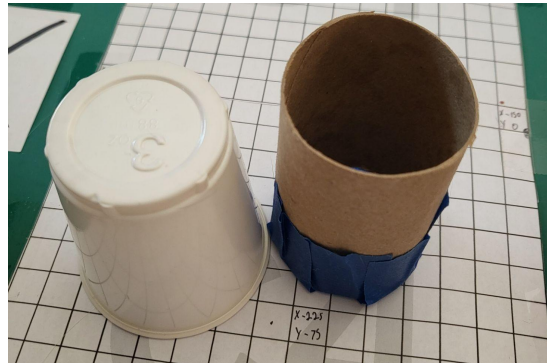
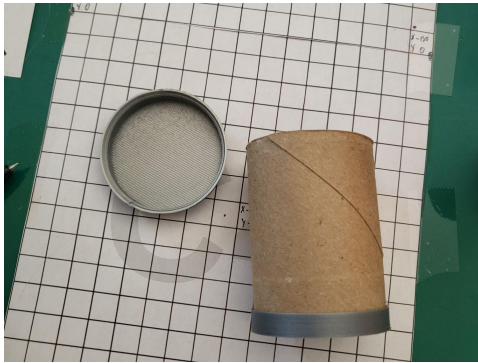


Pack and Play; ORA Style



- Above are two options for the 'shipping tube.' Version 1, left, uses 3D printed end caps ([file located here](#)). Version 2, right, uses masking tape and a 3-oz plastic bathroom cup. These can be teacher-created or student-created.
 - Version 1 requires 4 cardboard tube sections of 60mm each. This will mean 4 toilet paper tubes or 2 paper towel tubes. Then, print 8 of the [3D printed end caps](#).
 - Version 2 requires 4 cardboard tube sections (see above). Cover the bottom hole with tape and then use a 3oz bathroom cup as a top cap.
 - For more pictures and details, [please visit this slide deck](#).

Direct Instruction

Engage with Online Ordering!

Start the Engage section by presenting the students with the lesson challenge. Tell students:

"For this challenge, you will assume the role of Automated Packaging Technician at ORA Mechatronics. Cylinder-4-U, an online store featuring red, wooden cylinders (Slogan: 'Make a big statement with a tiny conversation piece!') has contacted your company about using an ORA to automate their shipping process. Their business went viral on social media and is seeing record sales. They need your help to fulfill orders and get them shipped!

Have the students spend a few minutes thinking about online shopping/ordering and answering the questions in the Engage section of the Student Activity Sheet. Then tell the students:

"Before we can solve this challenge, we need to learn more about robotic arms in the packaging industry and the careers related to them!"

Next, show the Lesson 11 video.

Explore Packaging Technician Career Connections

Students will do a brief guided virtual scavenger hunt related to the Packaging Technician career connection. Individually or in small groups, have them complete the Explore section on the Student Activity Sheet. If students are struggling with the job outlook section, have them go to the [US Department of Labor and Statistics Occupational Outlook Handbook](#). In this tool, you can find information about thousands of jobs. On the Index page, search for your career (Use Ctrl+F on a Windows machine or Chromebook). When you click on the career of your choice, there is a short video about the career as well as several key pieces of information. Packaging Technician is not available on this list, but there is a Packaging Engineer, a subset of Industrial Engineers, which could be a good stand-in.

Explain the uses of robotic arms in the Packing Industry.

Start the Explain section by asking the students, "How are robotic arms used in the packing industry?" Students should be able to recall from the video different aspects of the automated packaging process using robotic arms, such as lifting heavy objects, precisely picking and placing products, and sorting.

As discussed in the video, robotic arms are used in many ways in the packaging industry, including:

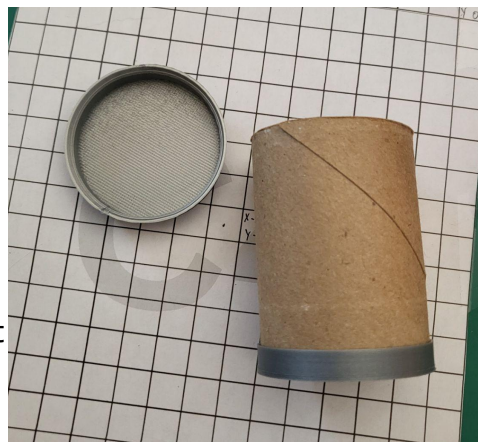
- Picking and placing: Robotic arms can pick up products and place them into boxes or containers.
- Palletizing: Robotic arms can stack and organize products onto pallets.
- Labeling and sealing: Robotic arms can label and seal packages.
- Sorting: Robotic arms, along with camera inputs and machine learning, can quickly sort packages for different destinations.

Hold up one of the wooden cylinders and ask the students, "What sort of packaging would we expect to use if we were shipping a single wooden cylinder? After getting responses, tell the students that we will be using a shipping tube. After that, ask the student, "If this item were fragile, how would you ship it to ensure that the item will arrive unharmed?" This will get students thinking about the Extension challenge if they will be doing it.

Preparing Materials for the Lesson

Challenge (skip this step if providing pre-made shipping tubes)

Show the students a shipping tube. Tell students that they will need to create 4, identical shipping tubes based on the materials provided.



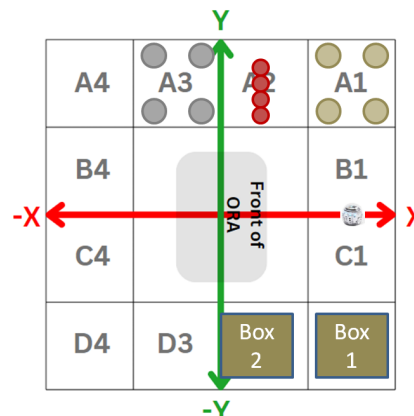
Lesson Plan 11: Pack and Play; ORA Style

Elaborate: ORA-Evo Cylinder Packaging Team

In this challenge, students program ORA to package 4 wooden cylinders in the shipping tubes. Next, students will park ORA in the Initial Position to allow a human coworker to attach and secure the caps with tape. Then, ORA will use Evo to scan the packages. ORA will use a logic statement to determine if the shipping tube will get sent to Box 1 or Box 2. Students will also program Evo to concurrently notify the human worker when it is safe to enter the workspace to attach the caps.

Setup:

Place 4 shipping tubes in A1 with the bottom capped/closed. Place four cylinders, on end, in A2. Place the 4 end caps in A3. Place Evo in between B1 and C1. Place the two boxes in D1 and D2.



Task Requirements:

1. ORA must start in the initial position.
2. ORA must use the vacuum grippers to pick the cylinders and place them in the shipping tubes in A1.
3. ORA must then pick up and place the caps on the shipping tubes
4. ORA will return to the initial position while the human coworker attaches the shipping tube caps and secures them with tape.
5. ORA must wait at **least 60 seconds** for the human coworker to attach the caps and move to safety.
6. Evo must illuminate green when humans may enter the ORA workspace.
7. After the caps are installed and the human coworker is out of the way, ORA will pick up Evo and use Evo to scan (light up) each shipping tube. Evo will be replaced back in its starting position.
8. ORA will then pick up each shipping tube and, using a logic statement, determine which box the package will go into.
9. ORA must finish in the Initial Position.

Direct students to plan this code in the Elaborate section of their Student Activity Sheet. After writing the pseudocode, and drawing the code blocks, direct students to create the code on their devices in the Ozobot Editor. Ensure students are connected to your shared workspace.

As students complete their code, they will test their code. Click on a given student's or student group's tab on the Ozobot Editor. Click "Run" to execute their code. Reset the materials between each code run. Remember to follow the Safety Protocol established in ORA Essentials. [Example solution code](#).

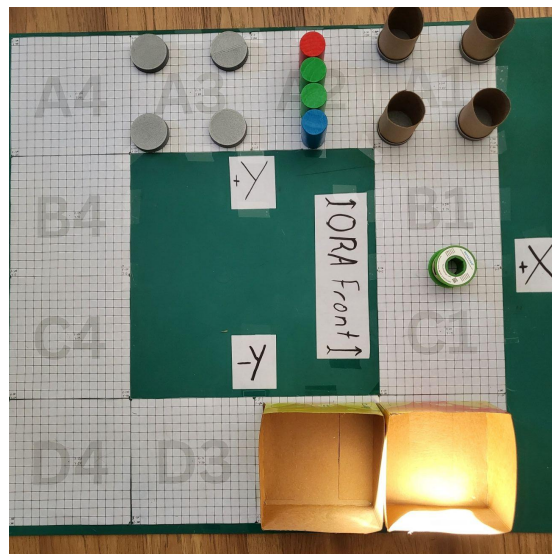
Lesson Plan 11: Pack and Play; ORA Style

If students are waiting for the ORA, they could complete the Evaluate section of the Activity sheets as an exit ticket.

Elaborate: Example solution

1. Setup

- Below is an image of the setup for the lesson challenge. Note: The tubes in A1 already have a base attached. Also, Evo is represented by the green spool of similar size.



2. Designed Materials

- For this challenge, the teacher or students (teacher's choice) will create 60mm cardboard tubes. Instructions are located in the Teacher Tips on how to create caps from either a 3D print file or 3oz cups and tape.



3. Sample Code

- [Example Solution Code](#)
- Note: This code is designed for the 3D printed caps. If you substitute 3oz cups, then change the pickup Z height to 57mm and increase the drop off height accordingly. In the "Scan" and "Sort Cylinder" functions, increase the Z height by 15mm.

4. Code Description

- The code begins when ORA moves to A2 and picks up the first cylinder. This is placed in the 'shipping tube' in A1. This process is repeated for all four cylinders and tubes. Then, ORA will move to A3 and pick up the caps to gently place on top of the tubes. ORA will park in the Initial Position for

Lesson Plan 11: Pack and Play; ORA Style

60 seconds while students secure the caps. This will include a gentle press-fit and a piece of tape. If 60 seconds is not long enough, please change the wait time accordingly! Once caps are secure, ORA will pick up Evo and hold Evo over each tube while Evo “scans” the package. Then, after placing Evo back down, ORA will pick up each cylinder and use a logic function to “sort” the cylinders into the ‘outbox’ of D1 or D2.

Evaluate: Exit Ticket

Students will fill out and submit the Elaborate section of the Activity Sheets as an exit ticket.

Optional Extension: ORA-Compatible Packing Material

In this activity, students will attempt to find out the best packing material(s) that are ORA compatible. Students will alter the code from the Elaborate section to include a step where ORA adds packaging material to the shipping tube.

Setup: Use the same setup as the Elaborate section along with student-created code.



Source: Canva

Task Requirements:

1. Students will research different types of packaging materials and determine the best compatibility with the ORA vacuum gripper.
2. Students will modify their code from the Elaborate section to include a step to add packaging materials to the shipping tubes.
3. Students will source and/or create packaging material.
4. Students will create any necessary tools to add the packing material.
5. ORA must complete packing/scanning/sorting tasks and then return to the initial position.

