Overview

This set of projects serves as an introduction to automata and mechanical toys. The whole set, or parts of it, can be taught. It includes:

- the Explorerium's basic introduction to cardboard automata (1-2 hours, timing is very flexible depending on available time, complexity of cams and projects, and availability of craft supplies)

- Robives' Agreeable Sheep automata project, also available on instructables.com (1-2 hours) The Agreeable Sheep project and instructions also exist as video tutorials via Google.

Photo credits from instructables.com and exploratorium.edu
**Educator Tips**

**Facilitation**
- The project set can be divided up over multiple days, weeks, or class sessions. Time estimates for each project are included on page 1 and in each project guide.
- The projects are meant to address similar (if not the same) concepts in different ways. The cardboard automata project allows for a bit more creativity, as well as a choice of cam complexity. The Agreeable Sheep project dictates the movement and mechanism, as well as the character, allowing students to focus on the assembly.
- Teachers can create a checklist of steps for each project. For example, teachers may dictate that students should choose a mechanism requiring only one cam and one cam follower, or teachers may require that students use at least 3 different types of craft supplies.

**Supply Shopping and Prep**
- Supplies for these 2 projects are basic craft supplies, easily found at the local Michael’s, Joann’s, craft store, recycling/reuse store, or dollar store.

**Project Modification and Extension**
- These projects are just the beginning! There are hundreds of more automata-related projects. Look to robives.com, instructables.com, and old mechanical toys (such as Jack-in-the-box and others).
- In addition to cardboard and cardstock, incorporate the use of new materials, including balsa wood, soft or hardwood, acrylic, etc.
- Create products that integrate electronics, motorized components, and lights.
- Design and draw automata before building them.
- Create 2D and 3D models. If 2D, the pieces can be cut on the laser cutter and assembled by hand.

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**Tools and Materials:**

**Materials (Consumable)**

- **Cardboard Automata (Exploratorium) (quantity per individual project)**
  - (1) or (0.5) cardboard box, approximately 6x6x6 or any similar size. Boxes can be cut in half for use by 2 students. These boxes can be easily sources from the US Post Office or FedEx.
  - (1) glue stick
  - liquid white glue
  - (1-2) bamboo skewers
  - (1) hot glue stick
  - (0.5) foam sheet
  - (1) straw
  - tape, masking or clear packing
  - pipe cleaners, multi-color
  - googly eyes
  - construction paper
  - fluffy balls
  - corks
  - buttons, caps, and other recyclable materials for decoration

- **Agreeable Sheep**
  - printed templates, on cardstock
Project Instructions

Cardboard Automata

Organize and prep your supplies.

Before you begin, make sure you have a full inventory of everything you need! This project takes approximately 1-2 hours but timing is very flexible, depending on complexity of cams, availability of time, and availability of craft supplies.

- 1) or (0.5) cardboard box, approximately 6x6x6 or any similar size. Boxes can be cut in half for use by 2 students.
- (1) glue stick
- liquid white glue
- (1-2) bamboo skewers
- (1) hot glue stick
- (0.5) foam sheet
- (1) straw
- tape, masking or clear packing
- pipe cleaners, multi-color
- googly eyes
- construction paper
- fluffy balls, corks, buttons, and other recyclable materials

Resources:
The Exploratorium’s Cardboard Automata guide is available here for download.

Robives.com also contains a number of other automata projects, available for purchase and download.


Get started!

You may want to start by reviewing cams and showing the differing movements.

Or students may jump right now and begin building.

Some may first decide on a character, sculpture, or object (to be displayed and moving on the top-side), or some may start building and finagling with the cam mechanisms.

Helpful Hints

- The cardboard structure may need to be stabilized by adding an additional support at the top or in the middle. It’s easy to use hot glue as an adhesive.

- Cams are sturdier if created out of 2-3 layers of foam sheets (glued together with glue sticks or liquid glue), or out of cardboard.

- The vertical skewers may need additional support via straws, corks, or other stabilizers.
Agreeable Sheep
Organize and prep your supplies.

Before you begin, make sure you have a full inventory of everything you need! This project takes approximately 30 minutes.

- (1) copy of Agreeable Sheep, on cardstock
- scissors

You may want to scale the current template to a large size for bigger sheep!

Templates and instructions are available at robies.com or instructables.com

Get started!
Simply cut out all of the pieces, and begin to fold and assemble them together.

The end product should be a sheep that nods its head as students turn the crank.

Helpful Hints
- Cutting may take a bit of time. To save time, teachers can opt to have pieces cut out beforehand, if necessary.
- If scaling up, be sure to keep all pieces in the same proportion.
- The sheep can be decorated further!

Resources:
The Agreeable Sheep project and instructions also exist as video tutorials via Google and YouTube.