TOY TAKE APART

Discover what makes your toys move, make noise, and light up by taking them apart! Use tools such as screwdrivers, scissors, and saws to explore the inner circuitry and mechanisms. Take apart more than one toy to hack them together to make something new!

Collect These Things:

- Plastic gloves
- Safety glasses
- Old or broken mechanical toys (mechanical plush animals, dancing Santas, remote-control cars, and more)
- Scissors or X-acto knife
- Small saw (such as a utility saw)
- Two colored markers
- A roll of paper to cover your workspace
- Screwdrivers in various sizes
- Wire stripper

[NOTE: Thrift stores are a great resource for finding interesting toys to take apart; give them a good clean when you get home.]

[NOTE: Safety is important! Safety glasses will protect your eyes from bits that may fly off unexpectedly as you dissect your toy. Many toys are greasy inside and gloves will help keep your hands clean.]

the tinkering studio

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Some Other Helpful Materials:

- Alligator clips or extra wire
- Hand wipes (for you and de-greasing parts)
- Extra batteries
- Cafeteria tray (great as a work surface and to stop small parts from rolling away)

GETTING STARTED

- Get to know your toy! Is it in working condition? Add new batteries and see if you can make it work. Notice what it does (or take a guess at what it might do if the toy is broken). For plush toys, try squeezing them to feel for hidden switches and mechanical innards.

- Choose one of the colored markers and make a list of the parts that you can see, feel, or hear. Make a drawing of what you imagine is inside the toy you are about to dissect.

- When you’ve recorded everything you notice about your toy, start dissecting!

  For mechanical plush toys, find a seam or start from the activation switch, and cut through the outer layer of fabric (or fur).
  Removing screws is often a good place to start with toys made from plastic. You may need to use a saw to get through fused plastic seams.

- As you dissect, work carefully so as not to cut any wires hidden just below the surface of the toy. Trace the wires to discover what elements they control.

- Switch your pen color, and record the actual parts, and mechanisms that you are finding inside your toy. You will end up with a drawing that shows your initial predictions (in one color) as well as what you actually discovered (in another color).

- Try to keep the toy working as long as possible, and don’t be afraid to take it down to its smallest pieces. If you are very careful, you might be able to fix a broken toy by reconnecting a motor, gluing a critical part, or soldering a wire.
TAKE IT FURTHER

• Make a “Franken-toy”: incorporate elements from several taken-apart toys into one. Combine the skin from one toy with the movement from a second and the noisemaker from a third to create a new crazy contraption!

• Break out the soldering iron: try de-soldering elements to reattach them on to other toys. Explore the connections to the circuit boards and try to hack in new parts. De-soldering is also a great way to free elements to use in other projects.

• Turn it inside out: reverse the “skin” of a plush toy, re-stuff, then re-sew to give a familiar toy a whole new look. You can also try sewing together the skins of several plush toys.

EDUCATOR ADDENDUM

A note on our philosophy:
The Tinkering Studio is based on a constructivist theory of learning, which asserts that knowledge is not simply transmitted from teacher to learner but actively constructed by the mind of the learner. Constructionism suggests that learners are more likely to make new ideas while actively engaged in making an external artifact. The Tinkering Studio supports the construction of knowledge within the context of building personally meaningful artifacts. We design opportunities for people to “think with their hands” in order to construct meaning and understanding.

Agency by Design has developed a series of Thinking Routines. These are routines that help structure discussions and activities toward the goals educators have for their students. The thinking routine that we incorporated into the Toy Take Apart activity is called Parts, Purposes, and Complexities. It goes something like this;

1) students working in pairs record as a list or drawing, all of the noticeable parts of the toy (by looking, hearing, touching, and feeling).
2) Students then discuss the purposes of the parts, and make a drawing of what they expect to see when they dissect their toy.
3) Students dissect the toy, revealing the actual construction and complexities of the toy. Each team should make a drawing of the actual mechanisms with a different colored marker.
4) Students and teachers have a discussion about student discoveries and questions.

This activity was designed in collaboration with educators and researchers at Agency By Design, a research initiative at Harvard’s Project Zero in Cambridge Massachusetts. http://www.agencybydesign.org

We had been hosting the toy take apart activity for many years before we became aware of this thinking tool, and now that we have integrated it into the activity we are finding all learners are more engaged in their project, asking deeper questions, making more careful observations, and communicating with their partners about a wider range of ideas.
Activity Design
(decisions and designs that support a tinkering experience)

Tinkering Studio activities and investigations are designed to encourage learners to complexify their thinking over time. The variety of materials and variables available for experimentation allows learners to enter at a point where they are comfortable starting, and then alter and refine their designs as they develop new ideas. Tinkering activities are often fun, whimsical, inspired, and surprising.

Taking things apart and demystifying the inner workings of objects we interact with on a daily basis is a profound way of getting to know how the world works. Dissecting toys is a playful platform to explore the mechanical and electrical “guts” of the items while gaining practice using many different tools. Here are a few principles that exemplify the design goals of this activity:

- Materials and phenomena are evocative and invite inquiry.
  This activity is an invitation to “peek behind the curtain” and see what makes familiar things work. It gives permission ask questions about what’s going on and answer them through direct observation.

- Activities and investigations build on learners’ prior interests and knowledge. Taking toys apart is a new lens on a familiar pastime—playing with toys in a whole new way!

- Activities and investigations encourage learners to complexify their thinking over time. The activity becomes not just about taking items apart, but investigating ways you can recreate the parts into something new and unique. Elements can be repurposed and tinkered with in many different contexts.

Environment
(the elements of the space that support tinkering)

*In the Tinkering Studio there are many things that we keep in mind when setting up an environment for a successful tinkering activity.*

Since learners often work with us for an extended period of time, we try to create a warm and welcoming workspace with comfortable seating, sturdy worktables, and good lighting. We often display exhibits or examples from past projects and current activities throughout the space to seed ideas and provide an introduction to what is happening that day. Materials are easily accessible and in close proximity to the tinkerers. We often work at large, communal activity stations to enable cross-talk and invite collaboration between participants, allowing them to look to each other for answers and solutions.

In the Tinkering Studio we often prepare the toy take-apart activity for a group by arranging cafeteria trays with safety glasses, gloves, and x-acto knives for each participant or pair. The trays are arranged at a large worktable where participants can see what others are dissecting; it’s an opportunity for learners to see commonalities that appear in many seemingly different toys.

Taking toys apart generates a large amount of stuff. It can be helpful to have bins on a side table to sort out skins, stuffing, and mechanical “guts.” As the activity progresses, these bins become the raw materials for making new creations.

It may also be helpful to set up separate areas for sawing (with a vice or clamp to hold pieces safely), soldering, sewing, and hot gluing as participants remake their toys.
Facilitation
(the things we say and do to support learning through tinkering)

Facilitation is a way of teaching where you support the learner’s own investigations, questions, and ideas within the framework of an activity. In the Tinkering Studio, we strive to practice a kind of facilitation that respects the individual path of the learner. As facilitators, we watch and wait until the precise moment to jump in and offer a hint, a material, or a new way of looking at a problem. As educators, we allow learners to feel frustration and encounter moments of failure as they work with real materials to try to solve their own challenges.

There are many ways that the facilitator can influence the interactions with participants in an activity. We help people get started with the activity by giving a quick sense of the goals. We invite them into the space and introduce the materials and tools they might use. We spark interest and sustain learner’s engagement by asking questions about their work and responding to their answers. We support multiple outcomes of the activity and are open to the possibility of new ideas, different solutions, and changing goals of the individual learners. We try to practice a style of facilitation where we are not teachers who transmit knowledge to passive learners, but rather are guides and co-learners on a path to understanding.

When facilitating toy take apart, it can be helpful to start by encouraging the learners to make careful observations about the outside of the toy. Ask them to notice where switches may be hidden inside, take guesses about what mechanisms may be in there, and observe the ways the toy is held together. When it’s time to cut into the toy, remind them to take their time and work slowly and carefully to keep the toy functioning as long as possible. Often a toy that seems broken can be fixed by repairing a broken switch or re-soldering a detached wire.

Some of the trickiest moments for learners are often when there doesn’t seem to be a way to take the toy apart further. This is an opportunity for you as a facilitator to help encourage observations of hidden screws or seams or provide an opportunity to use a new tool like a saw and vice. As the toy becomes more disassembled, you can introduce tools such as battery packs and alligator clips so learners can investigate activating the individual motors and lights they find inside the toy. Learners can also complexify the activity by using elements from several different taken-apart toys to hack them together into one “Franken-toy.” This allows the activity to broaden to include sewing, re-stuffing, soldering, and other skills.
RELATED TINKERING ACTIVITIES

Circuit Boards: Tinker with electricity using common objects: batteries, lights, buzzers, motors, switches, and more. This activity provides an introduction to exploring circuits before investigating more complicated circuits in the taken-apart toys.
http://tinkering.exploratorium.edu/circuit-boards

Squishy Circuits: Use homemade conductive and resistant Play-Doh to build electronic sculptures that light up, move, and make sounds. Like toy take apart, building circuits with Play-Doh provides a new take on playing with a familiar toy.
http://tinkering.exploratorium.edu/squishy-circuits

ARTIST CONNECTIONS

(inspiring connections to the Toy Take Apart activity)

Asia Ward is a Program Specialist and Artist in Residence for the Learning Technologies Center at the Science Museum of Minnesota, where she prototypes and develops hands-on activities for all ages, which are then tested in the classroom and on the exhibit floor. Her artwork ranges from animatronic creatures made from taken-apart toys to large-scale metal sculptures.
www.asiaward.com

Emiko Oye and Shana Astrachan are professional jewelry artists working with alternative/repurposed materials who encourage others to experience the beauty of making and reuse. Accessorize with Toys workshops have served countless enthusiastic makers-to-be since 2006 at venues such as Maker Faire, Renegade Craft Fair, and the California Academy of Sciences NightLife.
www.facebook.com/AccessorizeWithToys
www.rewarestyle.com/home.html
www.shanaastrachan.com/home.html

Jeremy Mayer disassembles typewriters of all vintages then reassembles the components into mostly life-scale human and animal forms. No wiring, soldering, gluing, or welding is done to put these assemblages together; all construction of his work is painstakingly done only with parts that come from typewriters.
www.jeremymayer.com