

**MAKEngineering Kit**  
**Facilitation Guide:**  
**Toy Hack (Give Toys a**  
**New Life)**

## **ENGINEERING TASK**

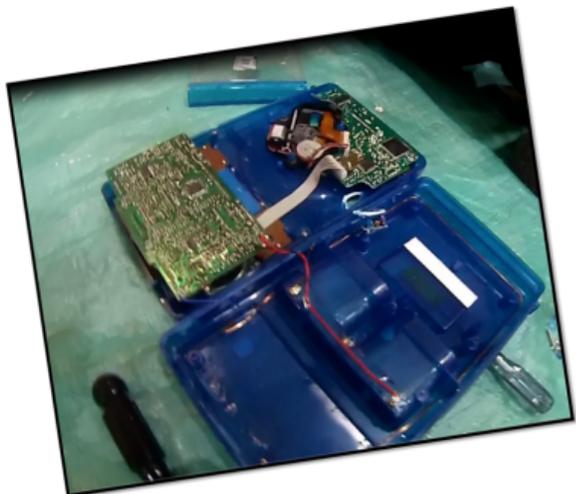
You have been asked by a toy refurbish shop to brainstorm ways to give old toys a second life using electronic parts. Make a prototype that renovates, redesigns, and/or remixes an old toy. The prototype should change the look and feel of the toy, or the toy's role in our life, using new materials.

# WHICH OF THESE TOYS ARE YOU FAMILIAR WITH?



## MATERIALS IN KIT

- ◆ 2 AA batteries
- ◆ 1 battery holder
- ◆ 5 LED lights
- ◆ 1 motor
- ◆ 1 buzzer
- ◆ 2 wires (~12 inches)
- ◆ Tape
- ◆ ~10 Velcro dots
- ◆ Scissors
- ◆ Hot glue gun & sticks
- ◆ Phillips head screwdriver
- ◆ Assorted craft materials



# PROTOTYPE

Prototype is a term we will use often, so what does it mean? One way to think of a prototype is a rough draft on a paper. Here are two videos that explain a prototype in engineering.

[https://youtu.be/\\_1bOaNSy5XY](https://youtu.be/_1bOaNSy5XY)

[https://youtu.be/k\\_9Q-KDSb9o](https://youtu.be/k_9Q-KDSb9o)

## STEP 1—RESEARCH

How have others hacked and repurposed toys?  
Let's watch a video to find out.

[https://youtu.be/FP6R\\_YW2VPk](https://youtu.be/FP6R_YW2VPk)

Engineers take notes to use in their design thinking. You can organize your notes into two columns.

I NOTICED...

I WONDER ABOUT...

## STEP 2—PLAN

Let's start with one toy. This can be the toy we provided or an old toy you no longer play with.



Explore the toy using your four senses (vision, smell, touch, hearing). What can you do to change the look, feel, smell, or sound of the toy?

We have questions on the next page for you to discuss and brainstorm together as a family. Keep taking notes!!!! And feel free to ask someone else to take notes for you.

## STEP 2—PLAN

1. What does the toy do? What role does it play in your life? What can you do to give it a new role?
2. Who is this toy designed for? What can you do to make it useful for other people?
3. What context does the toy belong? What can you do to make the toy appropriate for another context? For example, think about a setting for a dinosaur. How might you hack the dinosaur to be something used in the bathroom? (Psst. A toothbrush holder.)
4. Can you take apart or disassemble the toy (with the permission of your caregiver)? How might this be done?

## STEP 2—PLAN

Hum? How will you give the old toy a second life using electronic parts? How might you use the LED lights, the motor, or the buzzer (beyond making your family crazy)? Let's explore! Place the AA batteries in the battery pack. How does the motor need to be connected to work? What about the buzzer? And the LED lights?

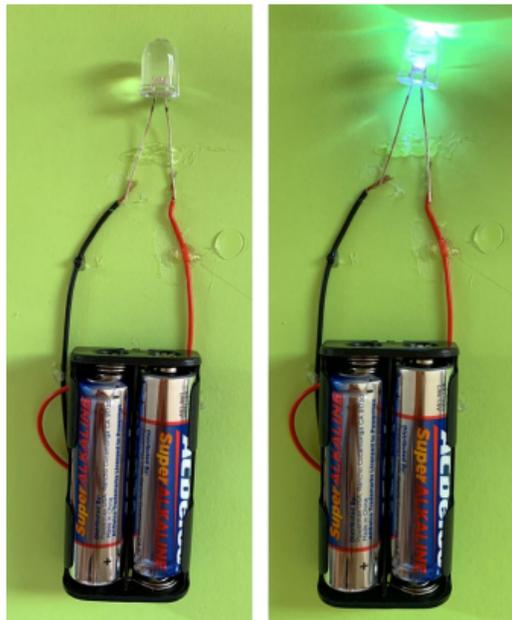
## STEP 2—SUPPORT

Look at the LED light carefully. What do you notice about the legs? The long leg is the positive probe and the short leg is the negative probe. How can we use this knowledge to connect the LED to the battery?



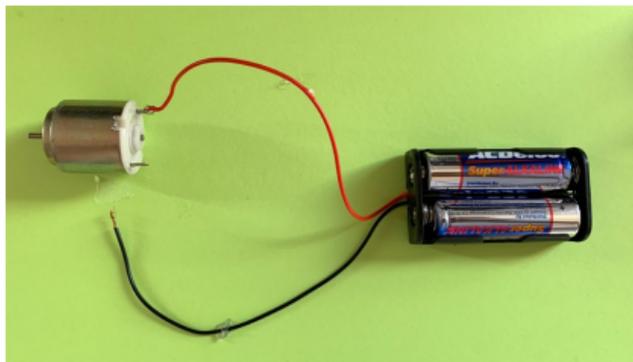
## STEP 2—SUPPORT

Typically, the red wire connects to the positive end of the batteries and the black wire connects to the negative end of the batteries. Why do you think the LED light is not working in the left hand image? What will happen if we flip the connection?



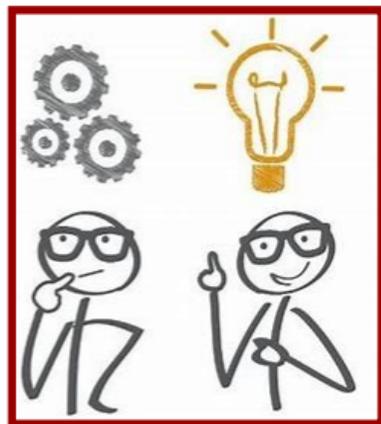
## STEP 2—SUPPORT

Next, explore the motor and/or buzzer. How does the black/red wire connect to the batteries? How do you know the battery is working? Do you hear any sounds when you connect the buzzer? Why? What will happen if you flip the black and red wires?



## STEP 2—PLAN

One more thing...take some time to think about and discuss ALL your notes, explorations, and ideas. Write down and/or draw out your final plan for how you will give the toy a new life. What materials will you use? You can use materials in the kit or in your home.



## STEP 2—SUPPORT

Potential questions to ask:

- \* What is the most exciting thing that we have learned? How will we use that information in our prototype?
- \* How will we add an electronic component?
- \* What materials and tools might we need that are not in the kit? Why? How will we use it?
- \* What is a strength you have that will come in handy in this project? Explain.



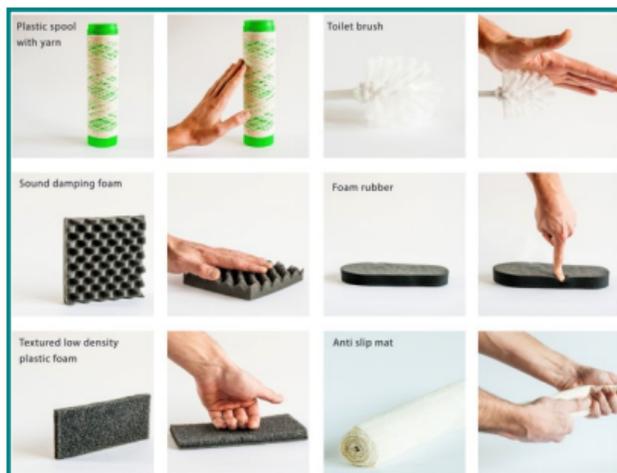
## COMMUNICATE

Have a conversation around the research and planning process. The camera can be focused on the notes.

1. Describe your plan. How will you transform an old toy into a new toy?
2. How would you market this toy in a commercial? Consider what makes this remixed toy one-of-a-kind. What about a new name for the toy so potential buyers are not confused?
3. What one word describes how you feel about transforming the toy? Tell me why.

# DID YOU KNOW...?

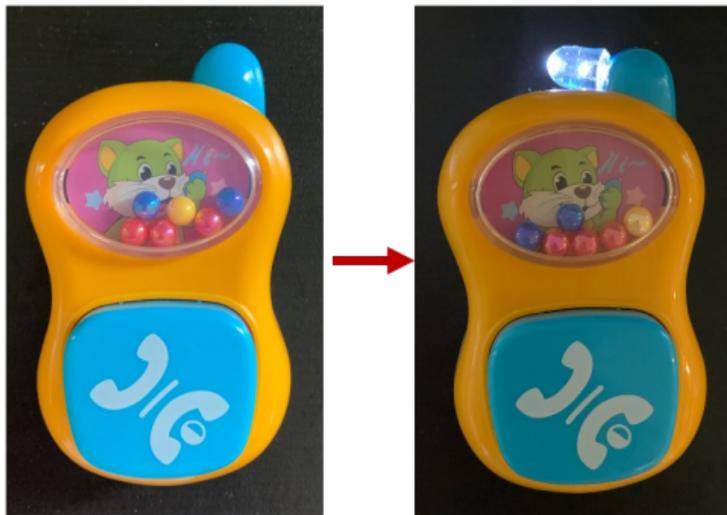
People who design products explore many materials to get insights into its possible use— its properties, how it can be manipulated (e.g., twisted), and how it feels.



Karana, Giaccardi, Stamhuis, & Goossensen (2016)

## STEP 3—CREATE

It is time to refurbish the toy—give it a new and different use for others to enjoy.



The transformation of a baby toy to a lantern.

## STEP 3—SUPPORT

Potential questions to ask:

- \* What do you think our first step should be? Why do you think this?
- \* What do you think the inside of the toy looks like? I am excited to see!
- \* What if we do \_\_\_\_\_ instead? What might be the advantage of this approach over the other?
- \* In looking at our notes, we planned on using \_\_\_\_\_. Do you think this is still a good idea? Why or why not?
- \* I like how you are thinking about \_\_\_\_\_.

## STEP 3—TEST

Interview 2-3 people about your new toy.



1. How might you use this toy?  
What do you think the toy does?
2. Where and when would we use it?
3. What kind of emotion does this toy spark? Why?

## STEP 3—SUPPORT

Planning the interview:

1. Who should we interview about the new toy? Think about who would use the toy.
2. Let's add one more interview question. What else do we want to know about the toy?
3. Maybe we should practice the interview. How will we start? Should we stand or sit? Should we encourage people to explore the toy using their four senses? When should we do this in the interview? How much time should you wait before asking another question?

## STEP 4—IMPROVE

- ◆ What were other people's reactions towards your new toy?
- ◆ Were their responses in agreement with your design intentions? Why or why not?
- ◆ What changes can you make to the new toy based on what you learned from the interviews?

Continue to re-create and re-mix the new toy based on the feedback.



## COMMUNICATE

Have a conversation around the create, test, and improve process. The camera can be focused on the new toy.

1. Explain any challenges that occurred in creating the toy. What did you do to overcome these challenges?
2. Based on what you learned from the interviews, what improvements did you make?
3. Tell us one new thing you learned from this project.

## DID YOU KNOW...?

You just acted like a product engineer. Product designers and engineers use usability testing to collect data and determine the participant's satisfaction with the product. Did you not put your product in front of potential users, walk them through your product, and collect feedback from them to improve your product? The shop keeper thinks so!!!

[https://youtu.be/BrVnBdW6\\_rE](https://youtu.be/BrVnBdW6_rE)

## **STEP 6—PARALLEL PROTOTYPING**

Given the same toy, are there any other ways you can build a prototype?

What are other electronic parts that could be added to your toy?

Can you prototype this toy to spark a different emotion in others?

What about a different toy? Is there another toy you would want to give a new life?

## WHAT TYPE OF ENGINEER ARE YOU?

Add a sticker to your Engineering Passport that identifies the type of engineer you were most like in bringing new life to an old toy. Don't forget to write why you chose the type of engineer.



This engineering kit would not have been possible without funding and support from the National Science Foundation.