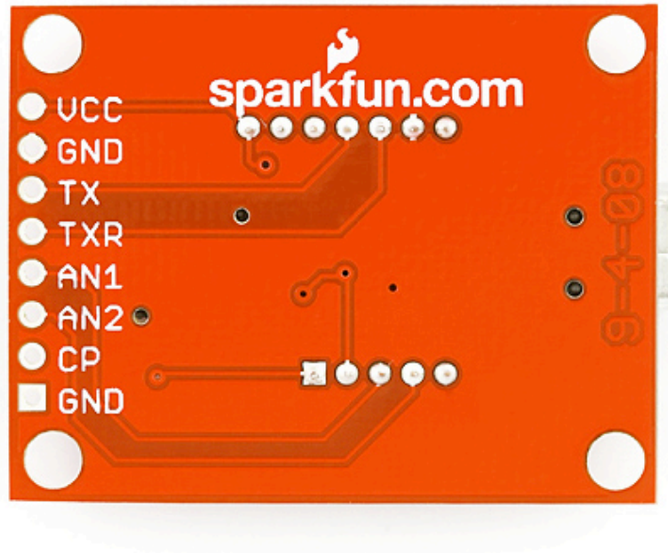
SOURCEBINDER.ORG



2. HACKABILITY
HARDWARE APPROPRIATION







2. HACKABILITY
REPURPOSING OFF-THE-SHELF TECH

3. ADDED VALUE WHEN TIME IS LIMITED

ALLOW THE DESIGNERS TO EXPERIMENT DIFFERENT VERSIONS OF THE ‘EXPERIENCE’

Design solution | Sweety

recording mode

happiness

sadness

coming information

courage, communicating

Sweety will change color depending on what speech tone the user is input. Happiness is expressed as orange, sadness as blue, green is a special mode for reminding coming information and red is a special mode for communicating with friends.

3. ADDED VALUE WHEN TIME IS LIMITED

BUILD SOMETHING CONVINCING TO BE PRESENTED TO PEOPLE

Image: Depending on how much Tom complained before, Sweety will give different "violent" levels of games, let Tom shake, punch, squeeze, blow, shout.....to control the game.

I²C

analog/continuous

binary

3. ADDED VALUE WHEN TIME IS LIMITED

ALLOW FOR IMPROVEMENTS AND MODIFICATIONS AT A LATER POINT IN TIME

Modkit Code Editor - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://127.0.0.1:5000/layout.html

4. VERSATILITY OR 5 WAYS OF DOING THE SAME THING

DIFFERENT APPROACHES AND PERSPECTIVES

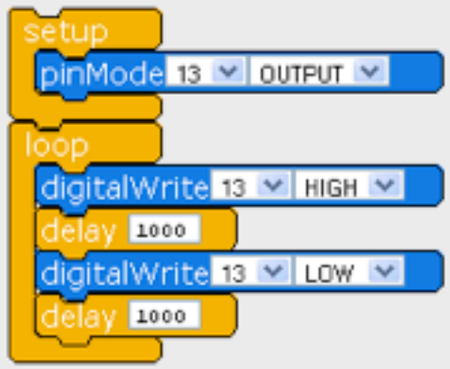
Arduino Diecimila (No Shield)

control | output | configure | operators

setup

loop

delay 1000




```
void setup(){
pinMode(13,OUTPUT);
}
void loop(){
digitalWrite(13,HIGH);
delay(1000);
digitalWrite(13,LOW);
delay(1000);
}
```

Transferring data from 127.0.0.1...

start | Modkit Blog - Mozilla ... | Modkit Code Editor -... | AVR Studio | arduino-0010 | C:\WINDOWS\syste... | C:\WINDOWS\syste... | Arduino - 0010 Alpha

4. VERSATILITY OR 5 WAYS OF DOING THE SAME THING

DIFFERENT APPROACHES AND PERSPECTIVES

Programming Resources

EMI Issues
ong Wires
es and Solutions
aracter Generator for the Phidget TextLCD

Sensors
Distance/Range
Force/Pressure
Touch
Motion
Environmental
Input
Voltage/Current

Motors
Servo Controllers
Servo Motors
DC Controllers
DC Motors
Stepper Controllers
Stepper Motors

Relays
RFID
Displays
Adapters
LEDs
Switches
Cables
Power Supplies
Kits

Discontinued

Code Sample
API Reference (COM)
Getting Started Guide

API Reference (COM)
Getting Started Guide

C#

Code Sample (Windows)
Code Sample (.NET Compact Framework)
API Reference (.NET)
Getting Started Guide

C/C++

Code Sample
API Reference (C/C++)
Working With GCC/MinGW

Cocoa

Code Sample
API Reference (C/C++)

Delphi

Code Sample
API Reference (COM)
Getting Started Guide

Flash AS3

Code Sample
API Reference (AS3)
Getting Started Guide

Flex AS3

Code Sample
API Reference (AS3)
Getting Started Guide

Java

Code Sample
phidget21.jar (version: 2.1.7.20100525)
swing-layout-1.0.3.jar
API Reference (Java)
Getting Started Guide

LabVIEW

Code Sample
API Reference (COM)
Getting Started Guide

MATLAB

Code Sample
API Reference (C/C++)
Getting Started Guide

Max/MSP

Code Sample (Windows)
Code Sample (Mac OSX)
Getting Started Guide

Microsoft Robotics Studio 1.5

Code Sample (No longer maintained)

Python

Code Sample
Python Module (version: 2.1.7.20100625)
API Reference (Python)
Getting Started Guide

REALBasic

API Reference (C/C++)
Getting Started Guide

Visual Basic .NET

Code Sample
API Reference (.NET)

Visual Basic 6.0

Code Sample
API Reference (COM)
Getting Started Guide

Visual Basic for Applications

Code Sample
API Reference (COM)
Getting Started Guide

Visual Basic Script

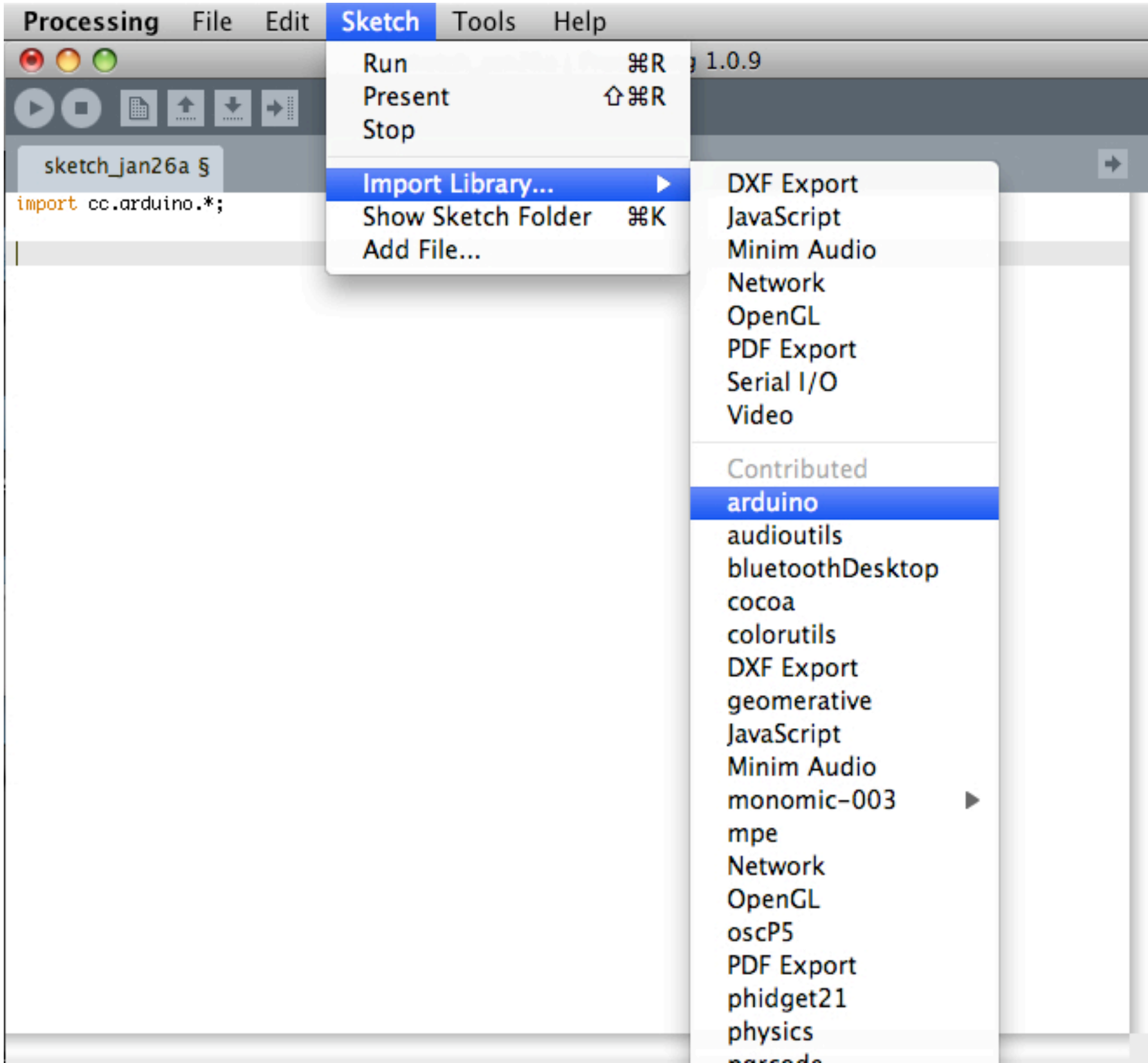
Code Sample
API Reference (COM)

Visual C/C++/Borland

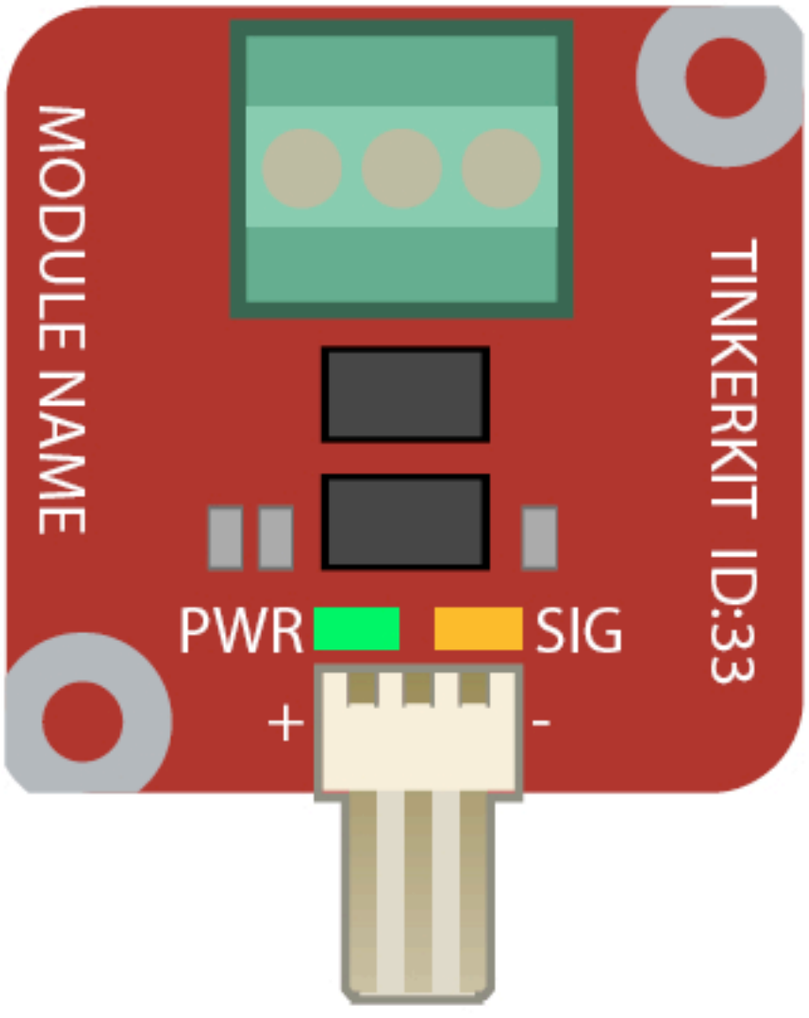
Code Sample
Phidget21 Lib (x86)

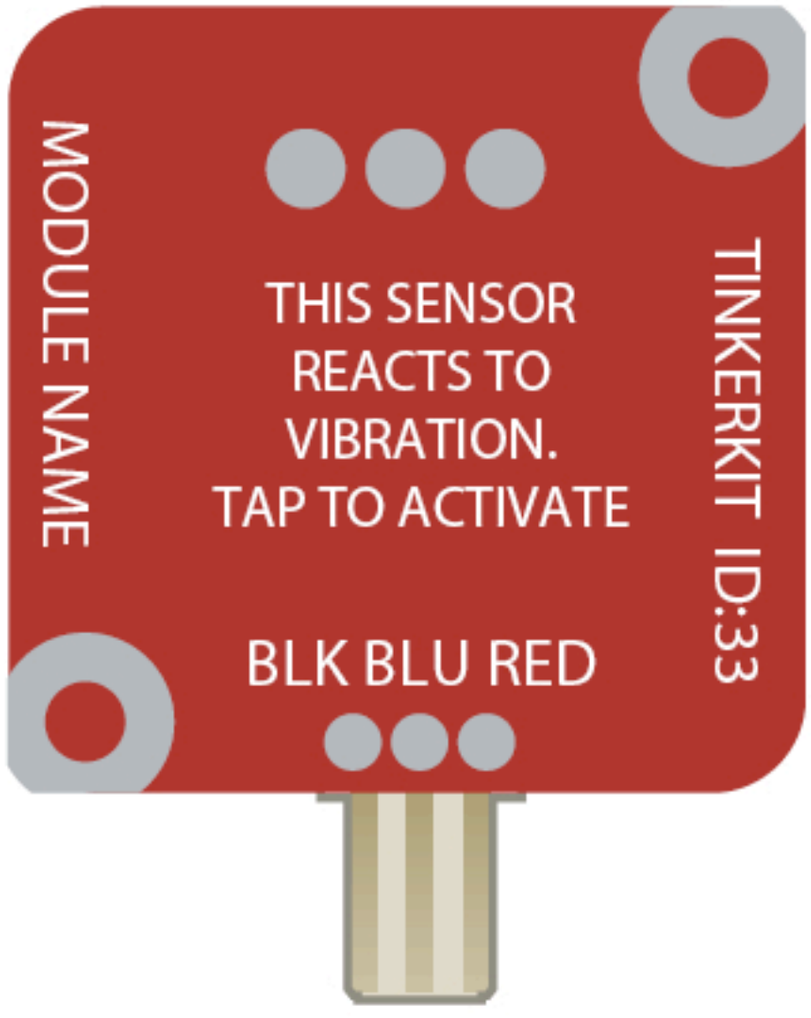
5. HUMAN FRIENDLY

5. HUMAN FRIENDLY



5. HUMAN FRIENDLY






TECHNO CENTRIC ↔ HUMAN CENTRIC

For who?

educators*

workshops

museums

groups

professionals*

kids

research labs

classrooms

design agencies*

art collectives

Time is limited

educators*

workshops

museums

groups

professionals*

kids

research labs

classrooms

design agencies*

art collectives

Cost is secondary

educators*

workshops

museums

groups

professionals*

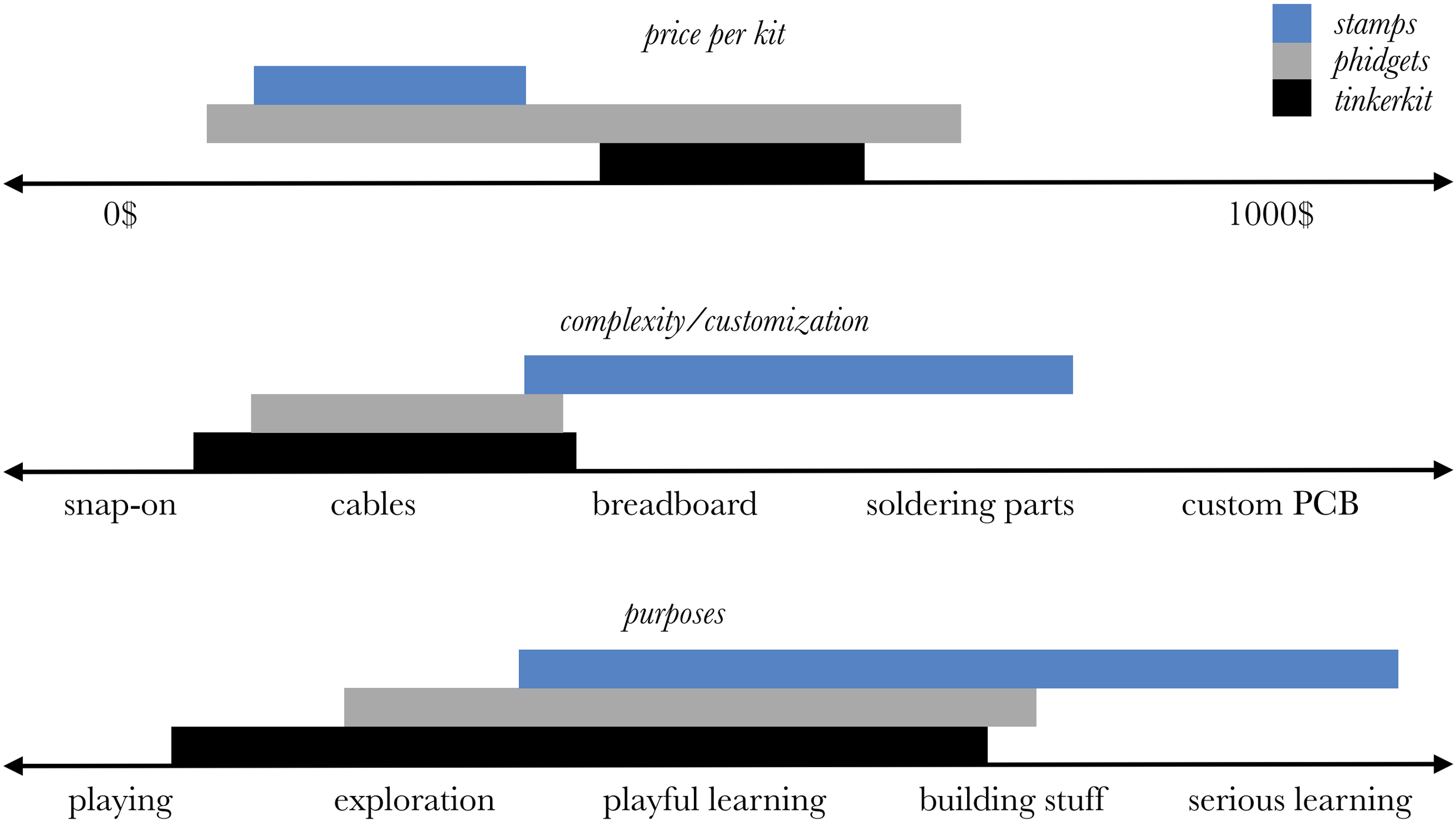
kids

research labs

classrooms

design agencies*

art collectives


price per kit
stamps
phidgets
tinkerkit
0$
1000$
complexity/customization
snap-on
cables
breadboard
soldering parts
custom PCB
purposes
playing
exploration
playful learning
building stuff
serious learning
focus/emphasis
hardware
software

TOWARDS **MOBILE HAPTIC** INTERFACES, **SKETCHING** MULTIMODAL **INTERACTION DESIGN**

MOBILE HAPTIC

(MOBILE) **HAPTIC**

Haptic interface

Haptic interface presents synthetic stimulation to proprioception and skin sensation.

Haptic perception

Combination of somatosensory perception on the skin and proprioception, no limited to one organ

First sense to develop in humans and may be the last to fade.

20x faster than vision, we can notice two stimuli just 5 ms apart.

Can sense displacements on our palm as low as 0.2 microns in length.

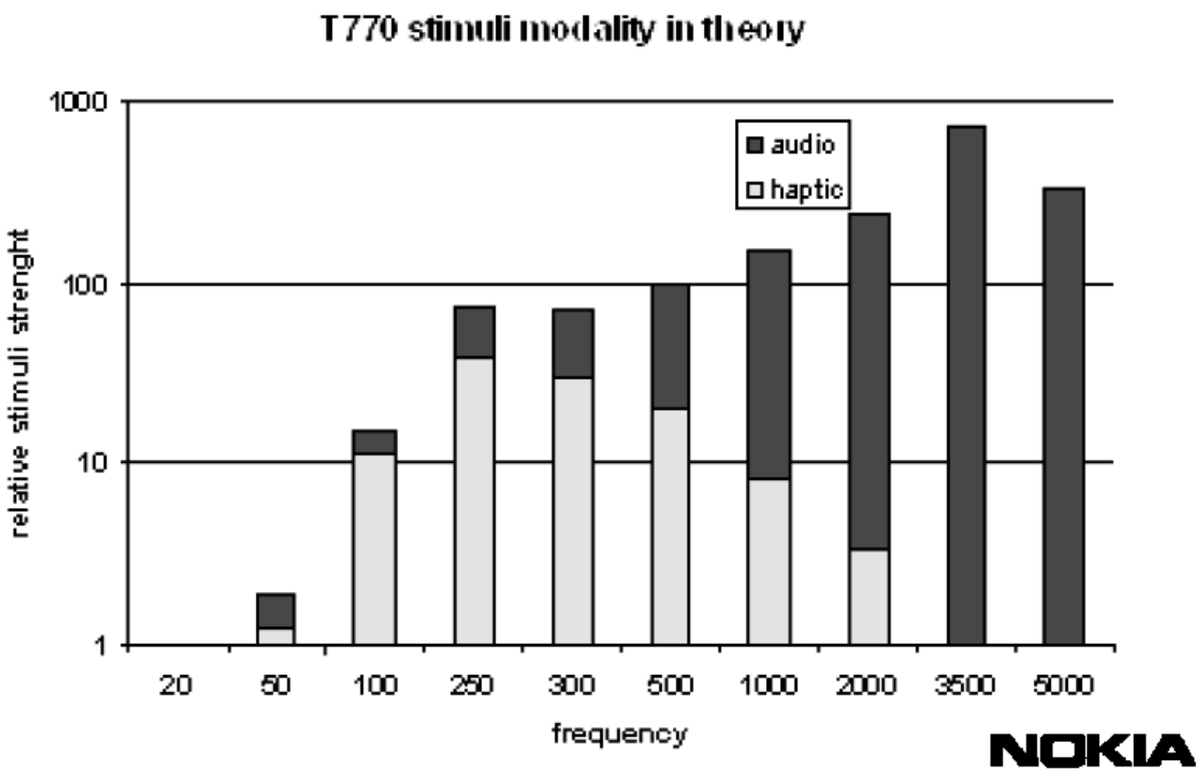
Haptic perception

Active vs passive touch

Haptic interaction is very often **multimodal**

Visual or audio cues can augment haptic perception

No clear boundary between sound and vibration, natural overlap



THE WORLD OF HAPTICS

TYPICAL INTERFACES

THE WORLD OF HAPTICS

SIMULATION OF DIFFERENT SURFACES

THE WORLD OF HAPTICS

COMPLEX AND TECHNICAL

THE WORLD OF HAPTICS

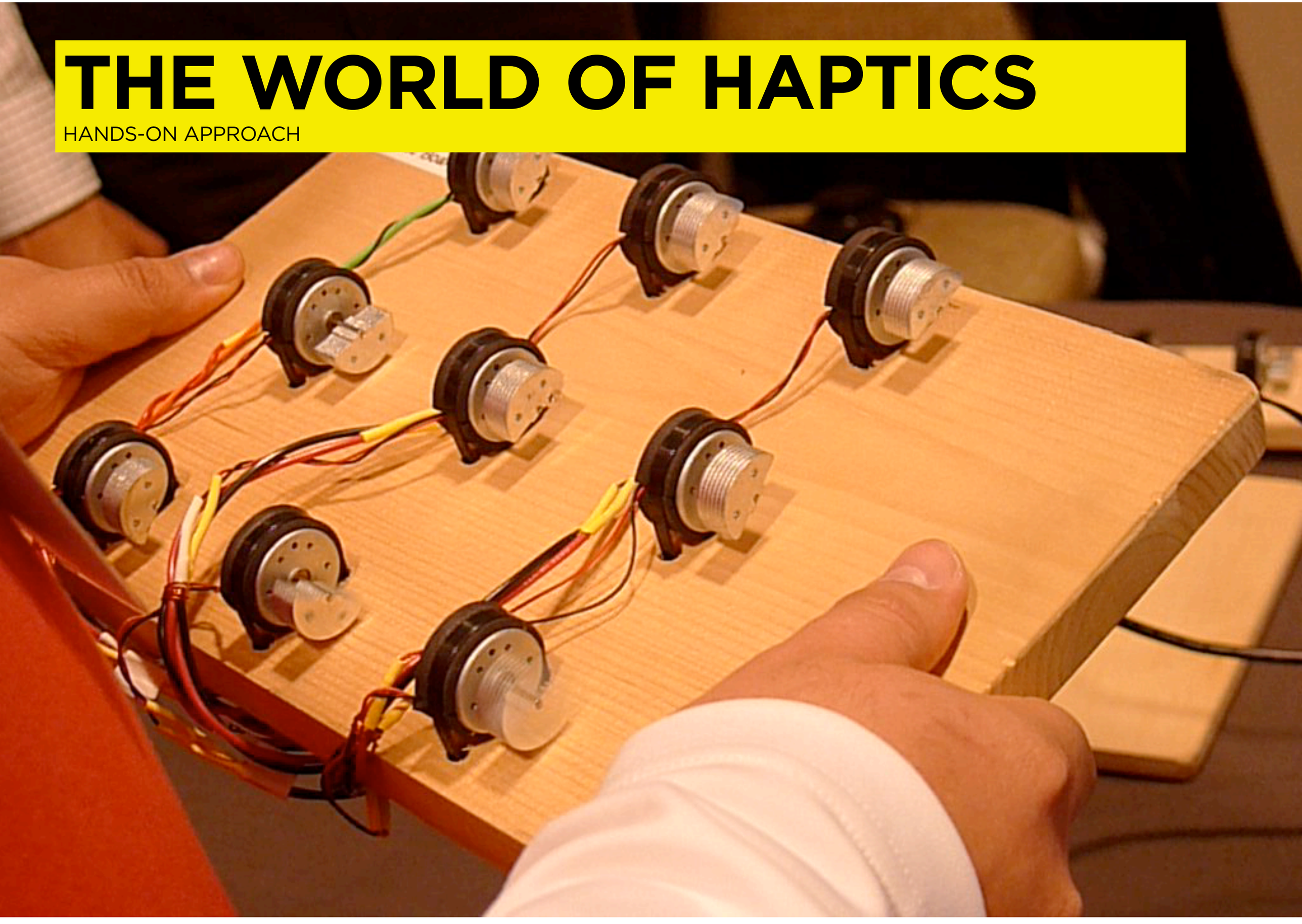
FORCE FEEDBACK - MOVING STUFF IN THE REAL WORLD

THE WORLD OF HAPTICS

SYNTHESIZING AND FAKING

THE WORLD OF HAPTICS

HANDS-ON APPROACH

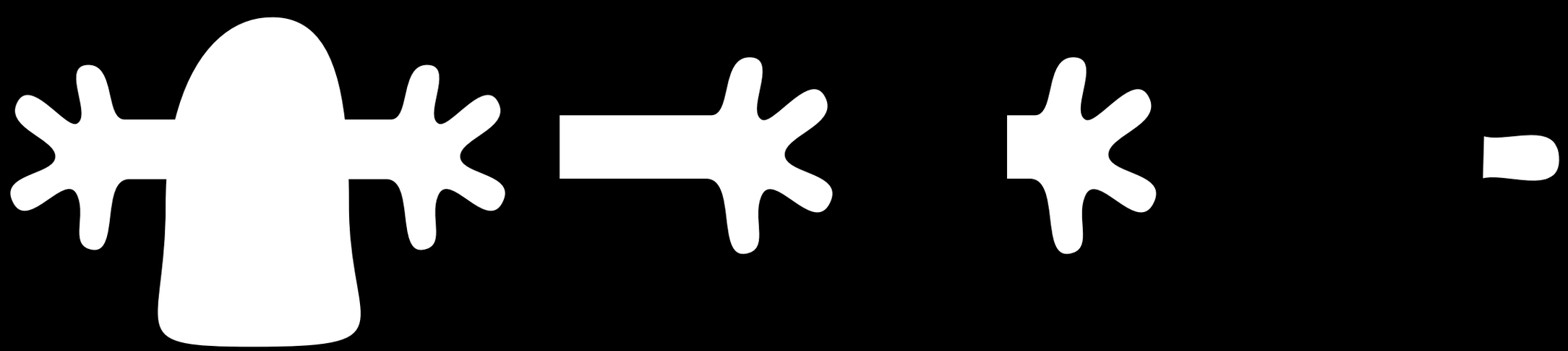


THE WORLD OF HAPTICS

RECREATING THE NATURAL INTERACTIONS

Haptic interface

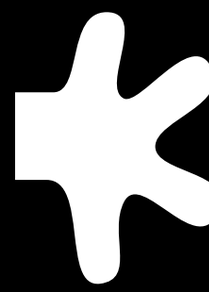
Body	Arm	Hand	Fingertip
1-3 m	20-100 cm	1-20 cm	under 1 cm



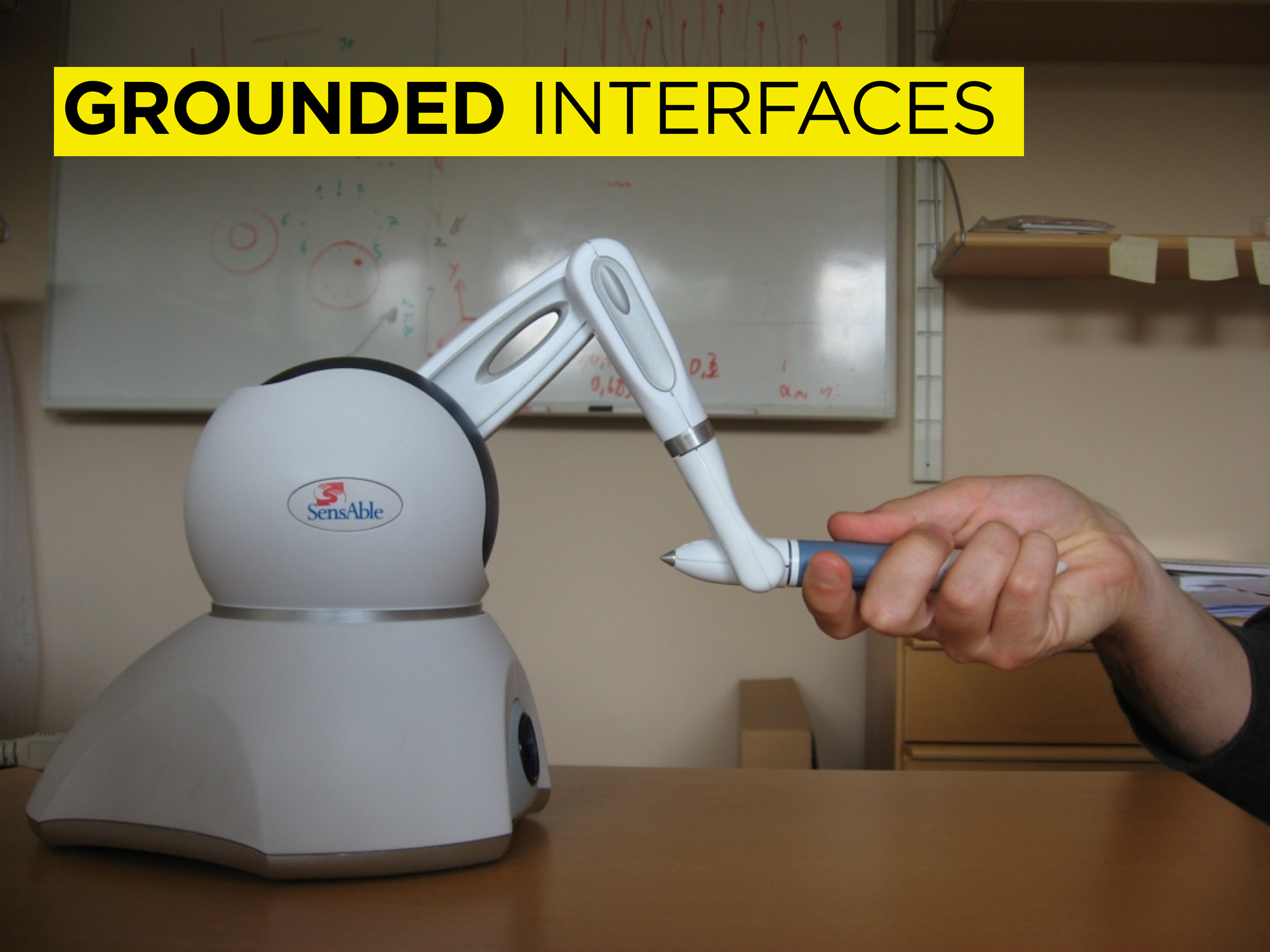
Haptic interface

Hand

1-20 cm



GROUNDED INTERFACES



UNGROUNDED INTERFACES

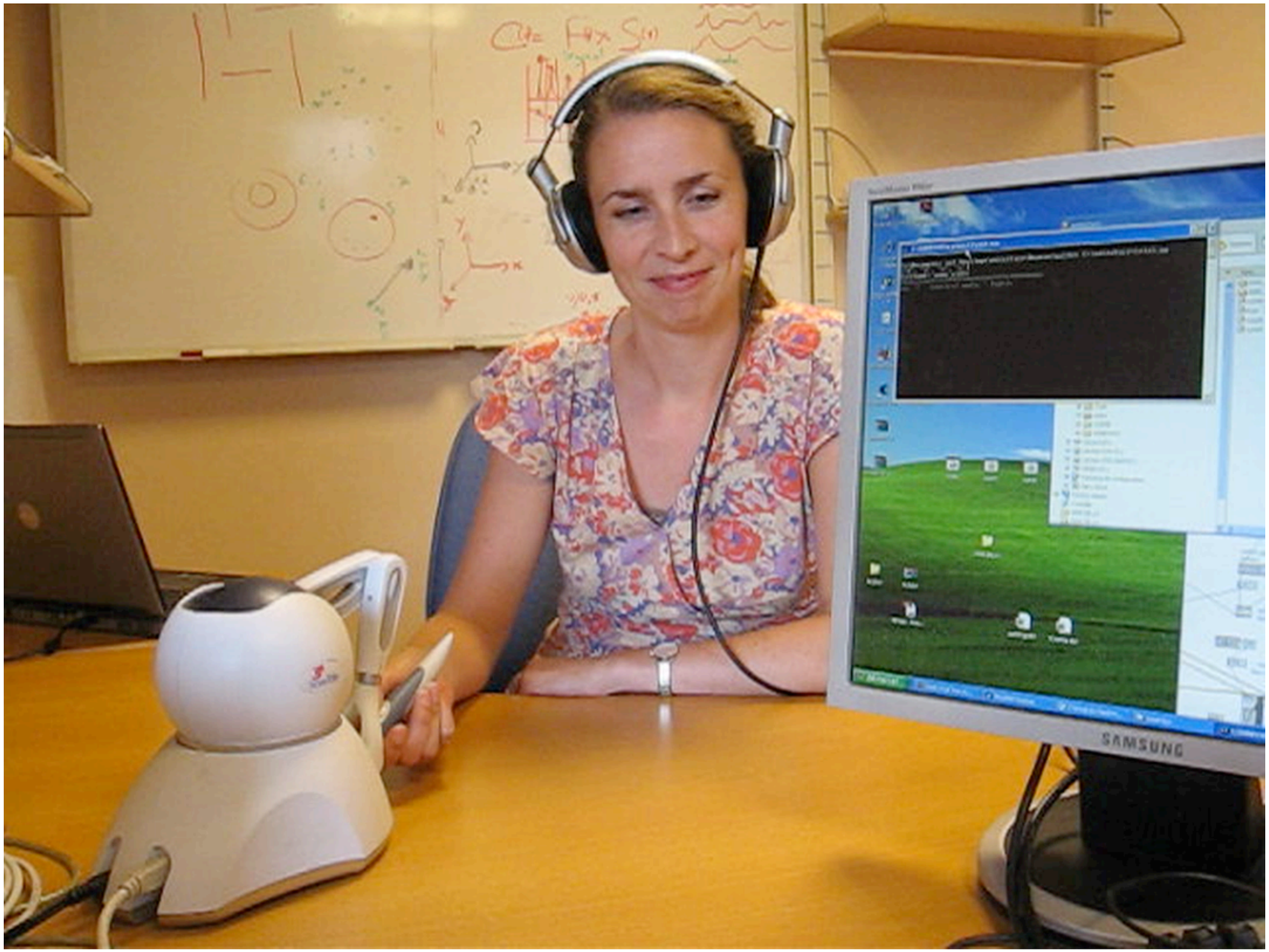
LIMSI

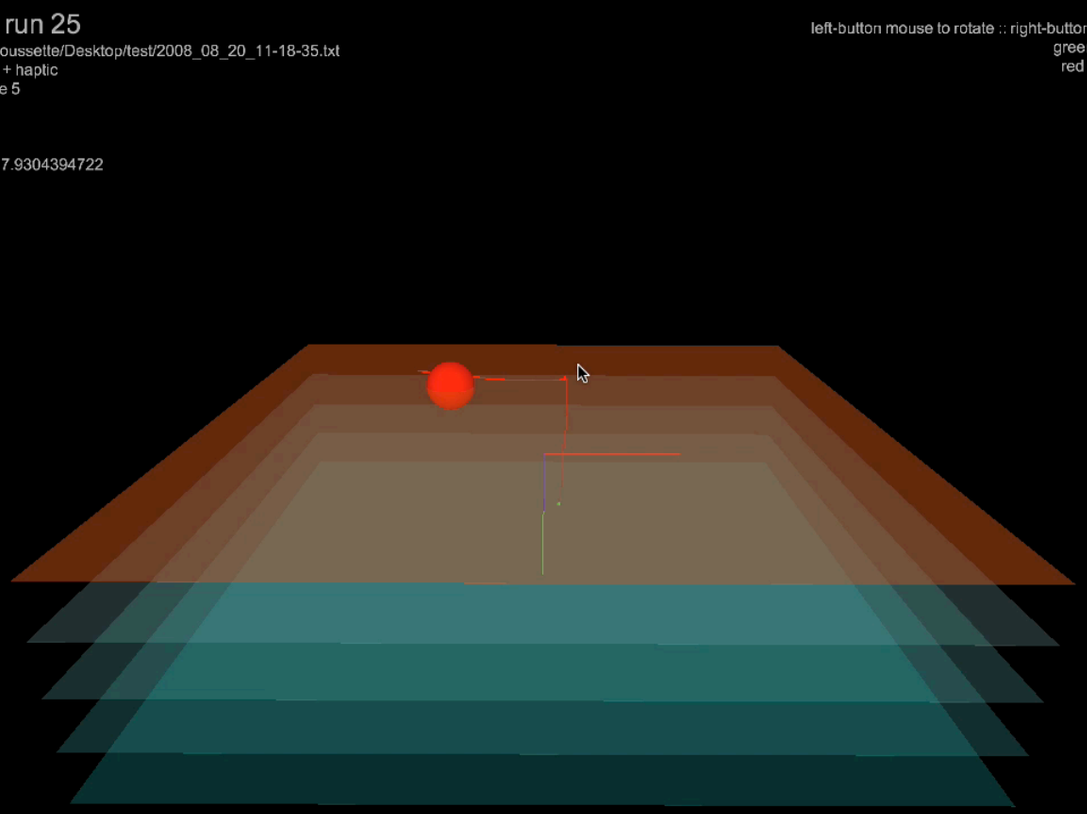
UNIVERSITE PARIS SUD

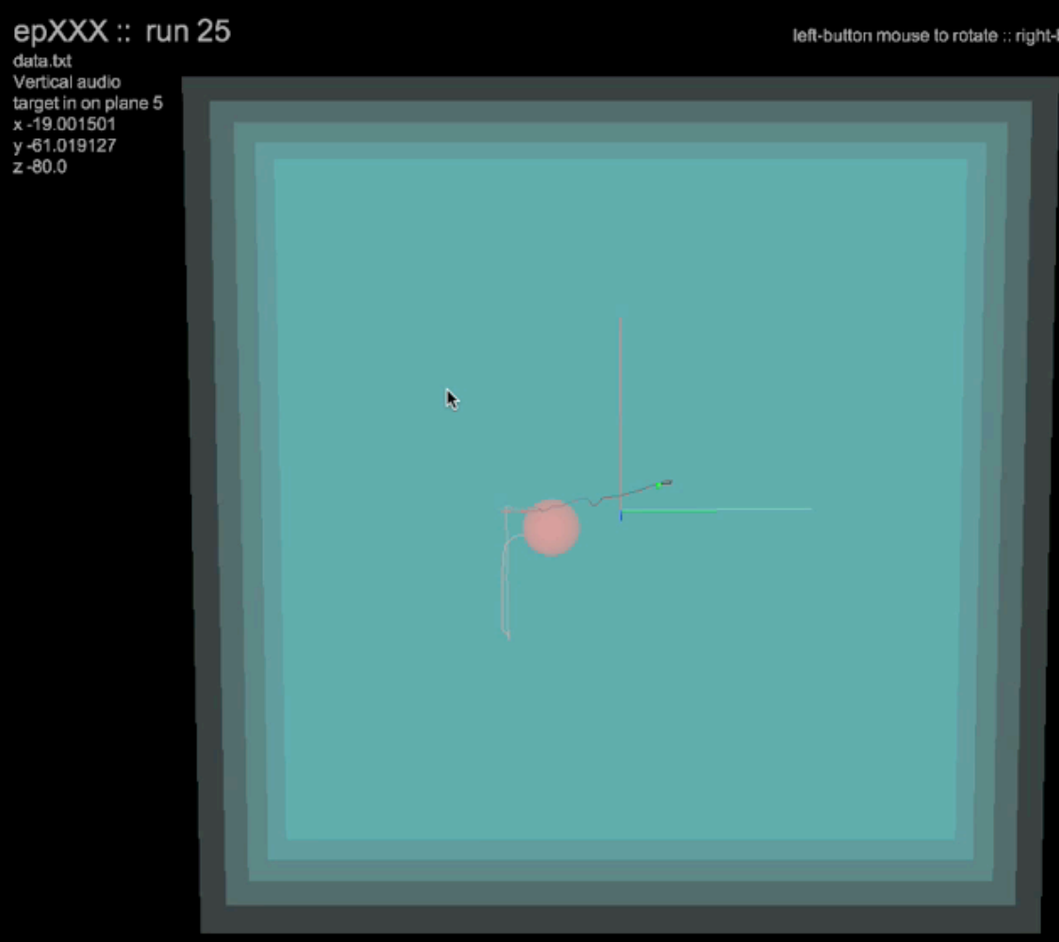
91 ORSAY

ENTERFACE'08 PROJECT - 4 WEEKS

A NON-VISUAL 3D VIRTUAL ENVIRONMENT, COMPOSED OF A NUMBER OF PARALLEL PLANES HAS BEEN DEVELOPED TO EXPLORE HOW AUDITORY CUES CAN BE ENHANCED USING HAPTIC FEEDBACK FOR NAVIGATION.


SAMSUNG



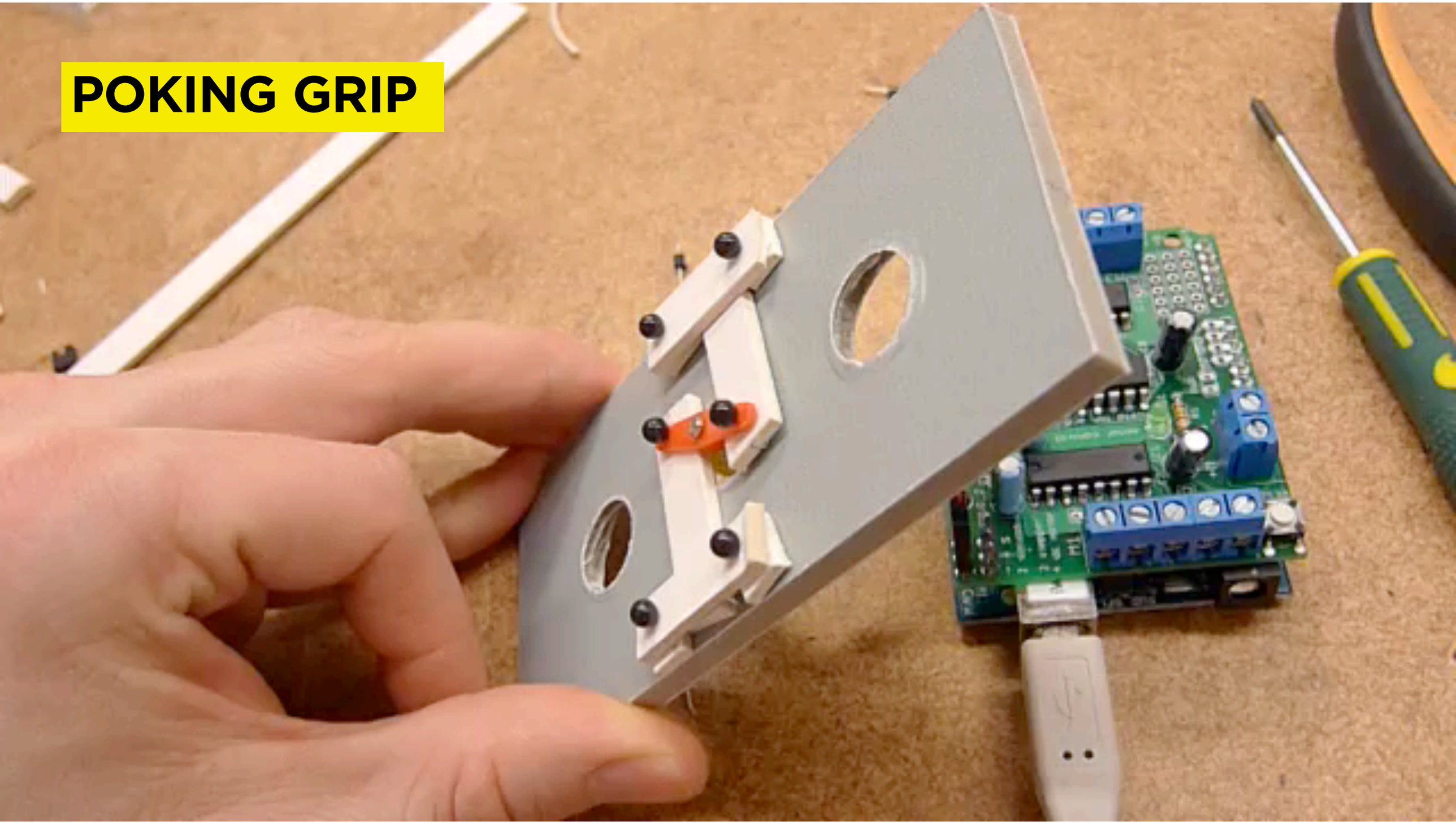


ENTERFACE'08 OUTCOMES

EXPERIMENT DESIGN
HEAD FIRST IN STATISTICAL ANALYSIS
REFINE MY CODING SKILLS (PYTHON + SCENE GRAPH)

NORDICHI 2008 WORKSHOP:
GUIDELINES FOR HAPTIC LO-FI PROTOTYPING

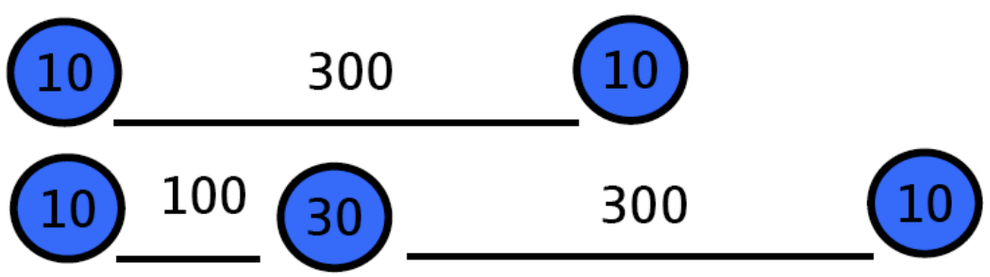
VIBRO GRIP


POKING GRIP

How do you describe and design haptic I/O?

Lexicon & vocabulary?

Notation system for I/O? Music, sequencer, etc.



Measurement unit for haptic? Audio => dB

Hardware based or perception based?

Does it work across devices, humans, contexts, brands?

grow, explode, shrink, scale, rotate, pulse, flick, rest, disappear, clutch, release, hold, capture, pin, prompt, confirm, repeat, stable, glide, slide, stop, hit, kick, cancel, ease in/out, ramp, augment, increase, decrease, agitate, shake, twist, transform, bounce, cycle, follow, guide, grab, screw, implode, circulate, constrain, channel, force, lead, invite, smooth, hard, harsh, solid, soft, compliant, bounce, spring, break, stop, collide, permute, accelerate, react

Related Works: Do It Yourself Haptics

The Art of Nonrealistic Usefulness and Realism Through Shortcuts

Hayward & MacLean, 2007

soft(n): Toward a Somaesthetics of Touch

Schiphorst, 2009

touch-effort	Description
tap	A soft, short, small, touch, rendered with a single finger.
pat	A bigger version of "tap" and a soft version of "slap". Usually rendered with an open hand or palm.
hold	A lingering, soft, big, touch. A hold is encompassing.
touch	"Touch" is a small version of "hold". An indication of comfort. Is rendered with the fingers, hand, or palm.
stroke	A traveling touch, soft but directional, rendered with fingers, hand or palm.
glide	A traveling, meandering, touch. Soft and directionless and rendered with the fingers, hand, or palm.
jab	A hard, short, small, touch. A hard poke by a finger or blunted object. Also known as "poke".
knock	A medium-sized, fist against, rapping hard. it is different than "jab" and "slap" in size only.
slap	An open-handed, hard, short, touch. In our scheme, a large version of "jab" and "knock".
press	This is a long, hard, touch.
rub	This is a moving, hard, touch.
knead	Kneading involves many fingers moving hard and in a slightly wandering fashion.
other touch-efforts not attempted in this system:	
punch	This is like a "knock", but is different in intensity and slightly different in timing.
flick	This is like a "jab", but a slightly different in shape over time. A "flick" wanders slightly more and a "jab" is more stationary.

Table 1: Touch Effort implemented onto Tactile Surface

Weight-Shifting Mobiles

Fabian Hemmert

Haptic design of vehicle interiors at AUDI
Werner Tietz, 2008

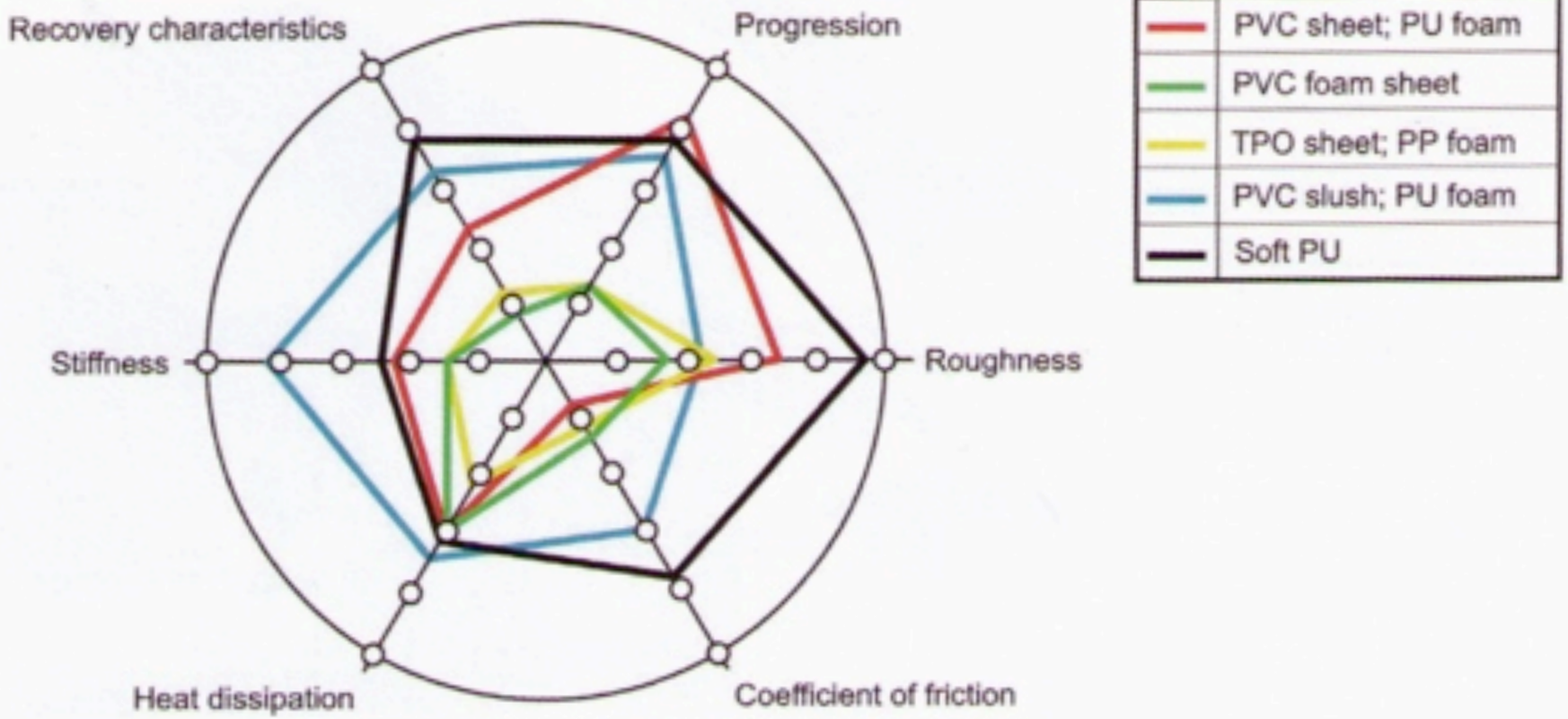


FIGURE 8. ASSESSMENT OF HAPTIC IMPRESSION BY MEASUREMENT

surface and his/her skin. Although it is possible to measure the quantities described above using suitable equipment, considerable deviations are found in the correlation between subjective perception and actual measurements.

The temperature perception reflects whether a surface feels 'warm' or 'cold'. The main factor in

objective, for example, is to achieve unifor in the softness of armrest surfaces, which be achieved by specific alteration of the stiff parameters.

The examples described here serve to an impression of the complexity of the con of 'haptics' for development of vehicle trim

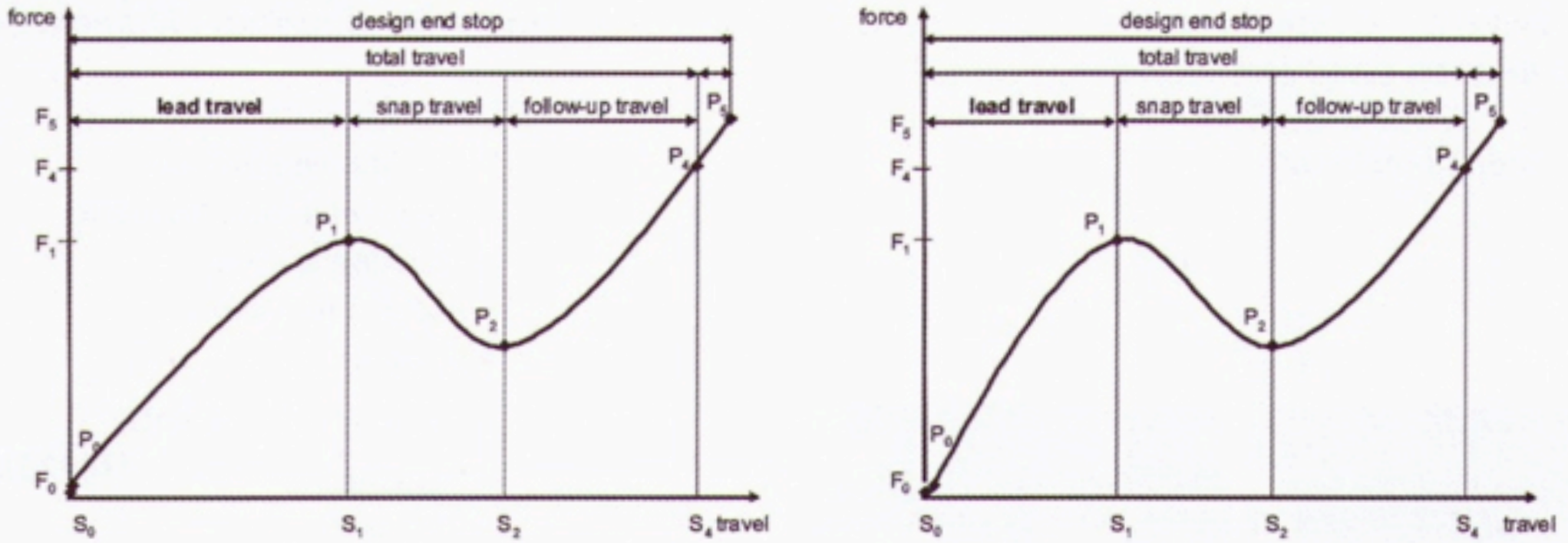


FIGURE 4. FORCE-TRAVEL CHARACTERISTIC: MODIFICATION OF LEAD TRAVEL TWICE

definition of variants the aim is to achieve maximum constancy of influencing factors which are not
swit
forc
contrast, is varied as systematically as possible
in order to clearly attribute differences in subjective assessment (dependent variable) to physical

ed (e.g., three conditions for lead travel x three conditions for snap travel). Figure 4 depicts sys-

variants being
te pair com-
parison, as used in psychophysics, is employed;
that is, each variant is compared to each other
variant with regard to various features. Paired

Haptics research at Daimler AG
Enigk, Foehl & Wagner, 2008

A Brief Taxonomy of Tactile Illusions and Demonstrations That Can Be Done In a Hardware Store

Vincent Hayward, 2008

Sec.	Name	Demonstrability	Stability	Analogs
2.1	Diplesthesia	Household	Not robust	Debatable
2.2	Funneling	Setup	Robust	Debatable
2.2	Cutaneous rabbit	Setup	Robust	Debatable
2.3	Size constancy failure	Household	Robust	Visual
2.4	Blackboard and parchment-skin	Household & setup	Robust	Cross modal
2.5	Weight-size and weigth-X	Household	Robust	Cross modal
2.6	Numerosity of taps from beeps	Setup	Robust	Cross modal
2.6	Numerosity of flashes from taps	Setup	Robust	Cross modal
2.7	Change numbness	Setup	Robust	Auditory and visual
2.8	Temporal ordering	Setup	Robust	Auditory and visual
2.9	Pseudo-haptic effects	Any computer	Moderate	Cross modal
2.10	Comb	Household & hardware	Robust	Tactile specific
2.10	Tactile lens	Specialized device	Robust	Tactile specific
2.10	Fishbone	Household & hardware	Robust	Tactile specific
2.10	Curved plate	Household & hardware	Robust	Tactile specific
2.10	Tactile barber pole	Hardware	Robust	Visual analog
2.11	Müller-Lyer *et alia*	Household & hardware	Moderate	Visual analogs
2.12	Kinaesthetic effects	Household	Robust	Visual analogs
2.12	Force by acceleration asymmetry	Setup	Robust	Tactile specific
2.13	Distal attribution	Household	Robust	Visual and auditory
2.13	Rolling ball	Setup	Robust	Auditory
2.14	Tactile Motion after-effect	Setup	Moderate	Visual and auditory
2.14	Weight after-effect	Household	Robust	Visual and auditory
2.14	Shape after-effect	Household	Robust	Visual
2.15	Texture force fields	Setup	Robust	Haptic specific
2.15	Corner smoothing	Setup	Robust	Haptic specific
2.15	Bump/holes	Hardware	Robust	Haptic specific

Mechanical non-programmable devices
Vincent Hayward, 2008

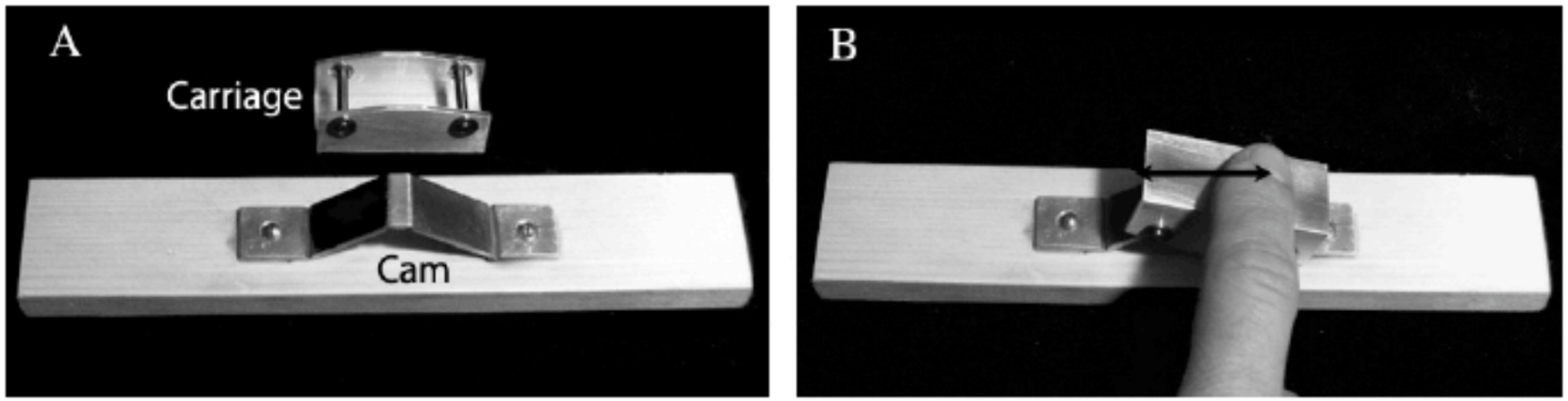


Figure 6: Mechanical delivery of the "curved plate illusion" [22]. (A) The device has a cam made of a bent metal strip which is secured to a wood base and a carriage having two rollers mounted on ball-bearings. Dimensioning is given in appendix. (B) Finger exploring the illusory curvature. For some subjects, the effect is more pronounced when the exploration is fore-aft rather than sideways. In any case it is important that the mechanism has little friction and produces little mechanical noise. These types of disturbances are prone to destroy or weaken the illusion. It is also important to press down lightly.

PUBLICATIONS

IASDR, WORKSHOPS AND SEMINARS

Designing for Touch: Creating and Building Meaningful Haptic Interfaces

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Abstract: This paper presents our initial findings about the problems and challenges of designing haptic interfaces. We support our discussion with observations and analysis of design activities realized in by our research group and design students. We conclude with initial ideas about how to structure, document and evaluate haptic qualities in the design process. Our hope is to expose the many questions and issues in this nascent design activity to eventually expand our haptic design toolbox and library, and bring consistency and rigor within the field.

Key words: Haptics, Multimodal, Touch sense, Prototyping, Design Tools, Sketching in Hardware.

1. Introduction

Over the years, design researchers and practitioners have refined our understanding and mastery of building systems that human can interact with relative ease and success. Most of the systems and devices surrounding us can now sense, monitor and track our commands, actions and movements via diverse input mechanisms or interfaces spanning many if not all of our senses. Unfortunately, the output repertoire of these systems is generally limited to the visual (indicators, pixels, etc) and auditory channels. Very few systems actively engage with users over our other senses.

Sketching and prototyping haptic interfaces: design challenges and insights

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ABSTRACT

This article explores and discusses some challenges of prototyping haptic (touch) interfaces early on in the design process. Using examples of prototyping activities for haptic interfaces that have strong 'sketching qualities', this paper elaborates on different prototyping levels and the consequences on fidelity, construction requirements and technical skills. It concludes by proposing various guidelines or insights relevant to the design of haptic interfaces by designers.

Categories and Subject Descriptors

and applications [4][8] have made it more accessible to build tangible and interactive systems that interact with the physical world. Can these tools help prototype and sketch non-traditional interfaces quickly and efficiently?

2. SKETCHING HAPTIC INTERFACES

The skin is a very complex, resilient and refined organ. It offers extreme sensitivity and tremendous capabilities as a medium between the external world (objects and environment) and us. The sense of touch is relatively well understood and documented

CHALLENGES AND DIFFICULTIES

Perception of touch: a collection of small and converging cues

Problems verbalizing and communicating sensations

Synthesizing movement and haptic feedback is not trivial, can be highly technical

Often technical problems/issues (i.e stiffness, latency) completely kill the interaction

Formal evaluation and comparison is impossible

Have to build stuff to inform/grasp/evaluate/discuss

QUALITIES AND AESTHETICS OF HAPTIC INTERFACES

Difficult balance between aesthetic and functional qualities

Haptic interfaces generally don’t fit well in our tactile eco-system

Naturalistic interactions are a good fit, but not an absolute rule

Timing, quality/precision, consistency, robustness, others [MacLean]

Tight sensory coupling seems appreciated

MSRC INTERNSHIP

SPRING 2010 - RICHARD BANKS, SOCIO-DIGITAL SYSTEMS

DESIGN CONSTRAINTS FOR MY MSRC INTERNSHIP

Build 4-5 demos in 12 weeks

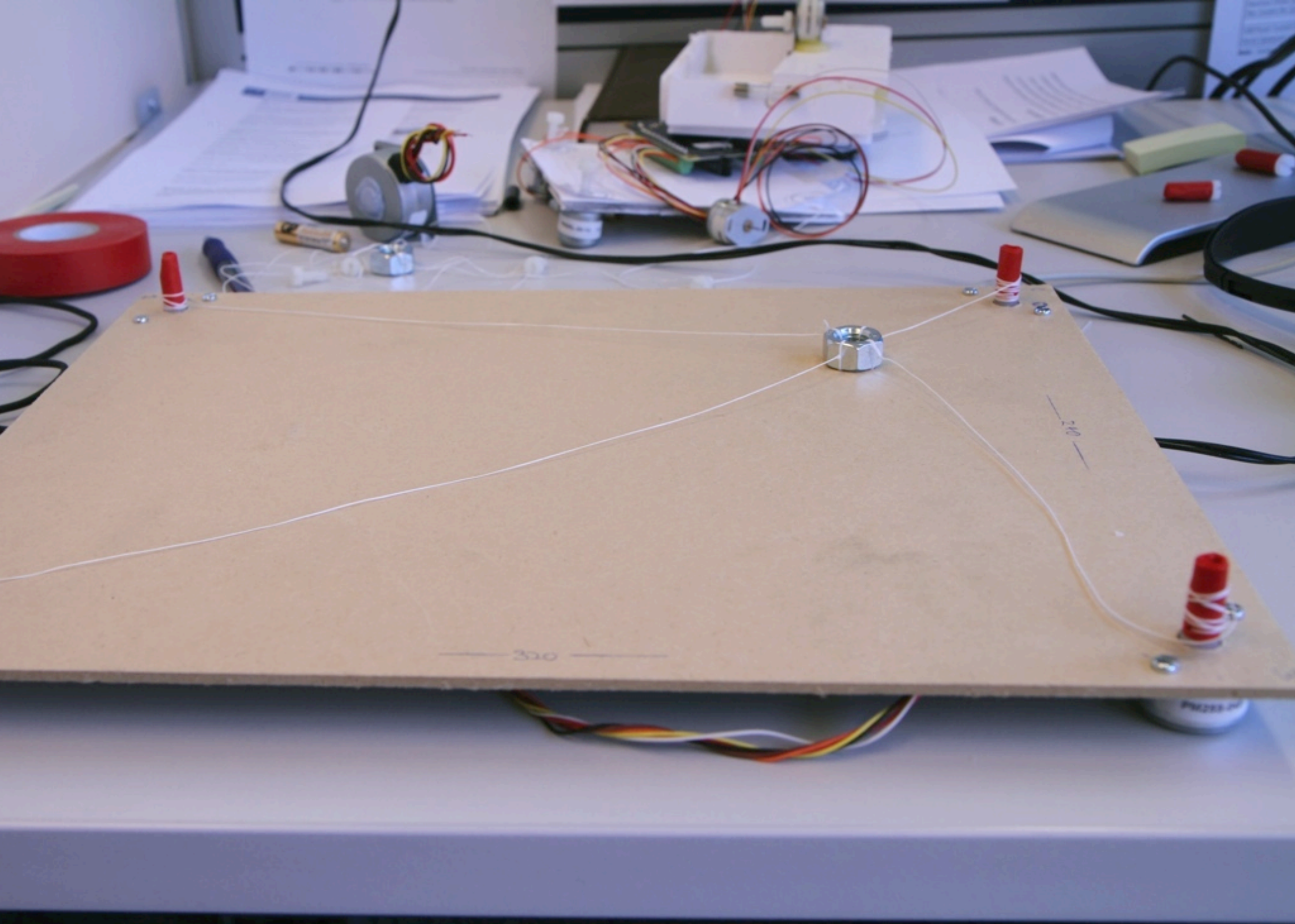
Handheld, ungrounded, fixed shell & size, one material (MDF)

Linked with UI, if appropriate

Simple components and parts (no high-end solutions)

Stimulation first, more abstract than feasible

Self-service (no experimenter intervention)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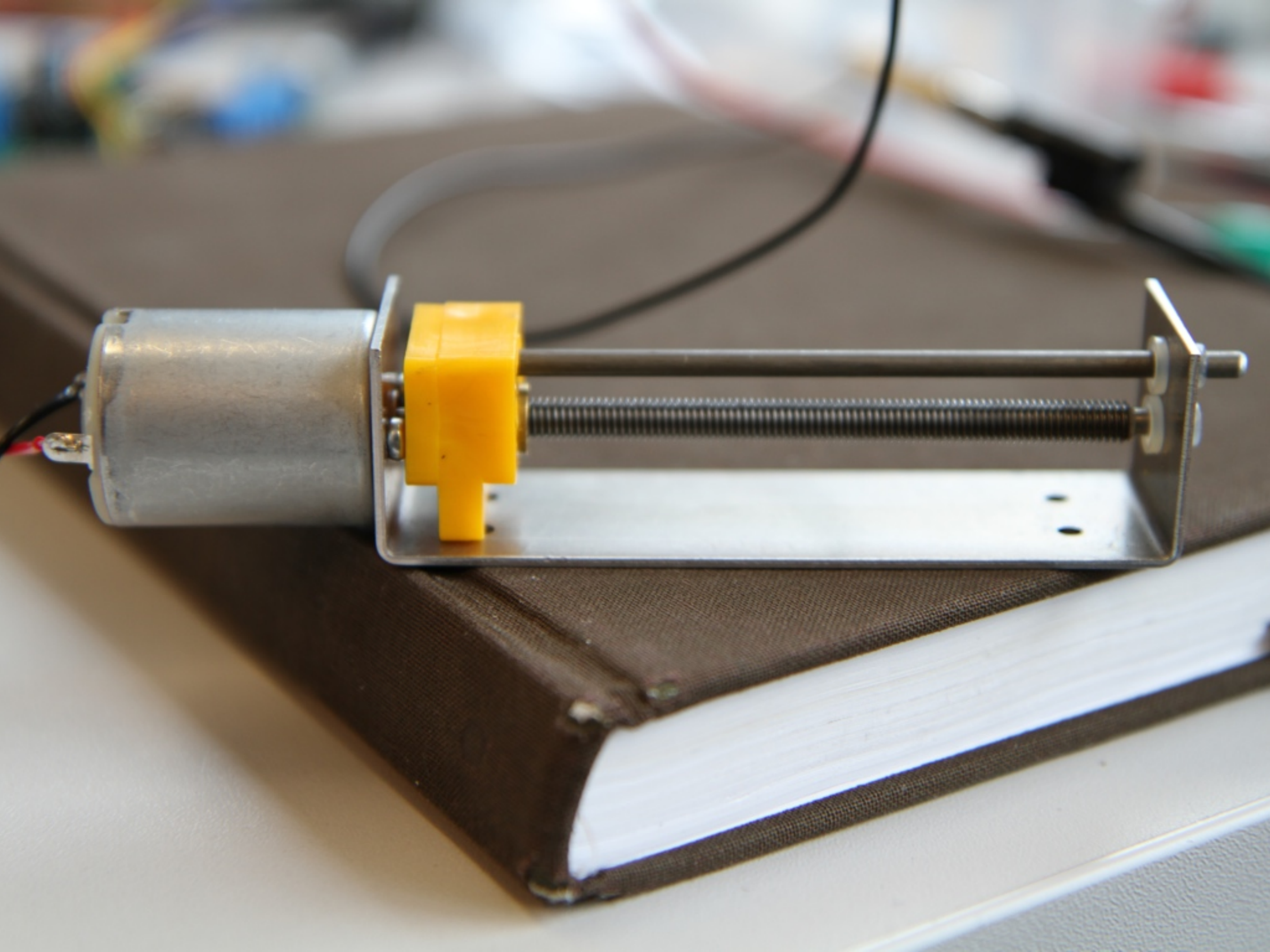
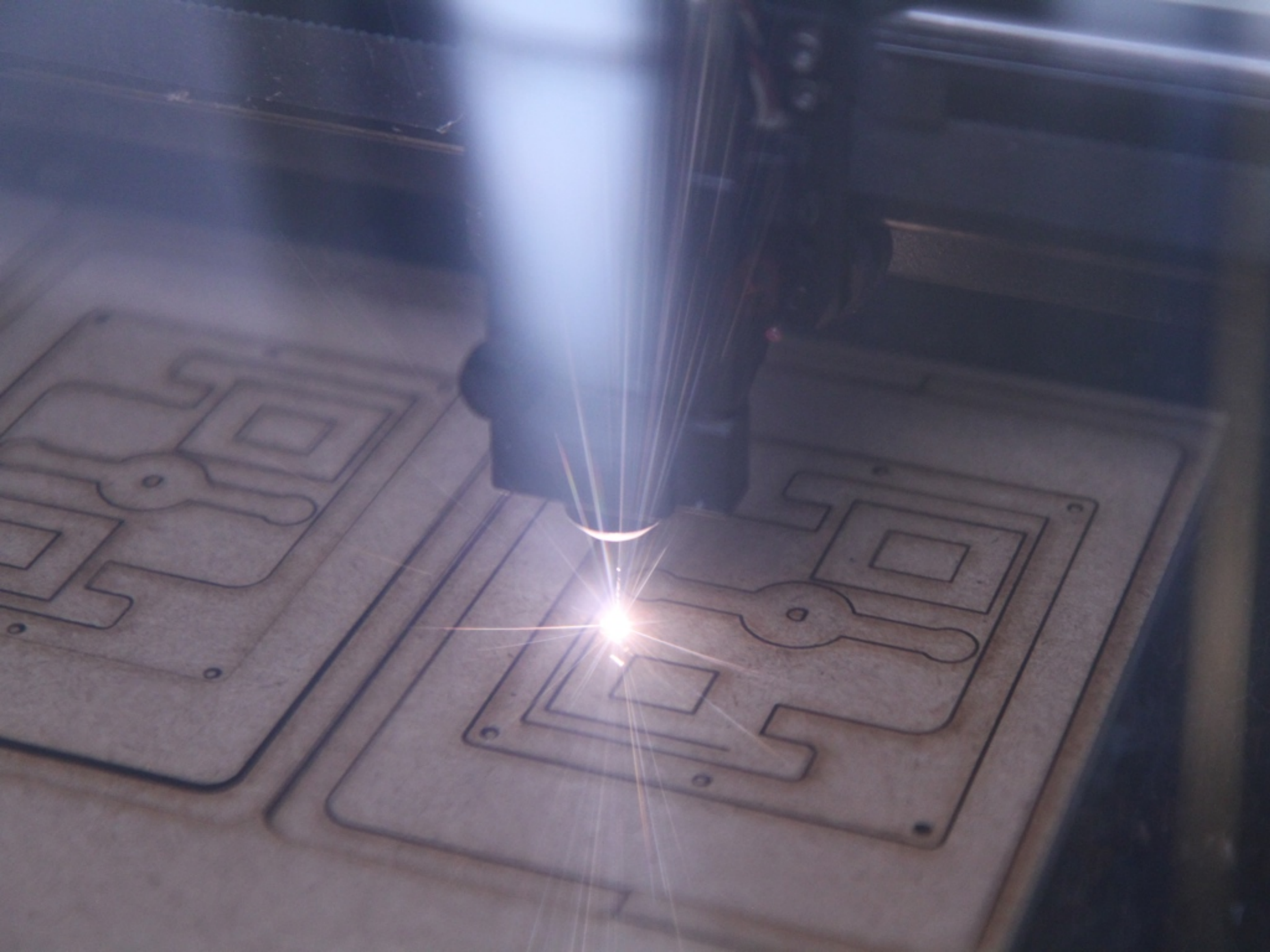
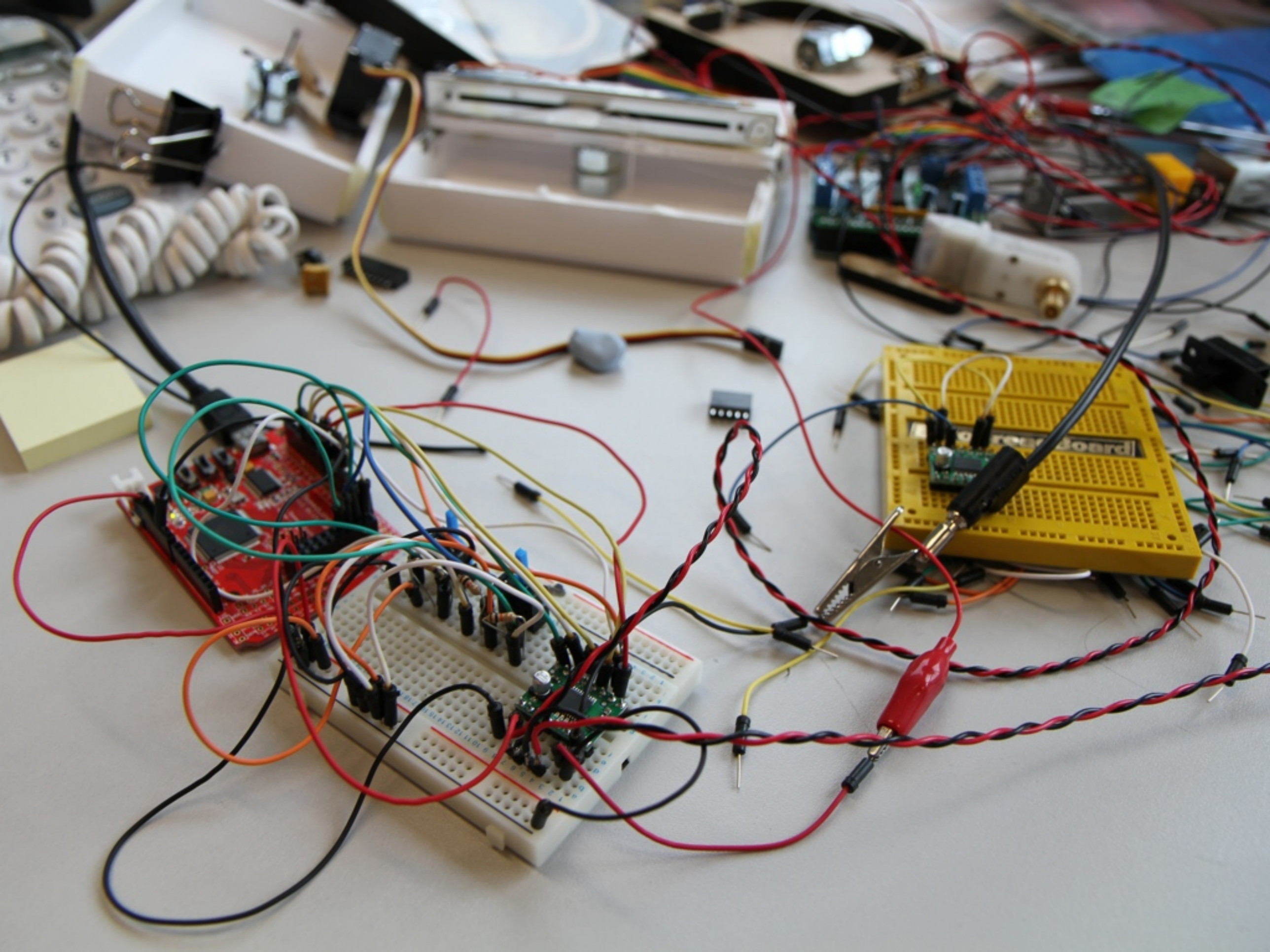


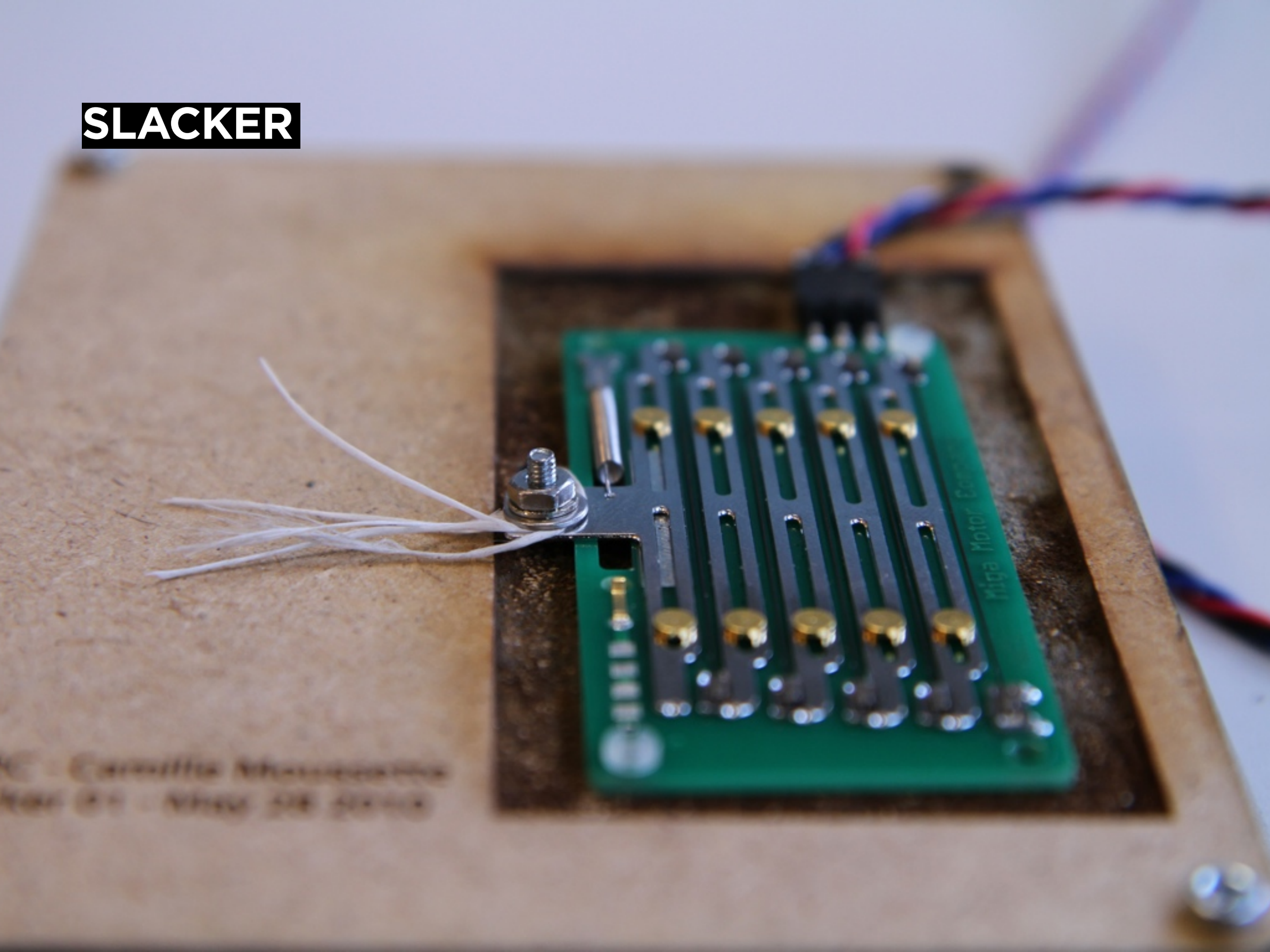




SLACKER

SLACKER

SLACKER



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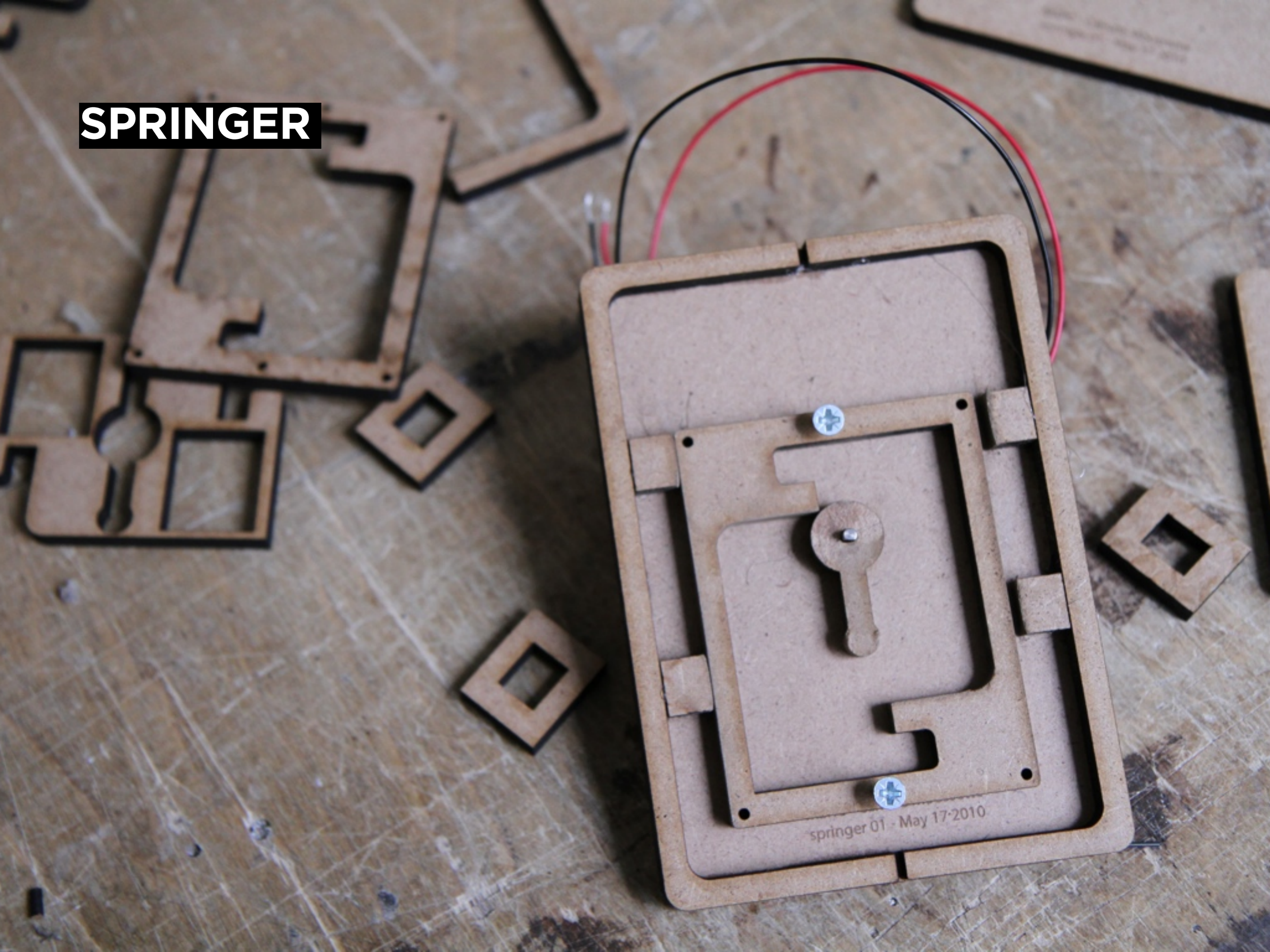

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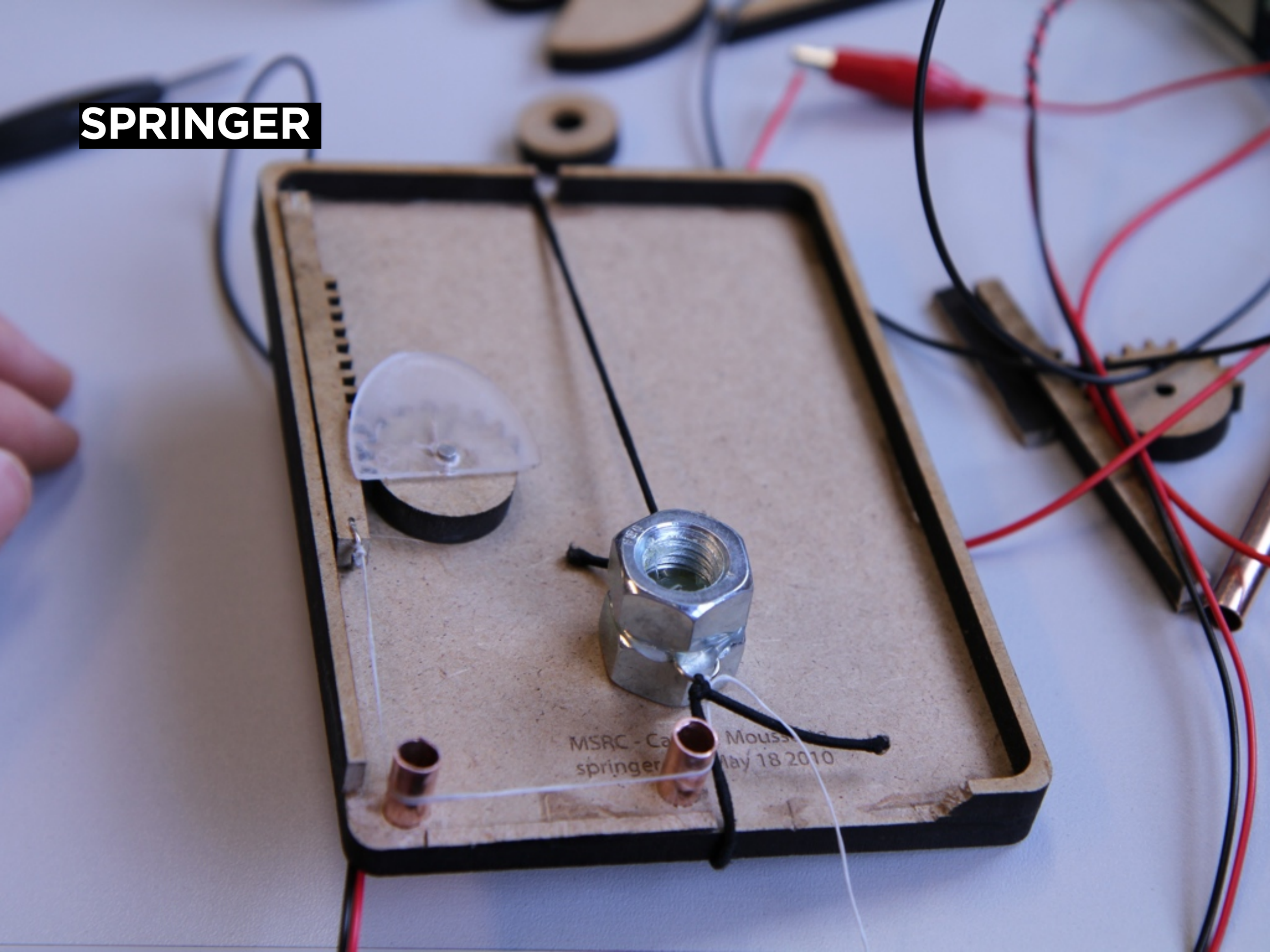


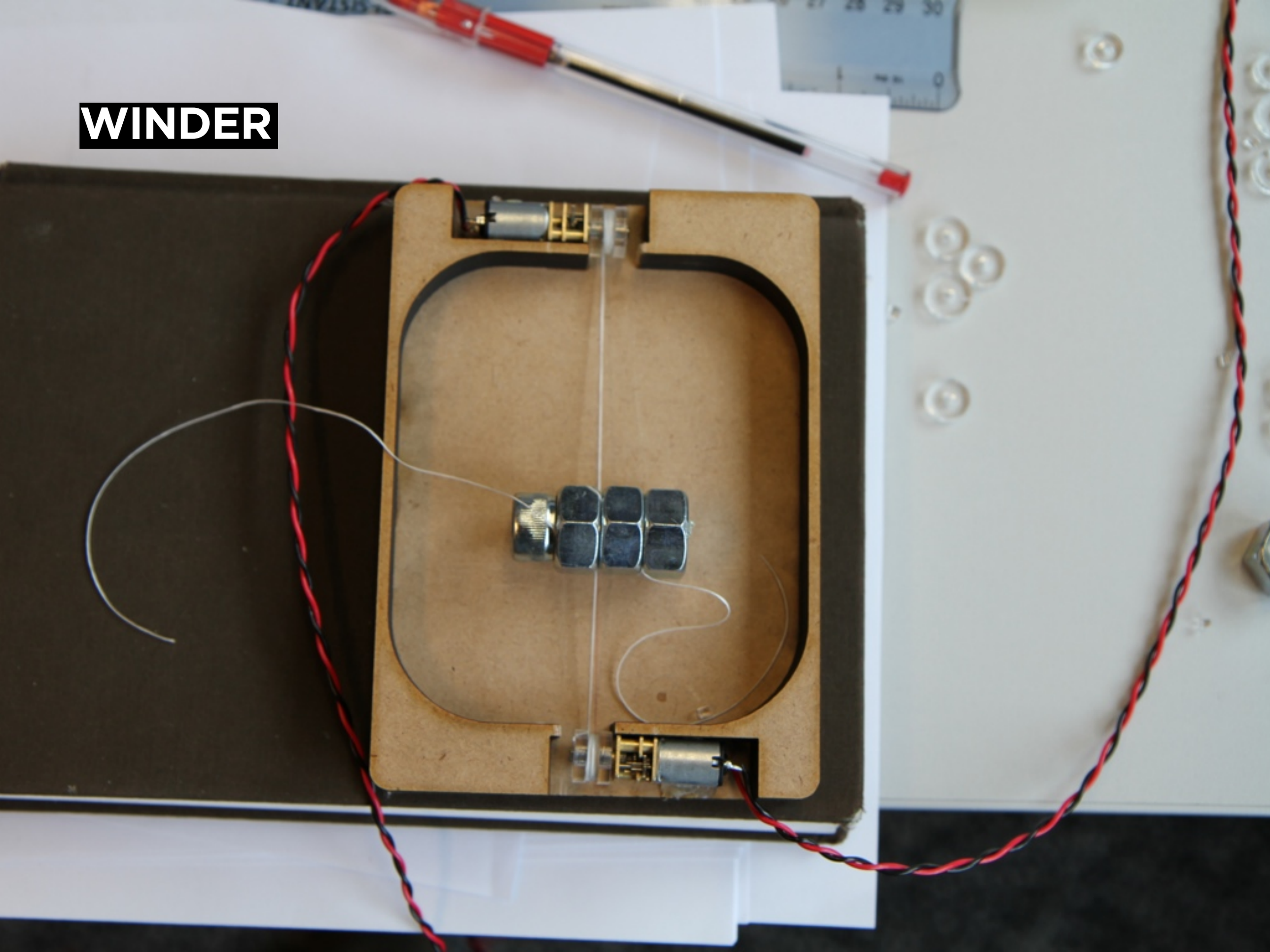
SPRINGER

SPRINGER

MSRC - Camille Moussette
springer 07 - June 18 2010

WINDER

WINDER



WINDER

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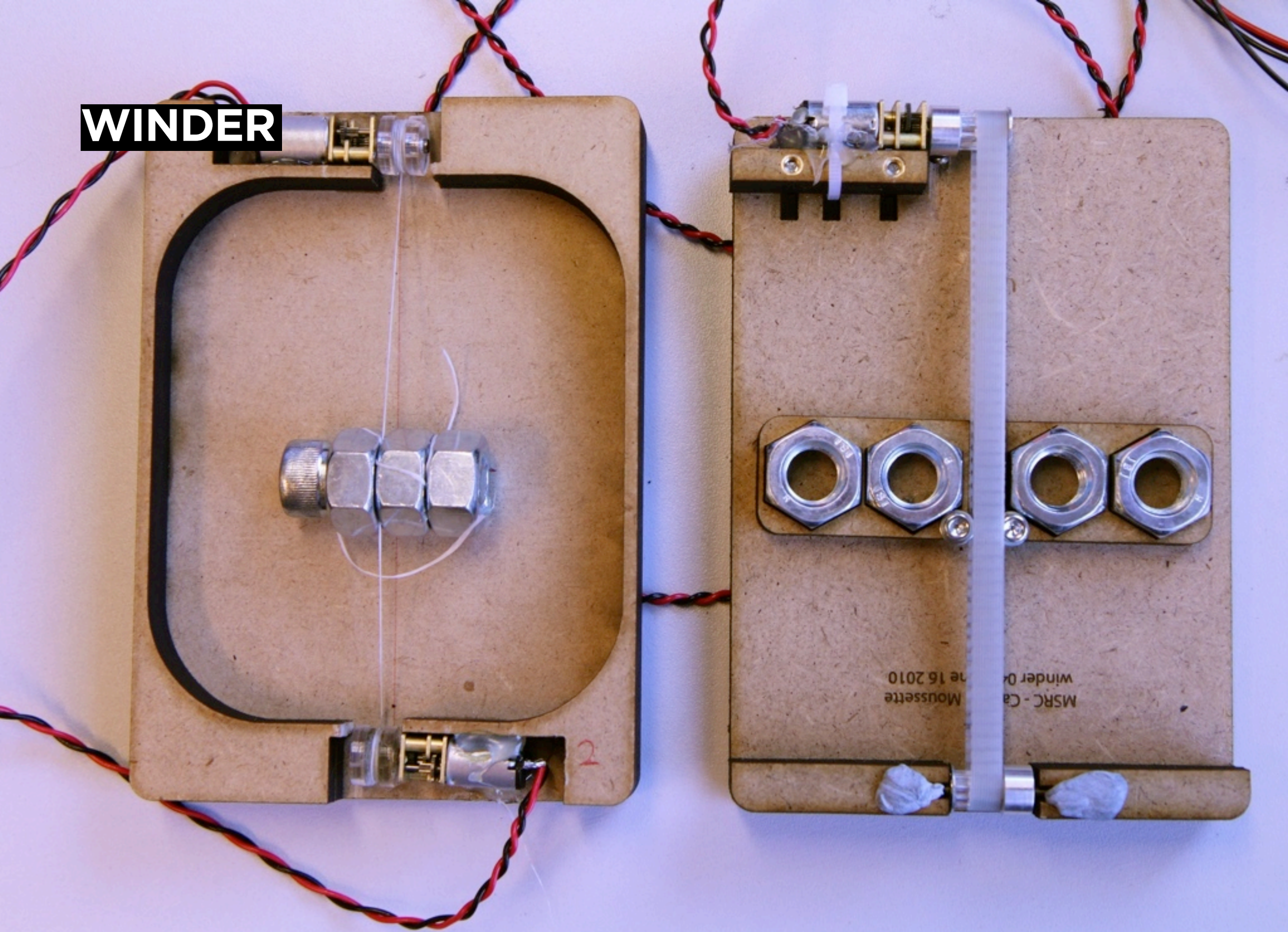


SPINNER

SPINNER

SPINNER

SPINNER

SLIDER

SLIDER

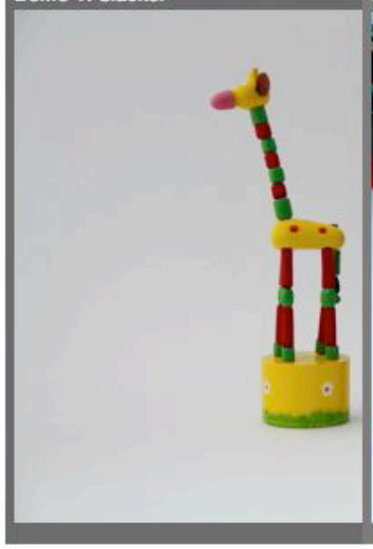
SLIDER

MSRC Internship Report - Camille Moussette

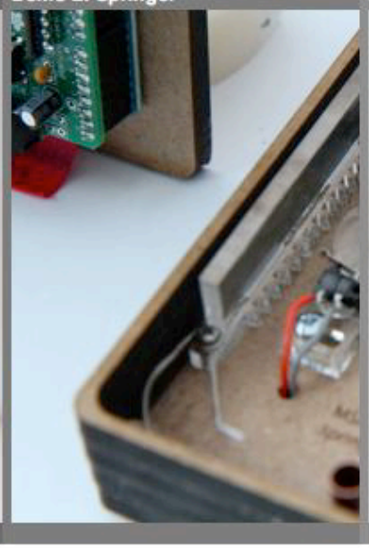
Microsoft Research

Simple Haptics

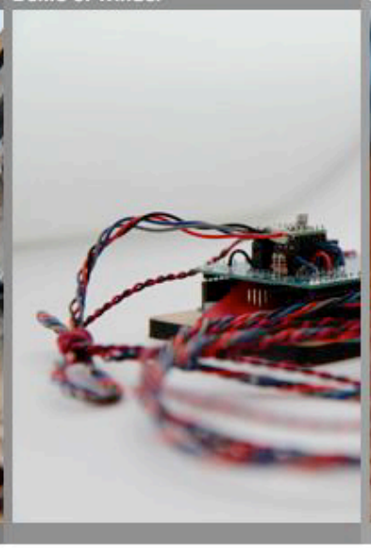
Demo 1: Slacker



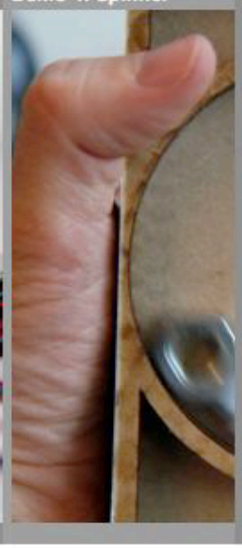
Demo 2: Springer



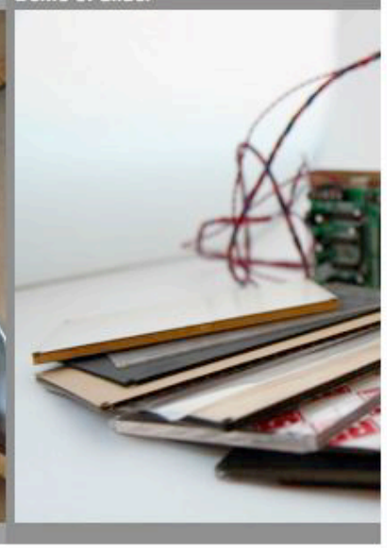
Demo 3: Winder



Demo 4: Spinner



Demo 5: Slider



INTRODUCTION

This is a report of my internship activities realized from April to June 2010 at Microsoft Research Cambridge under the supervision of Richard Banks.

Process & Activities

- **Literature Review**
- **Building Stuff**
- **Demo 1: Slacker**
- **Demo 2: Springer**
- **Demo 3: Winder**
- **Demo 4: Spinner**
- **Demo 5: Slider**
- **Final Presentation**

Weekly logs

- **Week 1**
- **Week 2**
- **Week 3**
- **Week 4**
- **Week 5**
- **Week 6**
- **Week 7**
- **Week 8**
- **Week 9**
- **Week 10**
- **Week 11**
- **Week 12**

Work documents

- **Arduino & Processing**
- **Laser cutting**
- **Presentation**
- **Photos: general**
- **Photos: final**
- **Videos**

FINDINGS AND INSIGHTS

Assembly technique matters (glued vs screwed)

Noise is almost inevitable and always felt

Exploit material properties

Absolute vs relative change (specially for CoM)

A good medium for shared understanding

Technical but valuable

Build modular (parts, connectors, controls)

DEMOS + SHORT BREAK

MID-PHD PRESENTATION

MY PHD PROJECT

RECAP FIRST 3 YEARS

RESEARCH INQUIRIES & PERSPECTIVES

PROTOTYPING AND SKETCHING IN HARDWARE

HAPTICS

DEMOS - BREAK

THEORETICAL GROUNDS AND POSITIONING MY PHD

NEXT 2 YEARS

WHAT ARE MY THEORETICAL GROUNDS?

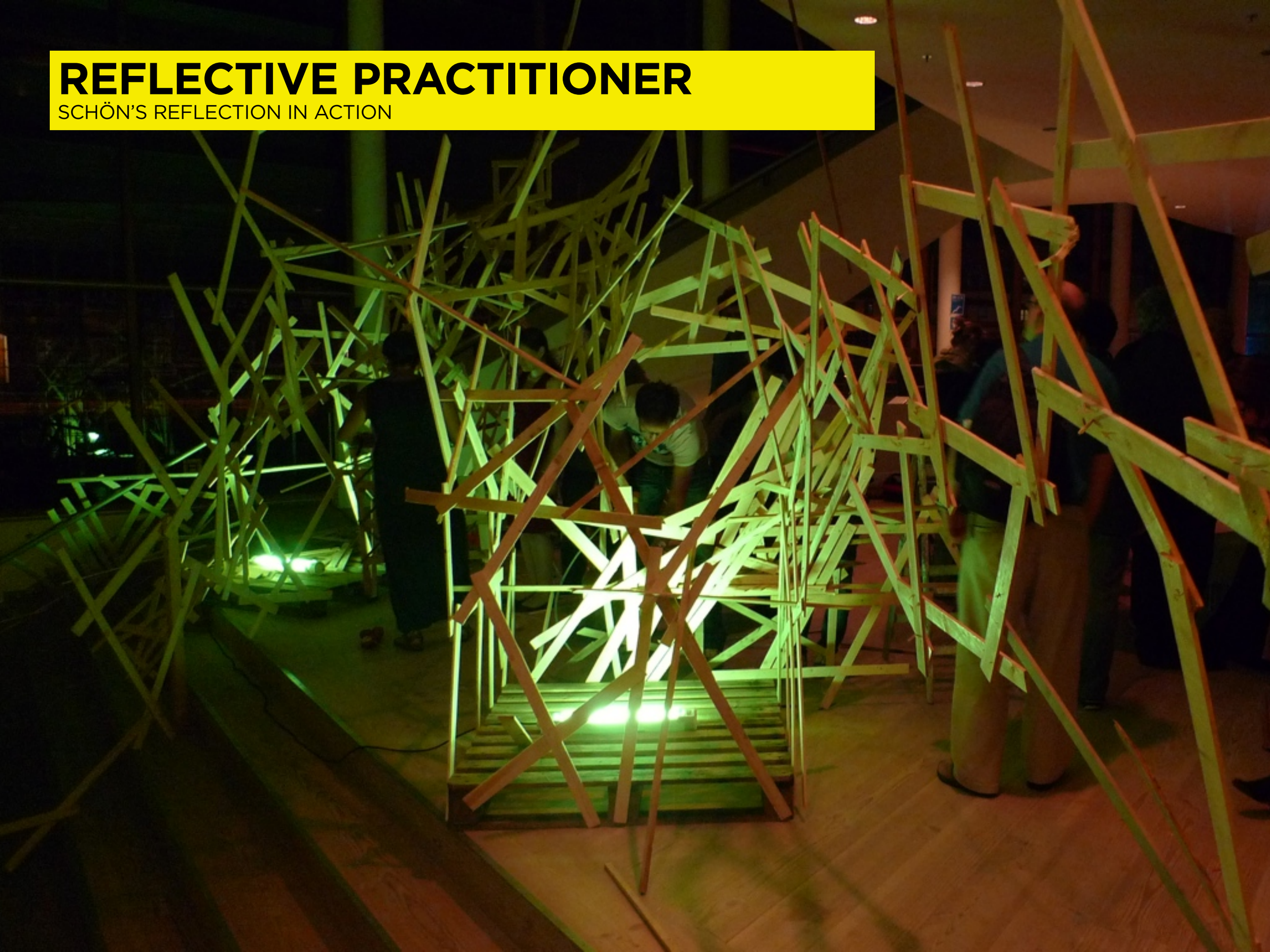
HOW DO I POSITION MY PHD WORK?

WHAT IS MY CONTRIBUTION?

RESEARCH **THROUGH** DESIGN

REFLECTIVE PRACTITIONER

SCHÖN'S REFLECTION IN ACTION

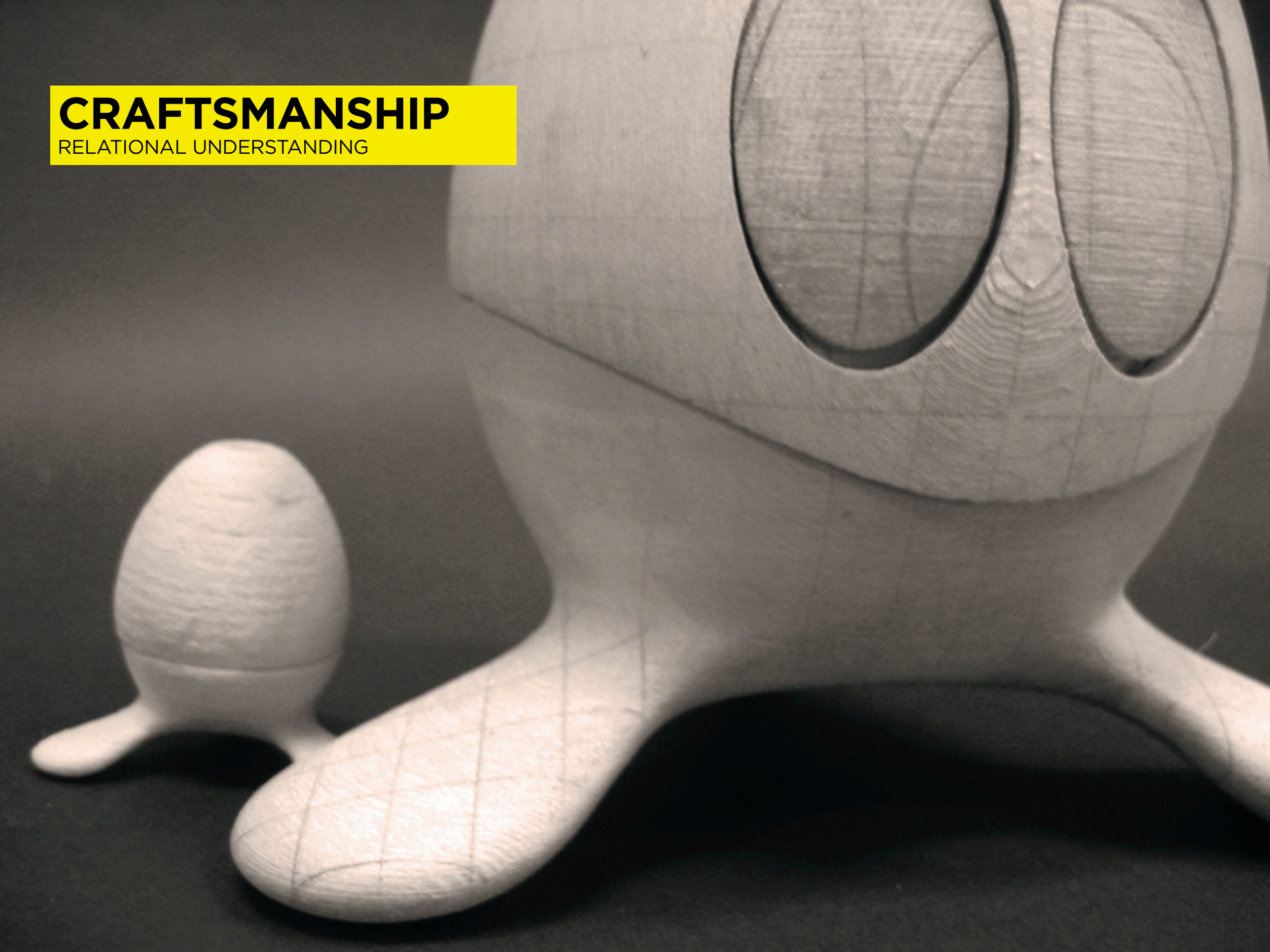


EMBODIED/TANGIBLE INTERACTION

PHYSICAL, ABSTRACT AND SYMBOLIC REPRESENTATIONS

CRAFTSMANSHIP

RELATIONAL UNDERSTANDING



"... is an enduring, basic human impulse, the desire to do a job well."

Richard Sennett, *The Craftsman*

MAKING KNOWLEDGE - EXPERTISE

Design Through Making

HOMO FABER

INTELLIGENCE, HENRI BERGSON

FACULTY TO CREATE ARTIFICIAL OBJECTS, IN PARTICULAR TOOLS TO MAKE TOOLS, AND TO INDEFINITELY VARIATE ITS MAKINGS.

CONTRIBUTION

RELEVANCE AND POSITION IN THE FIELD

CONTRIBUTION

IN IXD, NOT INVENTING NEW HAPTIC TECHNLOLY

TRAJECTORIES

DOCUMENTING MY ACTIVITIES AND INTELLECTUAL WHEREABOUTS

NEXT 2 YEARS

2 **SKETCHING HAPTICS WORKSHOPS** THIS FALL
WINTER 2011 - **SKINPUT PROJECT** AT MICROSOFT RESEARCH

NEXT 2 YEARS

FRAME AND WRITE THESIS

THESIS OUTLINE

PROTOTYPING AND SKETCHING IN HARDWARE

- PROTOTYPES, SKETCHES, MATERIALIZATION OF DESIGN HYPOTHESES
- HOMO FABER & REFLECTION THROUGH MAKING
- CRAFTSMANSHIP IN/FOR IXD

SIMPLE HAPTICS

- DESIGNING HAPTIC INTERFACES, TOOLS AND CHALLENGES
- EVOLVING AN UNDERSTANDING AND VOCABULARY FOR HAPTIC
- TOOLKIT FOR HAPTIC IXD DESIGN

THEORETICAL GROUNDS AND PERSPECTIVES

- HEIGHTENED SENSITIVITY FOR HAPTIC DESIGN

SIMPLE HAPTICS SKETCHING TOOLS FOR HAPTIC INTERACTION DESIGN

OPEN QUESTIONS

PHD INDUSTRIAL DESIGN?

RELEVANCE AND RIGOR IN MY WORK

INTELLECTUAL MOTIVATION AND PERSPECTIVE

MOVING FORWARD >> PACKAGE THESIS

CONTRIBUTION, TO WHOM, WHERE, WHAT ???

SEE YOU IN 2 YEARS!

Camille Moussette