**FACILITATOR GUIDE TO**

**AUTOMATA**

# DESCRIPTION

In this activity, learners make an *automaton,* a moving mechanical device that imitates the movement of a human, animal, or other living thing. The activity is designed to prompt conversation and reflection about responsible innovation, inspired by themes raised in Mary Shelley’s novel *Frankenstein.*

# AUDIENCES

This activity is best suited for ages 10 and up. Younger children can participate successfully with support from an educator or caregiver.

# LEARNING OBJECTIVES

# The primary objective of this activity is to encourage creativity and reflection about responsible innovation. In addition, learners will explore the following concepts:

# People are creative! We’re always learning more about the world and inventing new things.

* It’s important to think ahead as we study science and make new technologies.
* Researchers who study *artificial intelligence* make machines that can reason and learn over time.

# MATERIALS

* Plastic deli containers, 16 oz. size (1 per person)
* Bamboo skewers (2 per person)
* Small piece of drinking straw, about ½” long (1 per person)
* Foam circles, around 1.5” in diameter (at least 2 per person)
* Craft materials for decoration (such as craft foam, stickers, feathers, chenille stems, artificial flowers, googly eyes, and colored paper)
* Masking tape
* Safety scissors
* Activity booklet
* Info sheet showing how to build a cam system
* Sign stand and table sign

Sources and instructions for creating your own kit materials are provided at the end of this facilitator guide.

# PRESENTATION

**Preparation:**

Before doing this activity, build a few sample automata for practice. This will ensure you know how to make them so you can easily help participants, and will help you work out how to best organize your materials. It will also give you some examples to show participants.

To familiarize yourself with the activity, use the activity booklet. It provides step-by-step instructions for the activity. It also includes contextual information about Mary Shelley’s novel *Frankenstein* and the questions the story raises for current science and engineering.

**Activity flow:**

Open by asking participants if they’ve ever heard of Frankenstein’s “monster.” Share that the original story was written 200 years ago by Mary Shelley, and has been retold many times. Ask if they know what happens in the story, and establish the basic plotline. In the novel, a student named Victor Frankenstein builds a creature from dead body parts, and uses electricity to bring it to life. Unfortunately, Frankenstein didn’t think ahead to what his creature would do, or how he would take care of it, if he succeeded in bringing it to life.

Ask if participants know what an automaton is. An automaton is a machine that works automatically, like a clock. It can be wound up and will do something interesting. (Some people may know of automata from Brian Selznick’s book *The Invention of Hugo Cabret,* or the movie based on it.)

Make a connection between Shelley’s *Frankenstein* and automata by explaining that these special devices were very popular during the time Mary Shelley was alive and may have inspired her. Mary Shelley was probably familiar with some famous automata of her era, which mimicked people doing tasks like writing or playing instruments.

Show participants some example automata projects and ask them if they’d like to make their own device and make it move. Emphasize that they will use their own creativity (but you or a caregiver can help as needed).

In this project, participants make a simple automaton that uses a cam system. Share the activity booklet with participants so they can follow the instructions and read the information.

It is best if participants get their cam system aligned properly and working well *before* they add the decoration on the top. It is easier to make adjustments before the decoration is in place. In addition, the working system can give participants good ideas for figures or other decorative elements that work well with the motion of the cam and follower (or vice versa).

Once participants have successfully constructed the simple spinning movement, they can try other movements such as up-and-down or side-to-side before they decide on their final theme or decoration. A simple round cam and follower will spin the skewer (and decoration) around. An oval-shaped vertical cam will add an up-and-down motion as the skewer spins. Consult the supplementary info sheet that shows how to build systems that will create different motions.

As participants work, you can help them with the mechanics of their automata and ask guiding questions:

* *What will you put on top of your automaton?*
* *Can you make something that looks like it’s alive?*

As they complete their project, be sure to ask participants some or all of the reflection questions! These questions will give participants a chance to think about why people create, and to consider why it might be important to plan ahead and take responsibility for the things we create:

* *Is your automaton alive?*
* *How can you tell the difference between a machine and a living creature?*
* *How do you feel about automata? Are they cool or creepy?*
* *What is the difference between people and machines?*

Finally, return to Mary Shelley’s story. Victor Frankenstein built a creature and brought it to life, but he didn’t take responsibility for it. The creature was miserable, and did some very bad things. For example, he set fire to the house of a family that was mean to him.

* *Is the creature to blame for his crimes?*
* *Should he blame Victor for his suffering?*

There are no right or wrong answers to the reflection questions! Everyone can form their own opinions. You can help encourage participants to develop and share their own ideas by referring to the Conversation Tips guide.

**Additional tips:**

Some participants will need help building their cam systems. Be sure you have enough facilitators on hand to help participants.

**Audiences:**

Younger children and individuals with special needs may need assistance with some steps in this activity.

**Safety:**

* Supervise young children to ensure they do not mouth any materials, as some materials may present choking hazards.
* Advise participants to be careful with the skewers, as they have a sharp end, and assist as needed (particularly with young children).
* Be sure to tape over the sharp end of any exposed skewers once the cam system is in place.

**PROGRAMMING OPTIONS**

This activity can be incorporated into a variety of educational programs, such as after-school programs, family workshops, and summer camps. In longer program formats, you can use videos and books to familiarize participants with the Frankenstein story:

* The 1931 Hollywood movie *Frankenstein,* directed by James Whale, introduced the world to Boris Karloff’s iconic version of the creature.
* *Frankenweenie* is a 2012 retelling of the Frankenstein story directed by Tim Burton.
* There are also many books that share the story, which are appropriate for a variety of audiences.

You can also use videos to show participants examples of automata, computers, and robots.

* The news segment [Lost Art of Automatons Alive Again](https://youtu.be/C7oSFNKIlaM) (CBS Sunday Morning) explores how these machines can sometimes seem alive. YouTube: https://youtu.be/C7oSFNKIlaM
* A game show segment entitled [IBM’s Watson Supercomputer Destroys Humans in Jeopardy](https://youtu.be/WFR3lOm_xhE) (Engadget) supports conversation about the difference between mechanical automata and computers. YouTube: https://youtu.be/WFR3lOm\_xhE
* In [Robot Meets Self Driving Car](https://youtu.be/vtX-qVUfCKI) (Mobilegeeks.de), two humans take a humanoid robot for a ride in a self-driving car. YouTube: https://youtu.be/vtX-qVUfCKI.

# MATERIALS INFORMATION

**Sources:**

* Plastic deli containers can be purchased in bulk at restaurant or packaging supply companies, or you can reuse clean food containers. You can also use jumbo plastic drinking cups, available at grocery and discount stores. Make sure you choose containers that are made from a material that you can punch holes in, and that won’t crack or break easily.
* Bamboo skewers and drinking straws are available at grocery and discount stores.
* Foam circles can be cut from thick craft foam (3–4 mm, or about ¼” thick). Sheets of craft foam are available at many craft, educational supply, and discount stores; the thinner sheets are more common, so be sure to check the thickness.
* All other materials are available at craft, educational supply, or discount stores.
* Print materials for this activity can be downloaded from [nisenet.org](http://nisenet.org/).

**Preparation:**

* Make holes in the deli containers ahead of time, using a drill, awl, or other tool. Choose a tool that creates a hole your straws and skewers will fit through. Place one hole in the center of the bottom of the container. Place two holes in the sides of the cup, directly across from each other.
* Cut drinking straws into ½” pieces.

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Distributed in collaboration with the National Informal STEM Education Network: nisenet.org



This project was supported by the National Science Foundation under Grant Number 1516684. Any opinions, findings, conclusions, or recommendations expressed in this program are those of the authors and do not necessarily reflect the views of the Foundation.

This is a common activity that exists in many variations. The Frankenstein200 version was adapted fromMicro Automata, developed by the CSWNetwork. Retrieved from: http://www.cswnetwork.org/projects/projectDetails.php?projID=172

Instruction and promotion photos and illustrations by the Science Museum of Minnesota for Frankenstein200.

Illustration from an early edition of *Frankenstein* from Wikimedia Commons. Retrieved from: https://commons.wikimedia.org/wiki/File:Frankenstein,\_pg\_7.jpg

Photograph of 18th century Swiss automaton from Wikimedia Commons. Retrieved from: https://commons.wikimedia.org/wiki/File:CIMA\_mg\_8332.jpg

Photograph of Boris Karloff as Frankenstein’s monster from Wikimedia Commons. Retrieved from: https://commons.wikimedia.org/wiki/File:Frankenstein%27s\_monster\_(Boris\_Karloff).jpg

Photograph of driverless car from Wikimedia Commons. Retrieved from: https://commons.wikimedia.org/wiki/File:Waymo\_self-driving\_car\_front\_view.gk.jpg 1/3