getting hands-on with

soft circuits

a workshop facilitator's guide

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TABLE OF CONTENTS

The activities in this guide assume no prior knowledge of circuits, sewing, or design – so there are no prerequisite requirements aside from an interest in trying something new!

OVERVIEW

What Are Soft Circuits?

Soft circuits, also known as electronic textiles (e-textiles), are electrical circuits created using flexible conductive materials (such as conductive threads and fabrics) in conjunction with discrete electronics components (such as lights, batteries, switches, and sensors).

Why Soft Circuits?

Learning to design and create soft circuits of increasing complexity has the potential to be an empowering and formative experience for young adults. Such activities invite students to consider technology in a more creative context - and, likewise, to consider creativity in a more technical context.

By integrating electronic and craft materials, soft circuit activities can appeal to a wider variety of students than traditional science or art activities. Furthermore, students should develop a sense of confidence when working with science and technology, as they will be supported throughout the process of successfully debugging unexpected behavior in their projects.

As outlined in the following workshop activities, students will learn about electricity in the context of hands-on design. Because students are making creative decisions about appearance and functionality, their projects will reflect characteristics of personal identity. They may find the activities to be a welcome outlet for self-expression. Whether students are motivated by the technical or creative aspects of each activity, they will learn by *doing*, instead of just by listening, reading, or watching others.

Notes on Facilitation

As a facilitator, your role will be to guide students through the activities. This will include providing students with the technical understanding necessary to complete each project, while also promoting the development of creative problem-solving and design skills. If something isn't functioning as expected, refer to the *Troubleshooting* section of the guide for some helpful tips. But be sure to challenge students to question, reason about, and revise their mental models as well. In these activities, the process of discovery is just as important as the outcome.

You should also encourage students to help one another. Those who already know how to sew can assist peers who lack sewing experience; likewise, students with knowledge of electronics can aid those who lack this familiarity.

You may find it useful to begin the first session with brief introductions and an icebreaker exercise. This will allow students to begin to build social relationships, which they will draw on as they experiment with (and troubleshoot) their soft circuits.

Consider starting each session by connecting back to the previous session. For example, summarize what students learned (and created) last time, or ask a rotating student volunteer to do so. After you've done this, introduce students to what they'll be learning in the current session by framing it in the context of the session's tangible project. If you have time to try the activities ahead of time, bring your example(s) to share with students. Students may also find it helpful to walk through each activity's materials list as a group, visually identifying each component and reviewing its function or purpose.

Conclude each activity by asking students to take turns presenting their work to one another. Encourage them to share thoughts or the motivation behind the aesthetic design of their project, in addition to an explanation of how their circuit functions. This is a great time for students to share any difficulties that they encountered and how they managed to overcome them.

Additionally, invite students to take what they've learned in each session and relate it back to their daily lives. For example, at the end of the activity on switches, encourage students to think carefully throughout the coming week about which objects in their bedrooms or school classrooms would conduct electricity.

Structure

This guide has been developed for use in informal learning environments, such as after school programs, community technology centers, and art/science museums. With the exception of the final activity, each activity takes about two hours. A full morning or afternoon (4-5 hours) should be dedicated to the final activity. Ideally, the activities should be offered in close succession - for example, one session each week over the course of five weeks.

If necessary or desired, the activities may be compressed into a one or two-day weekend workshop. Alternatively, intermediate activities may be skipped if you wish to pursue a simplified version of the final activity.

If a student's circuit isn't working - or is functional, but not behaving as expected - see the *Troubleshooting* section at the end of this guide.

Additional information on the materials and tools listed for each activity may be found in the *Tools & Materials* section, also at the end of this guide. Pencils and paper should be available during each session, and you may choose to also offer conductive household items (paper clips, staples, safety pins, aluminum foil) from the second activity on.

The *Further Resources* section also includes suggestions for print literature and web sites related to these activities.

Intended Audience

Although the activities in this guide may be adapted for other age groups, they were designed with middle and high school students (ages 11-17) in mind. Each activity builds on those preceding it; ideally, participants should be able to commit to attending all workshop sessions.

activity #1
A SIMPLE CIRCUIT
connecting a light and a battery

alternatively, students can sew a simple circuit into something brought from home – such as a shirt, bag, hat, or hair tie (seen here)

Tools & Materials

For each student:
- battery
- battery holder
- piece of felt
- LED (light)

For the group to share:
- needle threaders or beeswax
- conductive thread
- fabric scissors
- hot glue gun and glue sticks
- needle nose pliers
- sewing chalk
- sewing needles

Summary

Students are introduced to circuits and sewing with electrically conductive thread. Each student will create his/her first soft circuit, connecting a light and battery.

Learning Goals

Students will...

- understand that power flows from the positive terminal of the battery, through components of a circuit (such as lights), and back to the negative terminal of the battery.
- recognize *positive (+)* and the color red as representative of *power*.
- recognize *negative (-)* and the color black as representative of *ground*.
- understand that LEDs have electrical *polarity*.
- understand that a short circuit occurs when positive and negative connections cross and that a short circuit is not functional.

Preparation

- Gather the materials.
- Cut felt into squares around 8″ x 8″ in size.
- If you plan to give students handouts of the simple circuit schematic, print copies in advance.

Activity

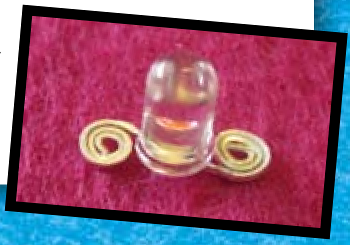
1. If examples are available, begin by sharing those with the students.
2. Review the simple circuit schematic and polarity diagrams (on page 6) with the students. This can be done by distributing copies, projecting, or redrawing the diagram on a chalkboard or whiteboard.

3. Explain that a circuit is a continuous loop through which electricity can travel. Our circuits all have a power source, and for our purposes this will be a coin cell battery. Additionally, circuits can have outputs, such as lights and motors. As we design a circuit, our goal is to guide the electricity out of the battery, through any output components (like lights), and then back to the battery.
4. Point out that batteries and LEDs have a "positive" and a "negative" side. This is called *polarity*.
   - Positive is also referred to as +, *power,* or by using the color red. The positive side of an LED is known as an *anode* and corresponds to the longer metal leg.
   - Negative is also referred to as -, *ground*, or by using the color black. The negative side of an LED is known as a *cathode* and corresponds to the shorter metal leg.
5. Explain that connections should be made from positive-to-positive and negative-to-negative. Positive and negative connections should never touch or cross - this will cause a *short circuit* (which won't be functional).
6. Ask students to sketch the electrical connections and placement of components for their first project. This may look similar to the example schematic, or it can vary (for example, the electrical connections might zigzag or follow a decorative path).
7. Distribute one of the following to each student: battery, battery holder, LED (light), felt piece. Make the rest of the materials available on a common table.
8. Ask students to pair up and compare LEDs, identifying the *anode* and *cathode*.
9. Instruct students to curl the legs of their LEDs using the needle nose pliers so that the LEDs can be sewn to fabric. (See photo at right for an example.)
10. Have students transfer their sketched circuit design onto their piece of felt by using chalk. (The chalk will wash or rub off after the project is complete.)
11. Suggest that students attach the components to their fabric with a dab of hot glue, being careful leave the conductive parts of the components exposed.
12. Students can follow the chalk pattern to sew the connections between components and sew the components to the fabric. Make sure they sew each component securely to the fabric (similar to sewing on a button) before sewing between components. After sewing each connection, students should tie a knot on the fabric's backside and cut the thread.
13. After students have finished sewing, show them how to insert the battery into the battery holder (with the "+" side facing up).

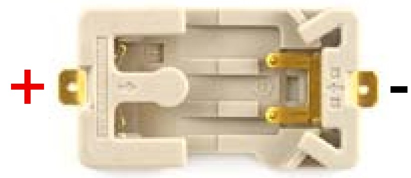
Tips for Working with Conductive Thread

- Try to keep your stitches as close together as possible - this will keep them in place whenever you bend or pull on your fabric.
- Conductive thread tends to fray, so if a circuit is not functioning, check for spots where the thread has frayed to the point of making contact with another electrical connection of opposite polarity.
- Because the thread frays easily, it may be difficult to thread your sewing needle. Run thread through beeswax or use needle threaders to help with this.
- Knots that are tied with conductive thread may not stay in place permanently on their own. Secure each of your knots by dabbing them with hot glue. This will also help insulate any loose thread ends.
- The soft circuits created in these activities are washable! Just remove the battery and hand-wash with gentle detergent.

a sewable LED whose legs have been curled with needle nose pliers



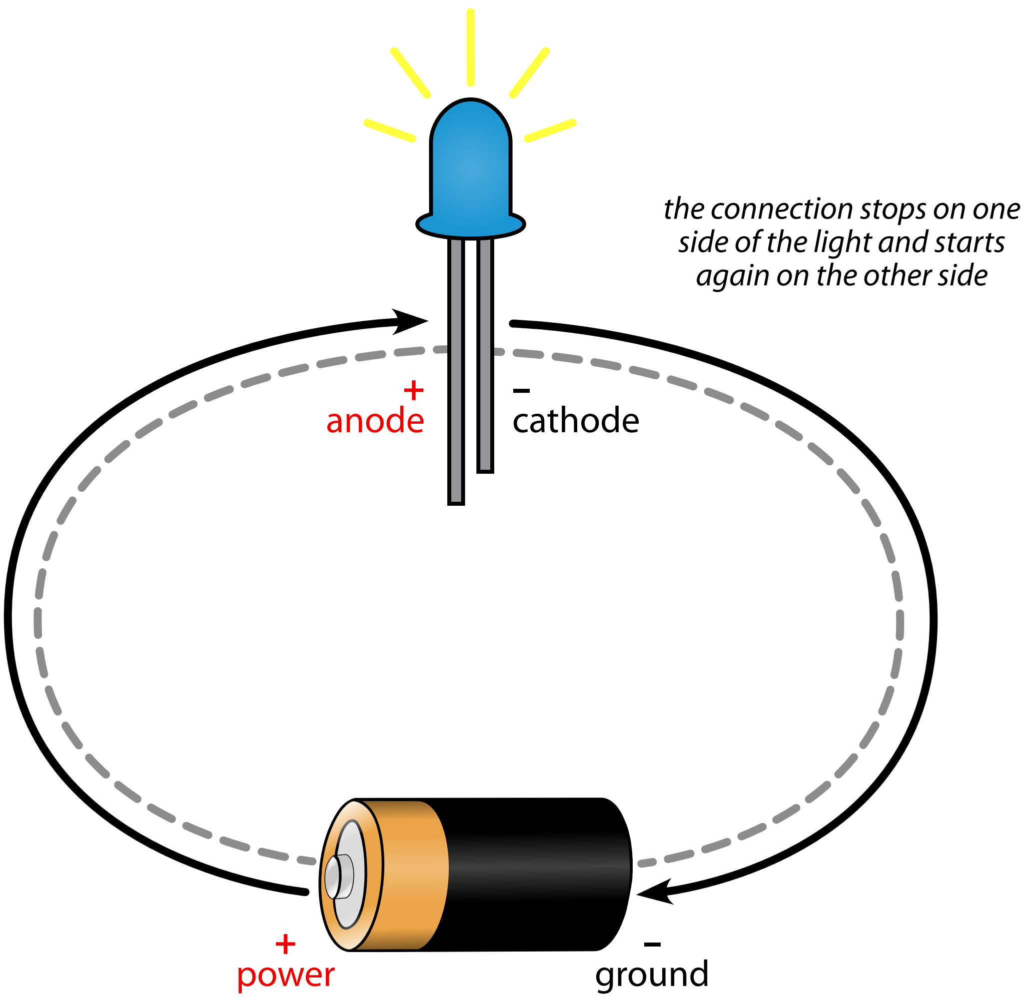
Identifying Polarity



battery holder

LED

A Simple Circuit Schematic



sewn electrical connections

directional flow of electricity through the circuit

activity #2
SWITCHES
a flickering brooch

Tools & Materials

For each student:

- battery
- battery holder
- LED (light)
- safety pin

For the group to share:

- needle threaders or beeswax
- conductive thread
- fabric scissors
- hot glue gun and glue sticks
- needle nose pliers
- sewing chalk
- sewing needles
- felt scraps
- metal (conductive) beads
- glass or plastic beads
- sewing thread (any color)

Summary

Students become familiar with switches and how they affect electrical flow through a circuit. Each student will construct a brooch which flickers as it moves, using a dangling metal bead to close a circuit.

Learning Goals

Students will...

- understand that a switch interrupts the flow of electricity through a circuit.
- understand that, unlike LEDs, switches are not polarized.
- become familiar with *conductivity* as a material's ability to conduct electrical current.

Preparation

- Gather the materials.
- If you plan to give students handouts of the simple circuit schematic for *switches*, print copies in advance.

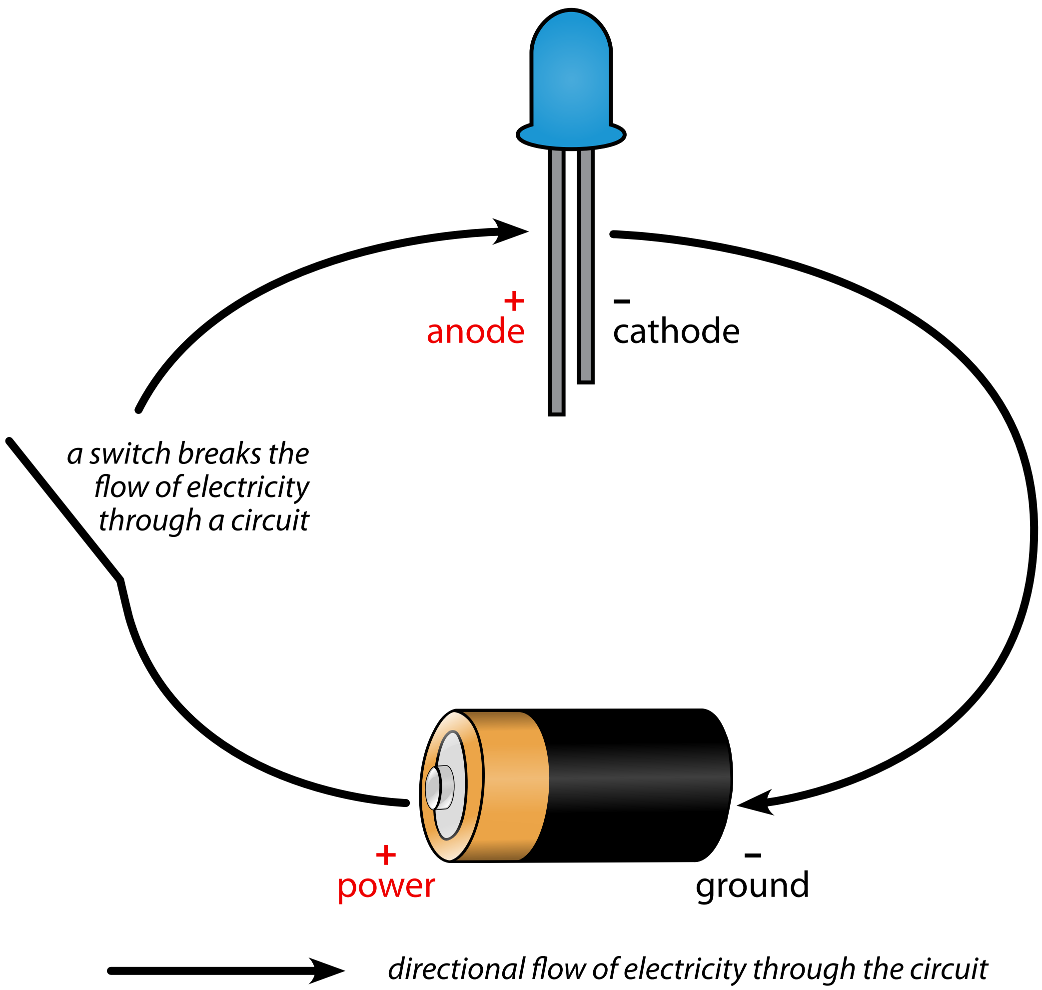
Activity

1. If examples are available, begin by sharing those with the students.
2. Share the simple circuit schematic for *switches* (on page 9) with the students. This can be done by distributing copies, projecting, or redrawing the diagram on a chalkboard or whiteboard.
3. Explain that a switch interrupts the flow of electricity through a circuit. An *open* switch stops the flow of power through a circuit, while a *closed* switch allows power to flow continuously through it. In this activity, we'll use a switch to control the flow of power to an LED.

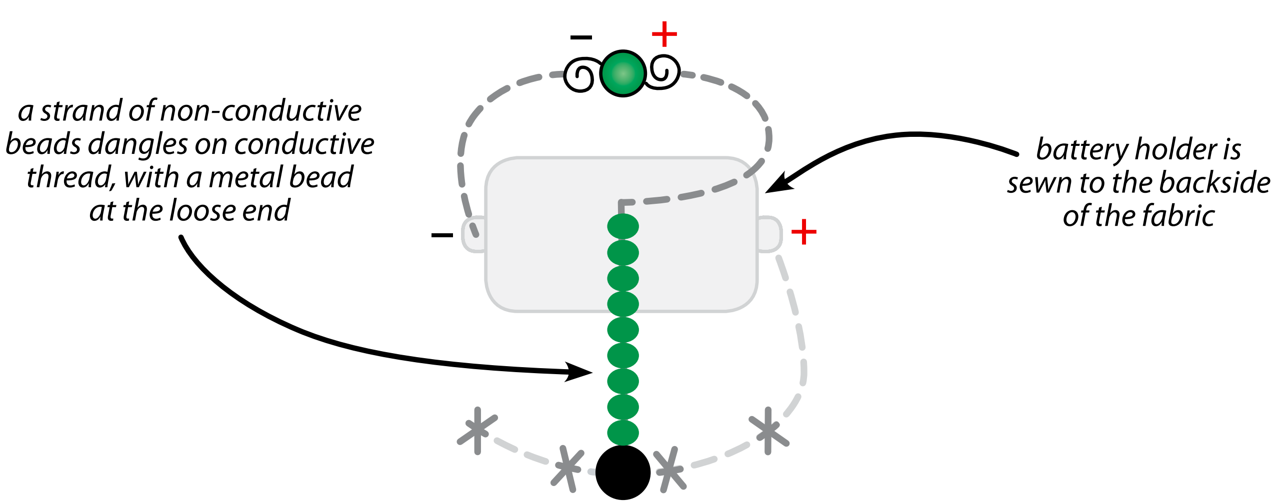
4. Additionally, explain that switches do not have polarity in the way that LEDs do – that is to say, they do not have a positive (+) side and a negative (-) side. Consequently, it doesn't matter which way they are oriented within a circuit.
5. Explain that a material which is *conductive* allows electricity to pass through it. Ask students to give examples of materials that are conductive (such as water, paper clips, and tin foil) and non-conductive (like wood, fabric, and paper).
6. Instruct students to curl the legs of their LEDs using needle nose pliers so that the LEDs can be sewn to fabric (see photo on page 5).
7. Review the circuit template (on page 9) with students and ask them to use chalk to draw the connections on their felt scrap(s). Explain that they will each make a switch using a metal bead which closes a circuit whenever it touches areas of conductive thread. Students can create the body of the brooch however they like, although its surface should be big enough to sew between the battery holder, LED, and switch.
8. Suggest that students attach the components to their fabric with a dab of hot glue, being careful leave the conductive parts of the components exposed.
9. Direct students to sew their components to their fabric, following the design pattern which they sketched in chalk.
10. Show students how to use regular thread to sew a safety pin to the backside of their brooches (see photo below). If the safety pin makes contact with any conductive thread, it can cause a short circuit – so be careful to separate it with extra felt if necessary.
11. Direct students to insert the battery into the battery holder (with the "+" side facing up).

a safety pin sewn onto the back of a felt brooch, using regular sewing thread

Simple Circuit Schematic for a Switch



Example Beaded Switch Template



activity #3
PARALLEL CIRCUITS
an illuminated cuff/bracelet

Tools & Materials

For each student:

- battery
- battery holder
- felt strip
- 3 LEDs (lights)
- matched set of metal snaps

For the group to share:

- needle threaders or beeswax
- conductive thread
- fabric scissors
- hot glue gun and glue sticks
- needle nose pliers
- sewing chalk
- sewing needles

Summary

Students come to understand what constitutes a parallel circuit. Each student will leverage this knowledge as he/she fabricates a bracelet or cuff which incorporates multiple lights and turns on only when it is worn.

Learning Goals

Students will...

- understand that lights arranged in a *parallel* configuration each receive the same amount of voltage.
- understand that multiple lights within one circuit should be arranged in *parallel* to ensure that they all light up.

Preparation

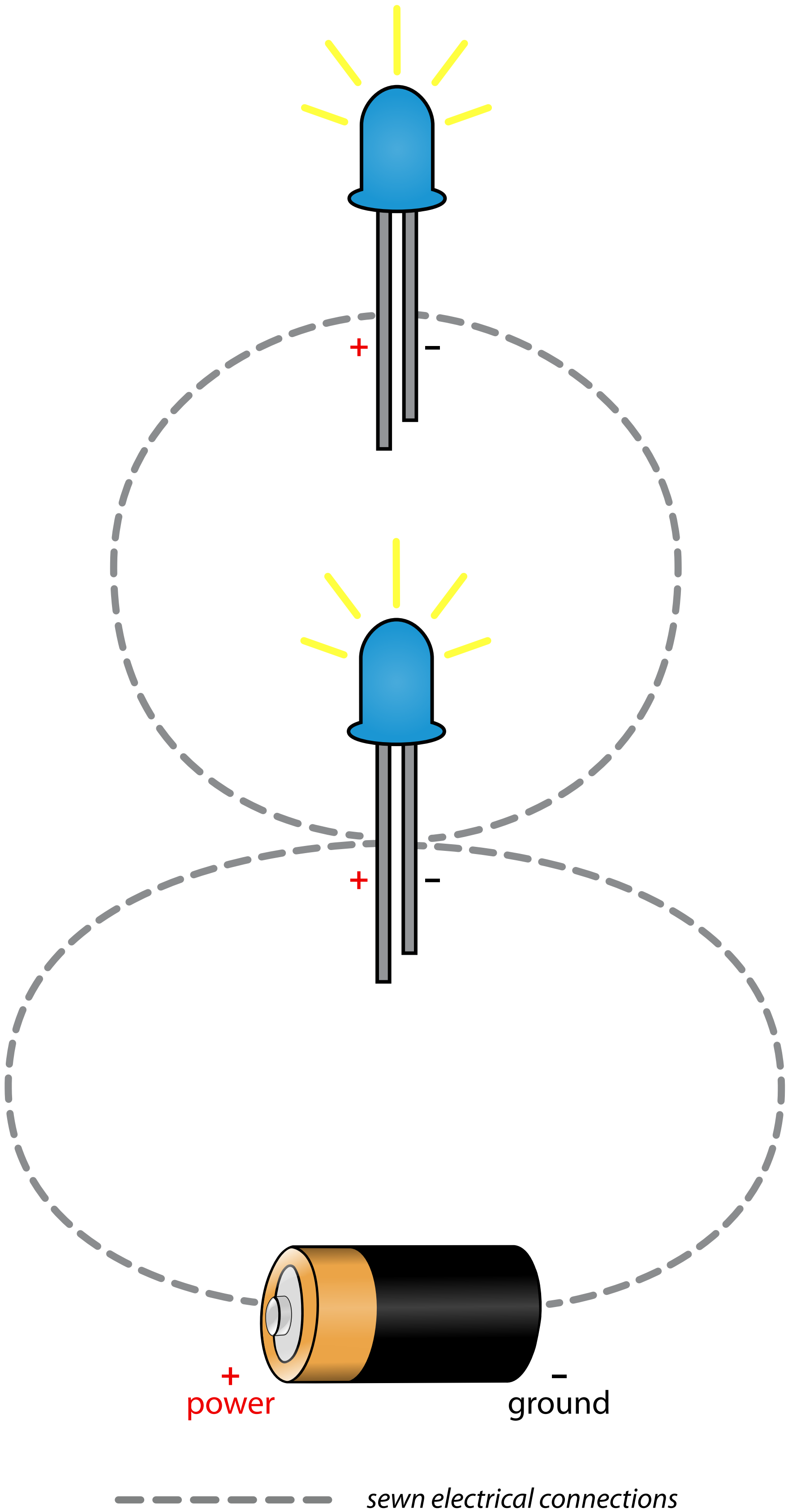
- Gather the materials.
- Cut felt into strips, about 2" wide and 16" long.
- If you are plan to give students handouts of the simple circuit schematic for *lights in parallel*, print out copies in advance.

Activity

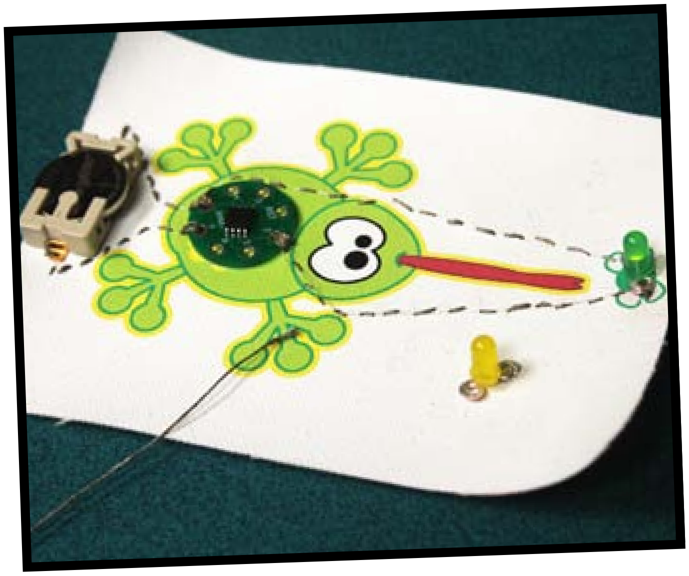
1. If examples are available, begin by sharing those with the students.
2. Share the simple circuit schematic for lights in *parallel* (on page 12). This can be done by printing copies, projecting, or redrawing the diagram on a chalkboard or whiteboard.
3. Explain that in order to add additional lights to a circuit, the lights must be arranged in *parallel*. This means that the first light's positive end is connected to the second light's positive end. Likewise, the first light's negative end should be connected to the second light's negative end.

4. Ask students to draw or sketch the electrical connections and placement of components for their project which will incorporate three lights. This may look similar to the example pictured here (see right), or it can vary. The electrical traces may spiral and/or travel anywhere on the fabric, so long as positive and negative connections do not touch or intersect.
5. Distribute one of the following to each student: battery, battery holder, felt piece. Distribute three lights to each student. Make the rest of the materials available on a common table.
6. Instruct students to curl the legs of their LEDs using needle nose pliers so that the LEDs can be sewn to fabric (see page 5 for a photo of this).
7. Ask students to wrap the felt strip around their wrist and trim it to the correct length – the felt should overlap by about 1″ or 2″ to leave enough room for the snaps and battery holder.
8. Show students how to attach their snaps to each end of their felt strip (sewing, riveting, etc., depending on which type of snaps are used). Tell students to leave enough room to sew to the snaps later in the activity, since this is how the snaps will be electrically connected to the rest of the circuit.
9. Have students transfer their sketched circuit design onto their piece of felt by using chalk.
10. Suggest that students attach the components to their fabric with a dab of hot glue, being careful leave the conductive parts of the components exposed.
11. Students can now follow the chalk pattern to sew the connections between snaps and components.
12. Finally, show students how to insert the battery into the battery holder (with the "+" side facing up).

Simple Circuit Schematic for Lights in Parallel



activity #4
MICROCONTROLLERS
an electronic patch



Summary

Students are exposed to microcontrollers and the concept of programmability. Each student will make a personalized light-up patch, using a sewable pre-programmed microcontroller to control the behavior of an LED.

Learning Goals

Students will...

- understand what a microcontroller is and how programming can add interactivity and dynamic behavior to an e-textile project.

Preparation

- Gather the materials.
- If you plan to give students the microcontroller diagram handout, print copies in advance.
- Print copies of the patch template(s) on an inkjet printer, using canvas paper. Make sure that the printer is adjusted to accept thicker print media (if available as an option). Cut out the individual patches.

Activity

1. Introduce the activity by sharing examples, if they are available.
2. Distribute the following materials to each student, or ask the students to collect them from a materials station:
    - one LED
    - one pre-printed canvas patch
    - one needle
    - 16″ or so of thread
    - sewable microcontroller
    - battery holder
    - battery
    - microcontroller diagram handout

Tools & Materials

For preparing patches:
- canvas paper
- inkjet color printer

For each student:
- battery
- battery holder
- LED (light)
- sewable microcontroller

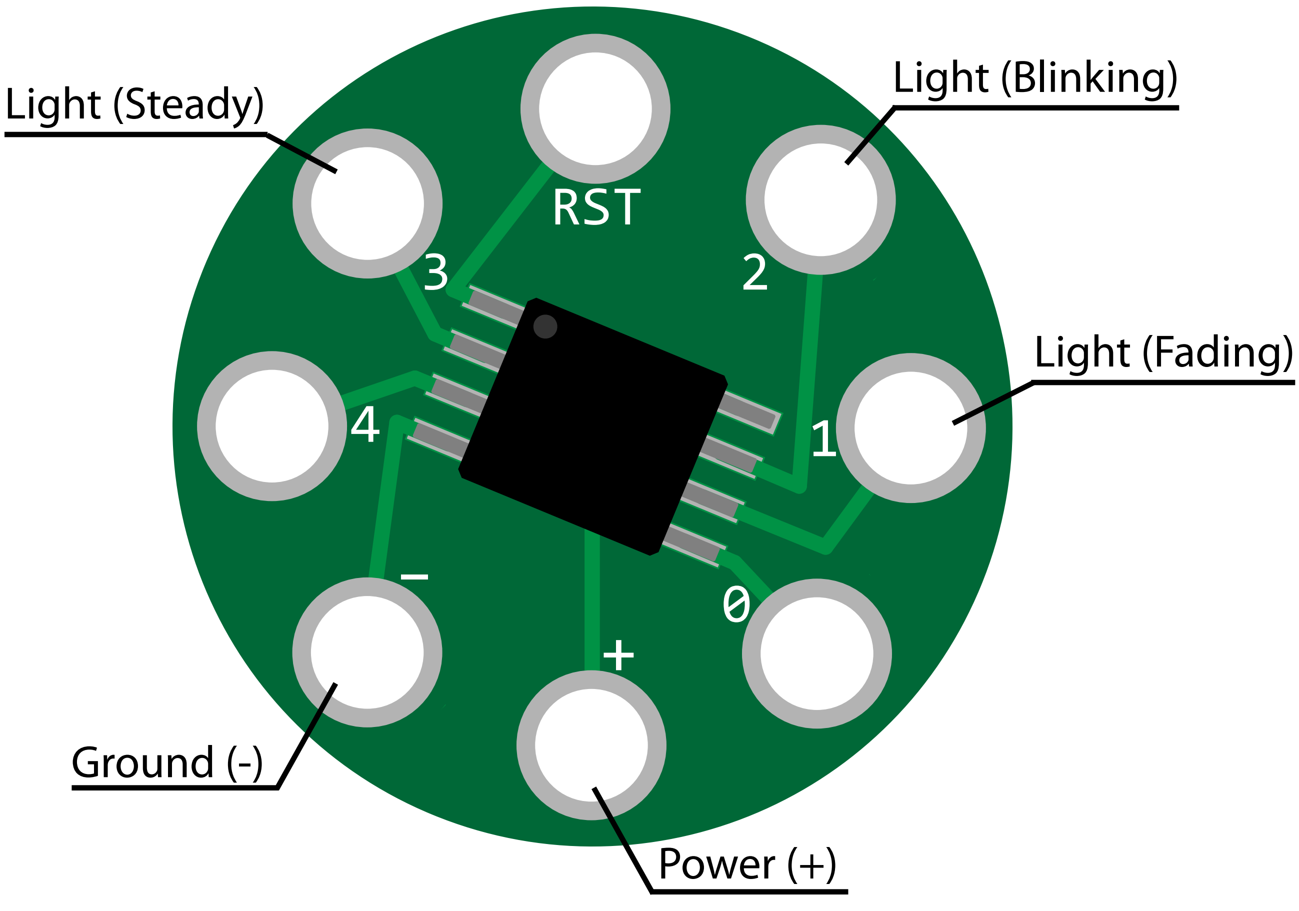
For the group to share:
- needle threaders or beeswax
- conductive thread
- fabric scissors
- hot glue gun and glue sticks
- needle nose pliers
- sewing needles

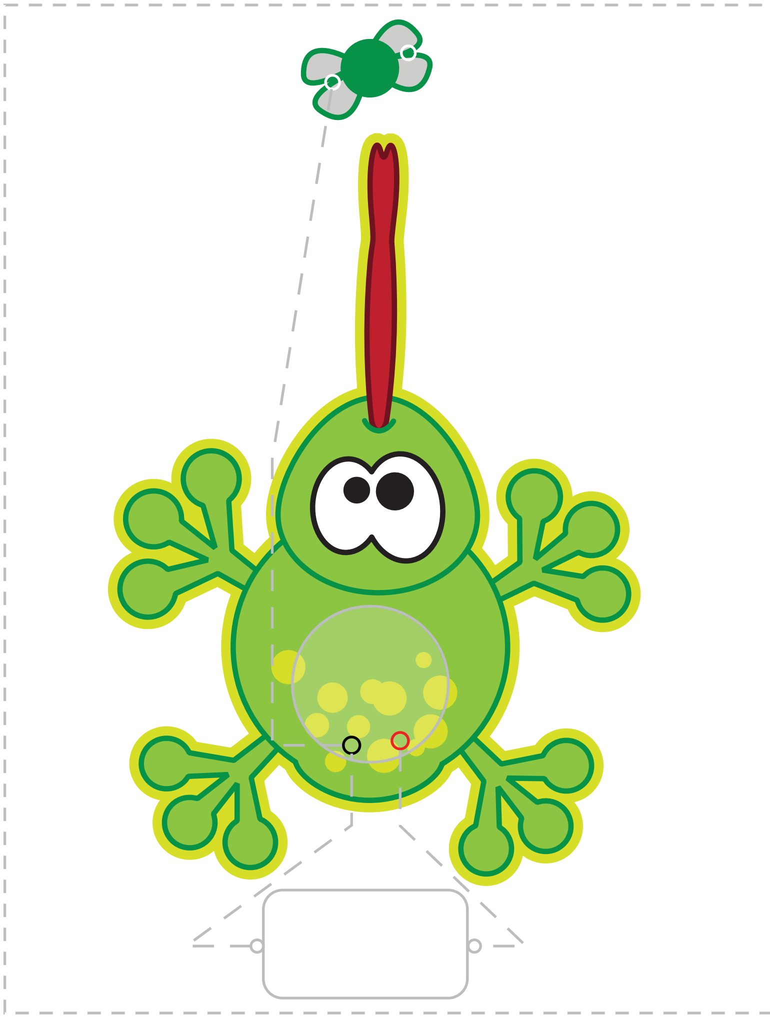
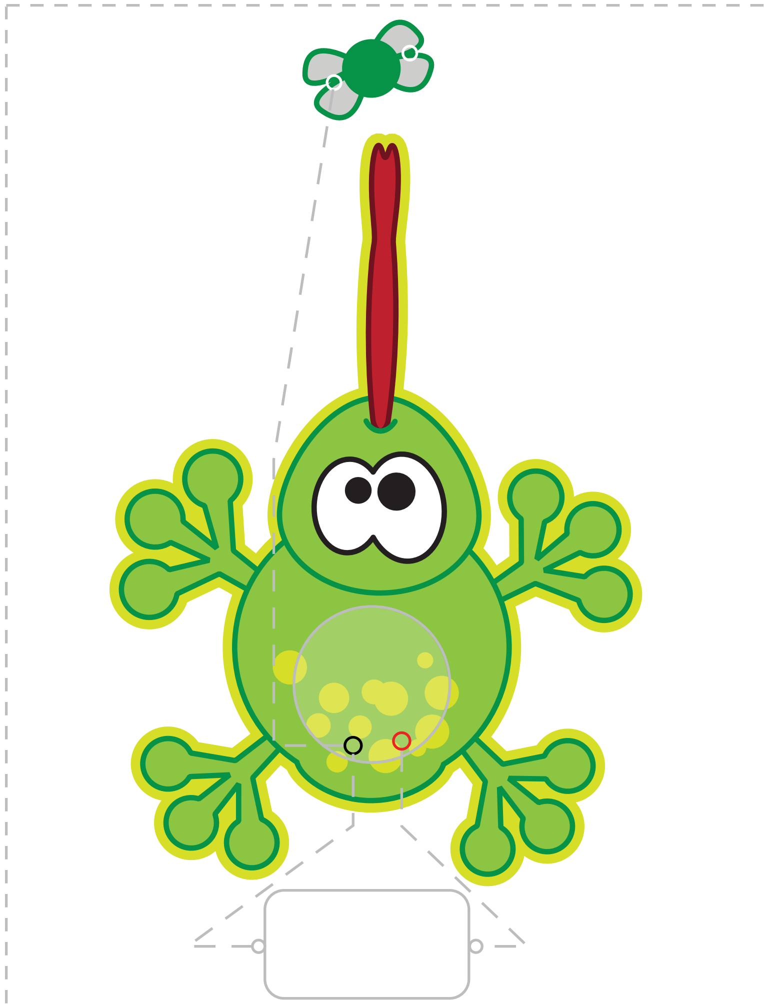
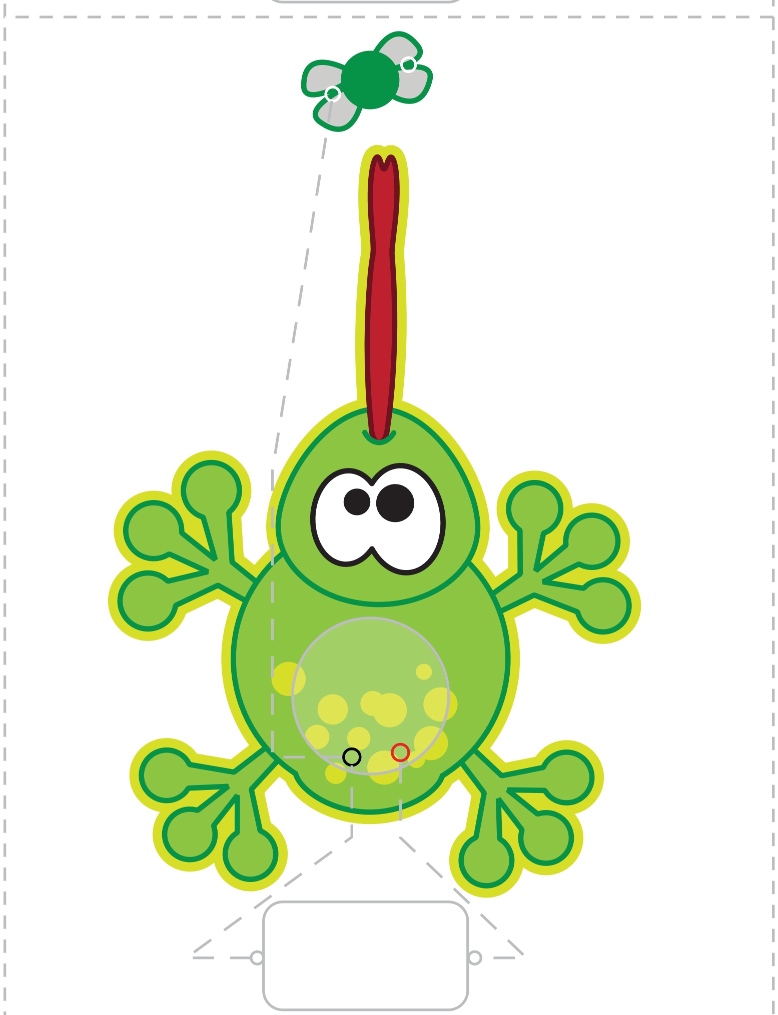
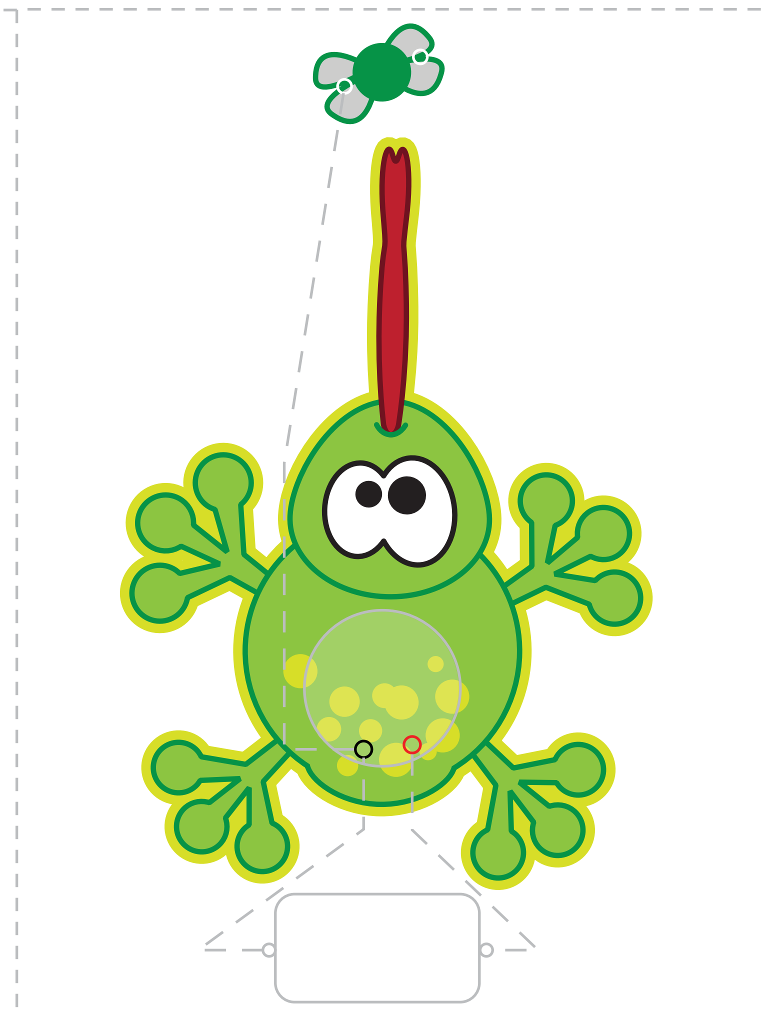
3. Spend a few minutes introducing the microcontroller as a miniature computer that can be programmed to control certain behaviors within a circuit. The microcontrollers in this activity have been pre-programmed to control the behavior of an LED.
4. Instruct students to curl the legs of their LEDs using needle nose pliers so that the LEDs can be sewn to fabric (see page 5 for a photo of this).
5. Guide students through creating their own patch. Begin by explaining the first step listed below, then allow students to spend the rest of the time working individually. As students begin to finish one step, pause to explain the next step in the process.
   - Follow the template on the patch to determine how to place the microcontroller. Orient the battery holder so that one dotted line connects its positive (+) hole to the positive (+) hole on the microcontroller. If the battery holder is placed correctly, another dotted line should connect its negative (-) hole with the negative (-) hole on the microcontroller.
   - Using a hot glue gun, glue the battery holder and sewable microcontroller to your patch. Use just enough glue to make the components stick; using too much glue will cover the metal contacts and prevent them from conducting electricity!
   - Sew from the positive (+) hole on the battery holder to the positive (+) hole on the microcontroller.
   - Sew from the negative (-) hole on the battery holder to the negative (-) hole on the microcontroller.
   - Decide which way you need to orient your LED so that the dotted line will connect the negative (-) side of your LED to the negative (-) hole on your microcontroller. Once you've figured it out, use a hot glue gun to glue the LED to your patch.
   - Sew from the negative (-) hole on your microcontroller to the negative (-) side of your LED.
   - Now, decide which behavior you would like your LED to have (steady, blinking, or fading). Look at the microcontroller diagram and figure out which microcontroller hole you'll have to connect the positive (+) side of the light to in order to produce this behavior. Once you've decided, sew from the positive (+) side of the light to that particular hole on the microcontroller.
   - Examine the backside of your patch and make sure that there are no loose pieces of thread that are accidentally touching one another. Trim any loose ends, if necessary. Using a hot glue gun, put a dab of hot glue over each of your knots. This will help protect them from unraveling and will also prevent the thread ends from shorting your circuit.
   - Insert the battery into the battery holder (with the "+" side facing up).

An Extra Challenge...

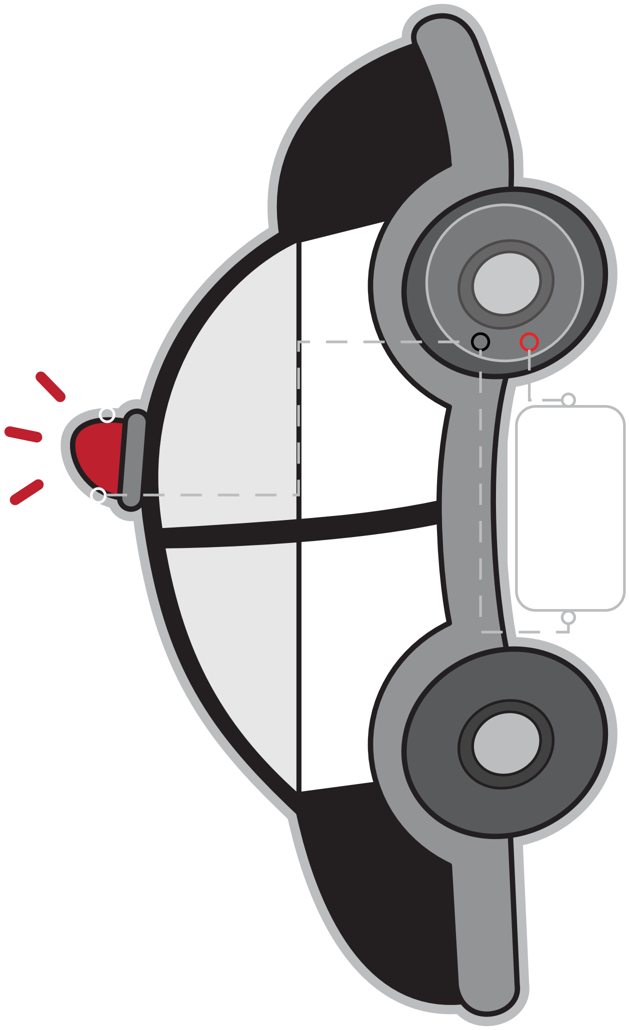
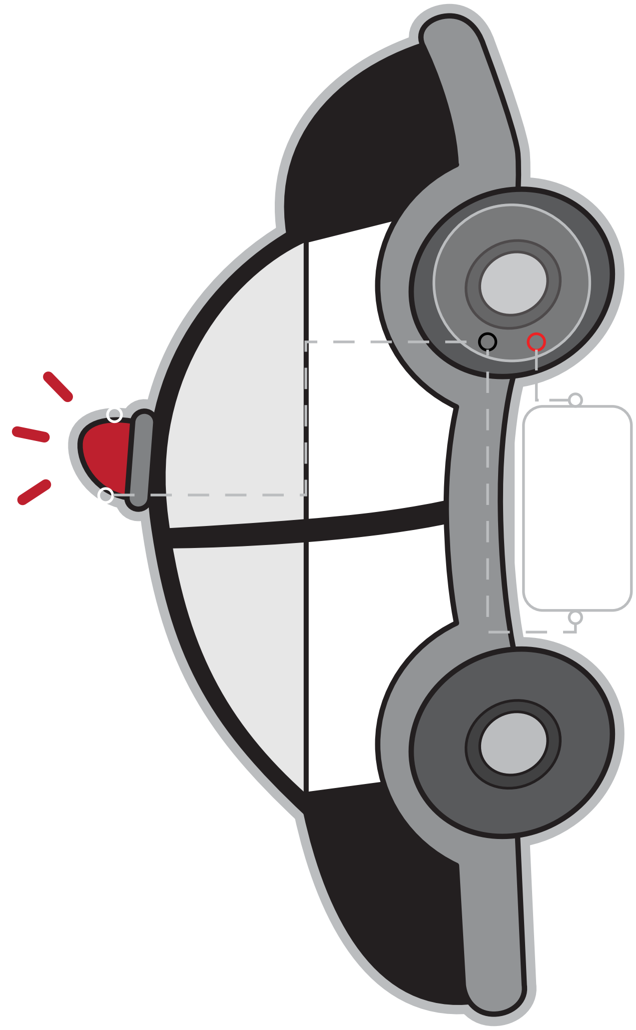
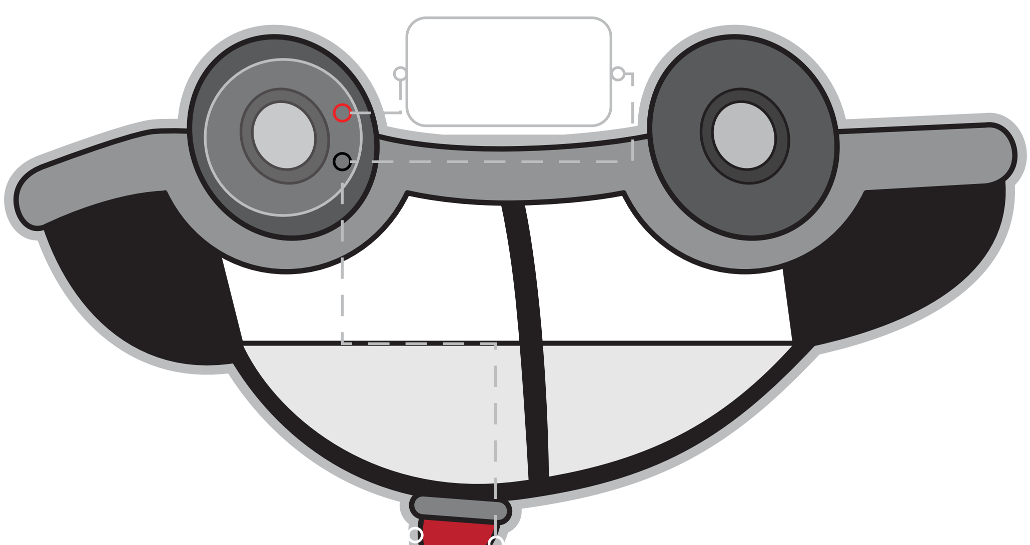
If students finish early, you can challenge them to add a second light to their circuit, in parallel.

Microcontroller Diagram





activity #5
CONNECTING BACK
a patchwork quilt

Summary

Students draw upon their understanding of circuits to make their own electronic quilt squares. The squares can then be pieced together to create an electronic patchwork quilt. Encourage participants to design and construct a few different squares; this way, some can remain part of a collective project, while others can be taken home.

The physical structure of the squares allows them to be rearranged repeatedly, encouraging the exploration and development of a group narrative and/or artwork.

Learning Goals

Students will...

- understand how to combine and apply all of the concepts covered in previous sessions.

Preparation

- Gather the materials.
- Cut out tabbed quilt squares (at least two per student), using the template on page 21. If using 9″ x 12″ pieces of felt, you should be able to fit two quilt squares on each piece. Cut along the template outline and cut slits along the short, straight lines.
- Decide how you would like students to attach embellishments to their quilt pieces:
  - Fabric glue is convenient, but takes a long time to dry.
  - Heat'n Bond Ultra Hold Iron-On Adhesive requires more preparation, but works almost instantly when ironed. (If using Heat'n Bond, it's best to use an iron to pre-fuse it to scrap felt. This way, students can cut out their desired shapes and iron them right onto their quilt squares.)

Tools & Materials

For preparing quilt squares

- 9″ x 12″ pieces of felt

For the group to share:

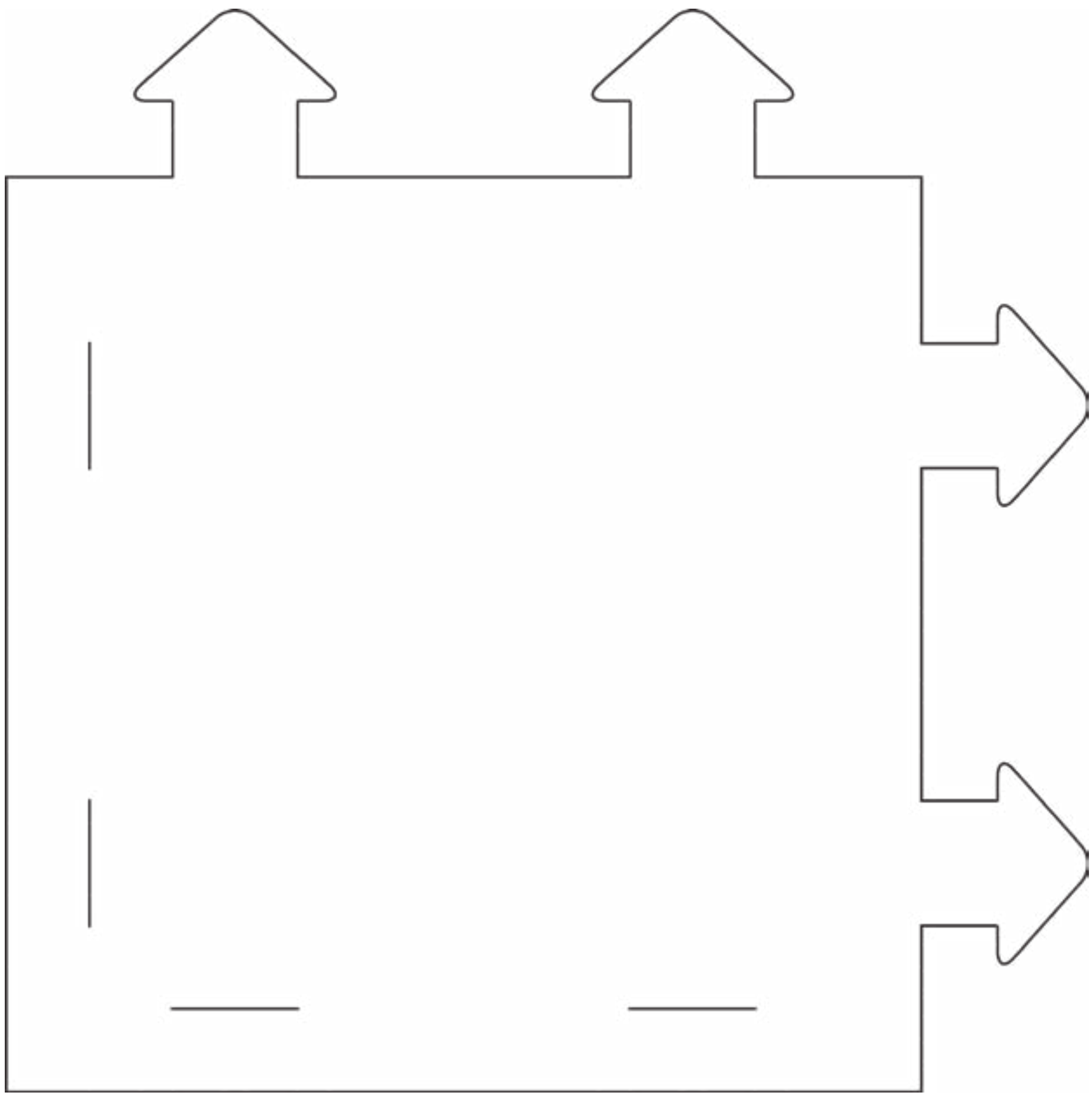
- needle threaders or beeswax
- conductive thread
- fabric scissors
- hot glue gun and glue sticks
- needle nose pliers
- sewing needles
- Heat 'n Bond Ultra Hold Iron-On Adhesive* with mini iron* ***or*** fabric glue*
- puffy fabric paint*
- sewing chalk
- batteries
- battery holders
- LEDs (lights)
- sewable microcontrollers
- small felt scraps
- assorted beads
- metal snaps

- Print copies of the quilt square template for students to sketch their designs on.
- Decide upon a theme for the electronic patchwork quilt. It should be broad enough to allow for creative interpretation, but narrow enough to provide guidance to students who might otherwise feel lost. The theme may be concrete (calendar months, seasons of the year, animals, etc.) or abstract (civic issues, personal aspirations, etc.)

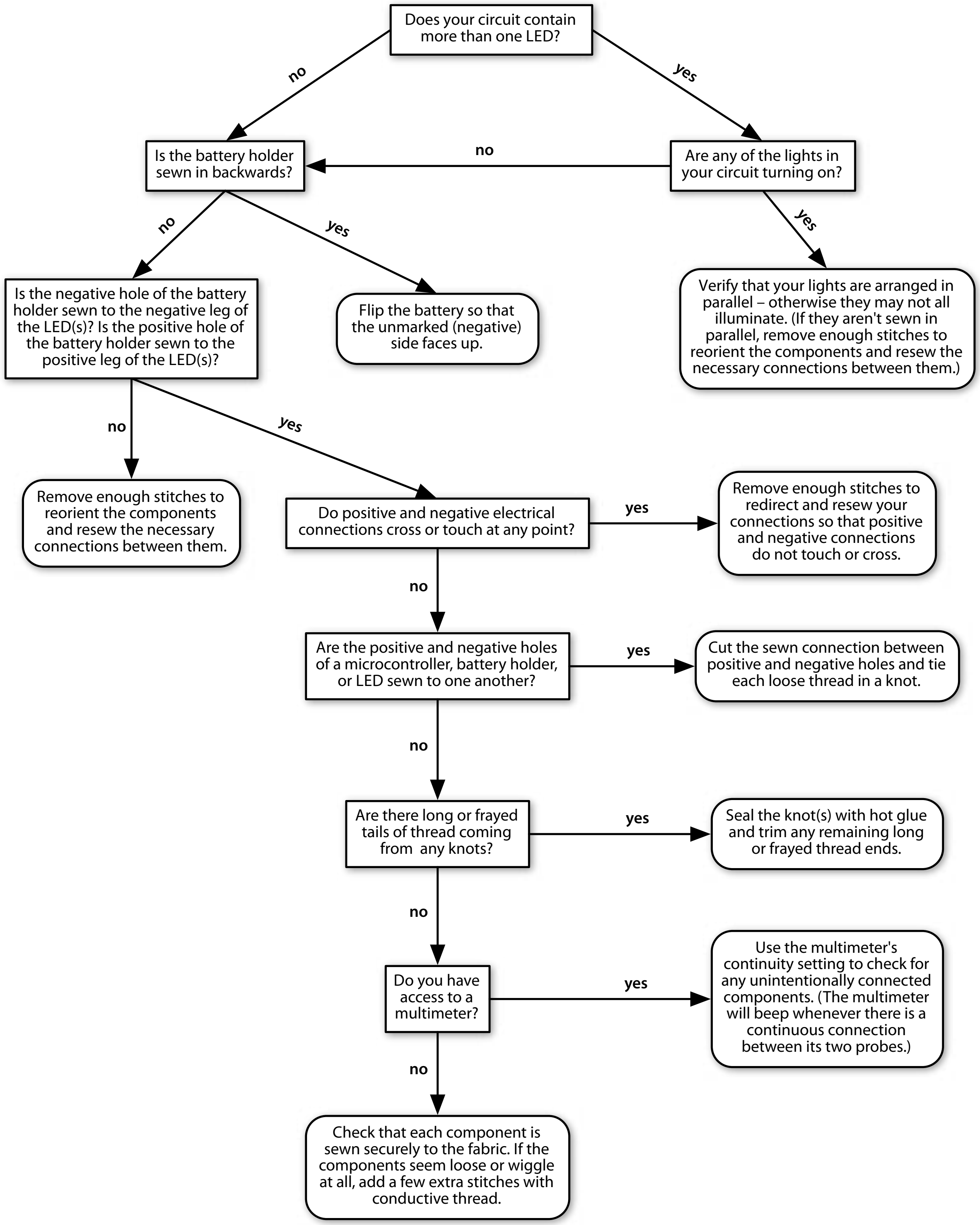
Activity

1. Introduce the activity by sharing examples, if they are available.
2. Explain that students will be making more than one quilt square during today's session; this way they can take one home to share with family and friends, while leaving others to remain part of the group quilt.
3. Ask students to draw or sketch the electrical connections and placement of components for each square onto the template provided. Their design may incorporate lights and/or switches along with decorative elements and a battery.
4. Distribute one of the following to each student (per square): battery, battery holder, quilt square. Make the rest of the materials (including a variety of lights) available on a common table.
5. Instruct students to curl the legs of their LEDs using needle nose pliers so that the LEDs can be sewn to fabric (see page 5 for a photo of this).
6. Have students use chalk to transfer their sketched circuit designs onto their quilt squares.
7. Suggest that students attach the components to their fabric with a dab of hot glue, being careful leave the conductive parts of the components exposed.
8. Direct students to sew their components to their fabric, following the design pattern which they sketched in chalk.
9. Encourage students to embellish their functional circuit with beads, additional fabric, and fabric paint. Feel free to provide additional craft supplies (such as feathers, sequins, and buttons) as well. You may even suggest that students sign their name in fabric paint somewhere on each square that they create.
10. As students begin to finish their patches, encourage them to arrange (and rearrange) how the pieces fit together.
11. At the end of the session, let students choose which square of theirs they would like to take home.

Quilt Square Template



TROUBLESHOOTING



TOOLS & MATERIALS

Item		Where to Purchase	Notes
alligator clips*		SparkFun[2] RadioShack	• SparkFun SKU #: CAB-08927 (or search for "Alligator to Alligator Cables") • RadioShack catalog #: 278-1156 (or search for "Test/Jumper Leads")
assorted beads		fabric & craft stores	• provide a variety of metal (conductive) and non-metal (glass, wood, plastic) beads
batteries (CR2032)		Digi-Key[1] SparkFun[2] RadioShack electronics stores	• Digi-Key part #: N189-ND • SparkFun SKU #: PRT-00338 (or search for "Coin Cell Battery - 20mm")
battery holders		Digi-Key[1] SparkFun[2]	• Digi-Key part #: BA2032SM-ND • SparkFun SKU #: DEV-08822 (or search for "Coin Cell Holder - Sewable SMD")
beeswax		JoAnn Fabrics fabric & craft stores	
conductive thread		SparkFun[2]	• SparkFun SKU #: DEV-08549 (or search for "Conductive Thread - 234/34 4ply)
fabric glue		fabric & craft stores	
fabric scissors		fabric & craft stores	
felt		JoAnn Fabrics A.C. Moore fabric & craft stores	• 9" x 12" size can fit two quilt square pieces • may also be purchased in large sheets/rolls

Item		Where to Purchase	Notes
Heat'n Bond Ultra Hold Iron-On Adhesive*		JoAnn Fabrics A.C. Moore fabric & craft stores	• a type of fusible interfacing which includes a paper backing • available in sheets (pictured here) or rolls
hot glue gun (with glue sticks)		fabric & craft stores hardware stores	• any glue gun will work, but "mini" glue guns work especially well with small craft materials and electronics components
LEDs (lights)		Digi-Key[1] SparkFun[2] RadioShack	• Digi-Key part #'s: 160-1127-ND, 160-1133-ND, and 160-1131-ND (red, yellow, and green) • SparkFun SKU #'s: COM-09590, COM-09594, and COM-09592 (red, yellow, and green - or search for "Basic LED")
metal snaps		JoAnn Fabrics A.C. Moore fabric & craft stores	• magnetic snaps work particularly well and are easy to sew into a project
mini iron*		JoAnn Fabrics Target Walmart fabric & craft stores	• a regular iron will also work, but will require an ironing board (or other large suitable surface on which to iron)
multimeter*		SparkFun[2] RadioShack Sears hardware stores	• SparkFun SKU #: TOL-09141 (or search for "Digital Multimeter") • RadioShack catalog #: 22-813 (or search for "29-Range Digital Multimeter) • digital multimeters will be easier to use than analog ones • your multimeter should be able to measure continuity (with a buzzer/beep sound)
needle nose pliers		SparkFun[2] RadioShack Sears hardware stores	• SparkFun SKU #: TOL-08793 (or search for "Needle Nose Pliers") • RadioShack catalog #: 64-062 (or search for "Mini Long-Nose Pliers")
needle threaders		fabric & craft stores	

Item		Where to Purchase	Notes
puffy fabric paint*		A.C. Moore Michaels fabric & craft stores	• can be used as an insulator when painted over sewn traces
safety pins		drug stores fabric & craft stores	
sewing chalk		A.C. Moore Michaels fabric & craft stores	• also known as "tailor's chalk" or "designer's chalk"
sewing needles		fabric & craft stores	• needles with bigger eyes will be easier to thread (look for "crewel" or "embroidery" needles) • needles must be slender enough to sew through the holes of the battery holders
sewing thread		fabric & craft stores	

* optional
[1] http://www.digikey.com - lowest prices, difficult to navigate
[2] http://www.sparkfun.com - slightly higher prices, easier to navigate

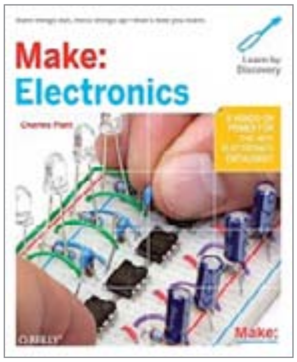
FURTHER RESOURCES

Print

Fashioning Technology
by Syuzi Pakhchyan

Switch Craft: Battery-Powered Crafts to Make and Sew
by Alison Lewis (with Fang-Yu Lin)

Fashion Geek
by Diana Eng



Make: Electronics
by Charles Platt

Web

Craft
http://www.craftzine.com

Fashioning Technology
http://www.fashioningtech.com

How To Get What You Want
http://www.kobakant.at/DIY/

Instructables
http://www.instructables.com

LilyPond
http://lilypond.media.mit.edu

Make
http://www.makezine.com

Soft Circuit Saturdays
http://softcircuitsaturdays.com/

talk2myShirt
http://www.talk2myshirt.com/