Hero's Engine

**Purpose**  To demonstrate Newton’s third law of motion.

**Materials**
- Scissors
- Ruler
- Pencil
- Petroleum Jelly
- 2 flexible drinking straws
- 9-ounce (300-mL) paper cup
- 24-inch (60-cm) piece of string
- 16-ounce (480-mL) plastic cup (A small pitcher will do)
- Tap water

**Procedure**
1. Cut two 2-inch (5-cm) sections from each straw with the flexible part of the straw in the center of each section.
2. Use the pencil to make two holes with a diameter a little smaller than the diameter of the straw sections on opposite sides near the bottom of the small cup.
3. Insert one end of a straw section in each hole leaving the flexible part on the outside of the cup. Make an effort not to make the hole any bigger than the straw. Put petroleum jelly around the straw on the inside of the cup to form a seal.
4. Use the pencil to make two small holes on opposite sides below the rim of the small cup.
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5. Thread one end of the string through both holes and tie the string so the cup hangs from a long straight string.
6. Bend the flexible part of the straw sections so that they point in the same clockwise direction.
7. Fill the large cup with water.
8. In an outdoor area, hold the small cup by the string and fill it with water from the large cup. Continue to pour water into the cup as you observe the motion of the cup in relation to the direction the straw sections are pointing.

Results
The cup spins in a counter clockwise direction, opposite the direction the straw sections are pointing.

Why? Newton’s third law of motion states that for every action there is an equal reaction in the opposite direction. The spinning cup is an example of this law. The water in the cup is forced out of the straws in the cup due to the pull of gravity. This is the action. The reaction is the movement of the cup in the opposite direction. Gravity is the force that pulls things toward the center of Earth. The water in the cup is being pulled down and out the straws. The rotating cup was originally called Hero’s engine after its inventor, Hero of Alexandria (c. a. d. 60).