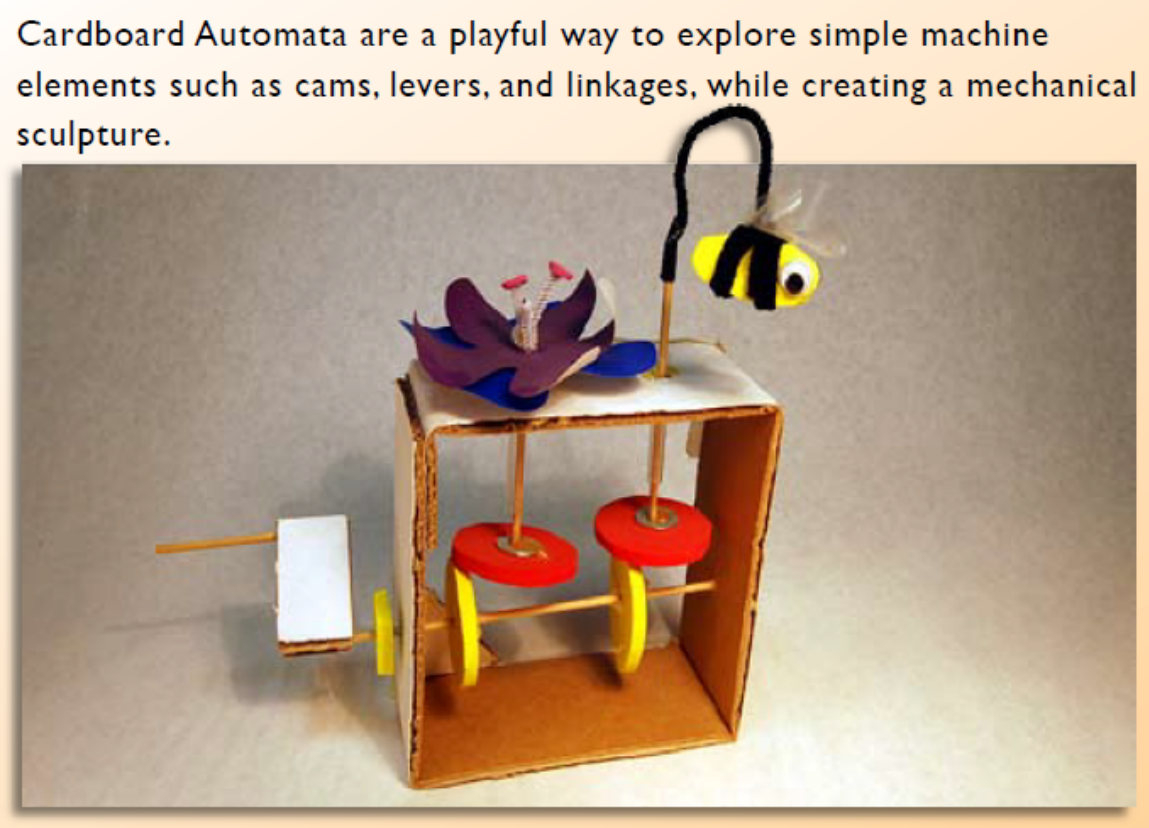
Curious Contraptions



(from The Exploratorium, San Francisco)

All groups will build the same cardboard frame and handle for their automaton mechanism. Each group will be able to customize their contraption to produce the desired movement.

Outline

Period 1	• 20 min: introduction to the workshop and its safety rules • 30 min: marking up and cutting frame
Period 2	• 20 min: students finish frame, axle, and handle • 30 min: students start building automaton mechanisms
Period 3	• Mechanisms
Period 4	• Last minute adjustments • If time permits, decorating contraptions

Materials and Tools

Materials

- Cardboard
- Brochette sticks
- Straws
- Popsicle sticks
- Foamcore
- Coroplast
- Elastics
- Wire
- Pipe cleaners
- Masking tape
- 1/8 inch dowel
- 1/4 inch dowel

Tools

- Hot glue gun
- Utility knife
- Safety ruler
- Rulers and protractors
- Wire cutters
- Cutting pliers
- Long-nosed pliers
- Saw and mitre box

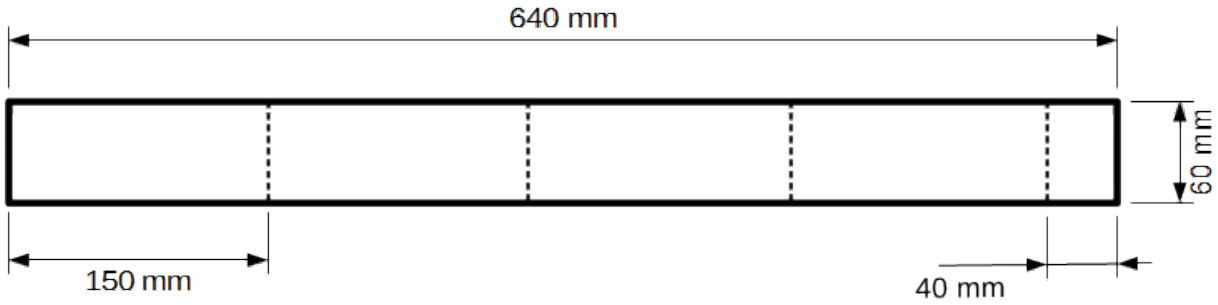
Instructions

Common Steps

All students will produce the same basic frame for their automaton

1. Make the basic frame for your automaton, a square 15 cm on each side, with a depth of 6 cm

   A) Measure and mark out the piece of cardboard to cut (*the frame*)



   B) Cut out the frame

   C) Score the dotted fold lines

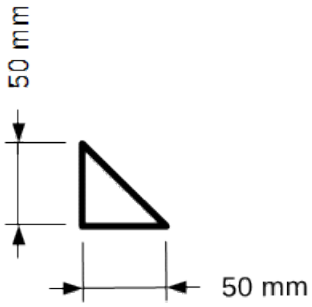
   D) Fold up the four sides of the square and glue it together using the small flap of cardboard and hot glue

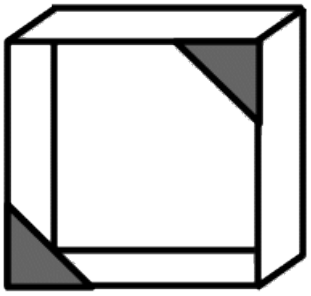
2. Stabilize the frame

   A) Measure and mark out two triangles (*the stabilizers*)

   B) Cut out the pieces

   C) Glue them in opposite corners in order to stabilize the square frame





3. Prepare the axle and handle

   A) Cut a stick (*the axle*) long enough to stick out both sides of the box and to hold the handle

   B) Cut a rectangle of cardboard, for the handle

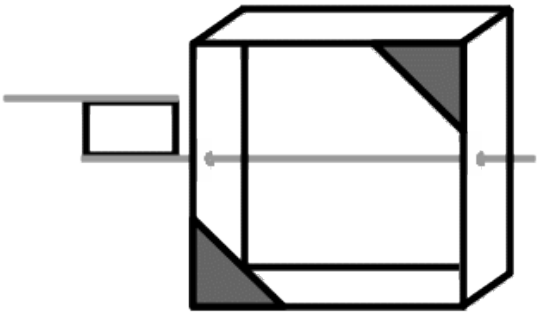
   C) Cut a smaller piece of stick, for the handle

   D) Assemble *the handle* on the axle using hot glue

   E) Cut 2 small squares of cardboard (*the bushings*)

   F) Put one bushing on the axle, next to the handle. If the bushing is loose, glue it *on the side of the handle, not on the side of the frame*

4. Prepare the holes for the axle. Insert the axle into the frame. Test that it moves easily



   A) The 2nd bushing will go on the end of axle outside the frame, opposite the handle. *Do not glue it in place yet*

Individual Design

You now have the chance to design and build the movement you wish, based off the common frame

1. Decide on the type of movement desired. The following factors will influence the movement
    A) Shape of the cam or wheel
    B) Number of cams or wheels
    C) Placement of the follower relative to the cam or wheel
    D) Presence of levers or other mechanisms included in the automaton
2. Build and test many solutions. Adjust as much as you need to get the movement you like
    A) Cardboard is cheap and plentiful. If you don't like the movement, try adjusting the piece or starting over
    B) Remember to first attach a piece with a removable link (i.e. tape) to test the movement, then with a non-removable link (i.e. hot glue) to solidify it once you are sure

Evaluation

Construction

- Does the box respect the dimensions given?
- Is the box stable; does it stand upright on its own?
- Does the handle move freely?
- Does the mechanism produce movement in the automaton on top of the box?

Design

Each group will produce a report (written, PowerPoint, Prezi, video, website, poster, etc.):

- Show a design plan of the mechanism both inside and on top of the box. Include a drawing of the shape of your cam or wheel.
- Include a front view of your automaton, with all of the parts labelled.
- Explain the mechanism. How does it work, in theory?
- Does your mechanism work as described in theory? In not, why not?
- Regardless of whether your automaton worked as desired or not, what would you change, add, or do differently if you had the chance to make your contraption work better? Note that this question asks about how it moves, not how it looks or how pretty it is!

Teamwork

Each person will submit a worksheet describing:

- Who did what in the group? How was the work divided? Be specific.
  Think of all of the steps of the project: the design, the production, and the “marketing” of your automaton (the report).
- Why did your group divide the work in this way?
- If you worked with this person or these people again in the future, how would you improve your working relationship in order to produce better results?