

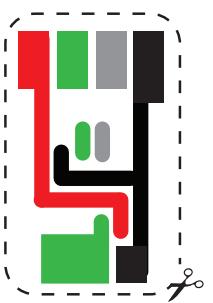
# 1key!

A low-cost MaKeyMaKey derivative exploring how non-dominant youth can build educational hardware to learn about and tinker with interactivity.

bk  
id.uarts '14



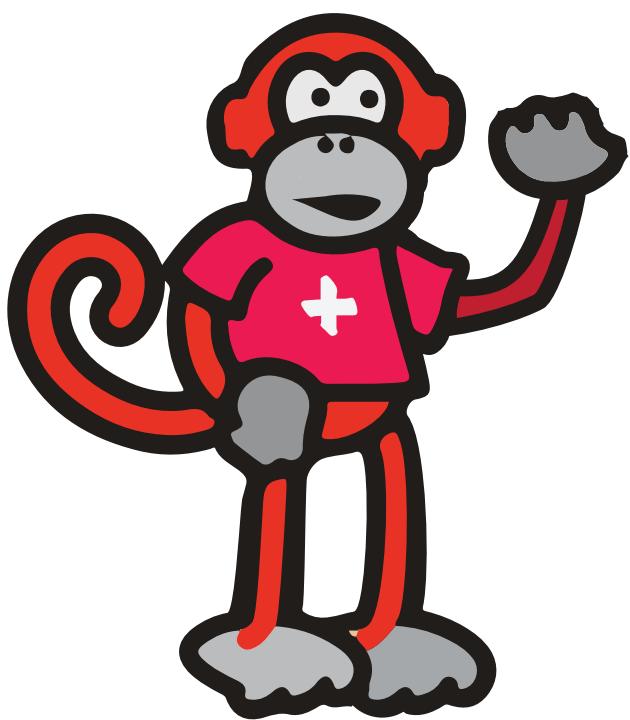


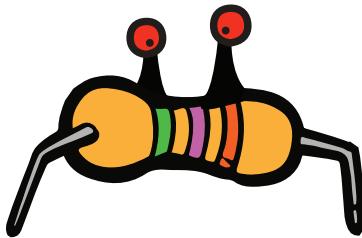


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bk  
id.uarts '14





ID UArts 2014  
Capstone Jawn

Advisors:  
Alexandra Schmidt-Ullrich (Spring 2014)  
Jonas Milder (Fall 2013)

Folks that have made this happen:

K-Fai Steele, everything!  
The kids at the Village.  
The kids at Kensington.  
Victor, #1 MaKey MaKey Extraordinaire.  
Dr. Anna Beresin, helping me think critically and letting me play.  
Will McHale, helping me get out of my head.  
Maker Jawn Mentor Peeps, for keeping it real.  
Steve Davee, air time, keeping me stoked+  
UPenn folks, feedback, encouragement, chatting+  
Yara Safadi for giving me some hackathon/mentor opportunities+  
Michael McAllister + Mitchell Wright for getting me into Arduino.  
Exhibits people at the Franklin for letting me tinker.  
My family, :)  
My friends, thanks for letting me go crazy.

If I forgot you or you are specifically not mentioned feel free to use the blank space below or around the monkey as a write-in:

## **Contents**

### **Part I**

Project Context

Summer of Making

The Free Library of Philadelphia

The Maker Jawn Initiative

Where I am

What I do

Maker Jawn Projects

Scratch Day 2013

the MaKey MaKey

Village of Arts and Humanities

Notable Moments

SPELLS Writing Lab Workshop

Maker Celebration Interactives

Maker Faire

Feedback: INST-INT 2013

Constraints

Moving forward

## **Part II**

Can youth make their own educational hardware?

The one input MaKey MaKey

Iteration

Working Prototypes

Group Workshops

Individual Experiences

Instructors Workshop

Materials

Feedback: DML14

Making in Public: STAMP Day

Refined Model

Making in Public: STEAMfaire

Final Form

Feedback: Maker Education Initiative

Next Steps

## **Appendix**

Fun Pictures

Code

thx!

# **Part I**

Embedding, learning, and making.



## **Project Context:**

I am currently focused on working directly with **youth** in **afterschool library locations** to introduce them to S.T.E.A.M. activities, introducing them to **evaluative thinking**, and increasing engagement through **project-based learning**.

I have been introducing these concepts to youth ages 4-22 through the implementation of digital humanities projects at the Free Library of Philadelphia with the Maker Jawn Initiative, which I helped to design and implement. **Maker Jawn targets youth in culturally rich, low-income neighborhoods** through programming in community libraries. Our mission is to improve access to S.T.E.M./S.T.E.A.M. programming in these neighborhoods through drop-in, interest-driven daily workshops. While we have successfully created working curricula for youth and professional development models, I'm continually surprised by the tangents, collaborations, and experiences that spawn from play and spontaneity with both youth and adults, and often the projects that arise from inter-generational collaboration. Play eliminates the experiential and social barriers that separate mentors such as myself from the youth we work with, and creates learning moments for us to share ideas and skills, and build on previous knowledge as a group.

S.T.E.A.M - Science, Technology, Engineering,  
Math + Art / Design

evaluative thinking - reflection on actions and making via sharing ones process and vision.

low-income - approximately 86% of households with children are below the poverty line.  
(The Village of Arts and Humanities Narrative)



## **Summer of Making**

Over the summer the library piloted a program with a diverse collective of people at the Free Library of Philadelphia with backgrounds as students, engineers, and artists. **Dedicated to mentoring youth as they articulate their own interests through the lens of technology we ran daily workshops in Free Library HotSpot locations and Branches.** A team of 5 mentors worked at 5 locations in targeted low-income undeserved communities and their respective library locations. Funding and tools for these mentors were initially granted by the Maker Education Initiative and their Maker Corps Program.

Over the course of the summer each individual location implemented their own **digital arts programming** based on youth interest, resources available, the mentor's interests and discipline, and collaboration between locations and external entities.

In my case I was stationed at the Village of Arts and Humanities in North Philadelphia on Germantown Avenue.



The Maker Jawn Initiative was deployed in 5 sites (l-r), Heavenly Hall, Widner Branch, I.D.A.A.Y. Hot Spot, The Village Hot Spot, and McPherson Sq. Branch.



Maker Jawn HQ, once a week all mentors gather in the Annex behind the Parkway Central Library on Vine Street.

## **The Free Library of Philadelphia**

The mission of the Free Library is to inspire knowledge, advance learning, and inspire curiosity. Its vision is to build an enlightened community dedicated to lifelong learning. The MakerJawn Initiative is embedded in libraries across Philadelphia. Its goal is to increase access to knowledge, tools, and resources in underserved communities by developing pathways for learning through low-cost, low-barrier projects.

## **The Maker Jawn Initiative**

MakerJawn is dedicated to mentoring youth as they articulate their own interests through the lens of technology, in daily afterschool programming and during citywide events and workshops, empowering youth in Philadelphia through project-based learning.



## **Project Context:**

### **Where I am**

I am a **Maker Mentor** working within a Library working on library floor daily.

I am also collaborator, prototyper, and implementer with other mentors and institutions on programming and larger multi-location projects.

I have found myself within a circle of folks in Philadelphia looking for ways to introduce electronics and S.T.E.A.M. programming to youth of all ages.

This was my initial network between the Library, the Franklin, Penn, and HASTAC(an online collaborative) when starting the project. I was directly connected to the Franklin Institute now I am directly connected to UPenn and the Research team there.

### **What I do**

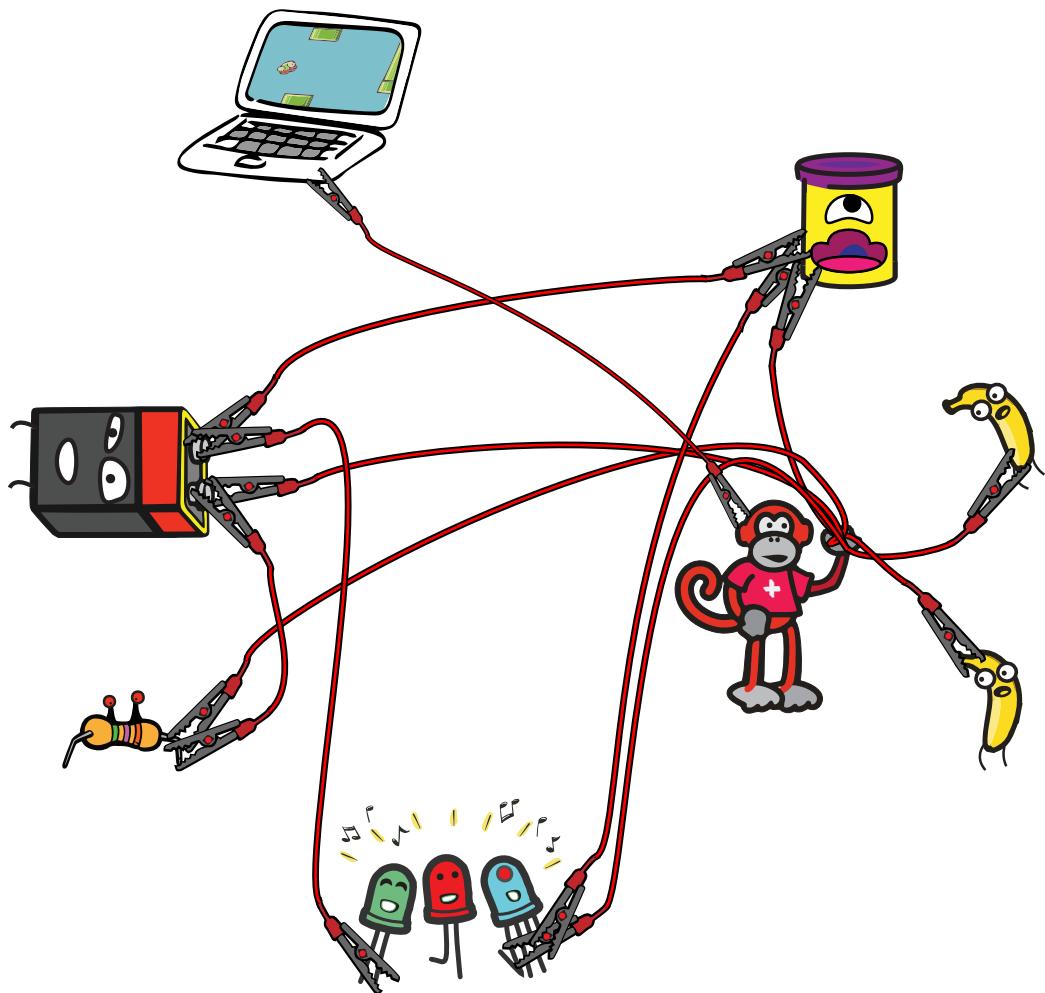
As a mentor I am a guide and facilitator:

Guided Learning - actively engaging youth and answering questions with content and materials at with the intent to build skills and provoke thought.

Workshops - brief projects focused on single concepts, usually done off the library floor.

Participatory Design Projects - long term, focused projects initiated or worked on by youth with mentor guidance.

Exploration - free form and completely hands-off exploration of materials and concepts, no specific project or motive.'



# **Maker Jawn**

## **Projects**

At the Free Library of Philadelphia we have created many projects using anything from simple circuits with wires and batteries to hardware like the MaKey MaKey. We also come to the table with a variety of arts and crafts or making activities to supplement or scaffold into more complex electronics projects. I've led quite a few projects, those using hardware as a means for kids to explore different types of interactive games or installation pieces.

## Scratch Day 2013

My first interaction with children within the context of a workshop occurred at Scratch Day '13 hosted at UPenn's Graduate School of Education.

Scratch is a web-based tool to introduce anyone to the basic structure or syntax of programming. You can create animations or games and share them via the same online portal. Our task was to create example modules for others to hack and modify to tell their own short story.

We gave three hour-long storytelling workshops to charter high school students, parents, elementary school students, and educators. Some remixed our examples and others went off on complete tangents with their Scratch explorations. Most notably we realized the need to hand-hold or heavily coach both pre-teens and adults throughout the process. When it came to presenting all were ecstatic to show off their work or experience the unexpected stories or animations others made.

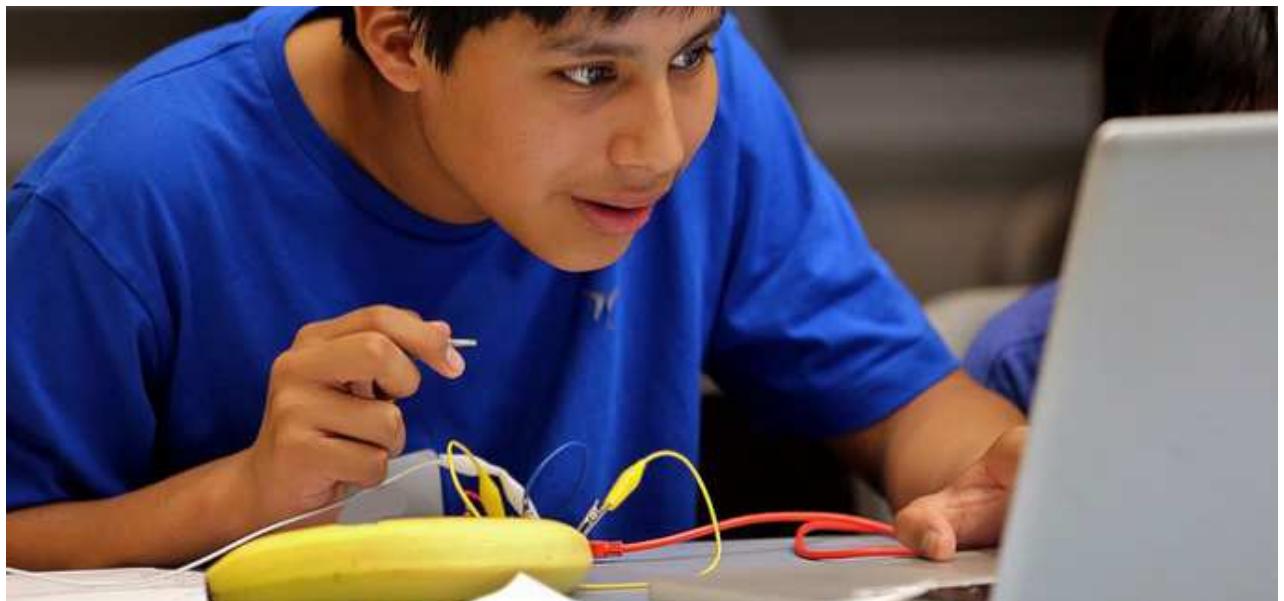
Sharing of stories, playing throughout the process, and the need for a bit of hand holding became apparent and important to me. Also as noted across the page,

I began to see the value of interacting with physical objects over software and its influence on the learning experience. Especially for middle school students ages 7-13.

Physical play with digital tools is where it's at!

Projects link:  
[http://scratch.mit.edu/  
studios/207409/](http://scratch.mit.edu/studios/207409/)





## **the MaKey MaKey**

This awesome piece of learning hardware was developed in the M.I.T. Media Lab's Life Long Kindergarten Group by Jay Silver and Eric Rosenbaum.

Their banana based research allowed them to unlock the potential in anything that conducts electricity and allowing it to be a keyboard key.

They successfully kickstarted a product which is now sold in kits costing \$50.

There is a fairly lively community developing projects using the MaKey MaKey. They range from game controllers, educational tools, and interventions for disabled folks.





### Village of Arts and Humanities Projects:

During the summer of 2013 I taught and mentored some awesome kids in digital media, electronics, and physical making.

At the Village I helped facilitate a number of workshops and guided a few projects that used the MaKey MaKey.

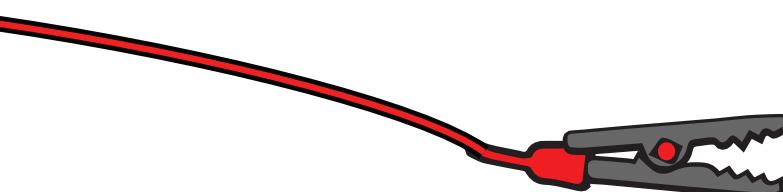
Initially I realized the impact it had on the kids I taught and mentored.

After quite a bit of use I found them viewing it as a toy instead of some piece of educational hardware. This was excellent, but lead to little ownership over the physical condition of it.

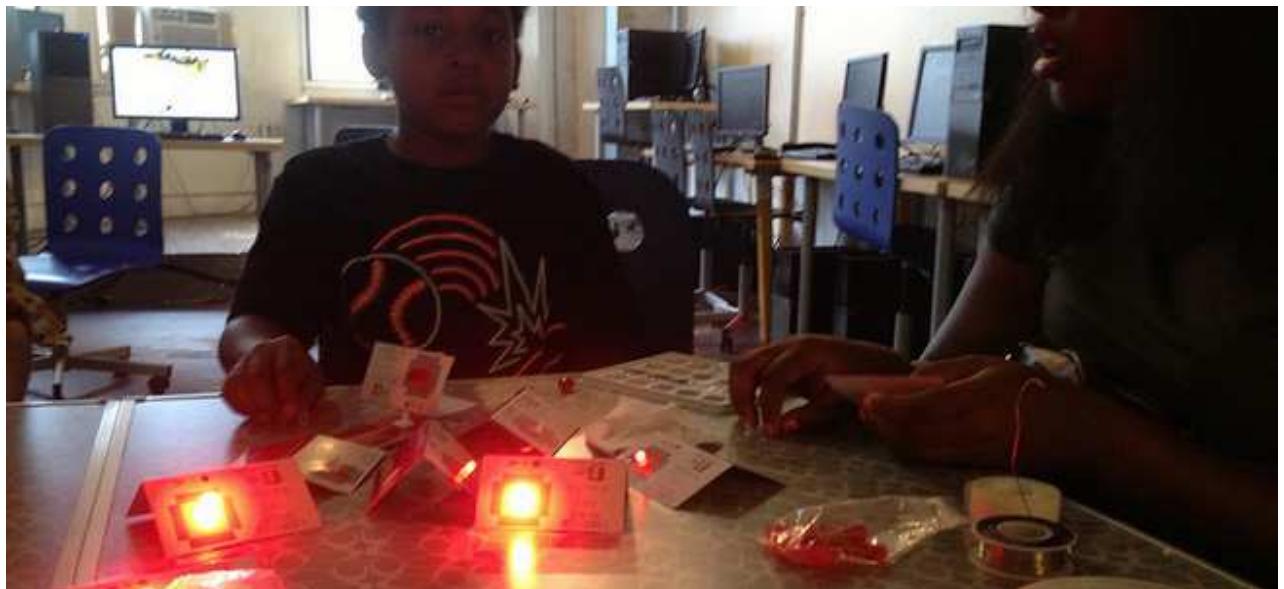
This got me thinking about the tools and technology we use and the sense of ownership participants have over it.

Another interesting issue the **inability for projects to be taken home**. Primarily this was because of the cost of kits or parts. The MaKey MaKey costs \$50 per kit, squishy circuitry parts cost around \$25, and even smaller projects add up quickly when taking into account 15 regular pupils.

This was resolved when we introduced a remix of Kindness Cards in the form of a simple circuit. At less than fifty cents per card it was easy to get funding for supplies and deploy.

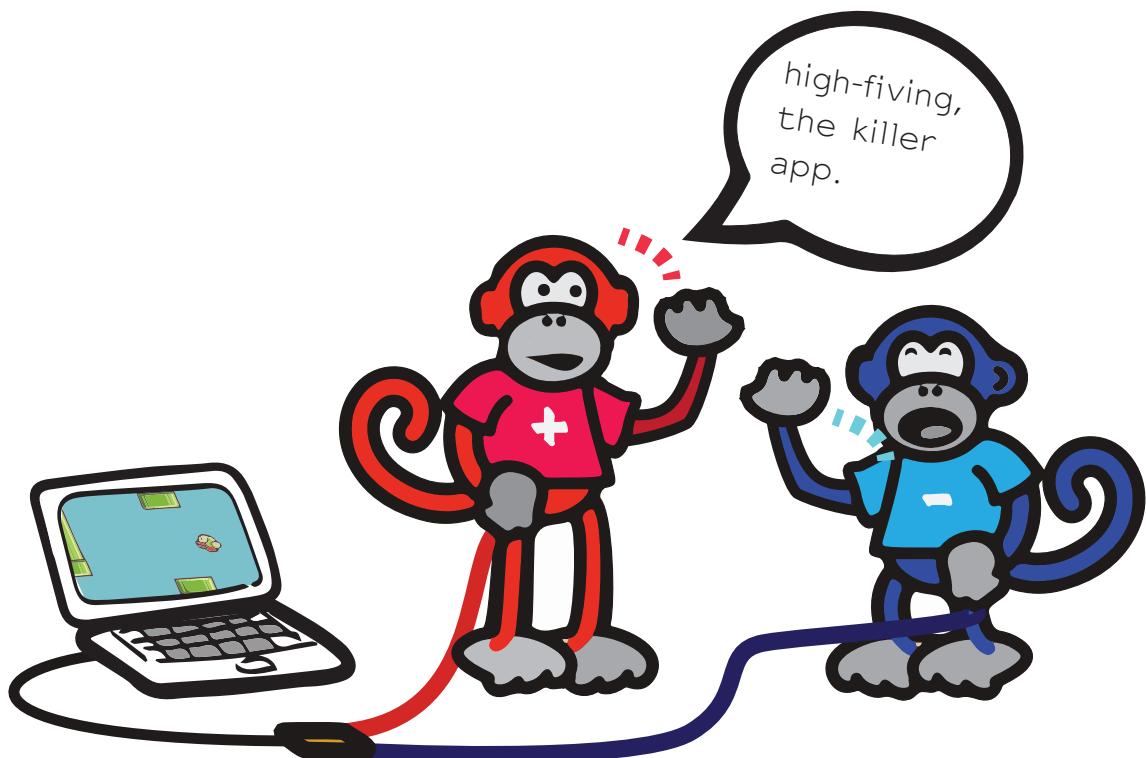


Almost all electronics projects cost too much for all to take home.



### SPELLS Writing Lab Workshops:

While embedded at the Village I facilitated a workshop at Spells to cap off a week of story boarding and creating platform style videogames. In this workshop I experienced how to convey the basic concepts of the MaKey MaKey in under two minutes. This was not the highlight of the event however. I realized that in order **to build a rapport** with youth quickly one must **get physical fast**. One should not just sitback and let things happen, in order to spark creative thinking we must have a sudden flash of interaction and surprise. You need to show the power of your tools immediately in order to command your participants attention. In doing this I learned the true power of the physical demonstration of the MaKey MaKey to an audience.





SCIENCE is fun!

DAVID

RYAN  
13  
SOCCER CAMP

costumes

### **Maker Celebration Interactives:**

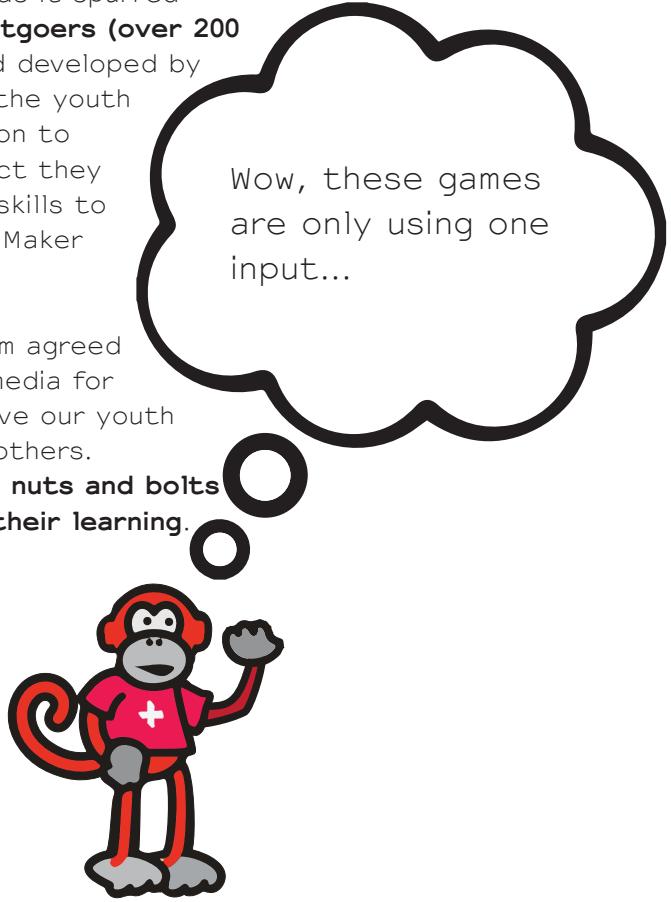
During the summer we collaborated with Penn GSE and Penn Design to create an over arching project named Connected Messages(<http://connected.ecrafting.org>). A digital mural module created by each Maker Corps location in north Philadelphia. At the end of the summer we exhibited the murals during an event in which we invited outsiders to see and experience what we were making and doing.

This event created a precedent for a type of programming which we still deploy today(Connected Messages and Kindness Cards) and **a collaboration between our youth and small business.**

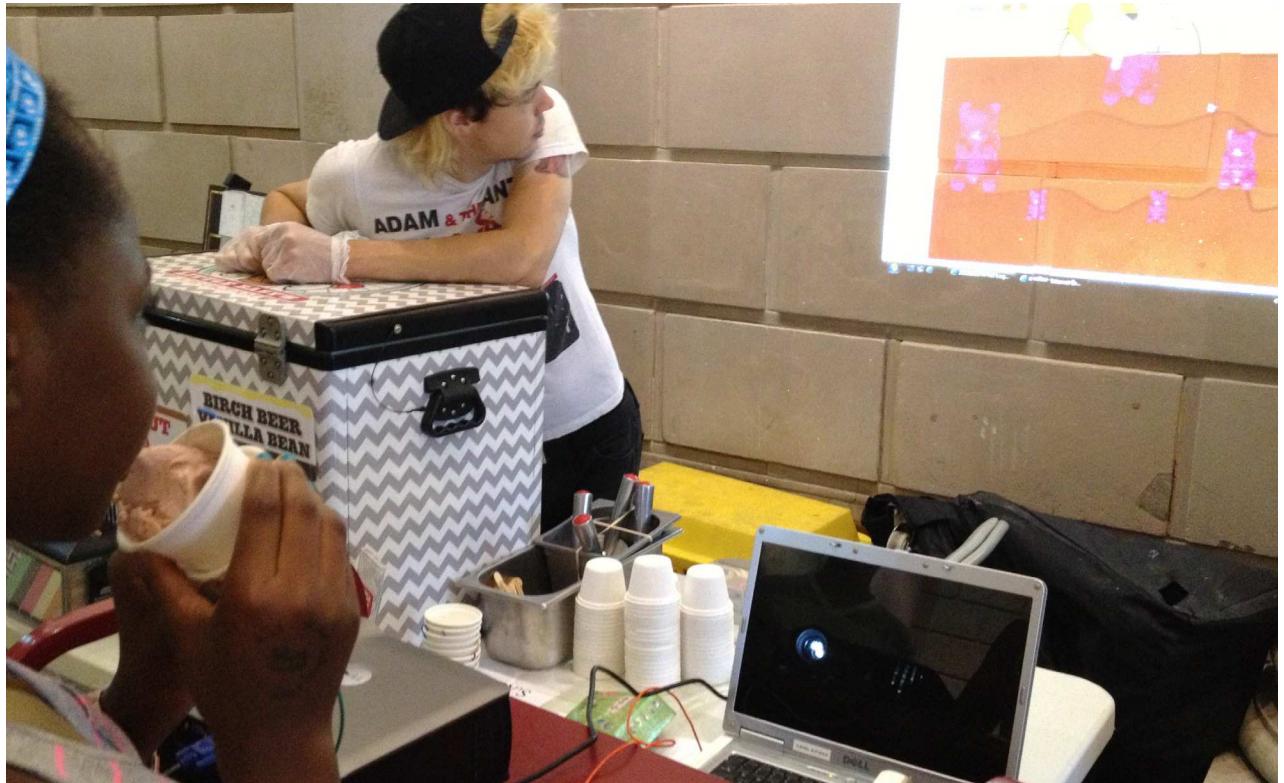
The former will be described as part of the Maker Faire, the later is of more interest as it spurred **interactives that many of our eventgoers (over 200 people) enjoyed.** All prototyped and developed by our youth with mentor guidance. As the youth at the Village learned skills in relation to their Magnetic Play-Doh Mazes project they were able to reapply the tools and skills to developing two interactives for the Maker Celebrations caterers.

Pizza Brain and Little Baby's icecream agreed to use dough and ice cream as our media for interacting with. We were able to have our youth see the influence of their works on others.

This empowered them to **convey the nuts and bolts of their work to others and share their learning.**



Wow, these games are only using one input...



### **Maker Faire:**

While we were successful in implementing Connected Messages at our own Maker Celebration its biggest success was at the 2013 NYC World Maker Faire. At the Faire we did day long workshops with Connected Messages and our Kindness Cards.

Connected Messages is a mural composed of shadowboxes that are constructed and decorated by youth participants. Each participant is given a introduction to simple circuitry and shown how to construct the box. Then they imbue a visual meaning on the boxes face with marker and are allowed to transcribe a corresponding statement or message to go with the piece. This can range from jokes to serious issues and topics as seen in CM's deployment in North Philly.

Kindness Cards are a take-away from our programming, again they are a simple circuit that we introduce the participant to. However in this case the end product is to be taken and shared with another person. The hopes of this interactive and interaction is that the participant can share their learning with another person.

From deploying these two interactives at Maker Faire I learned how the **pacing** for projects and its **impact on interest**. For instance deploying this project over the course of two weeks was like pulling teeth compared to getting as many people interested as possible in completing connected messages in one day.

At the Village I had to create modules for the youth to work within. At Maker Faire we worked with a deadline and had much more creativity and free form thought.



### **Feedback: @INST-INT 2013:**

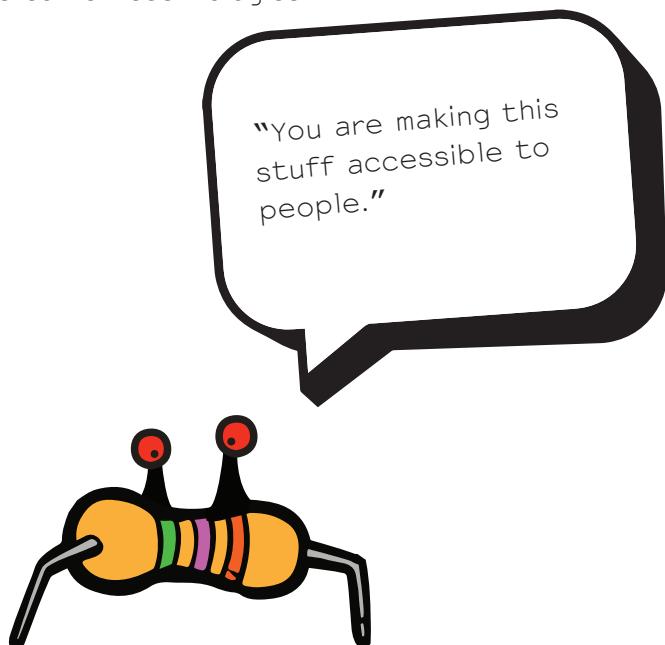
As a student volunteer at INST-INT in Minneapolis, Minnesota a conference on materials, methods, and processes in interactive installations of all types I presented my embedded research and open-ended ideas.

I was able to get feedback and encouragement justifying the track I was headed on at the time.

After my scheduled "Show&Tell" talk the best form of feedback I got was from Kawandeep Virdee of NewPublicArt out of Boston. He aligned with my project as did many other people, however he began injecting the word accessibility into my vocabulary.

Prior to this I saw that word as linked with features for those differently abled and always saw access as something to do with food or good water.

Bringing the term accessibility into my language when talking about the project began linking two things. The need for something low-cost for the library and the fact that there is little access to new technologies in the communities I work in.





## **Constraints at the Free Library**

After an initial batch of research on similar projects, contexts, and materials I came up with a formal list of constraints. (see: Maker Jawn isssu)

I am making myself a

resource.

By making my

skills and tools

accessible.

I am looking at a

hardware

platform

that needs to be

low-cost,

customizable,

able to be taken home,

quick,

+ physical.

## **Moving Forward**

These constraints have allowed me to focus on making a working/viable end product that can be funded and implemented with our youth.

I should investigate a

tool

that is

earned,

~\$10,

able to plug into many  
projects,

flexible,

+ also creates a  
community.

It will have

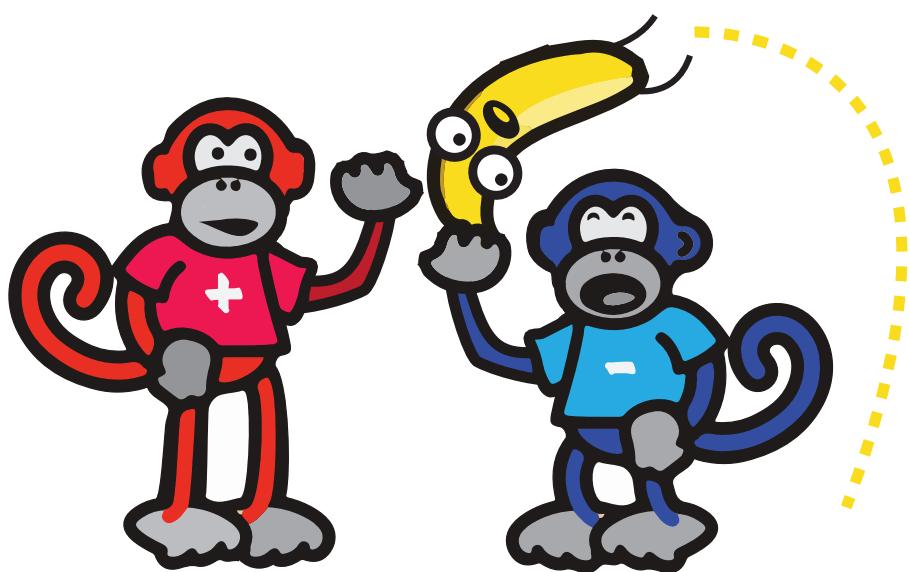
the qualities of our most  
valuable tools

and be

created via a workshop  
series.

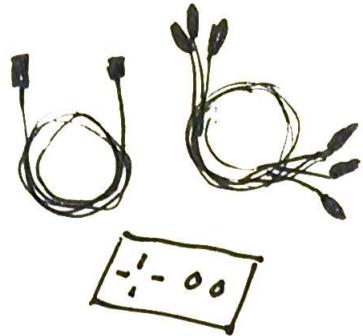
# **Part II**

Can youth make their own  
educational hardware?

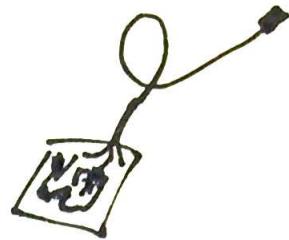


## **The One Input MaKey MaKey**

After working so closely with the MaKey MaKey it was a no-brainer to choose to create a clone of it as my first attempt at youth/institution created hardware.



\$50  
18 inputs  
plug/play  
< 1 min



\$7  
1 (up to 3)  
make | test    plug/play  
60 ~ 120 min

### **Iteration:**

#### **Flip.nl's 1 Key Keyboard**

In order to dive head first into this project I found a similar project by Flip van den Berg called the 1Key Keyboard.

An Industrial Designer his project was for having an extra key or button for flash based multimedia projects of his. His approach was like that of a electronic hobbyist or engineer, mostly due to his degree being engineering intensive. The code was written in C and hard to compile on non Windows computers. With its steep learning curve and requirements it was not accessible or a long-term solution. However, it allowed me to learn what was at the core of my project.

source:

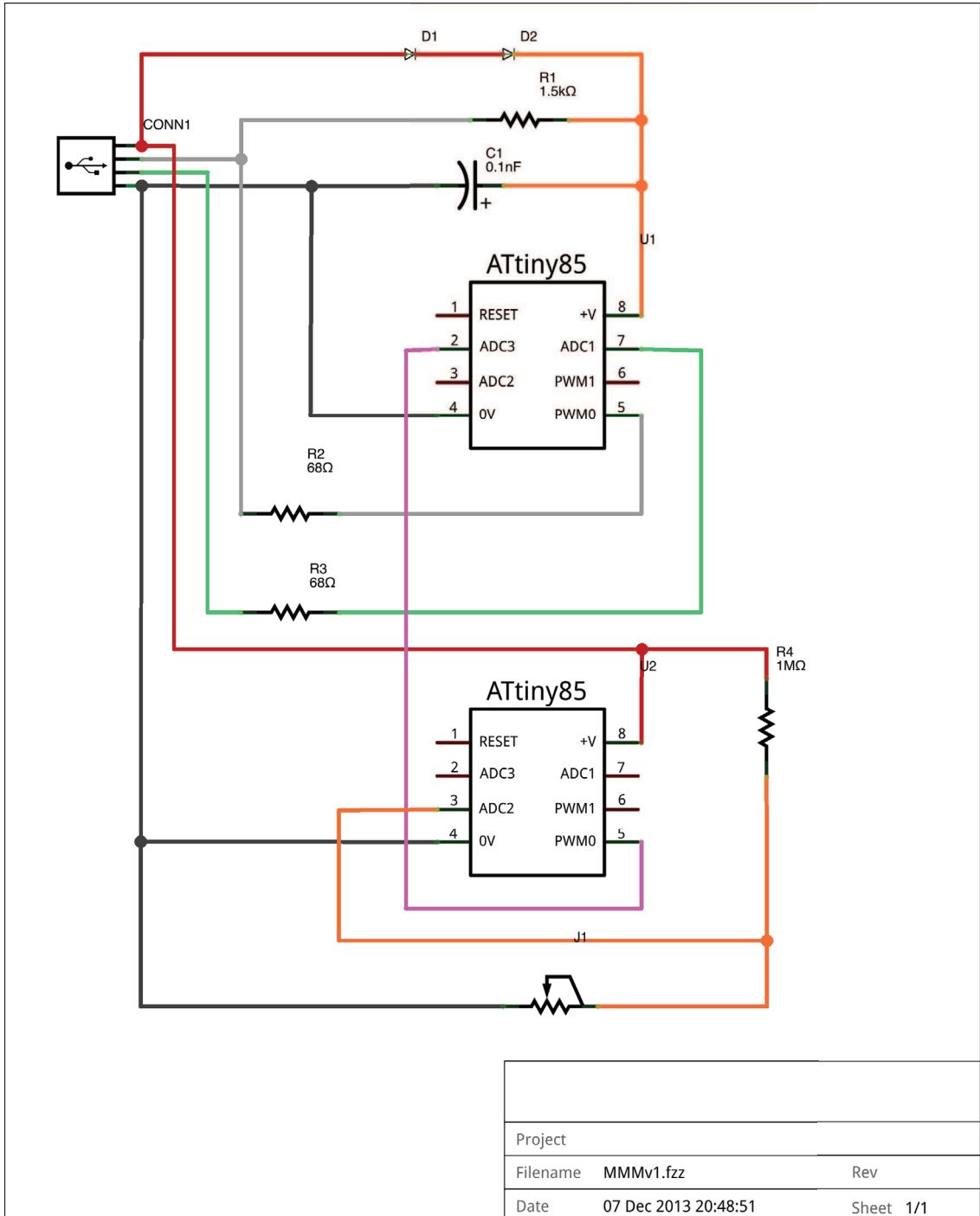
<http://blog.flipwork.nl/?x=entry:entry081009-142605>

#### **Moving Average Filter**

Along with Flip's project I needed to create the interaction that makes the MaKey MaKey what it is. Using Sebastian Nilsson's Moving Average Filter for Arduino I was able to create a working prototype of the OneKey. This allowed me to get a decent understaning of how the sensor data is manipulated and turned into an impulse or button press.

source:

<https://github.com/sebnil/Moving-Average-Filter--Arduino-Library->



**Iteration:**

**Breadboarding and point to point soldering.**

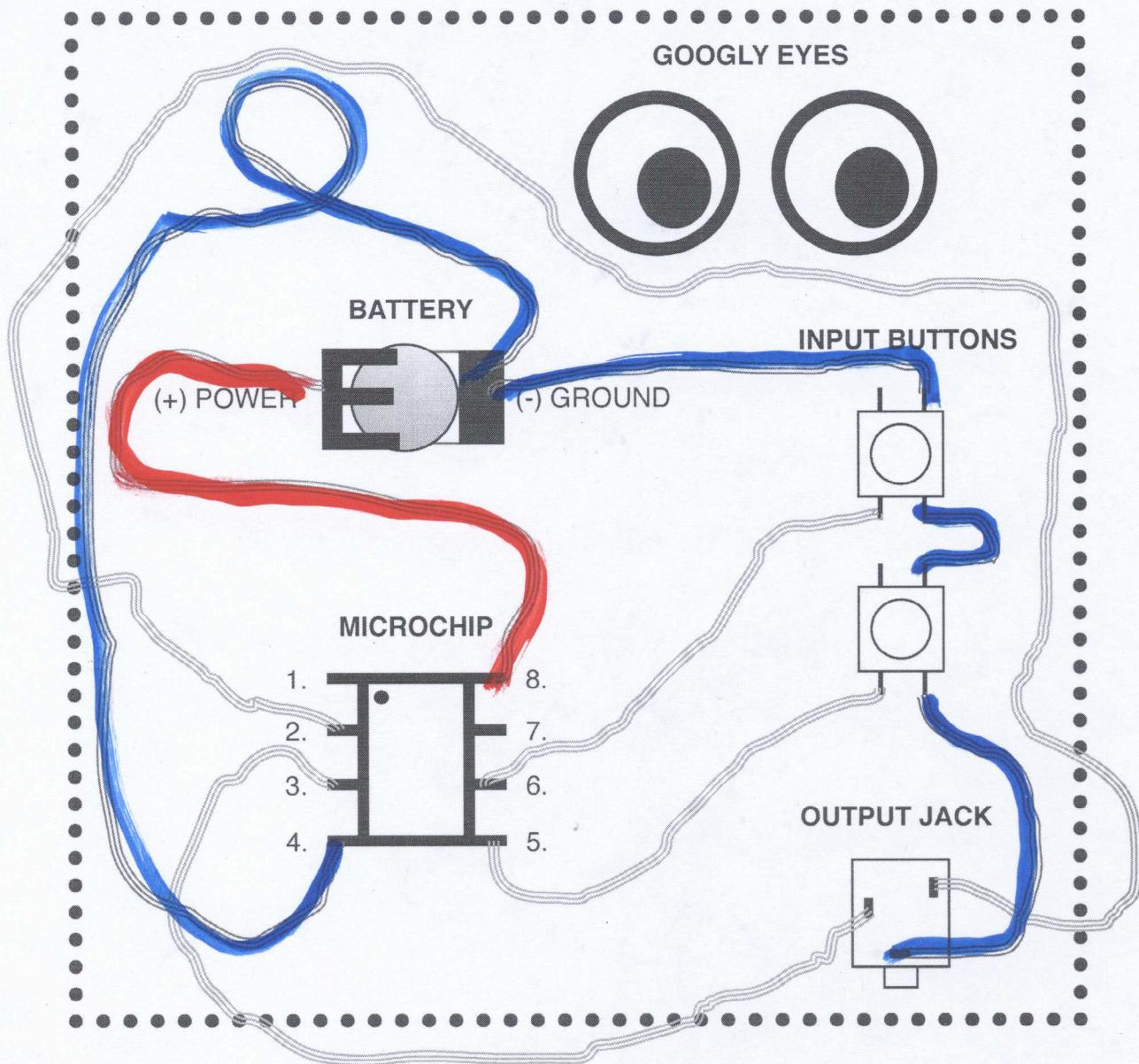
After creating a breadboarded prototype the feasibility(financially) of giving a one to each participant in future workshops scrapped that initial idea.

I then moved towards a method that I saw done when prototyping things at the Franklin Institute as well as a Noise Toy workshop with Leslie Flannigan and Loud Objects.

Point to point soldering or “spidering” takes lots of time and requires a lot of a beginner to soldering. It also either needs to be superglued to a substrate or the circuit is left very fragile.

Neither of these methods worked well due to complexity, lack of visual structure to the final form of the circuit, as well as cost.

# The Anatomy of a Noise Toy



- 1. not used
- 2. output
- 3. output
- 4. ground
- 5. input
- 6. input
- 7. not used
- 8. power

Red is for POWER

Green is for DATA

Blue is for GROUND

## **Iteration:**

### **Vinyl Cutter as Circuit Maker**

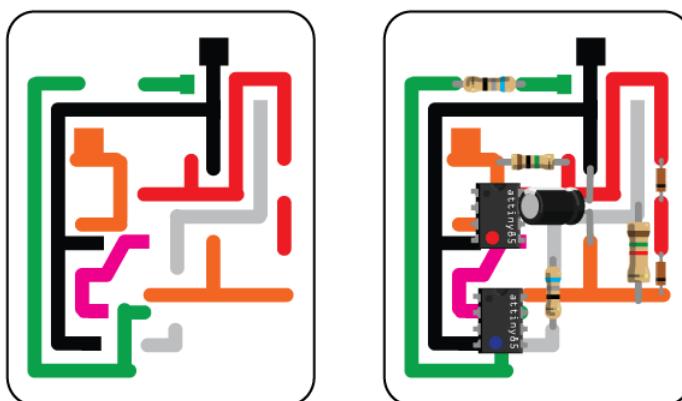
Trying to create an affordable and safe method for producing “circuit boards” led me to desktop vinyl cutters.

At the library had already been using 2” rolls of 3M Copper tape for our projects. Naturally and with precedent from M.I.T.’s How to Make (Almost) Anything class I moved to vinyl cutting over chemical etching of PCBs.

This process would allow me to have wiring or traces that would not degrade over time as easily as conductive paints on the market.

For the library it meant there would be another form of visual art possible in the form of vinyl decals and stickers.

It took about 8+ visibly different iterations to get a working circuit. I had to take into account how well they could be peeled, handled, soldered on, and fixed to flexible materials.



FAILBOT



## **Working Prototypes:**

### **Group**

With my initial working design I created three simple diagrams: the circuit, component names, and the final circuit.

I was able to facilitate multiple workshops at the Kensington Free Library Branch.

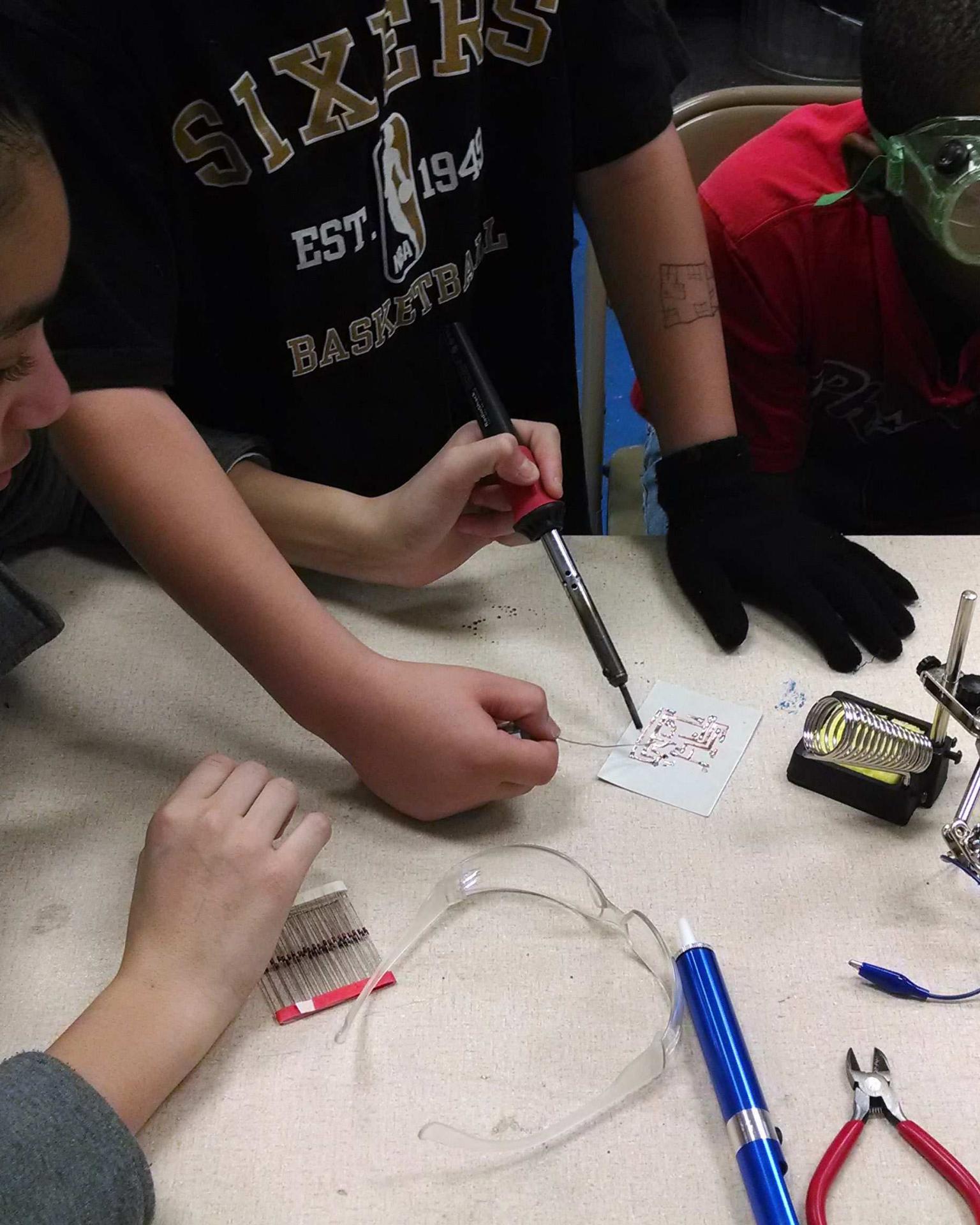
Out of about 20 participants total I left with 10 actively participating and messing around and making their own MaKey MaKey.

After working with groups of children ages 7-13 I worked individually with one child Frank.



All the kids need is a demo of the tools and an example to work off of.

SIXERS  
EST. 1946  
BASKETBALL



## **Working Prototypes: Individual**

Frank, aged 7, goes to the local Middle School and comes to the library with his friends for homework help and our "art club".

He was a part of one of my early group workshops and took to trying to light up LEDs with the circuit we created. He Geeked Out with the project as he found he could not only "blow-up" LEDs but also overload the usb ports to shutdown the PCs.

Eventually after taking 45 minutes to create one with me he had his own MaKey OneKey).

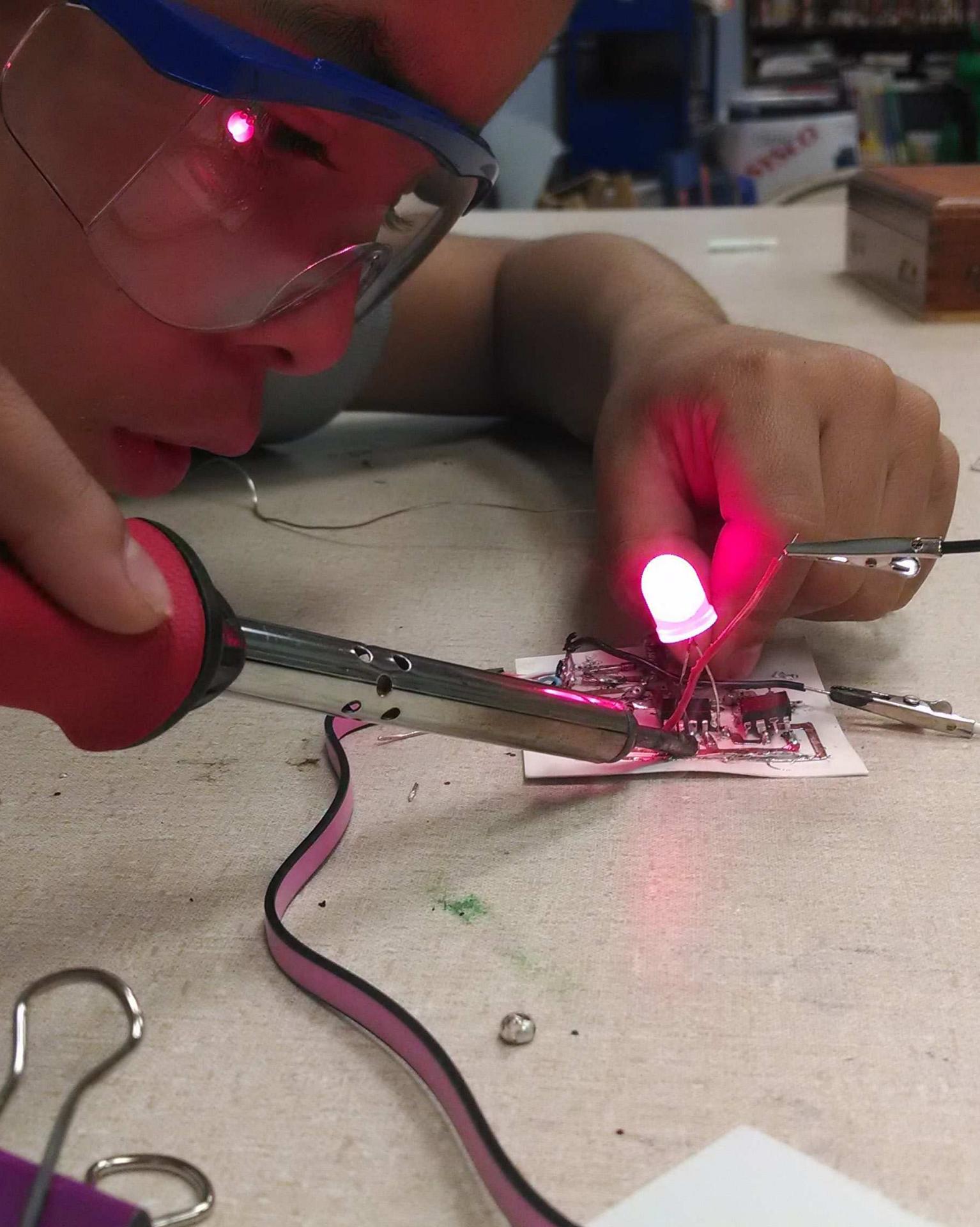
He was ecstatic!

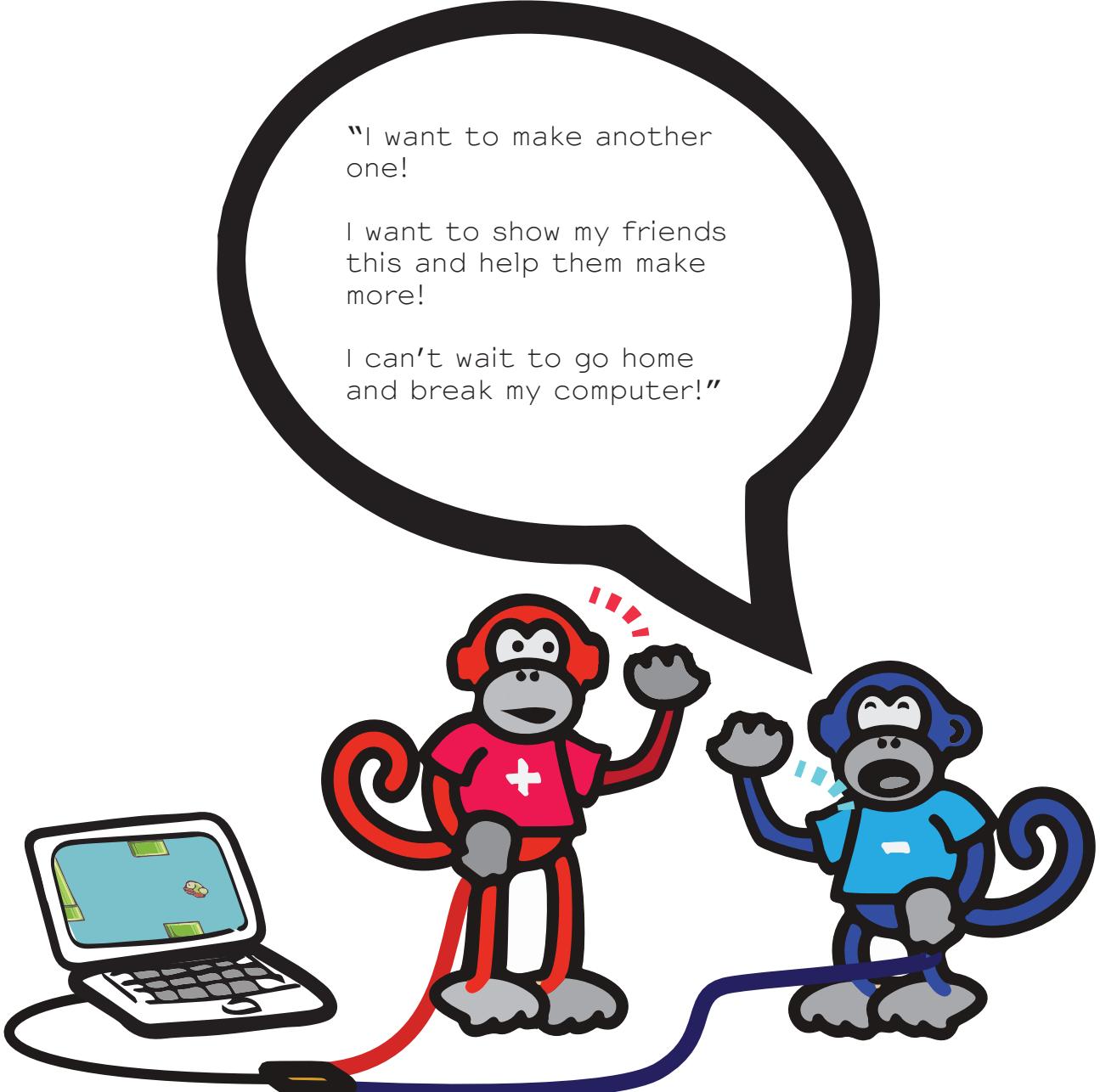
It was excellent to have an ally that would be able to get other kids involved from here on out. In sharing his own MaKey OneKey he began to get others interested.

I was amazed by the lack of questions he asked during the making process. As he put the pieces together he would retain the names of each component. However, after 45 min of using his OneKey with Minecraft his explanation for how we put it together, granted excited, was:

"We used a lot of wires, wires, and wires, and MaKey MaKey hot sauce(solder)."

It was interesting to see his use of playful language in explaining his work. Especially his hacked on LED which was unguided by me. My thoughts are that if he were to actually memorize the names of each component the creation of the OneKey would be associated with work rather than play.





A cartoon illustration of two monkeys standing next to a laptop. The monkey on the left is red, wearing a red t-shirt with a white cross on it, and has a red tail. The monkey on the right is blue, wearing a blue t-shirt with a small white logo, and has a blue tail. They are both looking at the laptop screen, which shows a simple 2D game with green platforms and a small character. A large black speech bubble originates from the laptop and extends upwards and to the right, containing three lines of text.

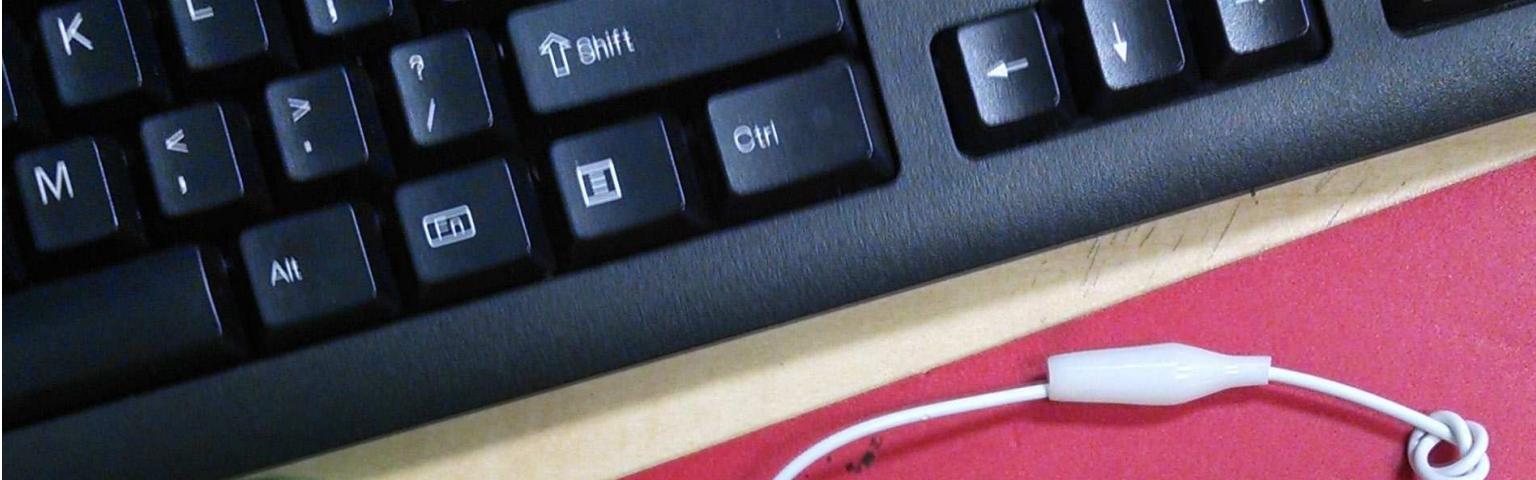
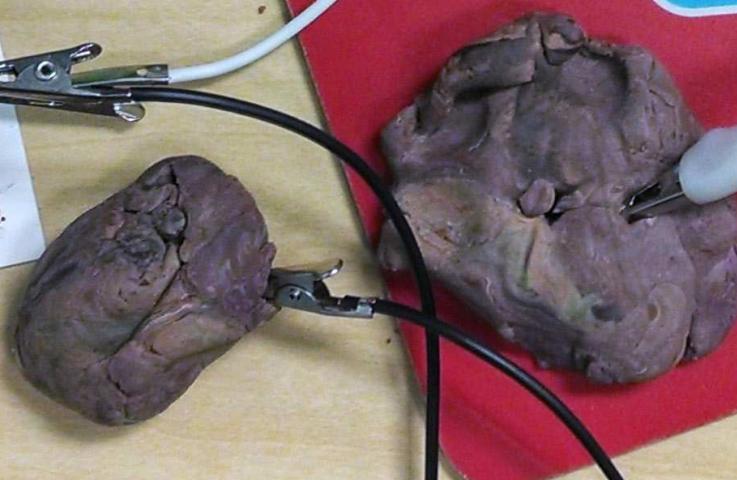
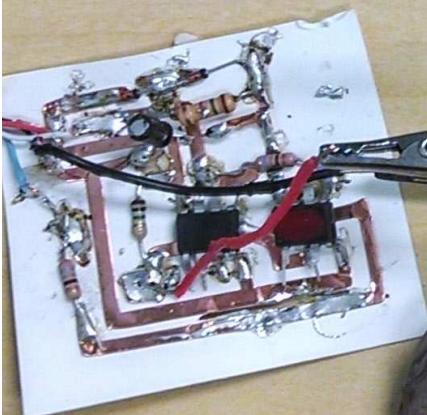
"I want to make another one!

I want to show my friends this and help them make more!

I can't wait to go home and break my computer!"

Free  
LIBRARY OF  
big idea

freelibrary



## **Working Prototypes: Instructors Workshop**

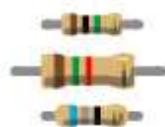
At the Free Library we have a team of 12+ mentors as a continuation of our maker programming from last summer. So to test the feasibility of my project being implemented from other mentors who have little experience with electronics I led a workshop.

In the workshop we created a semi-functional prototype so that the mentors could experience the process that the kids go through.

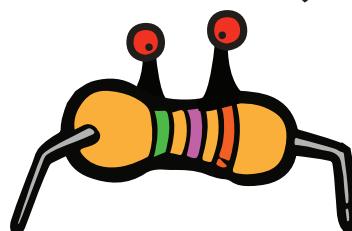
The workshop brought up a lot of concern over the ability of a non-technical mentor to explain components and how they work.

This led to the exploration of simple methods of explaining how each component works.

This leads us back to defining language for two different parties. Mentors view this object or workshop as work and therefore need technical knowledge and details. On the flipside children or participants just need to know how to make it, all the rest can come via inquiry and interest through play.



A resistor is like a faucet, it turns down the amount of power.





## **Feedback: @DML14:**

The weekend after the instructors workshop my advisor, bosslady, and friend K-Fai was able to meet a few people who have spent some time around the Media Lab. At the Digital Media Learning conference she actually ran into Eric Rosenbaum demoing the MaKey MaKey and had the chance to show off pictures of my progress.

Showing off one of the circuits the kids had soldered up at Kensington(pictured right) the response was quite hilarious.

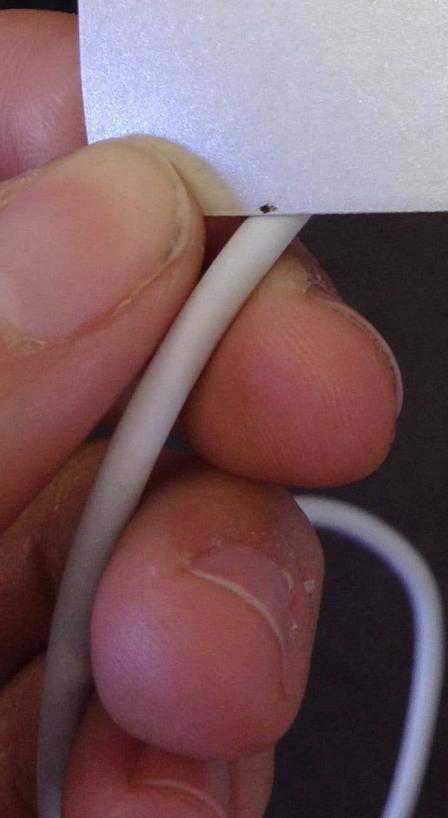
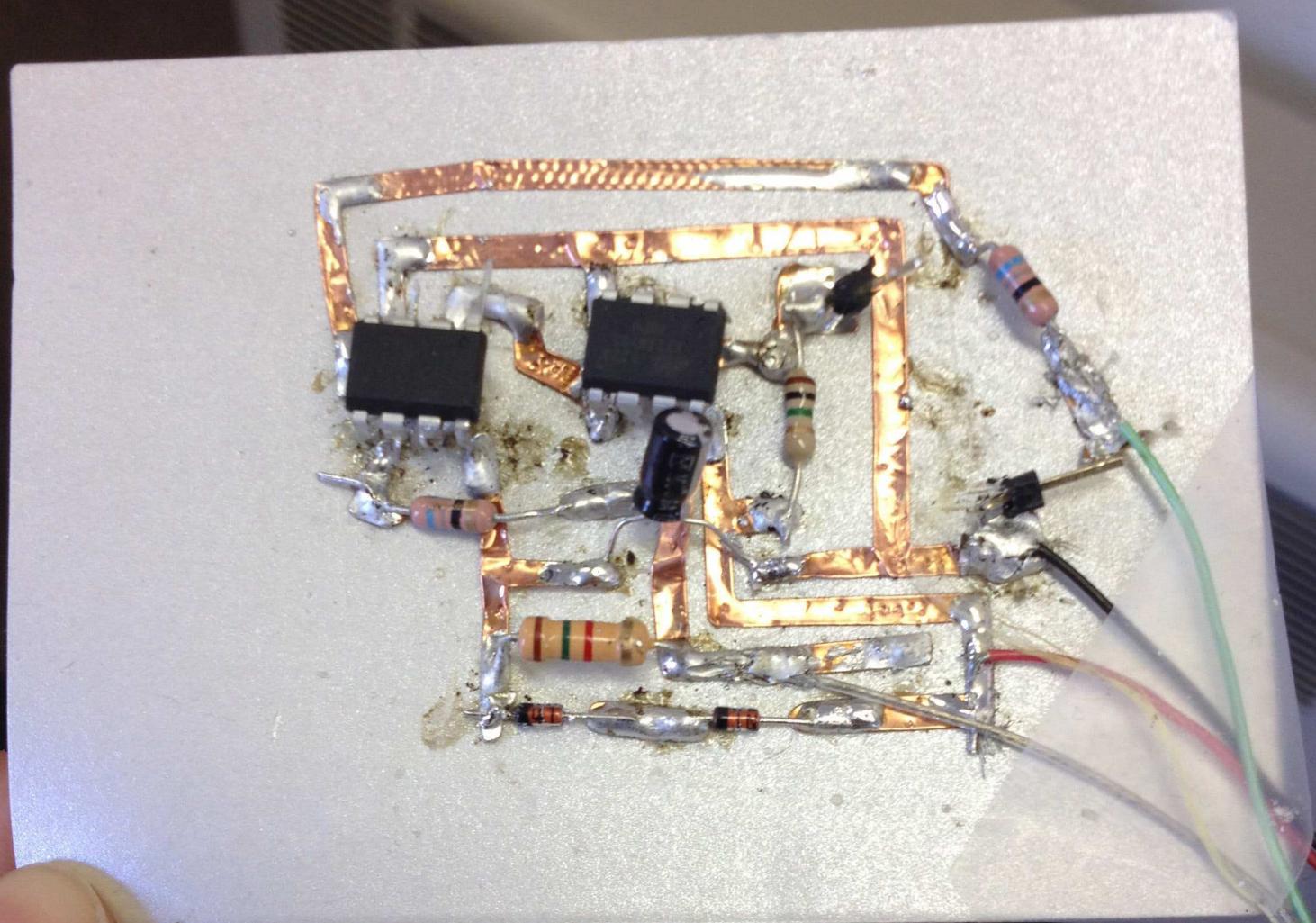
This is when I realized that they're so focused on plug-and-play with the MaKey MaKey that all the nitty gritty and or slightly ugly mechanical bits are neatly tucked away or hidden.

You can even see that they decorate and use traces as a way to get you intently focused on getting started on making with the tool rather than the tool itself.

This is something I could aspire to, however, I am not trying to sell my tool, I'm just trying to get kids to make, learn about, and take ownership of their tools.



*"What is  
even goin' on  
there, I don't  
understand!"*



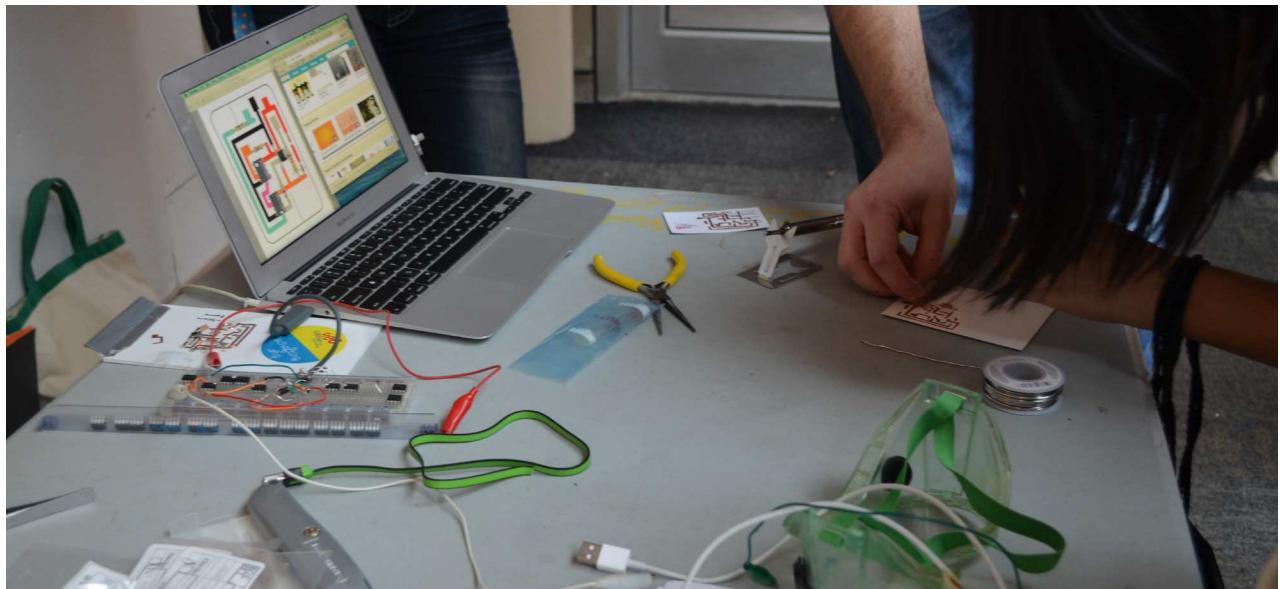
## **Making in Public: STAMP Day @ UArts**

As Maker Jawn three of us ran a table demoing the types of projects we work on. The focus of the event was to show teens what types of opportunities there are for after school and summer jobs, internships, or volunteer work.

For this project the purpose of this event was to demo the fact that youth can make their own hardware. It was a proof of concept in a public setting.

Also I was interested in trying different substrates such as paper, yupo, and cardstock to see how they reacted to novice soldering.





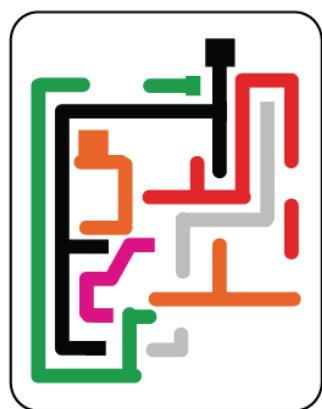
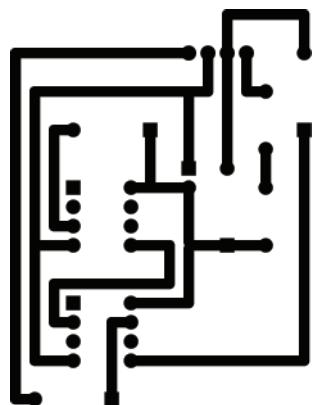
## **Refined Models**

After the STAMP day workshop and the Maker Jawn mentors workshop I went back to the drawing board on how to speak with my three different audiences: the Library, Mentors, and Participants.

1. If this were to be integrated into some sort of curricula at the library it would need to be packaged with a cue sheet listing materials, instructions, and explanations.
2. For easing mentors minds I found simple analogies for electronic components to be worthwhile. Also a visual walkthrough of the assembly was needed. This solved the need for technical knowhow for mentors without being too overbearing.
3. Finally for participants I just needed to create some sort of package that would allow for experience the creation of a MaKey MaKey with some visual guides and learning points. Play and the idea that this was not a solitary activity allows me to leave it light on text. This will hopefully create more verbal interaction between guide and participant.

The result was a pamphlet that integrated the actual copper tape circuit into the learning materials needed by a mentor guide.

The next page is an example of the inside of the pamphlet.



the parts and what they do:

the **attiny85** is the brains of the circuit...

---



...it can be programmed and sense/act on things.

**diodes** only allow electricity to go one-way...

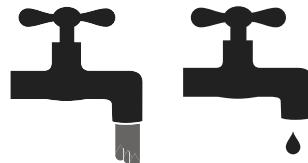
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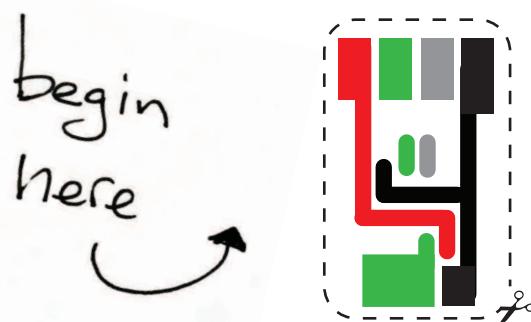
...they can only be placed in one direction.

**resistors** are like faucets...

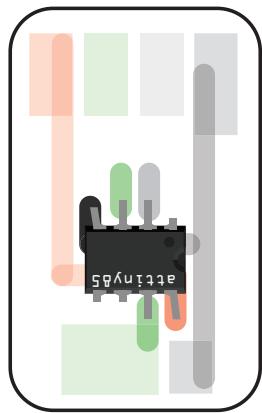
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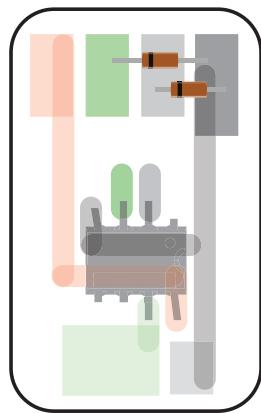
...they can reduce the amount of flow.



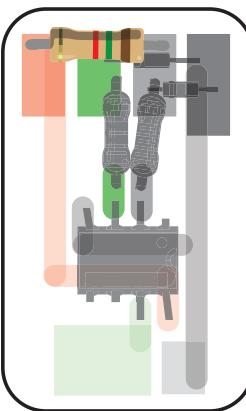
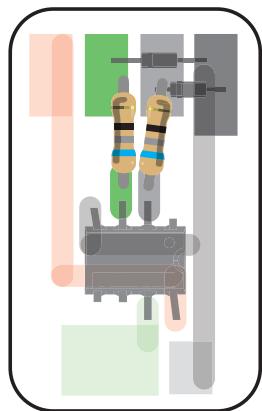
walk through:



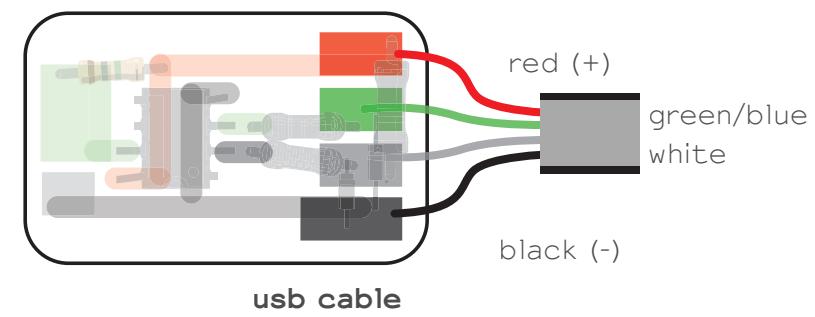
attiny85



diodes



resistors



usb cable

## **Making in Public: STEAMfaire**

With the final form of OneKey for this leg of the project I set out with a couple mentors to do a public workshop at STEAMfaire at Benjamin Franklin H.S.

This event was part mentor training part working with teens and young adults.

By the end of the mid-day event 4 MaKey MaKeys were created.

With input on the instructions, analogies, and layout of the piece from mentors, observation, and participant usage I was able to create a final working form for this part of the project.



WE OUT HERE



**Final Form:**

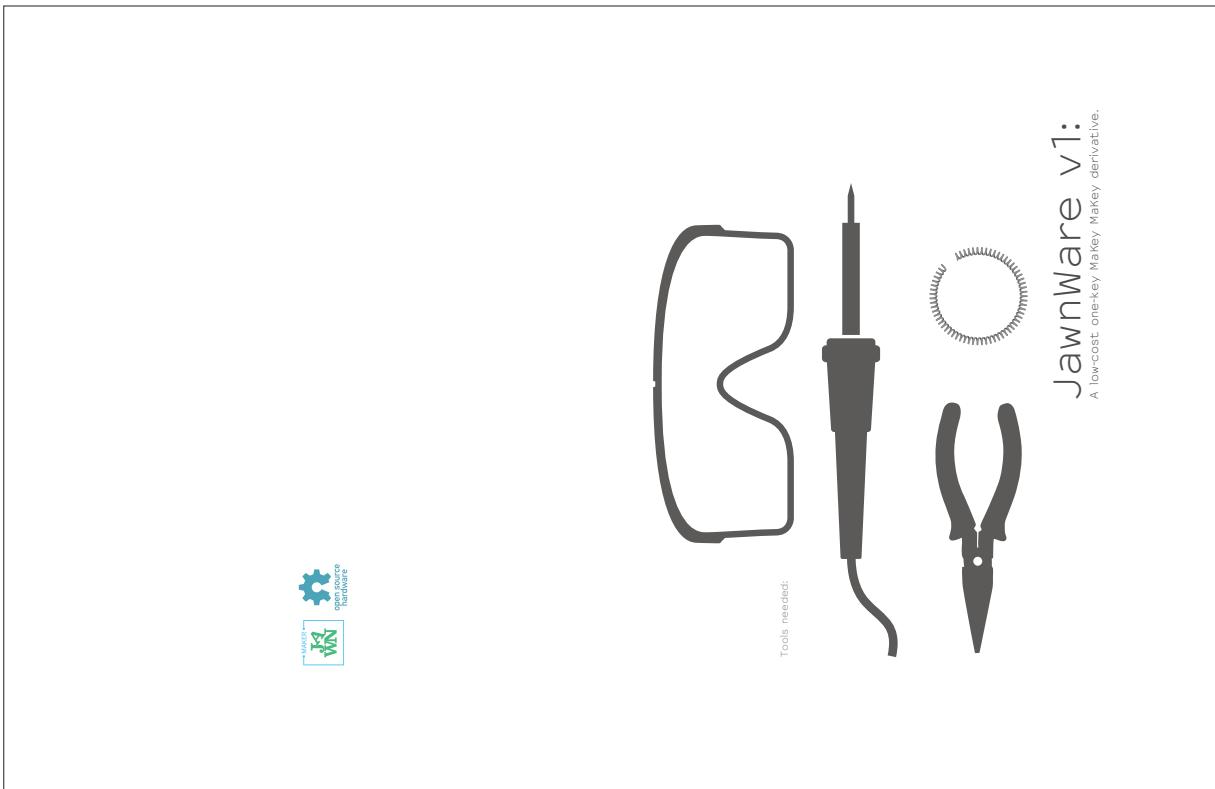
**JawnWare v1: OneKey a low-cost accessible derivative of the MaKey MaKey.**

I made a few final changes after deploying the OneKey at STEAMfaire.

The Walkthrough should be printed in color, however the cost of a production run of full color 11"x17" would be prohibitive. An alternative could be a color businesscard that has both the circuit traces and a color diagram and the pamphlet stays a separate entity.

Also I redesigned the layout so that the pamphlet is not visibly ruined if the OneKey is cut out.

This leaves the pamphlet as a take-away and learning tool if the OneKey is removed.



The parts and what they do:

**attny85** is the brains of the circuit.

...it can be programmed and sense/act on things.

**diodes** only allow electricity to go one-way...

**resistors** are like faucets...

...they can only be placed in one direction.

...they can reduce the amount of flow.

**ONE WAY**

**usb cable**

When the two pads are wired up as connected by an orange line, the electricity needs to go through the circuit, trying different paths.

Try reading the circuit for reading.

**attny85** is open source hardware.

**JawnWare v1:**  
A low-cost one-key MaKey MaKey derivative.

## **Feedback: Maker Education Initiative**

Towards the end of this project I was part of a online Google Plus hangout to talk about the second year of Maker Corps, the program that spawned Maker Jawn.

During the hangout I showed off the fact that I was working on a one-input version of the MaKey MaKey.

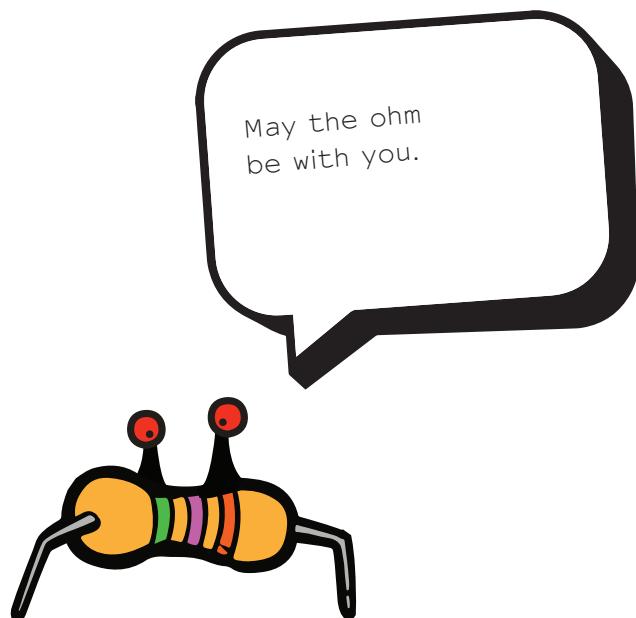
Steve Davee, Maker Ed's Director of Education, was beyond stoked about my project. It turns out he has even talked with Jay Silver(JoyLabz/MaKeyMaKey) about creating a one-input, simple, or analog version of the MaKey MaKey.

**“Awesome!”**

This seems to have been a project many people have thought of, but nobody has actually pursued it to the extent I have in a context like I'm in.

Source:

<http://www.youtube.com/watch?v=-7KByV6VbQY&feature=share>





where we're at



I have made an

educational tool

that is

earned by making,

~\$1.25,

able to plug into many  
projects,

flexible,

plugged into the context  
of low-cost, d.i.y. making.

It has

one input (and works like  
a MaKey MaKey)

and is

created via a workshop  
or mentor guidance.

## **So what is next?**

To be honest, I have no clue!

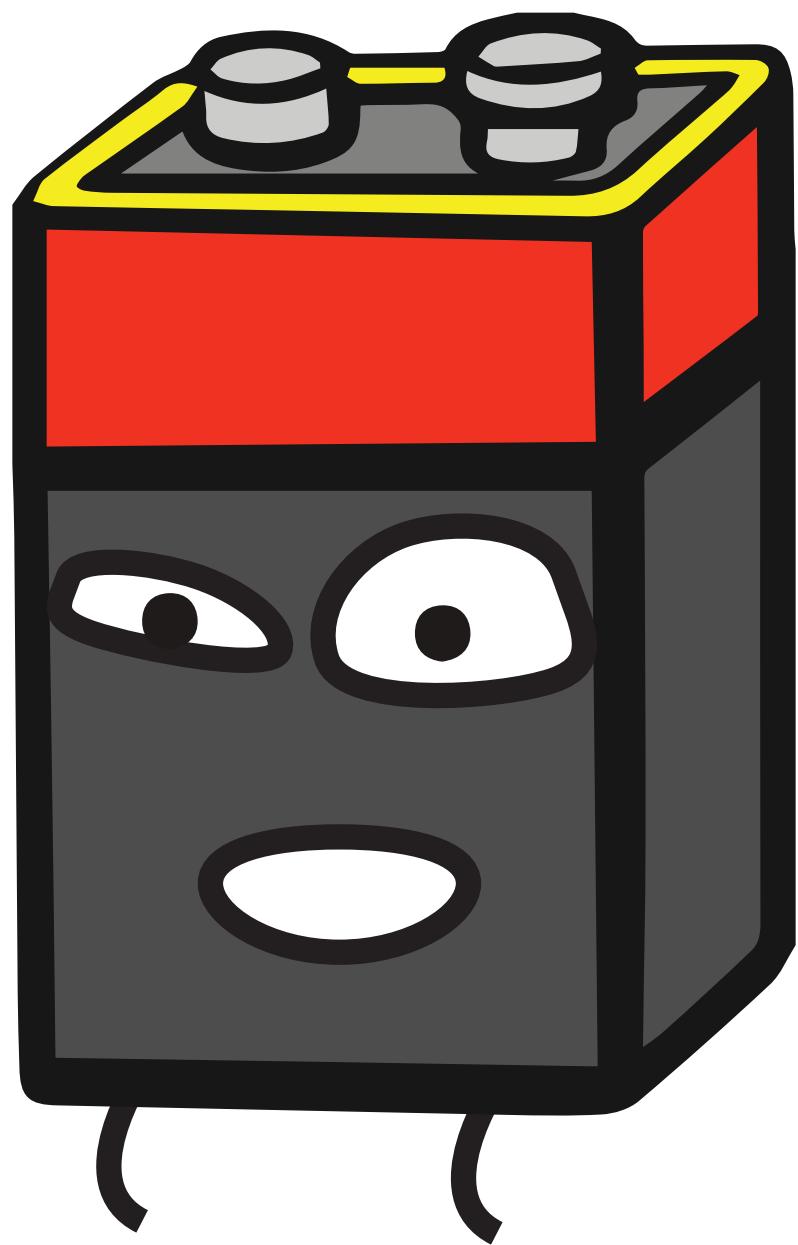
There are a few possible things that will happen with OneKey as the first piece o' JawnWare(multiple choice):

0. Immediate future, keep making stuff with my group of kids interested at Kensington. Present at the HASTAC conference in Peru. Somehow graduate from UArts and continue to work at the Library/UPenn.
1. We keep doing workshops and I develop OneKey one last time so that it can be deployed for a week across multiple branches. We seek out a summer competition similar to the DML grant that funded Connected Messages when we deployed it in collaboration between the Library and UPenn. We reach as many participants as possible, and we're all stoked.
2. I take the model or process I have created and apply it to other learning tools and hardware.
3. We periodically run the workshop and it eventually goes to the World Maker Faire NYC in the fall.
4. Someone picks up my sourcecode and remixes the project.
5. I present this Jawn at the Open Source Hardware conference in Rome in the Fall of 2014
6. I create an army of geniuses based out of Kensington to annex it as a Jawnlandia where all FCC regulations and naming trademarks don't exist and the pizza is free.



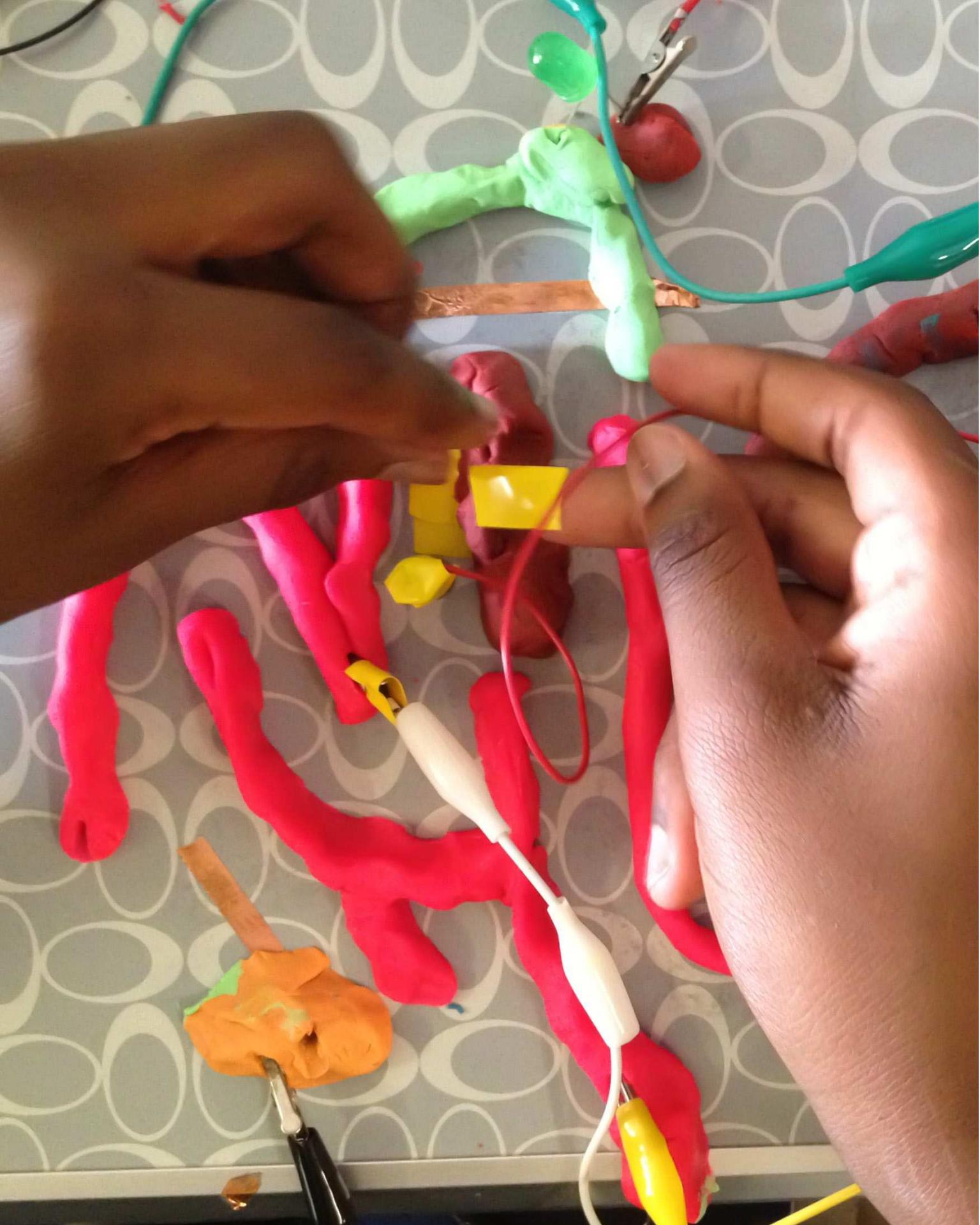
# **Appendix**

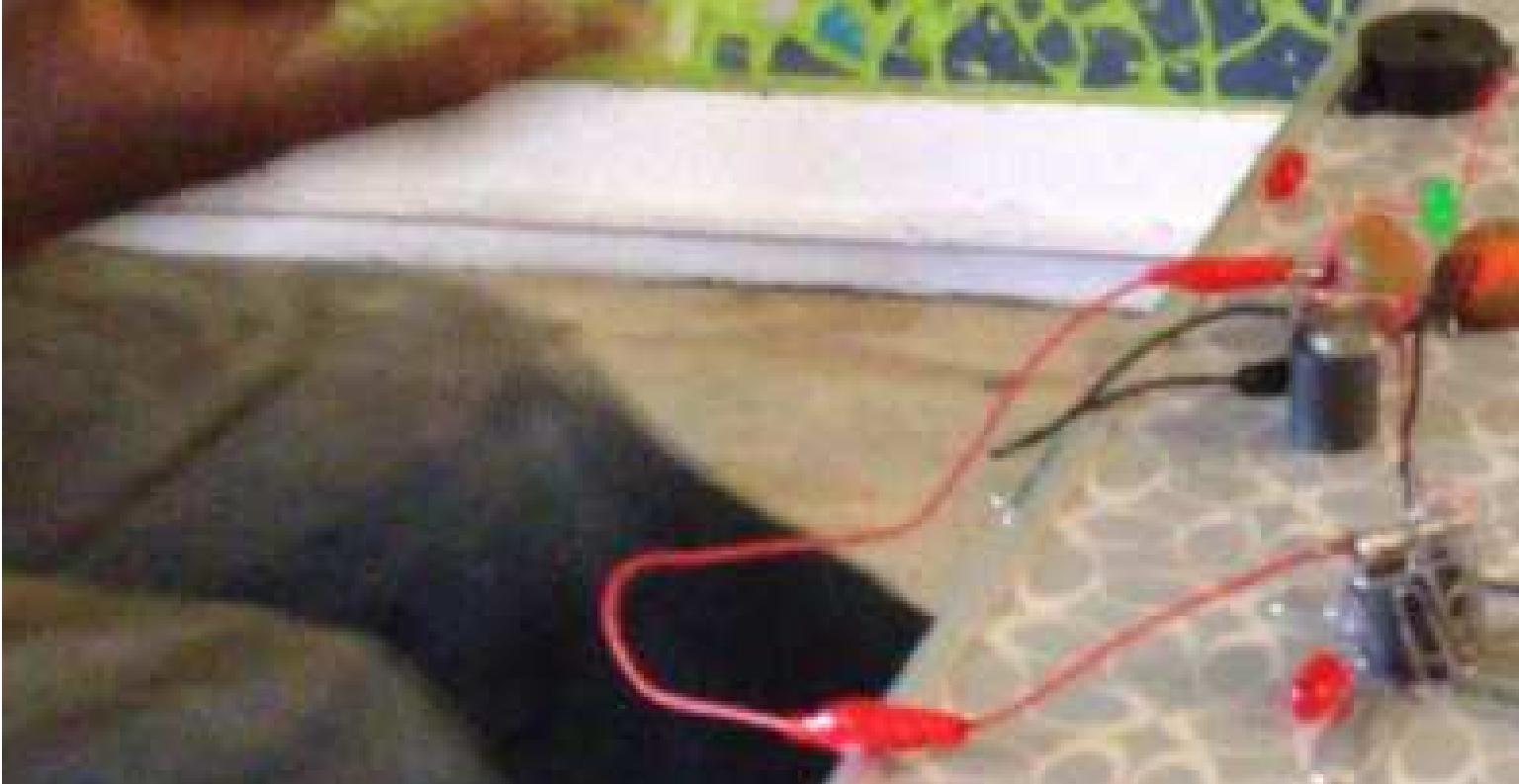
all the fun stuff.





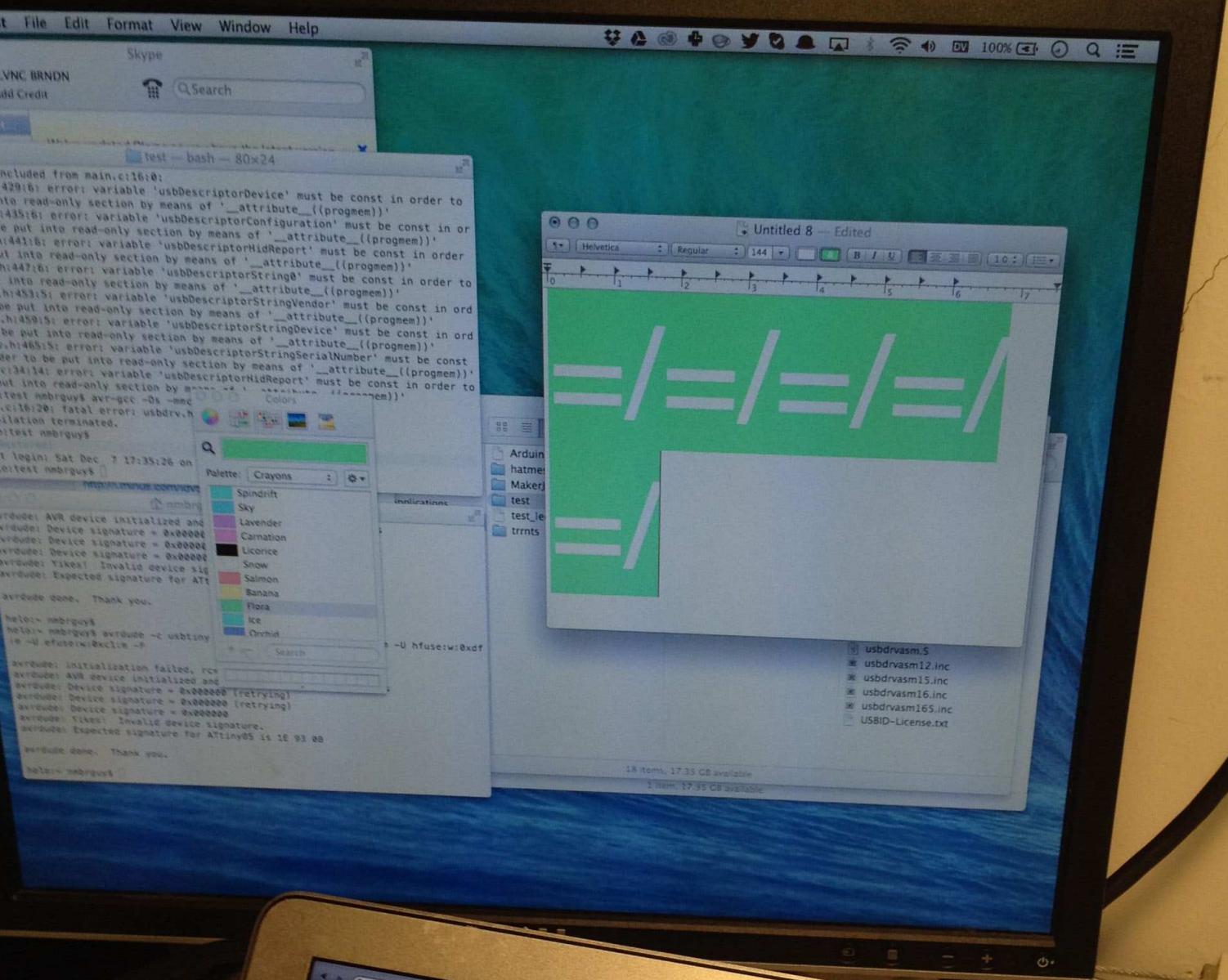


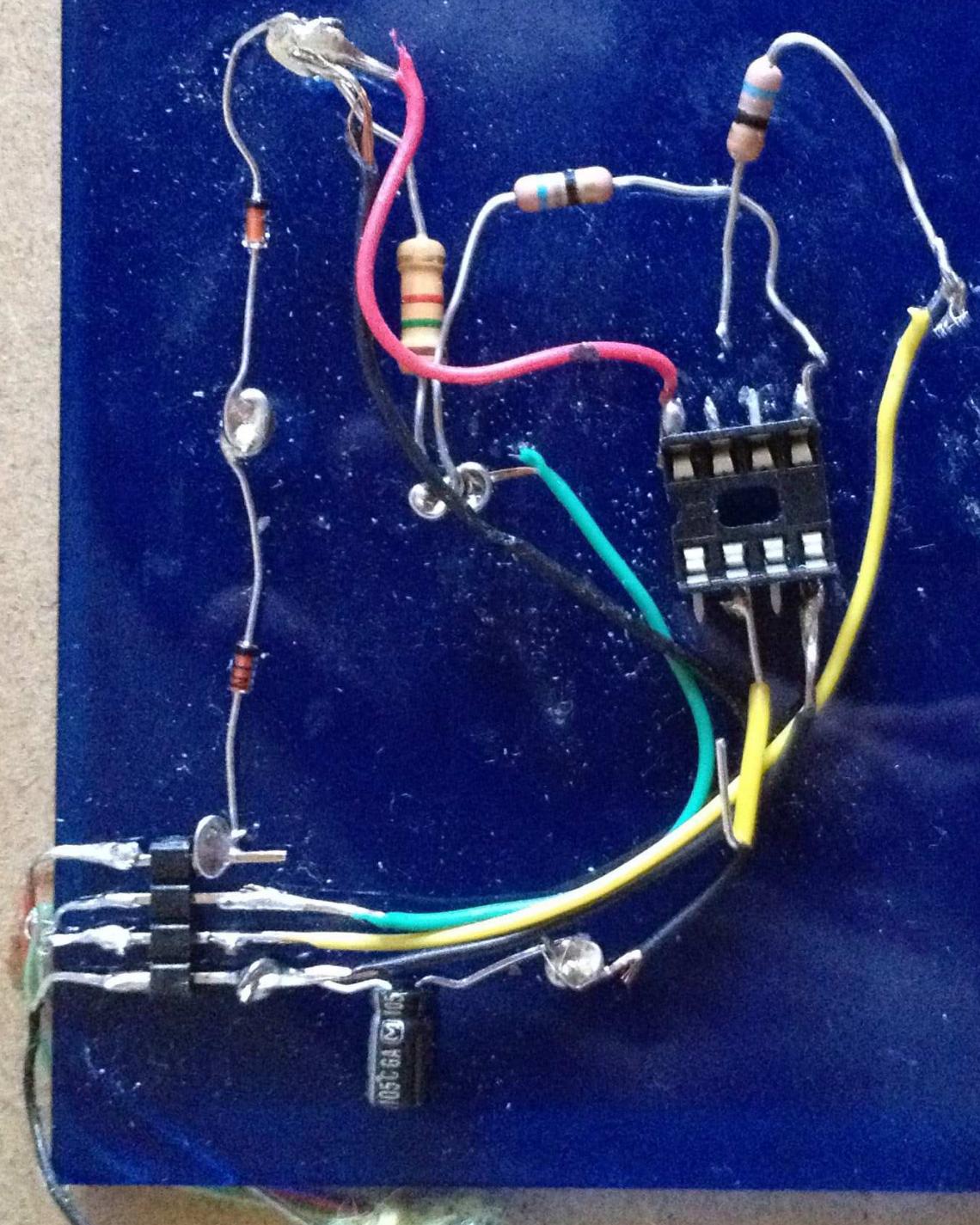


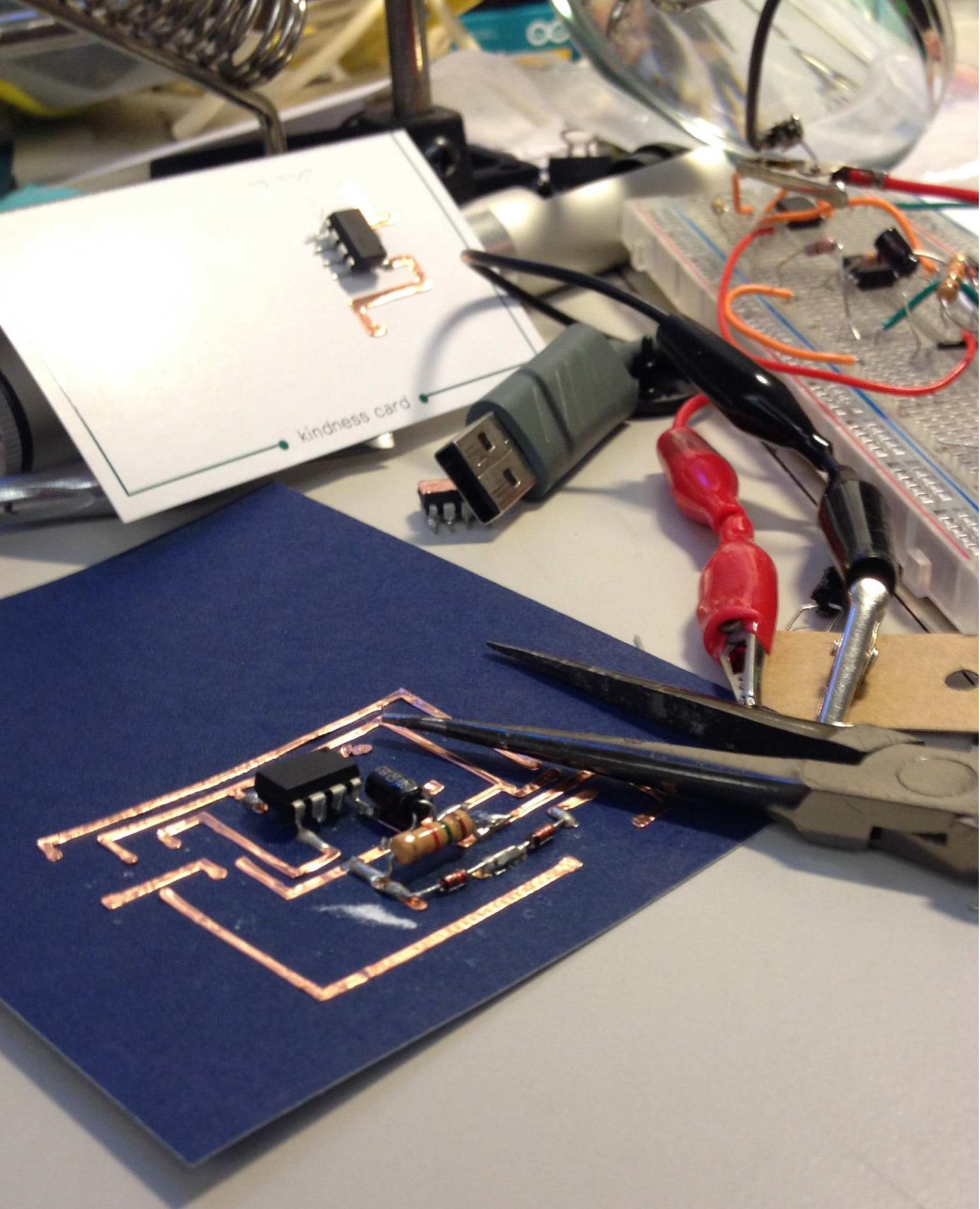


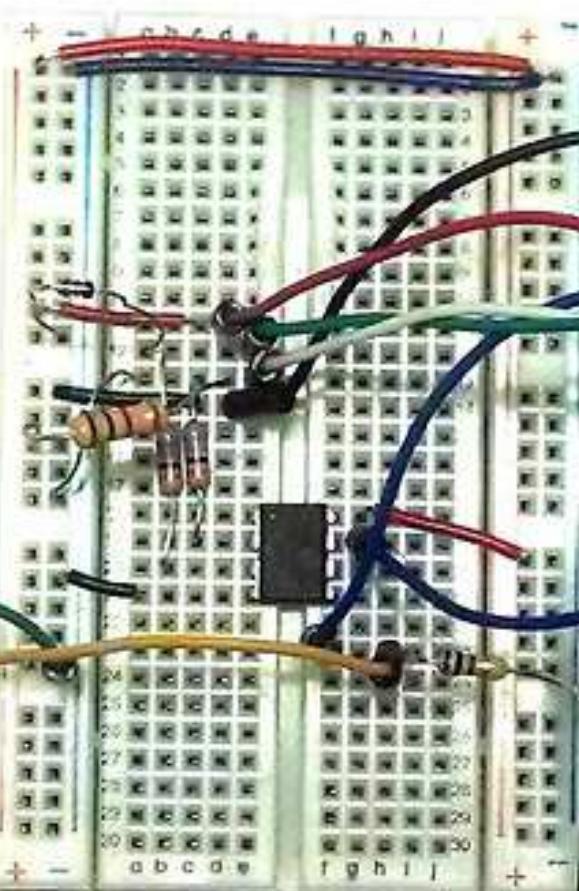




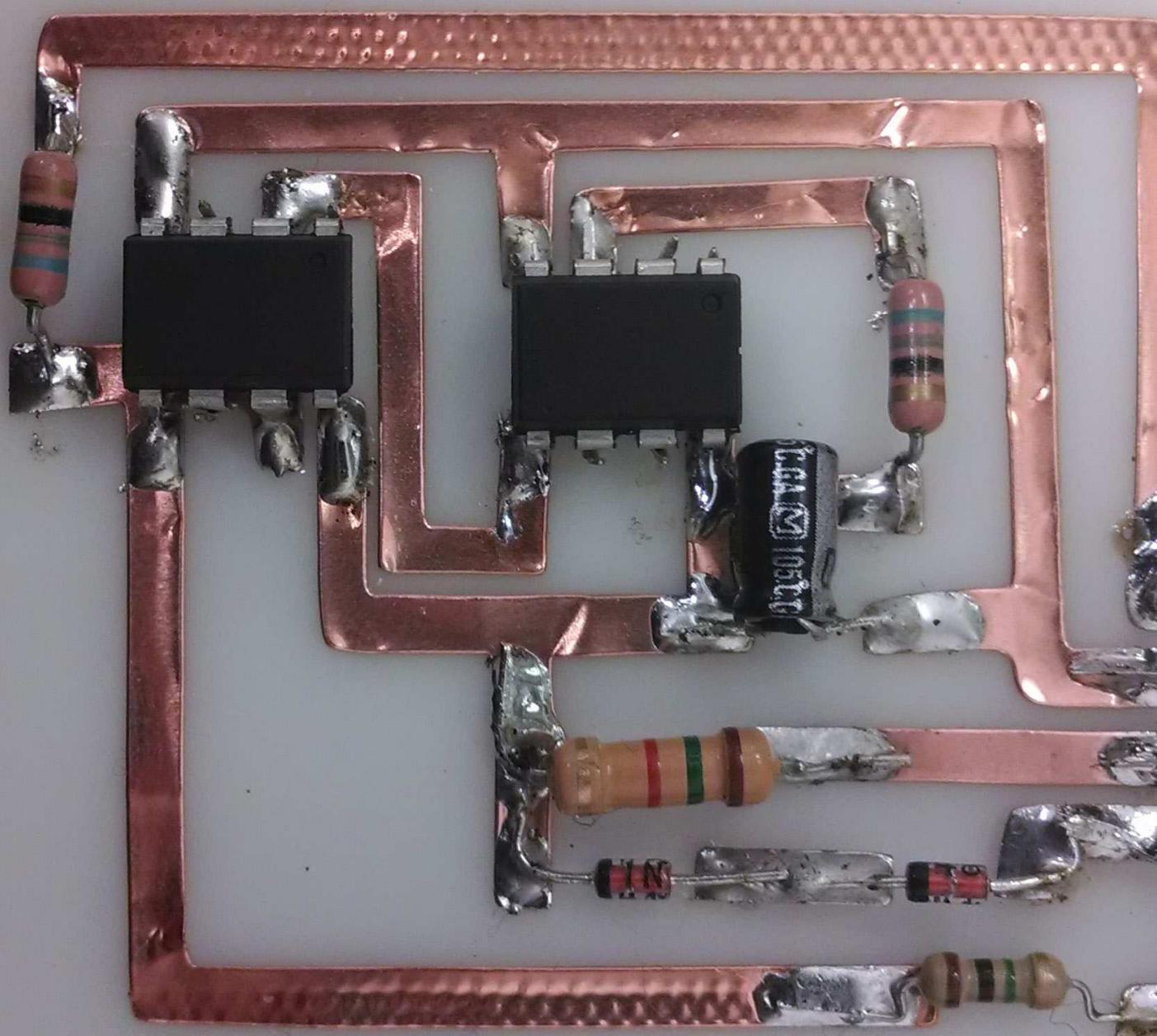




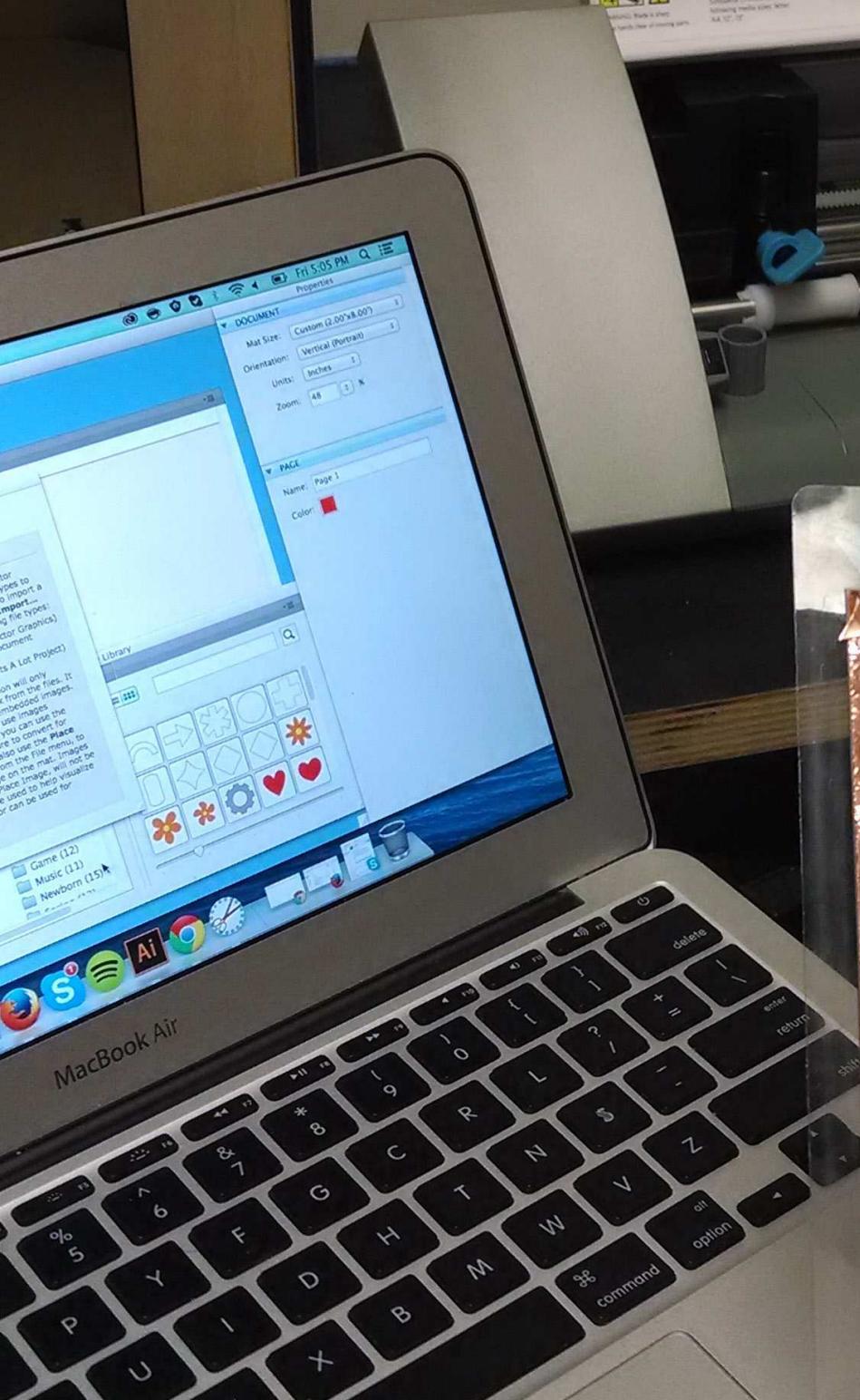


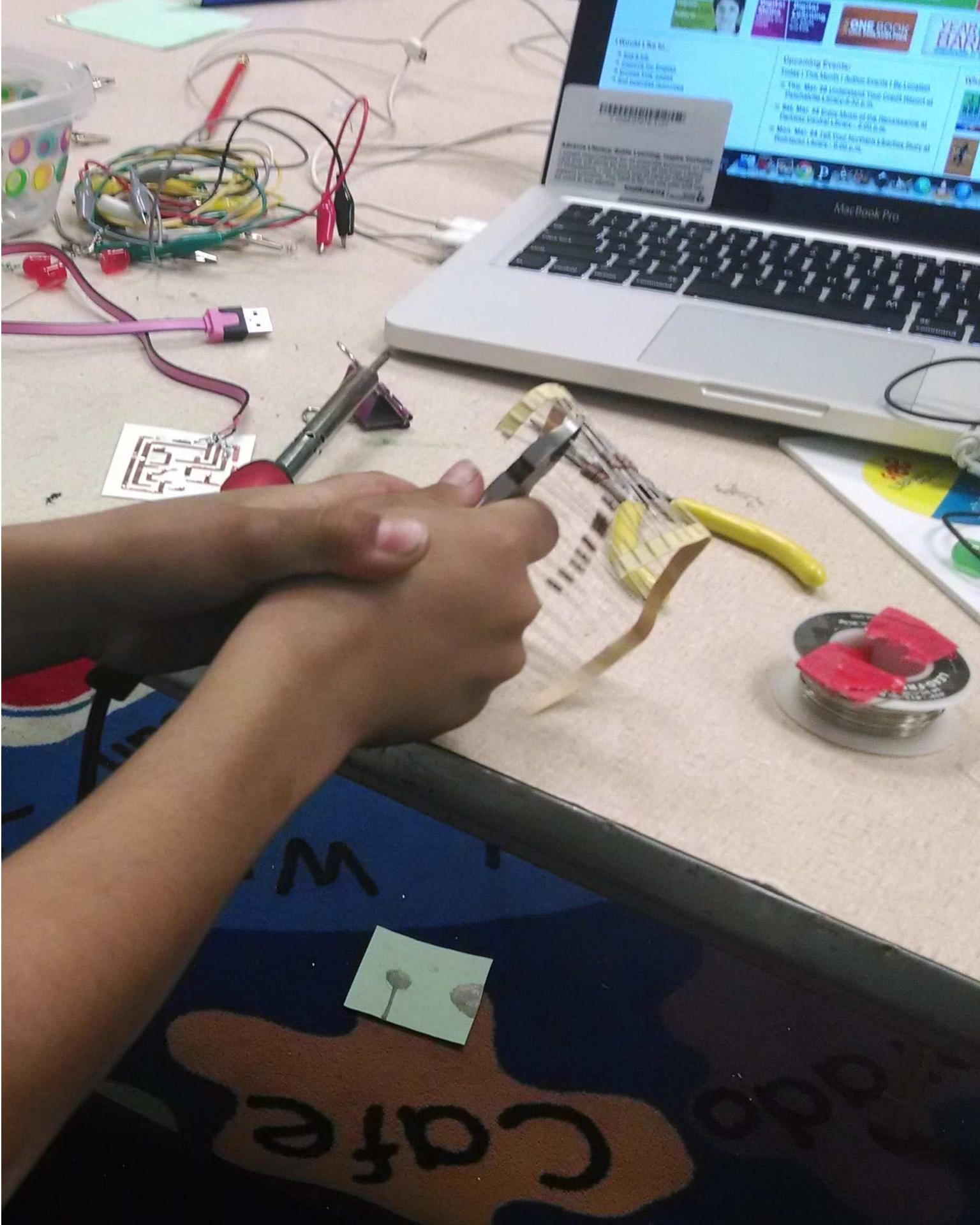


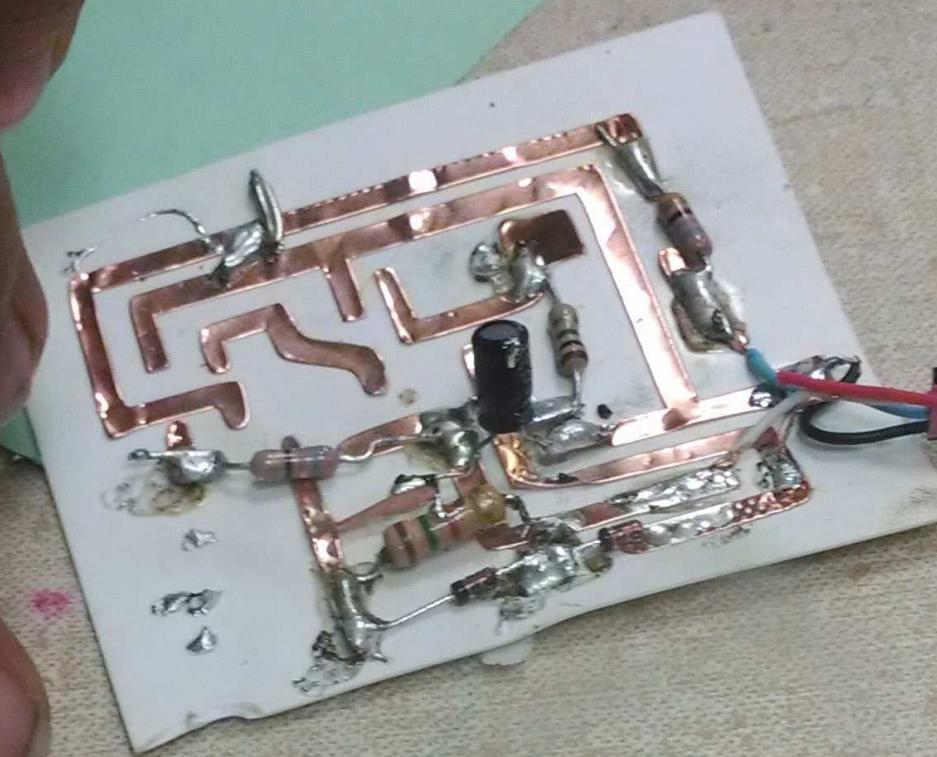


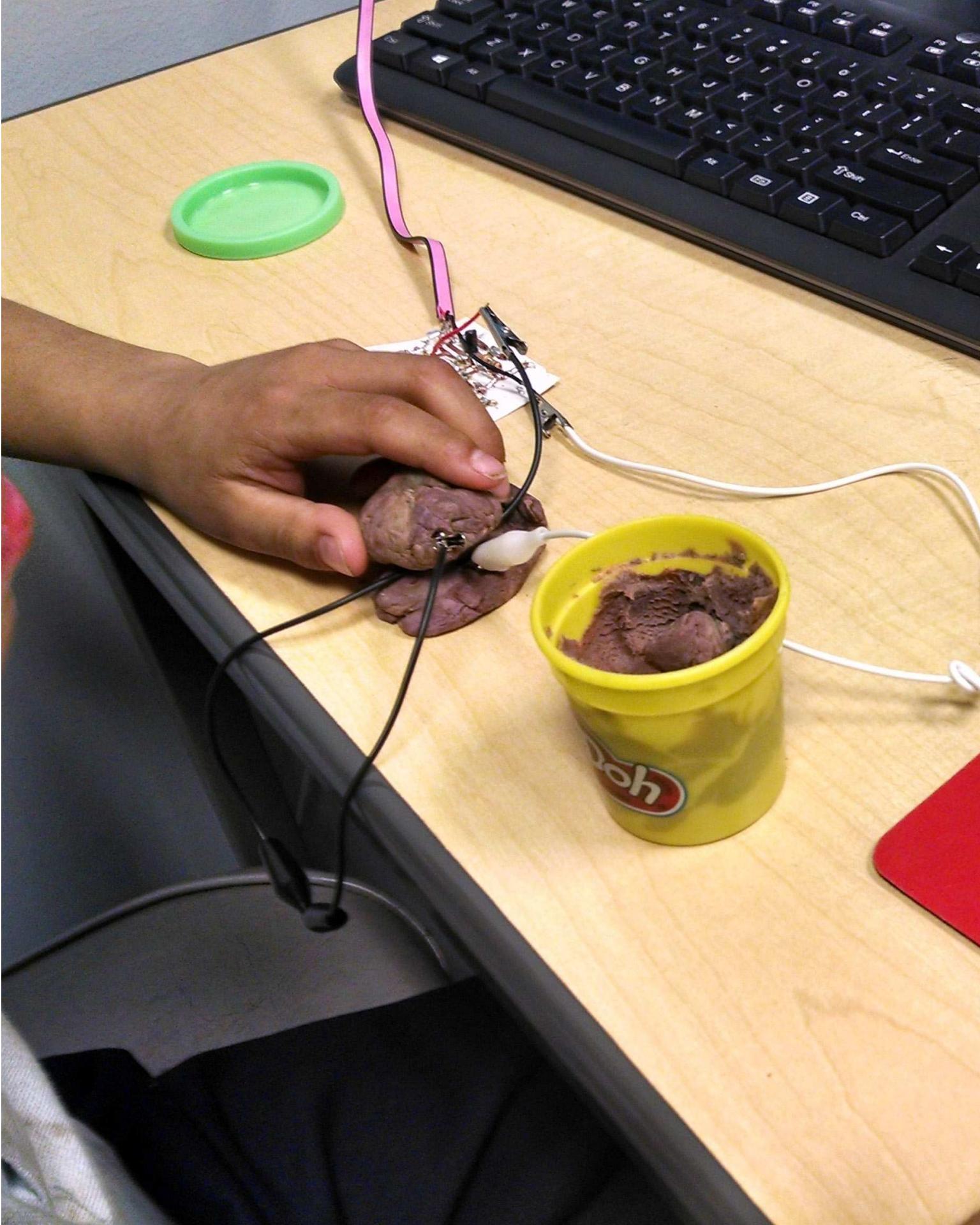


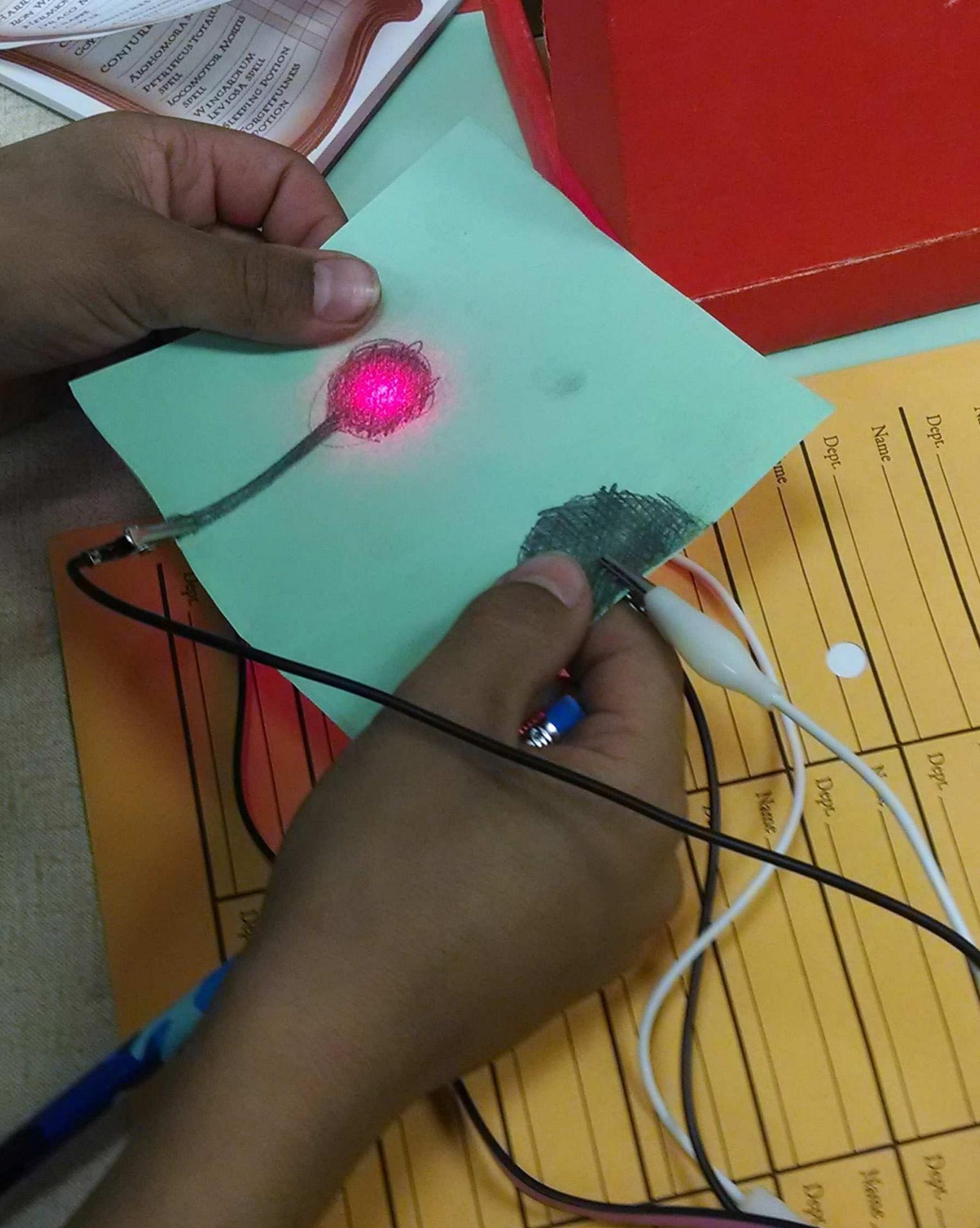
test - 7

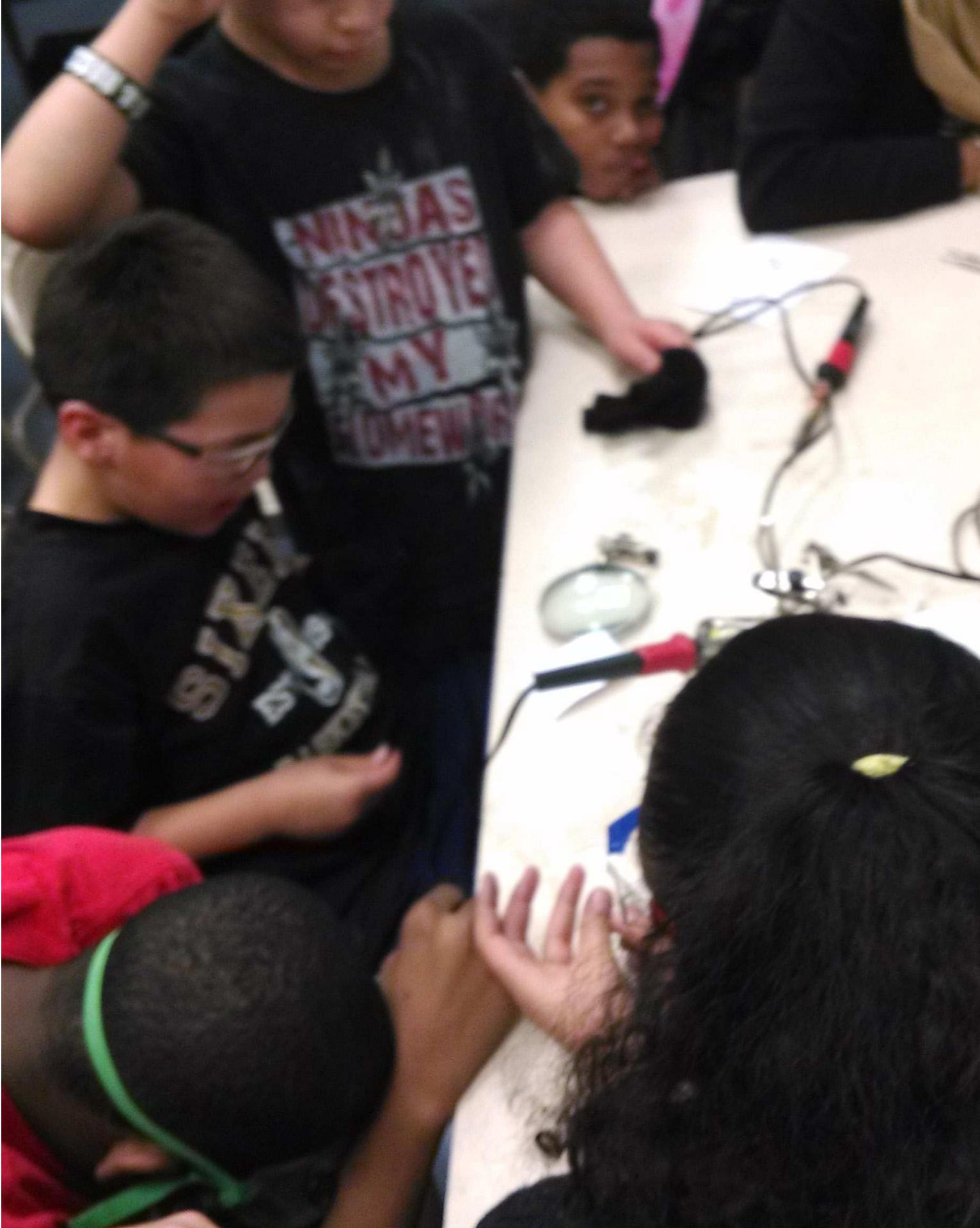






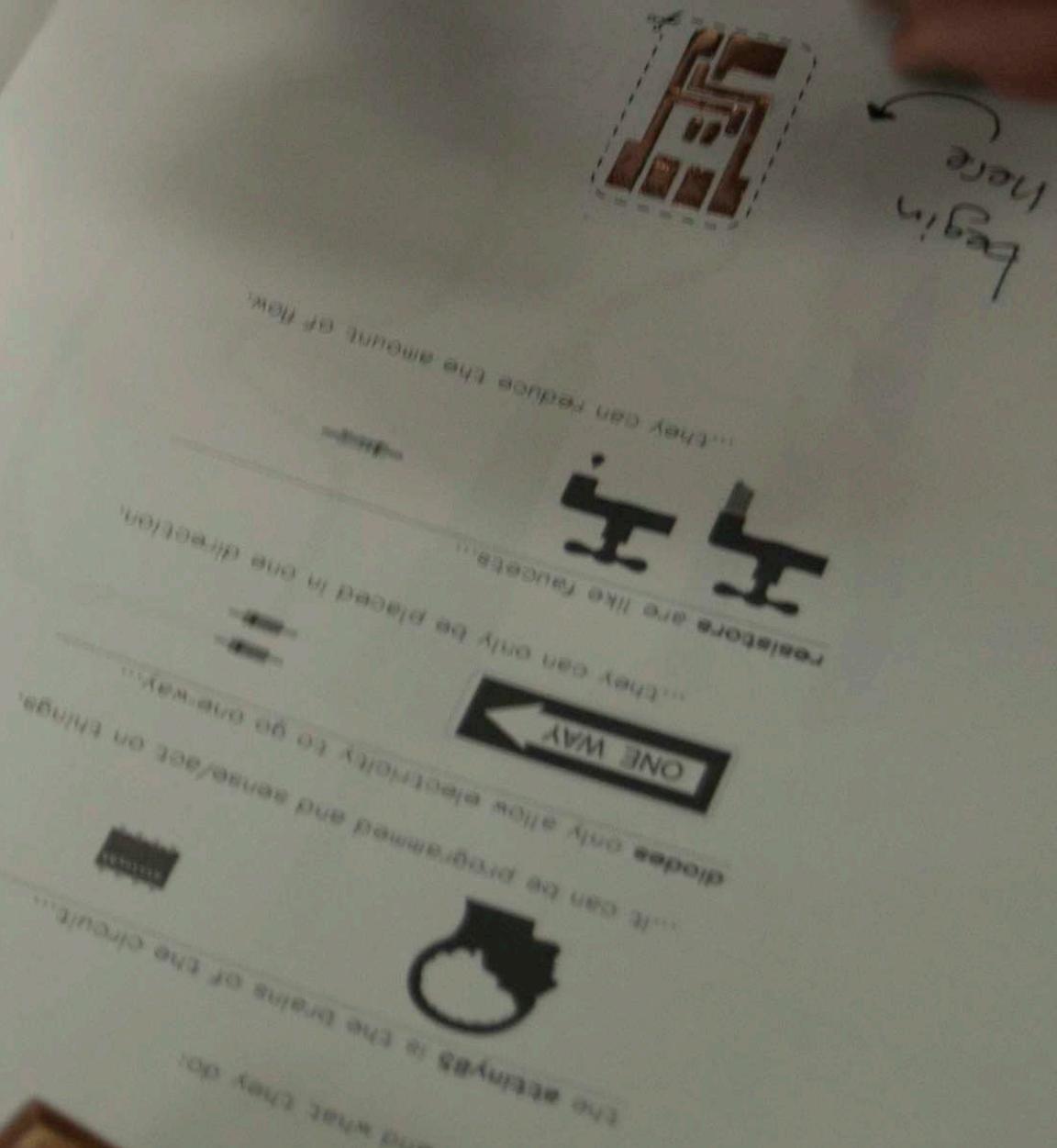


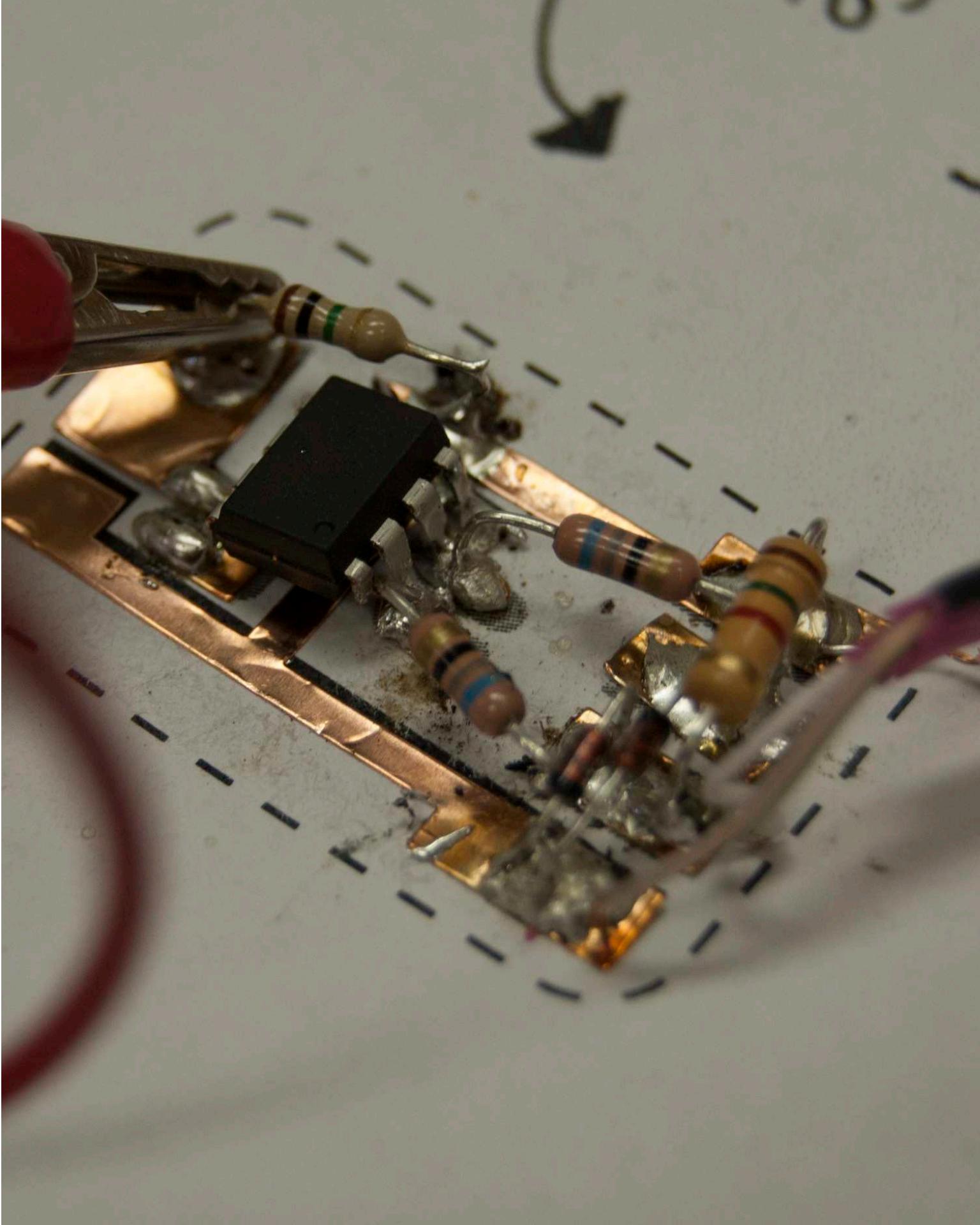






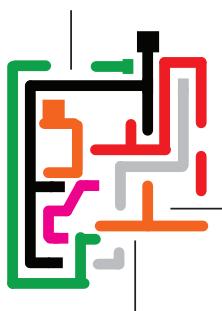
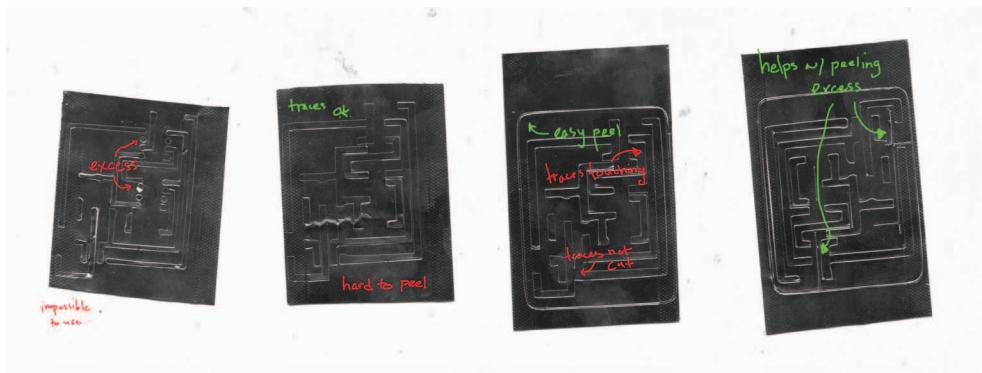
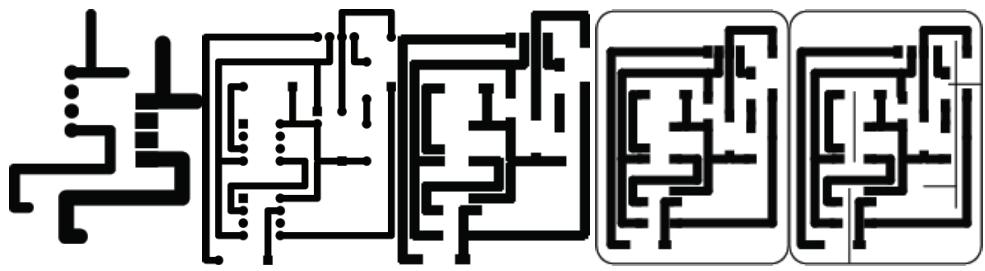




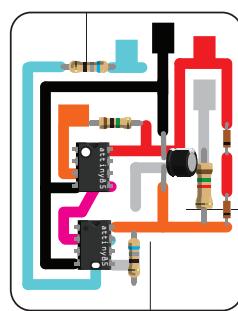




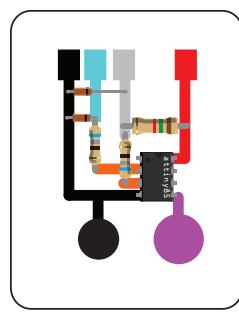
**source code + docs:**  
<https://github.com/makerjawn>



Iteration 8



Iteration 9'



Iteration 10.1'



Iteration 10.2



## Readings

- Case, Amber. An Illustrated Dictionary of Cyborg Anthropology. N.p.: n.p., n.d.  
[Http://cyborganthropology.com/store/](http://cyborganthropology.com/store/). Web.
- Dewey, John. Experience and Education. New York: Macmillan, 1938. Print.
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- Plowman, Lydia, Christine Stephen, and Joanna McPake. Growing up with Technology: Young Children Learning in a Digital World. London: Routledge, 2010. Print.
- Itō, Mizuko. Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning with New Media. Cambridge, MA: MIT, 2010. Print.
- Nilsson, Elisabet M. "The Making of a Maker-space for Open Innovation, Knowledge Sharing, and Peer-to-peer Learning." FUTURE LEARNING SPACES. Helsinki: Aalto University, 2011. 293-98. Print.
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- Allen, Felicity. Education. London: Whitechapel Gallery, 2011. Print.

## **Links of Interest**

<http://www.makerjawn.org/>  
<http://www.makeymakey.com>  
<https://pittsburghkids.org/exhibits/makeshop>  
<http://www.libraryasincubatorproject.org/?p=11684>  
<http://www.pensacolamesshall.org/explore/mess-kits/>  
<https://learn.sparkfun.com/curriculum>  
<https://www.fusestudio.net/challenges>  
<http://makerkits.org/kits-instructions/>  
<http://www.hastac.org/>  
<http://blog.flipwork.nl/?x=entry:entry081009-142605>  
<https://github.com/sebnil/Moving-Average-Fil-ter--Arduino-Library>

for more:

<https://www.diigo.com/list/bklvnc/Funstone/2p8pn0c1d>

The MaKey MaKey is Trademarked by JoyLabz.

I am remixing this hardware under a different name for non-commercial academic research.

All code and schematics have been open sourced, feel free to contact me if any issues or corrections are needed.

bk  
267.546.6668  
brandonklevence@gmail.com

thank you to  
everyone for  
giving me a new  
perspective on  
things ! ! ! ! !





