Maker Faire®

Classroom Playbook

Welcome

We have written this playbook for you, the teacher, to help you take advantage of Maker Faire and make it a meaningful part of your classroom teaching. To put this together, we've asked teachers who have attended Maker Faire in years past what they have done and what they wish they could have had in hand before attending. This packet will help you understand what you're going to see and provide you with materials to give to your students so they know what to expect. We also suggest some projects to do before and/or after your visit.

We also give you a sense of the Makers you'll see at Maker Faire. We then focus on two performances popular with all our attendees: the singing Tesla coils and hard rock (and harder physics!) of ArcAttack! and the giant Rube Goldberg-esque contraption Life Size Mousetrap.

We'd like to hear how you have adapted these materials for your classroom. Let us know the age of your students and how these materials worked or didn't work for your class, so that we can improve these materials for next year's Maker Faire.

Special thanks to Mark Perez and Esmerelda Strange of Life Size Mousetrap, physics teachers Marc Zeke Kossover and James Dann, Joe diPrima of ArcAttack!, the Santa Cruz Institute of Particle Physics, Instructables, the Ask a Physicist blog and to the masses of Wikipedia for their contributions to this Playbook.

And most of all, a big thank you to our generous sponsors at Intel who supported the development of the original Education Day Class Pack for Maker Faire Bay Area 2013.

What You'll Find in Your Classroom Playbook

Event Overview

As leaders in the Maker Movement, we're dedicated to celebrating and inspiring Makers. We are particularly interested in how this approach might reach students who don't fit well into the existing system or who have already dropped out of it.

At Maker Faire, there are no winners or losers — anything that's cool is fair game. It's not a competition, and there aren't prizes, so there are no judges deciding who has succeeded and who has failed. Yet Makers — some with two PhDs, others who never graduated from anywhere — are motivated to spend long hours in their studios, shops, kitchens, and garages finishing their projects. Makers work in art, craft, engineering, music, food, science, technology, health, and often in several of these areas at once. Their projects are thoughtful, challenging, and innovative. But most importantly, we notice that all Makers are curious and motivated people.

We call Maker Faire the Greatest Show (and Tell) on Earth—a family-friendly festival of invention, creativity and resourcefulness, and a celebration of the Maker movement. Part science fair, part county fair, and part something entirely new, Maker Faire is an all-ages gathering of tech enthusiasts, crafters, educators, tinkerers, hobbyists, engineers, science clubs, authors, artists, students, and commercial exhibitors. All of these "makers" come to Maker Faire to show what they have made and to share what they have learned.

The launch of Maker Faire in 2006 demonstrated the popularity of making and interest among legions of aspiring makers to participate in hands-on activities and learn new skills at the event. In 2013, over 60 community-driven Mini Maker Faires are expected around the world, including Tokyo and Rome.

Maker Faire is primarily designed to be forward-looking, showcasing makers who are exploring new forms and new technologies. But it's not just for the novel in technical fields; Maker Faire features innovation and experimentation across the spectrum of science, engineering, art, performance and craft.

Maker Faire is a gathering of fascinating, curious people who enjoy learning and who love sharing what they can do. It's a venue for makers to show examples of their work and interact with others about it. Many makers say they have no other place to share what they do. DIY (Do-It-Yourself) is often invisible in our communities, taking place in shops, garages and on kitchen tables. It's typically out of the spotlight of traditional art or science or craft events. Maker Faire makes visible these projects and ideas that we don't encounter every day.

Maker Faire is brought to you by Maker Media. Maker Media publishes MAKE magazine, produces Maker Faire, and offers DIY electronics, tools, kits, and books through its online and pop-up Maker Shed stores.

See **makerfaire.com** for all the details!

What is a Maker?

Teacher Overview

We believe that everyone is a maker. Because you are bringing your students to Maker Faire, we're guessing you agree. This isn't a future state-of-mind they will achieve through years of work. They can start making right now. We have some recommend starter projects in Before Your Visit and After Your Visit.

Try starting a conversation with your students about what they think a Maker is, or how they define it. If your students are completely unfamiliar with the Maker movement, you might have to prompt the conversation a bit. You can have this conversation both before and after your visit to Maker Faire, and see if their ideas and definitions change at all.

For fun, we've included a worksheet that you may want to use, Am I a Maker? (see next page and Masters section.)

At right, these are some of the things we've noticed about Makers. We do not recommend reading these to your class. Rather, we have included them for your own understanding.

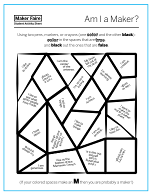
A Maker believes...

- Everyone is a Maker.
- Our world is what we make it.
- If you can imagine it, you can make it.
- If you can't open it, you don't own it.
- We share what we make, and help each other make what we share.
- We see ourselves as more than consumers—we are productive; we are creative.
- Makers ask, "What can I do with what I know?"
- Makers seek out opportunities to learn to do new things, especially through hands-on, DIY (do-it-yourself) interactions.
- The divisions between subjects like math and art and science dissolve when you are making things. Making is an interdisciplinary endeavor.
- It's all right if you fail, as long as you use it as an opportunity to learn and to make something better.
- We're not about winners and losers. We're about everyone making things better.
- We help one another do better. We are open, inclusive, encouraging and generous in spirit.
- We celebrate other Makers — what they make, how they make it and the enthusiasm and passion that drives them.
- We surprise and delight those who see our projects, even though the projects can be a bit rough-edged, messy and, at times, over-stimulating. (Think punk rock.)
- We are generally not in it for the money. This isn't about filing patents or making a profit.
- At the same time, we're not anti-commercial—Makers sometimes start businesses, and we celebrate that—but we don't make it a focus as it would change the spirit of the movement.

Before Your Visit

We don't need you to do anything before you come to Maker Faire—you can just come and experience it with your students! But if you want your students to get more out of it, here are some suggested activities to help them prepare.

Am I a Maker?



This activity is best for second grade and up (just because of the vocabulary we use in the game.) Using a color pen or crayon and a black marker, students color in the spaces that are true, and black out the ones that are false. The items are worded to reveal an "M" for just about anyone who is human, not an android, etc., so we expect everyone in your classroom to end up feeling like "everyone is a maker."

Sneak Peek

at Your Sneak Peek of Maker Faire

Preview videos of Maker Faire (see some of the best on **makerfaire.com/highlights** and engage your students in a KWL discussion.

Divide a paper into three parts. Before your visit, the students complete the "K" and "W" columns. The "L" column is for after your visit. Consider adding columns for Further Wanderings and How to learn more. Learn more about KWL tables here: **study-habits.com/kwl-table-chart**.

Make Something!

(suggested starter projects)

The best way to introduce your students to a joy of making and welcome them into the Maker movement is to make something. There is an excellent list of sample projects included in the book *A Blueprint : Maker Programs for Youth:* **dmp.nysci.org/#news/51**. Here are a few of our favorite introductory activities from that list:

- Squishy Circuits: Light LEDs with playdough and batteries
- BrushBots: Turn a toothbrush into a robot
- Papertronics: Toys with paper electronic circuits
- Homopolar: Motor from battery, magnet and wire
- Rubber Band Cars: Cardboard cars with rubber band motors.
- Origami Flying Disk: Bernoulli's principle comes to life in paper
- Soda Bottle Hydroponics
- Soda Bottle Sub: Underwater submarine

K	W	L
What I know	**What I want to know**	**What I learned**
What do the students know about Maker Faire, making, & the Maker movement?	What do the students want to know about Maker Faire, making, & the Maker movement?	After the visit, what have your students learned about Maker Faire, making, & the Maker movement?

Make Your Own Sketchbook

Students can make their own mini data notebook, science journal, or sketchbook to record what they see at Maker Faire. We have included photocopy masters to use for the book. Returning Maker Faire teacher Susie Kameny recommends this activity to develop the skills of observation and notetaking across disciplines in younger students, but certainly older students may also come with notebooks in hand!

Use the suggested templates in the Materials or your own plain paper. For best results, we recommend you print our templates directly to a laser printer (rather than using a photocopier) and at 100% (as the endsheets include rulers and the graph paper has 8 squares/inch.)

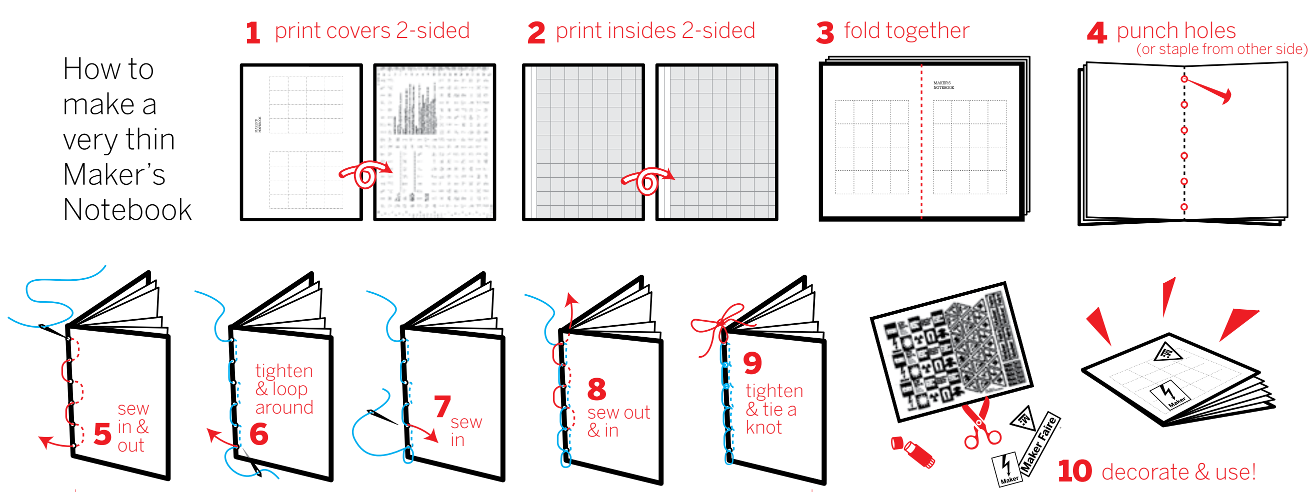
Print the cover and endsheets back to back, one per student, on thicker paper if possible. Print the template graph paper for the inside pages on both sides, 2 or more sheets per student (two sheets yield an 8-page sketchbook, five yield a 20-page sketchbook.) We've also included some black and white versions of our popular notebook stickers which you can print on sticky paper or have your students cut and paste them to add Maker flair to their notebook covers.

Students can fold this book together and make the cover. Then they can bind it themselves with two staples on the fold, using a long-arm stapler or using the method described below. If you stitch the notebooks, we recommend punching the binding holes at 0.5" / 2.0" / 3.5" / 5.0" / 6.5" / 8.0". That's 0.5" from each edge and every 1.5" inbetween.

Whether you use our templates or blank paper, the notebook should include space to draw what students see. Leave space so they can write a sentence or two about their experiences. You may want to choose terms from the list below (in English and/or Spanish) and encourage them to look for these during their visit.

Your students could define what they see at Maker Faire and what they understand about these things in words and pictures. You can even create your own sketchbook masters that have each word at the top of the page, so that your students' sketchbooks serve as a "passport" that they complete as they encounter these things at Maker Faire.

1. robot / *robot*
2. maker / *maker*
3. electricity / *electricidad*
4. rocket / *cohete*
5. experiment / *experimento*
6. prototype / *prototipo*
7. Arduino / *Arduino*
8. LED / *Led*
9. propane / *propano*
10. art / *arte*
11. reduce-reuse-recycle / *reducir-reutilizar-reciclar*
12. circuit / *circuito*
13. sewing / *costura*
14. musical instrument / *instrumento musical*
15. code / *código*
16. Tesla coil / *bobina de Tesla*
17. simple machine / *máquina simple*



School Bus Trip to Maker Faire

by Walt Hays
Teacher at Analy HS, Sepastopol, California

For five years now I've been taking a bus-load of students from my high school to Maker Faire in San Mateo each spring. We go on Saturday so students don't miss any school. Over the years I've learned a few things about how to make the trip go smoothly, and thought I would share these lessons with you.

Approval. First things first, get the field trip approved properly by your administration. Our district requires several weeks' notice for a field trip like this. Talk with your site administration to figure out what is required.

Buses. I recommend getting the school bus reserved months ahead of time. We go in a large yellow school bus that seats 56. I allocate space for 45 students and 5 staff chaperones (leaving 6 empty seats as a buffer.) I talk with fellow teachers and line up chaperones months ahead of time. Sometimes a teacher wants to bring a friend or their kids: that's why I have six extra seats.

Funding. We fully fund the trip using a portion of our school's GATE money (Gifted And Talented Education). This means all our expenses (primarily the bus and the entrance tickets) are fully covered by our school. There is no cost to our students.

Tickets. You can get discount tickets if you buy in advance for a large group if you. Go to makerfaire.com to find details. Often school groups get an even better deal; check makerfaire.com/education.

Sign-ups. The first year I took kids to Maker Faire, several students didn't bother to show up early Saturday morning. I had a waiting list, but by then it was too late to get kids to come take the empty seats. (As far as I could tell, some kids figured "whatever, it didn't cost me anything, I'm going to stay home and sleep in.") To help motivate kids for all subsequent years I require that students give me a $10 deposit when they turn in their paperwork. This holds their spot on the bus, and I give it back to them when they show up Saturday morning to go to the faire. If you have to charge students to go on the trip, I think that would be its own incentive to show up.

Letter to Parents. I write a cover letter explaining the trip is free, sign-ups are first-come-first-served, that we meet at school at 7:30am, then go down on a bus. I also explain that there is no cost to attend, but that walking shoes, sunscreen, and money for food and refreshments are good ideas. Finally the letter explains that we will be back to our school by 6:30pm. (Our school is nearly two hours away from San Mateo.)

Permission Slips & Paperwork. About 5 weeks before Maker Faire I send paperwork to families:

1. The cover letter, explaining what Maker Faire is about and how the field trip will work
2. School field trip form with student cell phone and parent emergency contact info
3. Maker Faire Liability Waiver form. This one is key: once at Maker Faire, students are only able to take part in hands-on activities if they are wearing a Maker Faire waiver wristband. The normal way to get wristbands is having a parent or guardian sign the liability waiver form at Maker Faire. Since these kids won't have their parents there, and since I am not their parent or guardian, we need parents to sign the waiver form ahead of time. The form is linked to makerfaire.com/education.

At Maker Faire. Our bus drops off near an entrance. This isn't where the bus gets to park; they just pull up and we get out. Before we get to the faire I give all the kids my cell phone number for emergencies, I give each student their ticket, and I give each student a map of the fairgrounds with our 4pm meeting place (the East Gate, also known as Gate 7) circled. Get and print a map of the faire the day before off the faire web site. Our bus has usually managed to park near there. I get the bus driver's cell number before we get off in the morning to help us connect in the afternoon.

Departing. Students meet at the gathering point at 4pm. I check everyone off carefully to make sure no one is left behind. The other chaperones help me find the bus, and we walk kids over to it. I again check everyone off when we think everyone is on the bus.

Fingers crossed, we've done the trip five times, and the worst thing that's happened has been a few kids showing up 10 minutes late. Each year it's been a fantastic experience for the students and chaperones.

During Your Visit

We don't need you to do anything during Maker Faire — you can just come and experience it with your students! But because teachers ask us for activities to help scaffold their students' experience, we developed these suggestions for you and your students to get more out of your time.

Educational Goals

We've identified 10 educational goals anyone who comes to Maker Faire can achieve. A few of these are just for the adults:

- Meet, interact, & converse with individual Makers, who are sharing their unique passions and projects.
- See the wide breadth of subject areas, projects, and interests on display from various Makers, performances, and activities.
- Experience a live performance or demonstration.
- Engage in a hands-on project or activity, which results in a product that students can take home.
- Work on a collaborative project, or sharing experiences with other students, teachers, chaperones, Makers, or members of the community.
- Become exposed to, and feel welcome and supported in, the Maker community.
- Become exposed to different areas and iterations of art, science, and engineering.
- Be inspired with at least one new idea to try at home or at school.
- Get a behind-the-scenes glimpse into the large-scale, set-up process of Maker Faire.
- Especially for you, the teachers: be inspired to bring at least one new idea, as well as information on how to integrate making – the projects, mindsets, and processes, into the classroom.
- Especially for Makers:
    - Get a chance to share their passions and engage with students and educators.
    - Get inspired to share their work with the educational community on a regular basis.
    - Remember what it's like to be a kid, and why they love what they do.

What We Hope Kids Will Do

- Try something new!
- Learn something new!
- Feel inspired to begin, increase, or continue a lifestyle that celebrates & incorporates frequent making, crafting, creating.
- Meet and interact with numerous Makers through conversation, demonstration, and hands-on interactions.
- Gain insight on the setup behind a large-scale community event.
- Get energized to return to Maker Faire with their families the next day or next year.

What to Expect from Staff and Makers

- Make the visit an all-around positive one for all our guests.
- Engage with students & teachers of all grades and backgrounds, treating all fairly and equally.
- Show, teach, and play with participants in interactive ways
- Convey a positive sense of the importance of following one's passion and becoming a Maker.
- Encourage kids to return for the blow-out weekend ahead!
- Support the goals of the teachers in their visits.
- Motivate the development of innate curiosity and love of learning in formal & informal settings
- Maintain safety for all students and chaperones. Kids must stay in approved areas in groups with an adult chaperone at all times, even the mature high-schoolers.
- Facilitate interactivity, inspiration, and interest.
- Show off Maker projects / do a hands-on activity.
- Acknowledge innate curiosity and love of learning in formal & informal settings as a way to grow as a creative Maker.
- But not everything: students won't see all the Makers onsite, & no Maker will see all attendees.

We Welcome Everyone!

Maker Faire is deeply committed to treating all our visitors with the utmost respect and consideration, and we have endeavored to train our staff to understand our goals. Foremost among these goals is to inspire everyone to be a Maker and become a part of the Maker movement.

If you observe any behavior towards your students that does not contribute to this and/or our educational goals, please notify us immediately.

We also welcome you to offer frank but friendly feedback to any Maker or Docent as soon as you see an issue arise, if you feel your input will improve the overall experience.

A Note about Safety

We cannot emphasize enough the importance of safety. To ensure the highest level of safety, we ask you to follow these guidelines with your group.

1. Get a safety waiver. Read it and understand what it means.
2. Wear protective gear whenever an injury is possible, even with a familiar tool like scissors or a drill.
3. Stay in designated safe zones.

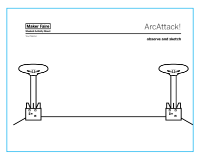
Suggested Onsite Activities

We've developed worksheets for each of these activities, all in the Materials section of the Playbook. These are suggested "assignments" for your students during their visit. We also encourage you to just have them come and experience the event!

Observe and document

Ask your students to fill their sketchbooks, notebooks, or science journals with their impressions of Maker Faire. Your students can use their mini Maker's Notebooks (see Before Your Visit and Masters sections). When you return to class, you can assemble their words and pictures in a shared class memory mural or book.

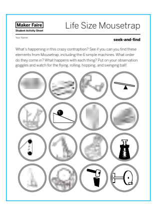
Annotate ArcAttack!



We've created a simple diagram to approximate the stage for a key act—ArcAttack! Distribute it to your students so they can draw what they see during the performance. You might even be able to assemble the sketches of all your students into a short animated flipbook. Using image processing software such as Adobe Photoshop, scan or take a picture of each sketch made by your students, align the drawings of the Tesla Coils so that they don't move from frame to frame, use the automated gif-building feature, and their unique drawings of sparks will create a short animated image to match ArcAttack!'s frenetic quality.

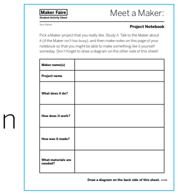
Before you go, review the Teacher Overview for ArcAttack! for your own understanding in case questions come up. After your visit, you can use what you glean from this overview as launching points for science units on electricity.

Mousetrap seek-and-find



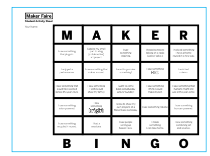
After the overview of ArcAttack!, we've shared some science and math relating to the Life Size Mousetrap. Again, we encourage you to review this for your own understanding, not to use it as a class curriculum. The activity sheet we've created for observing Mousetrap asks your students to look for elements of the game and classical mechanical pieces in a seek-and-find puzzle.

Focus on one project



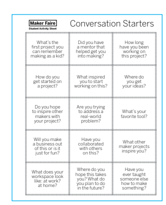
Saber Khan, a teacher who brought students to Maker Faire 2010 Education Day, prepared a worksheet we liked. Much of this sheet can be completed through observation. Your students will want to ask questions of the makers when they feel that what they see, notice, touch, and hear do not suffice.

Maker Faire Bingo



We have put together a grid of the kinds of experiences we hope your students will have and the kinds of things we hope they will see during their visit to Maker Faire. Please do what you can make sure that this "game" sparks interactions with makers rather than dampens them. We want to avoid having students run from maker to maker, trying to mark off all their boxes, cutting off their interactions with makers in order to check off another box, and in the end, winning the game but missing the point. We are sure that you can frame this lighthearted approach to a checklist of our educational goals in a way that is rewarding to your students, and which enriches their experience.

Start a conversation with a Maker



Makers may seem too busy to talk for more than a minute, but everyone appreciates a sincere question from an interested young person no matter how occupied they are. Prepare your students to interact with the Makers with the example conversation starters we've created.

We suggest cutting the master into 15 cards and handing one card to each student to make it "their" question to ask of at least two makers as they visit Maker Faire. Remind them to take notes about the makers' answers in their notebooks (if they bring those with them.)

Tesla Coils
The Science Behind Them

Teacher Overview

Today, Tesla coils are very popular among artists and physicists, but they were not conceived as entertainment or education. Nikola Tesla (1856 – 1943) originally designed his coils as a new way to transmit energy wirelessly, and he had interests and insights far beyond his Tesla coils. An inventor, electrical engineer, mechanical engineer, physicist, and futurist, he was best known for his contributions to the design of the modern alternating current (AC) electrical supply system. Your students may be more familiar with his professional rival, Thomas Edison, who advocated for DC (direct current) power.

In day-to-day life, electricity cannot be sensed, but with the million volts generated by a Tesla coil, you can see bright sparks, hear loud crackling noises, and smell the odor of ozone. The sparks you see around its big metal donut (or more precisely, "torus") are very similar to the lightning you find in nature, in a dramatic summer thunderstorm, for example. In this case, the Tesla coils generate the bright sparks, or "arcs," by creating an electrical field strong enough to free up the electrons from the air molecules right around the torus. Air is usually very resistant to conducting electricity, but when you add a million volts, it just can't resist! This causes arcs.

Arcs = sparks = plasma

Plasma is one of the four basic states of matter. Everyone knows about solid, liquid, and gas: you get plasma when you add energy to gas. The gas ionizes, meanings that the atoms and molecules break into negative ions (electrons) and positive ions. As plasma cools, the ions re-form into a gas.

Plasma lights up our life. Neon signs, sparks from static electricity, even some flames: these all glow because of plasma. Some TVs and fluorescent lamps use plasma to make ultraviolet light, which is then colored by powders on the glass. You can even find plasma in the sun and the stars!

As electrical current runs through the air, it knocks electrons into higher energy states along the way, ionizing the air as it goes. When the ions get knocked around and then fall into place again, you get a photon, and that's the light we all enjoy. Those bright sparks mean that at least hundreds of thousands, perhaps several million, volts are pumping through the coil. Paths of plasma through the air look like bright, sparkly bolts of lightning.

Getting to thousands of volts

The first critical component of a Tesla coil circuit, the transformer, takes relatively low voltage and transforms it to the high voltage we need to make things light up, as in a neon sign. See the diagram above. One side of a transformer, the primary coil, is wire coiled around a piece of easily magnetized iron. Connect the coil + iron to alternating current to create an electromagnet that turns on and off.

The iron extends into the secondary coil. Changing the magnetic field in the electromagnet creates electricity in the secondary. With more turns of wire in the secondary than in the primary, the voltage will be higher. You might imagine that you could have as many coils as you can in the secondary to get as high a voltage as you'd like. Unfortunately, this doesn't work for a variety of reasons, including the danger the secondary arcing through the insulation in its wire. The transformer is just a first component. For the amazing arcs in ArcAttack!, we need much higher voltages than a transformer usually provides (often they max out at 12,000 volts.) Tesla coils get us higher voltages.

Getting to millions of volts

There are many ways to build a Tesla coil. The group ArcAttack! uses a solid state tesla coil, with something called switch mode power supplies instead of big heavy transformers. The other main type, a spark-gap Tesla coil (see circuit diagram, below) starts with a transformer, connected to a primary coil (often coiled copper pipe), a high-voltage capacitor (it stores energy), and a switch (here, a spark gap.)

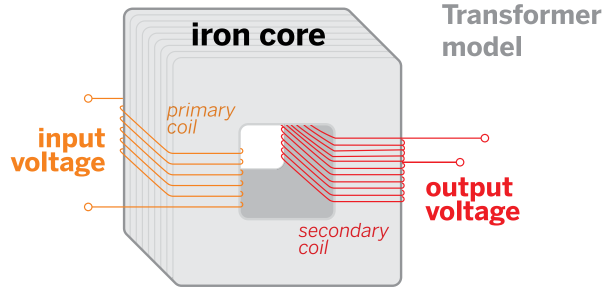
High voltage from the transformer charges up the capacitor. When enough energy is stored in the capacitor, the switch allows the current to flow back out of the capacitor very rapidly and into the coil of wire, creating a very large, fast-changing electromagnetic field. This high-frequency field is radiated away, essentially transmitted like a radio.

The primary coil transmits the energy to the next part of the circuit. Attached to the toroid (the donut shape where the arcs come out) is yet another very long coil of wire, called the secondary. Remember in the iron core transformer, there were two coils, physically separate? A Tesla coil could be called an *air core* transformer. Unlike in the iron core transformer, this secondary coil of the Tesla coil connects to ground, making it something of a capacitor, and it acts something like a radio receiver.

Something interesting happens, when the two coils are tuned correctly, the voltage can become much, much higher than that of transformer, and the arcs can jump through feet of air. You can tune a spark gap Tesla coil by changing the capacitor and the size and length of the coil.

This arcing has to do with resonance. Resonant objects have the same frequency and push on each other at just the right time, increasing the motion. Imagine a swing. If you push a child on a swing at just the right time, the child gets higher and higher with only a small push on each swing from you. The frequency of your pushing and the swing resonate. Similarly, in Tesla coils, the primary electromagnetic field pushes on the secondary's coil at the just the right time so that the electricity moves back and forth through it more and more, creating a higher and higher voltage.

While all Tesla coil arcs vibrate the air to create sound, you can make tones by turning the arc on and off at the frequency of the note. For middle C, for instance, you can turn the arc on and off about 262 times per second.



Think of it this way: the coil is creating a tone with another tone. It's like running your fingernail over the teeth of a comb. Each tooth of the comb makes a noise as your nail goes over it but the teeth act together to make another tone that depends on how many teeth per second your nail plucks.

The math behind the science

Making a Tesla coil more efficient requires fairly complex math. Take a peek at relevant equations and play with the parameters that affect a Tesla coil at **deepfriedneon.com/tesla_frame6.html**.

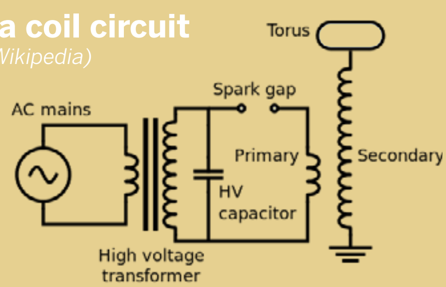
Just for the physics majors...

Have a firm understanding of advanced physics? You may appreciate this thorough overview: **teslacoildesign.com/docs/TheTeslaCoil-Gerekos.pdf**

About the invention of Tesla coils: **pbs.org/tesla/ins/lab_tescoil.html**

Tesla's high [voltage] hopes for a "World System" of power transmission in his book *My Inventions*: **lucidcafe.com/library/96jul/teslaautobio.html** or **tinyurl.com/NTbio**

A Tesla coil circuit
(source: Wikipedia)



Life Size Mousetrap
What You Need to Know

Teacher Overview

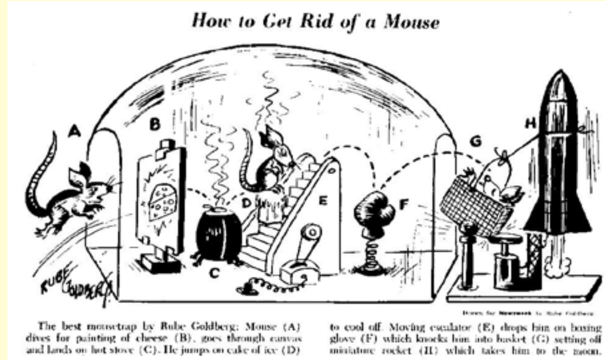
This performance art piece and wonder of grassroots, homegrown mechanical engineering takes the classic board game "Mouse Trap" to new heights. Scaled up so that the game's marble is now the size of a real-life bowling ball and full-grown humans wearing fuzzy ears act as the mice, it uses "the tools of wonder and excitement to plant the seeds of curiosity with a 25-ton Rube Goldberg machine!" The crew of five to 20 mice dance, sing, and keep the "marble" rolling through the contraption, until a grand finale.

See Life Size Mousetrap Maker Mark Perez in a two-minute CNN video: **tinyurl.com/LSMT-cnn** (originally **youtube.com/watch?v=Rdqrdw8qt3Y**)

Read more: **tinyurl.com/LSMT-smith** (originally **blogs.smithsonianmag.com/artscience/2012/10/teaching-physics-with-a-massive-game-of-mouse-trap**)

Simple machines—in song!

At its core, Life Size Mousetrap combines 16+ mechanical movements. All mechanisms can be boiled down to one or more simple machines: lever, wheel and axle, pulley, inclined plane, wedge, and screw. Read about these in greater detail in the next section, or turn to song! Esmerelda Strange explains some of the physics behind Mousetrap with How To Defy Gravity With 6 Simple Machines, a CD of physics-friendly tunes: "It's as if Mary Poppins puts on an accordion and goes to the county fair to teach kids about simple machines, basic physics and scientific inquiry."
See **tinyurl.com/LSMT-music**
(originally **cdbaby.com/cd/esmereldastrange2**)



Rube Goldberg machines

The original board game of Mouse Trap was designed by Marvin Glass who was, in turn, inspired by the entertainingly complex drawings of Rube Goldberg (1883–1970), a cartoonist, sculptor, author, engineer and inventor. He designed these whimsical chain reactions for ridiculousness and not for necessity or practicality. They are over-engineered to get a very simple task accomplished. With younger students, you can share David Wiesner's *Lights Out*, a nearly wordless picture book about a very complicated contraption built by a young mouse. Or browse Rube Goldberg's original cartoons at **rubegoldberg.com**. They are a delight!

Photo of Life Size Mousetrap, below, by Cory and Catska Ench (detail.)

Life Size Mousetrap
The Science Behind It

Life Size Mousetrap and its crew of performing mice have been touring science museums and schools across the country. Teachers find it to be a great introduction to some of our oldest physics knowledge: how simple machines, gears, counterweights, and gravity work together to create sometimes surprising motion.

For any machine, you can calculate the mechanical advantage by dividing the force you put into a machine by the force you get out of the machine. Arguably, with Life Sized Mousetrap and just about any Rube Goldberg device, the overall mechanical advantage is quite low, because there's a lot of energy put into one small task! But the steps along the way illustrate how a little bit of energy/work/ effort can translate into something grand.

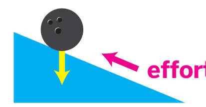
In Life Size Mousetrap, stored energy, mostly gravitational, is released over its many convoluted steps. Before the ball starts rolling, energy is stored in lifted objects or stretched springs. The ball releases this energy so that it can keep moving. Examples of translating between potential and kinetic energy in the Life Size Mousetrap include:

1. pulling a spring back and then releasing it will tug a cable that swings a hammer to hit a boot;
2. releasing a compressed coil spring will push a rod that nudges a bowling ball into motion.

A mechanical advantage reduces the force needed (that is, you don't have to push as hard) but you must apply that force for a greater distance. So the energy or work done ends up being the same (or more due to friction.) For example, it takes less force to go up a ramp than climb a ladder, but the length of the ramp is longer than the length of the ladder. We sometimes use mechanical advantage to increase the force we need, as with bicycle gears which make our wheels spin faster.

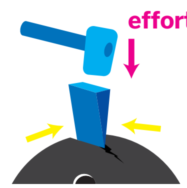
There are six special machines we call simple machines: the wedge, the inclined plane, the screw, the lever, the pulley, and the wheel and axle. To the average person, these may seem too basic to be called machines, but they form the basis for many other ideas in physics and engineering. For each mechanism, there's a trade-off in how much force you put into it and the distance it travels.

Simple Machine #1



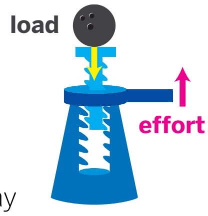
Inclined planes let you use less force to move an object. Ramps, sloping roads and hills, plows, chisels, hatchets, and wedges are all inclined planes. Blades are two inclined planes placed back to back, and they allow the two parts of the cut object to move apart using less force than would be needed to pull them apart in opposite directions. In the Life Size Mousetrap, look for the bowling ball rolling down the Crazy Stairs as an example of an inclined plane. Rather than falling quickly, the ball ambles down the steps.

Simple Machine #2



Wedges are inclined planes that can be moved around for a variety of uses: to separate two objects or one part of a thing from another, to lift a heavy object, or to hold an object in place. When you push on one end, the wedge sends the force out to its sloped edges. An axe is a classic wedge. Knives, scissors, chisels, and even teeth can sometimes be used as wedges, too. A short wedge with a wide angle might do the job faster, but it requires more force than a long wedge with a smaller angle. Nails, with their pointy edges, will sink into wood when hammered, but a bolt with its flat end cannot be pushed in. Wedges are sometimes considered to be inclined planes. Wedges can also be used to hold objects in place, as in a doorstop, where the friction between the bottom of the door and the ground keeps the door from slamming. Wedges are often used in the building of the Mousetrap to lift, position, and steady the contraption for operation.

Simple Machine #3

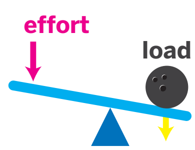


Screws convert rotational motion to linear motion, and rotational force (a "torque") to a linear force. That is, turning this way or that way can be translated into going forward or backward, or up or down. In Mousetrap, a Lifter carries the Ball from the bottom of the Stairs to the top of the Gutter: it uses a large screwy bolt near the center.

Simple Machine #4

Levers convert your downward motion into upward motion. Gravity makes it easier for things to go down than to go up. A lever uses its support and pivot point, or "fulcrum" for "leverage" to lift weight. Depending on where the force and the fulcrum are placed, a lever can multiply either force or distance.

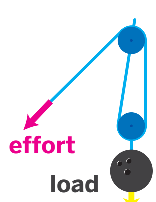
There are three kinds of levers. They differ in where the forces and the fulcrum are placed:



1. In seesaws and crowbars, the fulcrum is between the effort and the load/resistance.
2. In wheelbarrows and wrenches, the load/resistance is between the effort and the fulcrum.
3. In staplers and our forearms, the effort is between the resistance and the fulcrum.

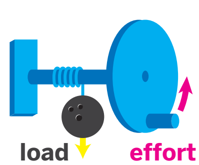
In Life Size Mousetrap, look for levers in the Hammer as well as the Seesaw that catches the bowling ball when it falls out of the Bathtub.

Simple Machine #5



Pulleys just reverse the direction of a force. When you connect two or more pulleys together, you can lift a heavy load with less force, trading a long movement at the end of a rope for a short motion of the load. In Life Size Mousetrap, the Crane has multiple pulleys to help lift the two-ton bank safe.

Simple Machine #6



The Wheel and Axle is a machine in which you trade a long motion at the edge of the wheel for a short, more powerful motion at the axle. Or you can do the reverse. In Mousetrap, the first piece that starts the Mousetrap, the Crank has three wheels and axles. (The interlocking teeth can also be thought of as a bevel gear, which translates rotation in one plane into a perpendicular plane.

Other mechanical elements

Look for mechanisms like gears, rack and pinion, cams, crank and rod, chain and belt, and ratchet in all machines you study.

A good reference for these is Henry T. Brown's 1868 book Five Hundred and Seven Mechanical Movements. It has been digitally recreated (with animations!) at **507movements.com**. We also recommend the automata artists of Cabaret Mechanical Theatre and their book Cabaret Mechanical Movement: **tinyurl.com/CbtMMbook** (originally **cabaret.co.uk/education/cabaret-mechanical-movement**).

The math behind Mousetrap

Consider engaging your students in an exercise about scale: taking the board game into the real world takes a lot of calculation! If the marble is the size of a bowling ball, how large are all the other components? Are the real bathtub and the bowling ball scaled at the same ratio in the game?

Alternatively, calculate the large budgets behind Life Size Mousetrap with your students: It's pricey to be an artist with a big dream: Driving a semi costs $3 a mile. The mice bought a crew bus, too, and that bus costs at least $1 a mile for travel. How much does it cost to travel from Mousetrap's home in San Francisco to San Mateo? To New York City?

The history behind Mousetrap

Introduce Leonardo da Vinci (1452–1519) and Sir Isaac Newton (1642-1727) who described many of the mechanisms and principles used in Life Size Mousetrap. Or examine the ancient discoveries of these energy-saving devices. Wedges, for example, were used as early as the Stone Age. Around 3000 BCE, Ancient Egyptians used wedges to extract blocks of rock for construction. Some Native American tribes used antlers to split and work wood for their canoes, houses, and other wood objects. Levers were first described in writing by Archimedes in 3rd century BCE, and probably known back to the earliest *Homo sapiens*.

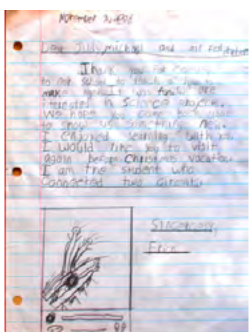
After Your Visit

Recap ... & Return!

Talk about what you saw and experienced. You can even do this on the bus or Caltrain ride home! If you introduced the field trip with a KWL discussion (see Before Your visit), return to that conversation to fill in the L column, "What I learned." What new insight into Maker Faire, making, & the Maker movement di your students gain?

After your visit to Maker Faire, please encourage your students to return on the weekend with their families. Maker Faire is bigger and better in every dimension! Distribute Maker Faire Tickets using the instructions you'll find in your teacher information pack.

Write to Makers



The makers presenting their projects to your students at Maker Faire take time out of their week to volunteer or even pay for the privilege of sharing their project. They do this because they love sharing the projects and passions with the next generation of Makers: your students. We know that they'd enjoy hearing from your students if they are moved to write. Above, you'll see a classic thank you note, which includes an illustration of a project made with a maker who visited a classroom in San Francisco in 2008.

Also, we find writing notes to be an authentic way to get your students to reflect on their experience, synthesize the impressions from their sketchbooks, and articulate what they will take away from their visit. Letters are worth their weight in gold, bringing warm feelings to the entire Maker Faire community.

Please consider sending a big class thank you to Intel, our generous sponsor.

Make Something!
(suggested starter projects)

We think making is the best way to welcome your students into the Maker movement before and/or after your visit to Maker Faire. We shared a list of suggested starter projects in our Before Your Visit section. The book *Blueprint: Maker Programs for Youth* **dmp.nysci.org/#news/51** includes an excellent list of dozens of sample projects.

After they've made something, it's also important to share what they've made more widely. We hope they saw this in action Maker Faire: dozens of Makers eager to share their work.

Do-It-Yourself Electrical Sparks

Play around with the phenomenon behind the electrical sparks of ArcAttack!

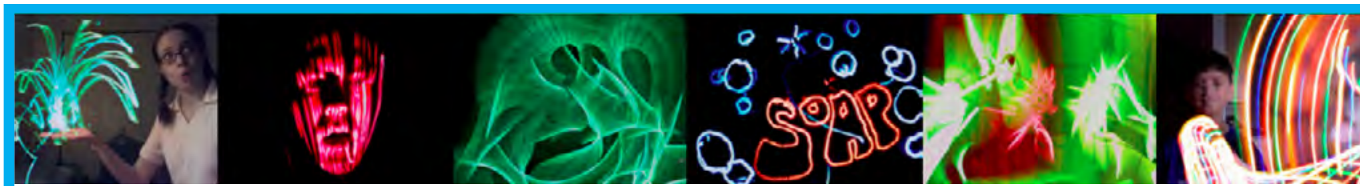
Create static electricity with this activity requiring only paper, some flat metal, a piece of wool cloth, and a stopwatch. **pbs.org/wgbh/nova/education/activities/2213_lightnin.html**

Try a bite of triboluminescence with Wint-O-Green Life Savers. While it has little to do with Tesla coils, like ArcAttack!, it's a sure crowd-pleaser! **straightdope.com/columns/read/119/why-do-wintergreen-life-savers-spark-when-crunched**

Do-It-Yourself Mousetrap

To build a whole unit around Rube Goldberg machines, take a look online, as it is a very common classroom project. One thorough lesson plan with a CC license: **tinyurl.com/RubeClass** (originally **thescienceguru.com/wp-content/uploads/2011/06/Rube-Goldberg-Project.pdf**)

A great video gallery has been put together by Larry Ferlazzo: **tinyurl.com/RubeVids**.



Light Up and Paint

The Light Up & Paint activity uses a simple LED light circuit and freely available software called Glow Doodle to let you paint with light.

Check it out

You can see example light paintings (and get your software) here: **tinyurl.com/LUPstuff** (originally **scripts.mit.edu/~eric_r/glowdoodle**)

See a video of the activity: **tinyurl.com/LUPvideo** (originally **youtube.com/watch?v=2hkf97HcEJw**)

Overview

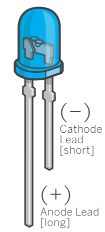
In this hands-on activity, students will be able to build their own simple circuit of an LED (light emitting diode) taped to a battery, with optional crafty embellishments. They will then take their homemade light brush into a darkened space and wave it front of a webcam-enabled computer running Glow Doodle to create a light painting.

What you need

The Light Up and Paint activity is easy to replicate at home or in the classroom. To build the LED circuit, you just need a few items:

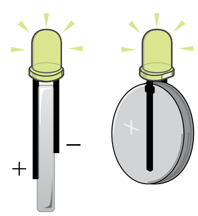
- LEDs (We used Amazon's **B0060FGA8A**)
- CR2032 Coin Lithium Batteries (We used Amazon's **B004AT066A**)
- Scotch Tape
- Craft supplies (tissue paper, feathers, pipe cleaners...aim for things that will diffuse/ pattern the light or allow the lights to be swung or moved in interesting ways)
- The software can be accessed via a web browser, or downloaded onto a computer. A computer and web camera

How to build a simple "glowie" circuit



Each LED has 2 legs or "leads" coming out of it. The longer LED lead, called the anode, should be touching the positive terminal (+) of the battery.

The shorter LED lead, called the cathode, should be touching the negative terminal (–) of the battery.



Nothing bad happens if you get it wrong, so you can figure it out through experimentation. (If you buy a grab bag from Jameco or another supplier, you may even find some bidirectional LEDs that glow amber in one direction and green in the other.)

Simply insert the battery between the leads & pinch them to the battery. The LED should light up. Tape the whole thing up, and you have a simple circuit.

How to capture your images

Glow Doodle automatically saves images to its website. Save images locally on your drive. Download the app, launch it, make your painting, then press the S key to save. Click to start your next painting. Images are saved in the same folder as the app.

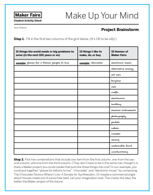
How this connects

Light Up & Paint introduces students to the basics of circuitry and also encourages creativity. It can be used as a stepping stone to further explorations of electronics and circuit building.

Maker Education Initiative
EVERY CHILD A MAKER

Thanks! This activity is sponsored by Intel as part of their commitment to the Maker Education Initiative: makered.org

Brainstorm Wacky Projects


Maker Faire
Make Up Your Mind
Project Brainstorm

We've put together a sheet you can use with your students to help them brainstorm a project they might create for Maker Faire. You can also do this activity as a class instead of individually. While we don't expect they'll do the exact project that results from this exercise, we want to encourage divergent thinking and interdisciplinary projects.

Make three columns in which you generate items with all the students or ask each student to add one item to each column (yielding about 25 ideas if you have 25 students.) In the first column, your students list "things the world needs" or "big problems to solve in the next 100 years or so." In the next column, they list things they "like to make, do, or buy." In the third column of Make Up Your Mind, we list 15 diverse themes of Maker Faire (but there are many more you can add to this list!)

Once you have three good lists, pick five combinations that include one item from the first column, one from the second column, and one from the third column. (They don't have to be in the same row, though!) Can your students create a Maker project you could create that puts the three things they picked into one crazy project?

In our example, you could put together "places for billions to live", "chocolate" and "electronic music" by composing The Chocolate Factory Where I Live: A Sonata for Synthesizers. Or maybe a commercial jingle about houses made out of cacao tree bark. Let your imagination soar. The crazier the idea, the better the maker project of the future!

Another way to brainstorm is to have a box full of interesting, diverse objects, like mechanical toys, tools, plastic figurines, and shapes. Ask your students to reach into the box and pull out the first two to five objects they put their hands on, and come up with some way to combine them physically or metaphorically.

As homework, your students can use the first object they encounter in each corner of their kitchen or living room, and bring in the objects that inspired a completely kooky contraption.

Share Projects and Ideas

MAKE magazine is a do-it-yourself technology magazine written by makers. Take a peek at **makezine.com** for lots of great project ideas.


Maker Faire
Do it Yourself
Get Your Project into MAKE

We'd love to hear your students' ideas for projects and articles for MAKE, especially any that would inspire other kids. If your students are advanced makers, or just really enthusiastic ones with a good story or project to share, share this activity sheet with them. We put it together for your students to think through all the things they would need to submit an idea to our magazine and blog.

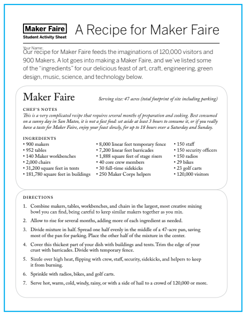
This exercise develops your students' Maker skills in explaining an idea or the process behind a project. Doing so well can make even the most mediocre project seem amazing, and doing it poorly will prevent anyone from understanding even the very best projects.

Start a Maker Club or Makerspace at Your School

Build on your students' interest and excitement for Maker Faire by starting a Maker Club or a Makerspace. You can meet after school or during lunch. We have lots of tips for getting started on **youngmakers.org** and **makerspace.com**. Take a look at two playbooks that can get you going: Maker Club Playbook (**youngmakers.org/playbook**) and Makerspace Playbook: School Edition (**makerspace.com/playbook**).

Maker Faire Planner Challenge

Using the numbers in A Recipe for Maker Faire, we've come up with some challenging scenarios you can use to prompt a classroom discussion.


Maker Faire Student Activity Sheet

A Recipe for Maker Faire

Your Name:

Our recipe for Maker Faire feeds the imaginations of 120,000 visitors and 900 Makers. A lot goes into making a Maker Faire, and we've listed some of the "ingredients" for our delicious feast of art, craft, engineering, green design, music, science, and technology below.

Maker Faire

Serving size: 47 acres (total footprint of site including parking)

CHEF'S NOTES

This is a very complicated recipe that requires several months of preparation and cooking. Best consumed on a sunny day in San Mateo, it is not a fast food: set aside at least 3 hours to consume it, or if you really have a taste for Maker Faire, enjoy your feast slowly, for up to 18 hours over a Saturday and Sunday.

INGREDIENTS

- 900 makers
- 952 tables
- 140 Maker workbenches
- 2,000 chairs
- 31,200 square feet in tents
- 181,780 square feet in buildings
- 8,000 linear feet temporary fence
- 7,200 linear feet barricades
- 1,888 square feet of stage risers
- 40 core crew members
- 30 full-time sidekicks
- 250 Maker Corps helpers
- 150 staff
- 150 security officers
- 150 radios
- 29 bikes
- 23 golf carts
- 120,000 visitors

DIRECTIONS

1. Combine makers, tables, workbenches, and chairs in the largest, most creative mixing bowl you can find, being careful to keep similar makers together as you mix.
2. Allow to rise for several months, adding more of each ingredient as needed.
3. Divide mixture in half. Spread one half evenly in the middle of a 47-acre pan, saving most of the pan for parking. Place the other half of the mixture in the center.
4. Cover this thickest part of your dish with buildings and tents. Trim the edge of your crust with barricades. Divide with temporary fence.
5. Sizzle over high heat, flipping with crew, staff, security, sidekicks, and helpers to keep it from burning.
6. Sprinkle with radios, bikes, and golf carts.
7. Serve hot, warm, cold, windy, rainy, or with a side of hail to a crowd of 120,000 or more.

Our list of ingredients does not include *everything* that goes into making the event, but it can help you estimate what we use and generate.

Scaling to your school

If you were create a Maker Faire for your school, how would you scale down our "recipe"? Some of the things you need will be 10 times as small, some will be 1000 times as small, or you might not need them at all!

It's just like when you change a muffin recipe from an industrial-sized bakery to one batch in your oven: you use a lot less sugar, but the muffin tins are about the same size.

Good fences make good Makers

At Maker Faire, we use a lot of "cyclone fencing" (also known as chain link fence) to guide traffic and separate exhibits.

1. Estimate how many linear feet of fence runs around your campus.
2. How many feet of fence would you need if you put a fence along all four walls of your classroom?
3. How large a school would need 8,000 feet of fencing, as Maker Faire?
4. Draw a picture of the largest room on your campus. How many 10x10 exhibits would fit into it? How many feet of fence would you need if you wanted to make a school Maker Faire, if you used fencing to separate the exhibits? Draw a picture (and remember not to put fence on all 4 sides of the exhibit areas!)

Environmental audit

We are committed to having as little impact on the environment as possible, but we know there's always room for improvement! Consider the data you could collect if you wanted to do a full environmental audit of the event.

1. Calculate how much trash and recycling the crew, staff, security, sidekicks, helpers, and visitors generate. Think about other impacts, like the cardboard boxes Makers use to ship their projects and all the paper we use for signs and maps. Can you imagine ways to reduce the total environmental impact of the event?
2. If everyone drove to Maker Faire, how many tons of carbon are generated? How much parking space would we need? How many tons of carbon are saved if everyone drove to Maker Faire with one other person? How about if everyone drove in a full car with at least four people? And what if nobody drove, but instead took public transit, walked, or biked?

Budget-o-rama

The budget for Maker Faire is HUGE. We're glad the visitors and sponsors support this event.

1. What would it cost to put on a Maker Faire with your estimate? You can guess what different things would cost, or look for prices online or by calling different vendors for your budget.
2. A beloved but expensive and non-renewable resource we use at Maker Faire is the propane. It creates the flame effects in the fire art by the Flaming Lotus Girls (FLG), The Crucible, and other artists and collaboratives. It's the same propane you might use in a backyard barbecue. But you need a lot of it for a fire sculpture. Running full blast, FLG's Serpent Mother uses about 70 gallons of propane an hour. Propane costs about $3.50 per gallon. How much would it cost to run Serpent Mother all 18 hours of Maker Faire? If you budget half as much for a sculpture, how could youreduce the cost but still give visitors a great experience?

More from

Maker Media

If you like Maker Faire, we have lots more to offer you! Through media, events and ecommerce, Maker Media serves a growing community of makers who bring a DIY mindset to technology. Whether as hobbyists or professionals, makers are creative, resourceful and curious, developing projects that demonstrate how they can interact with the world around them.

Start a Maker Club.

You'll be surprised how easy it to find makers in your school. They're everywhere! See youngmakers.org

Go to Maker Faire.

Events happen year-round and worldwide! Go to a local Mini Maker Faire, or host your own someday! makerfaire.com

Be a Part of Maker Camp.

Spend your summer with 6 weeks jam-packed with cool projects and epic field trips. It's online and free! makercamp.com

Explore Maker Shed.

The coolest, nerdiest book-store, arts & craft shop, electronics store, and more — all in one. We've got kits, sets, tools and supplies.

Read MAKE.

Each issue has dozens of projects like the ones you'll see at Maker Faire.

Stay connected.

We post lots of new maker content everyday at makezine.com.

Materials

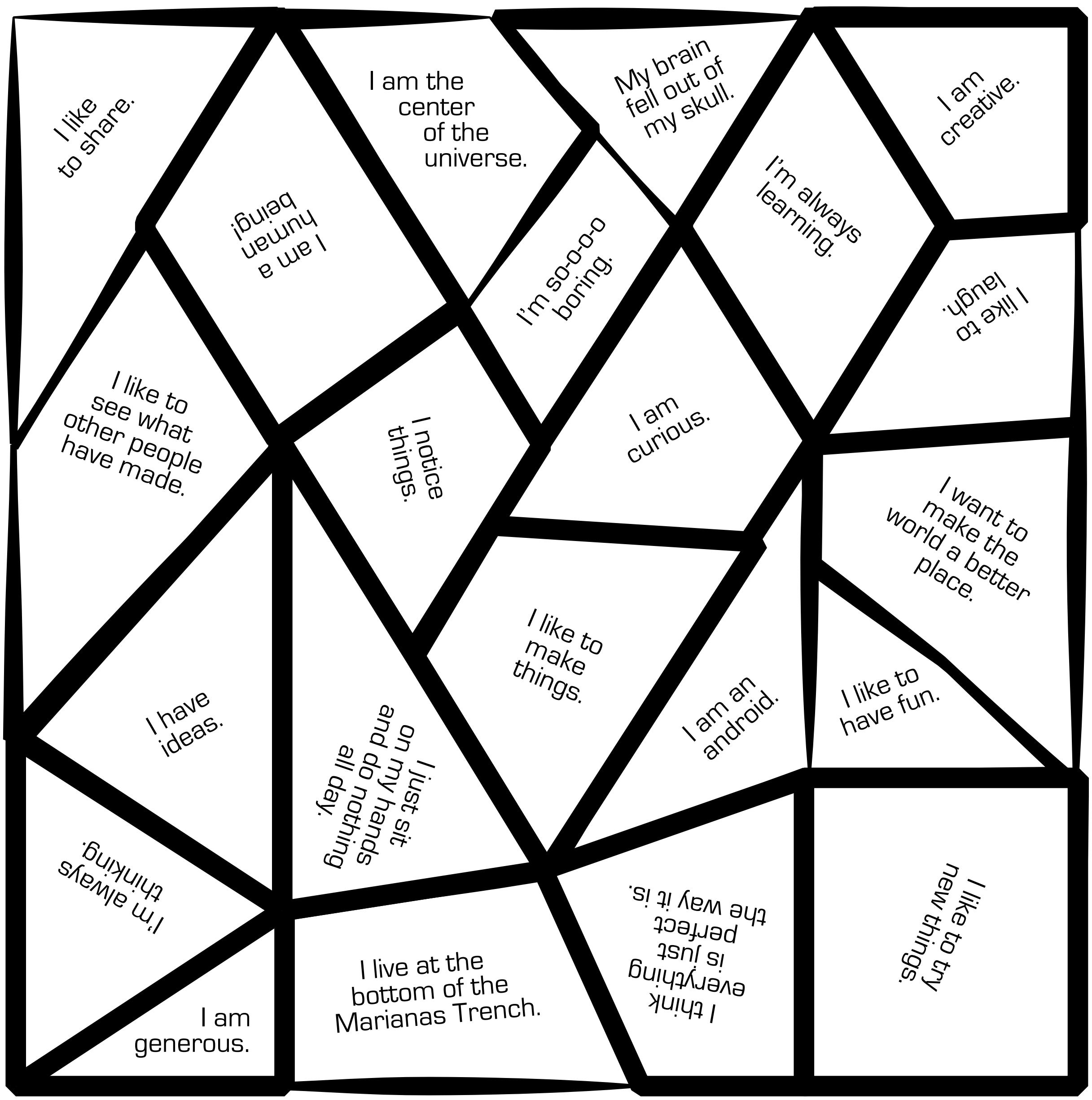
- Am I a Maker?
- Maker Faire Bingo
- Meet a Maker: Project Notebook
- Conversation Starters
- ArcAttack! observe-and-sketch
- Life Size Mousetrap seek-and-find
- Make Up Your Mind: Project Brainstorm
- Did it Yourself? Get Your Project into MAKE
- A Recipe for a Maker Faire

- Make Your Own Sketchbook elements
  (note: we recommend printing directly, not photocopying)
    - cover (print on thicker paper, back-to-back with endpaper; note orientation)
    - endpaper (print back-to-back with cover; note orientation)
    - inside pages (print double-sided with itself; note orientation)
    - stickers (print on uncut label paper, or glue/tape brightly colored or plain paper)

Maker Faire
Student Activity Sheet

Am I a Maker?

Using two pens, markers, or crayons (one **color** and the other **black**):
color in the spaces that are **true**,
and **black** out the ones that are **false**.



(If your colored spaces make an **M** then you are probably a maker!)

Maker Faire®

Student Activity Sheet

Your Name:

M	A	K	E	R
I saw something that plugs in.	I added my small part to a big [collaborative] art project.	I saw something inspiring.	I heard someone talking on a radio (walkie-talkie.)	I noticed something I have at home reused in a new way.
I enjoyed a performance.	I saw something that makes a sound.	I want to go make something!	I saw something BIG.	I watched a demo.
I saw something that could have existed before the year 1900.	I saw something I wish I could show my family.	I want to come back tomorrow!	I saw something I think I could make myself.	I saw something that humans might still use in the year 2999.
I saw something solar-powered.	I saw something bright.	I'd like to show my own projects at a Maker Faire someday.	I saw something ROBOTIC.	I saw something human-powered.
I saw something recycled / reused.	I had a new idea.	I saw people setting up Maker Faire.	I made something I can take home.	I saw something combining art and science.

B I N G O

Maker Faire®
Student Activity Sheet

Meet a Maker

Your Name:

Project Notebook

Pick a Maker project that you really like. Study it. Talk to the Maker about it (if the Maker isn't too busy), and then make notes on this page of your notebook so that you might be able to make something like it yourself someday. Don't forget to draw a diagram on the other side of this sheet!

Maker name(s)	
Project name	
What does it do?	
How does it work?	
How was it made?	
What materials are needed?	

Draw a diagram on the back side of this sheet. →

Maker Faire

Student Activity Sheet

Conversation Starters

What's the first project you can remember making as a kid?	Did you have a mentor that helped get you into making?	How long have you been working on this project?
How do you get started on a project?	What inspired you to start working on this?	Where do you get your ideas?
Do you hope to inspire other makers with your project?	Are you trying to address a real-world problem?	What's your favorite tool?
Will you make a business out of this or is it just for fun?	Have you collaborated with others on this?	What other maker projects inspire you?
What does your workspace look like: at work? at home?	Where do you hope this takes you? What do you plan to do in the future?	Have you ever taught someone else how to make something?

Maker Faire
Student Activity Sheet

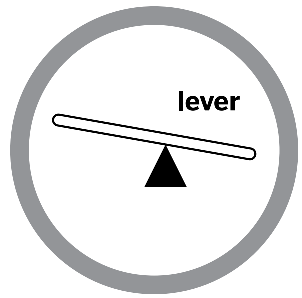
Life Size Mousetrap

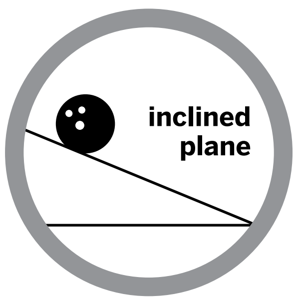
Your Name:

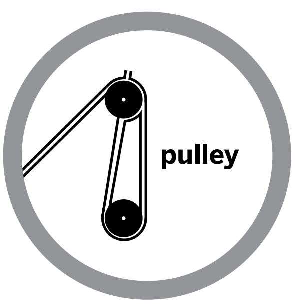
seek-and-find

What's happening in this crazy contraption? See if you can you find these elements from Mousetrap, including the 6 simple machines. What order do they come in? What happens with each thing? Put on your observation goggles and watch for the flying, rolling, hopping, and swinging ball!

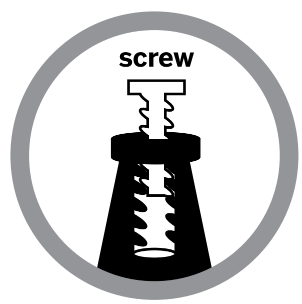


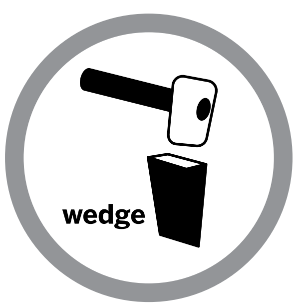



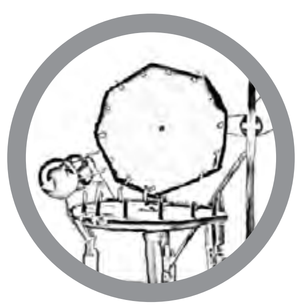
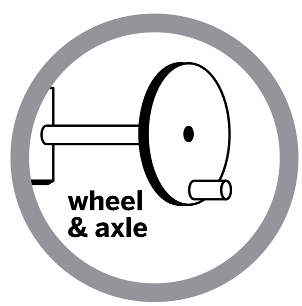







Maker Faire
Student Activity Sheet

Make Up Your Mind

Your Name:

Project Brainstorm

Step 1. Fill in the first two columns of the grid below. (It's OK to be silly!)

15 things the world needs or big problems to solve (in the next 100 years or so)	15 things I like to make, do, or buy	15 themes of Maker Faire
example: places for a billion people to live		alternative energy
		art cars
		bicycles
		cars
		crafts
		electronics
		electronic music
		knitting
		musical instruments
		photography
	example: chocolate	pinball
		robots
		rockets
		sewing
		sustainable food
		woodworking

Step 2. Pick five combinations that include one item from the first column, one from the second column, and one from the third column. (They don't have to be in the same row, though!) Is there a Maker project you could create that puts the three things into one?

In our example, you could put together "places for billions to live", "chocolate" and "electronic music" by composing The Chocolate Factory Where I Live: A Sonata for Synthesizers. Or maybe a commercial jingle about houses made out of cacao tree bark. Let your imagination soar. The crazier the idea, the better the Maker project of the future!

Maker Faire®
Student Activity Sheet

Did it Yourself?

Your Name:

Get Your Project into MAKE

MAKE is a do-it-yourself technology magazine written by makers just like you. MAKE Magazine brings the do-it-yourself mindset to all the technology in your life. MAKE is loaded with exciting projects that help you make the most of your technology at home and away from home. We celebrate your right to tweak, hack, and bend any technology to your own will.

Take a peek at **makezine.com** for lots of great project ideas, features, reviews, and more.

We'd love to hear your ideas for projects and articles for MAKE. If you want to write for us, you have to tell the story behind your project. Have you made something cool? Or have you come up with a cool hack or tweak for something? Do you want to show other people how to make it? We want to hear about things you've made that will inspire other people. (Don't tell us about things you are just thinking about making. Make it first and then tell us!)

Your Bio (a one-sentence description of who you are)

Title (a one-sentence description of your idea)

Have you built this project? yes / no

Have you taken good quality digital photos of each step? yes / no

Do you have video of a working prototype? yes / no

Description. Now, describe your project in a paragraph or two. For your project's introduction, explain the story behind it, where your initial inspiration came from and how it developed. Write about your project as if you're telling a friend how you did something. Write for a smart person who doesn't necessarily know what you know. Imagine the questions they'd ask about your project. Tell them everything they need to know to recreate what you made. Describe difficulties you encountered, and suggest workarounds. Draw pictures or take photos of each step along the way.

What's next? Use the back side of your worksheet to draft your proposal. When you're done, you can fill out our form online at **blog.makezine.com/contribute**, and we'll let you know if we can publish your project. By the way, the best way to submit a project to MAKE is to document it on Make: Projects at **makeprojects.com**!

Maker Faire
Student Activity Sheet

A Recipe for Maker Faire

Our recipe for Maker Faire feeds the imaginations of 120,000 visitors and 900 Makers. A lot goes into making a Maker Faire, and we've listed some of the "ingredients" for our delicious feast of art, craft, engineering, green design, music, science, and technology below.

Maker Faire

Serving size: 47 acres (total footprint of site including parking)

CHEF'S NOTES

This is a very complicated recipe that requires several months of preparation and cooking. Best consumed on a sunny day in San Mateo, it is not a fast food: set aside at least 3 hours to consume it, or if you really have a taste for Maker Faire, enjoy your feast slowly, for up to 18 hours over a Saturday and Sunday.

INGREDIENTS

- 900 makers
- 952 tables
- 140 Maker workbenches
- 2,000 chairs
- 31,200 square feet in tents
- 181,780 square feet in buildings
- 8,000 linear feet temporary fence
- 7,200 linear feet barricades
- 1,888 square feet of stage risers
- 40 core crew members
- 30 full-time sidekicks
- 250 Maker Corps helpers
- 150 staff
- 150 security officers
- 150 radios
- 29 bikes
- 23 golf carts
- 120,000 visitors

DIRECTIONS

1. Combine makers, tables, workbenches, and chairs in the largest, most creative mixing bowl you can find, being careful to keep similar makers together as you mix.
2. Allow to rise for several months, adding more of each ingredient as needed.
3. Divide mixture in half. Spread one half evenly in the middle of a 47-acre pan, saving most of the pan for parking. Place the other half of the mixture in the center.
4. Cover this thickest part of your dish with buildings and tents. Trim the edge of your crust with barricades. Divide with temporary fence.
5. Sizzle over high heat, flipping with crew, staff, security, sidekicks, and helpers to keep it from burning.
6. Sprinkle with radios, bikes, and golf carts.
7. Serve hot, warm, cold, windy, rainy, or with a side of hail to a crowd of 120,000 or more.

MAKER'S
NOTEBOOK

CENTIMETERS

Maker Mnemonics

MATHEMATICS

May I have a large container of orange juice now?
to recall: digits of pi to 10 places (count the letters in each word): 3.141592653

SCIENCE

Kids prefer cheese over fried green spinach.
to recall: taxonomy in biology: Kingdom, Phylum, Class, Order, Family, Genus, Species

Anyone can make pretty high heeled shoes
to recall: us on the tree of life: Animalia, Chordata, Mammalia, Primate, Hominidae, Homo, Sapien

My Very Educated Mother Just Served Us Nachos
to recall: the planets in order: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

TECHNOLOGY

Roy G. Biv
to recall: the visible electromagnetic spectrum: Red, Orange, Yellow, Green, Blue, Indigo, Violet

Black beetles running on your garden bring very good weather
to recall: resistor color values: Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Gold, White

Twinkle Twinkle Little Star Power equals I squared R
to recall:
Power (watts) = Current (volts)^2/Resistance (ohms)

This notebook belongs to:

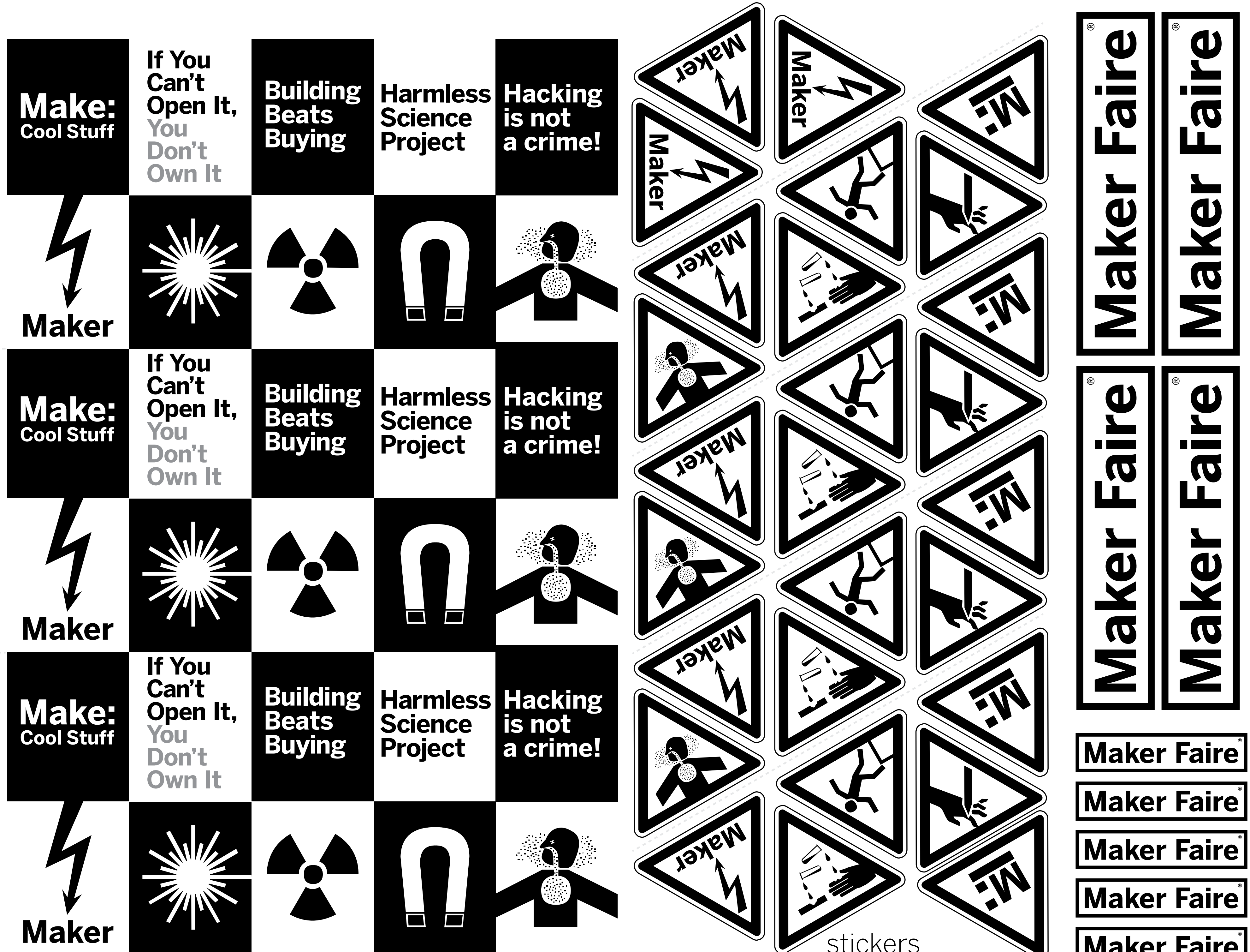
I started using it on this day:

What is in this book:

INCHES

IDEA/PROJECT

IDEA/PROJECT



stickers
to decorate sketchbooks