ICTP SciFabLab:
lessons learned in science education

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ICTP SCI FAB LAB
scifablab.ictp.it

The Abdus Salam
International Centre
for Theoretical Physics

Scientific Fabrication Laboratory

since August 12, 2014

What is a FabLab?

A *fab lab* (*fabrication laboratory*) is a small-scale workshop offering (personal) digital fabrication facilities.

A FabLab is generally equipped with an array of *flexible computer-controlled tools* that cover several different length scales and various materials, with the aim to *make "almost anything"*.

FabLab: an academic idea

- The concept of a FabLab was first imagined at the Center for Bits and Atoms (CBA) at the Media Lab in the Massachusetts Institute of Technology, in 2001.

- The paradigm was established in 2005 with The famous book by Neil Gershenfeld "Fab: the coming revolution on your desktop—from personal computers to personal fabrication".

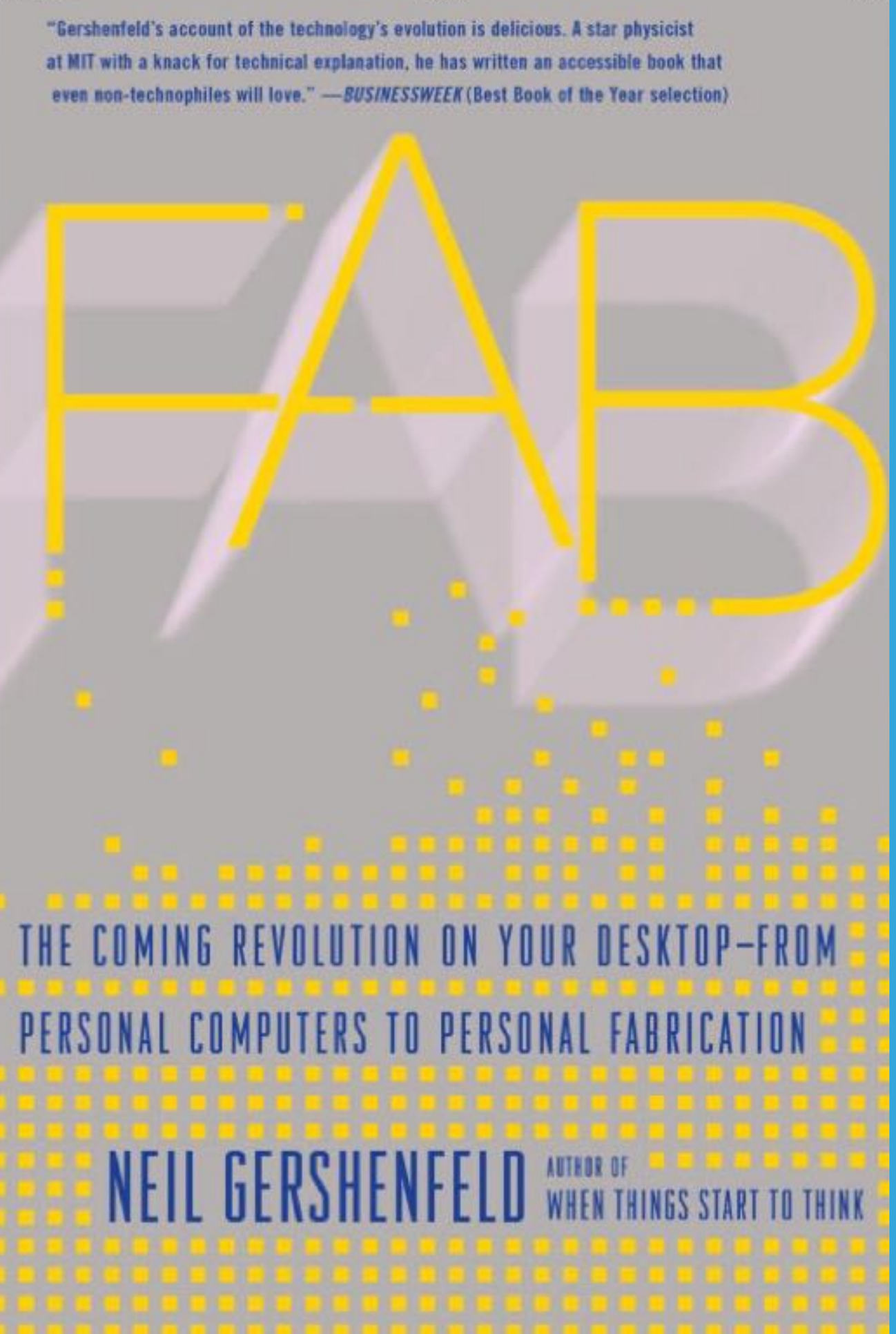
CENTER FOR BITS AND ATOMS

MIT MEDIA LAB

E15-001
LEGO Learning Laboratory

Smart Cities
Computing Culture
Lifelong Kindergarten

Center for Bits and Atoms



FAB: THE COMING REVOLUTION ON YOUR DESKTOP –FROM PERSONAL COMPUTERS TO PERSONAL FABRICATION

Neil Gershenfeld, 2005

FAB, PAG. 14:

In 1998 we tried teaching "How To Make (almost) Anything" for the first time. The course was aimed at the small group of advanced students who would be using these tools in their research. Imagine our surprise, then, when a hundred or so students showed up for a class that could hold only ten. They weren't the ones we expected, either; there were as many artists and architects as engineers. And student after student said something along the lines of "All my life I've been waiting to take a class like this," or "I'll do anything to get into this class." Then they'd quietly ask, "This seems to be too useful for a place like MIT —are you really allowed to teach it here?"

Students don't usually behave that way. Something had to be wrong with this class, or with all the other classes I taught. I began to suspect the latter.

FAB, PAG. 23:

This thought led to the launch of a project to create field "fab labs" for exploring the implications and applications of personal fabrication in those parts of the planet that don't get to go to MIT. As you wish, "fab lab" can mean a lab for fabrication, or simply a fabulous laboratory. Just as a minicomputer combined components—the processor, the tape drive, the keypunch, and so forth—that were originally housed in separate cabinets, a fab lab is a collection of commercially available machines and parts linked by software and processes we developed for making things. The first fab labs have a laser cutter to cut out two-dimensional shapes that can be assembled into three-dimensional structures, a sign cutter that uses a computer-controlled knife to plot flexible electrical connections and antennas, a milling machine that moves a rotating cutting tool in three dimensions to make circuit boards and preci-

Neil Gershenfeld:

Unleash your creativity in a Fab Lab

TED2006 · 17:18 · **Filmed** Feb 2006

17 subtitle languages

View interactive transcript

MIT professor Neil Gershenfeld talks about his Fab Lab — a low-cost lab that lets people build things they need using digital and analog tools. It's a simple idea with powerful results.

FABLAB (DEFINITION)

A Fab Lab is a **technical prototyping platform for innovation and invention**, providing stimulus for local entrepreneurship. A Fab Lab is also a **platform for learning and innovation**: a **place to play, to create, to learn, to mentor, to invent**. To be a Fab Lab means **connecting to a global community** of learners, educators, technologists, researchers, makers and innovators- -a knowledge sharing network that spans 30 countries and 24 time zones. Because all Fab Labs share common tools and processes, the program is building a global network, a distributed laboratory for research and invention.

A Fab Lab is comprised of off-the-shelf, industrial-grade fabrication and electronics tools, wrapped in open source software and programs written by researchers at MIT's Center for Bits & Atoms. Currently Fab Labs include a laser cutter that makes 2D and 3D structures, a sign cutter that plots in copper to make antennas and flex circuits, a high-resolution NC milling machine that makes circuit boards and precision parts, a large wood router for building furniture and housing, and a suite of electronic components and programming tools for low-cost, high-speed microcontrollers for on-site rapid circuit prototyping. Originally designed for communities as prototyping platforms for local entrepreneurship, Fab Labs are increasingly being adopted by schools as platforms for project-based, hands-on STEM education. Users learn by designing and creating objects of personal interest or import. Empowered by the experience of making something themselves, they both learn and mentor each other, gaining deep knowledge about the machines, the materials, the design process, and the engineering that goes into invention and innovation. In educational settings, rather than relying on a fixed curriculum, learning happens in an authentic, engaging, personal context, one in which students go through a cycle of imagination, design, prototyping, reflection, and iteration as they find solutions to challenges or bring their ideas to life.

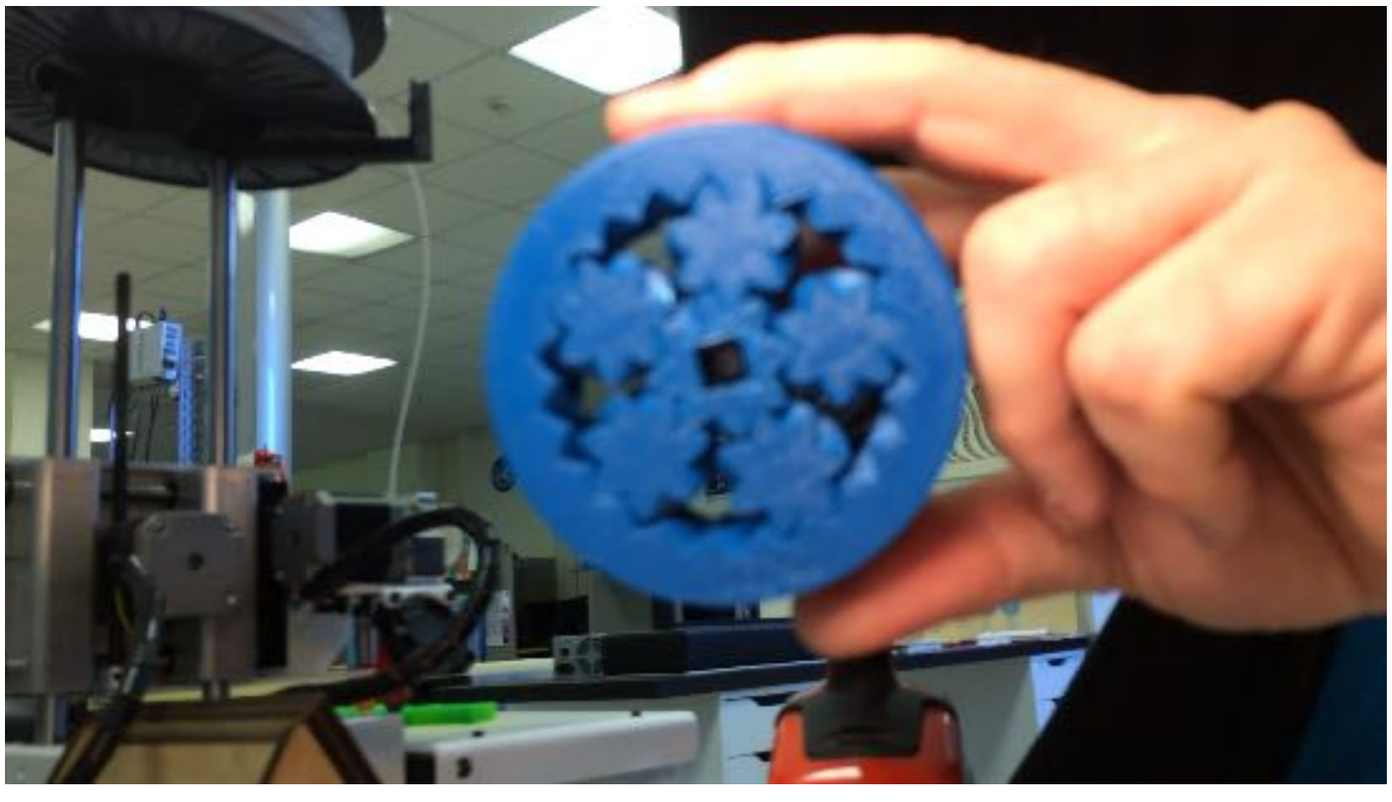
FABFOUNDATION

Source: http://www.fabfoundation.org/fab-labs/what-is-a-fab-lab/

FabLab = $(d\mathbb{F} \times \vec{\mathbf{p}})^{\mathcal{S}}$

Three key components
(plus one!)

- **digital fabrication** technologies
- rapid **prototyping**
- **sharing** of skills and experiences through Internet



PEOPLE, TOOLS & MACHINES

PEOPLE (MAKERS)

- At the very center of a FabLab are we, the people, the ones who make, the *makers…*

- …out of curiosity, passion, sometimes also for work, but mainly because they like to make something with their own hands...

(DIGITAL) TOOLS

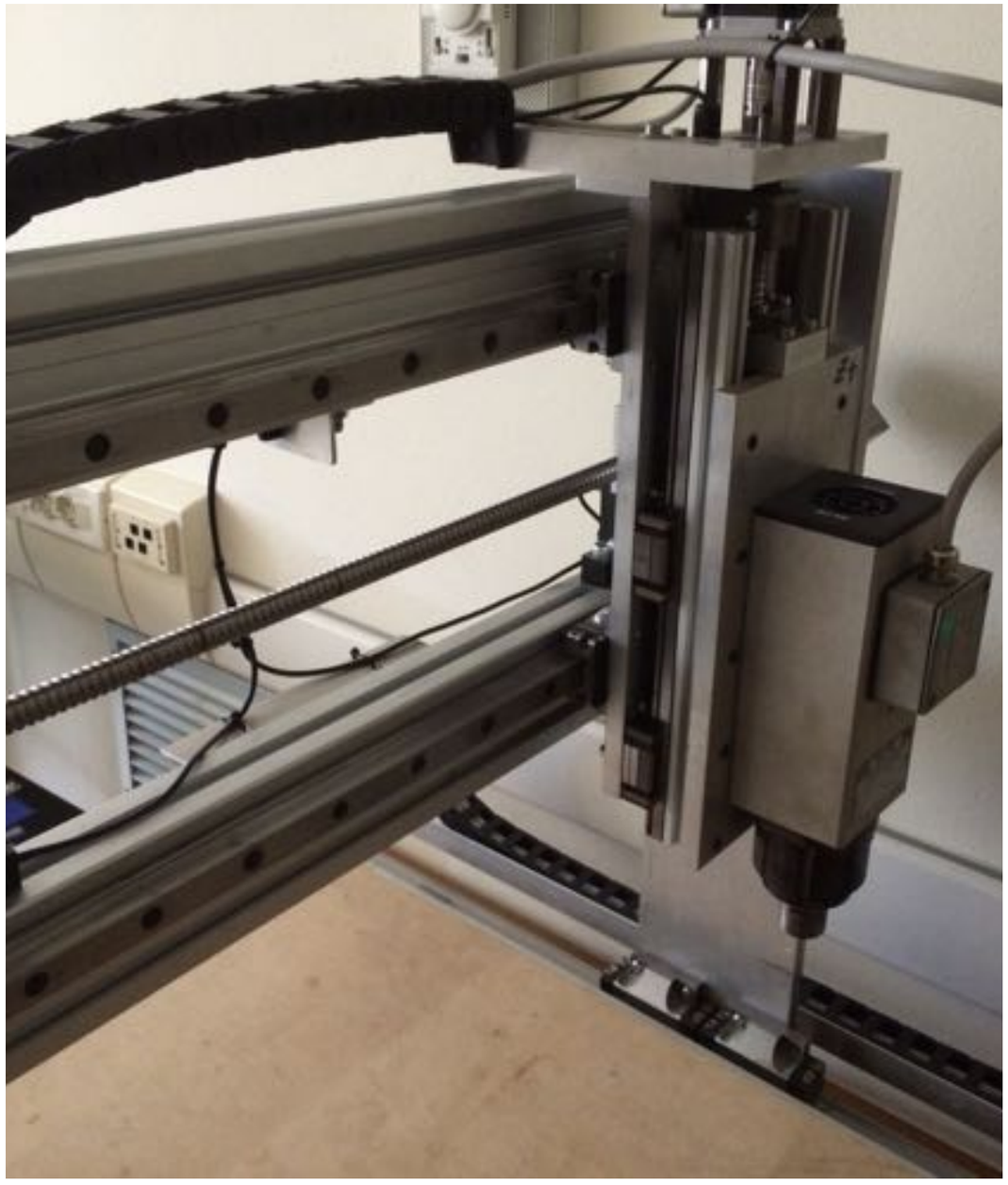
- A computer-controlled lasercutter, for press-fit assembly of 3D structures from 2D parts

- A larger (120x240cm) numerically-controlled milling machine, for making furniture- (and house-) sized parts

- A signcutter, to produce printing masks, flexible circuits, and antennas

- A precision (micron resolution) milling machine to make three-dimensional molds and surface-mount circuit boards

- Programming tools for low-cost high-speed embedded processors



http://fab.cba.mit.edu/about/faq/

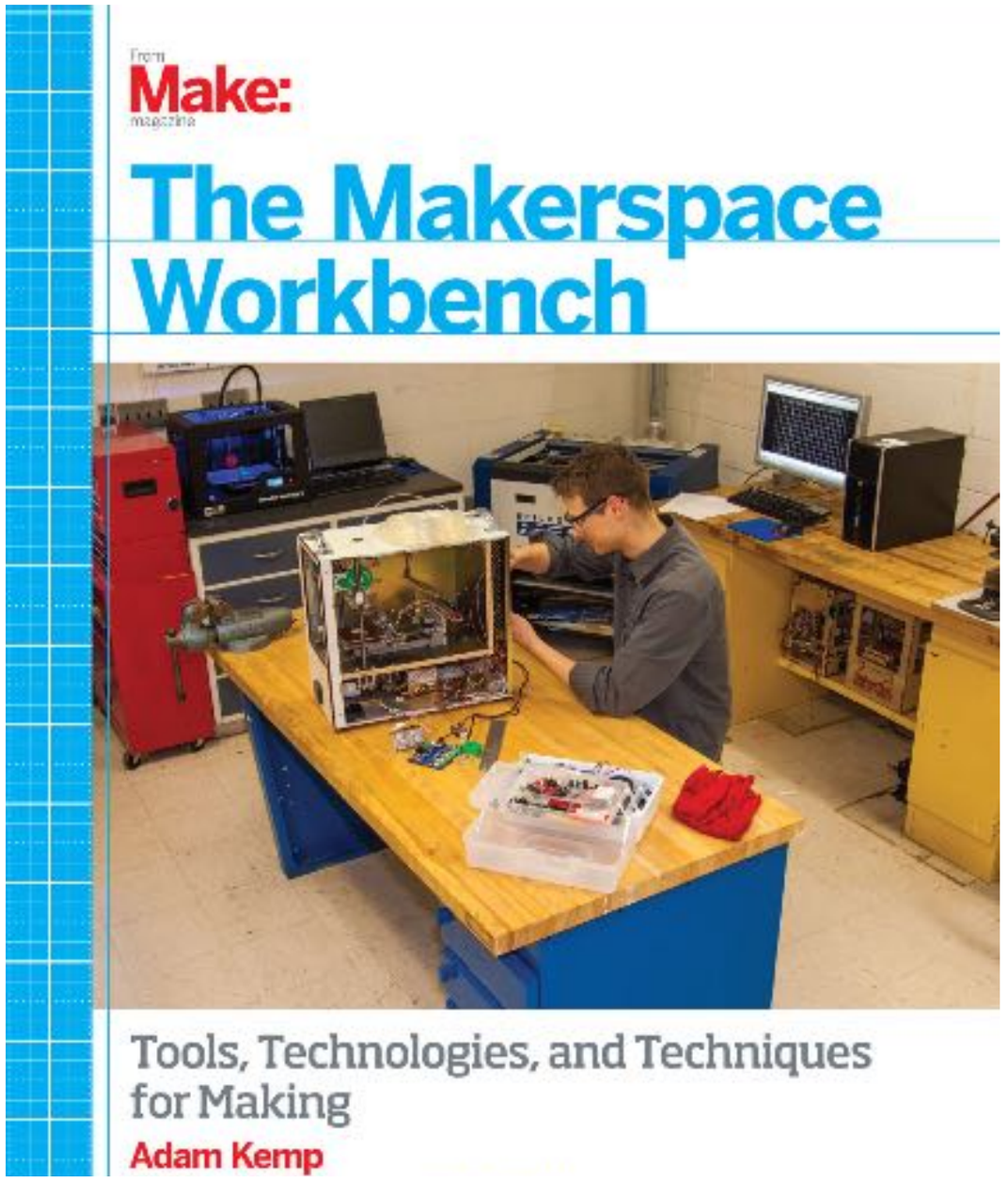
ACTIVITIES

- **Prototyping**: make *often*, make *quickly,* do *iterate*

- **Digital technologies**: digital files with open standards are easy to share on the Internet

- **Sharing**: to allow derivative works, natural evolution of idea, and "cascade effect"

- **Collaboration**: a shared working environment facilitates the exchange of experiences and knowledge



NETWORK

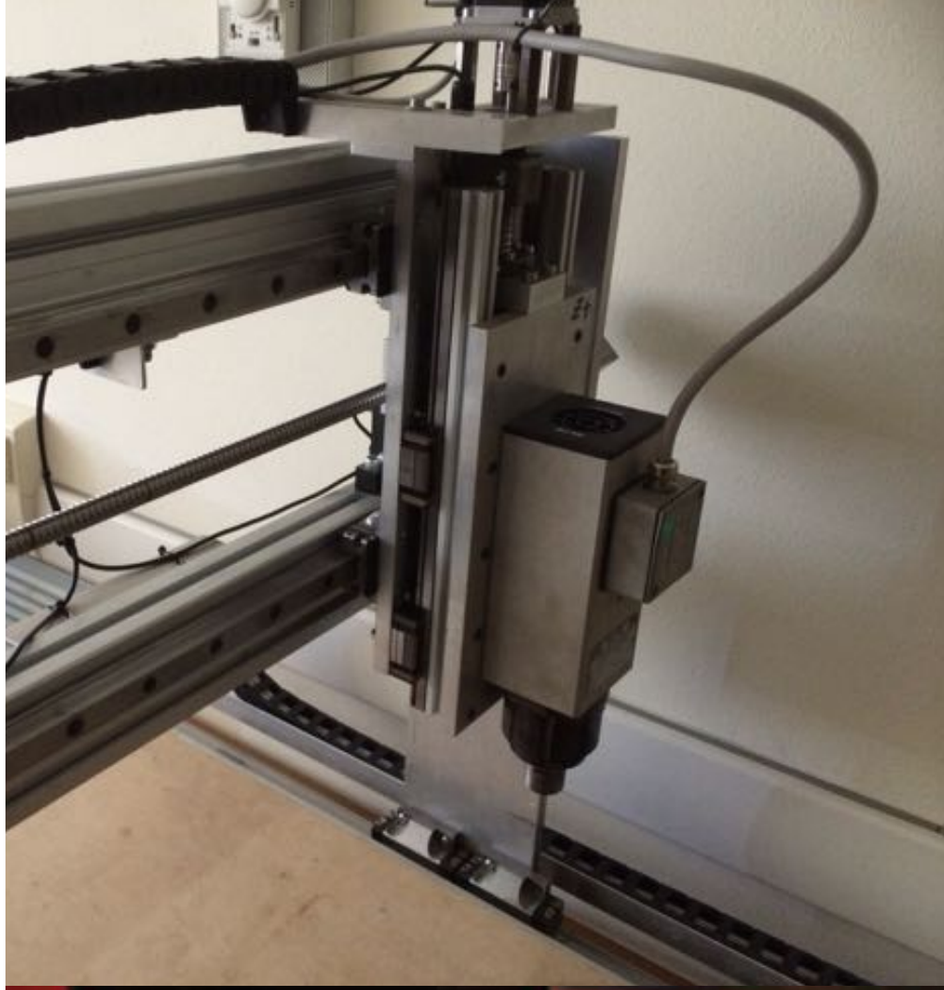
- **Fab Labs have to share a common set of tools and processes. A prototyping facility is not the equivalent of a Fab Lab. A 3D printer is not a Fab Lab.**

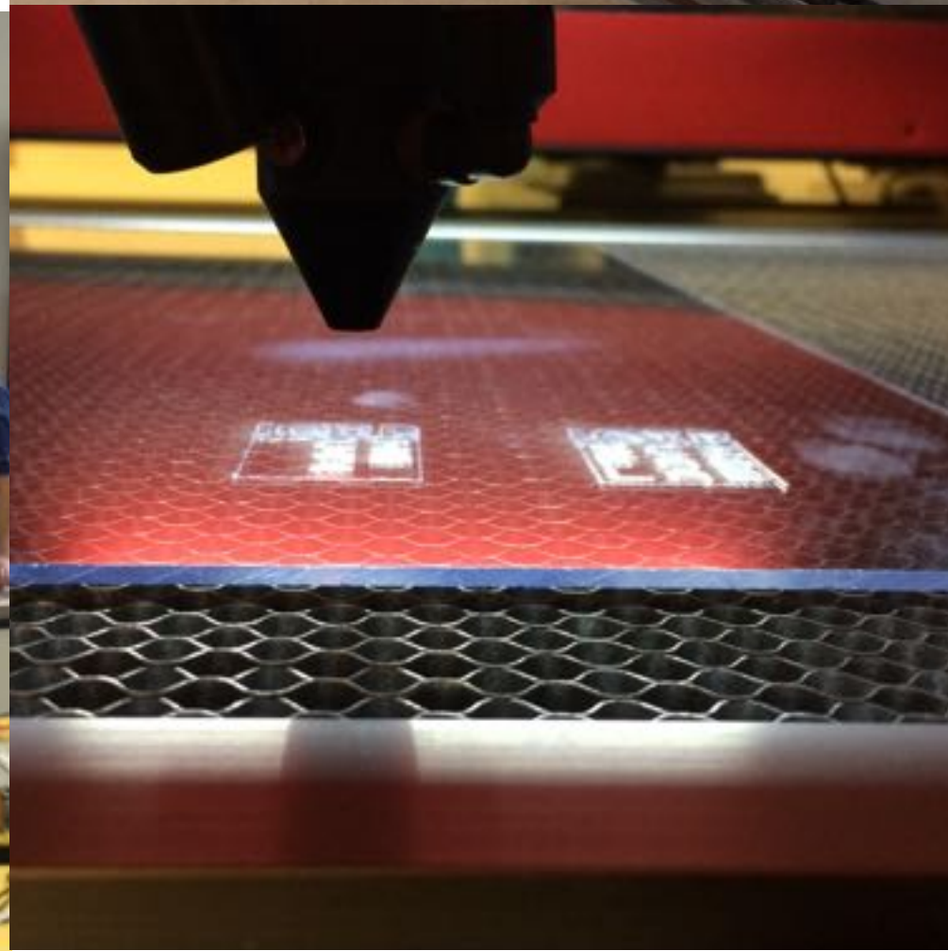
- **The idea is that all the labs can share knowledge, designs, and collaborate across international borders.**

- If I make something here in Boston and send you the files and documentation, you should be able to reproduce it there, fairly painlessly. If I walk into a Fab Lab in Russia, I should be able to do the same things that I can do in Nairobi, Cape Town, Delhi, Amsterdam or Boston Fab Labs

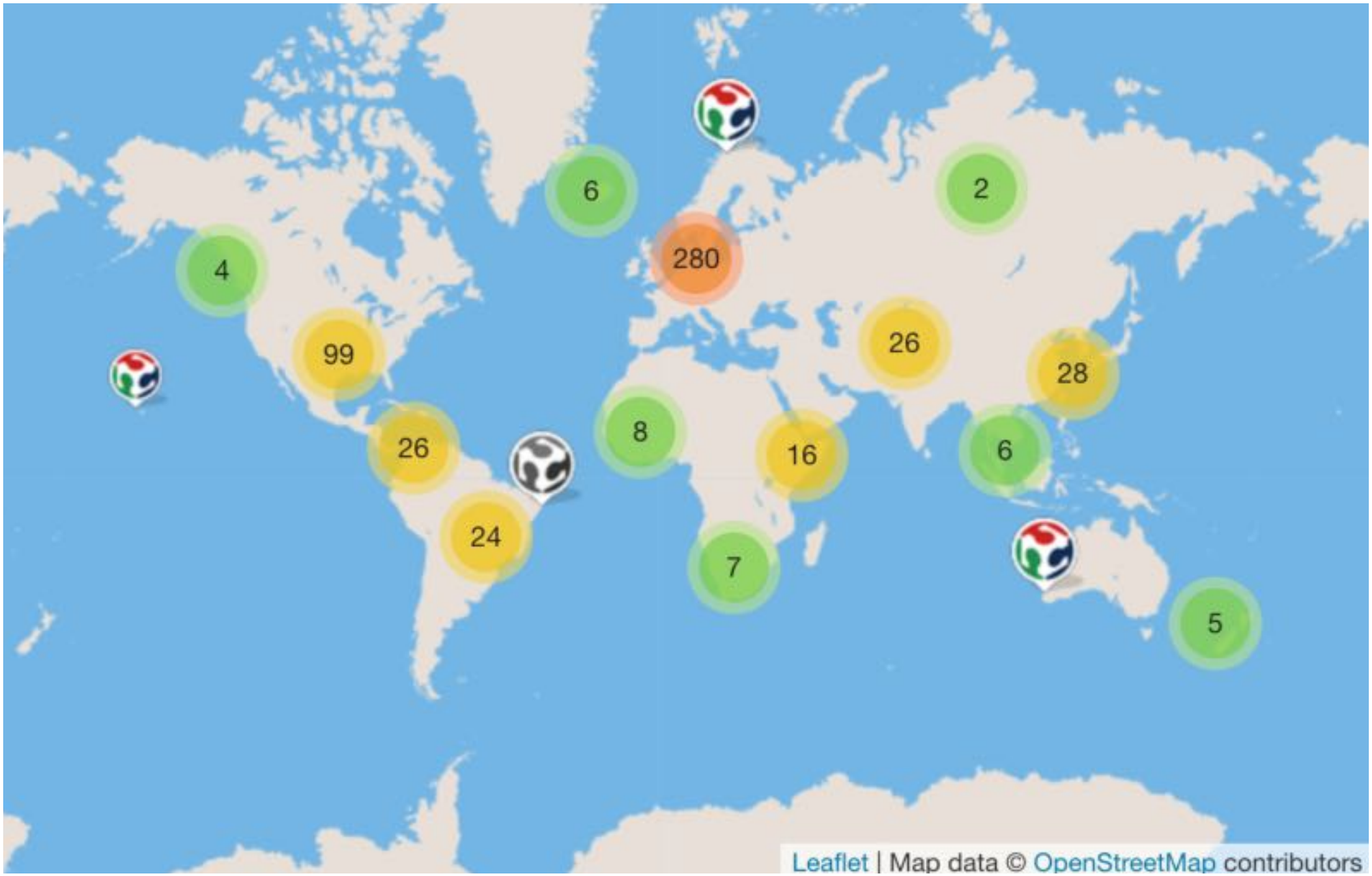
II Fab Charter

What is a fab lab?
Fab labs are a global network of local labs, enabling invention by providing access to tools for digital fabrication
What's in a fab lab?
Fab labs share an evolving inventory of core capabilities to make (almost) anything, allowing people and projects to be shared
What does the fab lab network provide?
Operational, educational, technical, financial, and logistical assistance beyond what s available within one lab
Who can use a fab lab?
Fab labs are available as a community resource, offering open access for individuals as well as scheduled access for programs
What are your responsibilities?
safety: not hurting people or machines
operations: assisting with cleaning, maintaining, and improving the lab
knowledge: contributing to documentation and instruction
Who owns fab lab inventions?
Designs and processes developed in fab labs can be protected and sold however an inventor chooses, but should remain available for individuals to use and learn from



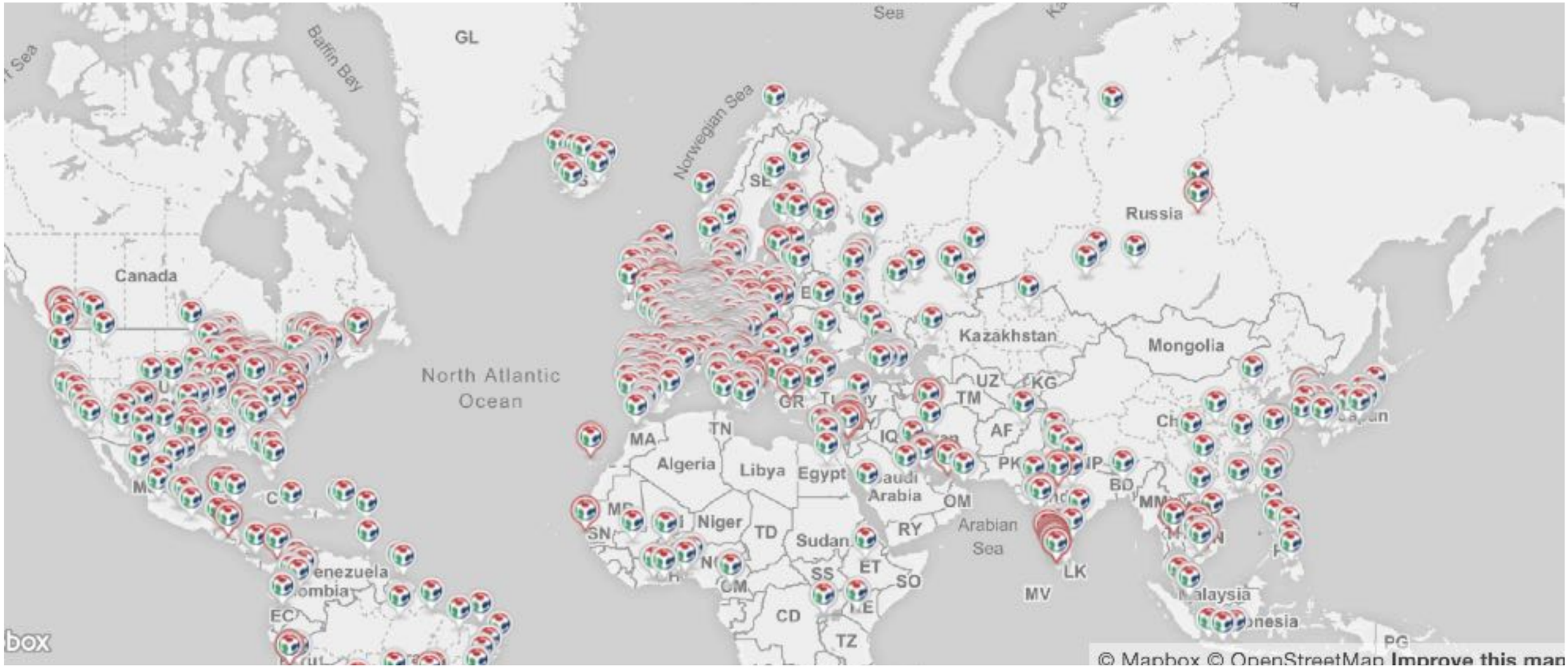


FABLABS IN THE WORLD (2015)



http://www.fabfoundation.org/fab-labs/ https://www.fablabs.io/labs

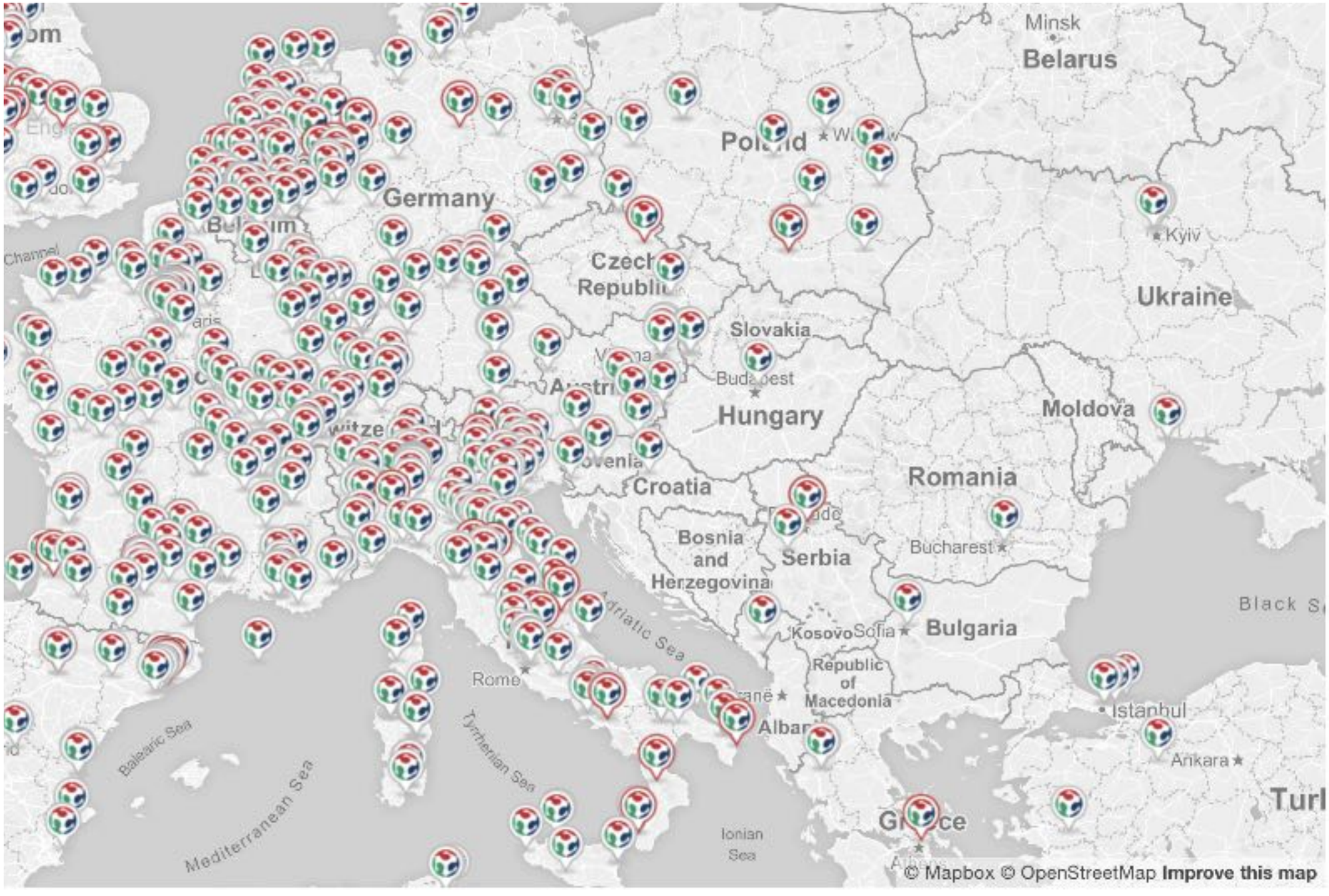
FABLABS IN THE WORLD



http://www.fabfoundation.org/fab-labs/

https://www.fablabs.io/labs

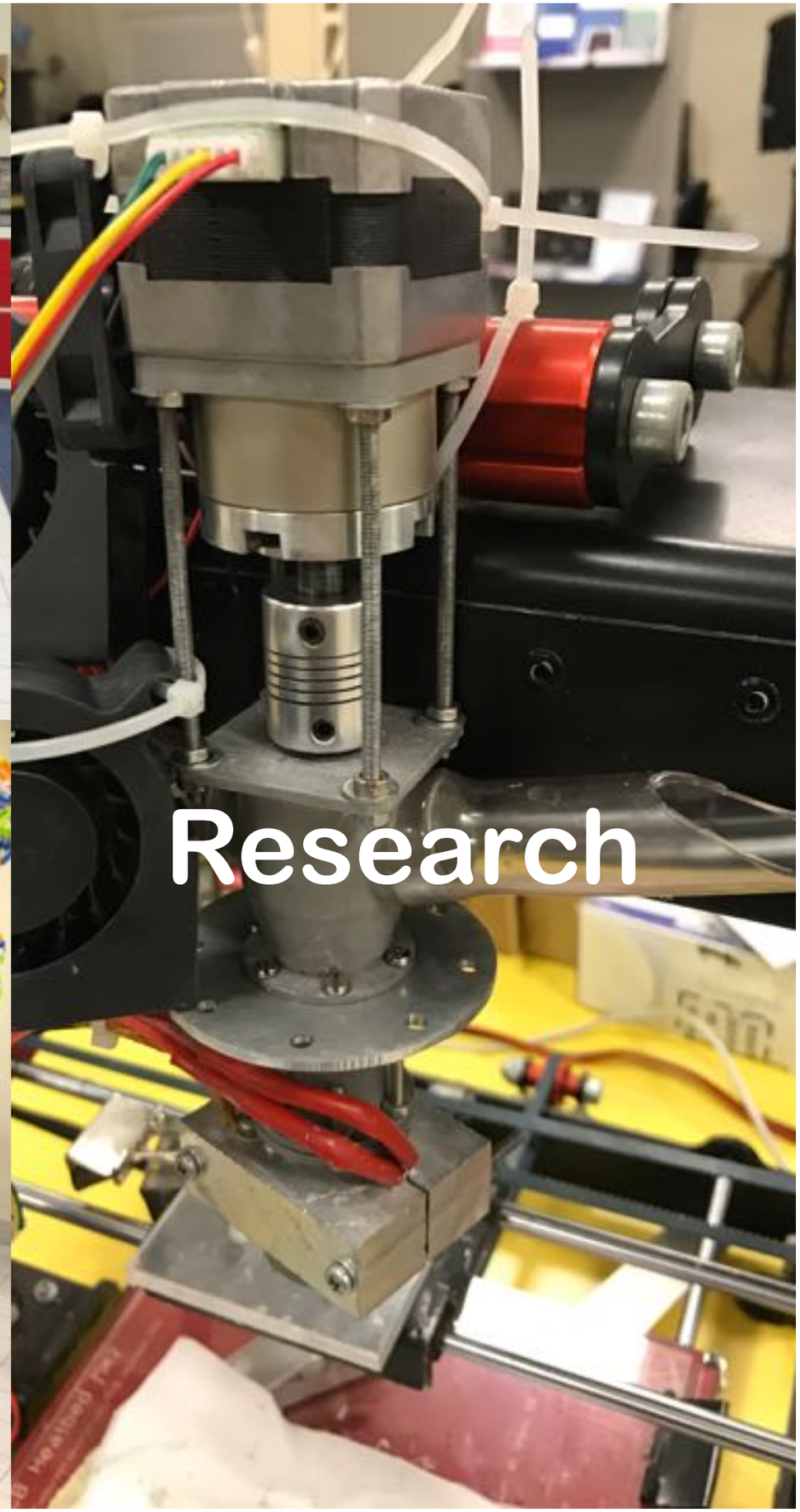
FABLABS AROUND THIS AREA



http://www.fabfoundation.org/fab-labs/

https://www.fablabs.io/labs


Outreach


Research


Training

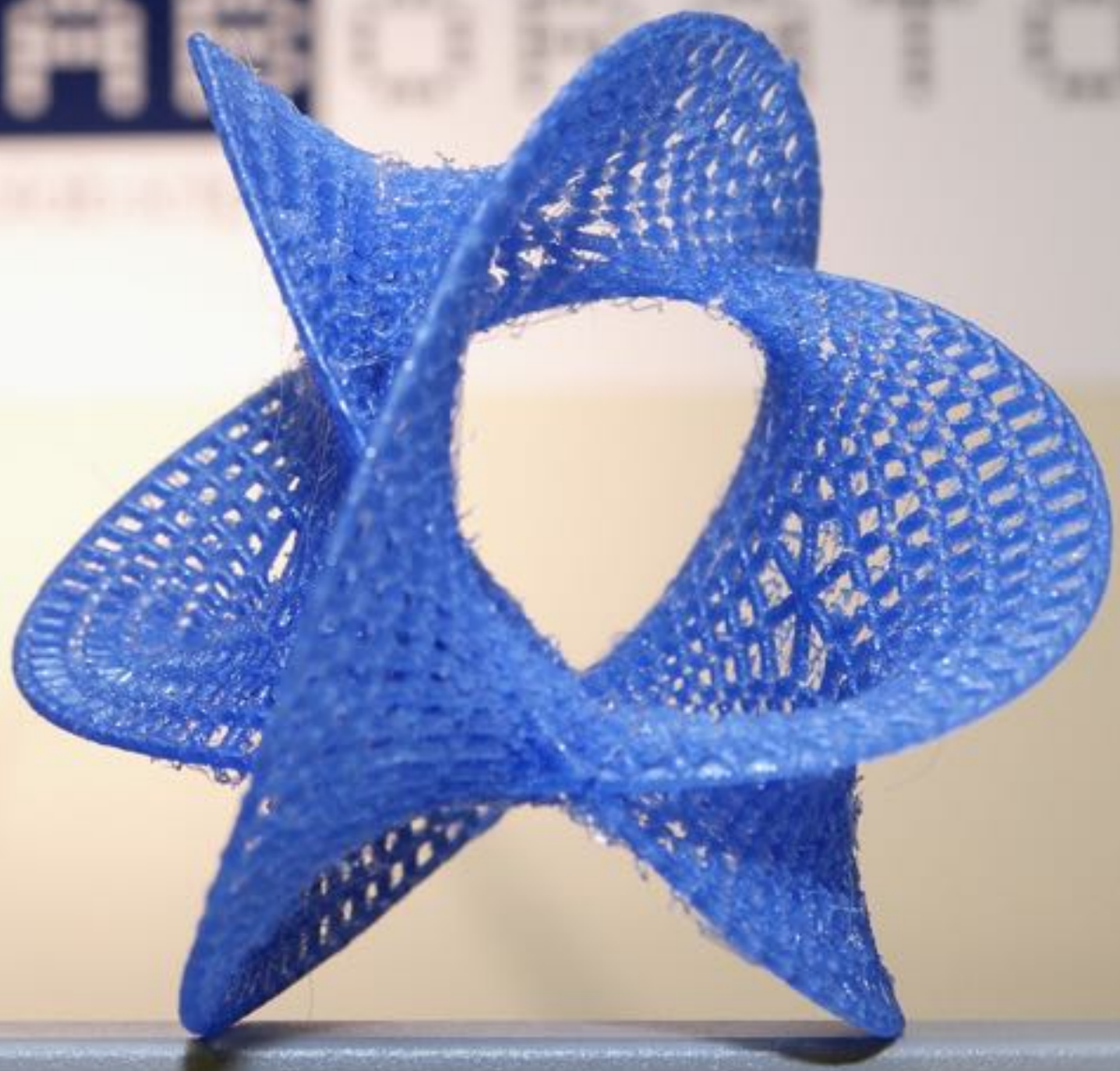
Open to the public

- Engagement of the **local community** of makers
- ICTP mandate is to **share knowledge**
- To attract **young** curious people to **science**
- To **“mix together” scientists** (they have problems to solve and little time/money to learn new skills) and **makers** (they are passionate people looking for problems to solve, often with valuable technical skills)

CTP

SCI FAB LAB

ENTIFIC
RICATION
ORATORY



FabLab + Science = ?

Are FabLabs helping scientific research?
What about education? And development?

Make:
makezine.com

MAKE 39: Robotics

There's never been a better time to get excited about DIY robotics! In this issue Mythbuster, model maker, and combat roboticist Grant Imahara talks about hacking everything from a giant spiderbot to R2-D2. Check out the latest in humanoid robots and open-source robotic platforms. Then, build your own bots that... Read more »

MAKE 38: High-Tech DIY

Make 38 celebrates our love of personal tech with the coolest new mobile gadget projects, from touchscreen tablets to open-source laptops to arduino-powered cell phones. Take your photography to the next level with 3D printed cameras and the latest camera hacks and tricks. And get inspired with many other exciting how-tos.... Read more »

MAKE 36: Boards

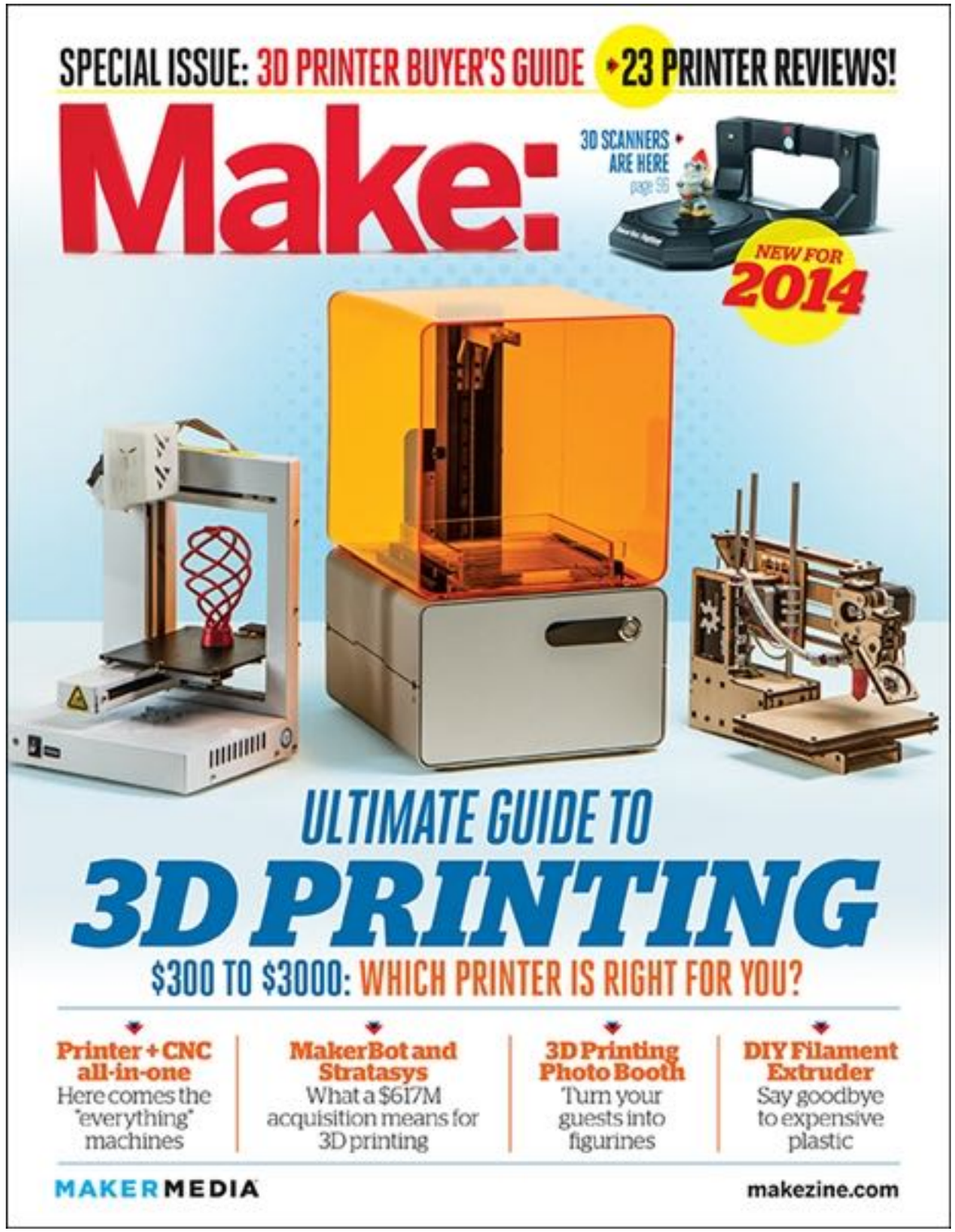
MAKE Volume 36 takes a look at the exploding market of boards and microcontrollers. Powerful and easy to use, microcontrollers allow anyone to add sophisticated interactivity to their projects, and Arduino and Raspberry Pi have ushered in a whole new generation boards tailor-made for making. In this issue, we take... Read more »

MAKE 37: Drones

MAKE Volume 37 takes a look at the evolving technologies that allow makers to do amazing things with both traditional R/C and self-piloting drones. Get a handle on terminology with a drone anatomy diagram, check out how to get amazing photos and videos using quadcopters, and get tips on using... Read more »

Make: Ultimate Guide to 3D Printing 2014

Which 3D printer is right for you? The world of desktop 3D printing is rapidly expanding and new companies and



from a magazine to a movement

Maker Faire®

WHAT'S IT ABOUT | CHECK OUT THE PROGRAM | HOW TO PARTICIPATE | IN THE MEDIA | SEE ALL THE FAIRES

Maker Faire Bay Area
May 17 & 18, 2014

12 : 19 : 24 : 41
Days Hours Minutes Seconds

BUY TICKETS NOW

May 17 & 18
San Mateo Event Center
Sat. 10 AM - 8 PM | Sun. 10 AM - 6 PM

Get news and updates on all faires and calls for makers.

Enter your email GO

Maker Faire Bay Area
May 17 & 18, 2014

World Maker Faire New York

Beyond USA...

View Larger Map

This map is color-coded to reflect various levels of Maker Faires:

- Yellow = Flagship faires
- Red = Featured, larger-scale faires produced in collaboration with Maker Faire
- Blue = Current Mini Maker Faires—smaller-scale, community-produced events
- Green = 2013 Mini Maker Faire applications
- Purple = Past events (no longer recurring)

May 17 & 1
San Mateo Event

Sat. 10 AM - 8 PM | Sun. 1

Get news and updat
faires and calls for

Enter your email

Goldsmith Spon

Silversmith Spon

View Larger Map

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2014

Upcoming Maker Faires

- Chicago Northside Mini Maker Faire (IL): May 3, 2014
- Austin Mini Maker Faire (TX): May 3, 2014
- Martinsville Mini Maker Faire (VA): May 3, 2014
- Denver Mini Maker Faire (CO): May 3 & 4, 2014
- Aarhus Mini Maker Faire (Denmark): May 9 & 10, 2014
- Ann Arbor Mini Maker Faire (MI): May 10, 2014
- San Luis Obispo Mini Maker Faire (CA): May 10, 2014
- **MAKER FAIRE BAY AREA** (San Mateo, CA): May 17 & 18, 2014
- Stockholm Mini Maker Faire (Sweden): May 17 & 18, 2014
- Trieste Mini Maker Faire (Italy): May 17, 2014
- Mendocino County Mini Maker Faire (CA): May 24, 2014
- Maker Faire Taipei (Taiwan): May 24 & 25, 2014
- Torino Mini Maker Faire (Italy): May 31, 2014
- Jerusalem Mini Maker Faire (Israel): June 5—7, 2014
- Eugene Mini Maker Faire (OR): June 7, 2014
- Maker Faire North Carolina (Raleigh, NC): June 7, 2014
- Reno Mini Maker Faire (NV): June 7, 2014
- Montreal Mini Maker Faire (Quebec, Canada): June 7 & 8, 2014
- Vancouver Mini Maker Faire (BC, Canada): June 7 & 8, 2014
- Columbia Mini Maker Faire (SC): June 14, 2014
- Waterloo Mini Maker Faire (Ontario, Canada): June 14, 2014
- **Maker Faire Paris** (France): June 21 & 22, 2014
- McAllen Mini Maker Faire (TX): June 21, 2014
- Barcelona Mini Maker Faire (Spain): June 22, 2014
- **Maker Faire Kansas City** (MO): June 28 & 29, 2014
- Maker Faire Hannover (Germany): July 5 & 6, 2014
- Bilbao Mini Maker Faire (Spain): July 12 & 13, 2014
- Kingsport Mini Maker Faire (TN): July 13, 2014
- SolarFest Mini Maker Faire (Tinmouth, VT): July 19 & 20, 2014
- Anchorage Mini Maker Faire (AK): July 26, 2014
- Singapore Mini Maker Faire (Singapore): July 26 & 27, 2014
- **Maker Faire Detroit** (MI): July 26 & 27, 2014
- Manchester Mini Maker Faire (UK): July 26 & 27, 2014
- New Braunfels Mini Maker Faire (TX): August 2, 2014
- Chicago Southside Mini Maker Faire (IL): August 2, 2014
- Ottawa Mini Maker Faire (Canada): August 16 & 17, 2014
- Dover Mini Maker Faire (NH): August 23, 2014
- **Maker Faire Trondheim** (Norway): August 29 & 30, 2014
- Midcoast Mini Maker Faire (Camden, ME): September 6, 2014
- Pittsburgh Mini Maker Faire (PA): September 7, 2014
- Nashville Mini Maker Faire (TN): September 13, 2014
- Greenbrae Mini Maker Faire (CA): September 13, 2014
- Salt Lake City Mini Maker Faire (UT): September 13, 2014 (tentat
- Portland Mini Maker Faire (OR): September 13 & 14, 2014
- Cincinnati Mini Maker Faire (OH): September 13 & 14, 2014
- Albuquerque Mini Maker Faire (NM): September 13 & 14, 2014
- **WORLD MAKER FAIRE NEW YORK** (NYC): September 20 & 21
- Kerkrade Mini Maker Faire (Netherlands): September 20 & 21, 20
- León Mini Maker Faire (Spain): September 27, 2014
- Louisville Mini Maker Faire (KY): September 27, 2014
- Elephant & Castle Mini Maker Faire (London, UK): September 27,
- **Maker Faire Rome** (Italy): October 3-5, 2014
- Scranton Mini Maker Faire (PA): October 4, 2014
- NoCo Mini Maker Faire (Loveland, CO): October 4, 2014
- Greater Portland Mini Maker Faire (ME): October 4, 2014
- **Maker Faire Atlanta** (GA): October 4 & 5, 2014
- Champlain Mini Maker Faire (VT): October 4 & 5, 2014
- Charlottesville Mini Maker Faire (VA): October 4, 2014
- Chattanooga Mini Maker Faire (TN): October 11, 2014
- Colorado Springs Mini Maker Faire (CO): October 18, 2014
- Akron Mini Maker Faire (OH): October 18, 2014
- East Bay Mini Maker Faire (Oakland, CA): October 19, 2014

2018

Faires around the world

Explore Maker Faires | Location, Name, Type, Date | Select by Type: Flagship, Featured, Mini, School

Flagship Maker Faires
Faires curated and produced by the Maker Media team

Featured Maker Faires
Larger-scale regional events

Mini Maker Faires
Community events

School Maker Faires
K-12 Faires (closed to general public)

Trieste Mini Maker Faire

www.makerfairetrieste.it

Reader

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Trieste Mini Maker Faire®

Sabato 17 Maggio 2014
10:00 — 18:00
ICTP Campus, Miramare, Trieste

Italiano | English | About | Makers | Programma | Iscriviti | Contatti | Sponsors

Comunicato stampa

Italiano, English, Slovenščina, Hrvatski, Deutsch

Poster: Sei un Maker?

Italiano, English, Slovenščina, Hrvatski, Deutsch

Poster: La festa dell'ingegno

Italiano, English, Slovenščina, Hrvatski, Deutsch

Iscrizione Makers!

Conto alla rovescia:

51 Day, 14 Hr, 01 Min, 43 Sec

Open "http://www.makerfairetrieste.it/apply.html" in a new window

Trieste Mini Maker Faire®

Make: makezine.com

ICTP The Abdus Salam International Centre for Theoretical Physics

IS science centre immaginario scientifico

costruttori
inventori
creativi

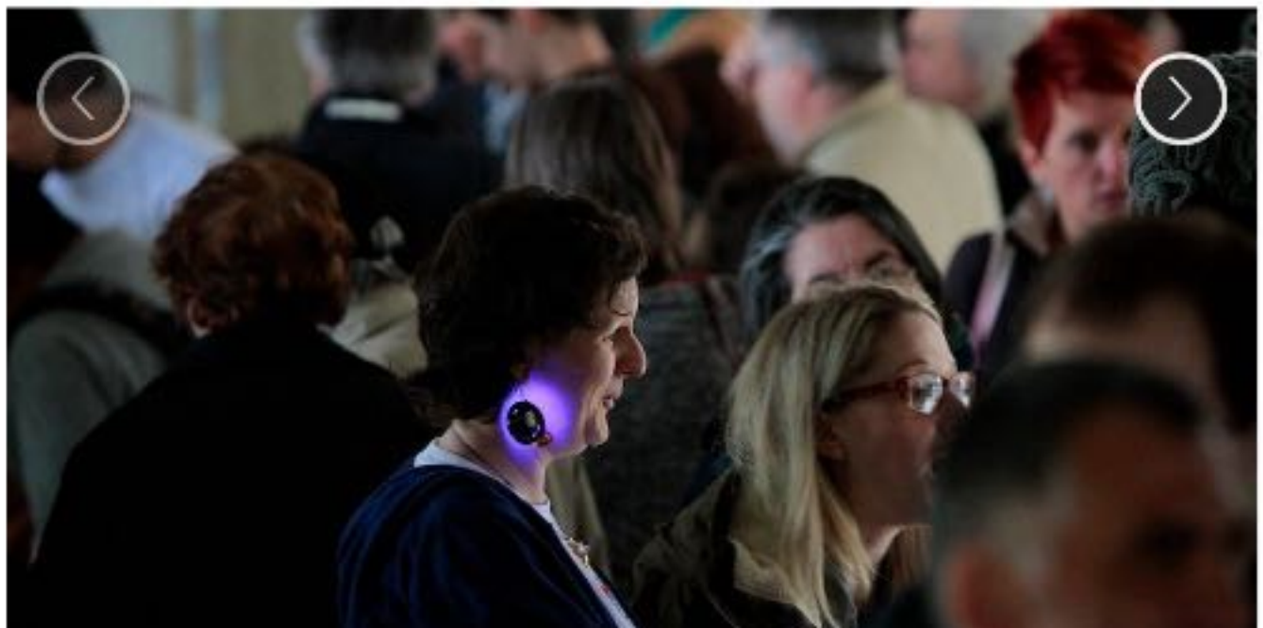
17 maggio 2014

La festa dell'ingegno

a Trieste la prima Mini Maker Faire italiana

The Trieste Mini Maker Faire Roundup

By Alasdair Allan Posted May 20th, 2014 8:20 am Category Makers View Comments



Trieste Mini Maker Faire®

17 MAY 2014

FIRST EDITION

@ ICTP CAMPUS, MIRAMARE, TRIESTE


MAKER
Trieste Mini
Maker Faire


FLASH
M-60
M-61


M-14
Electronics
Heartthrob
acer

01

CLEANING 01 DRYING

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Then put them in the blower to make sure they will be completely dry.

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impara costruisci mostra

LA FESTA DELL'INGEGNO


M-91
Self


Element

9 – 10 MAY 2015 @ ICTP CAMPUS, MIRAMARE, TRIESTE

SECOND EDITION

2016


Trieste Mini
Maker Faire
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ALGIDA
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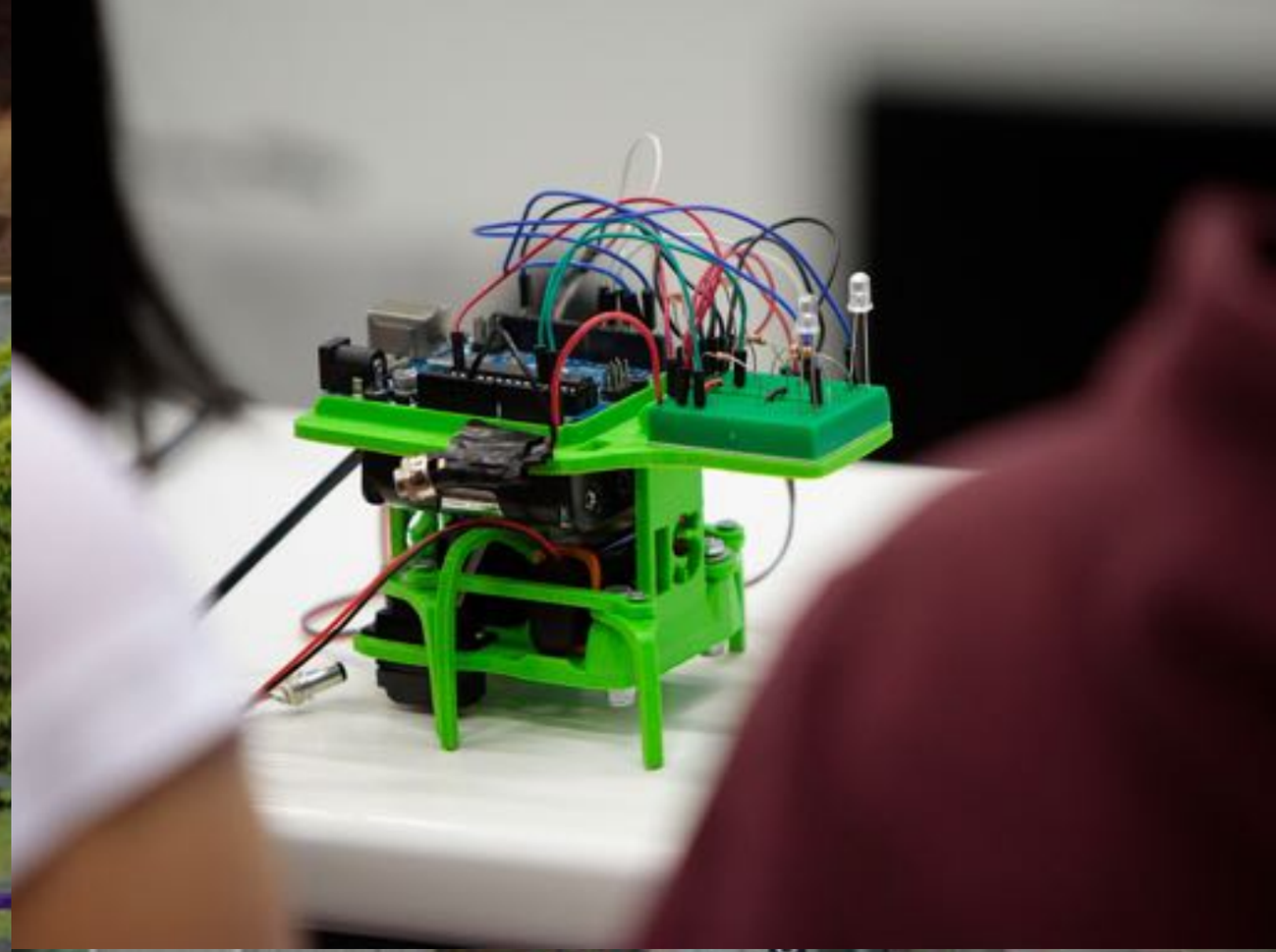

20-22 MAY 2016 @ ICTP CAMPUS, MIRAMARE, TRIESTE

THIRD EDITION

science picnic

TRIESTE, VENERDÌ 20 MAGGIO 2016
DALLE ORE 9:00 ALLE 16:00
PRESSO IL CAMPUS DELL'ICTP DI MIRAMARE

UNA FESTA DELLA SCIENZA PER LE SCUOLE,
DALLE ELEMENTARI ALLE SUPERIORI

LABORATORI DIDATTICI CREATIVI

Attività per ragazzi in grado di innescare creatività e curiosità attraverso il gioco

Laboratori didattici per scoprire in quali e quanti modi si trasforma l'energia, procurarti tutto il necessario per costruire esperimenti, viaggiare nel tempo con il dinosauro Antonio, conoscere i trucchi del cervello e capire i moti terrestri e molto altro!

ESPERIMENTI DIVERTENTI

Exhibit interattivi dove giocare con la scienza e la tecnologia

Giocare per capire la fisica e la matematica attraverso la sperimentazione, sfruttando le tecnologie a disposizione, usare gli smartphone per costruire microscopi, misurare la velocità del cervello, costruire robot con materiali di recupero e tanti esperimenti divertenti!

THE SCIENCE SHOW

Spettacoli di arti e scienze varie dal palco

"Doyouspeakscience?" dimostrazioni interattive dal palco direttamente dal famoso canale YouTube. I Crazy Scientists presentano "Happy Cryo", la scienza che vi gela il sangue nelle vene! E molto altro!

LA SCIENZA PARLA

Brevi incontri con scienziati e divulgatori

Conversazioni con esperti che ci raccontano la scienza da un punto di vista personale e curioso. "Scienza in 3 minuti" pillole di scienza somministrate dai giovani ricercatori finalisti di FameLab. Visite guidate alla biblioteca dell'ICTP e altri incontri personali con la scienza e i suoi attori!

AREA MAKER

Stand ed exhibit di scienze, arti e tecnologie varie a cura dei Maker

Progetti incentrati su materiali innovativi, "intelligenti", ecosostenibili, passando per le wearable electronics, il riciclo dei materiali, la robotica, l'elettronica, la programmazione e molto altro! Visite guidate al FabLab dell'ICTP.

PER INFO E PRENOTAZIONI:
040 6754250 (orari di ufficio) · **PRENOTAZIONI@SCIENCEPICNIC.IT**
il programma aggiornato delle attività è disponibile sul sito
www.sciencepicnic.it

INGRESSO GRATUITO!

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Frankie


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SHAPING WATERSHEDS


5


AUTOBALLOON
PREZZO
2 S
IMAGINATION
IS MORE
IMPORTANT
THAN
KNOWLEDGE.
{Albert Einstein}

Trieste Mini Maker Faires 2014-2018 a total of:

50,000+ visitors

1000+ makers

5 years of ideas

MASSIMOGOINA.COM


RadioHam
Fair
Trieste Mini
Maker Faire
sabato 9
domenica 10
maggio 2015
CAMPUS ICTP MIRAMARE
ICTP
SCI
FAB
LAB
scifablab.ictp.it

Public Events (Arduino Day)

R&D Projcts @ fablab

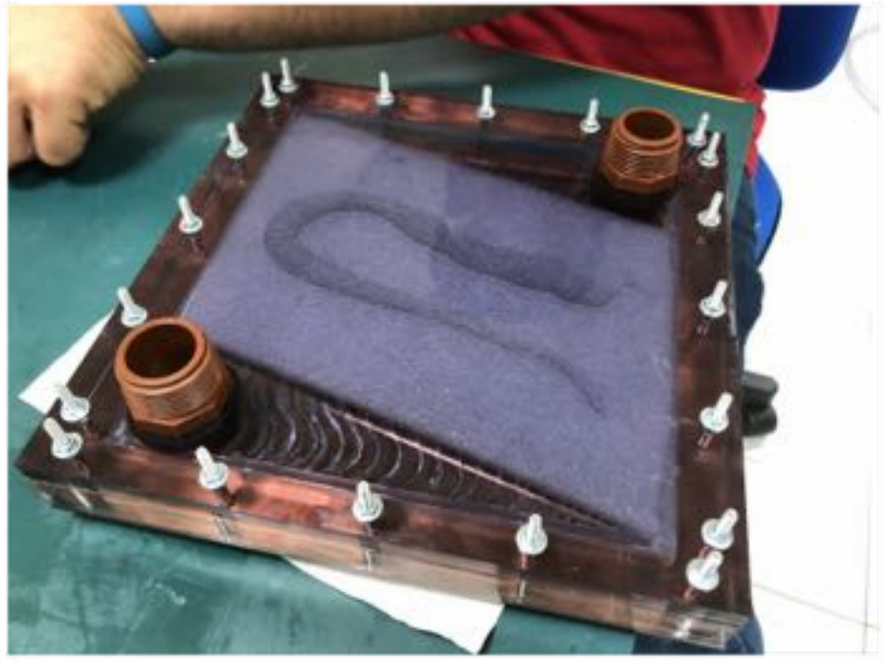
Low-cost exhibits/devices for science education:

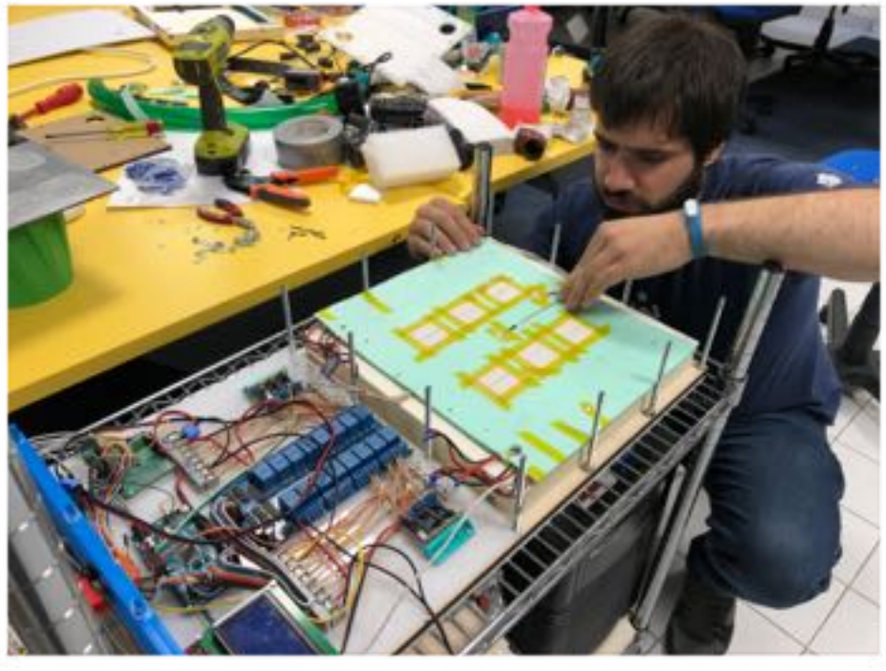
- Augmented Reality Sandbox (UC Davis, USA)
- “Weather-in-a-Tank” weather simulator (MIT)
- DIY “cloud chamber” particle detector (ICTP)
- “BoraMat” wind simulator (ICTP) *(not so much scientific ;-)*
- Water cycle demonstrator (ICTP, in development)

“BoraMat” wind simulator

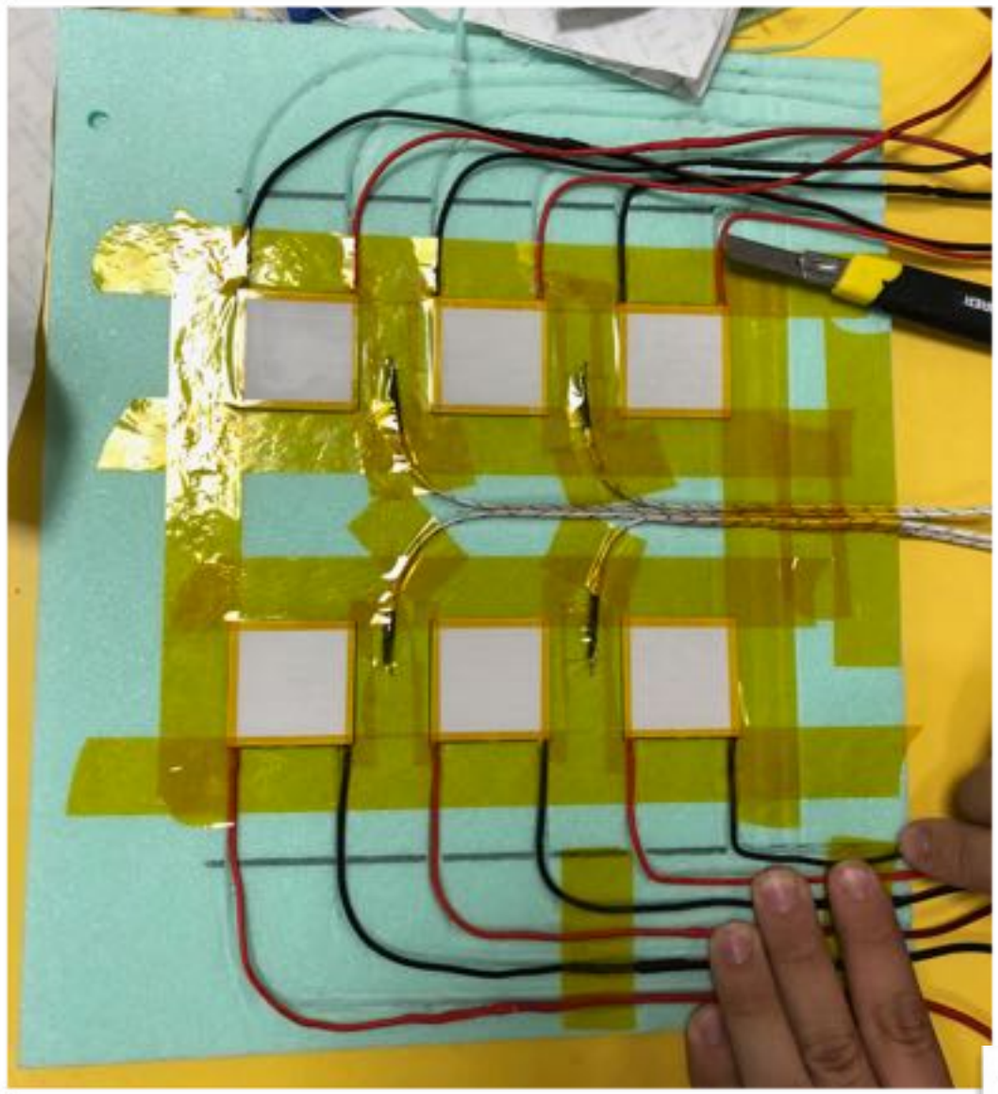
- three electric fans can generate an air flow up to 80-100 Km/h, to simulate the local strong wind “Bora”
- controlled by Arduino with distance sensor
- “Bora scura” setting adds also water droplets (wind with rain)

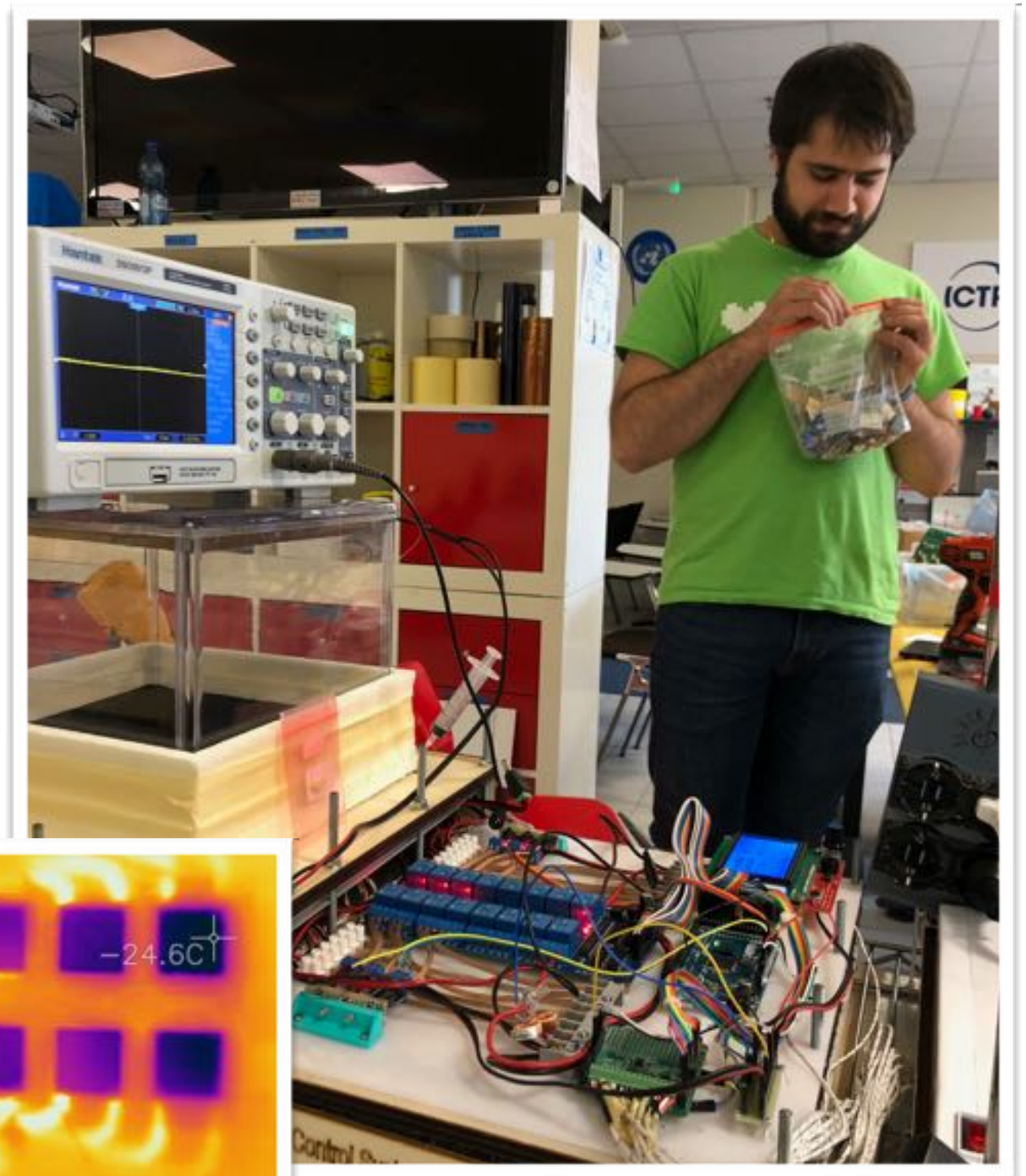
DIY Cloud Chamber

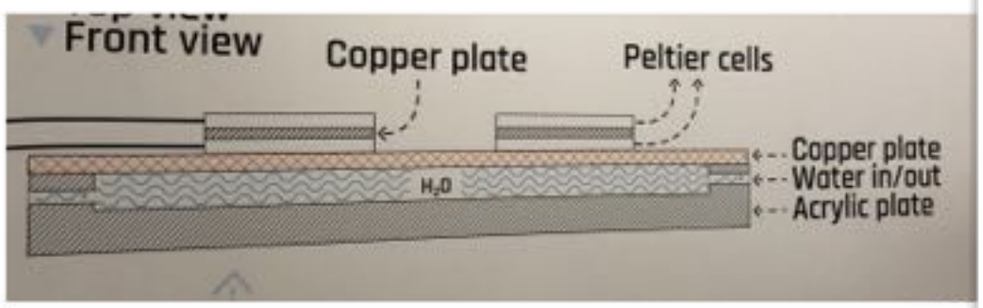




DIY Cloud Chamber



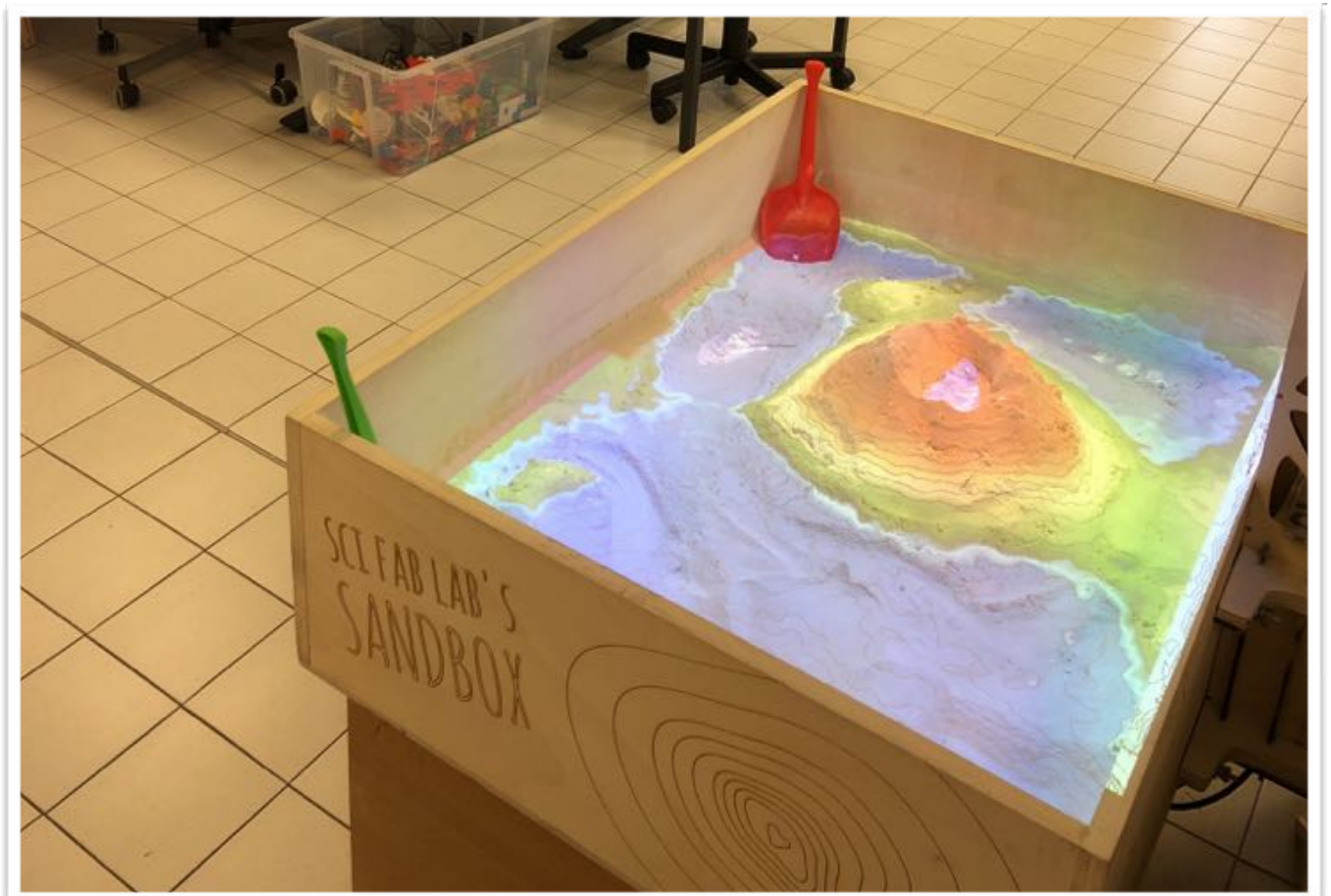




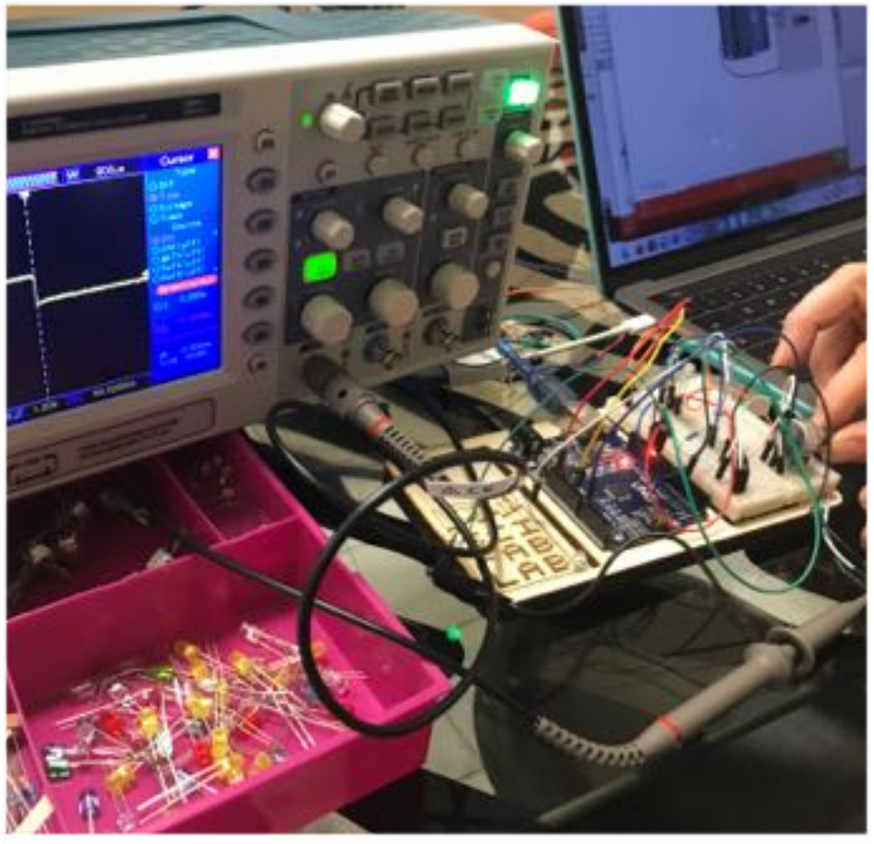
DIY Cloud Chamber

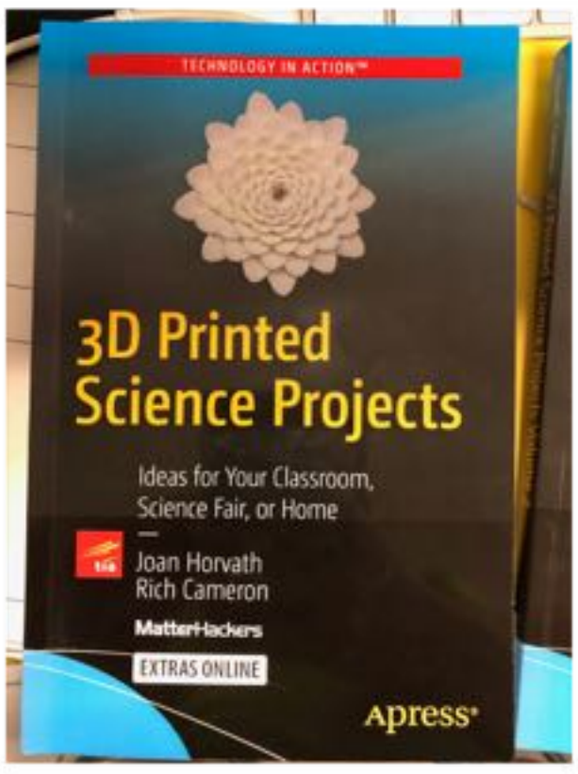
Weather-in-a-Tank (MIT)

A. R. Sandbox (UC Davis)



arsandbox.org https://arsandbox.ucdavis.edu

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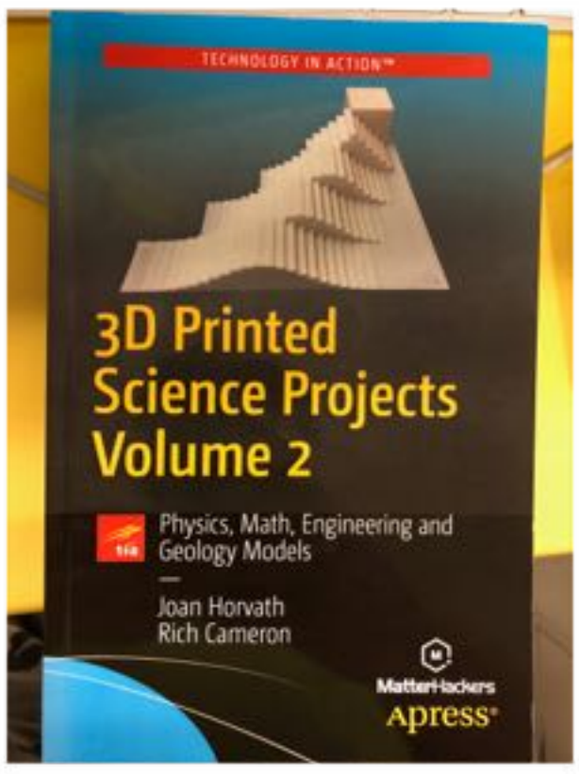
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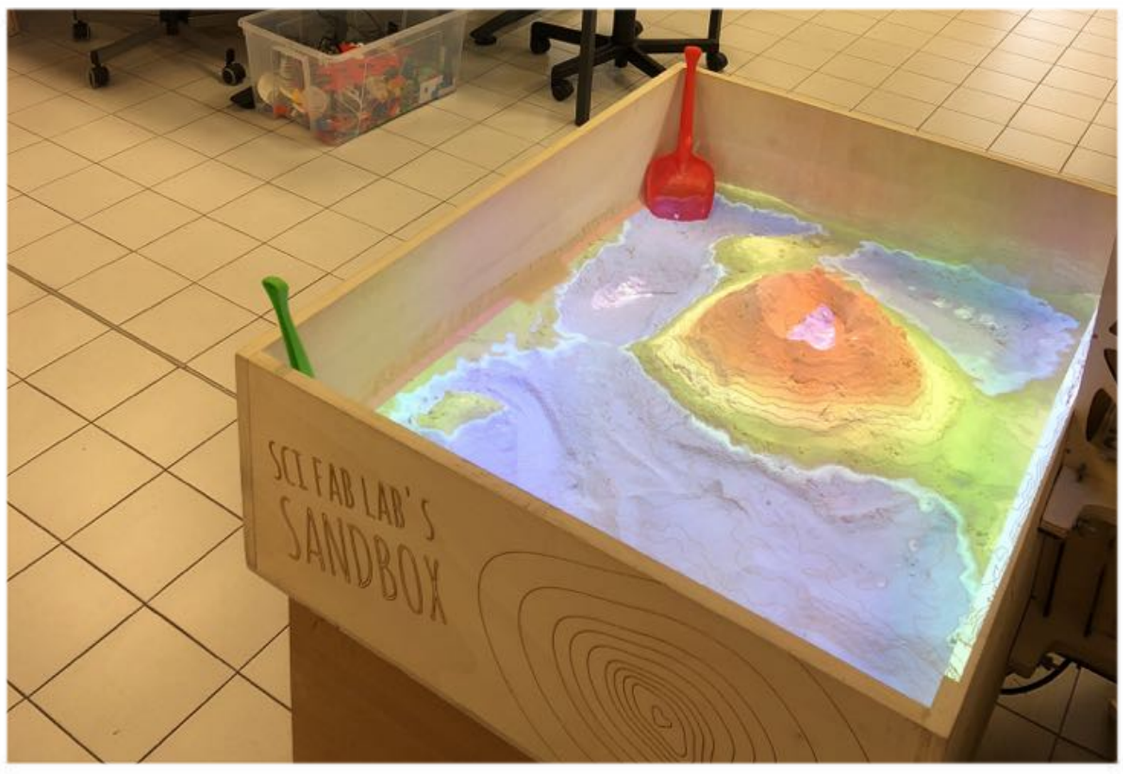
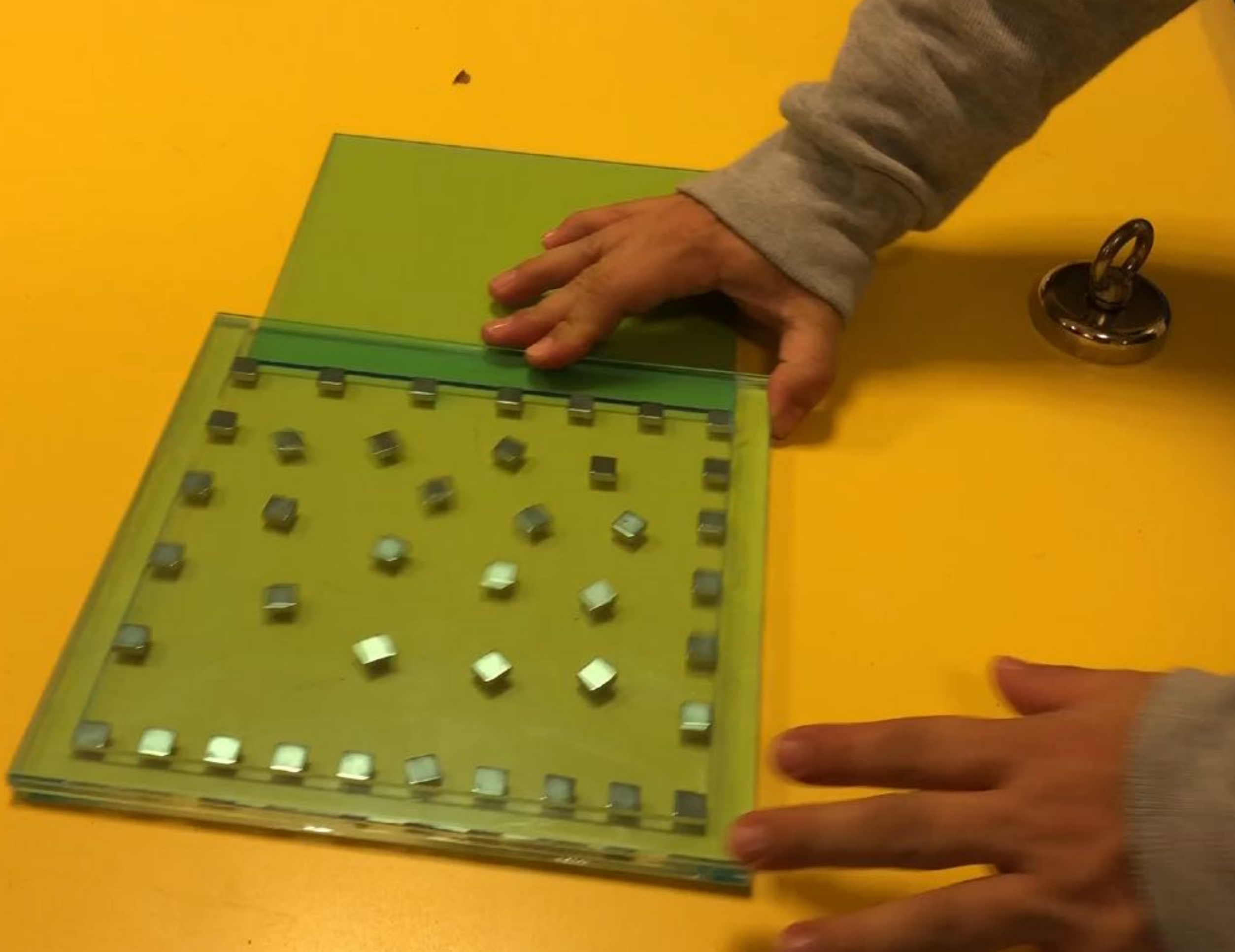

SCI FAB LAB'S
SANDBOX



Thank You for Your Attention!

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