



The Sturdy-Motorized Car

Lesson Objective: Teach the students about Lego motors, wires and the RCX by building a motorized car.

Concepts: Simple car, Motors, Outputs and Electrical connections

The Challenge: To build a car that will move using RCX and motors.

Materials:

- Lego Mindstorms Kit

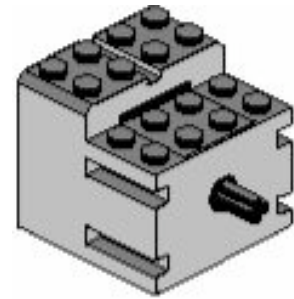
Vocabulary:

- Axles
- Wheels
- Bushings
- Motor
- Connecting wire
- Batteries
- RCX brick
- Output

Procedure: Begin the lesson with these ideas, questions and demonstrations.

Show the students the RCX motor and ask some questions about it.

- What do you think this Lego piece is for?
- Where have you seen a something like this?
- Do all motors look the same?
- Why were they invented?
- What does a motor do?
- What makes a motor run?
- Do all motors run on the same fuel?
- What does our Lego motor need to make it move?



Introduce the RCX and ask some questions about it.

- Has anyone ever seen one of these before?
- What is it called?
- What do you already know about it?

Take time here to discuss the different parts of the RCX. Refer to the reference pages if you need clarification of ports. A good hint is the gray ports are for the sensors (inputs) and the black ports are for the motors and lights (outputs).

Explain that program 1 and 2 are locked, and those are programmed into



the brick and cannot be changed. Those are the programs that we will work with today. We will not use the computers yet.

Go over the sequence of how to get the RCX to run.

1. Push the on/off button
2. Check your program number
3. Press run

Introduce the connecting wire. Show the inside of the RCX and count how many batteries are needed. Explain how the wires need to make a metal connection to send power to the motor. Demonstrate how the wire is connected to the motor and the RCX. Draw attention to the metal on all pieces. Run the motor. Also discuss the direction that the motor is spinning and how you can change direction by rotating the connecting wire on the RCX.



Show the students a pre-built model of the sturdy car they will be building. Introduce all of the different sizes of wheels that can be used on the car and their differences. Point out the two axles on the car and explain that they attach the wheels to the car and they rotate so that the wheels can move. Also, discuss what bushings are. They can best be explained as spacers that keep the axles in place and prevent the wheels from hitting the car. Lastly, be sure to point out the motors and wires used on the car.

Engineering Challenge: Explain that the children will be working with a partner or in small groups to build their own sturdy cars. Encourage them to use both the pre-built model car and the Building a Study Car sheet during construction. The students should not be expected to complete the cars in on class period. It is helpful if they have a place to store their cars between lessons.

The students should test their cars as they build to be sure that they are sturdy. The teacher can test the cars sturdiness with the 'shake test.' The test involves holding the car by the RCX and shaking it back and forth. No pieces should fall off.

Have the students complete the Lego Engineering Log or assign it for homework.

Be sure to keep the car for the next lesson!

Extensions: See next lesson.

Wrap-Up and Sharing: Review the different parts of the car. Play particular attentions to the functions of the RCX, the wires and the motors.

Ask the students some questions about their cars.

- What were the hardest parts of building the car?
- What made the car stronger?



- How could this car be used?

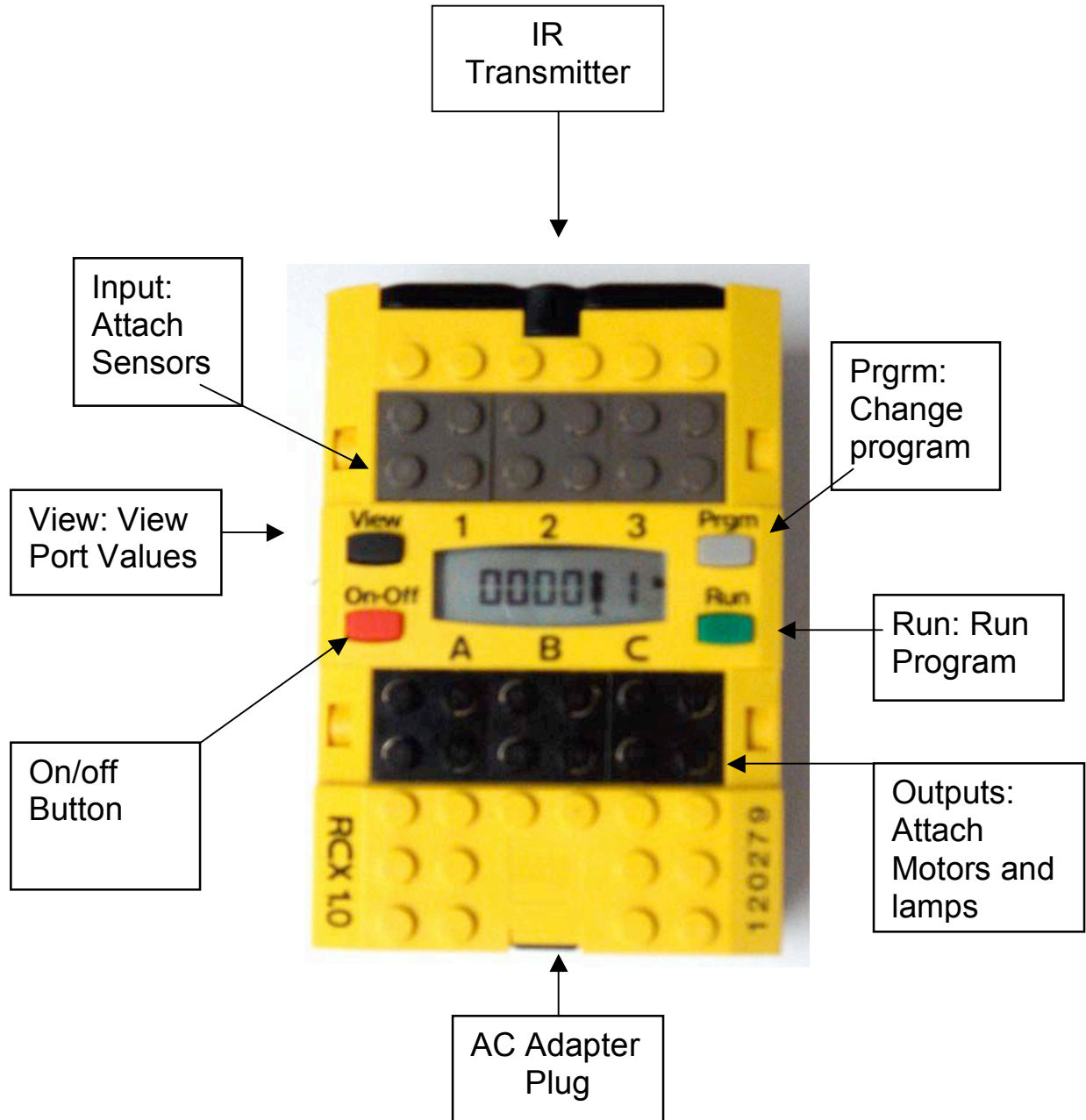
Explain to the students that they will get to use their cars in the next lesson!

Troubleshooting:

- Some students will be very familiar with vocabulary and building while for others this will be a new experience
- Watch that children do not try to make fans and put the motors close to their faces! Hair can get caught in the motor!
- Be sure that every student get a chance to work with the RCX, motors and wires. They are complicated devices that will be used in later lesson. Getting experience is the best way for the students to understand how they work.

Resources:

- Lego/Tufts website: <http://www.ceeo.tufts.edu/curriculum>
- Lego Dacta “Simple and Motorized Machines” Teacher Guide





Building the Sturdy Car

In this challenge, you have more to think about than just a sturdy chair. What you are building is now comprised of an RCX and two motors. Once again, we don't want what we build to fall apart, so here are some hints that you may find helpful when attaching your motors.

1. You'll notice that the motor is a bit shorter than the RCX. Build up your motor with plates and a brick so that they're pretty much even. Do this for both motors.



Gather two 1x2 plates, two 2x4 plates, and one 2x4 brick



Place the 1x2's in the places on either side of the smooth, slightly curved surface. Place the brick on the other side.



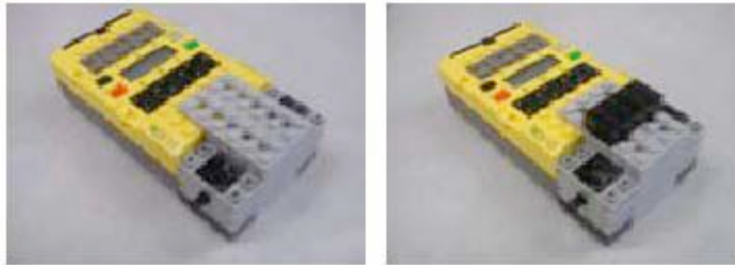
Place the remaining flat 2x4's on the 1x2's so that each side is even.



2. And then attach it to the back end of the RCX by using longer plates to support it on the bottom.



3. Place additional longer plates on the top for more support. Once you do that, you can put a brick or a plate (your choice) going across, so that the two motors don't split apart.



4. Use two beams like this on the bottom of your RCX to secure front wheels.



5. Attach front wheels to the beams, and some back ones to the motor, and you've got a simple RCX car that won't fall apart- too easily.





Lego Engineering Log

Engineer: _____ Date: _____

1. Draw your car:

2. What are two things you like most about your car?

3. What was the hardest part to build?
