

Magic Hat

Introduction

The brick models and the LEGO® Education WeDo™ programs used in this activity are suitable for children from the age of seven and up, but for children at the younger end of this age range to become fully engaged in the learning process they will need to be supported and encouraged by an adult. Much of the written text is directed towards an adult reader, but certain parts of the activity have a more child-oriented approach. It is hoped that adult guidance and support will assist in making this activity a rewarding experience.

Description

In this activity you will build and program the Magic Hat. You will also build a wand with a Tilt Sensor. When the wand is waved a rabbit's head will flip up from the Magic Hat.

Objectives

- Using technology to create and communicate ideas
- Demonstrating knowledge and operating digital tools and technological systems
- Building and testing using feedback and knowledge of simple machines
- Tracing the transmission of motion

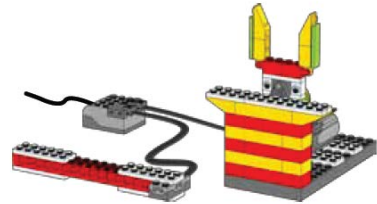
Vocabulary

As you have already tried the LEGO Education WeDo Software, the terms used in this activity should be familiar. If you need additional guidance, we recommend referring to the Teacher's Guide, which is included in both 2000097 LEGO Education WeDo Software and 2009580 Activity Pack for LEGO Education WeDo Construction Set.

- | | | |
|------------------------|---------------------|------------------------|
| • Start Block | • Wait For Block | • Any Tilt |
| • Motor On For Block | • Motor Power Block | • Motor This Way Block |
| • Motor That Way Block | • Number Input | |
| • Play Sound Block | • Tilt Down | |

The following words will be used in the activity and might need explaining:

- | | | |
|------------|--------------|-----------|
| • Friction | • Belt | • Pulley |
| • Magician | • Circus | • Top Hat |
| • Wand | • To flip up | • Magic |



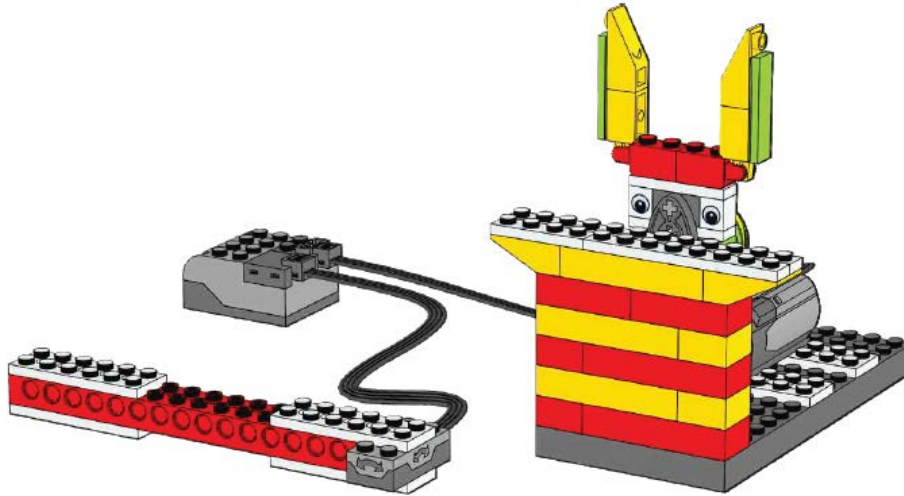
Curriculum links

Science Physical Science	Students should be taught to: <ul style="list-style-type: none"> • build and create a working model. • understand it takes energy to change the motion of objects. • investigate the effect of applying various pushes or pulls on an object. • plan and conduct a simple investigation. • explain the motion of driver and follower gears, spur and crown gears.
Inquiry	Students: <ul style="list-style-type: none"> • use critical thinking, scientific reasoning, and problem solving to make informed decisions. • explore a topic through teamwork. • brainstorm. • build and test a model. • develop the skills necessary to do full inquiry. • Ask a simple question, complete an investigation, answer a question, and share the results with others.
Communication	Students: <ul style="list-style-type: none"> • communicate verbally ideas and discuss the benefits and weaknesses of proposed solutions. • interpret illustrations.
Technology	Students: <ul style="list-style-type: none"> • write/program a logical set of steps. • work with a technology design. • explore the way things work. • experience science through technology.

LEGO® Materials Required

- 2000097 LEGO Education WeDo Software (alternatively 2000095 LEGO Education WeDo Software + 2009580 Activity Pack for LEGO Education WeDo)
- 9580 LEGO Education WeDo Construction Set

Connect



Mia and Max are at the circus. They especially love the part of the show when the magician appears with his magic hat and his wand. The magician places his top hat on a table and waves his magic wand over it. Suddenly he pulls a rabbit out of the hat. When they come home, Mia and Max want to try a magic trick just like the one they saw at the circus. They want to create a magic hat trick where a rabbit's head flips up when they wave a magic wand.

Now try the following:

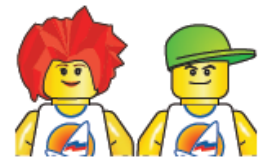
- Build a Magic Hat with a rabbit's head that flips up.
- Program the Magic Hat to react when the wand is waved.
- Create and build a wand with a tilt sensor.

Here are some other ways of connecting:

Have you ever been to the circus? Did you see a magician or a magic show? What other magic tricks do you know?

Let's imagine that you're going to give a magic show. How would you present your magic trick?

How would you be dressed? What would your magic wand and magic hat look like?

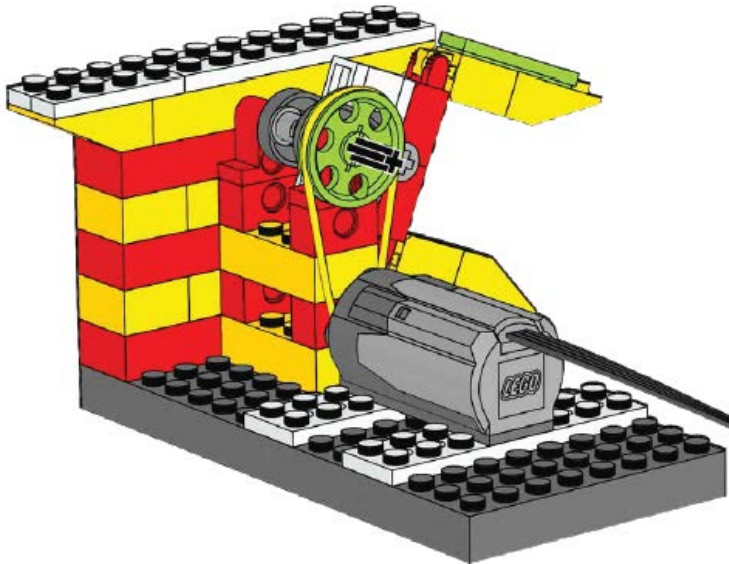


Construct

Build the model

Build the model following the step-by-step instructions, or create your own model. If you create your own you may need to change the example program.

To operate the Magic Hat best, make sure that the cams are not too tight and that the pulleys and belt can move freely. This will help to prevent friction, so that the Magic Hat can work properly. It is important that the starting position for the rabbit's head is that it is turned down as far as it will go on the rabbit's right-hand side, as shown below.



When the rabbit's head has been built, notice how pulleys are used. Pulley systems are simple machines.

Our model...

Uses a motor to turn a small pulley...

The small pulley moves a belt...

The belt moves a large pulley...

The large pulley has an axle attached to the center of it ...

The rabbit's head is connected to this axle, which turns ...

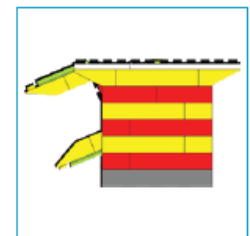
The Magic Hat works.

Try this idea or create your own!

Program the model

Program the Magic Hat to work only when the wand (with its built-in Tilt Sensor) is moved, simulating magic. You might have to change the power level of the Motor Power Block, depending on how your model works. Follow the step-by-step instructions shown below.

Try our program or create your own!



Hint

See the Software section of the Teacher's Guide for the Sound List relating the Block numbers to their descriptive names.



Contemplate

Investigate the movements the rabbit's head makes.
Try the following, and make notes of your observations.

- Watch the motor and the pulleys as they move:
 - How does it work?
 - What starts the movement?
 - Write down or draw what happens.
- Put on a magic show! Can your audience figure out how it works?

The rabbit is hidden as if it was inside the hat. A motorized mechanism moves the rabbit up when the program senses a change in the position of the Tilt Sensor in the "magic" wand.

Try making some changes to the model and the program.

Continue

Create a program, with an additional sound, so that the Magic Hat can make the rabbit both appear and disappear when you wave your wand. You might have to change the power level of the Motor Power Block, depending on how your model works. It is important to pay attention to which Tilt Sensor Input is used in the program. It is still important that the starting position for the rabbit's head is that it is turned downwards on the rabbit's right-hand side, as shown earlier.

Try our solution, or create your own!



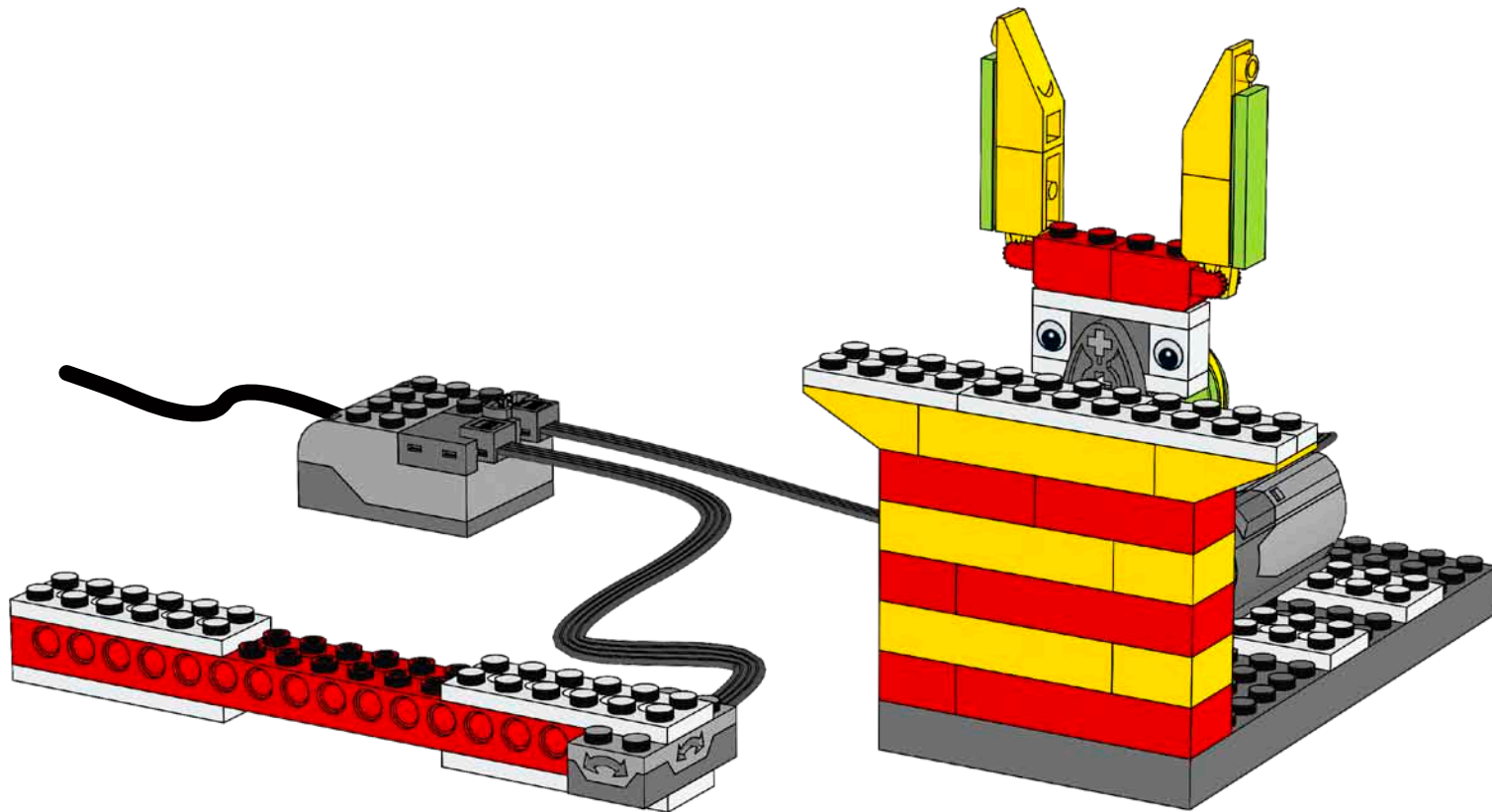
Hint

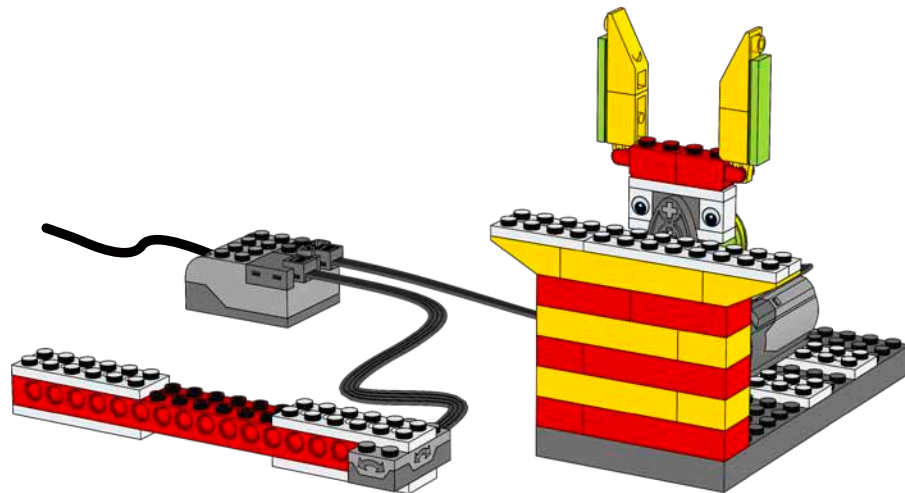
See the Teacher's Guide, "Getting Started, 6. Tilt Sensor" for another example using the Tilt Sensor.

Did you know?

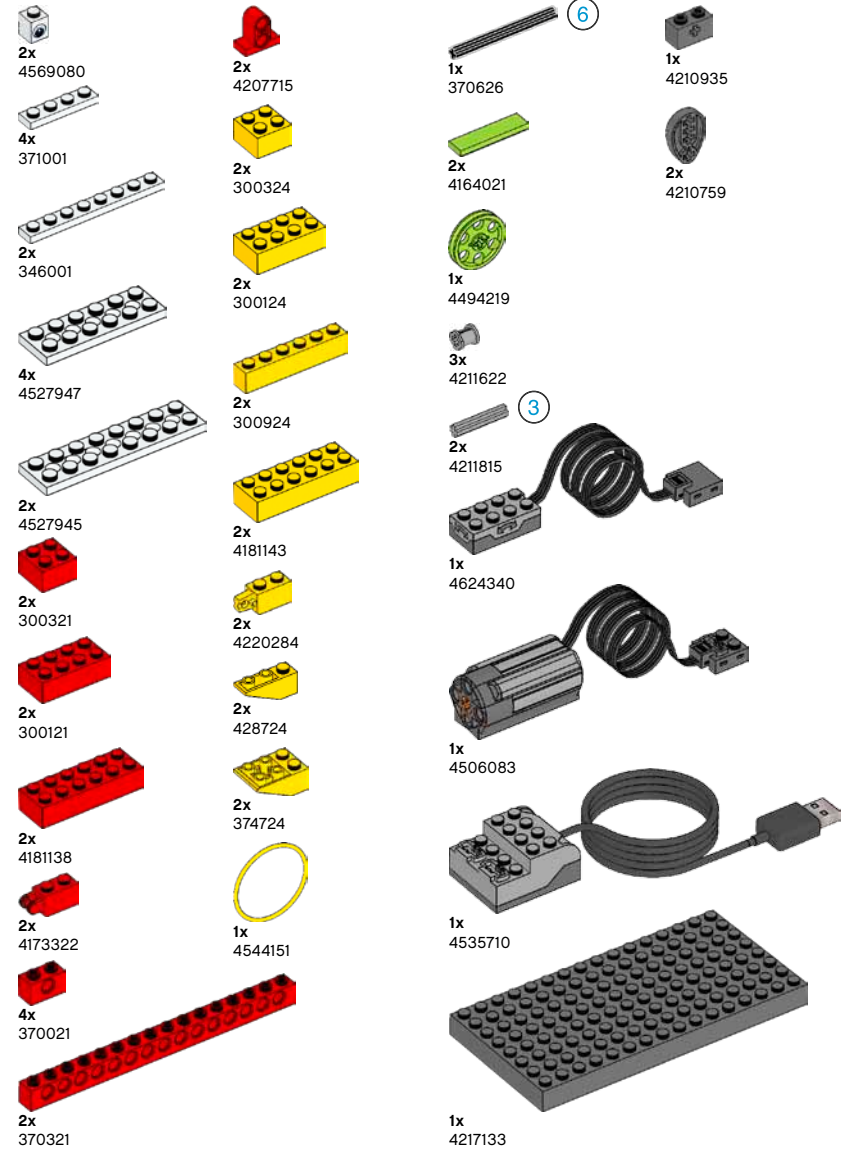
You can change the Tilt Sensor Input to any of six positions: Up, Down, This Way, That Way, No Tilt, Any Tilt. Left-click on the Tilt Sensor Input to cycle through the six options.

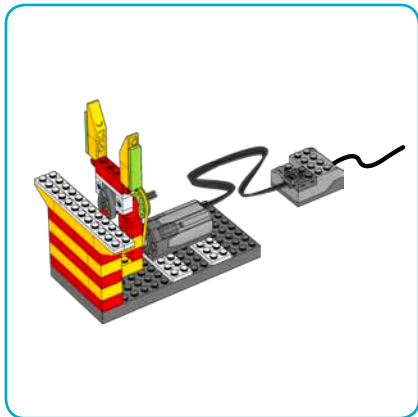




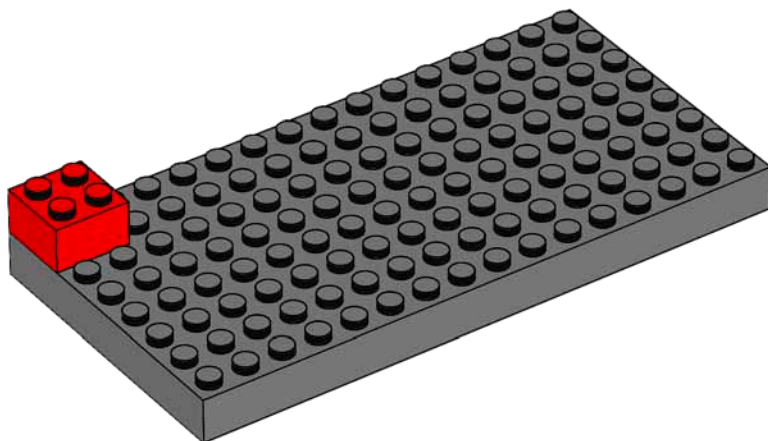


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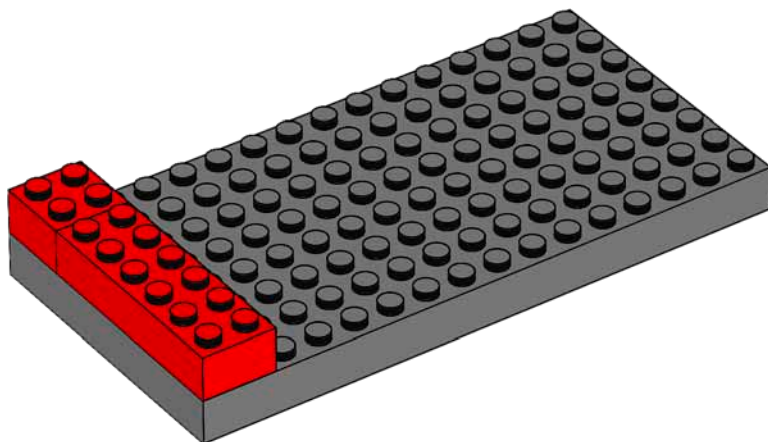




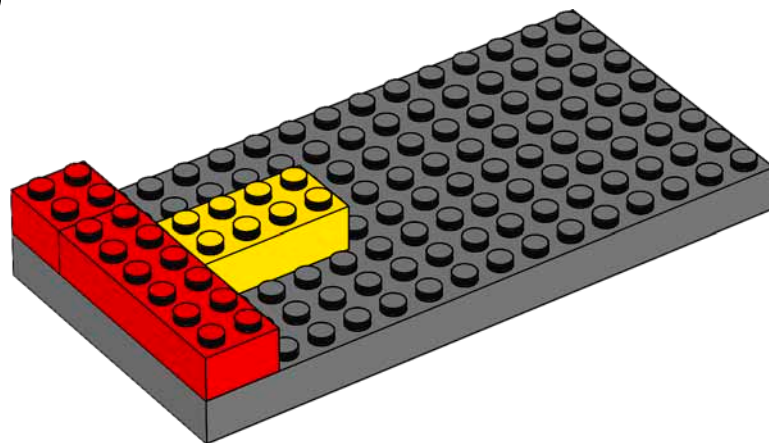
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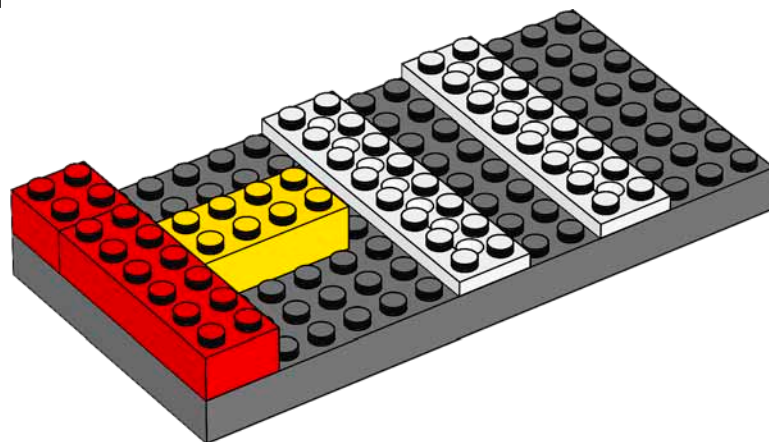
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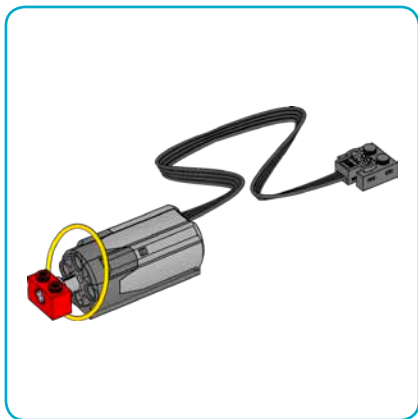


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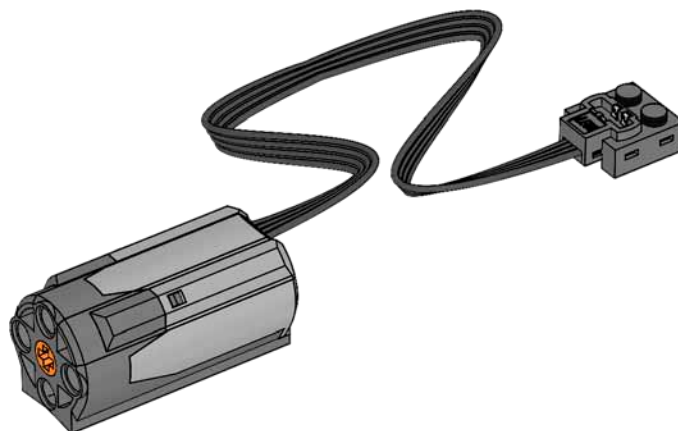


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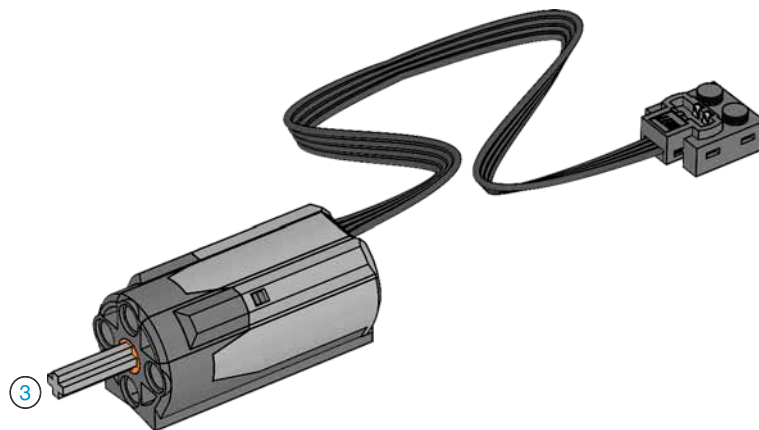




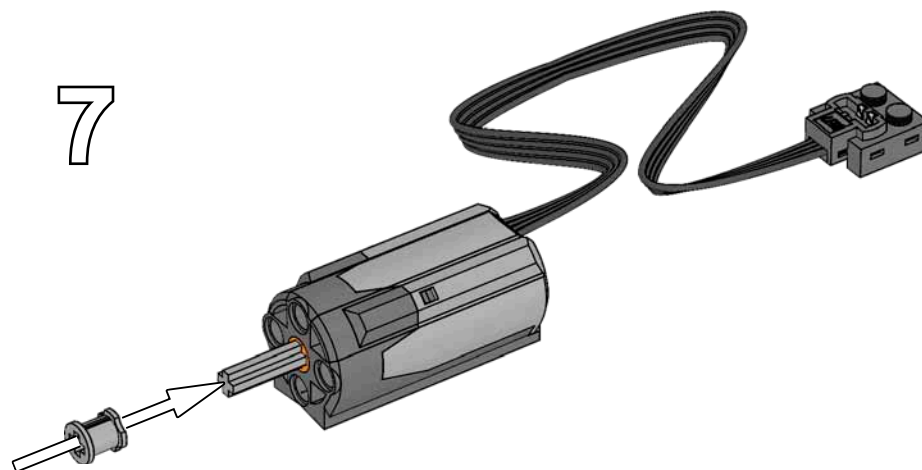
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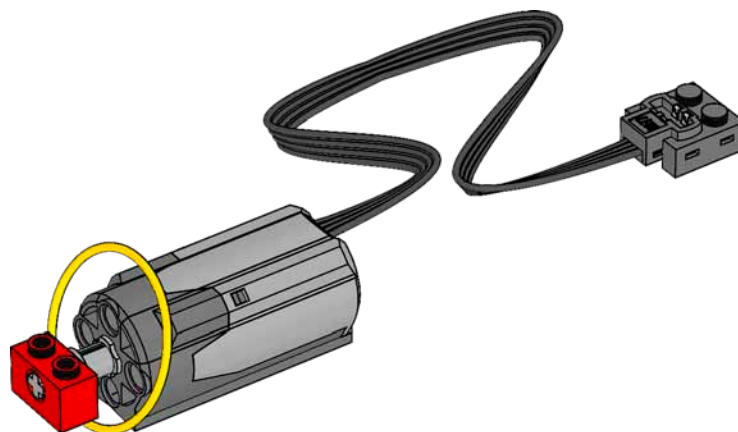
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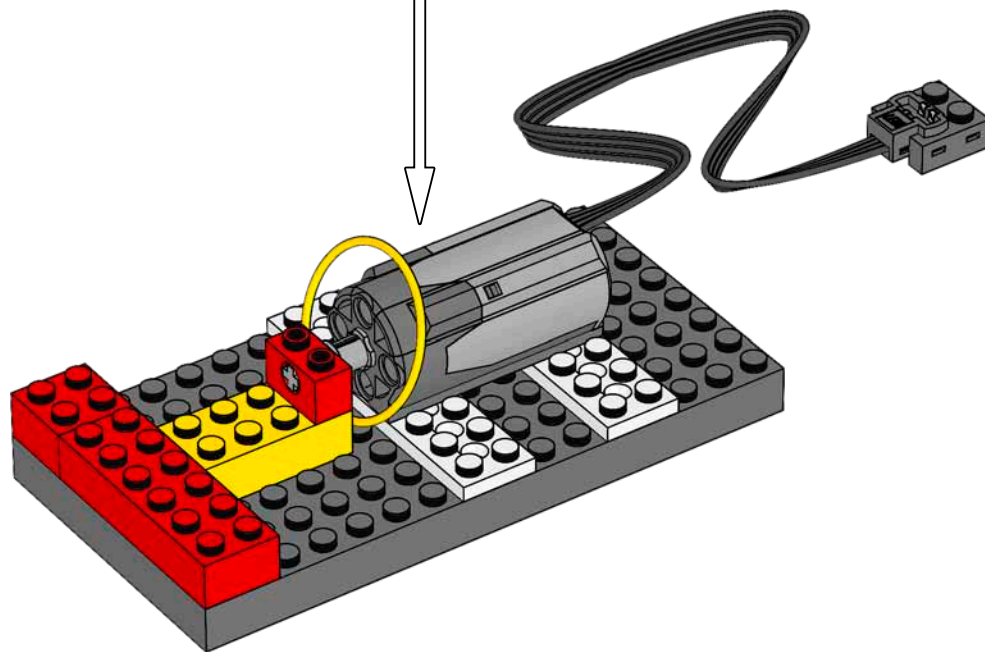
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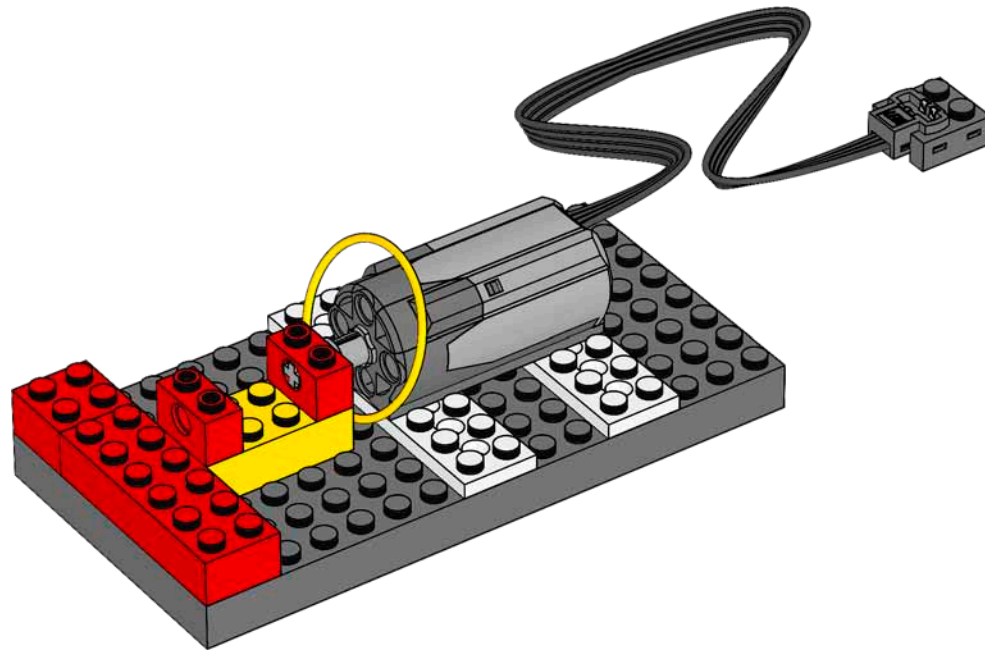
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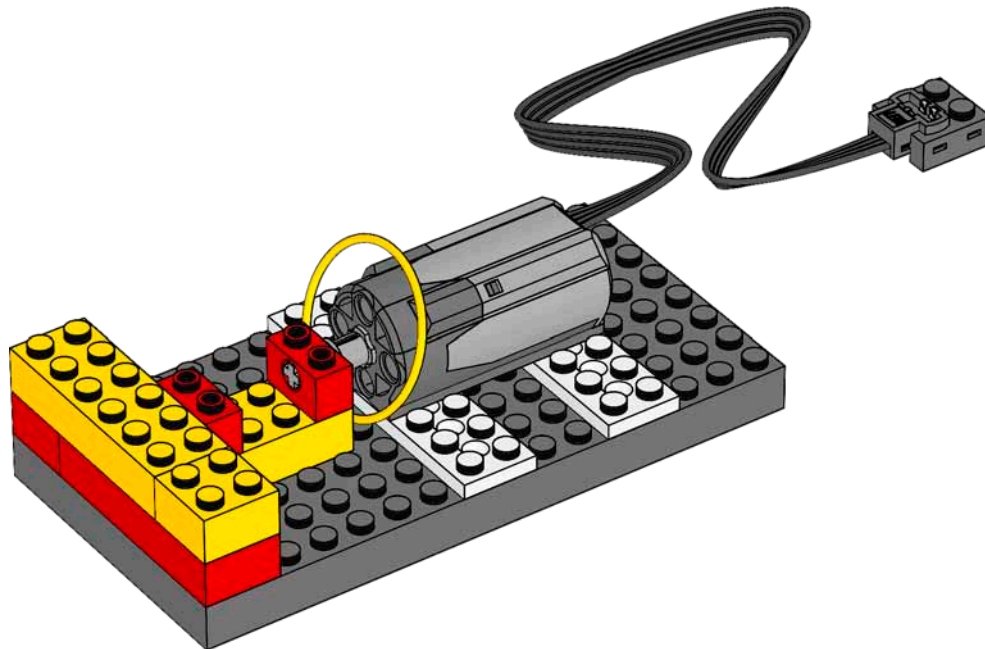
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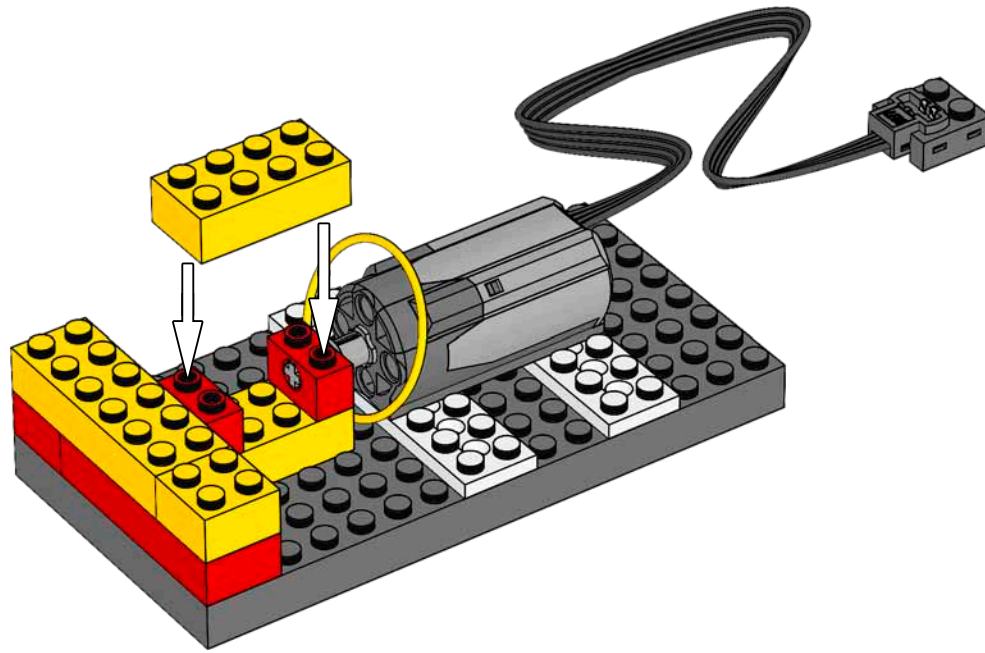
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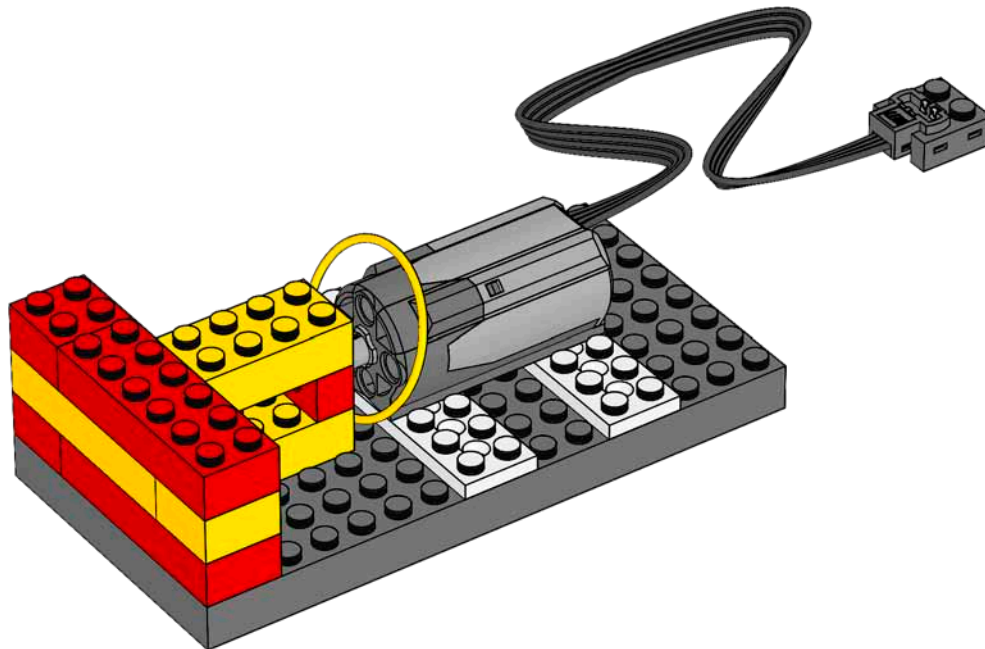
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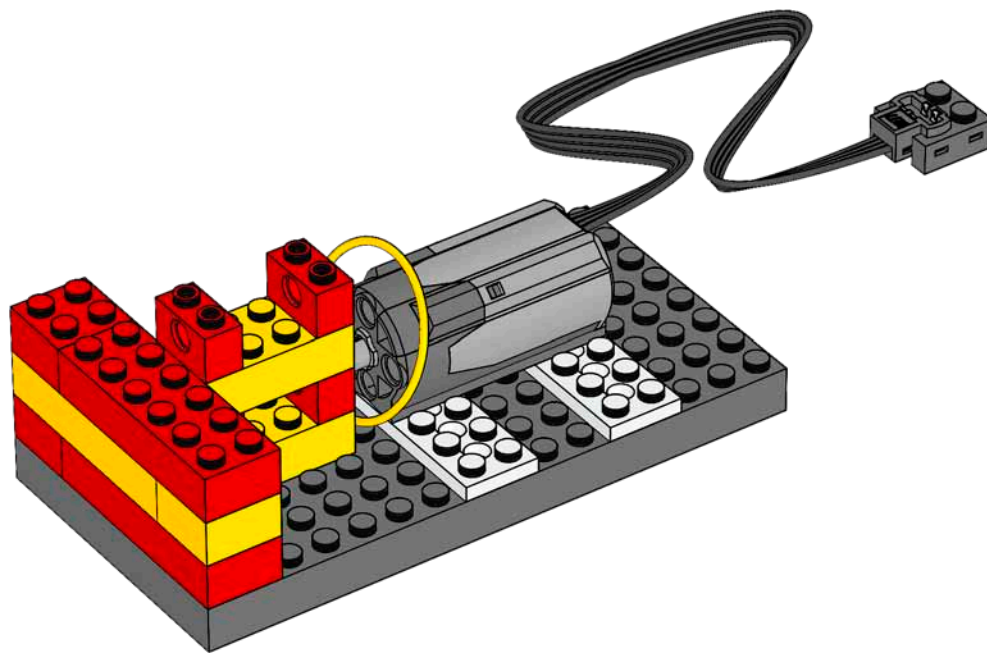
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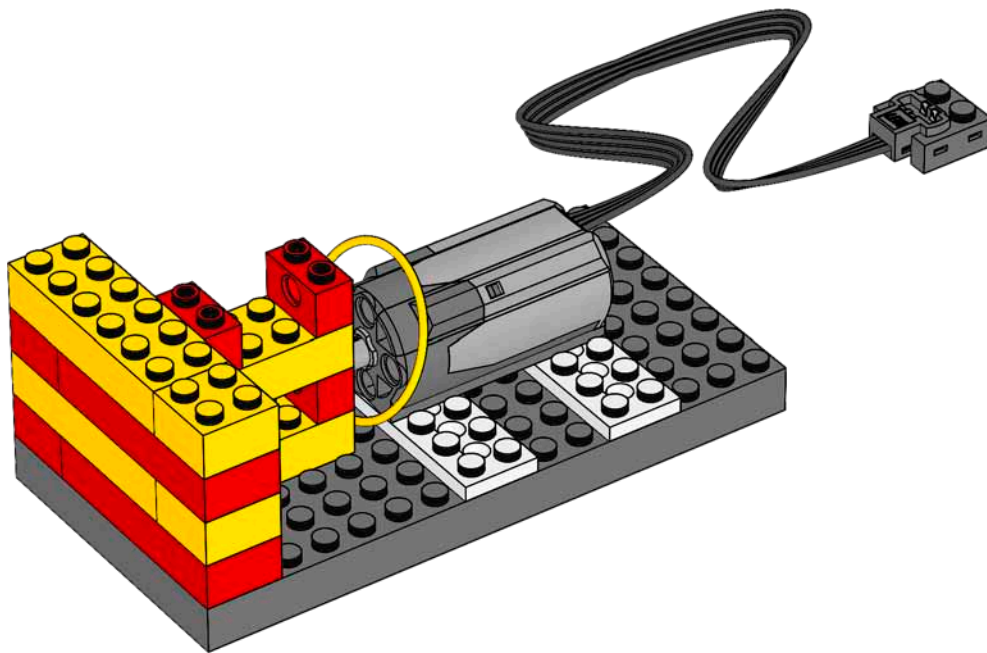
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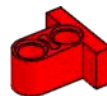
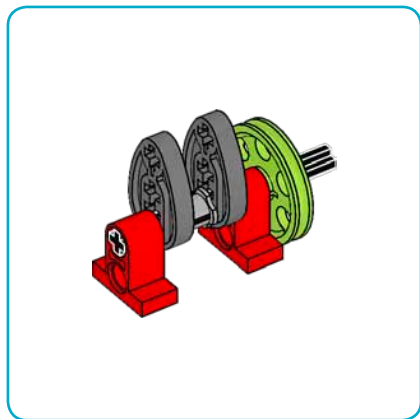
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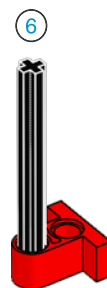
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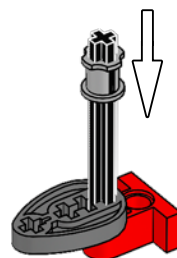
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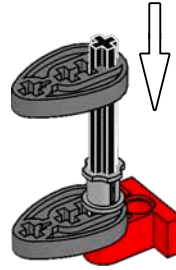
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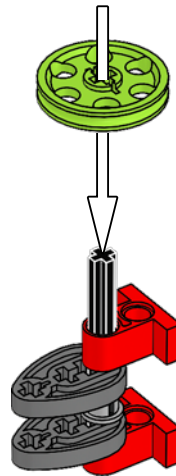
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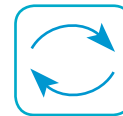
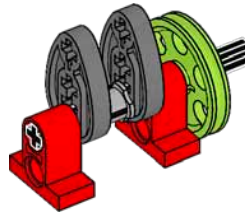
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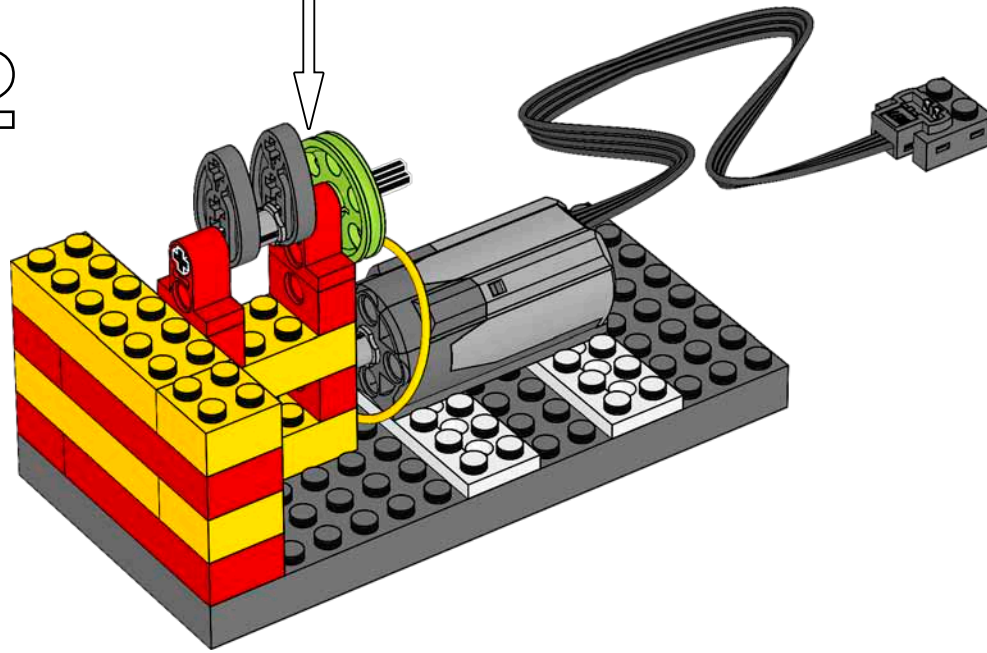
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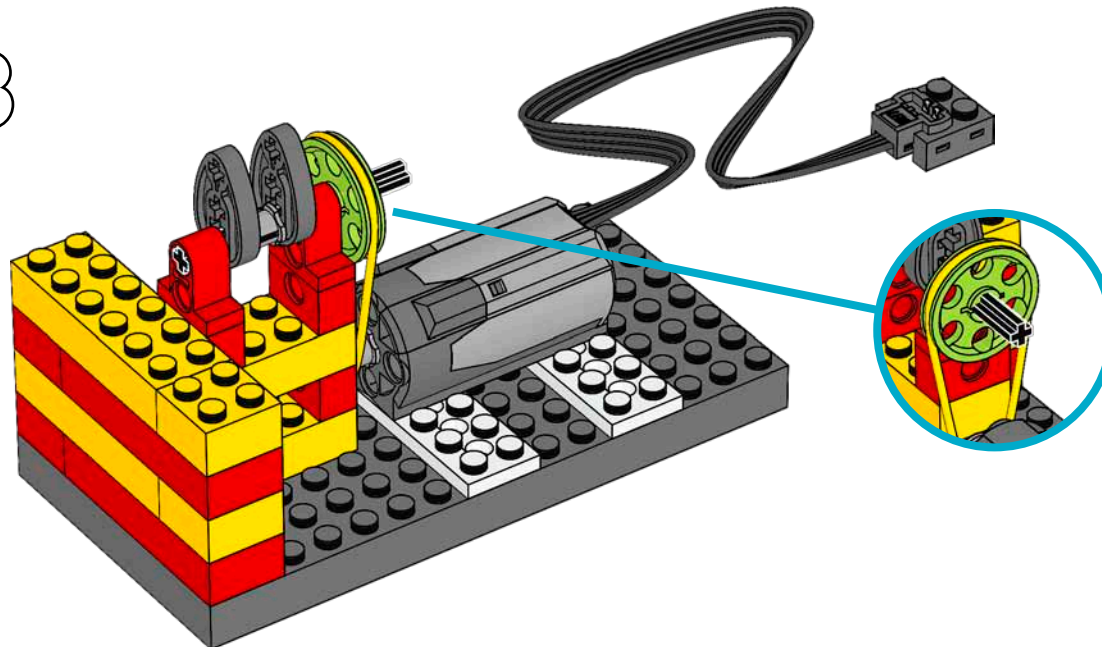
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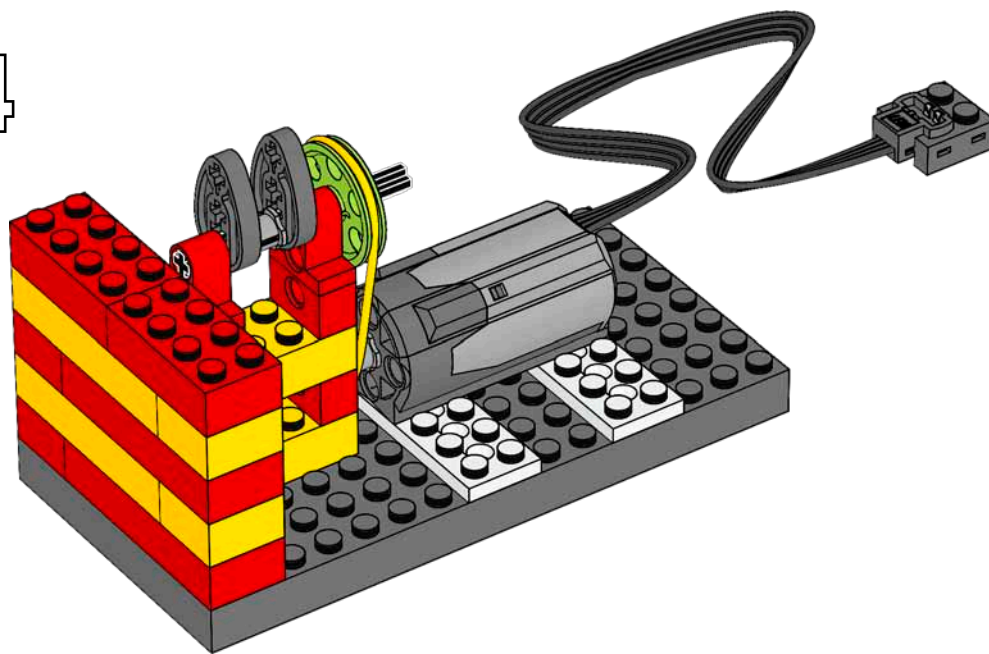
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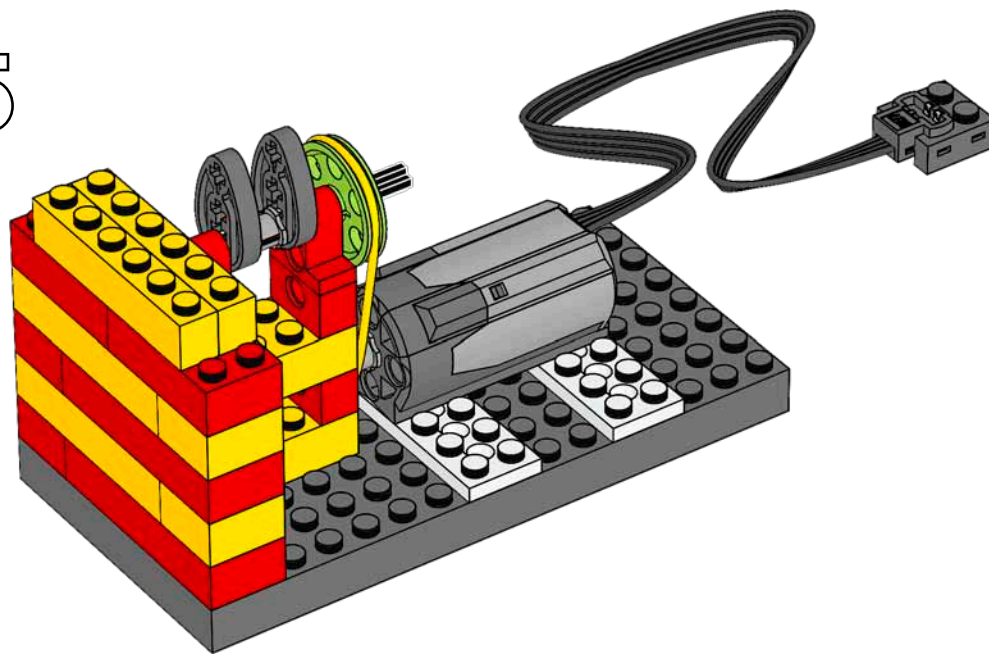
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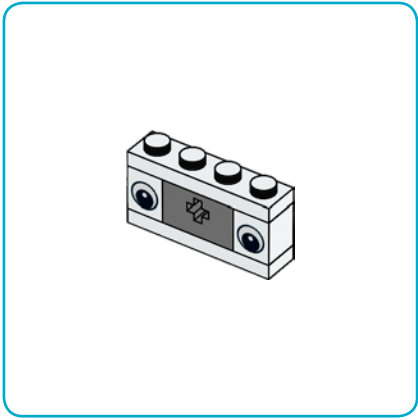


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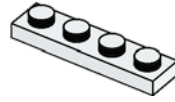


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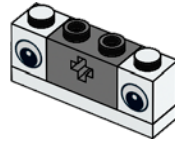




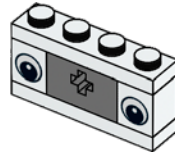
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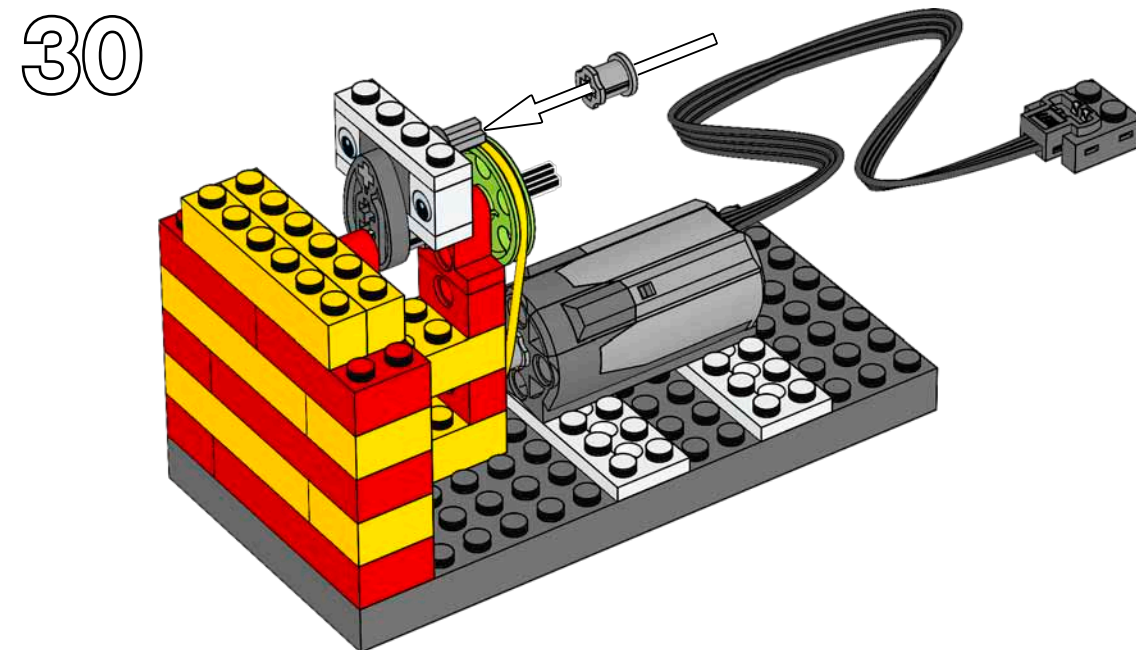
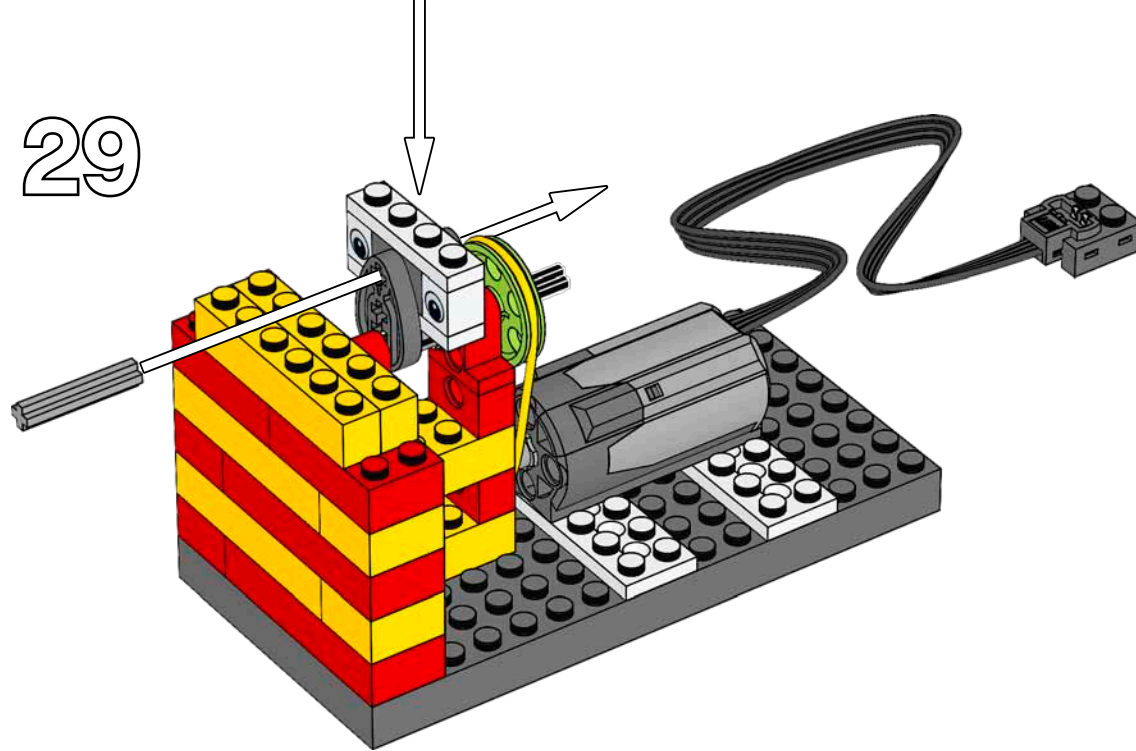


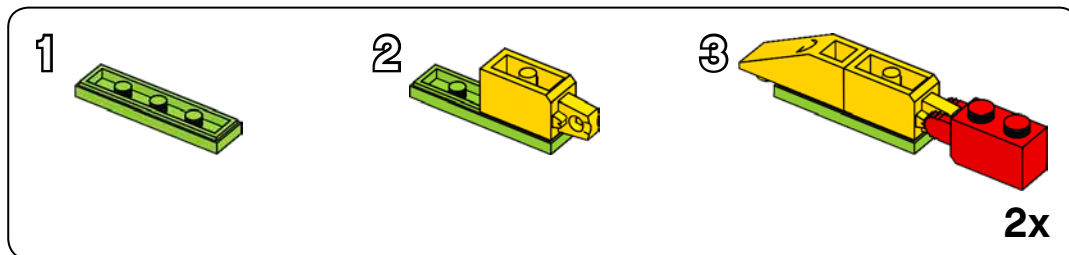
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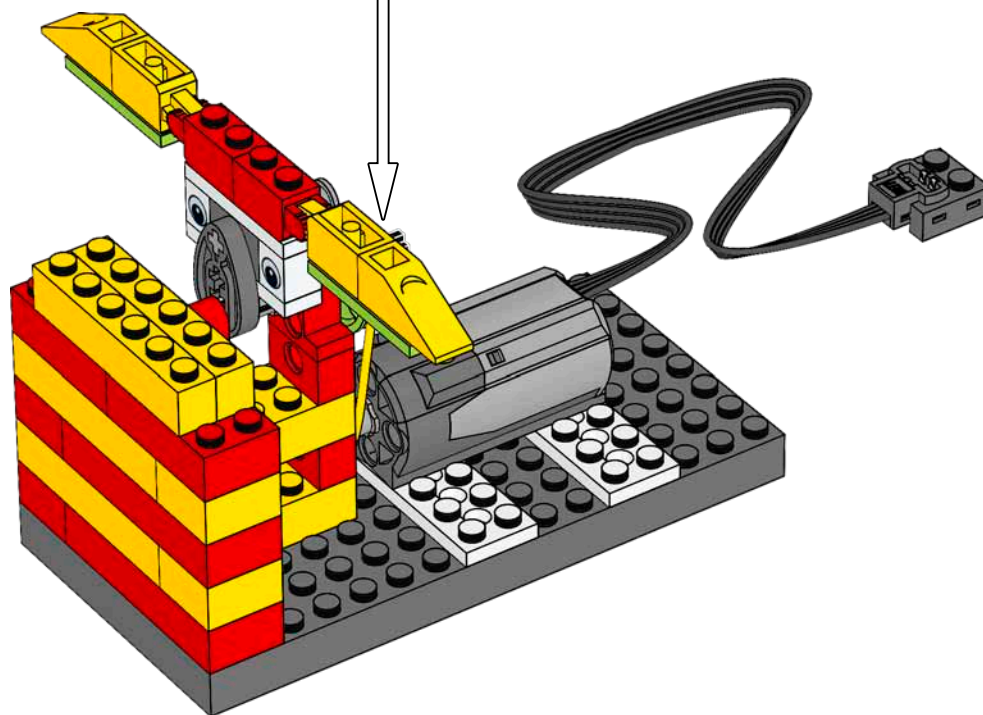
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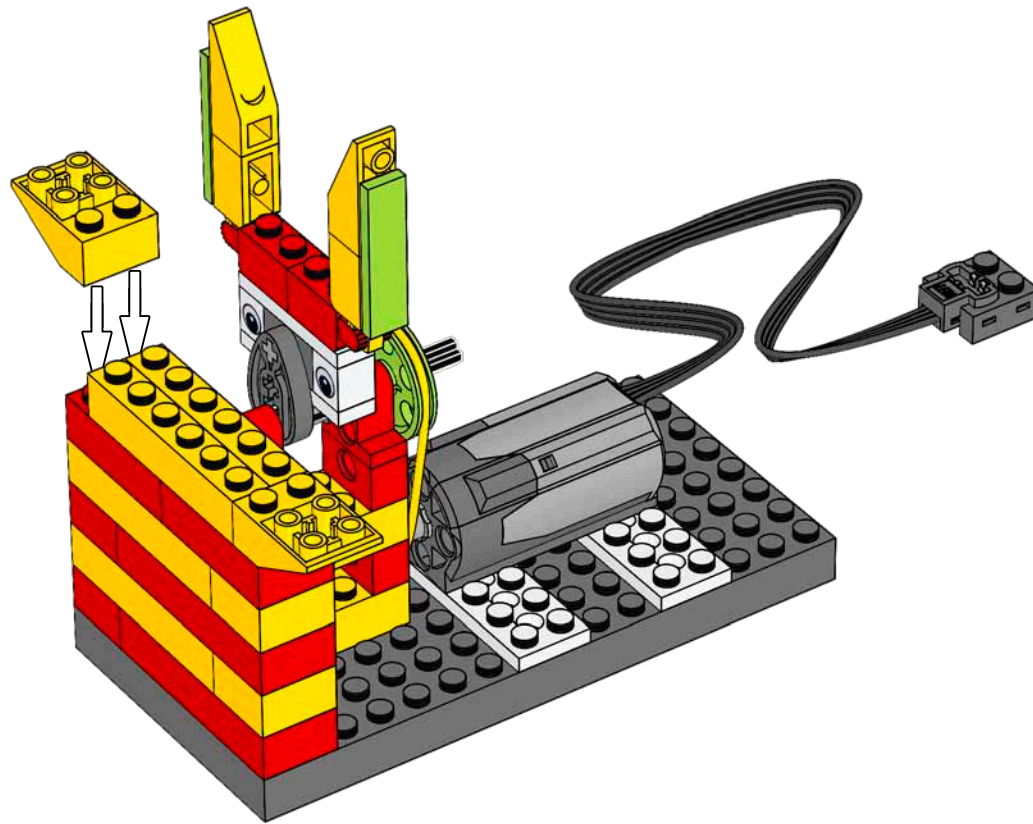




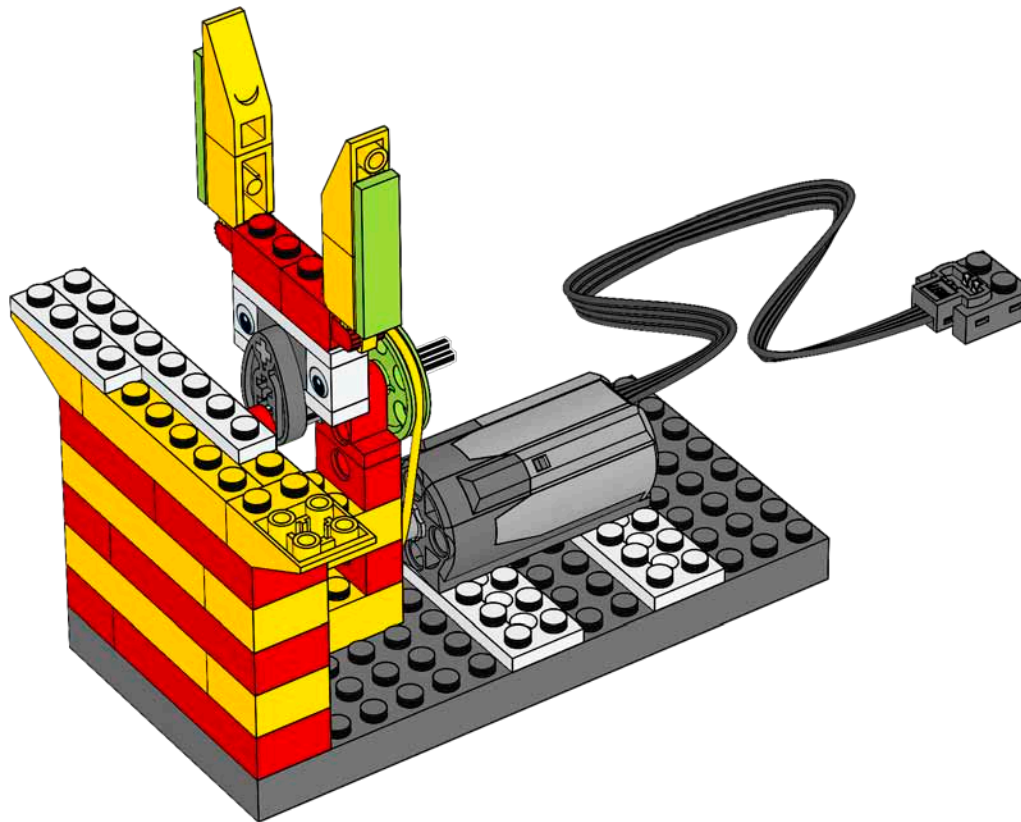
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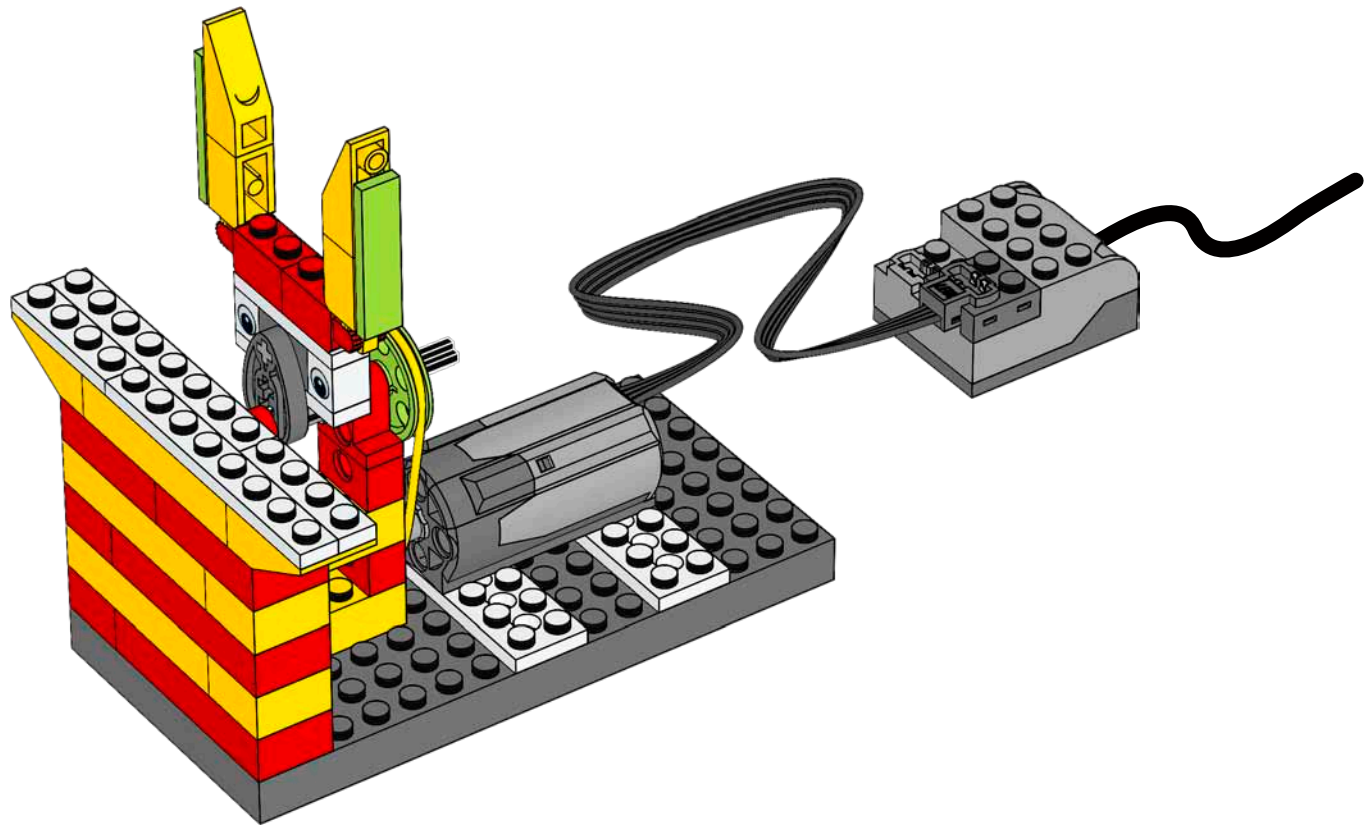
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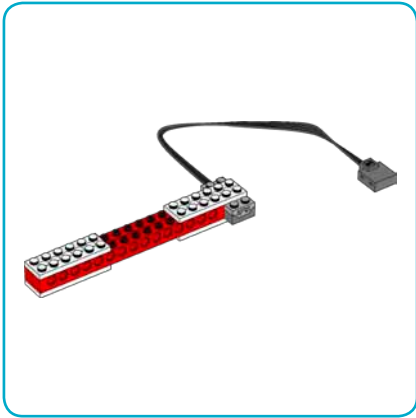


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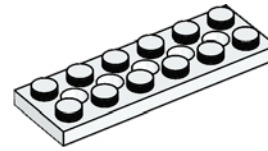


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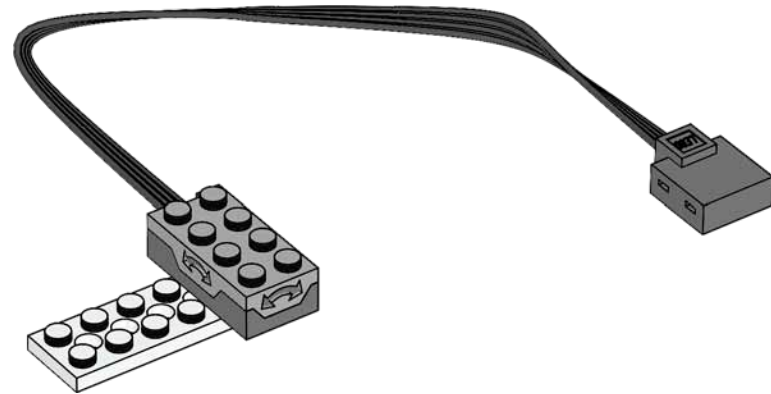




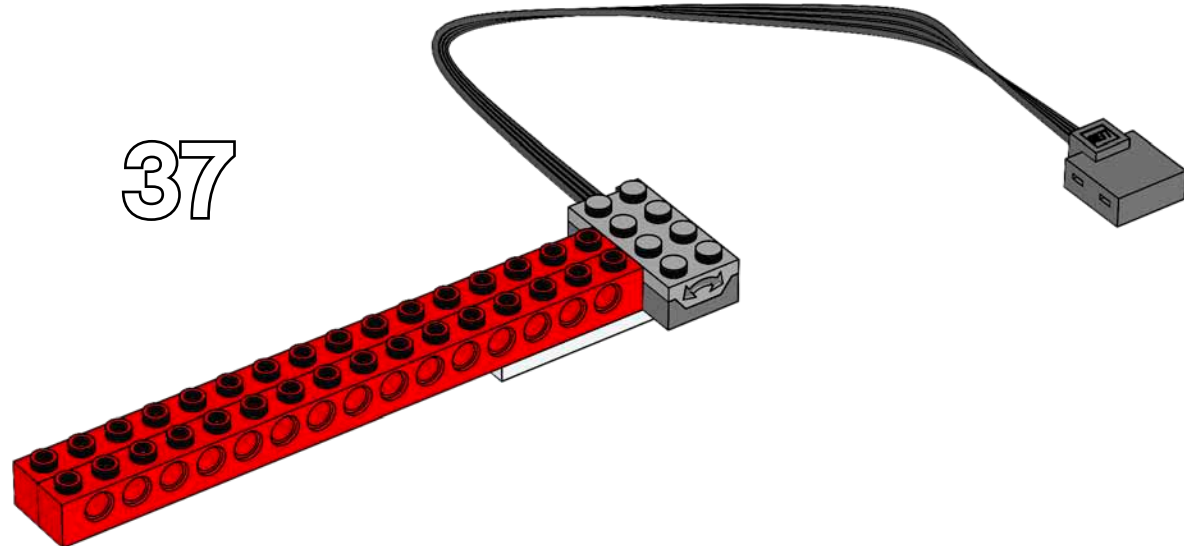
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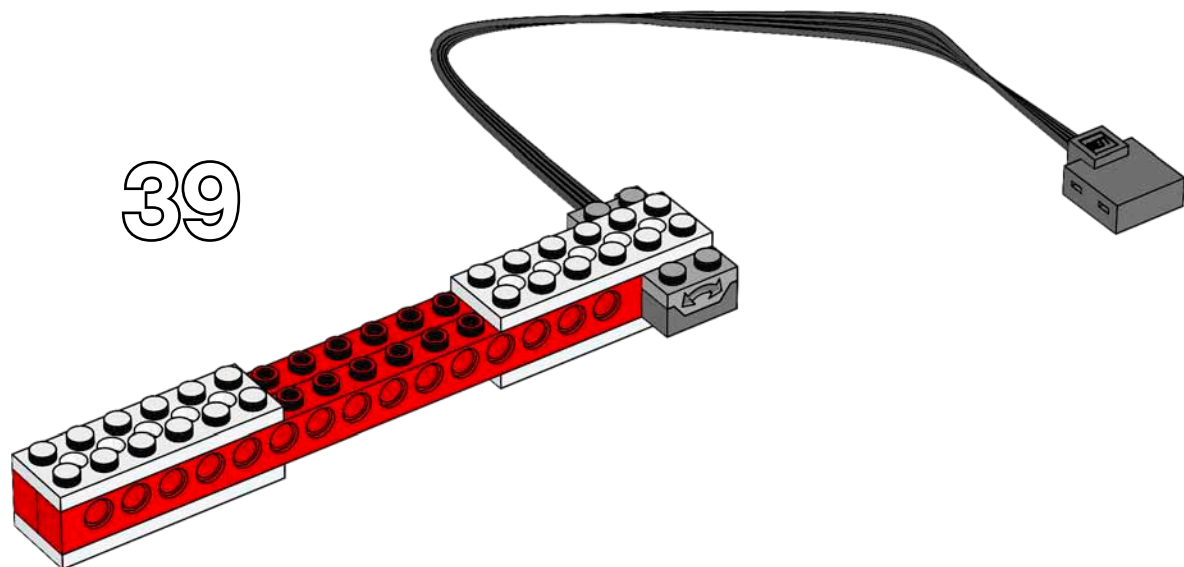
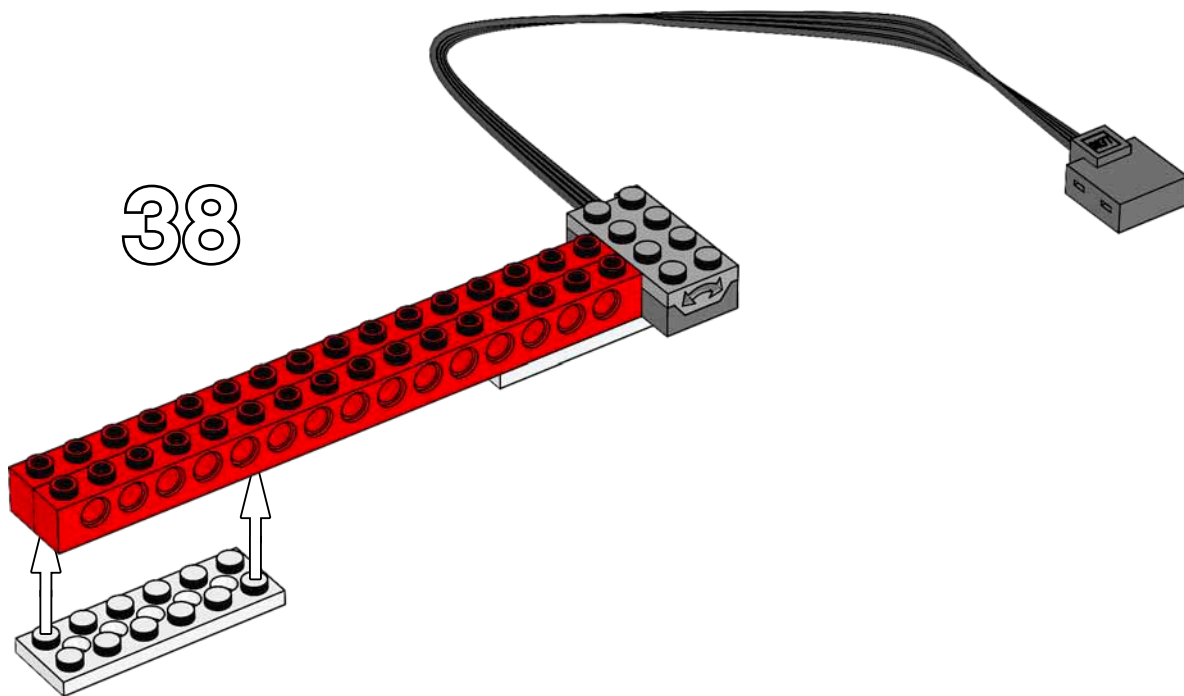


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