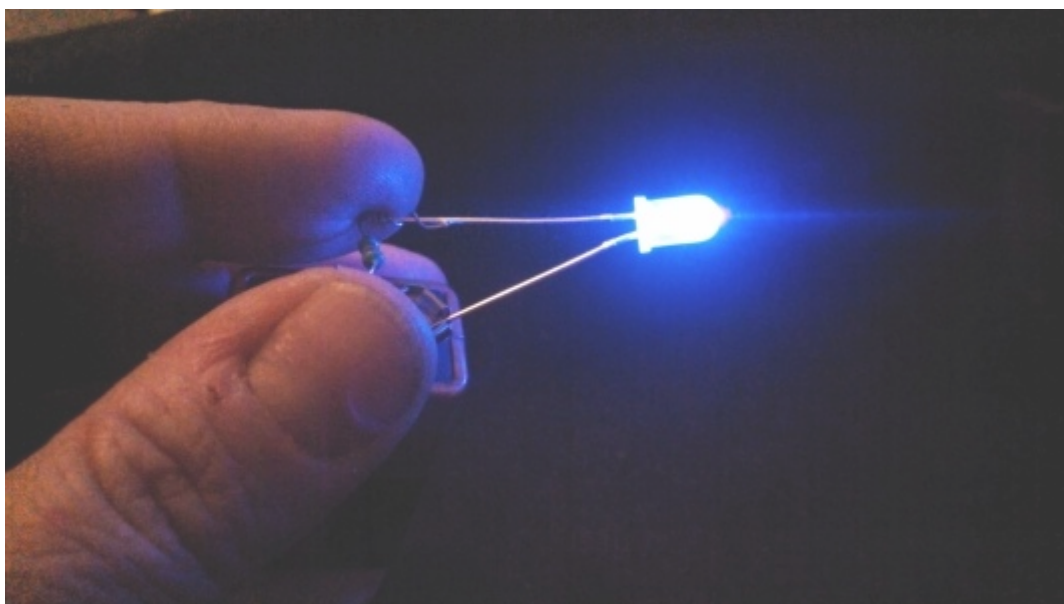


Makerspace Manual

2014



Barnum, Susan, 1975-
Makers in the Library: Summer Reading Program Manual,
sponsored by YALSA and Dollar General / Susan Barnum
P. 52

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1. Makers. 2. DIY. 3. Electronics. 4. How-to.



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Thanks!

This program and this book were made possible by an awesome grant from YALSA and Dollar General.

The program and the book could not have happened without the support of my co-workers and friends in the El Paso Public Library and Teen Town. You rule!



About

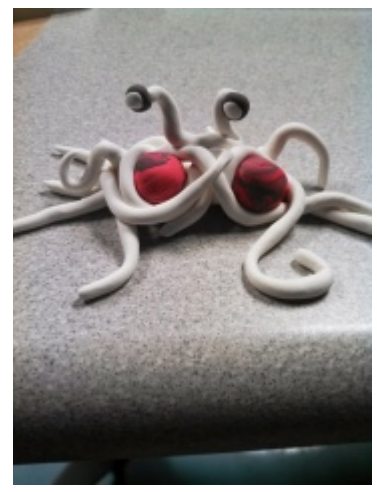
I'm Susan Barnum, a Public Services Librarian in El Paso, Texas who loves to geek out about science.

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Along with this book, I've also created a blog to document Maker Projects in El Paso Public Library. Tutorials, examples and printables are available there. You can also see new projects as we do them at the library.

Find the blog here: <http://elpasocreate.wordpress.com>



LET'S MAKE STUFF!!!

Makers: A HISTORY OF AWESOME

WHY MAKE STUFF?

Makers change the world—literally. Anyone who picks up a tool and starts using it to create has made something new, something that adds to the world as a whole. These tools can be anything; from pencils to programming languages and as people create, they learn, change and grow. Sometimes creating new things only affects their own personal growth: sometimes Makers create entire new industries.

You're going to learn some new maker skills. I say "new" because you're already a maker. All humans create things on some level—we're just going to step it up a notch!

The skills you learn in this book will also give you a foundation to continue exploring technology that you enjoy. Because our world increasingly needs people with technological and problem-solving skills, you'll be ready to take on those challenges.

Once you really get interested in creating, you're in good company! This summer, we're going to be working on projects that range from using electronics, robotics, paper-folding, open-source programming and creative hacking. Some makers very involved in these technologies include Limor Fried, Linus Torvalds, Akira Yoshizawa and Ayanna Howard.

"Technological literacy... enables us to become better citizens."

Gary Stix and Miriam Lacob from *Who Gives a Gigabyte?*

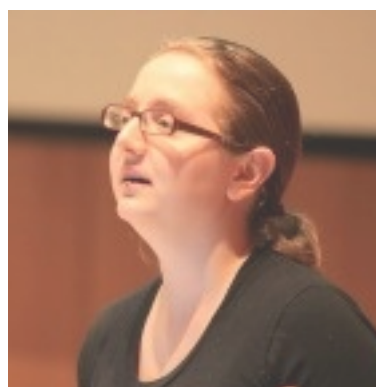
Ayanna M. Howard, © 2008 Rob Felt via Wikimedia Commons.



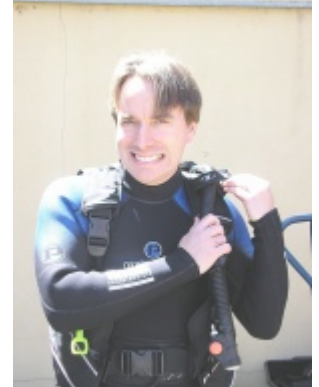
Akira Yoshizawa, © 2012 Tavin via Wikimedia Commons



Limor Fried on the Open Hardware Summit, © 2010 Repat via Wikimedia Commons



Linus Torvalds, © 2008 Paul Fenwick via Wikimedia Commons.



ORIGAMI TEA LIGHT



ORIGAMI TEA LIGHT

HI TECH AND LOW TECH: IT'S ALL TECH TO ME

In the Origami Tea Light project we'll be using technologies which are often grouped into the categories of "high" and "low" tech. Sometimes people assume that high or (hi) tech solutions are the best. However that's not always true! Often it's smarter (and cheaper!) to use the materials available and turn to "old" solutions to problems. In this project, we're using an "old" technology of paper-folding and including a "new" technology of LED lighting.

Origami is the process of folding paper into various structures. Origami dates back to the Edo Period in Japan which started in 1603! Origami is not just a beautiful form of art, but it also expresses math concepts such as geometry, tessellation and even algebra! As a form of technology, it's a way of turning a (basically) two dimensional object into a 3-D form. Pretty cool.

$$R = \frac{V_s - V_f}{i}$$

If you find that your wires feel hot, there's probably too much voltage going through your wires. You may need more resistance.

To calculate resistance you need to know how many volts your battery provides (V_s) and from the LED data sheet, you find the LED forward drop in volts (V_f). Also from the LED datasheet, find the forward current (i). Resistance (R) is calculated by using this formula on the left. You can also calculate how much resistance you need online here: <http://led.linear1.org/1led.wiz>

A Light Emitting Diode or LED is a type of light that is low energy, low cost and lasts a long time. While many people believe that LEDs are new technology, they've actually been around for more than 50 years. The photons of light which are emitted from the LED are created by very extreme technologies such as semiconductors, yet LEDs are easy to work with and easily integrated into many types of projects.

Using the art of low-tech (paper-folding) and hi-tech (LED electronics) we'll create unique and beautiful lighted structures.



STUFF YOU NEED

ELECTRICITY AND LED'S.

Electrical currents have a positive and negative side which most of us have seen when using batteries. The Positive side of a battery is marked with a plus (+) sign and the negative side is marked with a minus (-) sign.

LED lights also have a "positive" and "negative" side, though it's more accurate to call the "positive" side the *anode* and the negative side the *cathode*.

In this project, you'll need to know how to locate the positive and negative outputs for your battery and how to identify the anode and cathode of your LED.

VIVA LA RESISTANCE!

LED lights need a resistor to apply the proper amount of energy to the light.

Depending on the type of LED light you are using, your power source and how many LED's you are powering off of this source.

A resistor provides exactly what it seems to: resistance. It makes the electrical current "slow down." Inside of a resistor is wire coiled in loops. We use resistors to regulate the amount of voltage being applied to the LED. If you have too much resistance, your light (or lights) will be dim. Not enough, your LED will pop or even melt.



This is a "button" type battery. It provides 3 volts and this is the positive side.



The stripes on a resistor help identify how much resistance is provided.

LED LIGHTS.

These can be purchased very inexpensively today from many places online or from stores like Radio Shack. It's a lot cheaper to get them online, I've noticed.

RESISTORS.

Sometimes these come packaged with the LED lights. If not, make sure you purchase some of the right type (we'll get to that.)

BATTERIES.

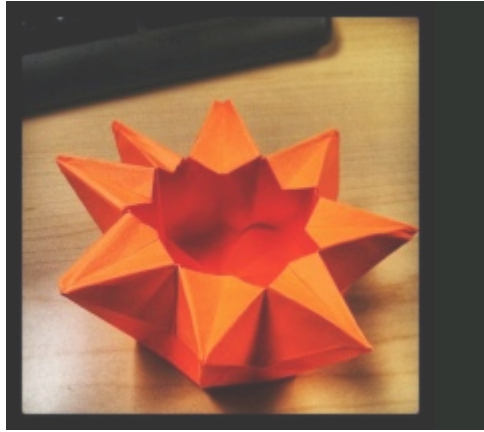
Any type is fine! Have at least 3 volts total.

ORIGAMI PAPER--SQUARE.

If you don't have "special" origami paper, you can either print your own or use any type of printer paper. If you print your own or use printer paper, you'll have to make it square! (see p. 35)

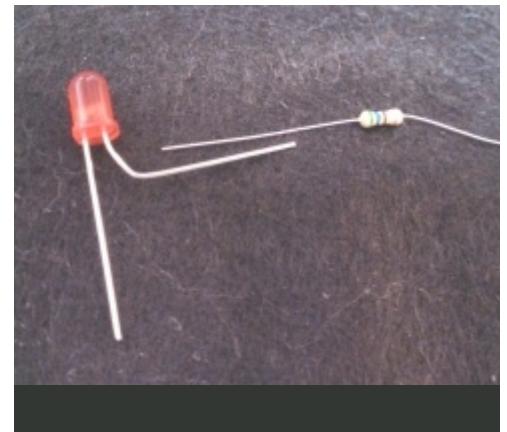
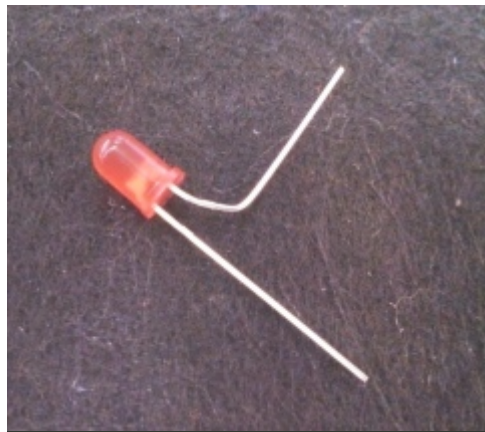
STEP BY STEP

ORIGAMI TEA LIGHT



1. First create your tealight shape. (see the appendix on how to make the origami)

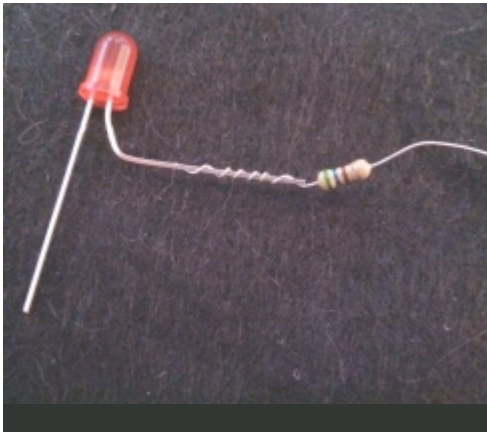
2. Look at your LED light. Find the "anode" side of the LED. This is usually the longer "leg" or wire attached to the LED.



2a. If your LED legs are bent and it's hard to tell from the leg, you can also look at the LED itself. Inside of the plastic, you'll see some metal. The smaller piece of metal leads to the anode.

3. Bend the anode at an angle.

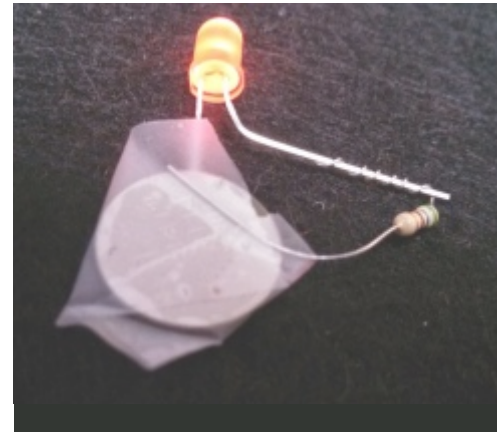
4. Your resistor is going to be attached to the anode leg of the LED. There is no polarity on a resistor, so you don't have to "line" it up a certain way.



5. Wrap the resistor wire-end around the leg of the LED.



6. Now you can attach the cathode side of the led to the negative side of the battery. Touch the end of the resistor to the positive side. It'll light up!



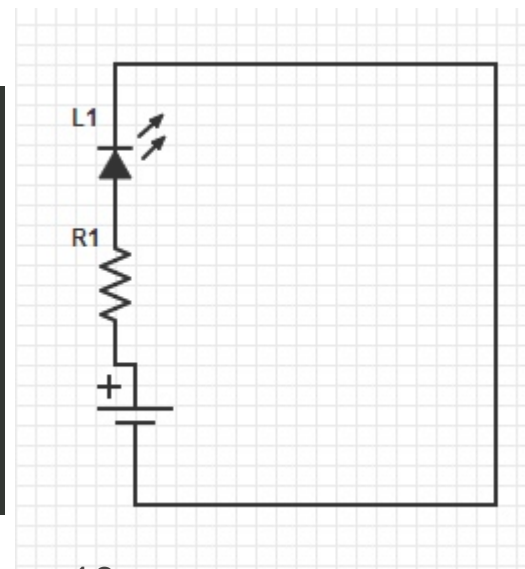
7. Here's another picture of the connection. I taped the wires down. This is a very simple connection and a very simple circuit!



8. Drop your circuit into the origami tea light.



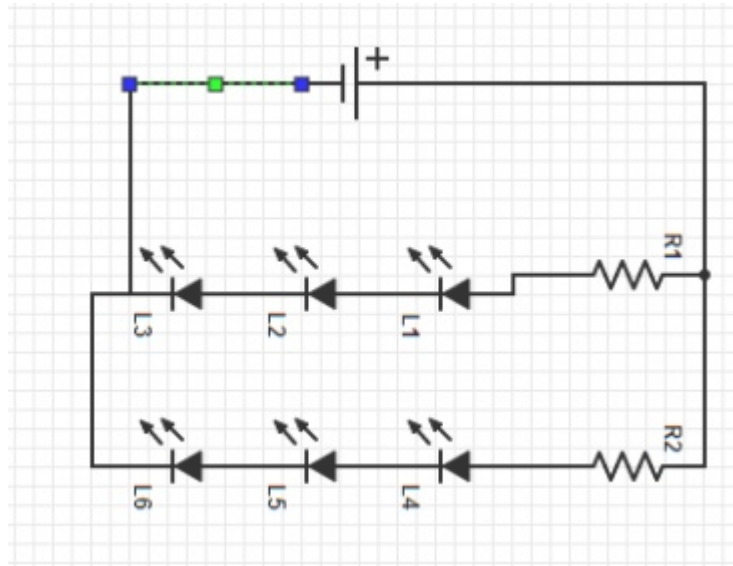
9. What would happen if you wanted to hook up more than one LED in your circuit? What about adding a switch to turn it on and off?



10. Here is what that simple circuit looks like. L1 is the LED, R1 is the resistor and the other symbol indicates the battery.

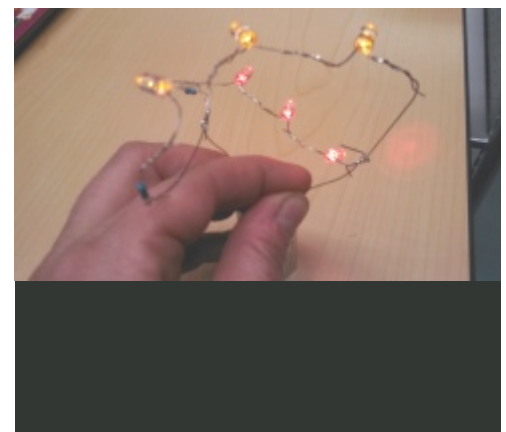
STEP BY STEP

MULTIPLE LED WIRING & TROUBLESHOOTING



1. If you want to wire up multiple LED's, you need to figure out how to "chain" your LED's. Here's a sample schematic for parallel wiring.

Notice that there are two resistors. How can you calculate the amount of resistance you need?



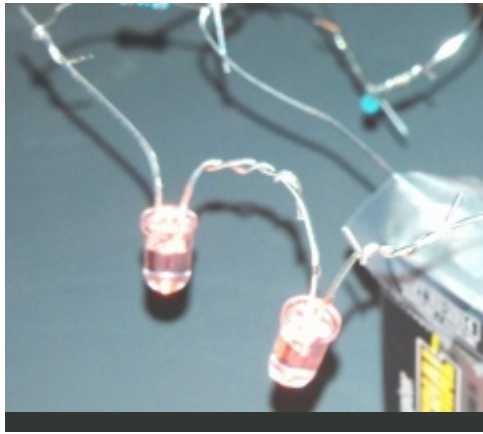
2. Here is what that schematic looks like wired up. There are wire attached to the ends to connect to the battery.

3. Here's what that looks like lit up.



Nothing is lighting up!

First: Check that all of your polarities are correct. Did you connect the anode side to the positive side of the battery? Are all of your LED's lined up the same way?



Lights aren't very bright.

Your LEDs might have too much resistance applied, or need more power. Try adding another battery or using a different resistor.

SOFT CIRCUITS

When I discovered that there was such a thing as conductive thread and that LEDs could be sewn into clothes I was seriously excited. The best part is that it's very easy to do and you get to be super creative with it. We already talked about LEDs, so let's talk about sewing, conductive thread and circuitry.

Sewing is one of the world's oldest technologies! Thread and needles were often made from plant materials or from the bodies of insects and animals. Being able to sew allows people to join pieces of material together to create larger, more complicated structures like clothes, blankets or tents. Working with materials rose to great prominence in many cultures. In Europe during the Renaissance, textile production made many people very rich and influential, allowing them to shape politics for hundreds of years. In China, only Emperors were allowed to wear silk. For much of human history, fabric, sewing and its various art forms has defined social status.

Safety First!

Don't forget that needles are sharp. You have to be careful when you're threading and sewing so that you don't prick yourself with the needle. Go slowly and pay attention to where you are threading the needle in and out of the fabric. If you remain aware, you won't end up a pin-cushion!

Conductive thread is exactly what it sounds like: it's a thread that you can sew with and it conducts electricity. It's often created with stainless steel fibers or regular fibers coated with a conductive substance. An alternative to buying conductive thread is to strip old wires to obtain the thin metal inside which can also be sewn into fabric.

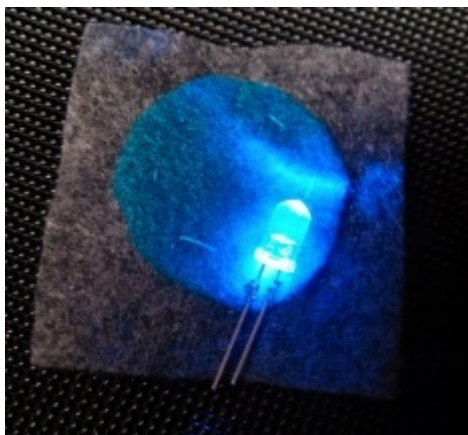
The conductive thread is used to create a circuit. A circuit is a closed system that provides electricity to a device. When the circuit is open, it's "off." Batteries provide the power to move electrons through the circuit. This is voltage and measured (naturally) in volts (V). The current of the flow of electrons is measured in amperes (A). Multiplying the voltage and the amps of the circuit lets you figure out how many watts (W) of power are generated. $V \times A = W$ Too easy!



STUFF YOU NEED

When you're creating your soft circuits and wearable LED projects, plan ahead! If you know what shape you're working with, that will inform where you will be sewing and where you'll want to place your electrical components!

You may wish to allow people to see the electrical parts and make it part of your design, or you might want to hide it, placing it on the back of the project or covered with other fabrics. It's up to you: be creative and have fun!



The back and the front of a simple electric badge. The front only shows the LED light, but the back contains all of the electrical parts that allow the circuit to flow.



Using conductive thread is easy. I only sew with one line of thread at a time. But with "regular thread" I normally "double" the thread on the needle for strength.

LED LIGHTS.

These can be purchased very inexpensively today from many places online or from stores like Radio Shack. It's a lot cheaper to get them online, I've noticed.

RESISTORS.

Sometimes these come packaged with the LED lights. If not, make sure you purchase some of the right type (we'll get to that.)

BATTERIES.

Any type is fine! Have at least 3 volts total.

BATTERY HOLDER.

Any type that fits your battery.

FABRIC.

Any type is fine. We're using felt because the edges of felt don't fray.

CONDUCTIVE THREAD.

This is special thread that can conduct electricity.

REGULAR THREAD.

Any type of non-conductive thread.

NEEDLE.

Any kind of needle will work.

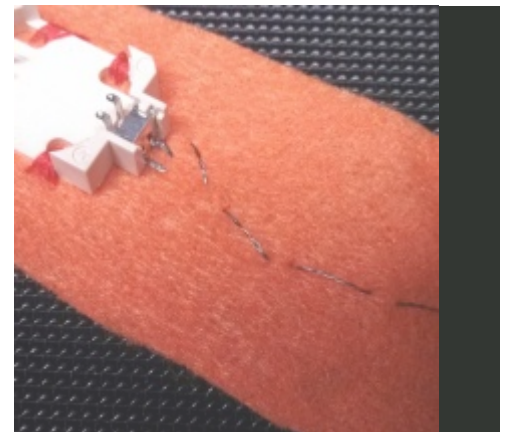
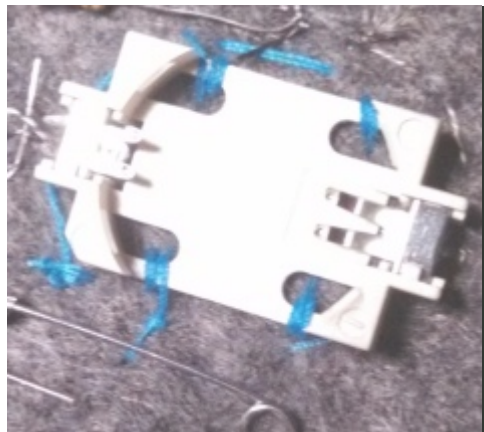
STEP BY STEP

SOFT CIRCUITS



1. Cut out some fabric. For this tutorial, I'm showing you how to make a bracelet, but you can make any kind of shape you wish.

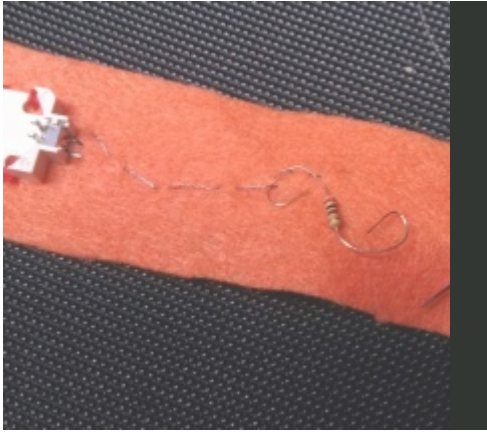
2. Figure out where you want to place your battery holder. Make sure the connections are able to be sewn down.



3. Sew the battery holder down using regular thread.

3a. Another shot of the sewn-down battery holder. Depending on the type of battery, you might be sewing it down differently.

4. Start sewing with conductive thread. First connect the thread to the positive end of the battery. Make sure your thread goes around the metal coming off of the battery holder. Sew your circuit along your fabric.



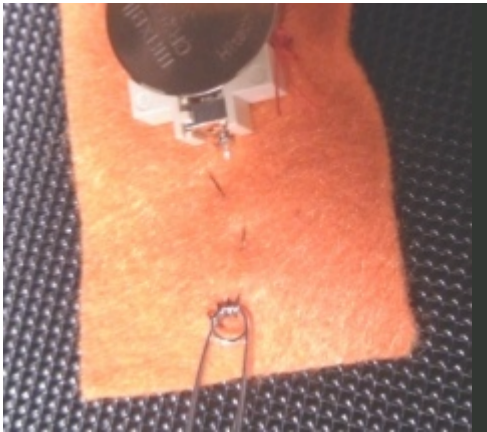
5. Get a resistor. In this case, I bent it into an interesting shape and then I sewed the conductive thread onto one end of the resistor. Sew a knot and cut your conductive thread.



6. Start the conductive thread again, sewing the other end of the resistor to your LED. Again, cut the thread after you've connected both of these things together.



7. Sew from the LED to the end of your fabric. Make a few lines across the end of the fabric and then cut the end of the thread.



8. On the other end of the battery holder connect the negative end to a safety pin. You can also put your battery into the holder.



9. When you connect the safety pin to the lines of thread you made in step 7, you complete the circuit. Put on your bracelet and shine!



10. Light up the night with your cool new bracelet! Make other variations, such as badges, necklace or plushies that light up.



<-- To the left, you can see the whole bracelet at once.

VIBROBOT

Robots or automatons have been documented to exist as far back as 270 BCE, where a Greek engineer, Ctesibus, was reputed to make clocks and instruments with figures that moved on their own! The word "robot" comes from Czech play, "Rossum's Universal Robots" by Karel Capek. Robots today are used to explore other planets in the solar system, build cars and to entertain.

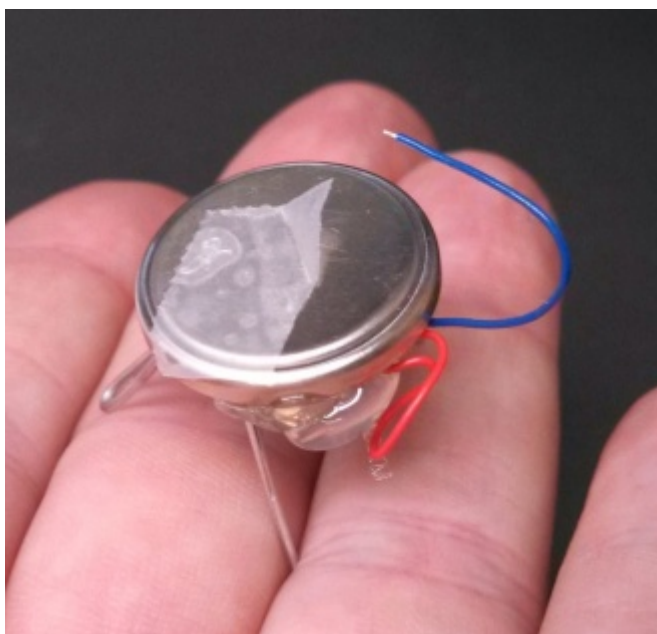
Vibrobots are little devices that move through vibration. They are simple "robots" in that they move and respond to stimuli only in the sense that they will change direction (sometimes) by bumping into objects. They're fun because they are so simple and silly: they bounce around on a desk in a cute way that seems to bring cheer and inquiry about how they work.

Electric motors work because of magnetics. There's two magnetic fields inside the motor. The first magnetic field is encased inside of another magnet. The field created by the other magnet pushes and pulls at the first one, causing it to move and create motion. This constant push and pull is activated when you apply electricity to the motor because the types of magnets used inside are "electro-magnets."

Safety First!

If you are using a hot glue gun, remember that these tools can become hot enough to burn your skin and leave blisters! Don't touch the tip of the glue gun when it's plugged in or for several minutes after it's been plugged in. Also, remember that the glue stays hot for several minutes after you've applied it. Touching hot glue can lead to blisters, too!

Our motors vibrate because the part of the motor that moves (which you can't see in the examples I use in the instruction) is unbalanced. It causes a "harmonic vibration" which can translate into movement for our tiny construction.

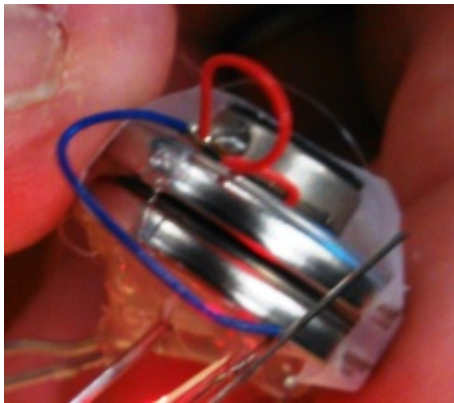


STUFF YOU NEED

This Vibrobot instruction is based on an Instructable, "Itty Bitty Vibrobot" by pepik. It can be found online here:
<http://www.instructables.com/id/Itty-Bitty-Vibrobot/?ALLSTEPS>

You can see different types of motors that you can use below. Make sure to note how much voltage you'll need to power your motor and that will let you know how many or what type of battery you'll need to use.

Note: if you use two different button type batteries, make sure you press them together so they are touching. Don't put the same pole (negative or positive) next to each other. It doesn't work. Instead, make sure you put the positive side against the negative side. Then place the first wire on one battery and the other wire on the other pole of the second battery.



Two batteries taped together. Notice the red wire on the first pole and the blue wire on the second battery's other pole.



Cell phone vibrating motor. This motor is known as a "pancake" motor.



A cell phone motor that has an unbalanced rotation.

PAPERCLIPS.

Everyone has some paperclips somewhere! If you don't have any handy, experiment with wire or toothpicks.

CELL PHONE MOTOR.

There are different types of these vibrating, buzzing motors. The kind I used in this project were small, cheap and had adhesive on one side. Any small motor (even one taken out of an old phone or toy) will work.

BATTERIES.

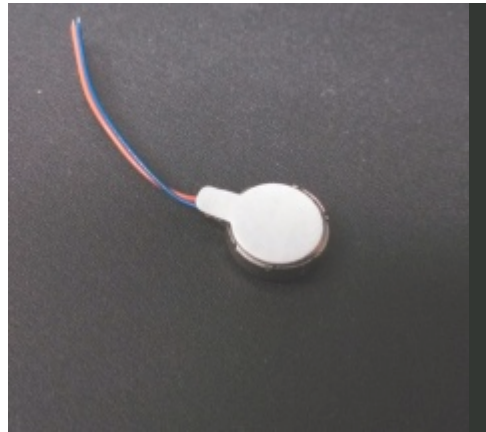
The smaller the better! Have at least 3 volts total.

GLUE GUN AND GLUE STICKS.

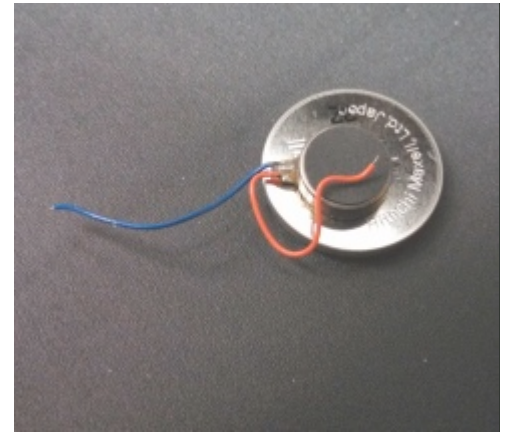
Glue guns are actually really cheap. It's the glue sticks that are expensive. If you don't have a glue gun, experiment with using rubberbands or wire to keep your legs on the vibrobot.

STEP BY STEP

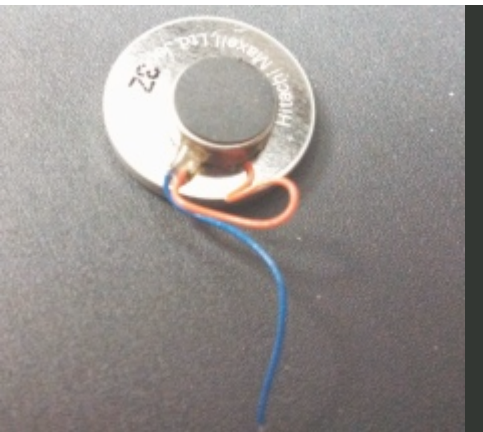
VIBROBOTS



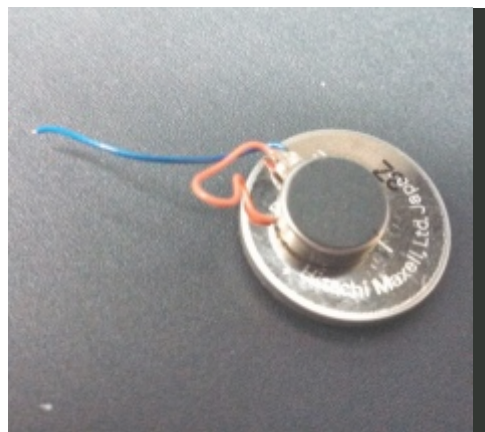
Step 1:
Look at the bottom of the cell-phone motor. There's a white piece of paper covering the sticky part. Peel the paper off.



Step 2:
Stick the motor to the positive end of the battery. It will have a (+) symbol and writing on it most of the time.



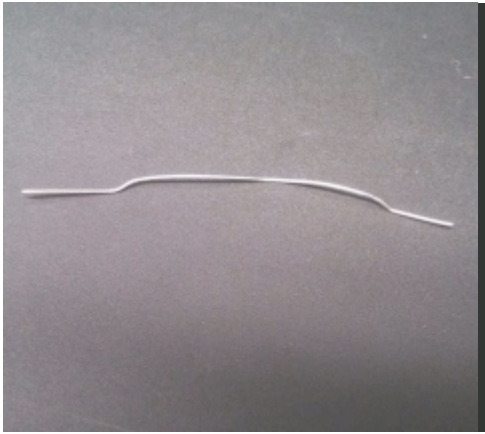
Step 3:
tuck the red wire under the motor. This usually creates the first part of the connection and holds it in place initially.



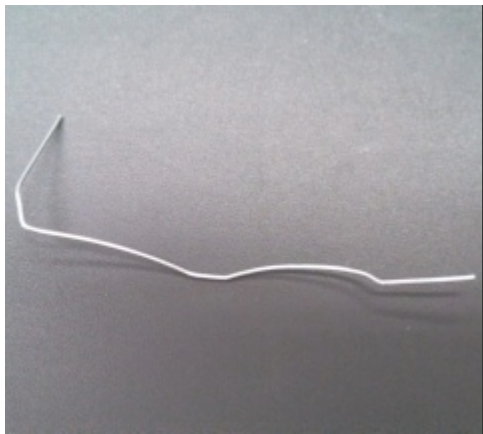
Step 3:
Another view of the wires. To test the circuit, touch the silver end of the blue wire to the negative side of the battery which is on the bottom. If it buzzes, you've created a good circuit! Add glue, clay or tape to hold the red circuit in place. Keep the blue wire loose.



Step 4:
Get a paperclip.



Step 5:
Unfold your paperclip into a straight line.



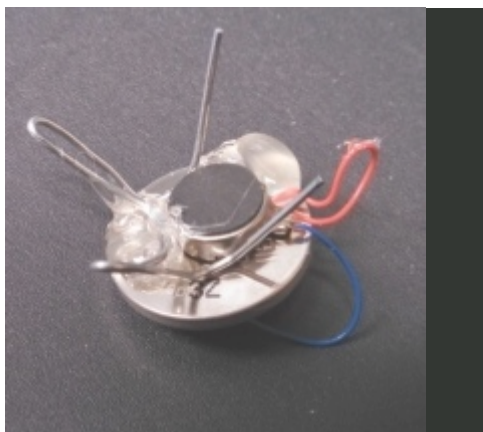
Step 6:
Start bending to create legs.



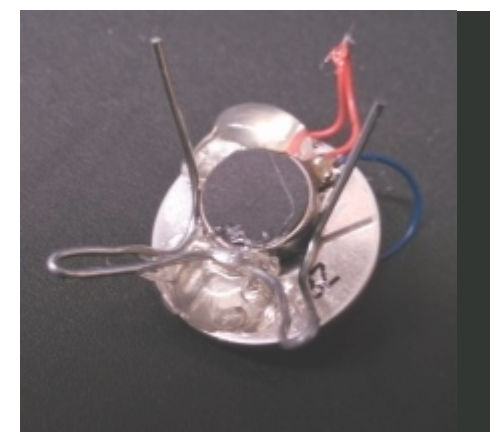
Step 7:
This is an example of 3 legs.



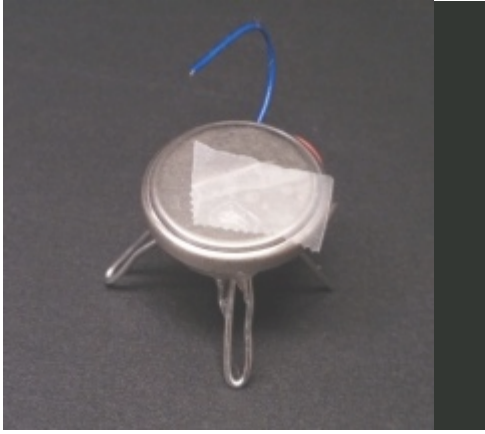
Step 7:
this is an example of 4 legs.



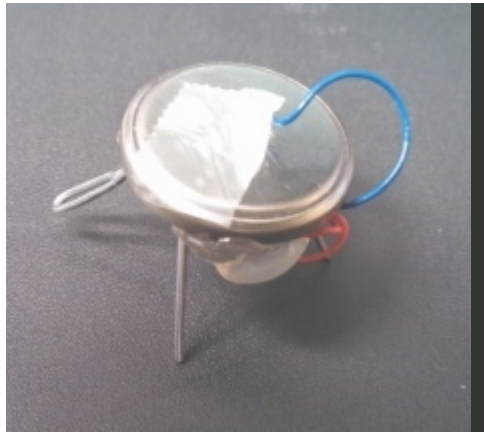
Step 8:
Glue the legs onto the robot.



Step 8:
Another view of the robot.



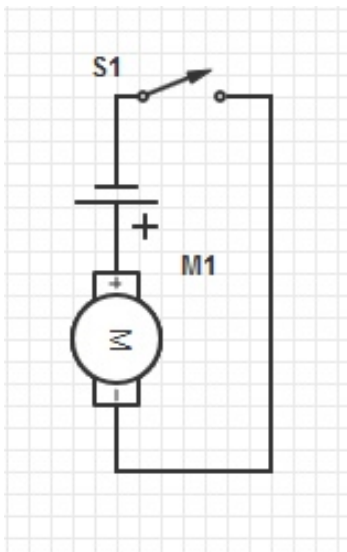
Step 9:
Flip your robot over.



Step 10:
Touch the wire to the robot and hold it down with tape. It will start dancing around because of the vibration of the motor.



Step 11:
Turn the robot off by removing the wire from the battery.



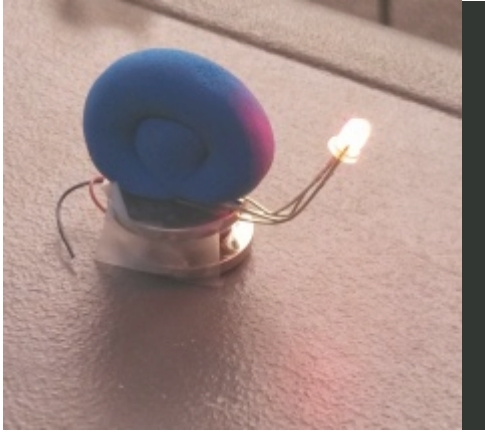
A diagram of the simple circuit with the "switch" open. Closing the switch – touching the wire to the battery – closes the circuit and turns everything "on."



Troubleshooting:
Most of the problems found when working with these vibrobots comes from the connection of the wire to the battery. If you don't have a good connection, your bot won't move. The Insulation (the colored part of the wire) can be scraped off, carefully, to reveal more wire for a better connection.



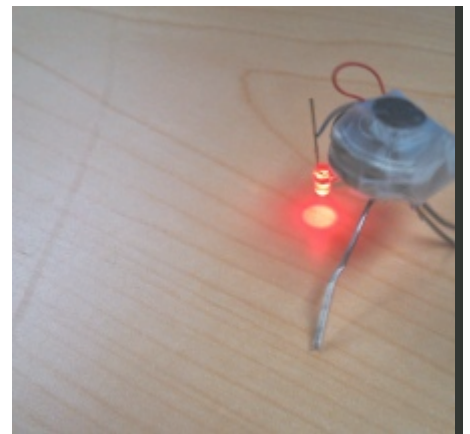
Variation 1:
Put the vibrobot in a box and scare your friends and family!



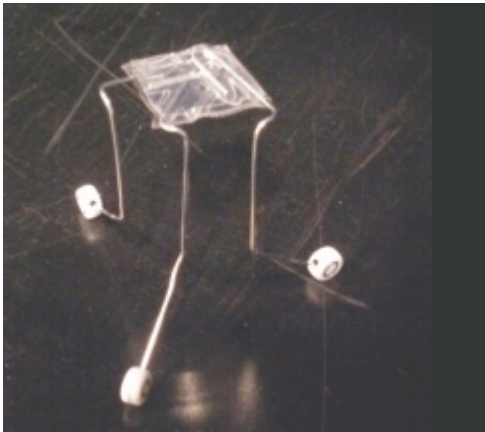
Variation 2:
Snailbot! Add LED lights to your vibrobot. (may need an extra battery as shown.)



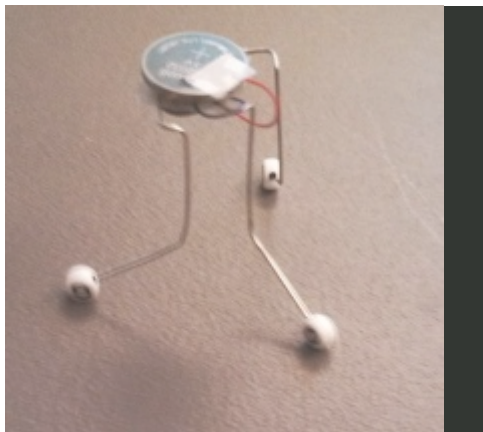
Variation 3:
Crab-bot. Variation on the legs.



Variation 4:
Add an LED. This vibrobot needed an extra battery, too.



Variation 5:
Cool tall vibrobot base.



Variation 5:
Tall vibrobot completed.



What will you come up with?

A close-up photograph of a yellow pen and a yellow highlighter resting on a speckled, brown and tan surface. The pen is positioned horizontally, and the highlighter is positioned vertically next to it. The text 'MAKEY MAKEY' is overlaid in white, bold, sans-serif font across the middle of the image.

MAKEY MAKEY

Human Interface Made Fun

MaKey MaKey is a really cool project developed by Eric Rosenbum and Jay Silver in collaboration with Sparkfun at the MIT Media Lab. It was a Kickstarter-funded project, which means that MaKey MaKey was funded by regular people across the world just because the project seemed awesome.

And it is awesome! MaKey MaKey gets its name from the fact that you can make anything into a computer key. You can turn a bannana or your friend into a keyboard controller and make music, play games and more.

The MaKey Makey board is based on the open-source hardware platform known as Arduino. It can even be reprogrammed like an Arduino (if you're feeling very frisky and know what you're doing!)

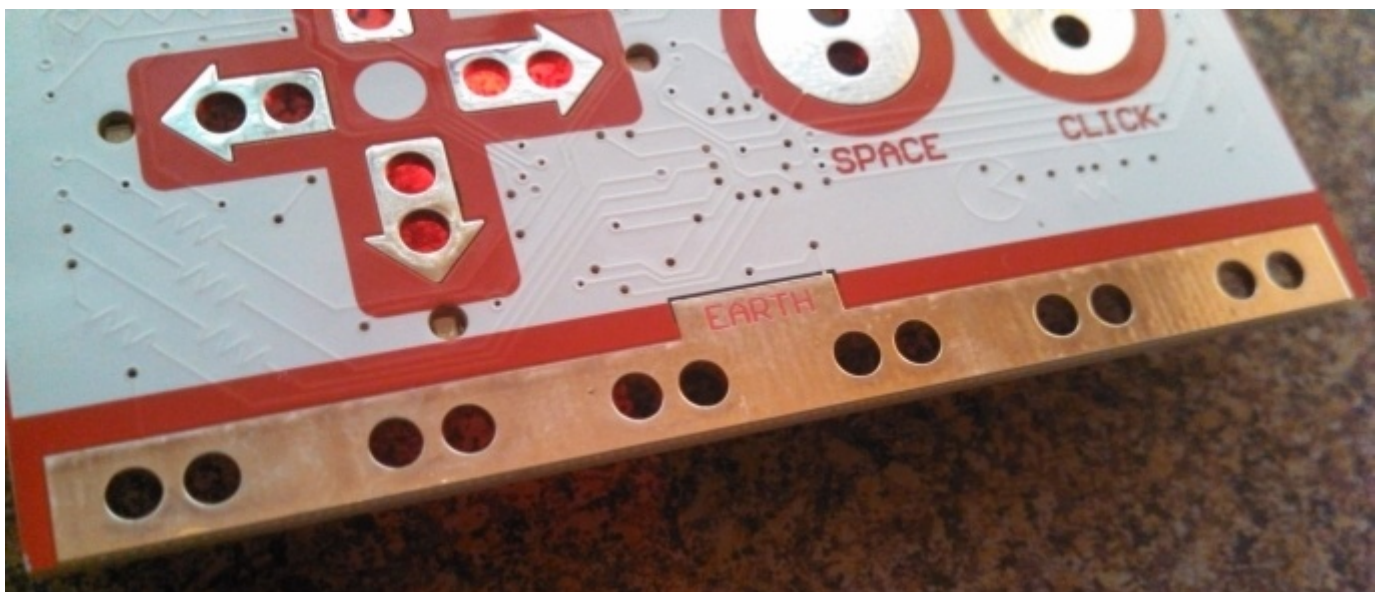
MaKey MaKey is intended to put technology into the hands of everyone. It comes with a board, alligator clips, USB interface and wires. Everything you need to get started is in the kit.

Learn More!

Other types of Human Interface Devices (HID) include keyboards, mice and tablets.

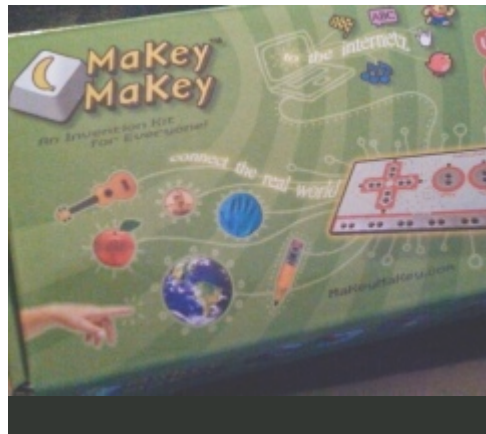
When you plug the kit into the computer, the computer recognizes it as a Human Interface Device (HID). When you attach the alligator clips to the MaKey MaKey board and then to another object, that object becomes the "key" for the computer to recognize.

MaKey MaKey allows you to emulate the arrow keys, WASDFG keys, spacebar and mouse click. You can "press" 6 keys at once. MaKey MaKey runs on Windows, Linux and Mac OS.



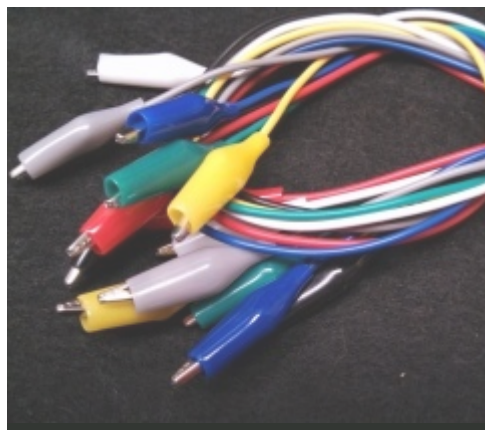
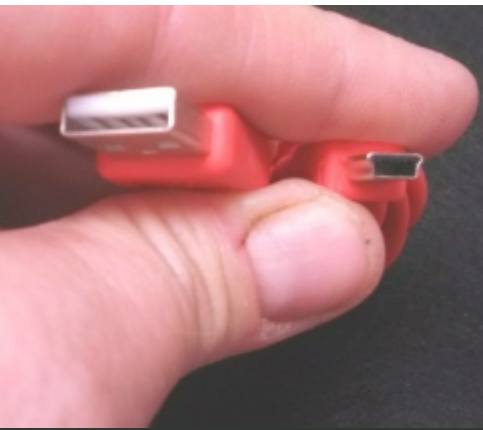
STEP BY STEP

MAKEY MAKEY GETTING STARTED



1. MaKey MaKey comes in a box that includes everything you need to use it. The library will provide MaKey MaKey's for everyone to share.

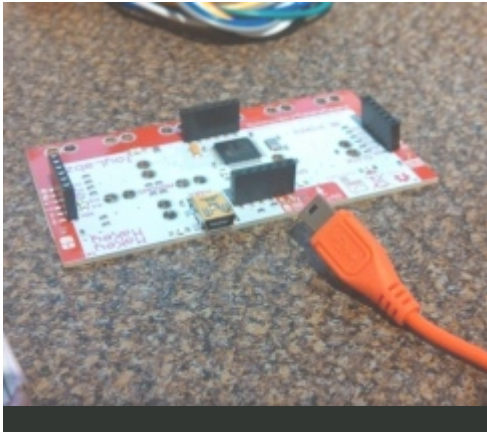
2. The board has holes where you can attach wires or alligator clips. This picture shows the front side where we will use alligator clips.



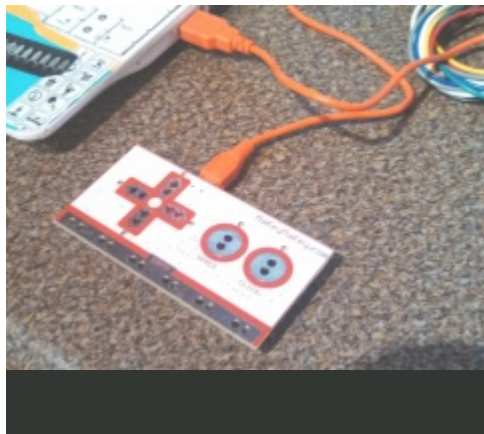
3. This is the USB connection. USB stands for Universal Serial Bus and it was developed to allow many different kinds of devices to attach to computers. The MaKey MaKey comes with a USB to mini USB connection.

4. Alligator clips. They come in different colors just for you to be able to better remember what you hooked up and where. However, it's good to use the black as the "ground" when we get to that.

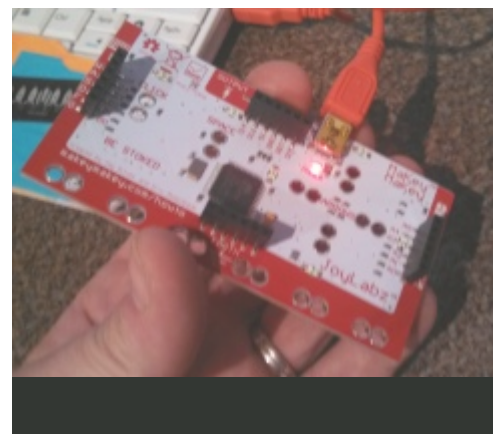
5. Get your MaKey MaKey and a computer. Any computer or laptop will work.



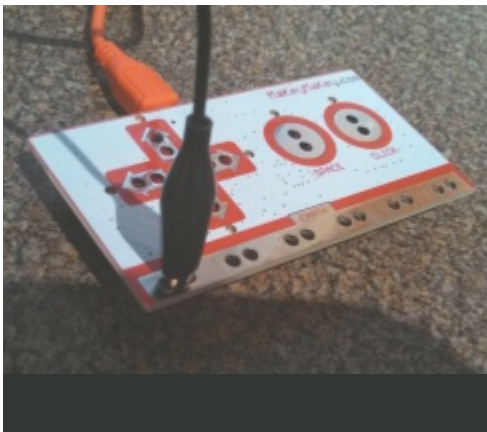
6. Flip your MaKey MaKey over. The gold colored rectangle is where you are going to plug in the smaller end of the USB. The USB cord doesn't just allow the computer to interface with the MaKey MaKey: it will also power it.



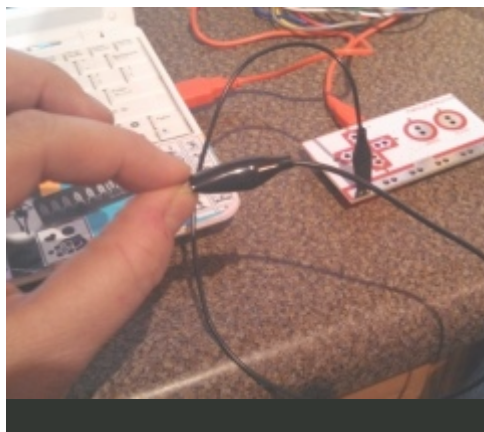
7. Plug the other end of the USB into your computer. You'll see some lights blink.



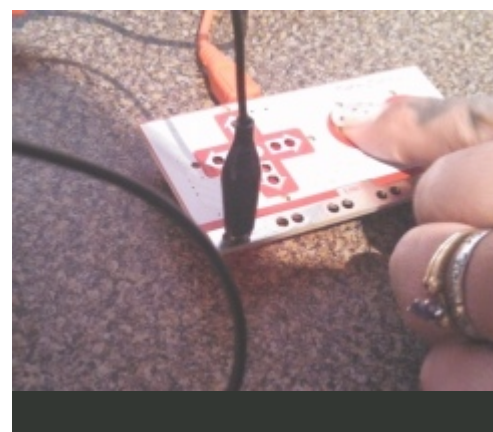
8. You can see the lights on the back of the MaKey MaKey to check that it's working.



9. Now we're going to "ground" our MaKey MaKey. Grounding is the process of removing excess charge on an object. Clip one end of the alligator clip to the bottom where it states "Earth."



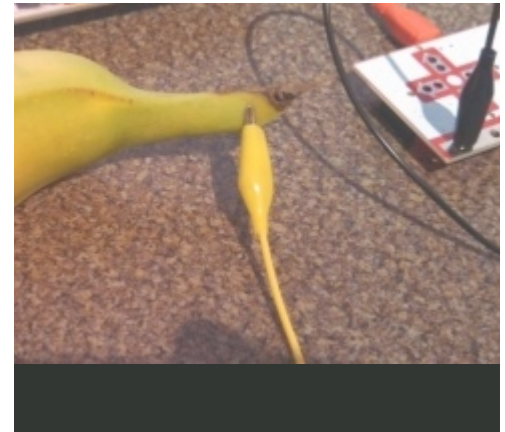
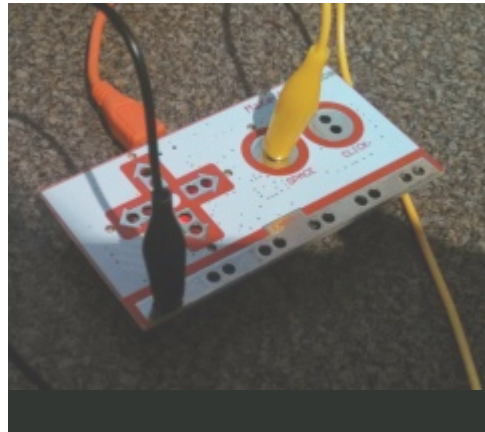
10. Hold the other end of the alligator clip (the metal part) between your fingers. Don't worry: it won't shock you!



11. Test that your MaKey MaKey is working. Hold the ground with one hand and touch the "space" circle with your other finger. You'll see a light. If you did, you're up and running!

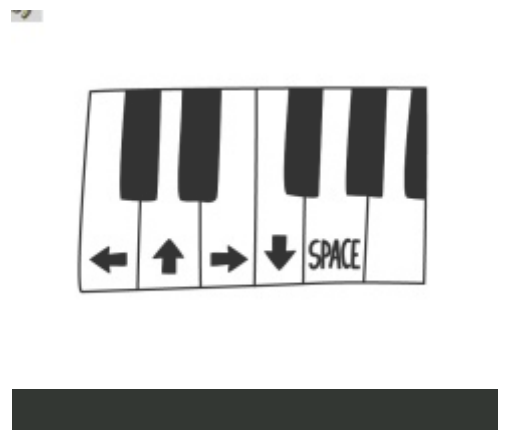
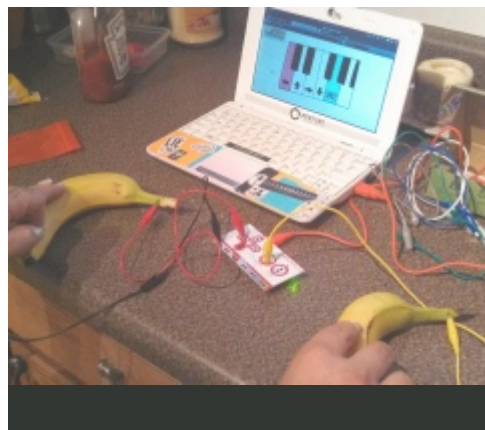
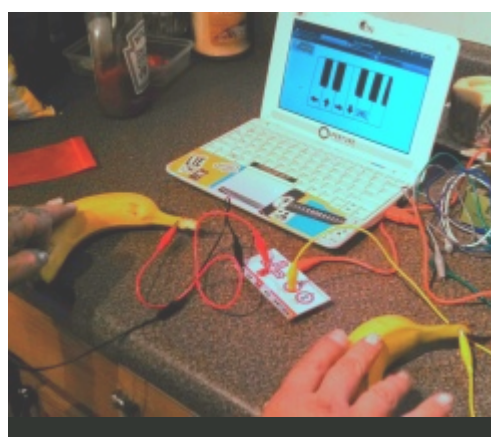
STEP BY STEP

MAKEY MAKEY SOME IDEAS



1. Play piano using bananas. Connect another alligator clip to the spacebar.

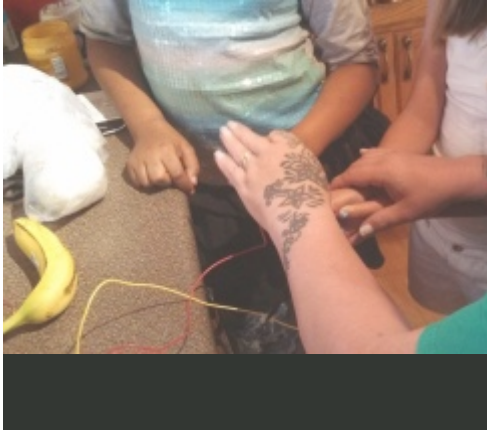
2. Attach the other end of the alligator clip to a banana. Attach another banana to the arrow key.



3. Open up the MaKey MaKey website (www.makeymakey.com) and find a game. Here we chose the piano.

4. As you touch the bananas, they'll act as "keys" and play the piano. Make sure you're still grounded though, or it won't work!

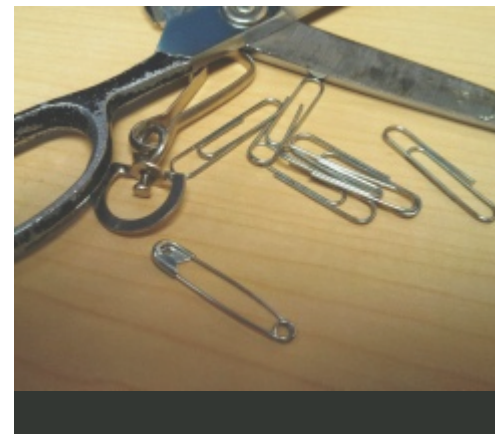
5. This is a screenshot of the piano app that you can play around with on the MaKey MaKey site. You can hook up bananas to each of the spaces on the board.



6. What are some other things you can hook up to the MaKey MaKey? People are one choice! Have friends hold onto the ends of the alligator clip, then when you touch them, they'll trigger the keyboard.



7. Fruits and vegetables are conductive. What does that mean? Conductive objects are able to "conduct" electricity. Try out different produce. Which ones work better?



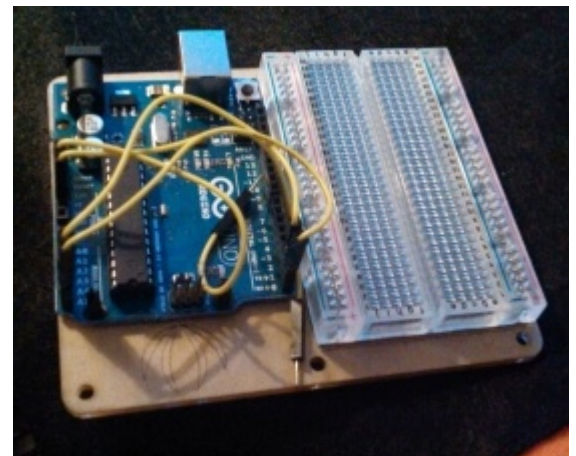
8. Metal objects are also conductive. Some types of metal are more conductive than other types. Graphite from pencils is also conductive.

MaKey MaKey allows you at a very basic level to interface with your computer using any object you wish to use. Because you can use almost anything that is conductive (including people!) you can make some very creative art, music and inventions.

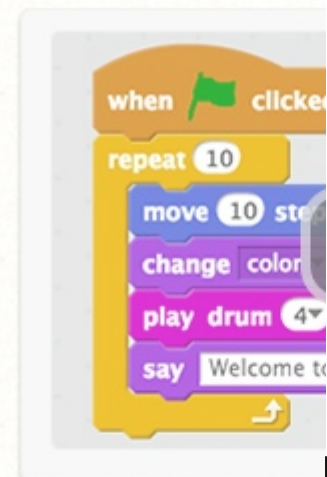
At the heart of a MaKey MaKey is a microprocessor known as an Arduino. Arduinos are open source hardware—all of the specifications for the Arduino are available for anyone to view. So anyone can use them to make new and interesting things, like MaKey MaKeys.

If you search MaKey MaKey projects online, you can find some of these amazing projects:

- * people playing Mozart using gummi worms
- * dances that create music
- * video games controlled with play-doh
- * drawings that become percussion
- * interactive sensors to detect the environment
- * photoboos for cats
- * What will YOU think of?



Create stories, games, and animations
Share with others around the world



A creative learning community with **6,012,377** projects shared

SCRATCH

Scratch is an educational tool developed to help anyone (but especially students) learn to program and create their own games. Scratch simplifies the process of coding by turning the code itself into buildable, snap-able blocks. These blocks of code can be easily changed, re-arranged and remixed. Remixing is one of the key ideas of Scratch. Anyone's game can be remixed, learned from and built upon.

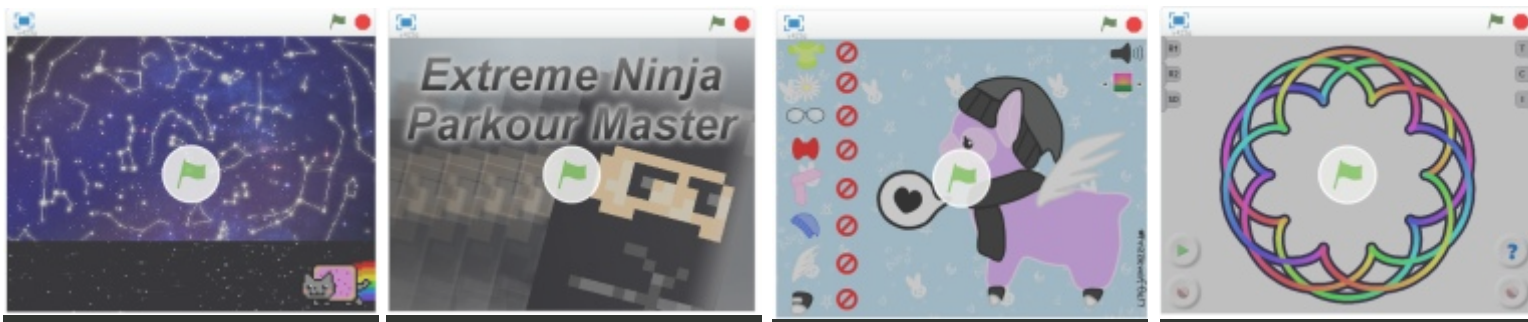
Scratch was developed by the Lifelong Kindergarten Group at the MIT Media Lab. It's been online and freely used by more than 7,500 educators around the world since 2007.

Scratch is written in a computer language called "Squeak." Scratch's source code can be freely viewed and modified (with some provisions about trademark). This makes Scratch a type of Open Source Code.

Scratch is easily used online by editing code in your browser window. But you can also download the Scratch Offline editor. Scratch can be used on Windows, Mac and Linux computers in offline mode.

In this book, I provide a very basic overview of how to remix a project. However, the Scratch website contains many tutorials on how to script, animate and make your Scratch project something special. (Check out the cool examples below!)

Find Scratch online at: <http://scratch.mit.edu>



Open Source

Open Source is something—often hardware or software—that is allowed to be modified by almost anyone. Anyone can look at how its made, anyone can tweak it and then if you've created something that is really useful from the original design, you can share your creation with the world.

What's so great about Open Source? It's awesome that you are allowed (and often even encouraged!) to view and change the design of an Open Source thing. You can create new objects or code based on the original. You can customize, upgrade, tweak and hack an Open Source thing or idea. Open Source provides a stimulus for innovation.

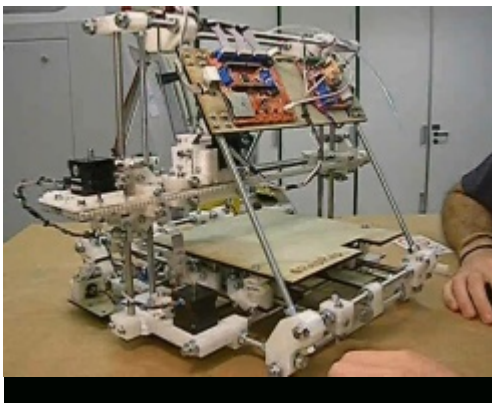
Learn More! Open source licenses are often covered by either Creative Commons or GNU Public Licenses. You can choose to release your own creations using the guidelines from these groups. Using a license on your work allows you to decide how others should be allowed to copy it, modify it and distribute it. Take control of your work and find out more!

Many of us have used computers with Windows installed. Windows is "proprietary software" and only Microsoft may make changes to Windows. However, an alternative to Windows, Linux, allows users to change the software, create their own versions and make something that works for them. Open Source is about giving control to the Maker instead of keeping control at the corporate level. When information is freely shared, more people can creatively solve problems.

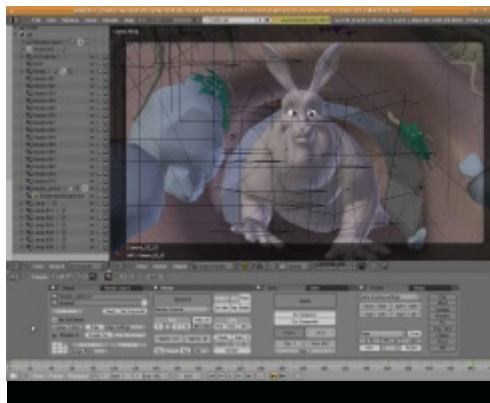
Not all Open Source hardware and software is free, although most of it is. Open Source is released with certain agreements. When you are looking to modify any kind of open source item, check the agreement and make sure that you abide by the rules. In some cases, you may have give credit to the original creator. Sometimes you may only use the open source item for not-for-profit projects.

Open Source has been central to the Maker movement. Using open source software like Scratch, Linux and hardware like Arduino have allowed many Makers to creatively change the world around us. What will you come up with when you're allowed to look inside of the code?

RepRap is Open Source 3D Printing.
"RepRap 'Mendel'" by CharlesC via
Wikimedia Commons.



Blender provides Open Source 3D image
rendering and animation. Blender
Foundation via Wikimedia Commons.

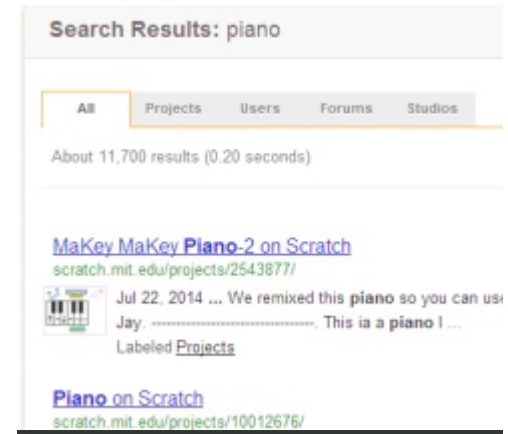


Linux is an open source operating system for
your computer developed by Linus Torvalds.
Linux Screenshot via Wikimedia Commons.



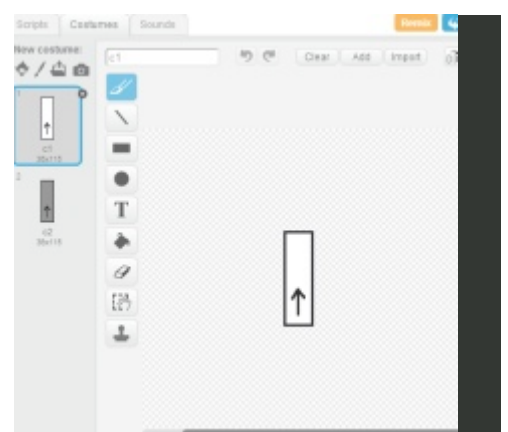
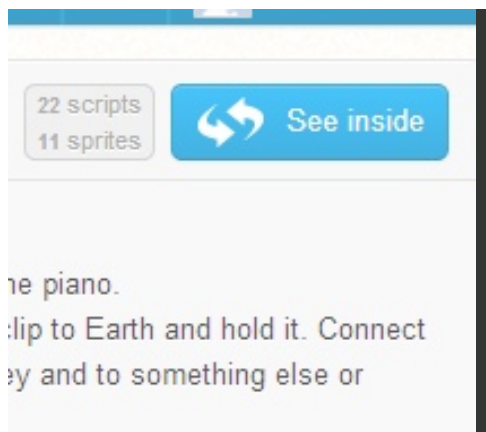
STEP BY STEP

REMIXING SCRATCH



1. Find Scratch online:
<http://scratch.mit.edu>
You can browse what others are doing, but if you want to save your work, you'll have to create an account. It's totally free and easy to set up an account!

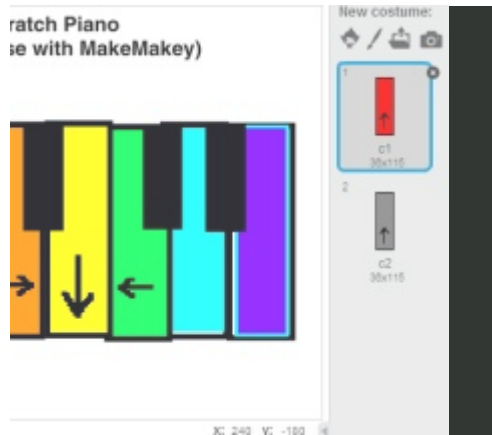
2. Search for the kind of game or program you want to remix. Here I've chosen "piano." Click on one of the results. The project will load.



3. You can play around with the game as it is, but when you are ready to remix, click "See Inside." Once you do that, another screen will load allowing you to see the scripts, sprites, costumes and sounds used in the game.

4. The sprites area is the easiest to play around with. Click on a Sprite and then on the piano above, click to move the sprite around. It's easy, right?

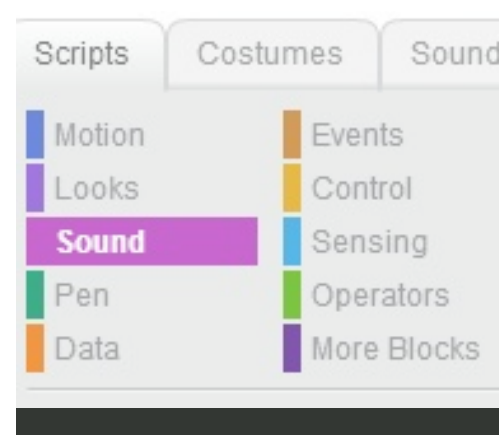
5. Click on the costumes tab and you'll see your sprite, some drawing tools and a color palette (not shown here). We're going to edit our sprites. I'm going to change the color. Notice when you change the color of the sprite on the drawing board, it changes on the game area.



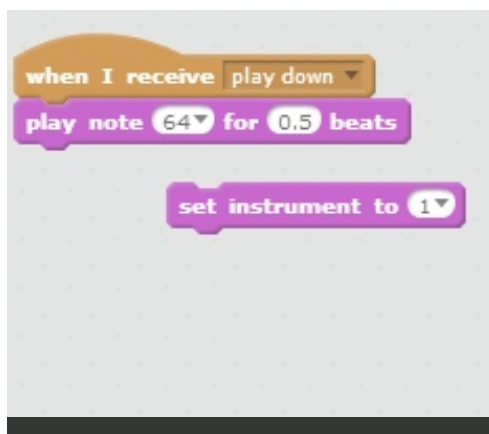
6. Here you can see that I've changed the colors. Also, notice that under costumes, there are two versions of most of these sprites. Use the arrow key to play a note. Did you notice that they key turned gray? That's part of the script where when the piano is "played" the sprite "switches costumes." Switch to the Scripts tab.



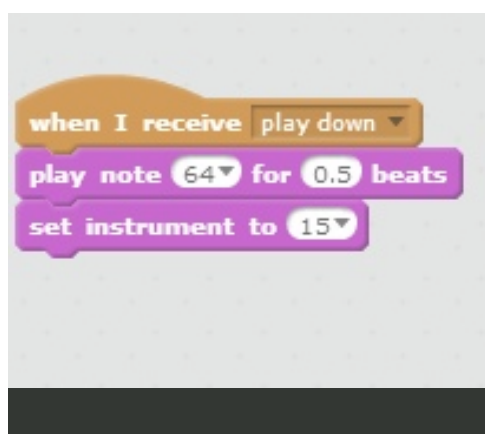
7. Find this block of code. This is what causes the piano keys to "change costumes" when the piano is "played." In Scratch, code is created by using logic blocks. This is the way you code your game. In a Remix, you are just going to tweak settings as you like. When you click on a different Sprite, you'll see a different block of code for that sprite.



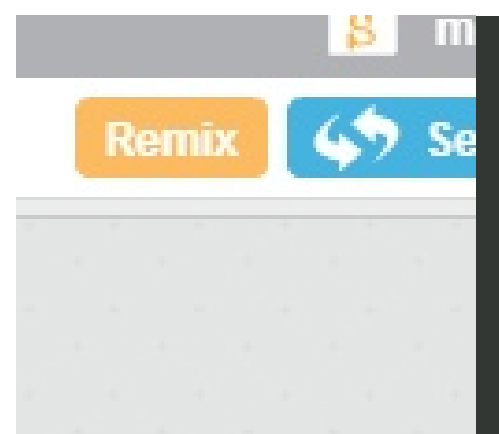
8. Choose the "Sound" tab. A whole lot of different magenta-colored blocks will be displayed below. We're going to change the type of instrument we're going to be using when the key is pressed.



9. Find this block of code (there will just be the 2 in the piano example). From the Scripts menu, drag the "Set Instrument to" block onto the script area.



10. Snap it onto the code block. Change the number from 1 to something else. Do this with each one of your Sprites with different instrument numbers. Make any other changes you'd like. Changing the instrument type makes it so that instead of playing "piano" you are playing a different instrument online.



11. When you've finished your remix, press the "Remix" button. This saves it to your account. You've remixed a game!

Makers: WHAT WILL YOU MAKE?

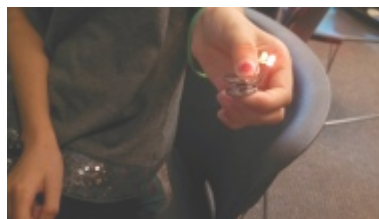
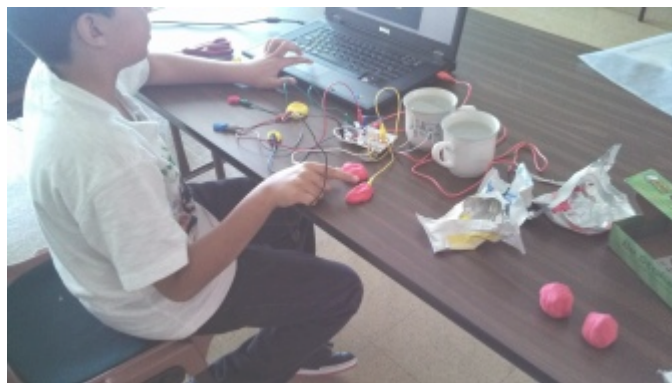
You've got some new skills now... so what we need to know is what will YOU make?

Being a maker means looking at something and not seeing what's there... but seeing what's there AND its possibilities. You have some basic maker skills and knowledge. It's time to put it to the test!

If you'd like to see more Maker-related projects going on at the El Paso Public Library, please visit our Makerspace blog:

<http://elpasocreate.wordpress.com>

Keep being awesome and make the world yours.

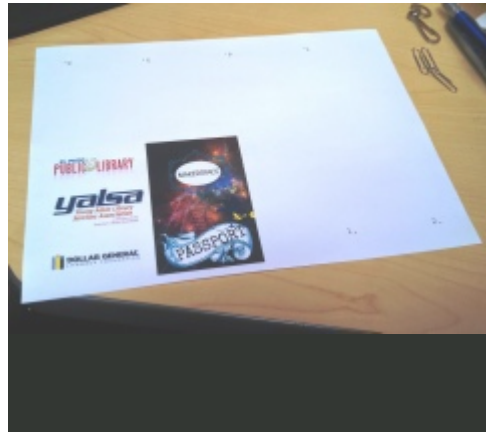


Appendix

The appendix contains information supplemental to the projects described in the rest of this book.

STEP BY STEP

MAKERSPACE PASSPORT



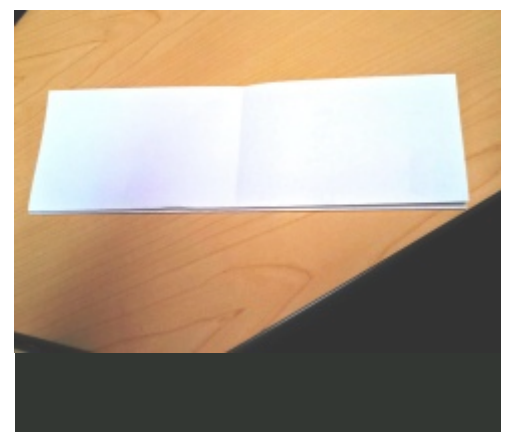
1. Start with a normal-sized piece of paper. For this program, we have provided a cool passport template.

2. Fold it in half.

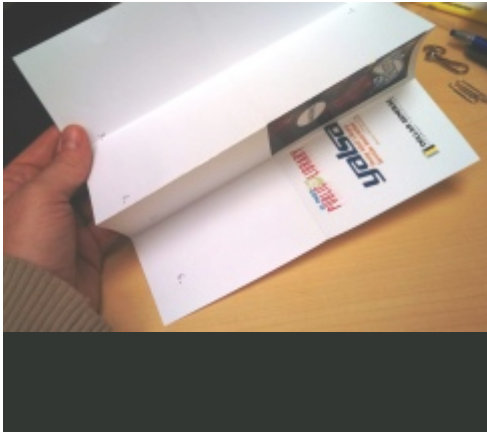


3. Open it back up and then fold it in half again in the other direction.

4. Fold the ends into the inside of the fold.



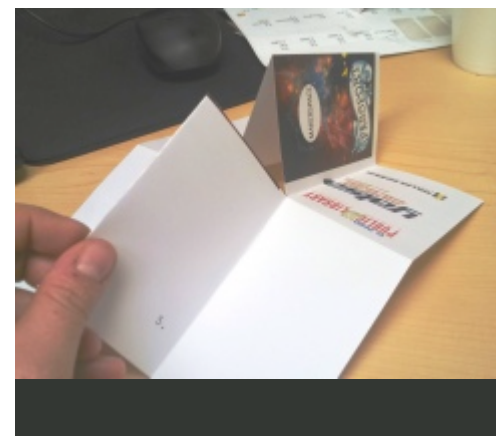
5. Fold it over again.



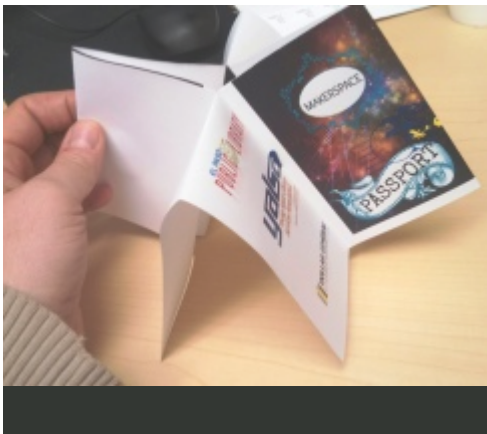
6. Open it up again.



7. Cut only the middle fold.



8. Open it along the hole you cut.



9. Fold it over and crease.



10. Your passport is finished!

STEP BY STEP

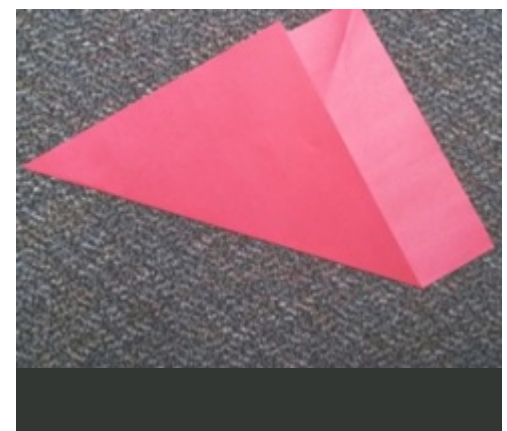
ORIGAMI SQUARE



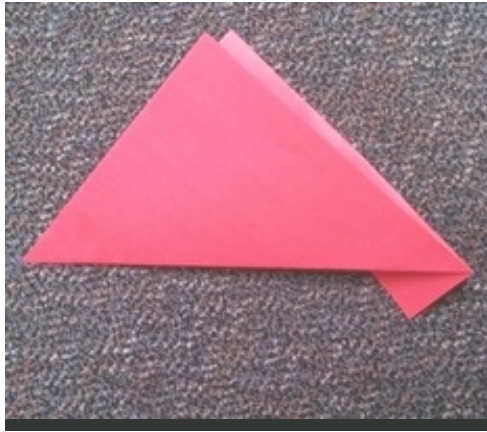
1. Start with a rectangle-shaped piece of paper.



2. Fold one end of the paper on the diagonal, creating a right triangle.



3. This is what it will look like.



4. Fold the "extra" end over and crease.



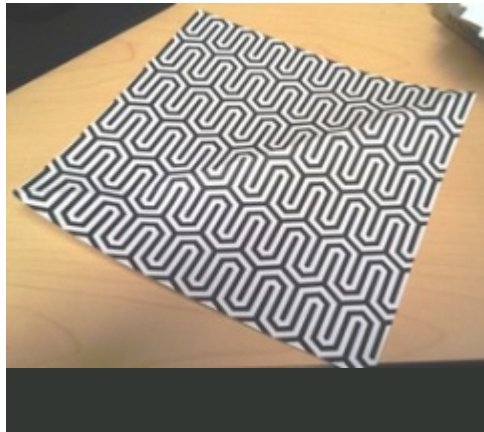
5. Cut the end off.



6. You now have a square-shaped piece of paper!

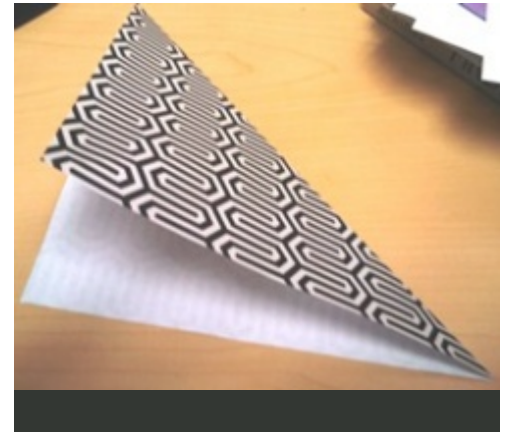
STEP BY STEP

ORIGAMI VASE



1. Start with a square piece of paper.

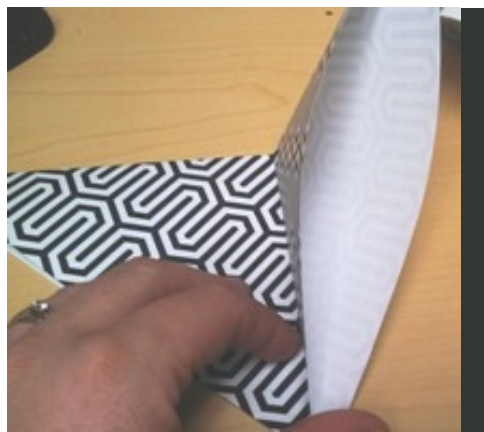
Fold it diagonally in half, keeping the "nicer" side on the outside.



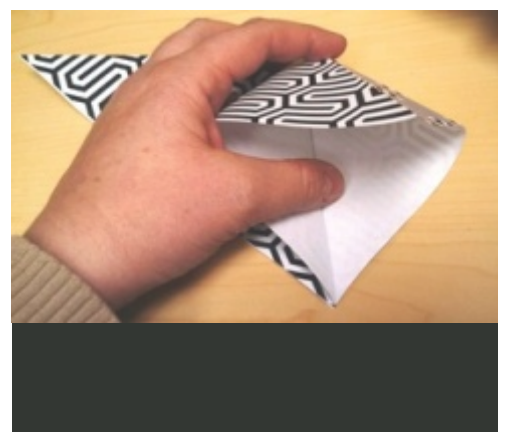
2. Now you're going to have a triangle-shaped piece of paper. Fold it in half again, creating another



3. Get prepared to squash! We're going to lift one edge of the triangle straight up.



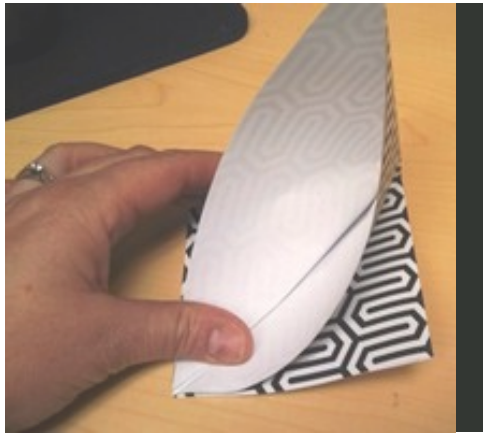
4. Hold down the fold on the outside with your finger and slide your other finger inside of the flap and force the paper into a square shape.



5. The tip of your square should line up and then crease your paper when you're sure you've squashed your paper correctly!



6. Your paper will look like this now. Flip it over and squash again, repeating steps 4 and 5.



7. Open and squash the other flap.



8. This is the square-shaped piece of paper you'll end up with. Keep the open end towards yourself.



9. Fold the top flap in your square over to the midline.



10. This is what it's going to look like. We're going to squash the triangle-shape you're creating now.



11. Open the triangle and squash it flat.



12. This is the shape you'll end up with.



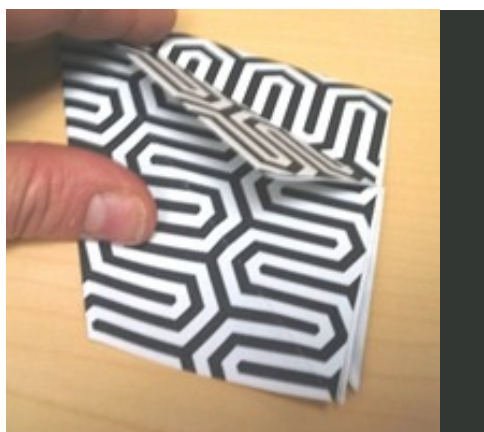
13. Fold the shape over, hiding the squash you just created.



14. This is what your shape will look like. Repeat the triangle fold and prepare to squash.



15. Your shape will look something like this. Fold it over like you did in step 13 again.



16. Fold over the triangle and squash the shape into a triangle shape like



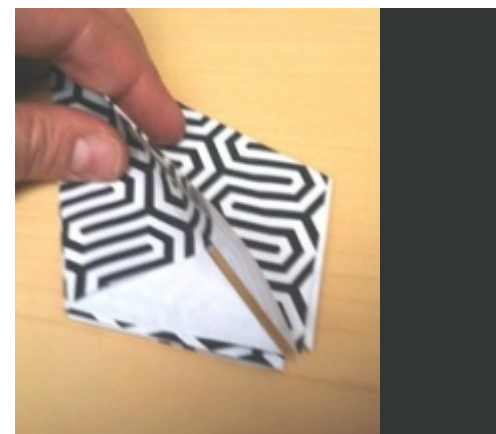
17. This is what your paper will look like. Continue until all sides have been squashed.



18. This is what your shape will look like. This is also known as a "frog" base in traditional origami.



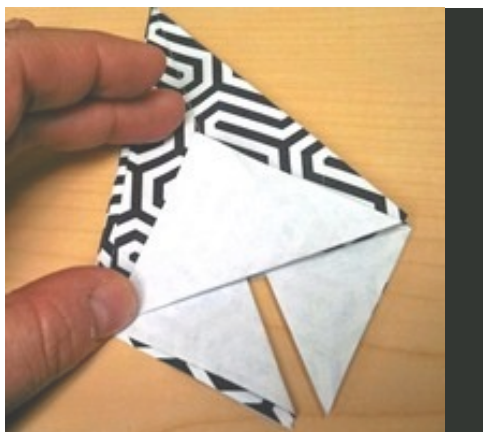
19. Look at your shape. Does it look this way? If so, good! Keep going. If not, go back and try again.



20. Fold one side over, hiding the "wrong" side of the origami that's currently showing.



21. This is the shape you'll end up with. It looks very much like an upside-down kite.



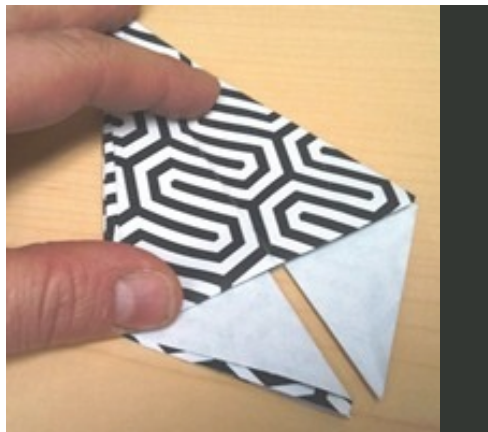
22. Fold the tip of the kite over, creating a triangle.



23. Now, fold your triangle back over and tuck it under the shape.



24. Another view of the triangle being tucked under.



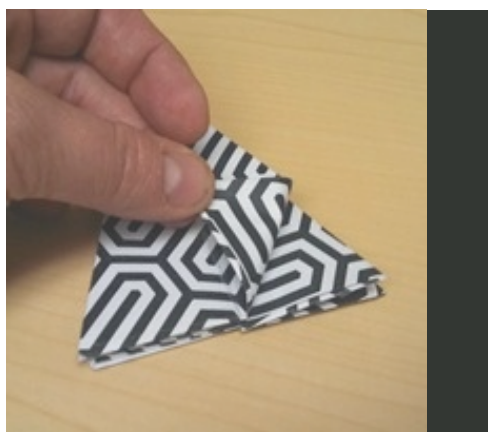
25. Flatten your shape. It will look the way it does in the picture above.



26. Fold over and repeat these steps until all triangles have been folded and tucked under.



27. This is the shape you'll end up with.



28. Fold the edge or corner over to the middle of the triangle.



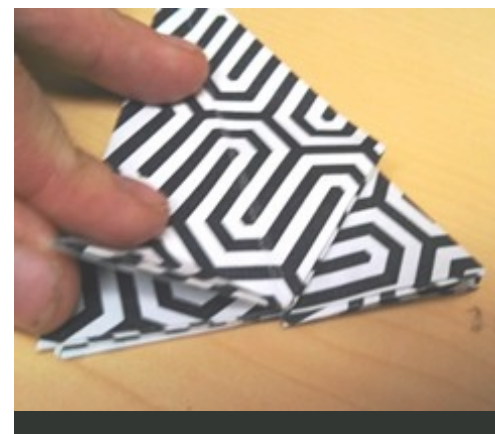
29. This is what the fold looks like. Get ready, we're going to do an "opposite squash."



30. You're going to turn the triangles inside-out, creating a point-type shape.



31. Your new pointy shape will look something like this.



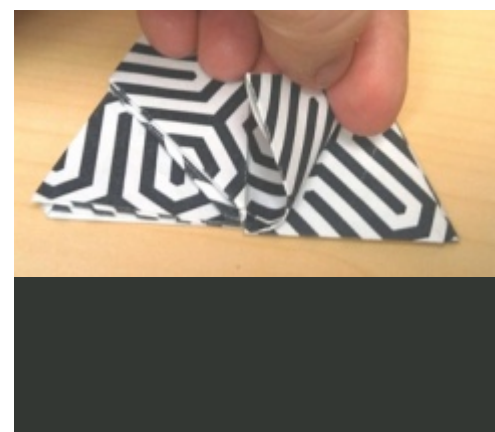
32. This is another look at shape you create.



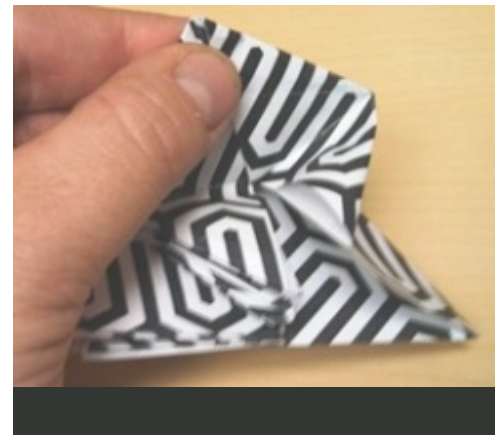
33. Fold over to the next side.



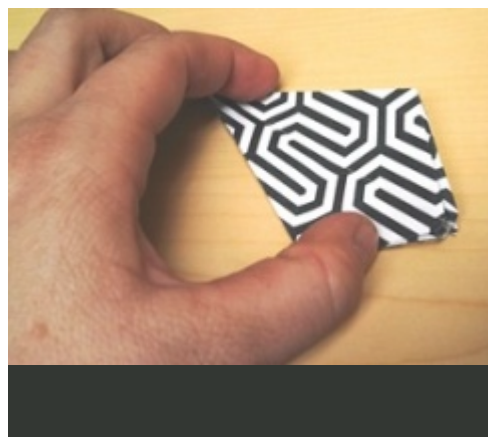
34. Lay flat.



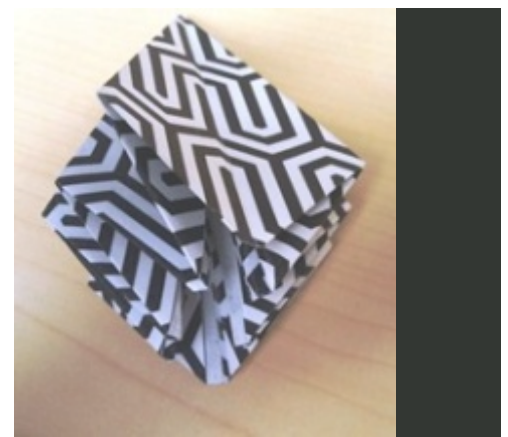
35. Fold the corner over again and repeat the opposite squash.



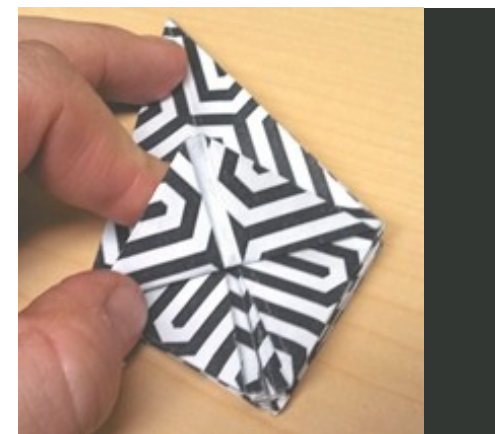
36. This is a shot of what the inside-out squash looks like.



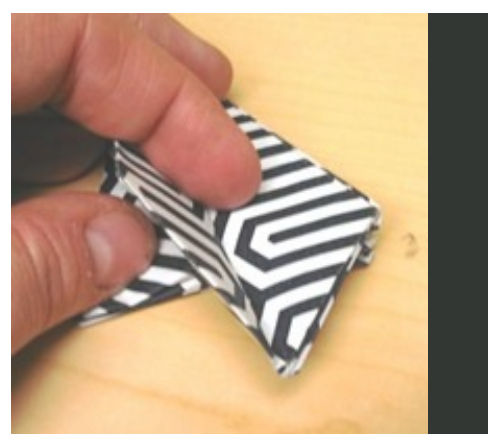
37. Continue the process until you have a shape that looks like this. It's a kite shape again!



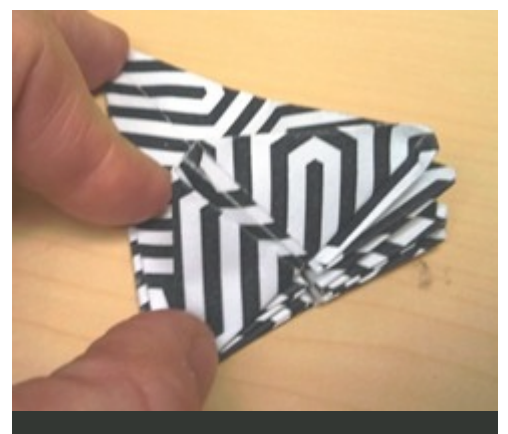
38. Another shot of the origami shape.



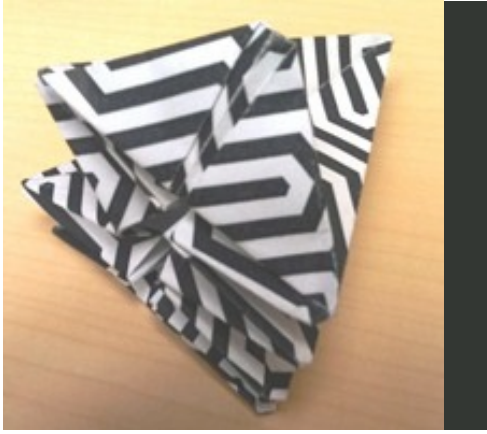
39. Fold the triangle shape over and crease.



40. Fold over again.



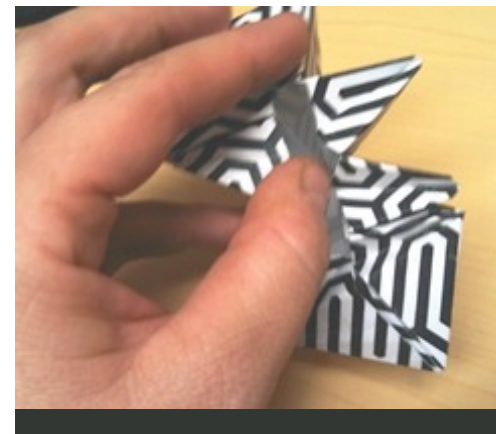
41. Continue folding triangles until all points have been folded back.



42. This is the shape you end up with.



43. Turn the shape around and fold the tip upwards. This is going to create the base of your vase.



44. Turn the shape around and locate the opening.



45. Pry it open and push from the bottom to create the vessel.



46. This is the bottom of the vessel.



47. Ta-da! You've done it!

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