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Playfully Inventing & Exploring
with Digital & Other Stuff



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Chain Reactions

A cat scratches a piece of string. The string pulls down a lever. The lever releases a ball. The ball rolls down a track and turns on a radio...

In this class, we read a story (in which one thing leads to another, to another, to another) and then we built chain reactions. The chain reactions don't have to be just machines - they can tell a story, too.

Goals of the Workshop

- Get inspired to make a large construction out of many parts that all work together for a shared goal.
- Experiment with materials and motion to find ways to trigger a sensor
- Plan and revise your design to be part of the larger construction.

Materials



- Crickets, motors, and cables.
- Sensors - light sensors, touch sensors, and resistance sensors are especially useful
- Copper foil
- Marbles - glass and metal
- Building supplies: cardboard, 1" pink insulation foam, tagboard, wood scraps
- Stuff to attach with: cable ties, pipe cleaners, hot glue, glue sticks, masking and duct tape
- Stuff that can hold or move a marble: tubes, cups, spoons
- Stuff to decorate with: glittery paper, tinsel, and mylar, construction paper, "doo-dads" (little plastic toys & beads), yarn
- A selection of LEGO pieces: gears, axles, axle connectors, beams, [small grey pieces]. See the EZ modules pages for ideas on LEGO supplies.

Set Up



We offered this 2-hour chain reaction workshop for a small group of adults. We've also held workshops like this one for kids both as a short, 3-hour workshop and a longer, five-day class.

For our chain reaction workshop, we used laptops so we could have computers and building space together on a table large enough for pairs to work together.

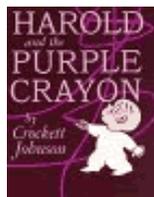


For a chain reaction workshop, it also works to have the computers nearby and large tables (or floor space) for building.



We set materials out on tables, grouped (roughly) by category: building materials, craft supplies, Cricket materials, LEGO pieces.

Introduction



I started the workshop by reading *Harold and the Purple Crayon*. *Harold and the Purple Crayon* is a chain reaction that tells a story. Harold doesn't know what's going to happen next, but each event responds to the thing before it, and has an effect on the adventure after it.



To get groups thinking about motion, we made a people-powered chain reaction. We have participants devise ball-moving tools on the fly out of craft materials and pass a ball around the table without using their hands.

While the participants were still standing in a line, we paired them up, and made the order of that line the sequence of the chain reaction.



When we have more time we sometimes ask the group to make a chain reaction drawing that went all around the table.

Each person drew an imaginary contraption that was part of the chain reaction: your drawing has to continue what came before it, and go on to the drawing after it.



Here's the contraption that one of the 9-12-year-old participants imagined.



We asked participants to work in pairs. We determined the order of the chain reaction before anyone started building.



Most groups start by experimenting with the motors and sensors...



And with materials.



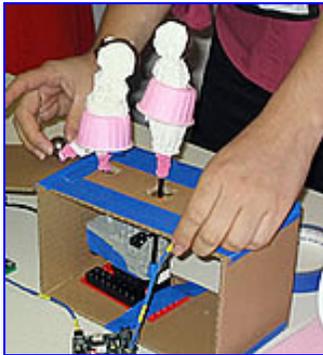
As part of week-long workshop, we sometimes have the kids make mini-marble mazes as a one-day, warm-up activity. They get to test out the sensors and motors and do a little programming before starting work on the big chain reaction.

[Learn more about making Marble Machines.](#)

Working & Playing



Recycled cardboard tubes are one way to move a marble through a contraption...



But having other types of materials available can encourage other types of solutions & creations.

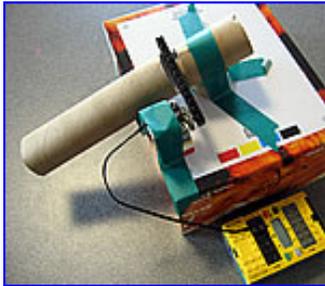
This contraption featured two ballerinas on top made from styrofoam balls and little paper cups. When the dancers twirled, they moved a ball.



This chain reaction started when the doll boot kicked the can.



As participants worked, we asked them to keep thinking about how to add motors and sensors to the constructions.



This contraption used a motor to lift a gate and release a marble down the tube.



We reminded participants to talk to the people in the groups before and after their to figure out how the contraptions can connect.



At least 20 to 30 minutes before the end of the time, we moved the contraptions into place in the chain reaction. Then they made adjustments to make sure their creation fits in with each of its neighbors.



About 15 minutes before the end of the time, we held a practice run. This gave the group a chance to try the chain reaction, then make some quick last-minute adjustments before the official Final Run.

Other Thoughts & Reflections

Chain Reactions don't always work. (Maybe that's why you always end up telling stories: "The ball starts here when the squirrel spins and it rolls down the hill, where it was supposed to knock over the barrel....")

The materials you provide help shape the workshop. It is usually much easier and faster to fashion structures out of craft supplies and use LEGO pieces as little as possible. Tubes are handy, but you can build really interesting chain reactions without using any tubes if you provide other kinds of building materials.

Chain reactions take time. We led a 90-minute chain reaction workshop for adults and had barely enough time.

The week-long workshops give you more time, and students can keep adding to and improving their contraptions.

It seems like it is hard for people to imagine how to build something that will move. I wish we had had some built examples on hand of the EZ Modules. They require a minimum number of LEGO pieces and can be adapted easily.

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