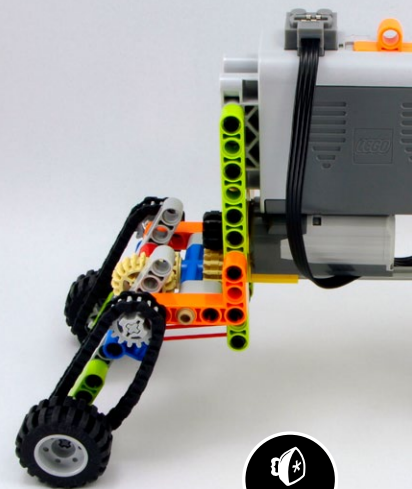
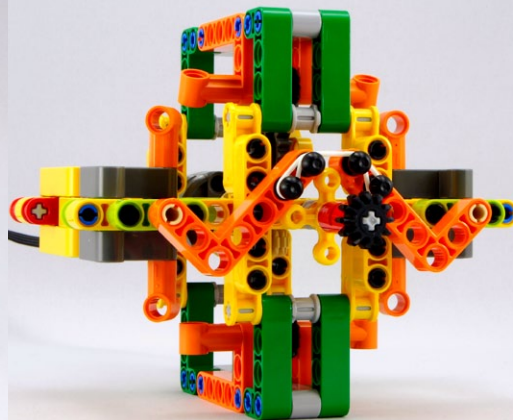
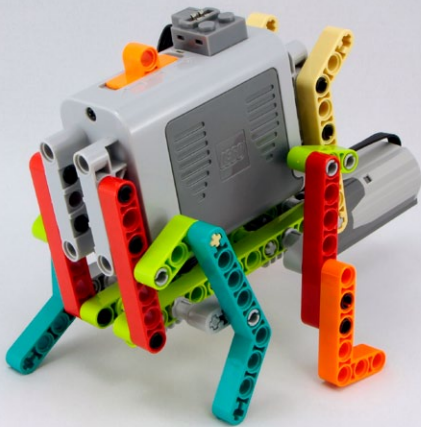


THE LEGO®
POWER
FUNCTIONS
IDEA BOOK

CARS AND
CONTRAPTIONS

YOSHIHITO ISOGAWA



THE LEGO® POWER FUNCTIONS IDEA BOOK
CARS AND CONTRAPTIONS

VOLUME 2

**THE LEGO®
POWER
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IDEA BOOK**

**CARS AND
CONTRAPTIONS**

Y O S H I H I T O I S O G A W A



The LEGO® Power Functions Idea Book, Volume 2: Cars and Contraptions.

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First Printing

19 18 17 16 15 1 2 3 4 5 6 7 8 9

ISBN-10: 1-59327-689-3

ISBN-13: 978-1-59327-689-8

Publisher: William Pollock

Production Editor: Riley Hoffman

Cover Design: Beth Middleworth

Photographer: Yoshihito Isogawa

Author Photo: Sumiko Hirano

Developmental Editor: Tyler Ortman

Technical Reviewer: Sumiko Hirano

Proofreader: Fleming Editorial Services

For information on distribution, translations, or bulk sales, please contact No Starch Press, Inc. directly:

No Starch Press, Inc.

245 8th Street, San Francisco, CA 94103

phone: 415.863.9900; info@nostarch.com

www.nostarch.com

The Library of Congress has cataloged the first volume as follows:

Isogawa, Yoshihito, 1962-

The LEGO power functions idea book / by Yoshihito Isogawa.

pages cm

Summary: "A compilation of small projects to build with LEGO Technic parts, including gears, motors, gadgets, and other moving elements. Contains step-by-step building instructions for rack-and-pinion steering systems, sliding doors, grasping claws, and ball-shooting devices. Explores principles of simple machines, gearing, and power translation"-- Provided by publisher.

ISBN 978-1-59327-688-1 -- ISBN 1-59327-688-5

1. Machinery--Models. 2. Power (Mechanics) 3. LEGO toys. I. Title.

TJ248.L863 2016

621.8--dc23

2015021881

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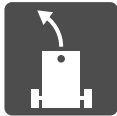
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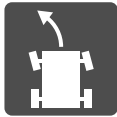
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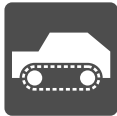
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Introduction

This is an idea book, offering hundreds of projects and mechanisms you can build with LEGO Technic parts. The book especially focuses on LEGO Power Functions, which is the latest version of the Technic system of motors, lights, and other electric building elements.

Where Are the Words?

Other than this brief introduction and the table of contents, this book has almost no words. Instead, you'll find a series of photographs of increasingly complex models, each designed to demonstrate a mechanical principle or building technique.

While the book lists the pieces needed to build each model, it does not include step-by-step building instructions. Look at the photographs taken from various angles and try to reproduce the model. Building in this way is something like putting together a puzzle. You'll get the hang of it after a little practice.

The Use of Color

The examples in this book are made with parts of various colors to make it easier for you to see the individual bricks' shapes. But you don't need to use the colors I've chosen in your models; use whichever colors you want to make the projects your own.

Substituting Parts

The parts used in this book were selected from among the easily obtainable ones as much as possible, but you'll probably still be missing a few.

Try to build as many models as possible using the parts that you already own. If you find that you're missing parts, try to think of ways to substitute other parts for the ones that you're missing.

For example, there are many types of LEGO tires. If you don't have the tires shown in a particular project, try using any tires you have that are a similar size. Also, there are several types of Power Functions motors. In this book, the commonly available Medium (M) motors are used most frequently. It's relatively easy to replace the M motor with the Large (L) motor or older motors from earlier systems, so use whatever you have available.

The Parts List in the back of the book will help you find the pieces you need.

You Are the Creator

Look at the models you build closely. By thinking about how they move and why they are designed that way, you will greatly improve your building skills.

This is an idea book; it's about imagination. It is my sincere hope that you make these projects your own, combine them, and evolve them into something even better—your own original models.



PART 1

Vehicles



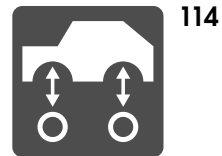
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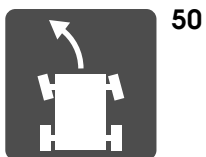
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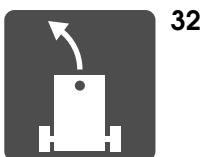
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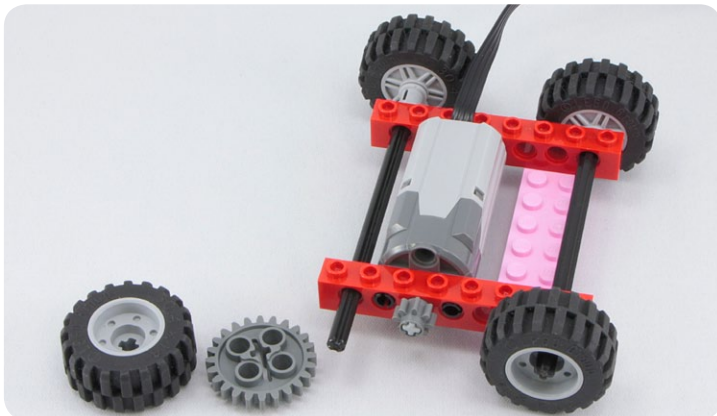
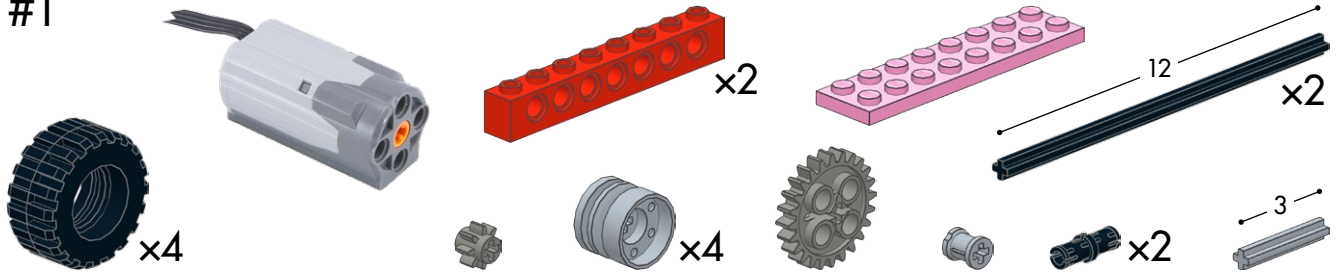


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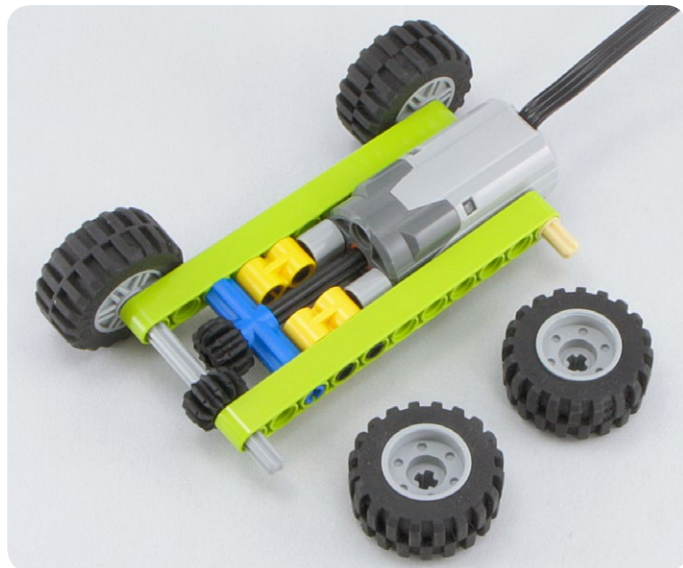
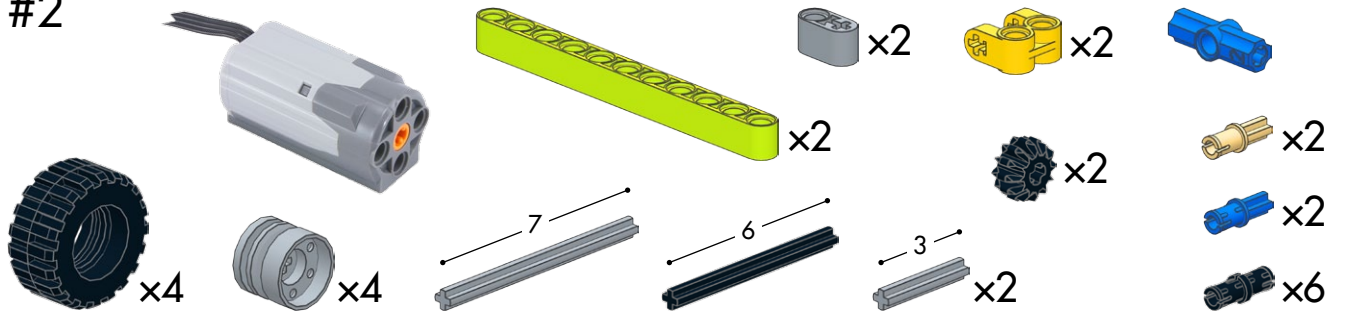


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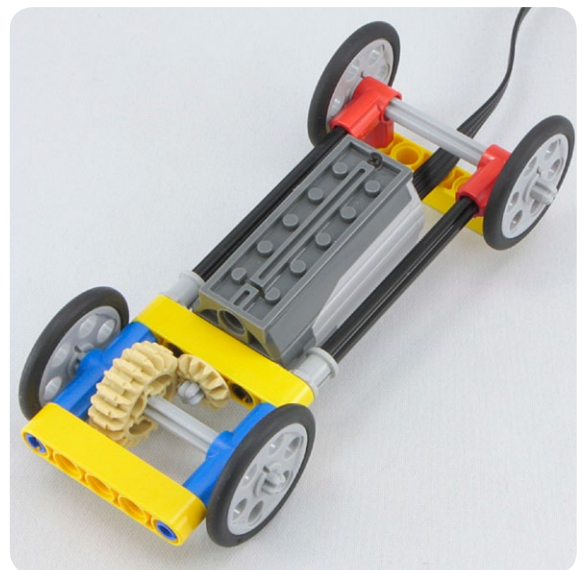
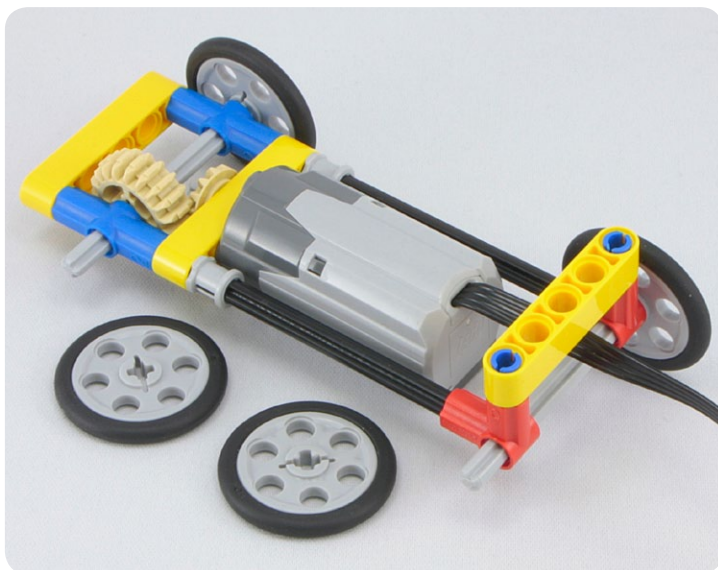
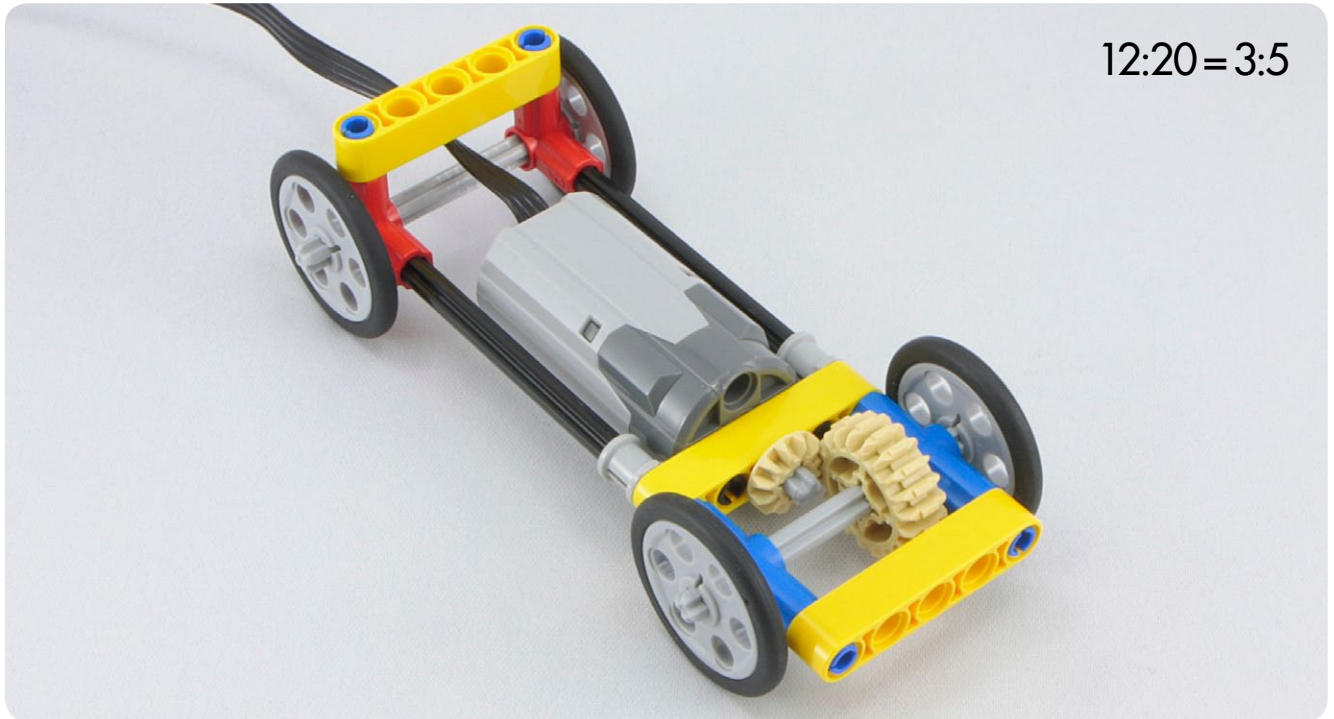
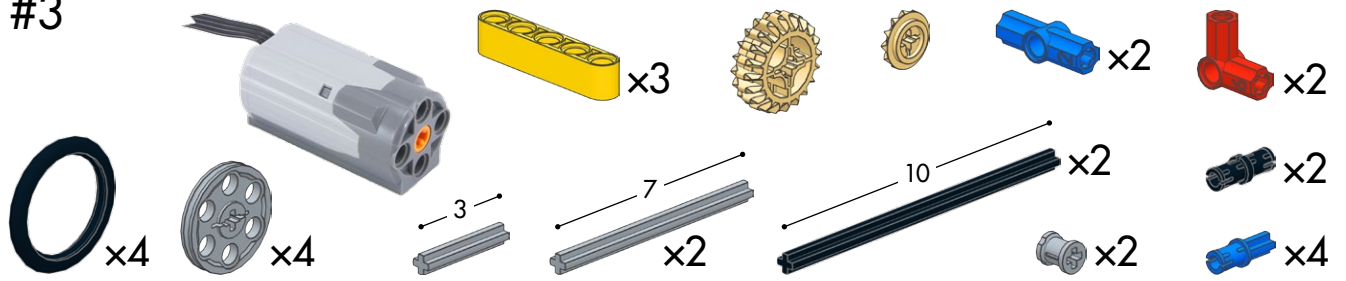
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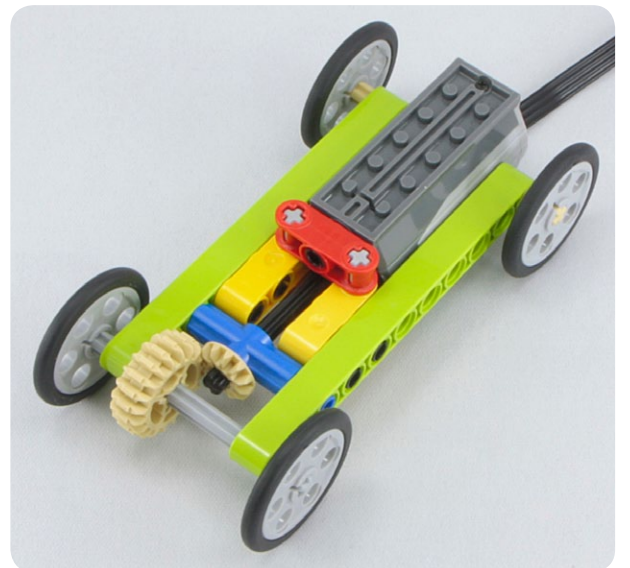
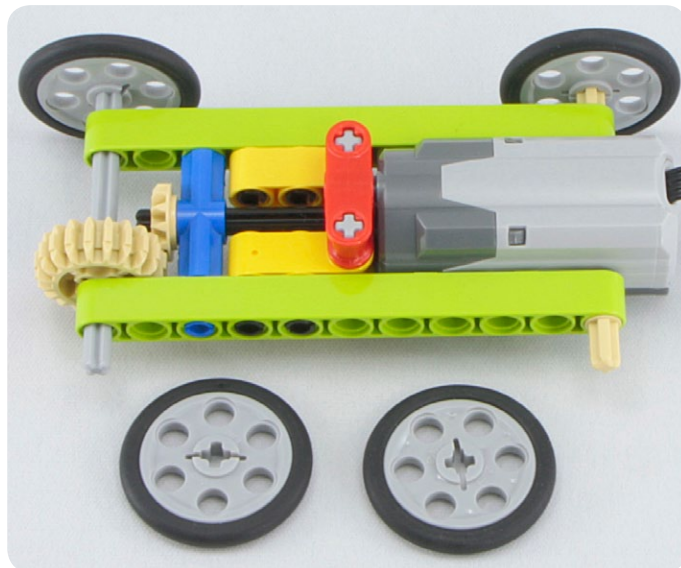
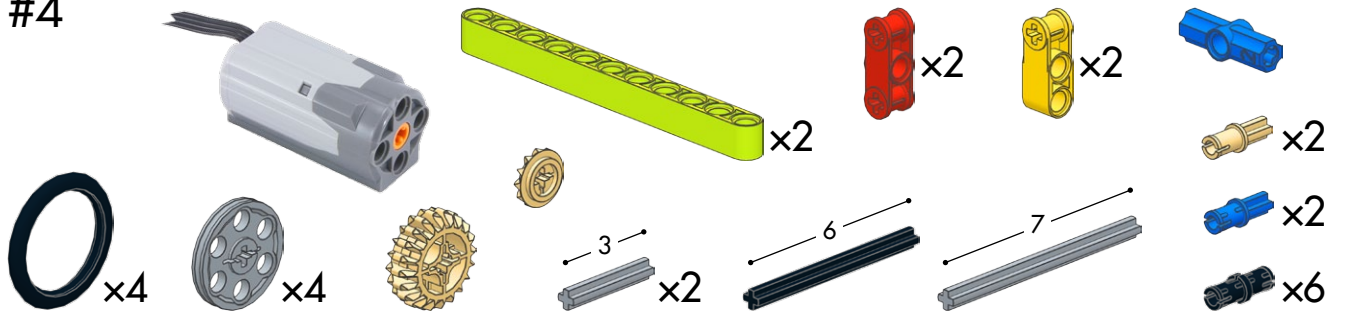
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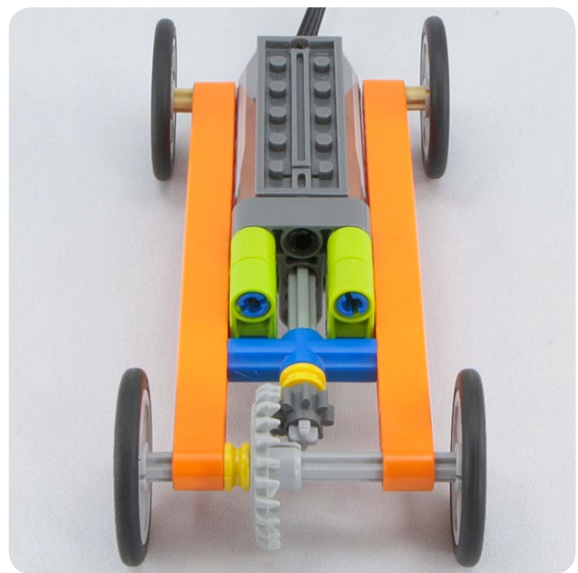
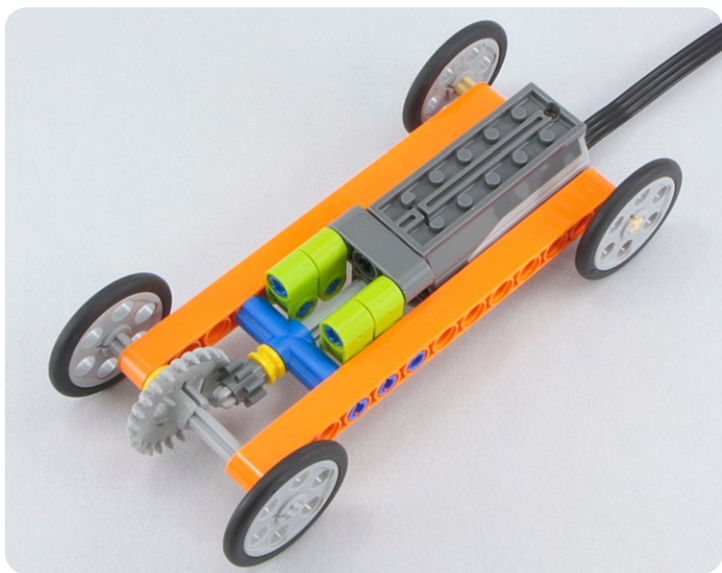
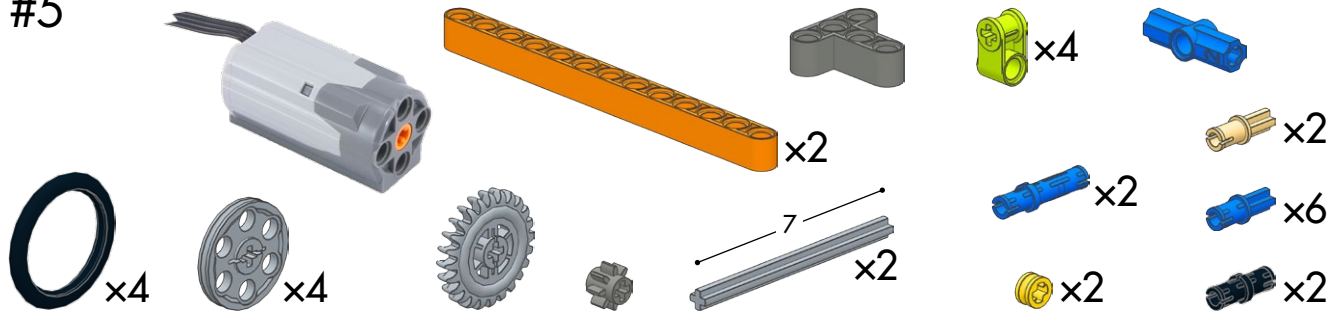
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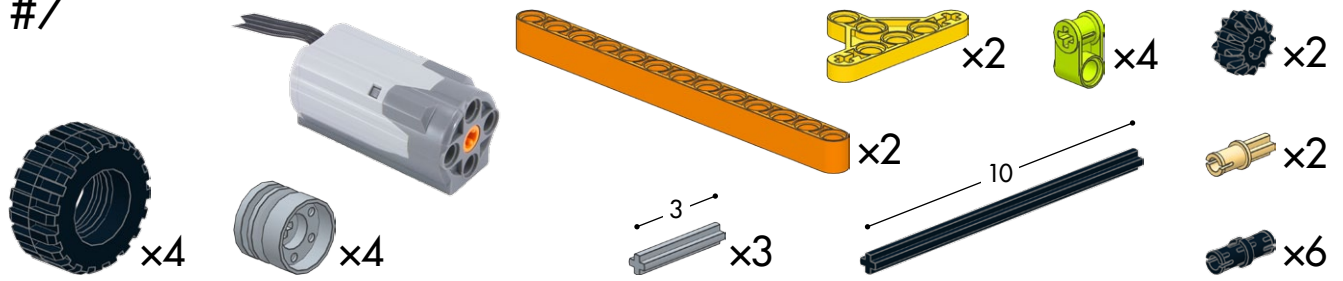
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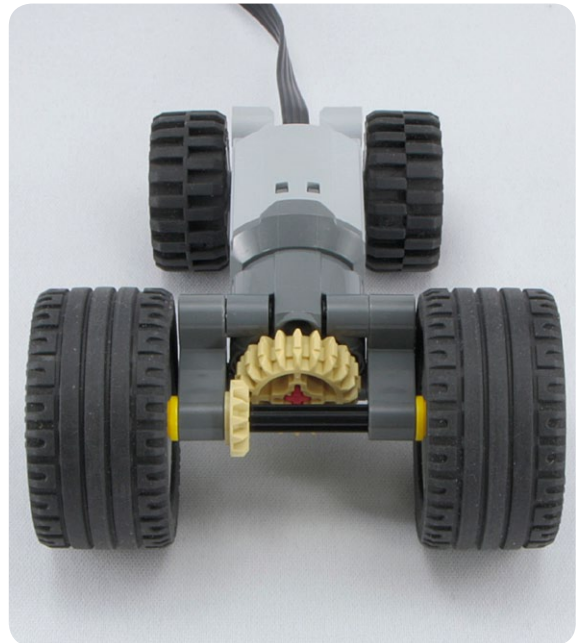
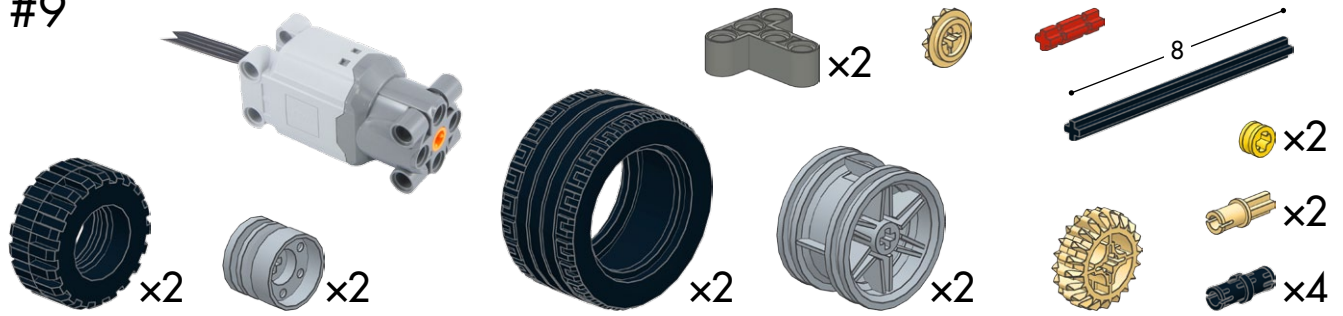
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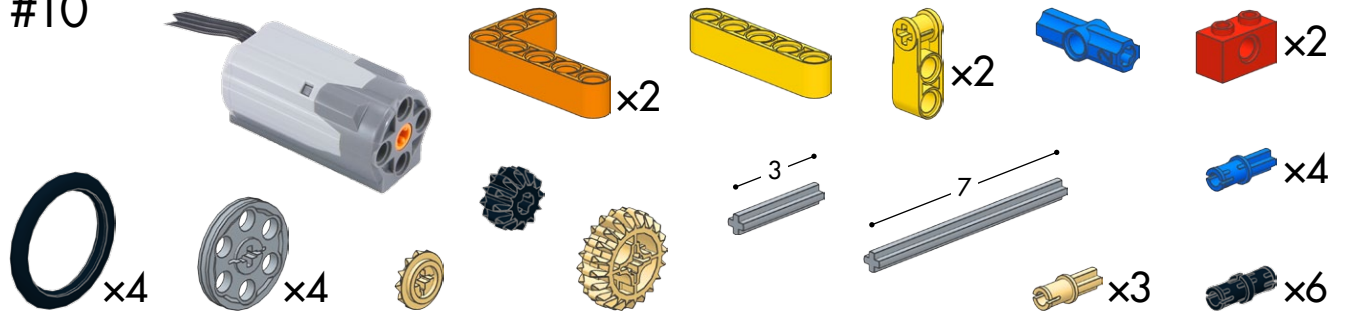
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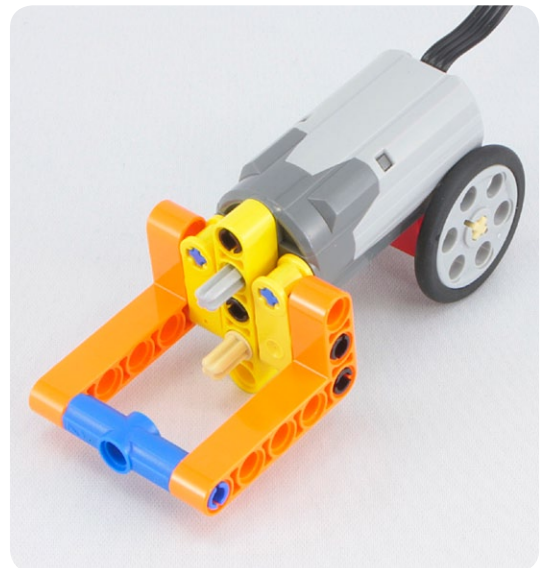
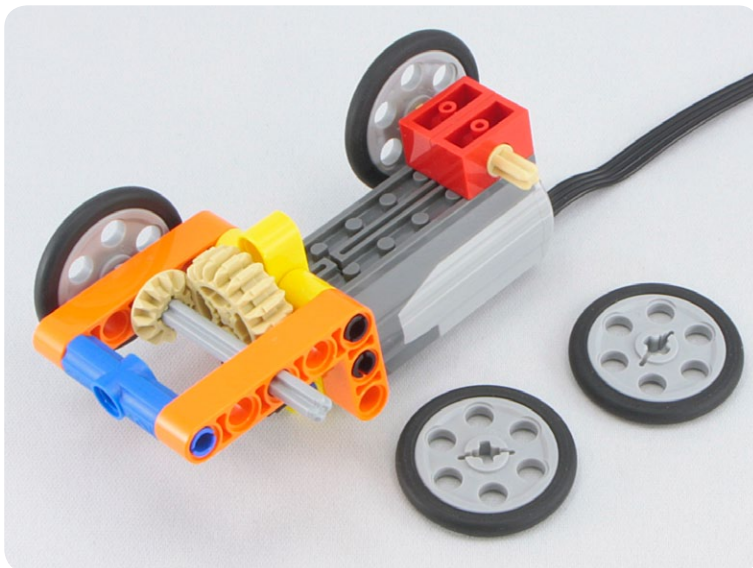
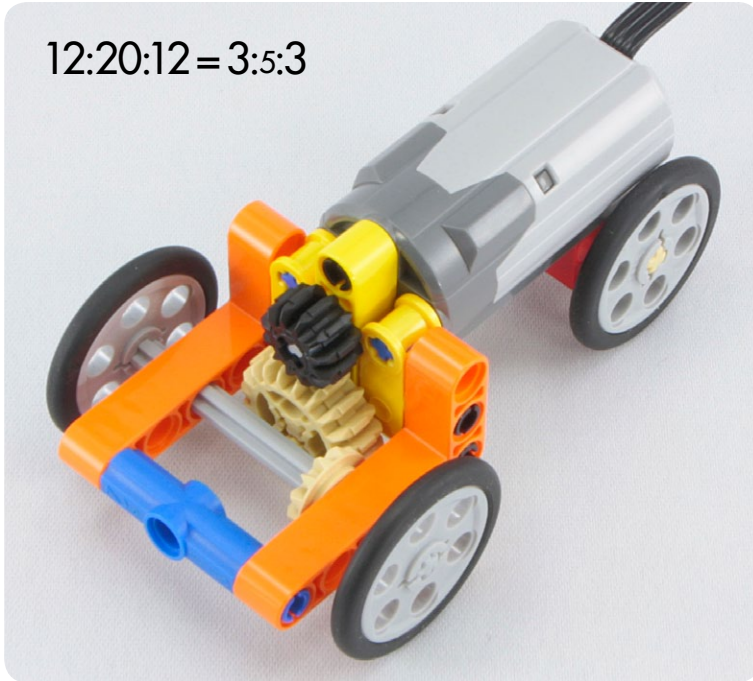
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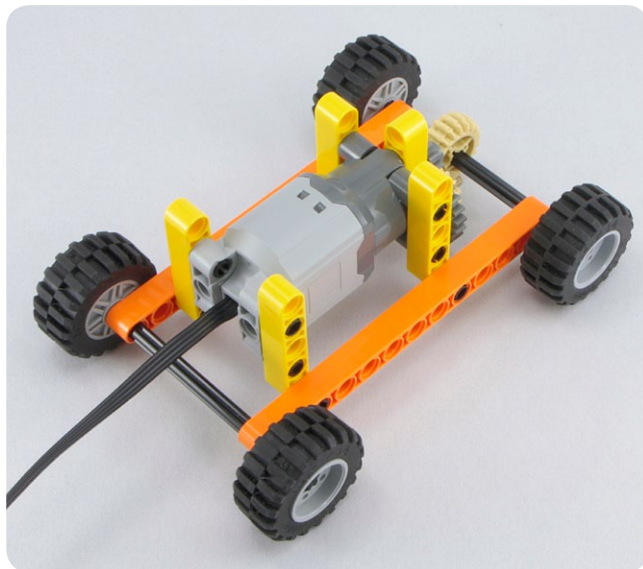
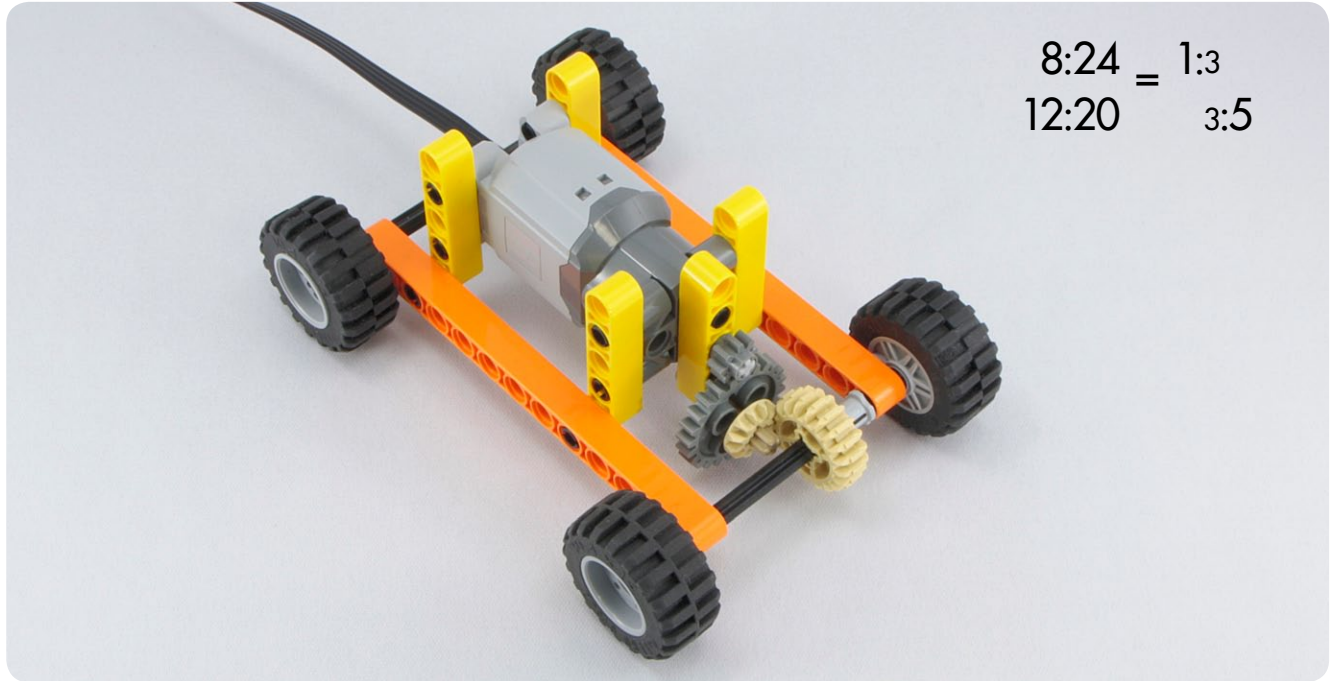
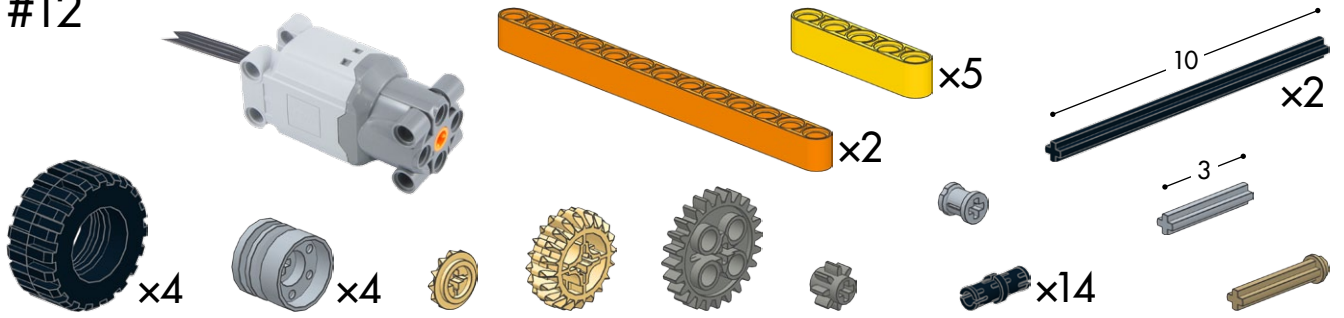
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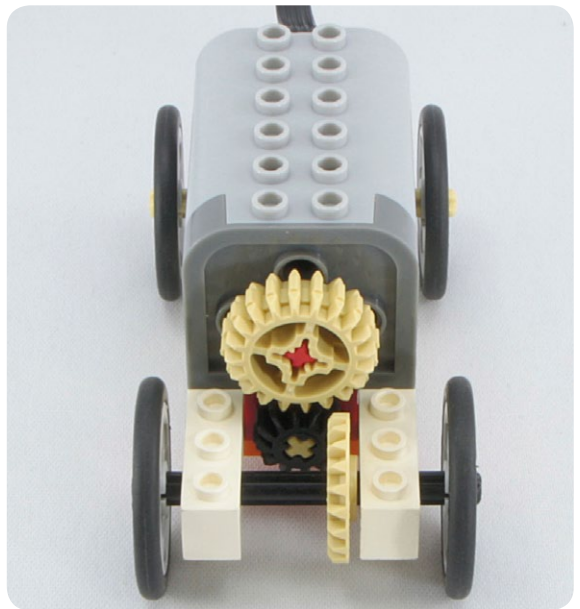
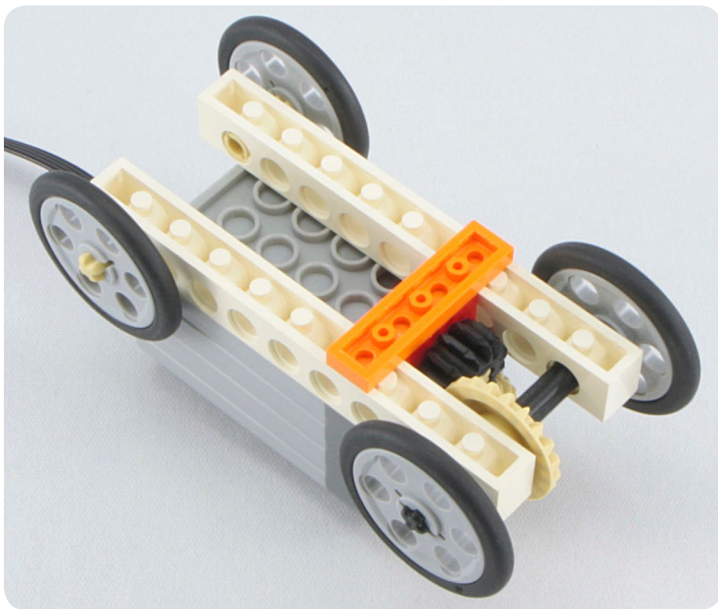
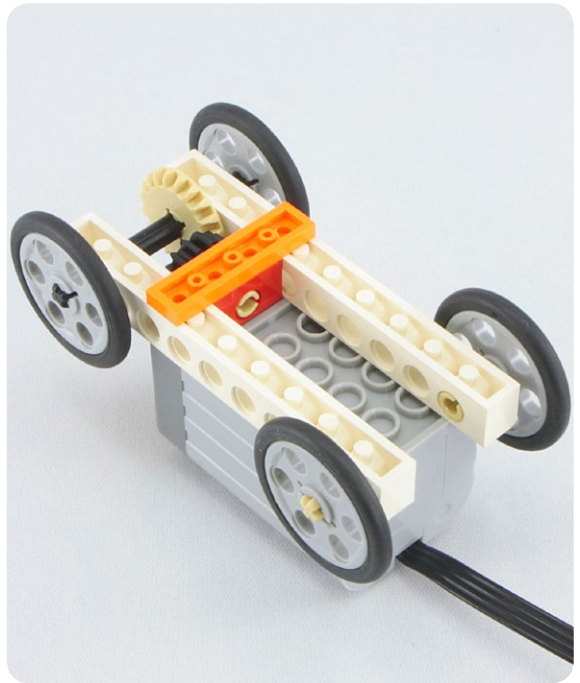
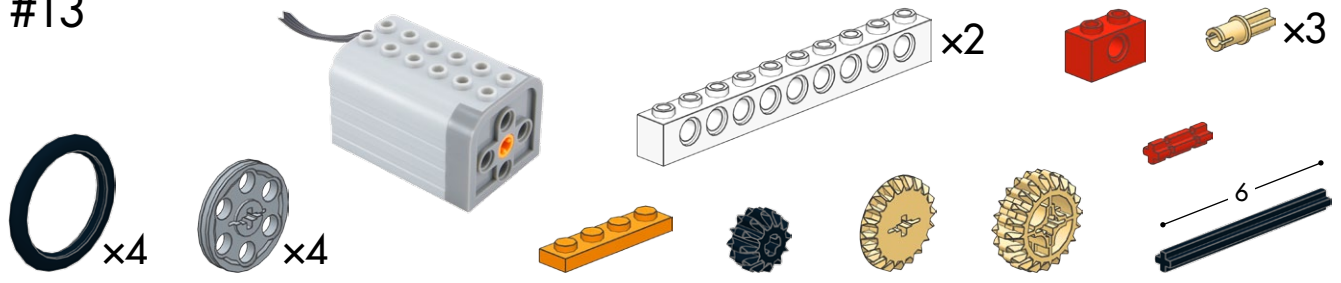
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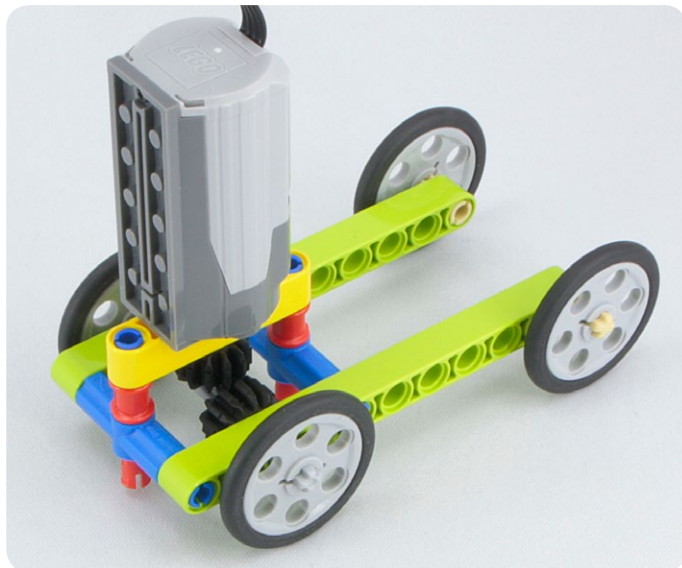
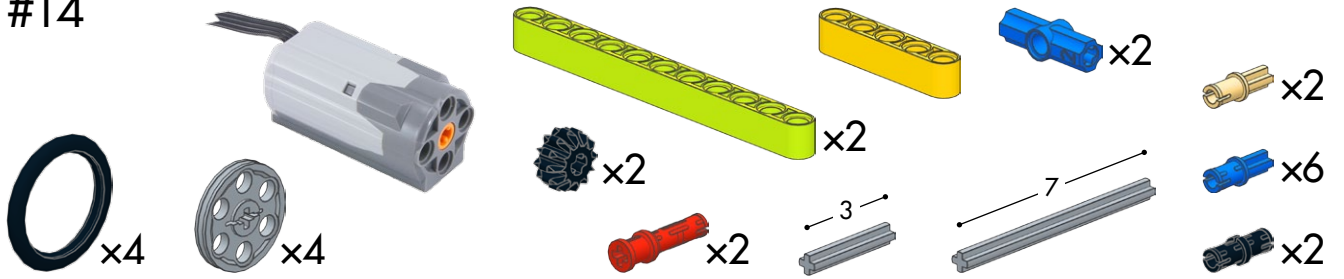
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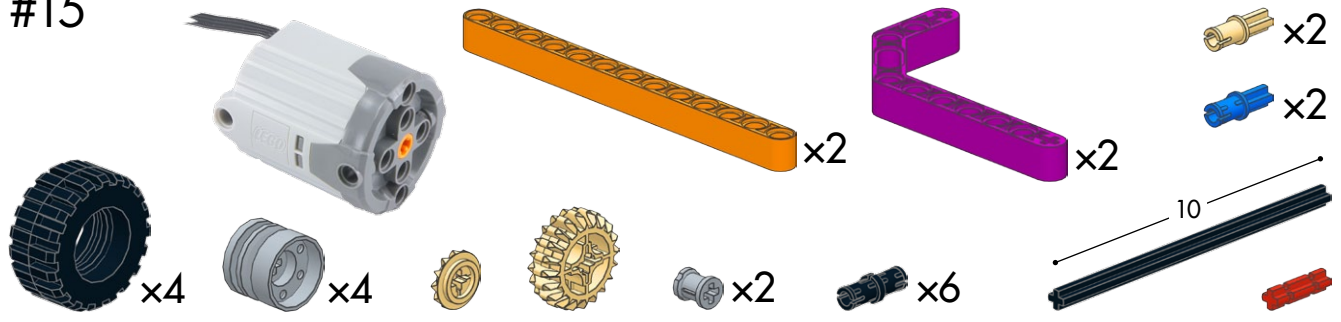
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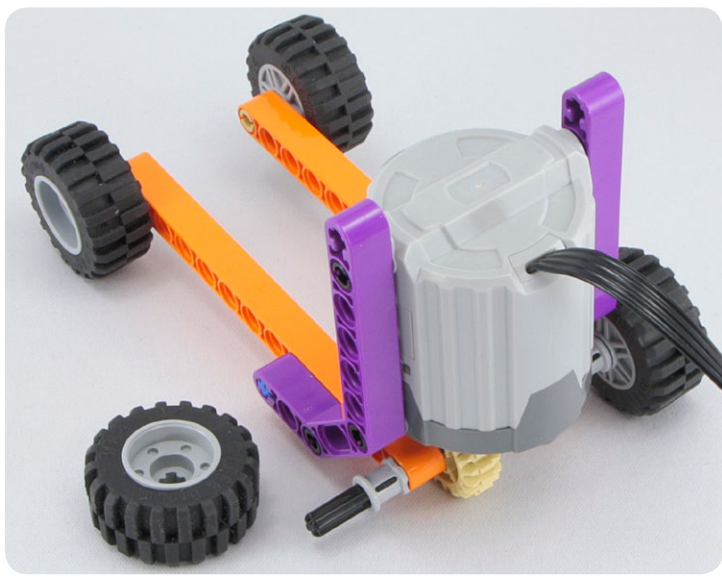
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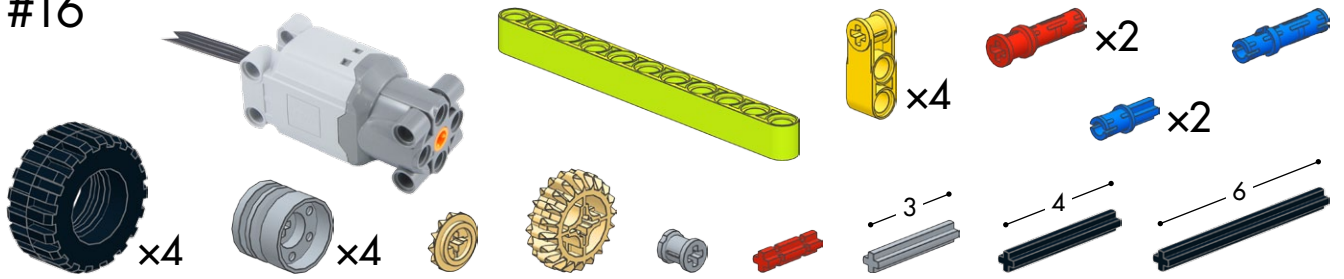
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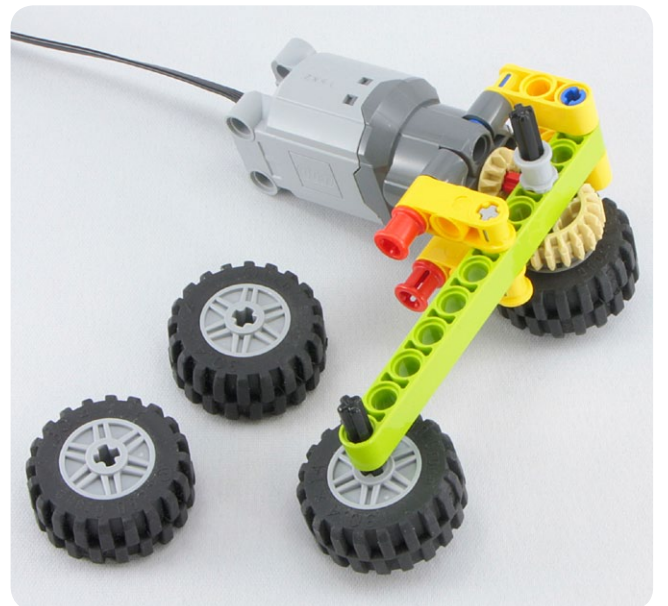
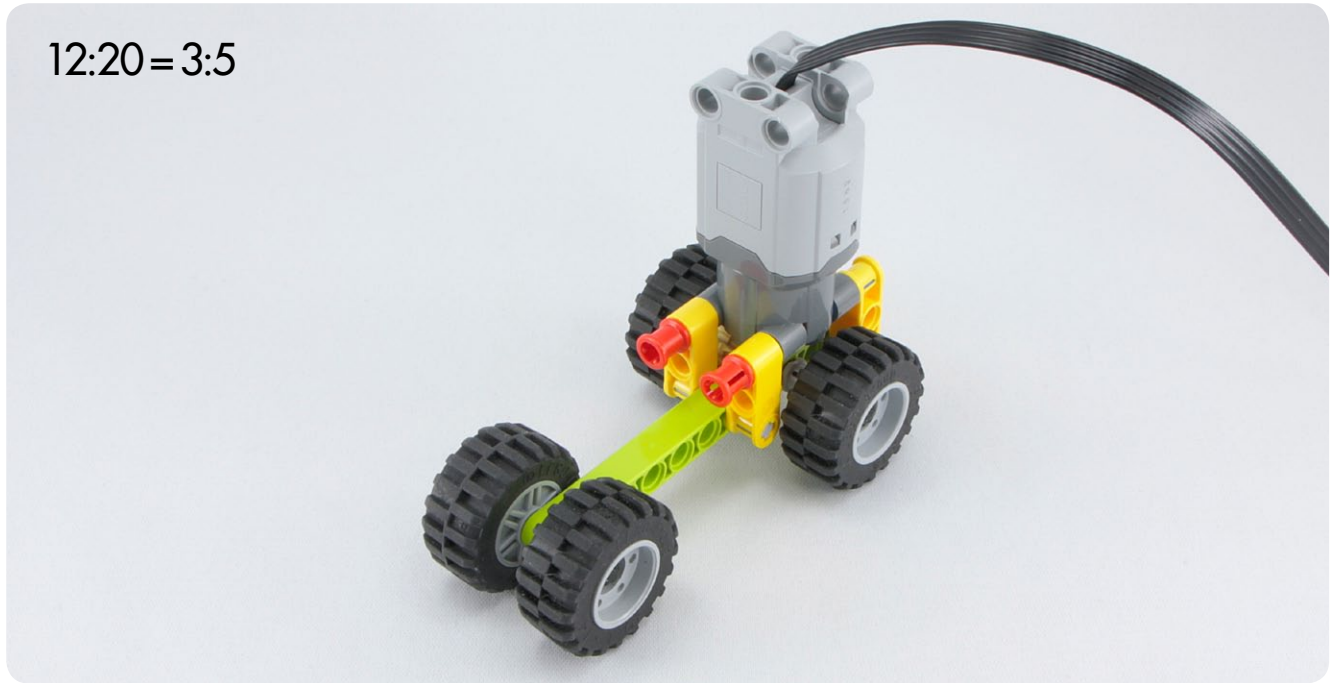
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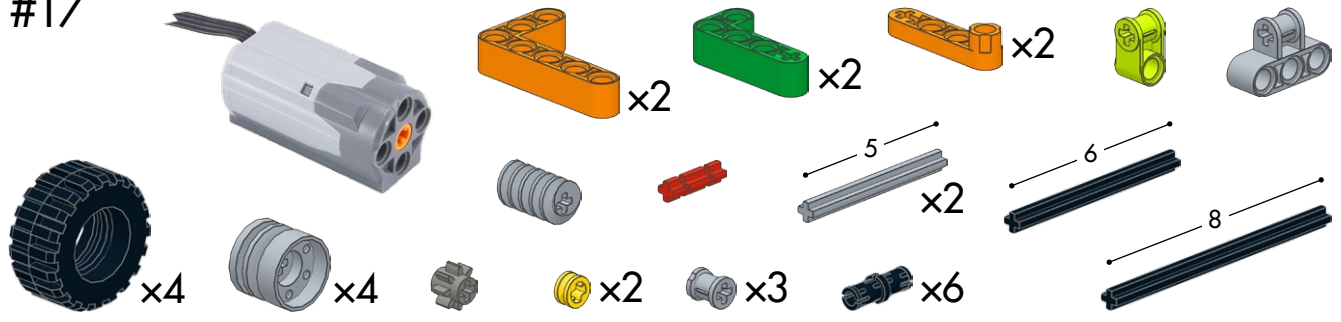
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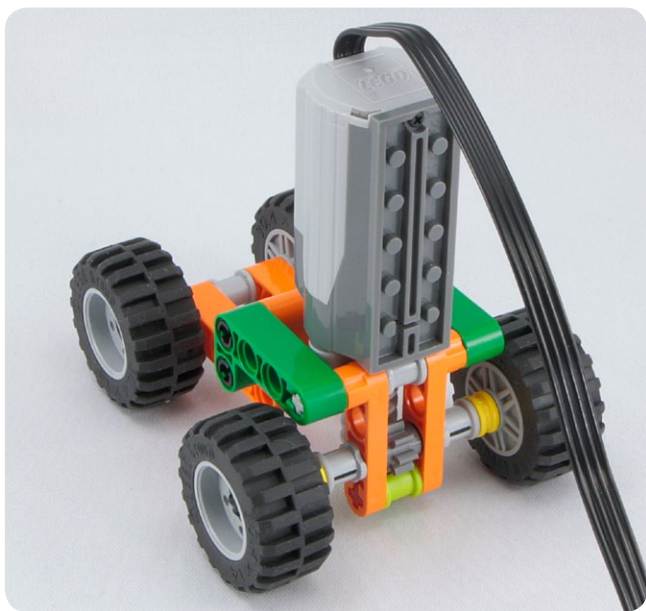
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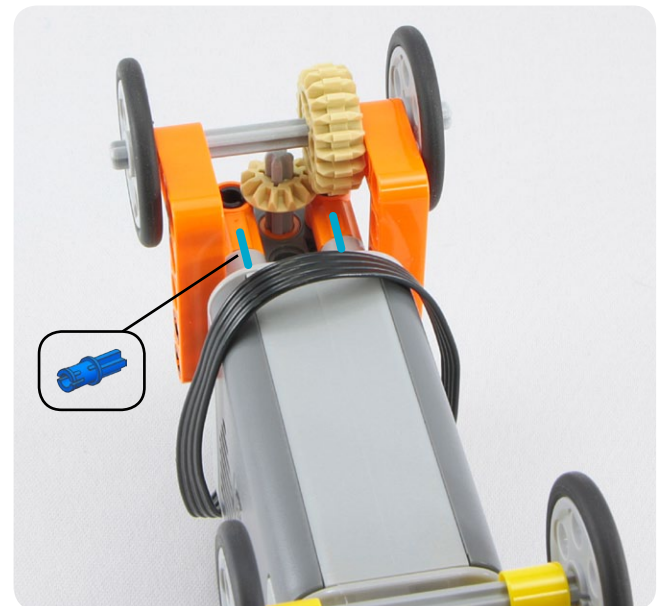
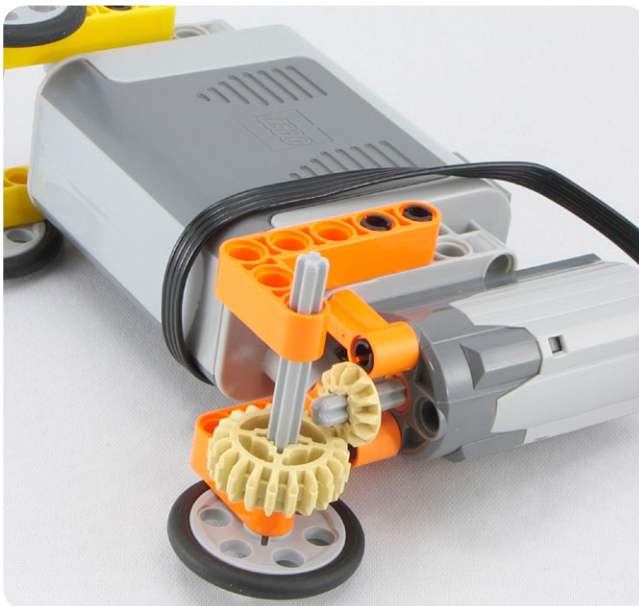
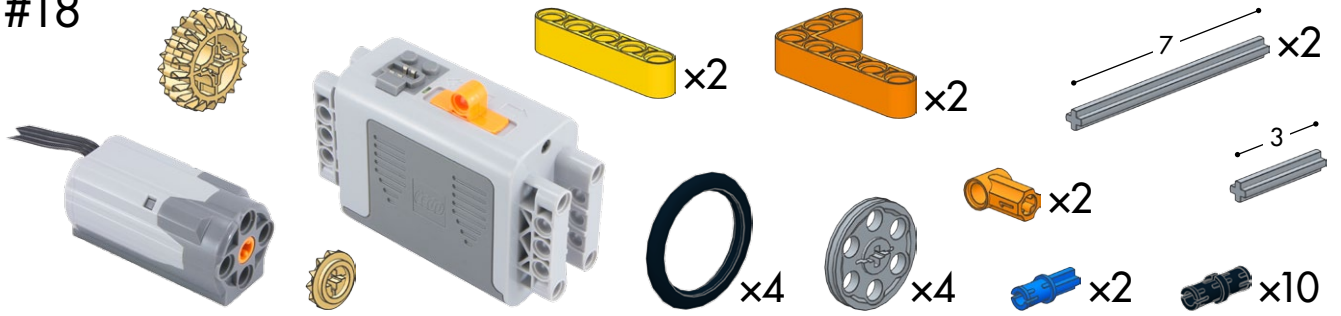
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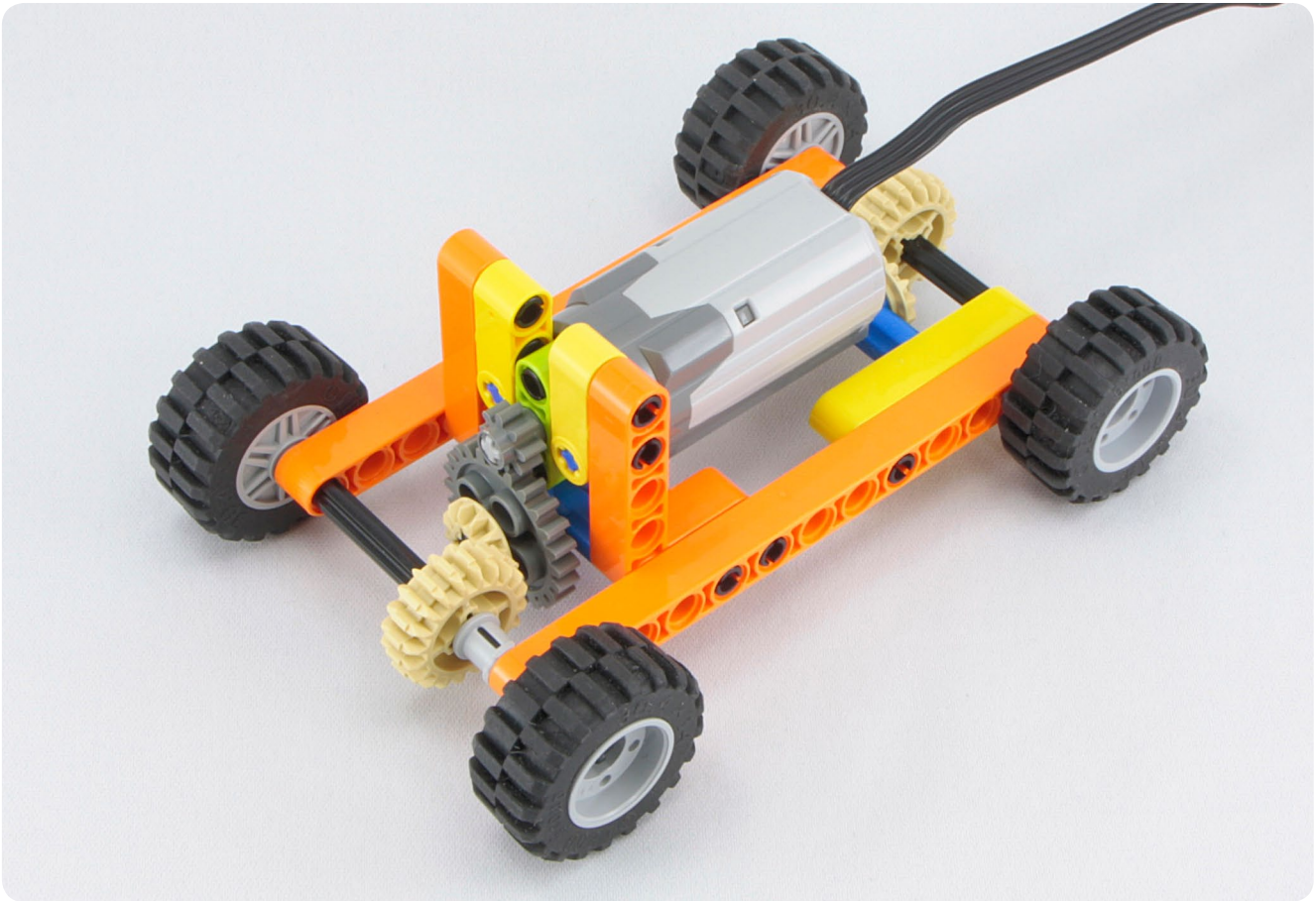
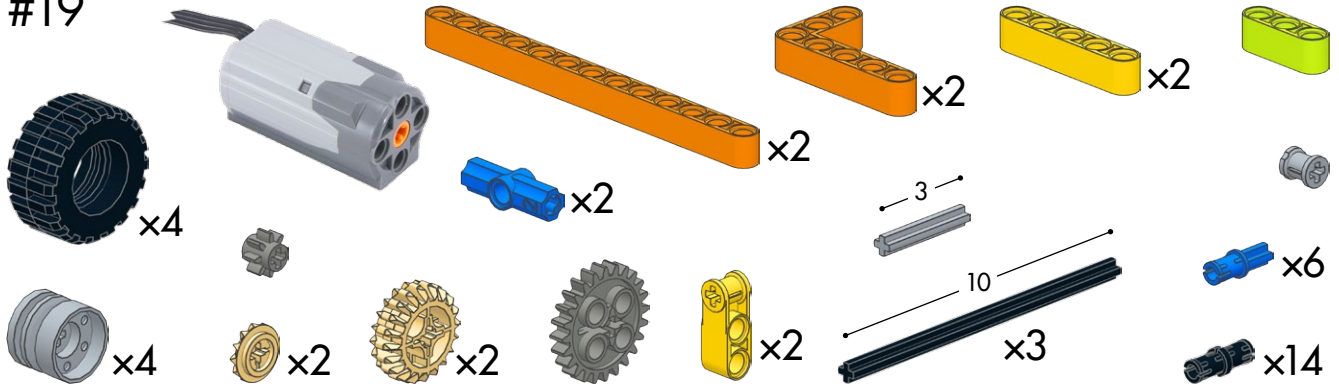
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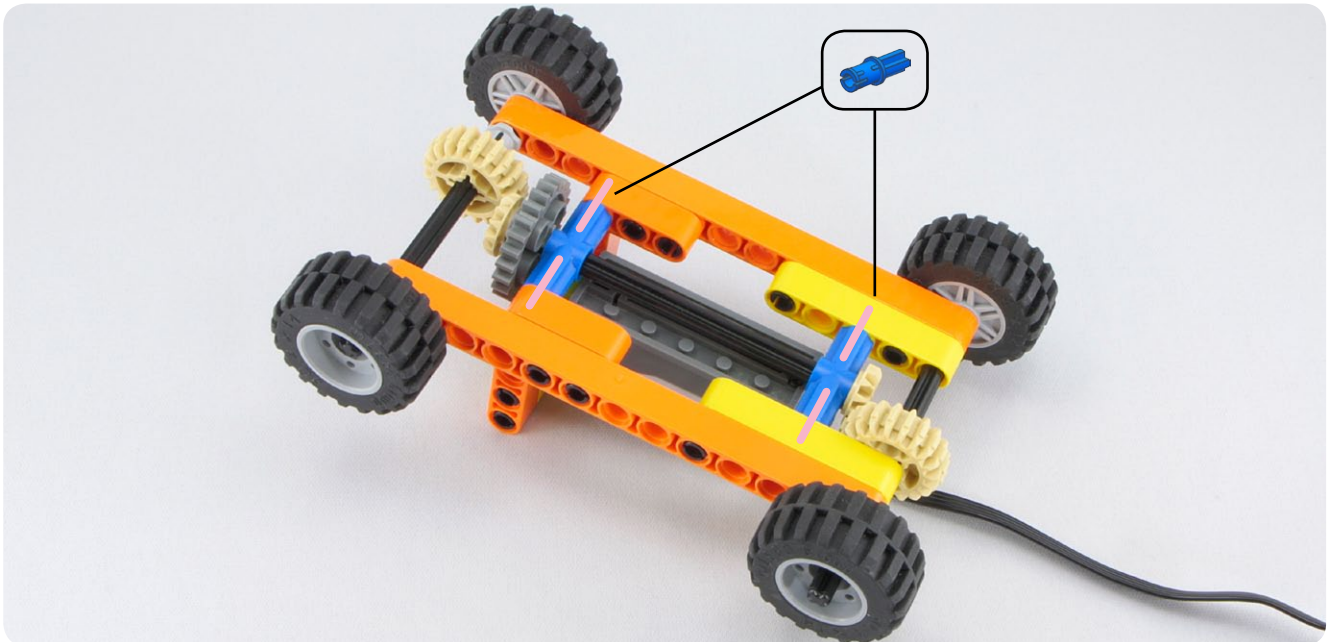
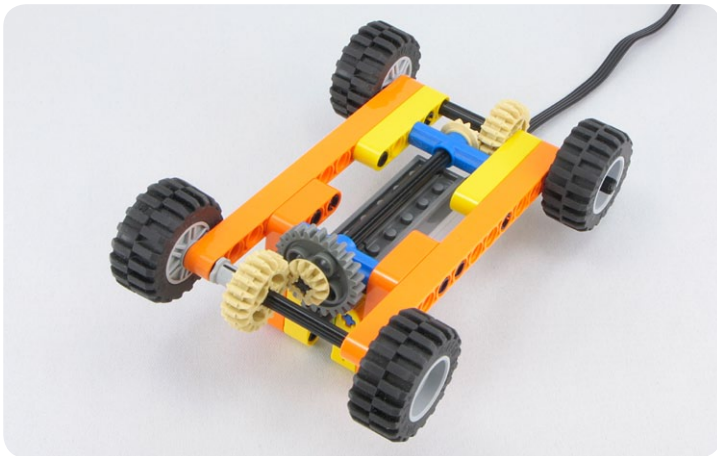
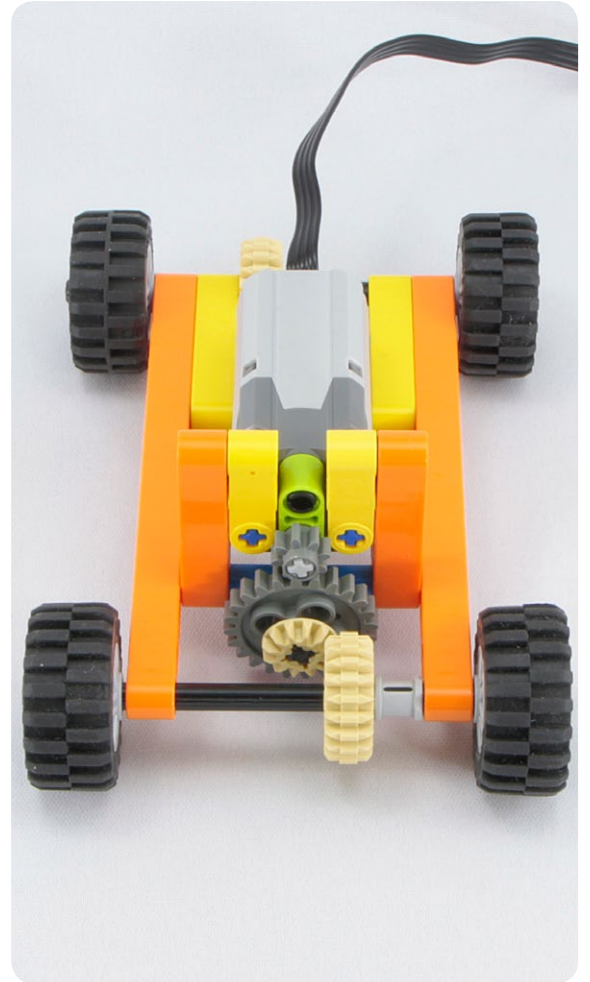




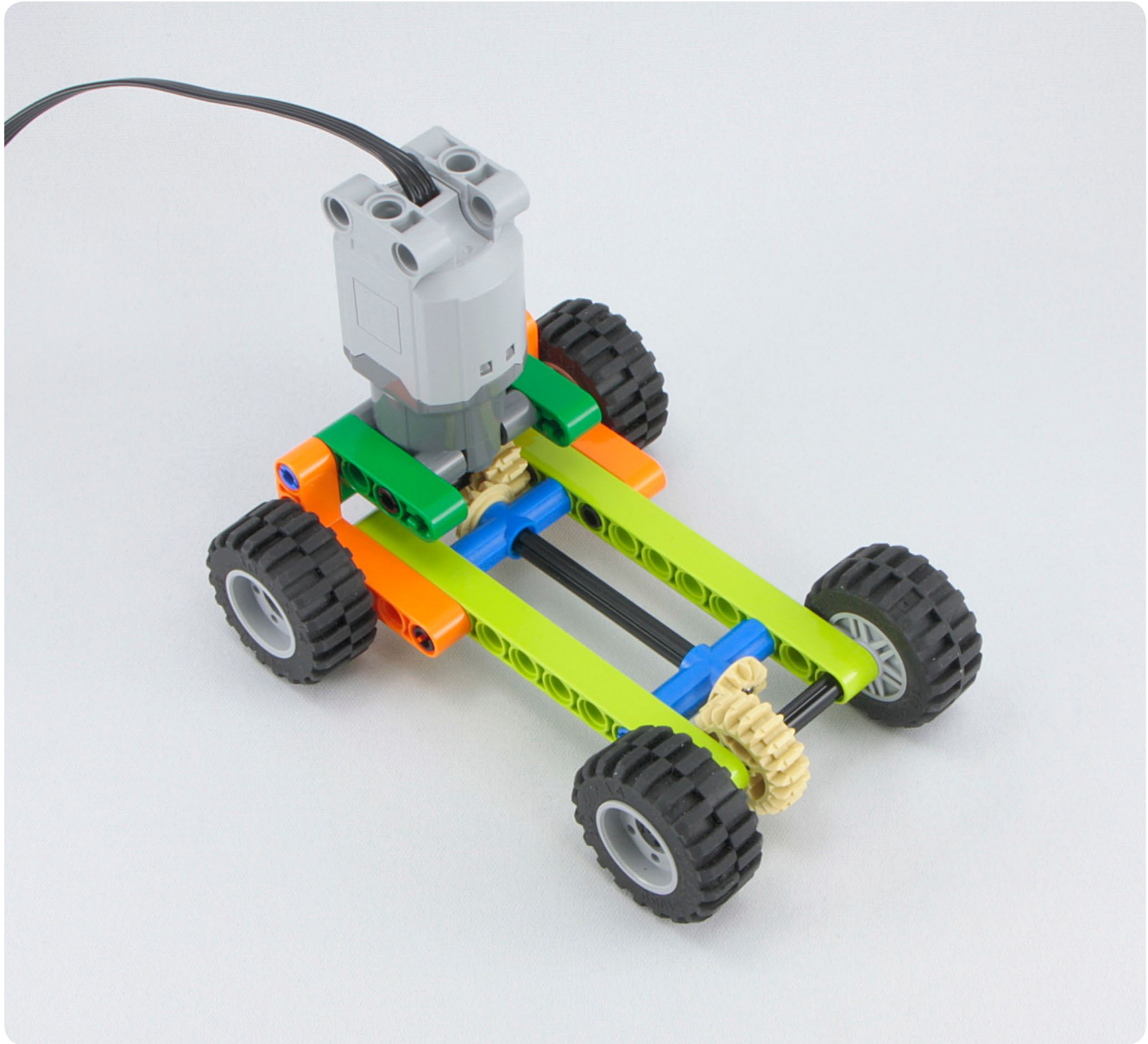
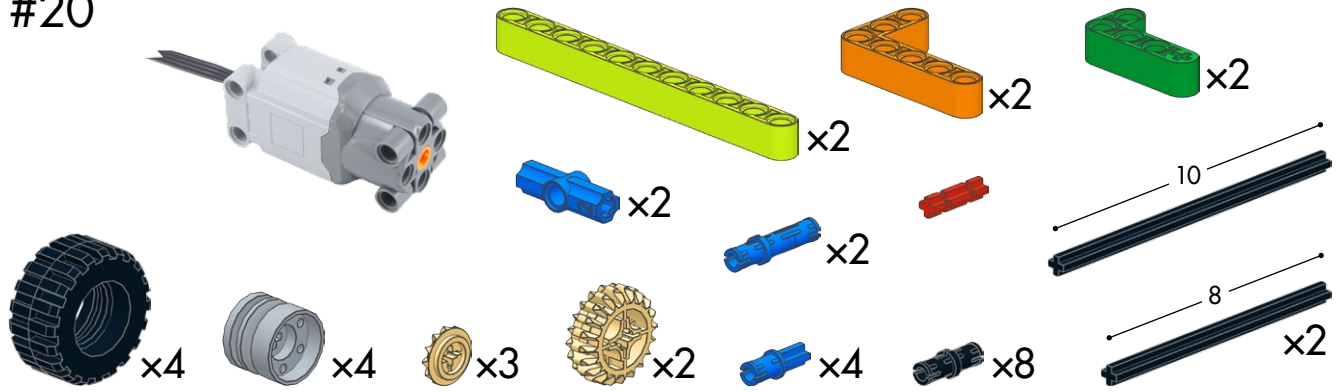
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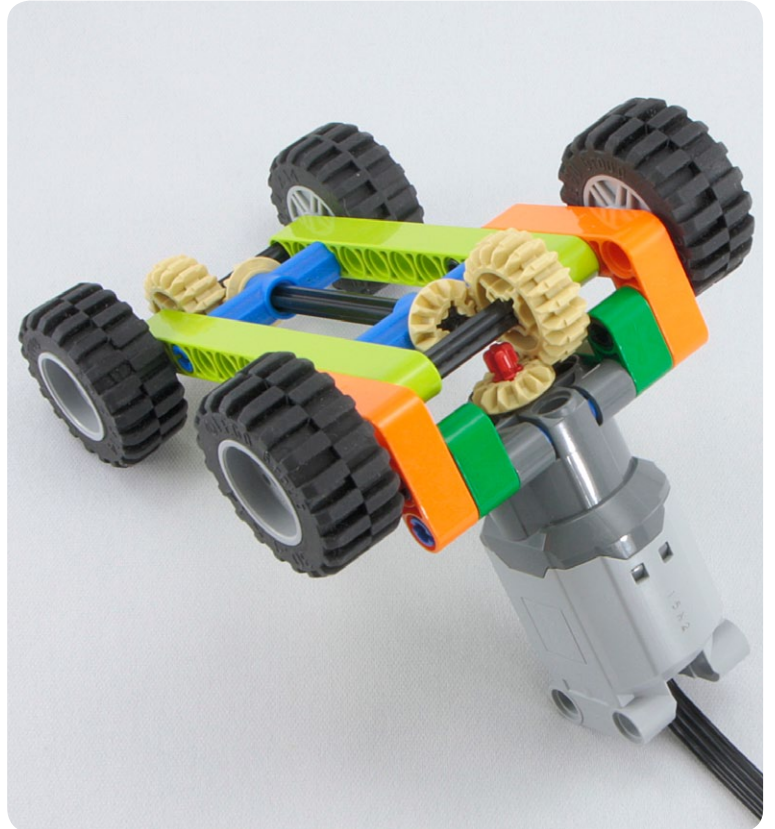
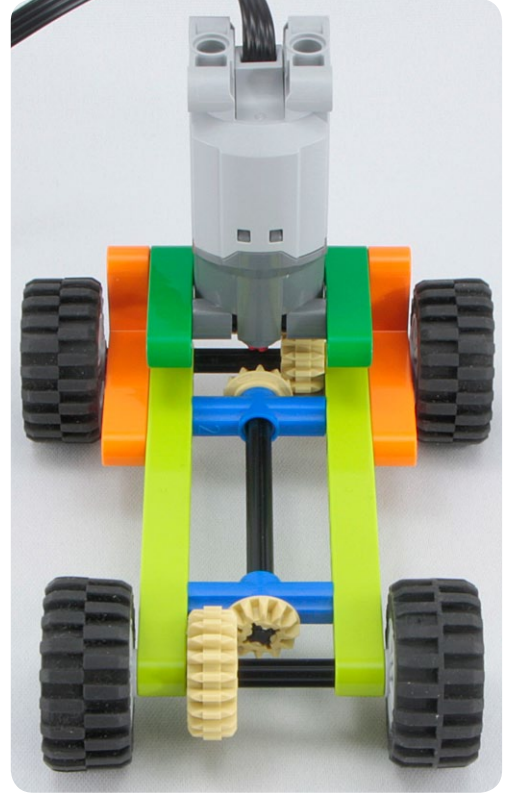
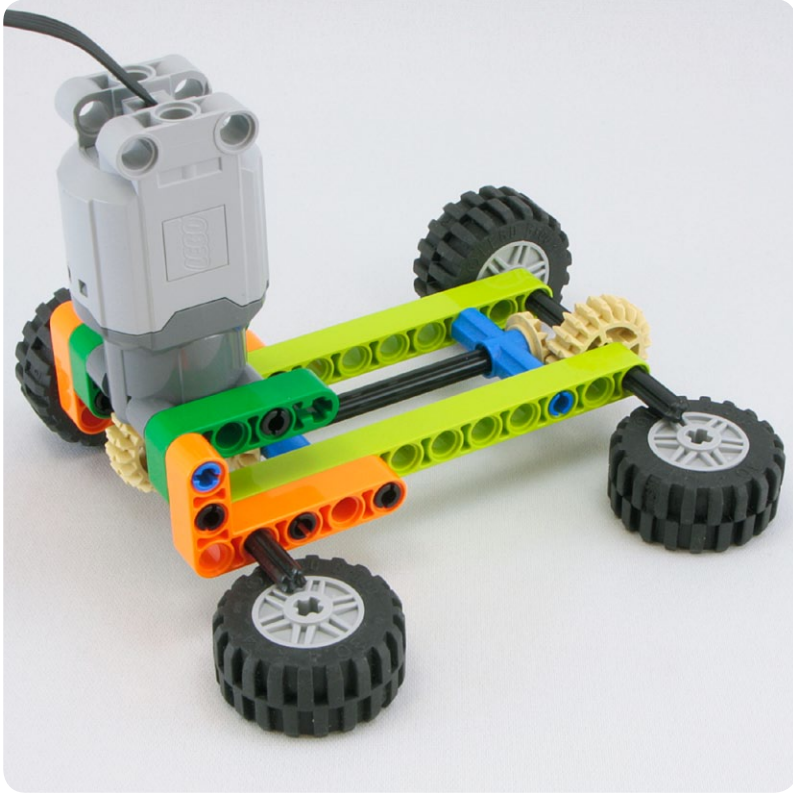
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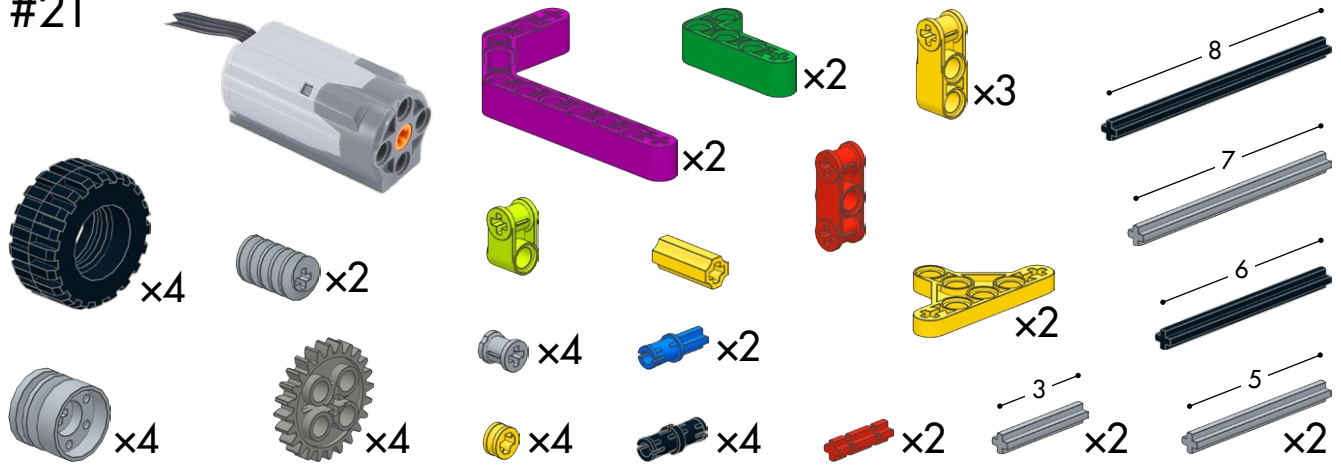


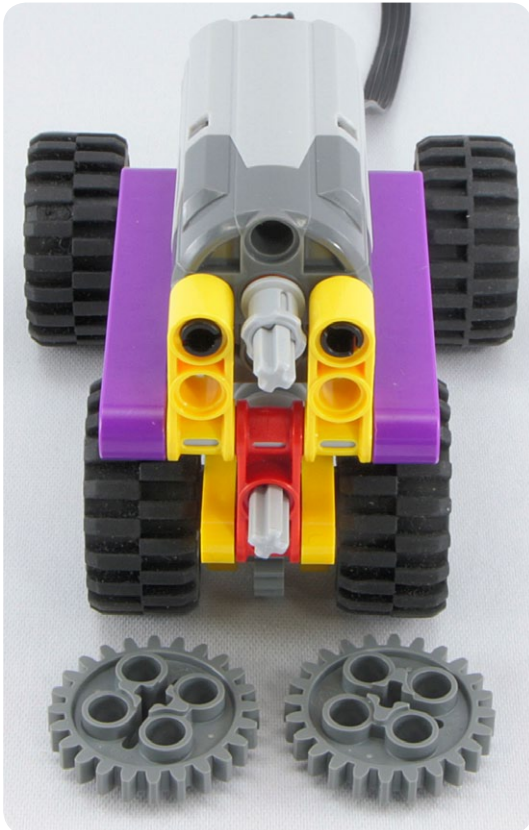
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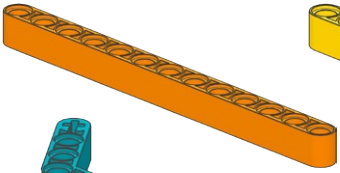
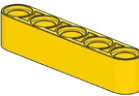
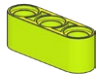
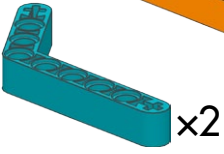

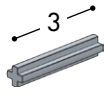
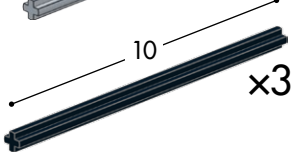
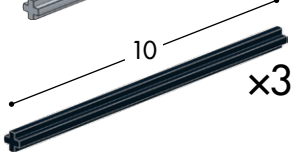
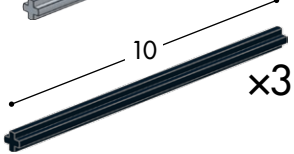


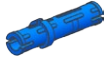




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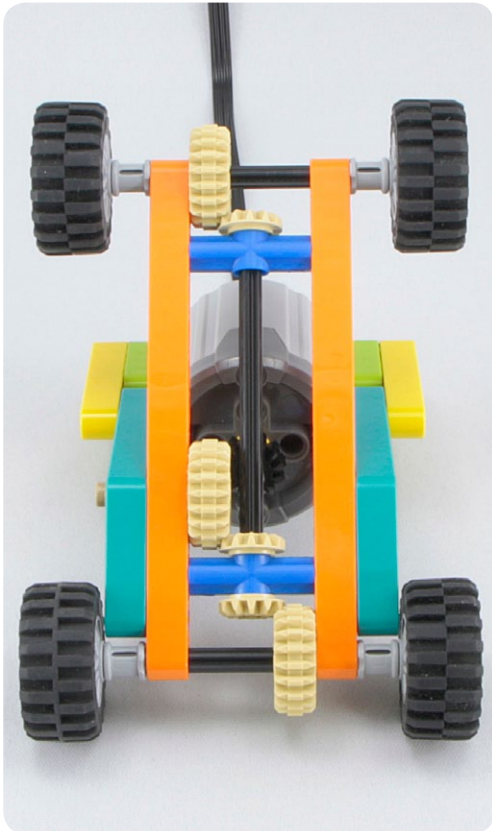
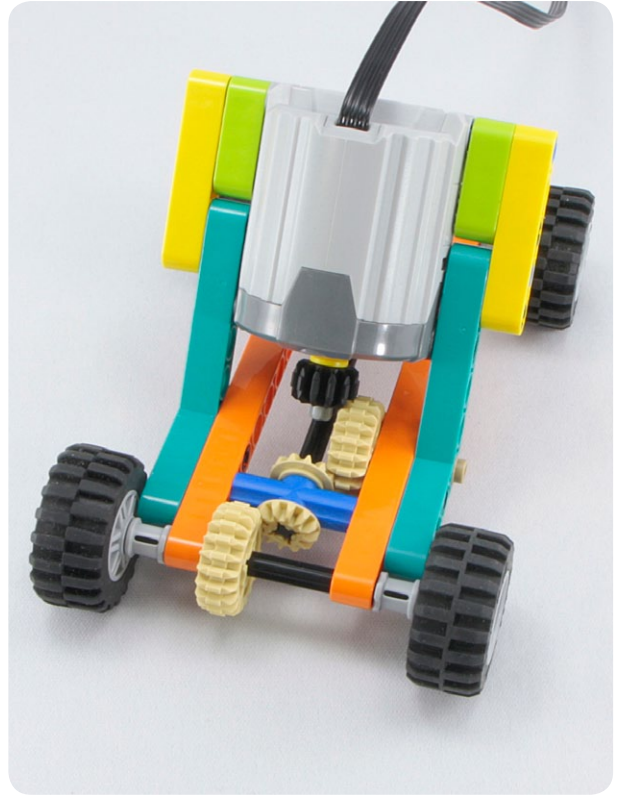


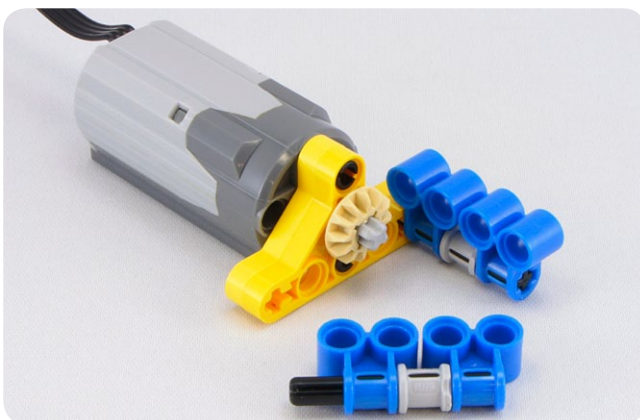
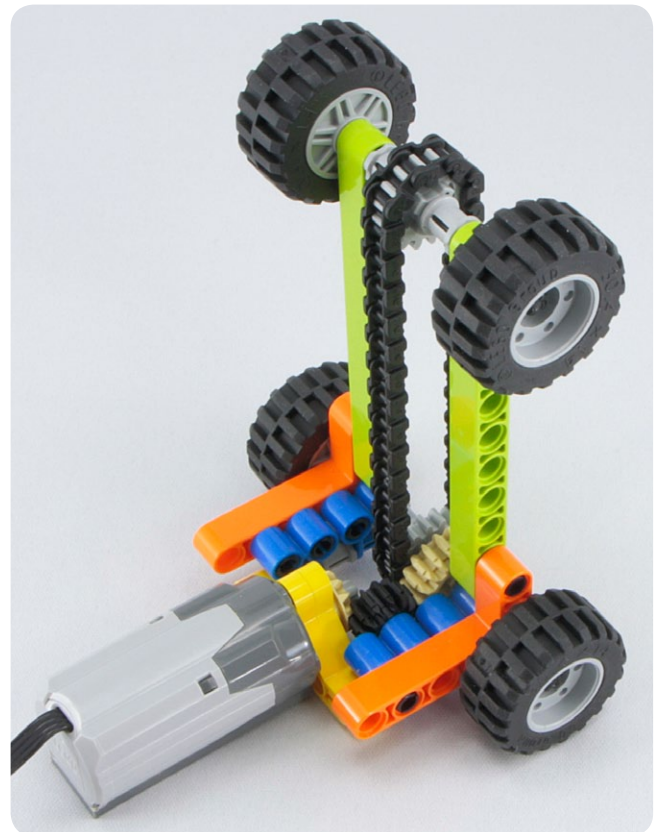
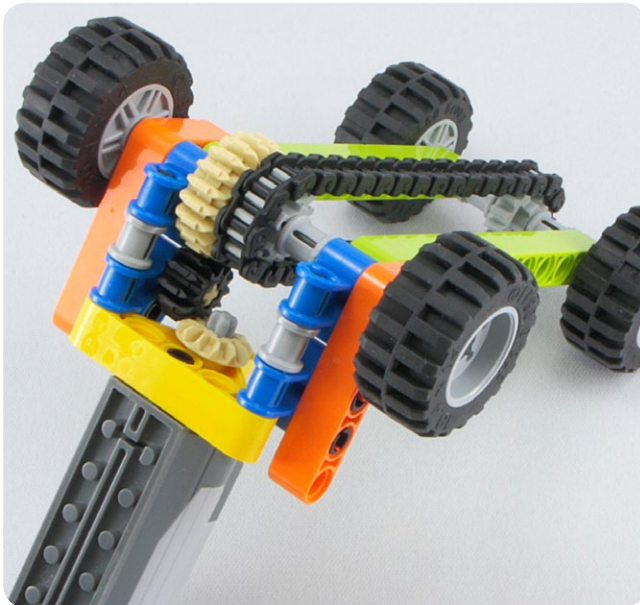
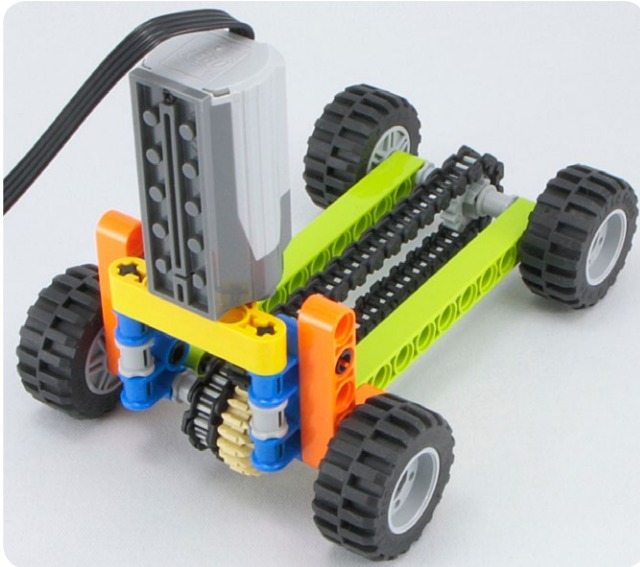


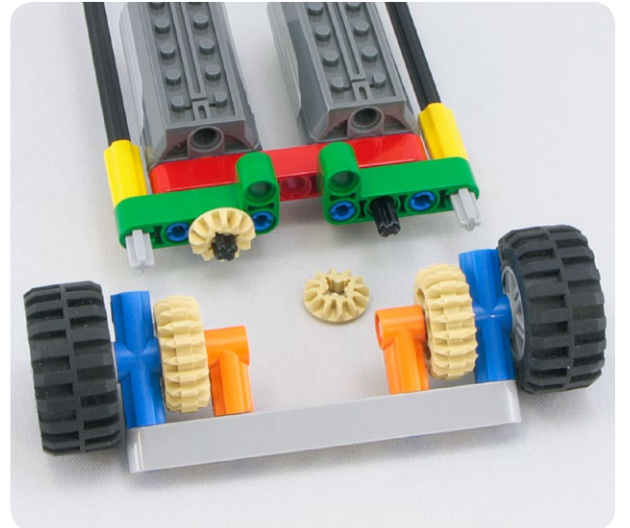
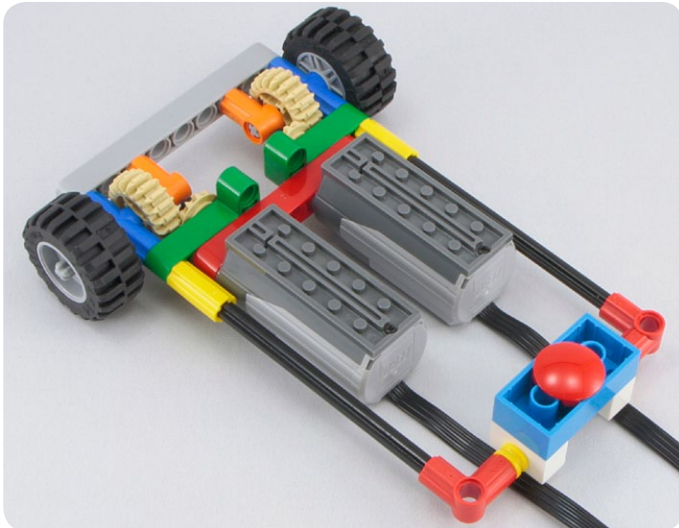
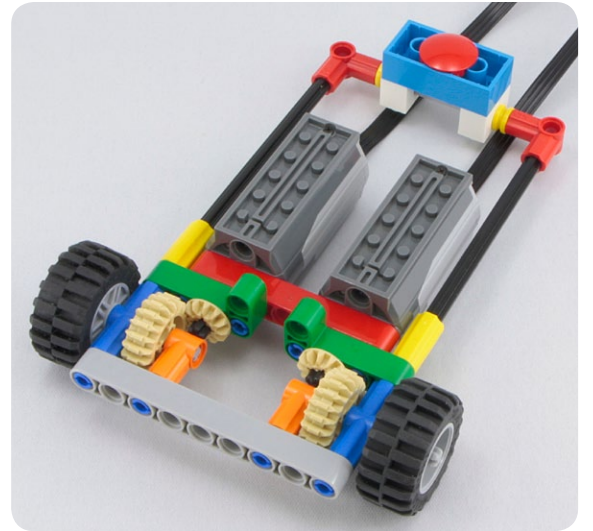
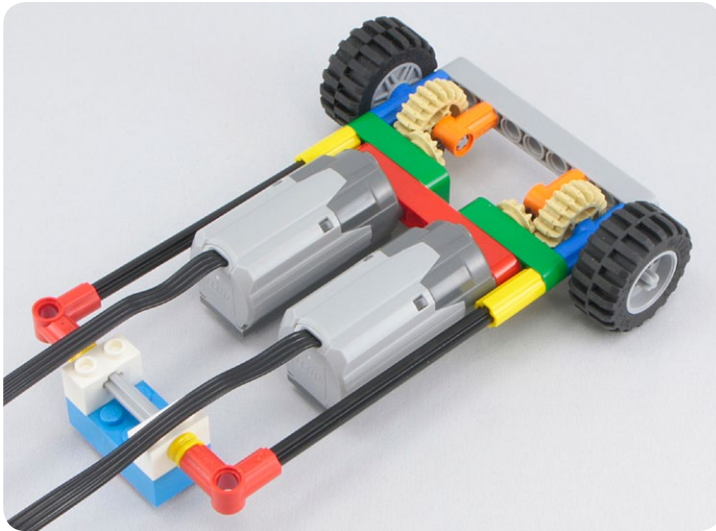
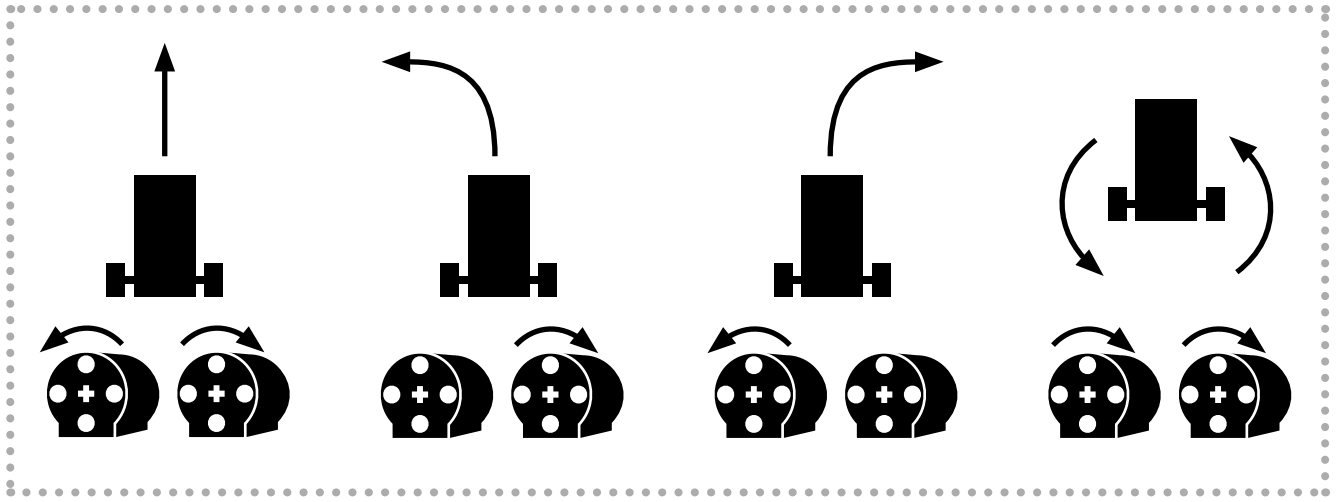
#22

-  Motor
-  x4
-  x4
-  1
-  x3
-  x3
-  1
-  x2
-  x2
-  x2
-  x2
-  1
-  3
-  10
-  3
-  3
-  x2
-  x4
-  x2
-  x8
-  x8

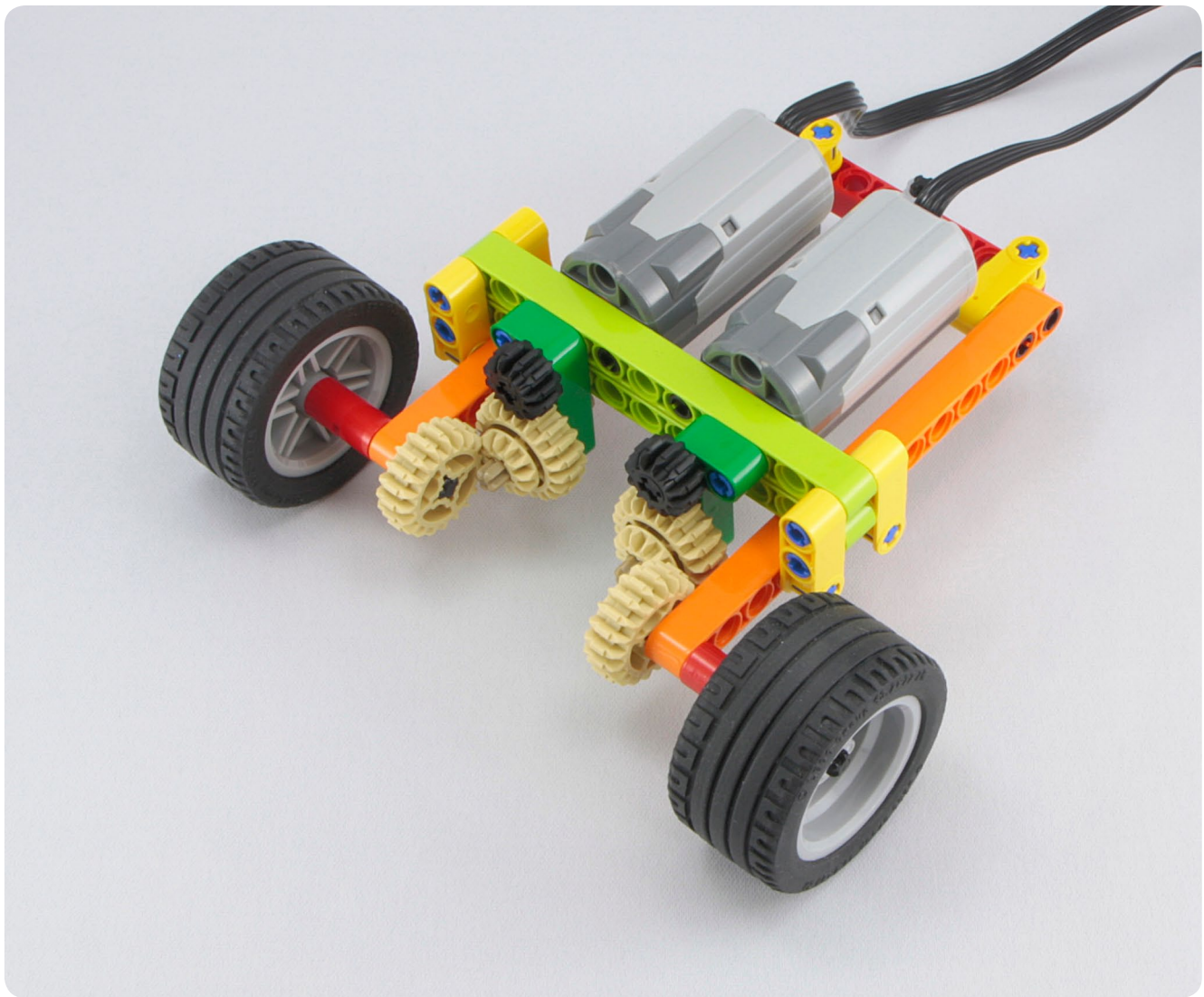
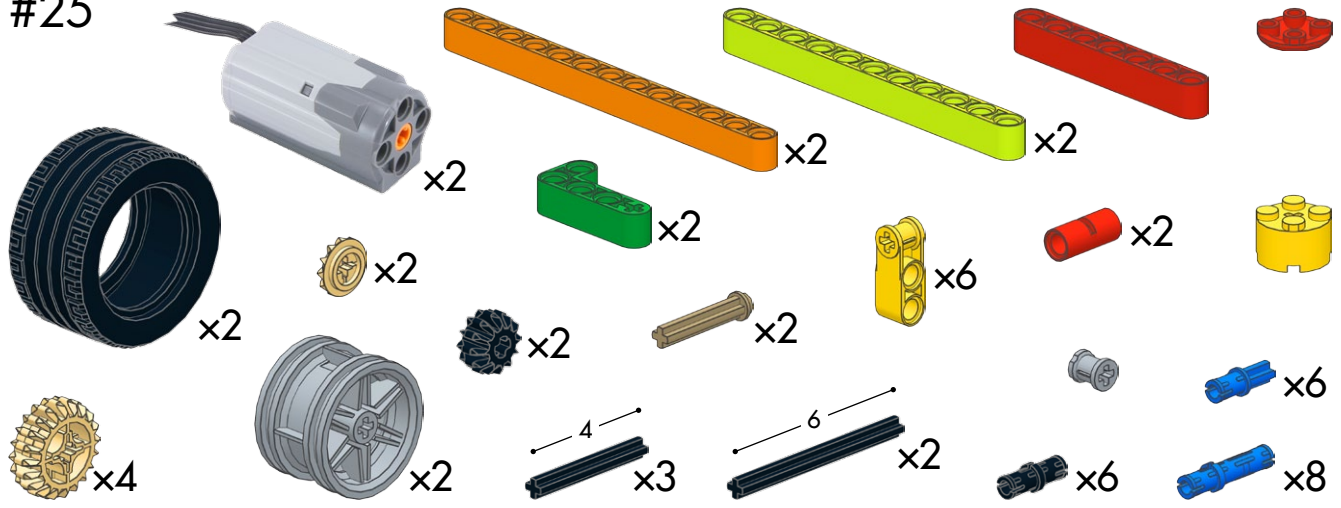


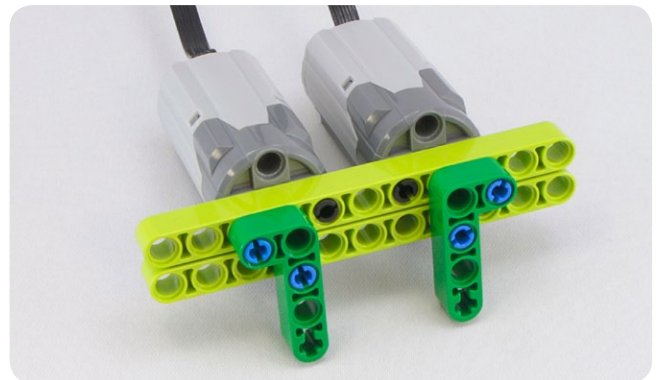
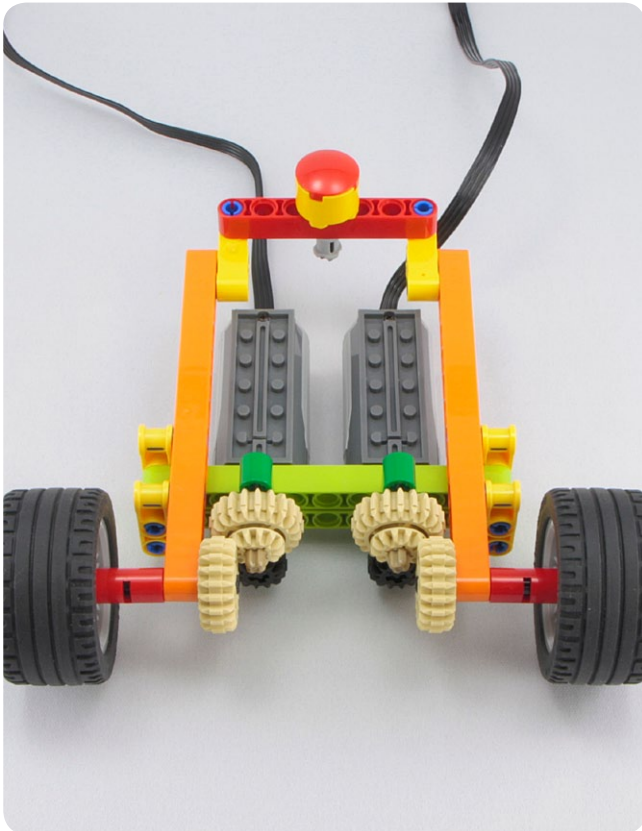
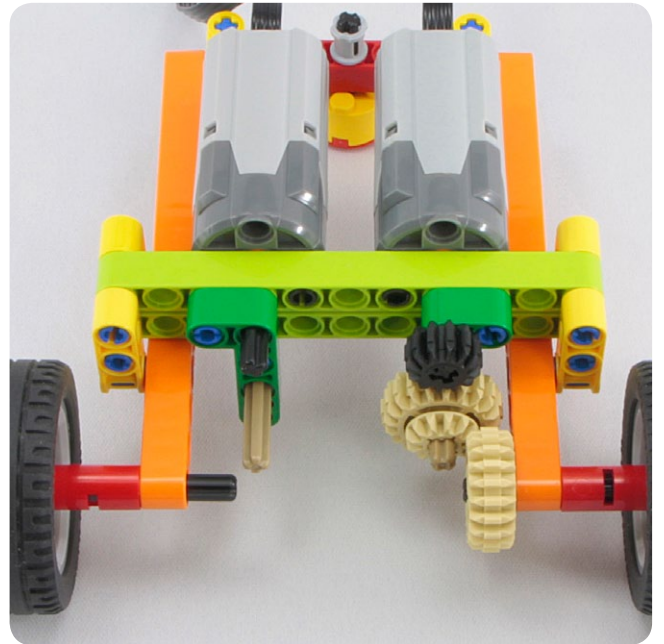
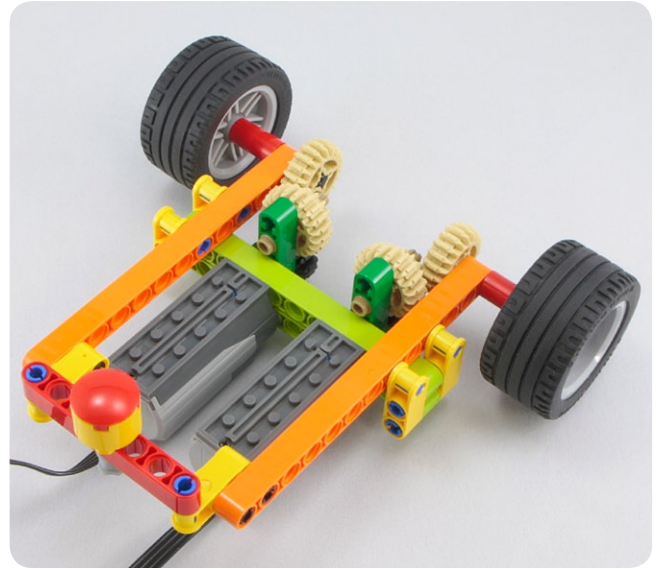


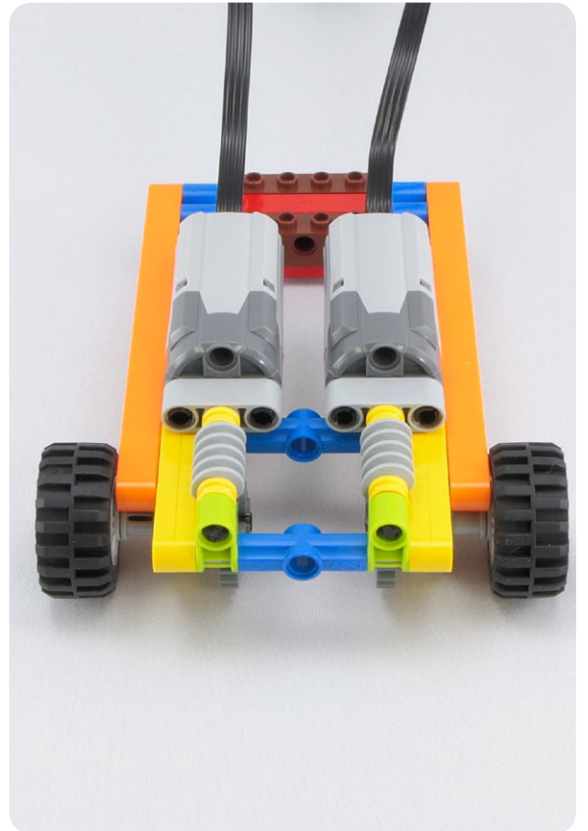
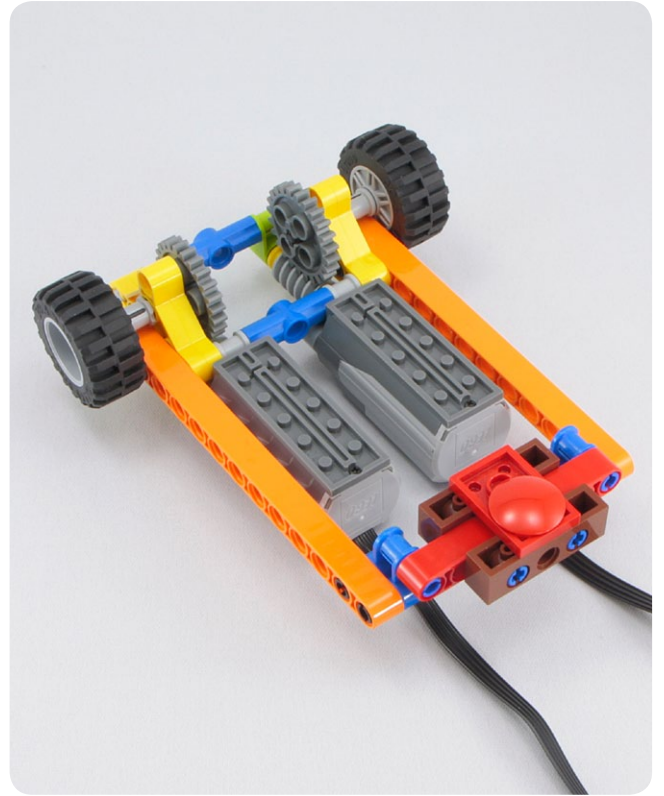
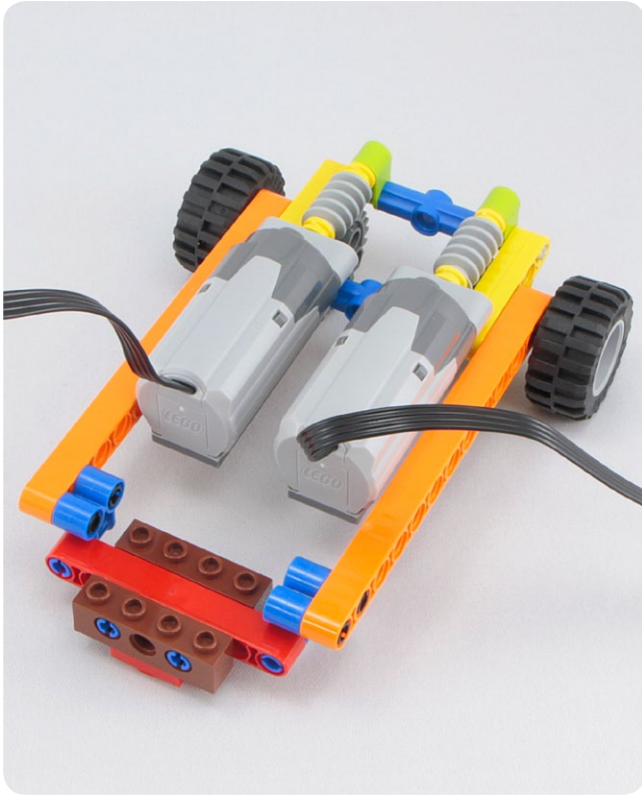




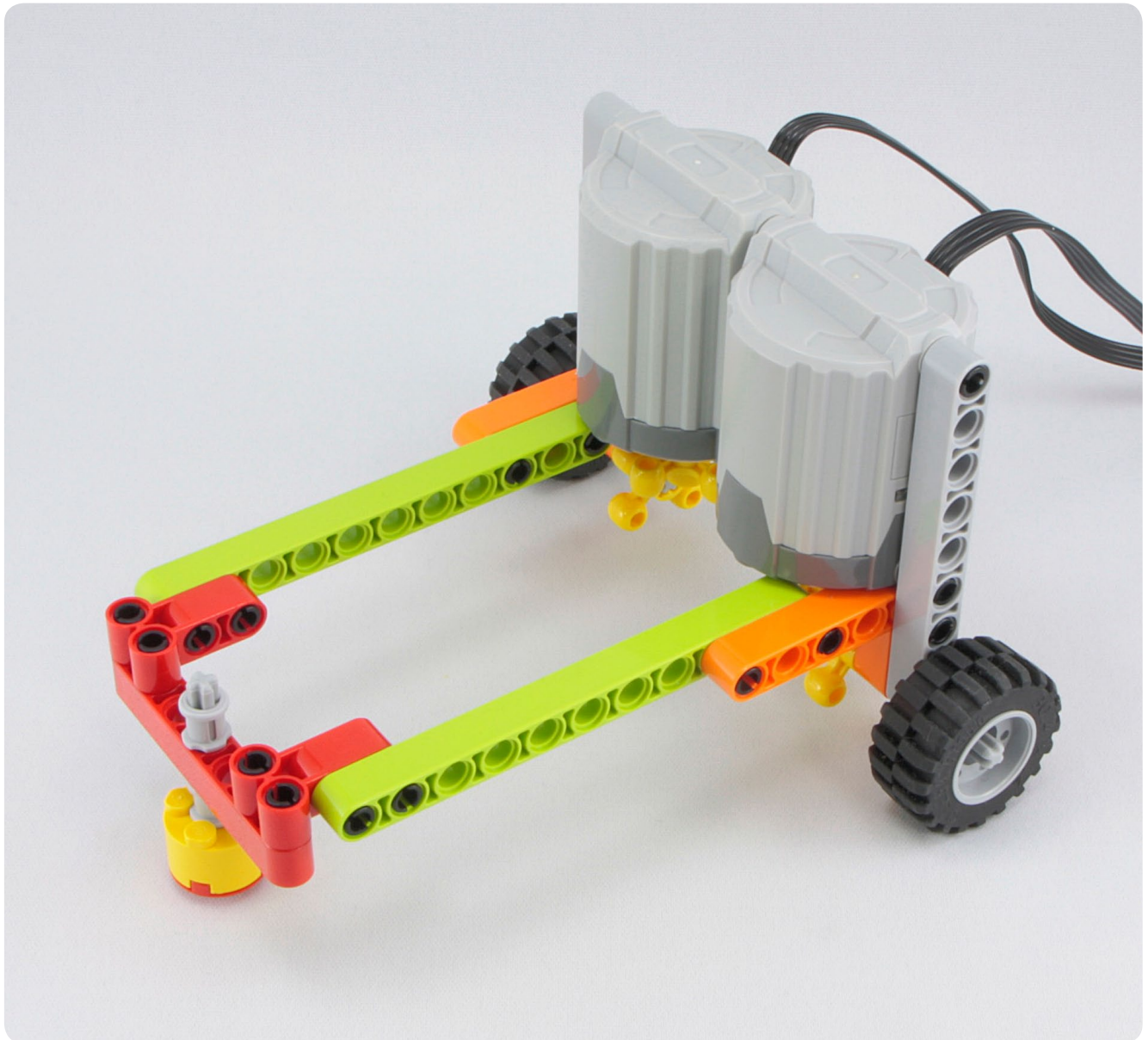
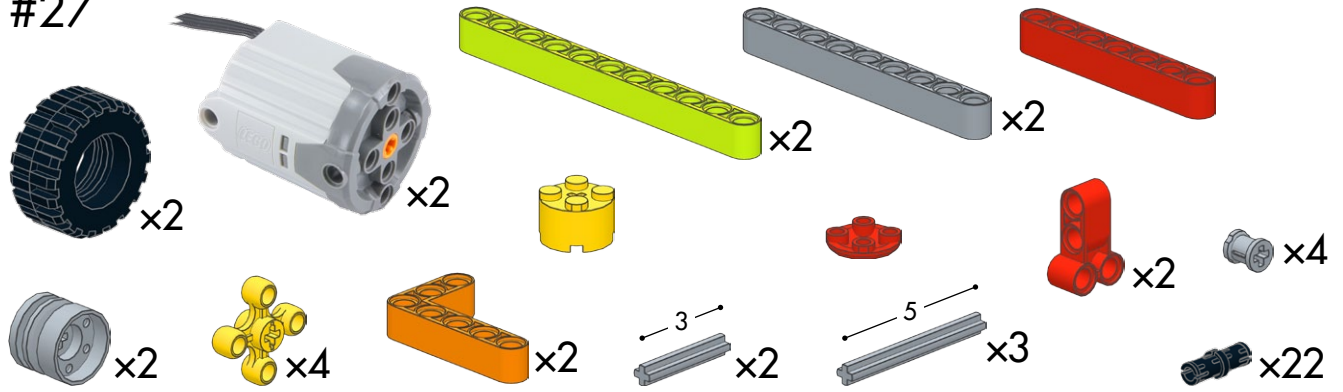
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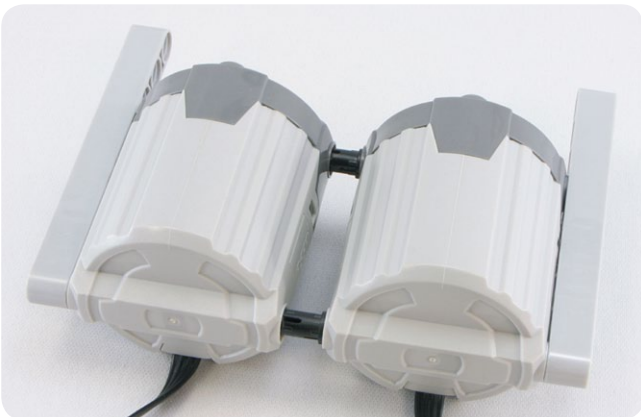
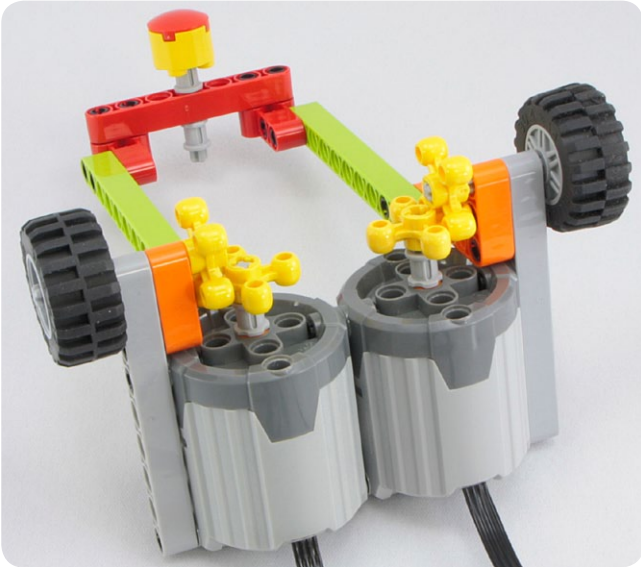
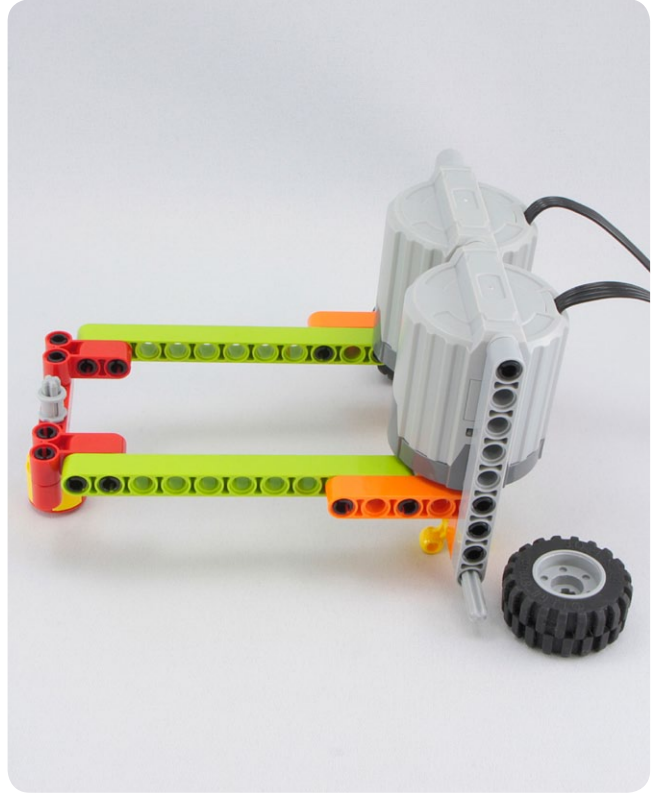
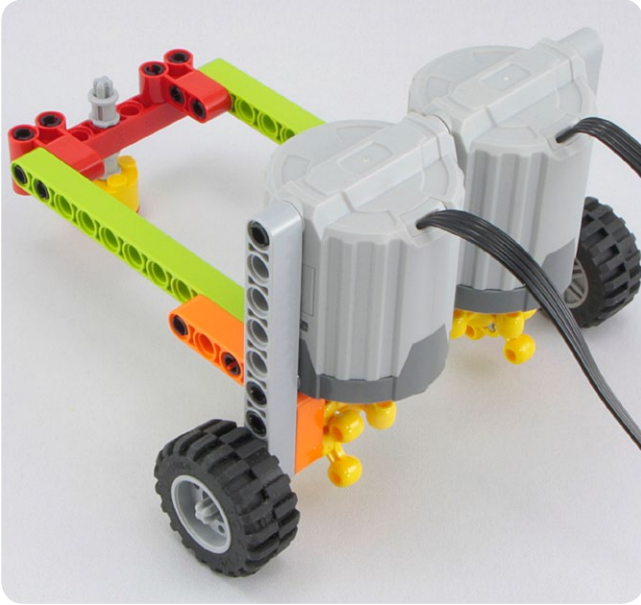


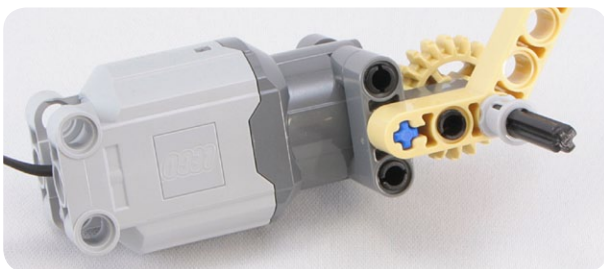
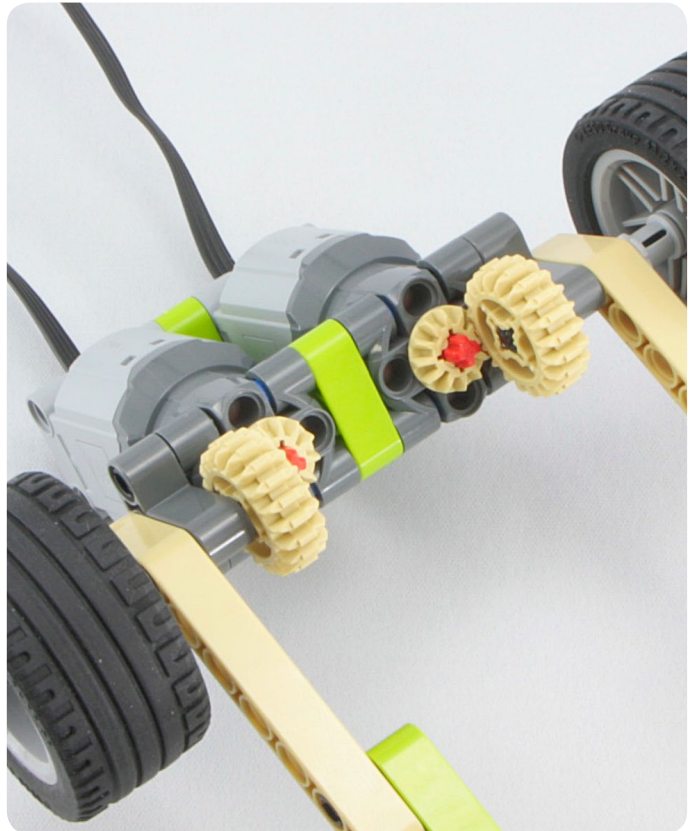
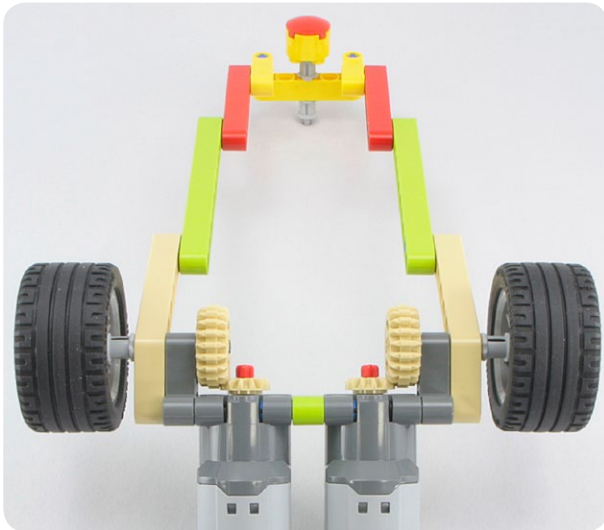
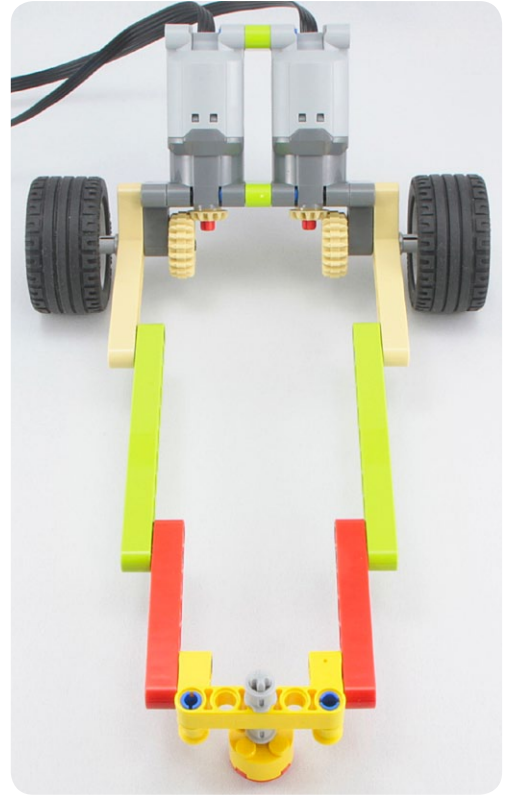


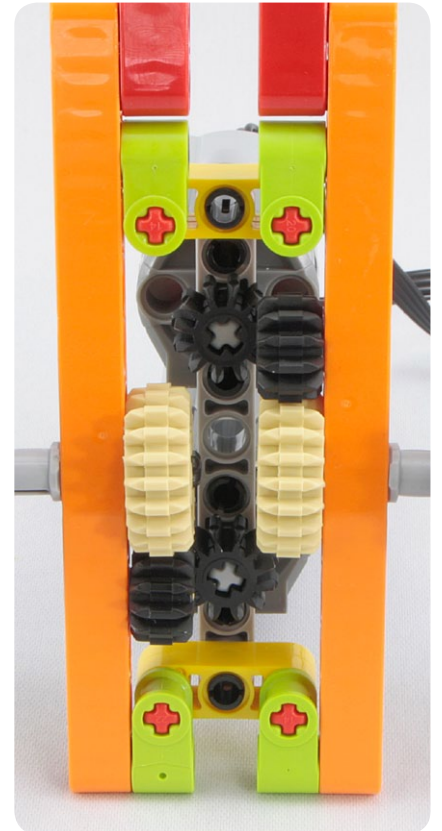
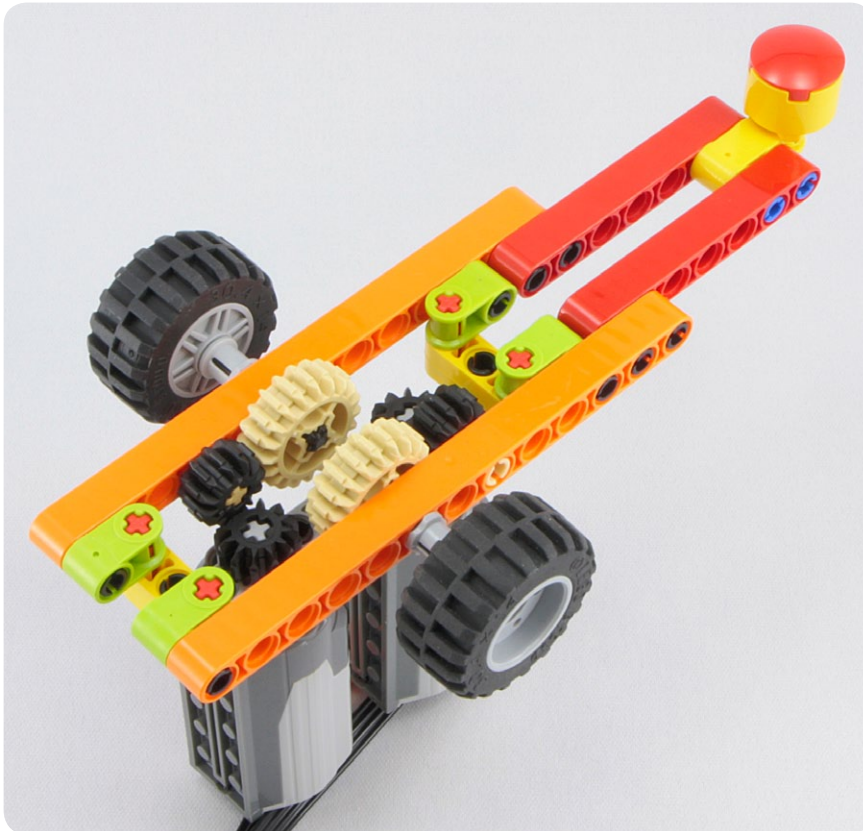


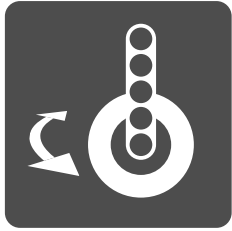
#27









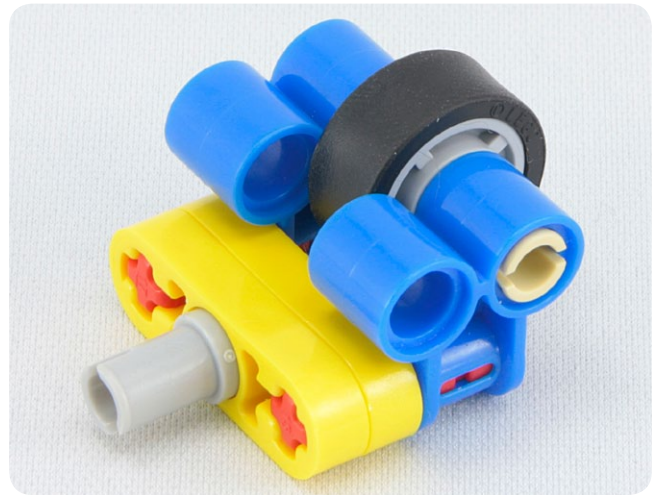
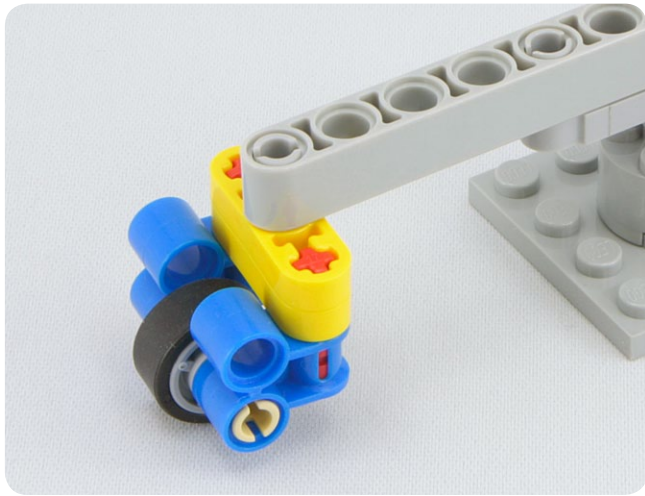


You can build cars that steer by combining these with the models in **Each motor turns a wheel** (page 32).

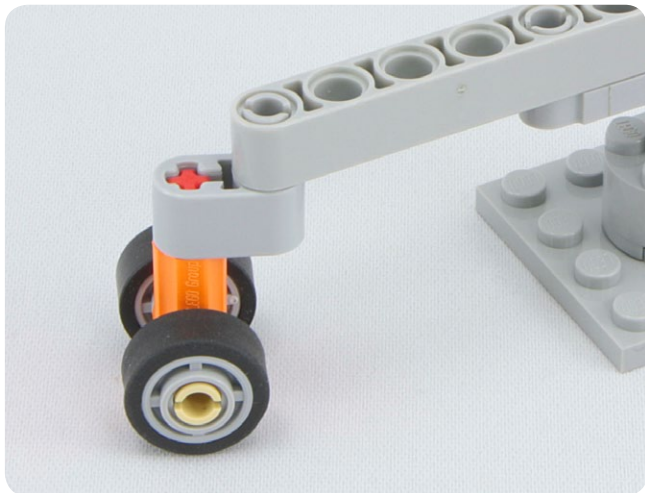
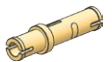


Caster wheels

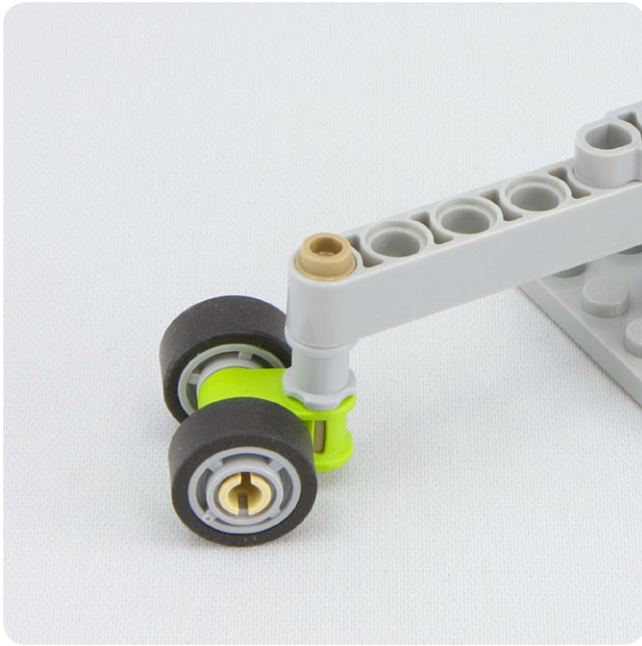
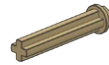
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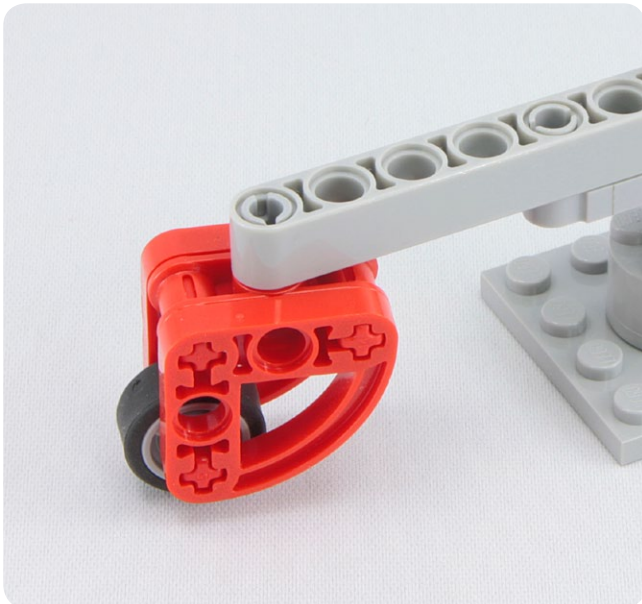
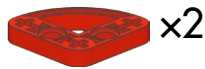
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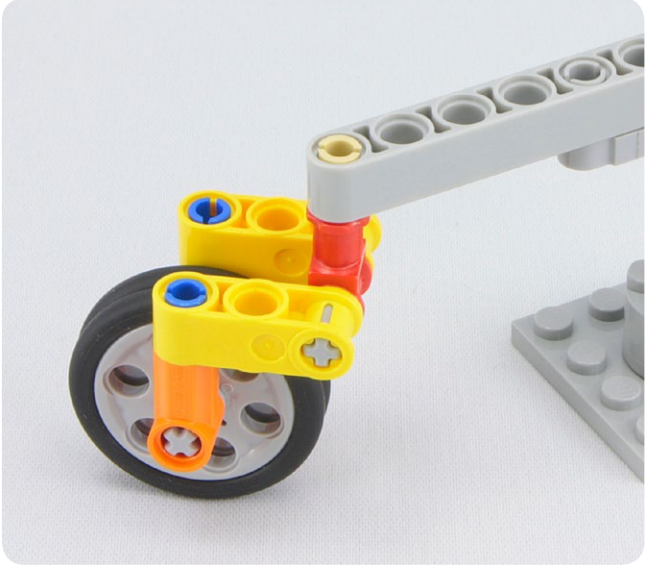
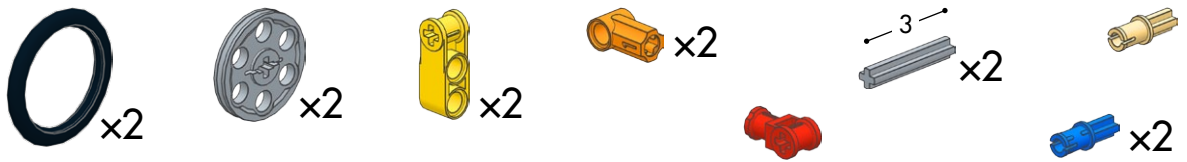
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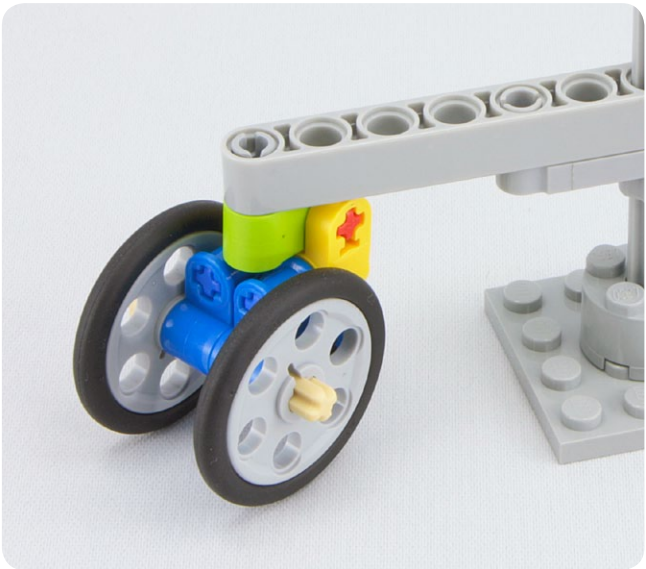
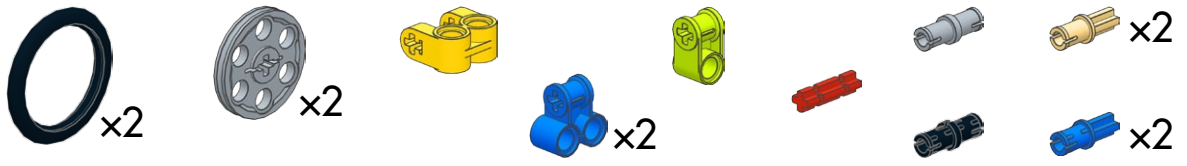
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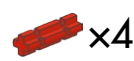
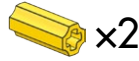
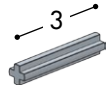
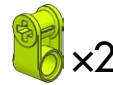
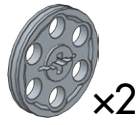
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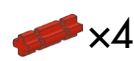
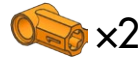
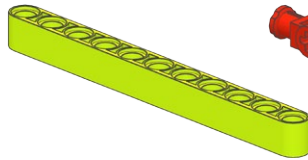
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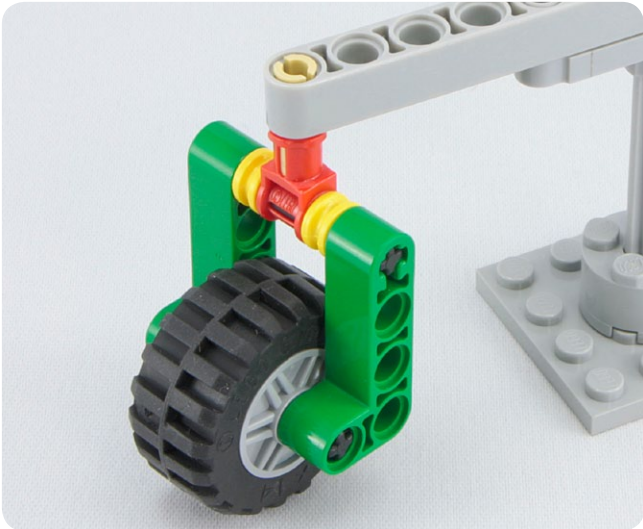
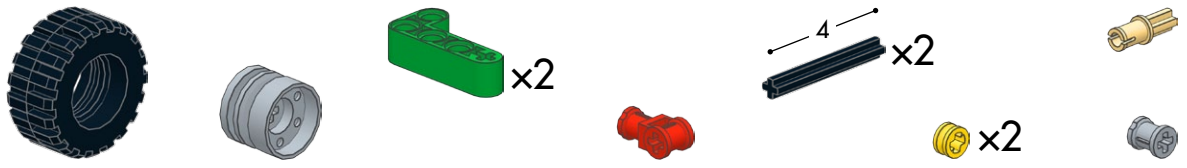
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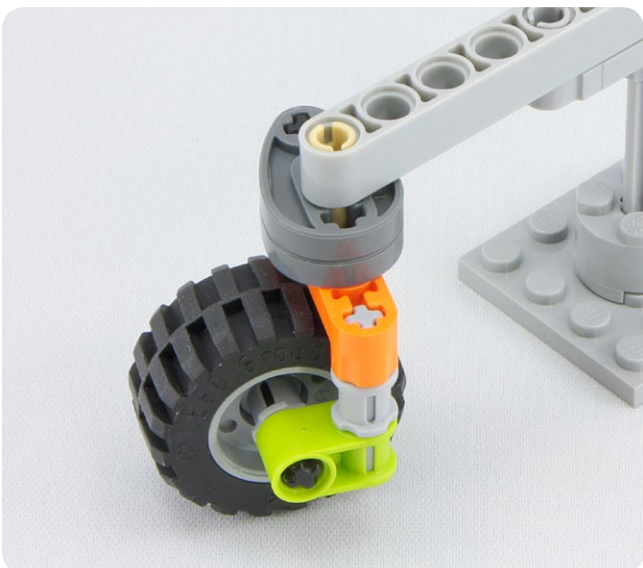
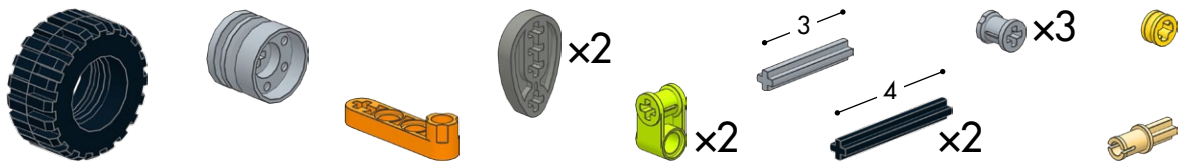
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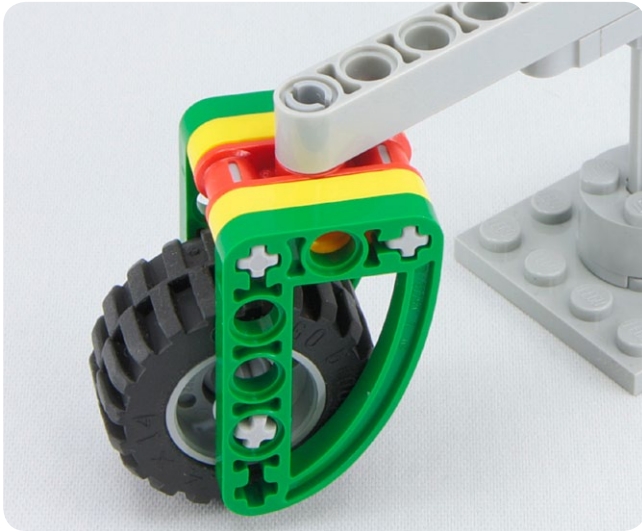
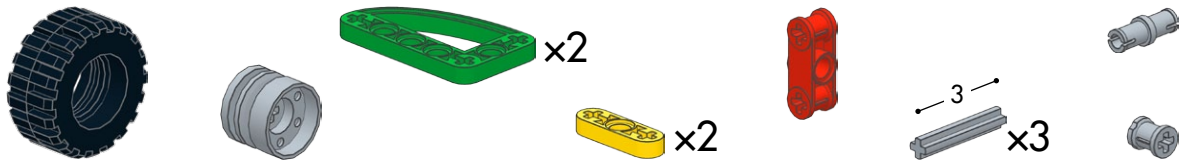
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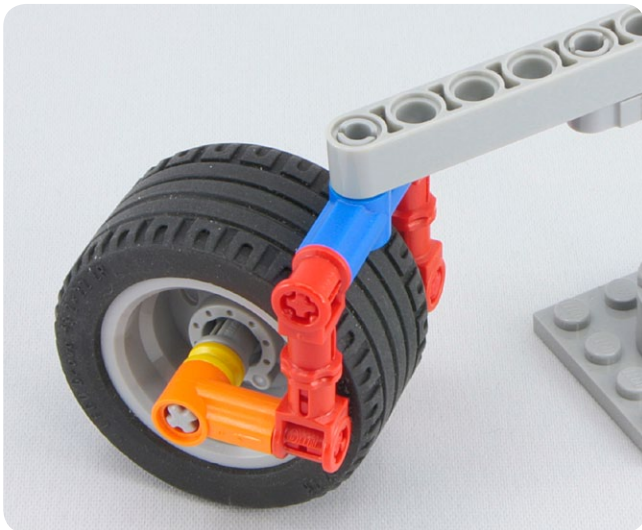
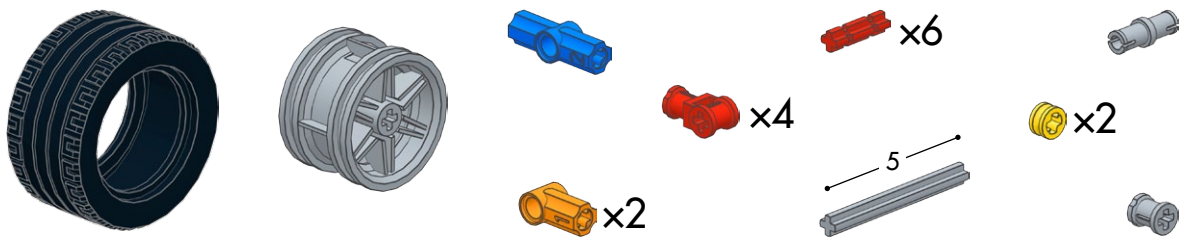
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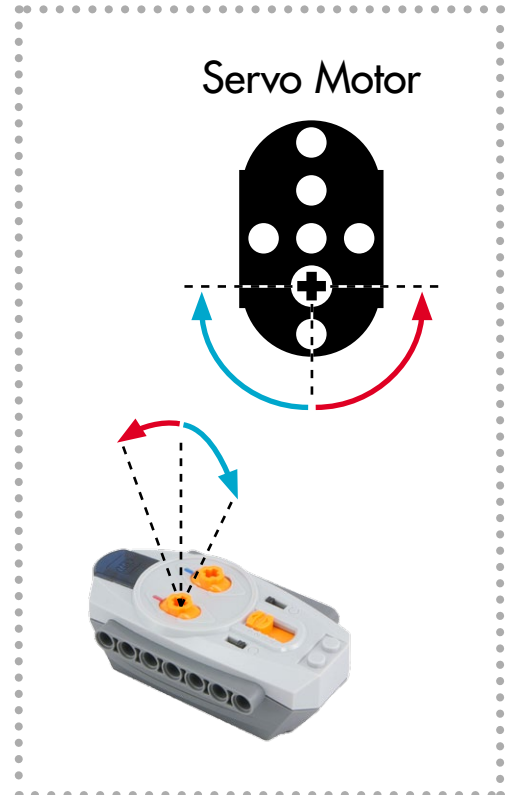
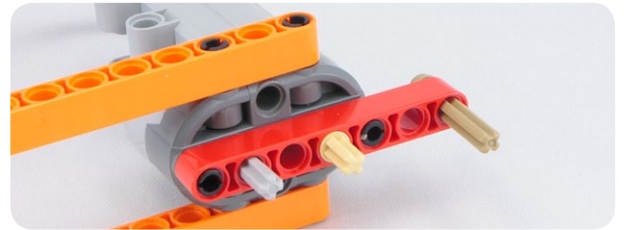
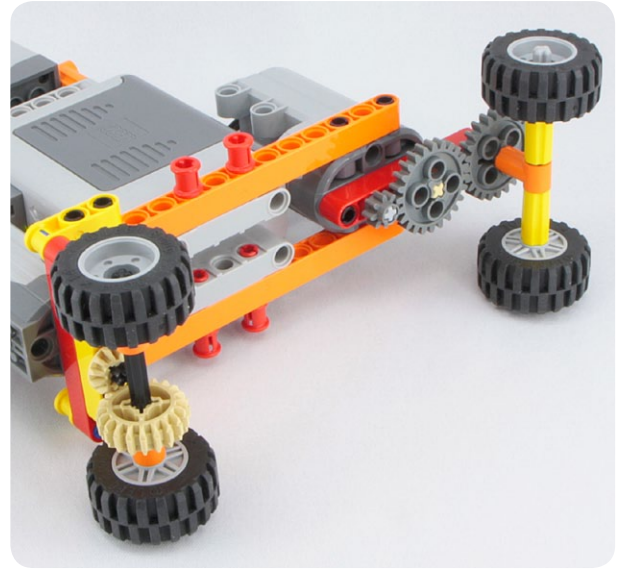


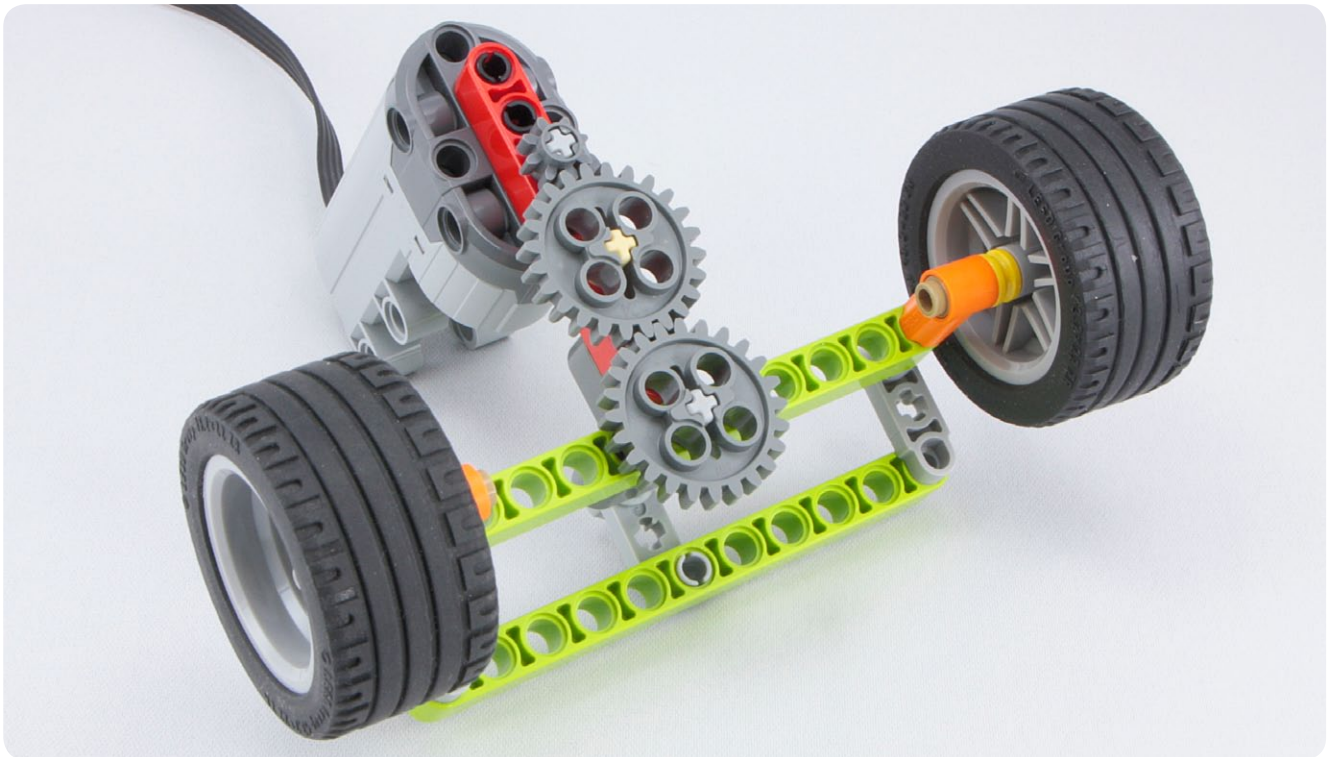
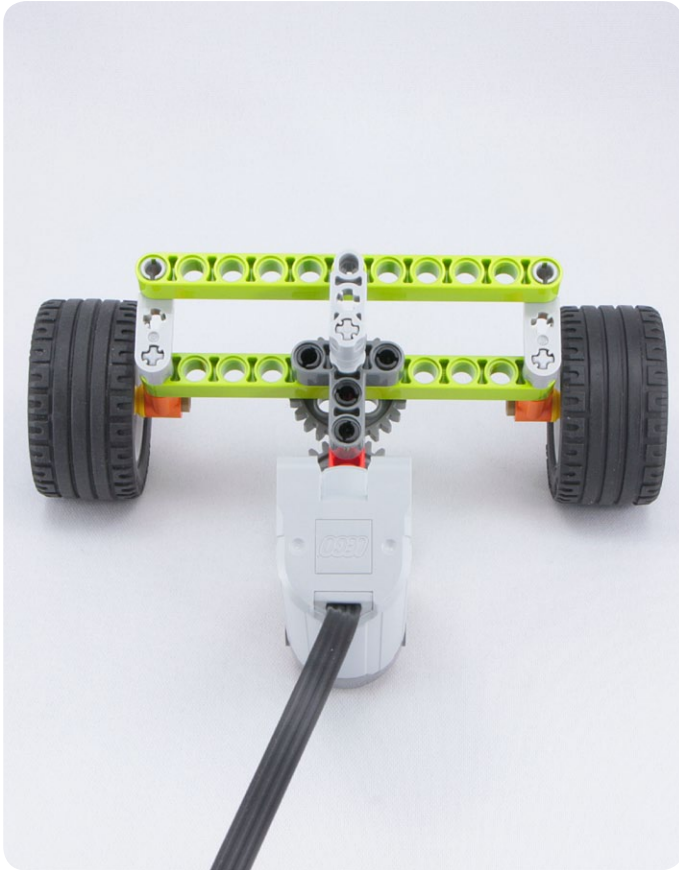
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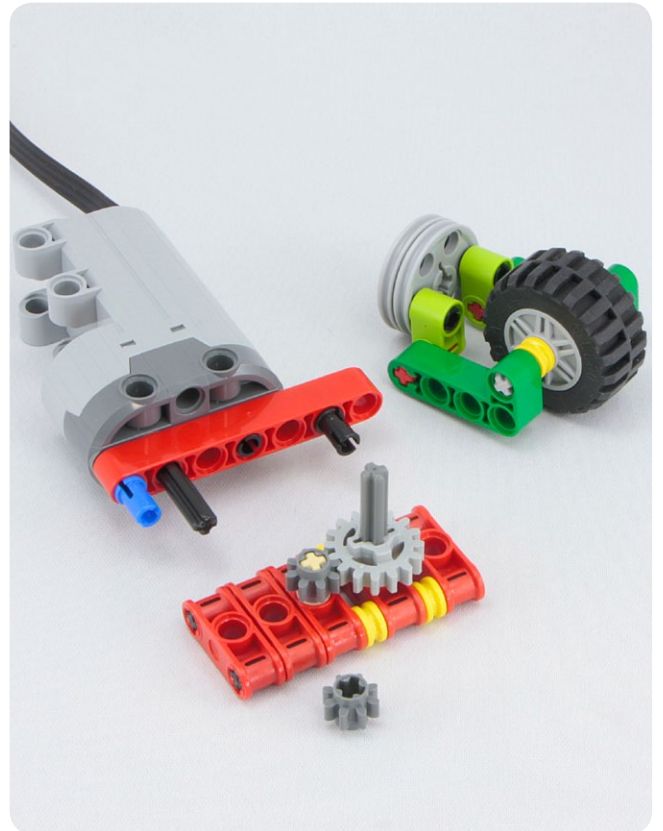
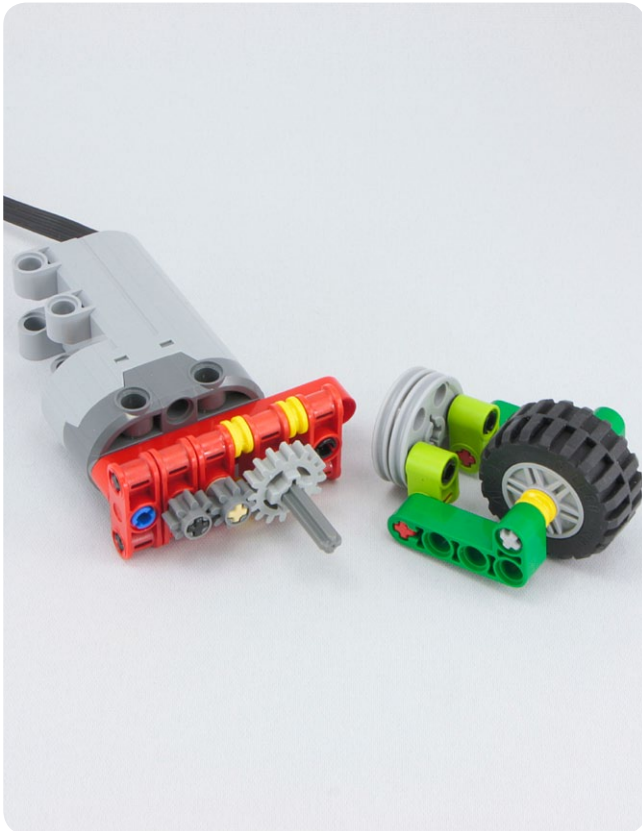
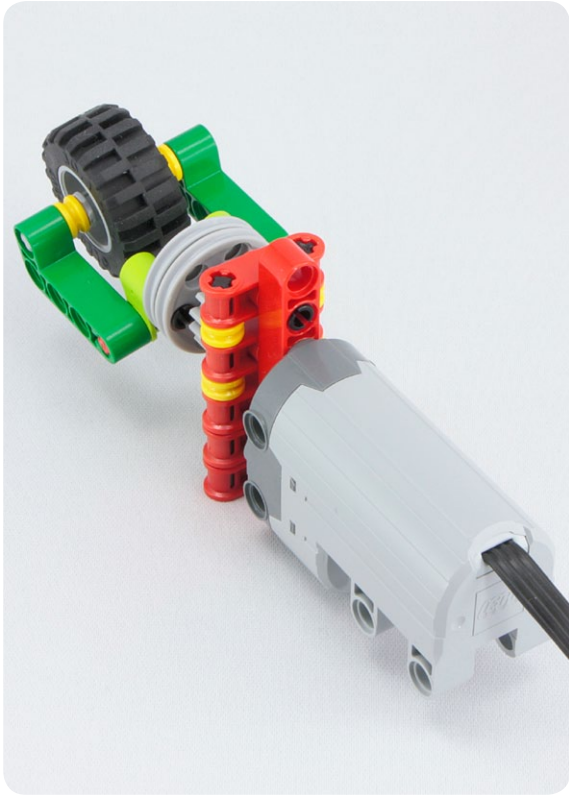


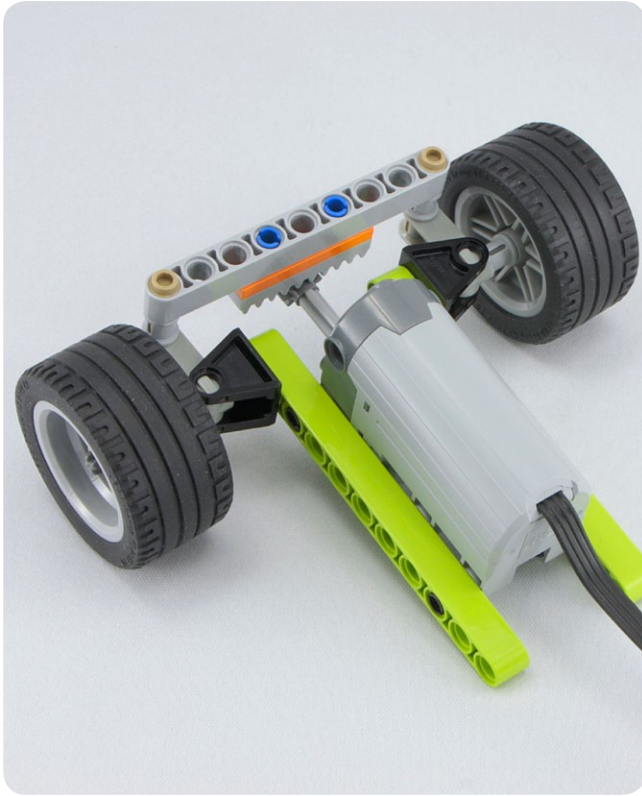
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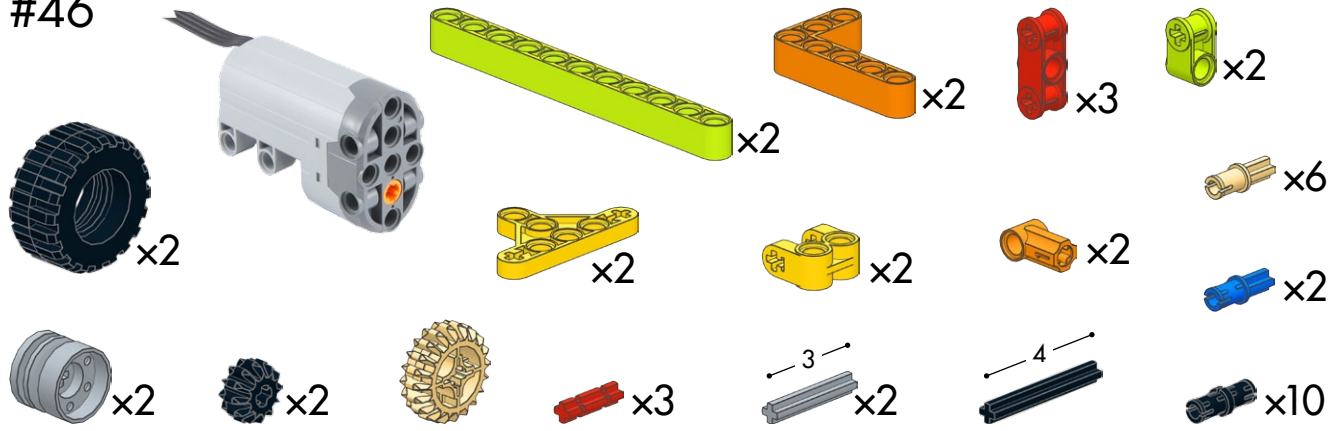


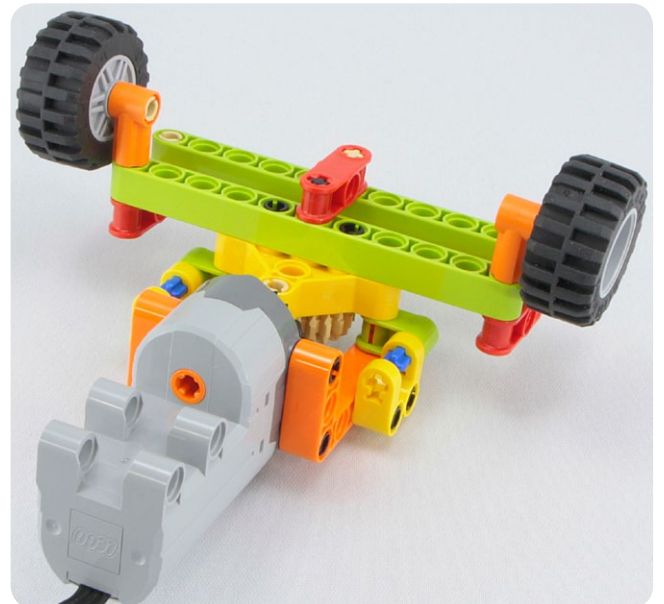
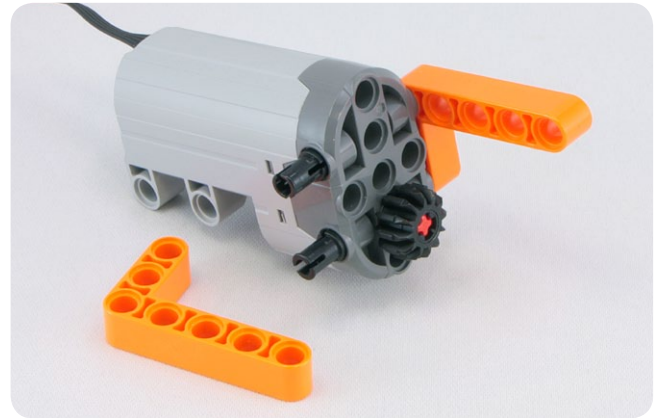


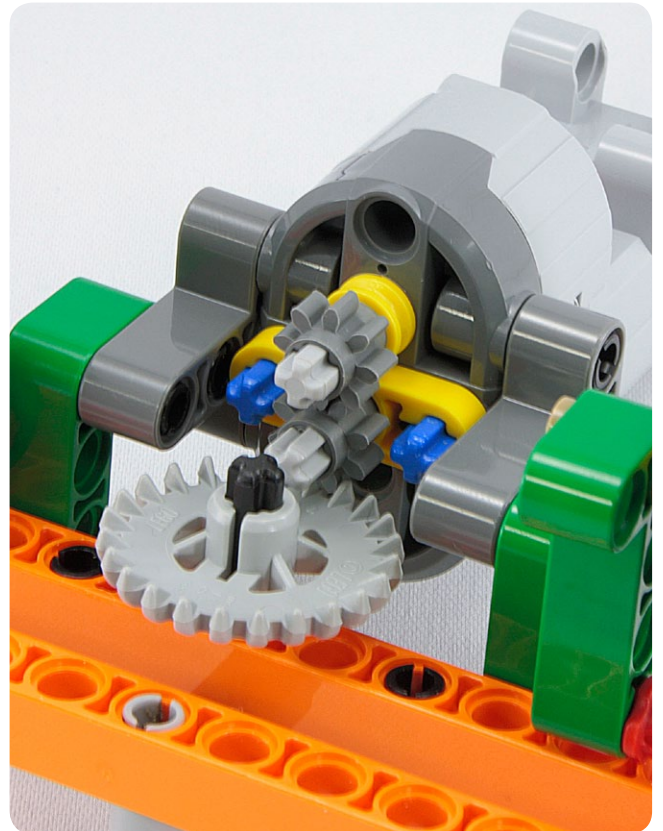
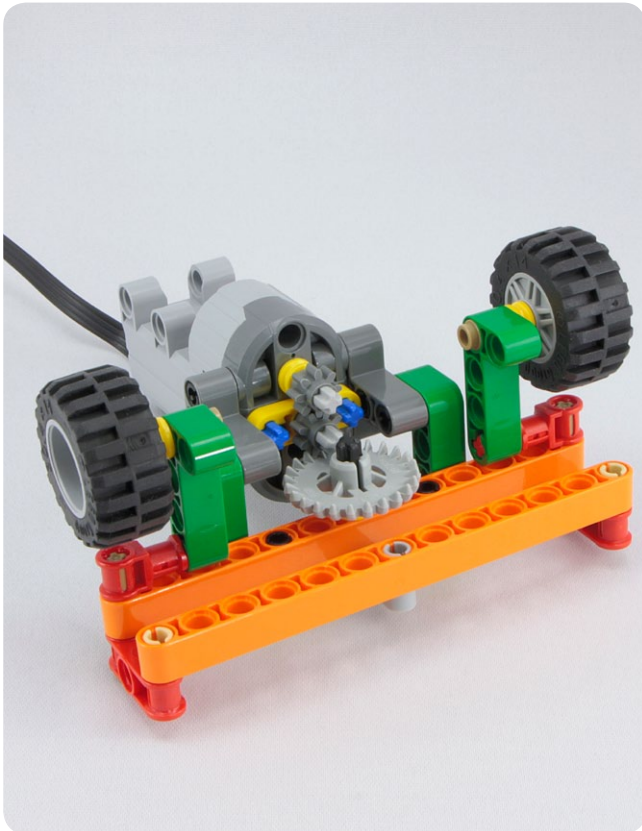
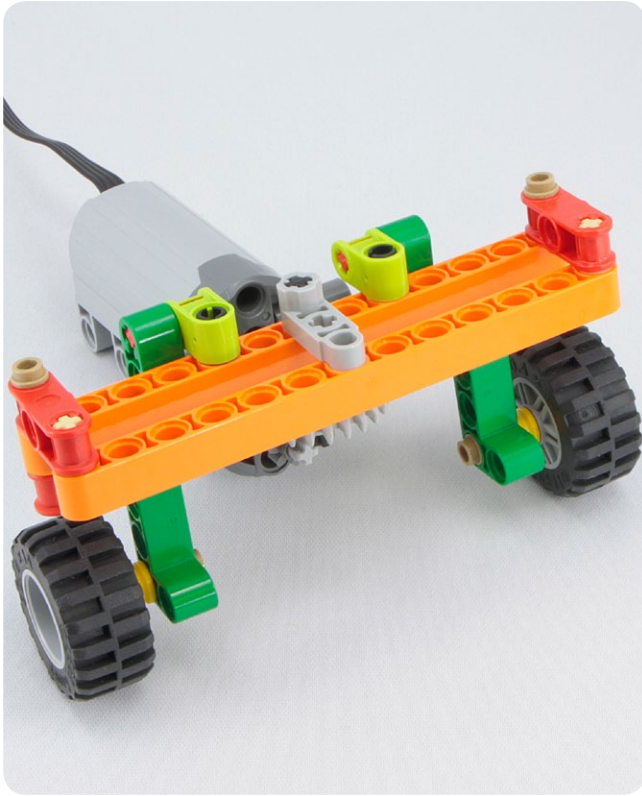


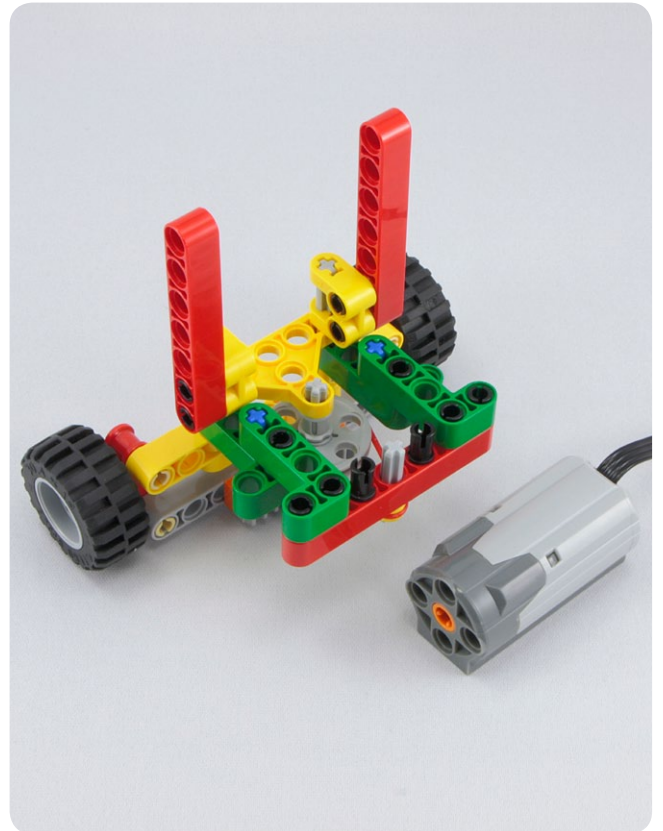
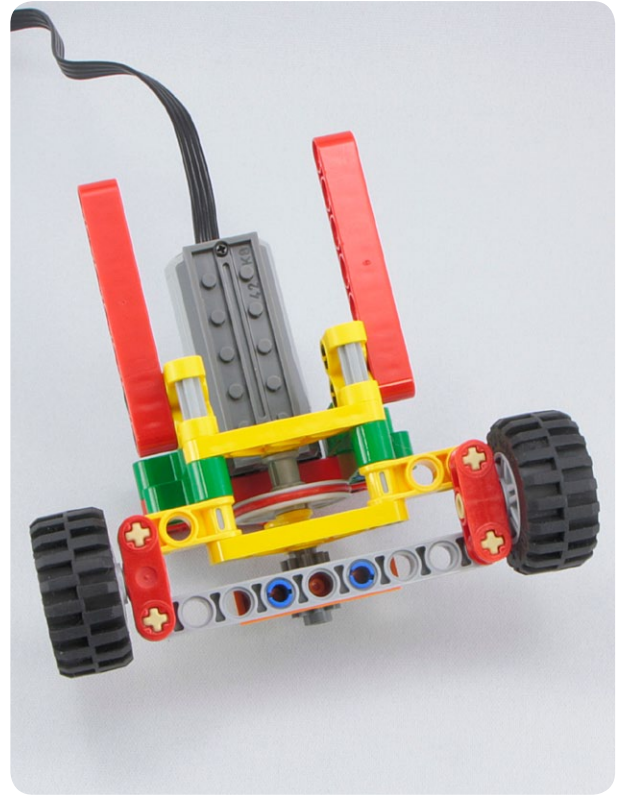
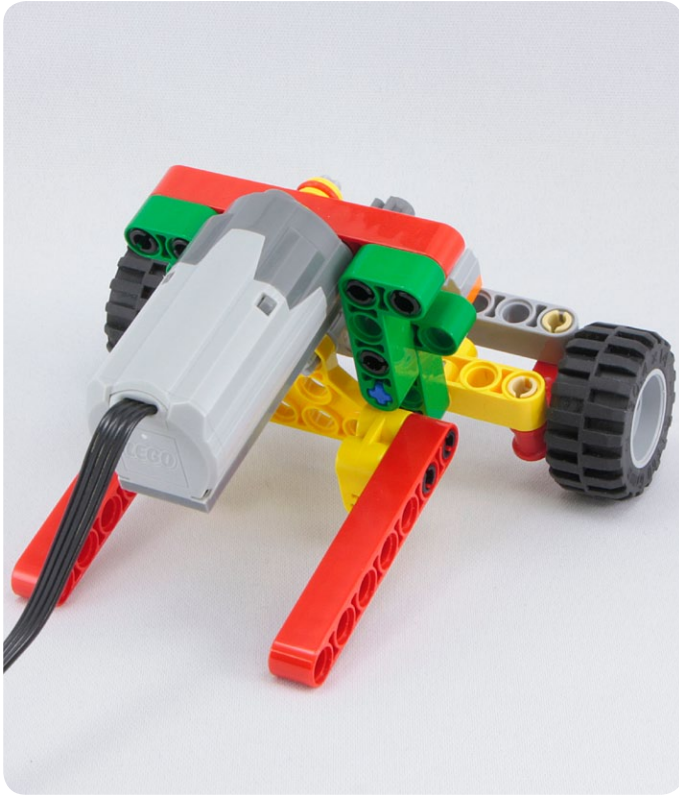


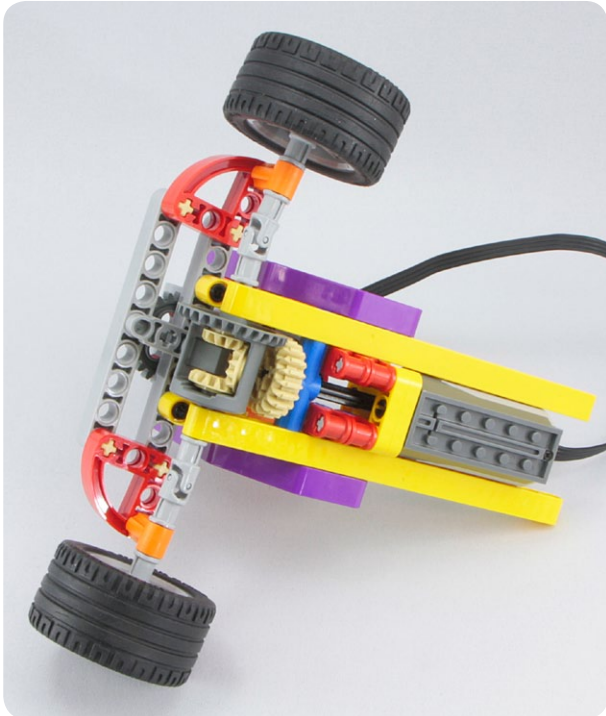
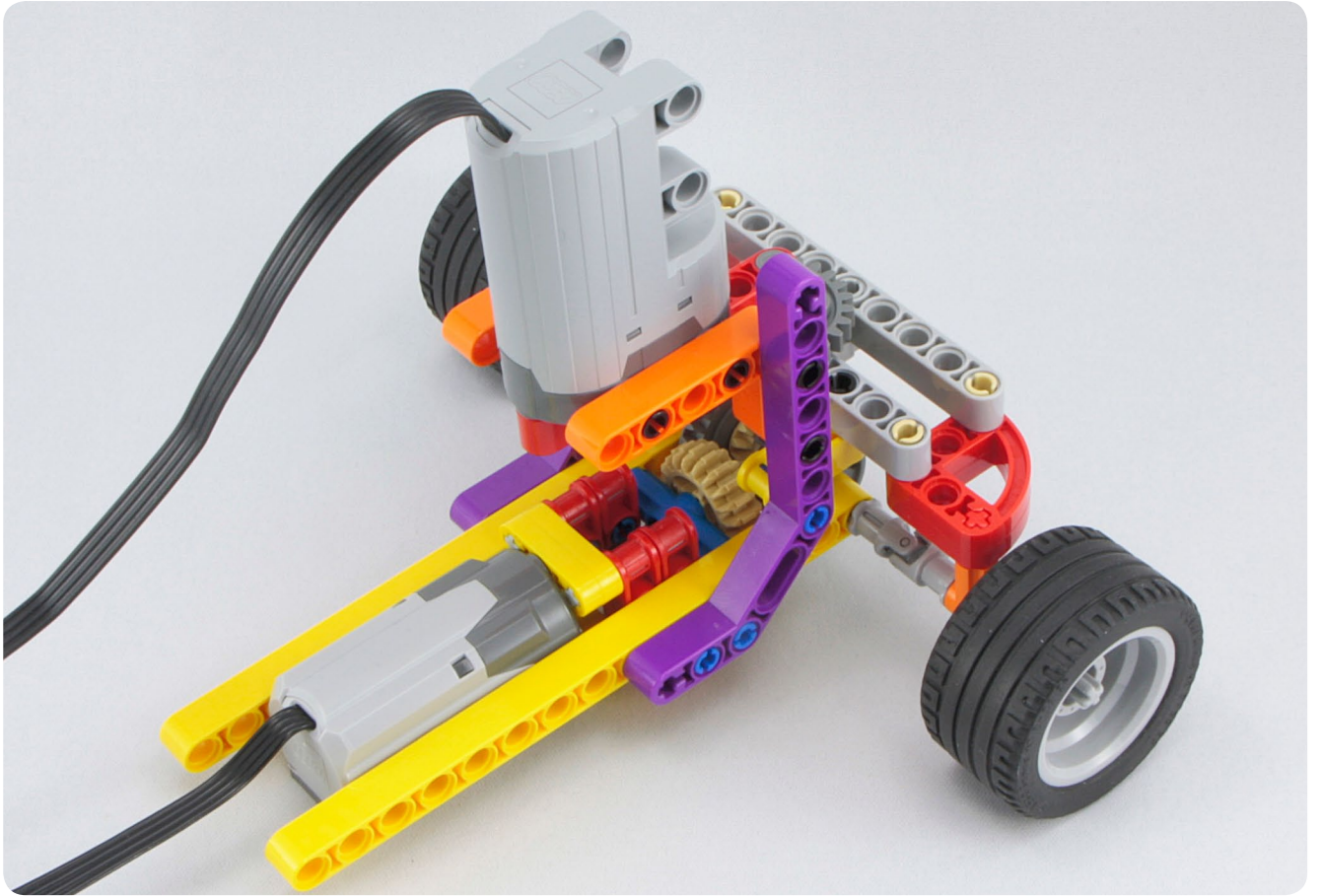
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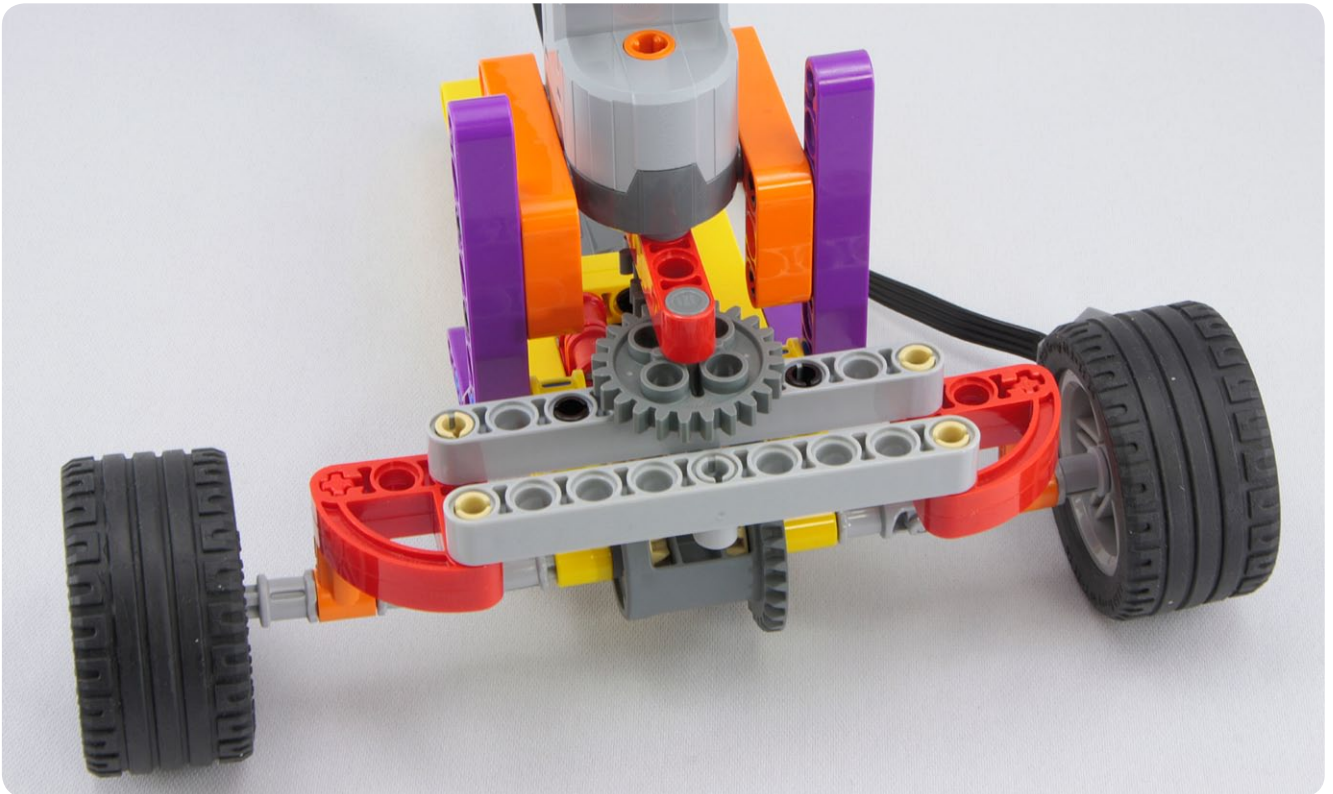
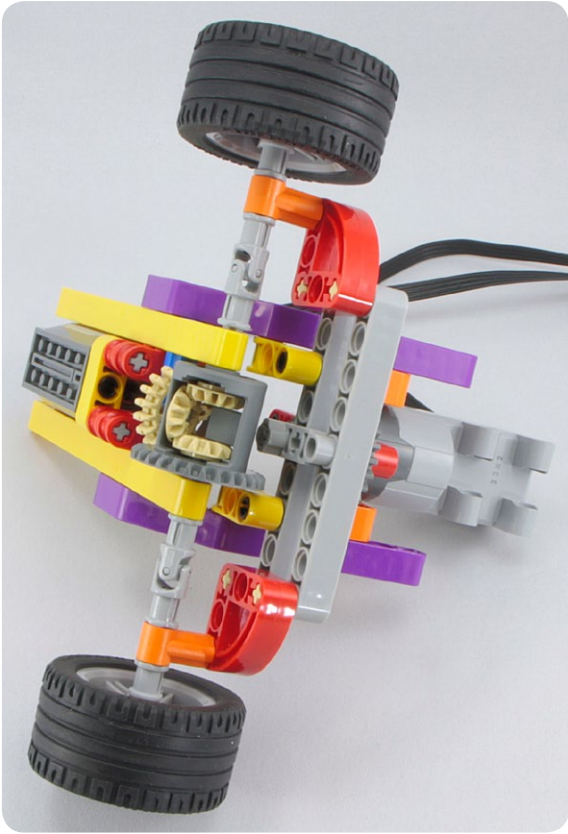


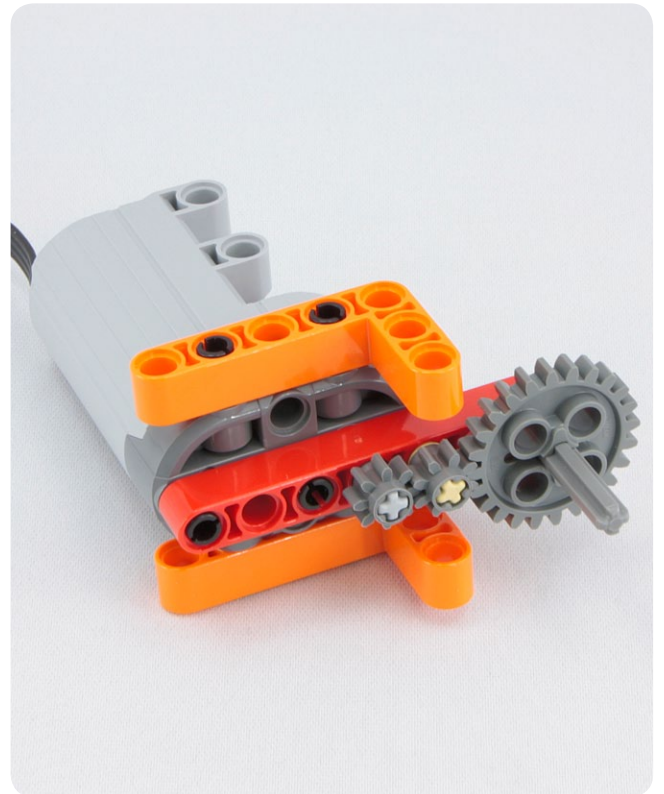
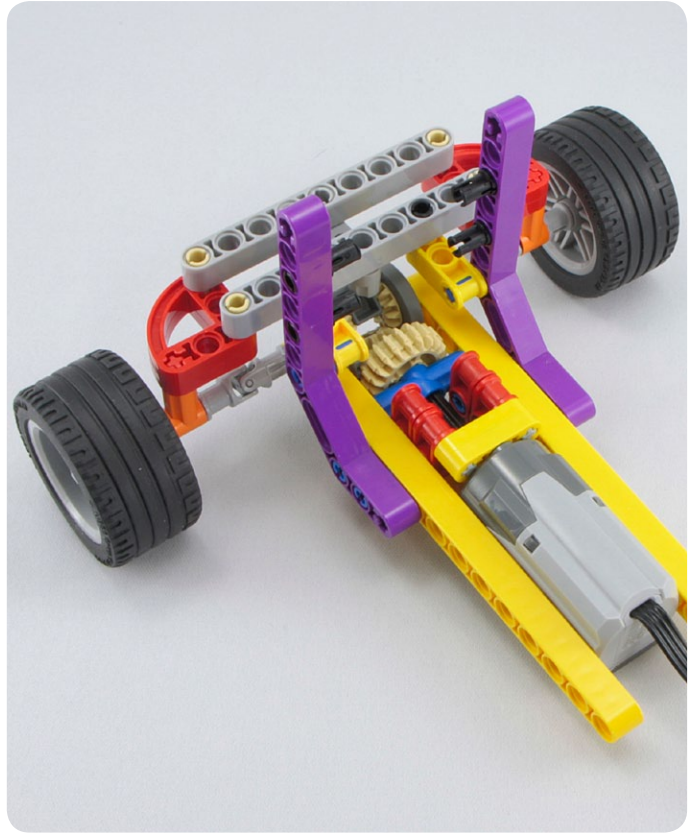
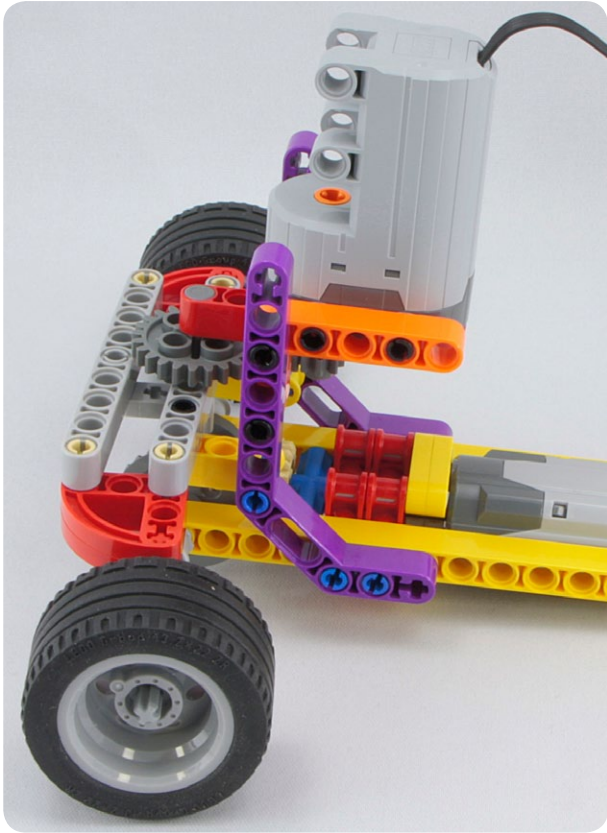


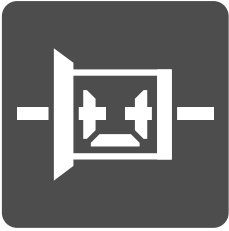










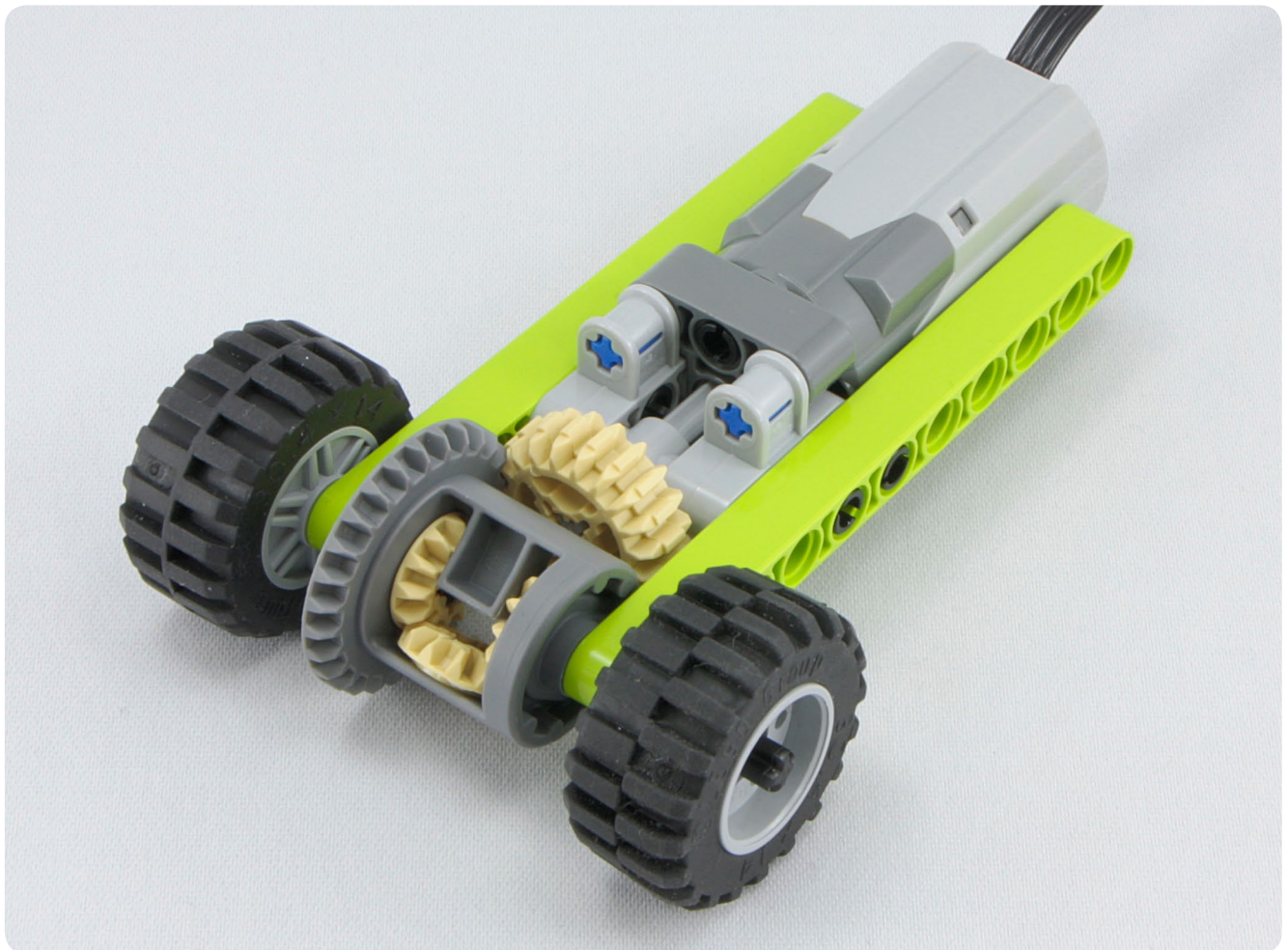
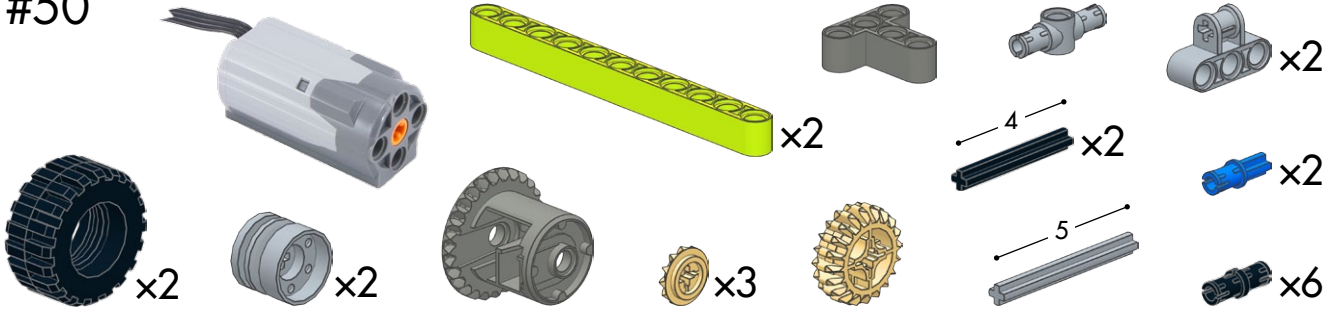


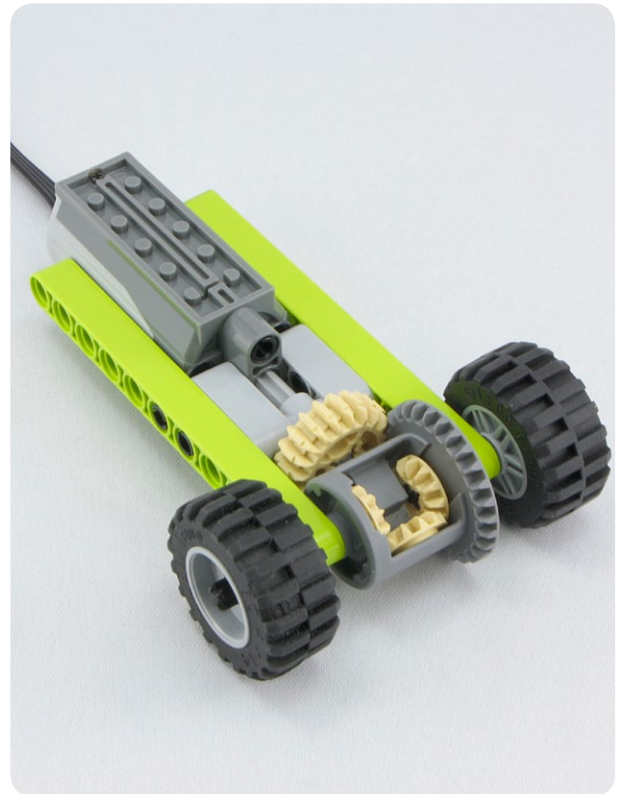
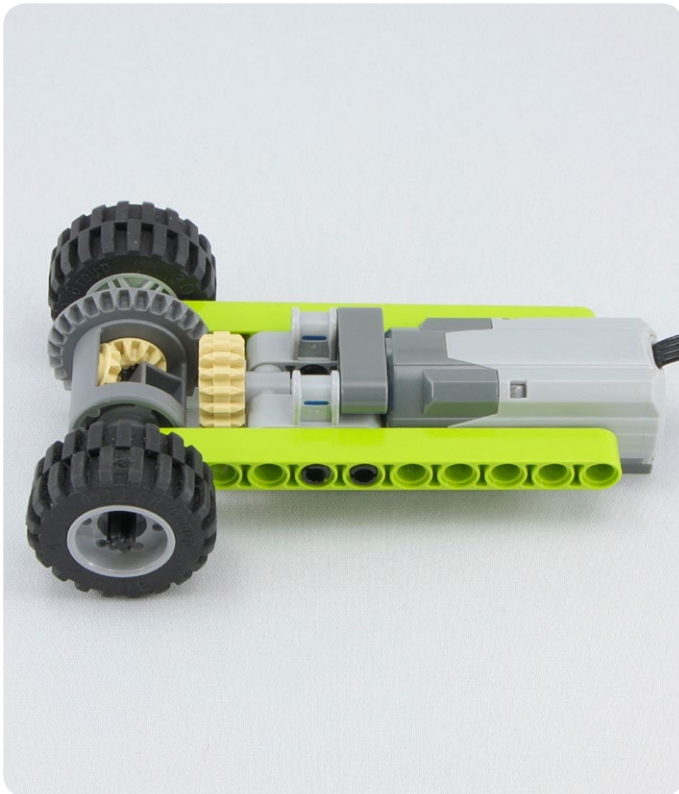
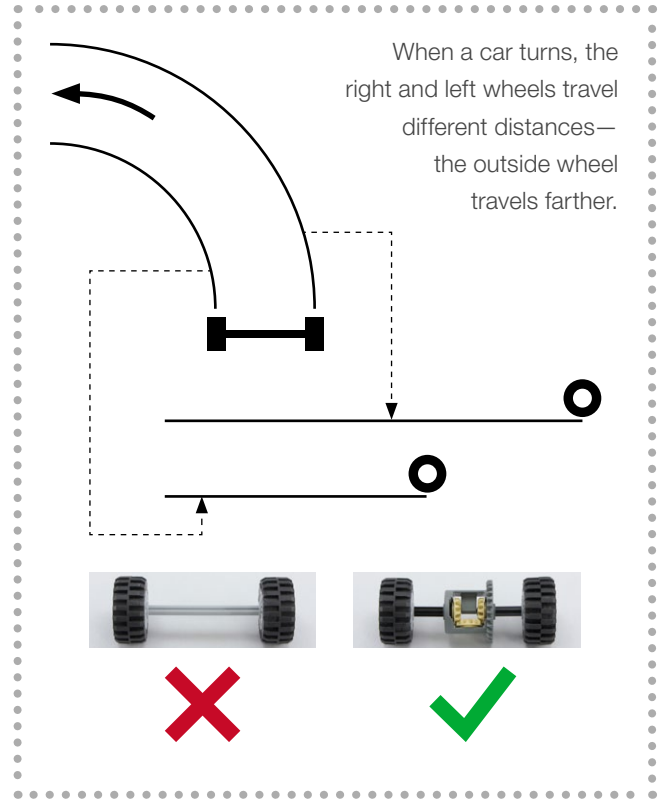
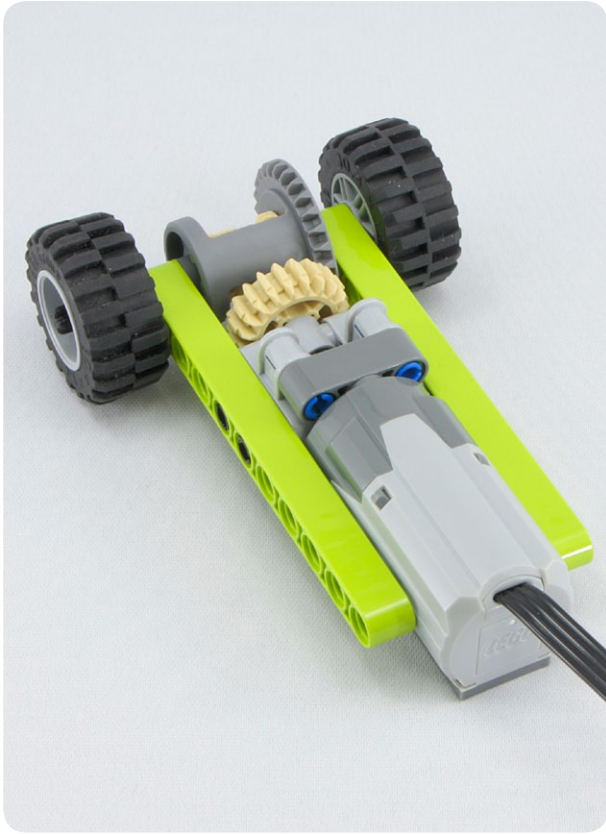
You can combine these models with those in **Steering with the servo motor** (page 50).



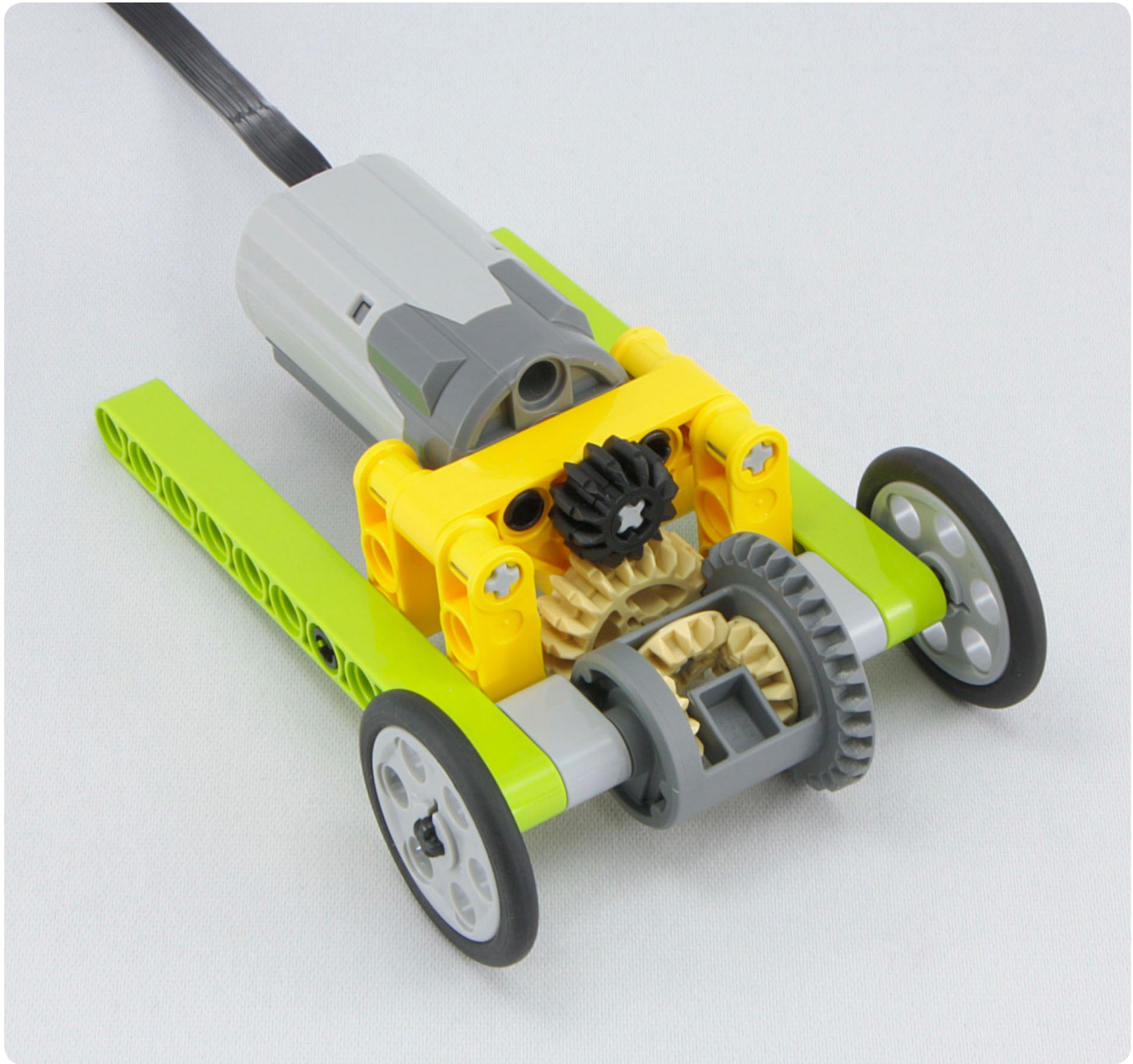
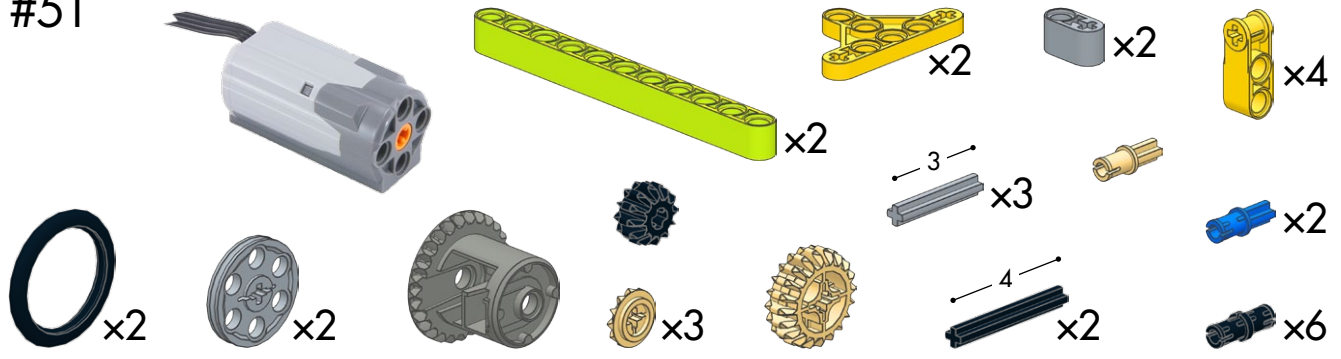
Differential gears

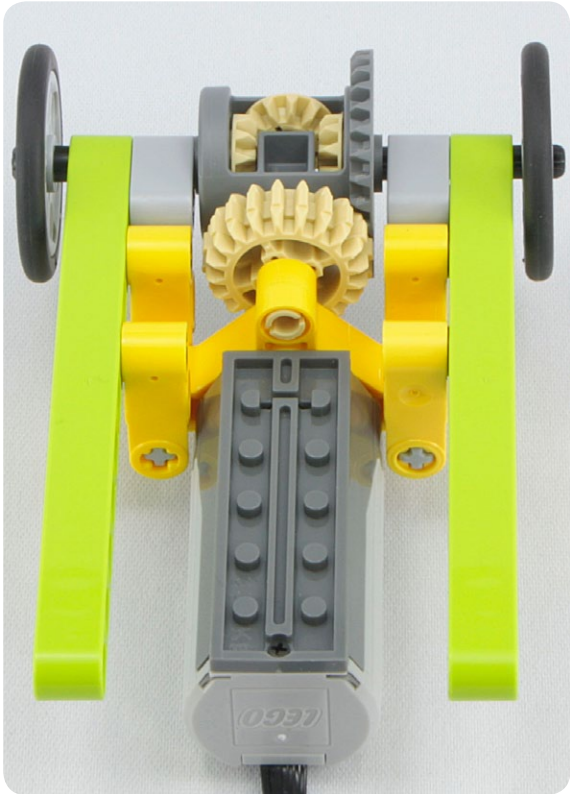
#50



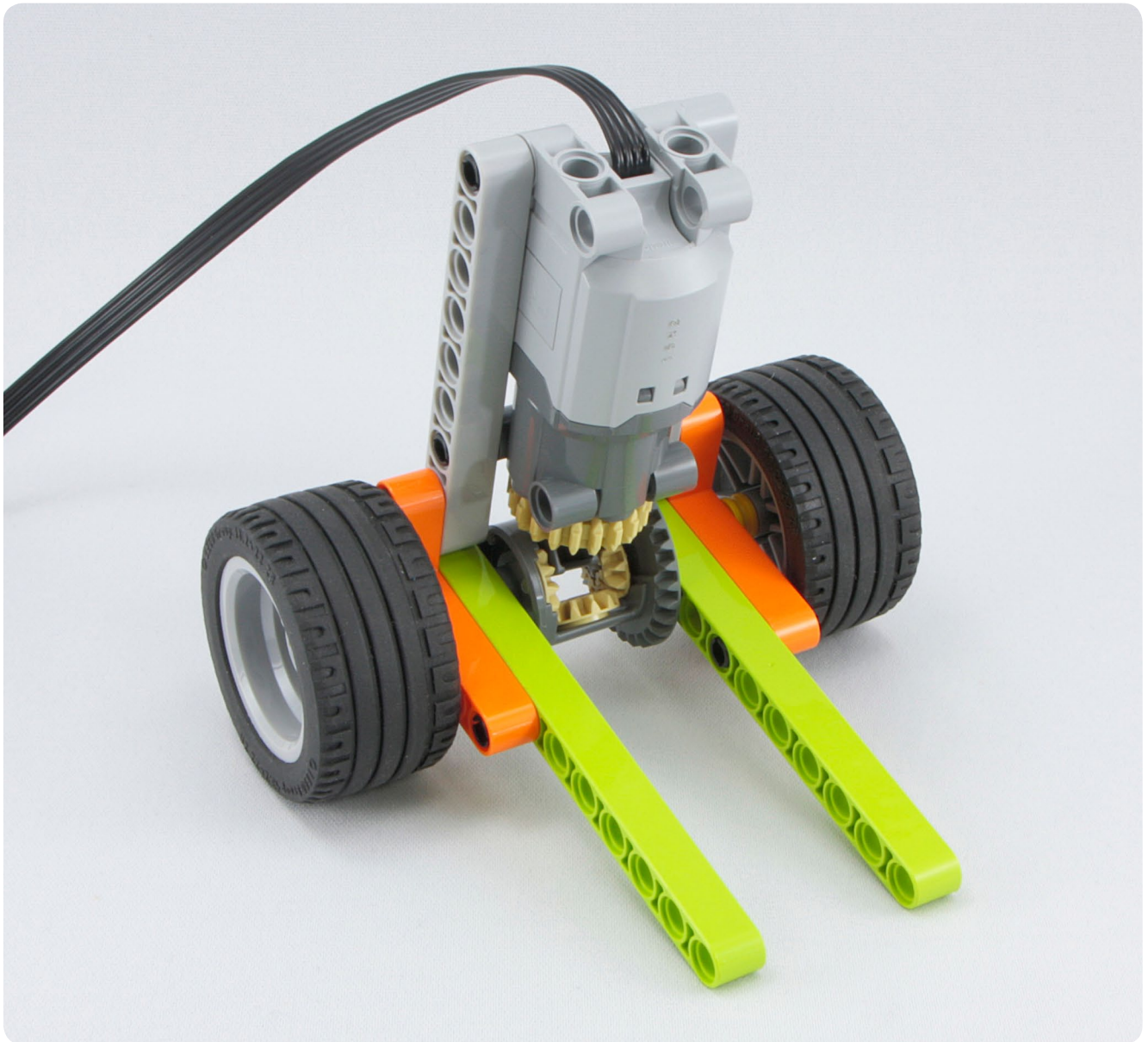
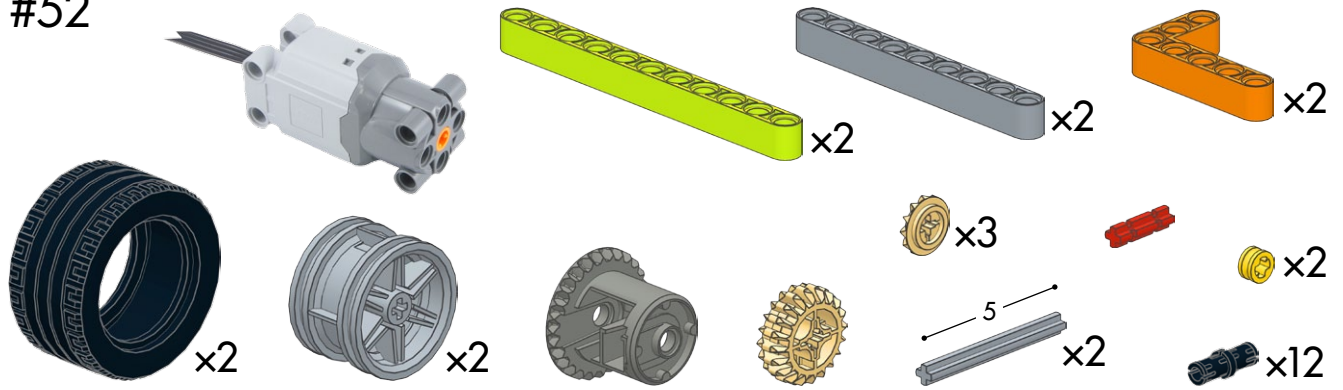


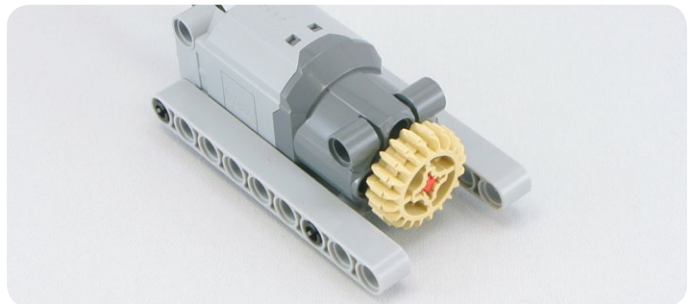
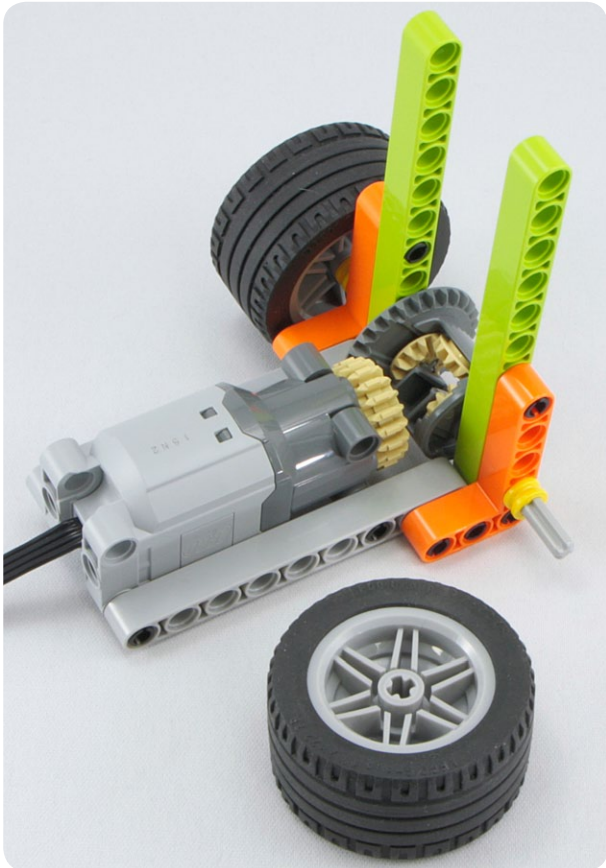
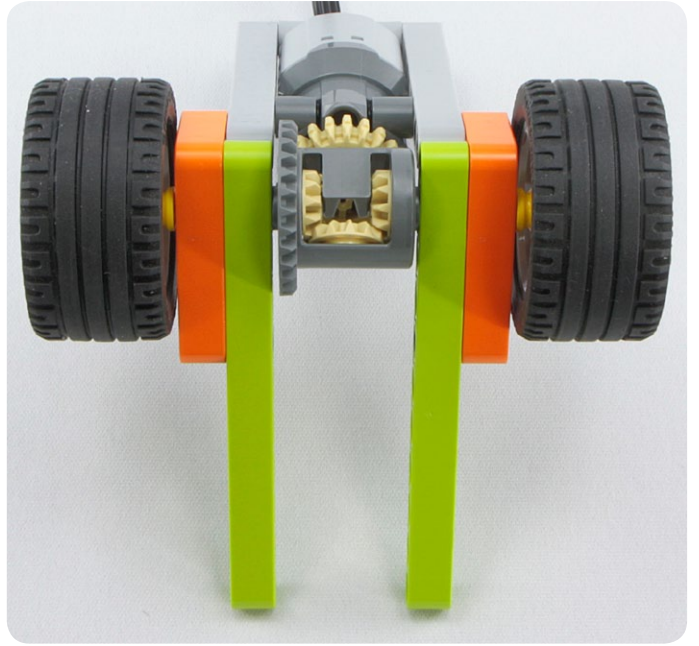
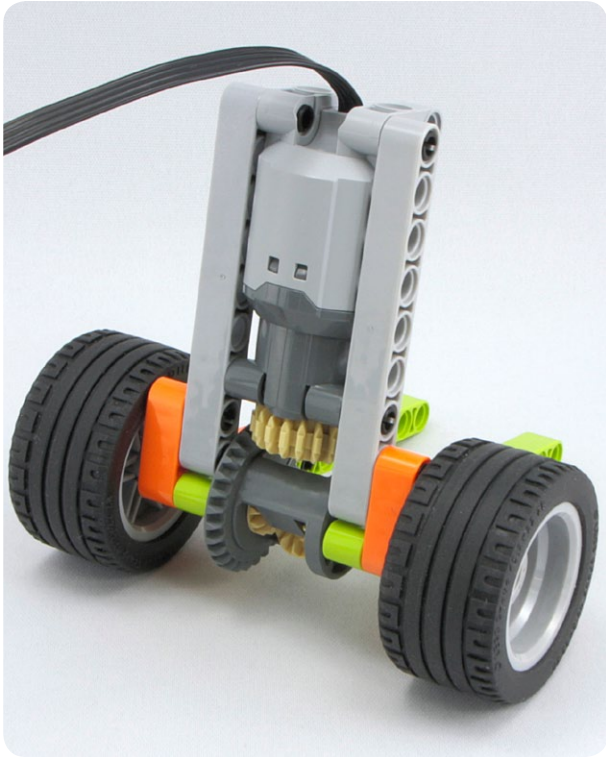
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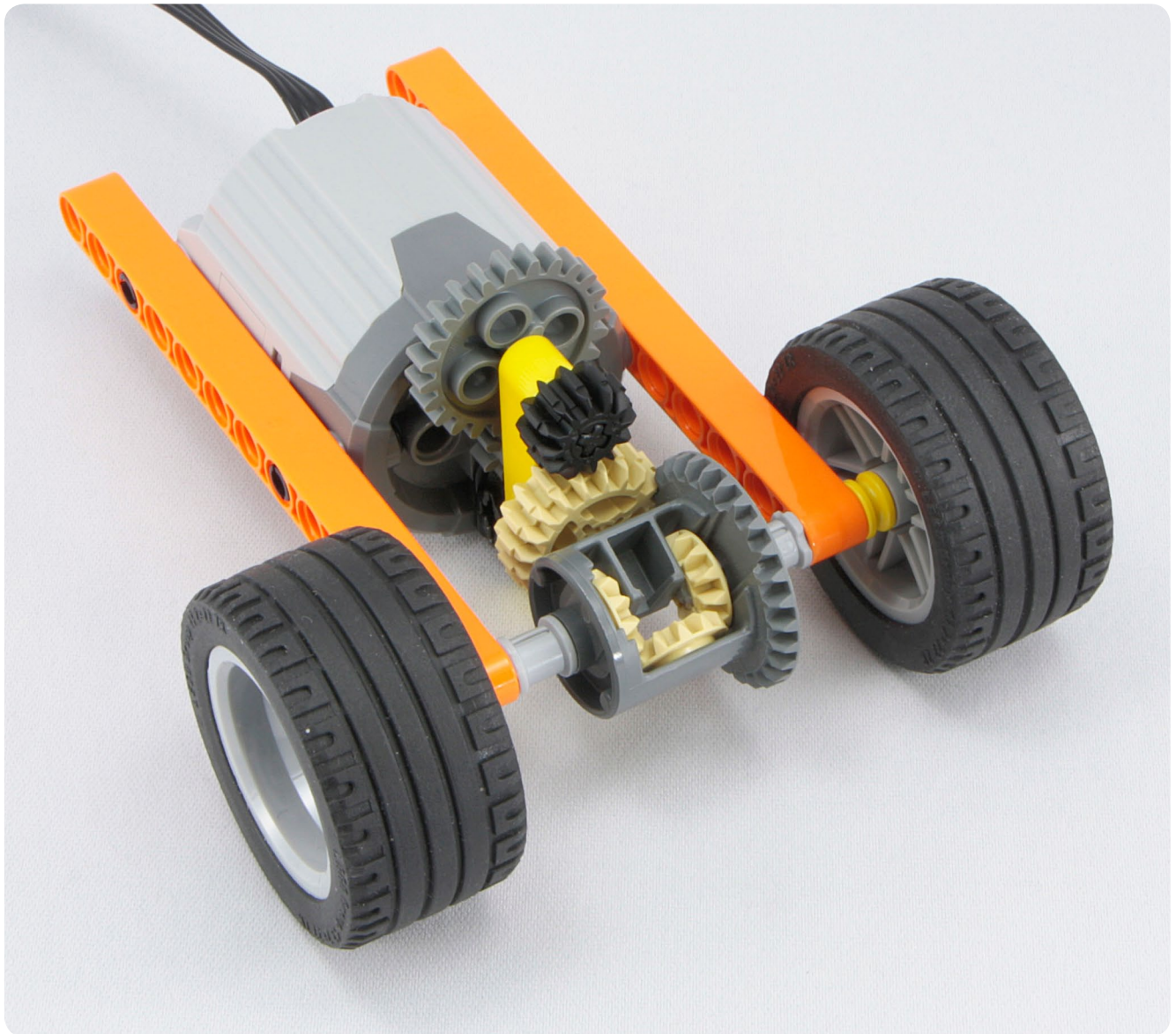
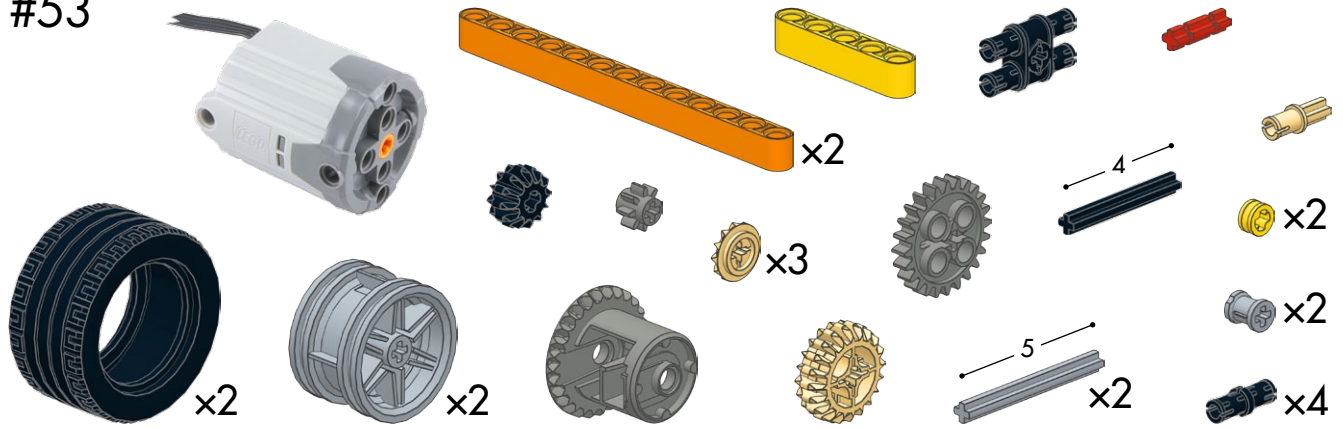


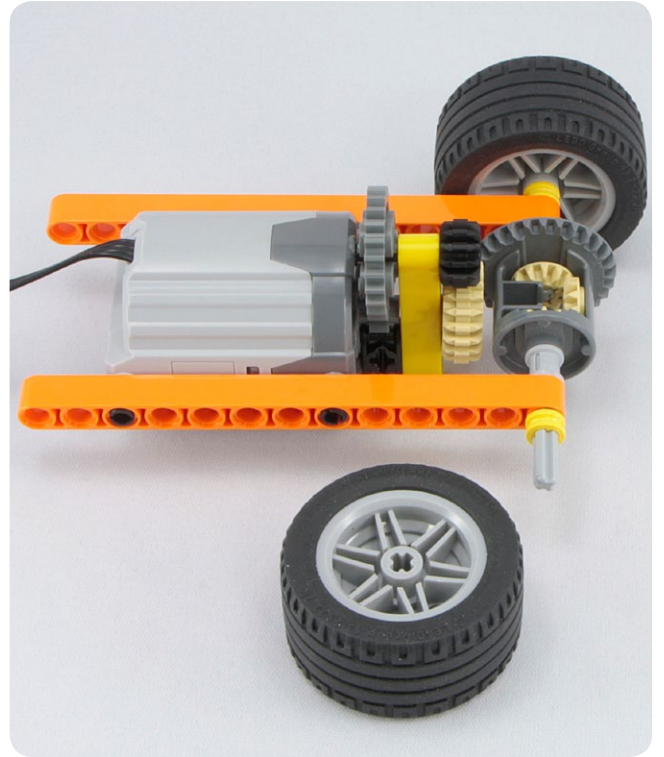
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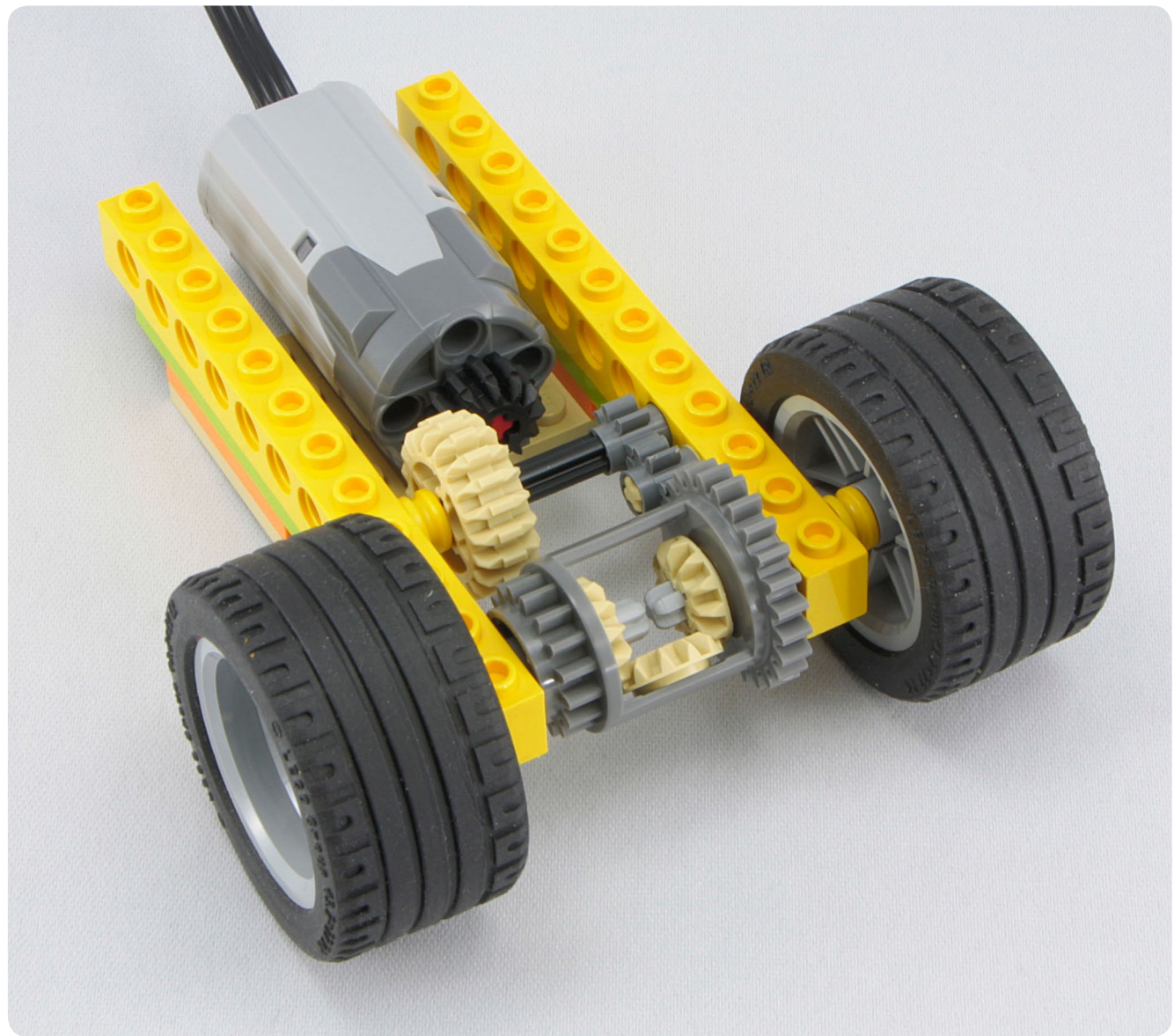
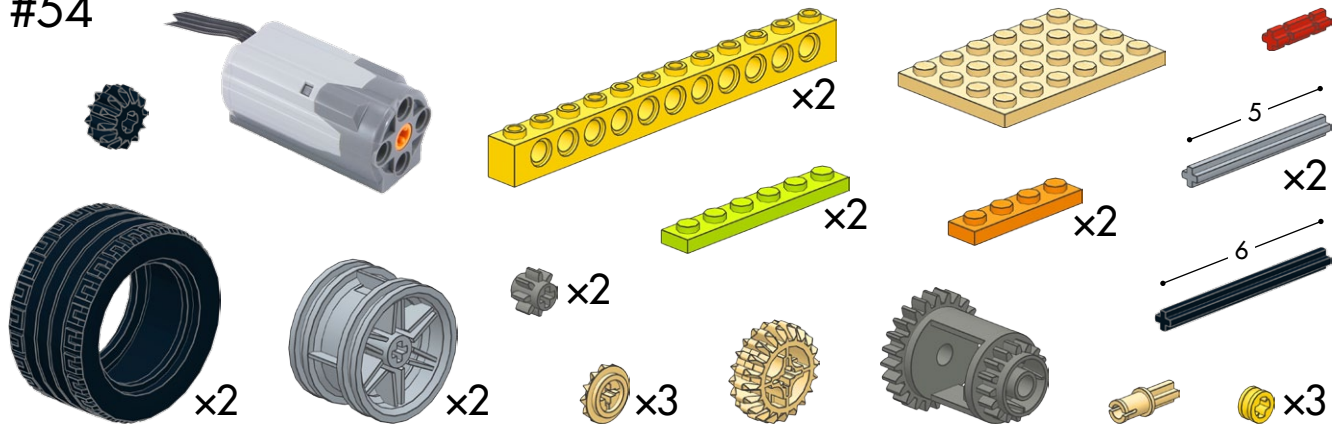


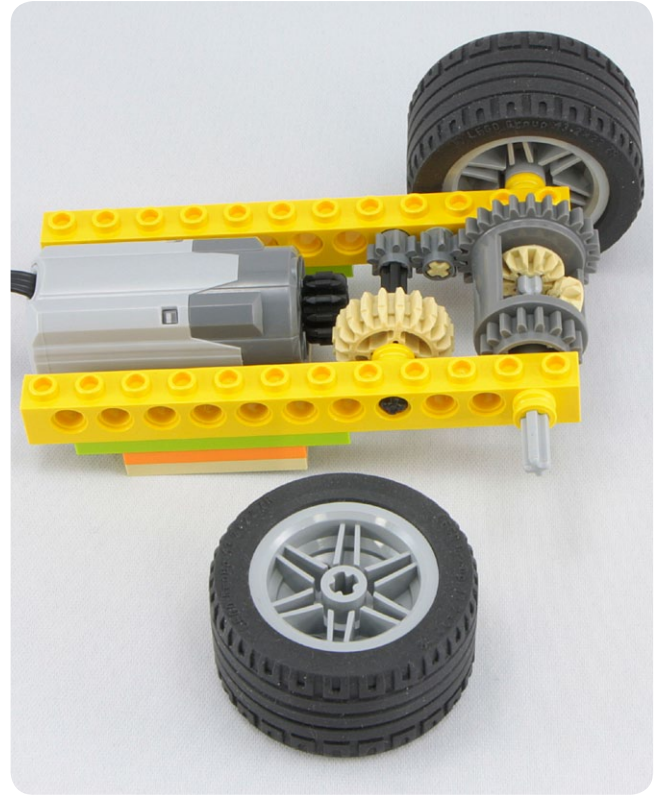
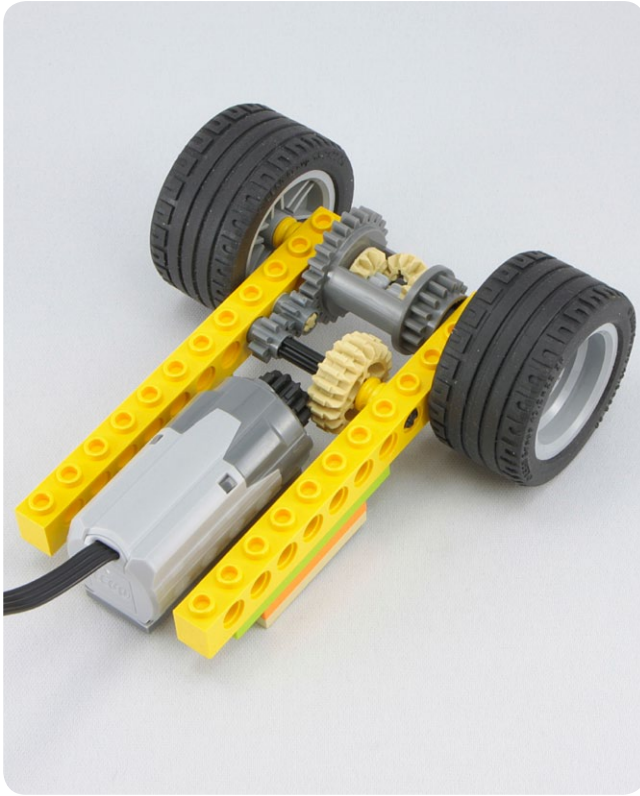
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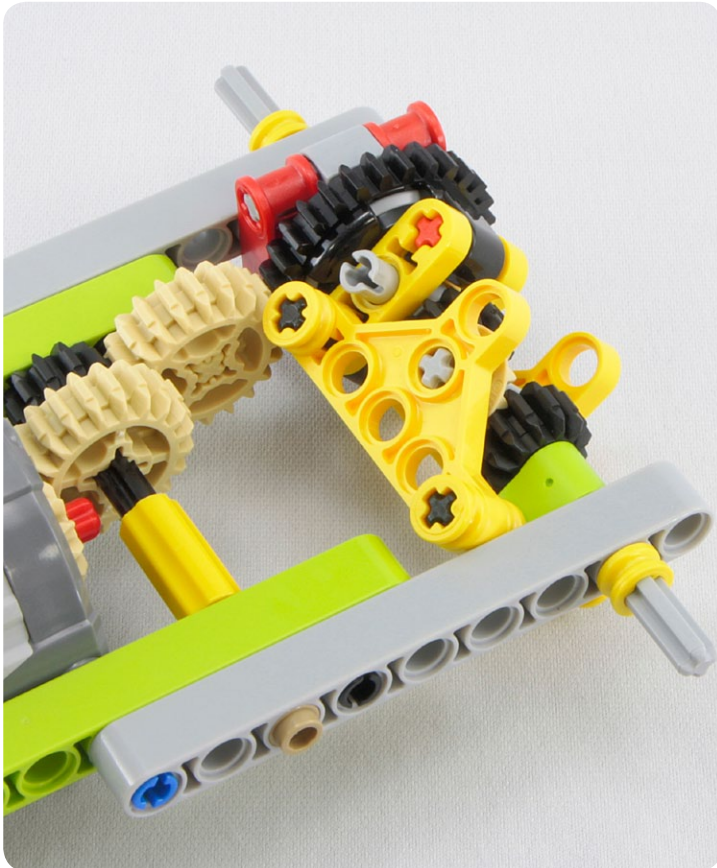




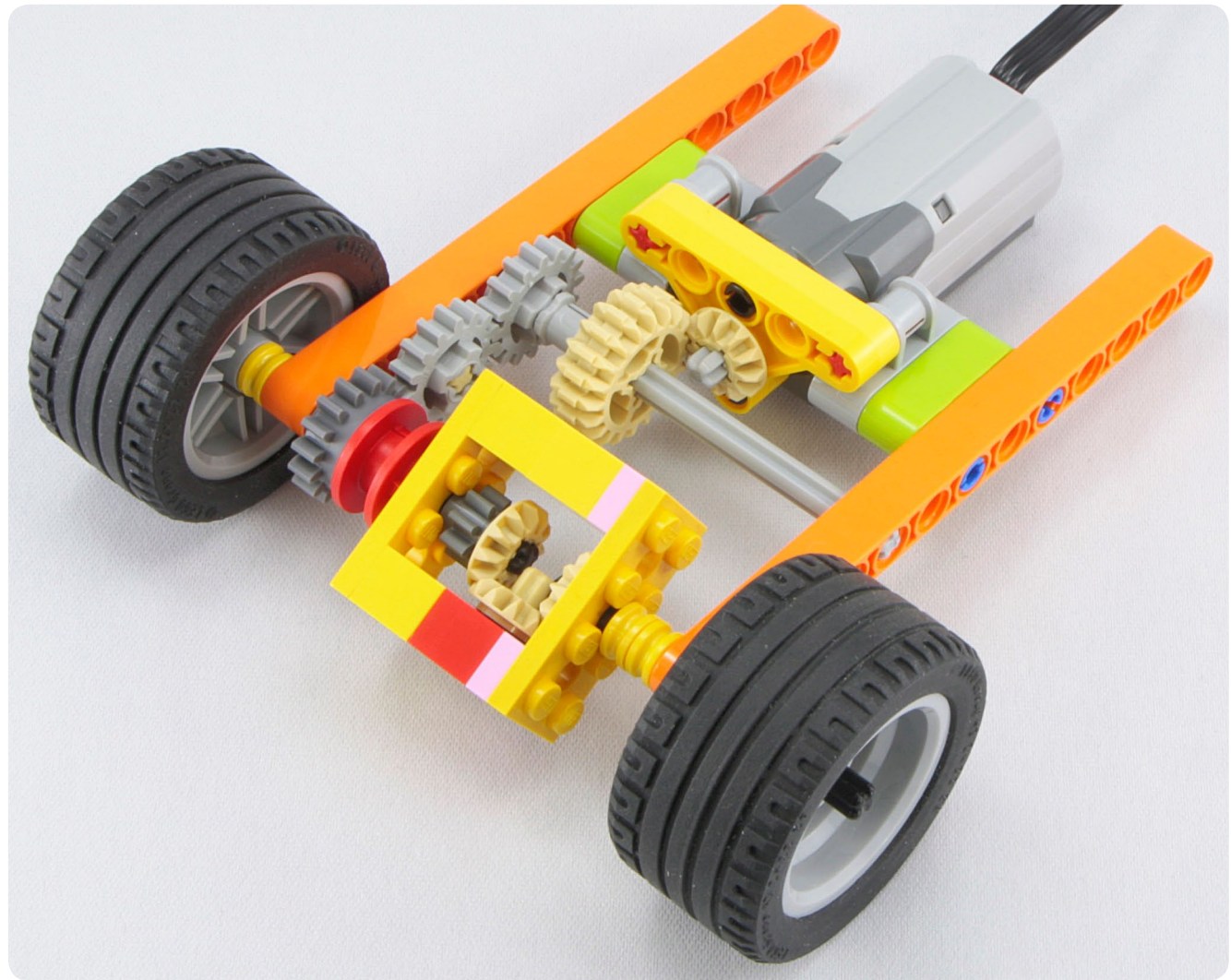
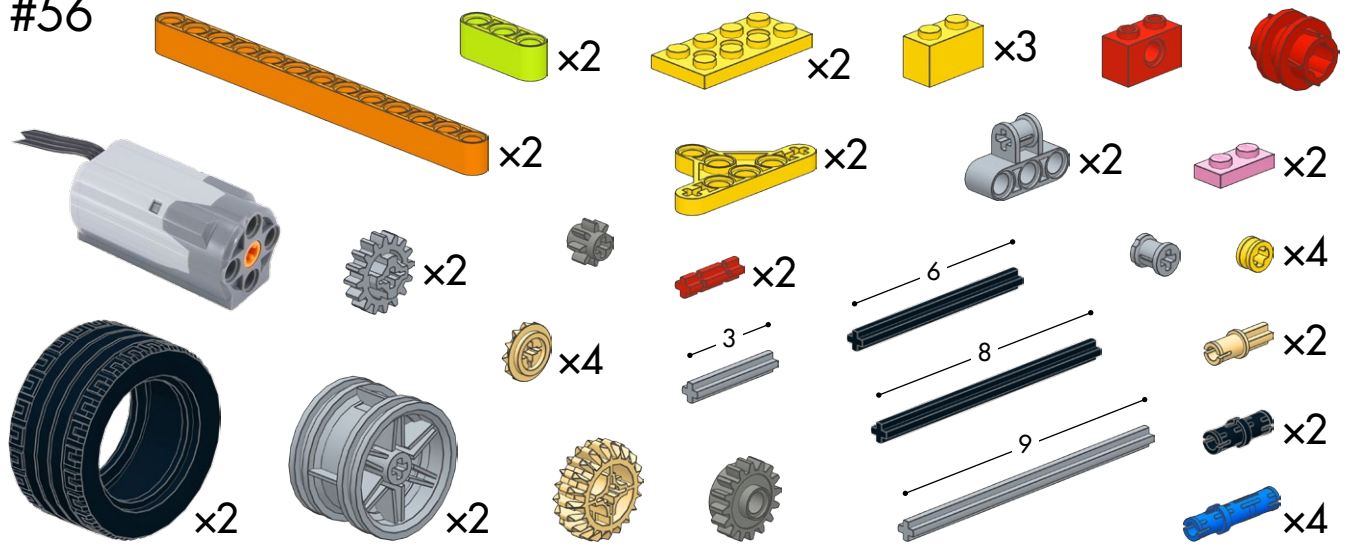
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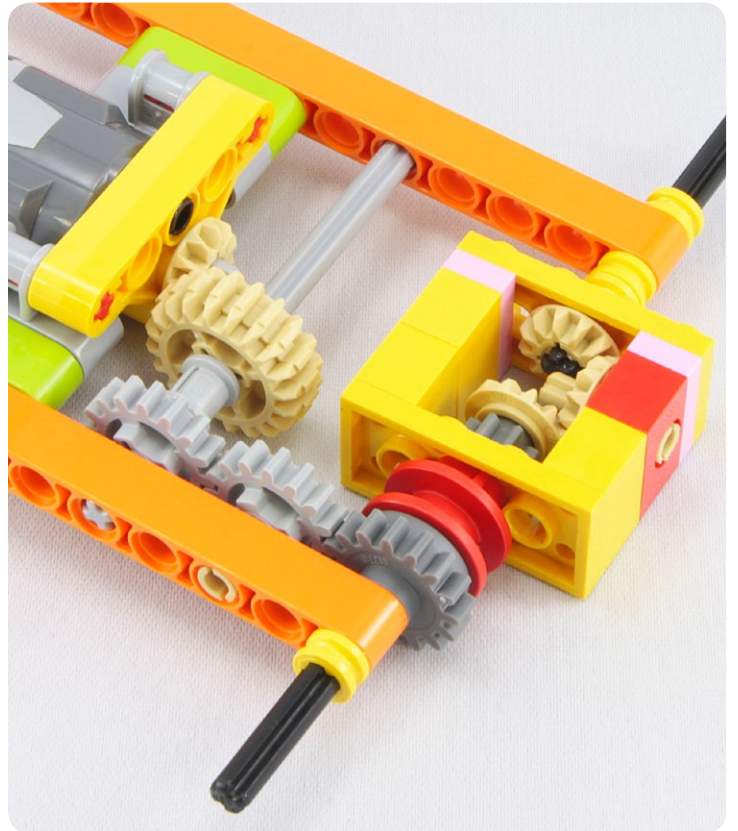
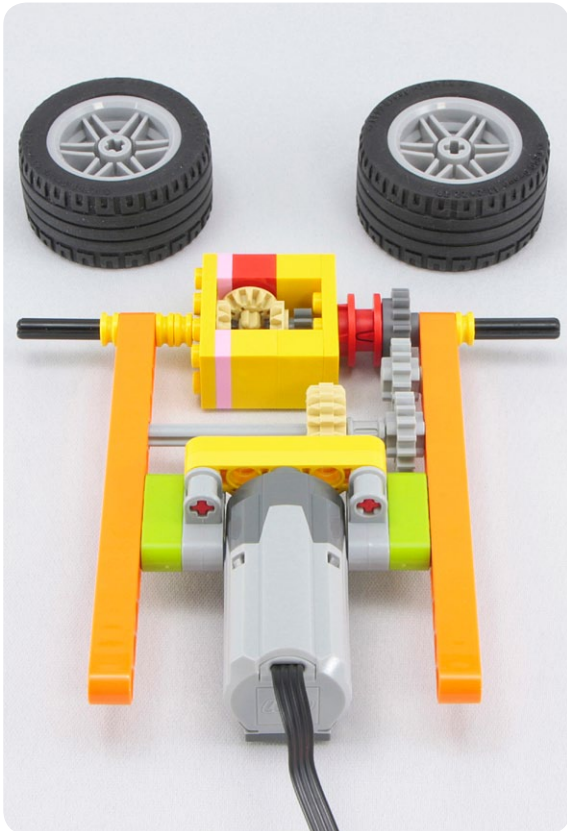
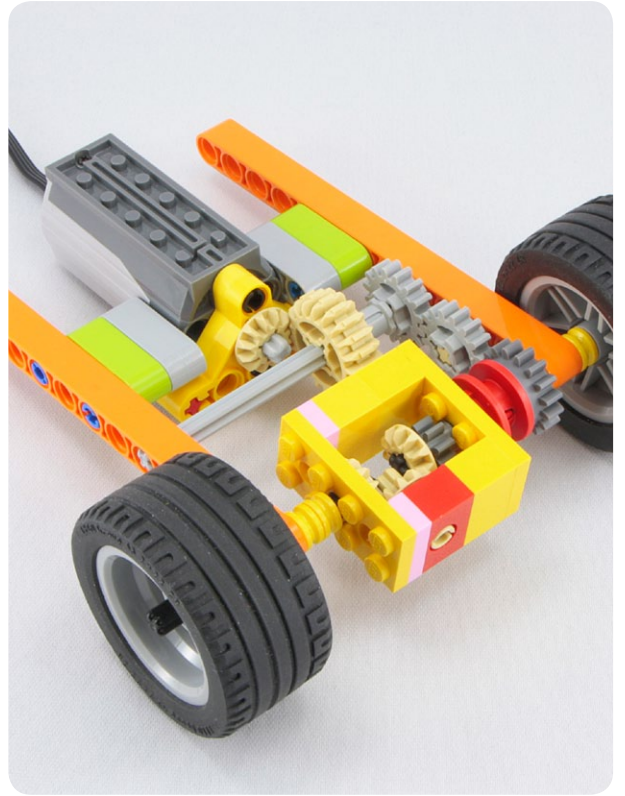


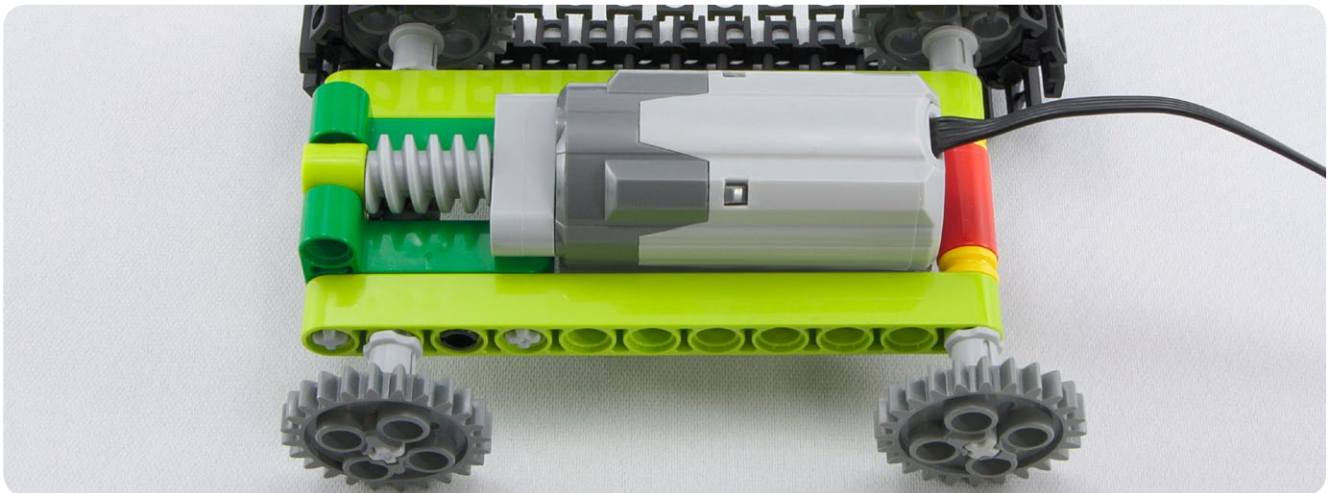
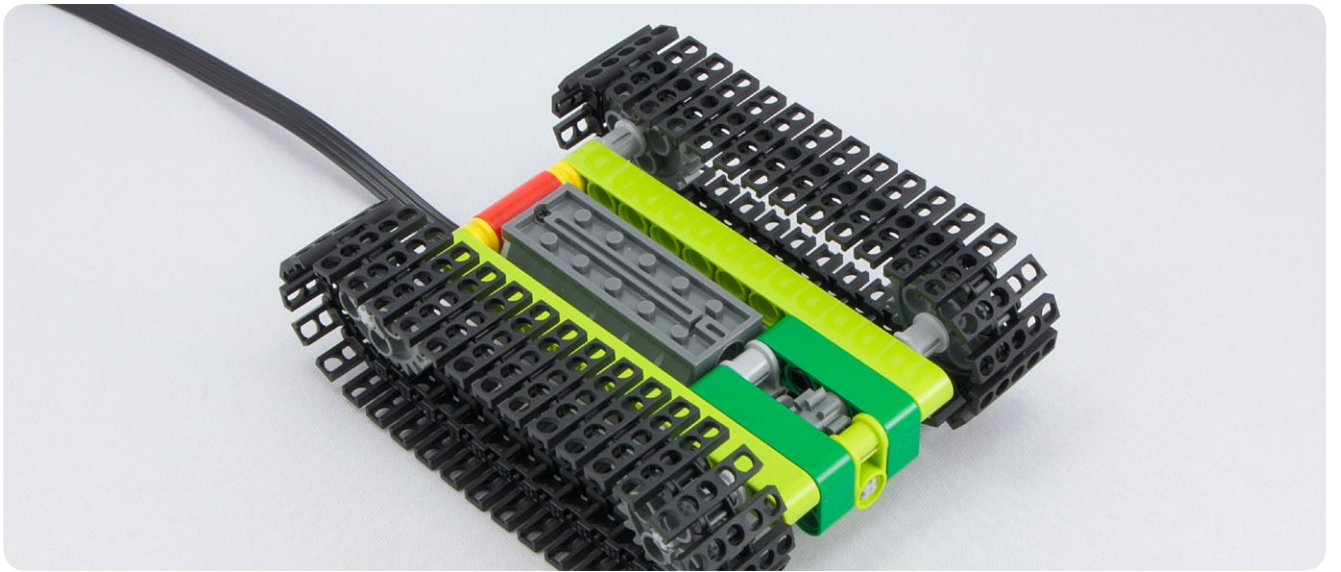
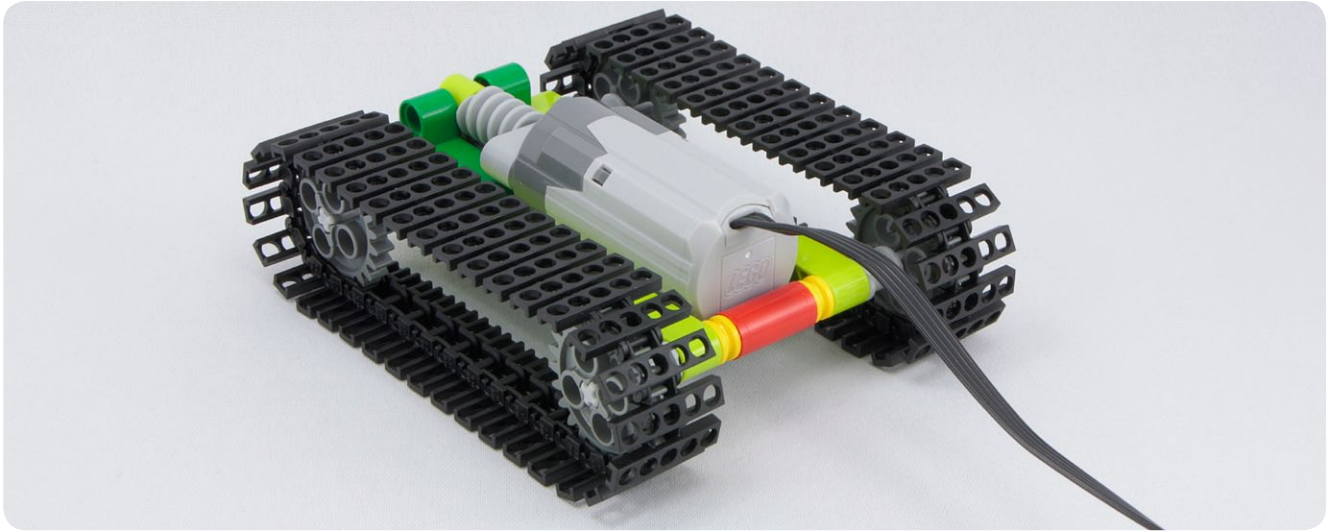


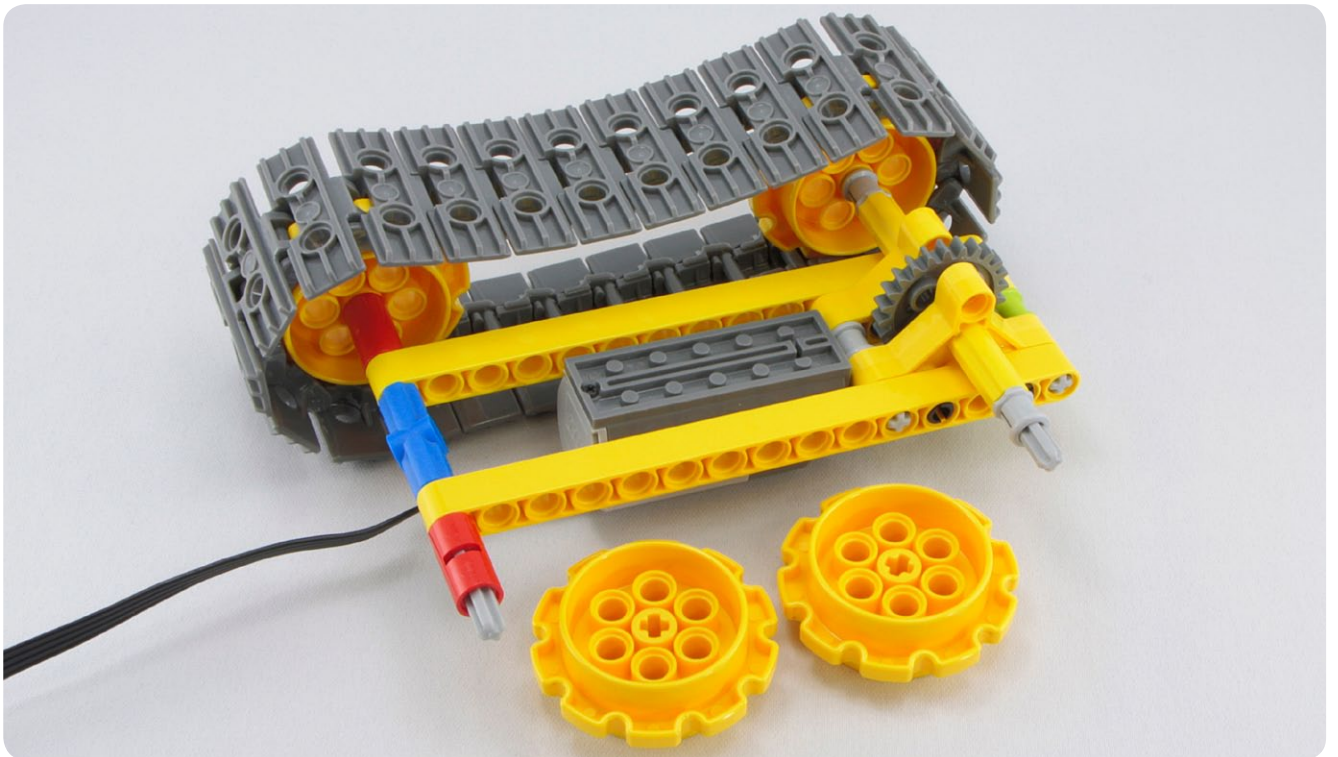
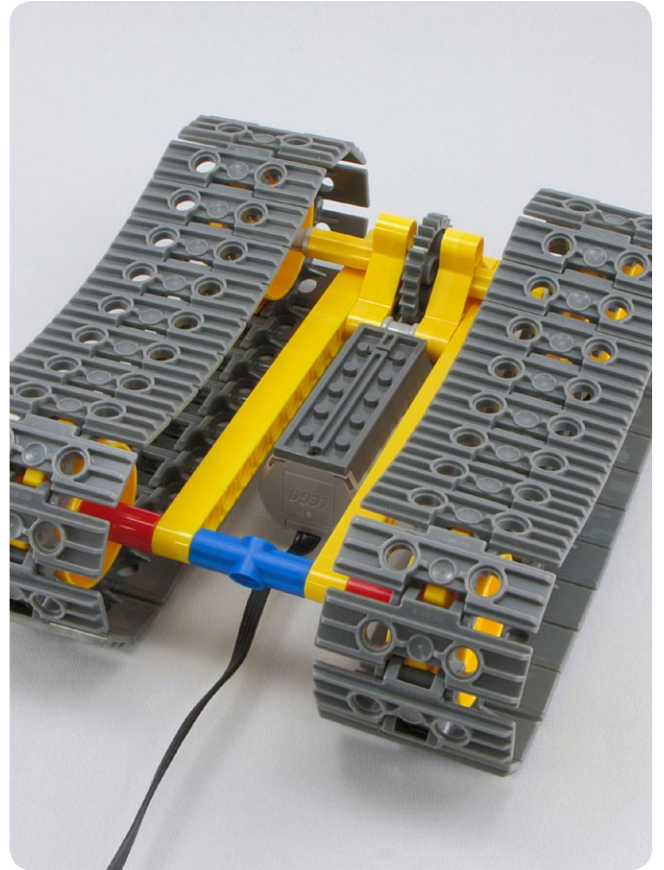
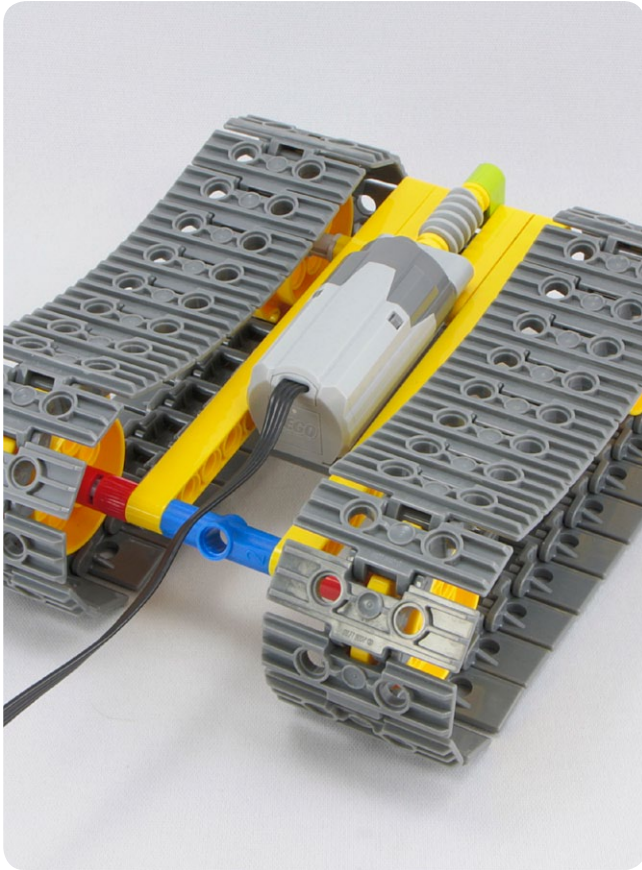


#56




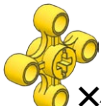





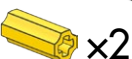

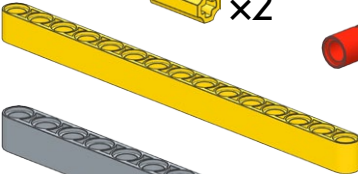
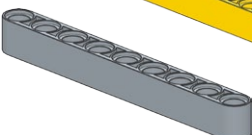




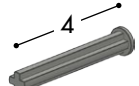
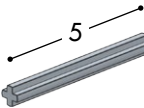
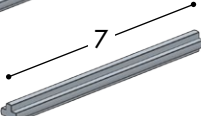






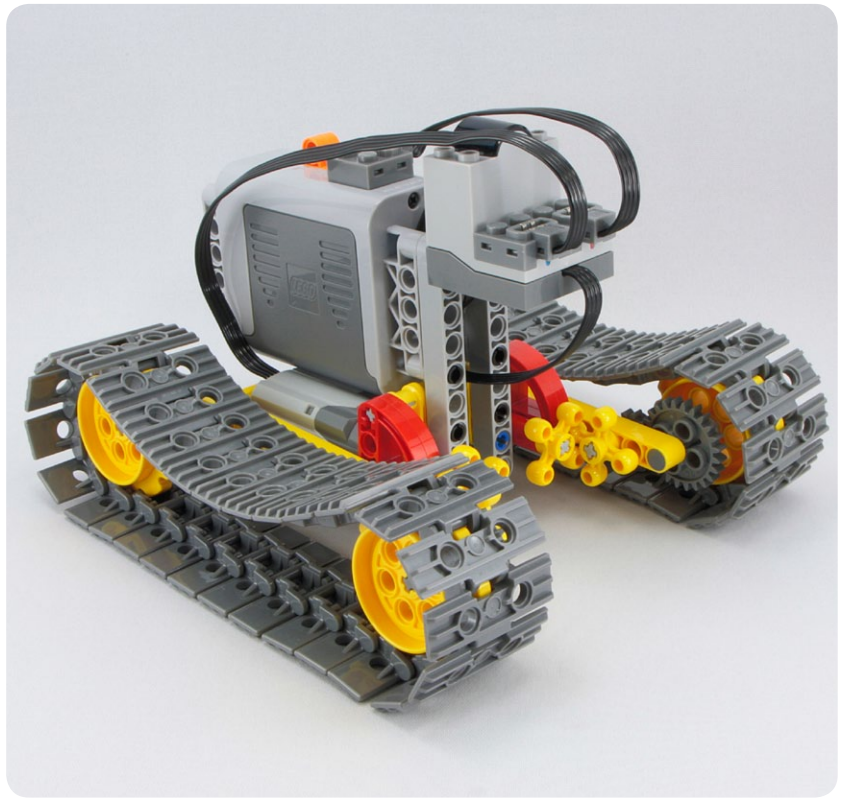


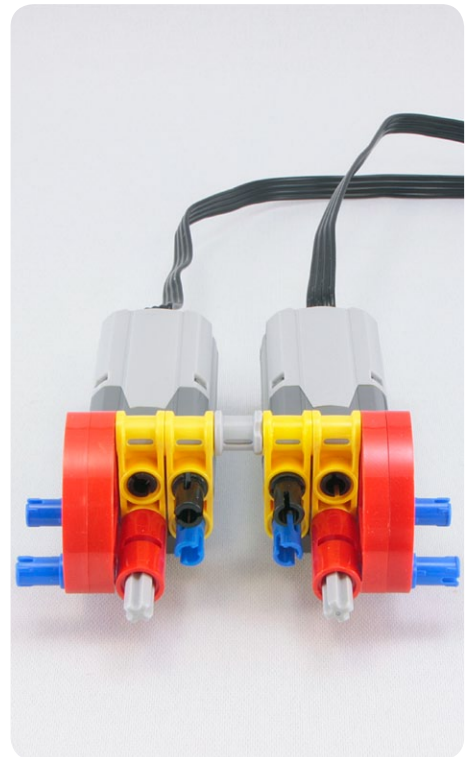
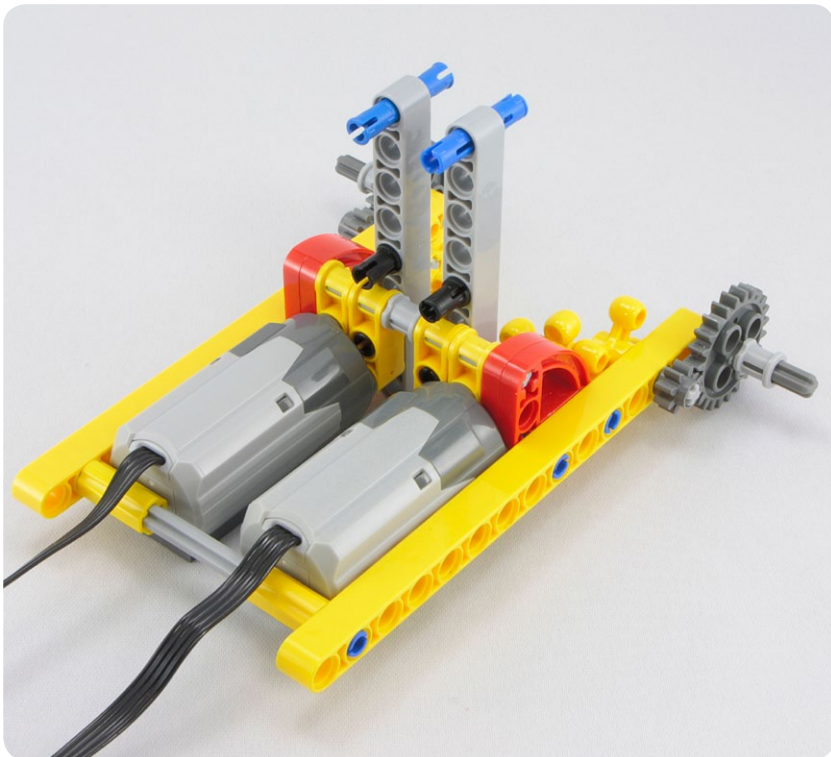




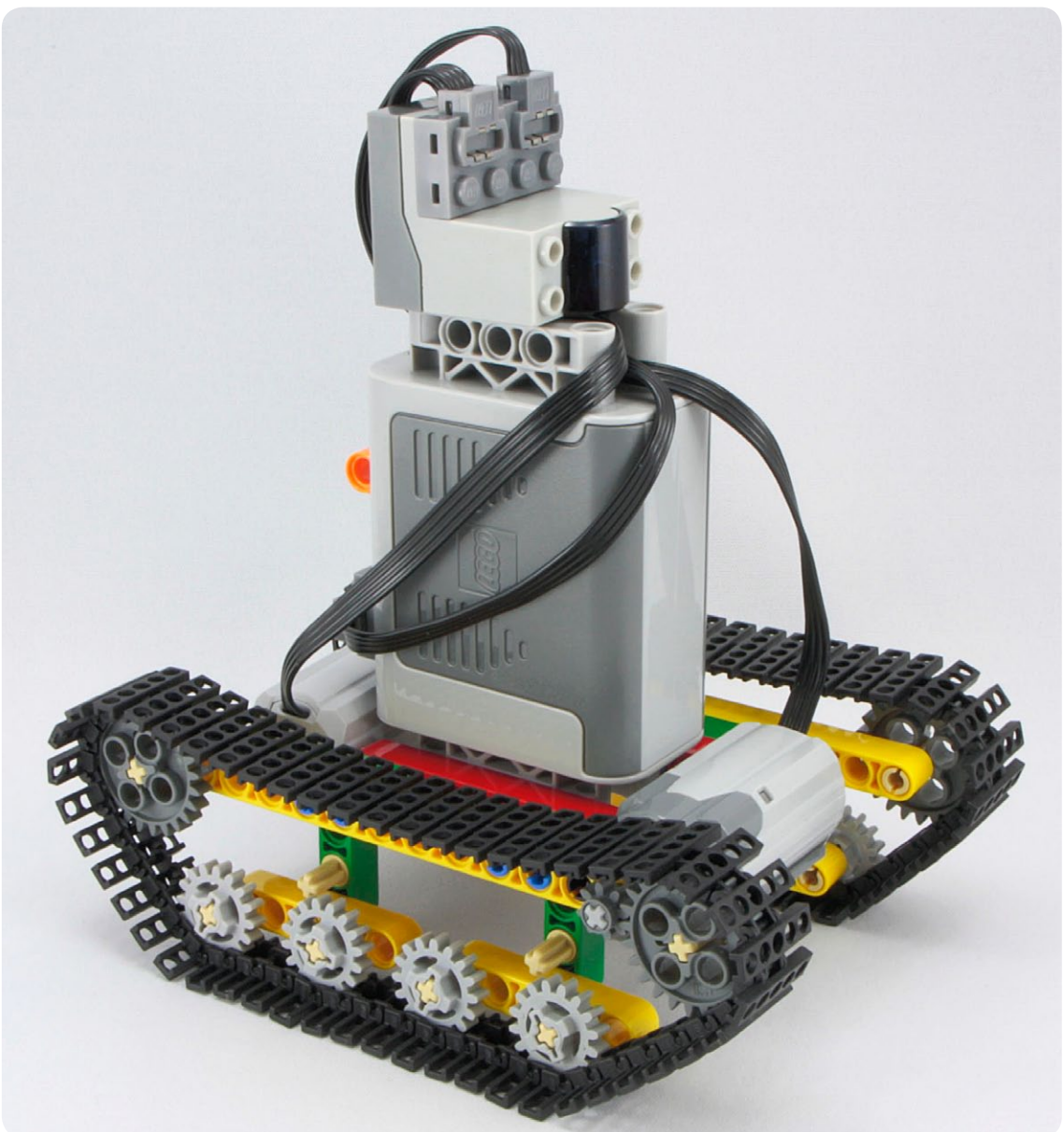
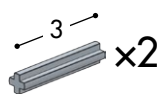
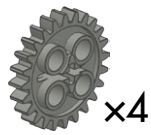
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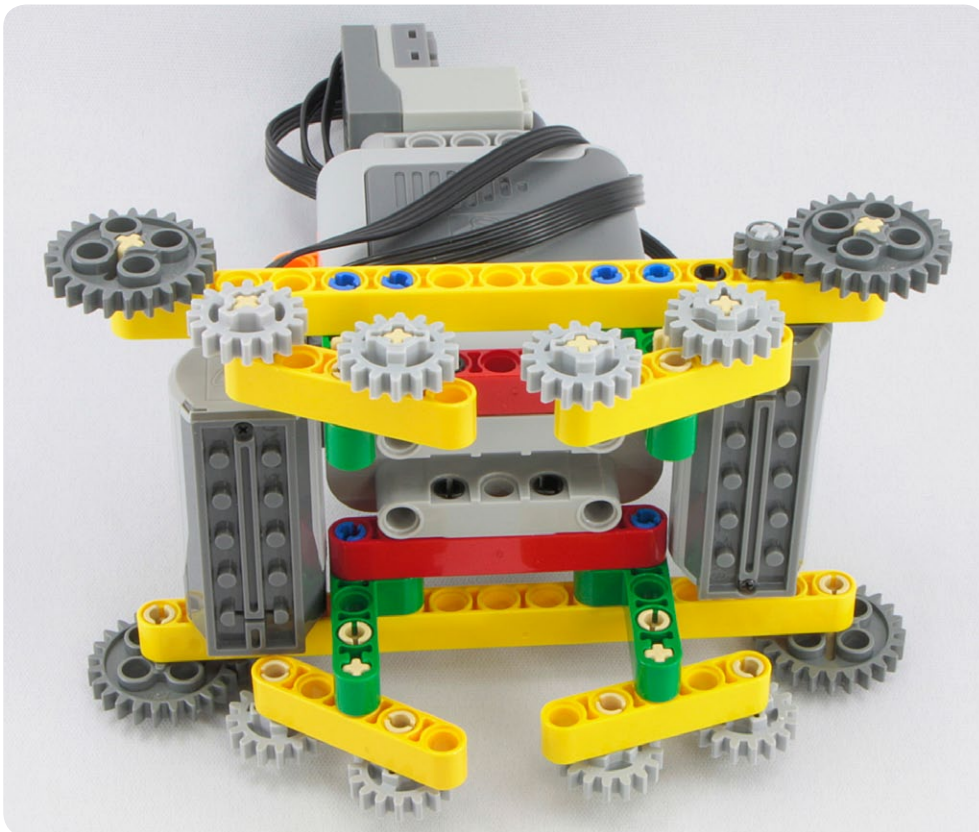
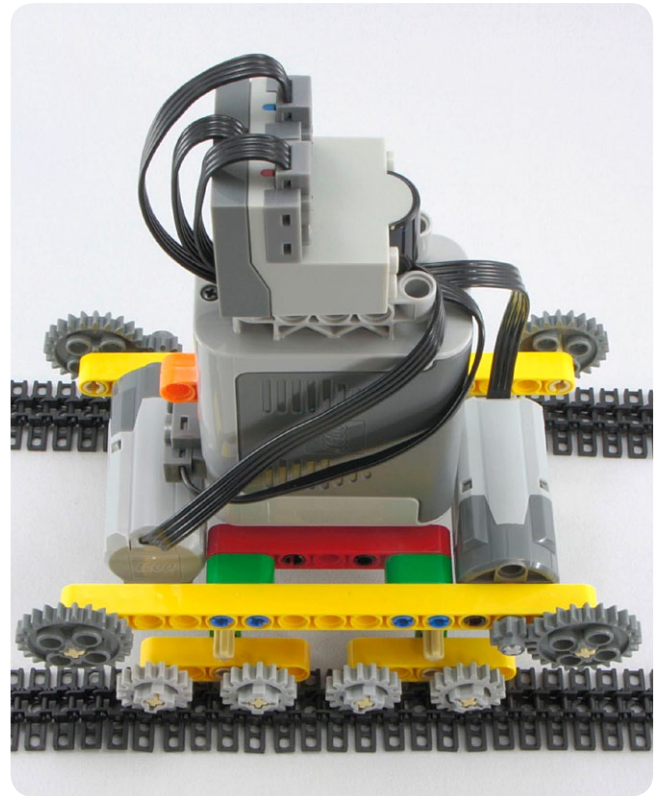
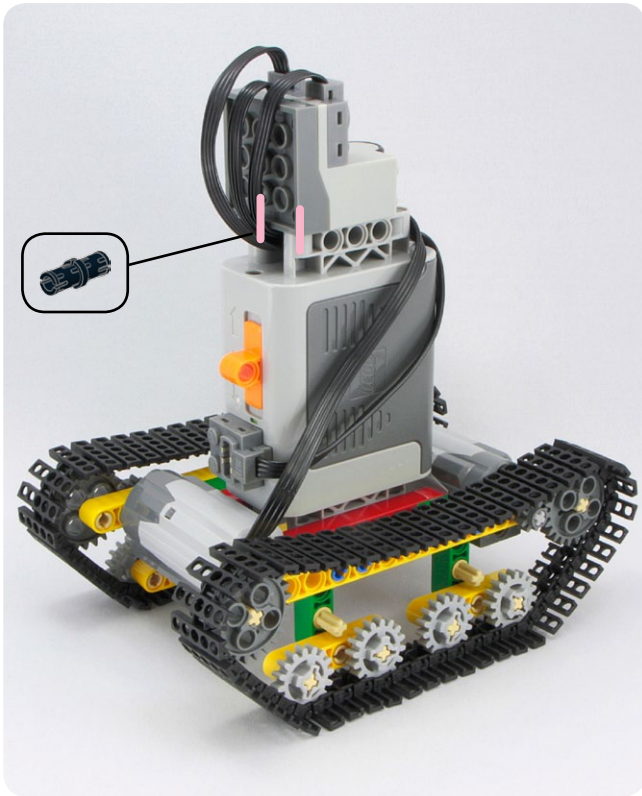
-  x2
- 
-  x2
-  x4
- 
-  x2
- 
-  x4
-  x58
-  x2
-  x4
-  x2
-  x2
-  x2
-  x4
-  x4
-  x2
-  x4
-  x3
-  x4
-  x4
-  x3
-  x6
-  x6



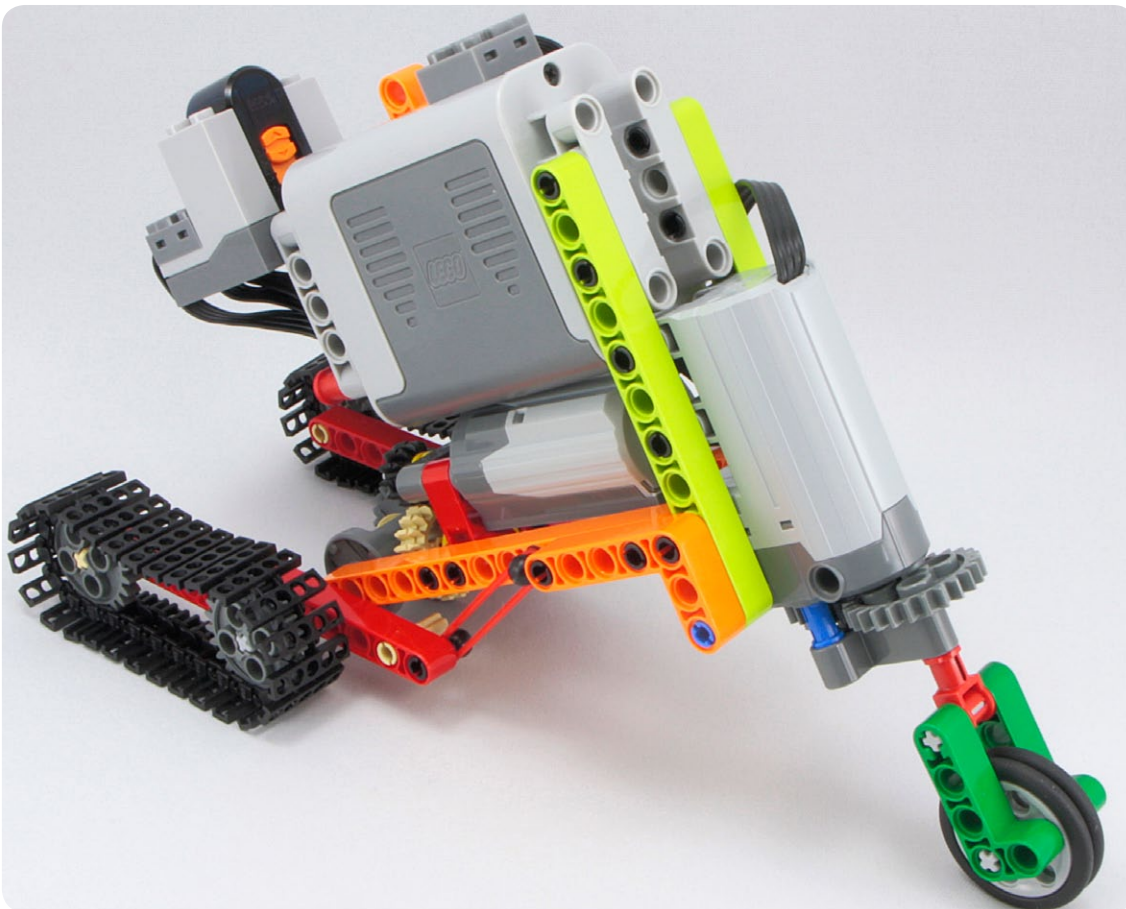
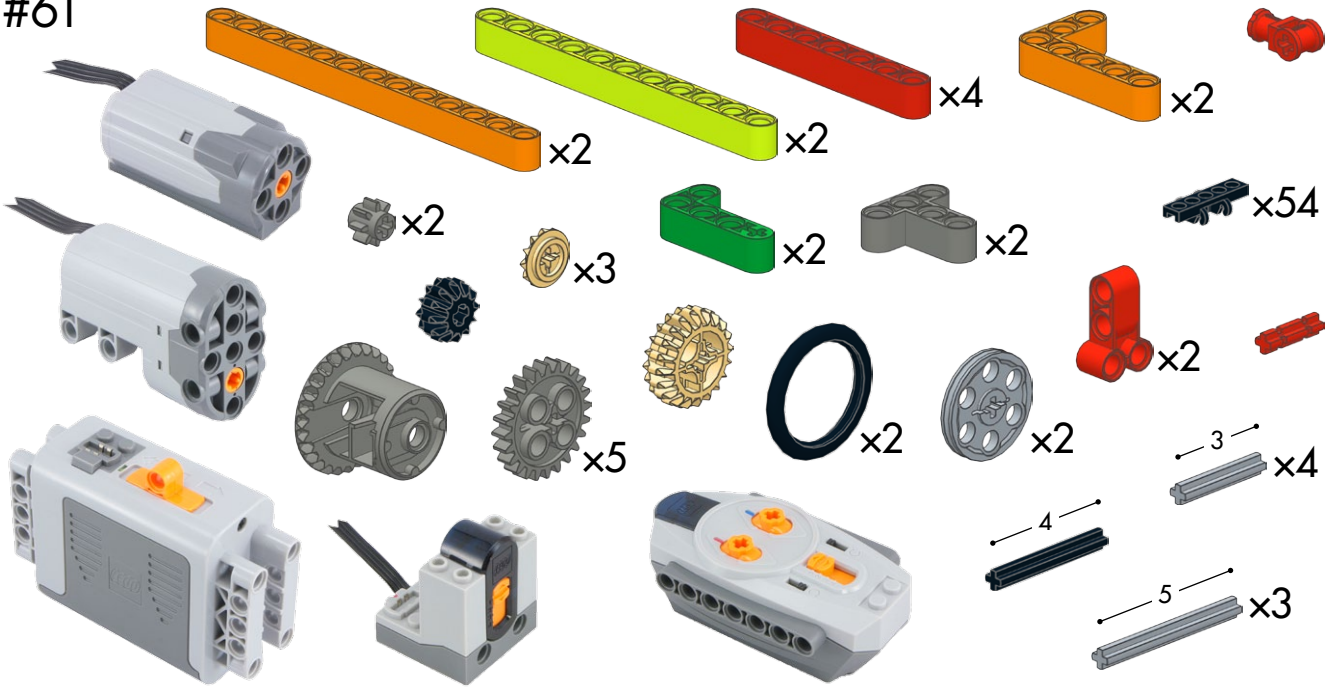


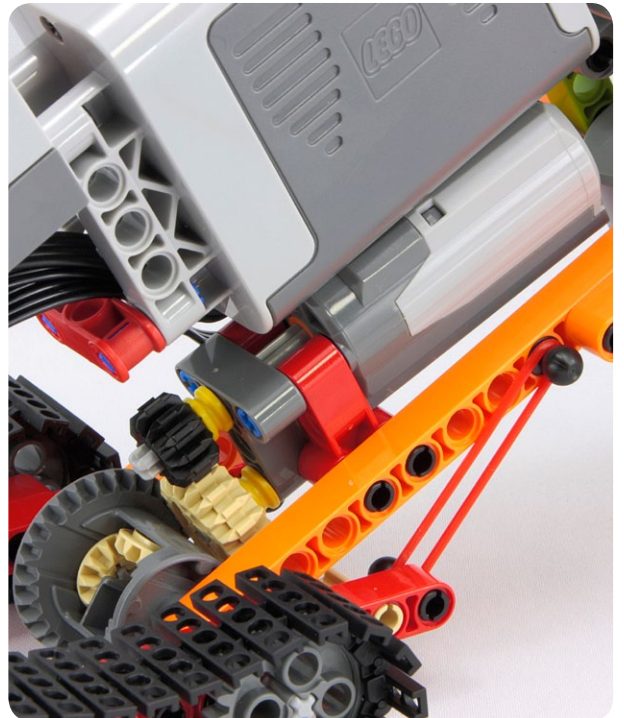
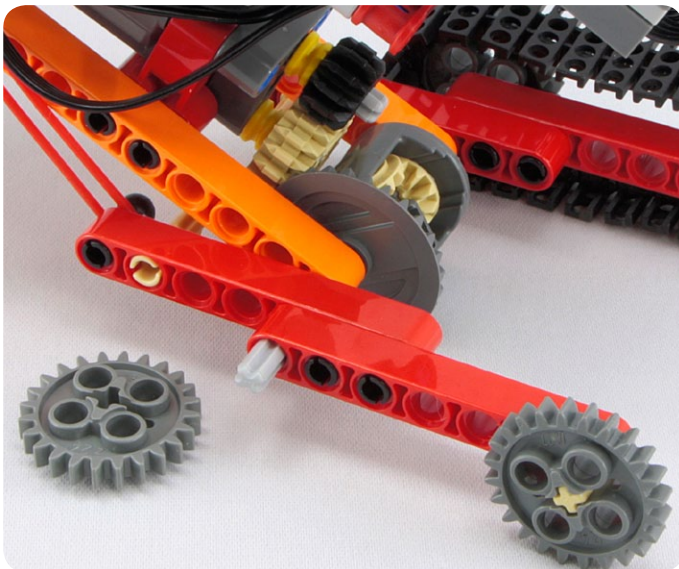
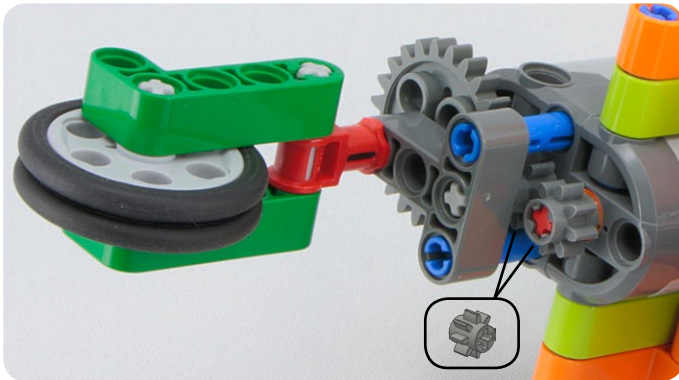
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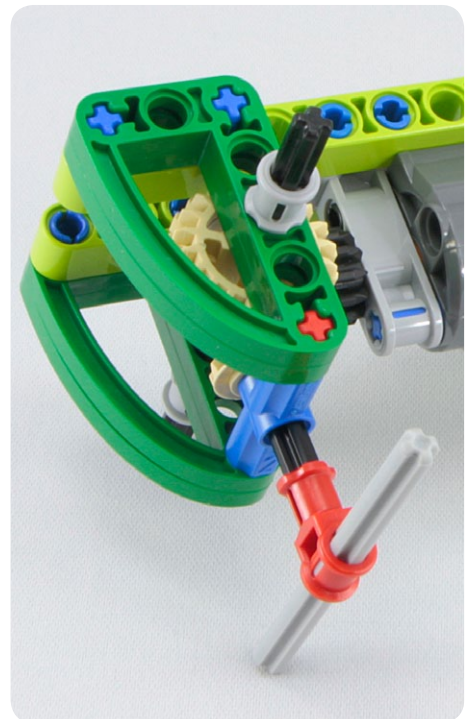
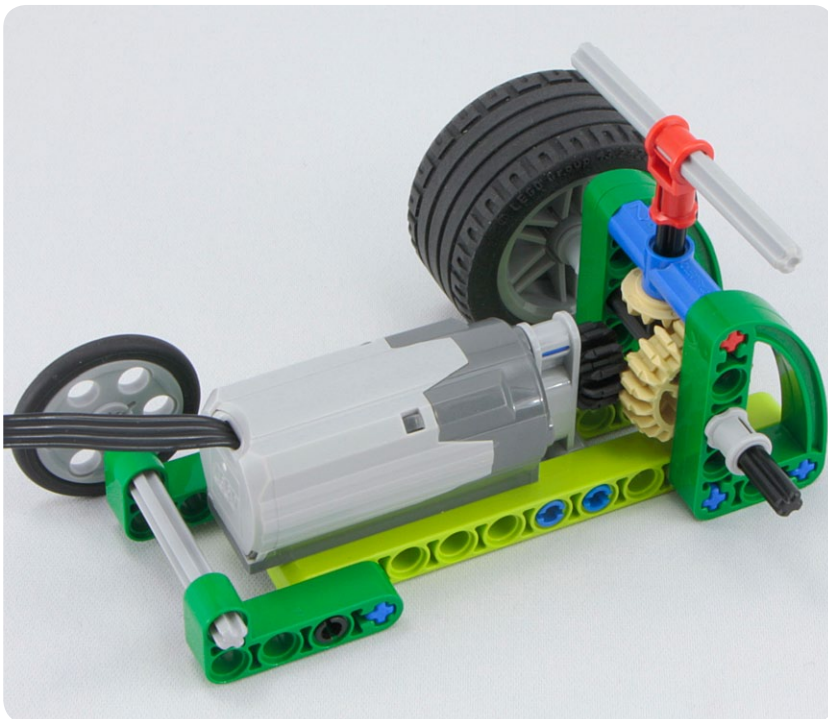
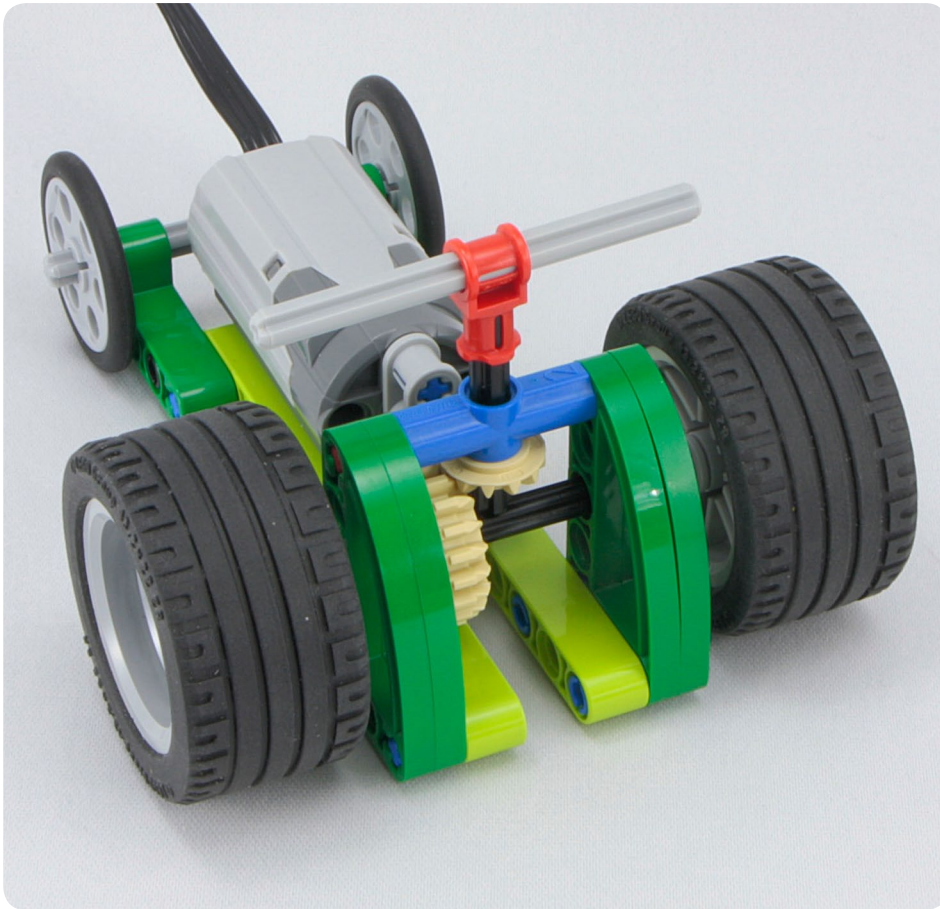




#61

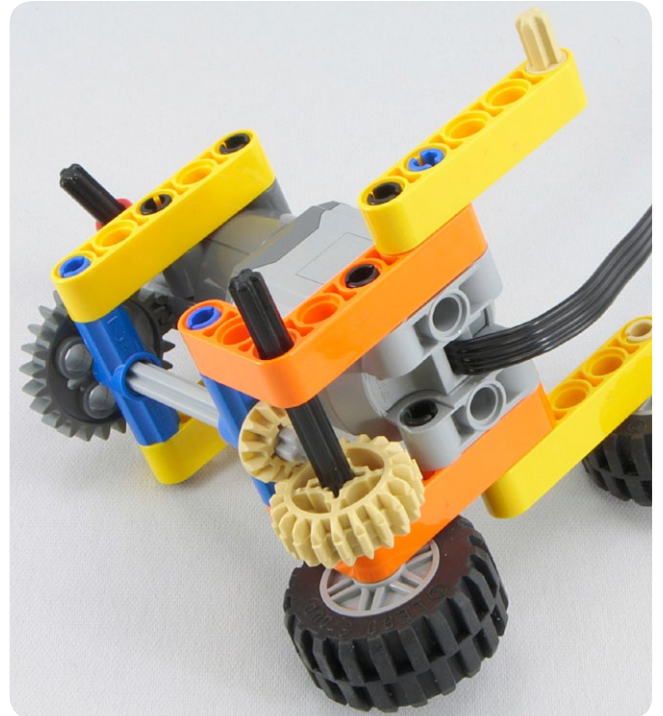










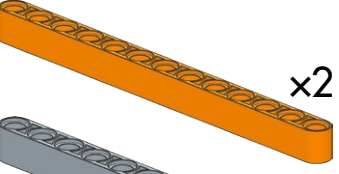
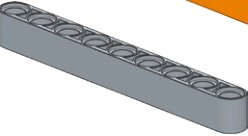






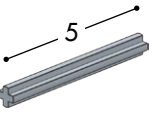
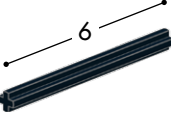
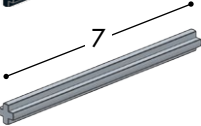




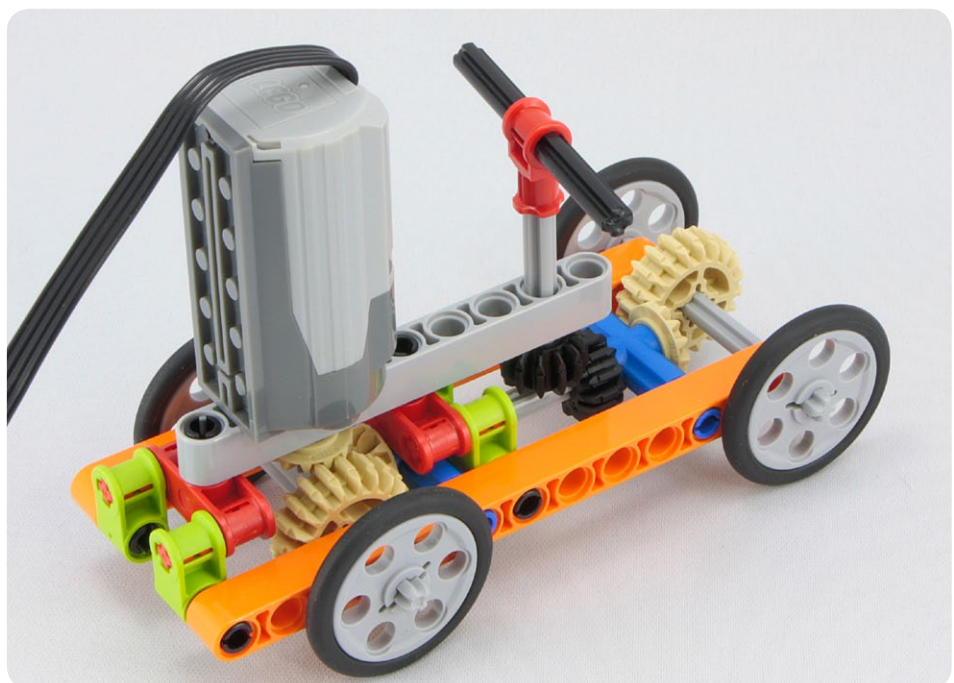
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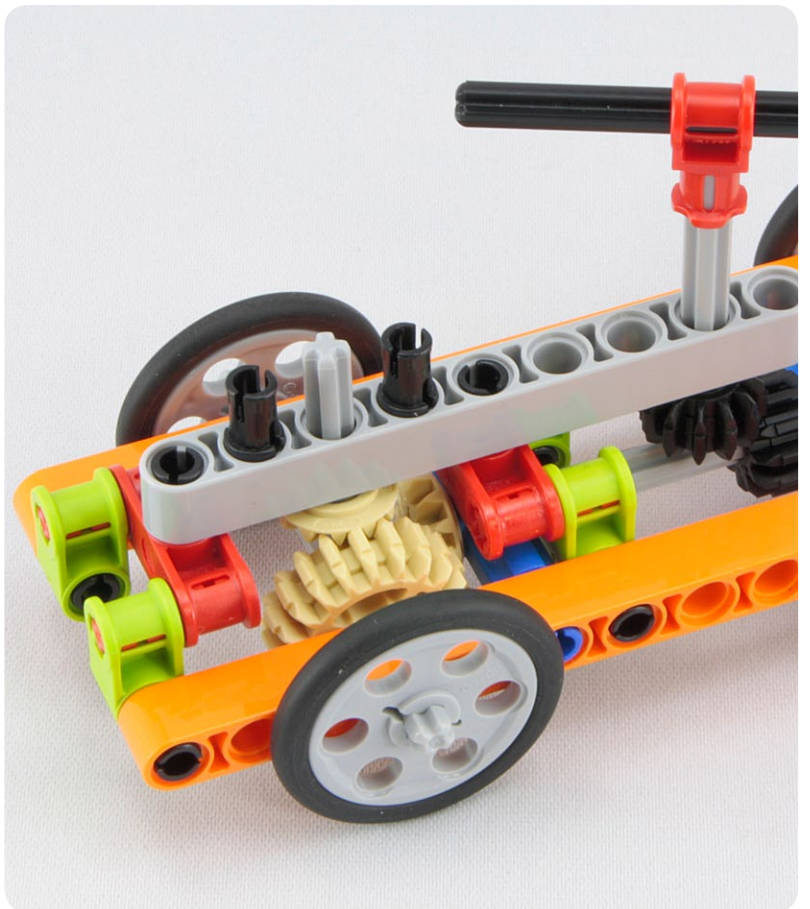
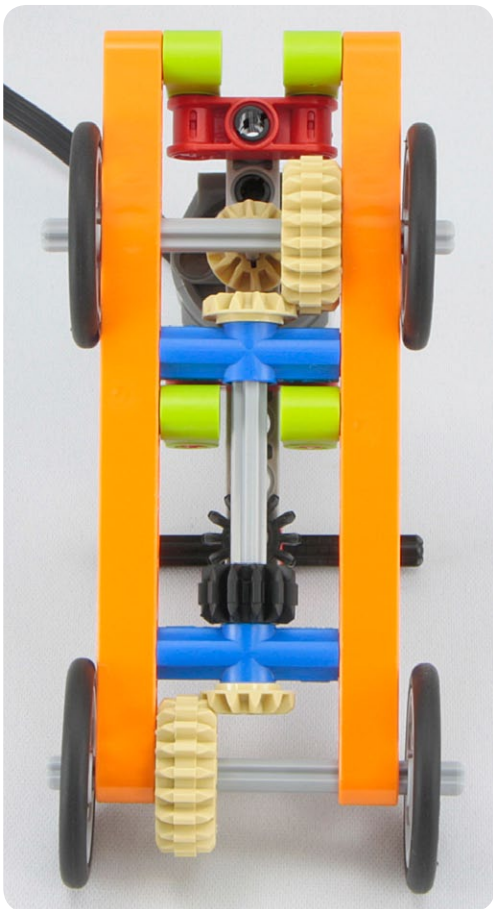
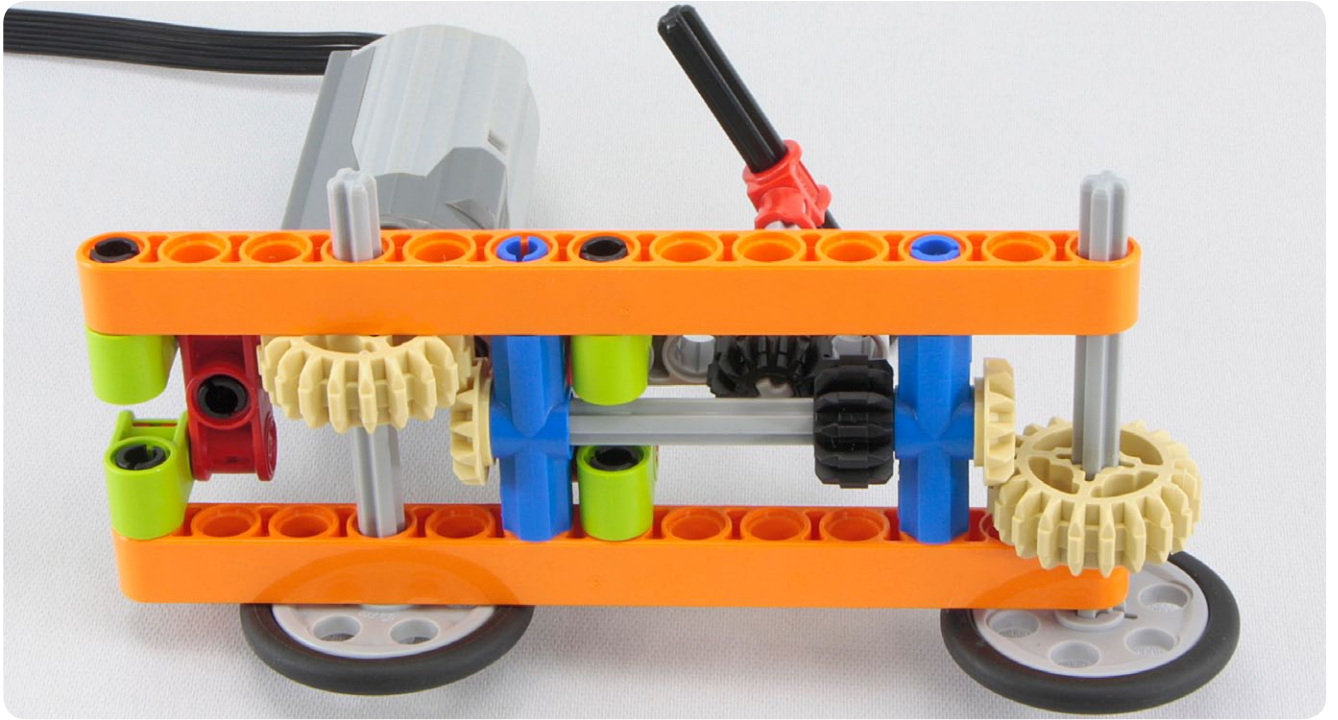
- x4
- x4
- x1
- x1
- x4
- x1
- x2
- x1
- x2
- x2
- x2
- x2
- x2
- x2
- x2
- x3
- x4
- x8







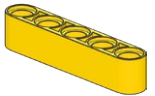
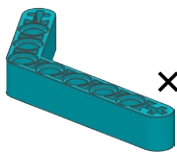

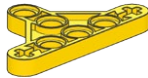







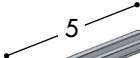
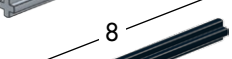
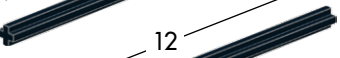




#65

-   x2
-  x3
-  x2
-  x4
-  x4
-  x2
- 
-  x2
- 
-  x4
-  x2
-  3
-  x4
-  5
-  6
-  7 x3
-  x4
-  x8

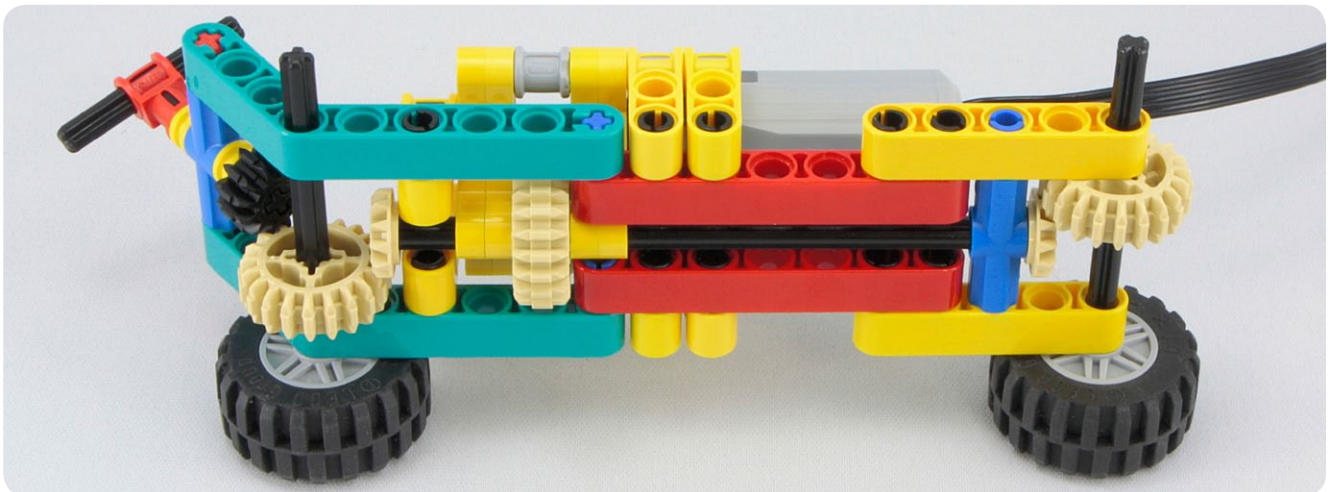
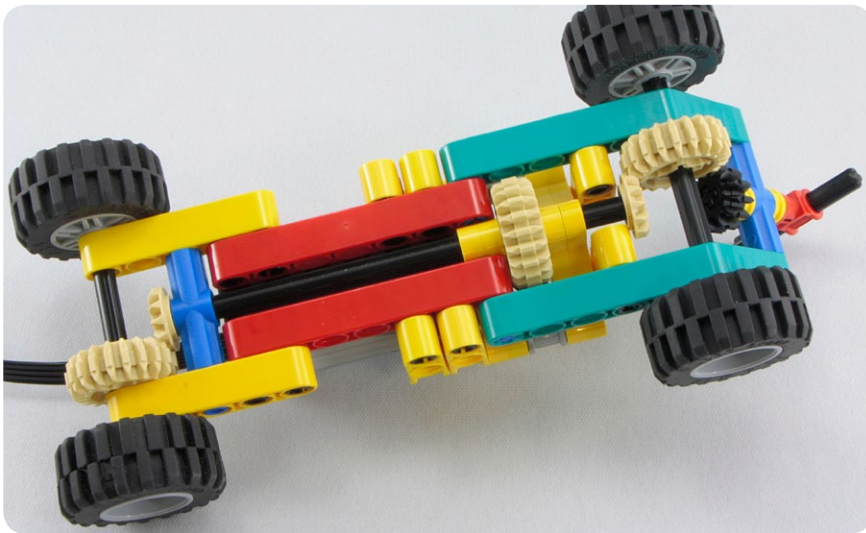
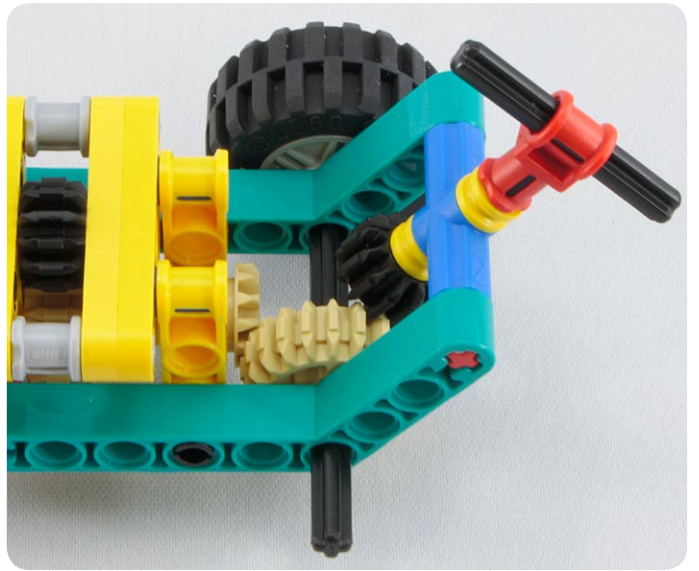
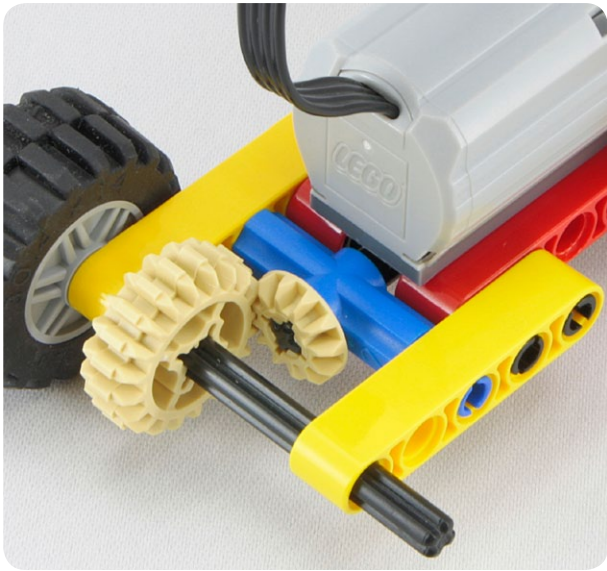


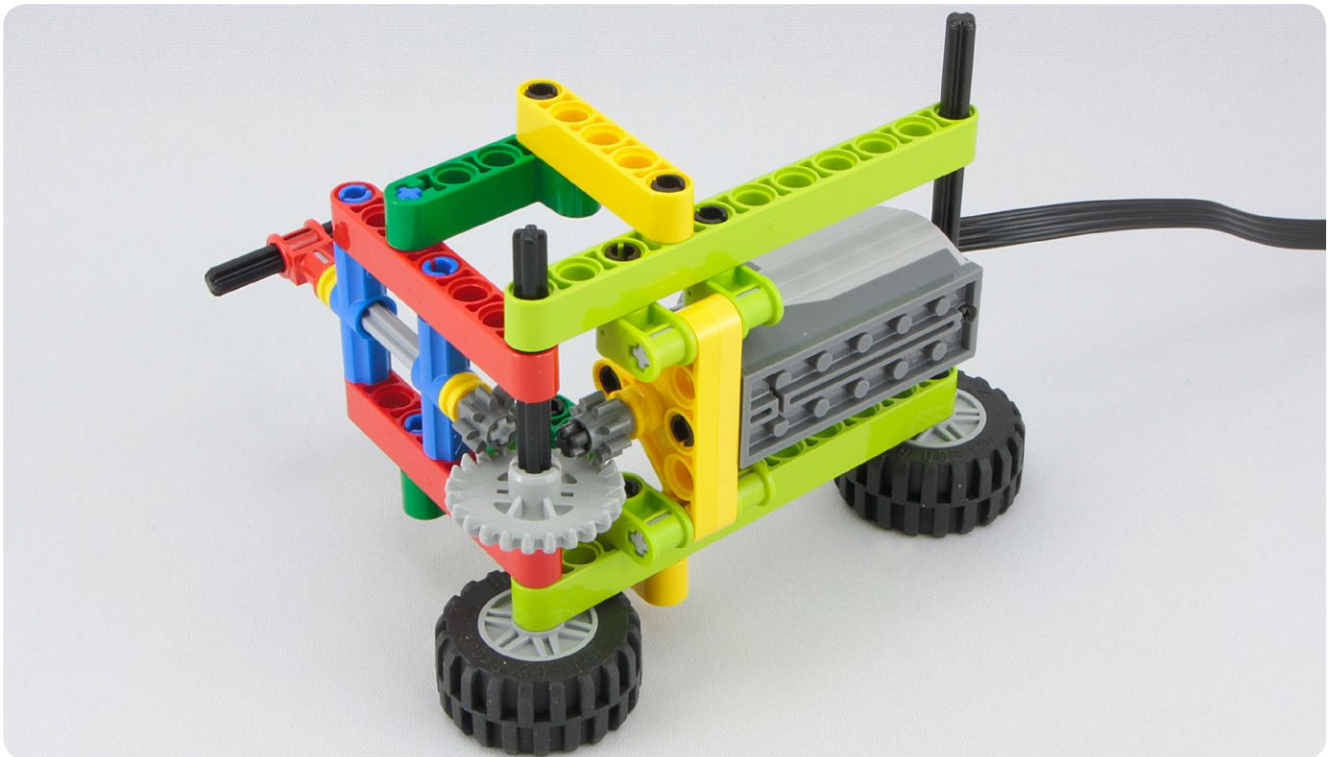
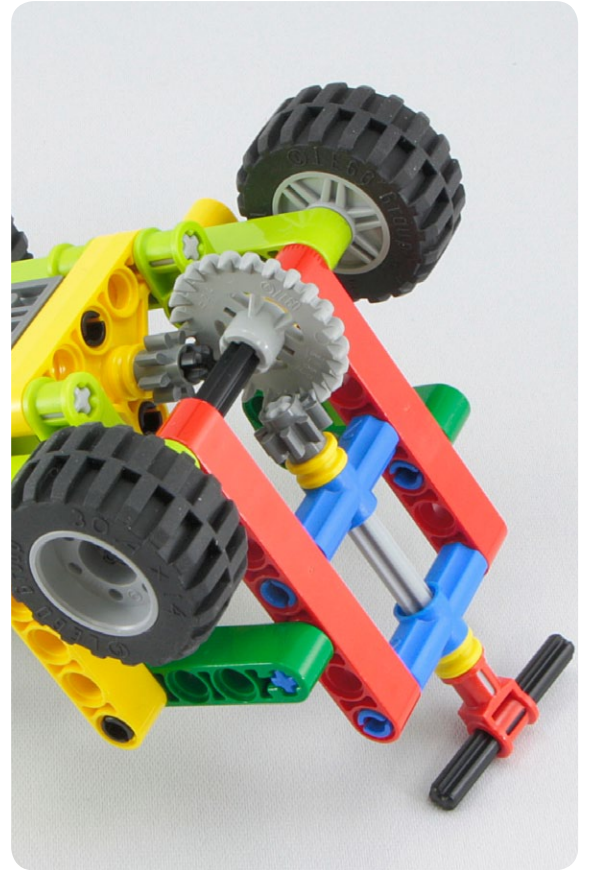
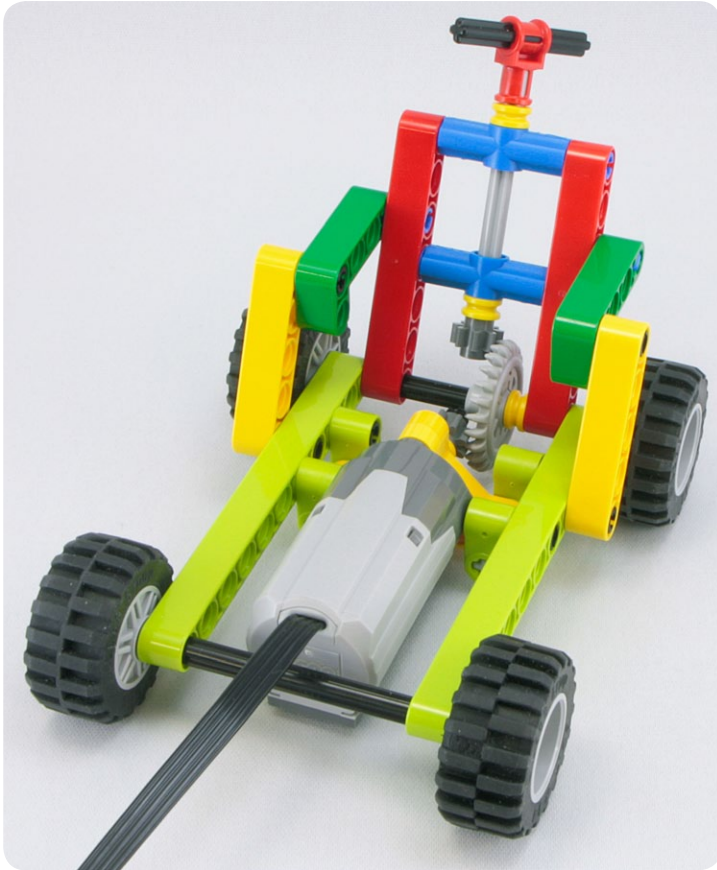


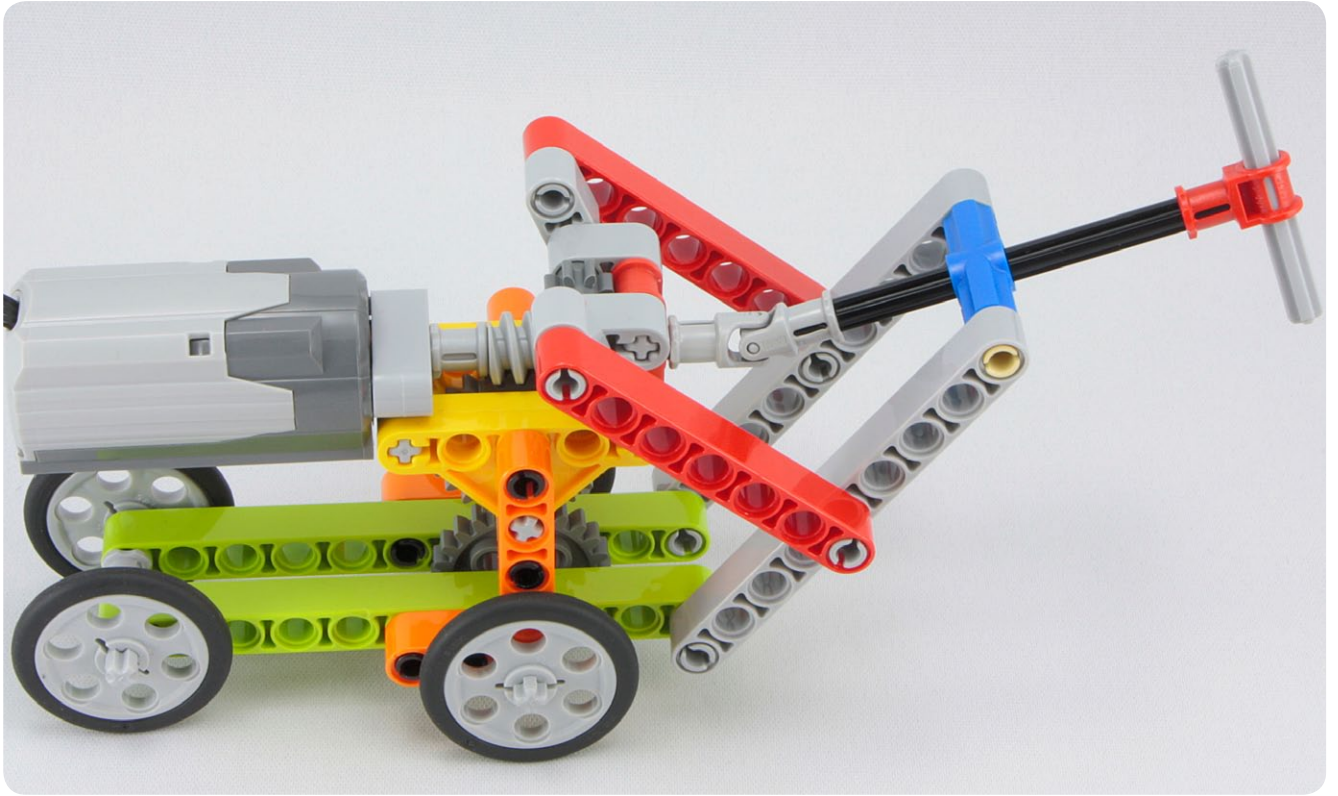
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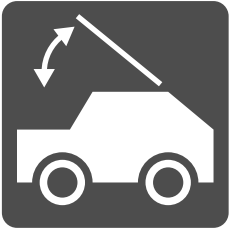
-  x1
-  x4
-  x4
-  x2
-  x2
-  x2
-  x1
-  x4
-  x6
-  x2
-  x3
-  x2
-  x2
-  x2
-  x3
-  x2
-  x2
-  x2
-  x2
-  x2
-  x6
-  x13





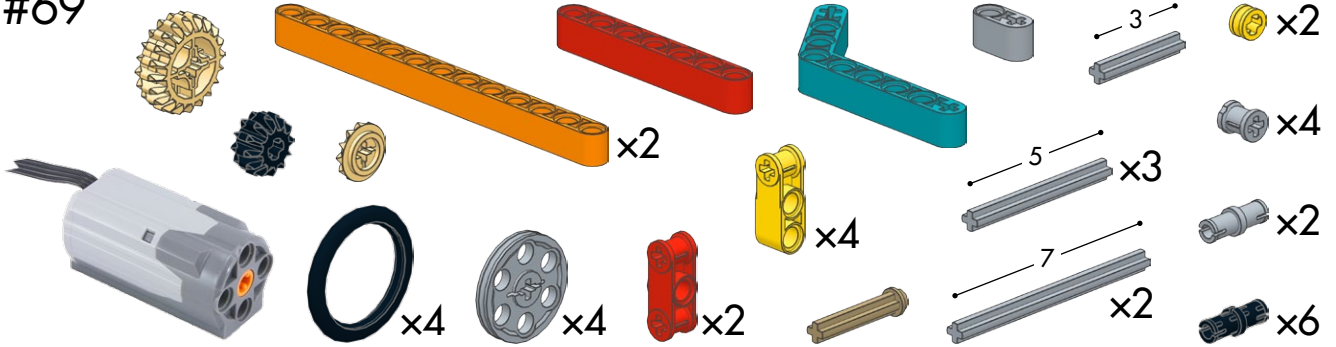


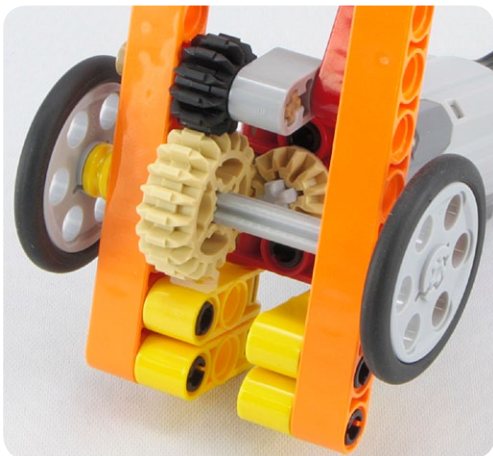
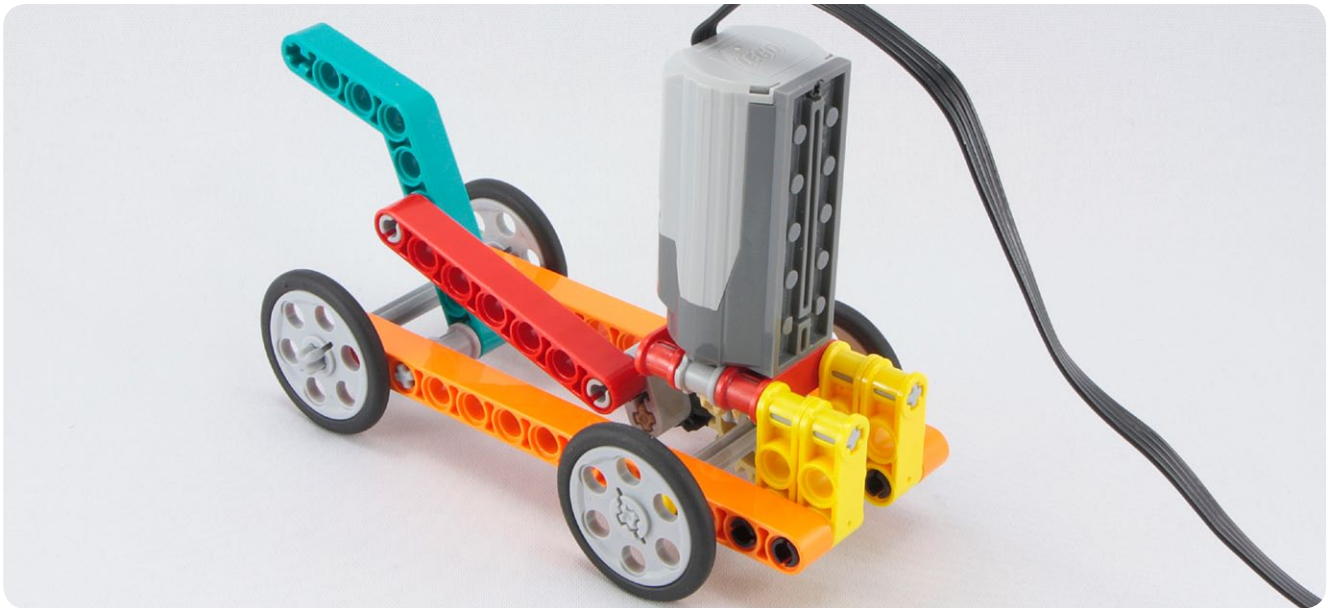




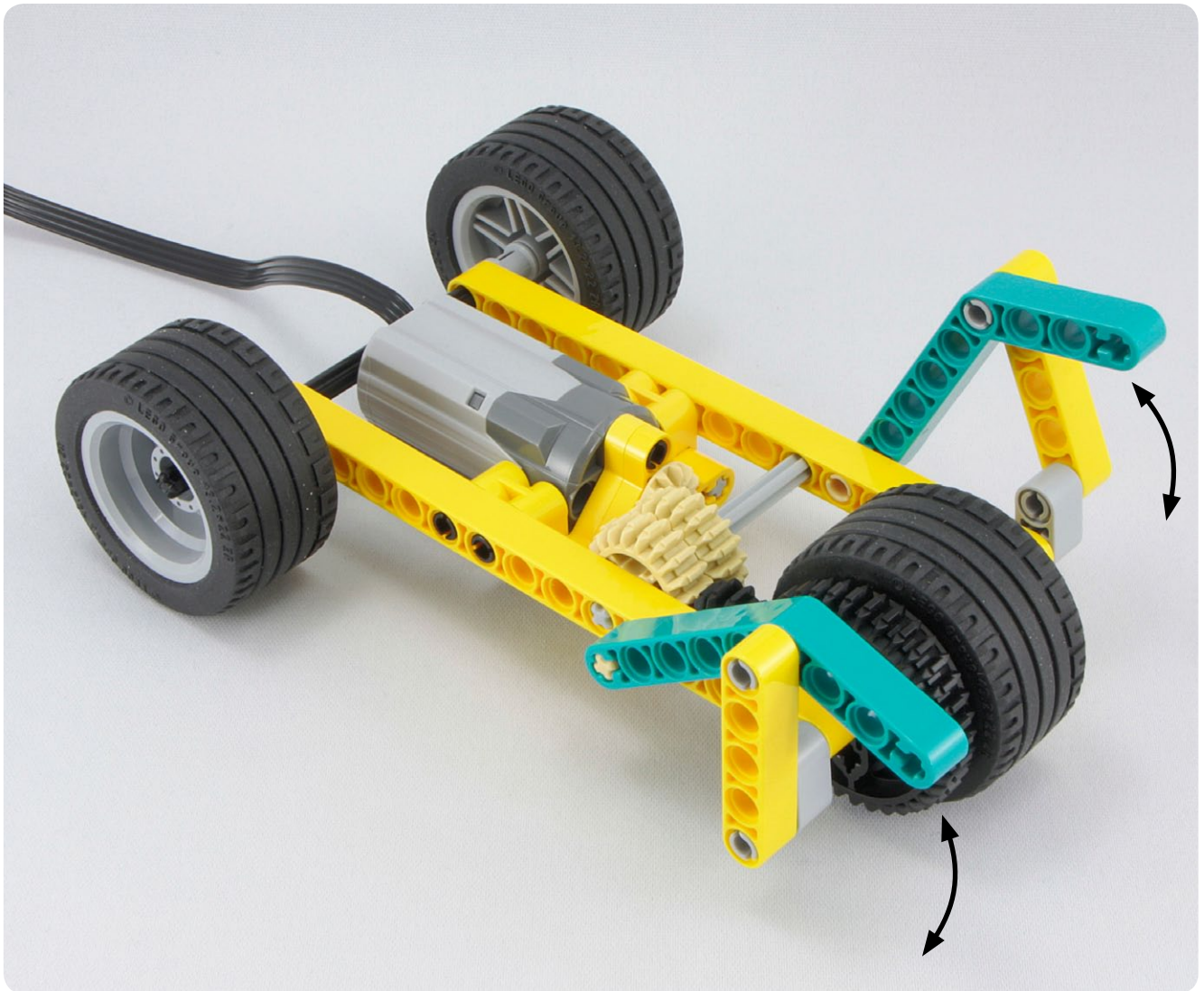
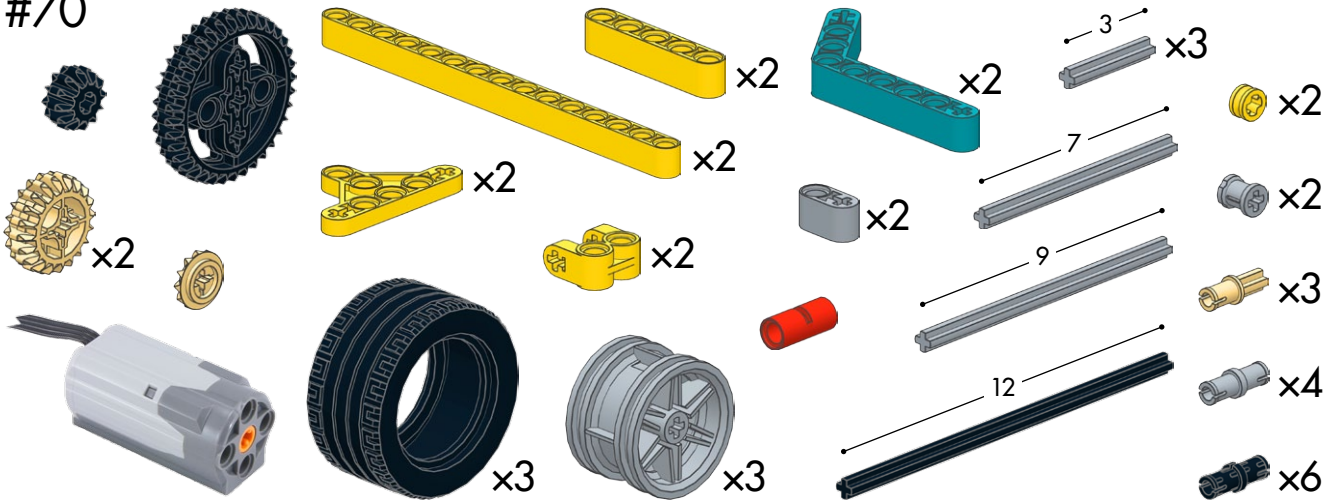
Cars that move something

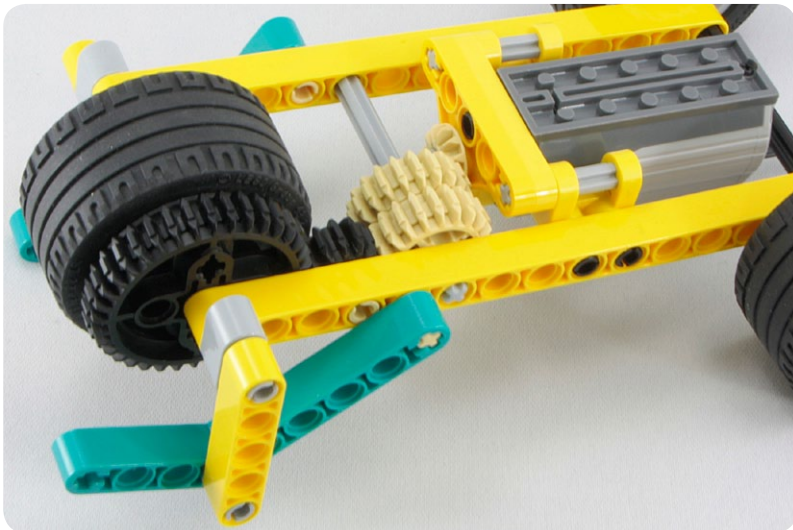
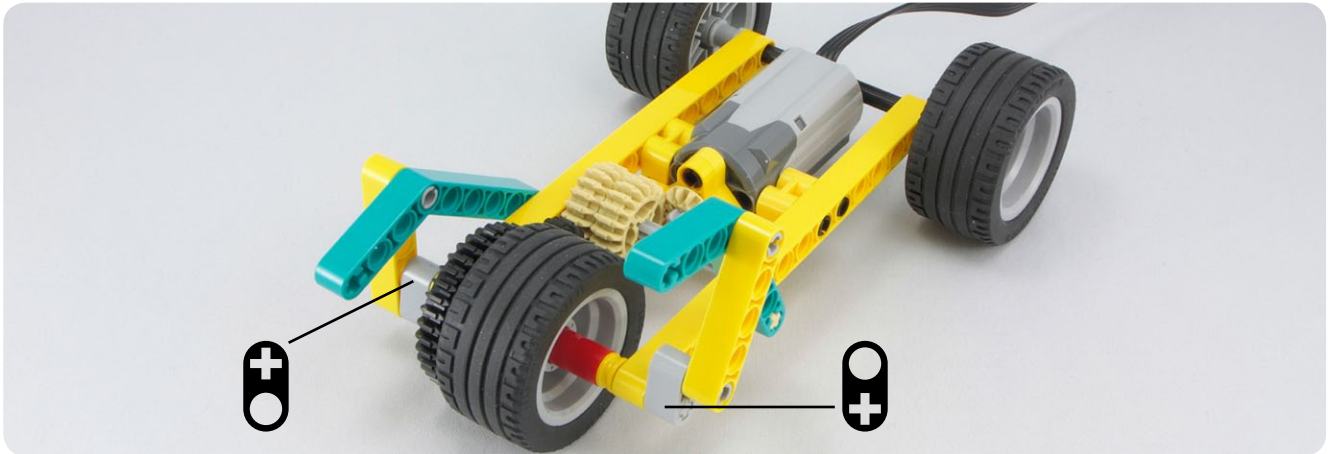
#69

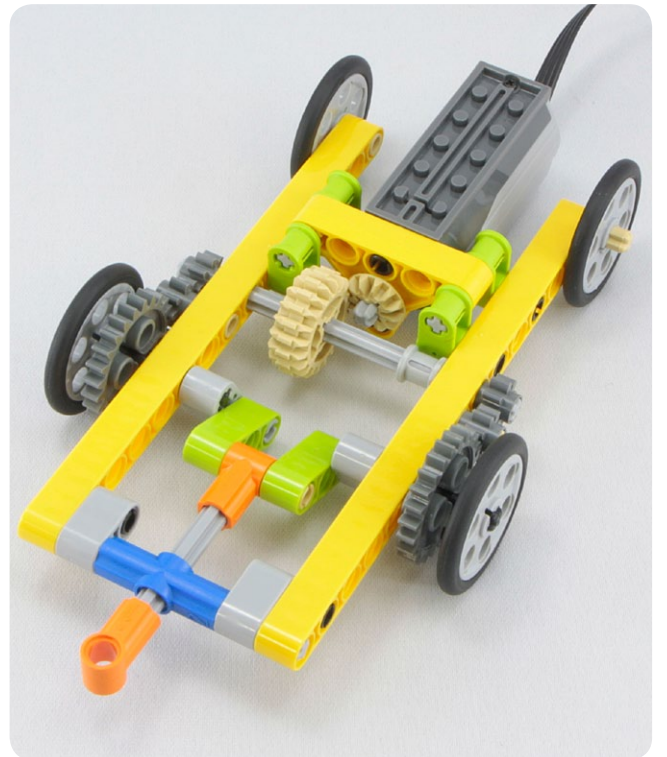
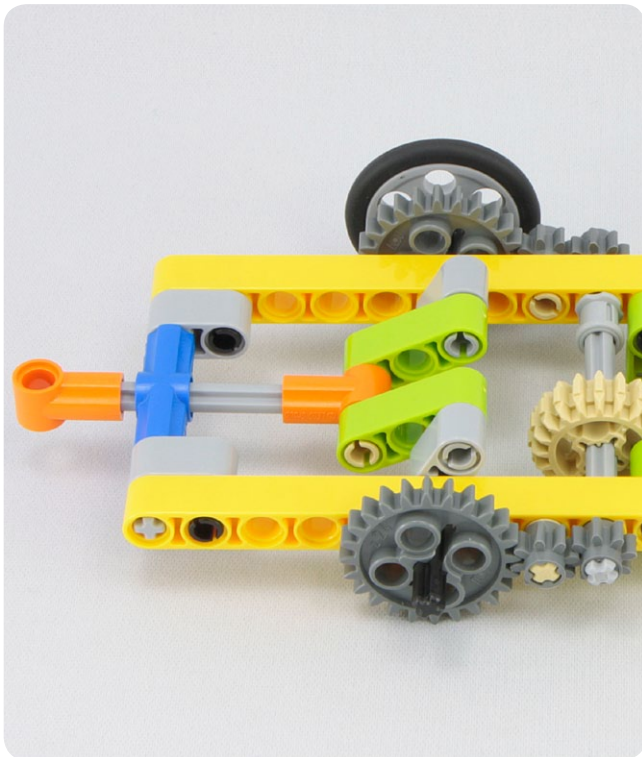




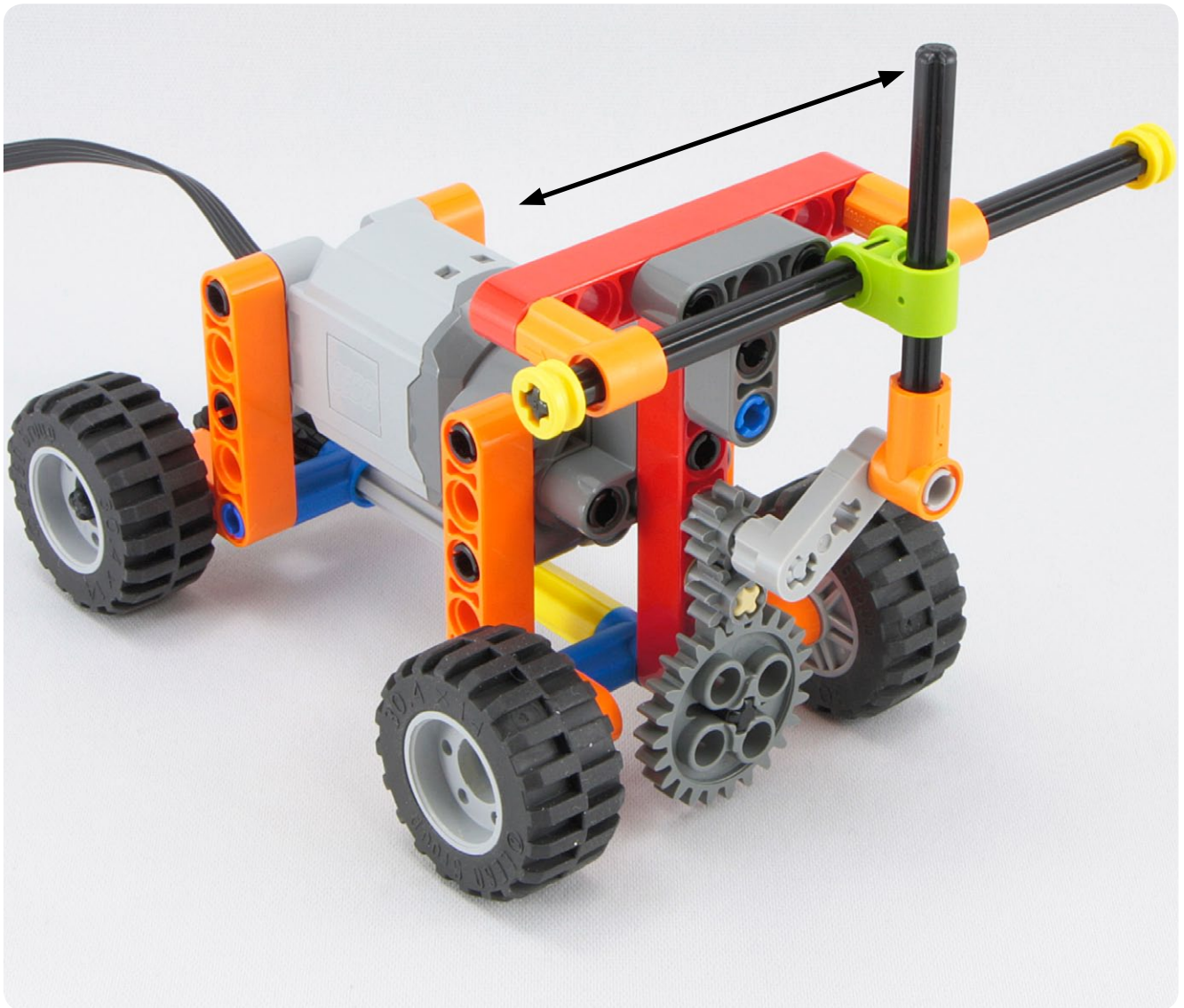
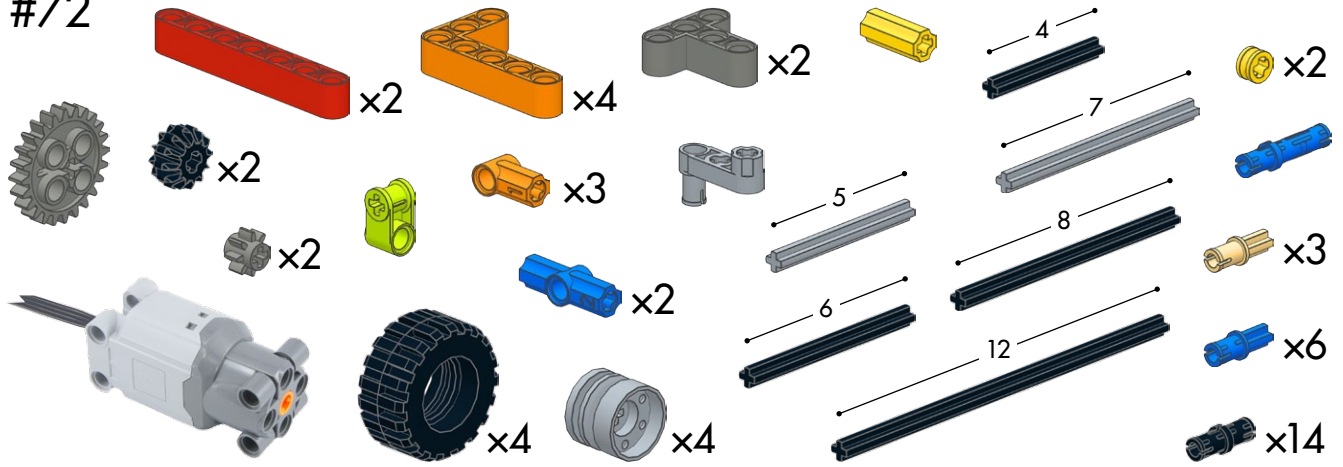
#70

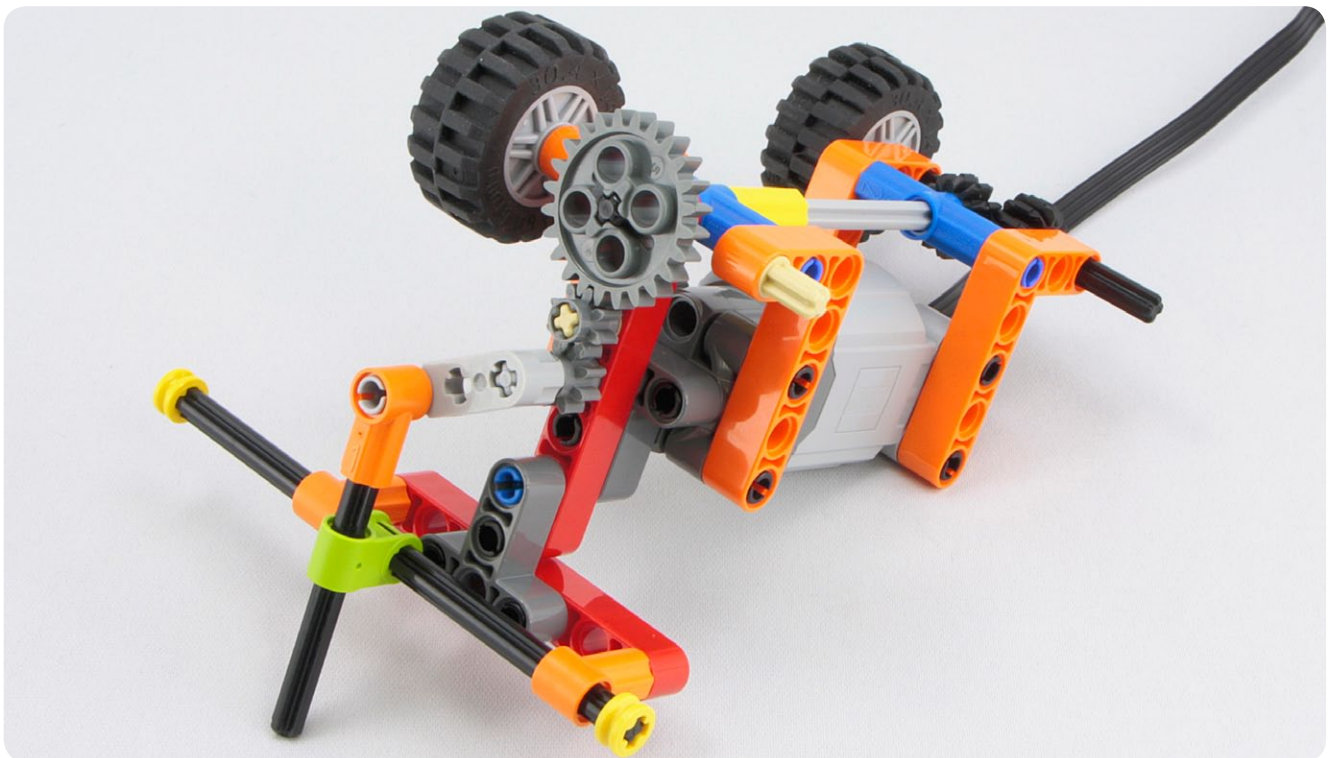
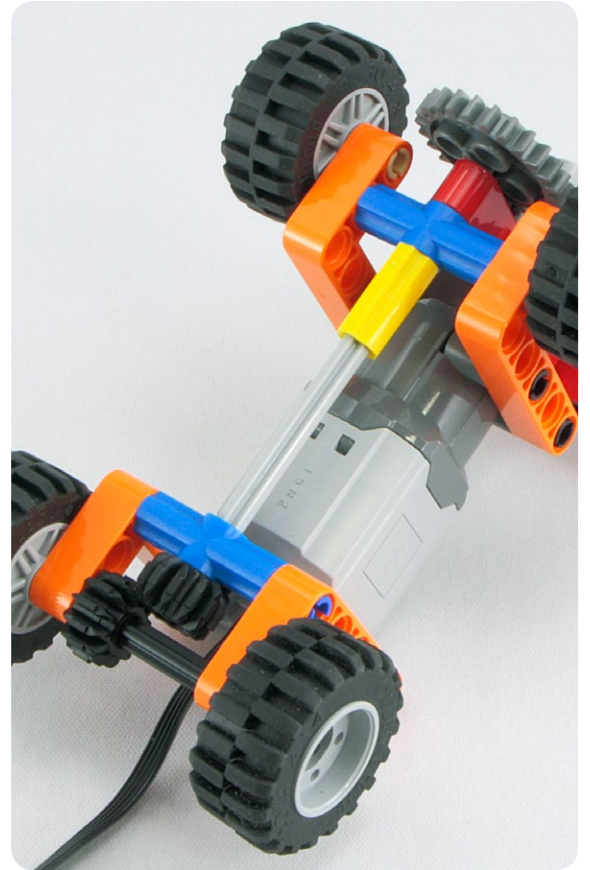


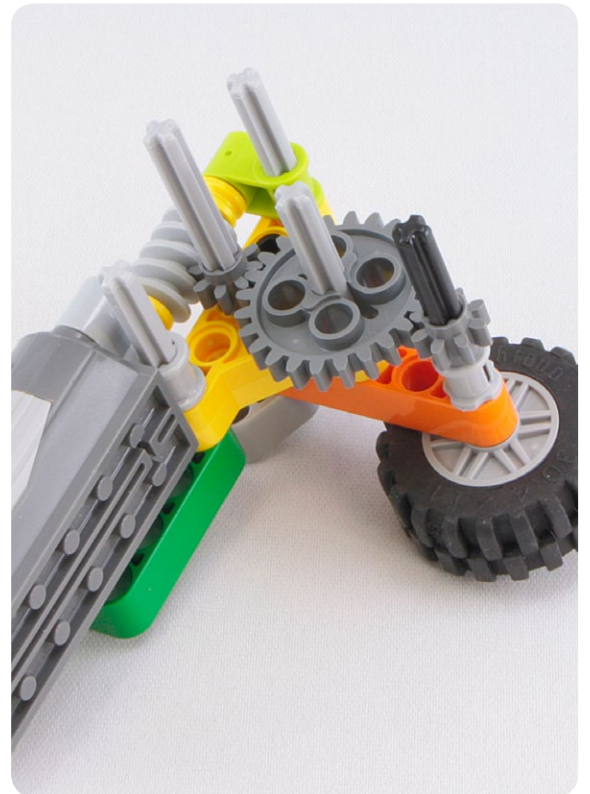
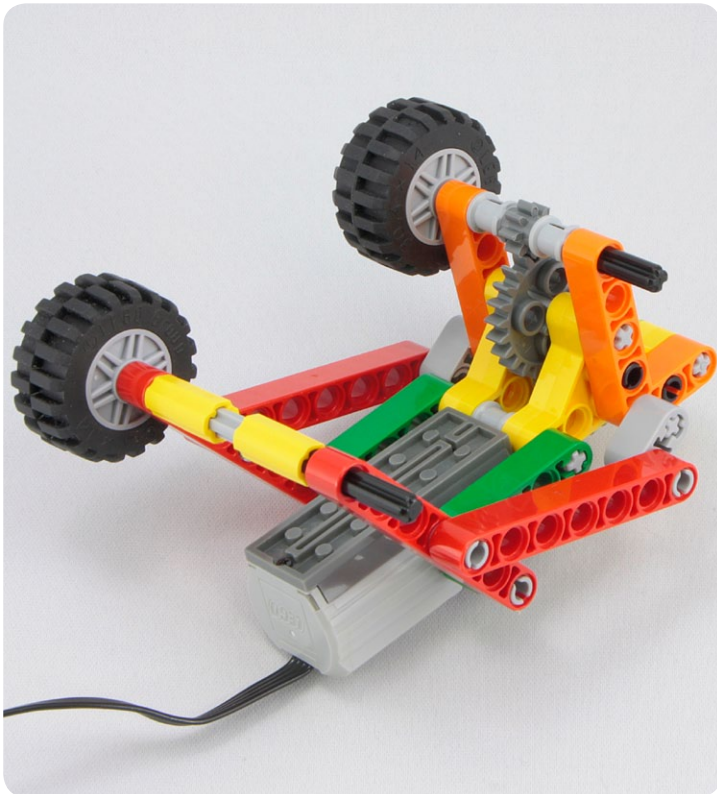




#72



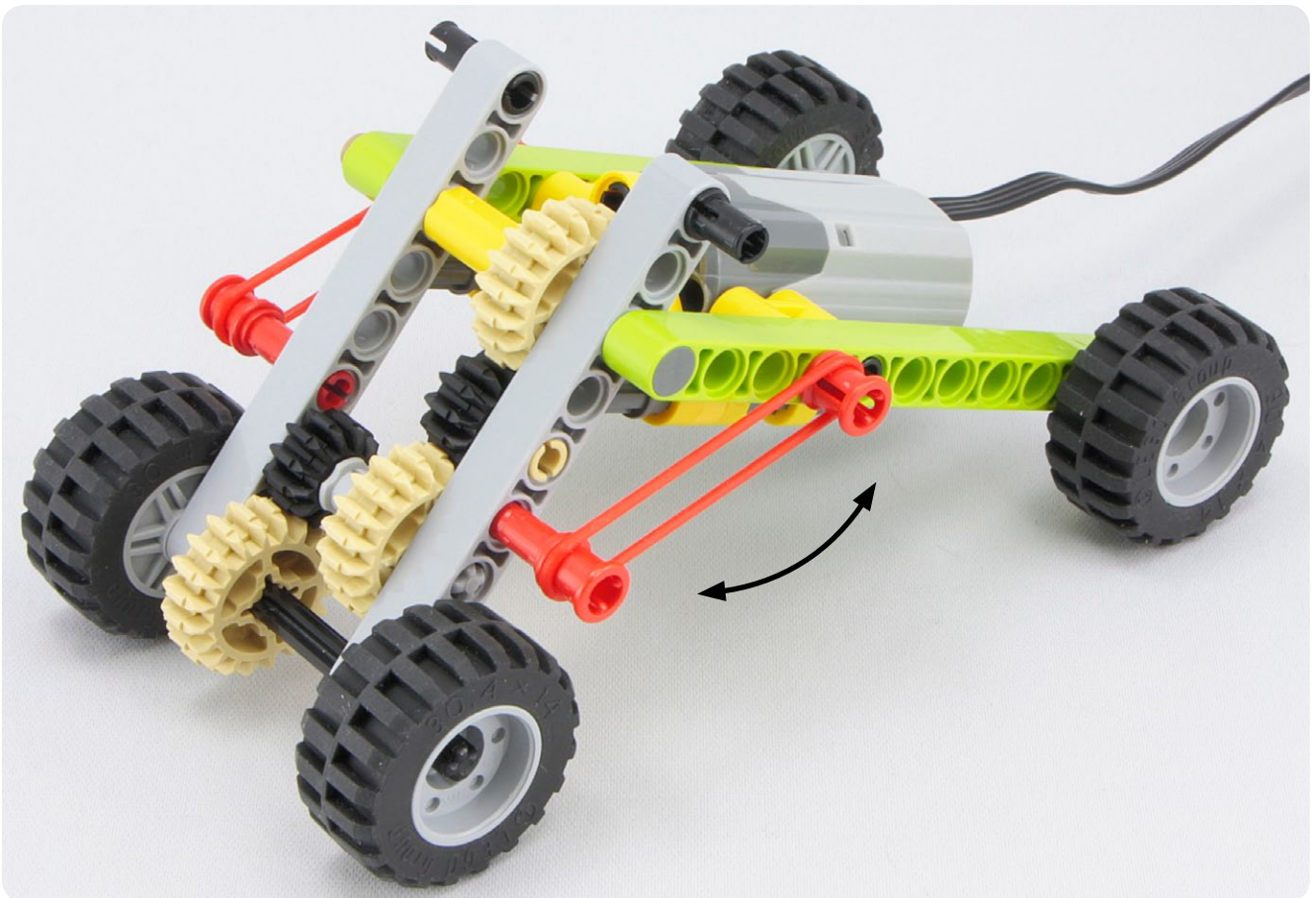
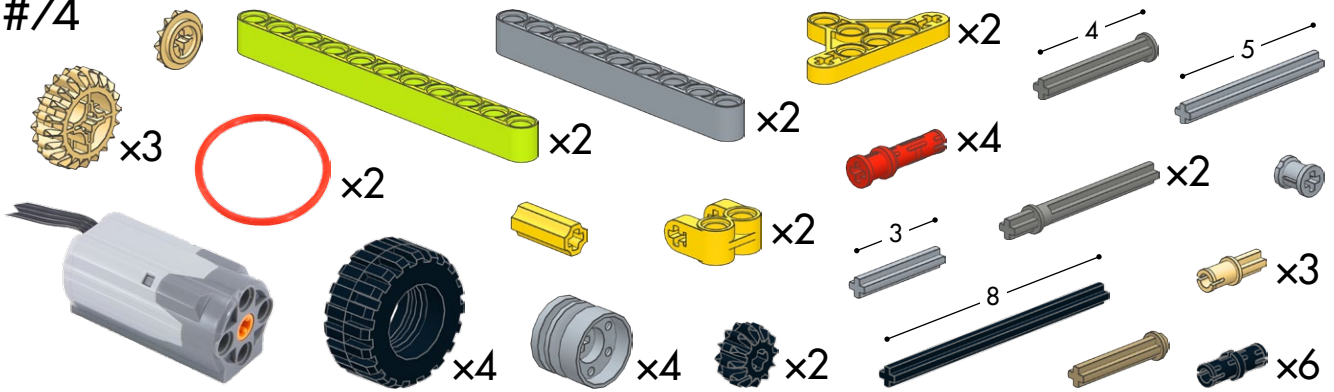


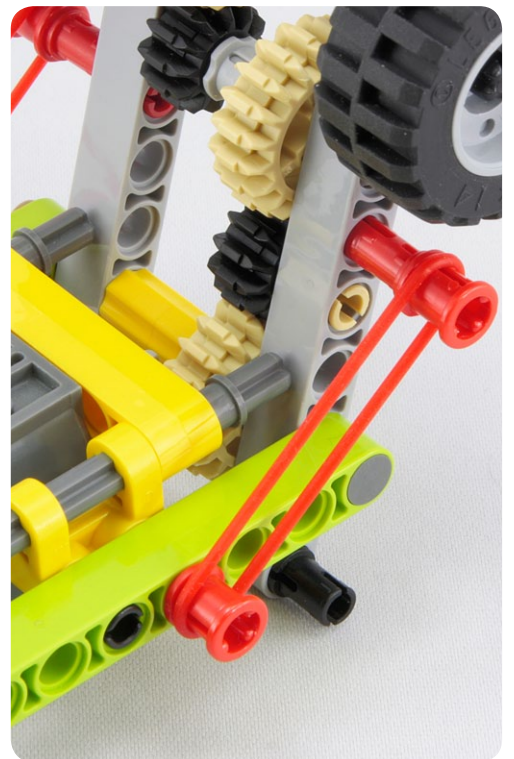
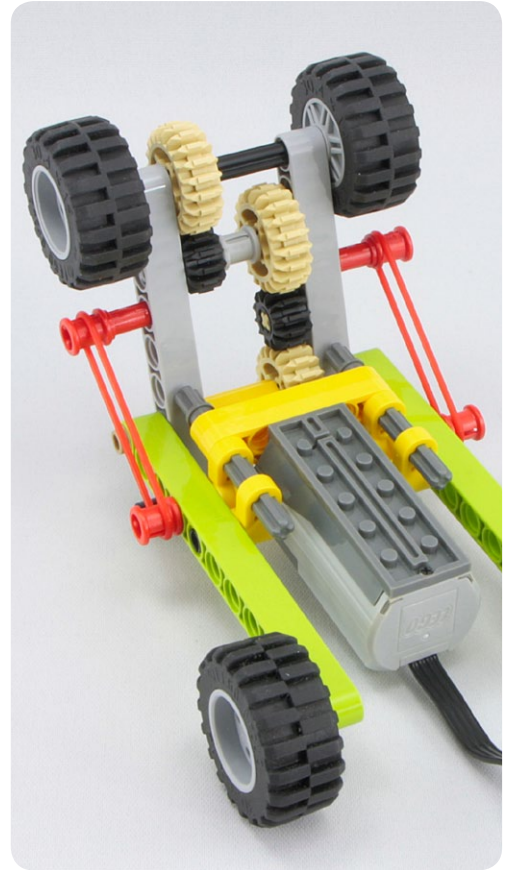


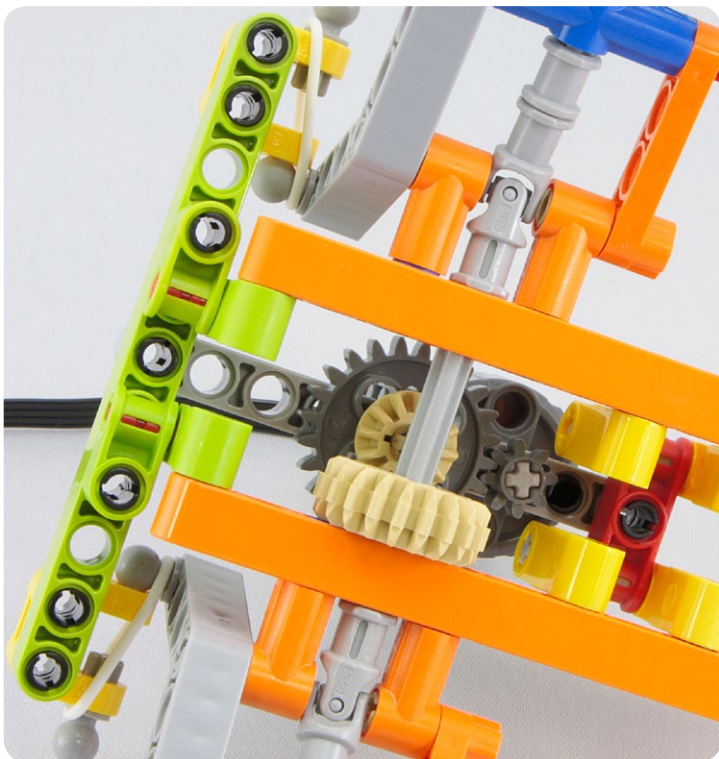
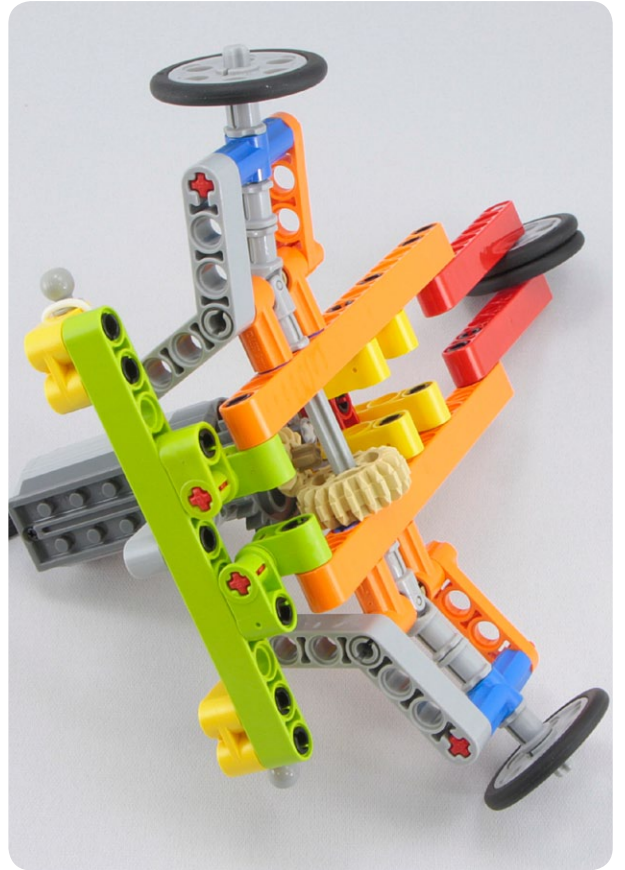


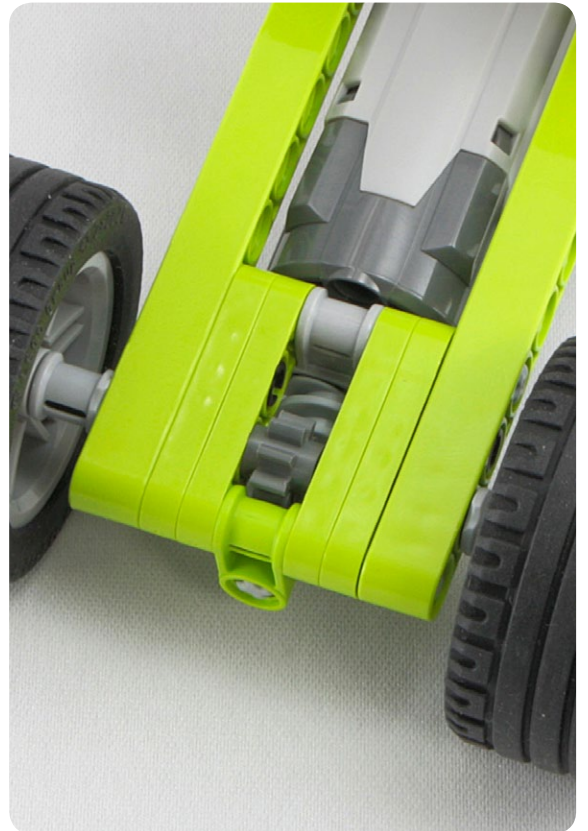
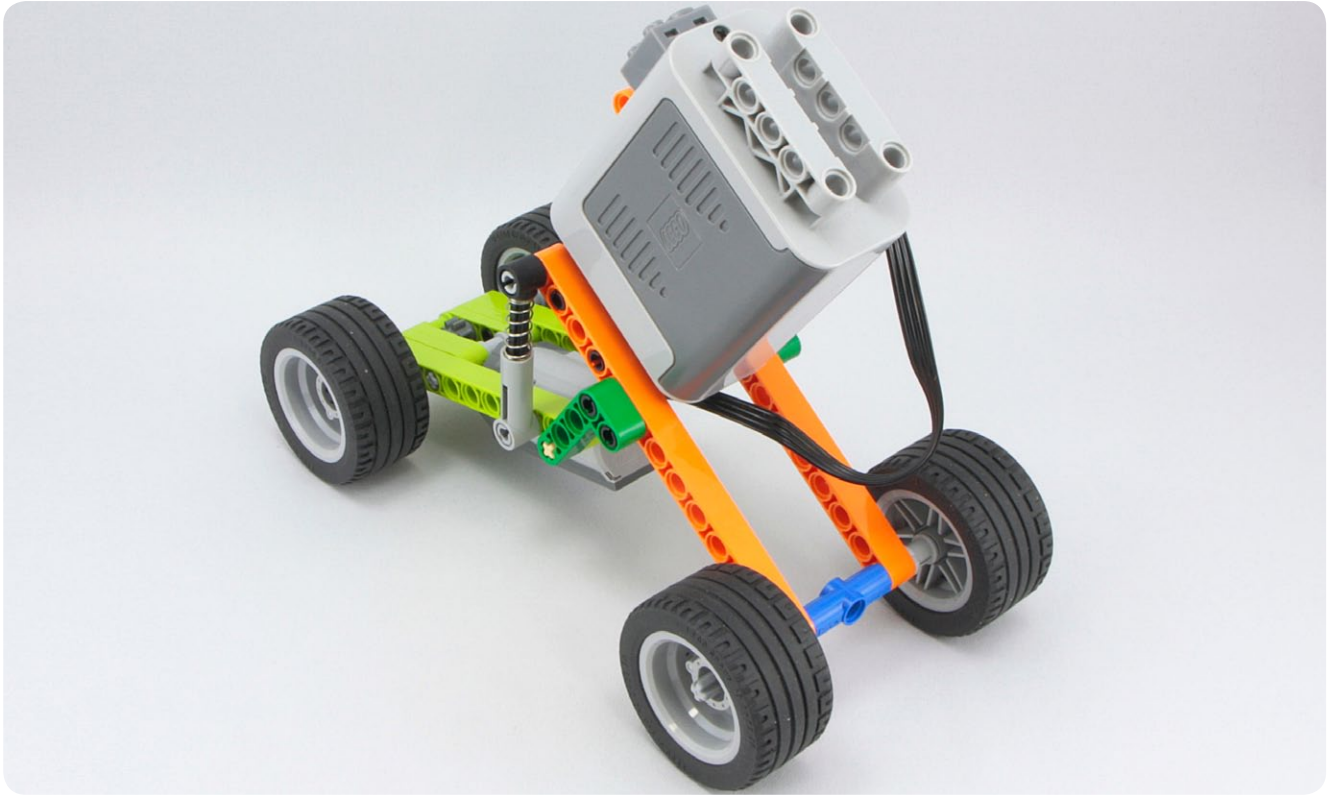
Cars with suspension

#74

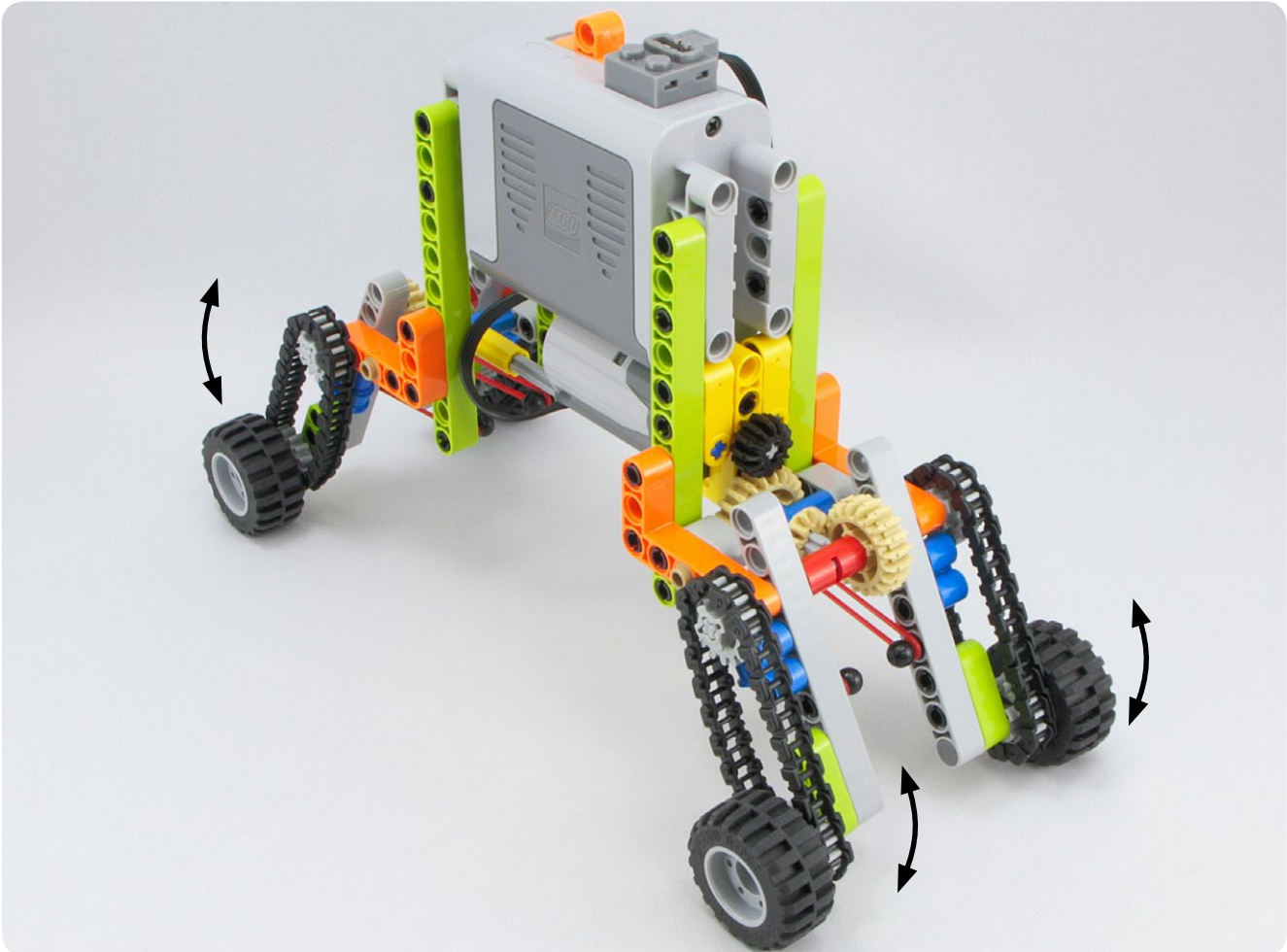
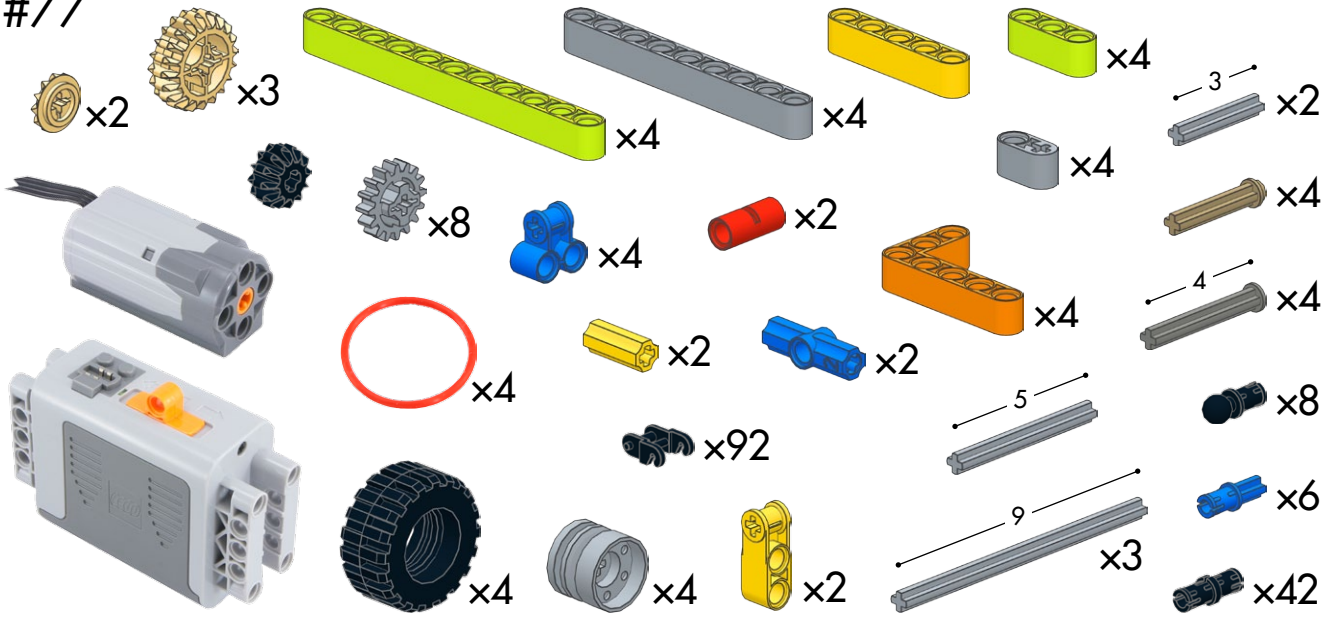


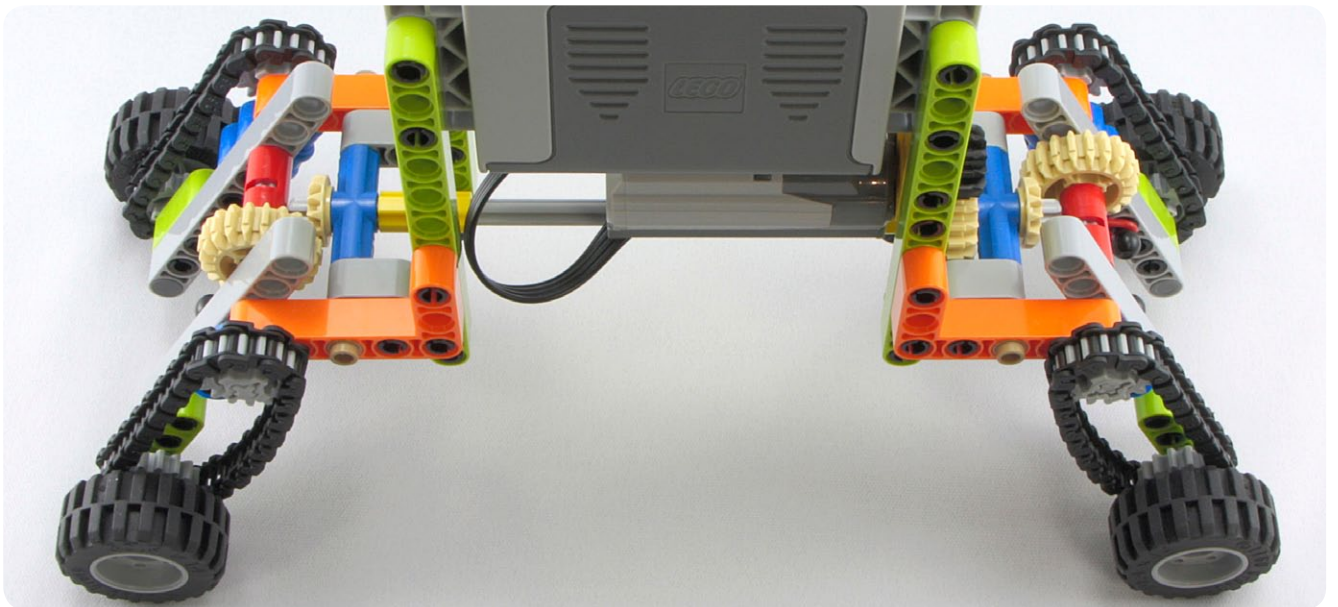
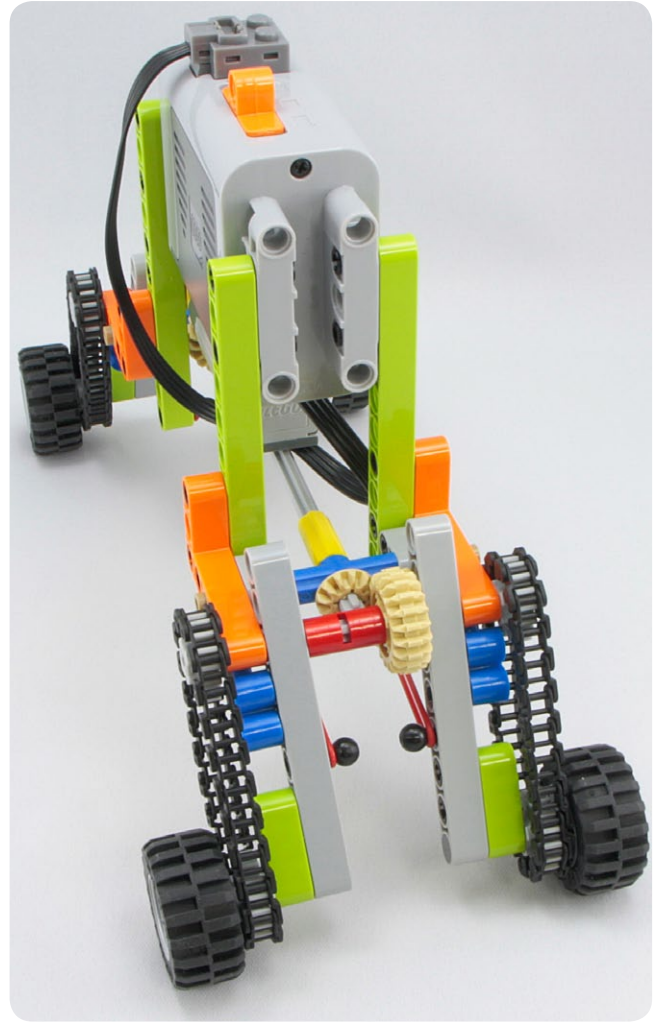
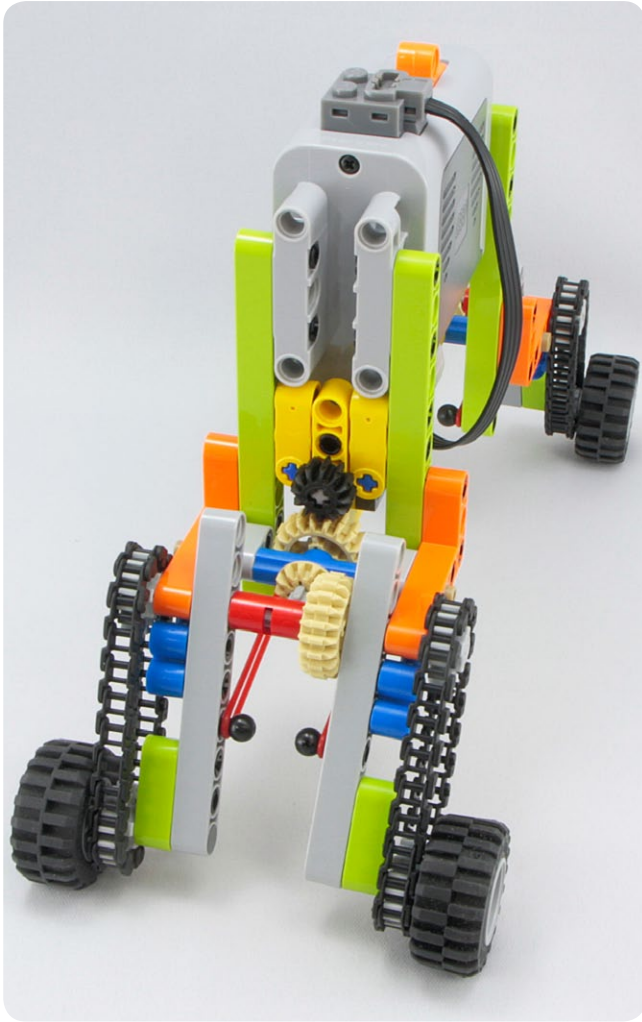


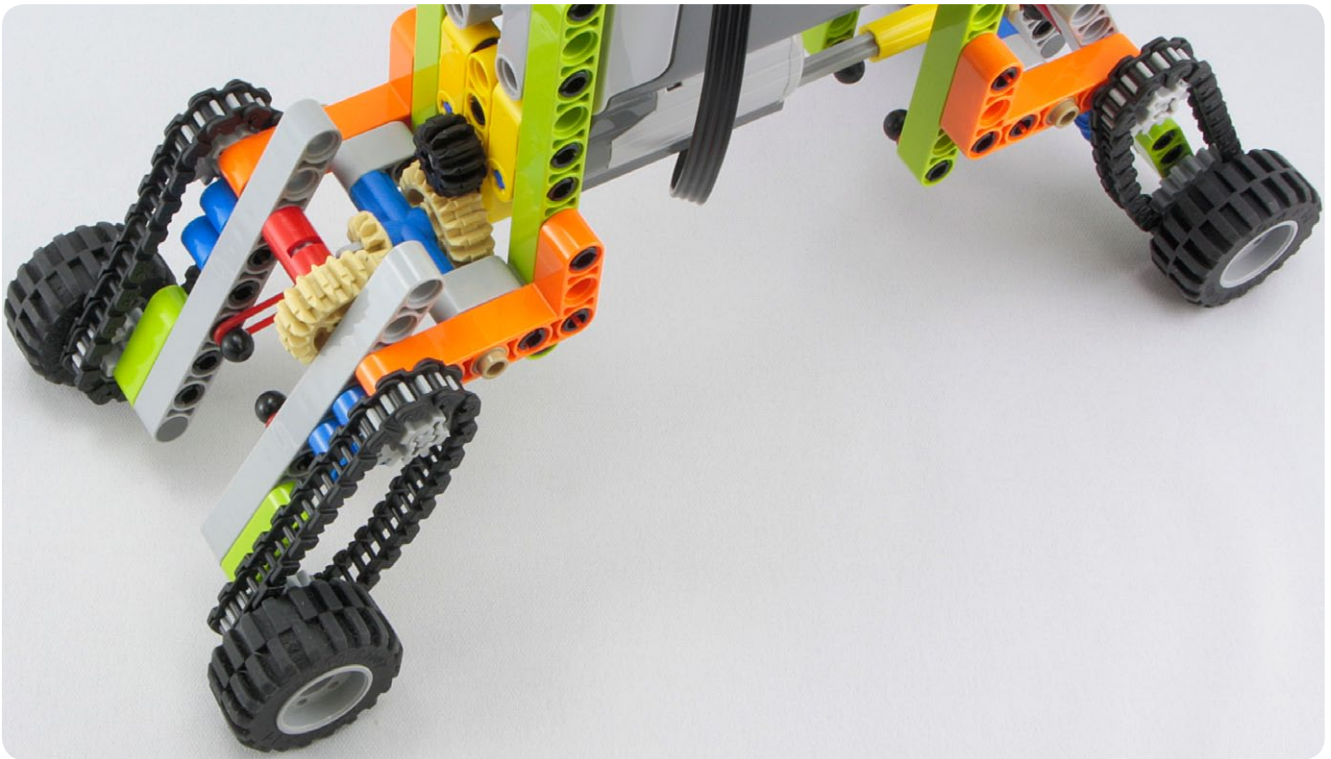


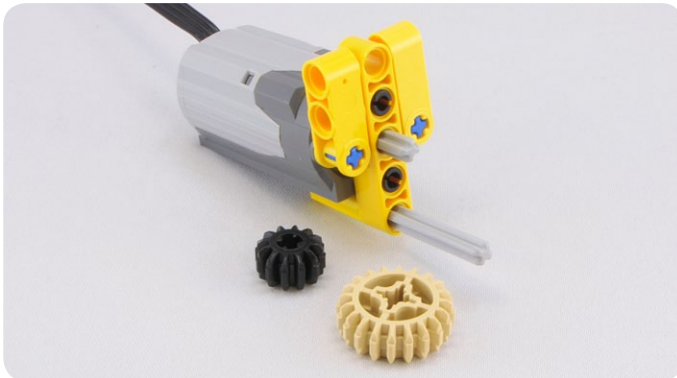
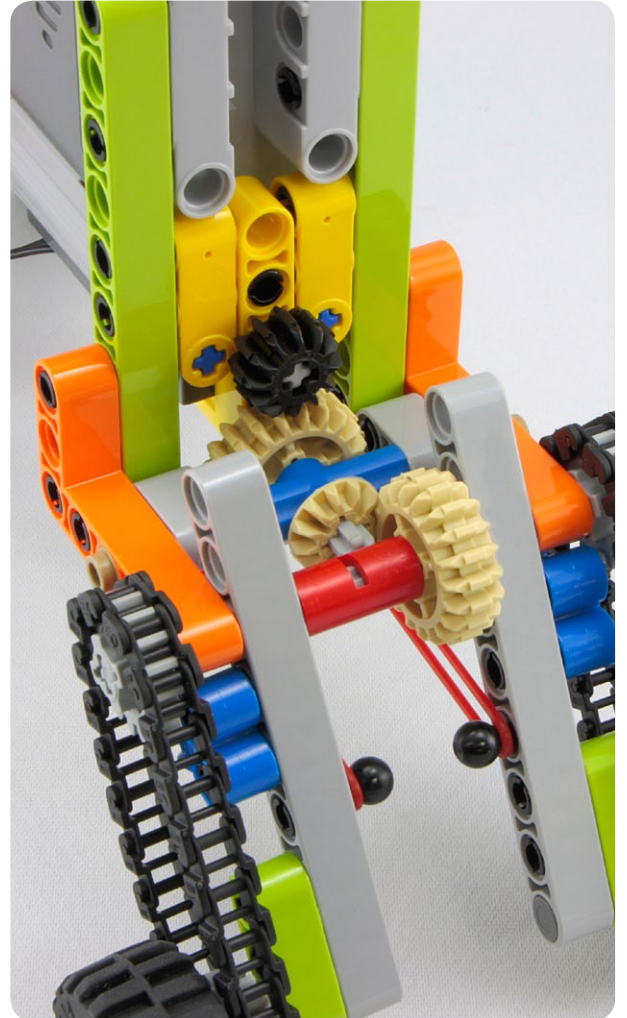
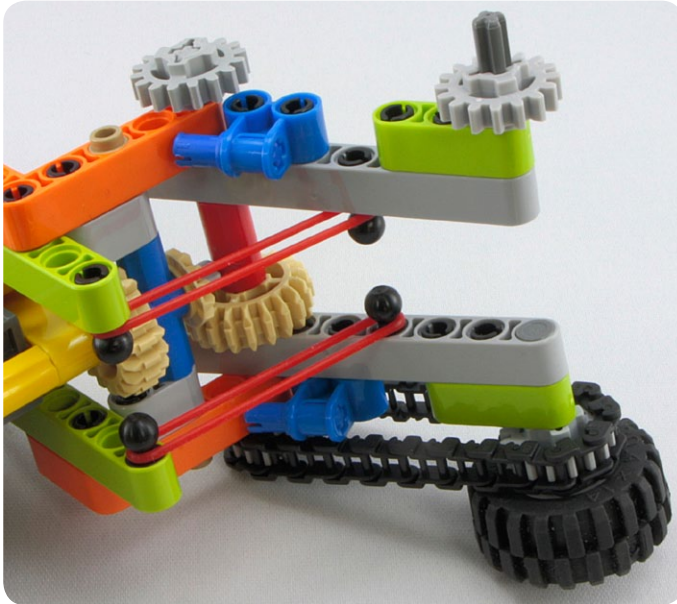
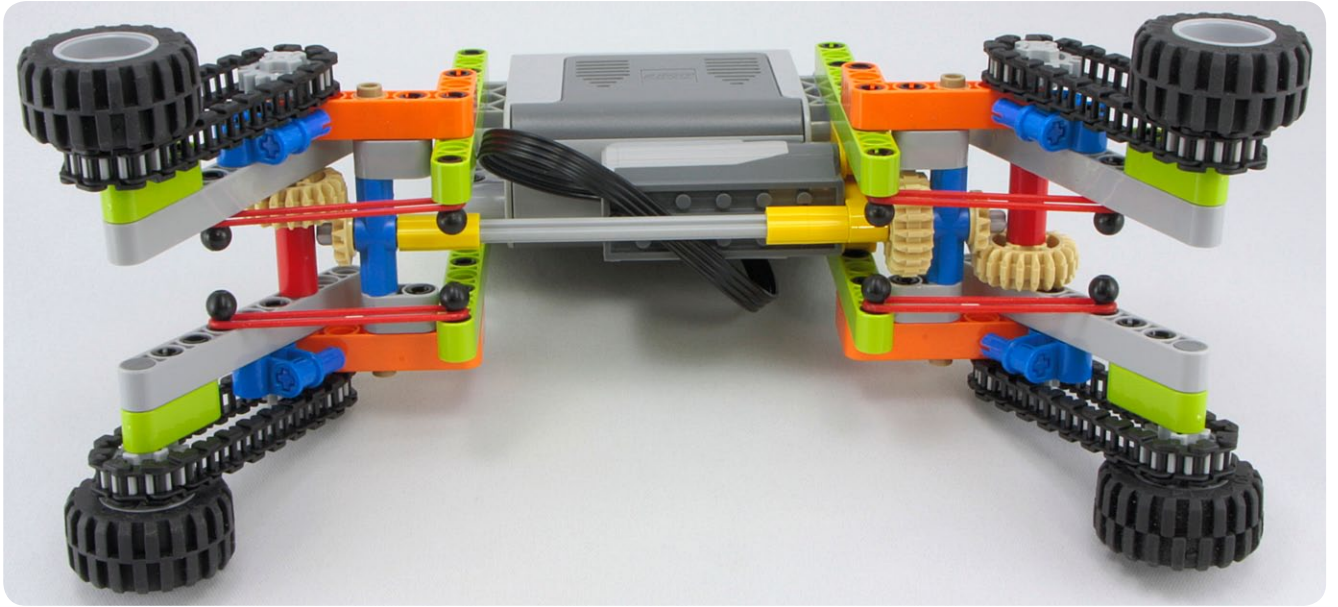


#77

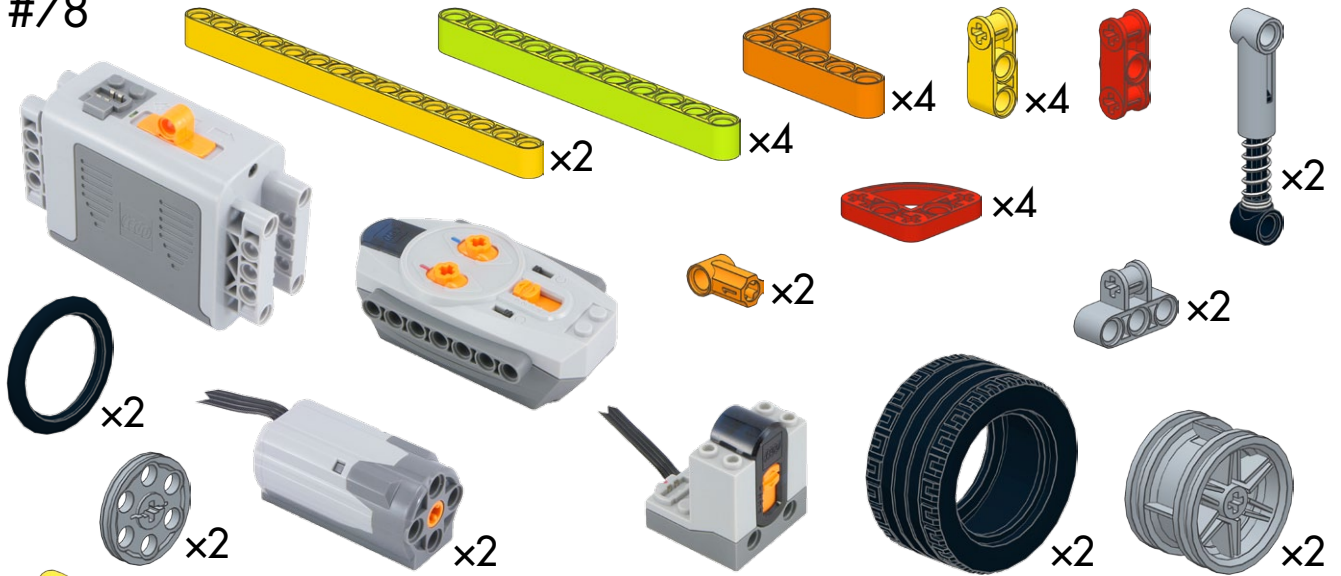


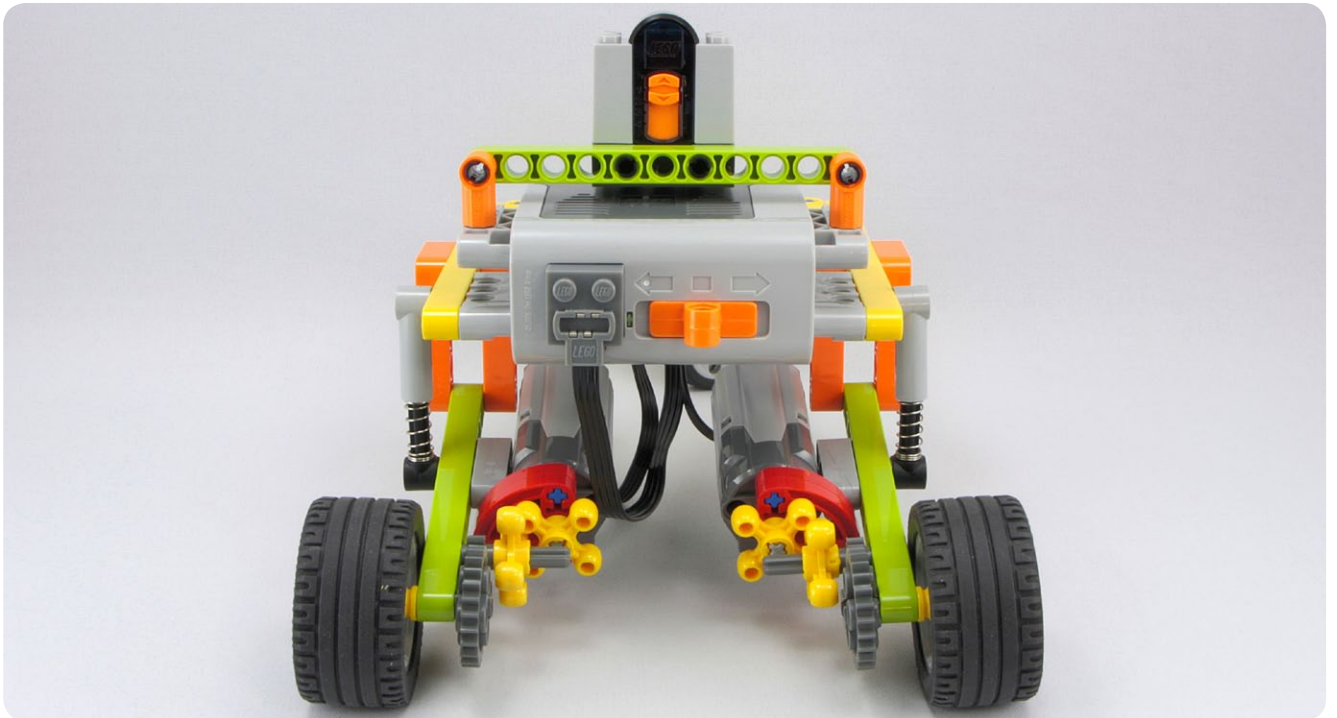
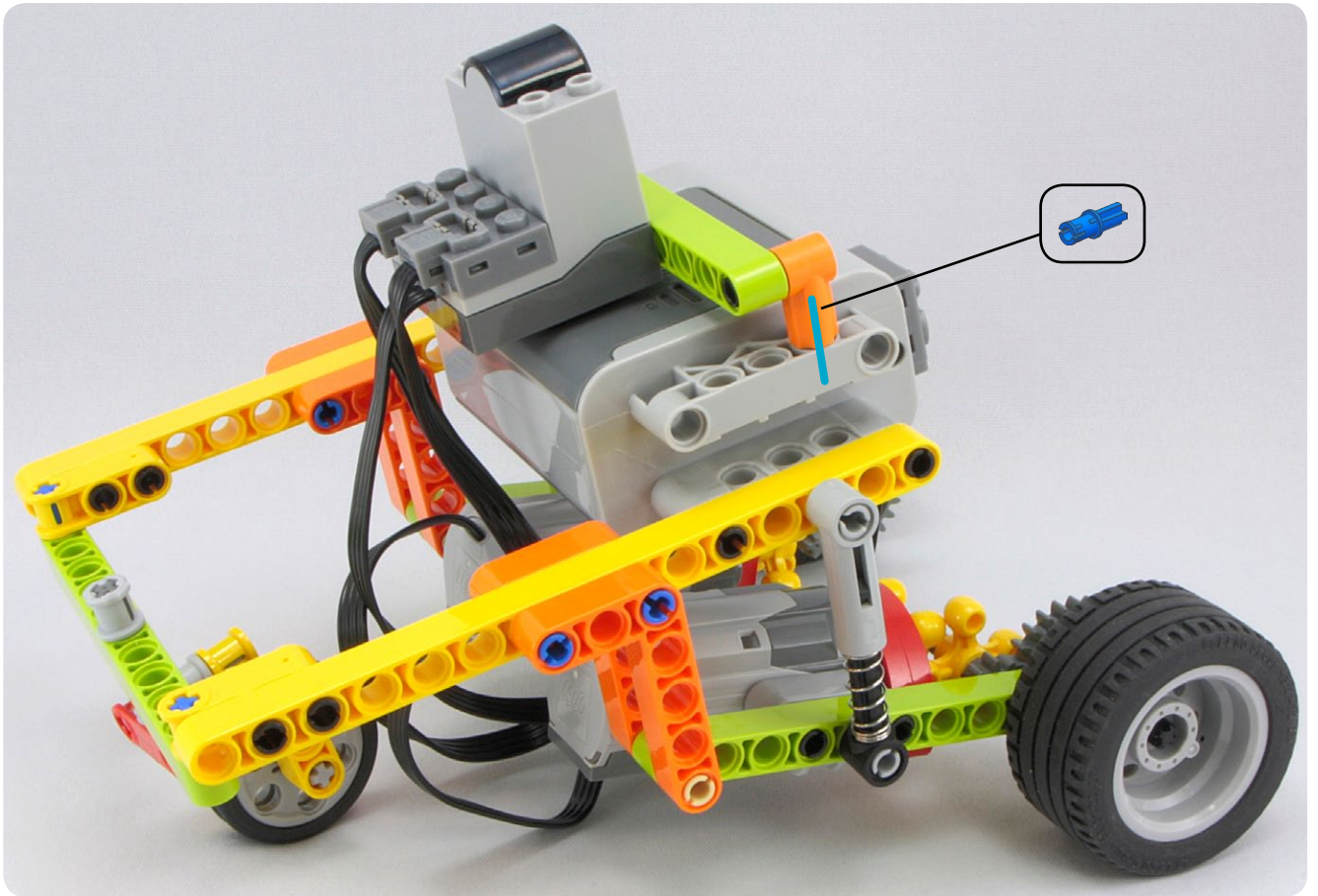


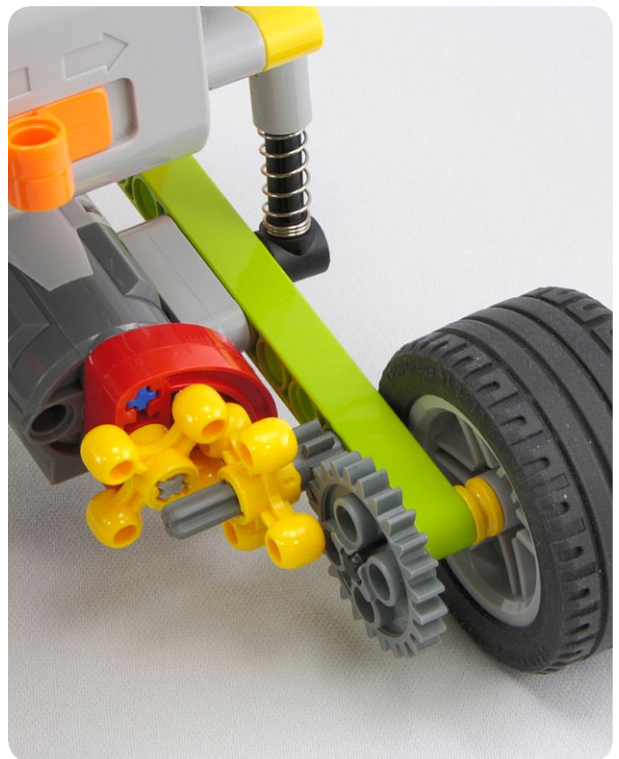
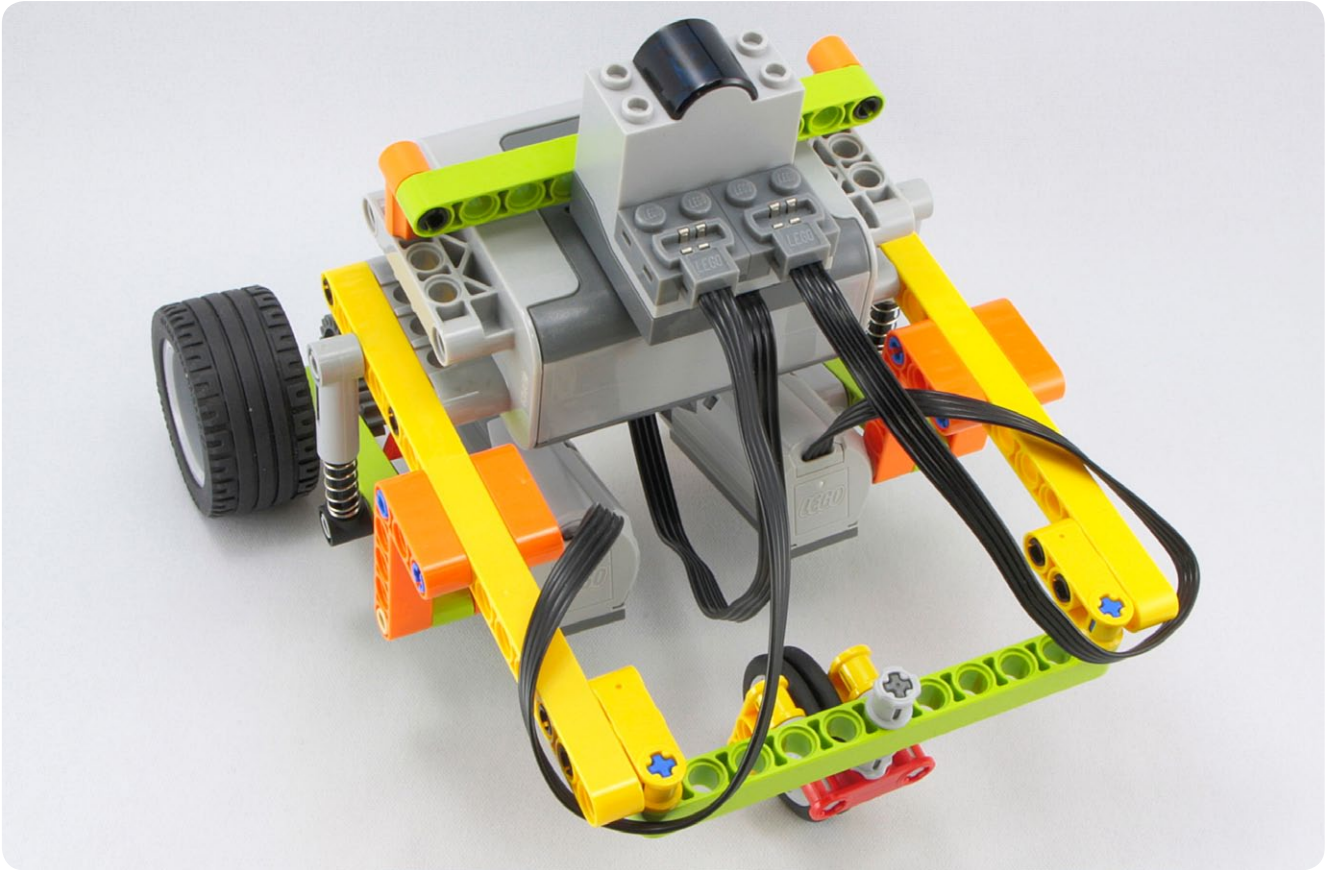




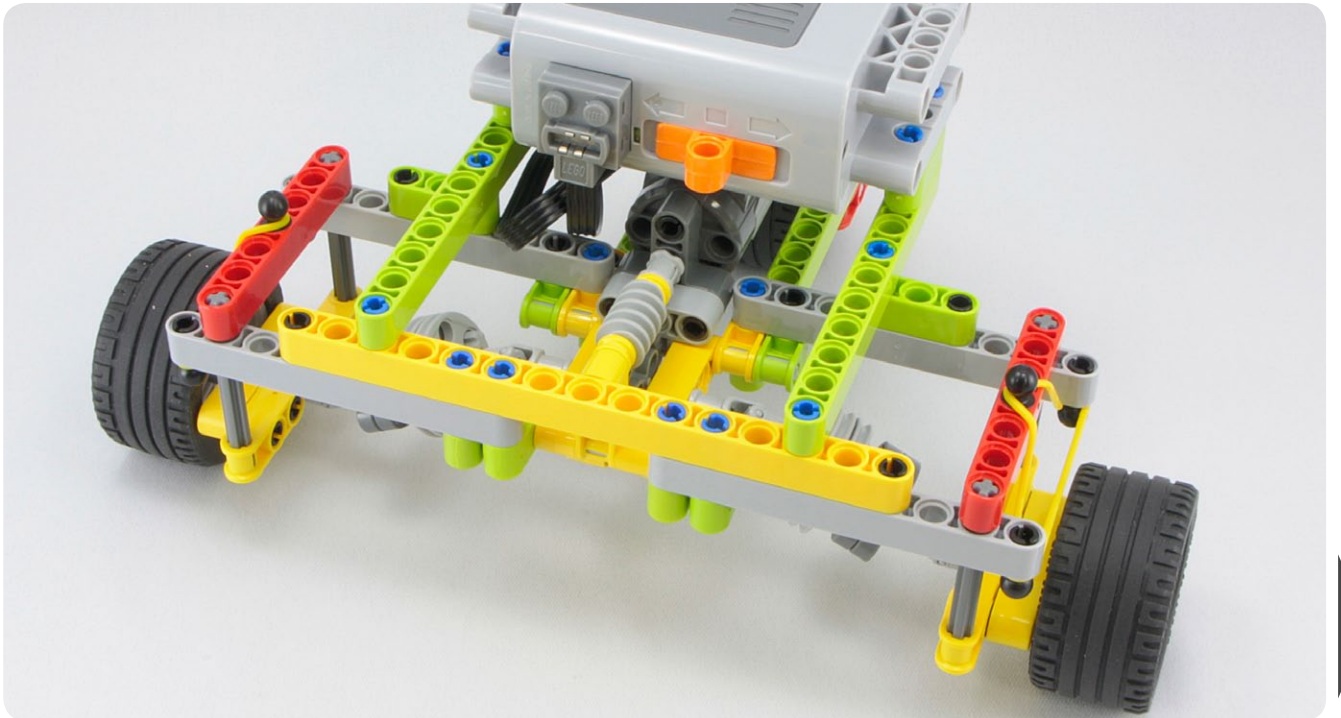
#78

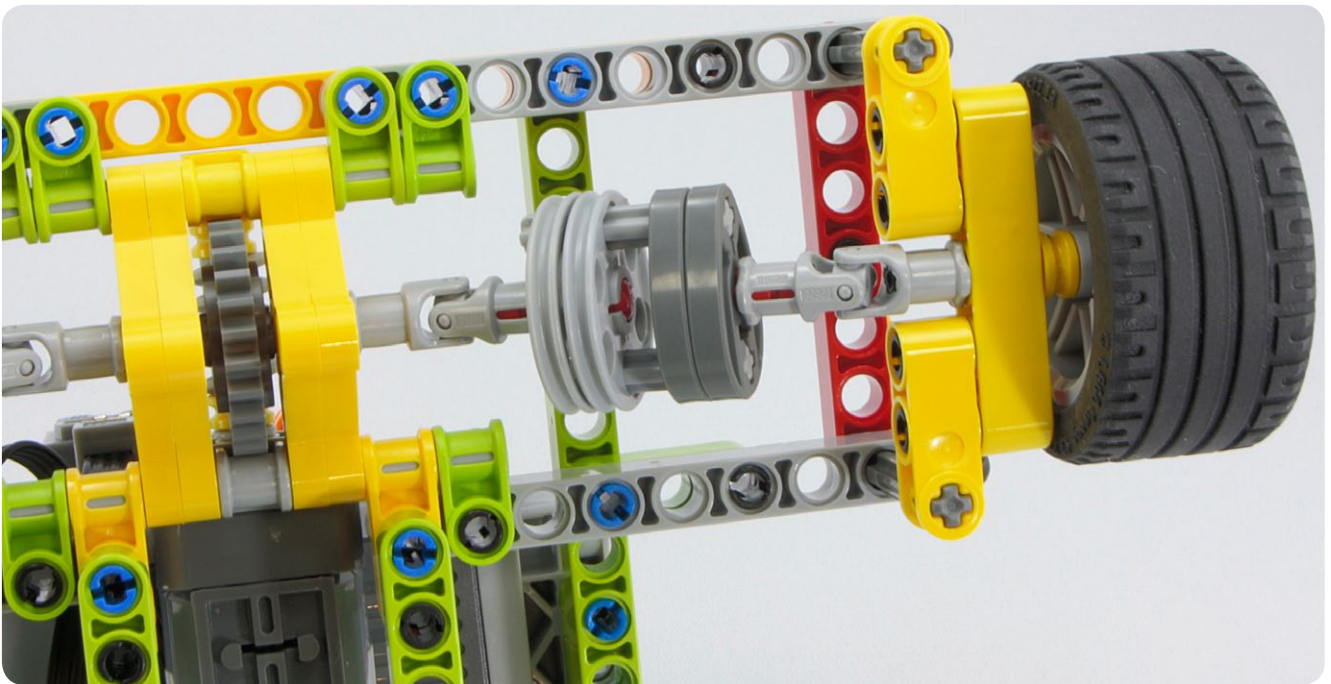


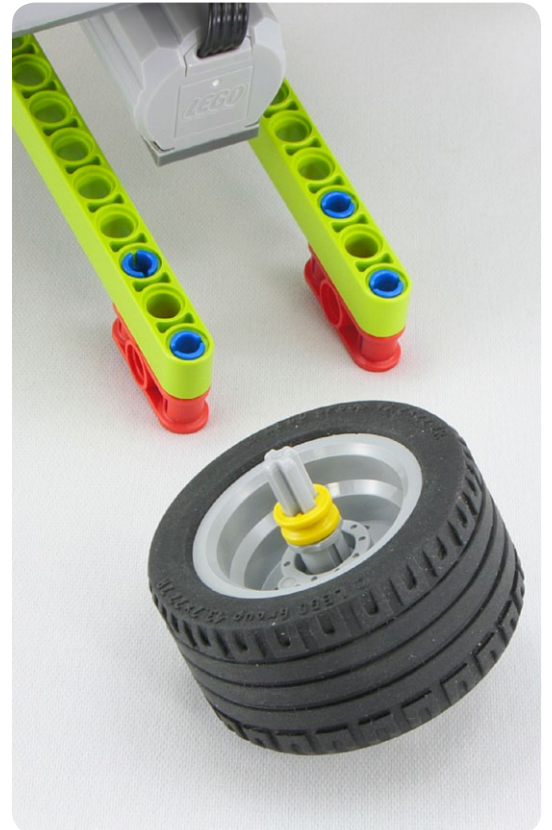
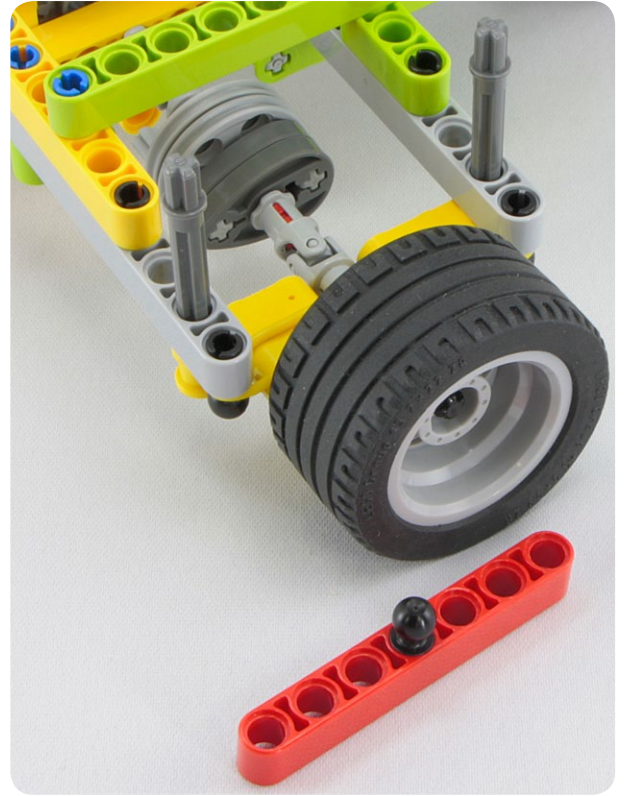






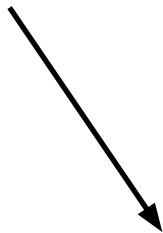
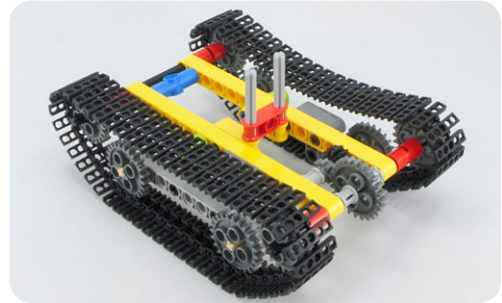


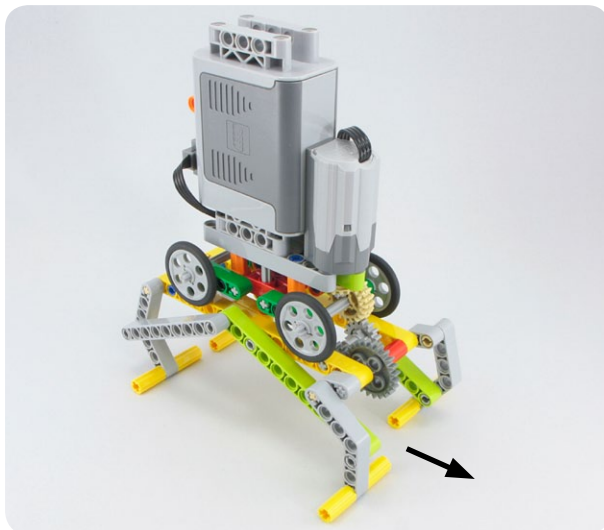
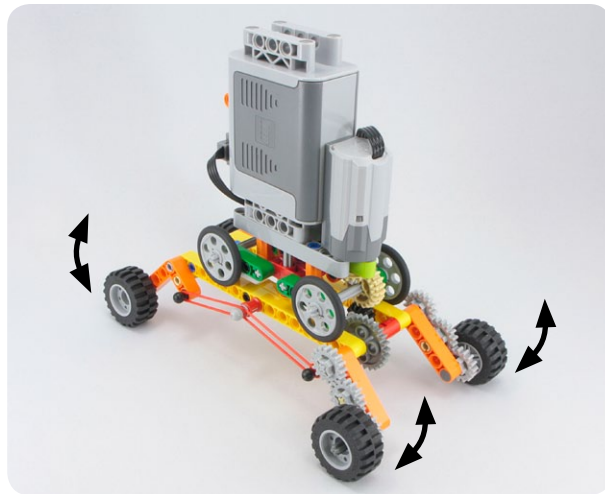
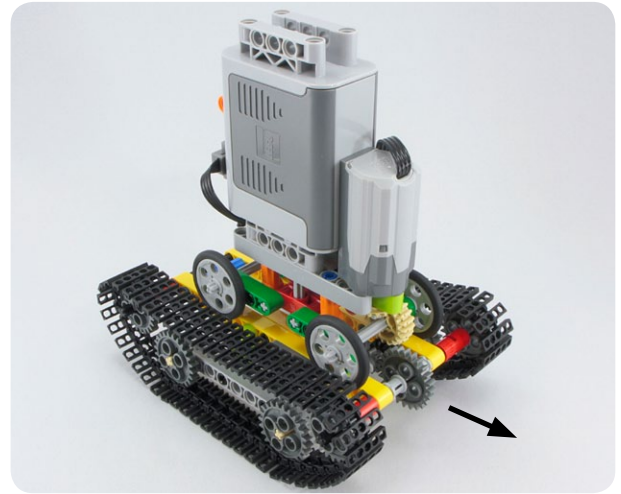




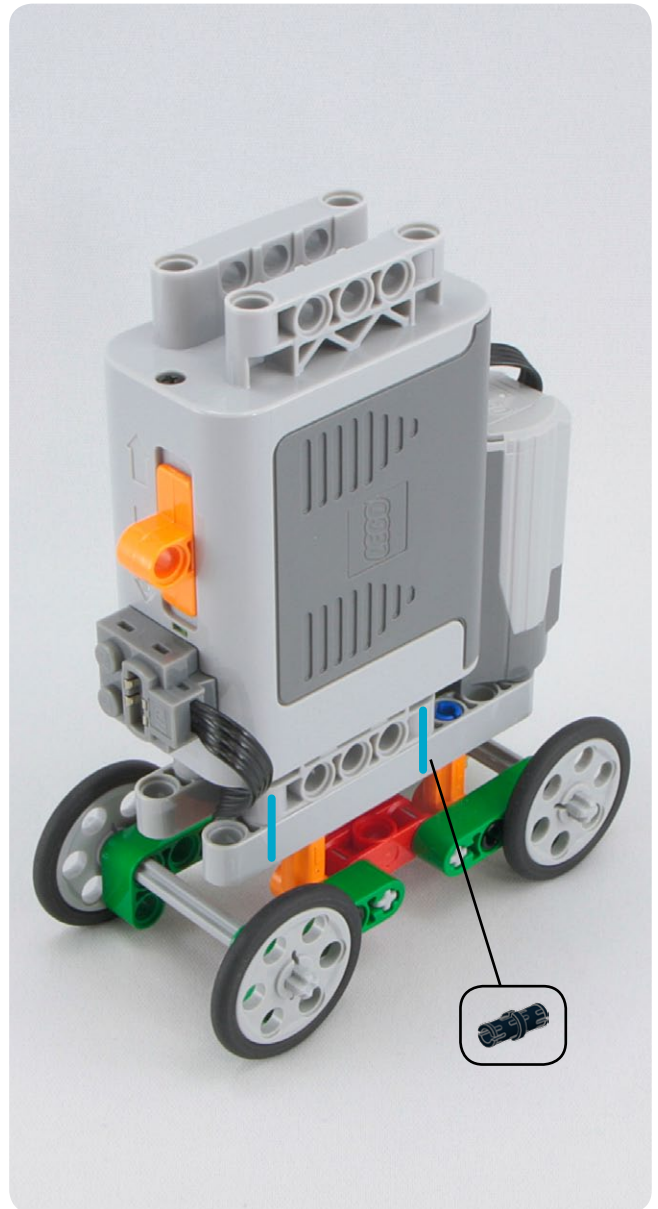
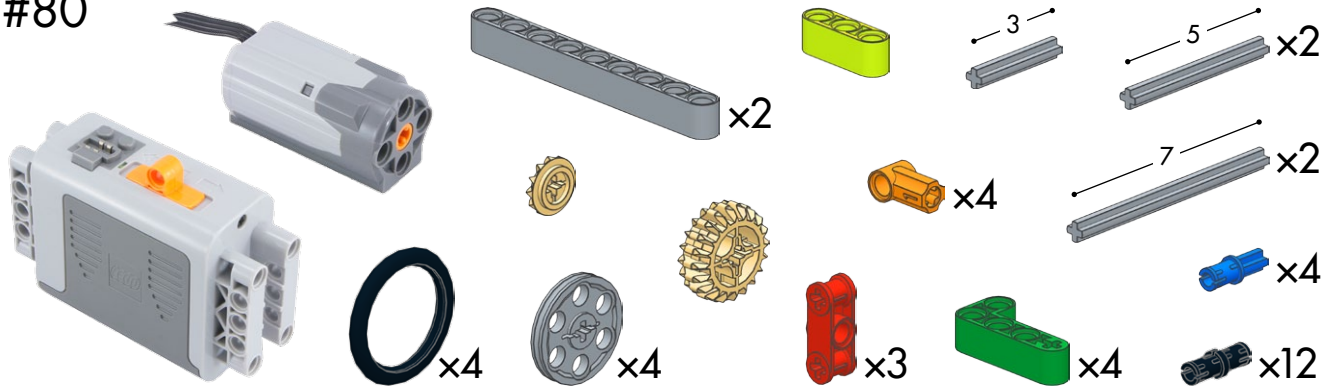


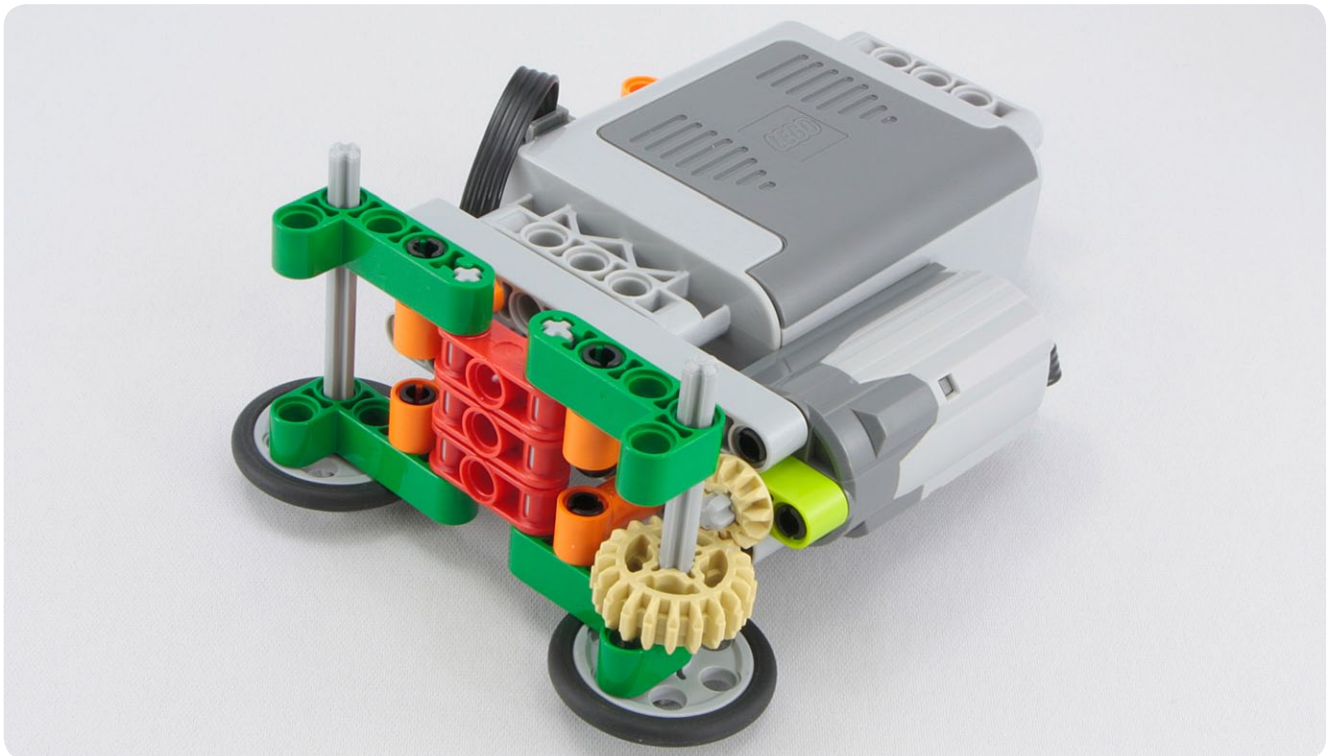
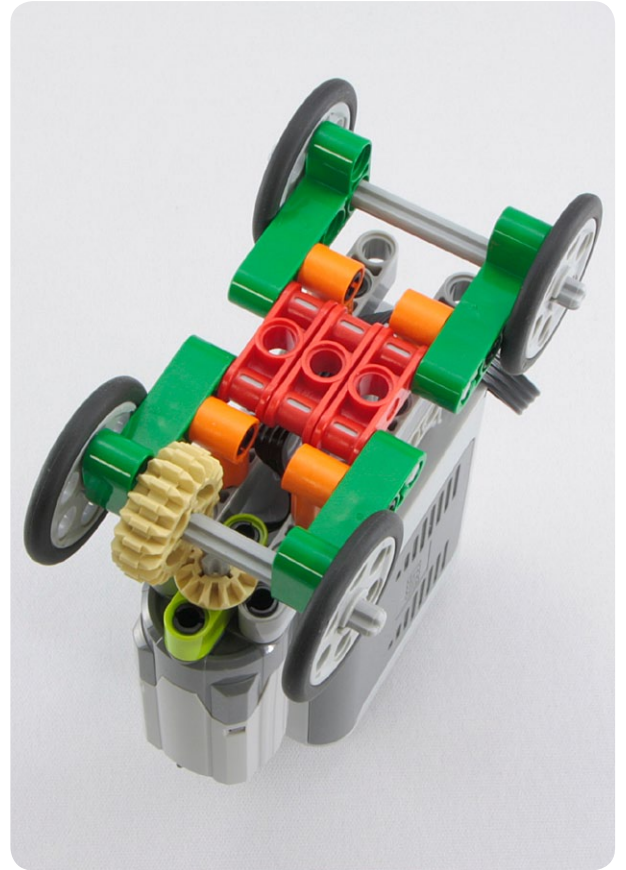
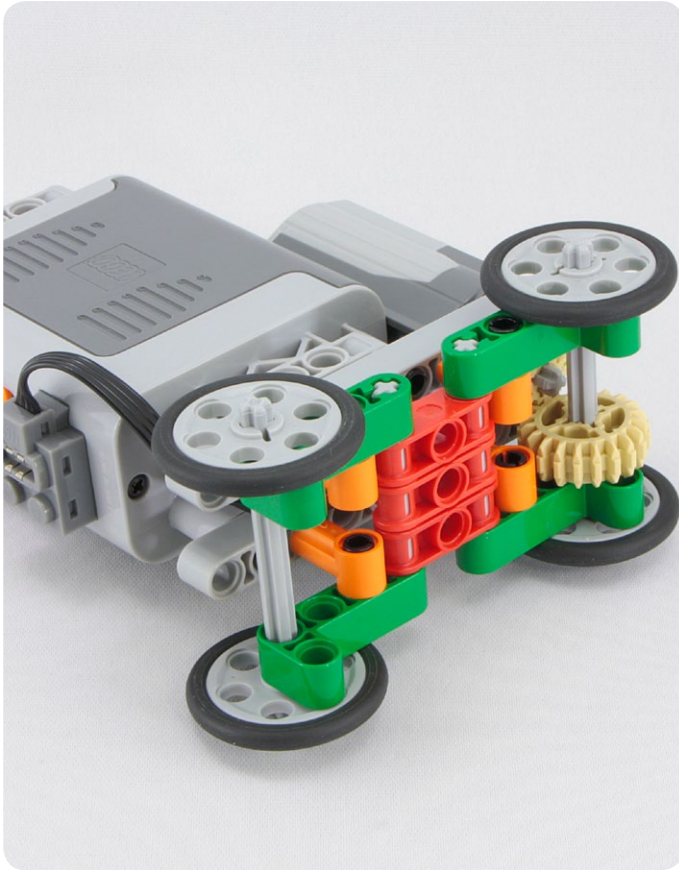
Five different bases for a small car



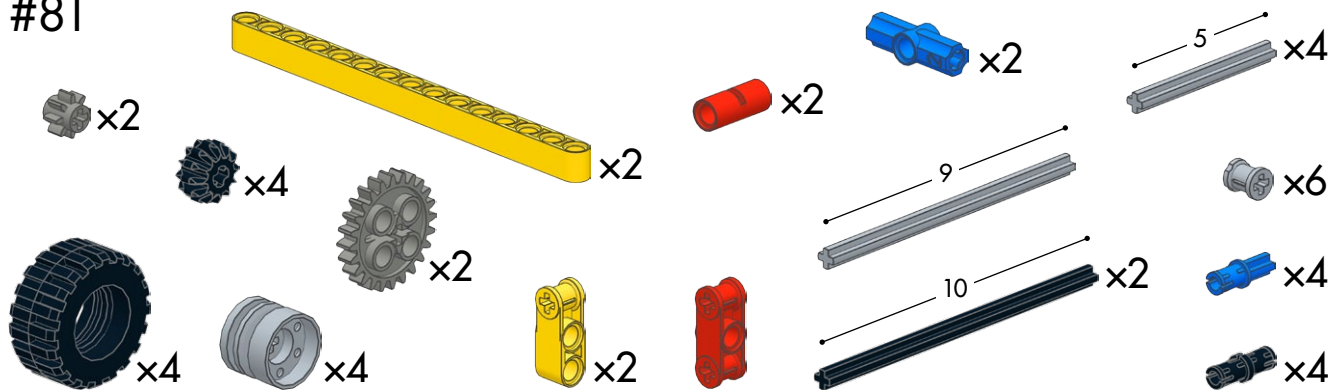


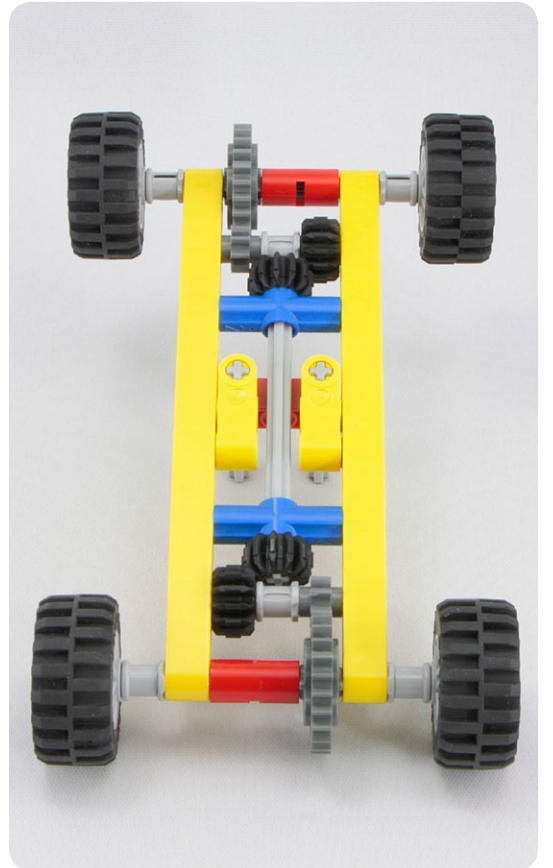
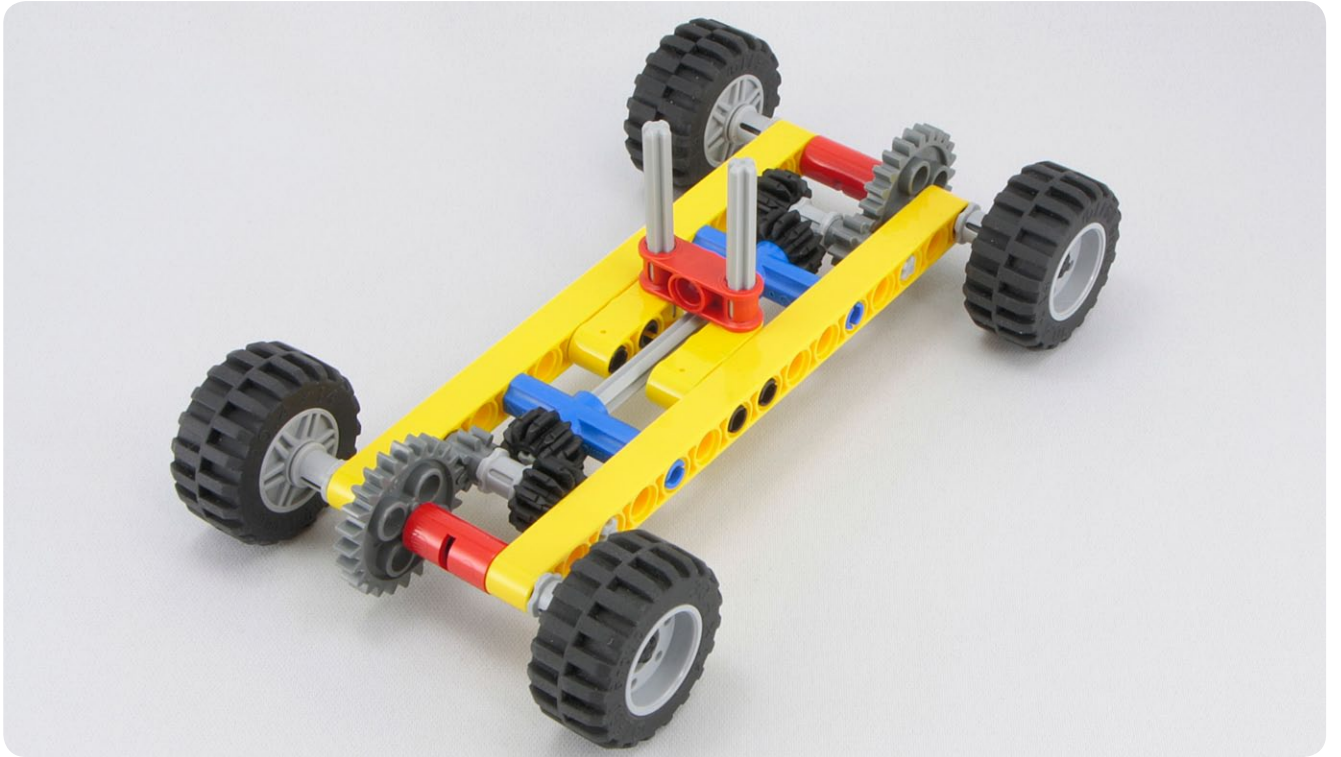
#80



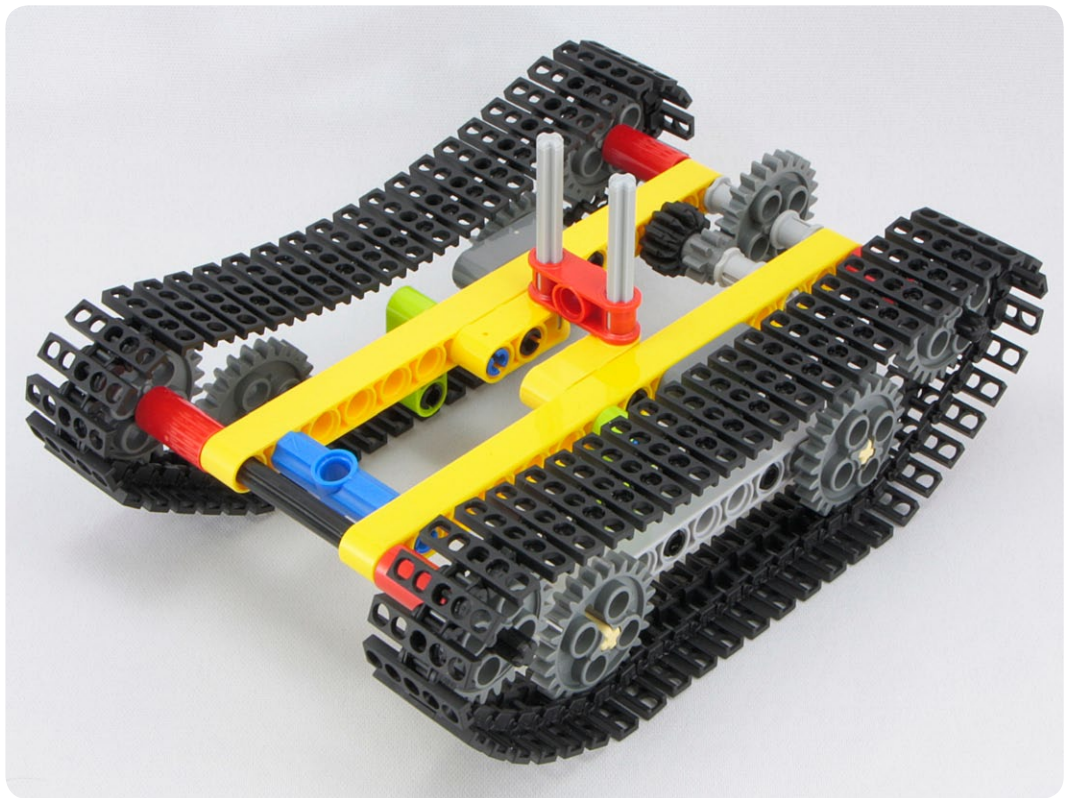
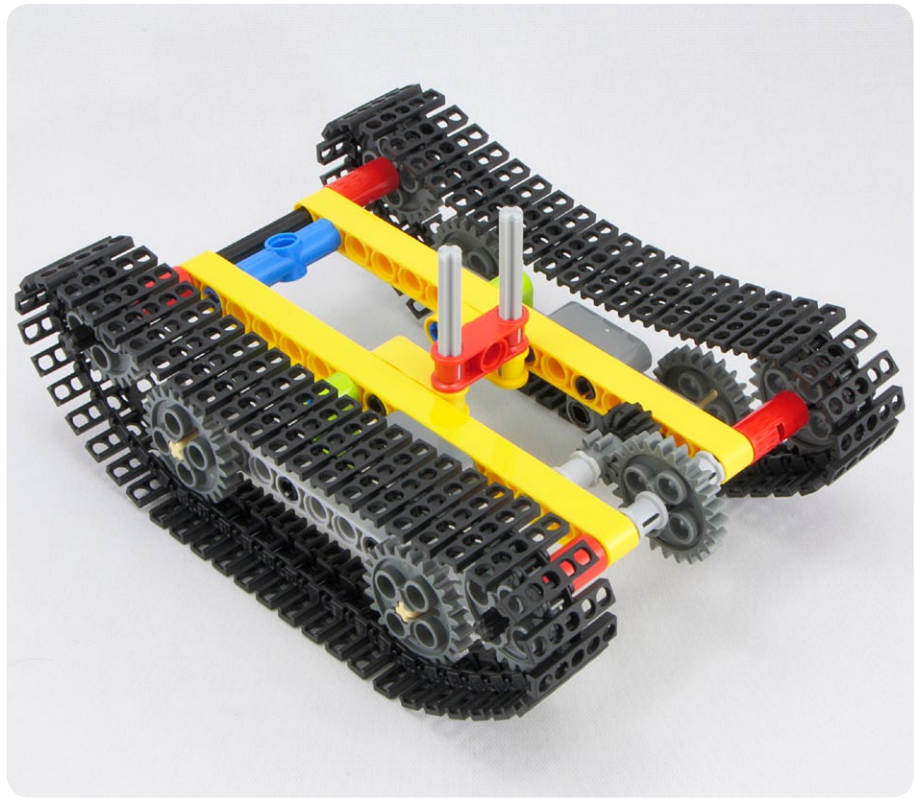
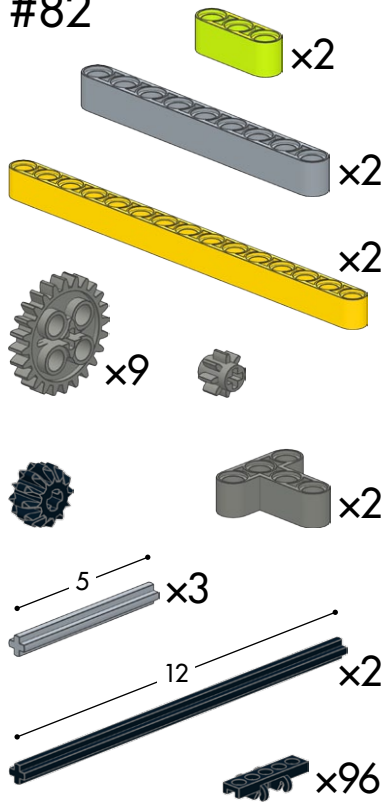


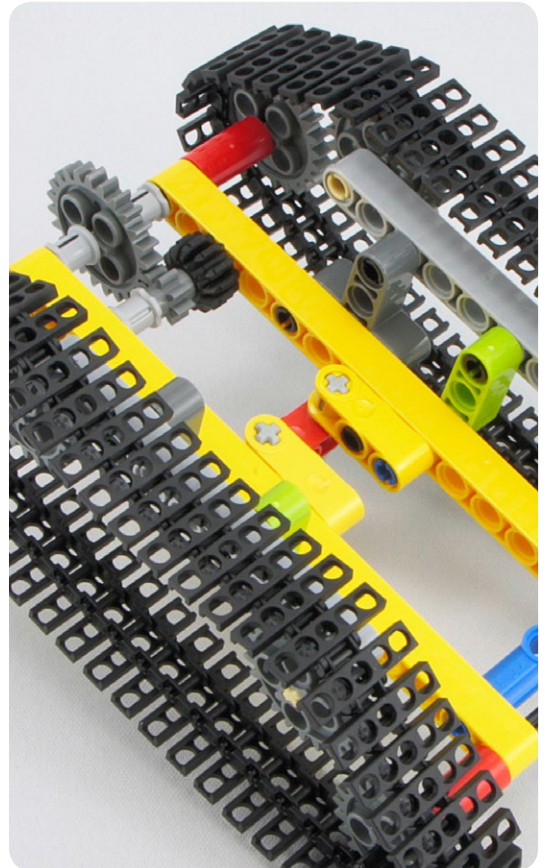
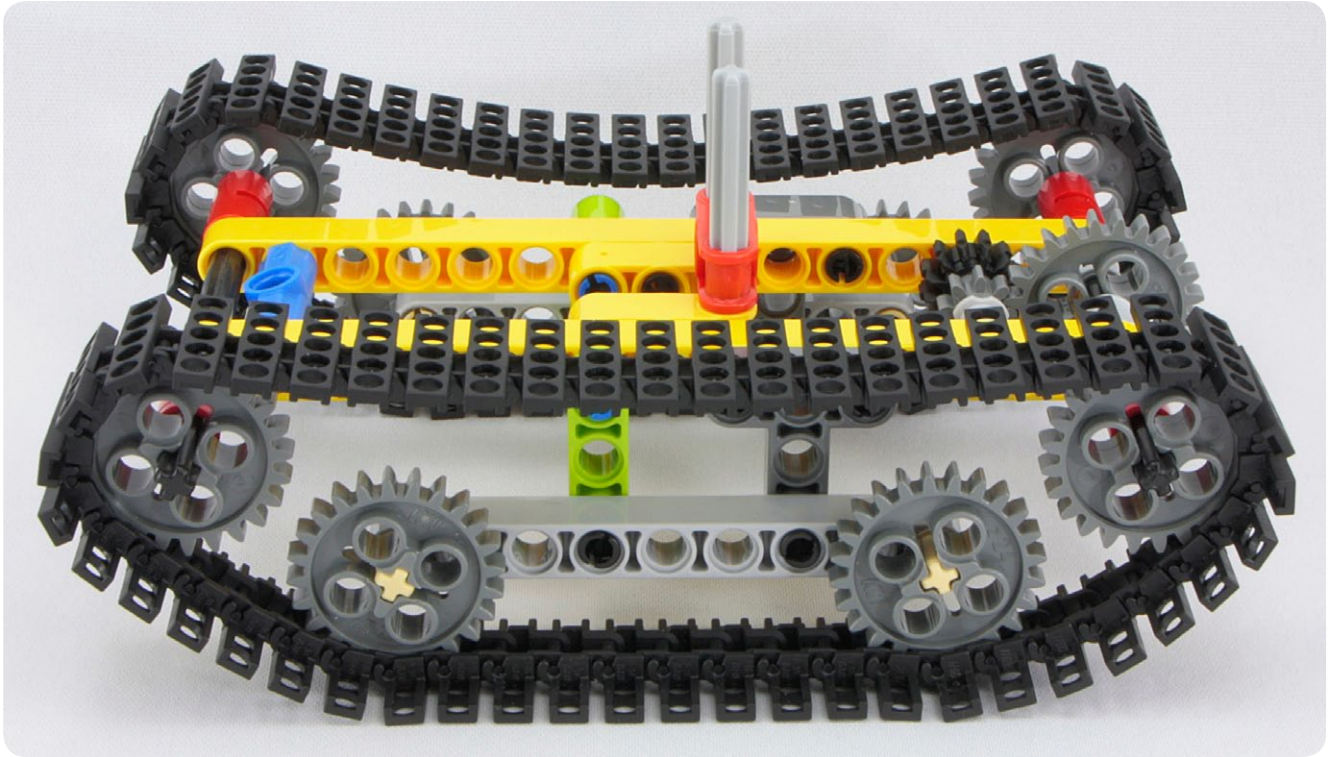
#81



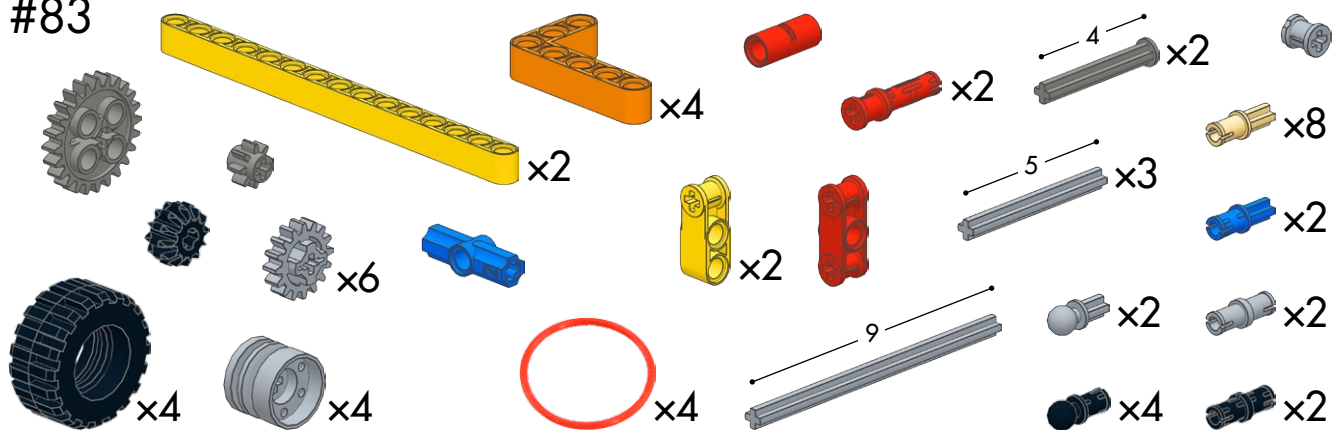


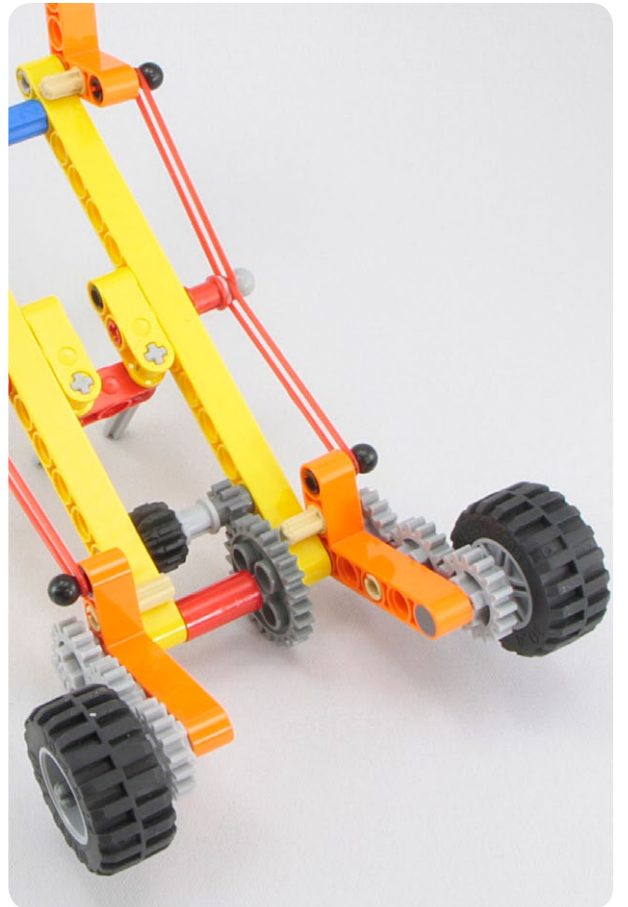
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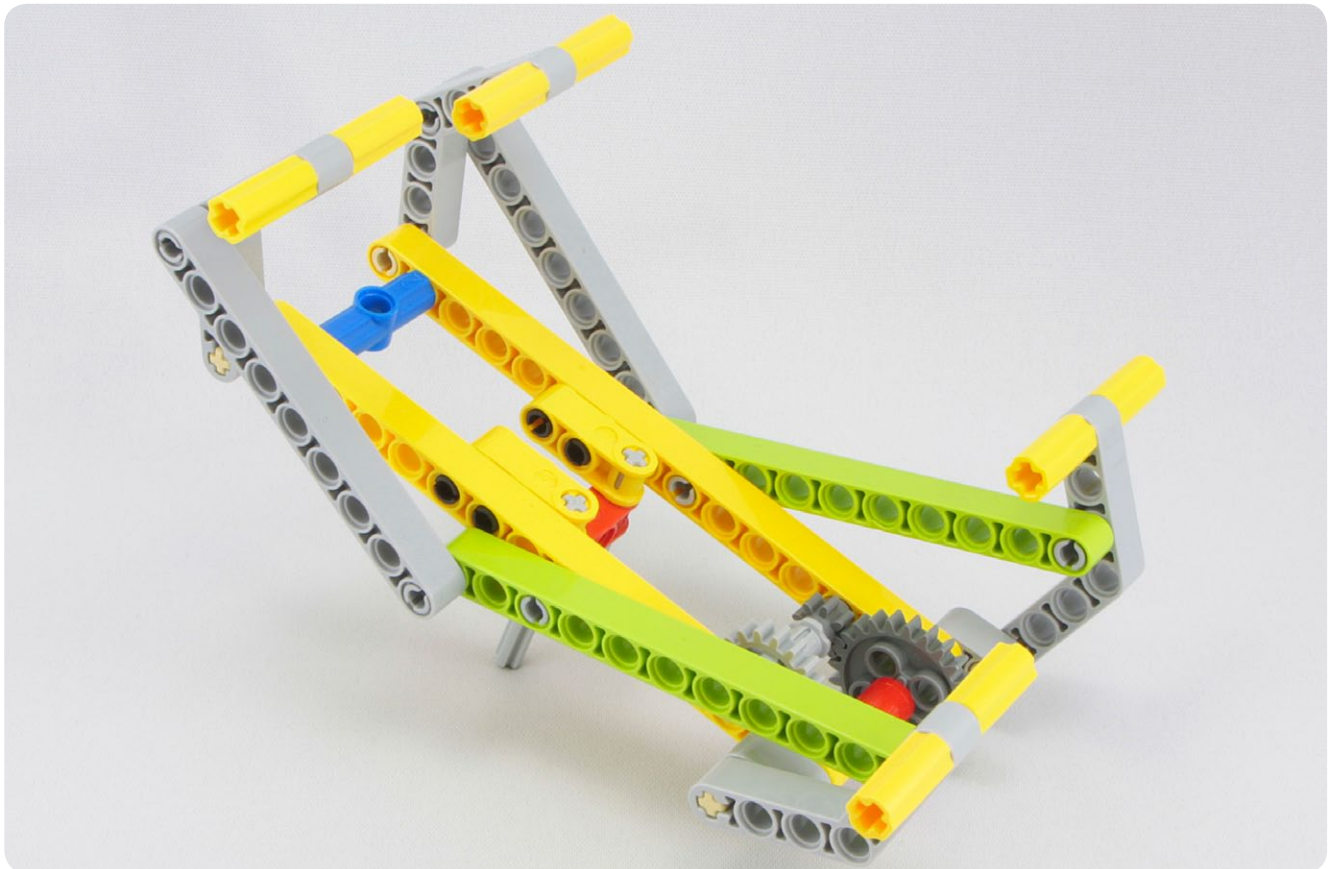


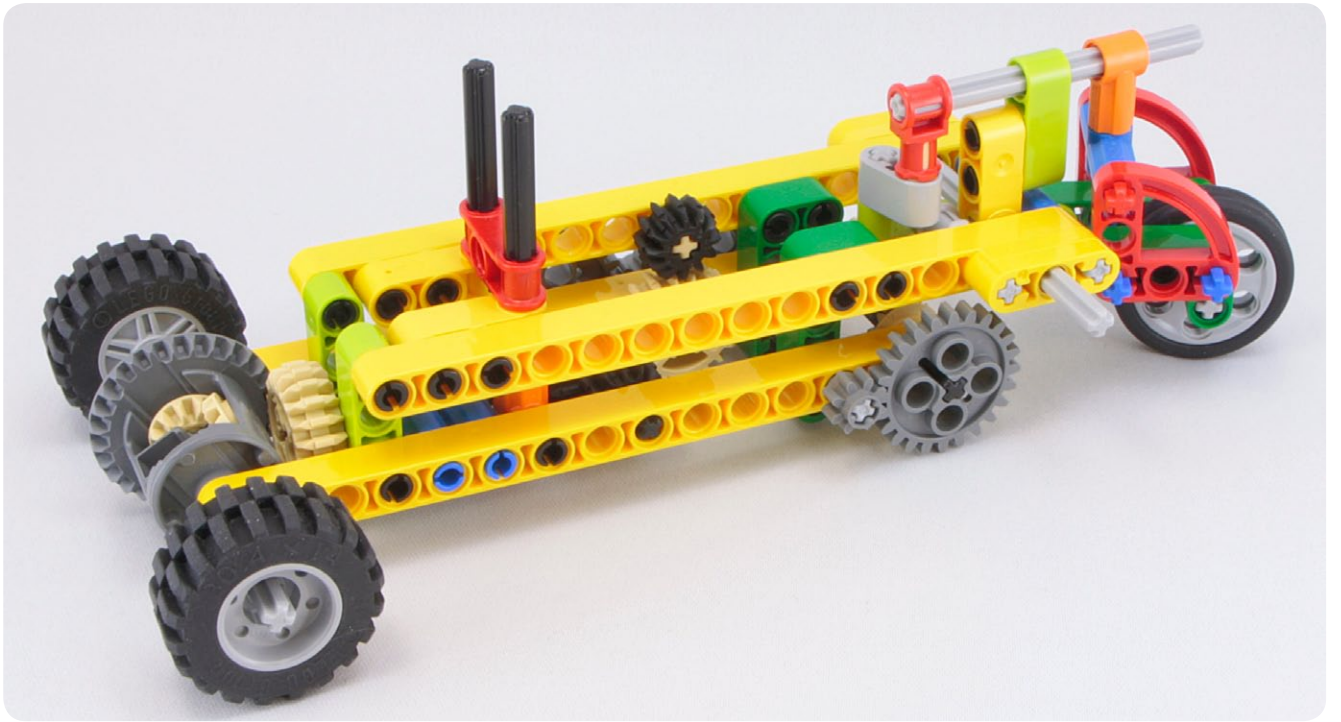


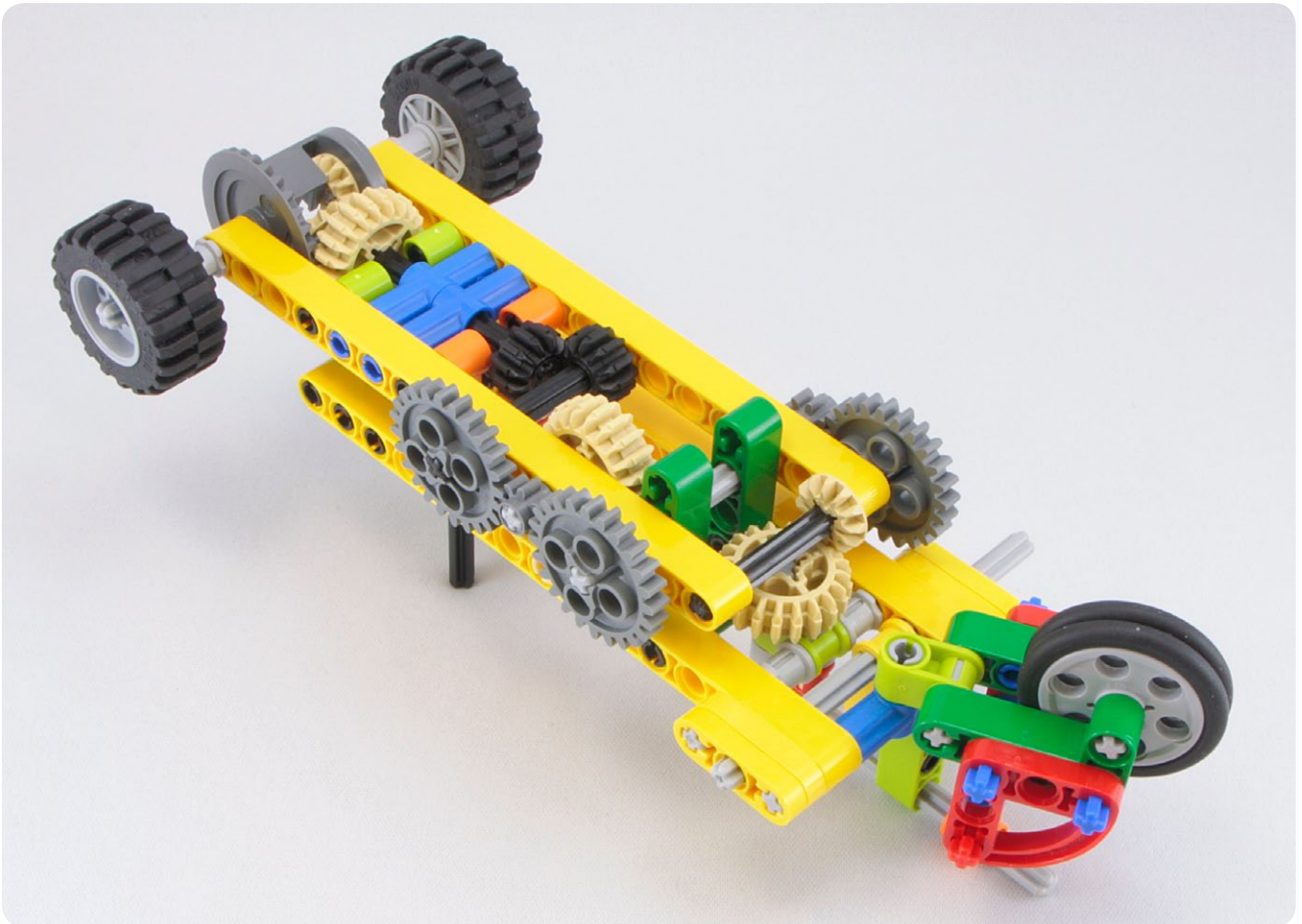
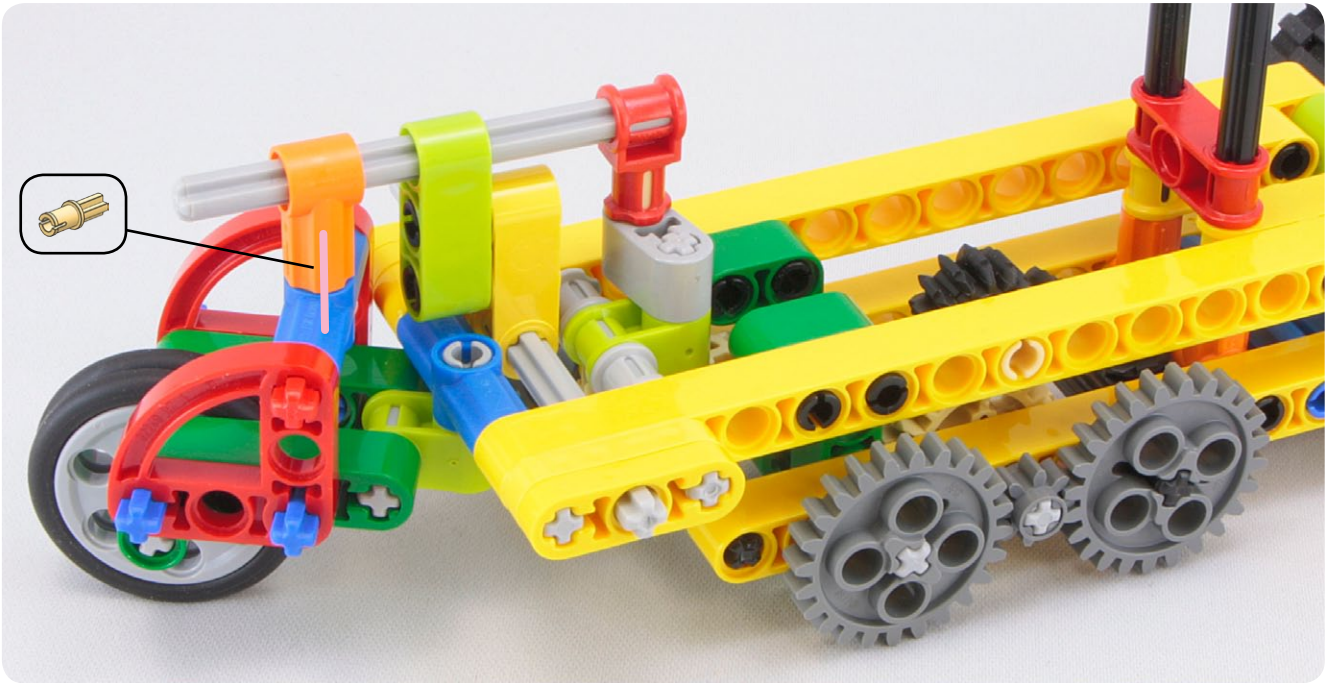
#83

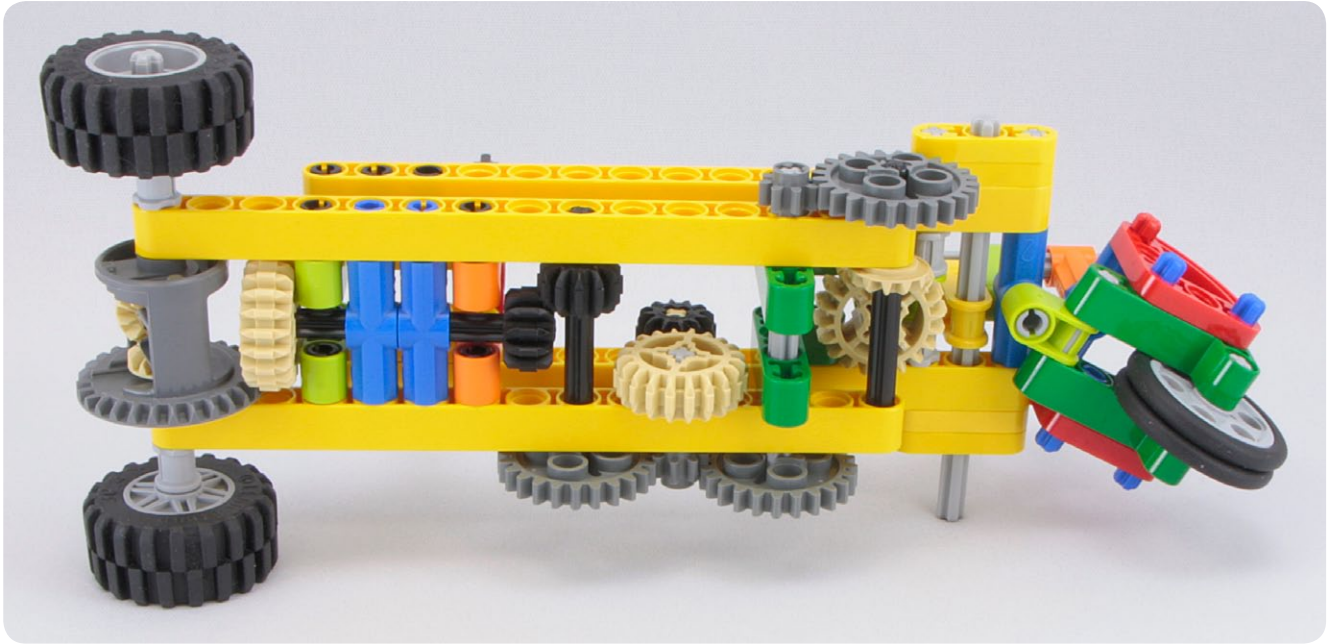




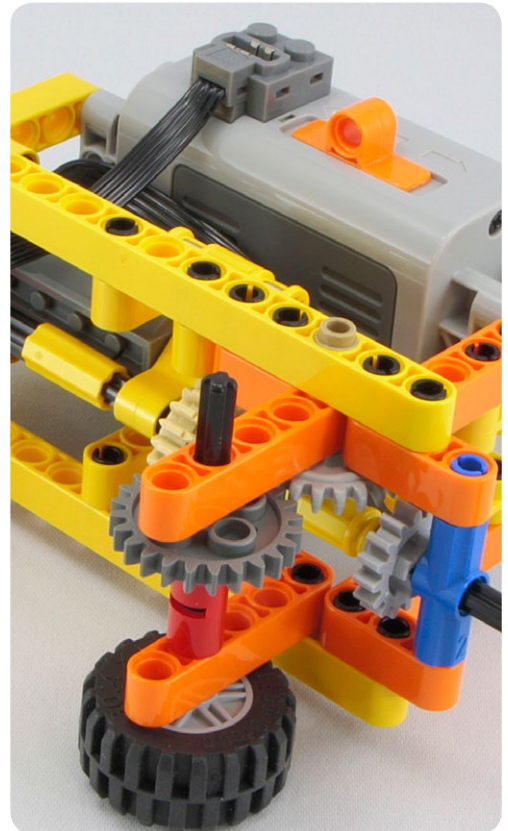
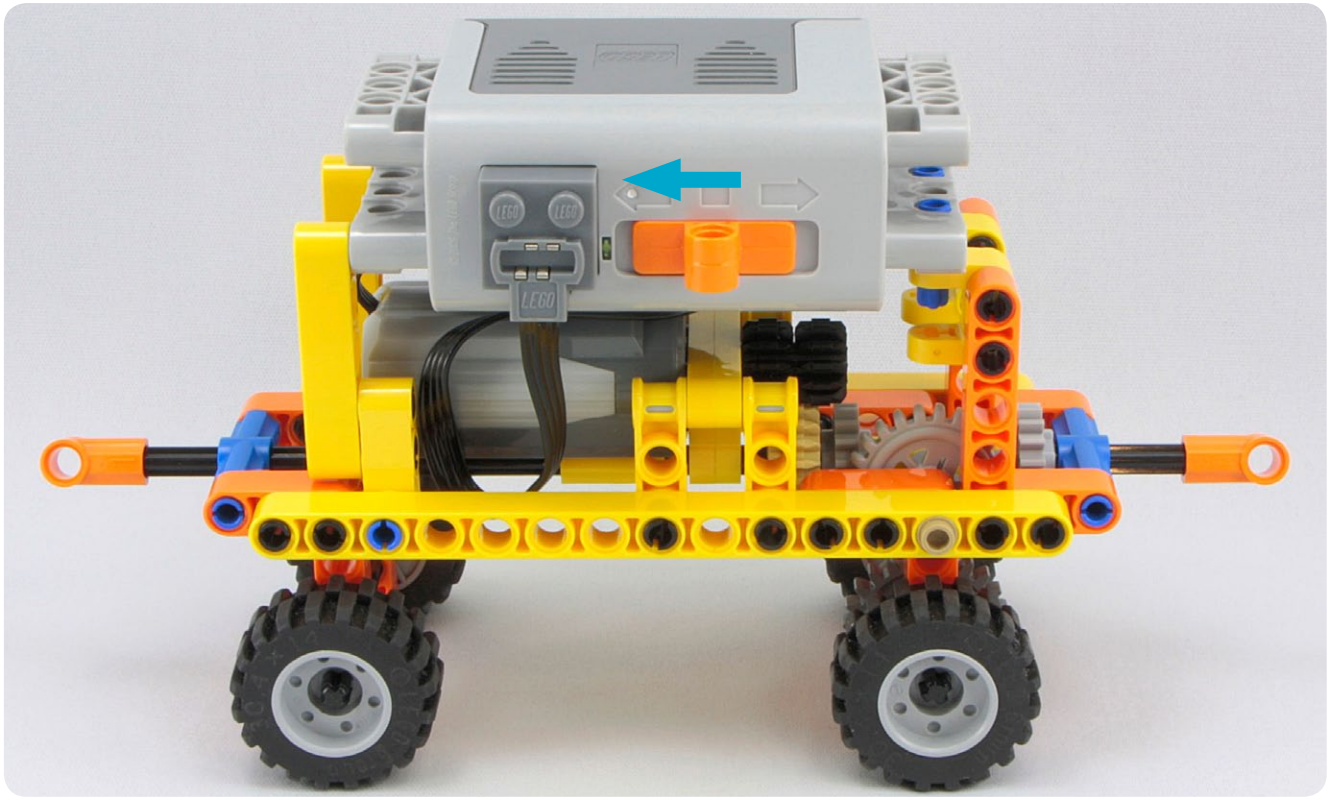


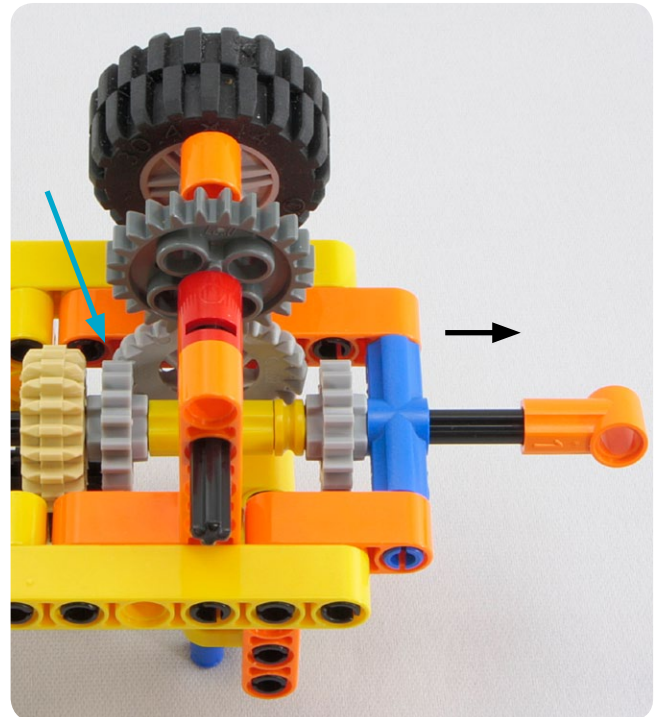
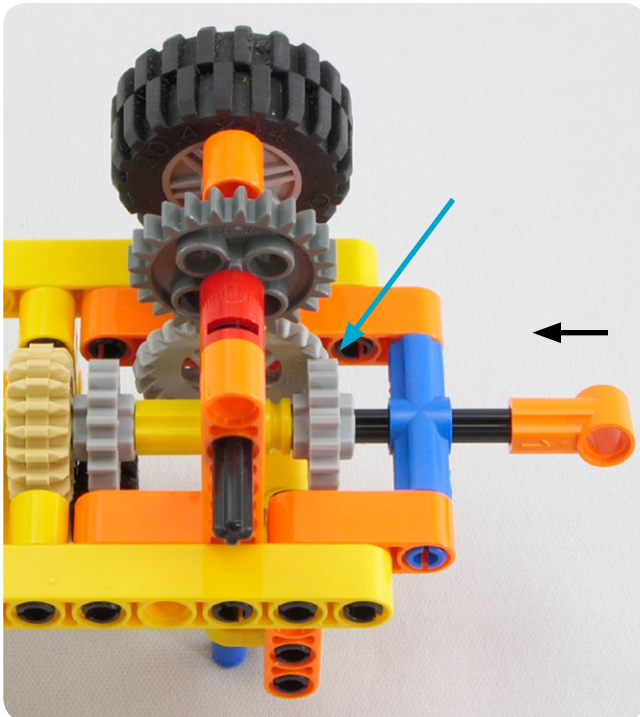
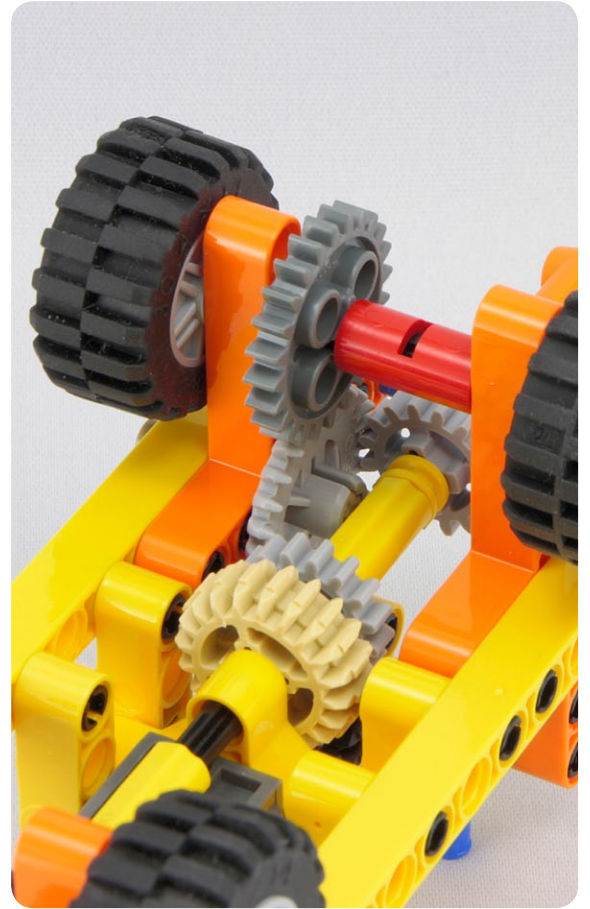




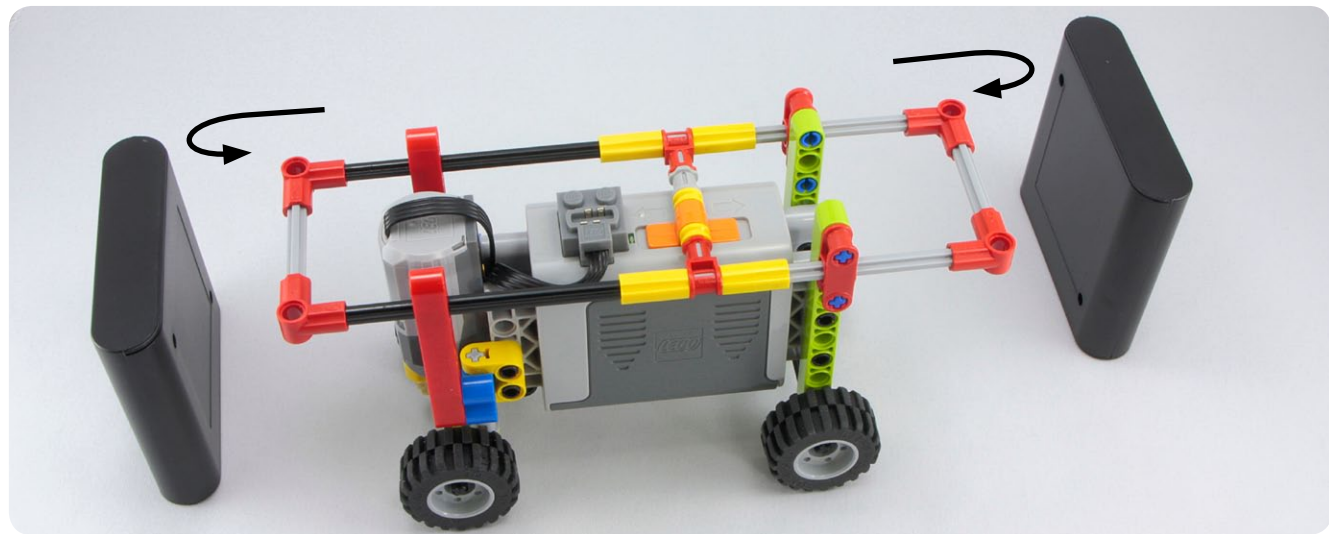
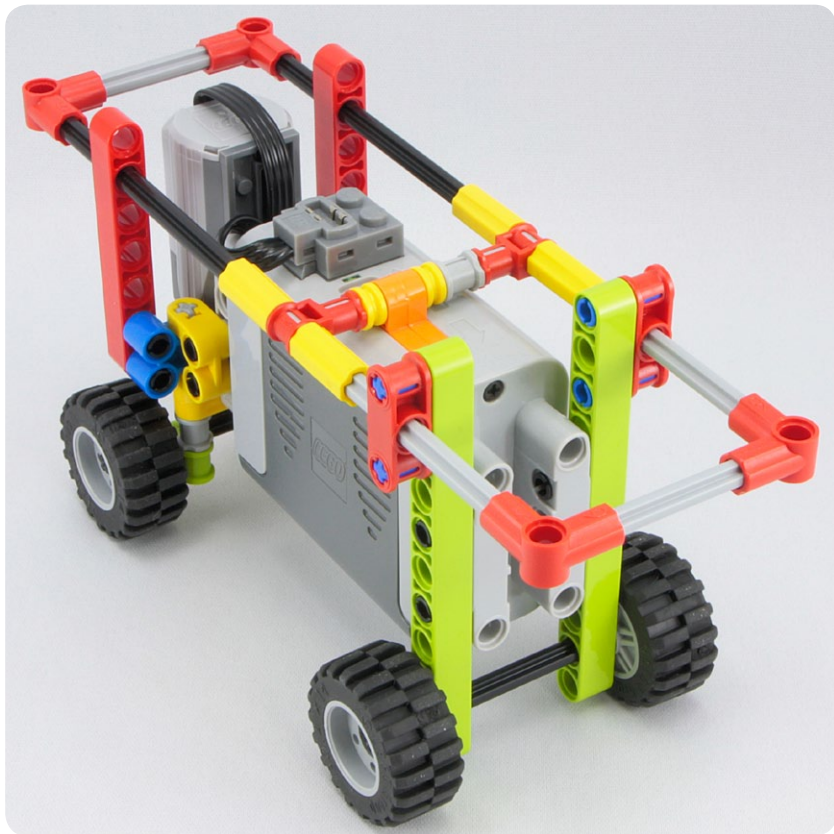
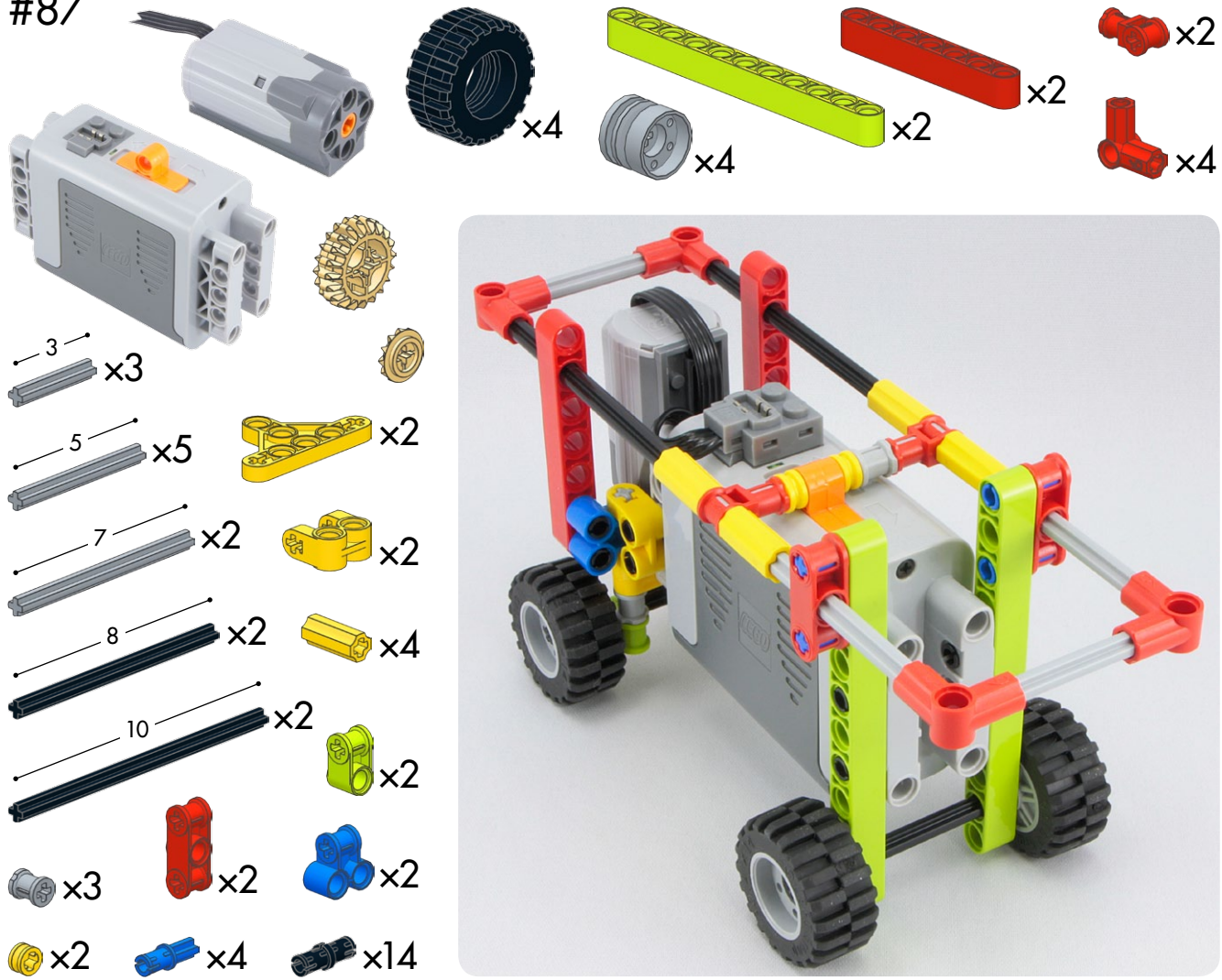


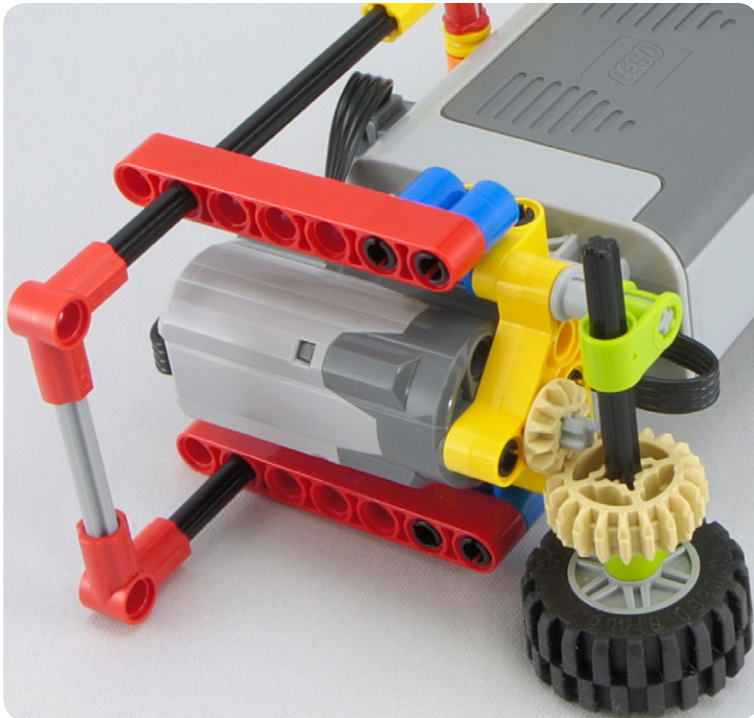
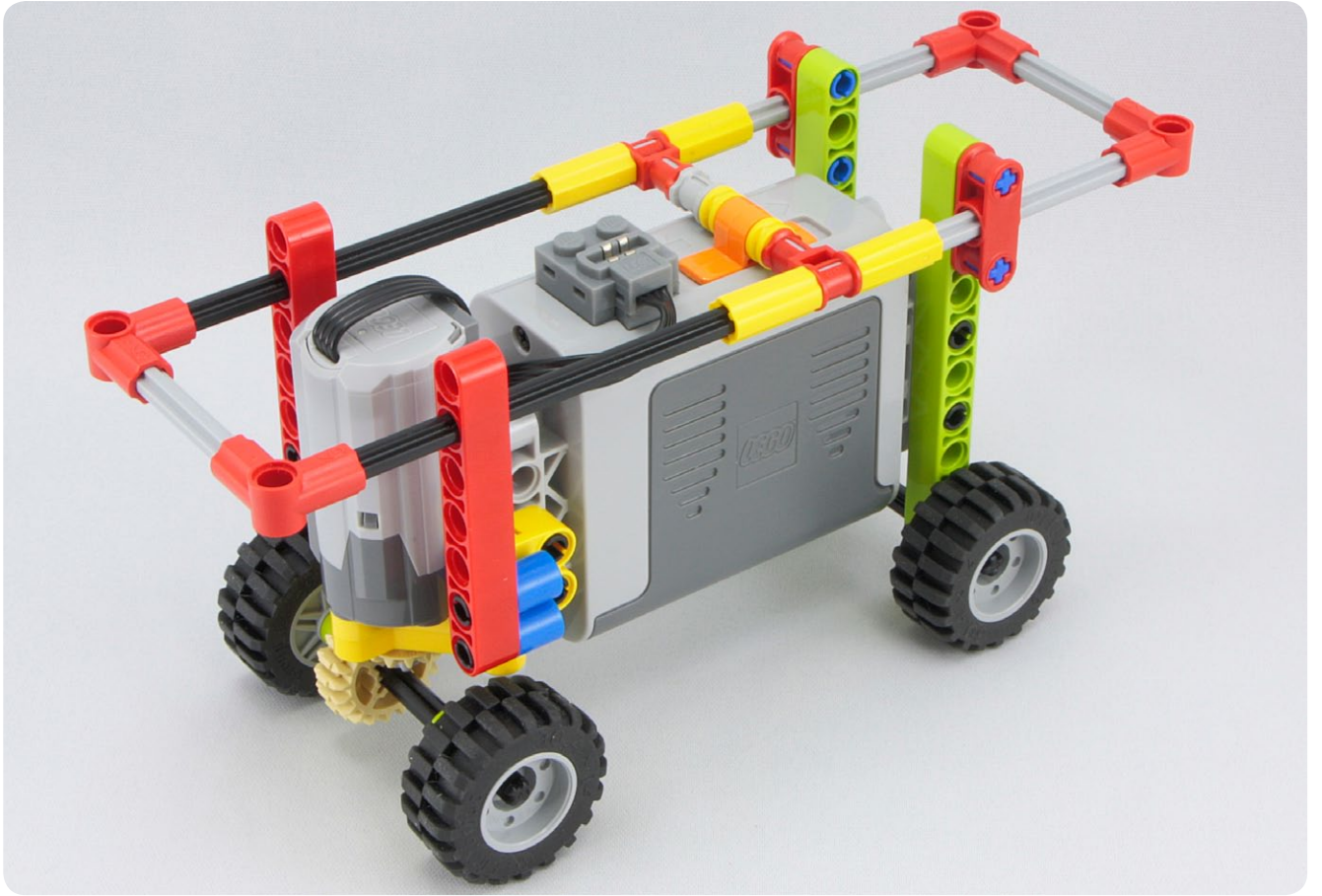




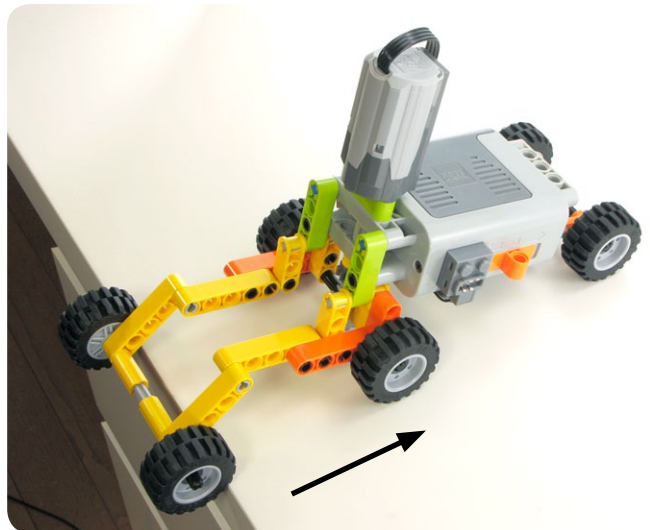
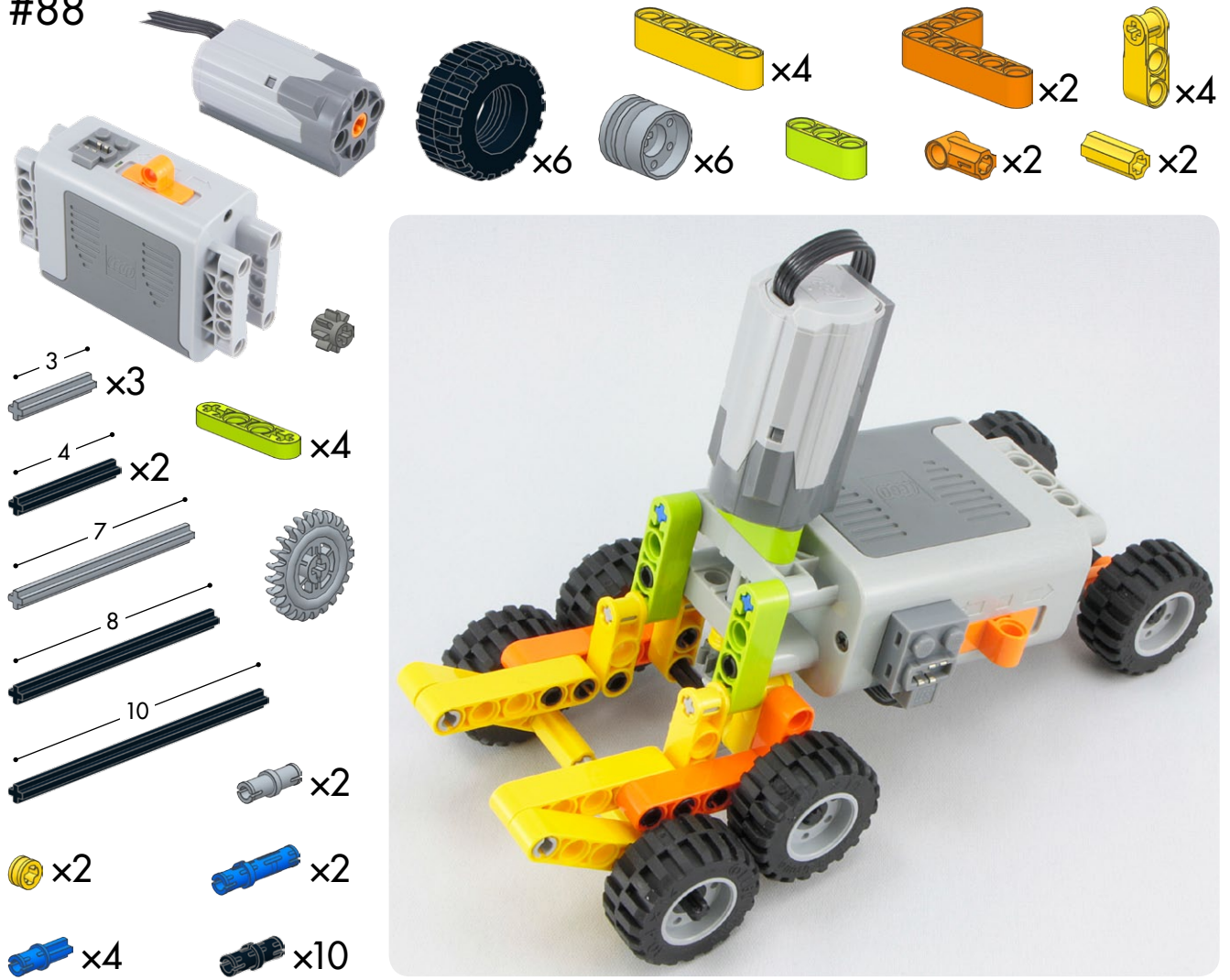


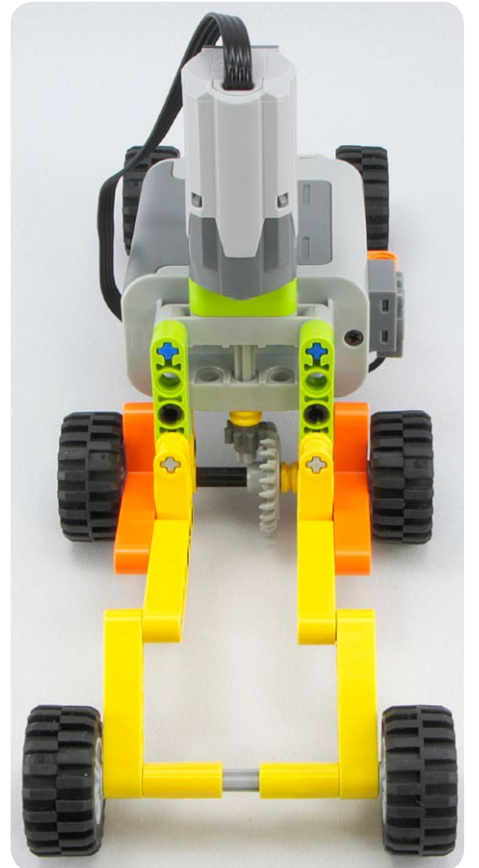
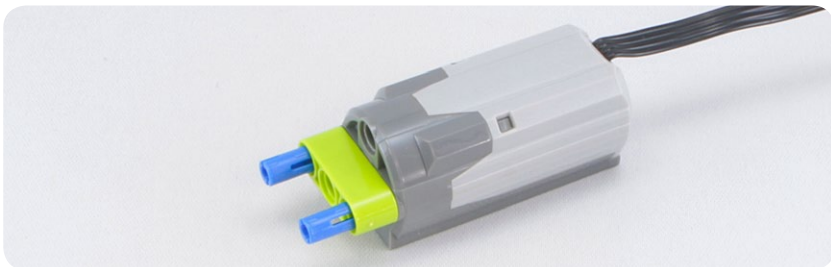
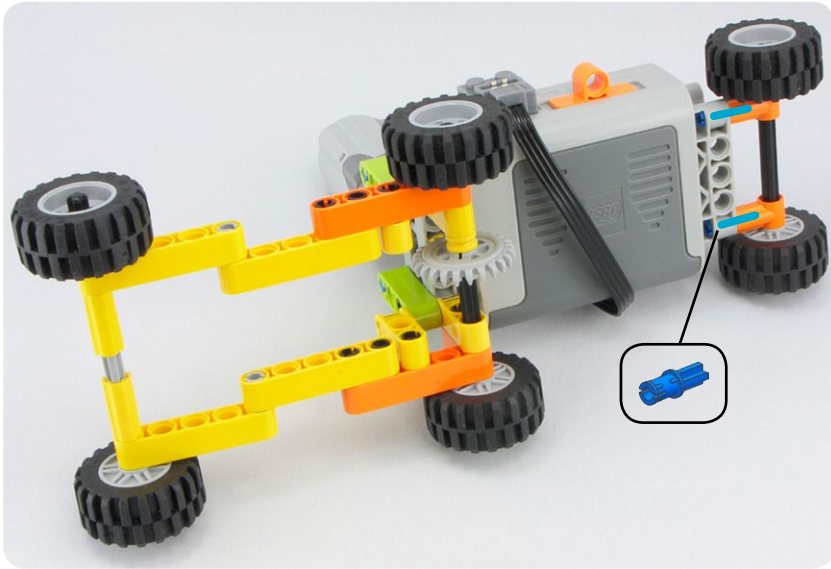
#87

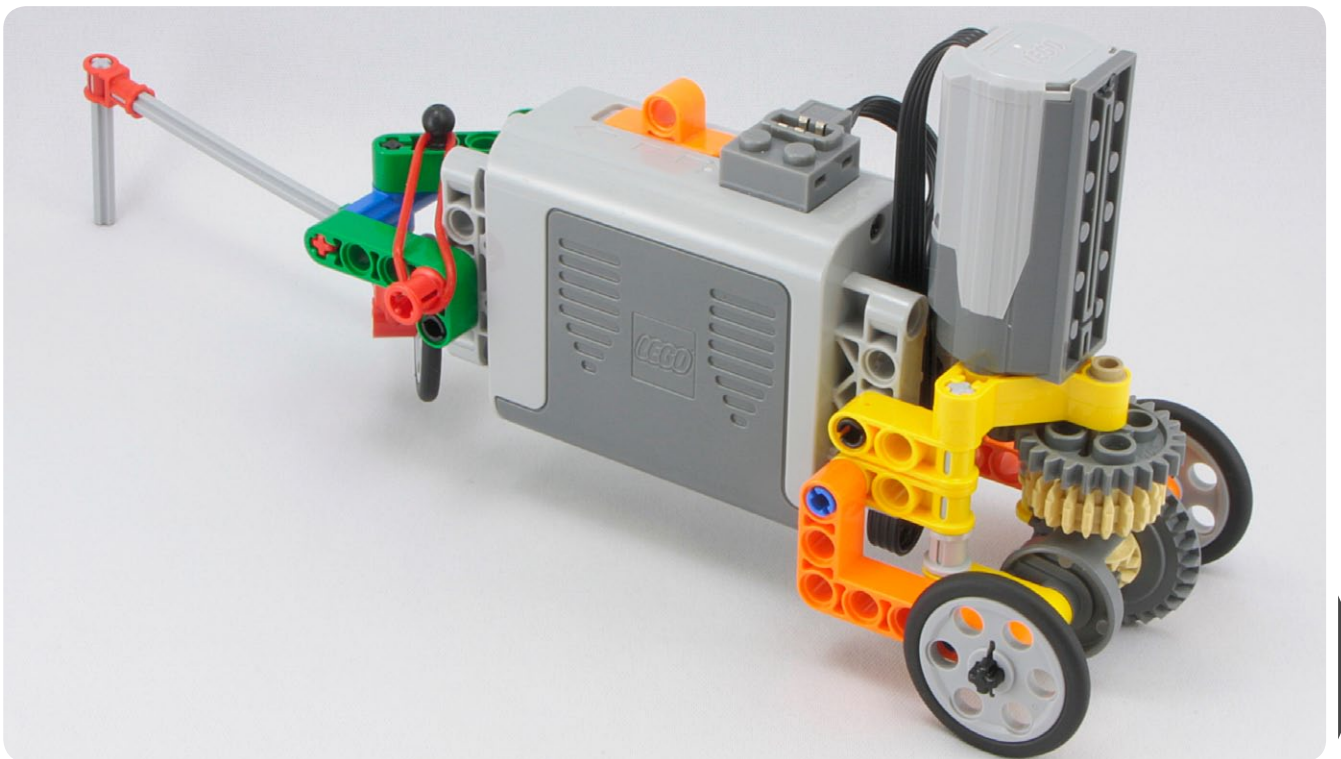
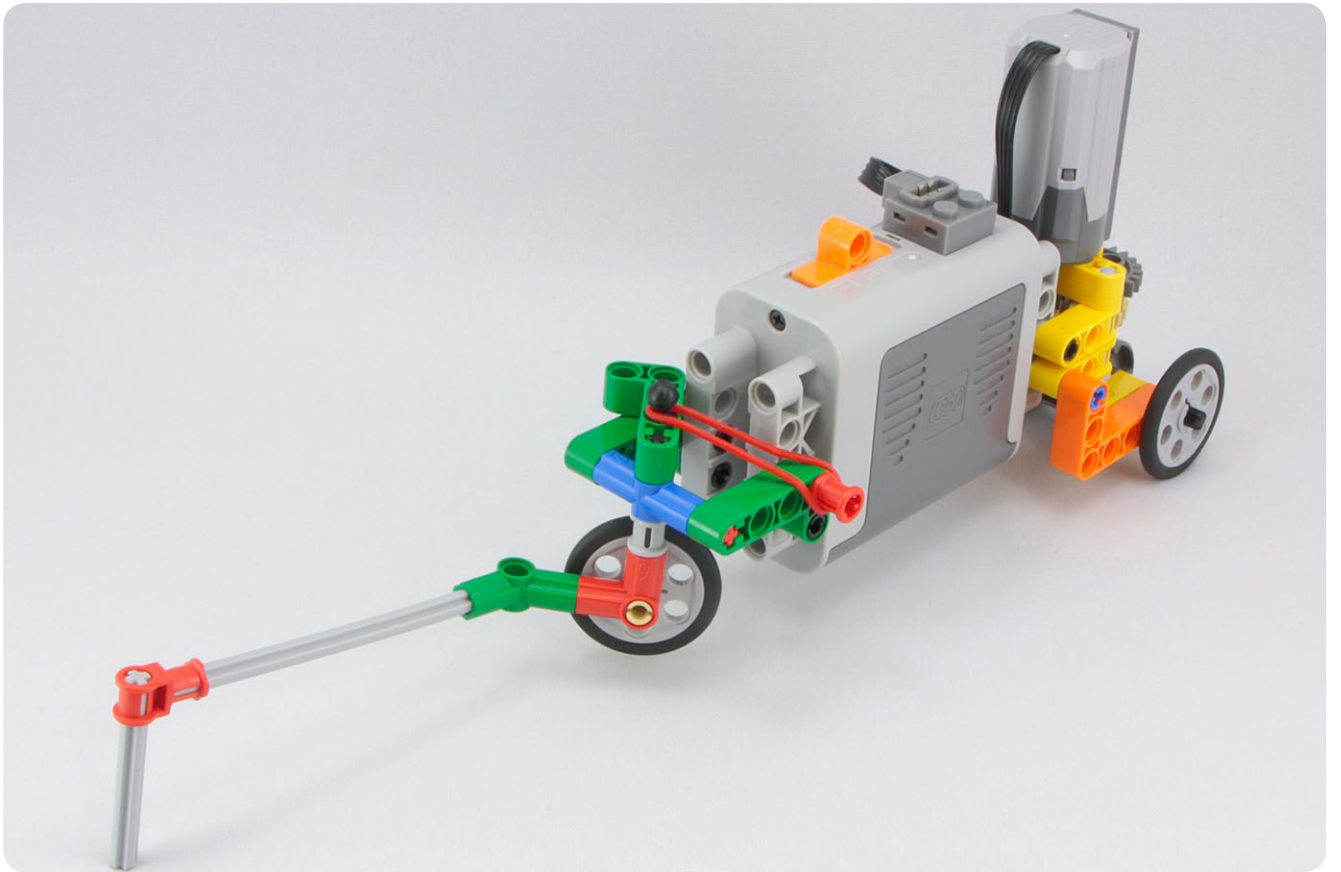


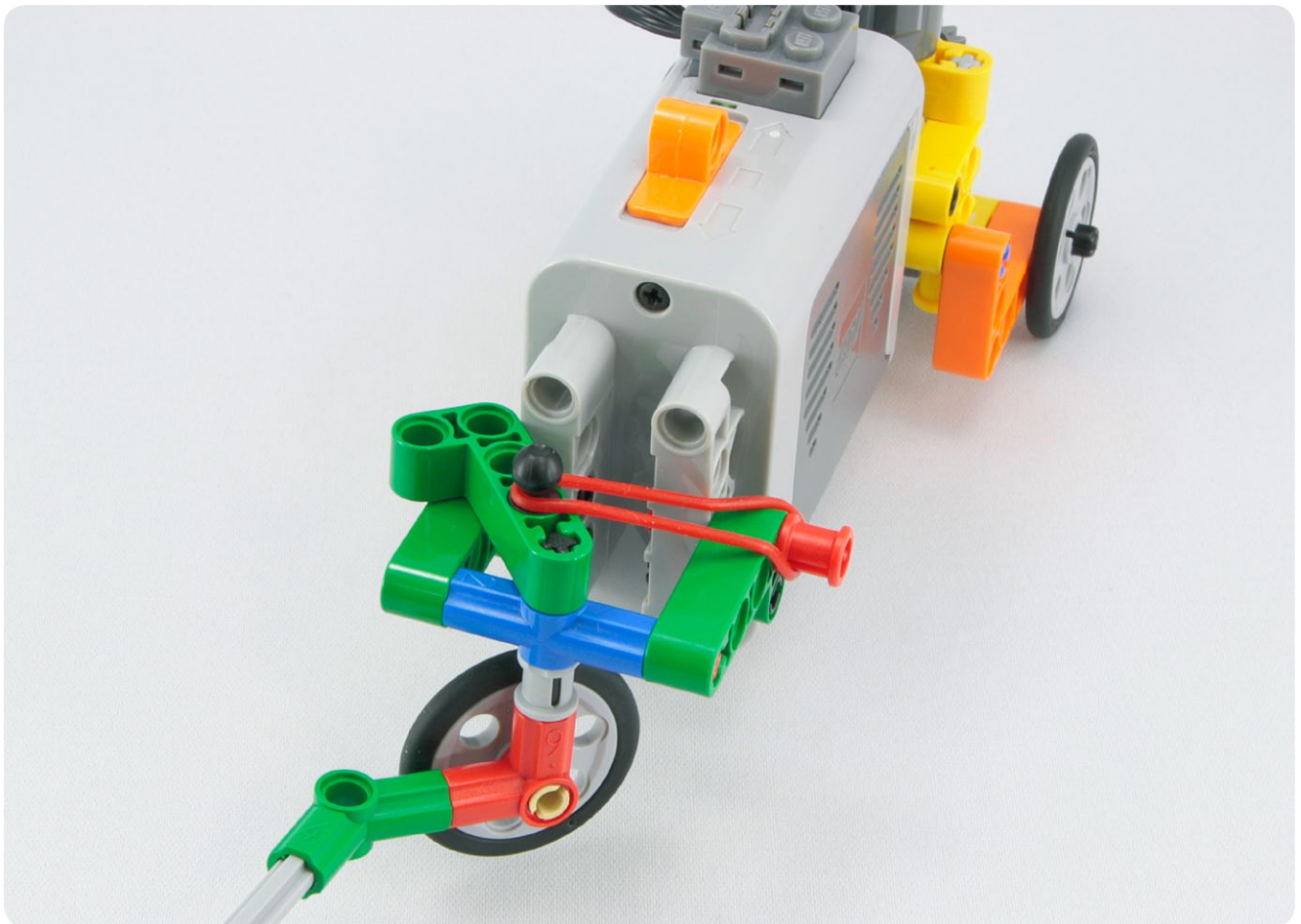
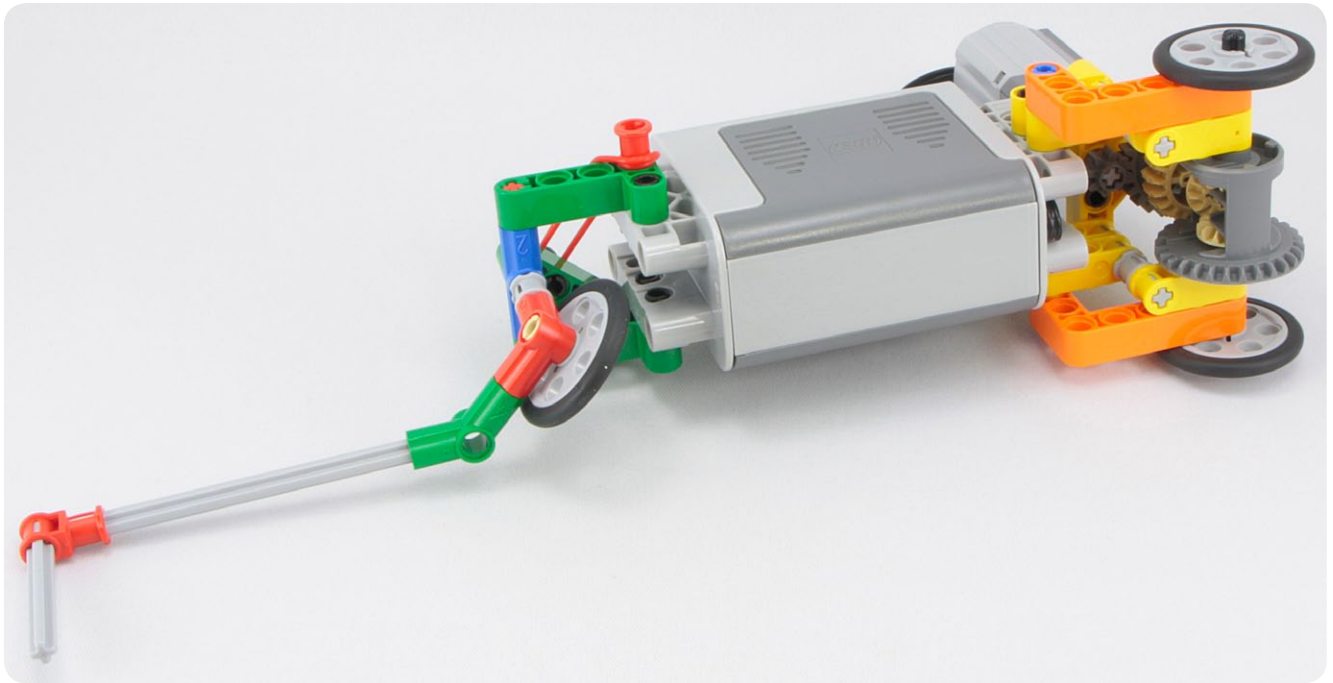


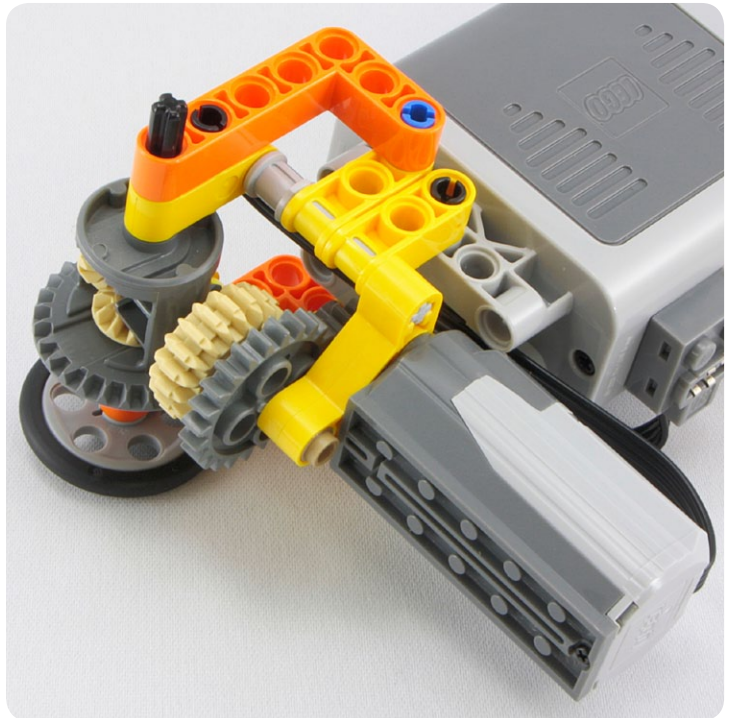
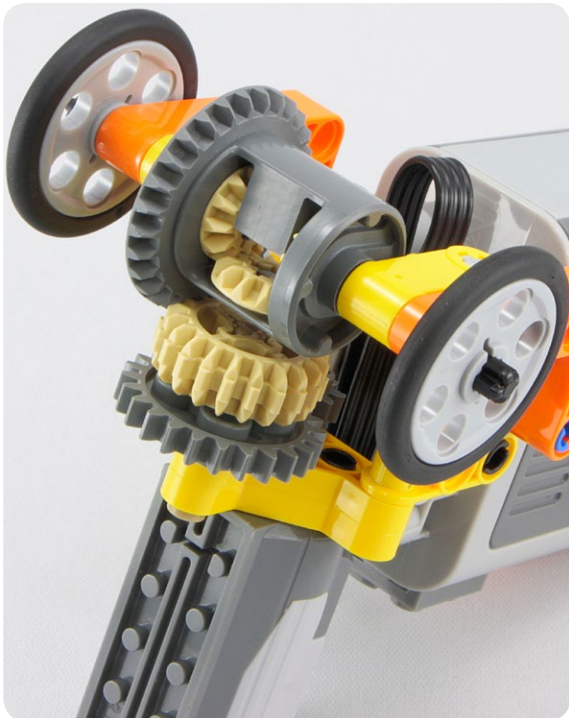
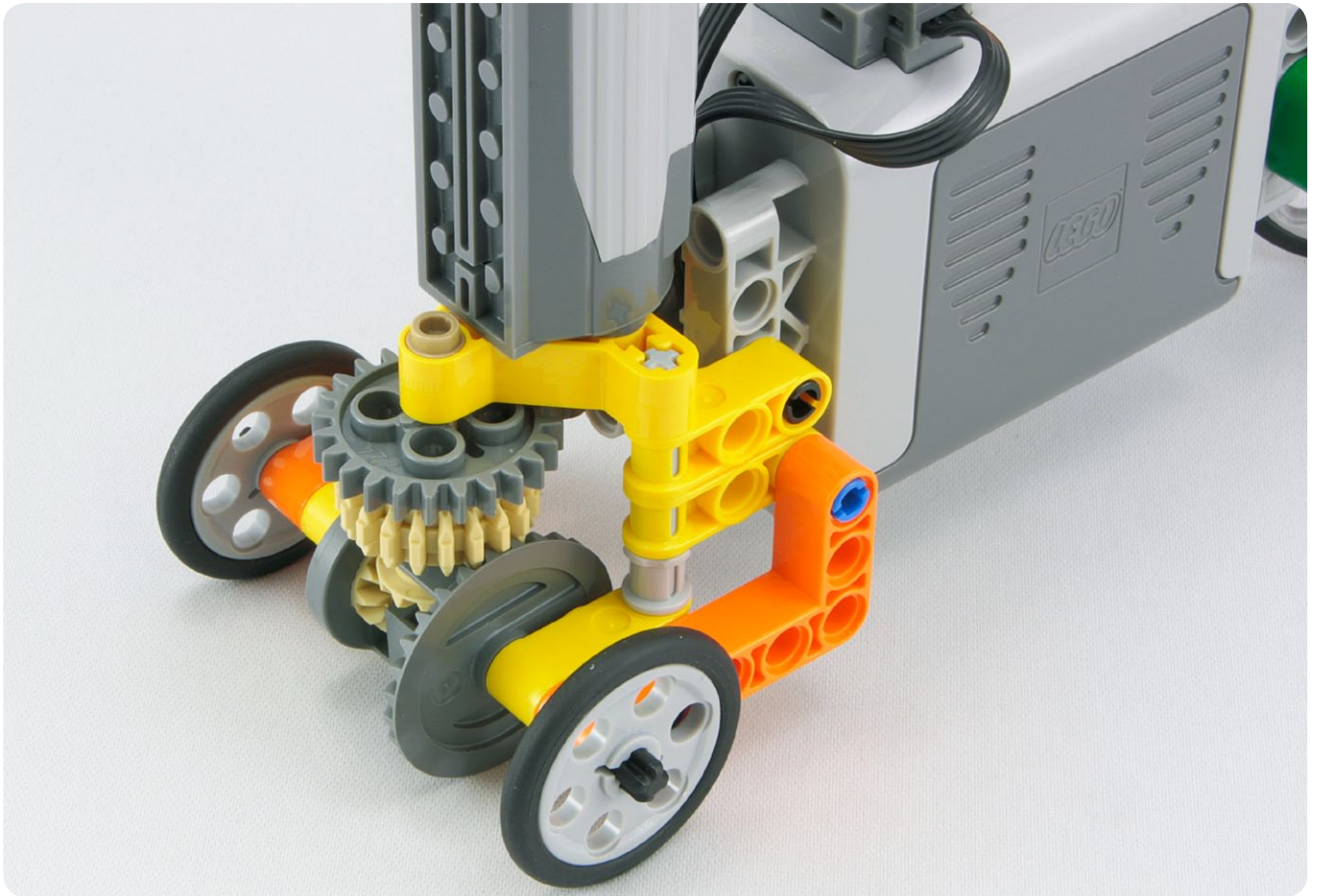
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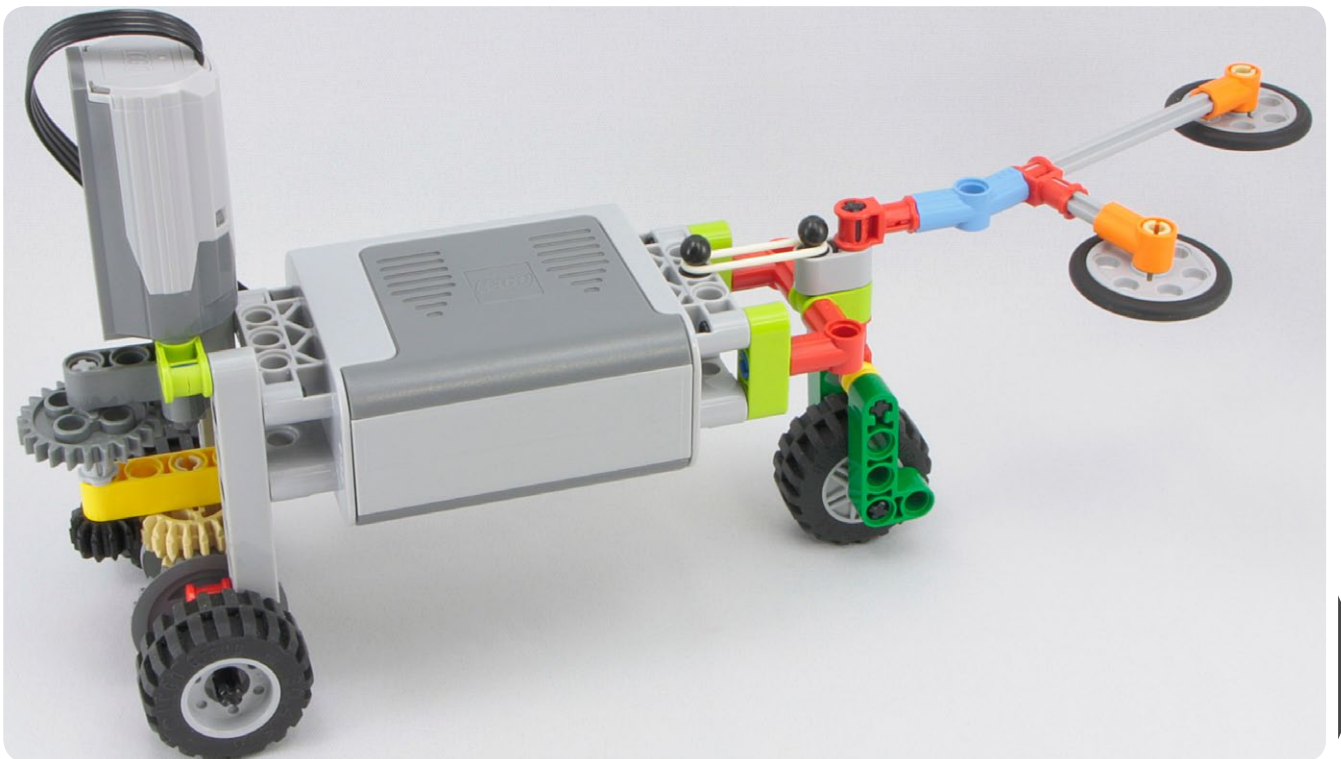
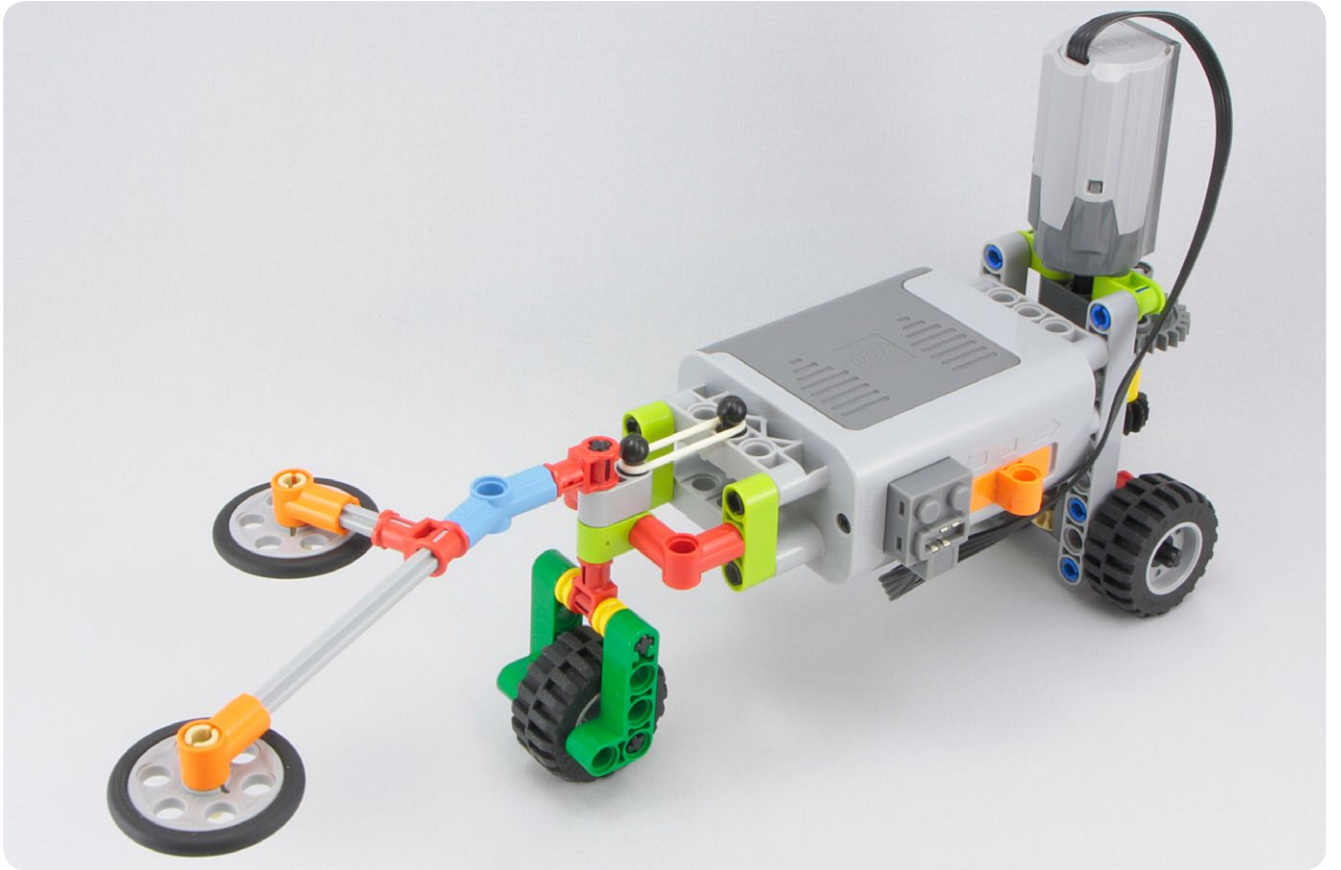


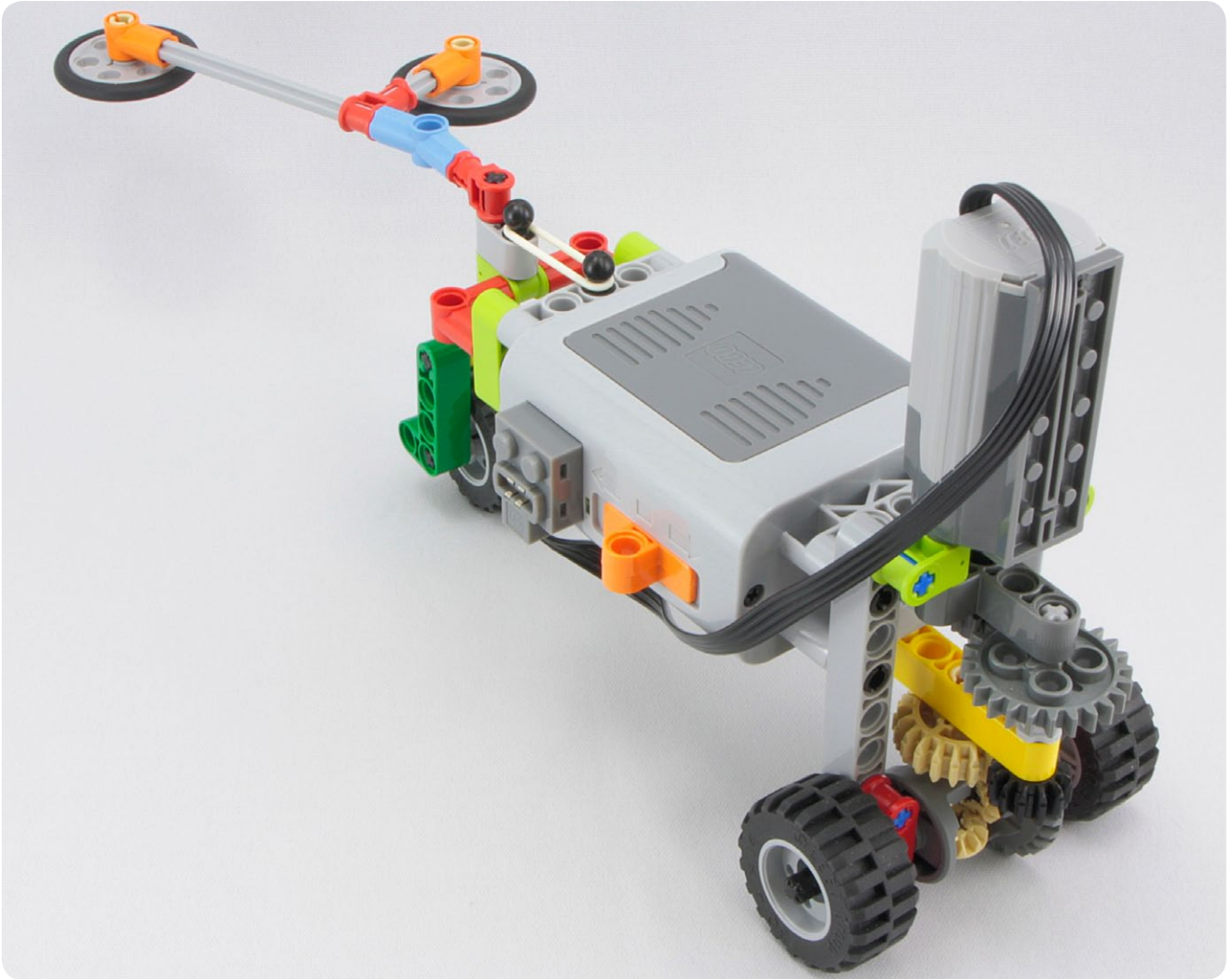


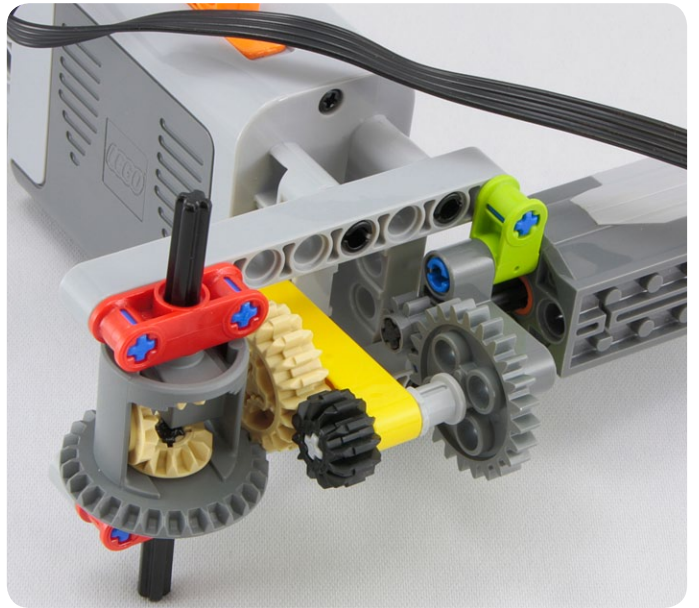
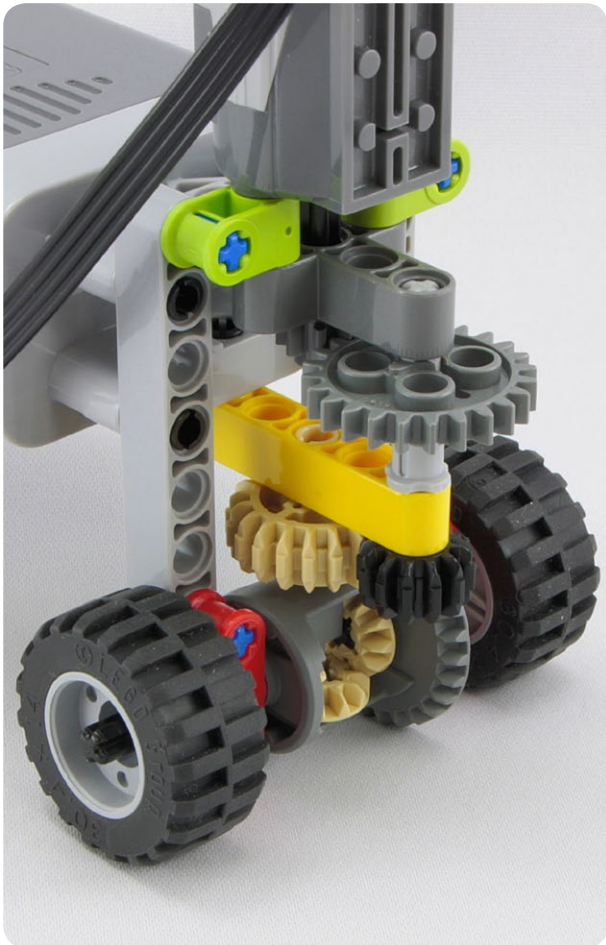
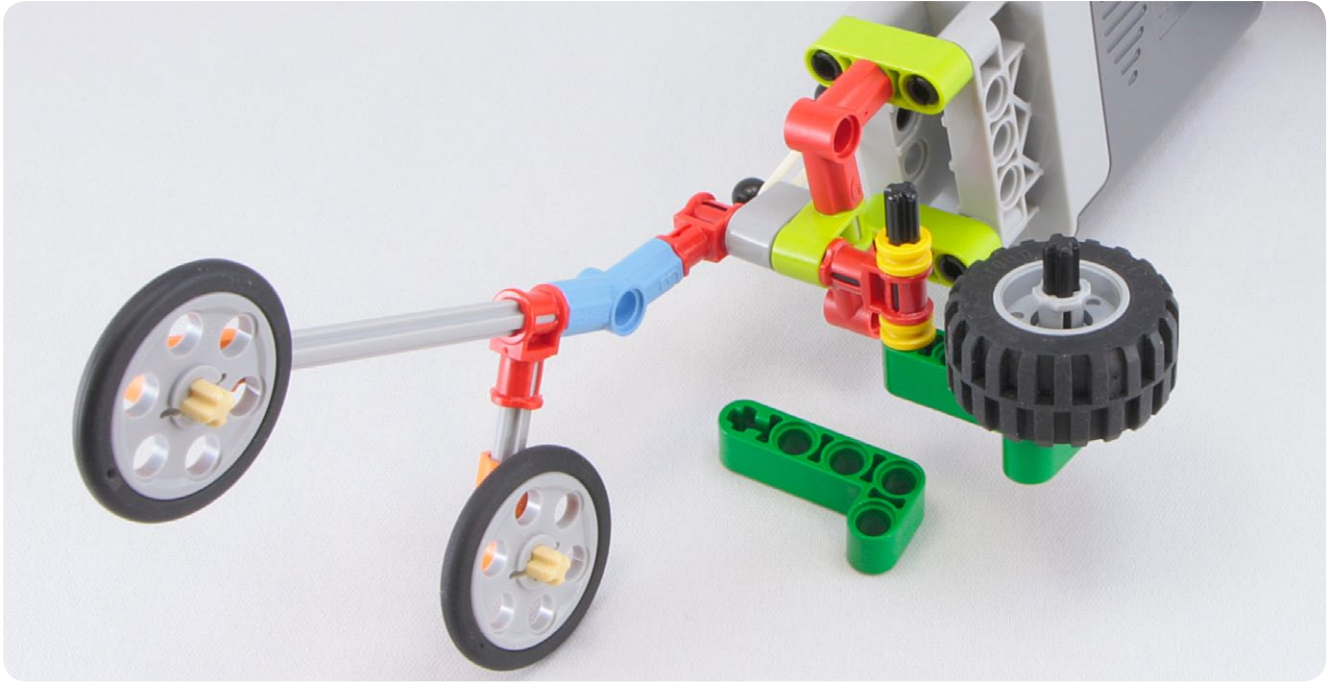




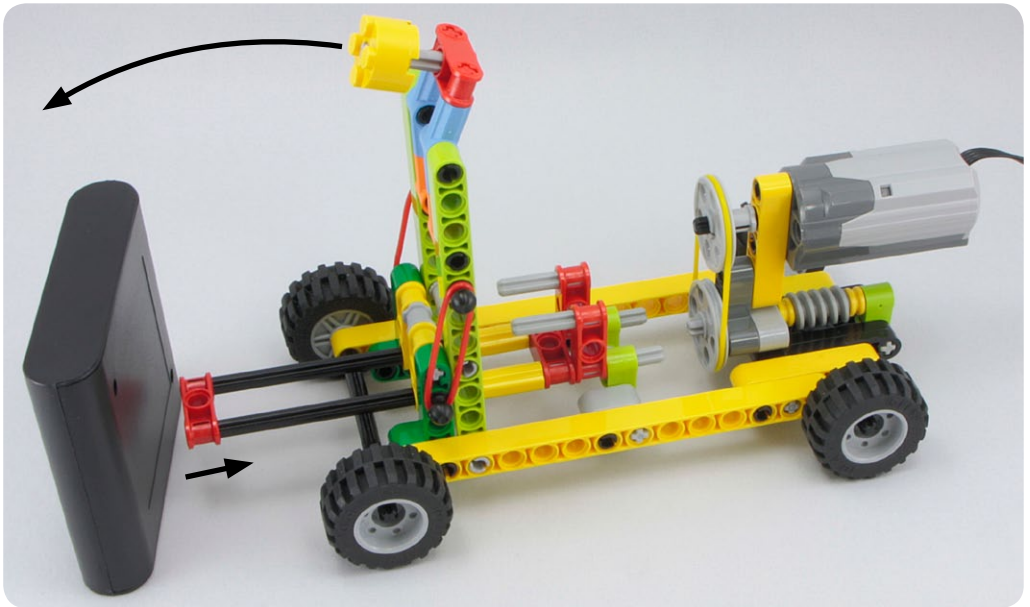
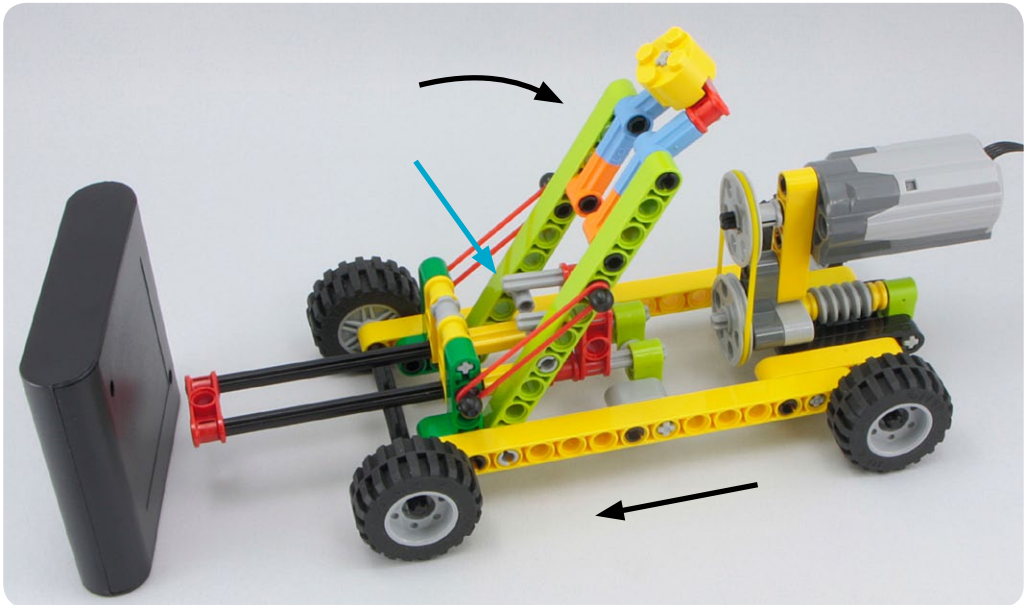
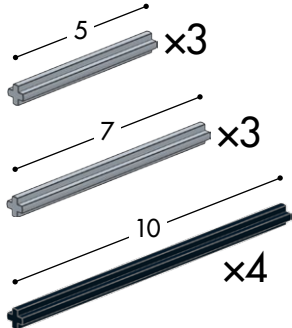
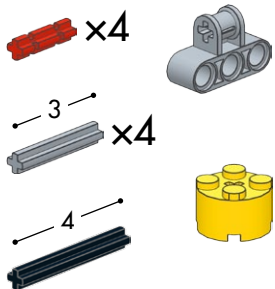
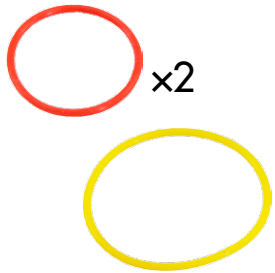
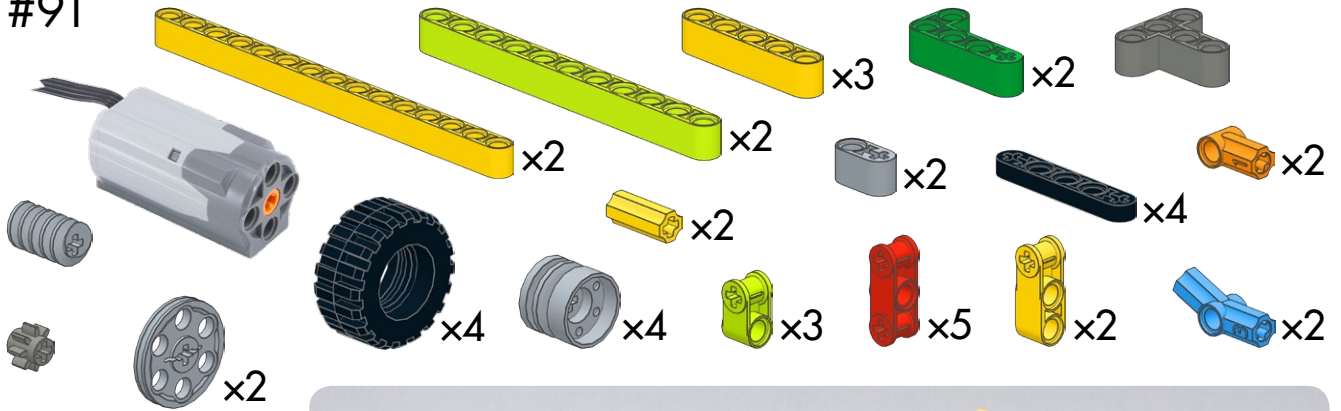




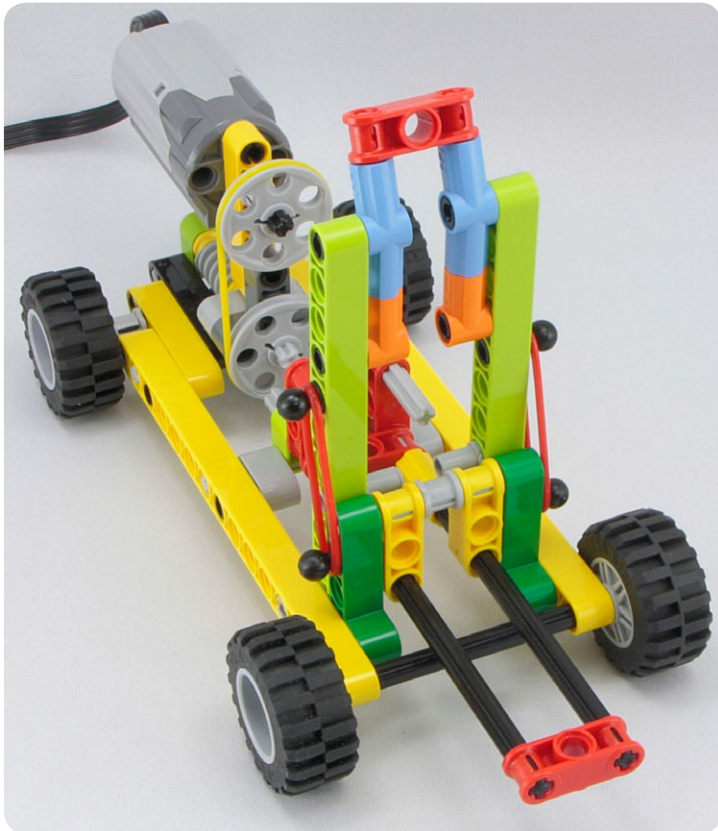
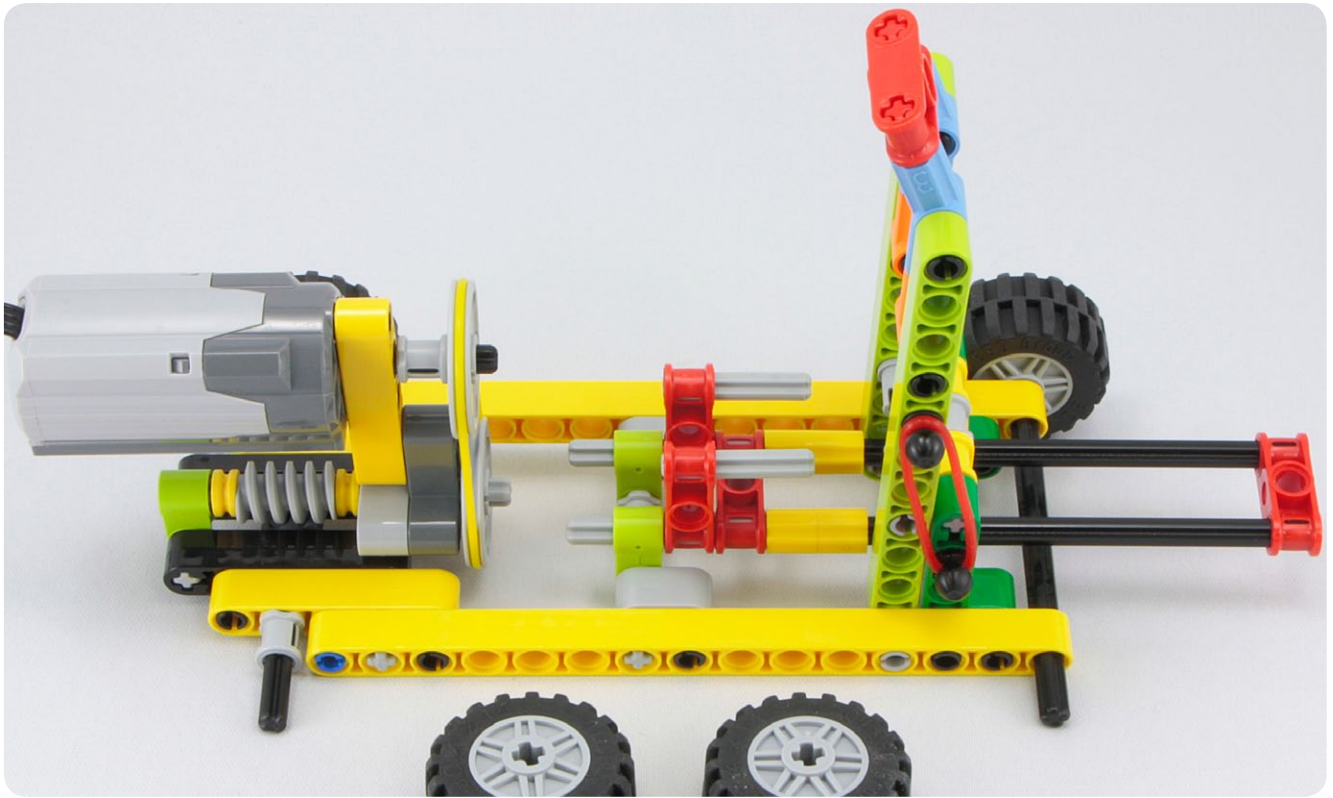


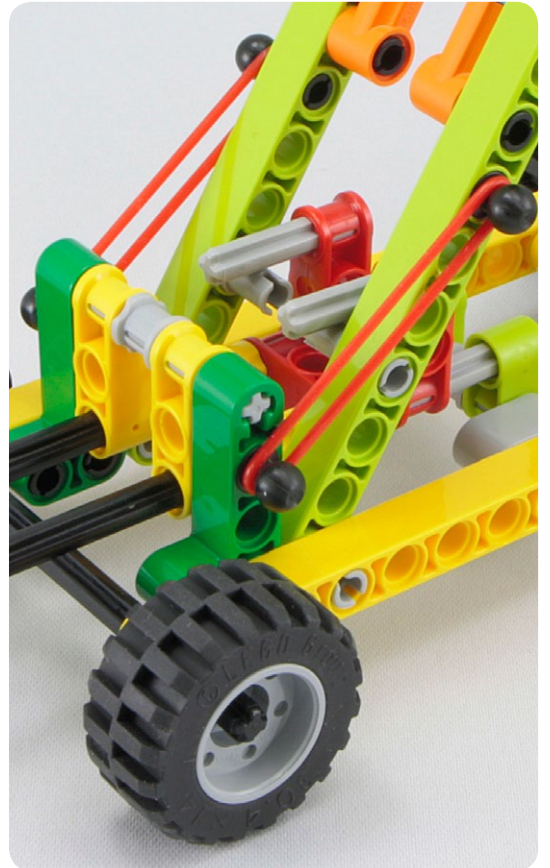
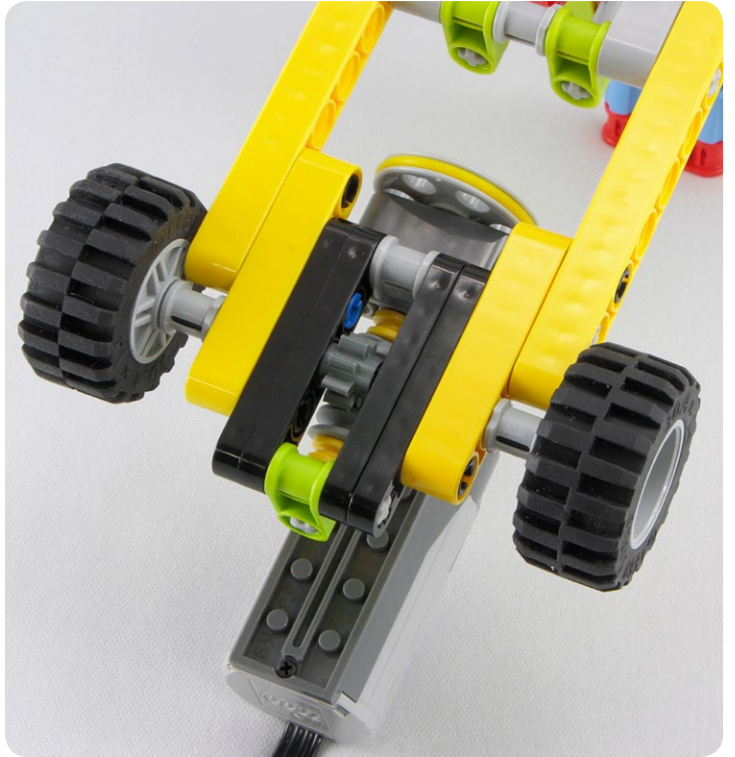
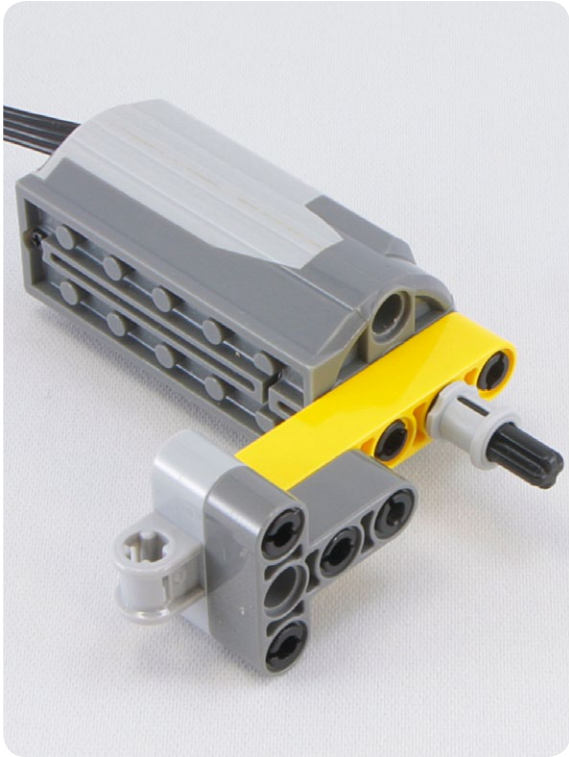


#91

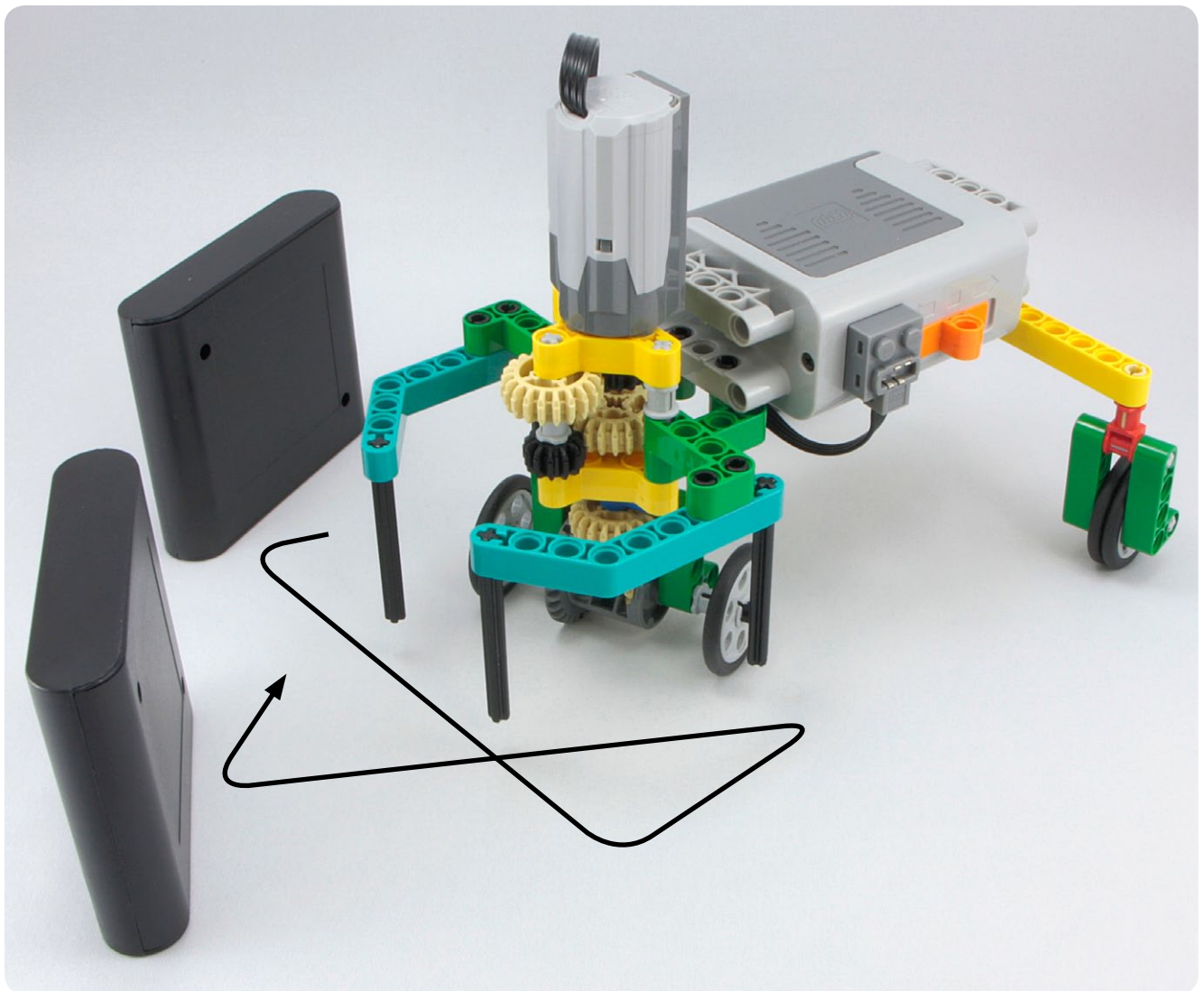
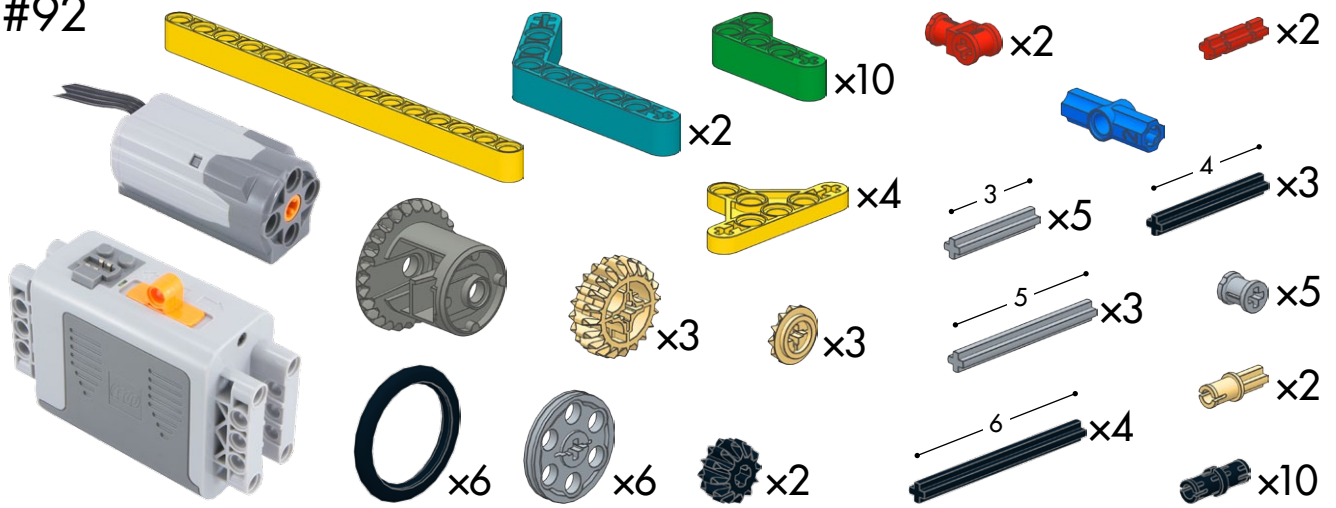


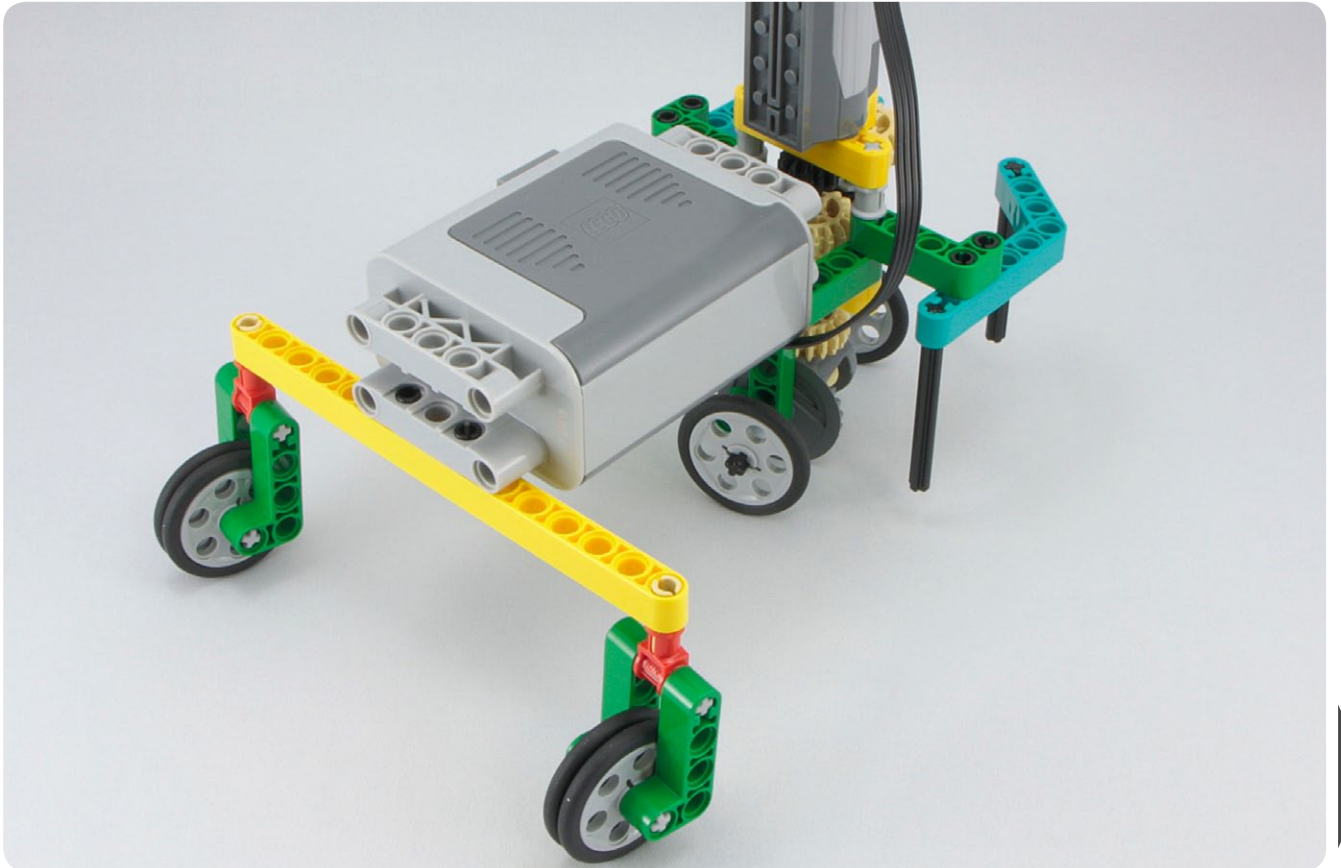
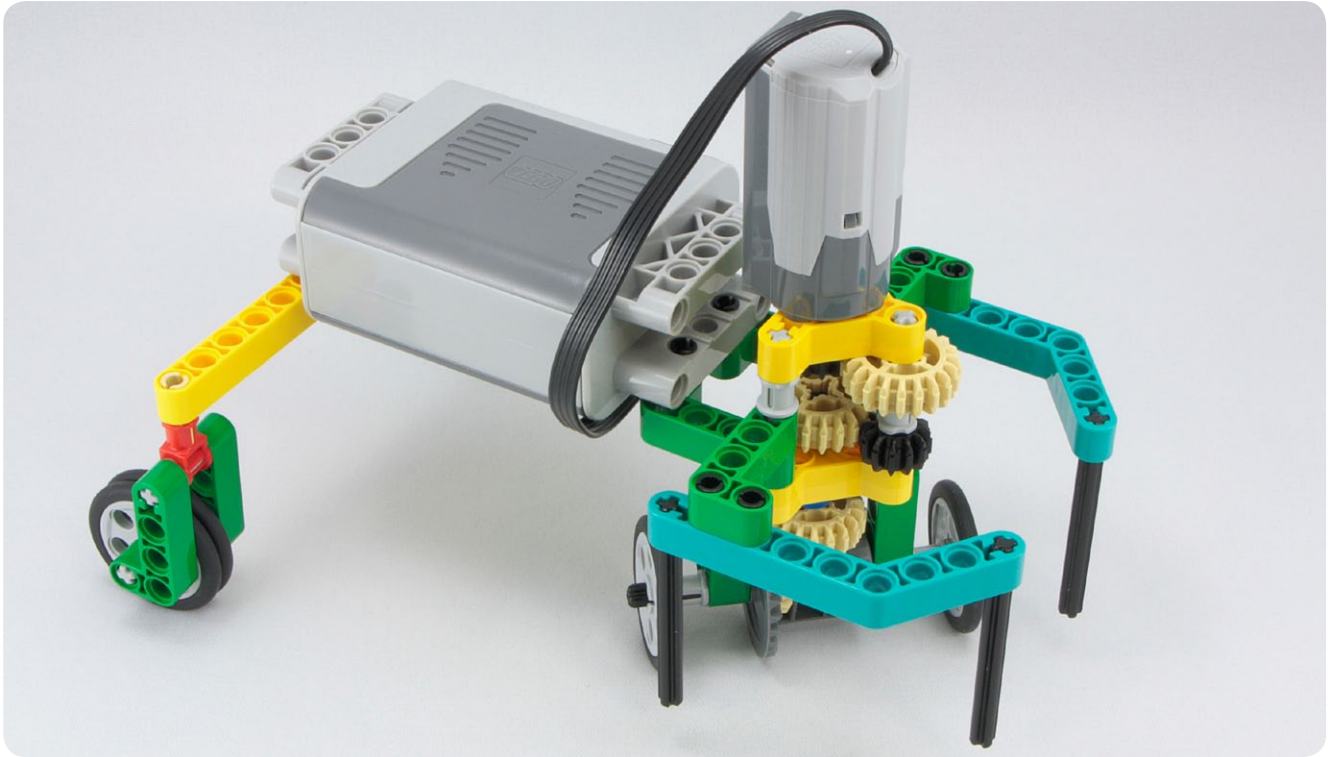


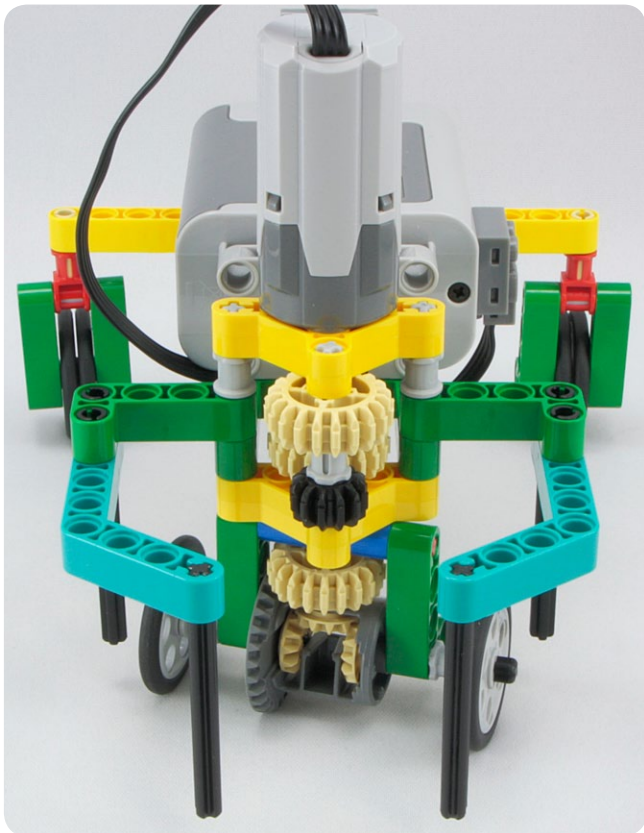
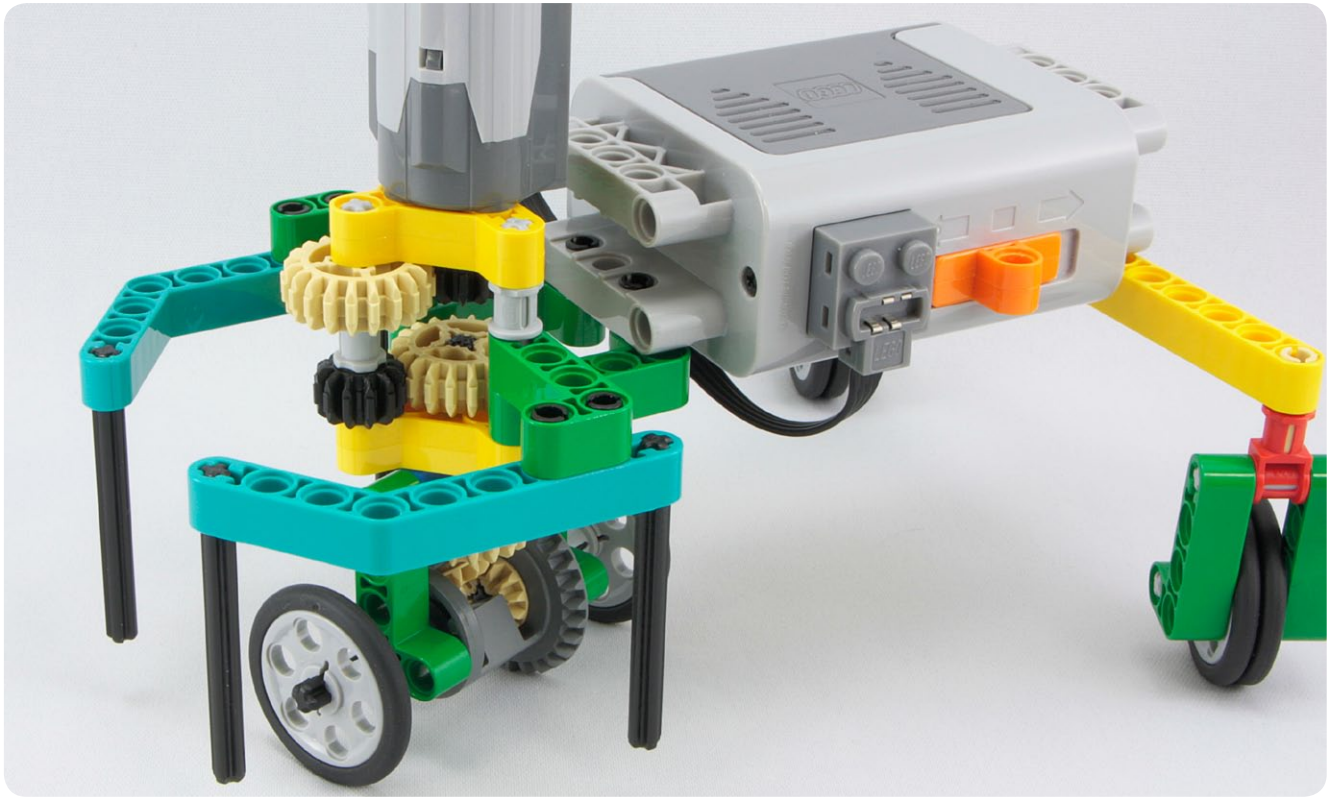


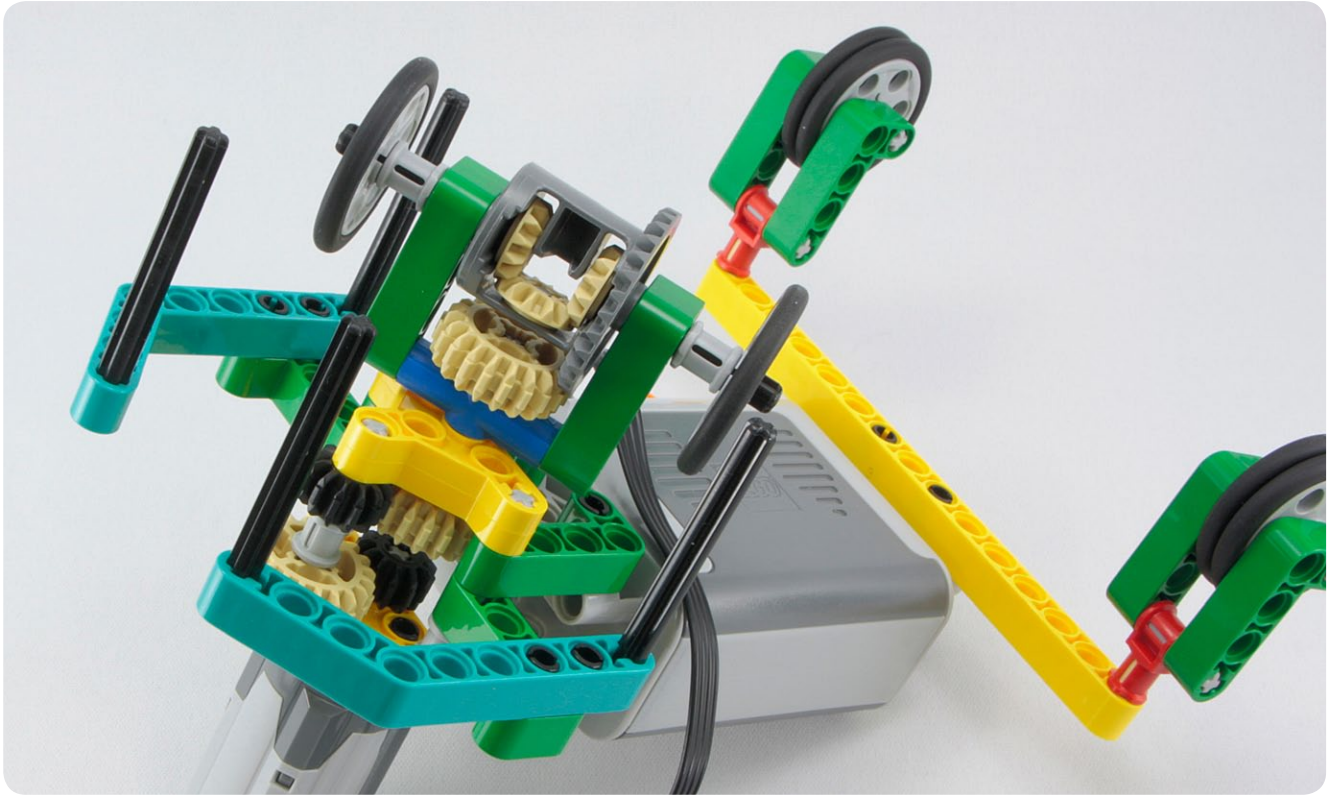


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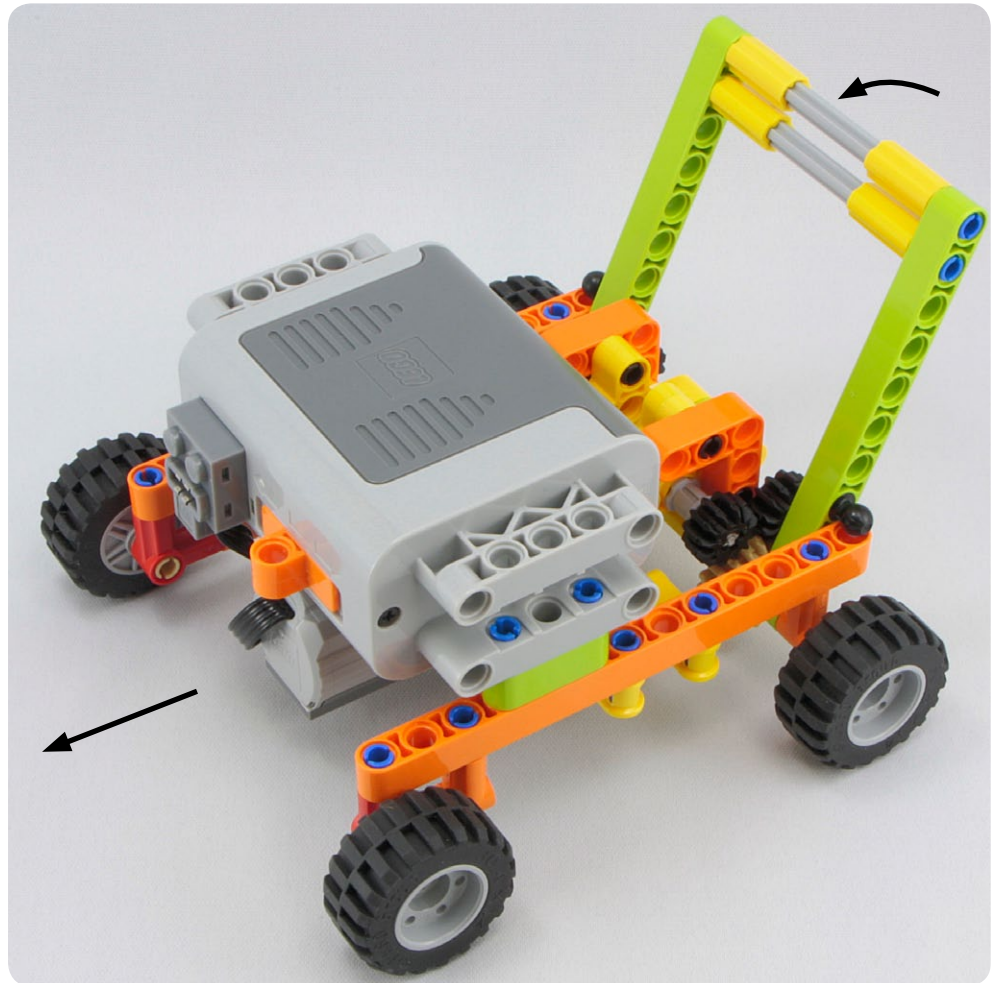
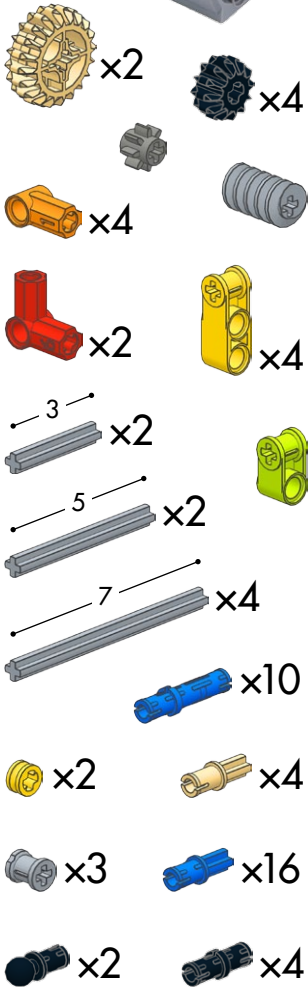
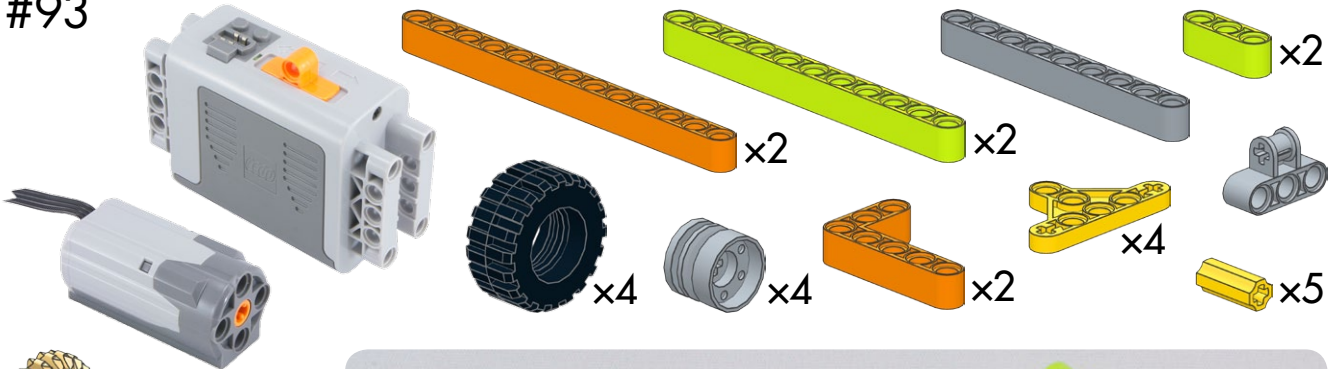


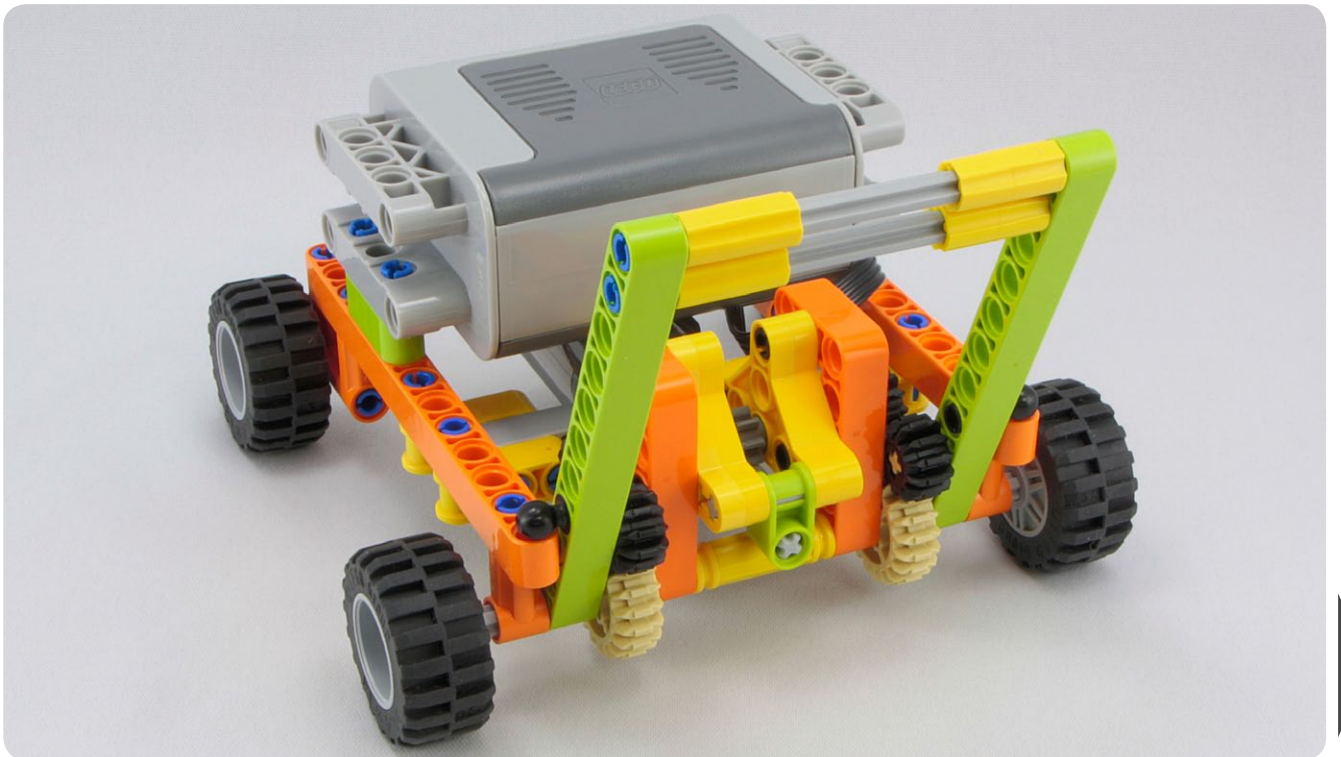


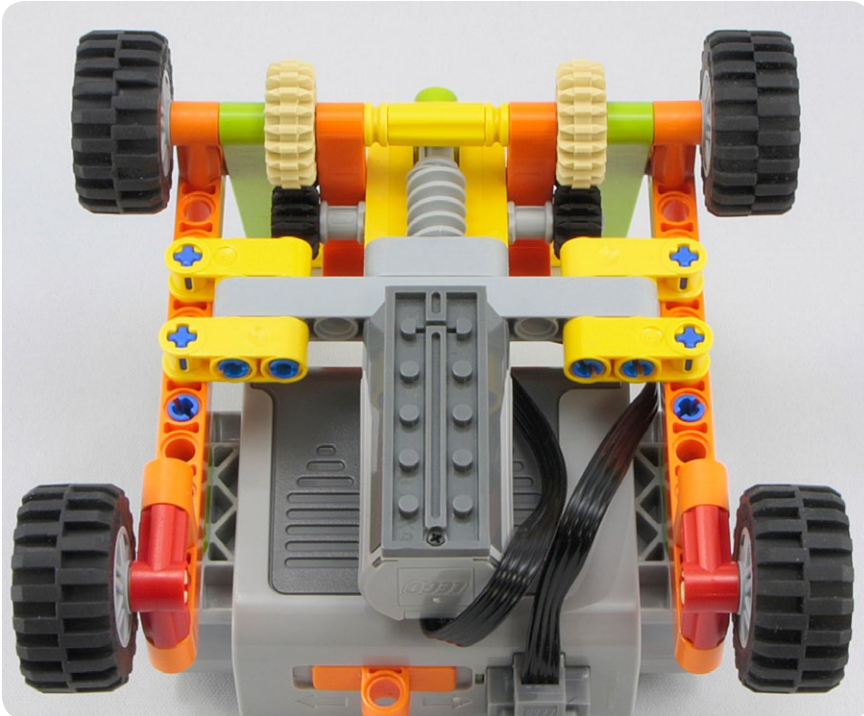


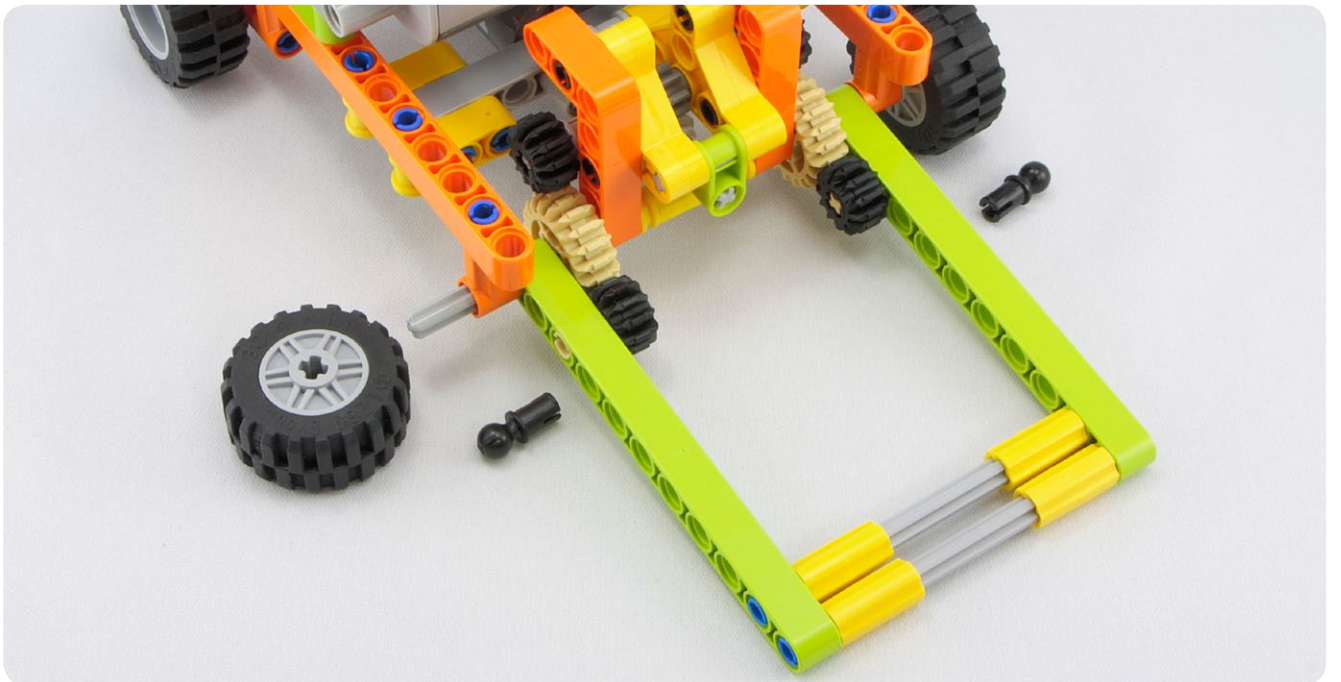
Cool cars

#93

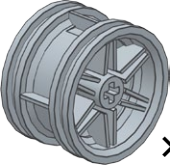





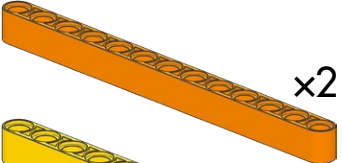

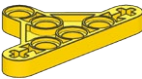














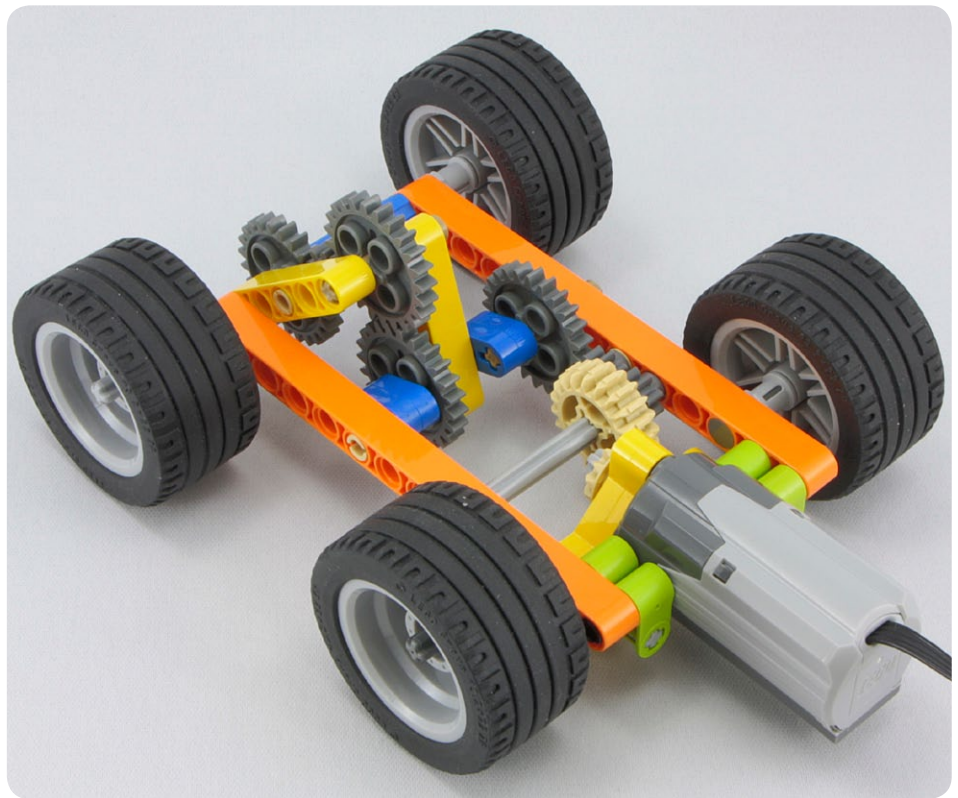
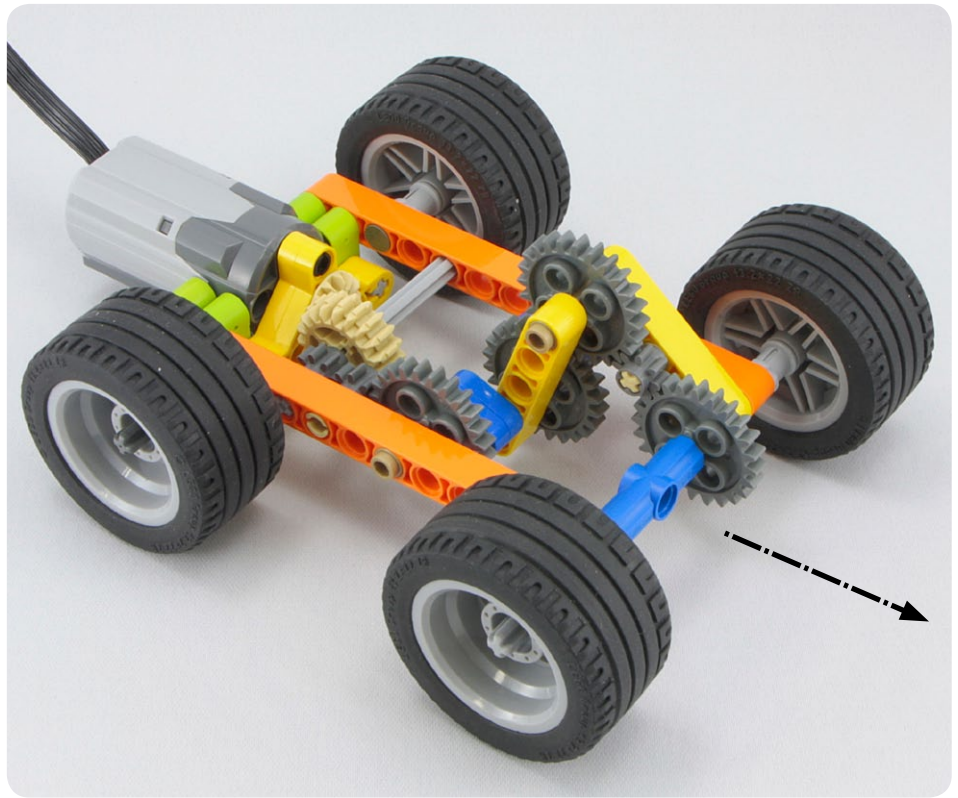


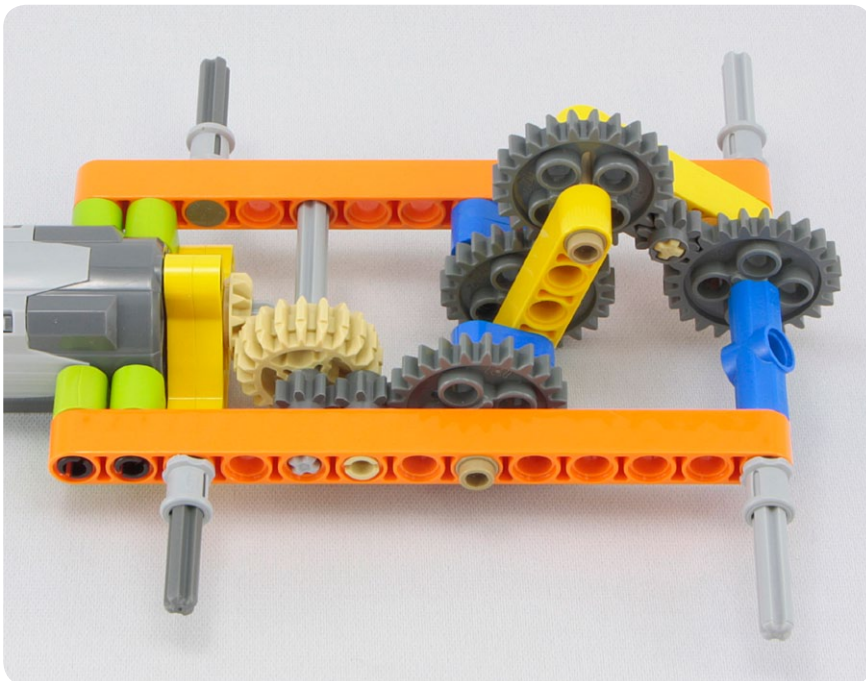
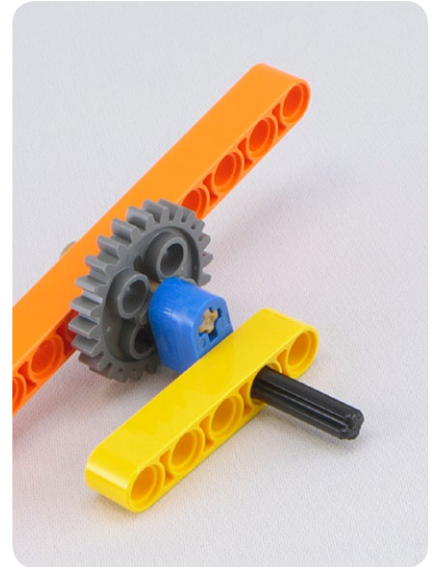
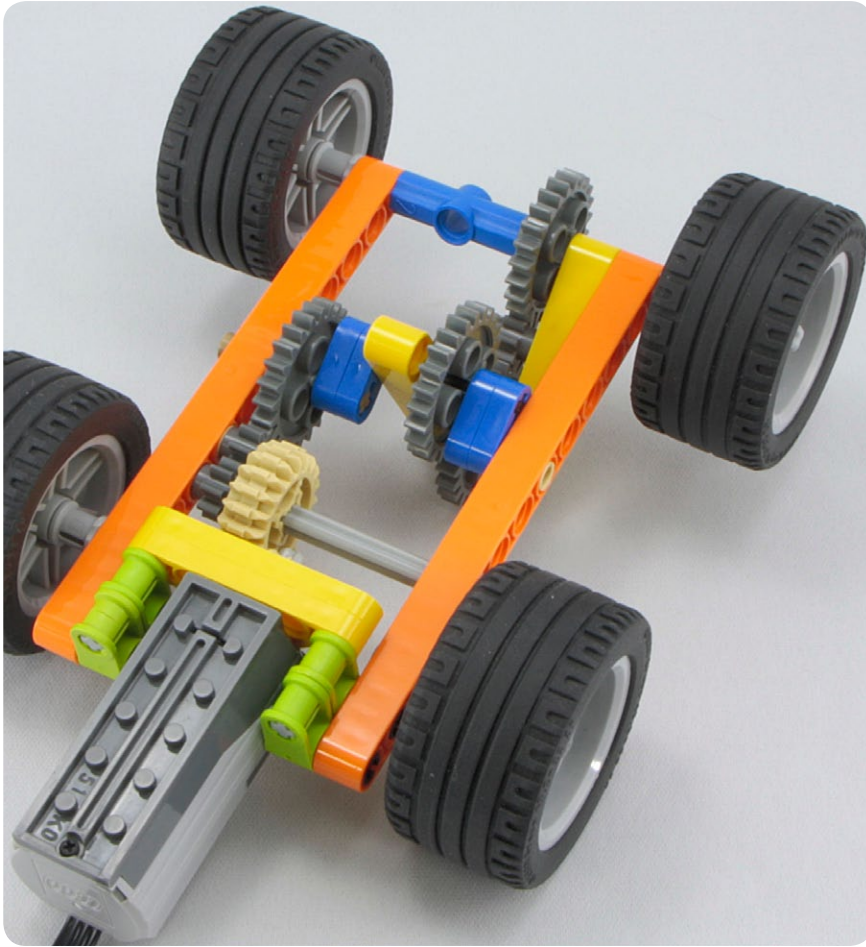













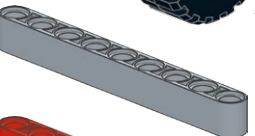

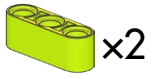
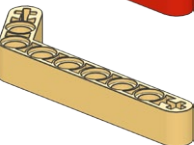
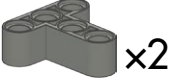
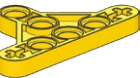

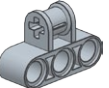
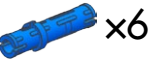






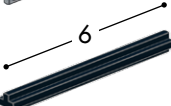
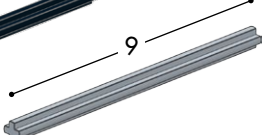
#94

-  x4
-  x4
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-  x3
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-  x4
-  x2
-  x2
-  x2
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-  x4
-  x4
-  x3
-  x4
-  x2
-  x2
-  x4
-  x3
-  x3
-  x2
-  x6

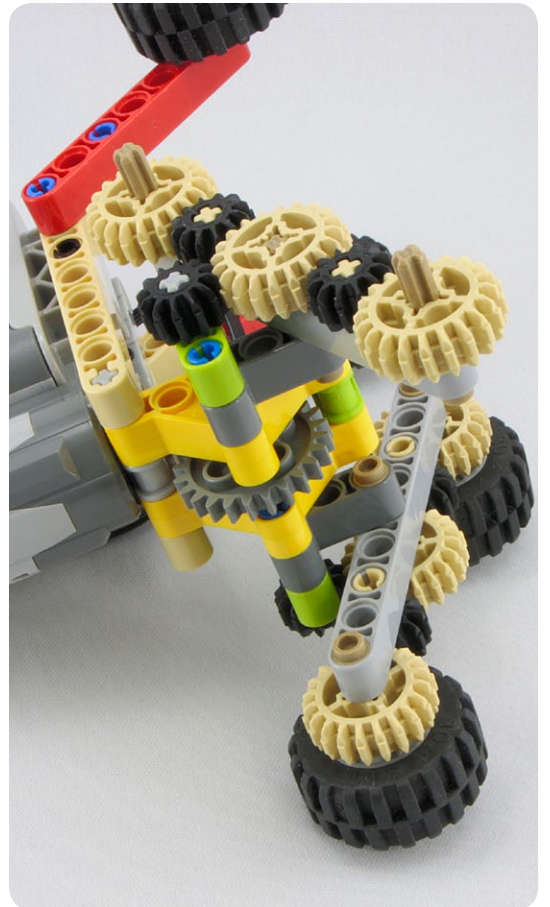
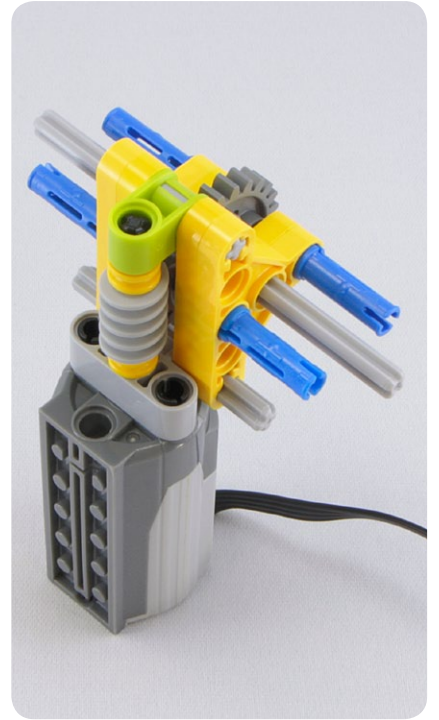
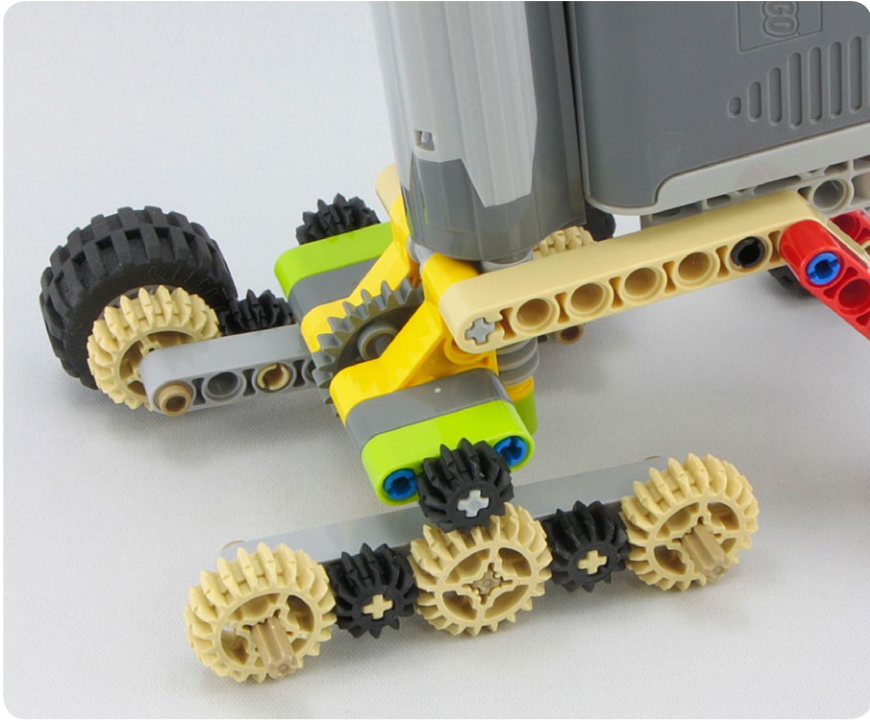


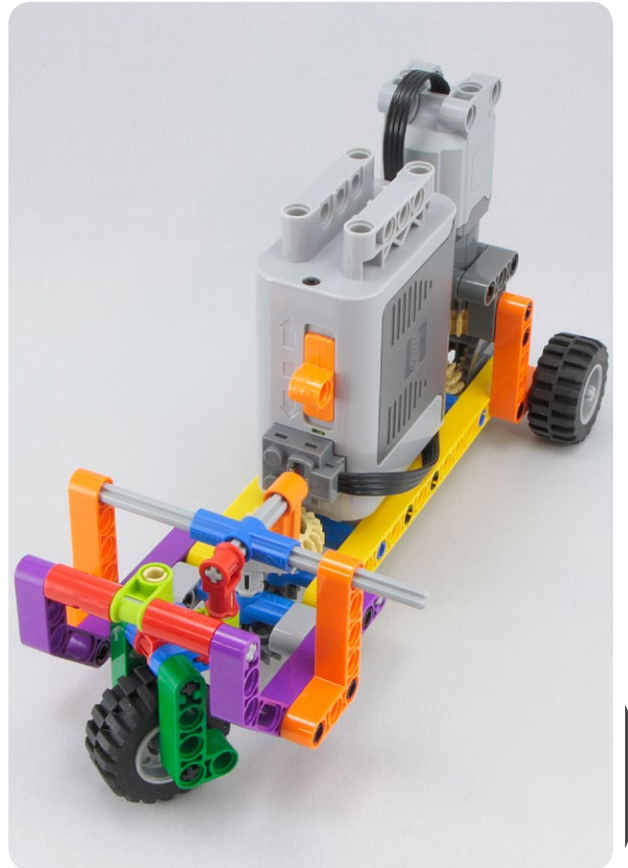


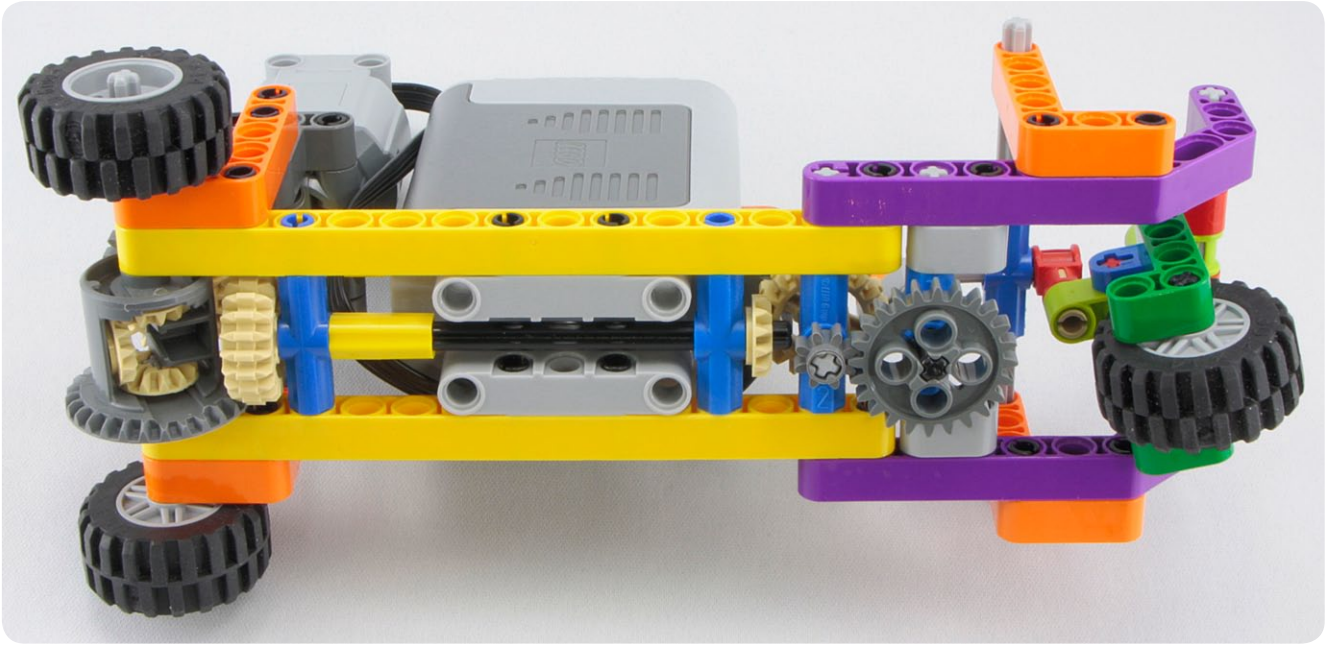
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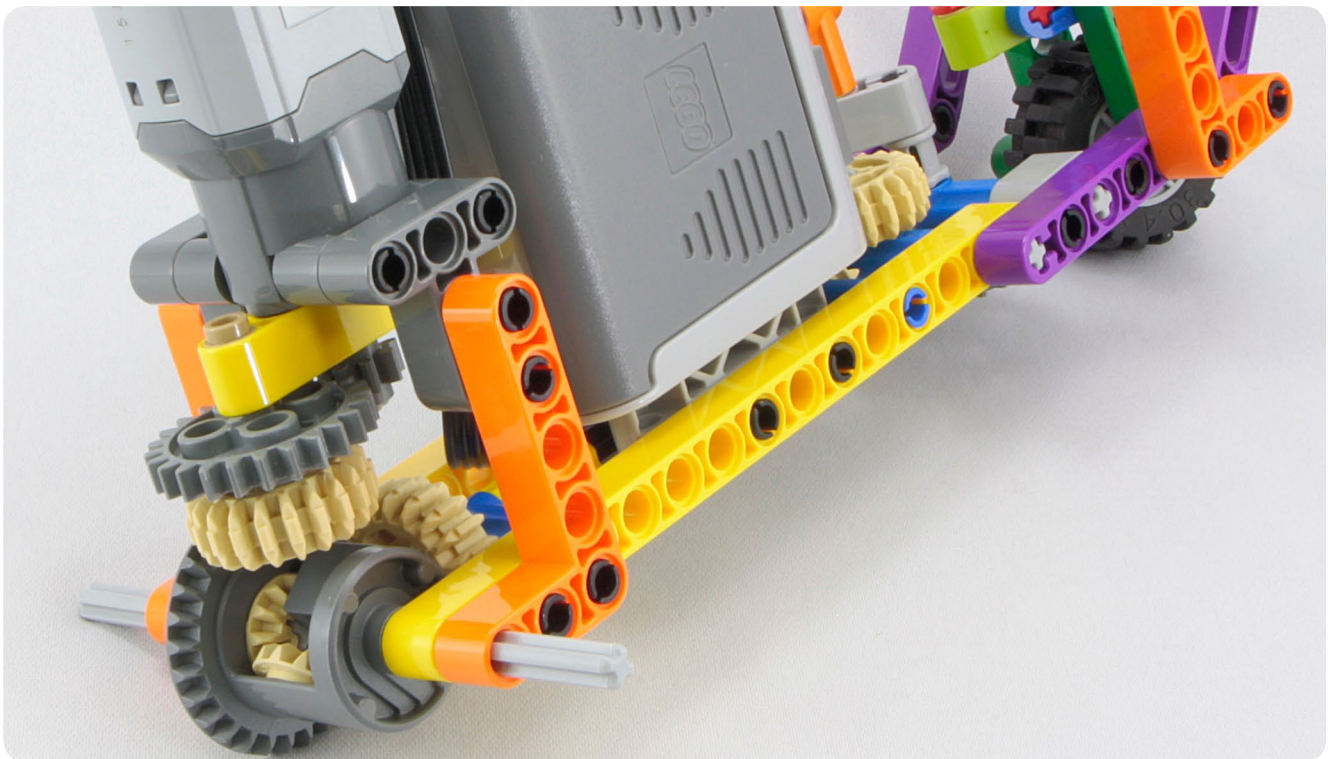
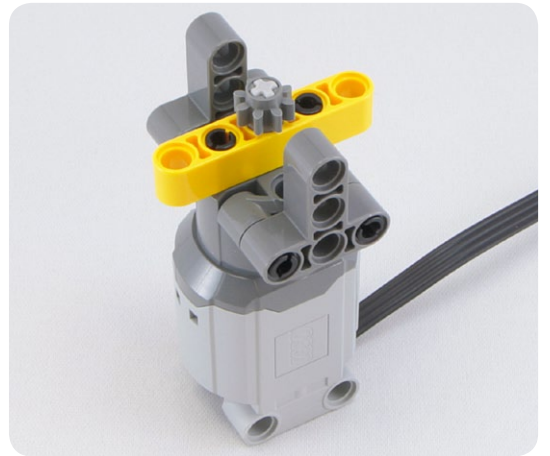
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- 
-  x6
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-  x6
-  x2
-  x2
-  x2
-  x2
-  x2
-  x4
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-  5
-  x4
-  6
-  9



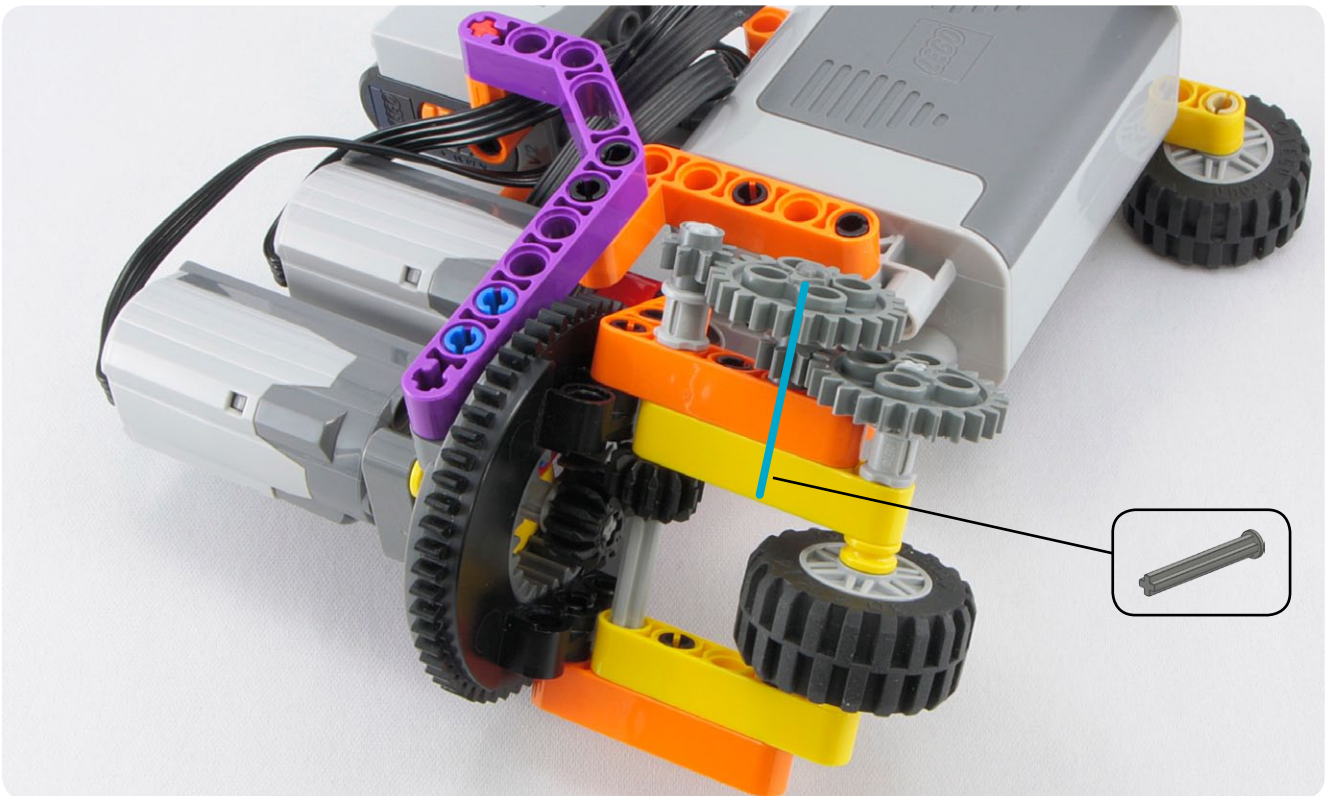
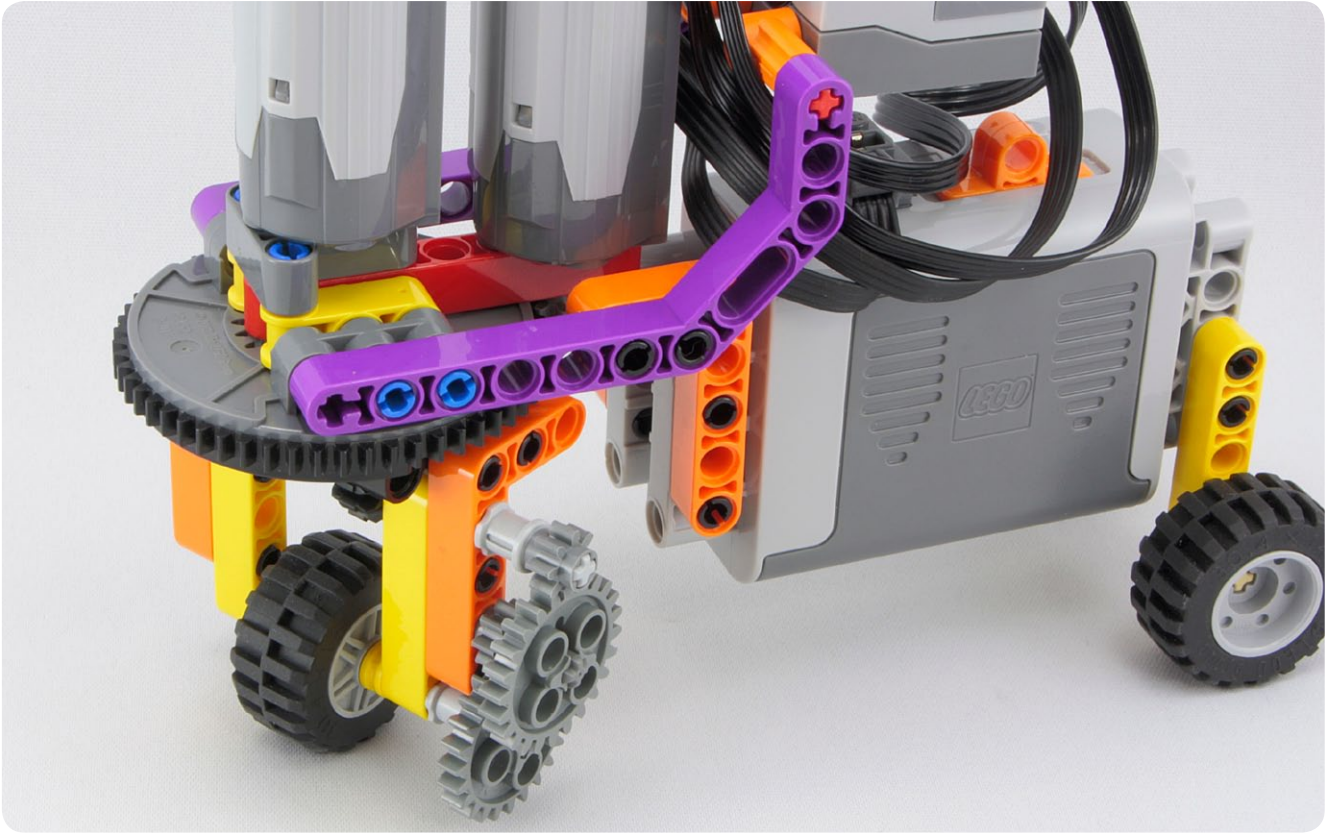


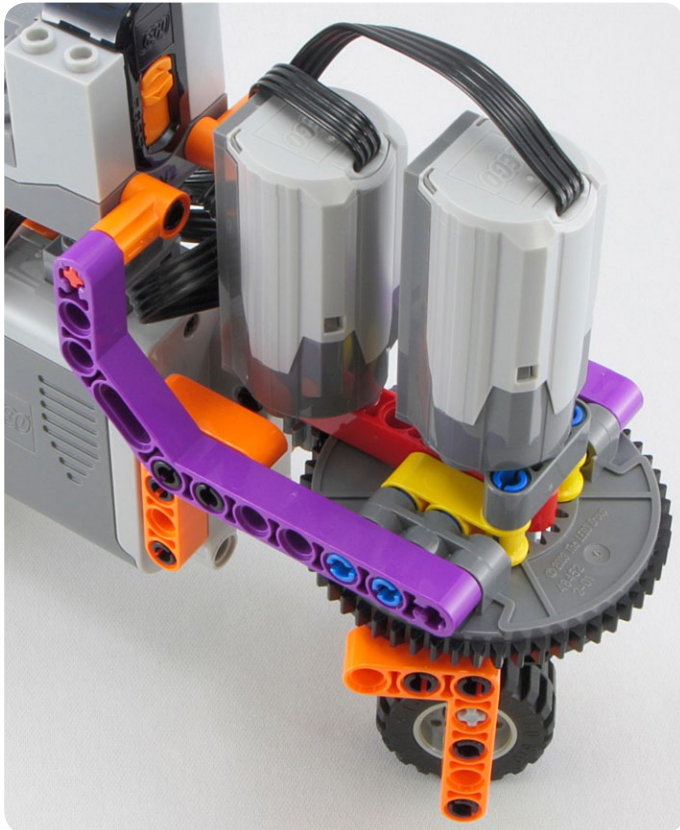
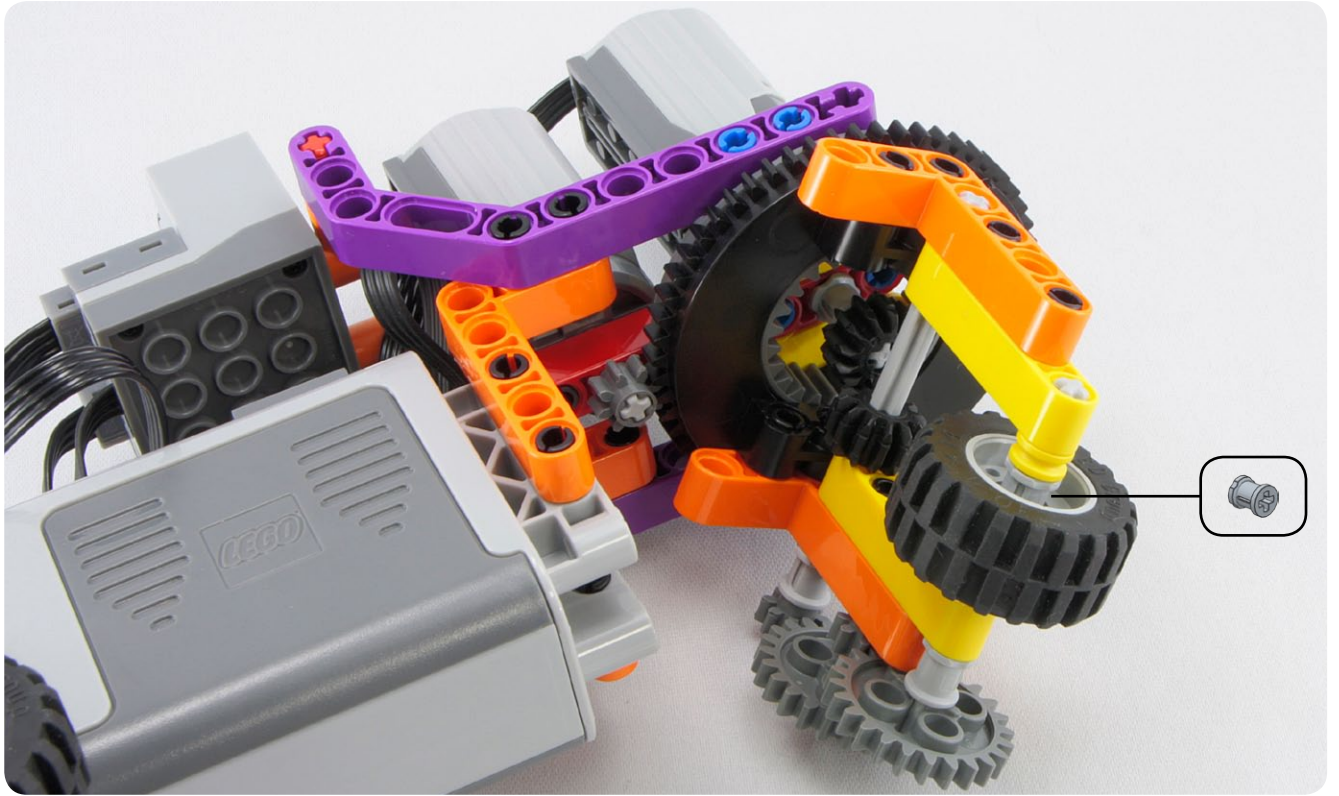


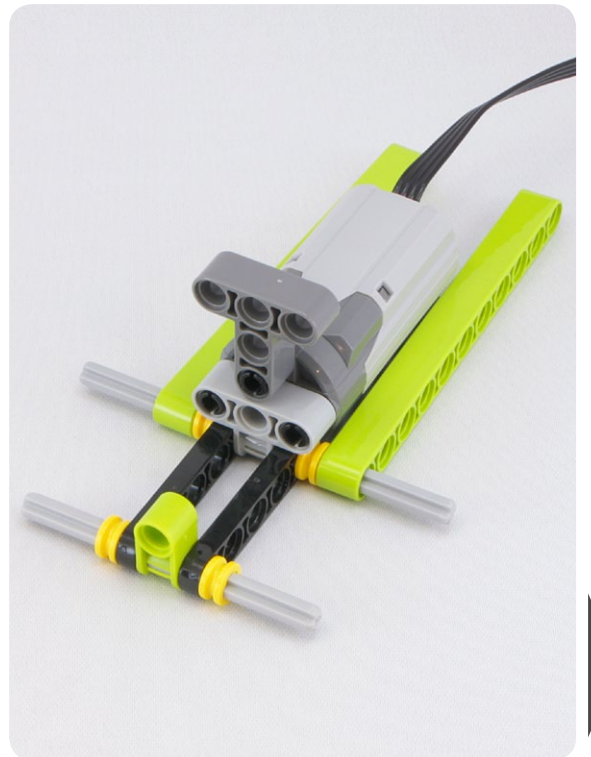
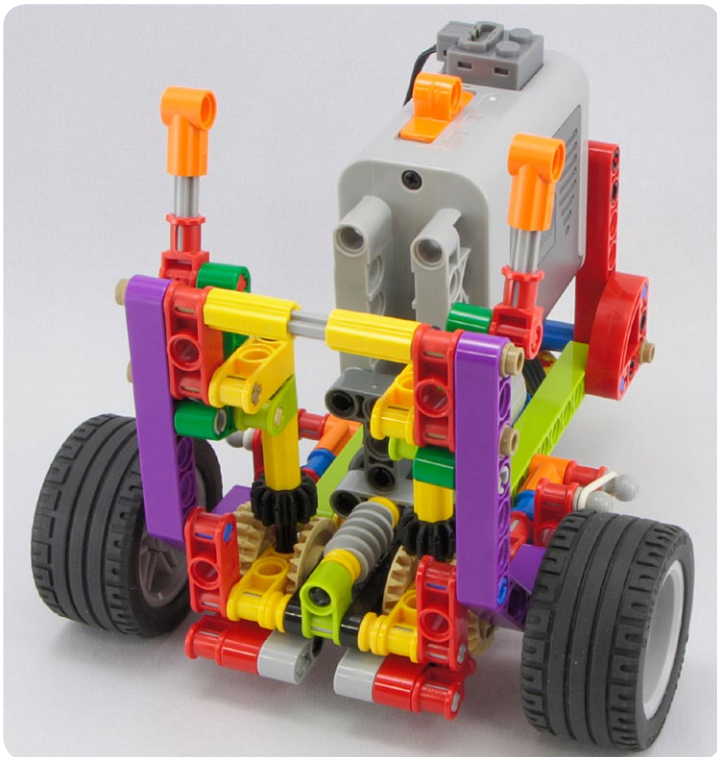




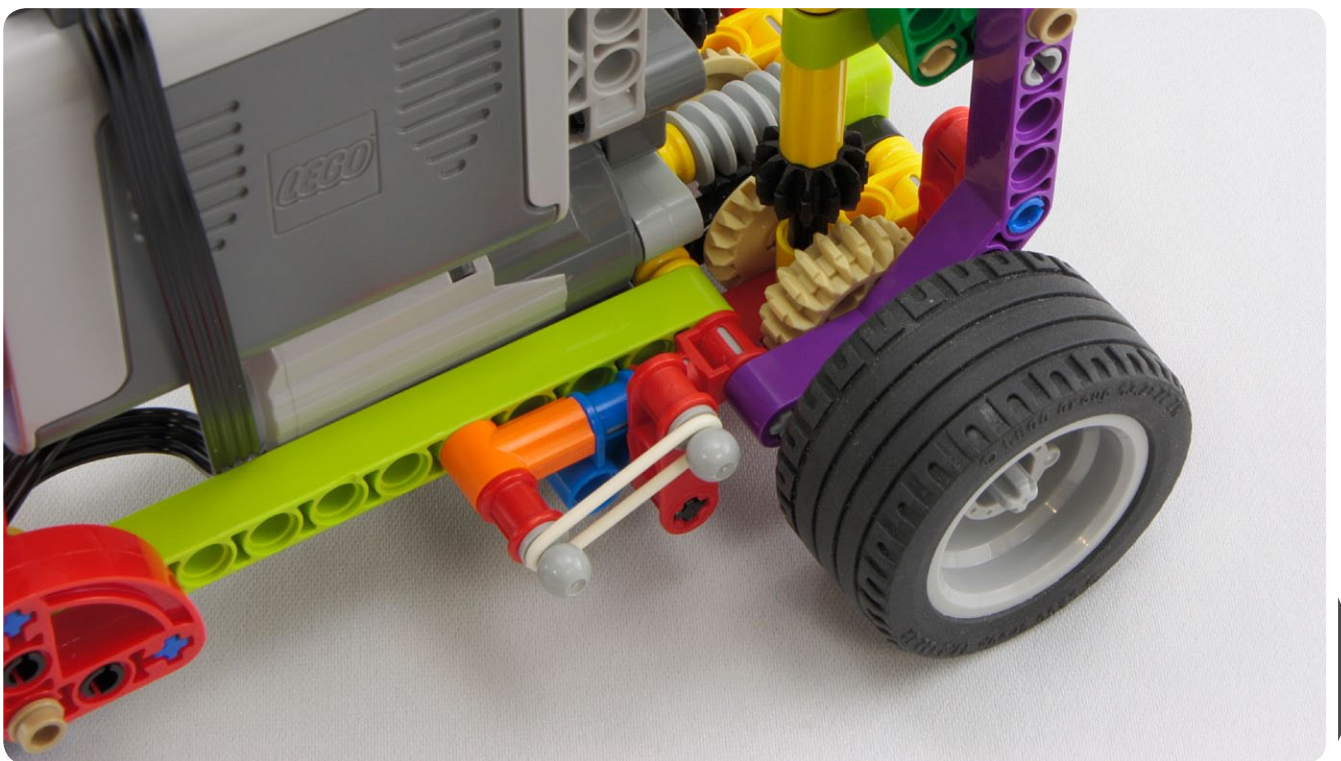
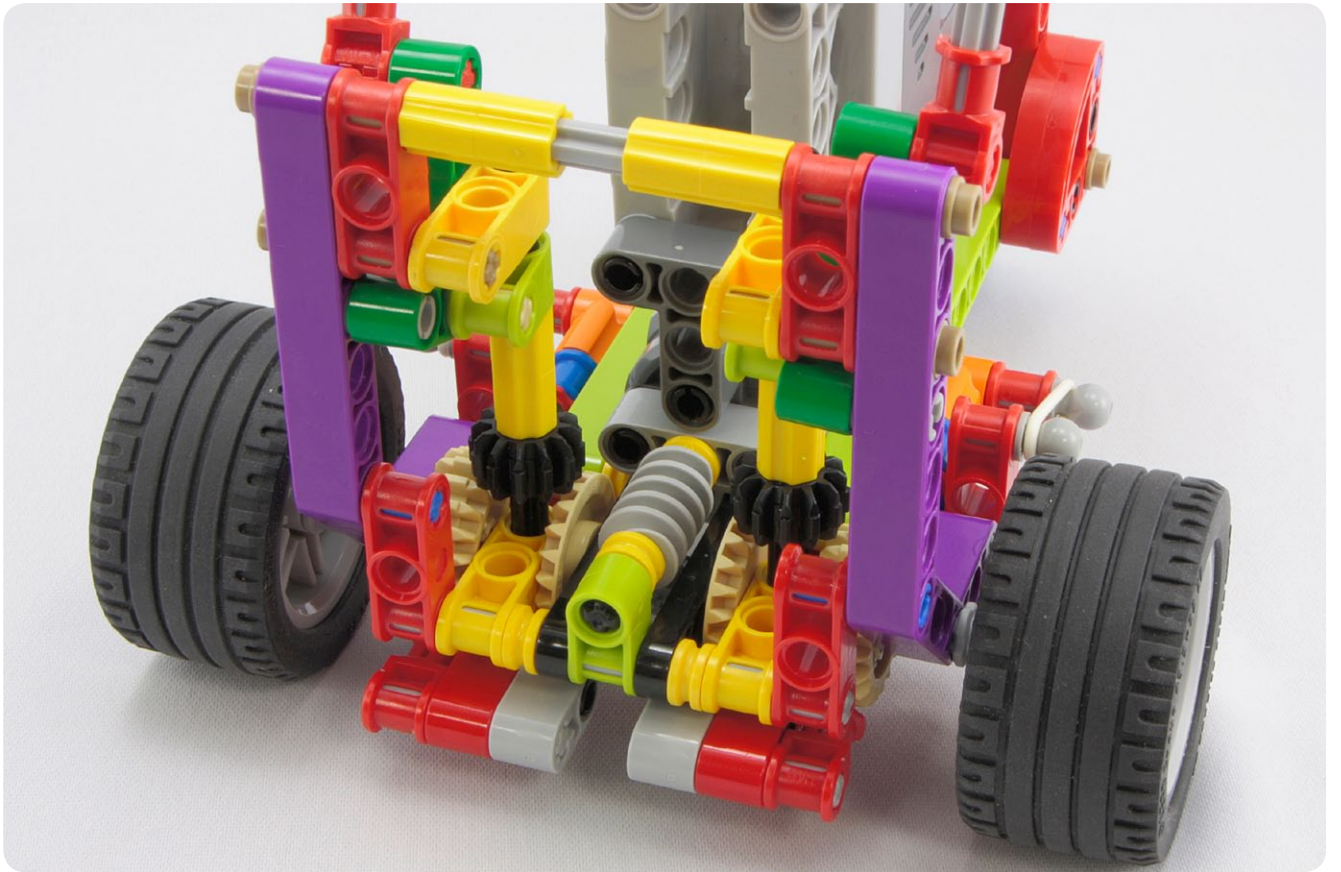


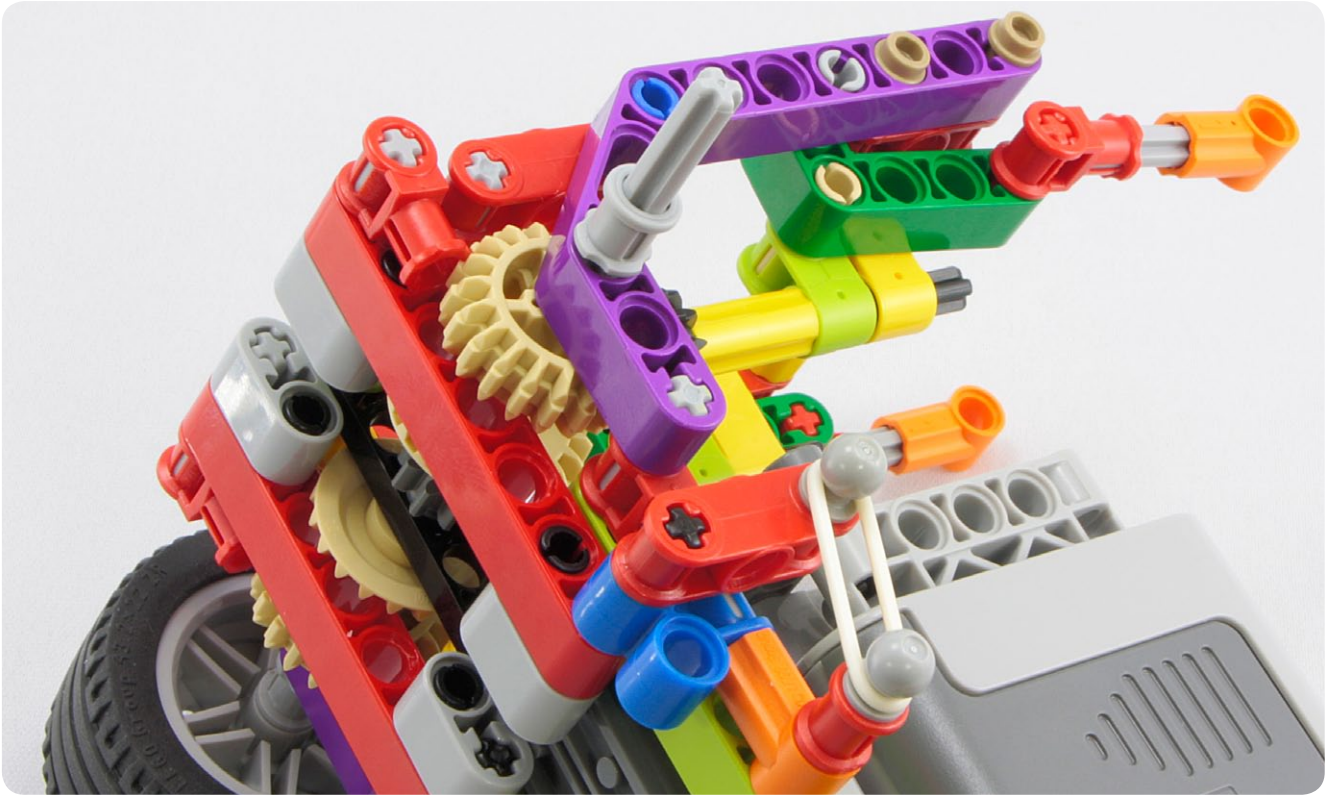


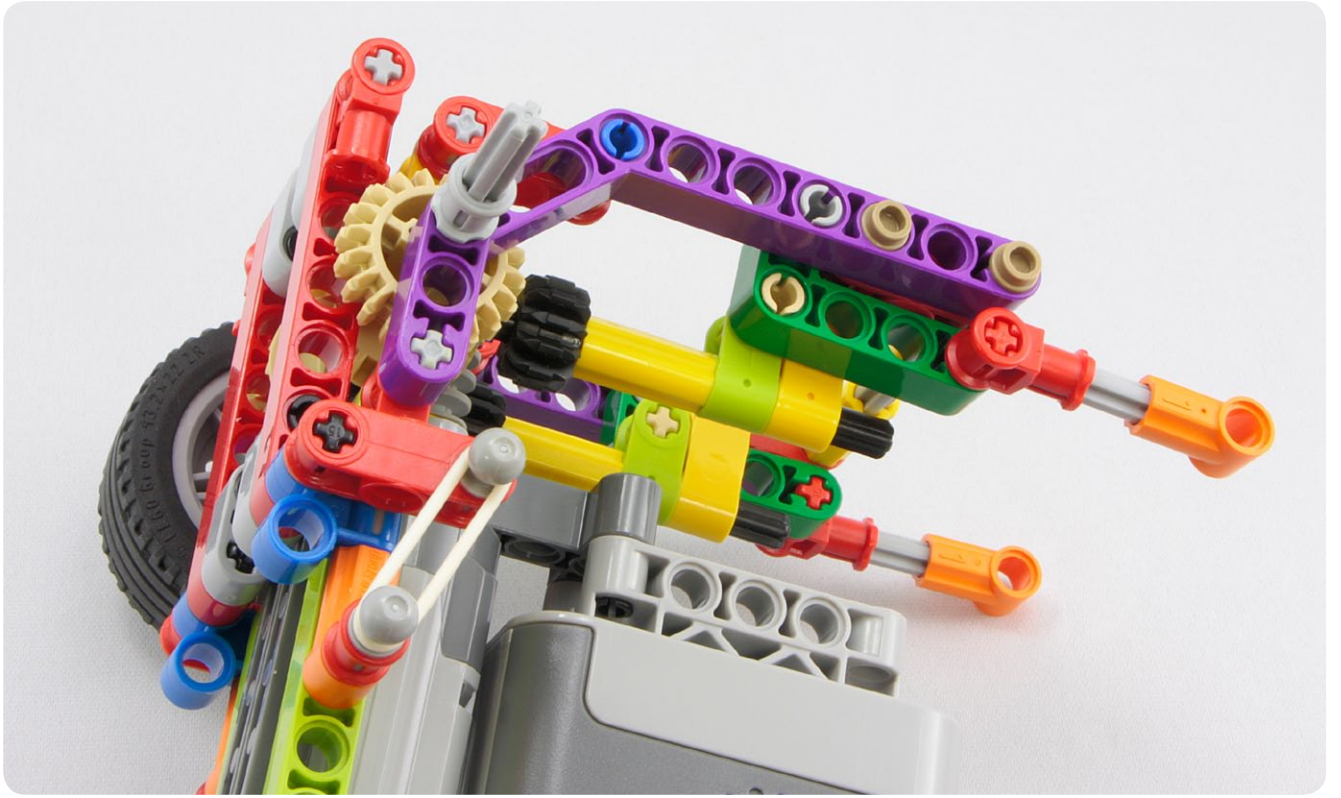


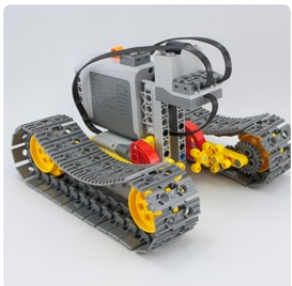












PART 2

Moving Without Tires



196



220



234



244



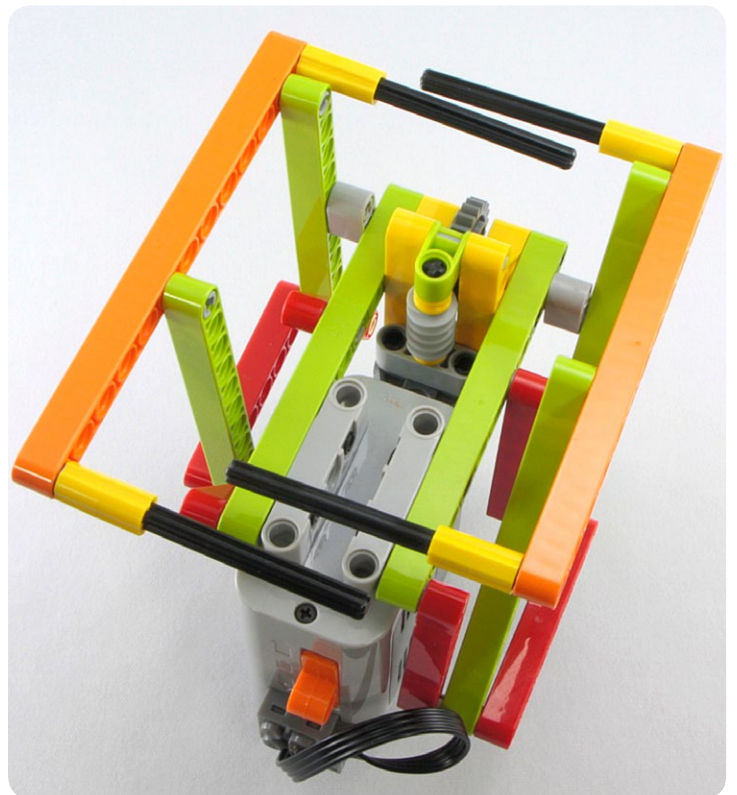
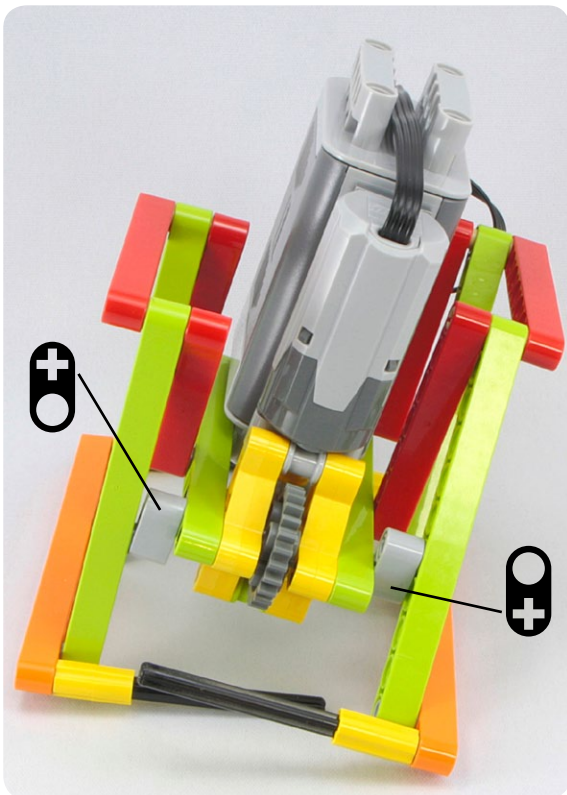
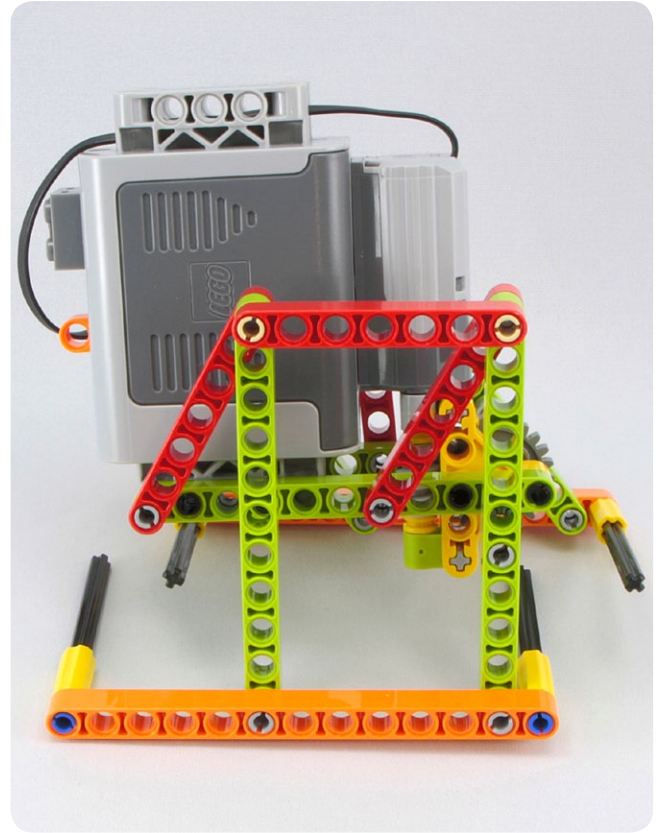
208



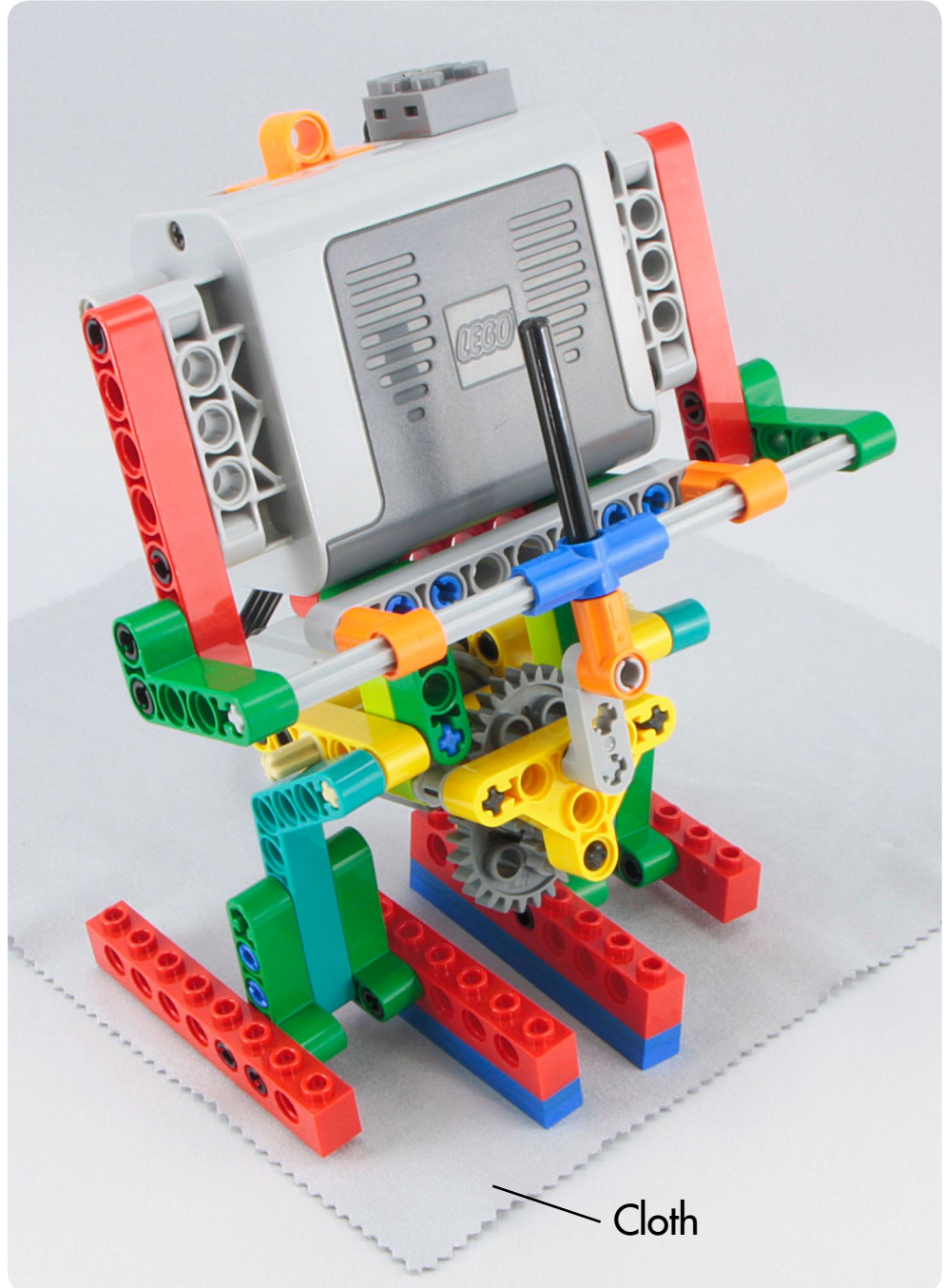
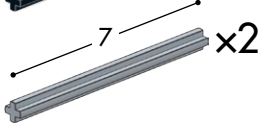
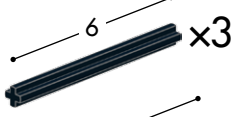
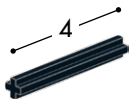
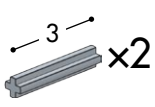
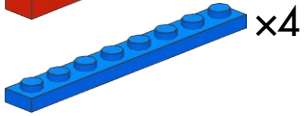
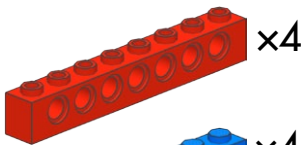
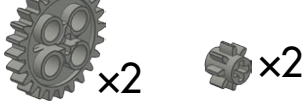
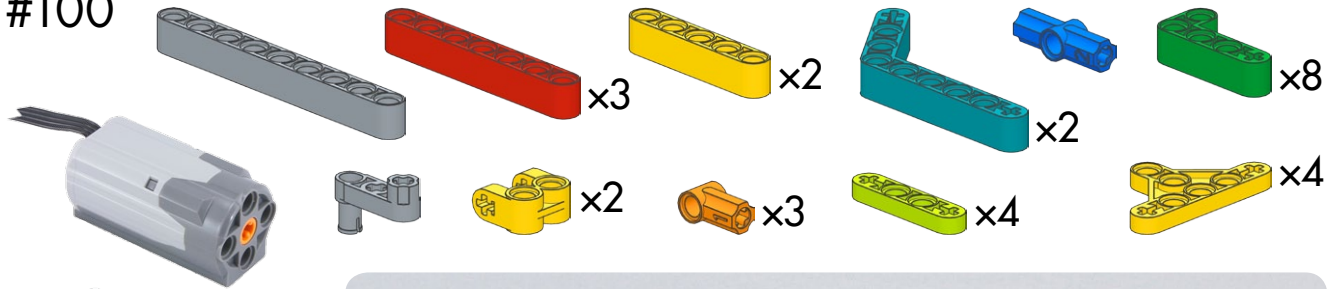
224



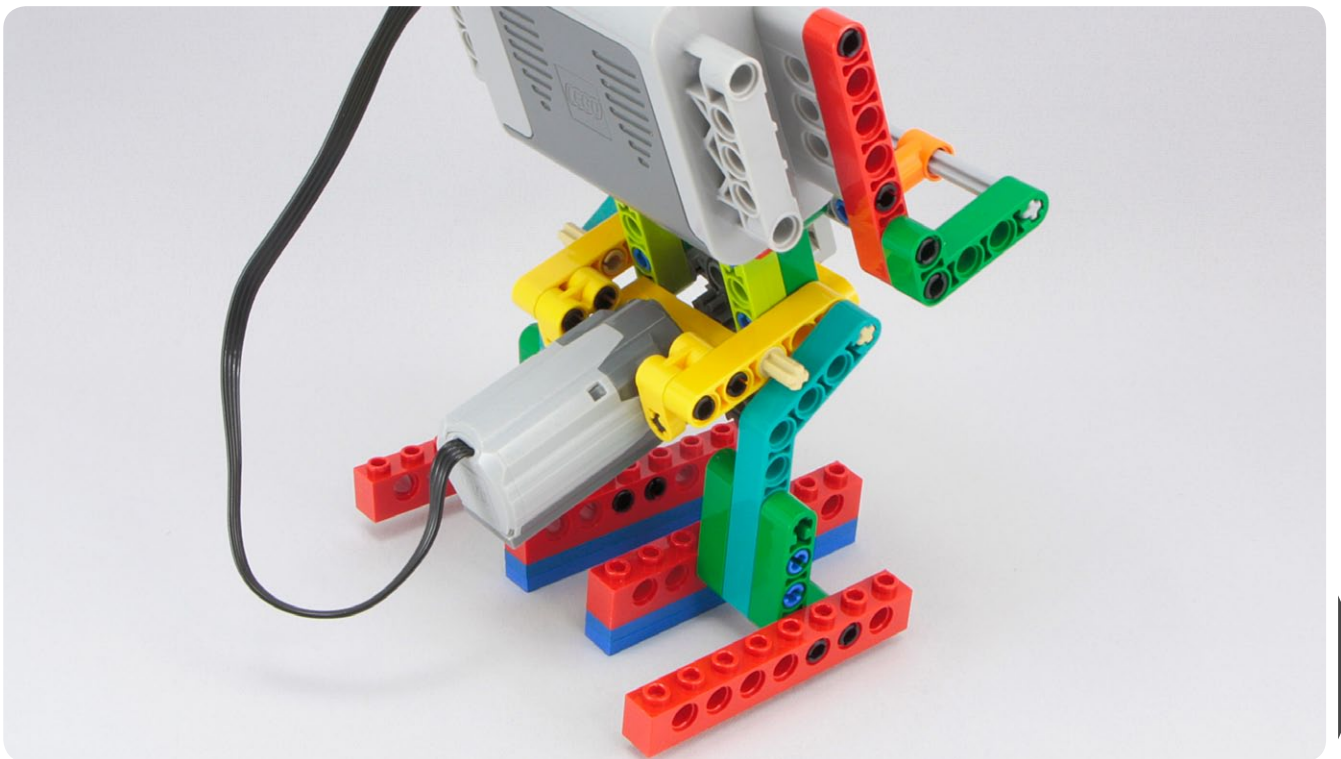
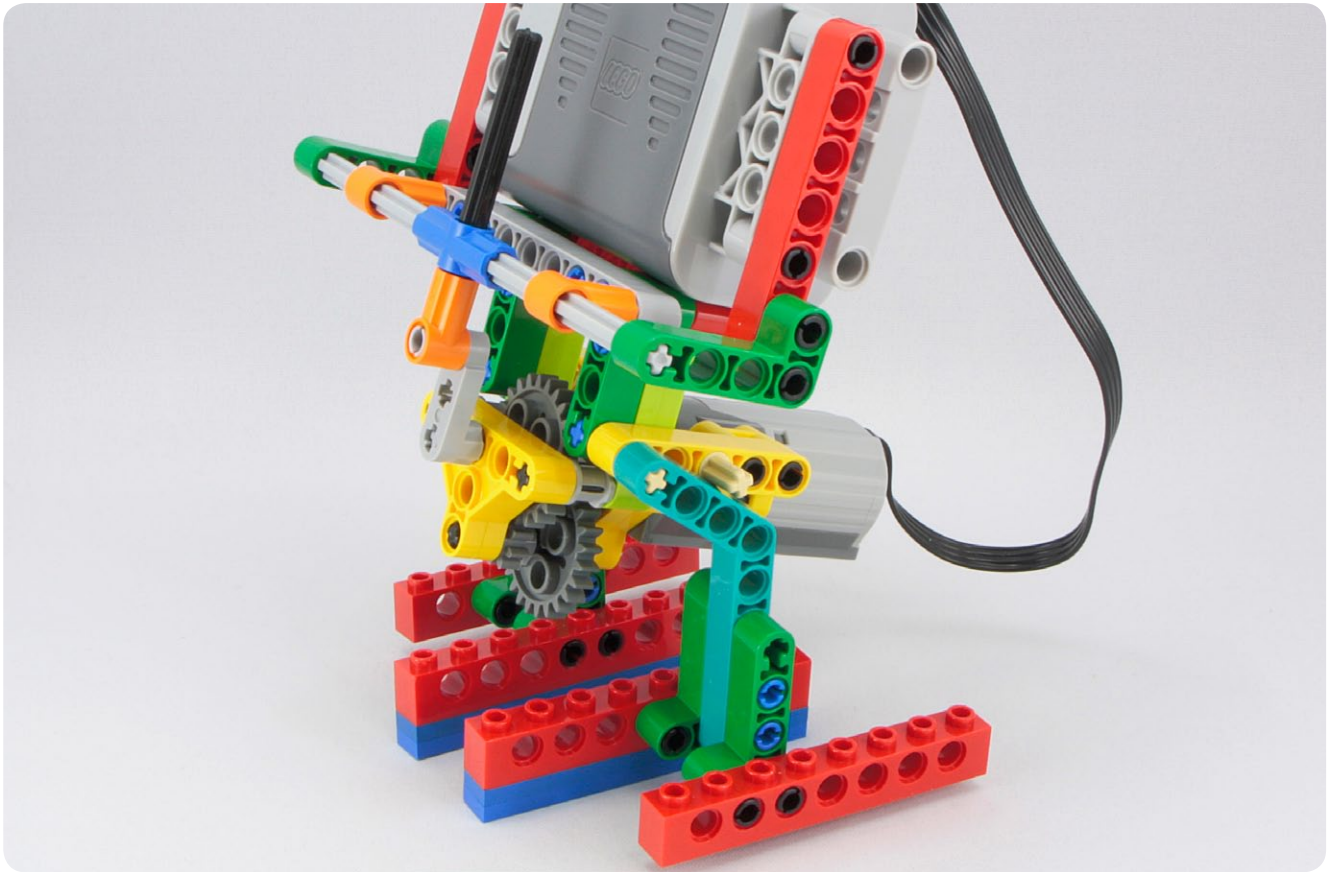
240

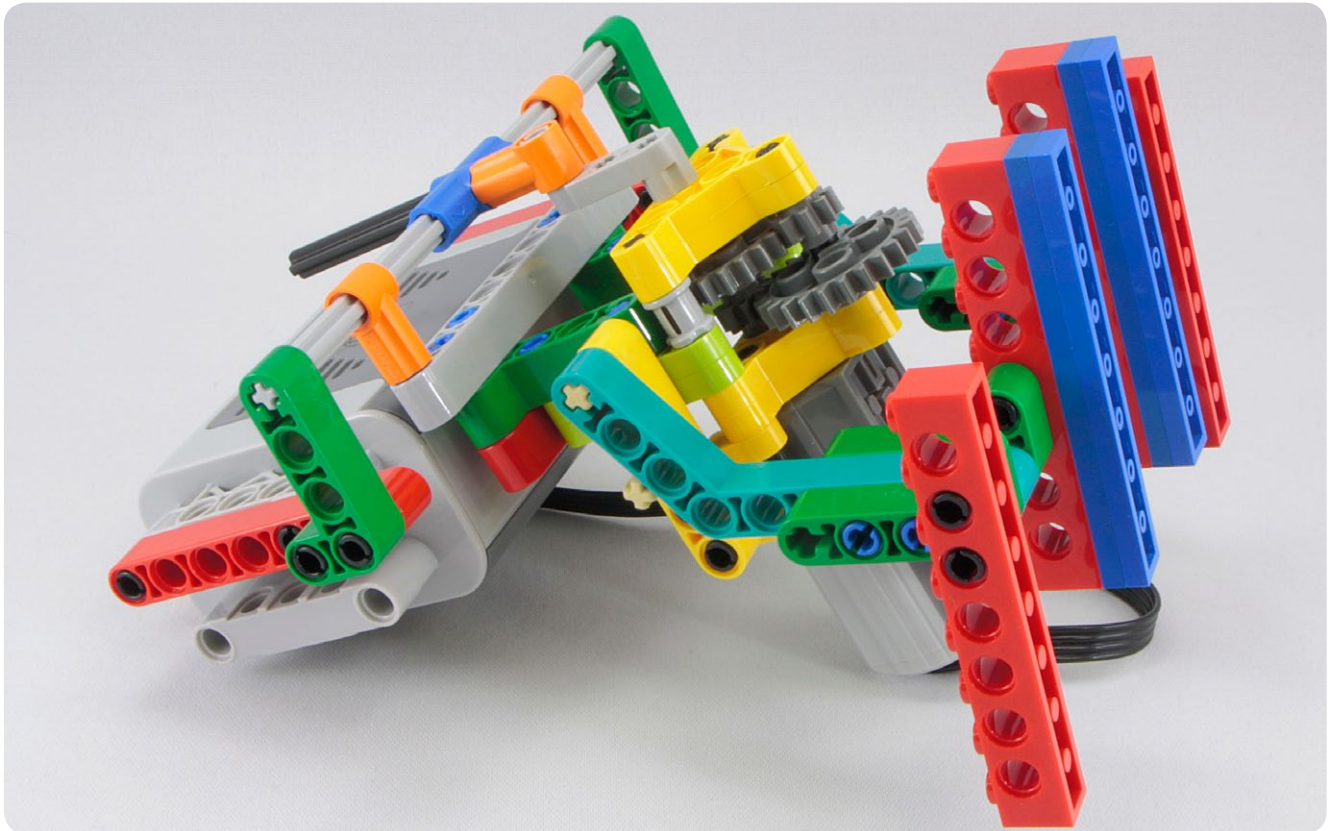
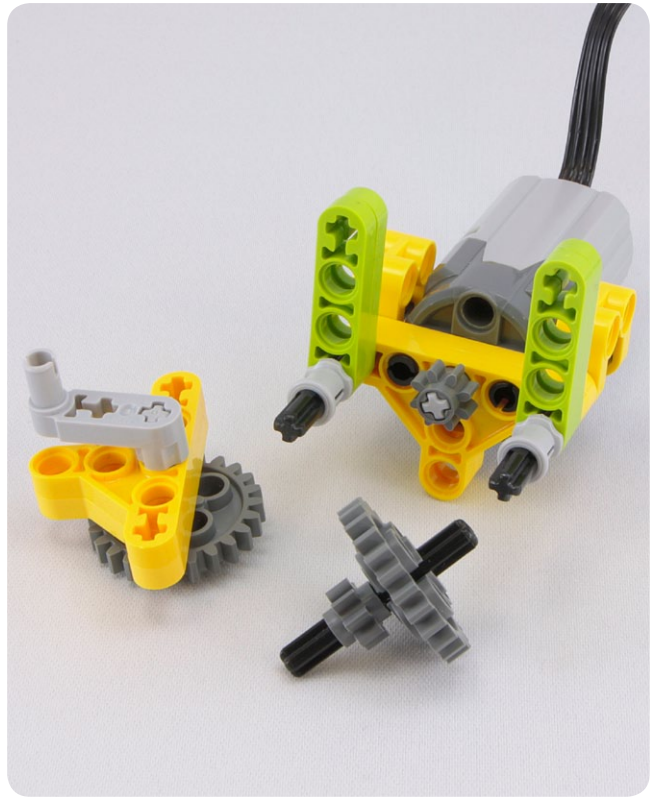
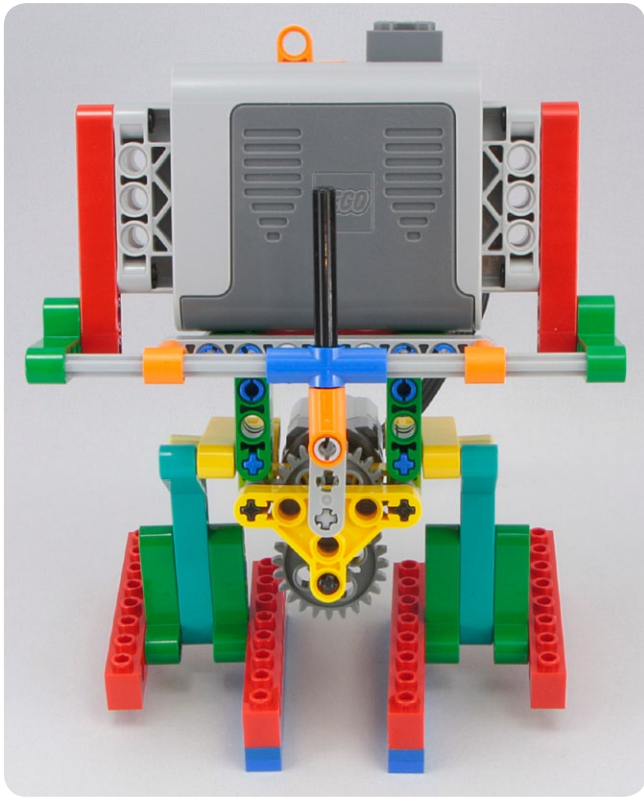


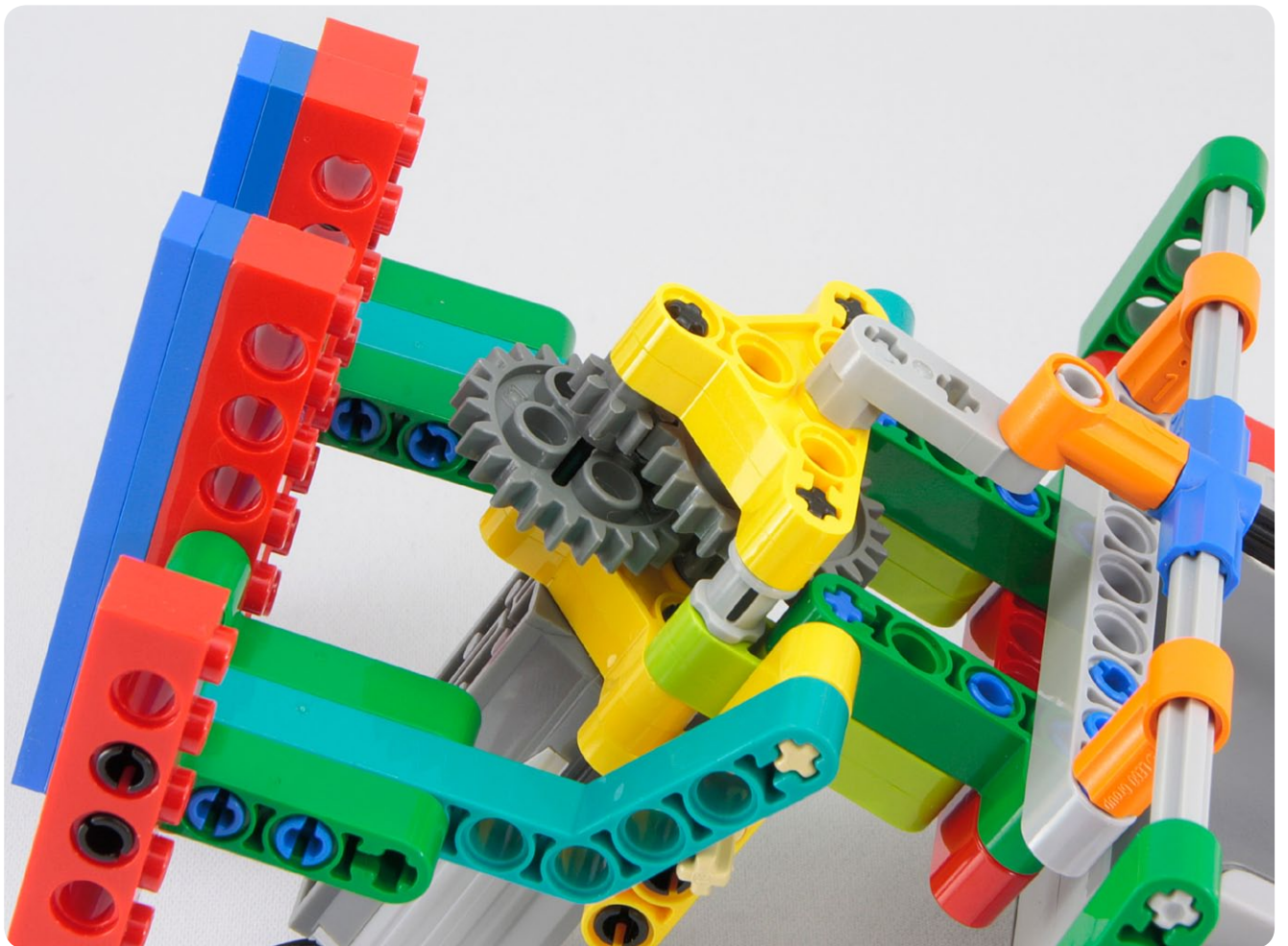
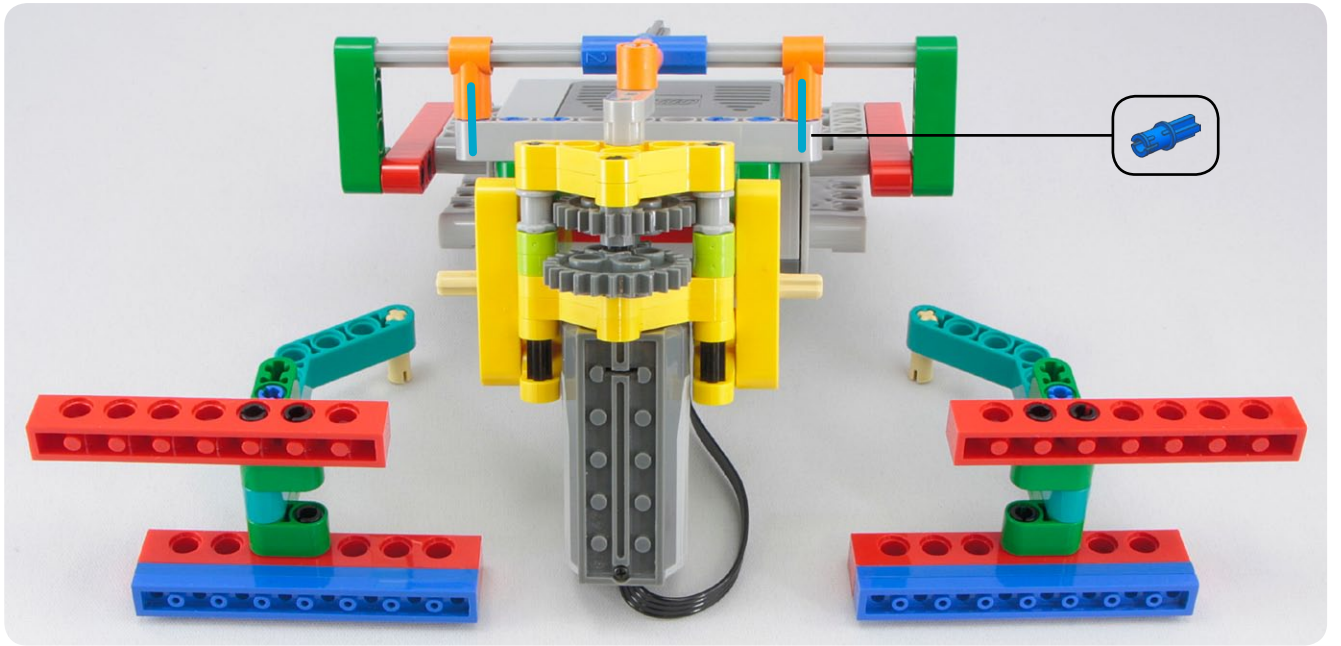
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Cloth

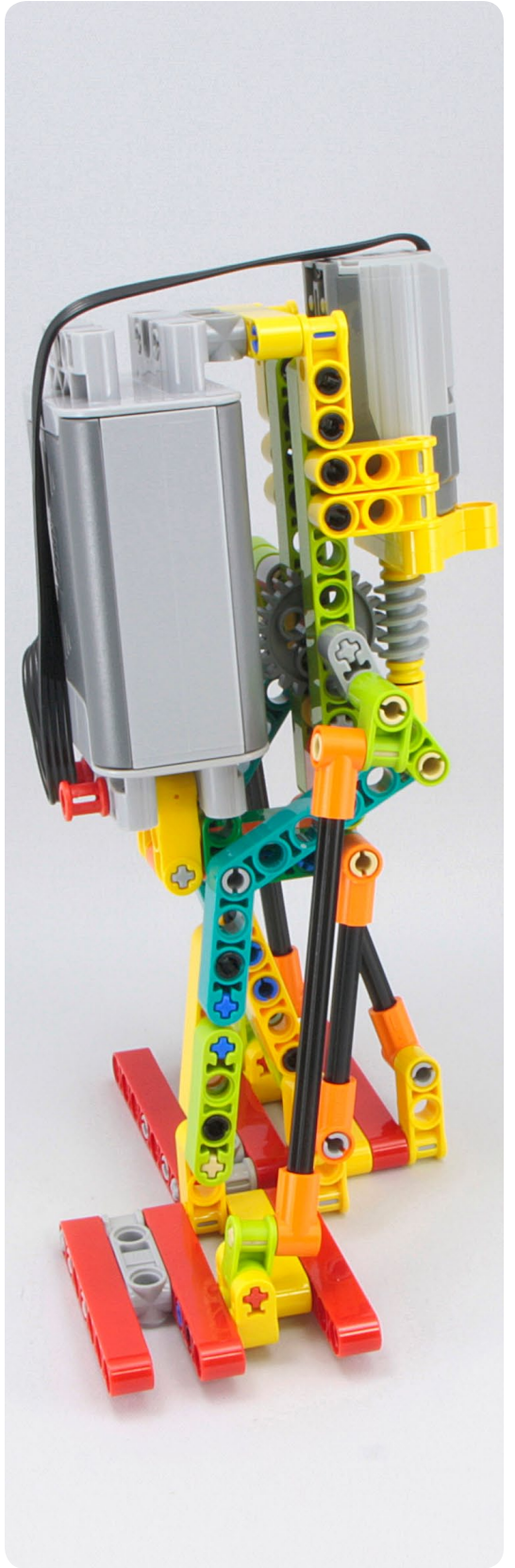
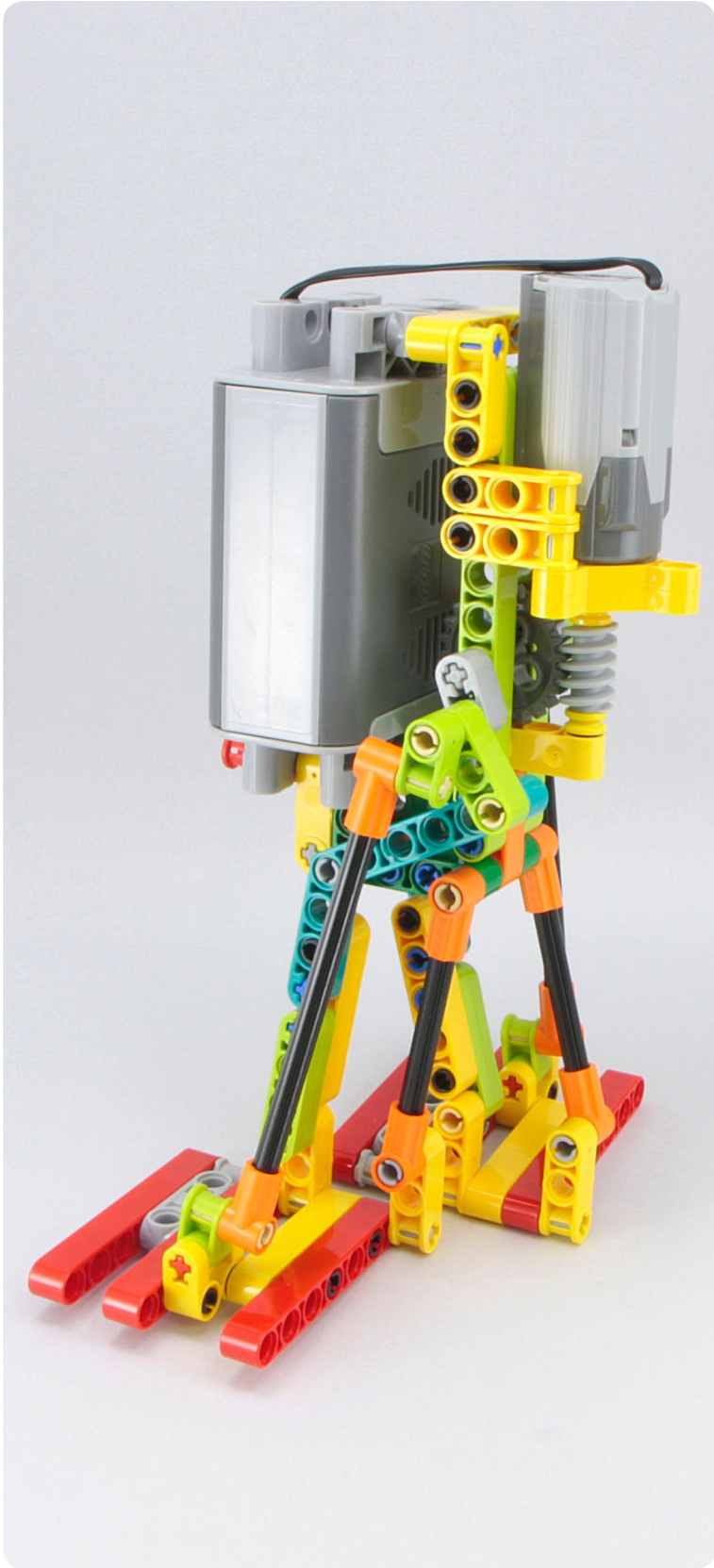


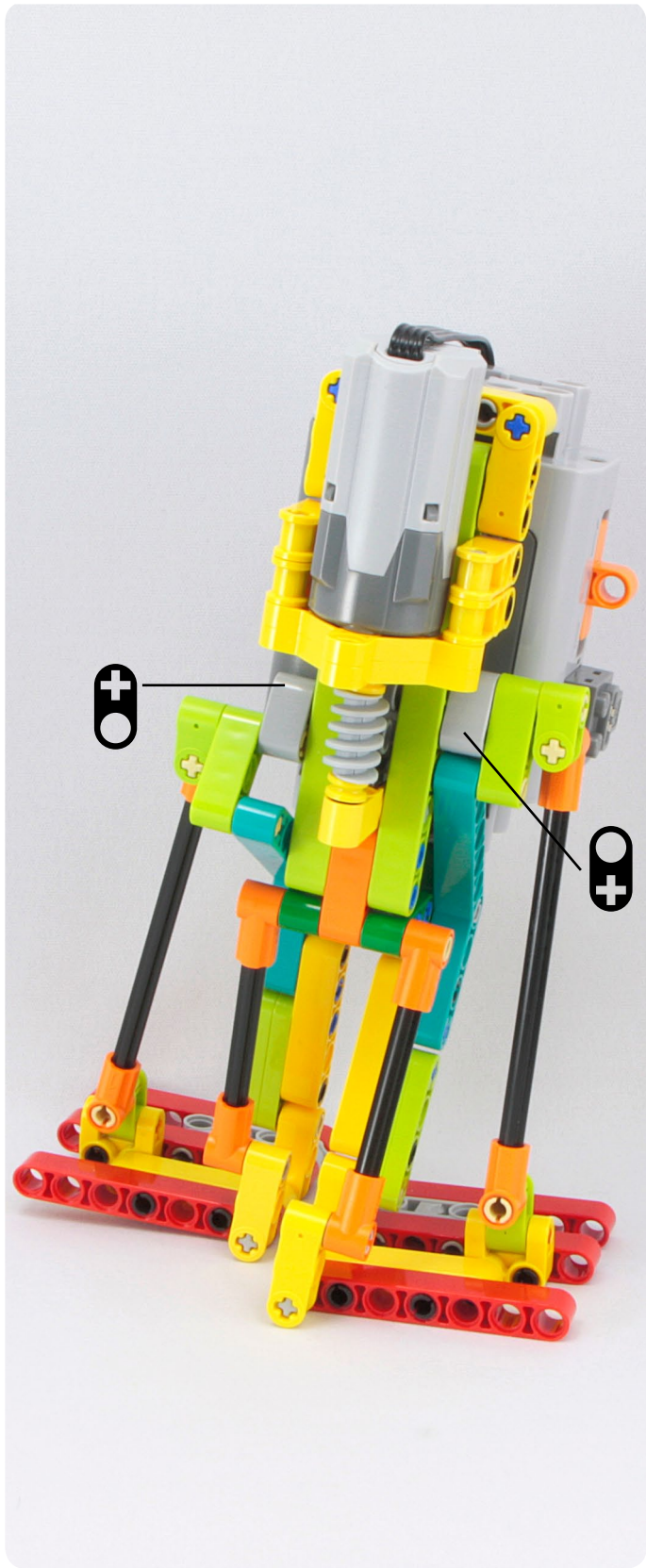


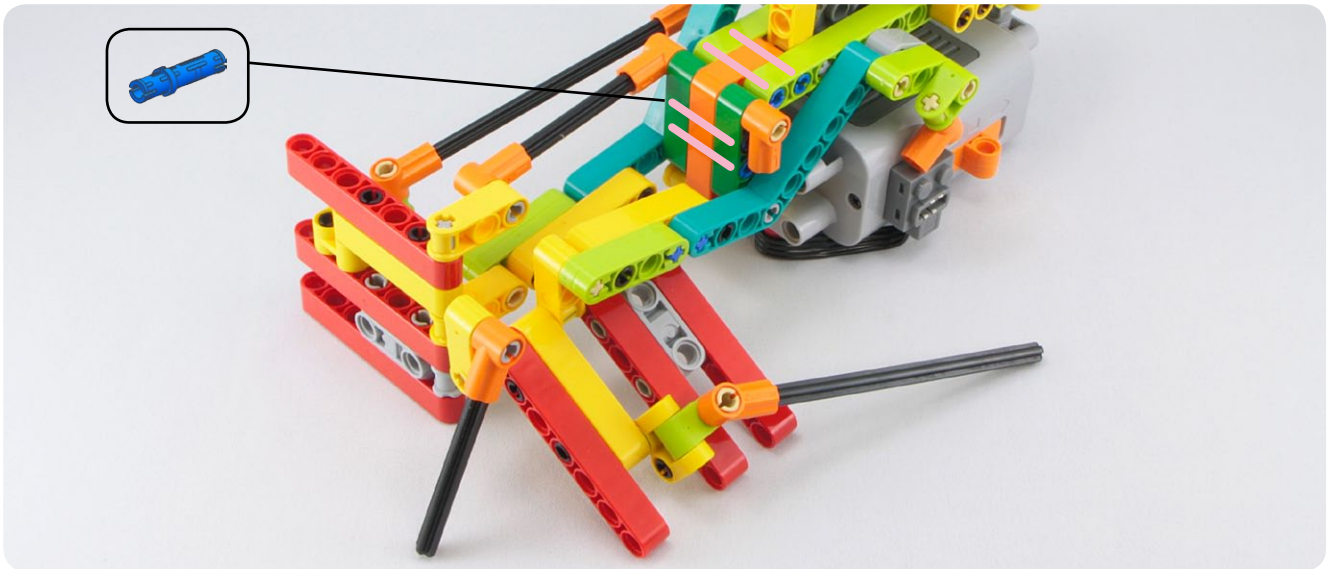
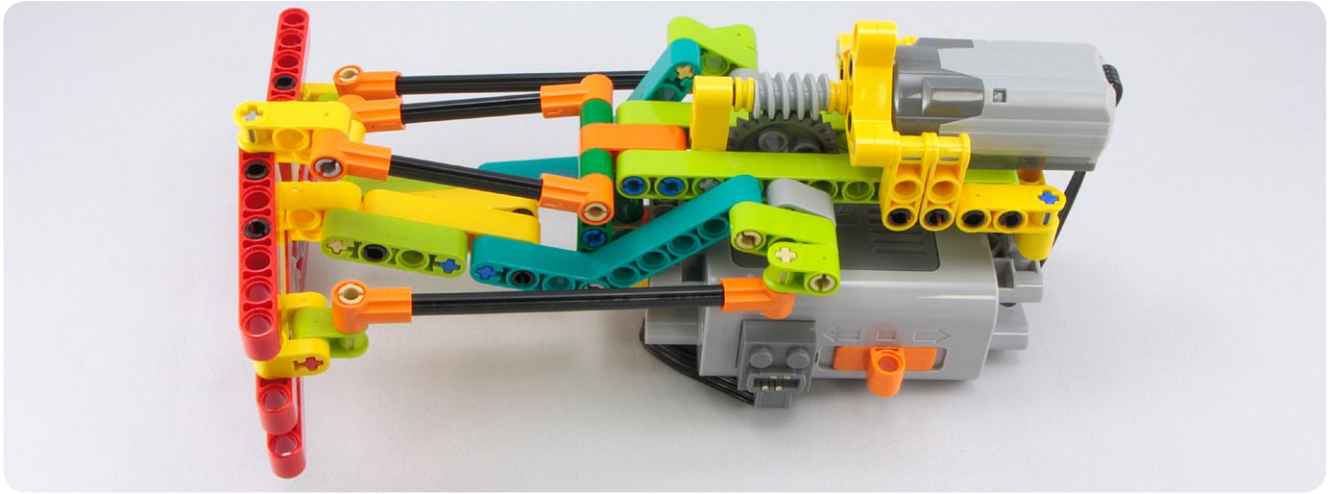


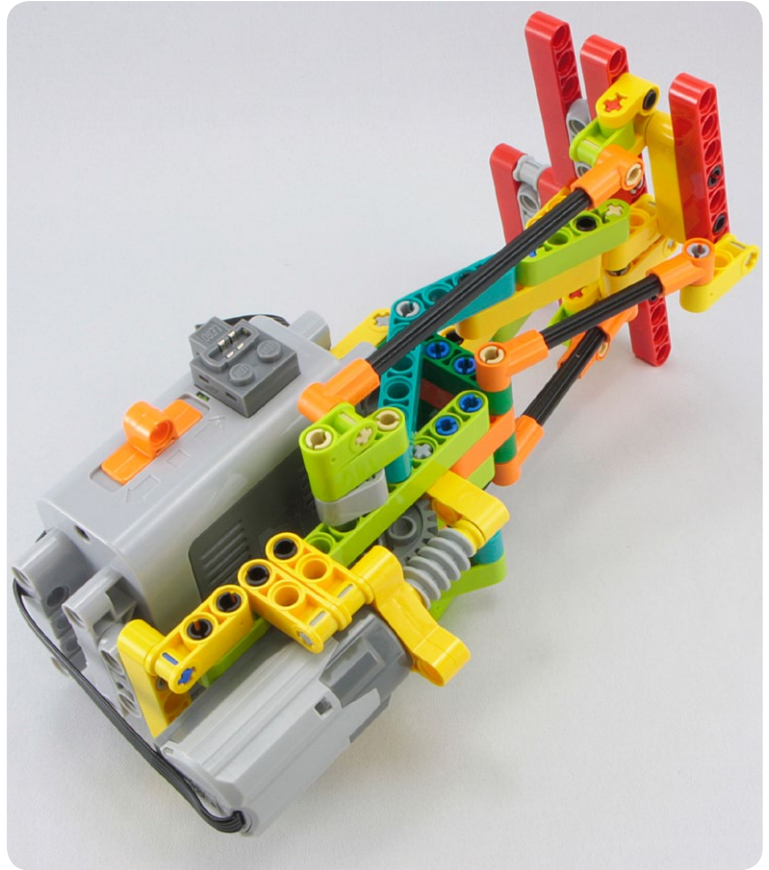
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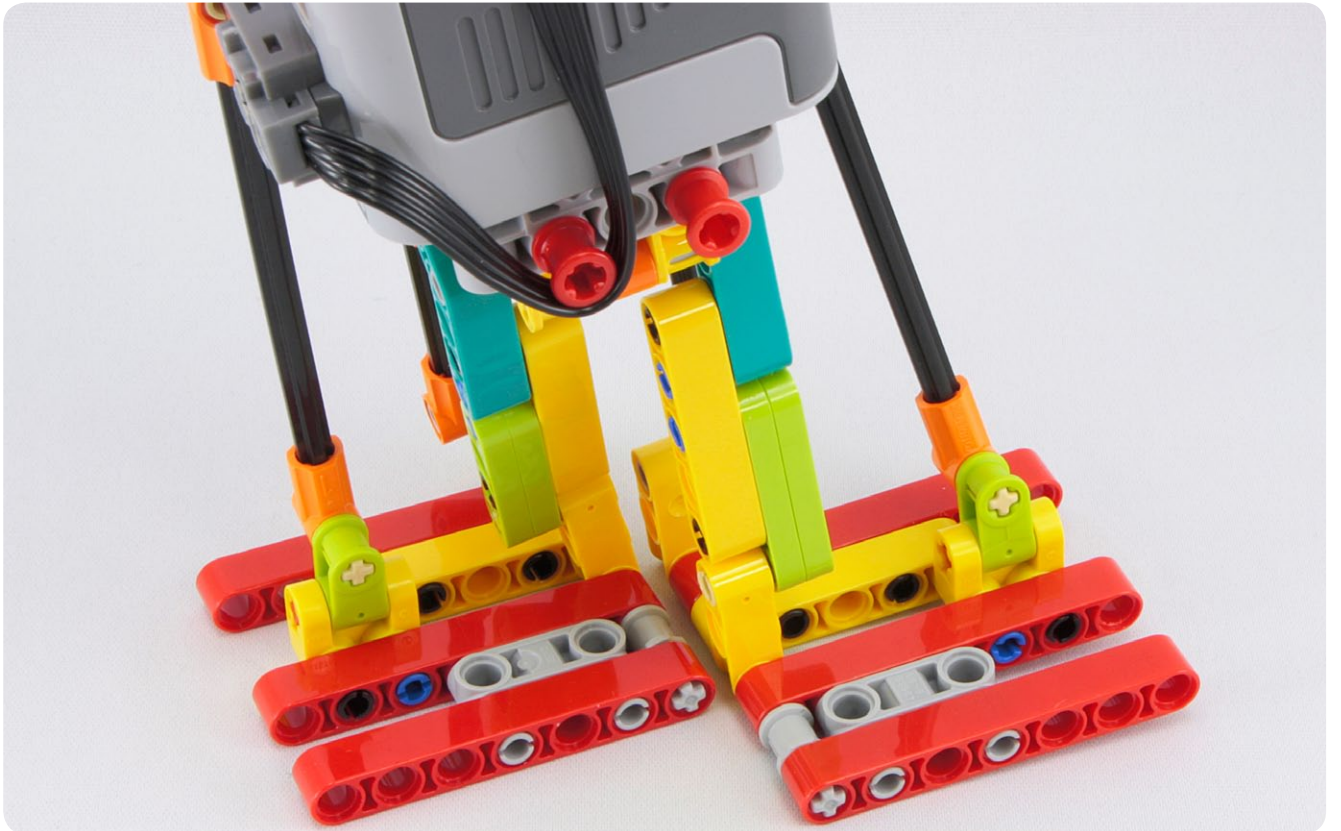


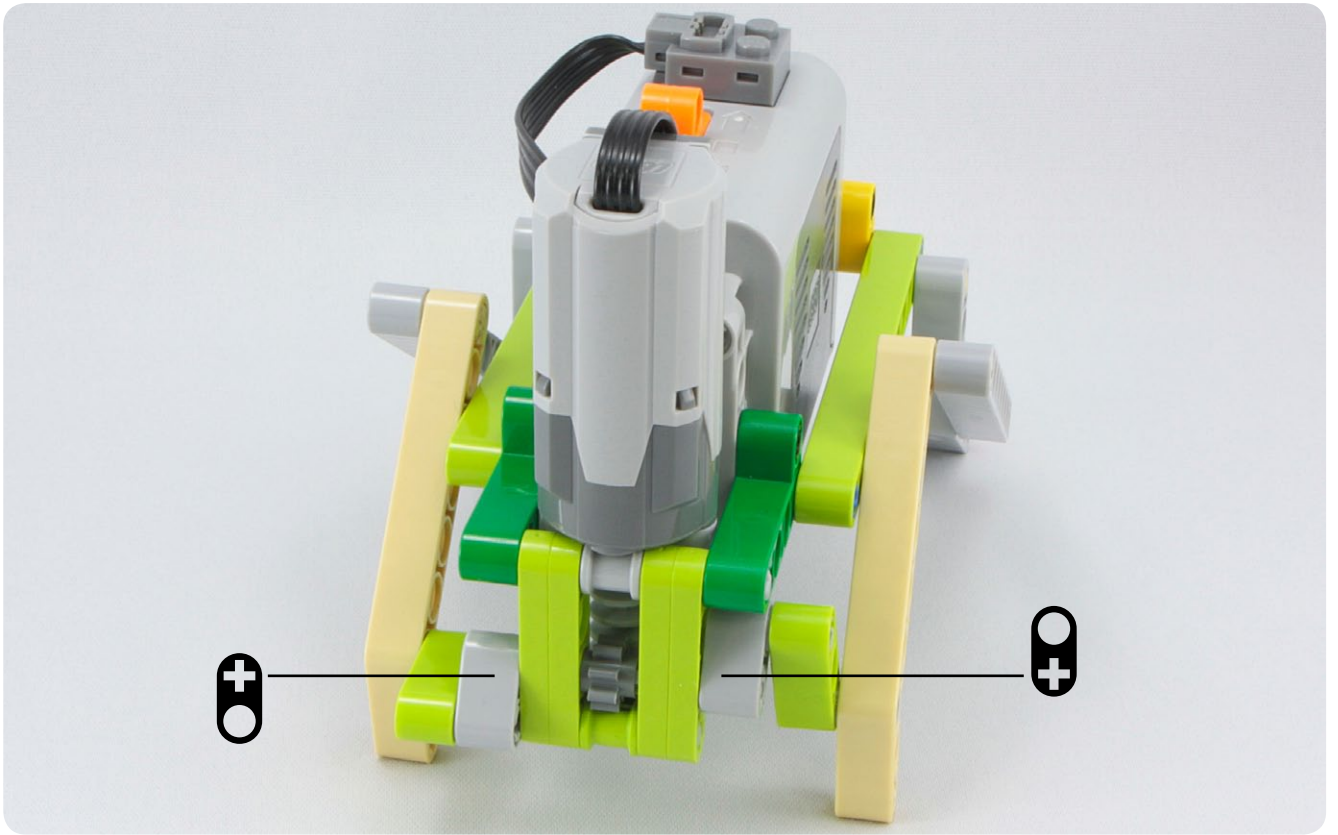








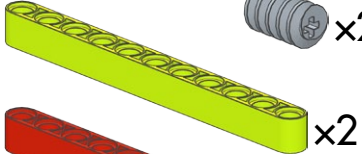
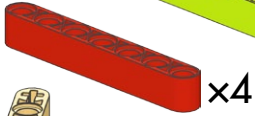
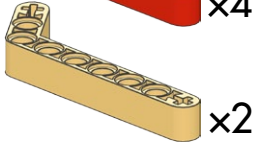

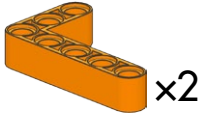
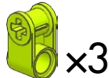
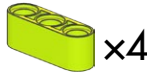
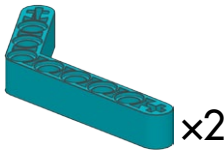
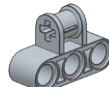

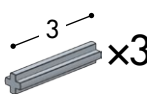
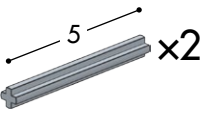
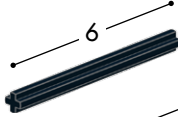
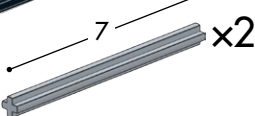






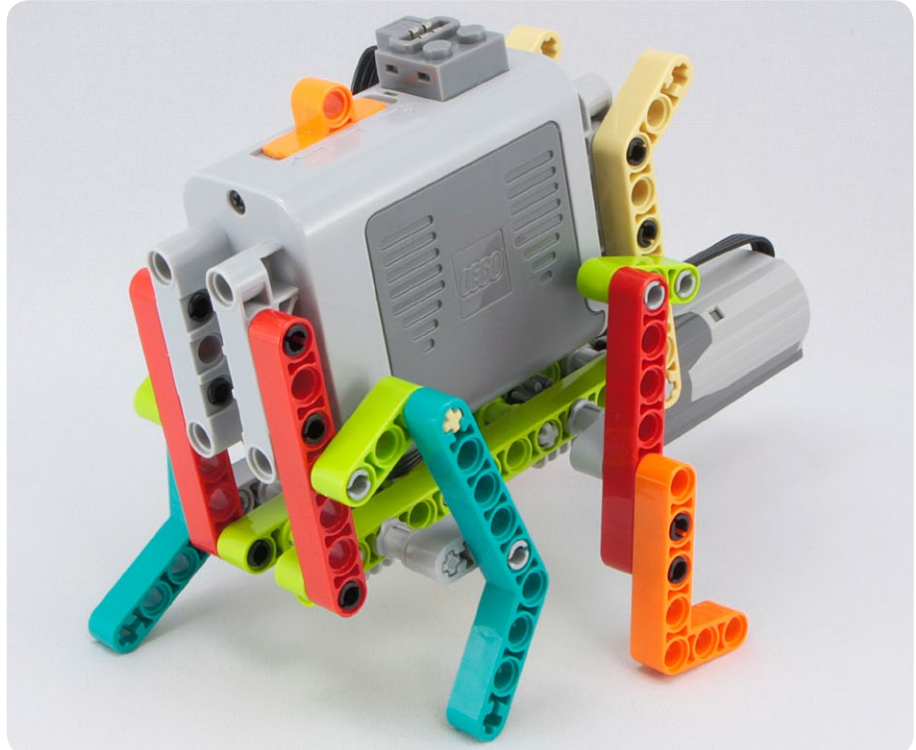
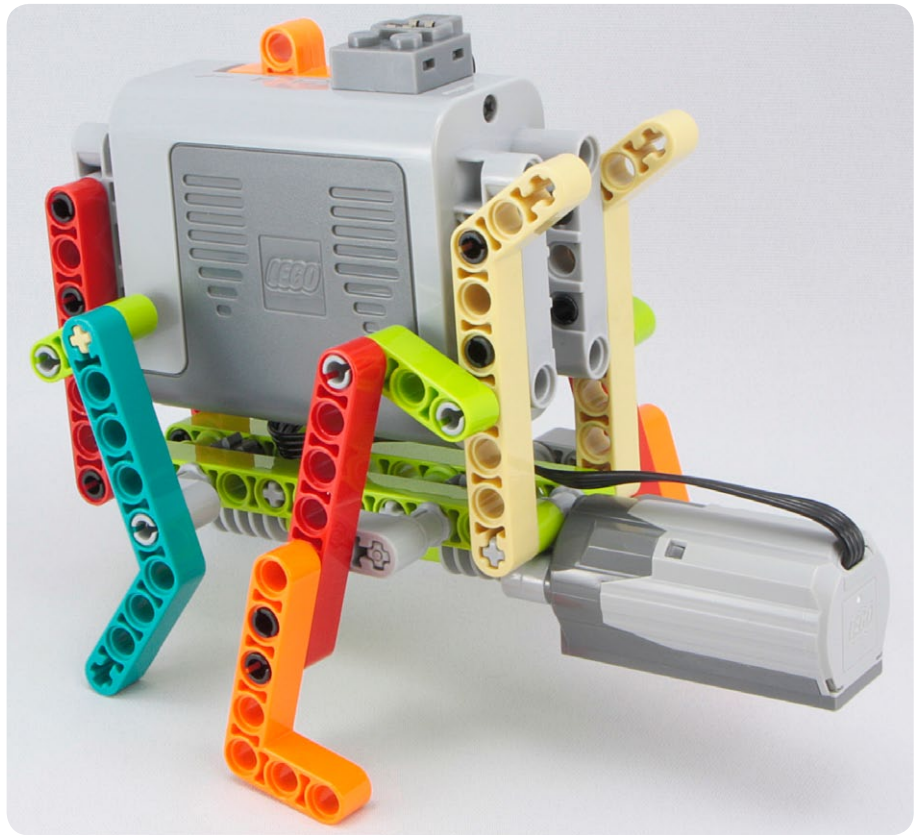


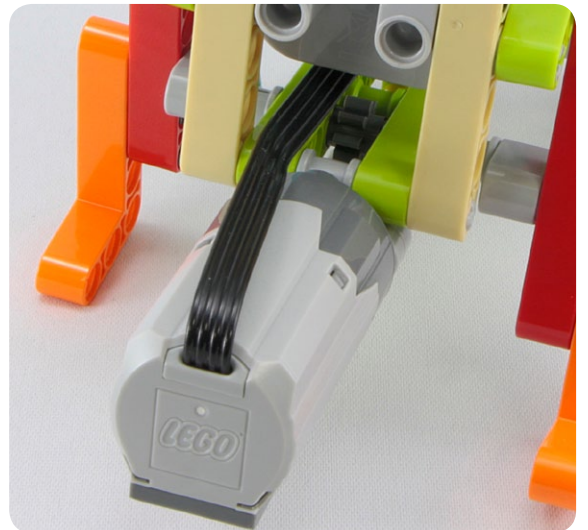
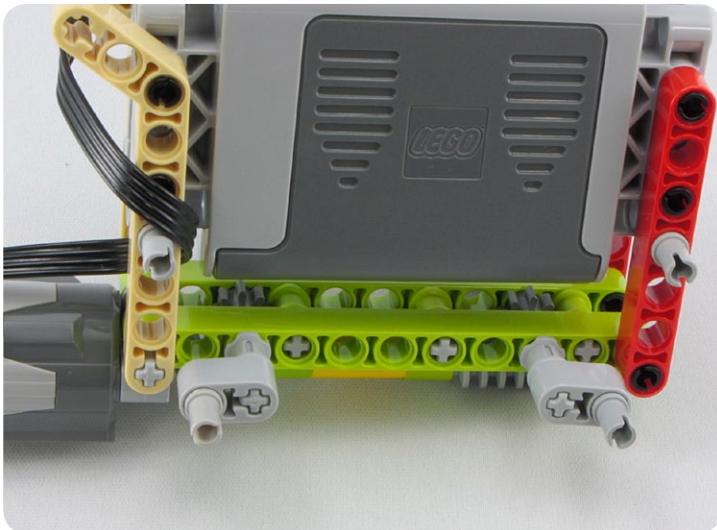
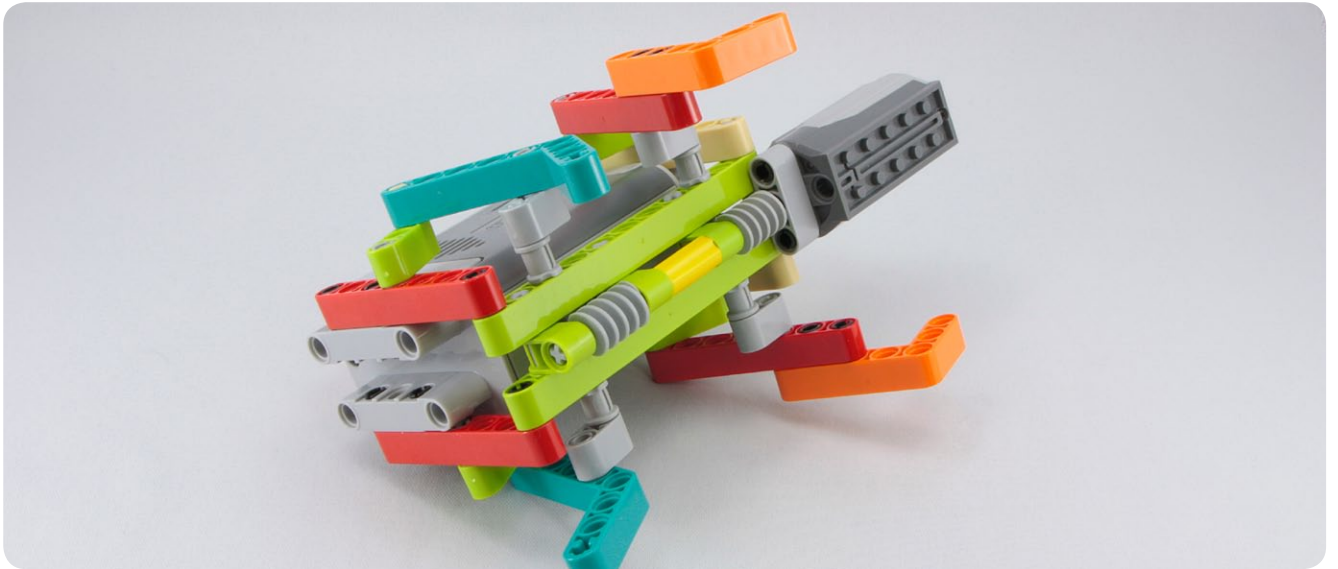
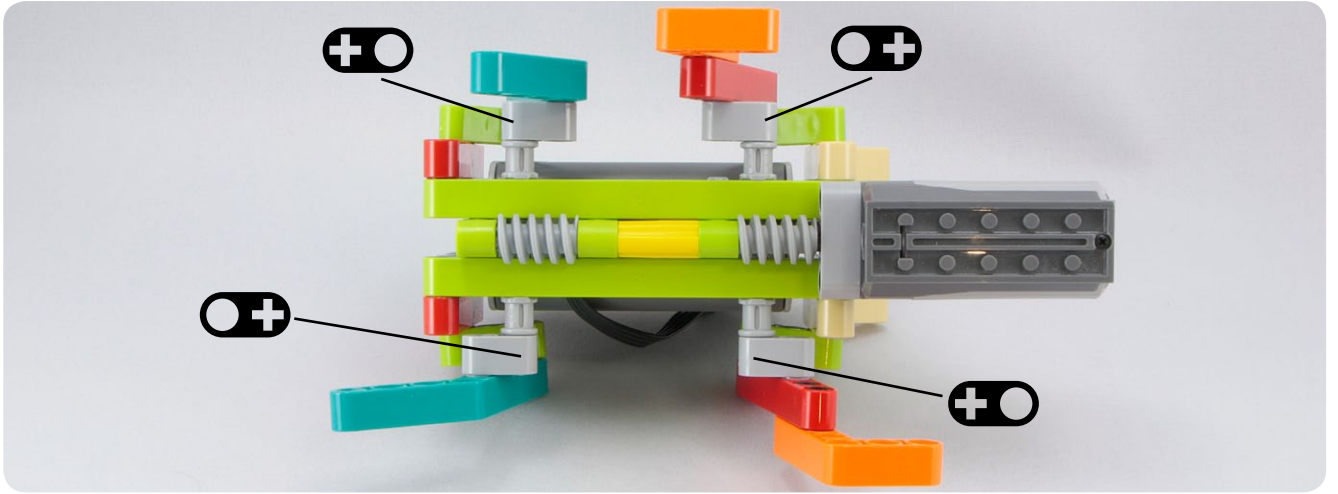




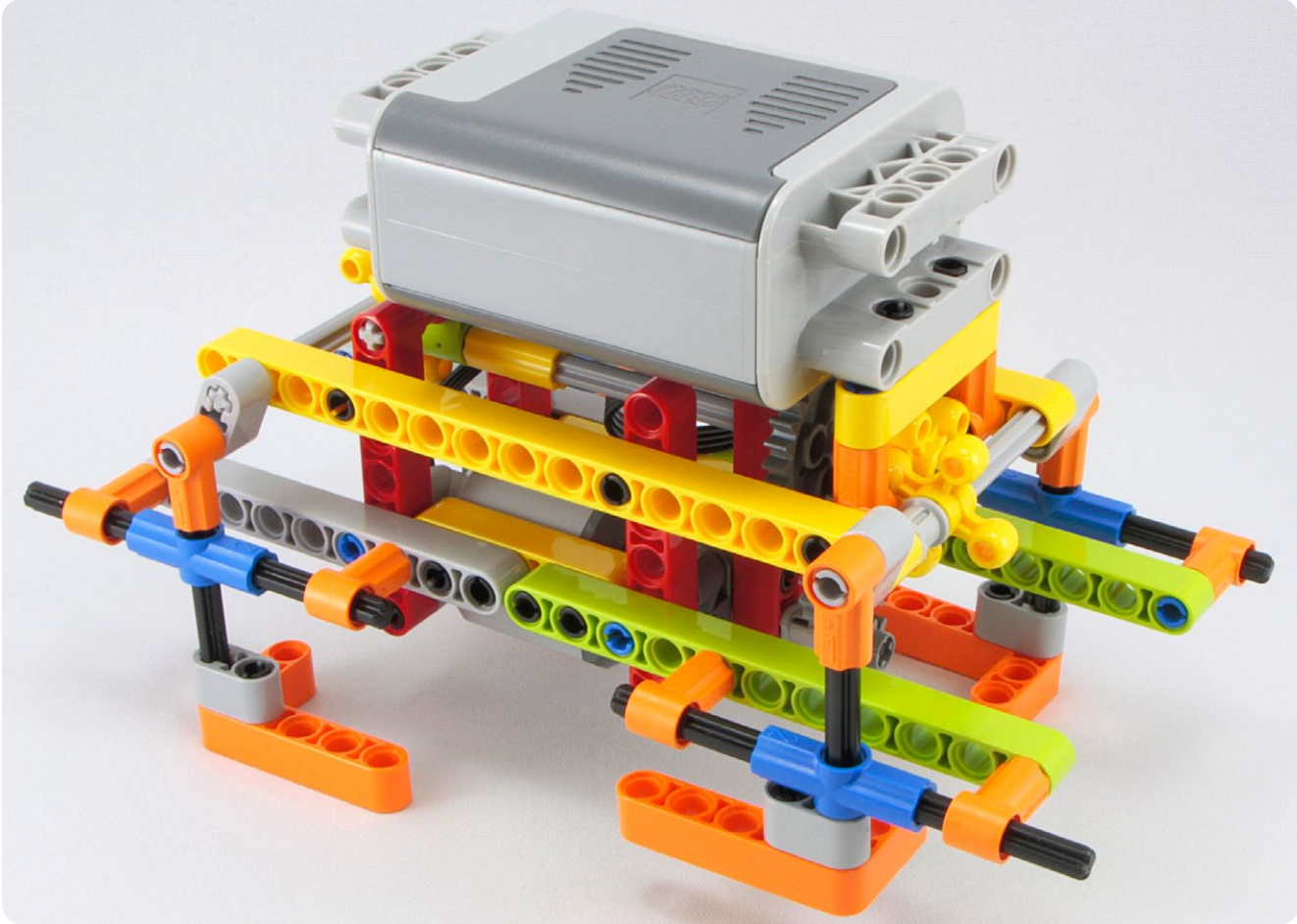
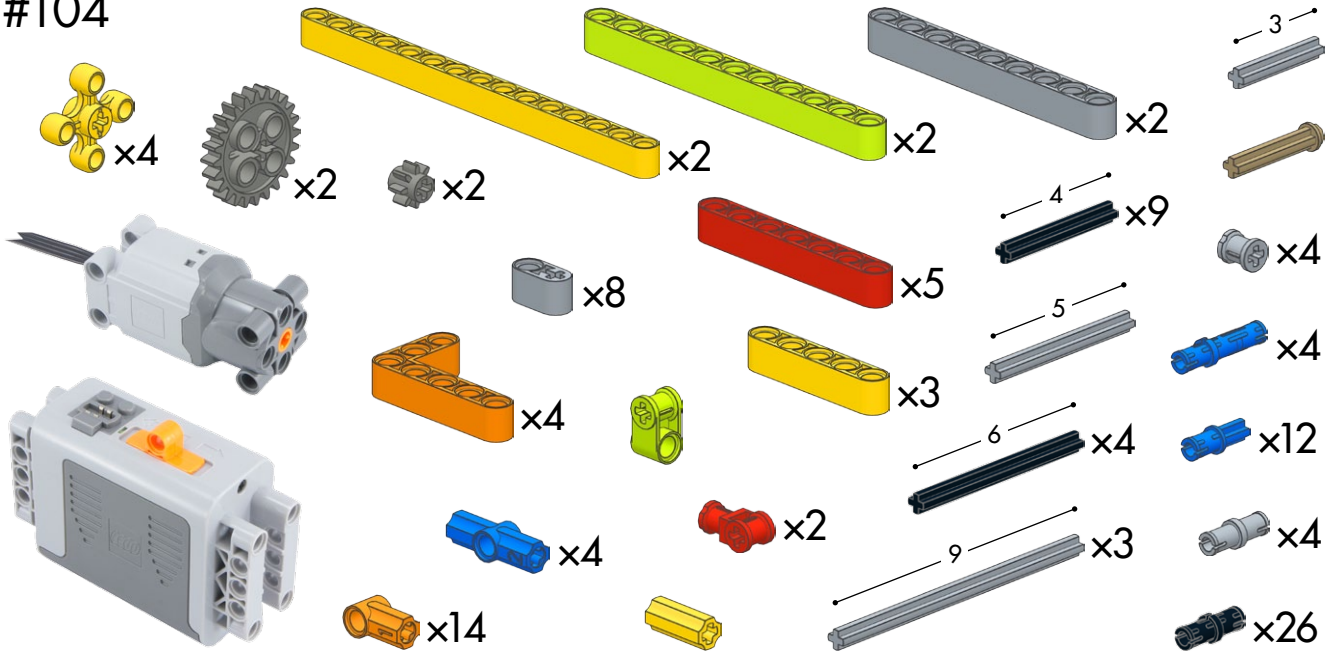
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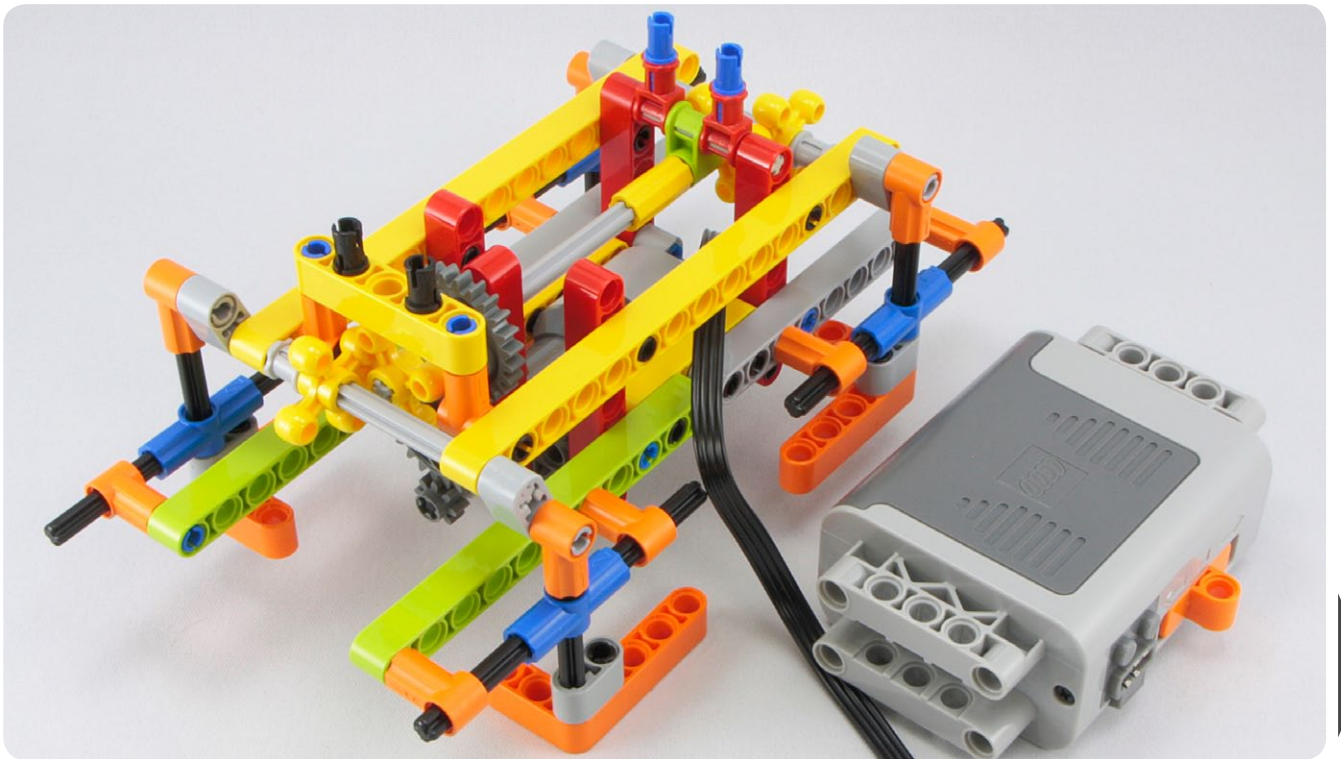
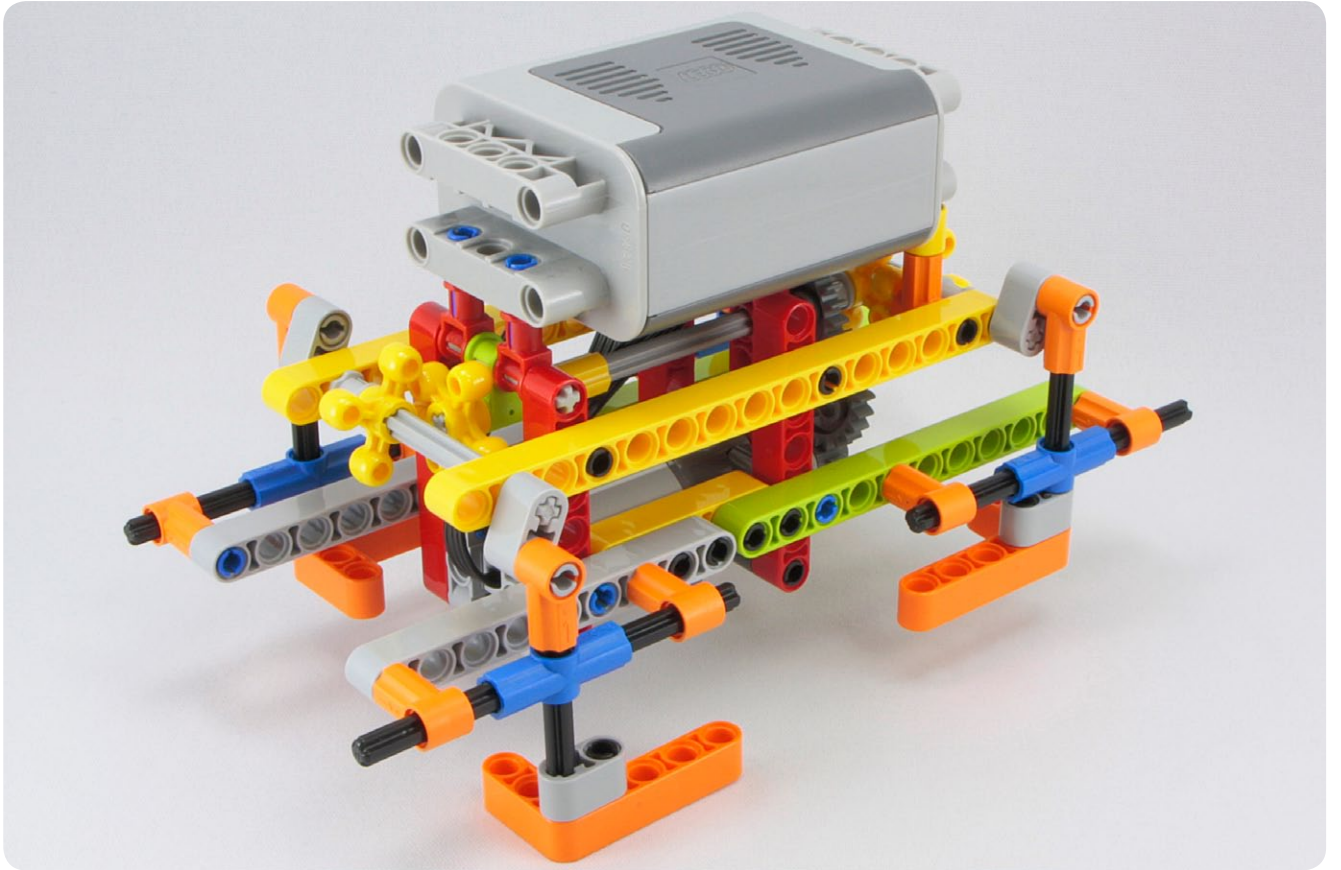
- 
- 
-  x2
-  x2
-  x2
-  x4
-  x2
-  x4
-  x2
-  x3
-  x4
-  x2
-  x2
- 
-  x3
-  x2
-  x2
-  x2
-  x4
-  x2
-  x10
-  x16

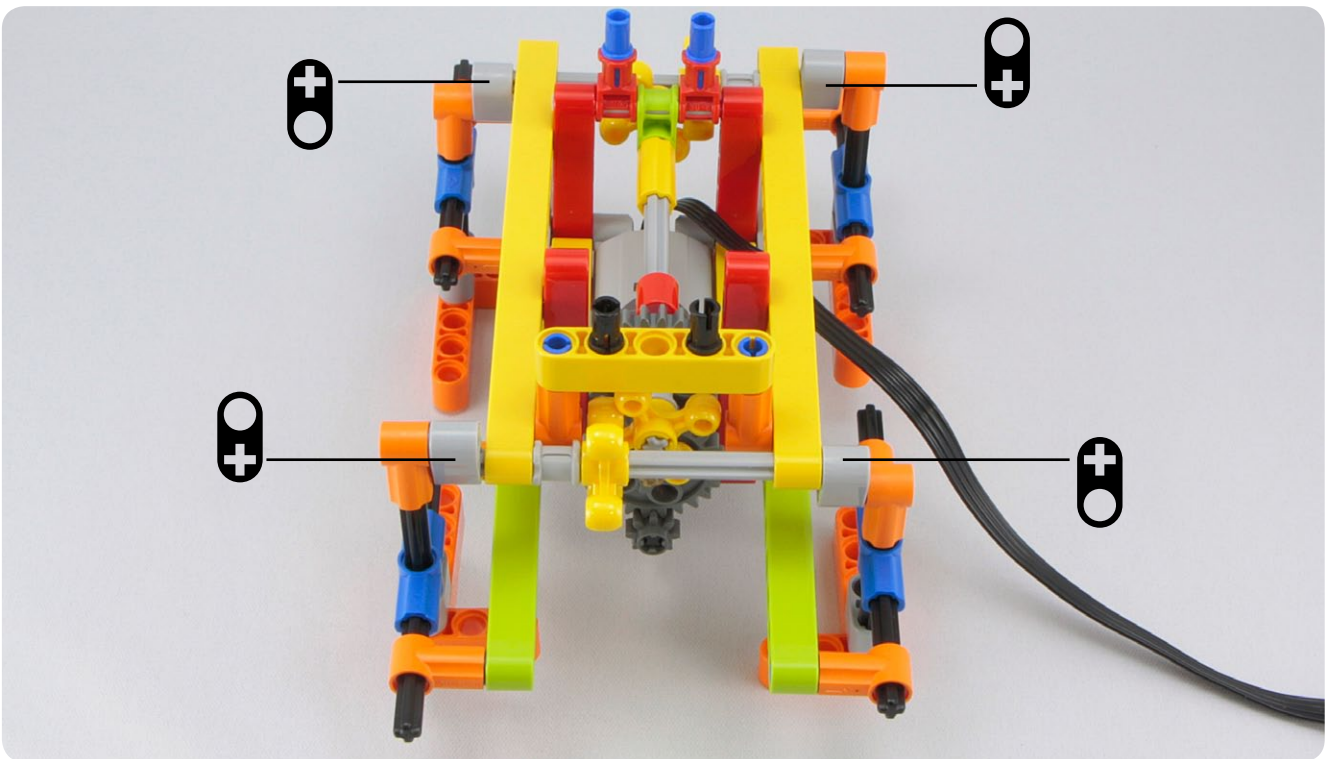
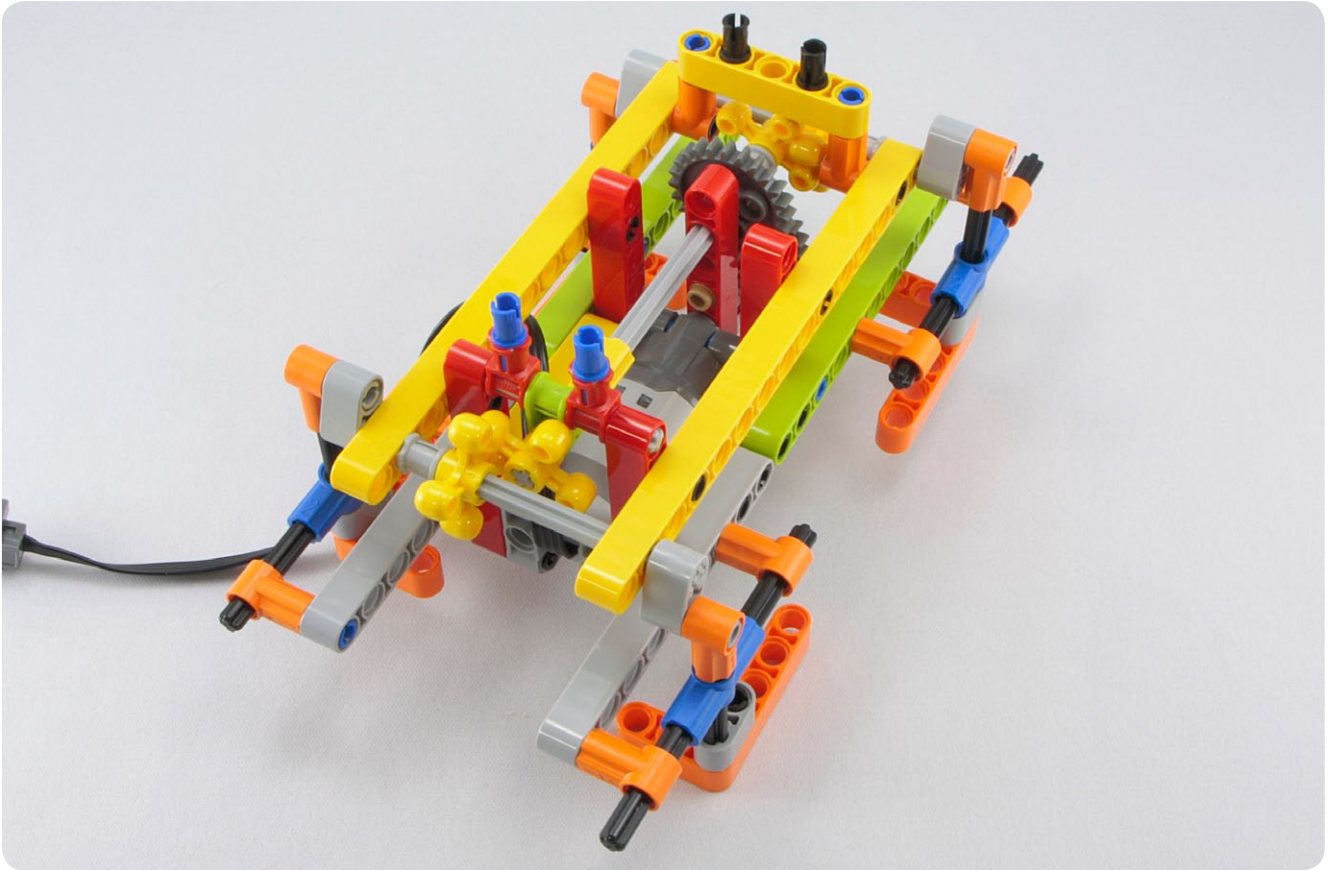


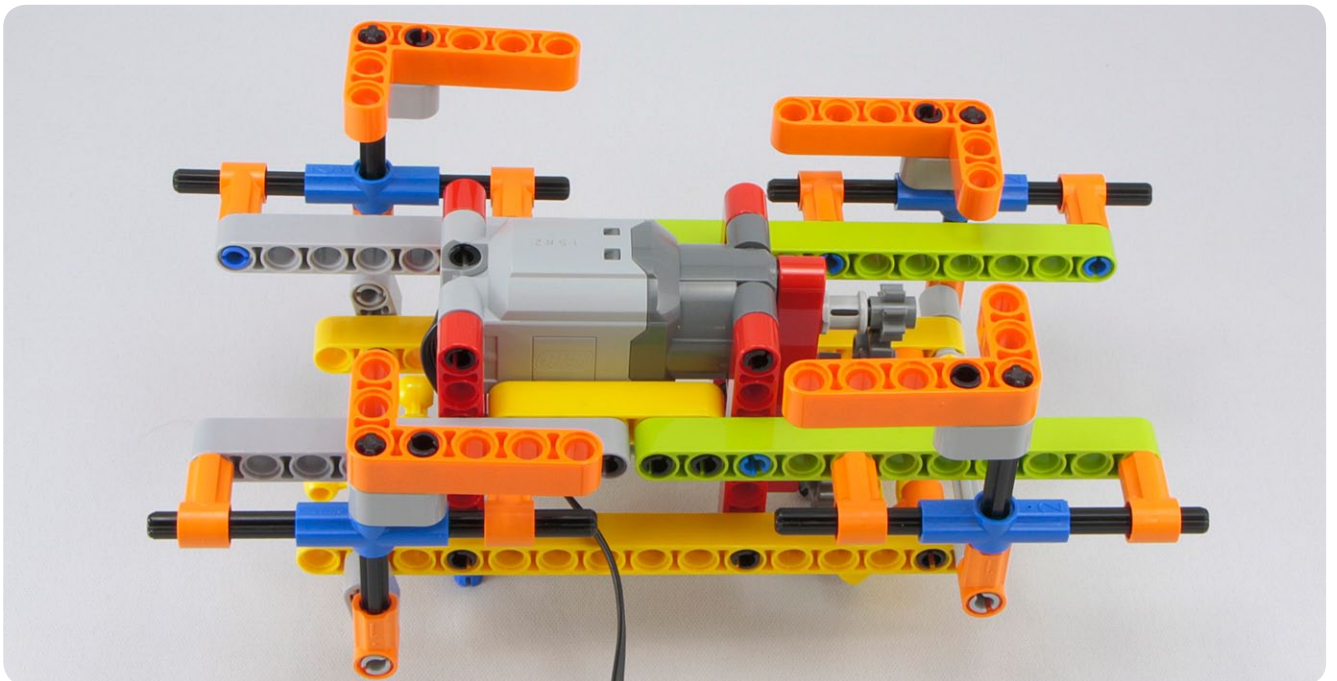
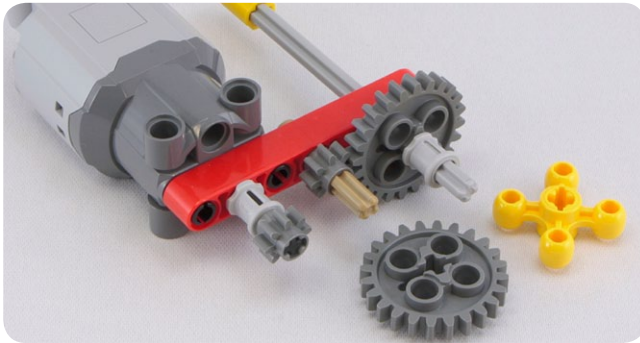
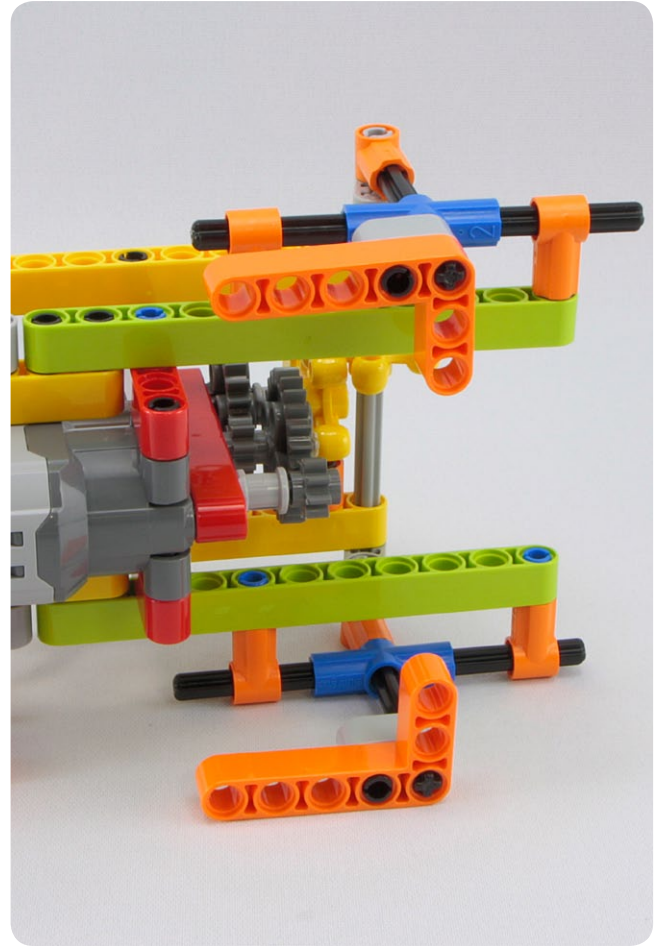


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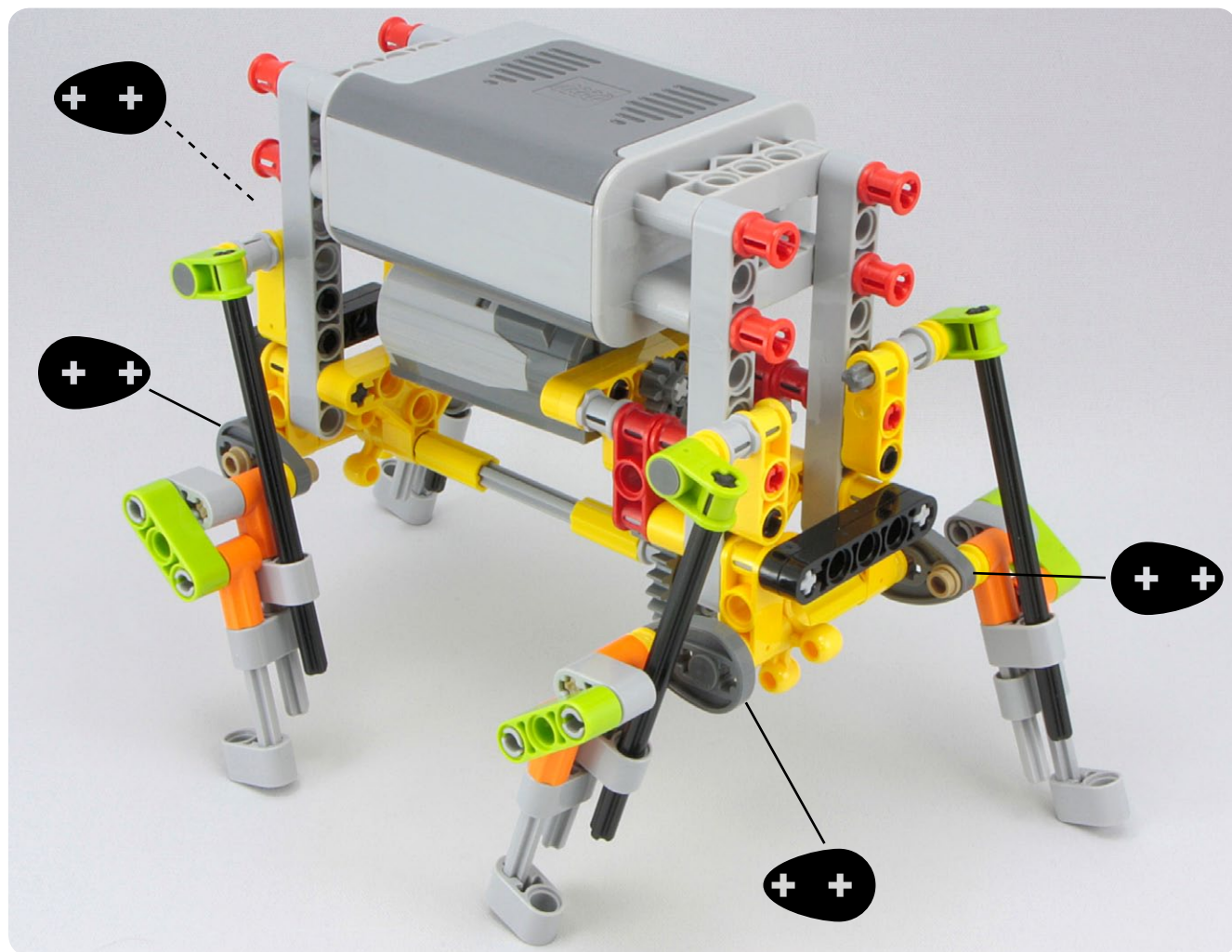
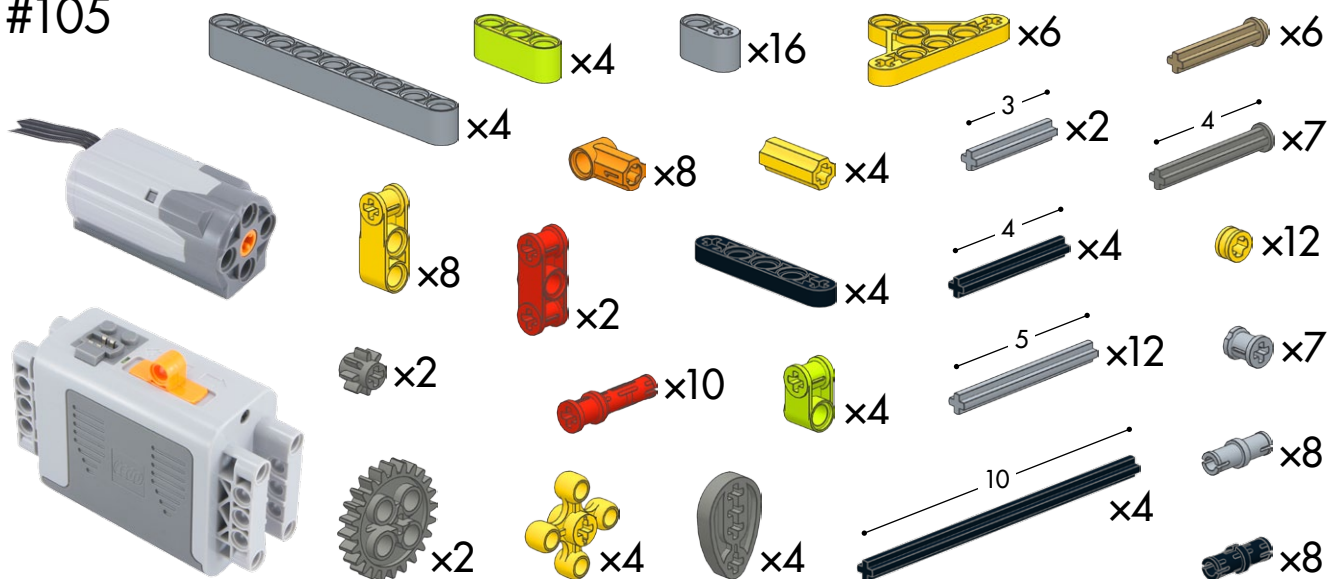


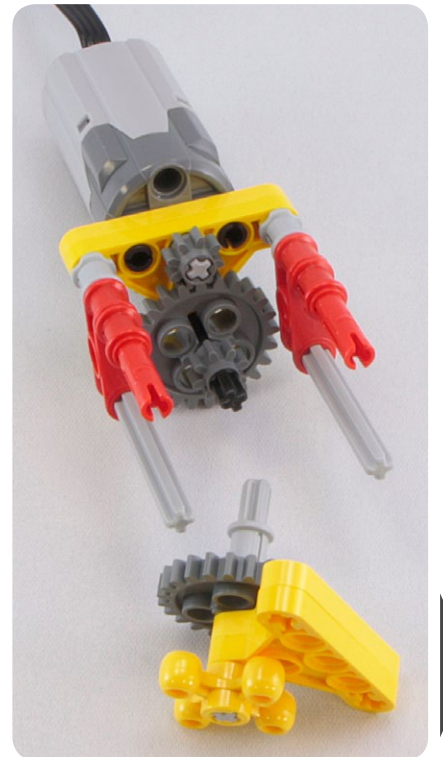


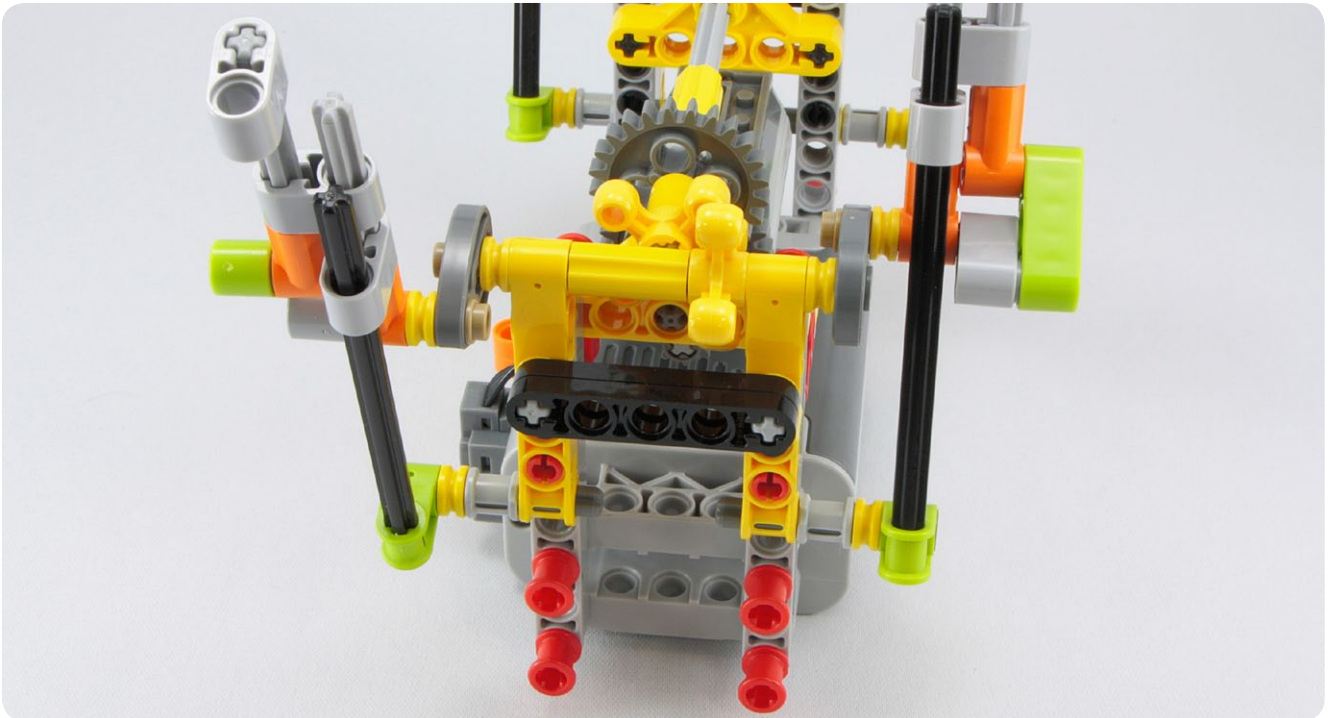
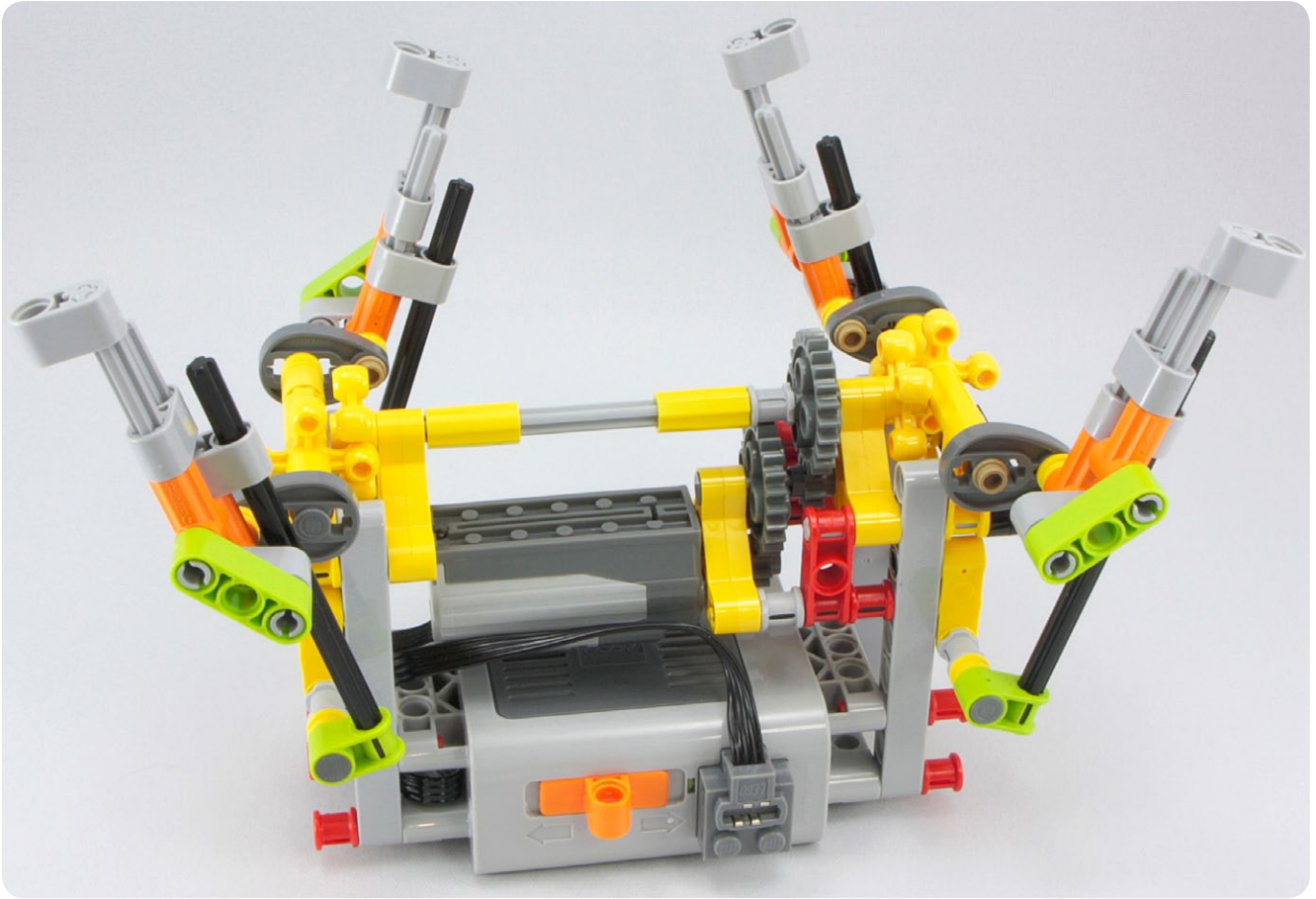


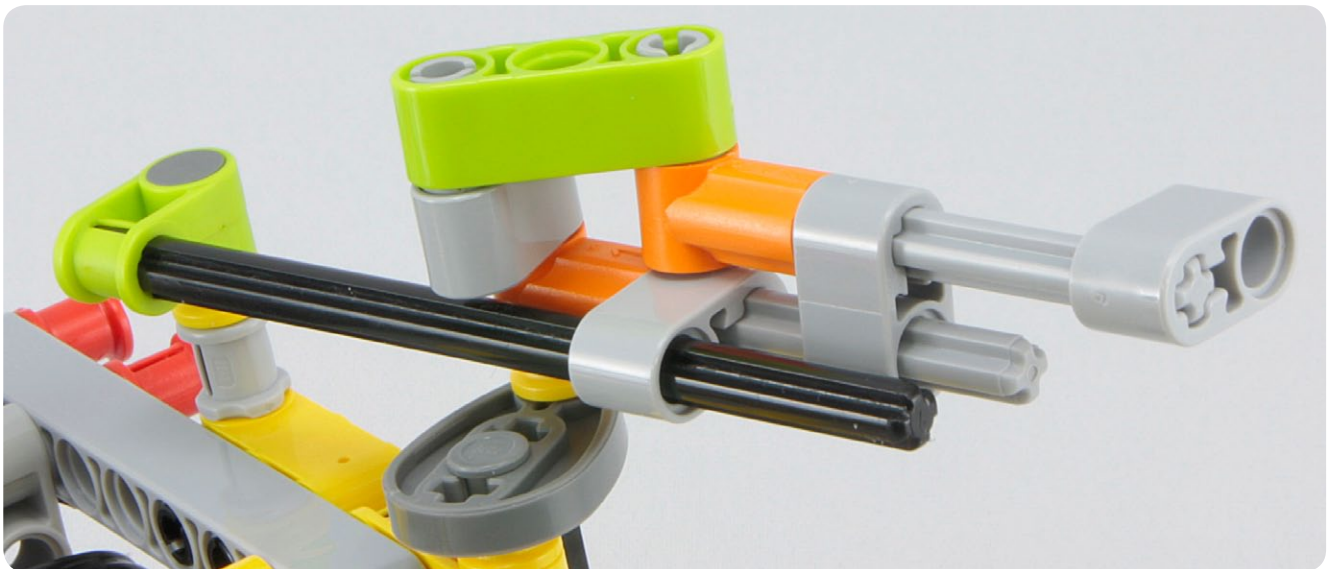
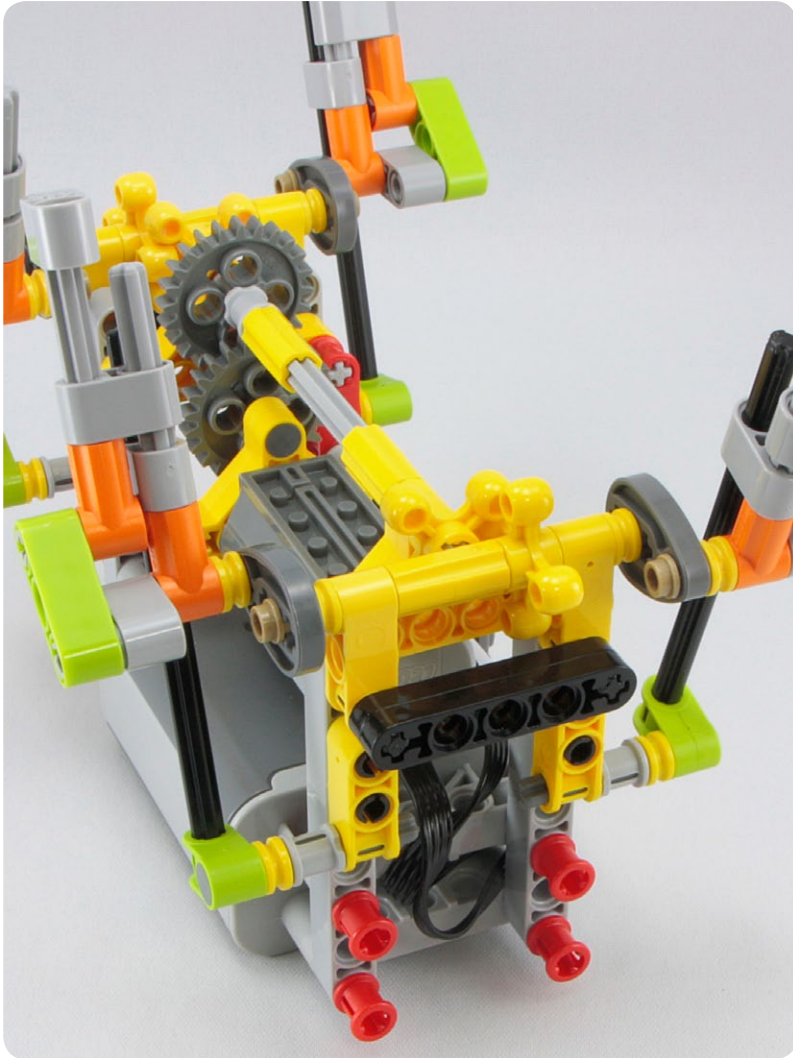


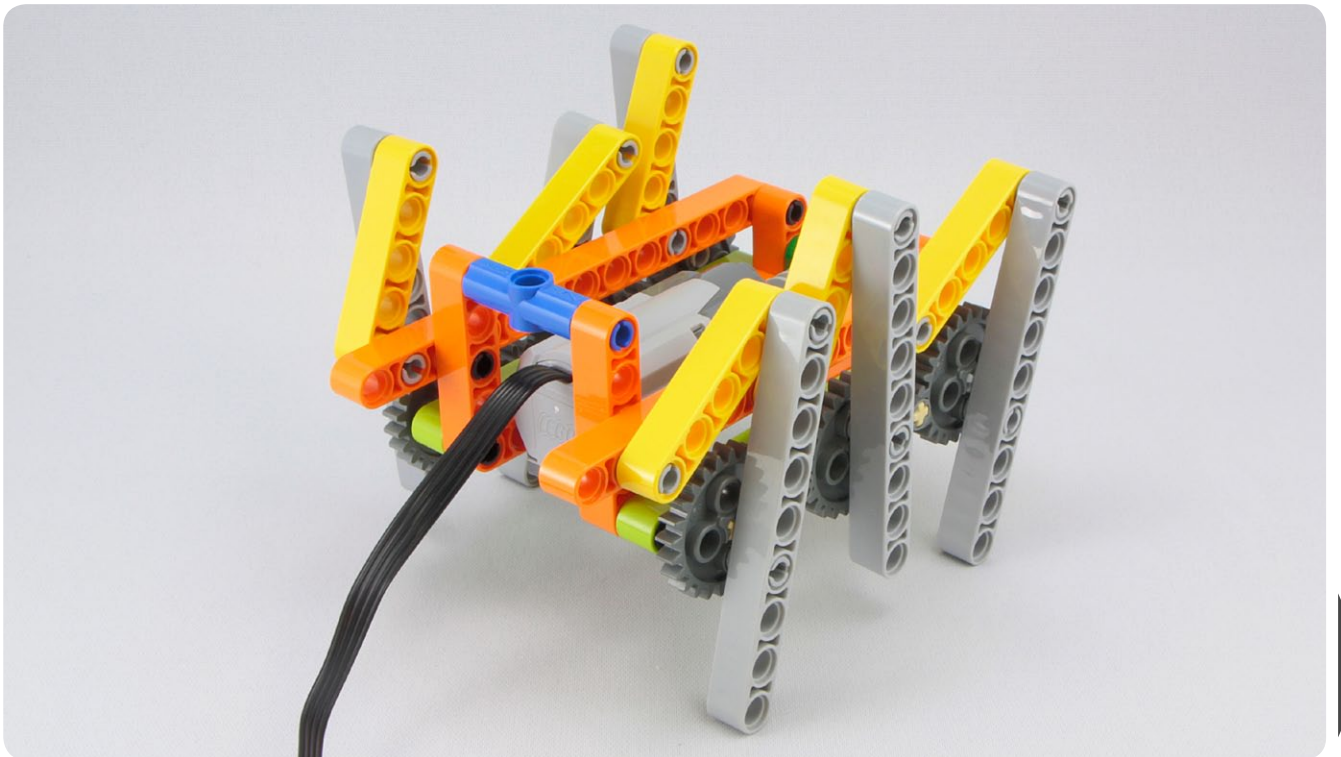
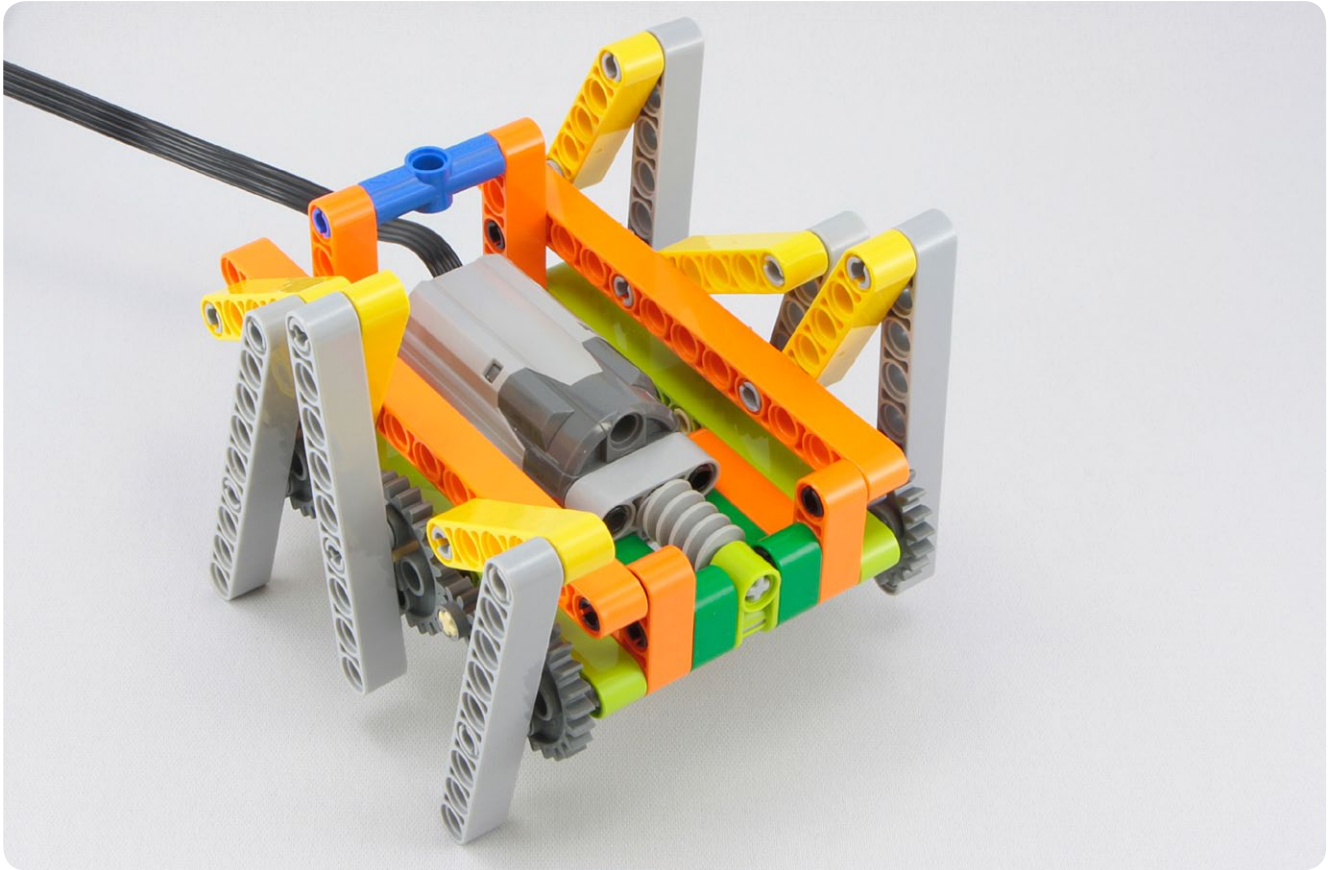
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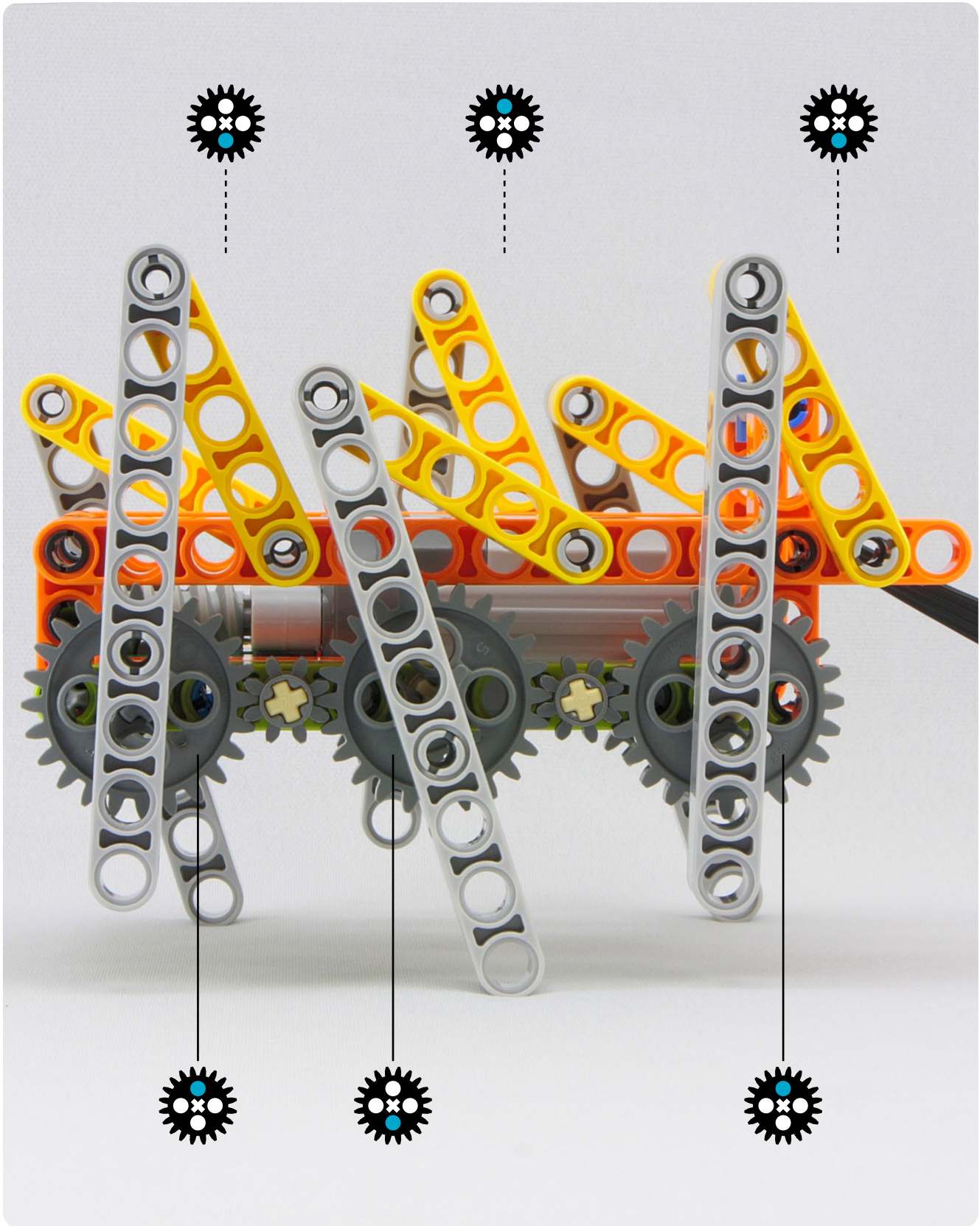


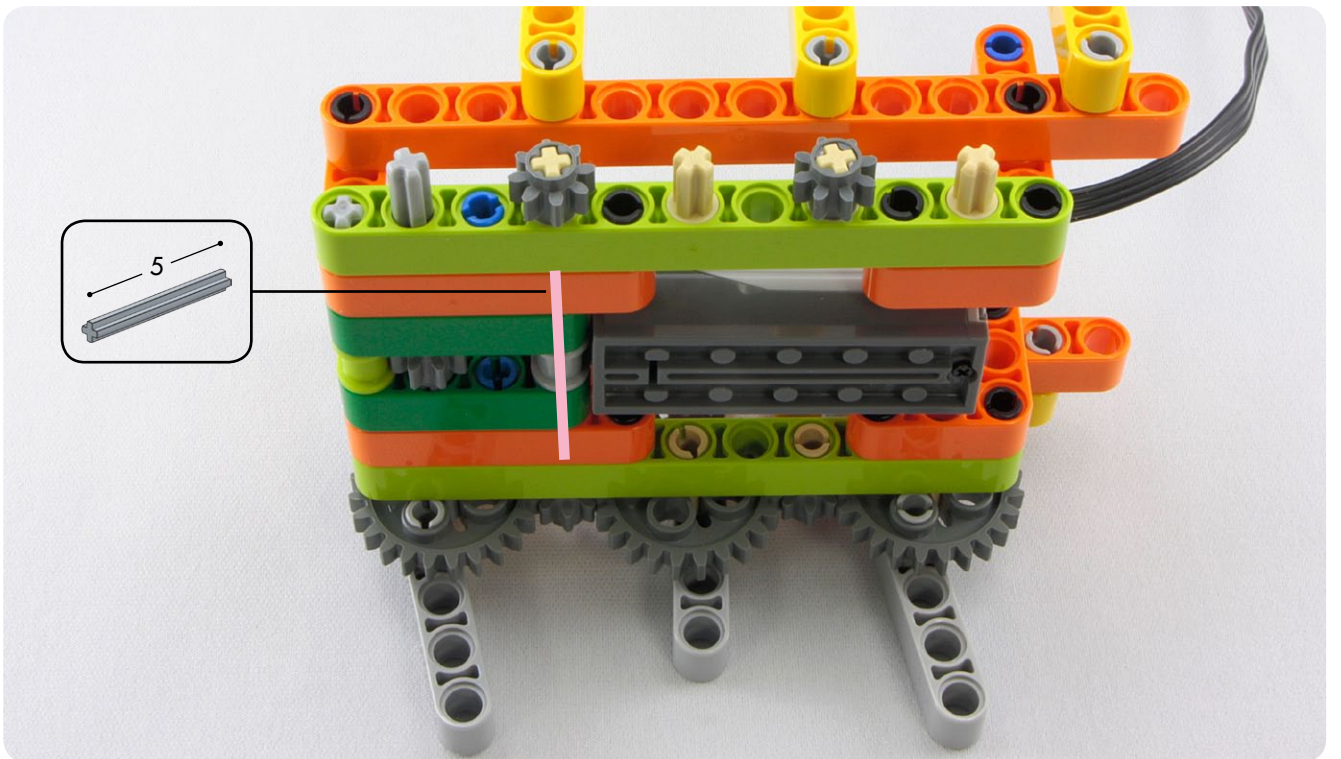
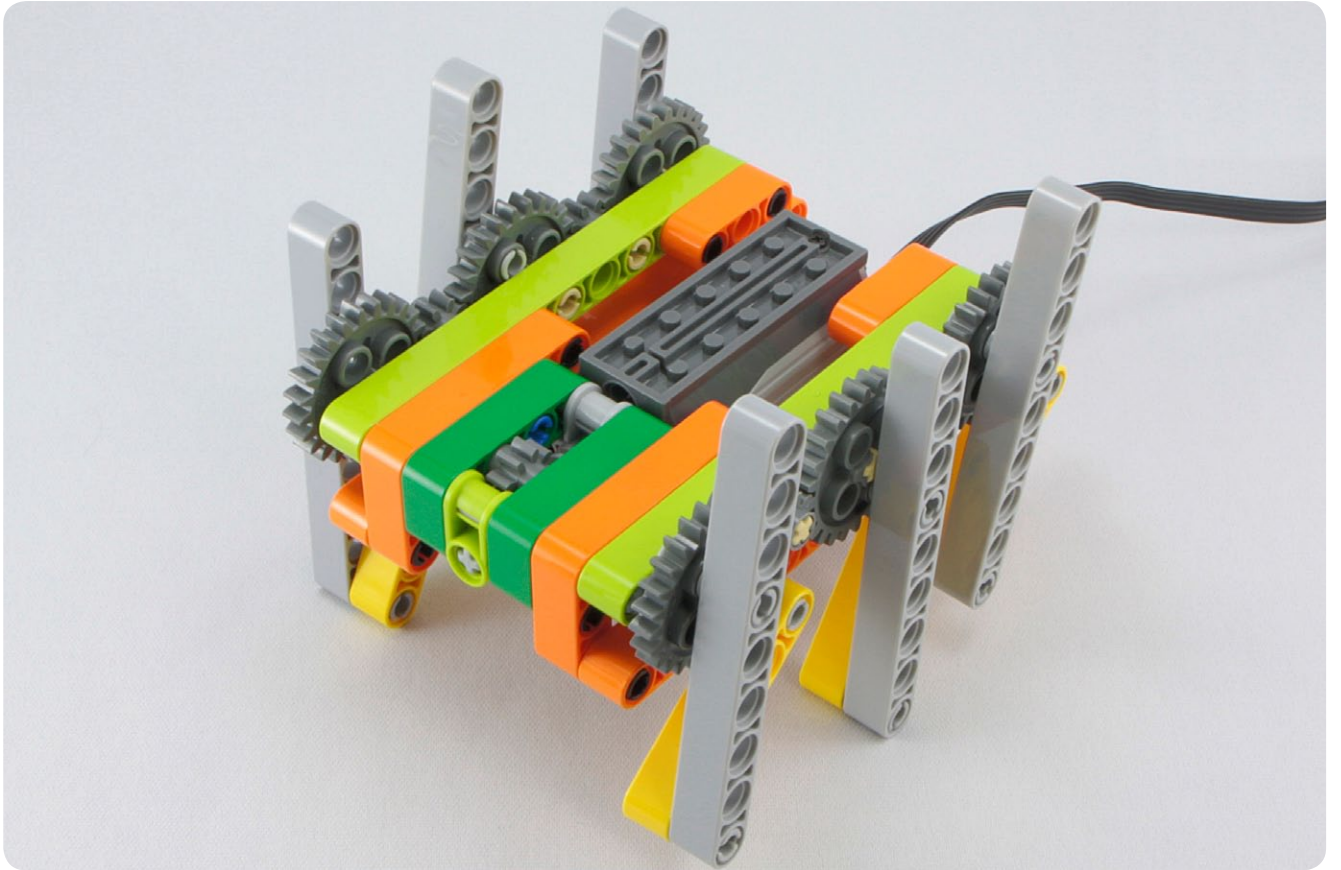


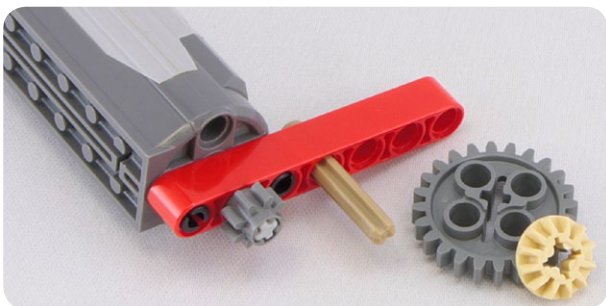
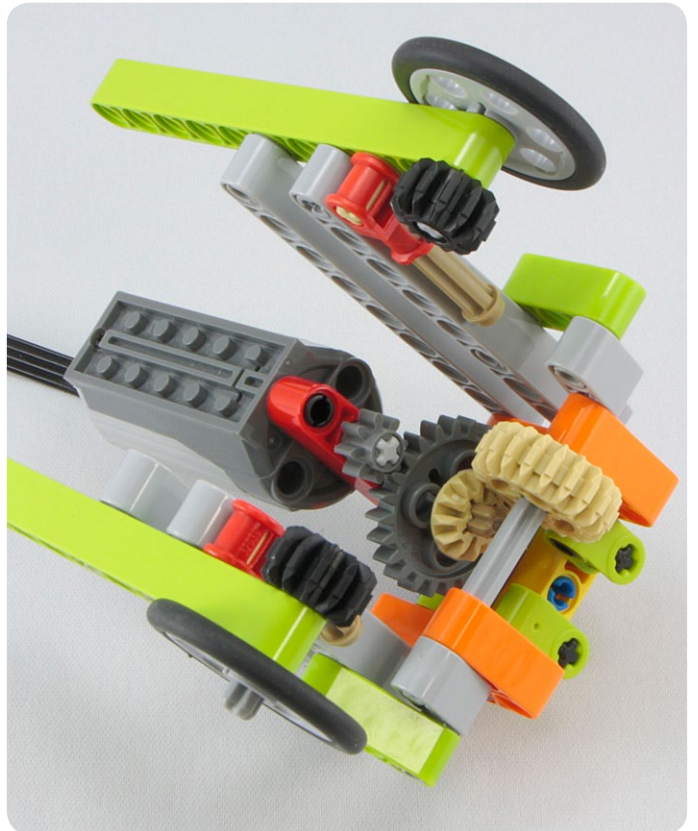
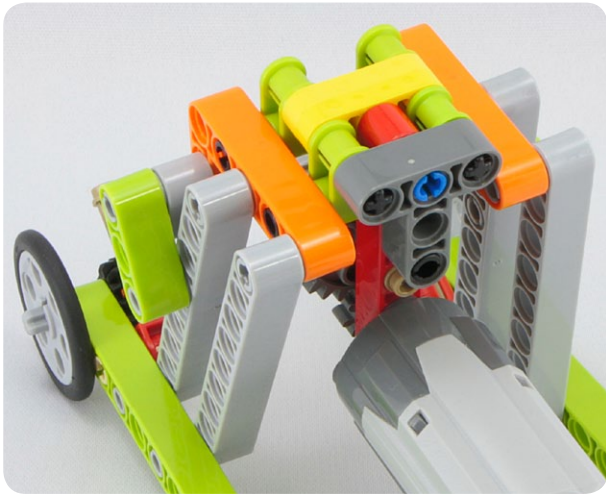
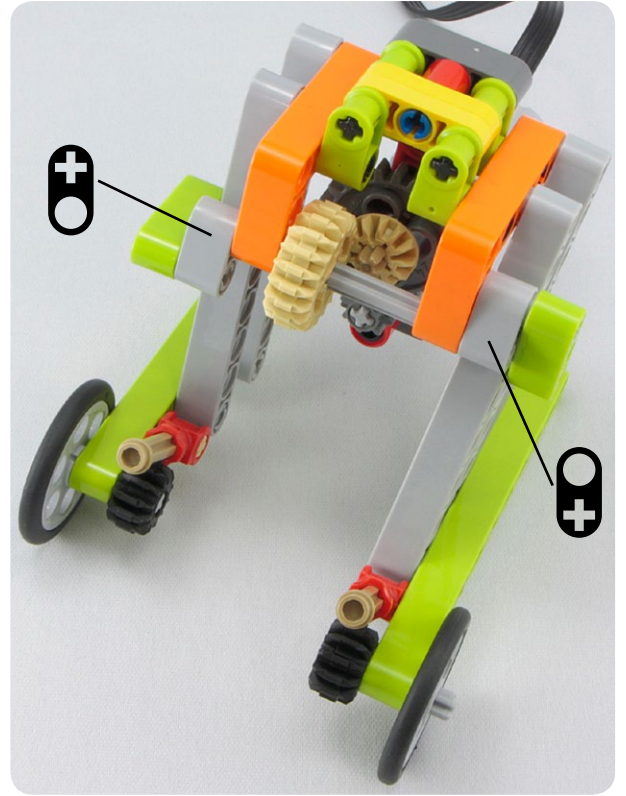
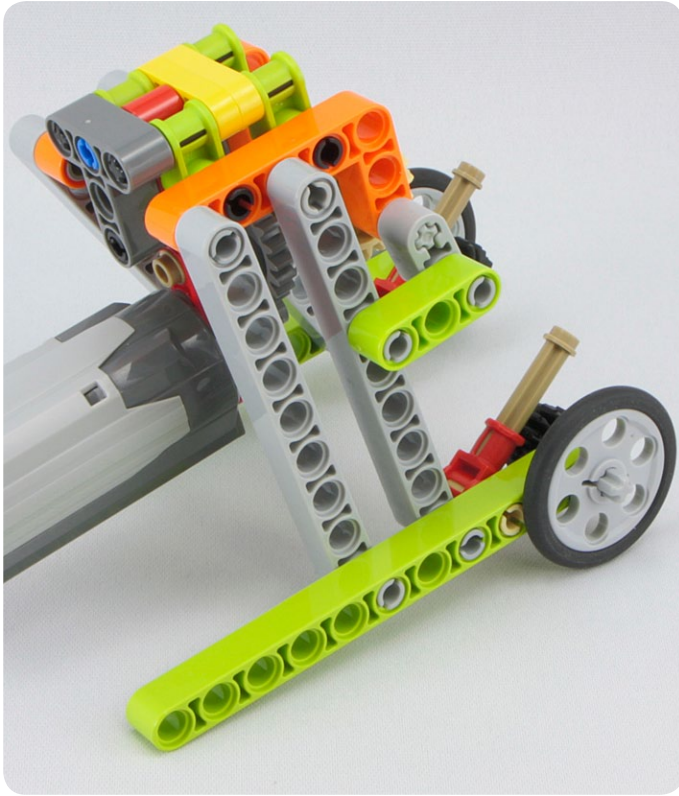


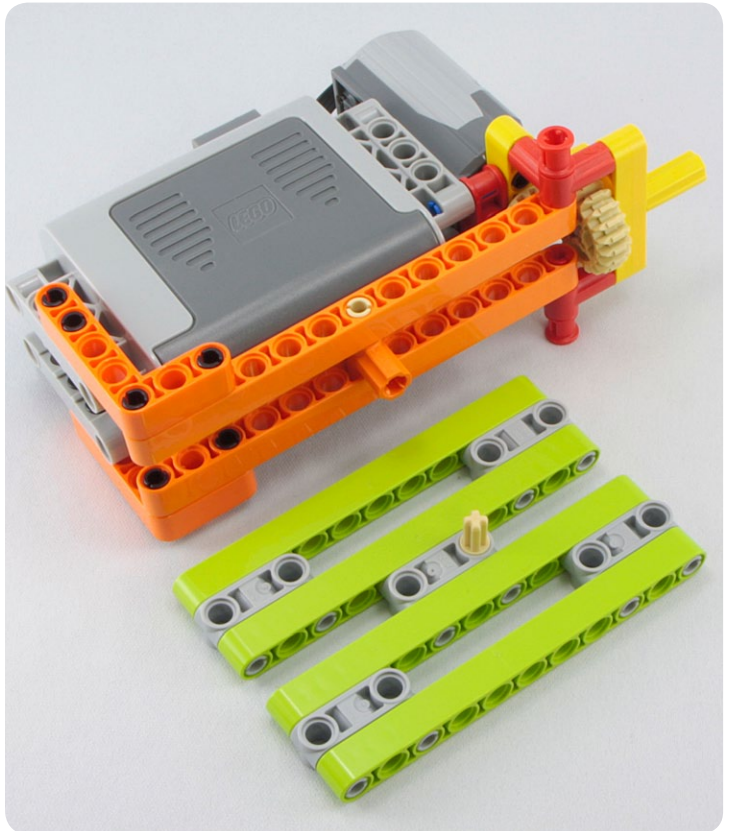
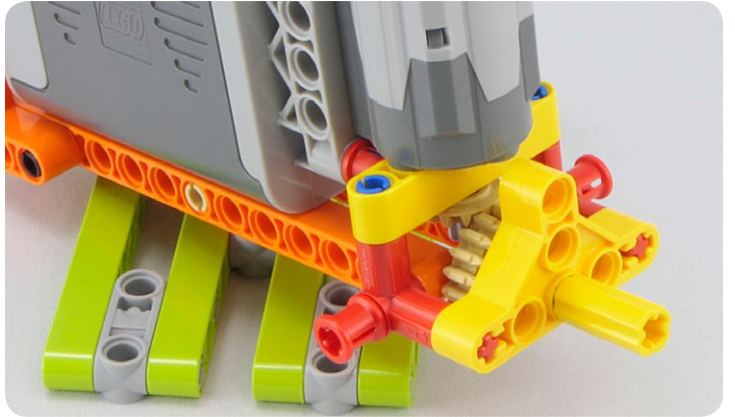
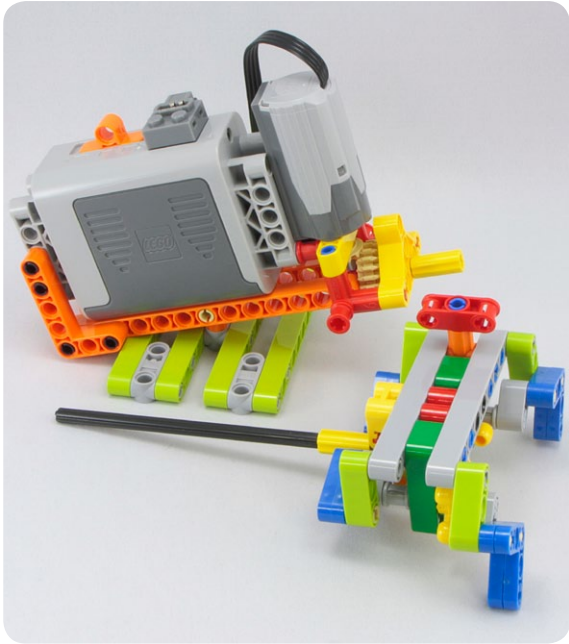


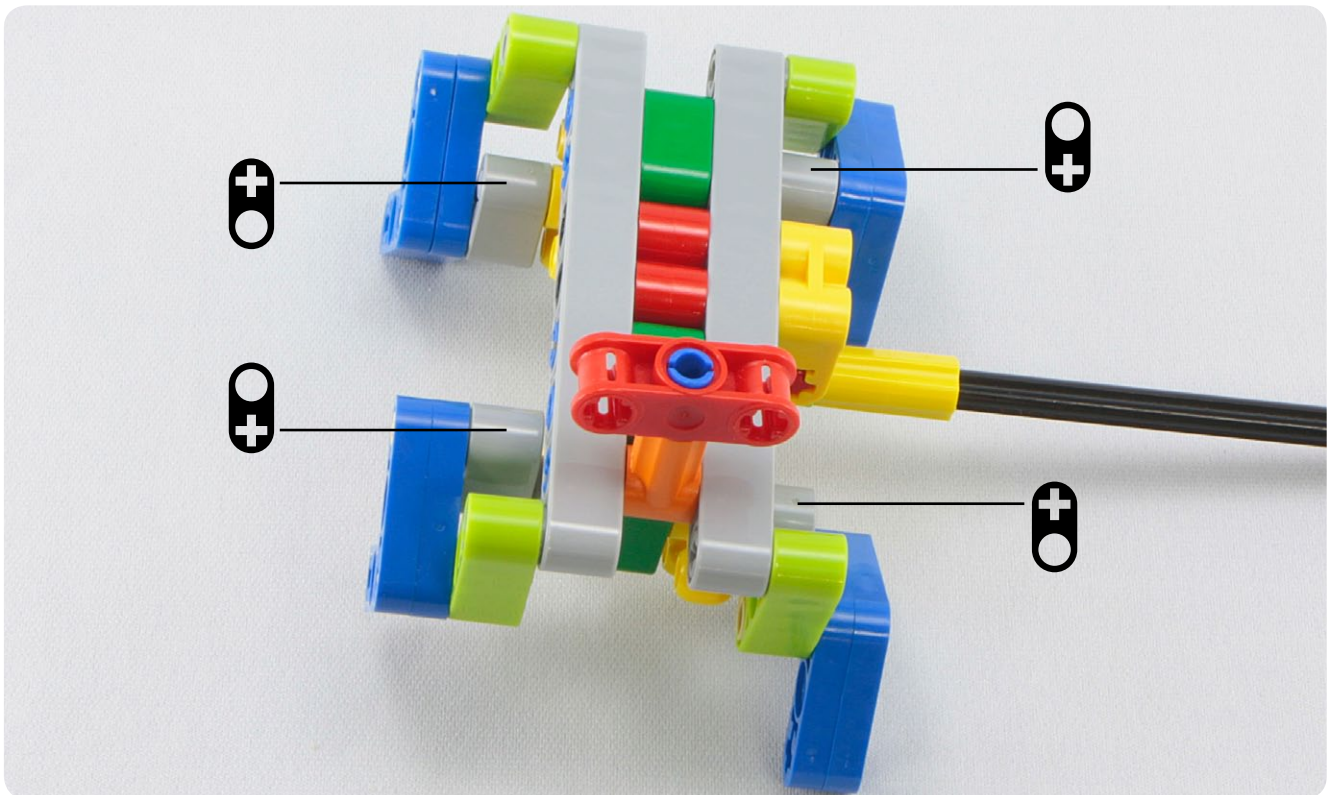
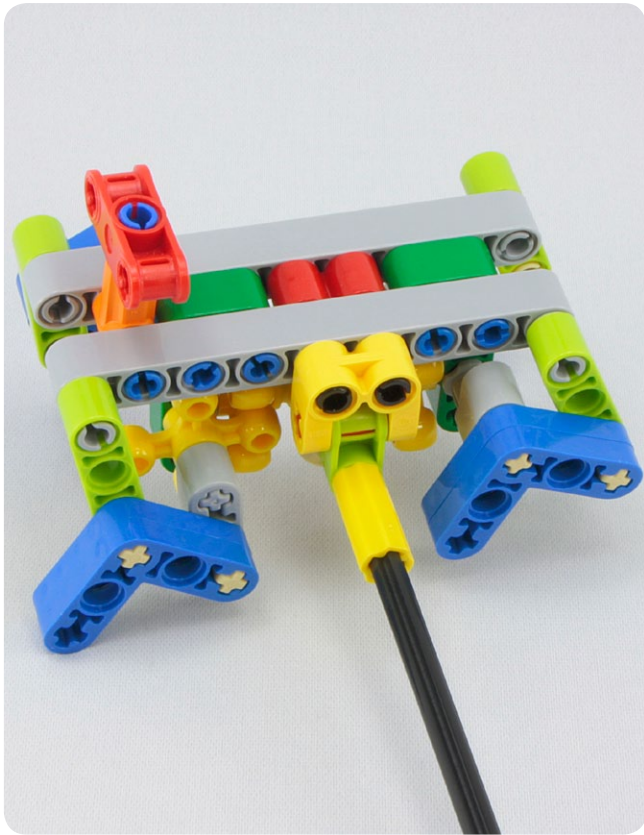


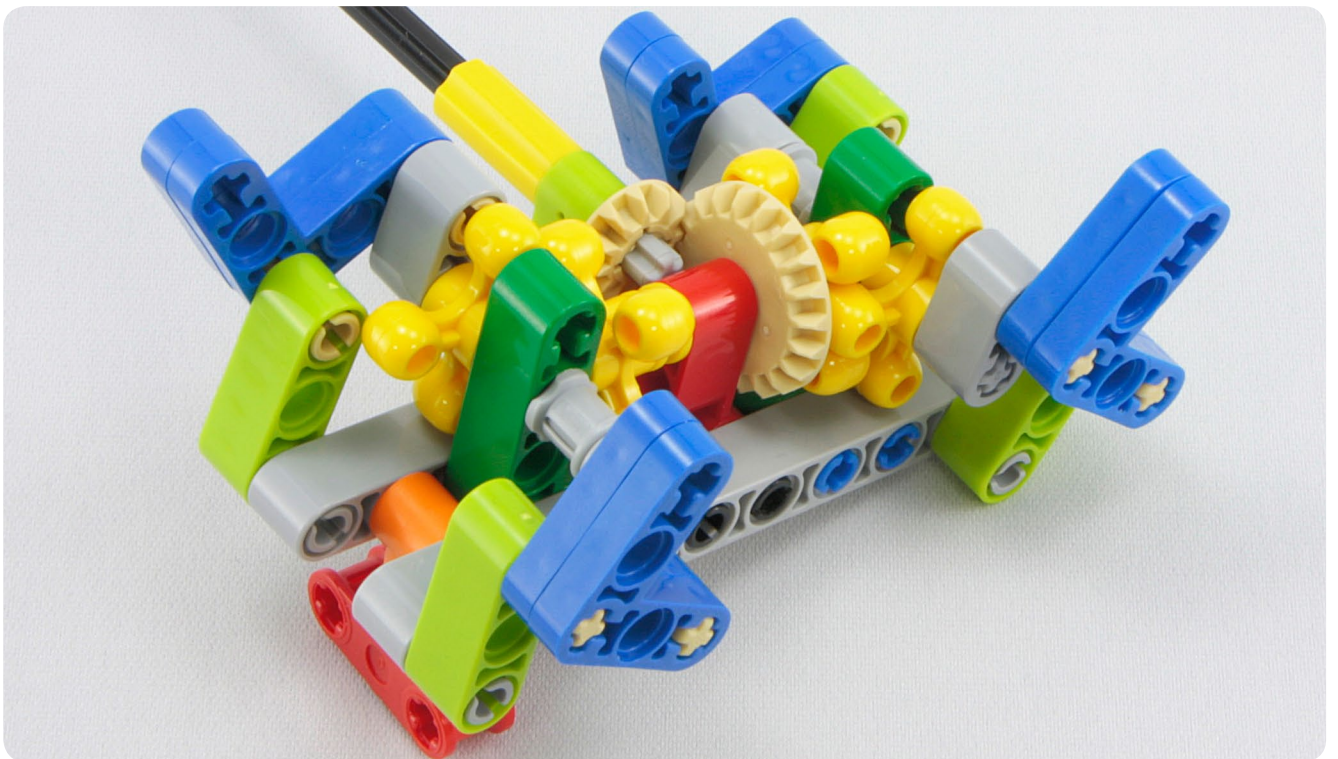
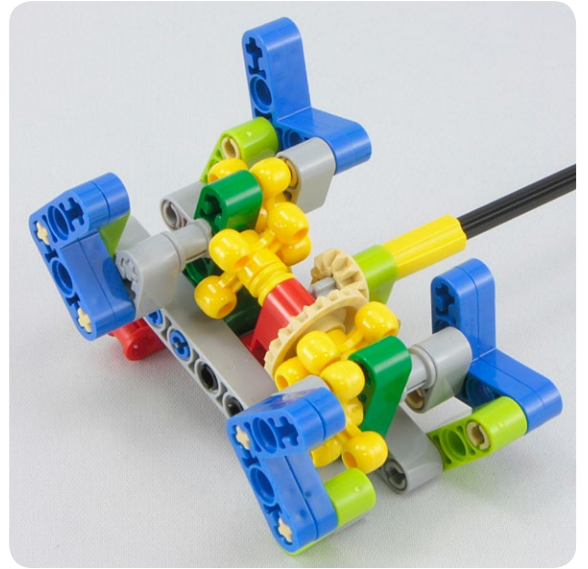
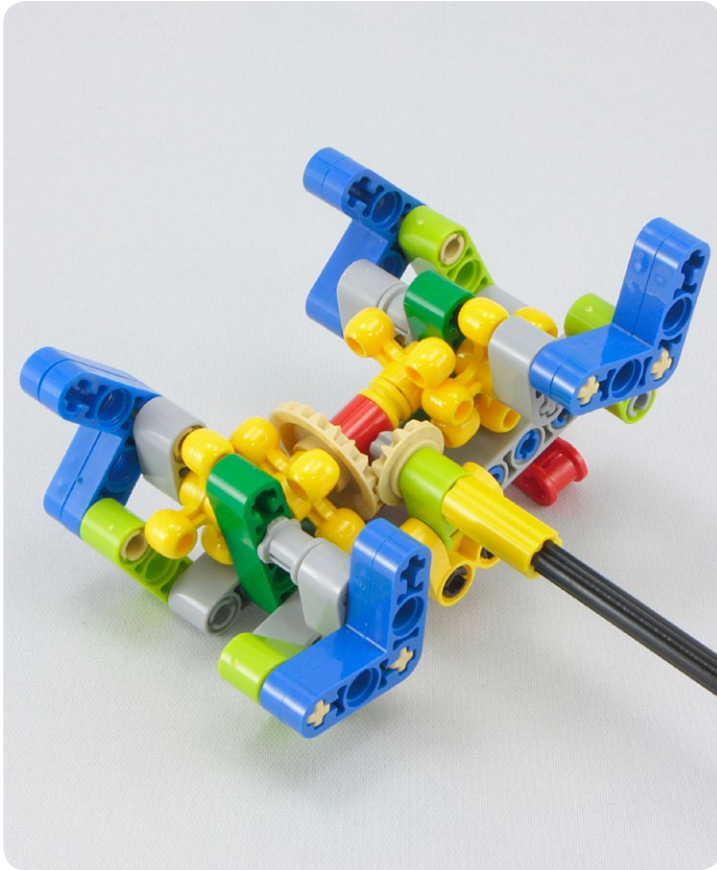


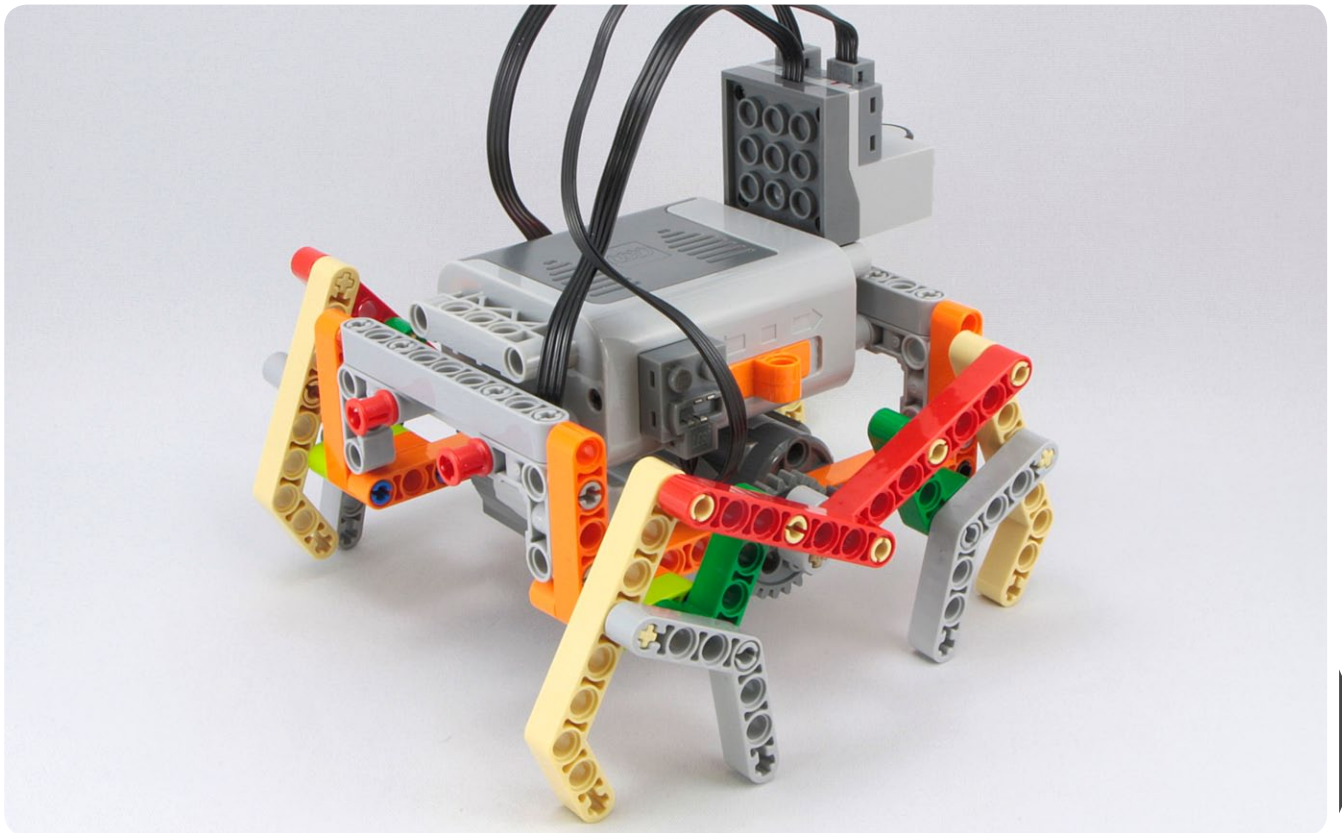
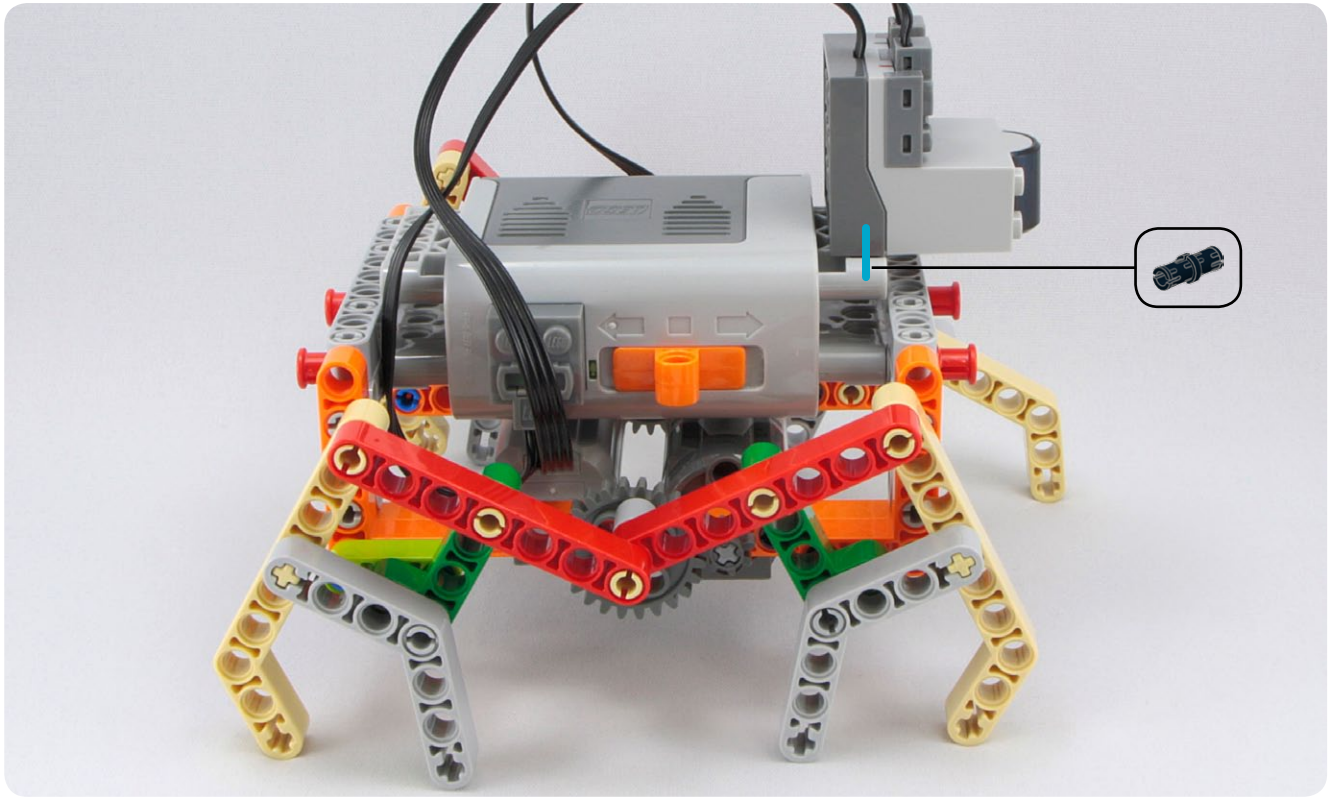


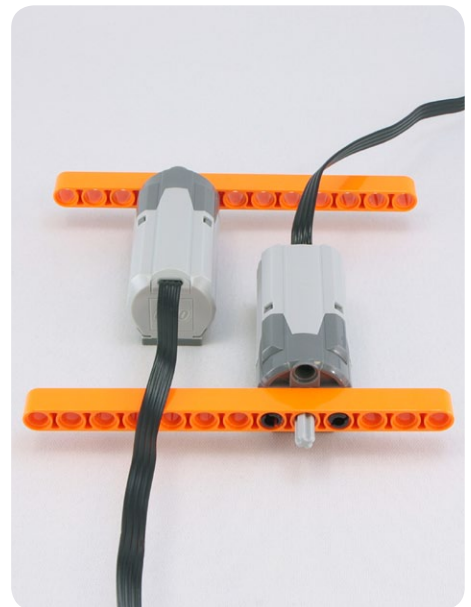
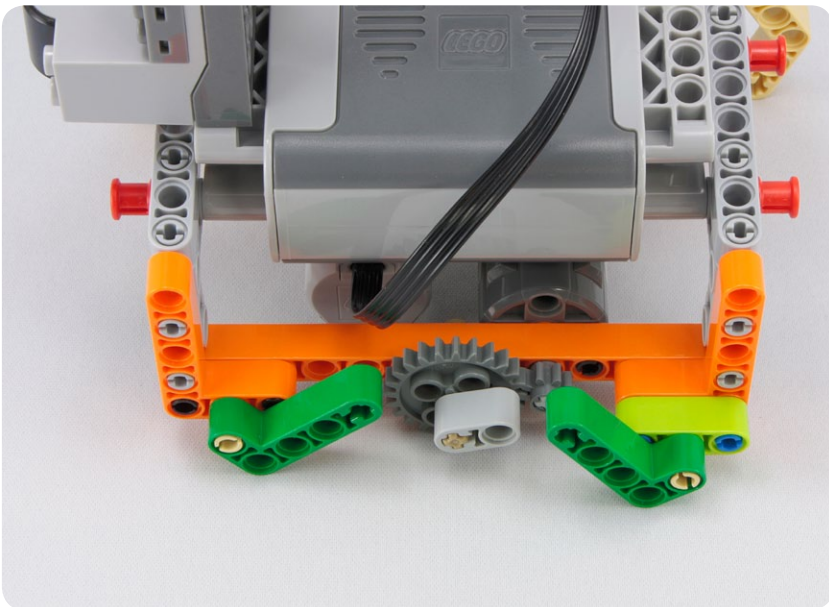
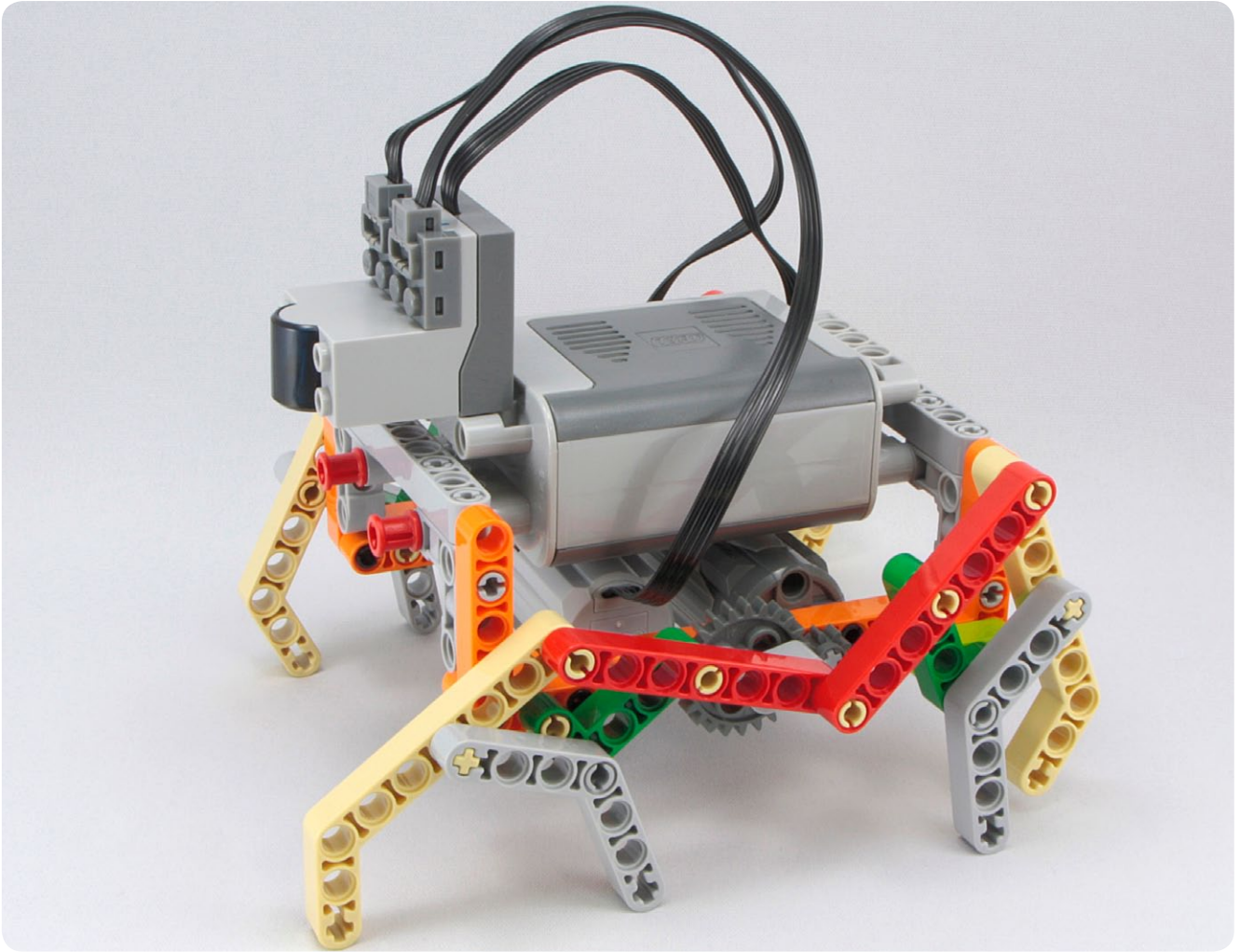


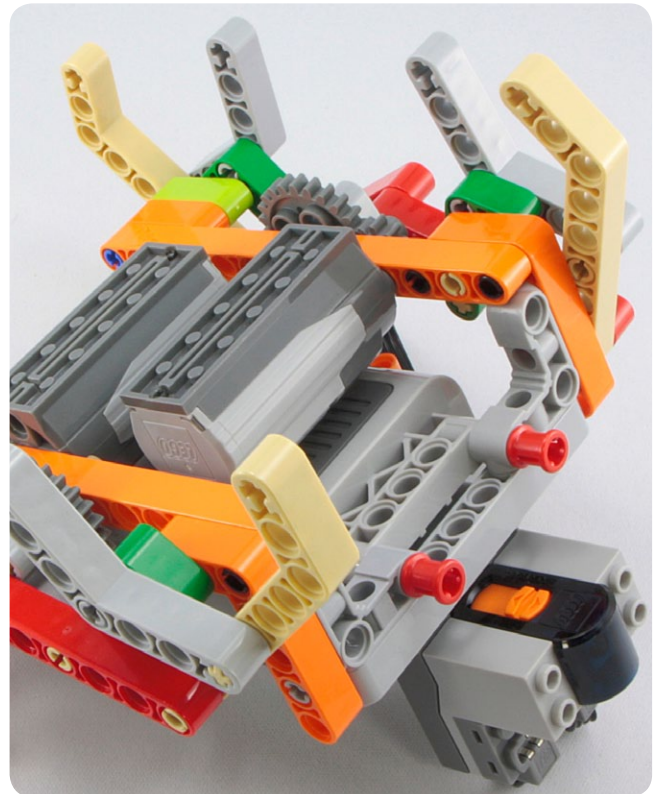
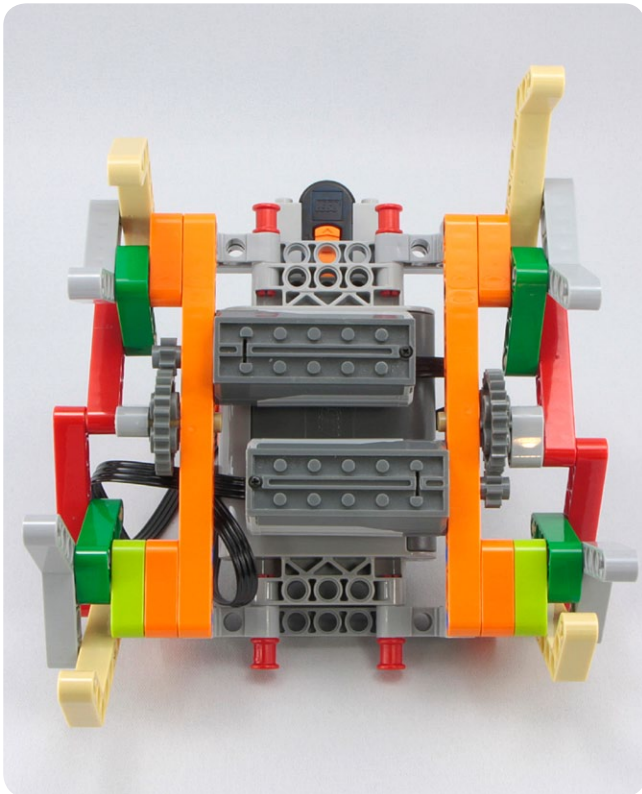
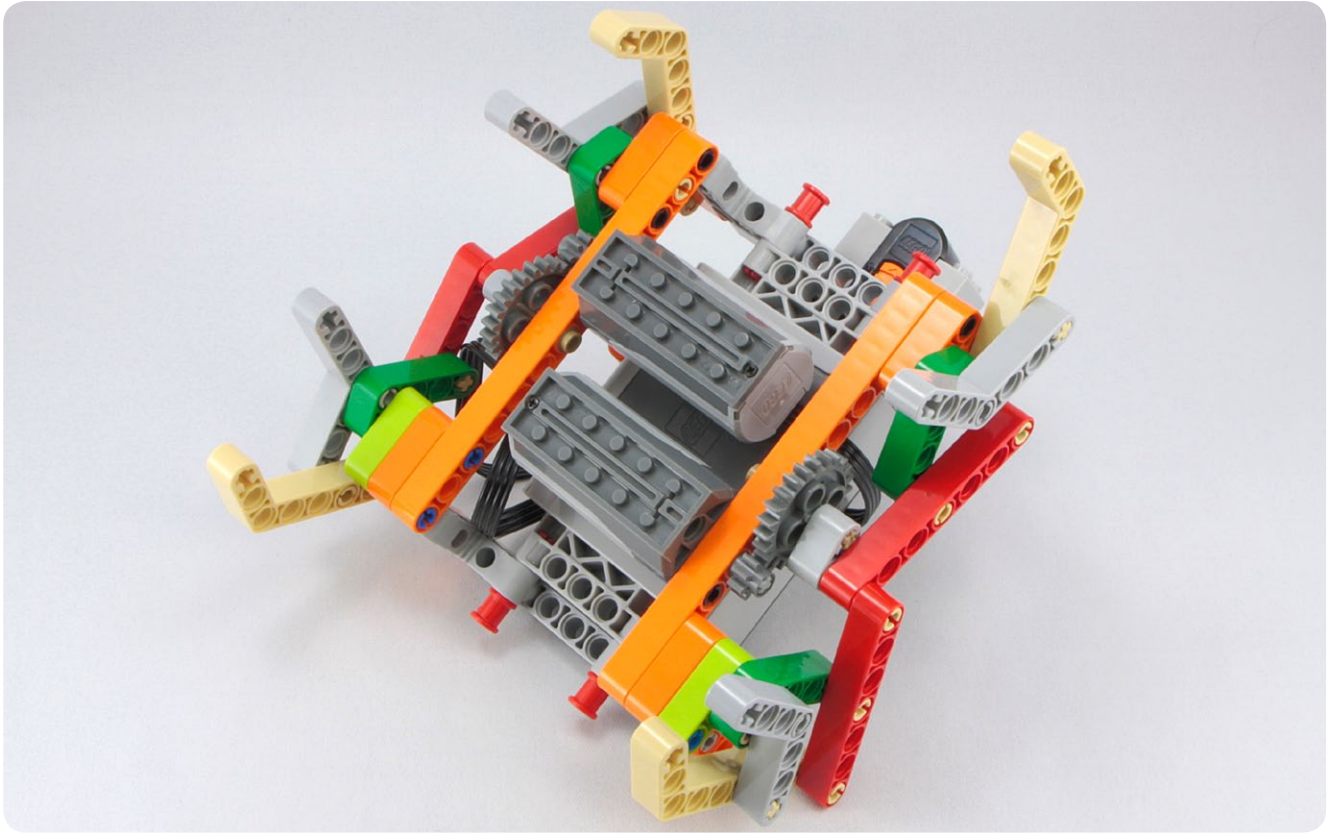


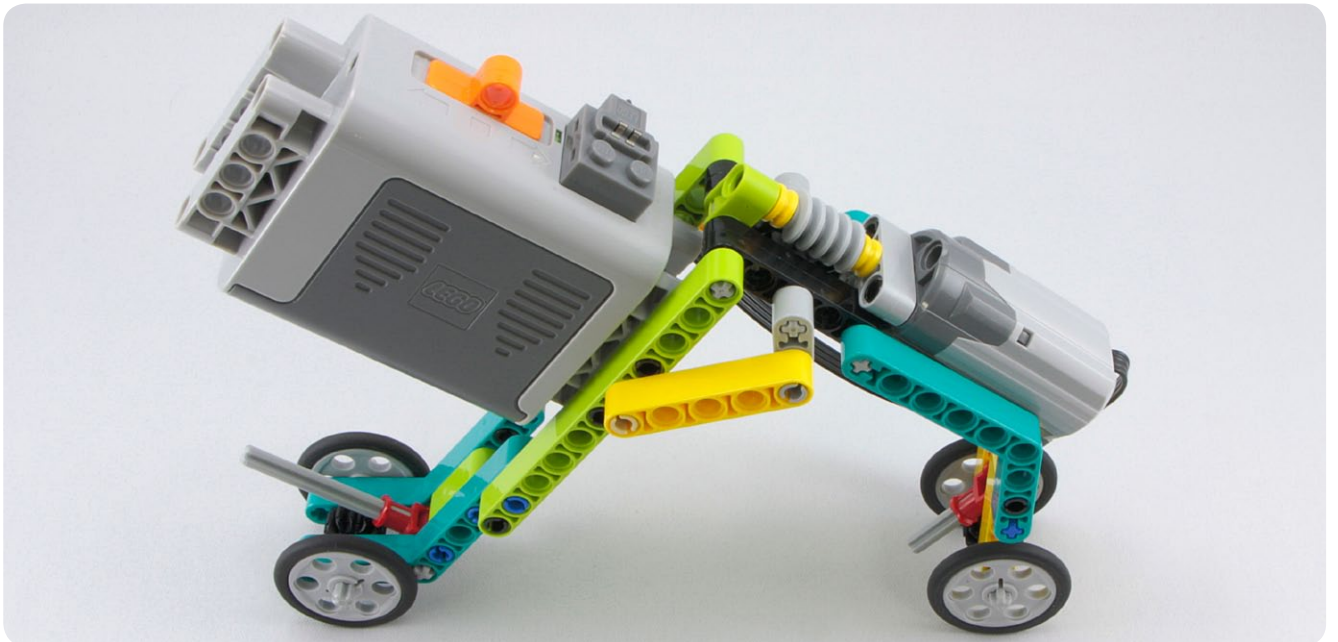
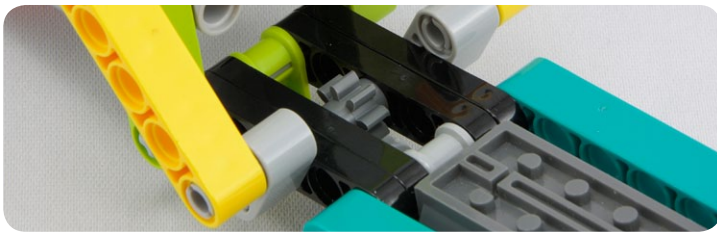
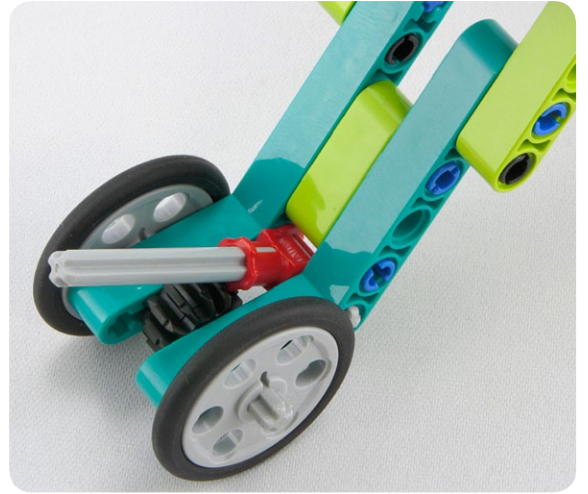


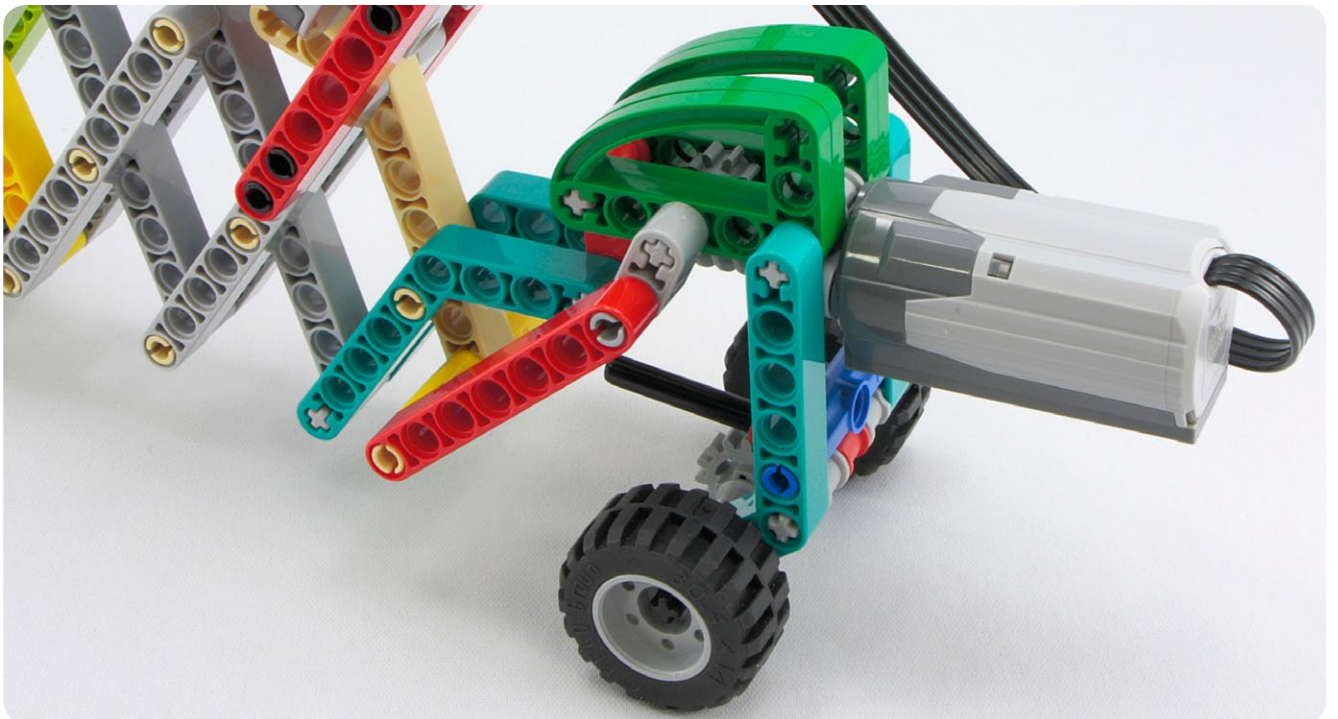
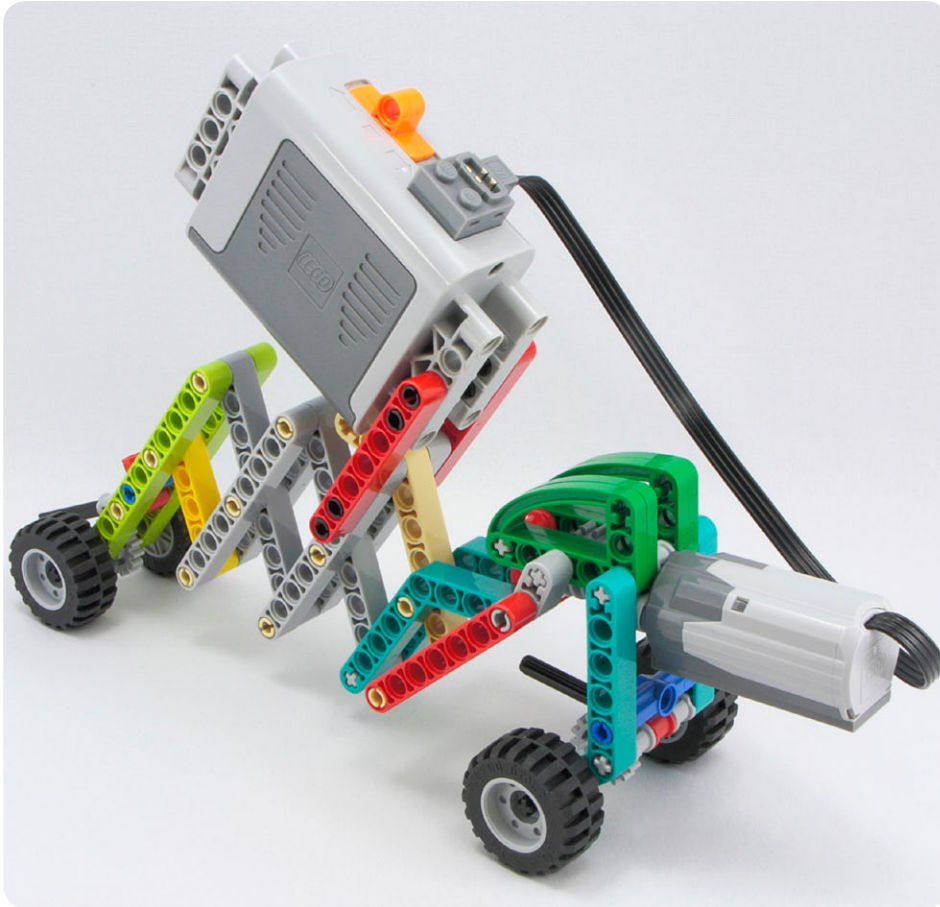


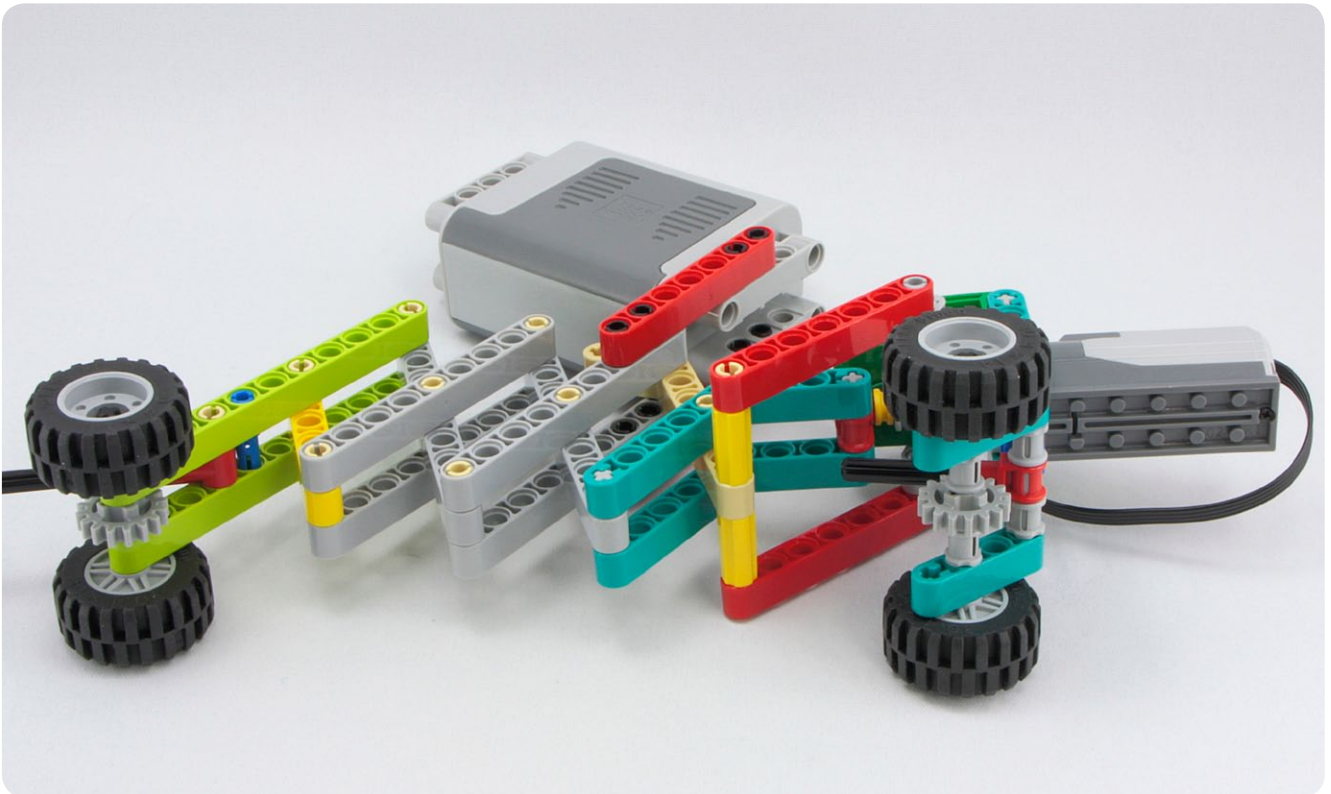
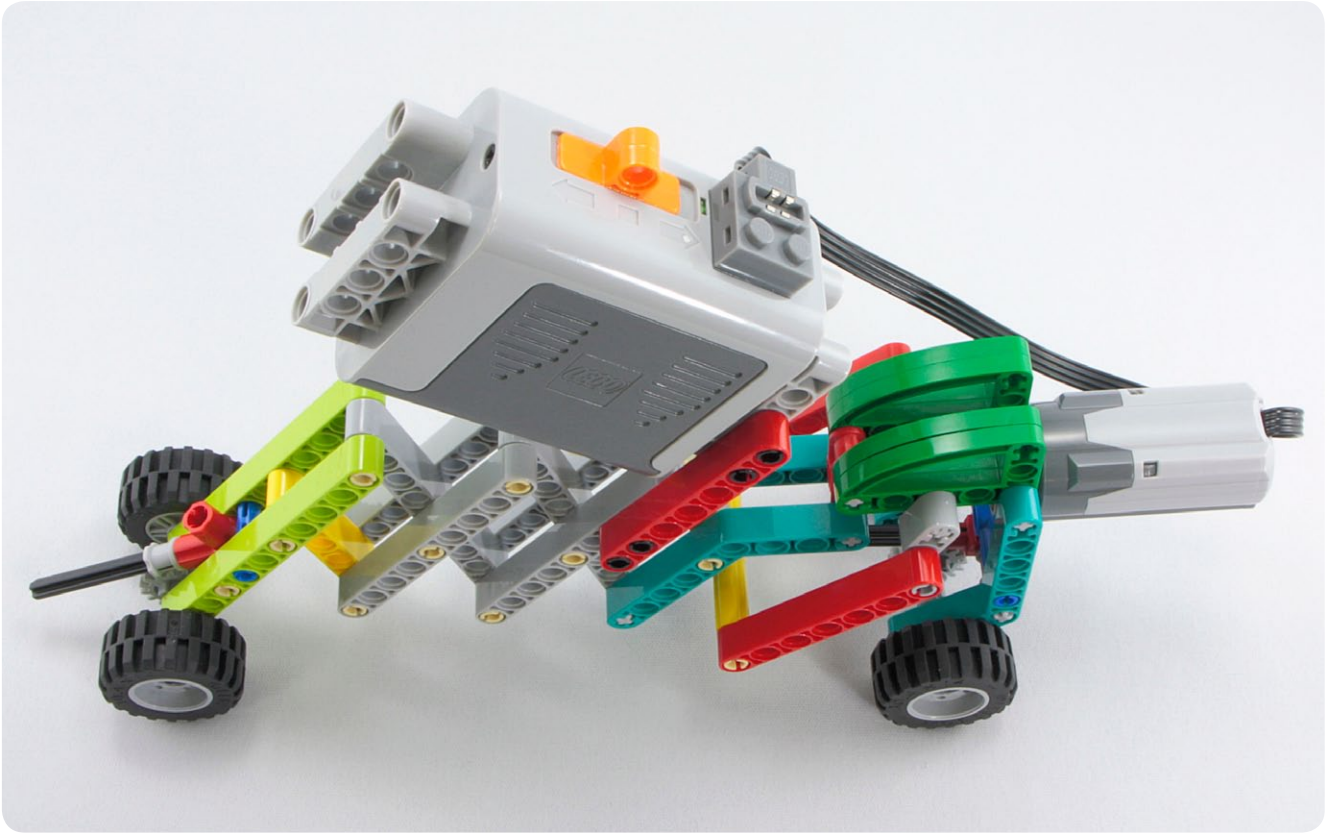


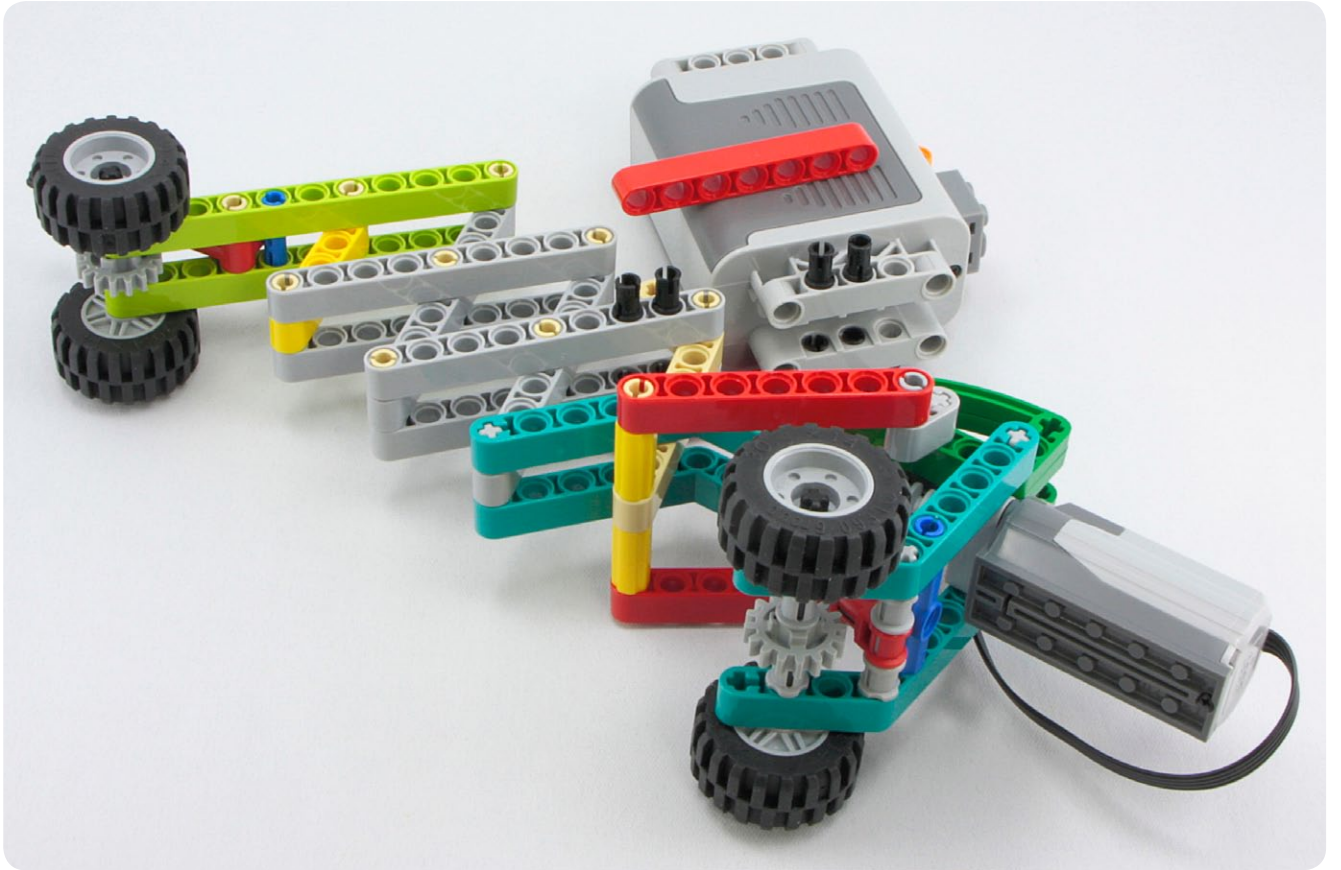


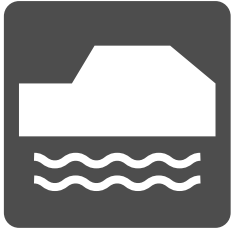






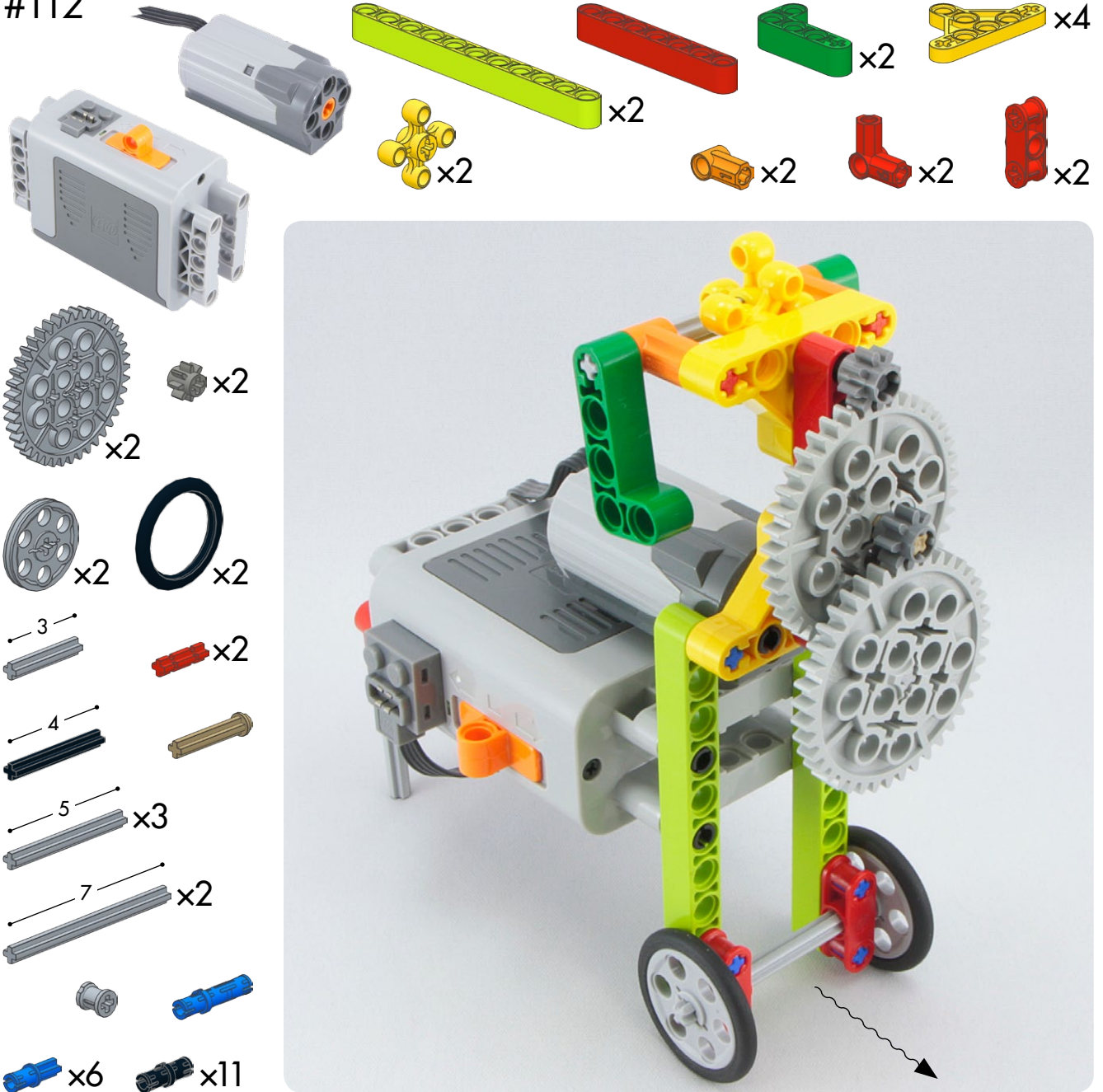


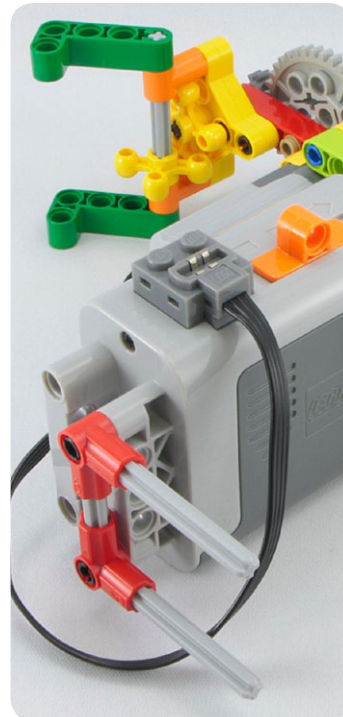
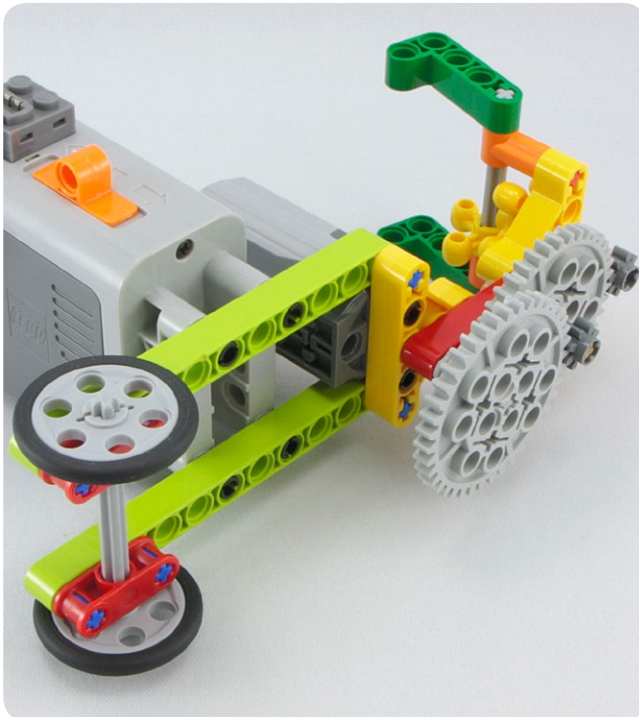
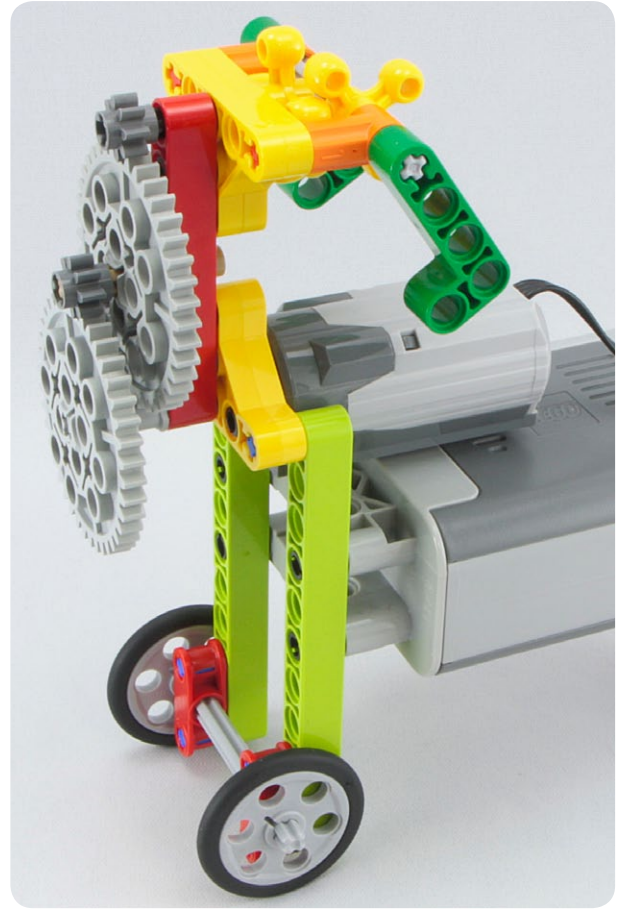


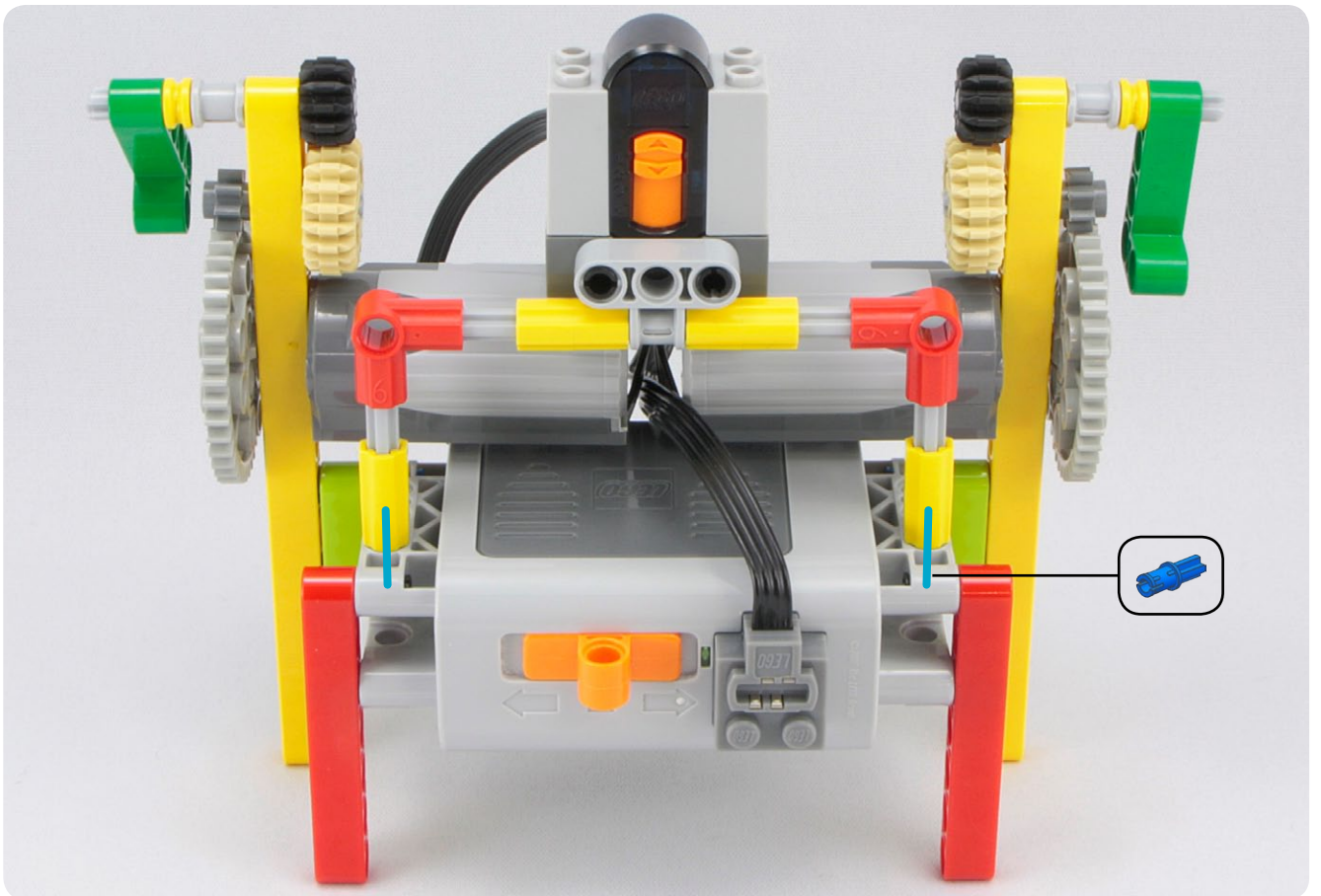
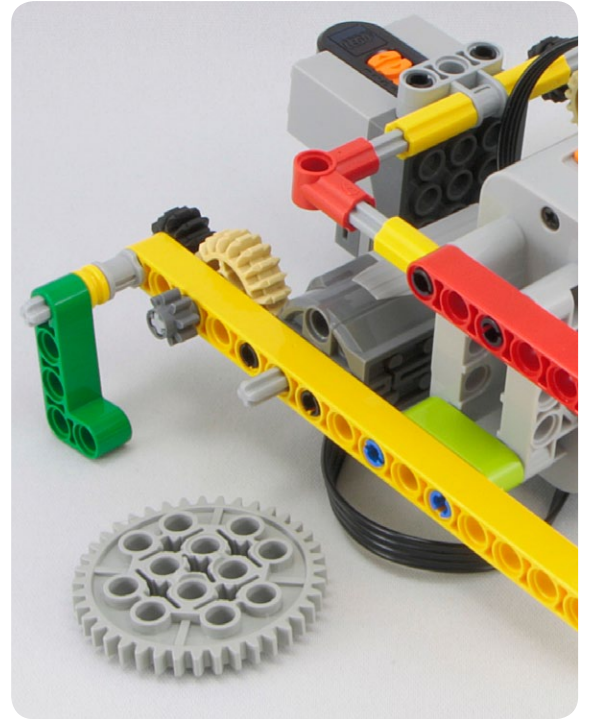
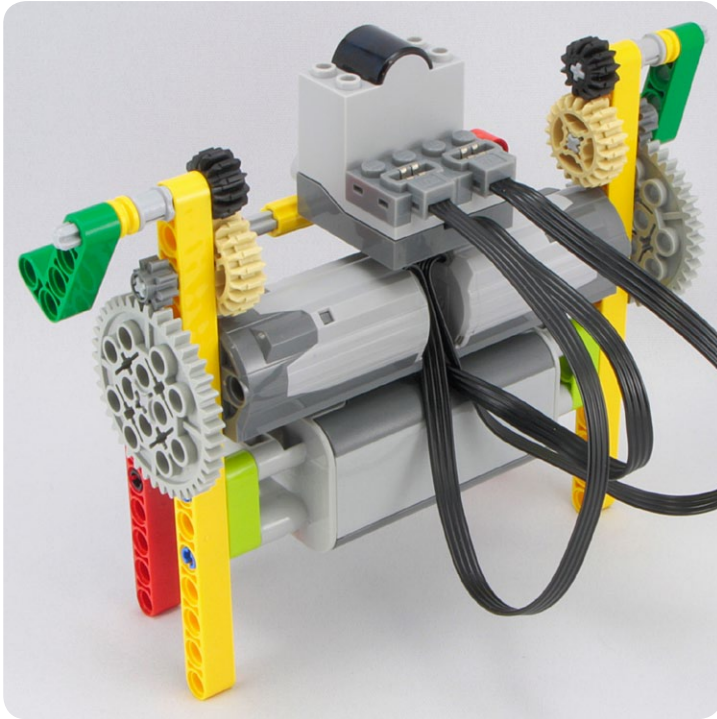


Moving through vibration

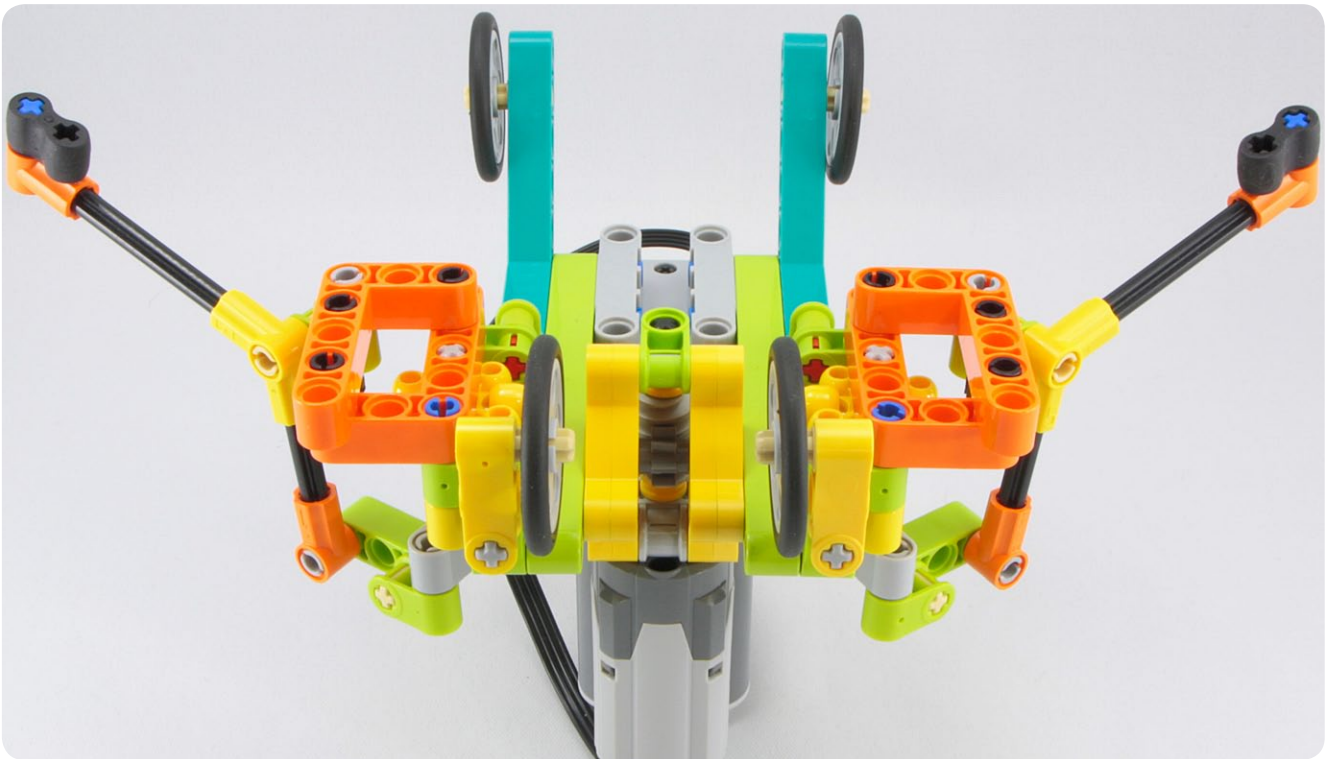
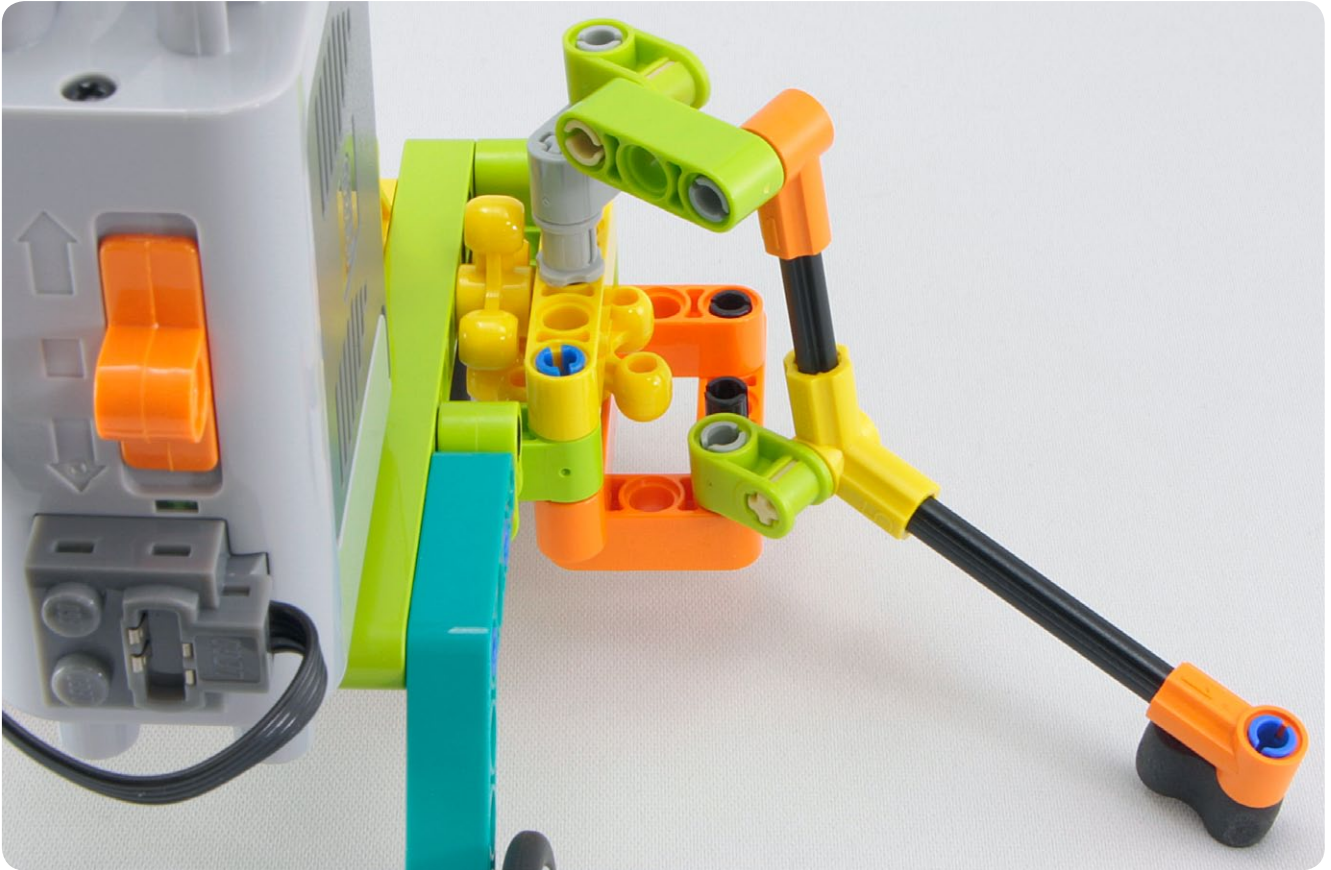
#112

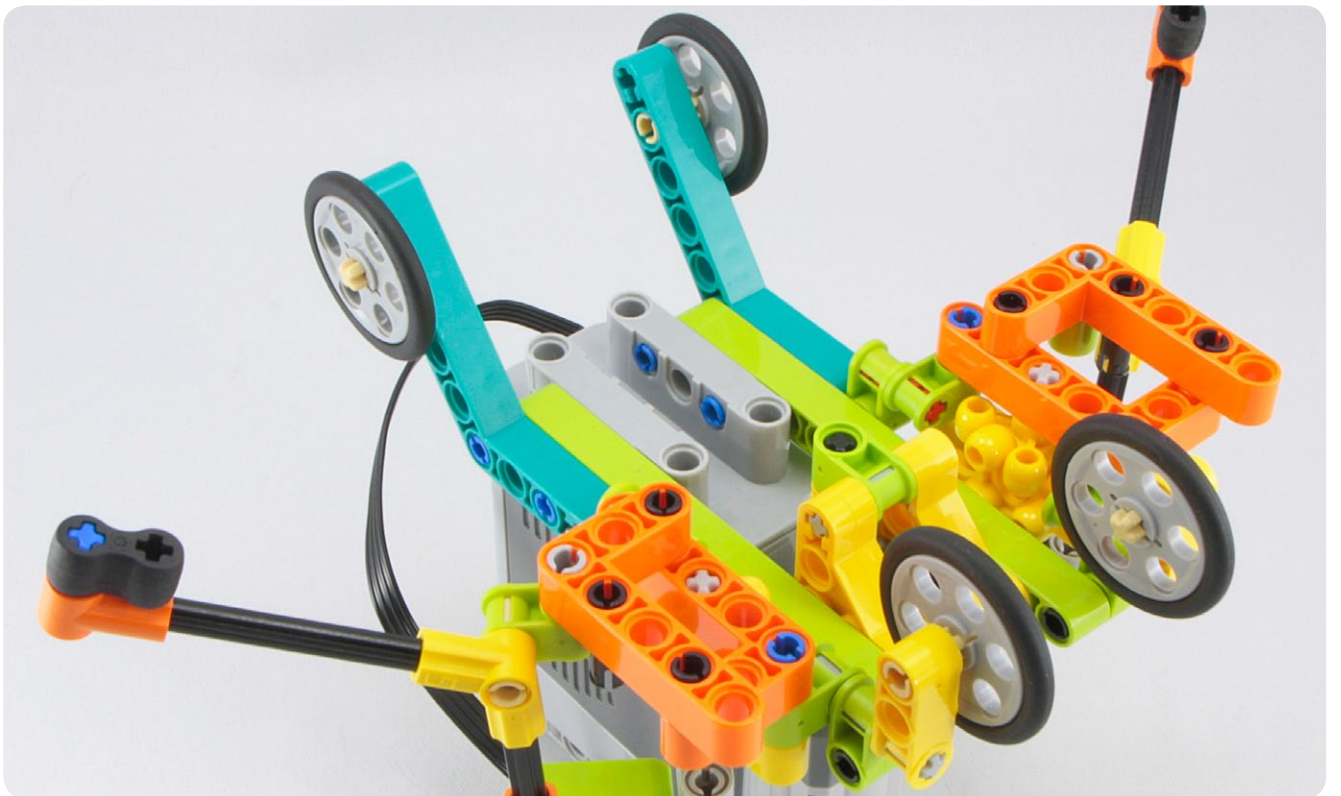


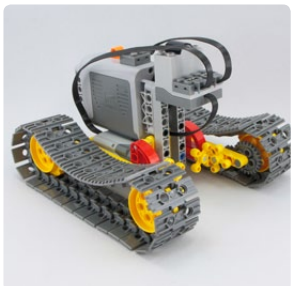












PART 3

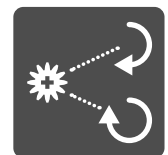
Special Mechanisms



250



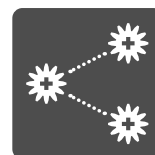
264



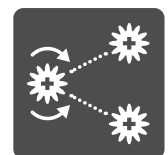
288



256



272

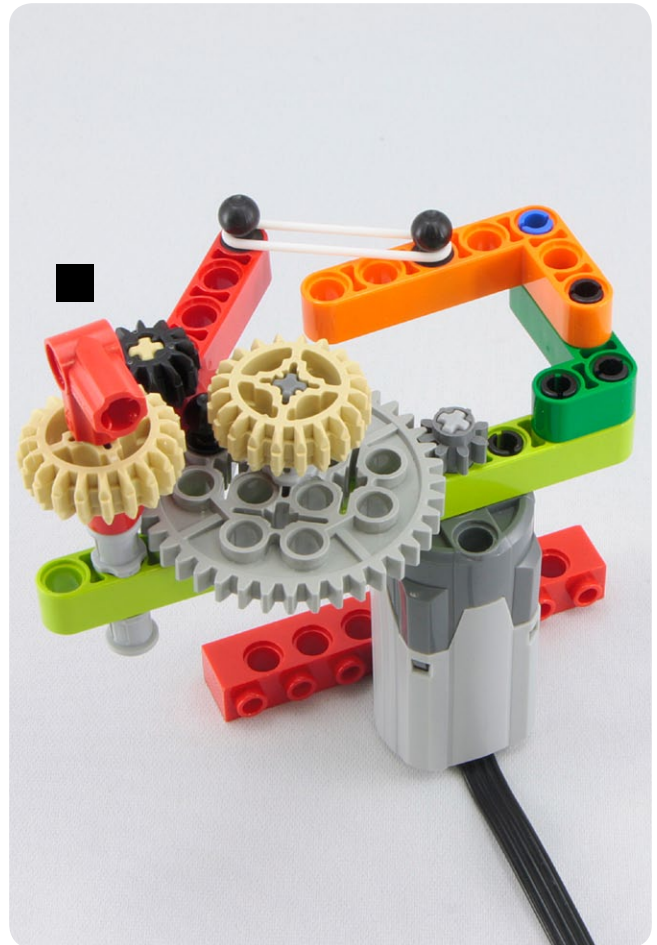
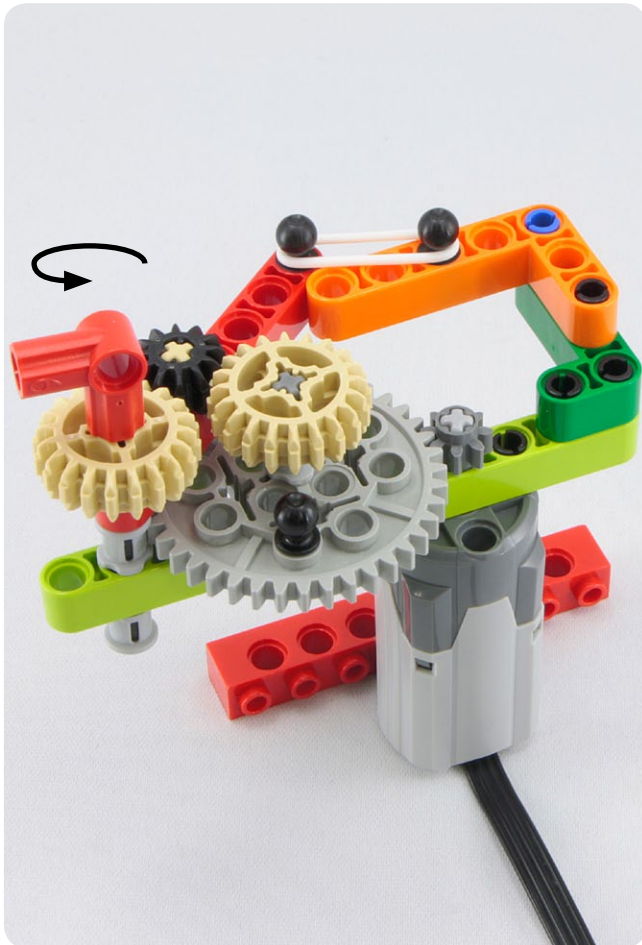
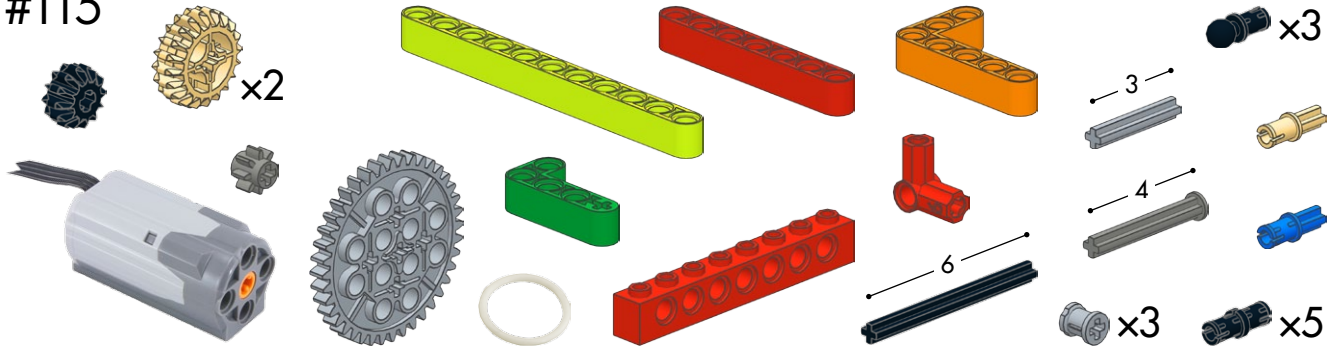


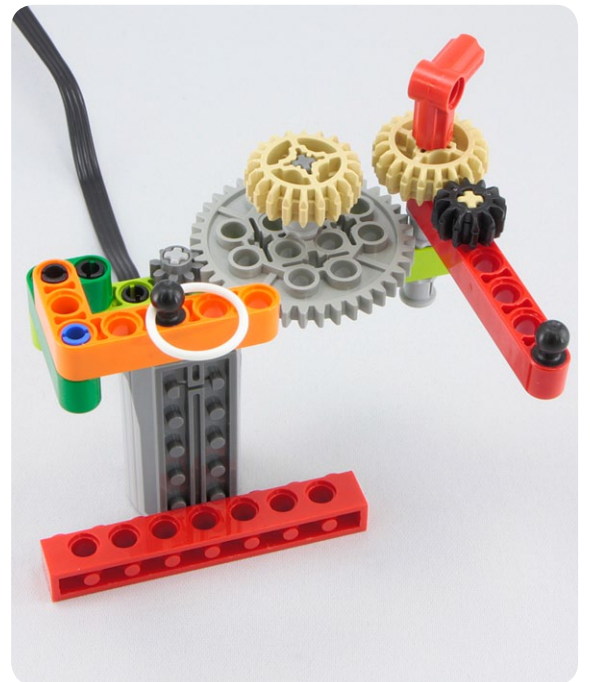
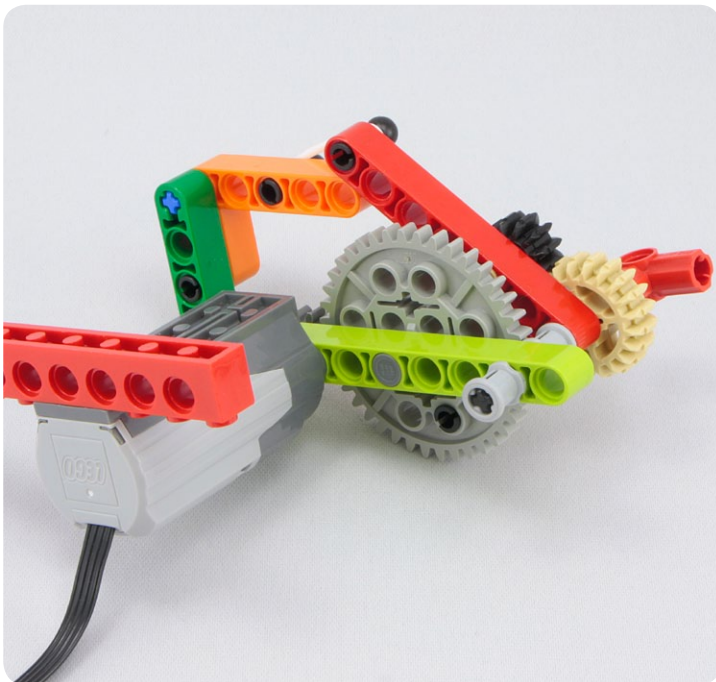
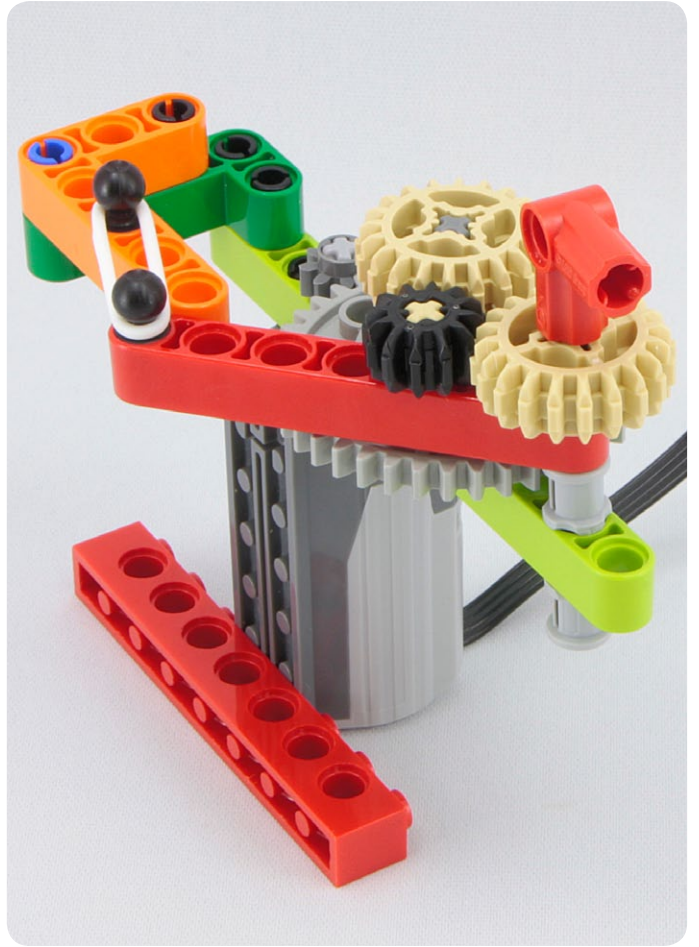
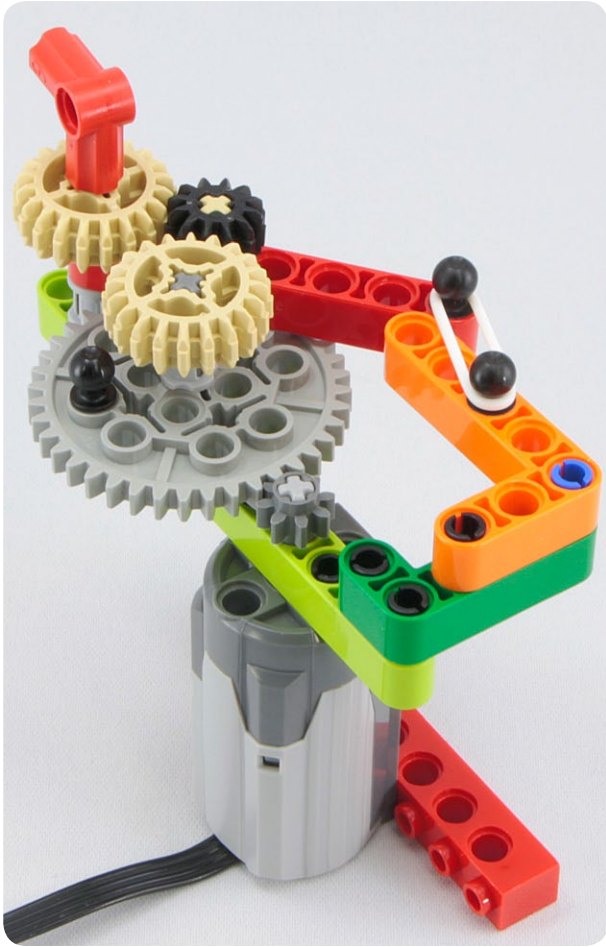
308

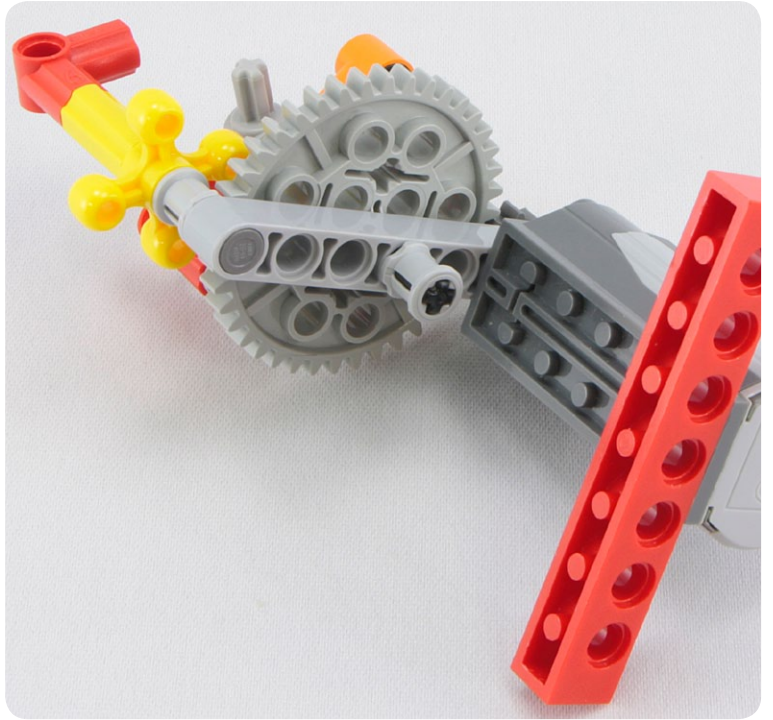


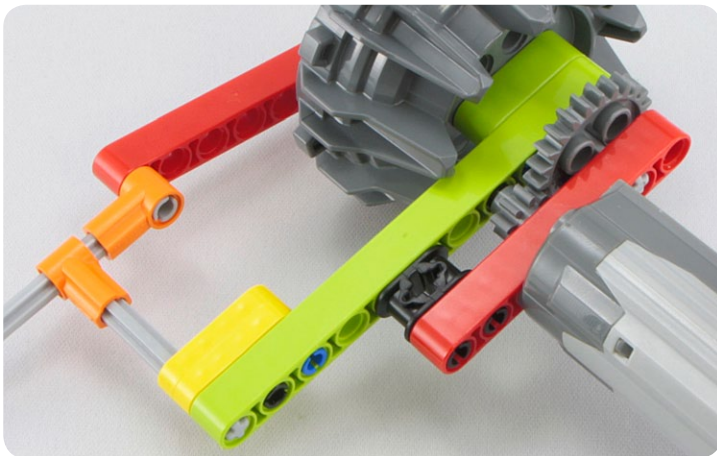
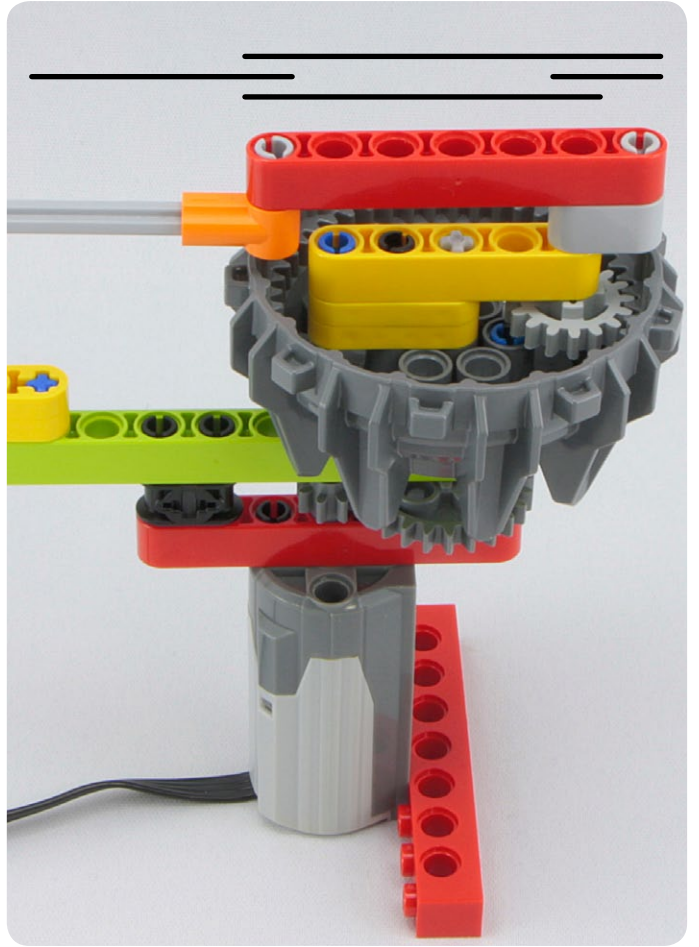
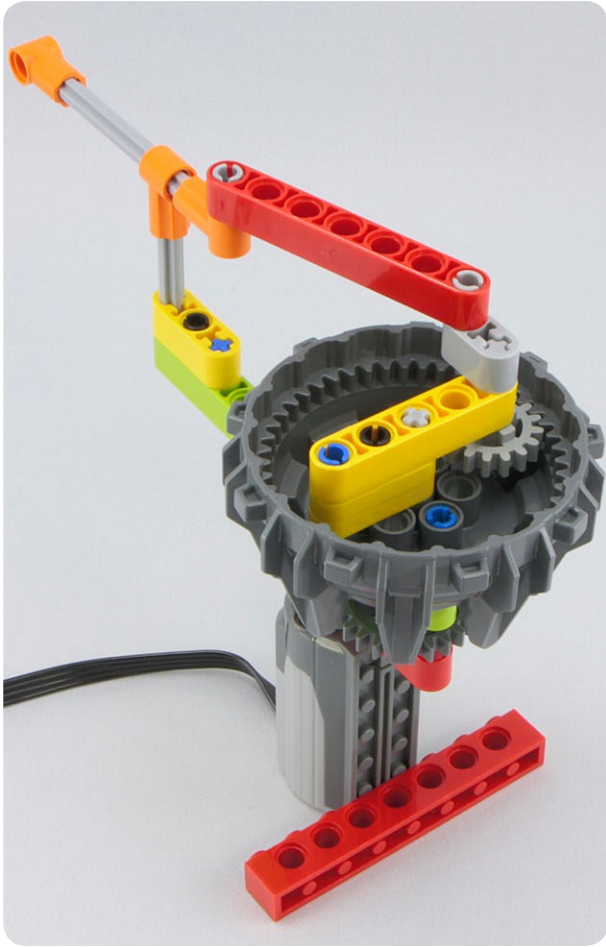
Intermittent motion

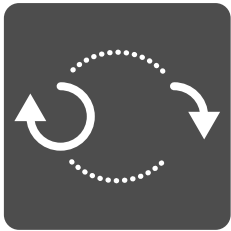
#115





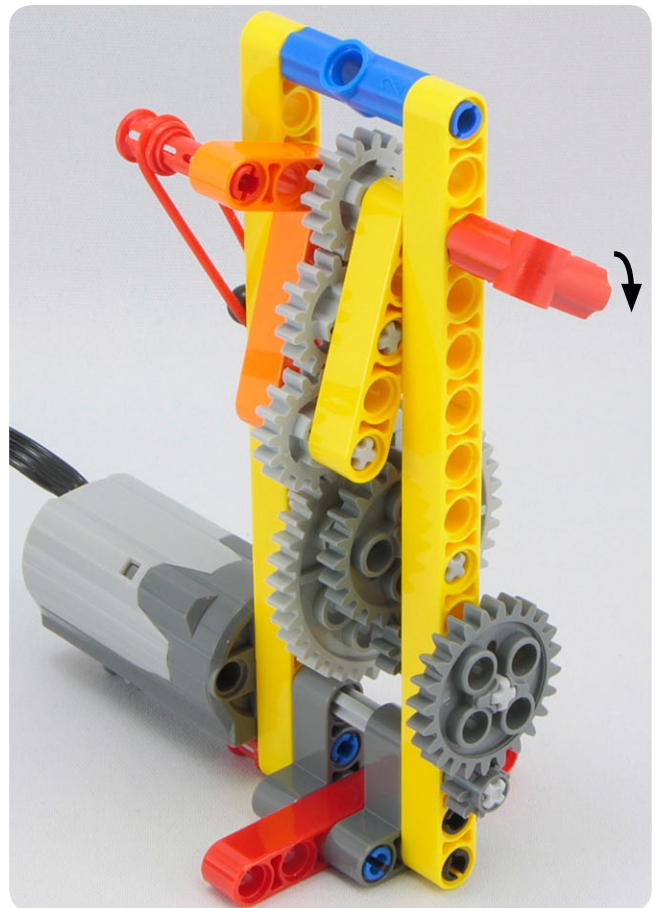
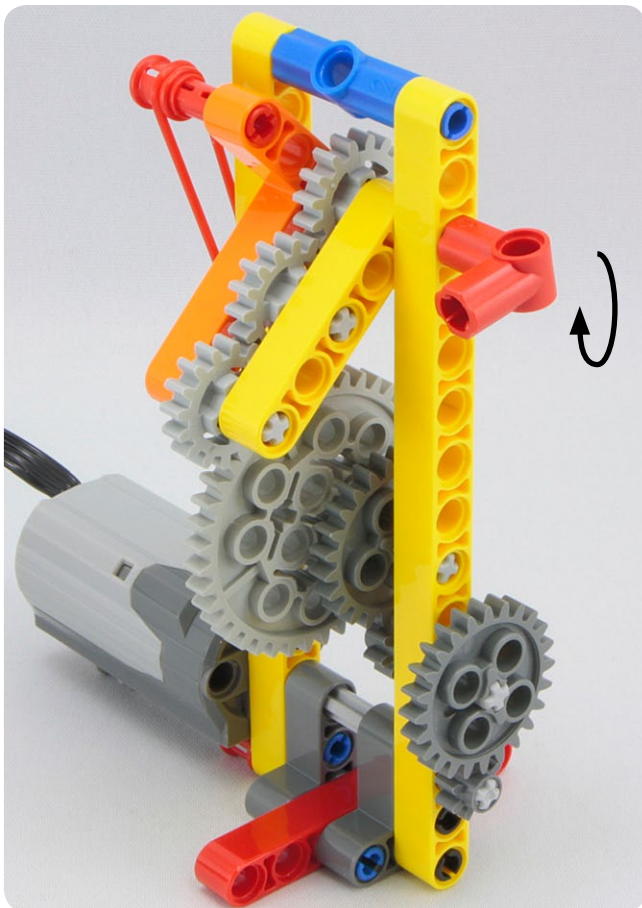
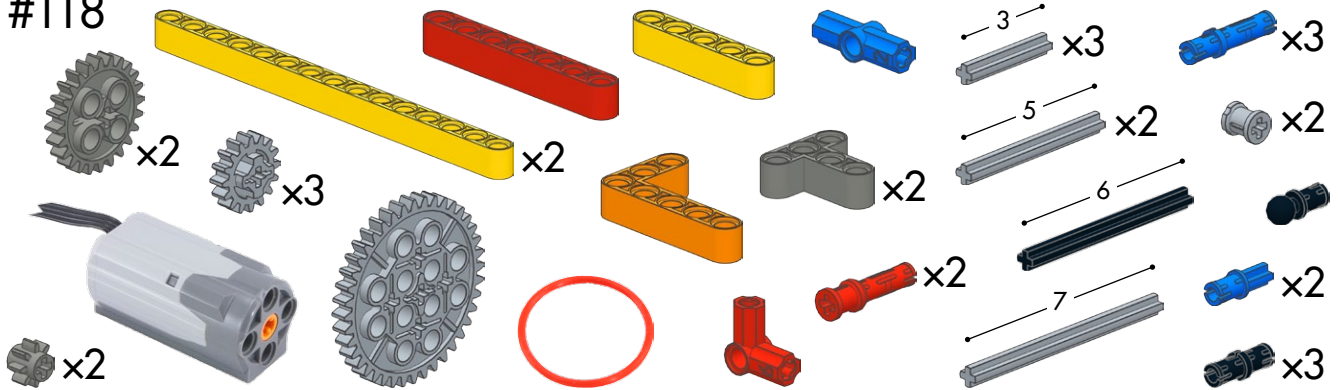


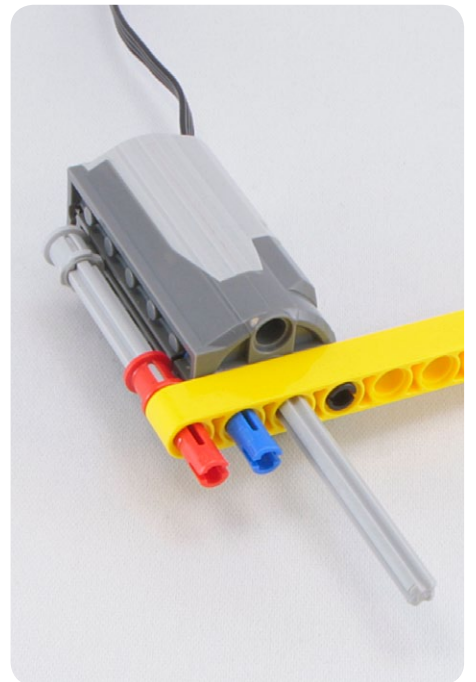
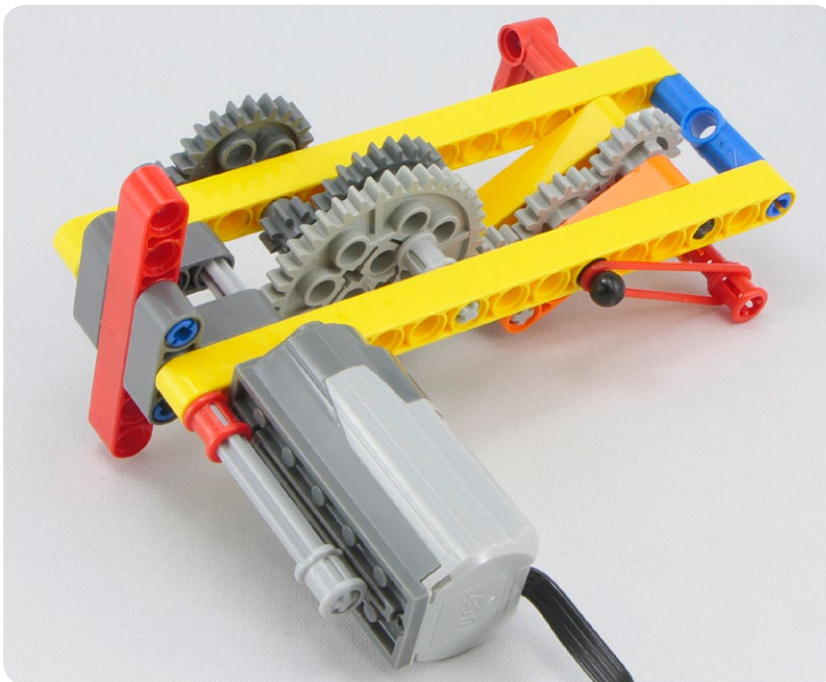
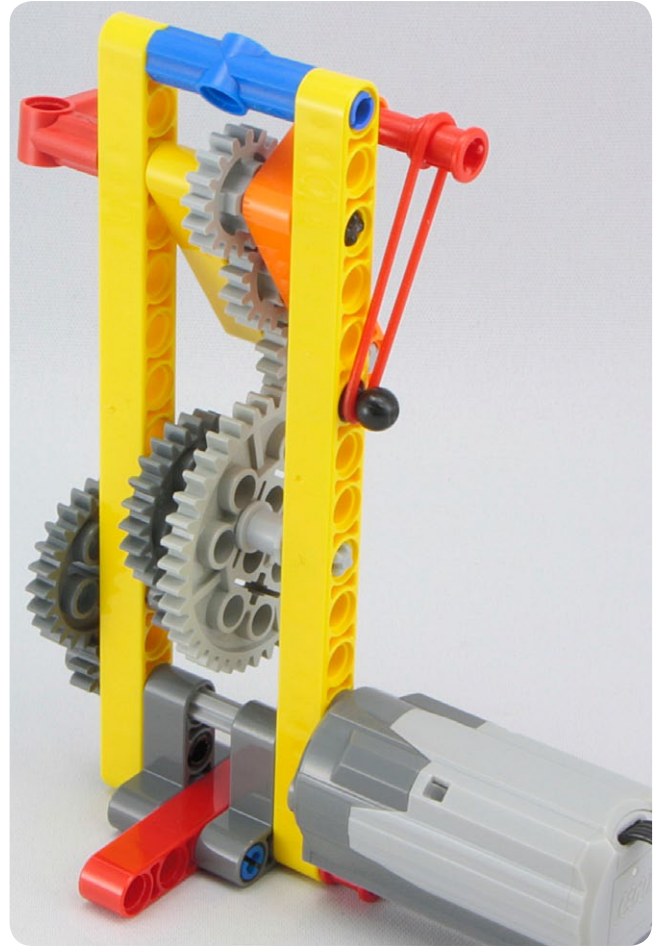




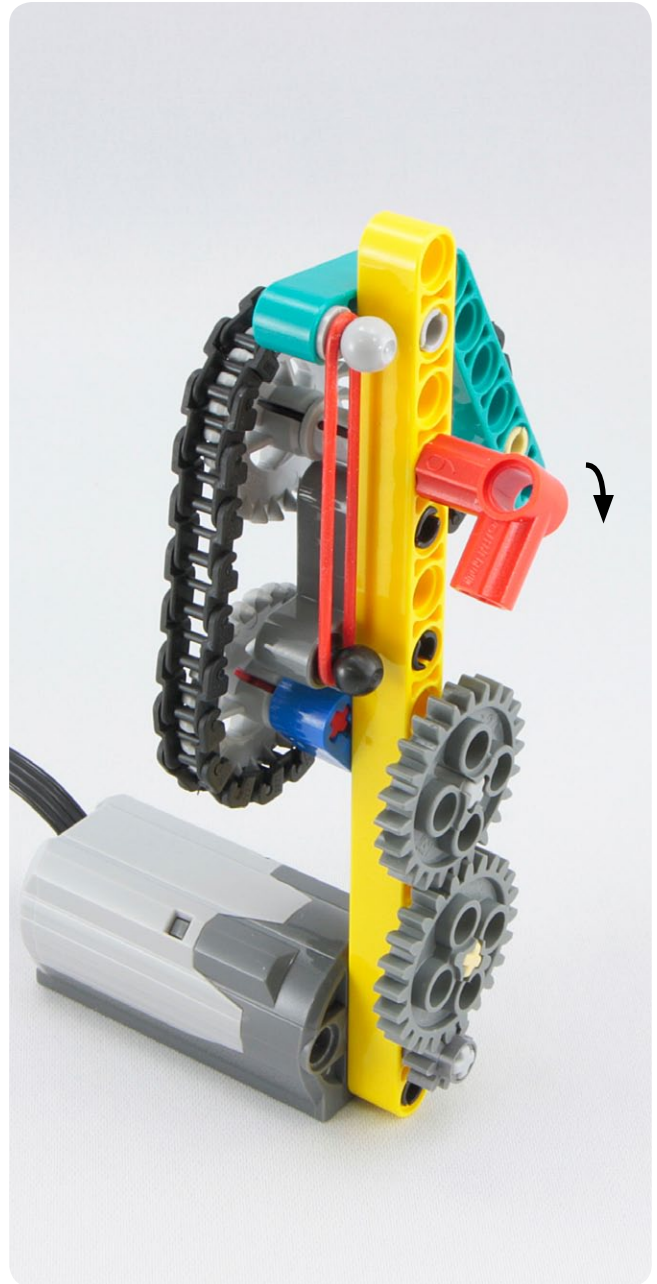
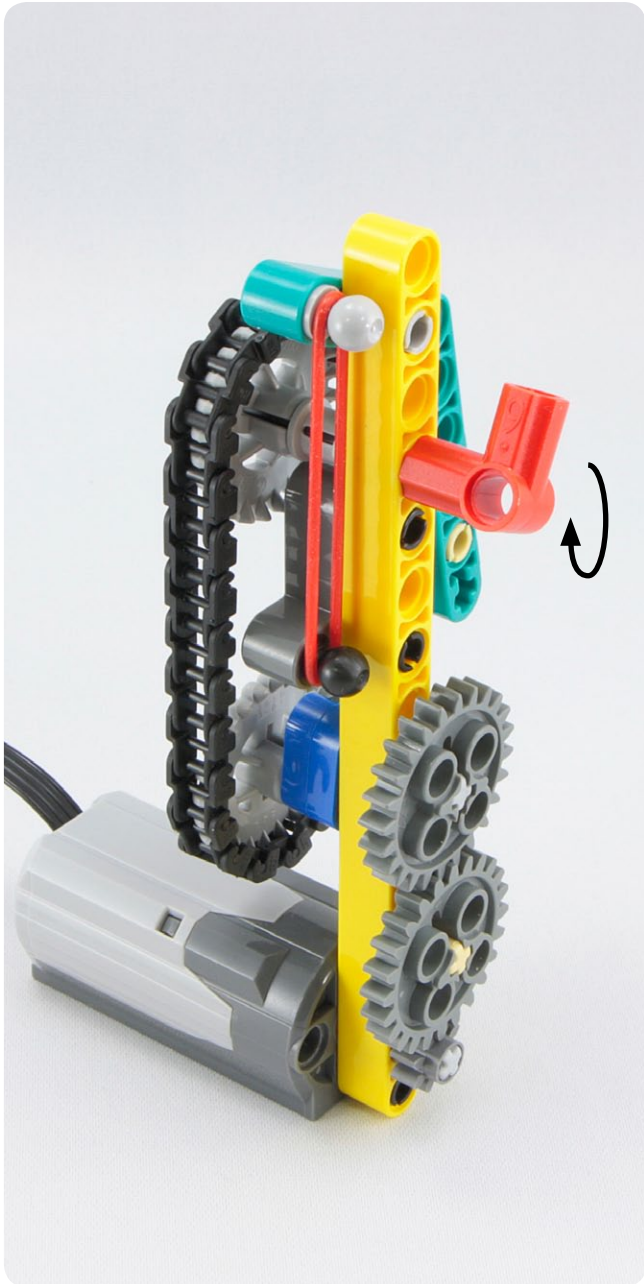
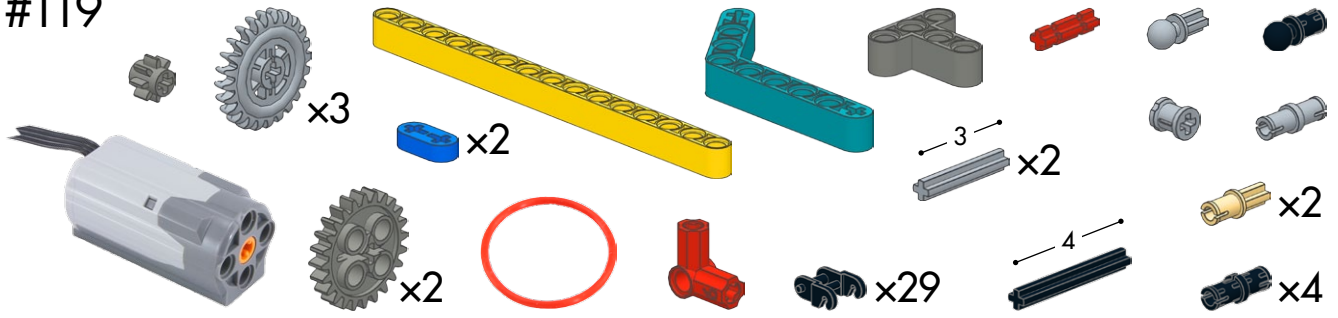
Smooth changes of rotation speed

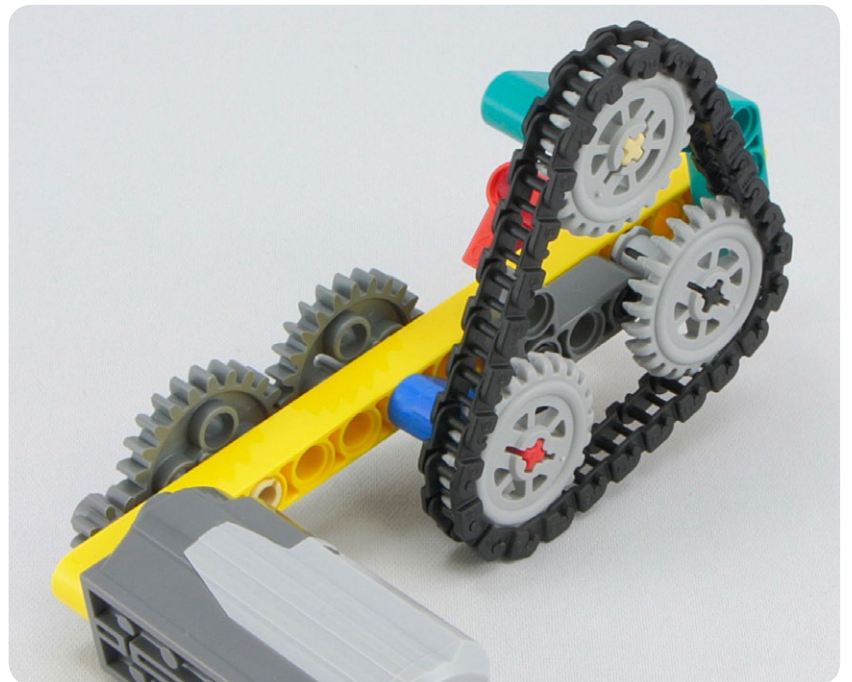
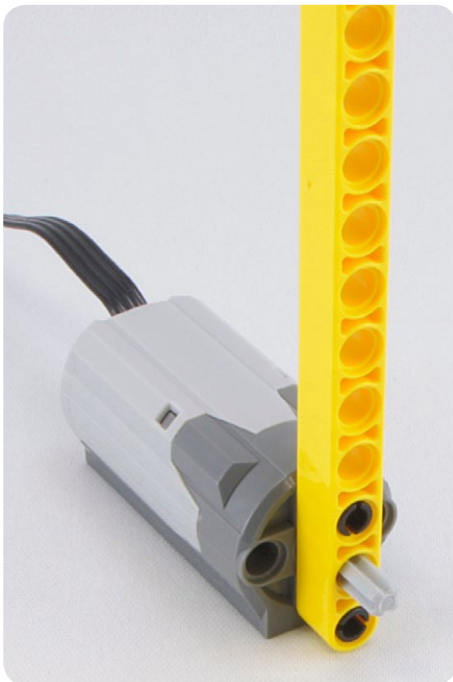
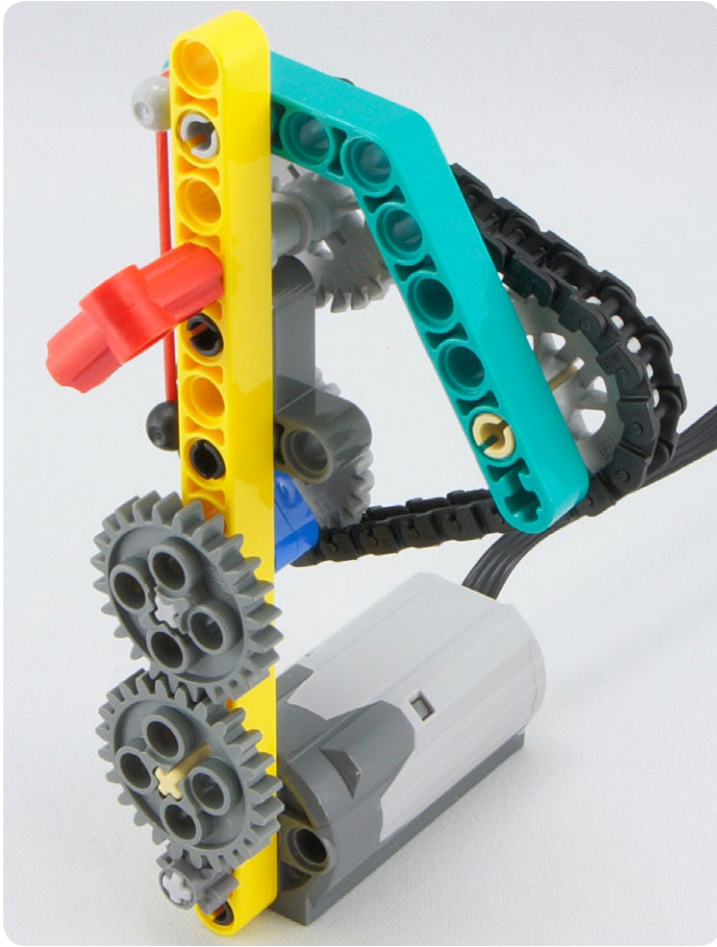
#118




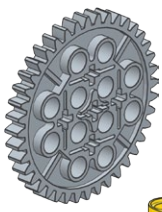

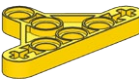
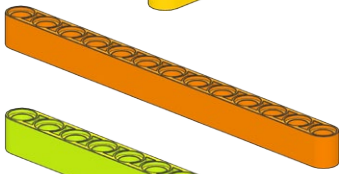
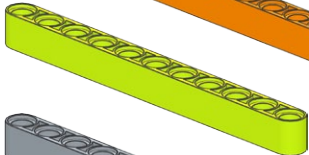
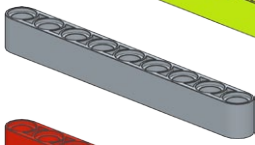
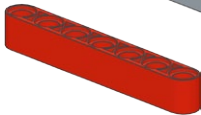
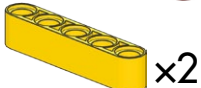



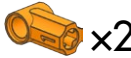

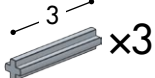
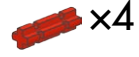
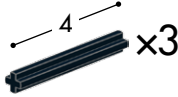
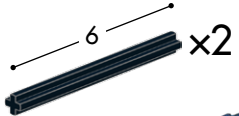





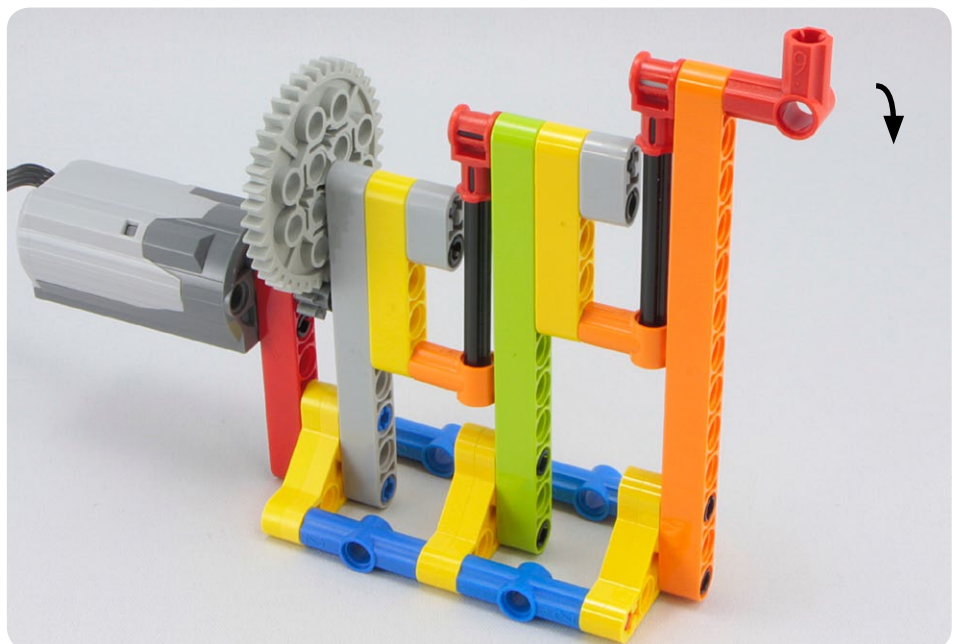
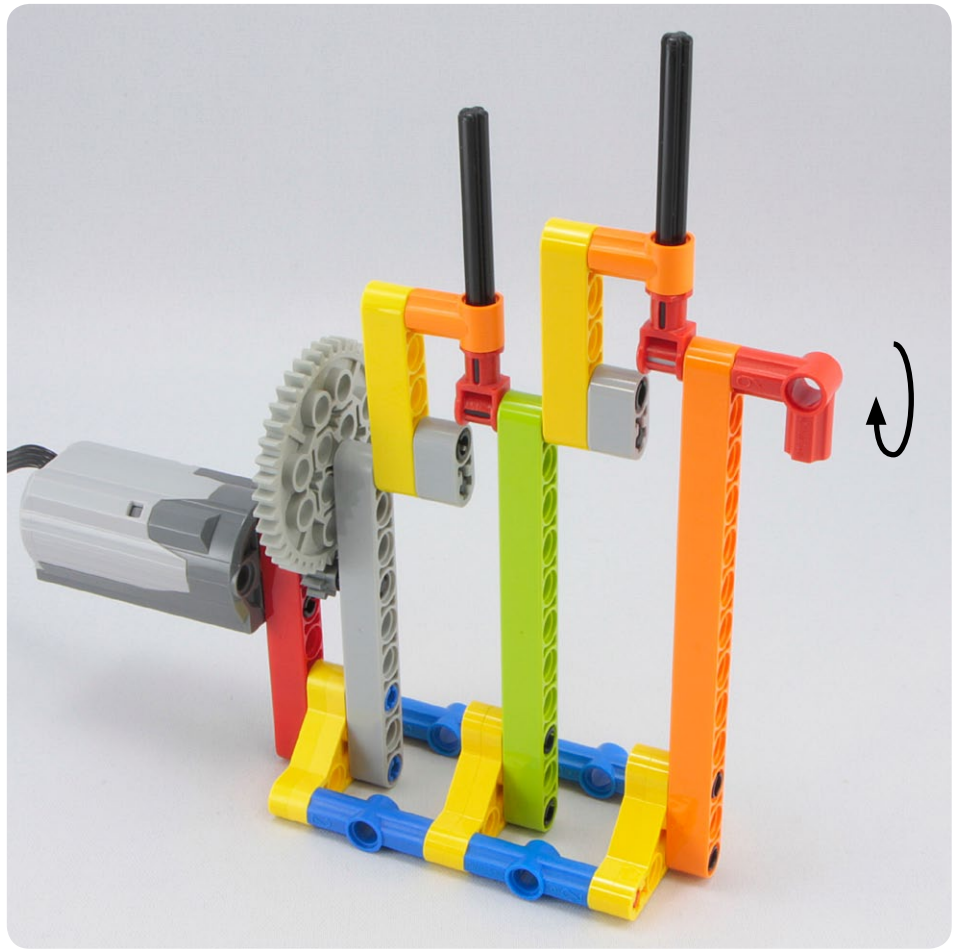
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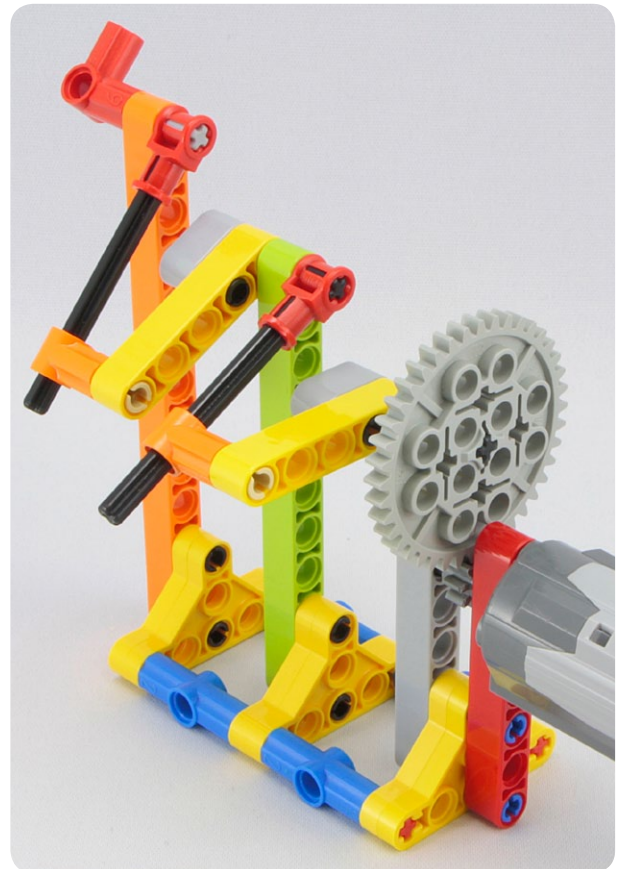
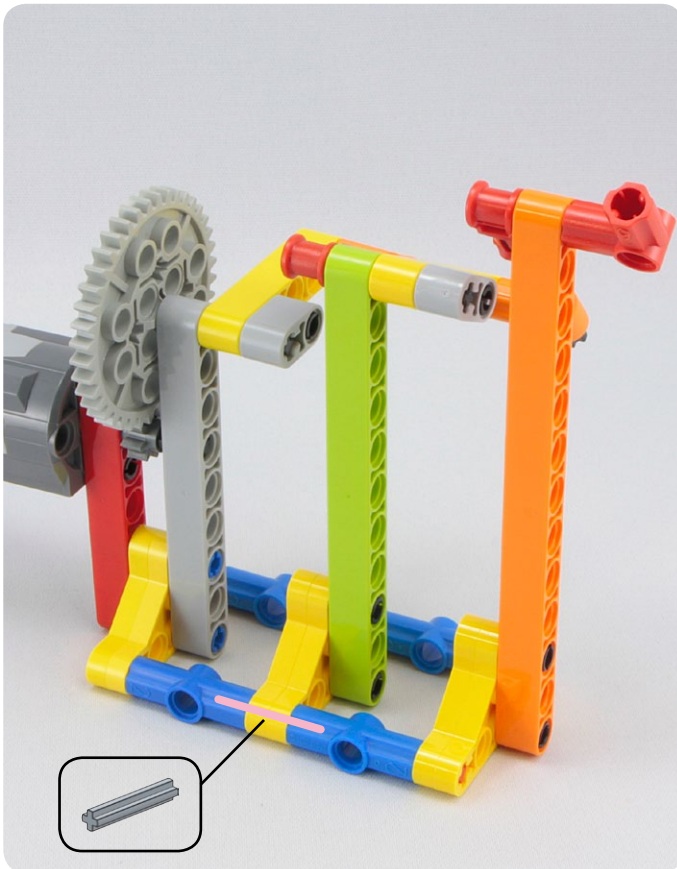
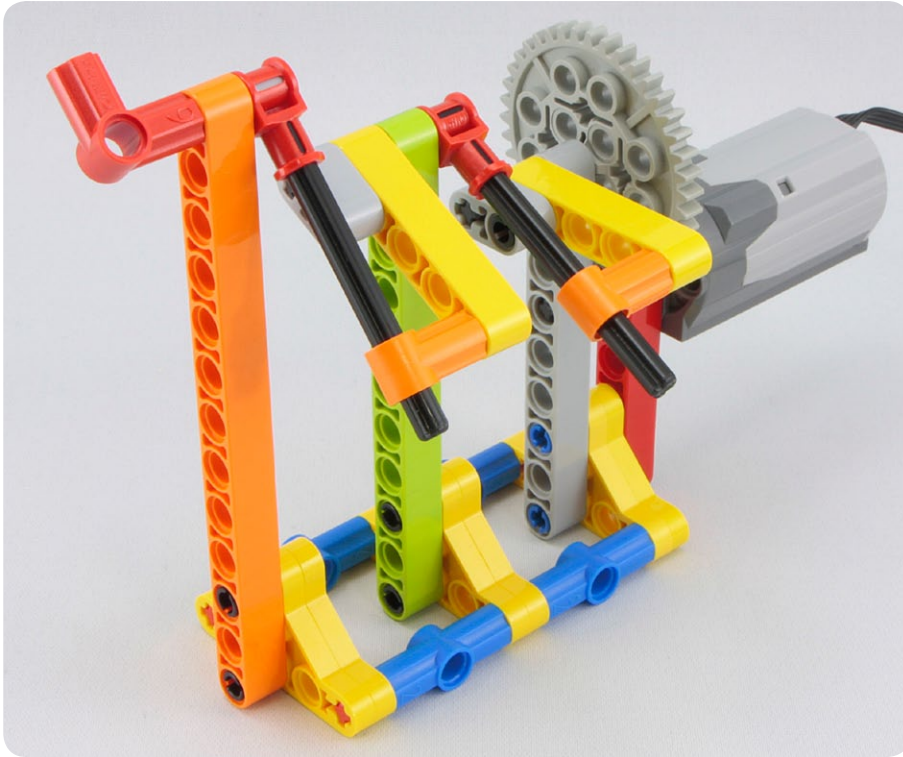


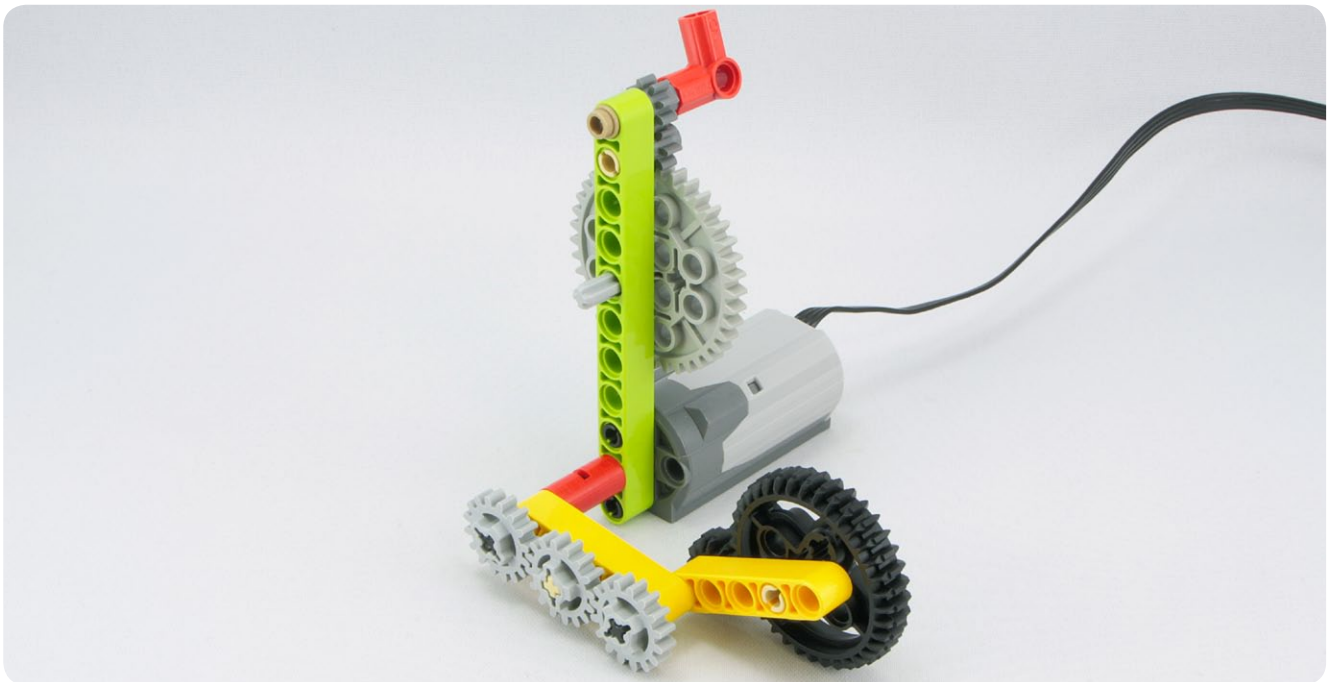
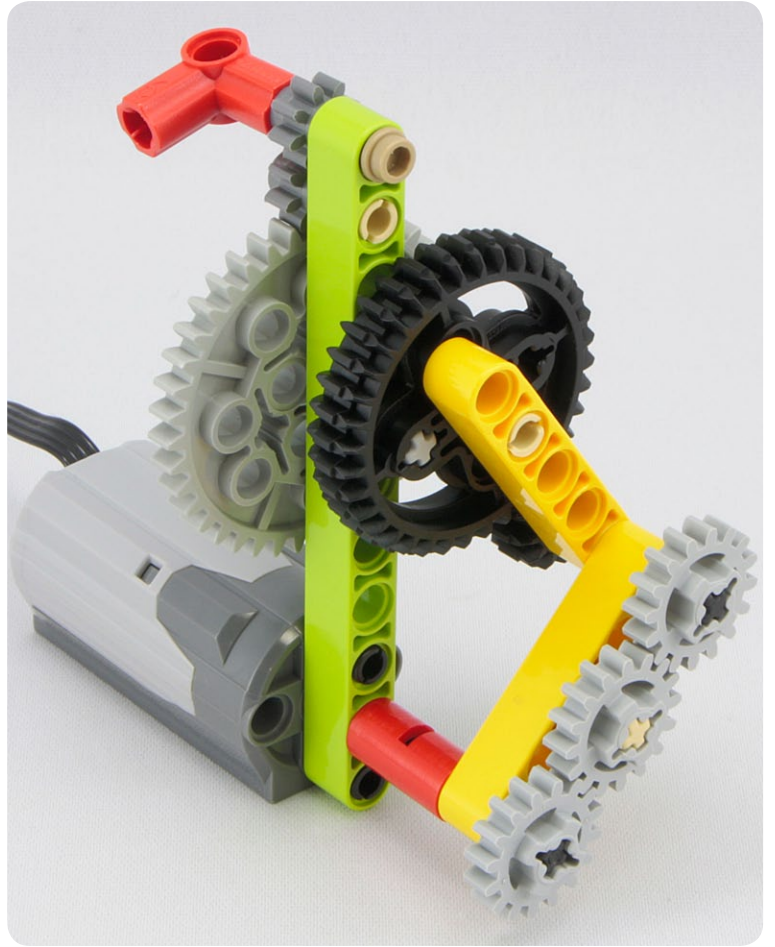


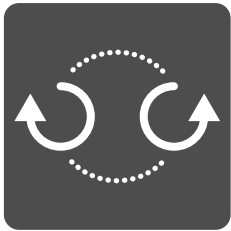
#120

- 
- 
- 
-  x6
- 
- 
- 
- 
-  x2
-  x2
-  x2
-  x4
-  x2
- 
-  x3
-  x4
-  x3
-  x2
-  x2
-  x2
-  x8



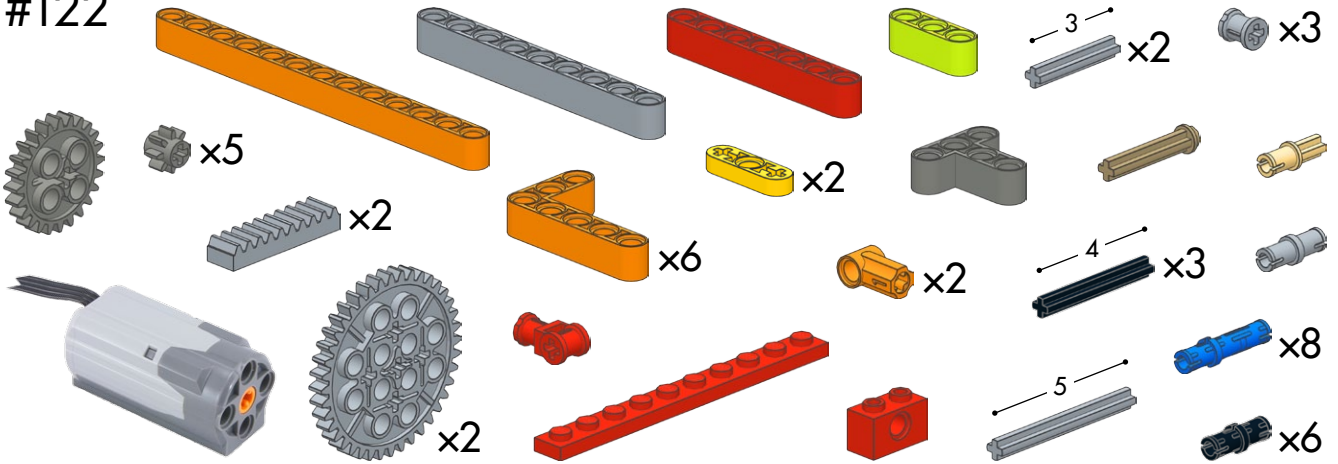


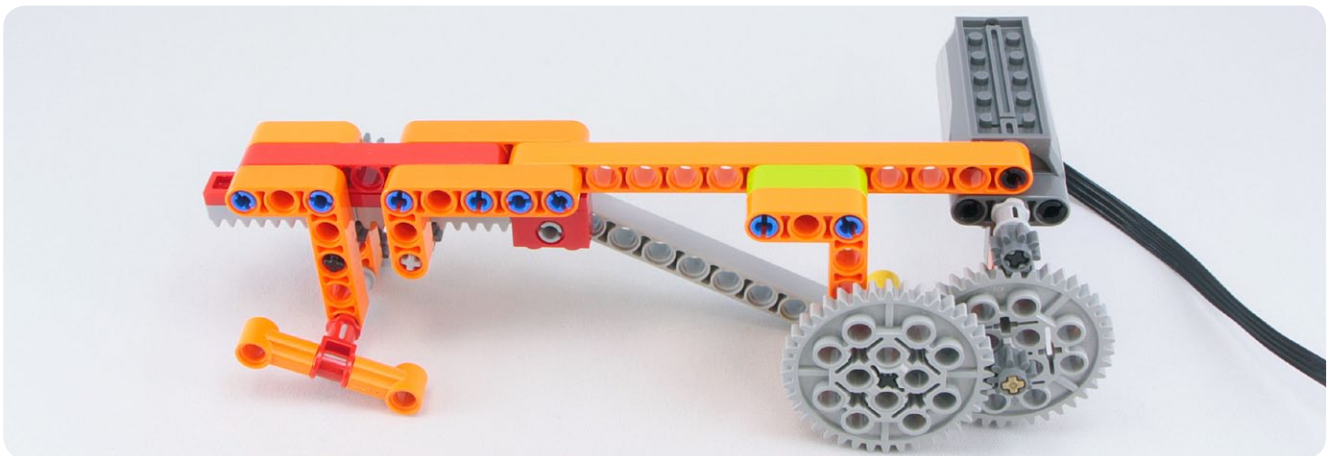
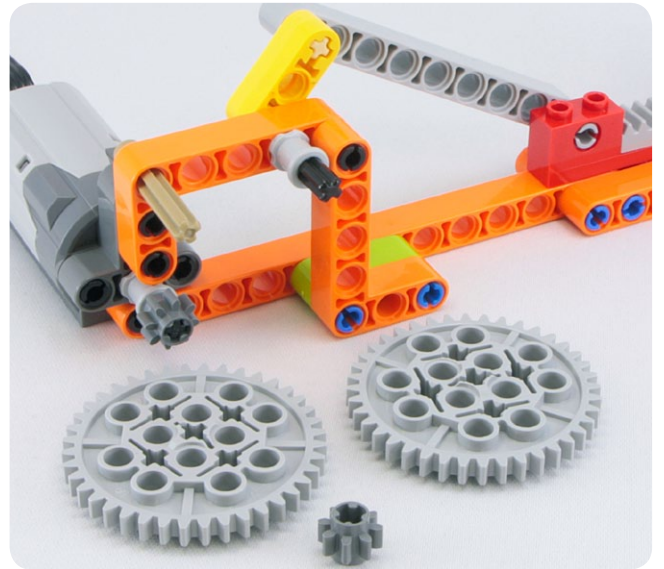
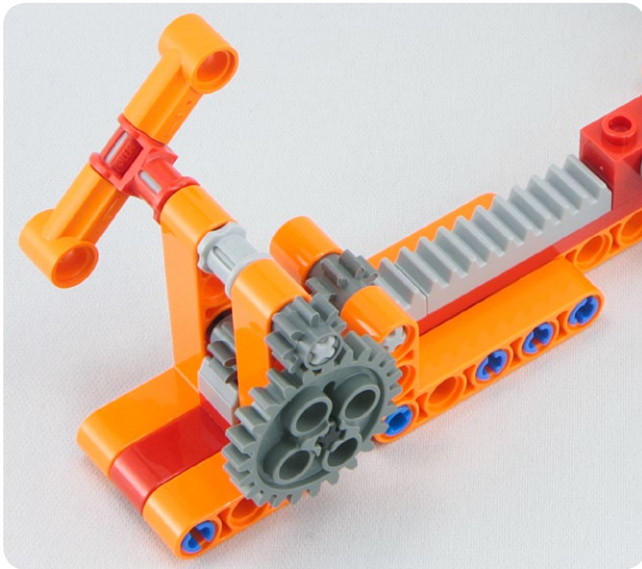
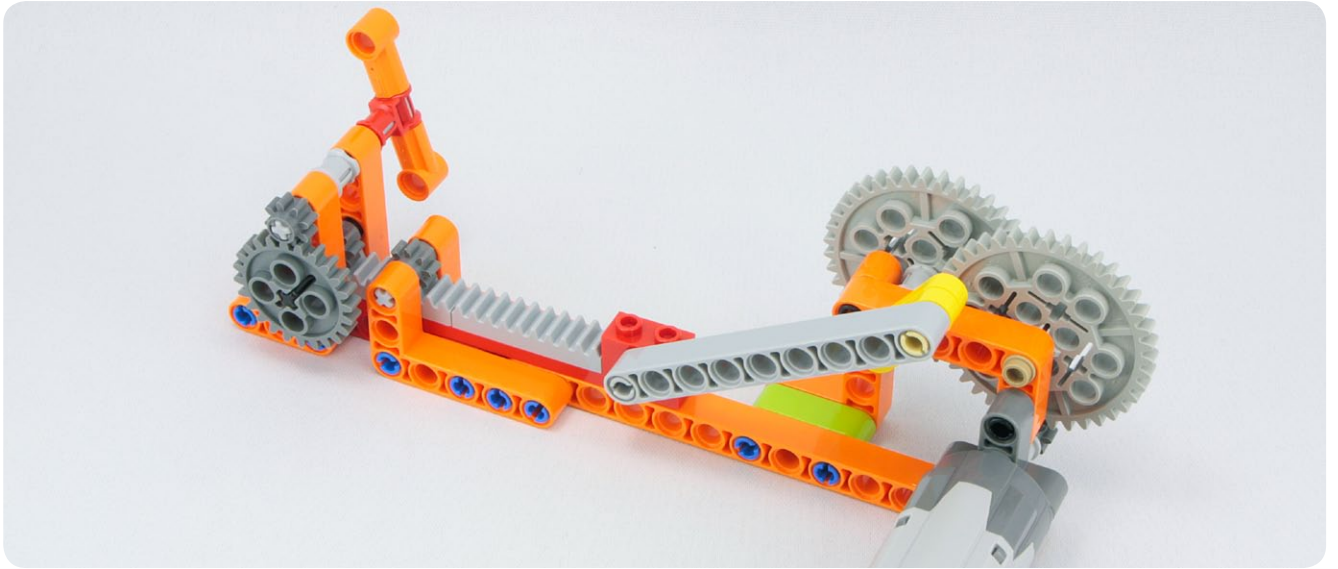


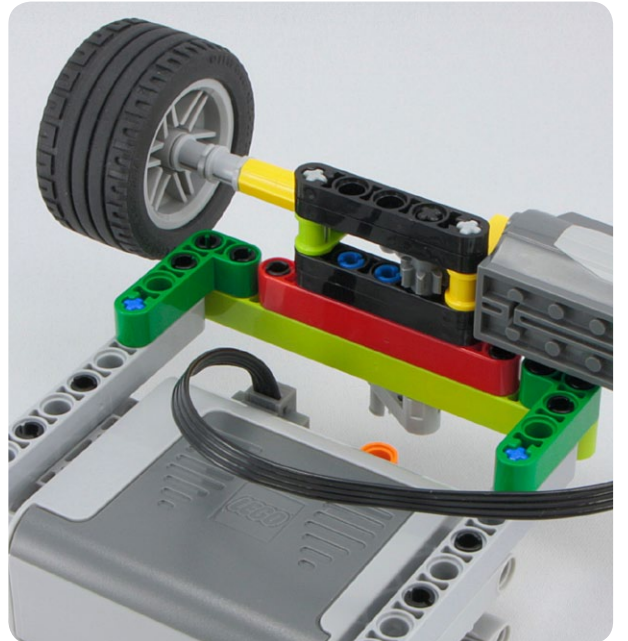
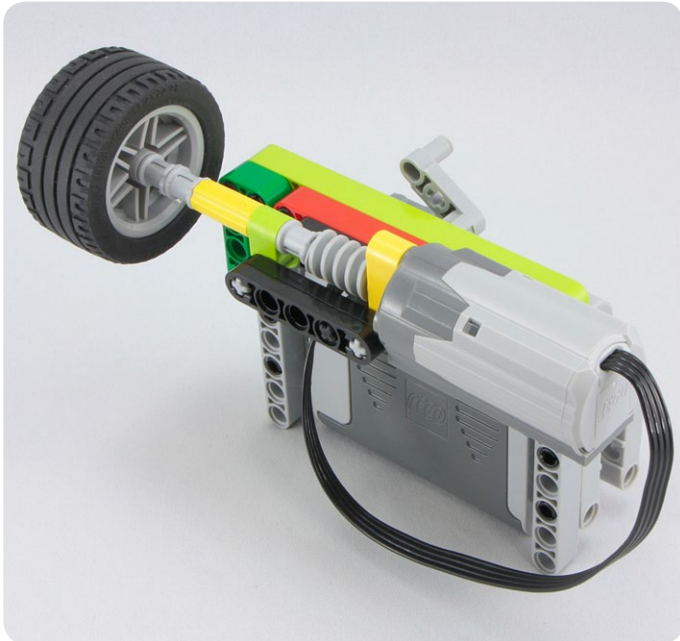
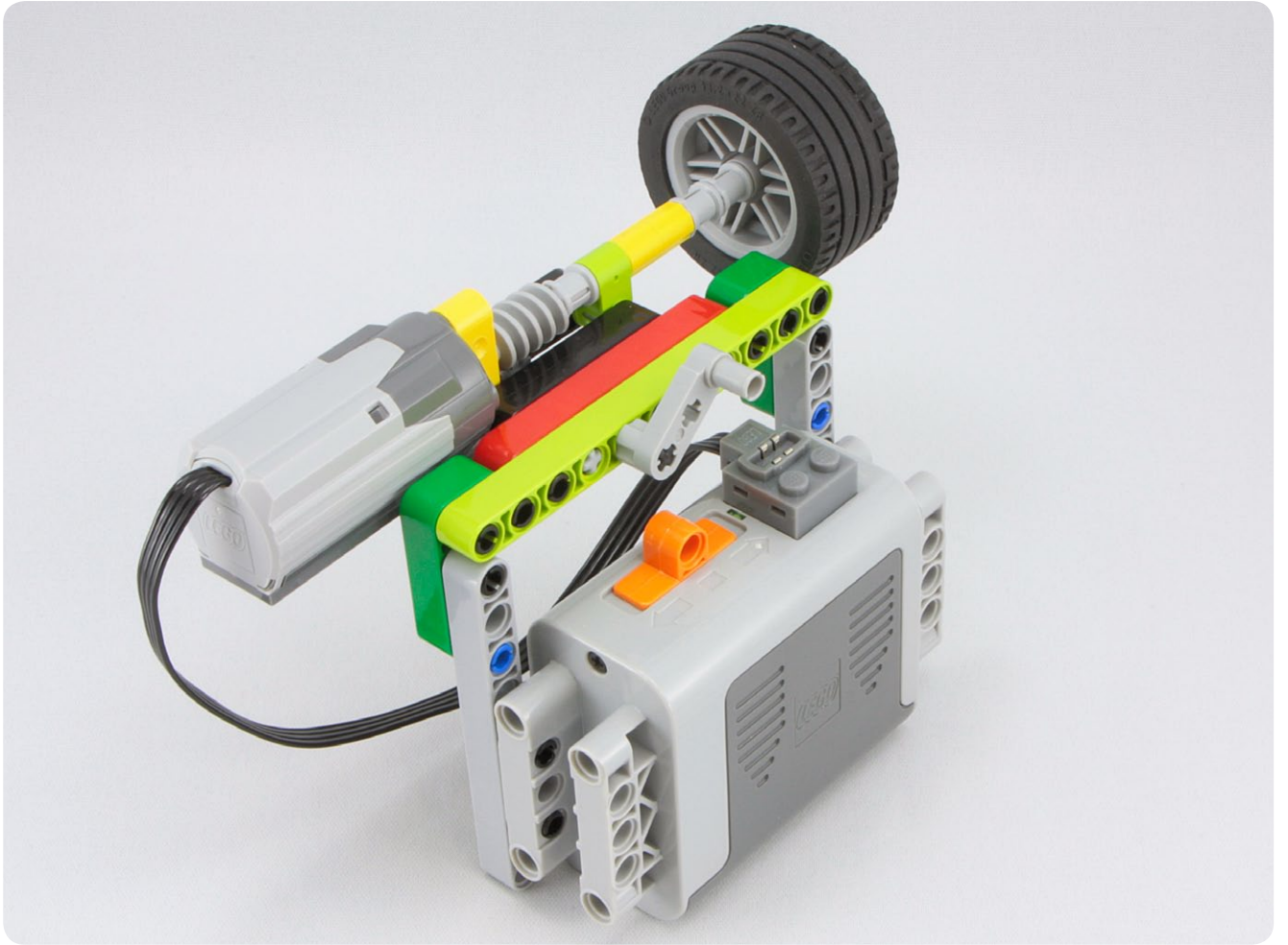


Switching rotational direction


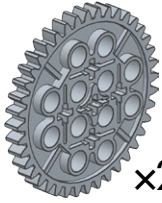




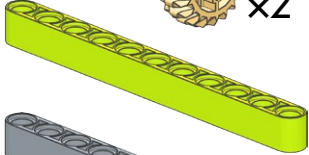
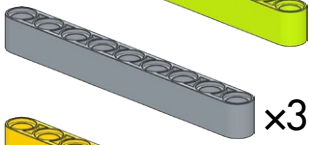
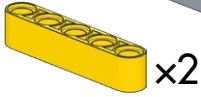
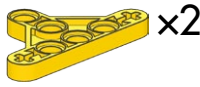
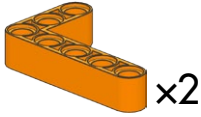
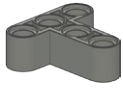
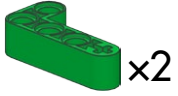
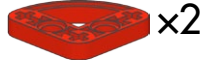

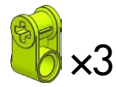


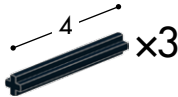

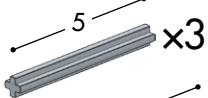
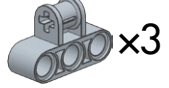
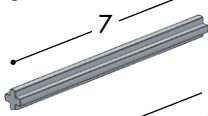
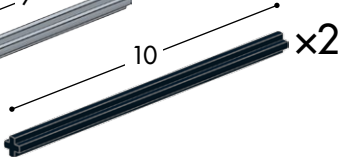





#122

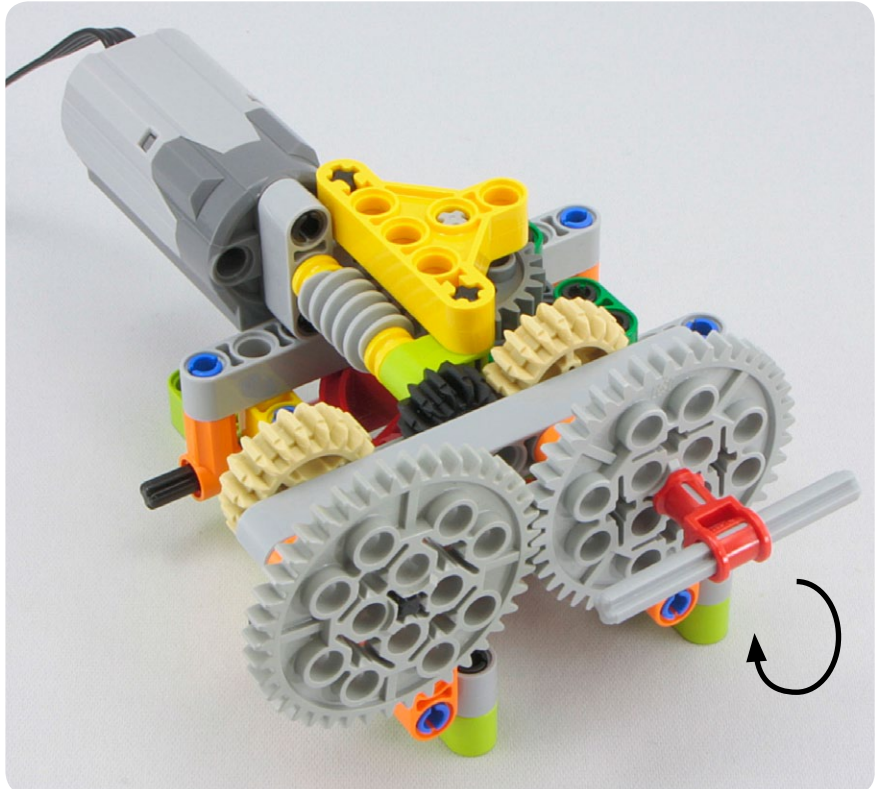
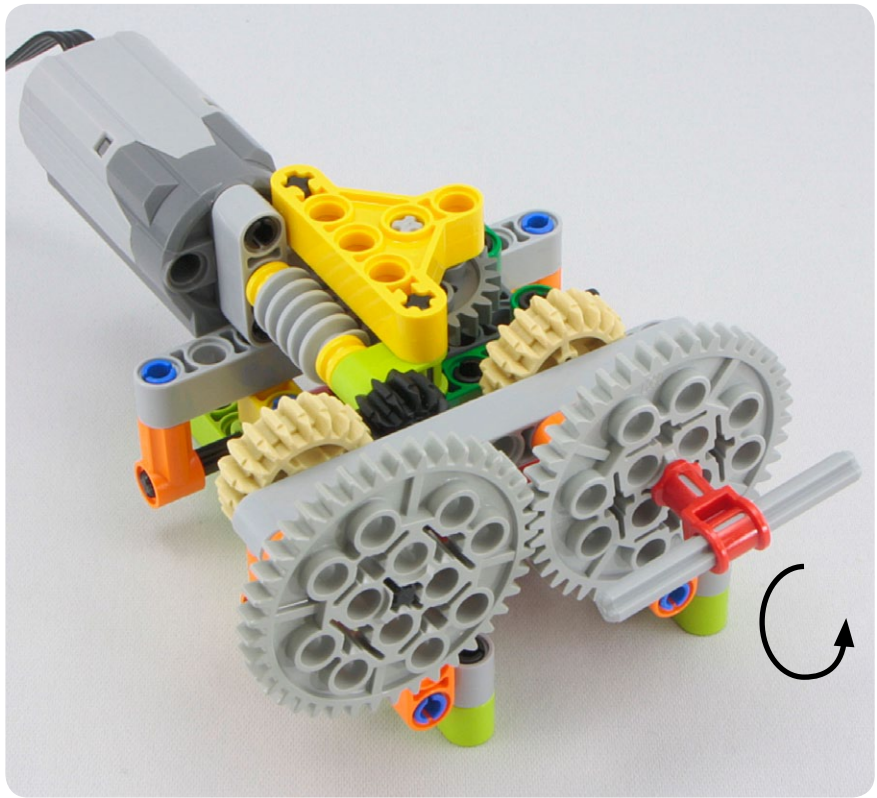


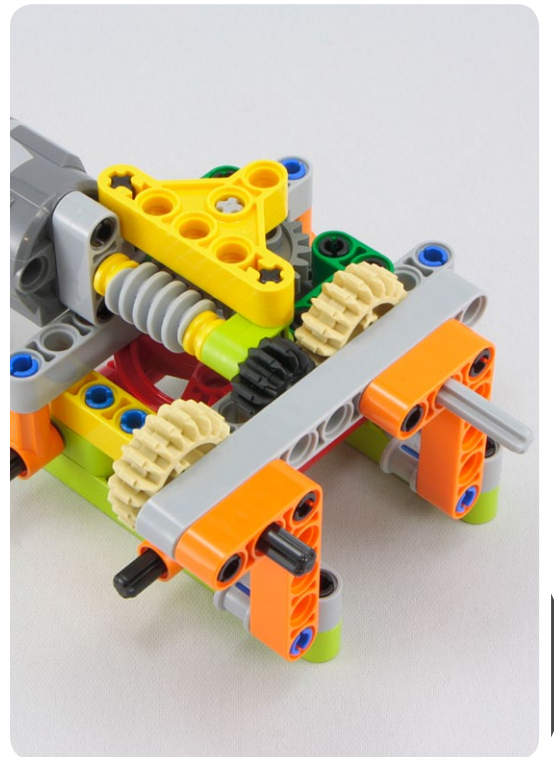
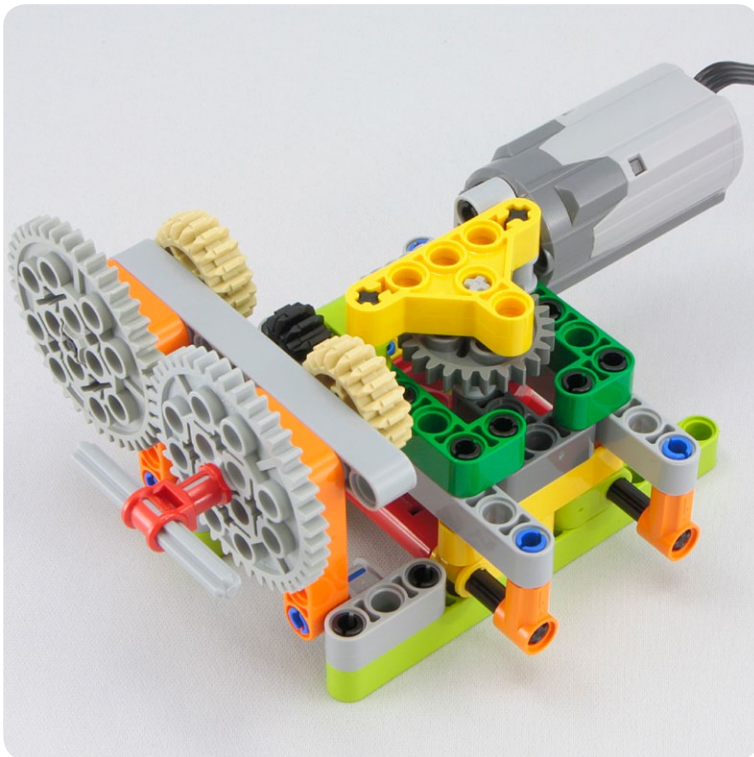
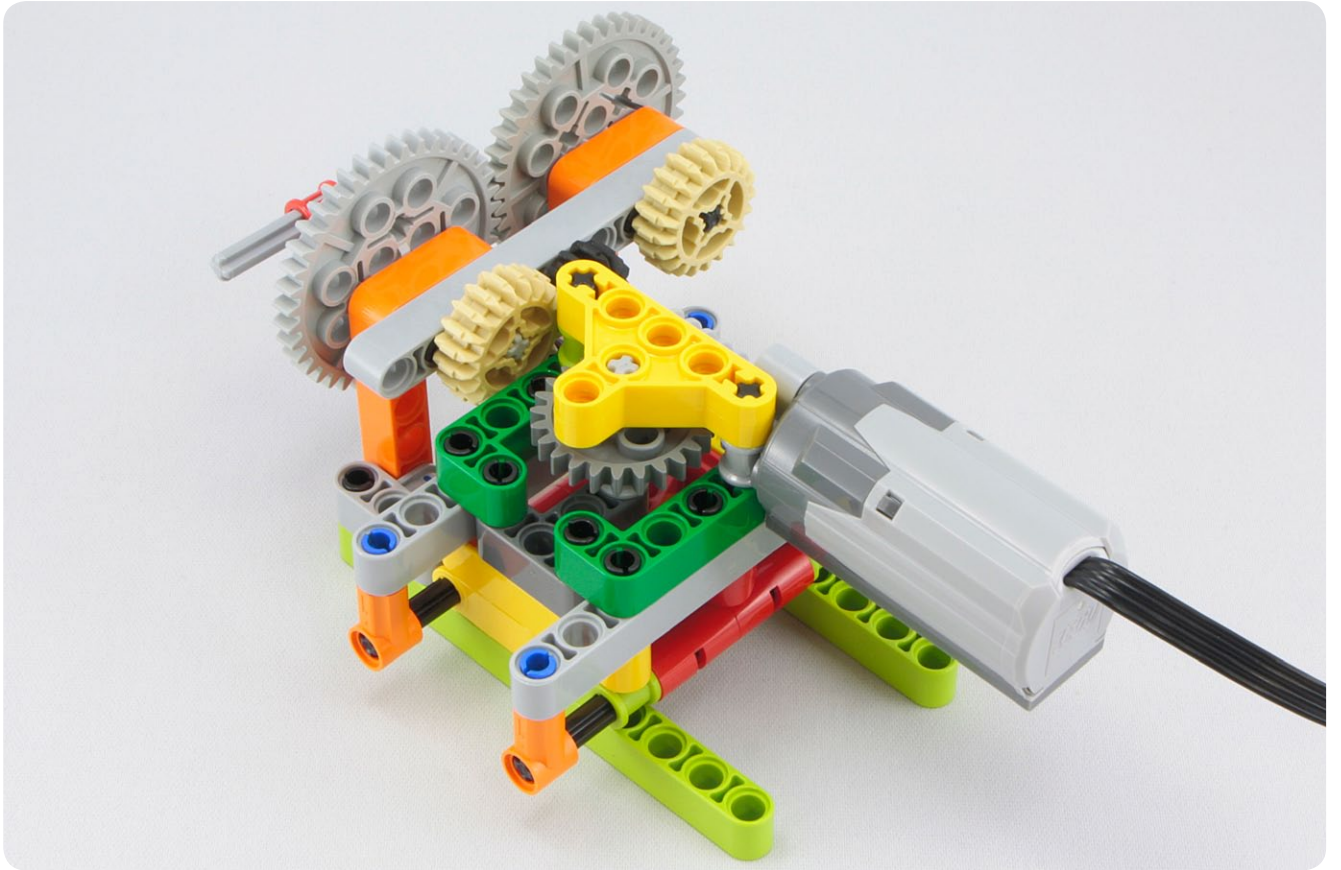


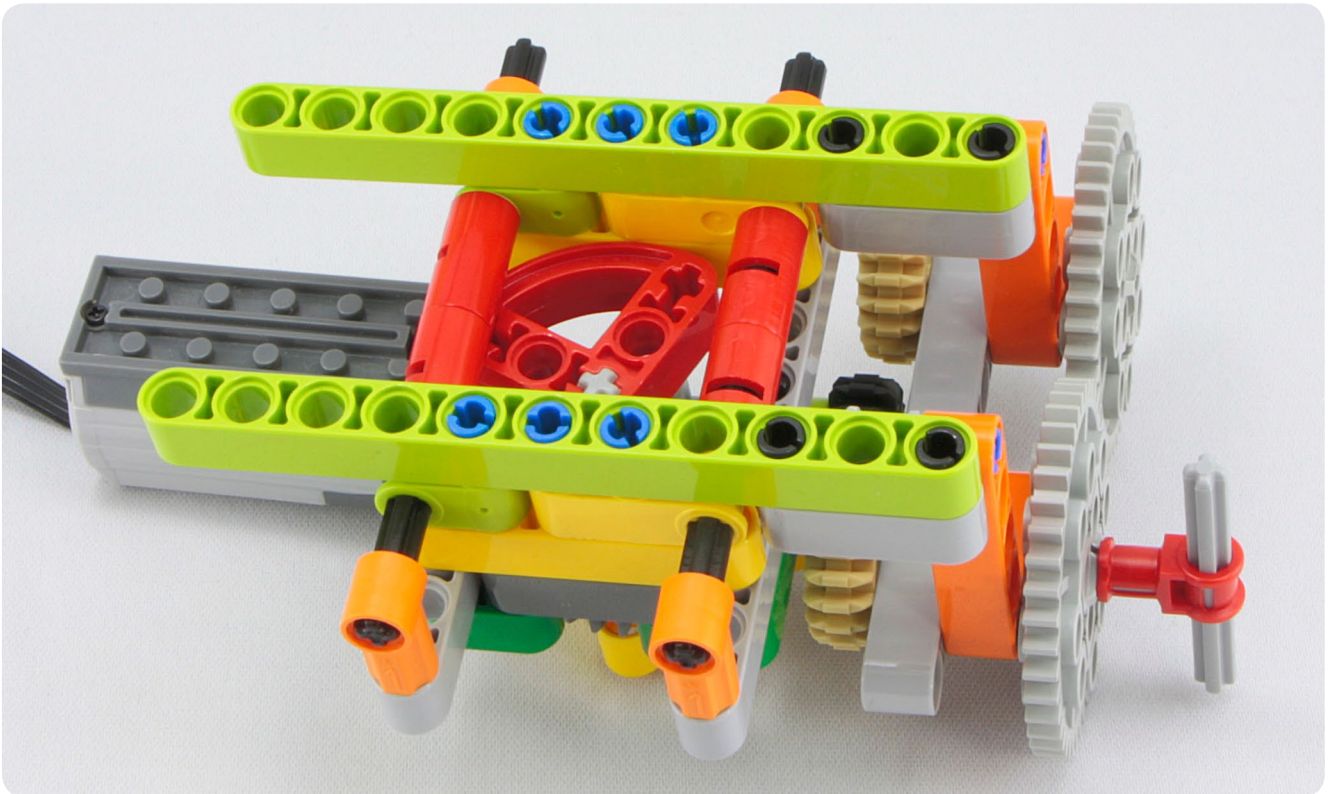
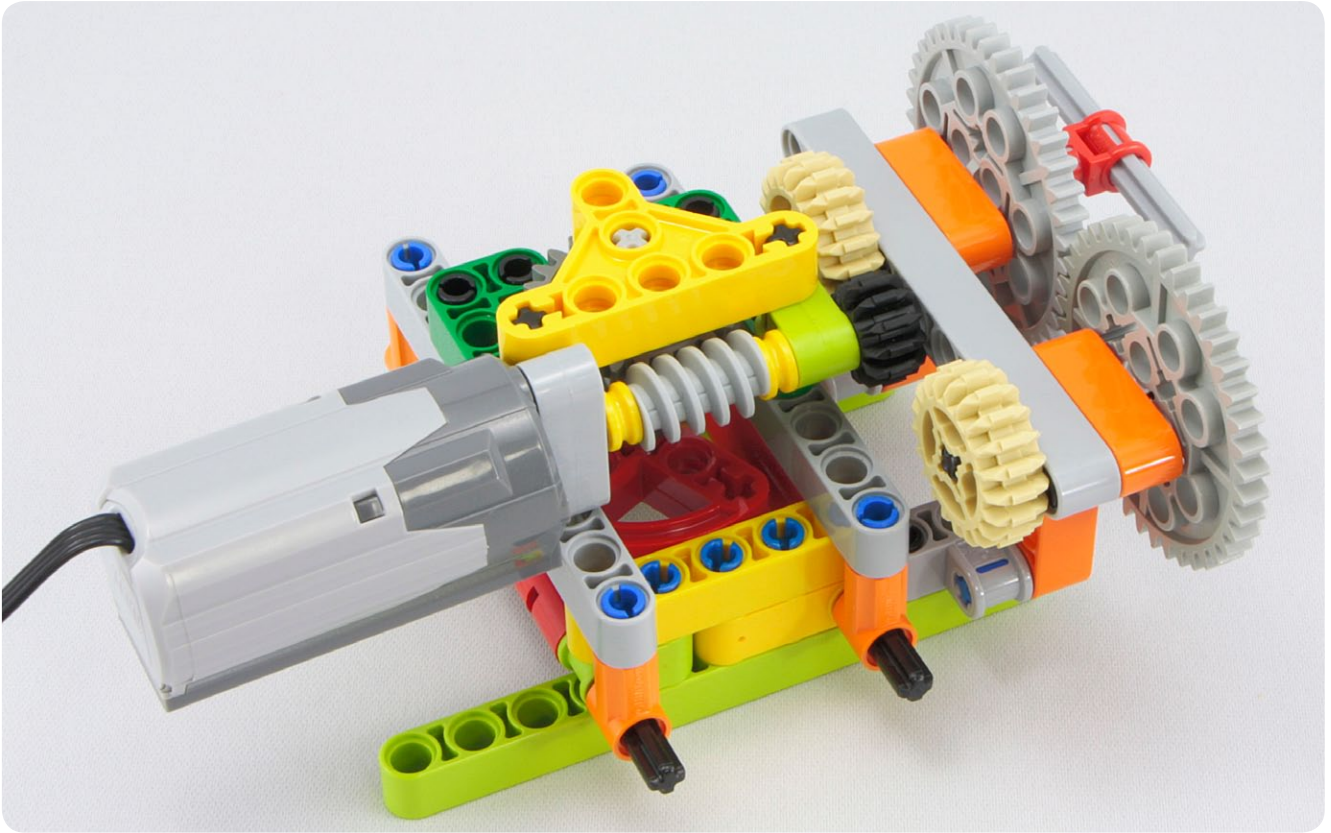


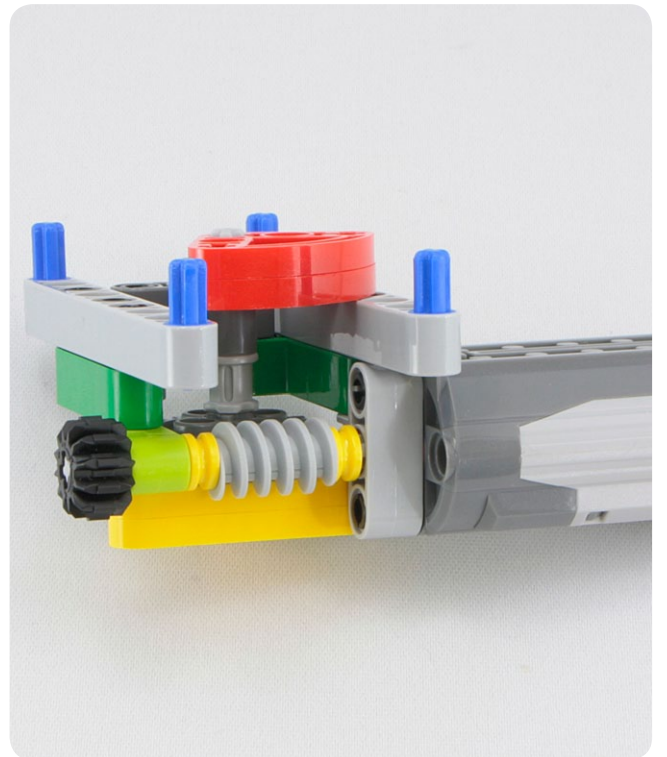
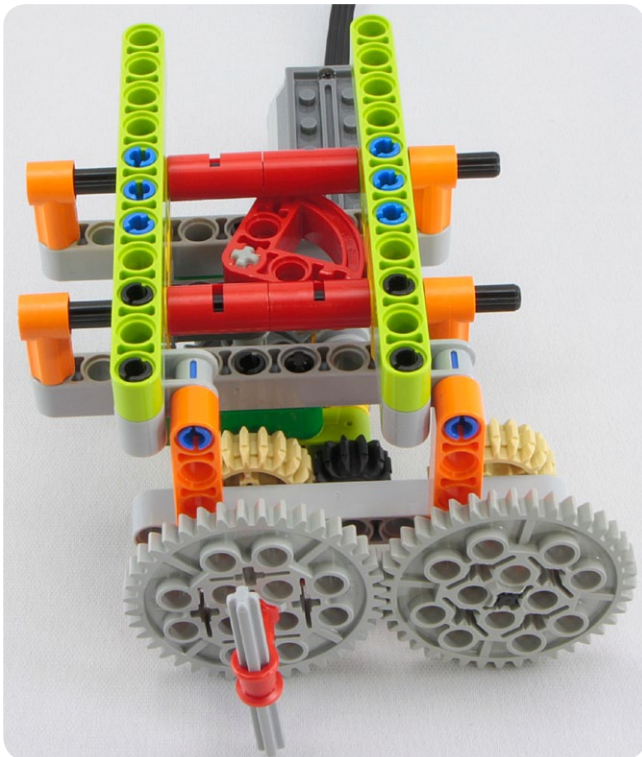
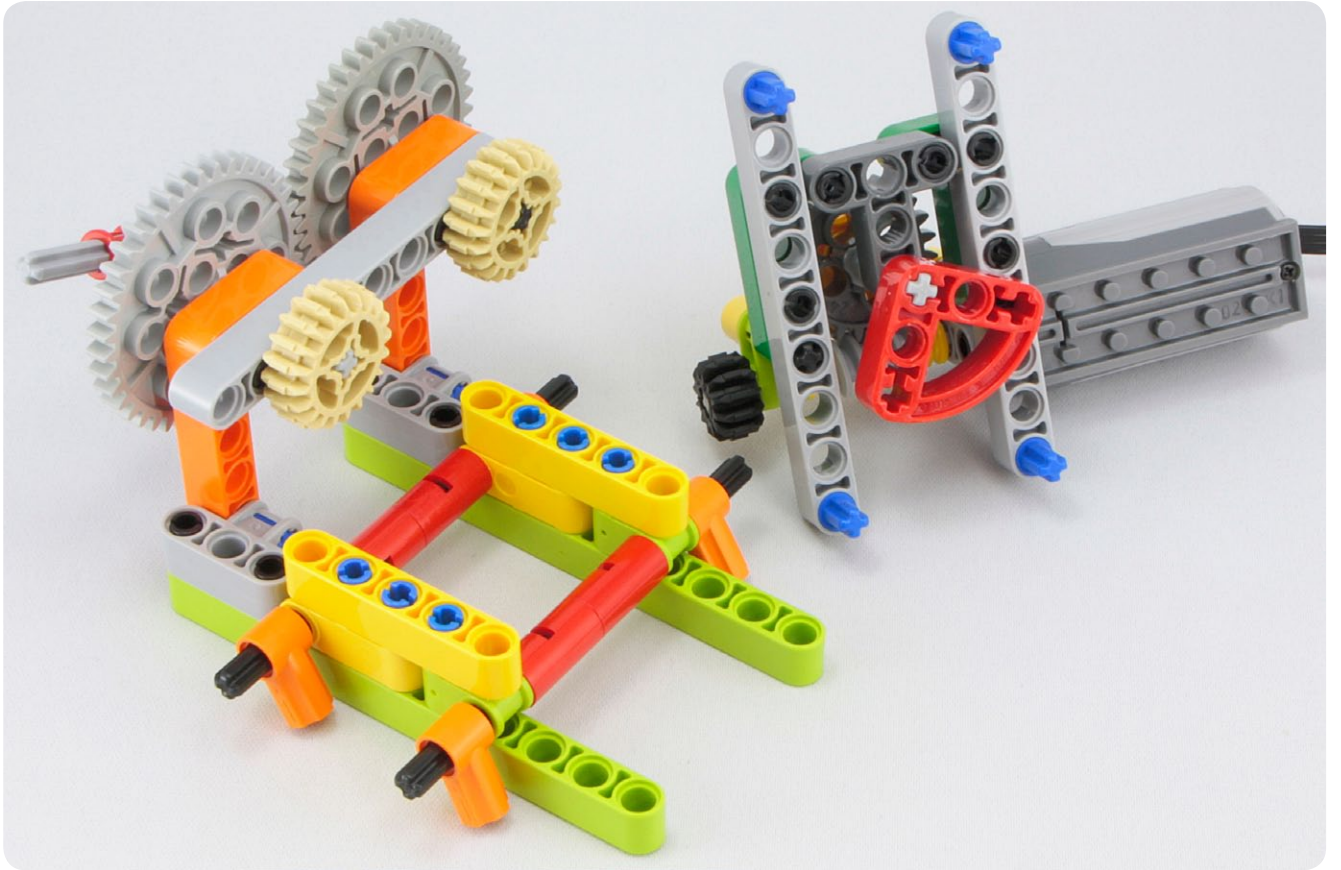
#124

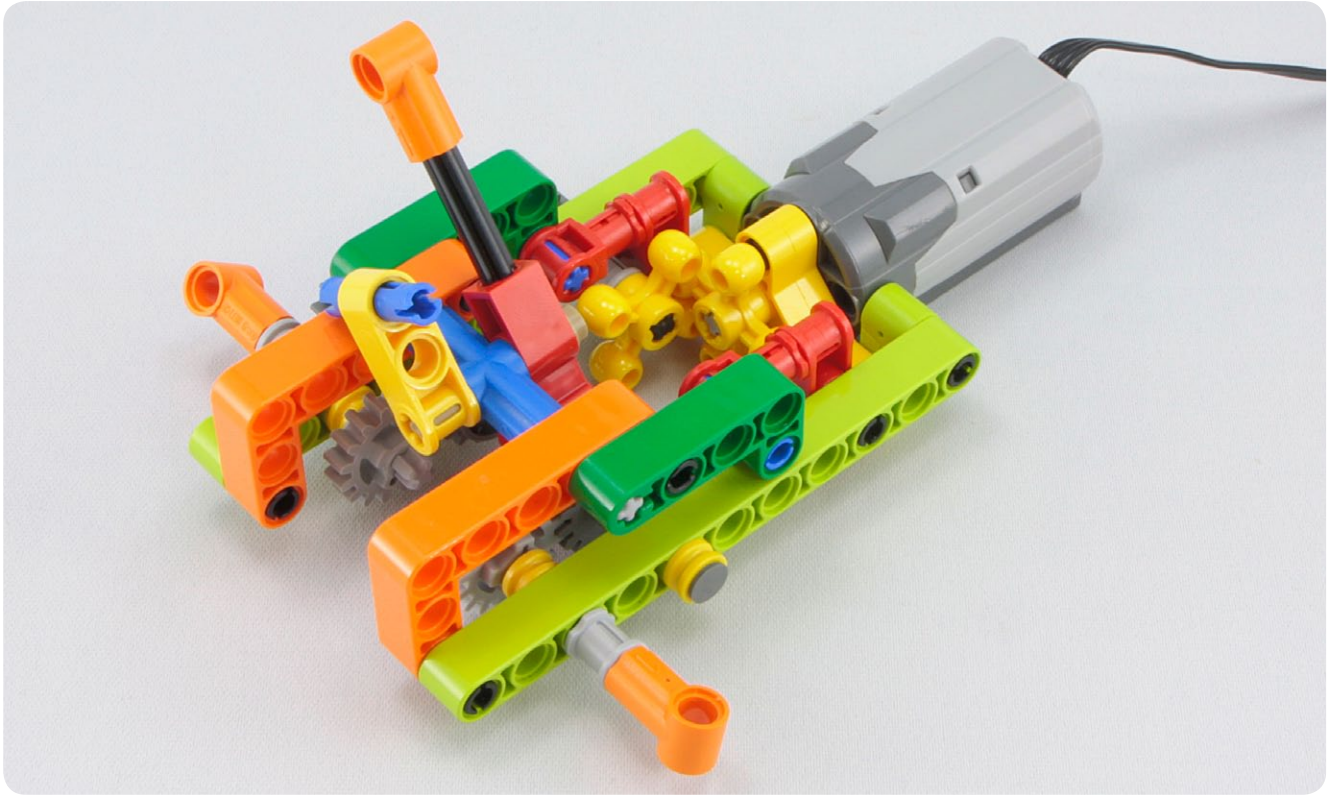
-   x2
-    x2
-   x2
-  x3
-  x2  x2
-  x2 
-  x2  x2
-  x2  x3  x4
-   x3  x4
-  x3  x3
-  x2  x2
-  x2  x6
-   x6  x16

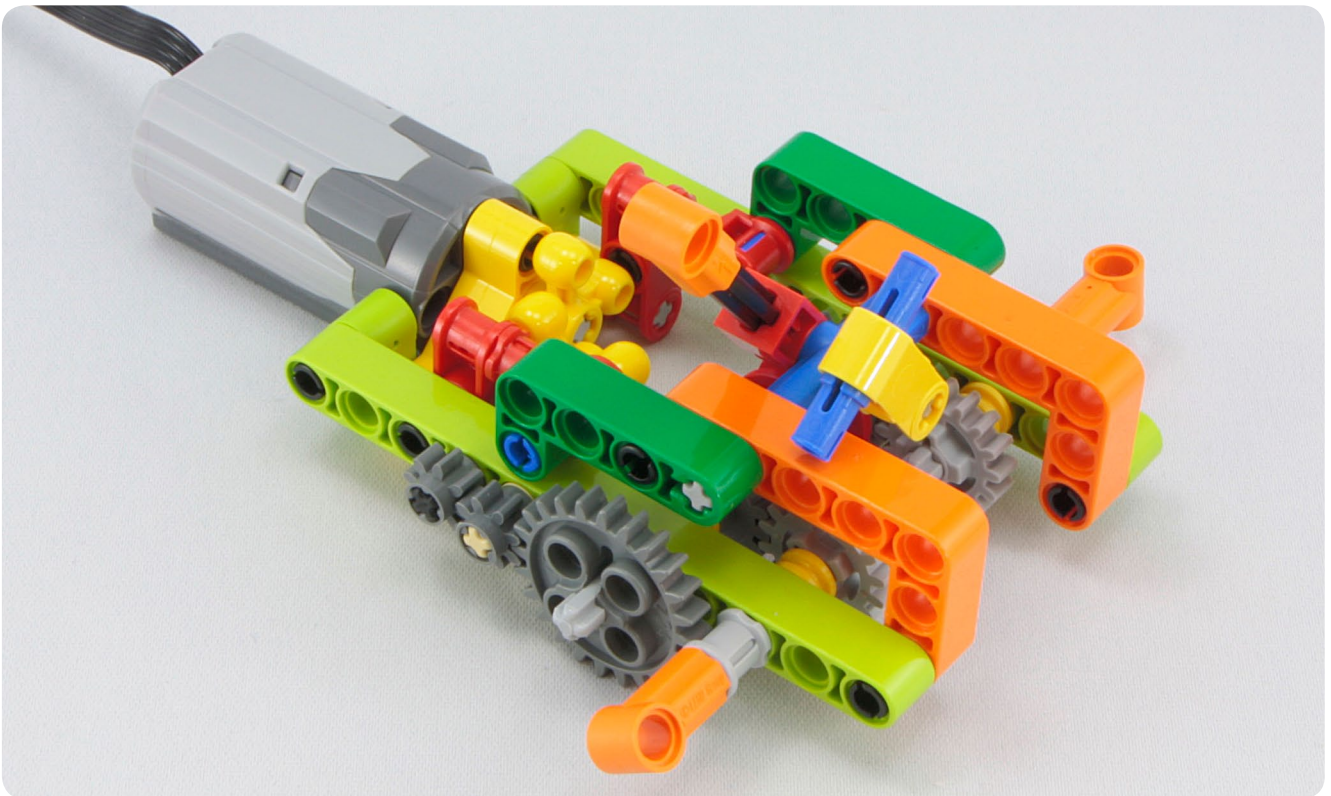
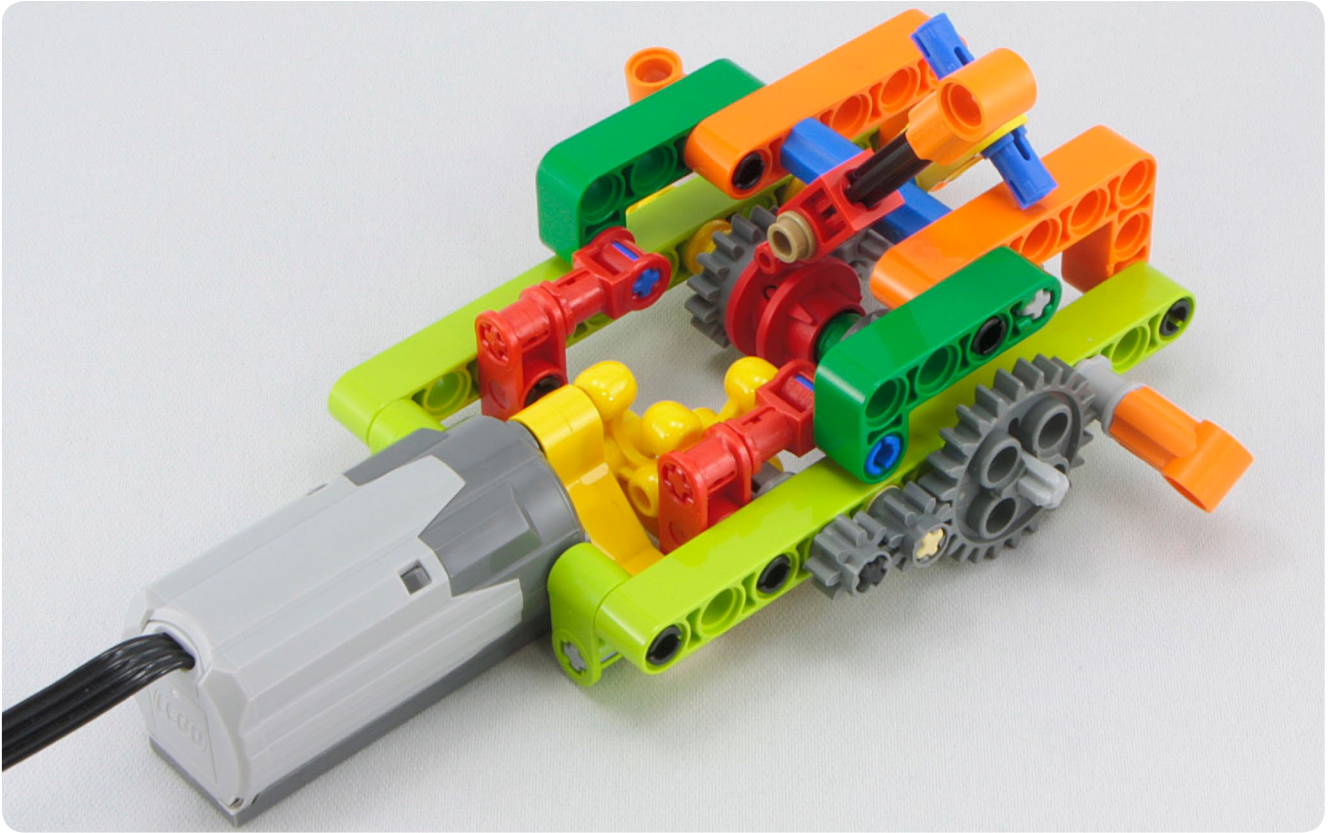


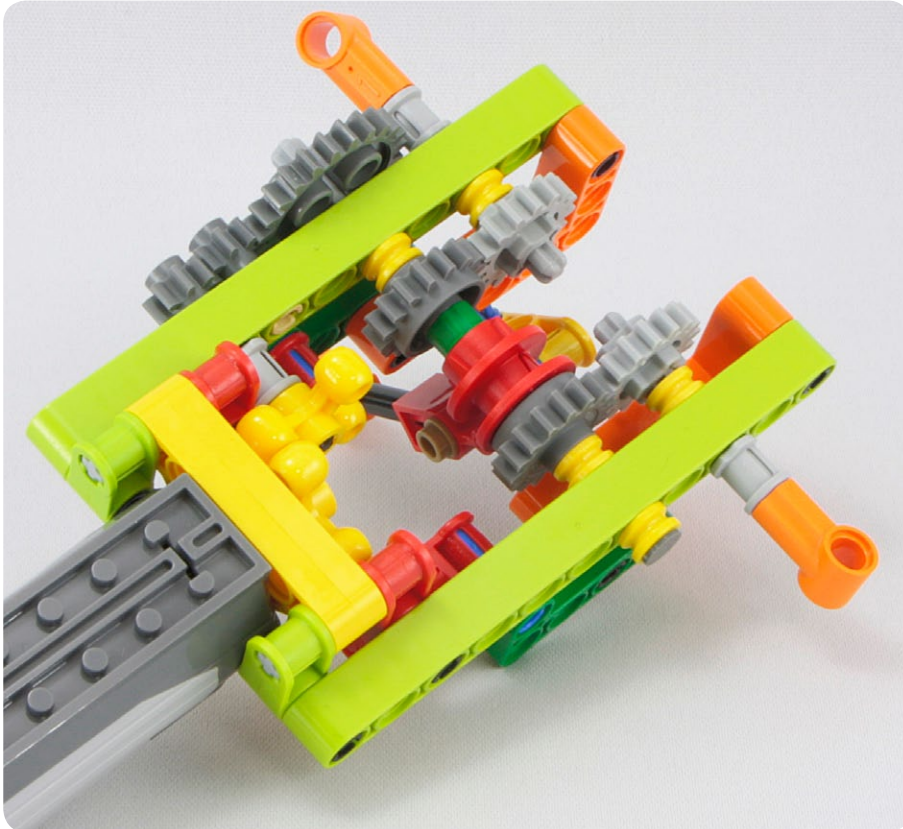
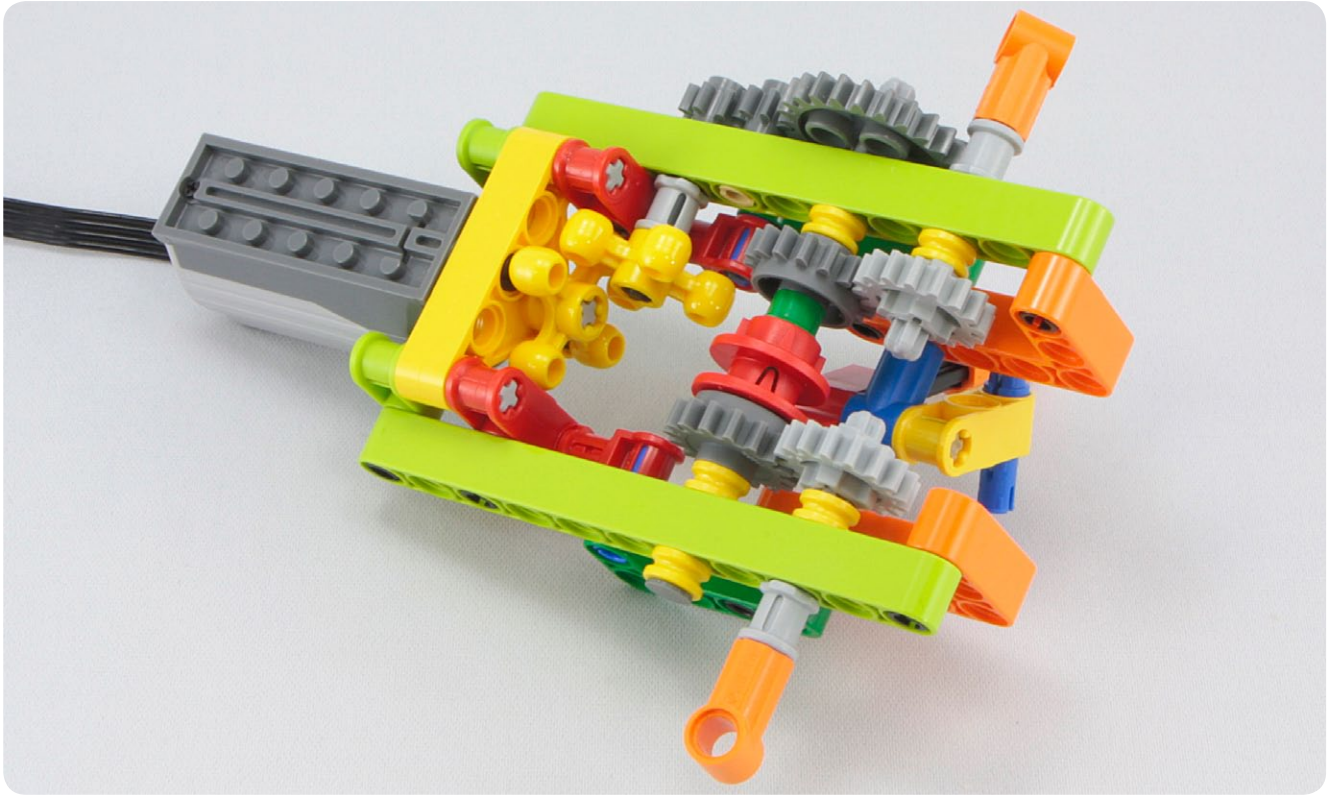


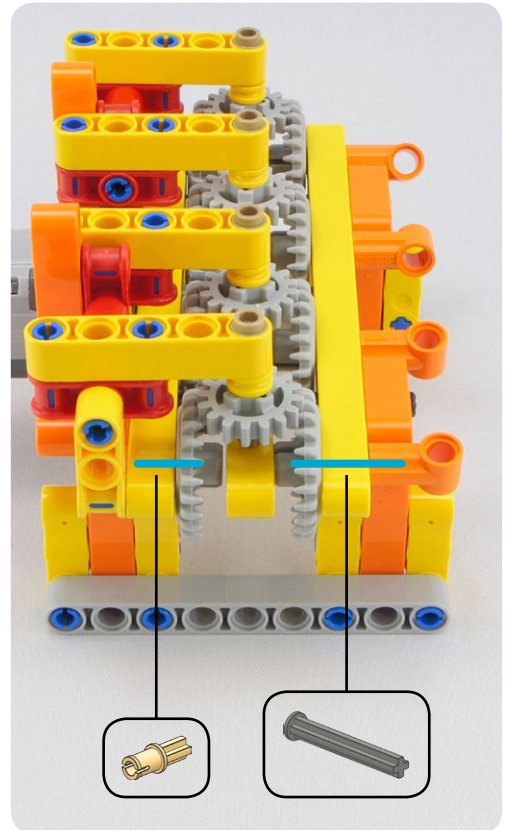
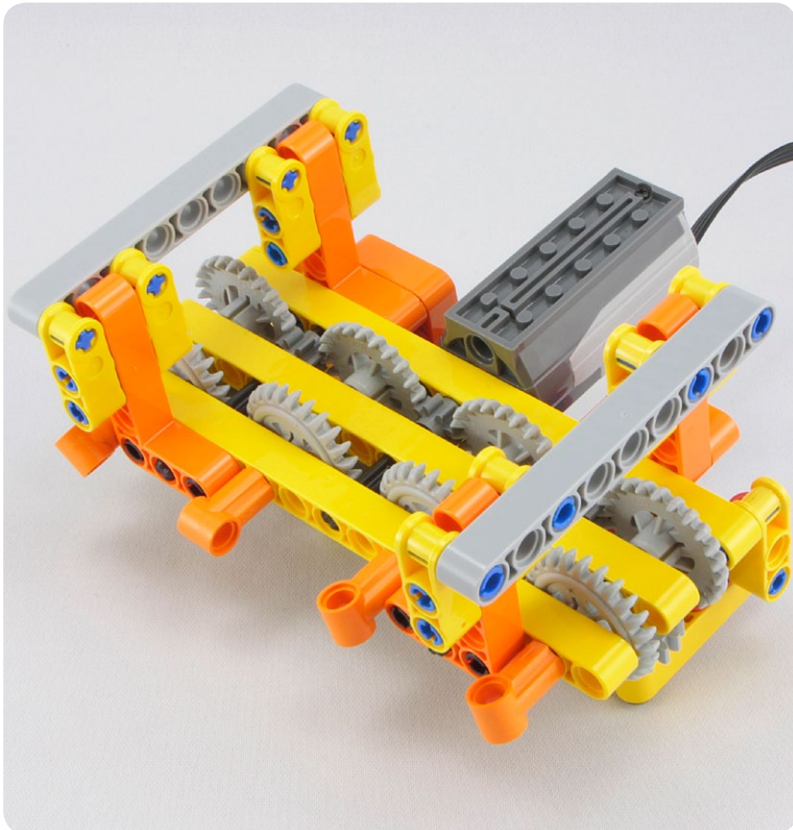
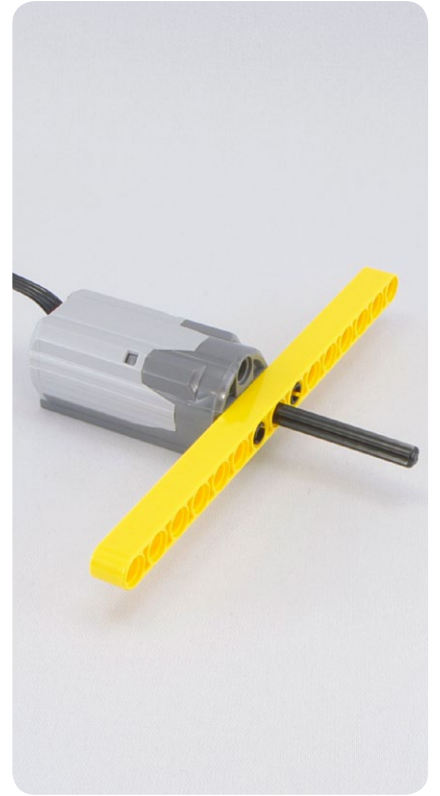
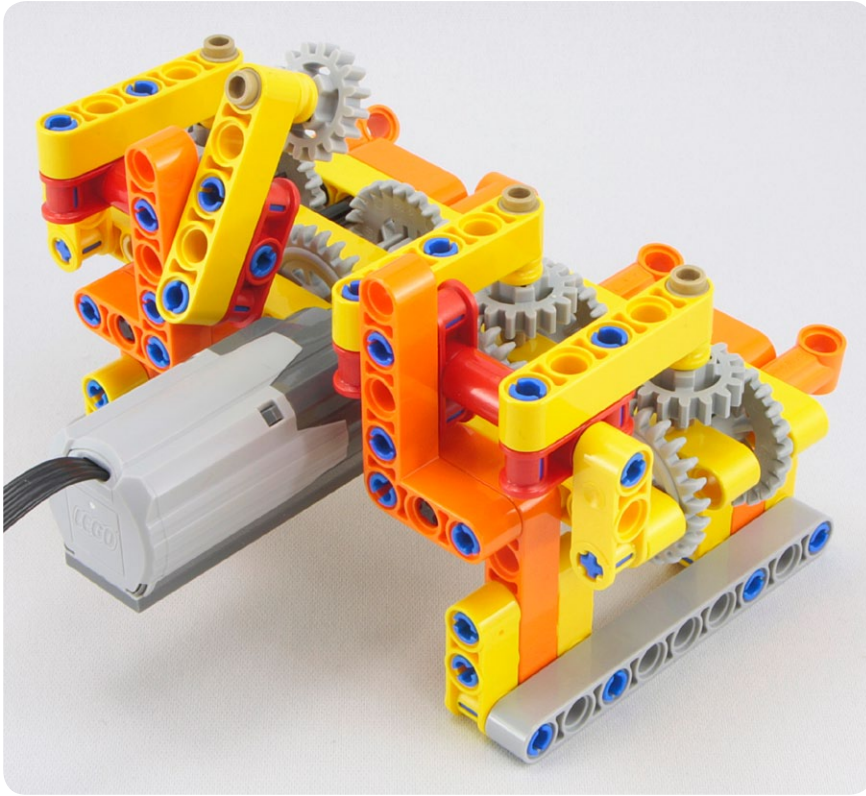








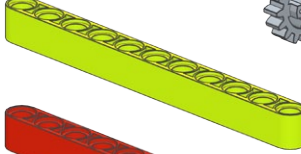

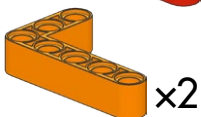
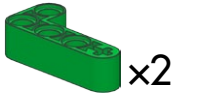

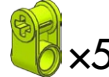
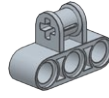
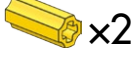
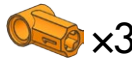


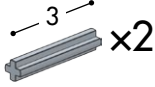



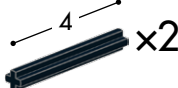









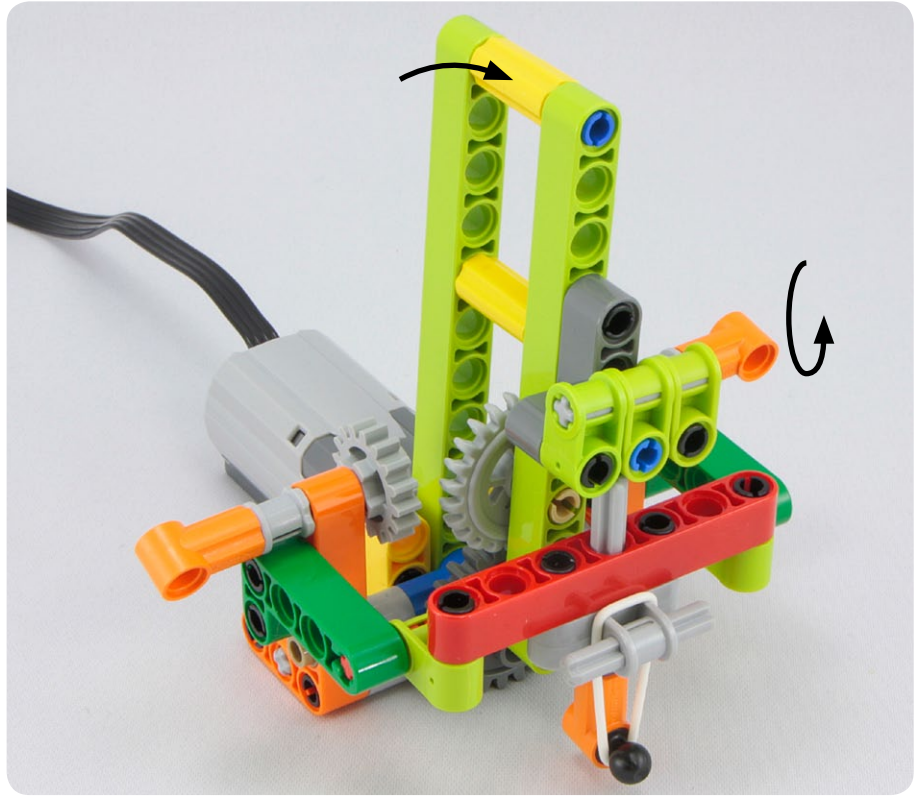
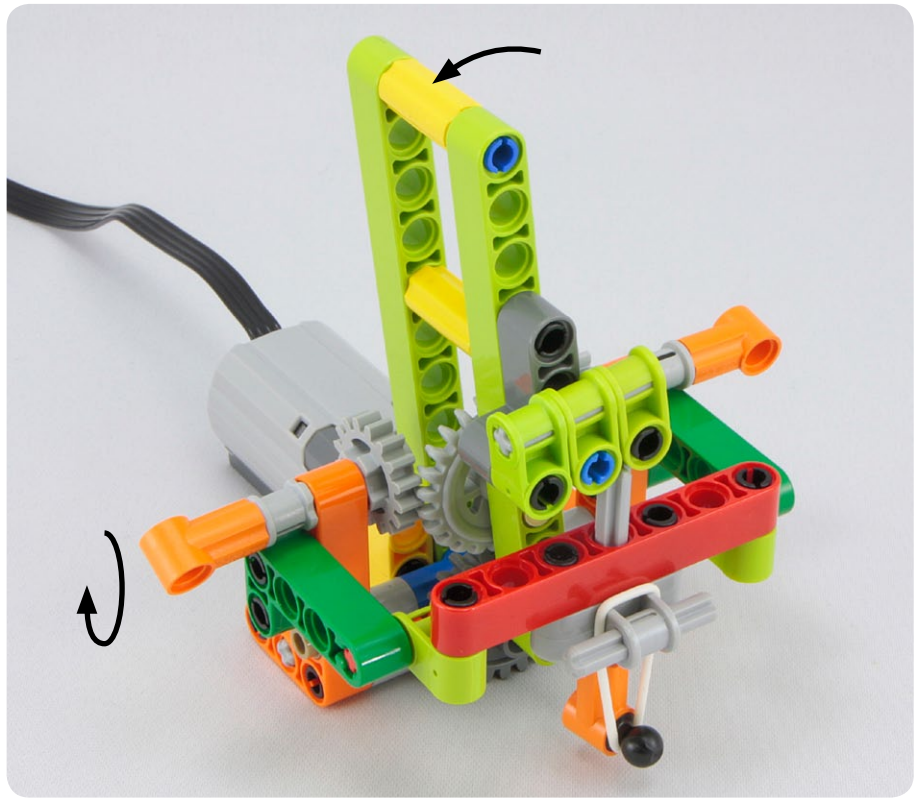


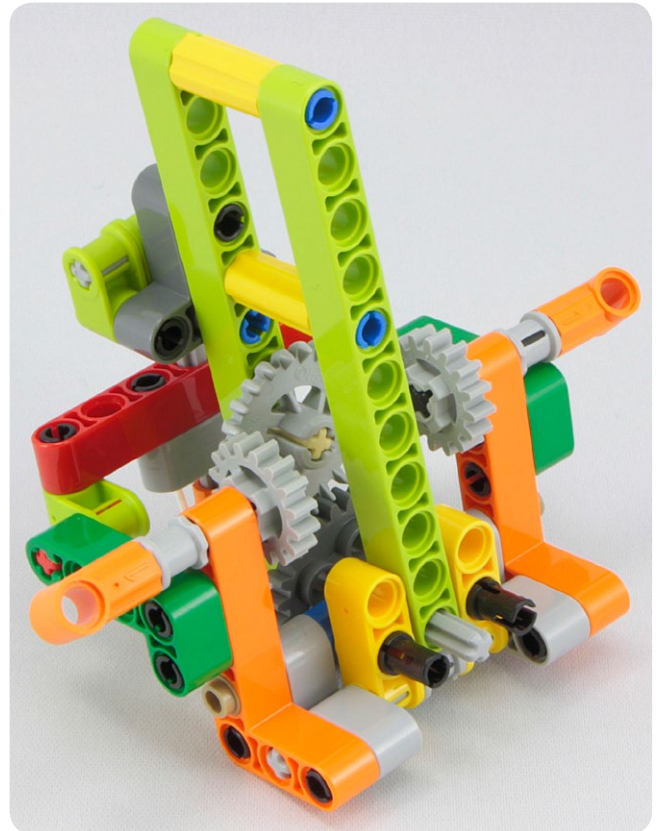
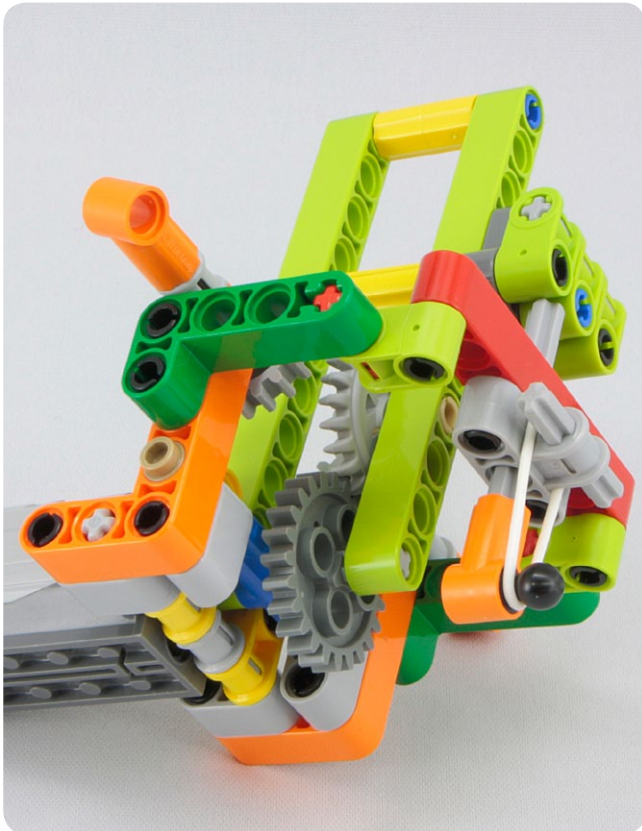
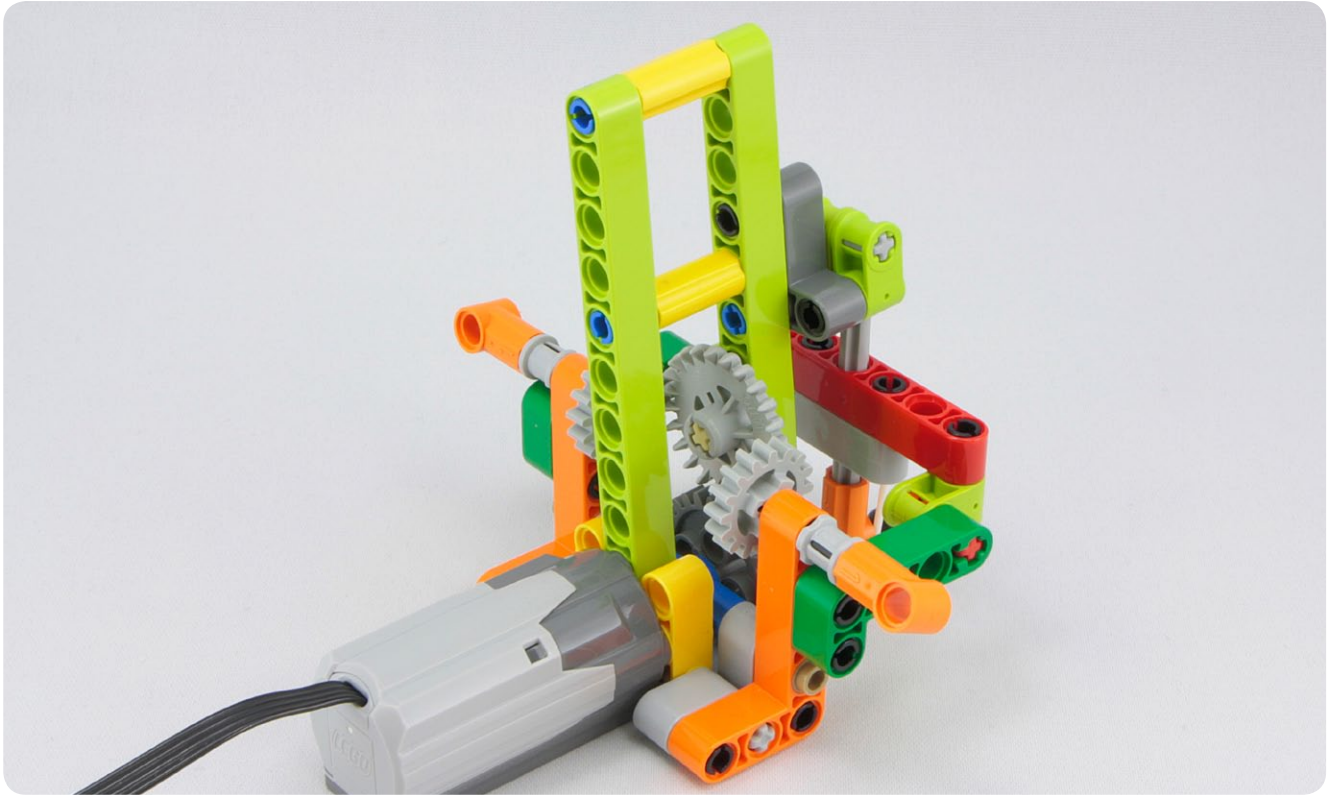


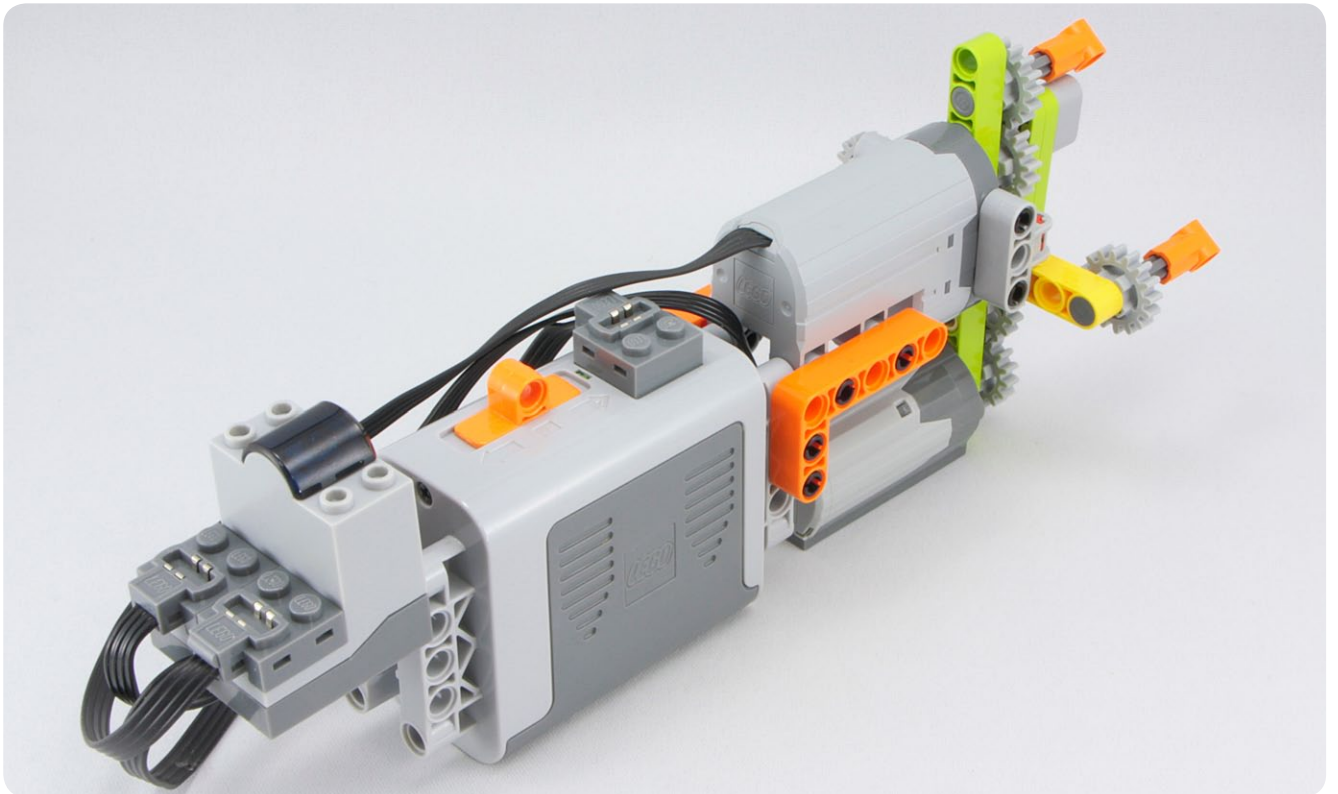
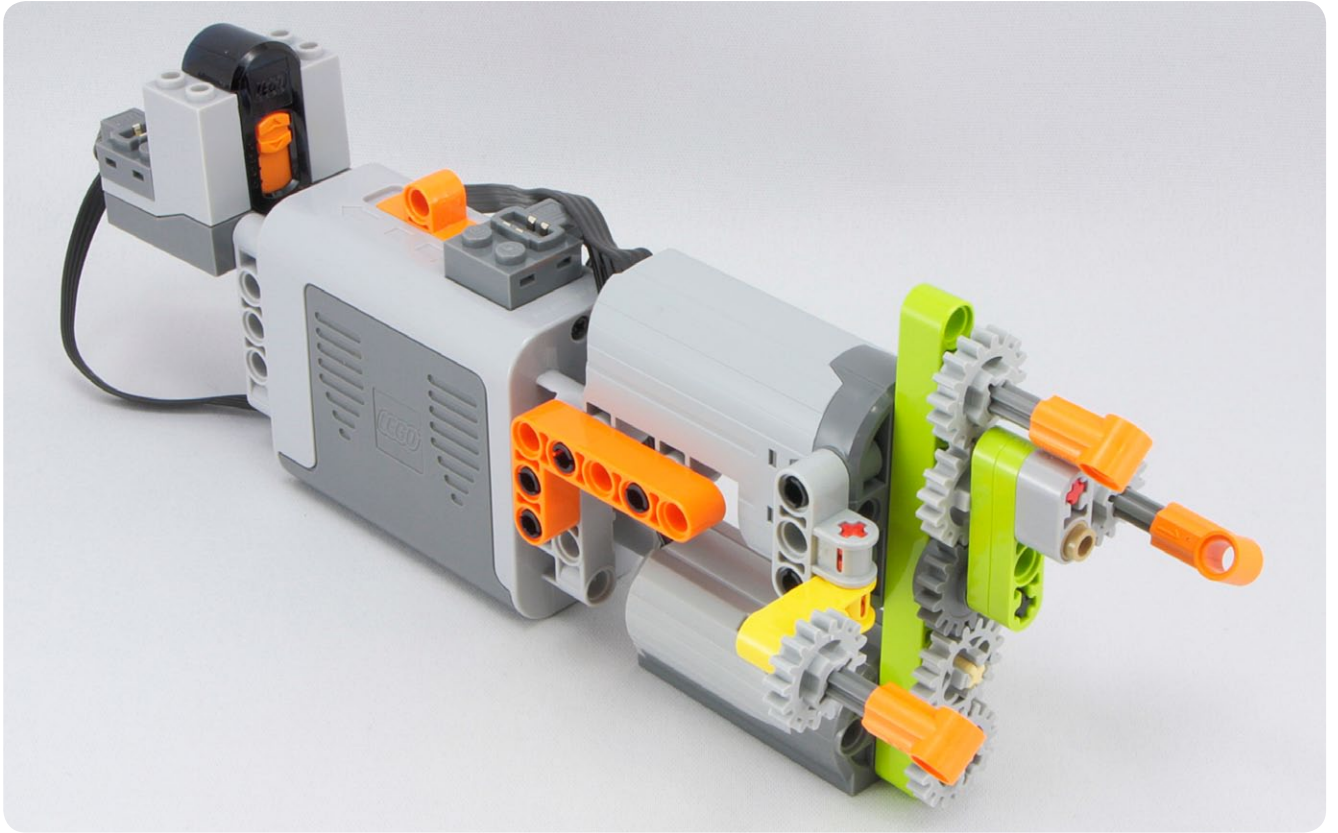


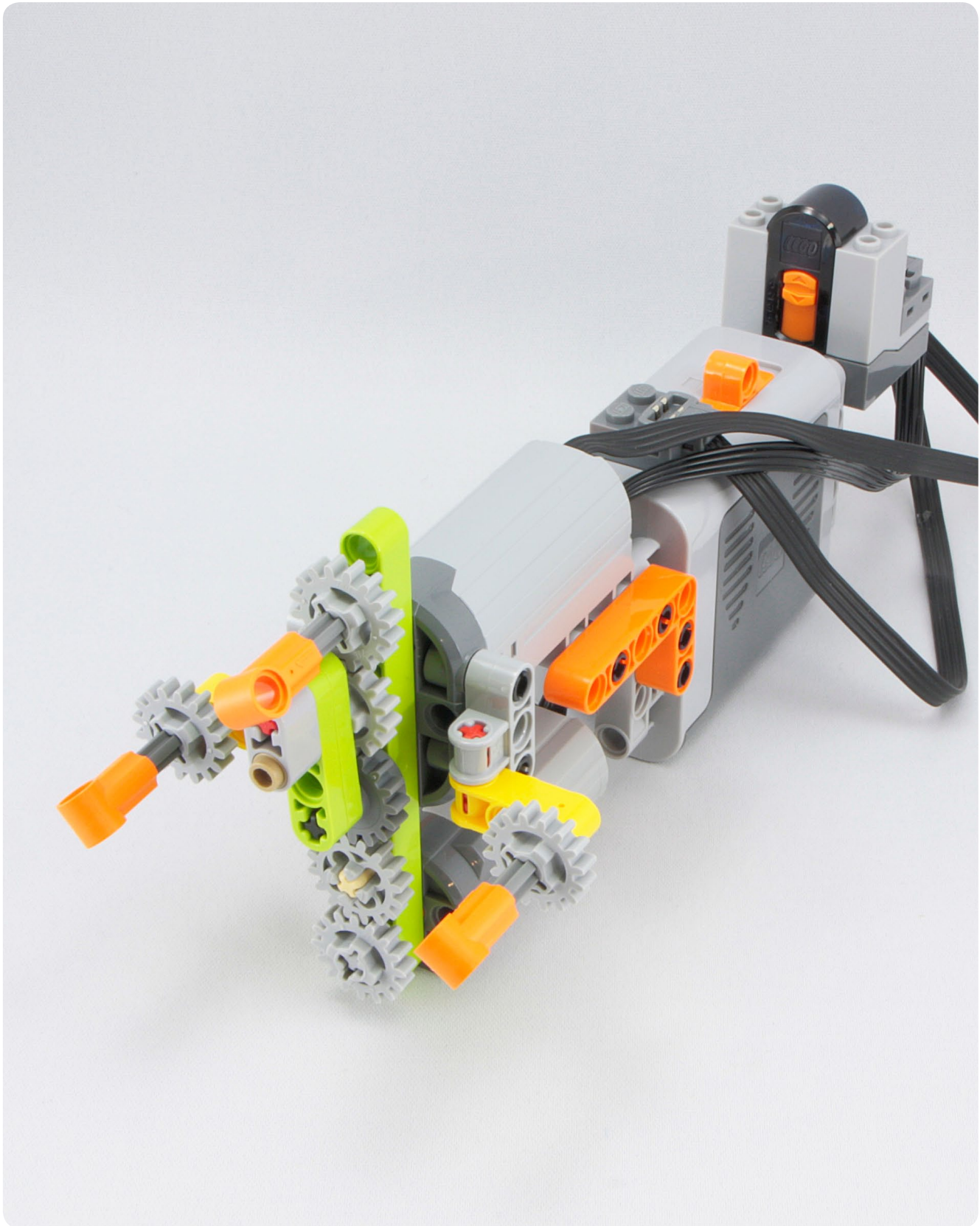
#127

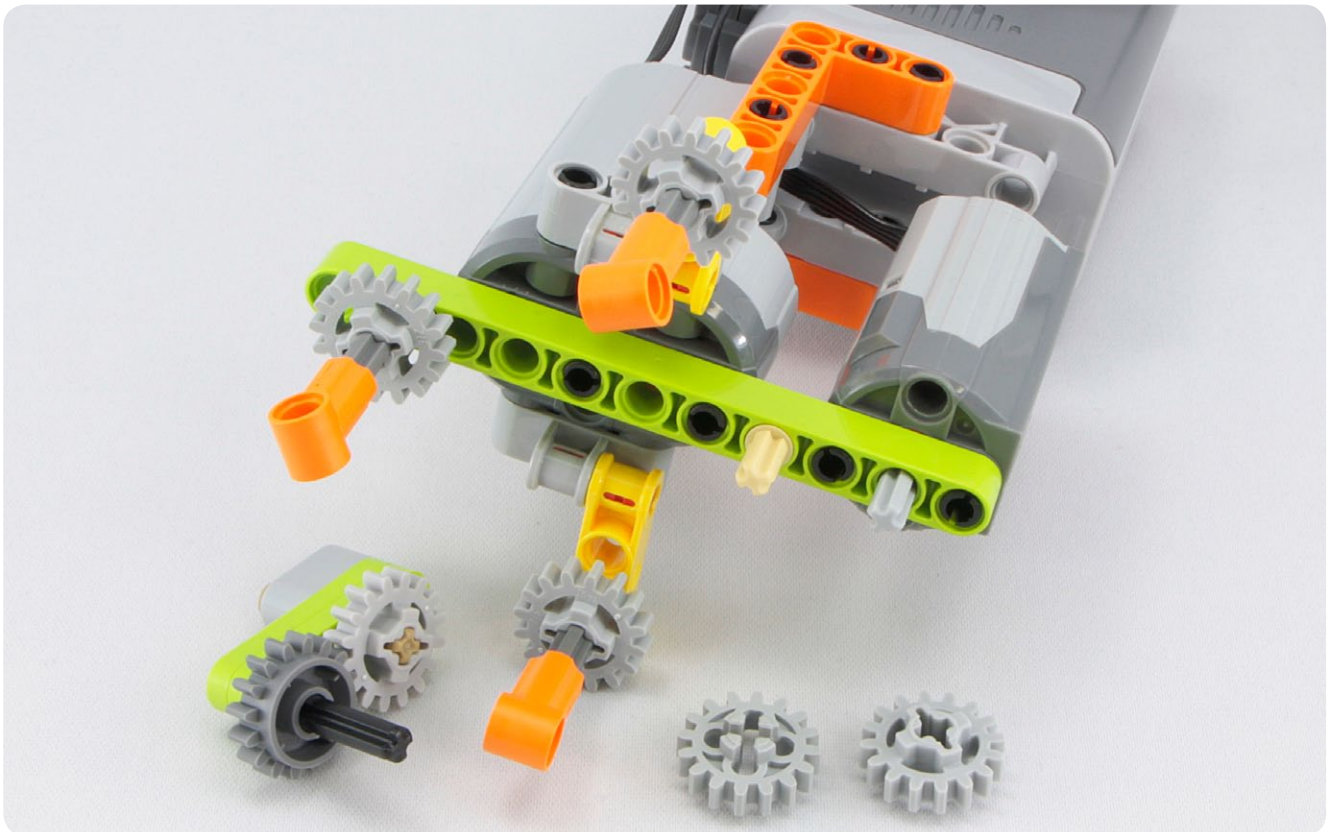
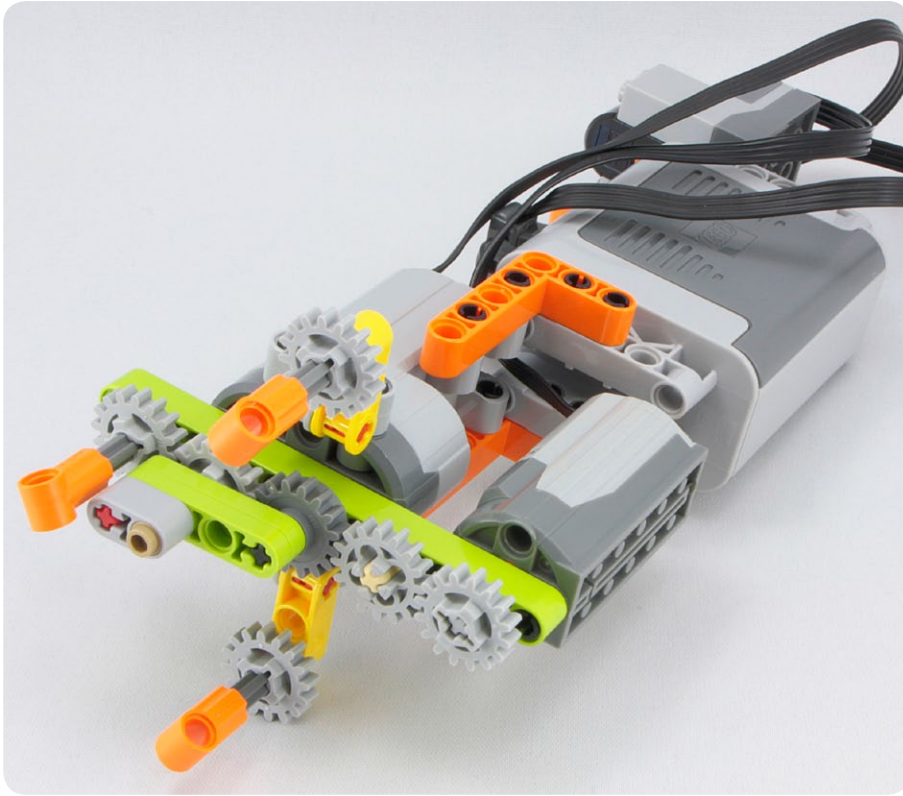
-  Motor
-  Gear 48
-  Gear 24
-  Gear 12 x2
-  Beam 1x12 (light green) x2
-  Beam 1x6 (red) x2
-  Beam 1x3 (orange) x2
-  Beam 1x3 (green) x2
-  Bracket (yellow) x2
-  Bracket (light green) x5
-  Bracket (grey) x4
-  Pin (yellow) x2
-  Pin (orange) x3
-  Pin (red) x2
-  Pin (blue) x3
-  Pin (grey) x2
-  Pin (grey) x3
-  Pin (tan) x2
-  Pin (black) x1
-  Pin (black) x2
-  Pin (blue) x2
-  Pin (grey) x2
-  Pin (tan) x1
-  Pin (grey) x2
-  Pin (blue) x4
-  Pin (grey) x2
-  Pin (black) x17



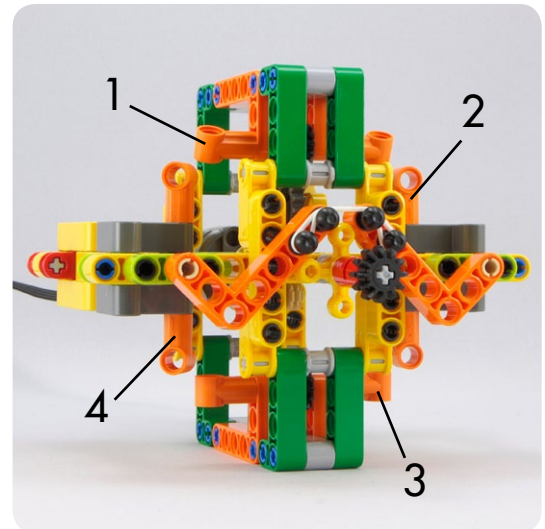
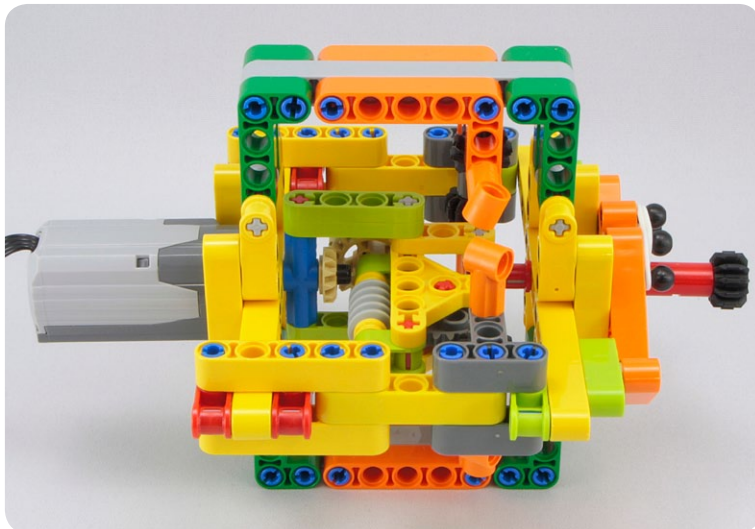
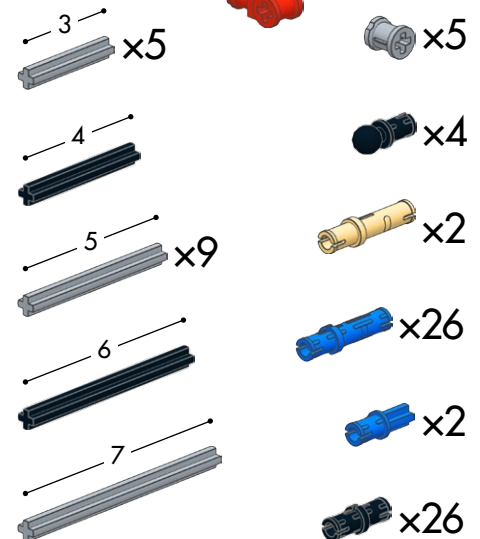
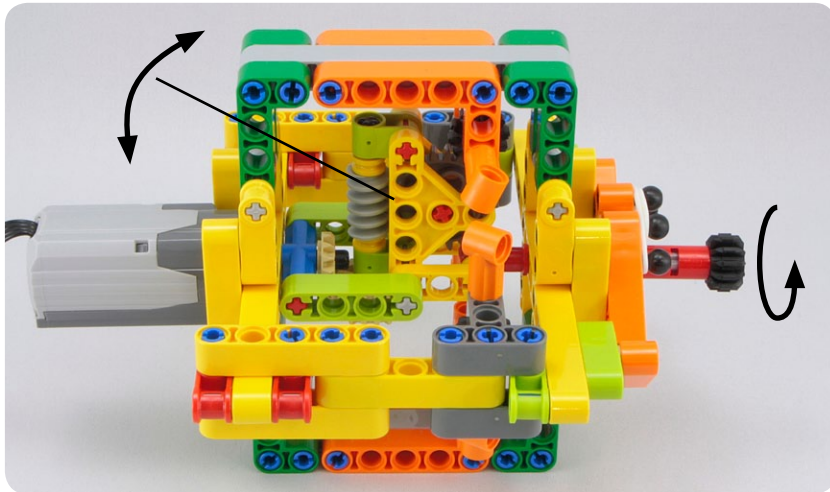
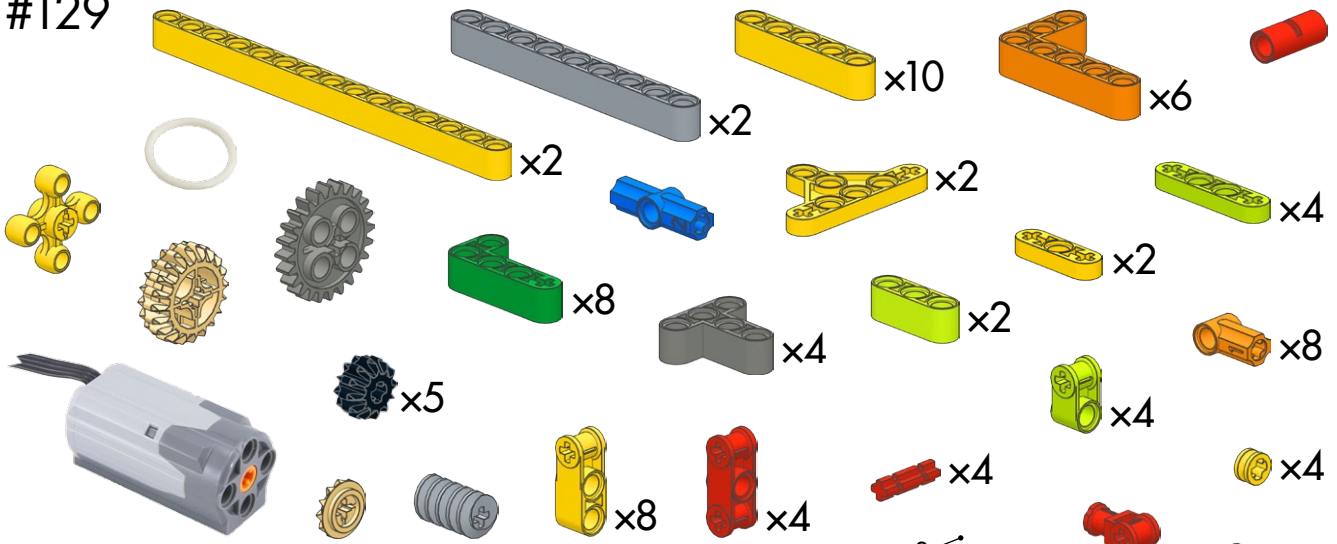


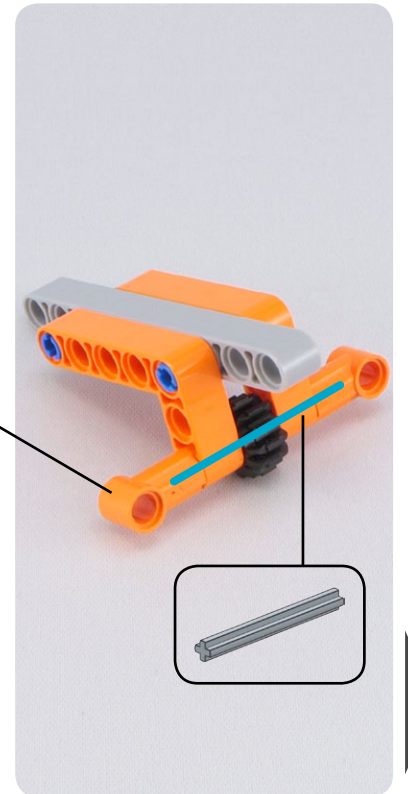
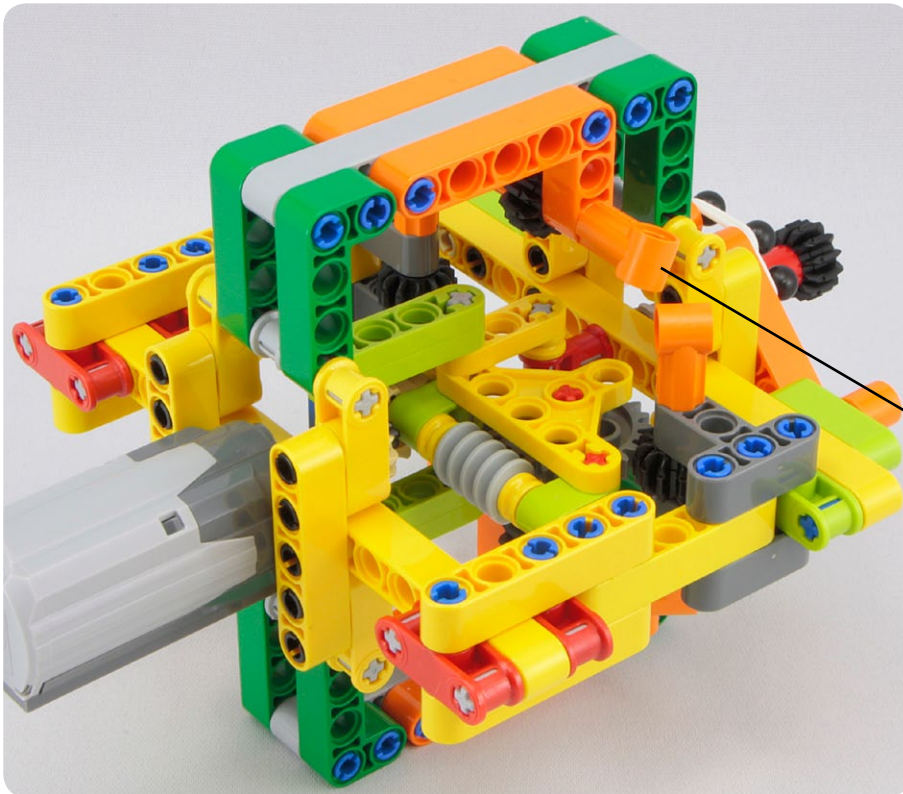
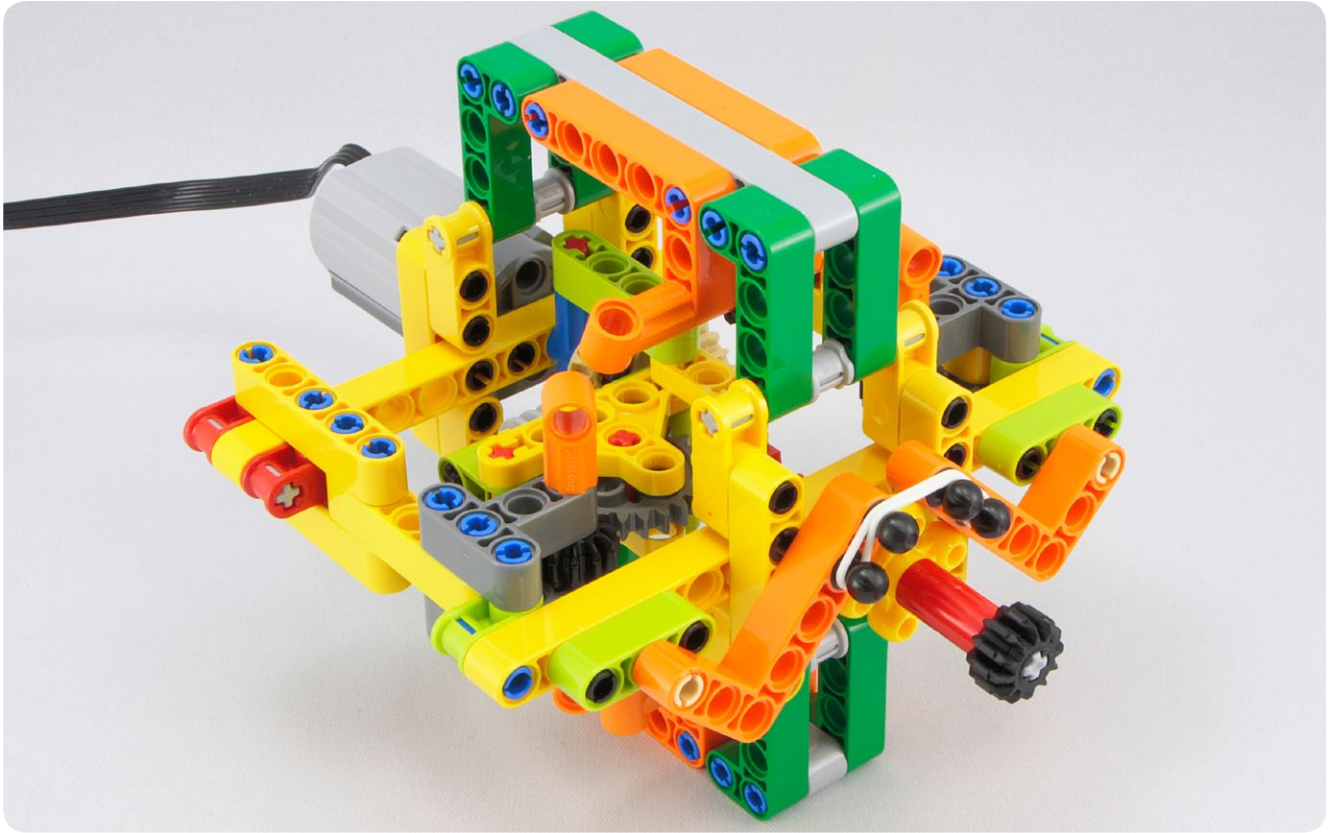


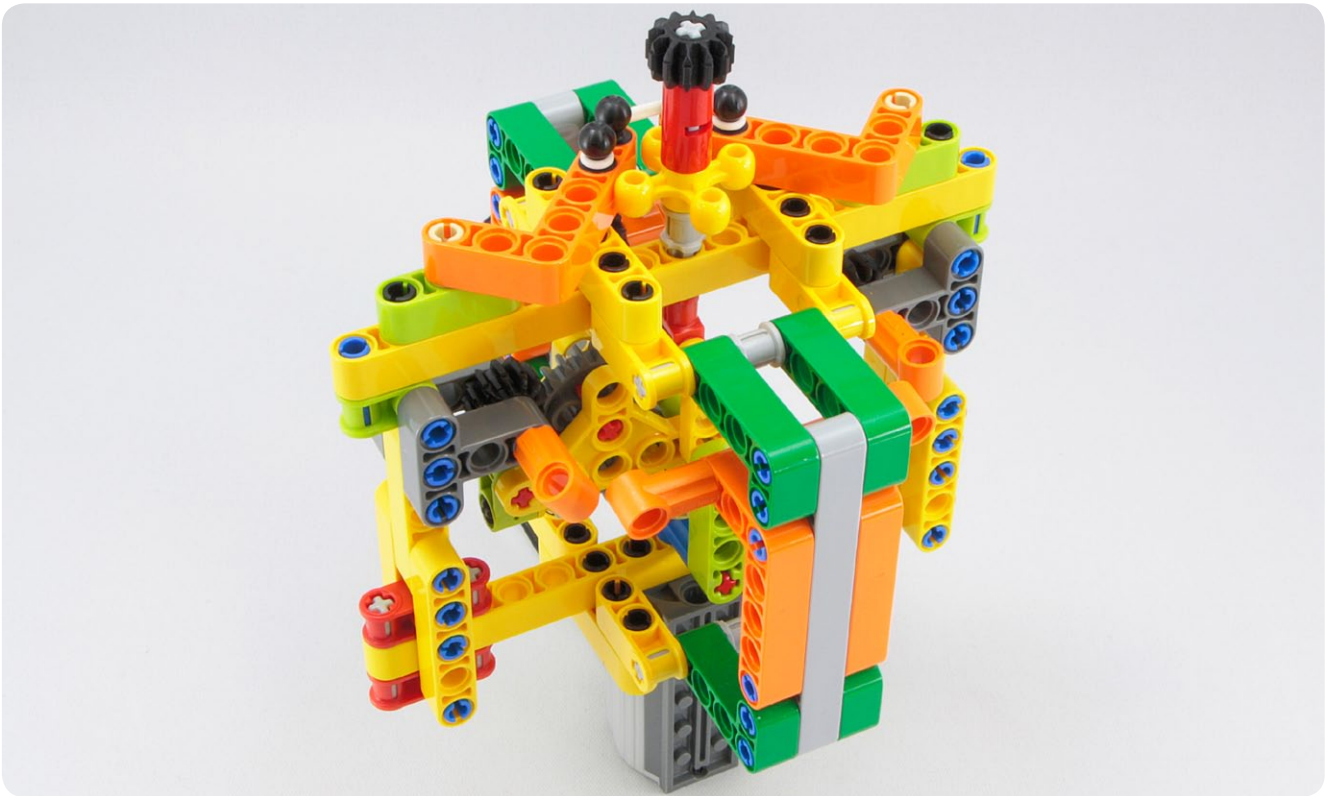
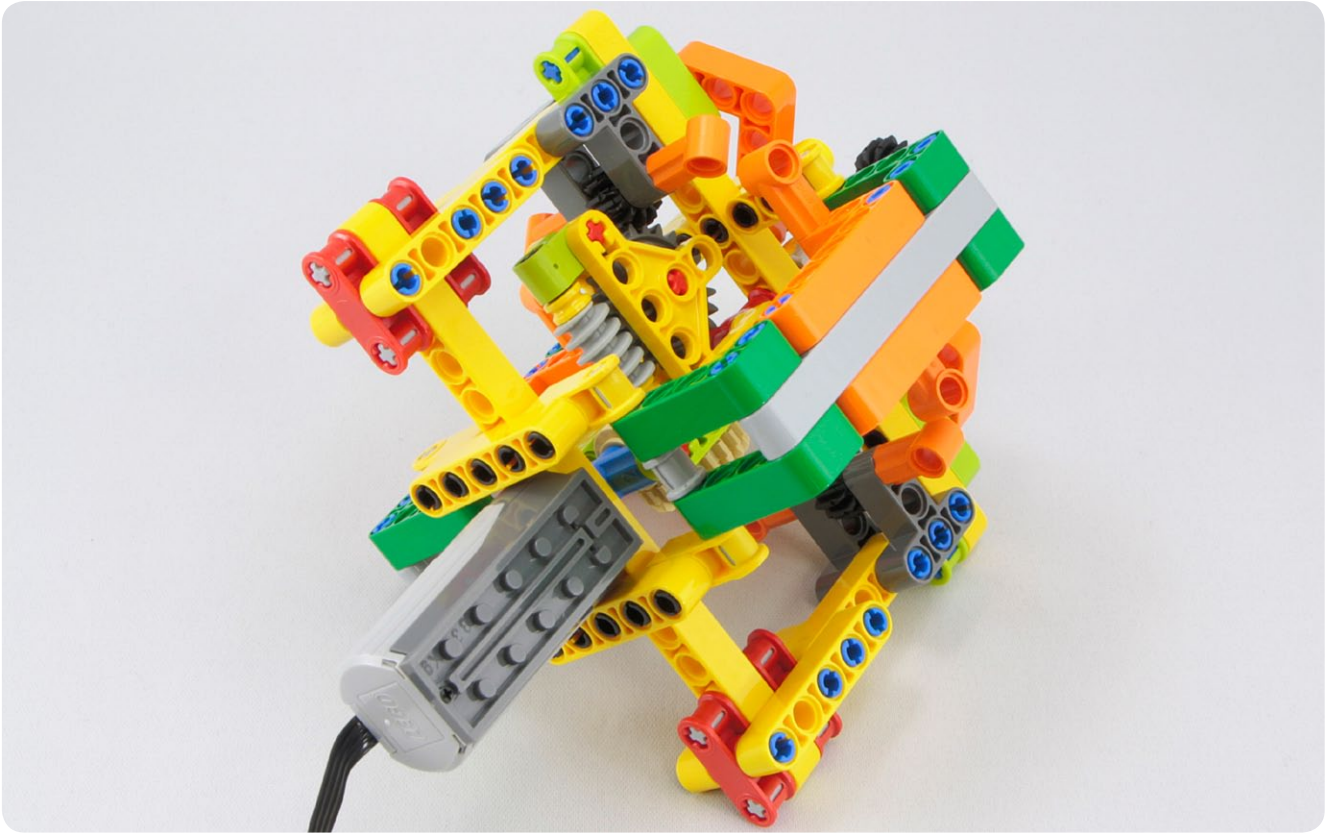


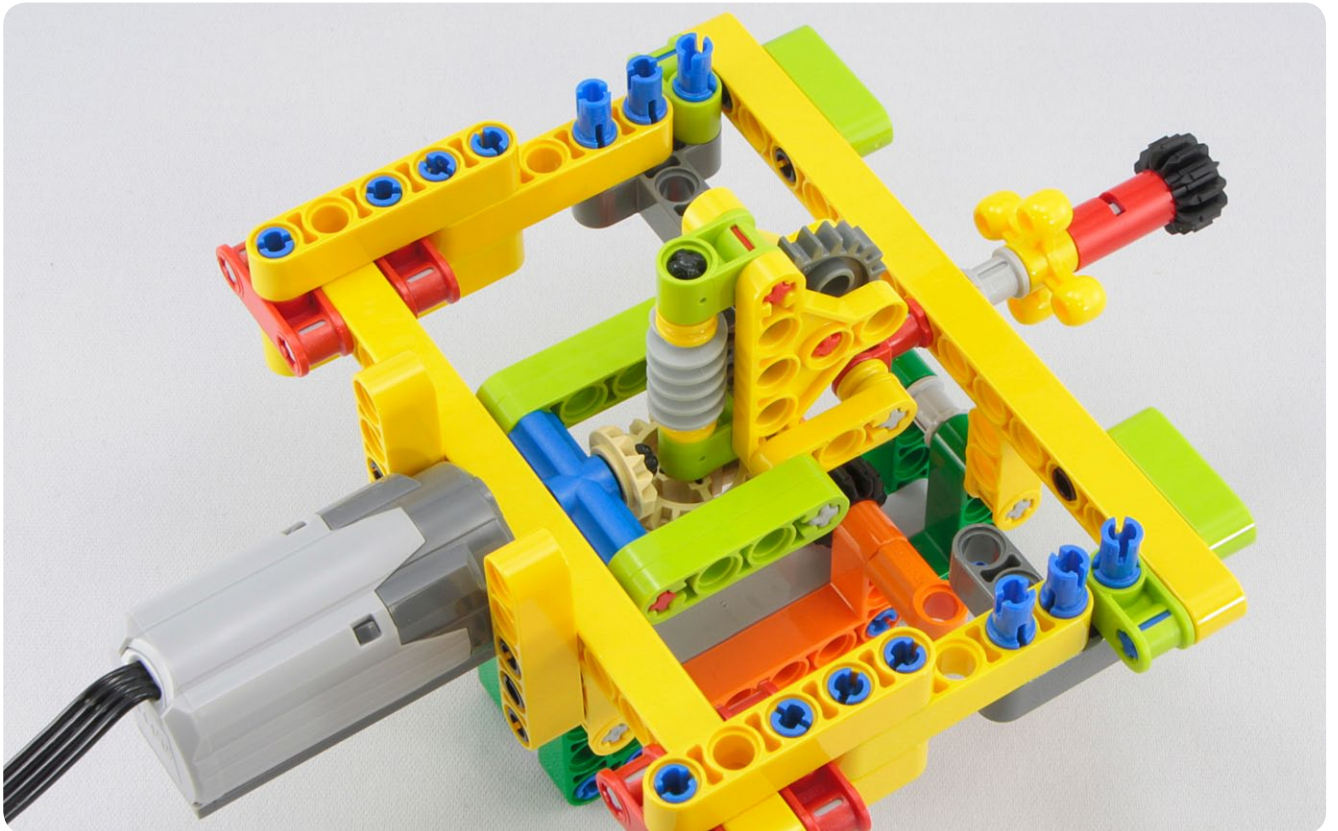
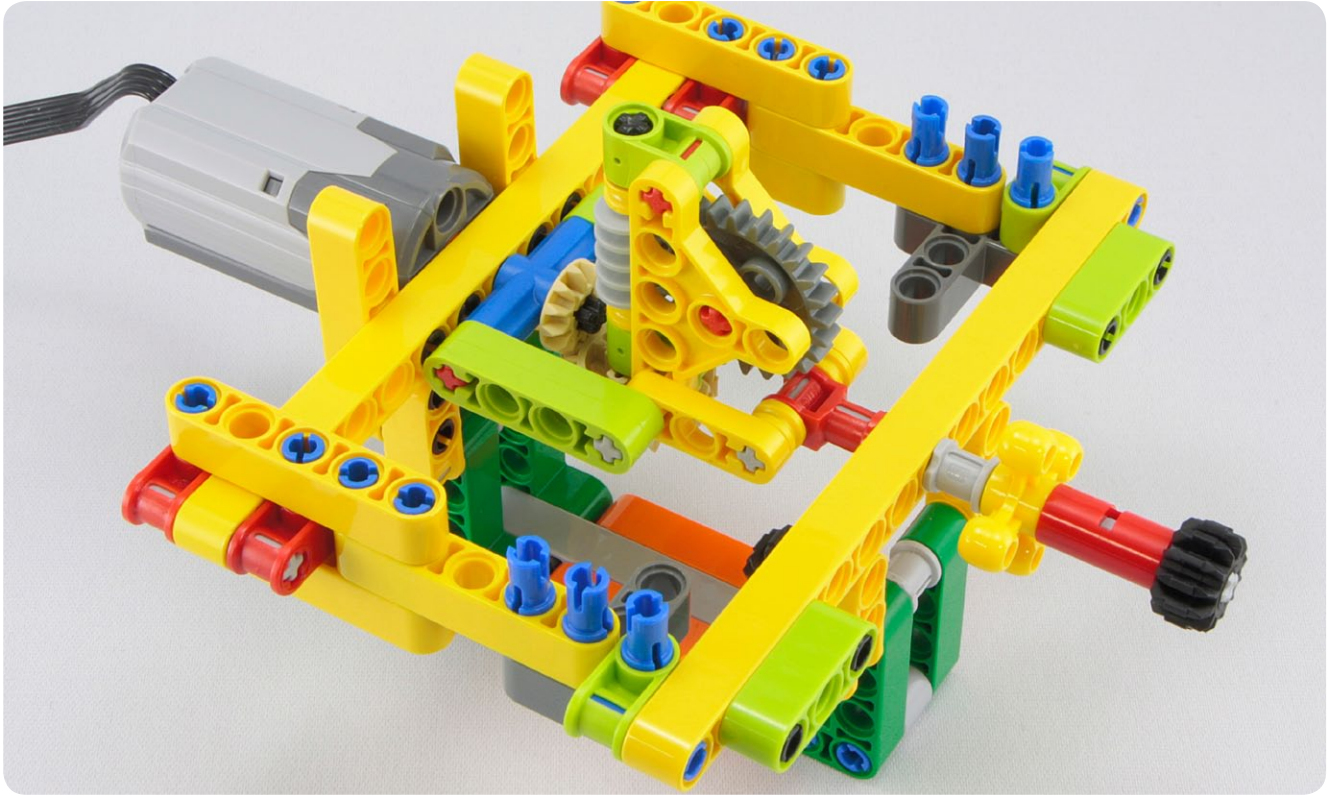


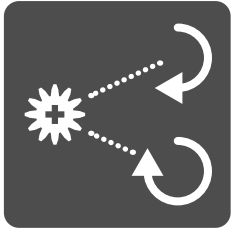
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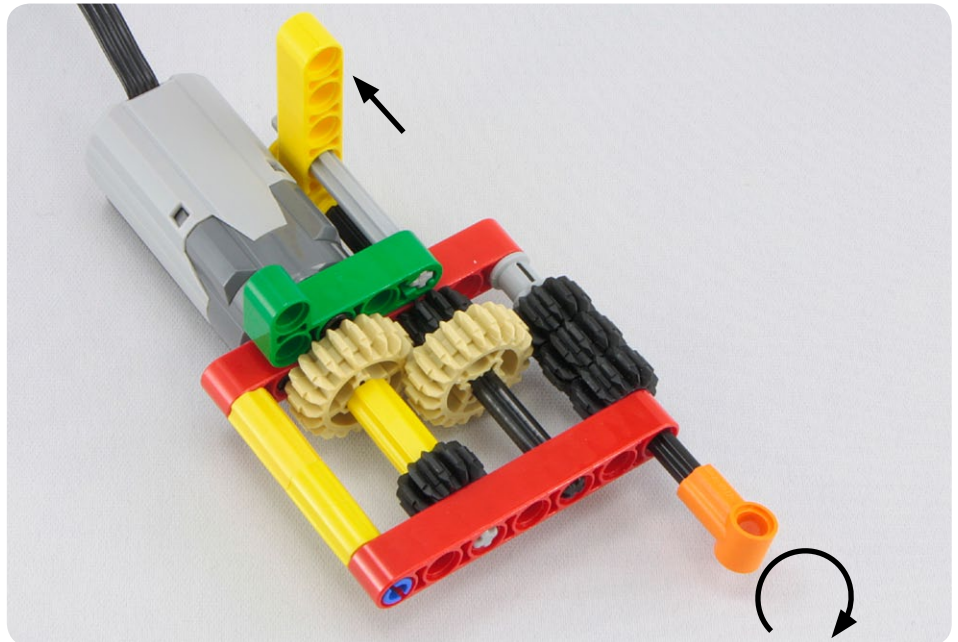
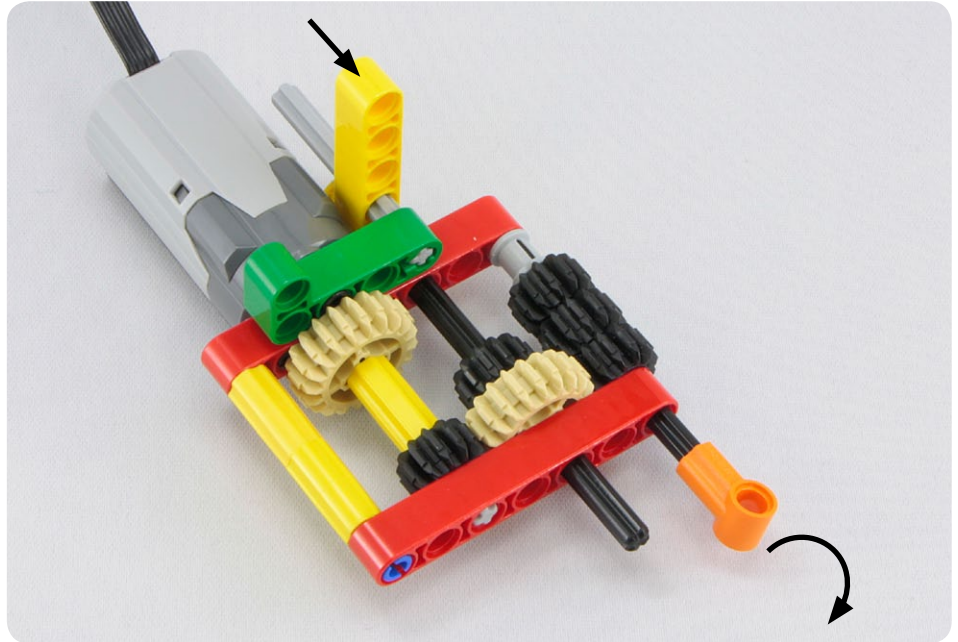
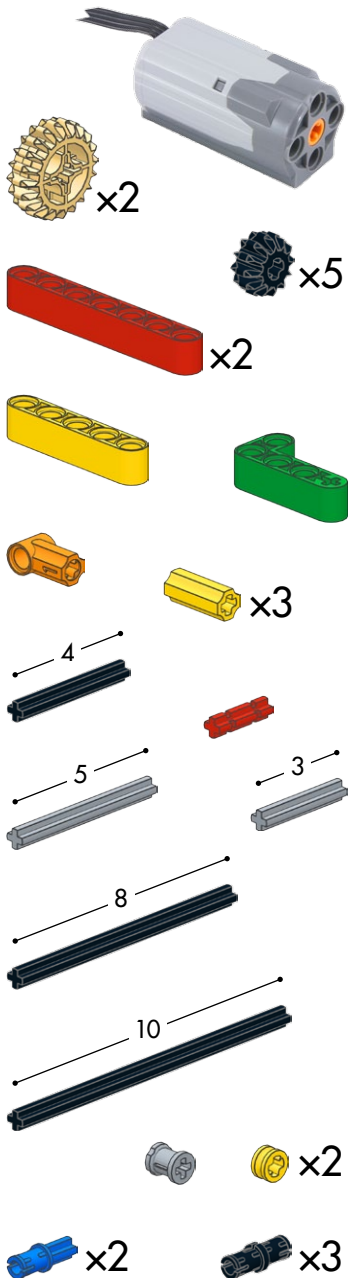


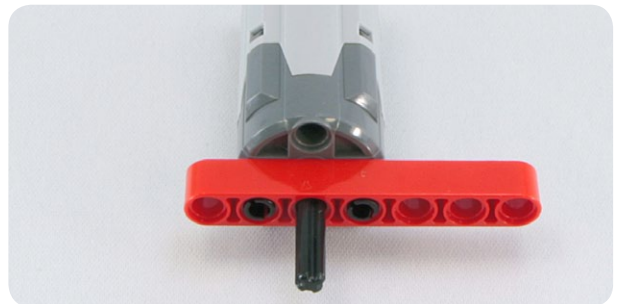
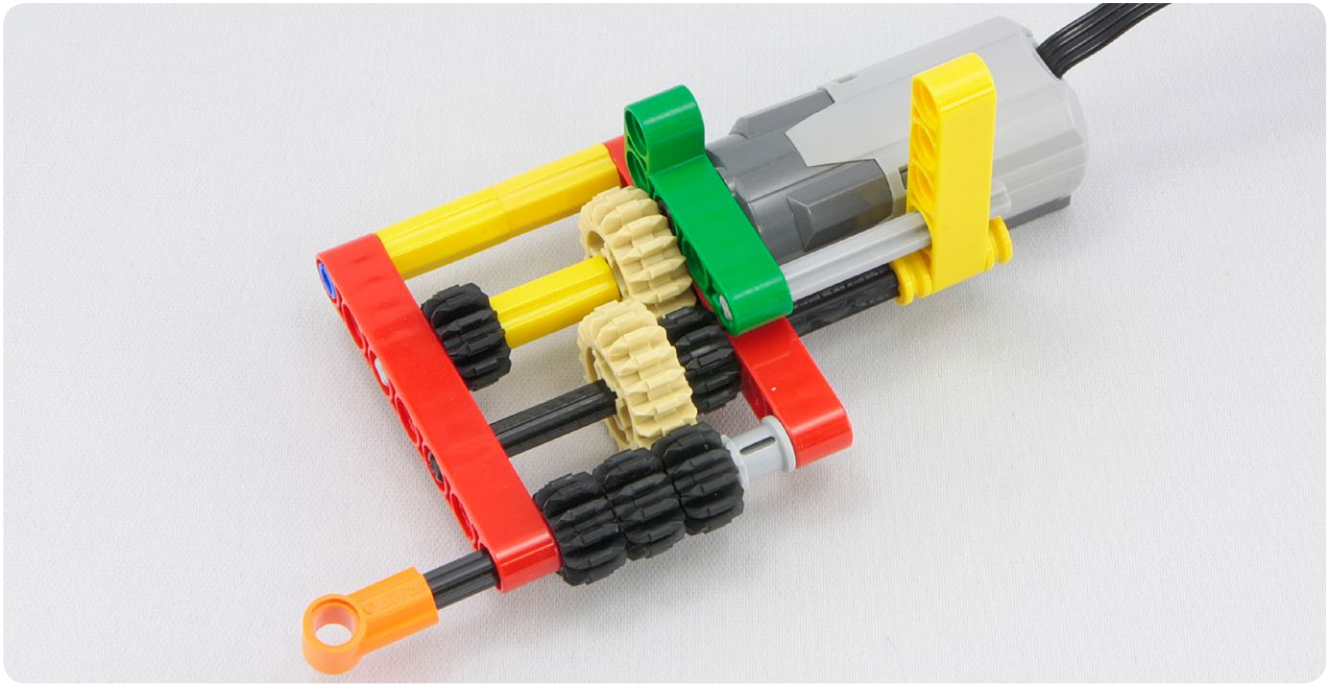




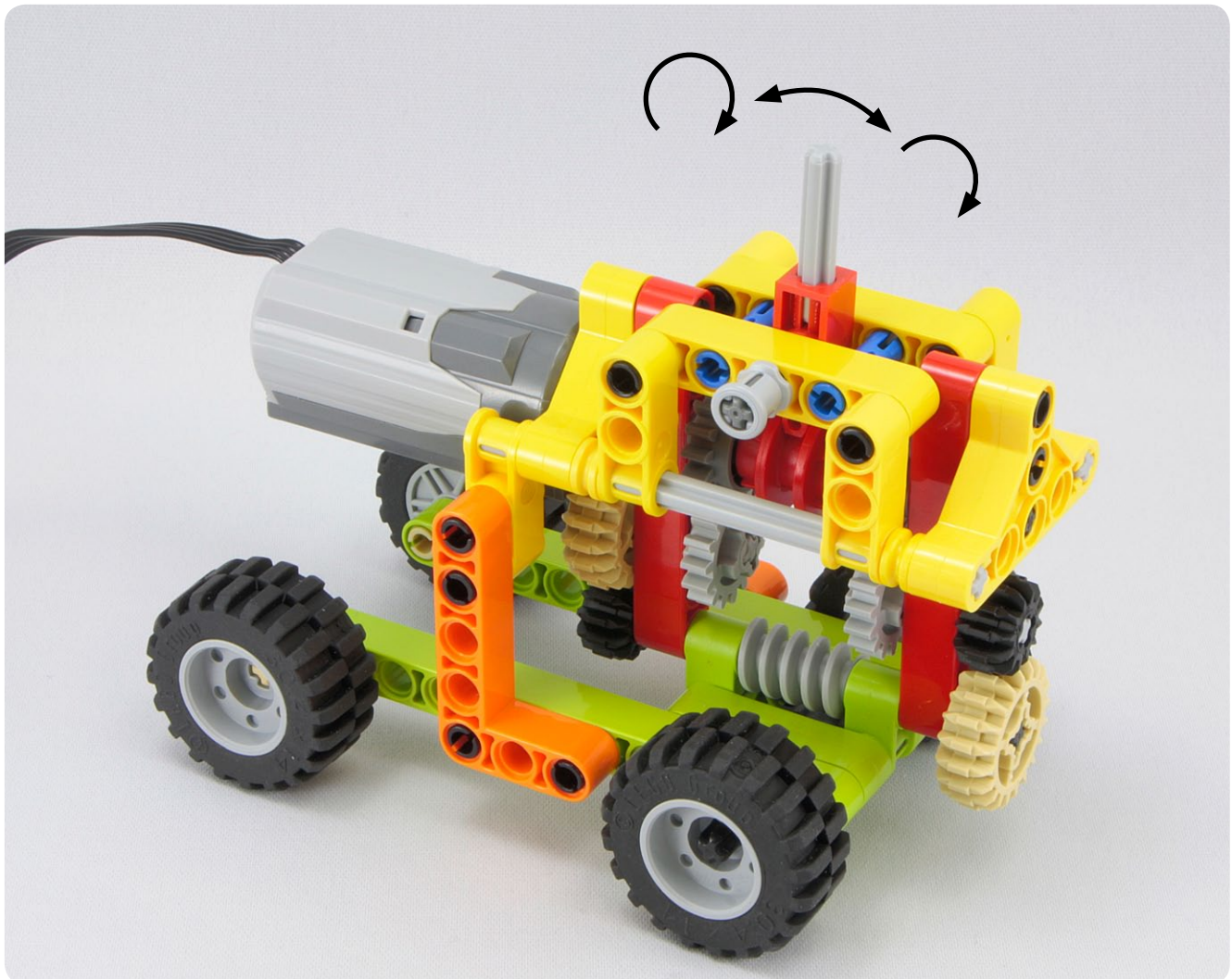
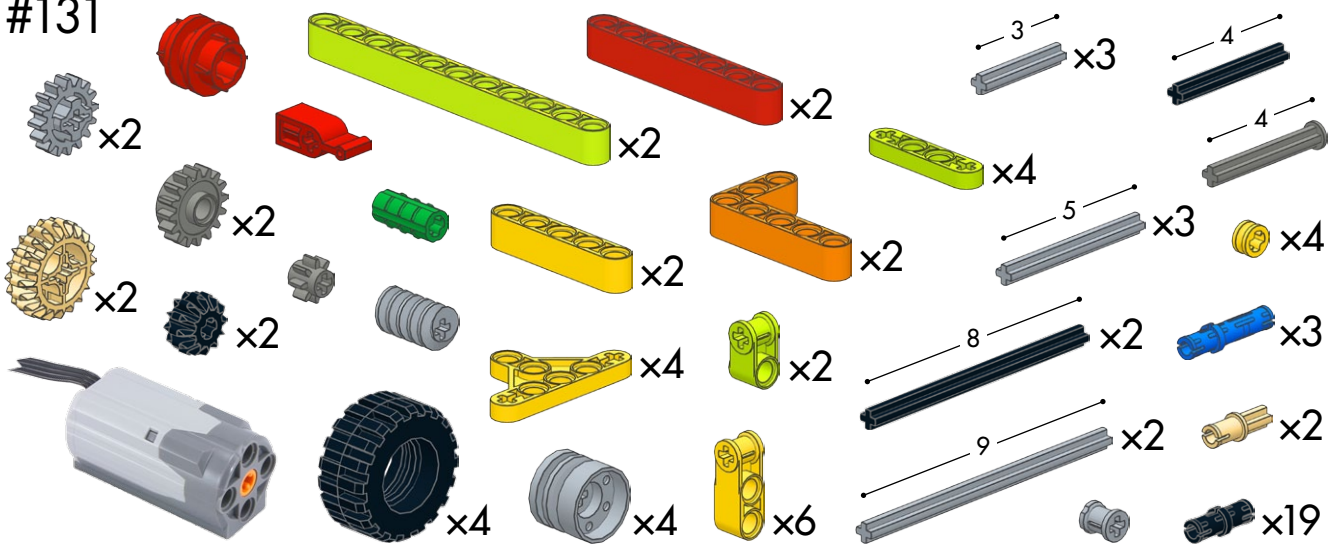
Transmissions

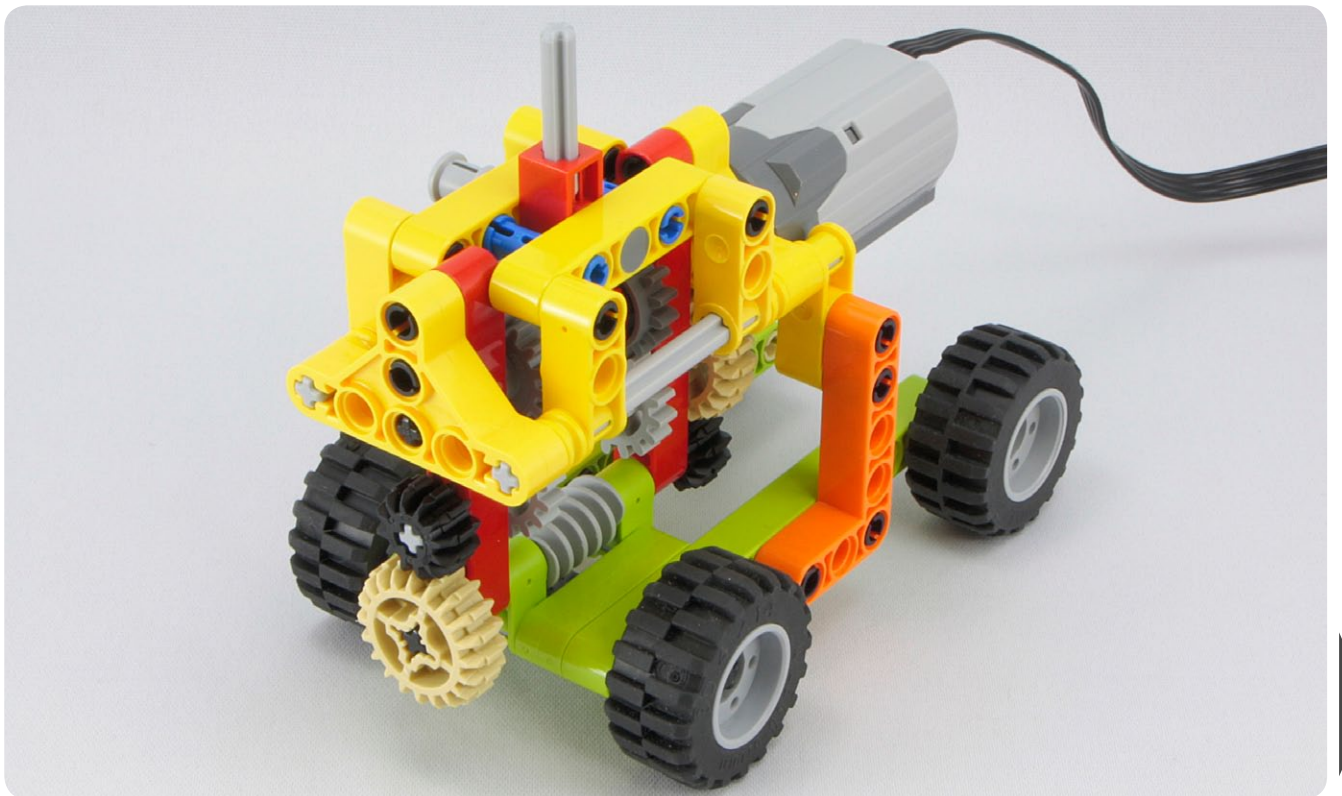
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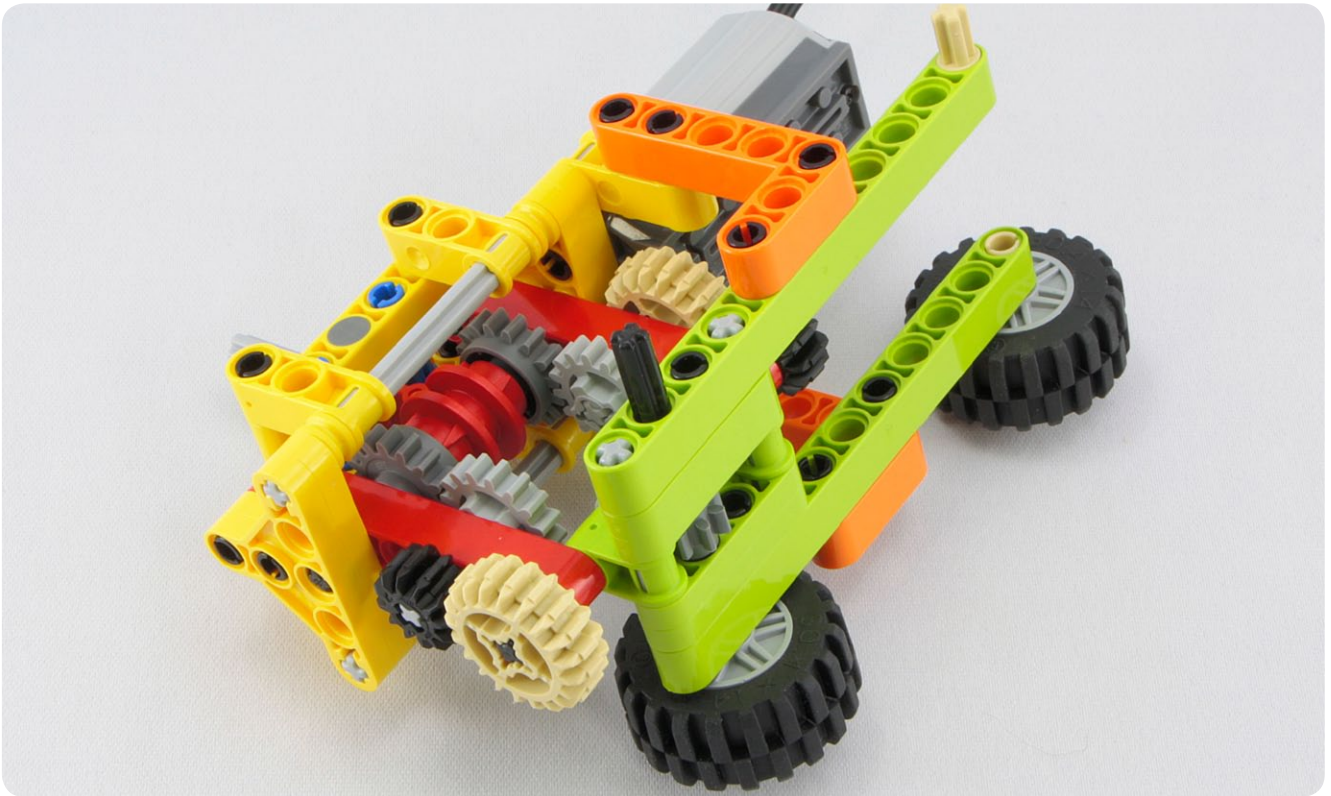
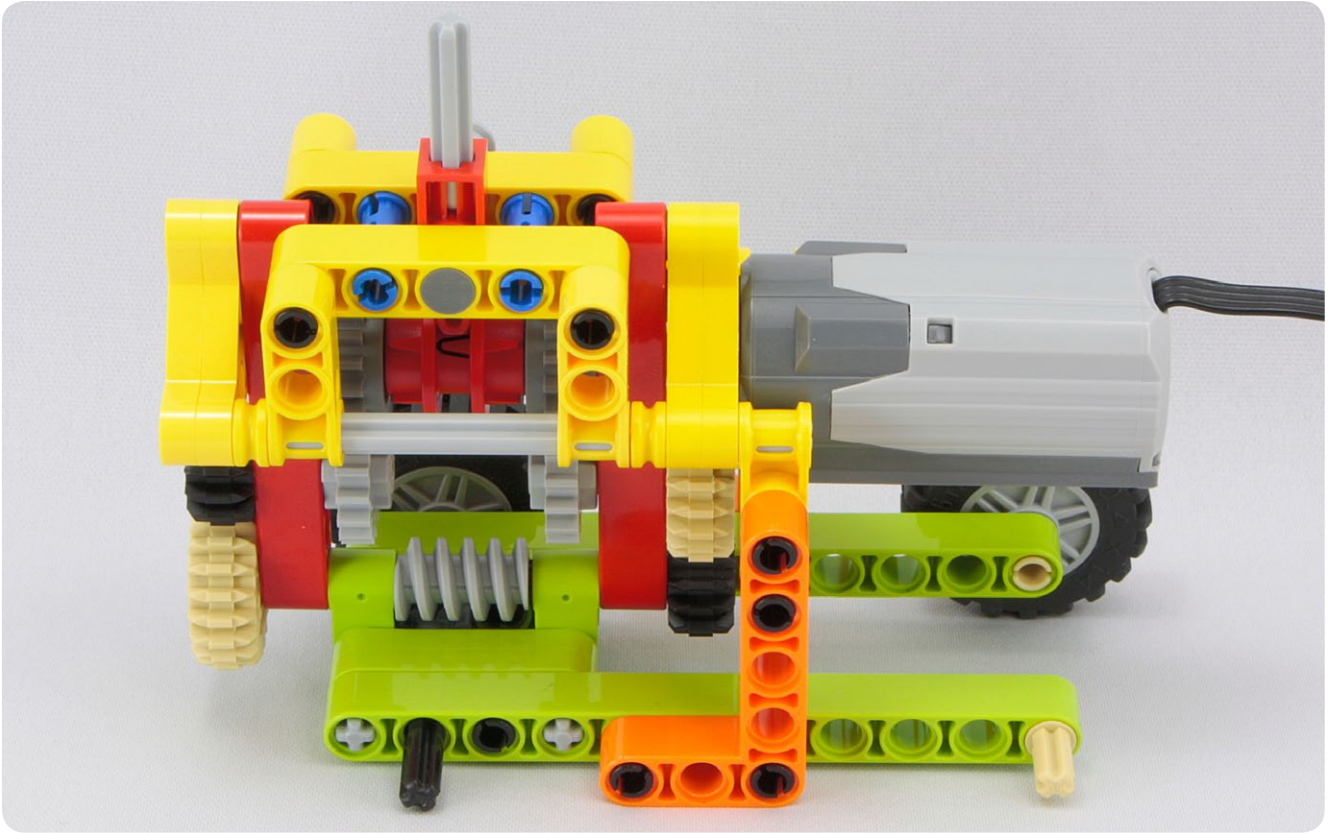


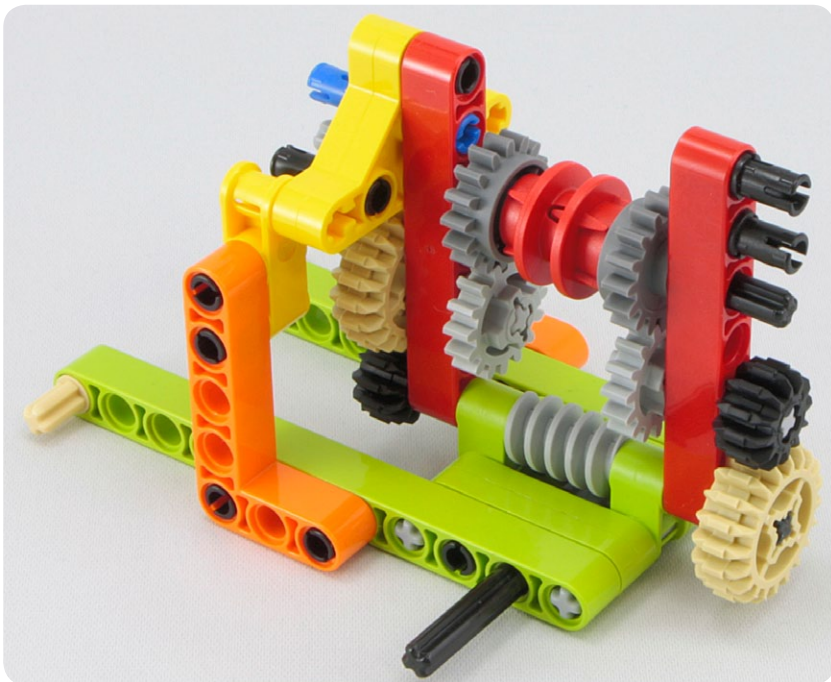


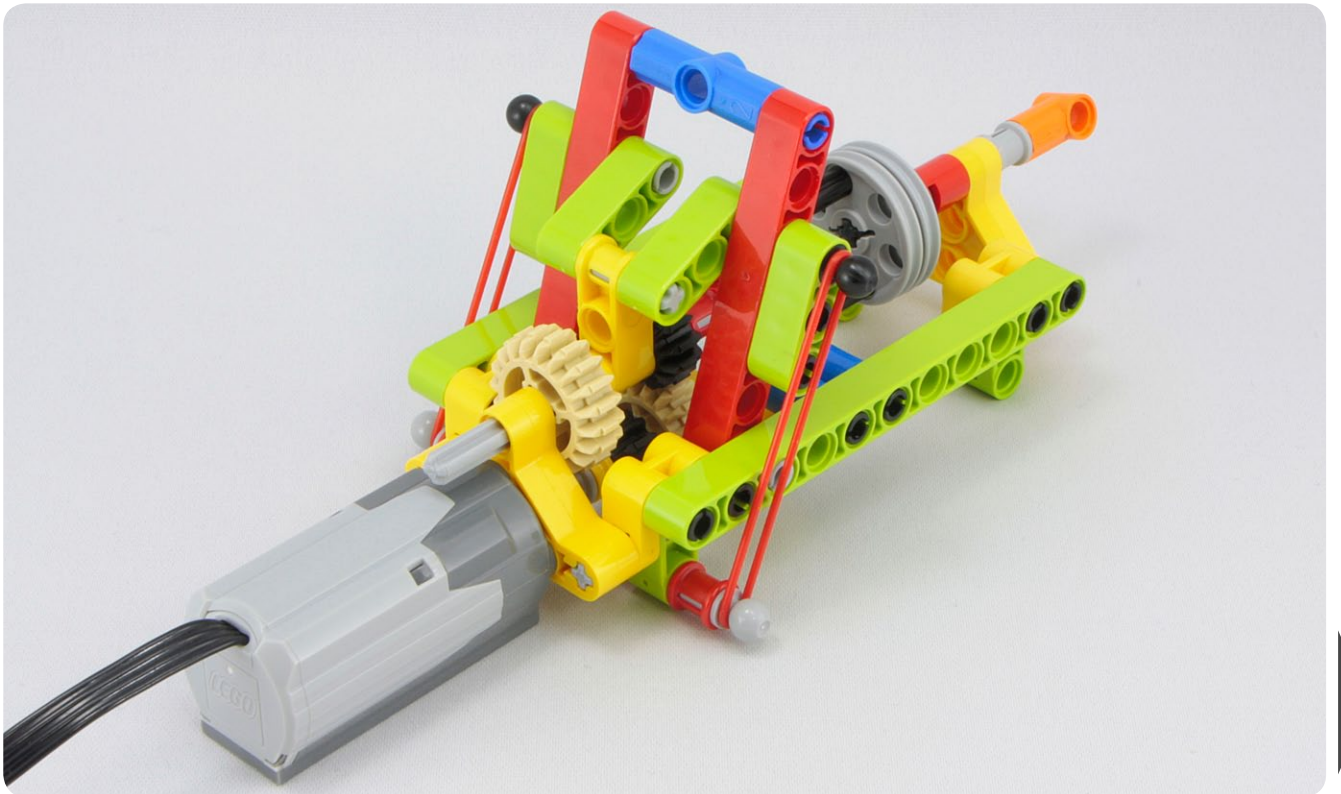
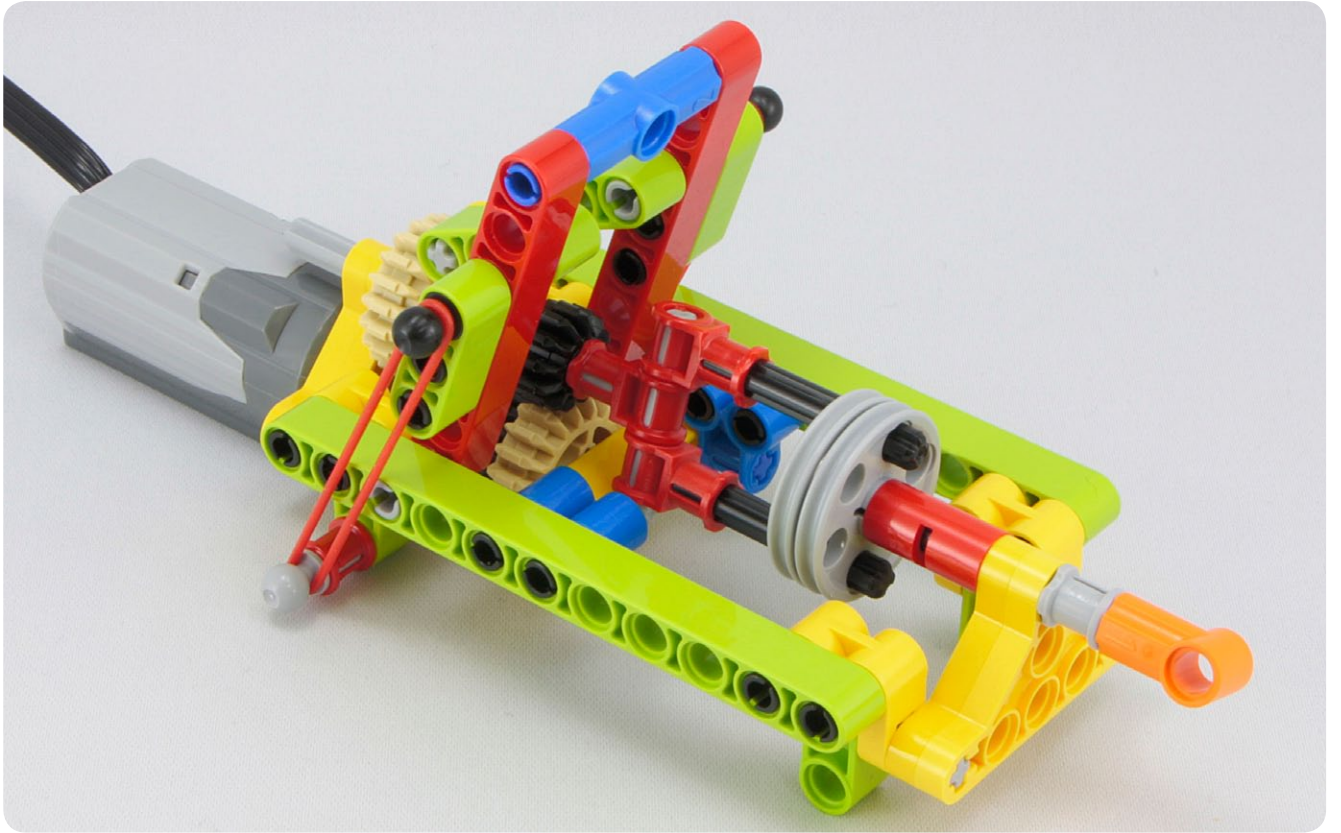
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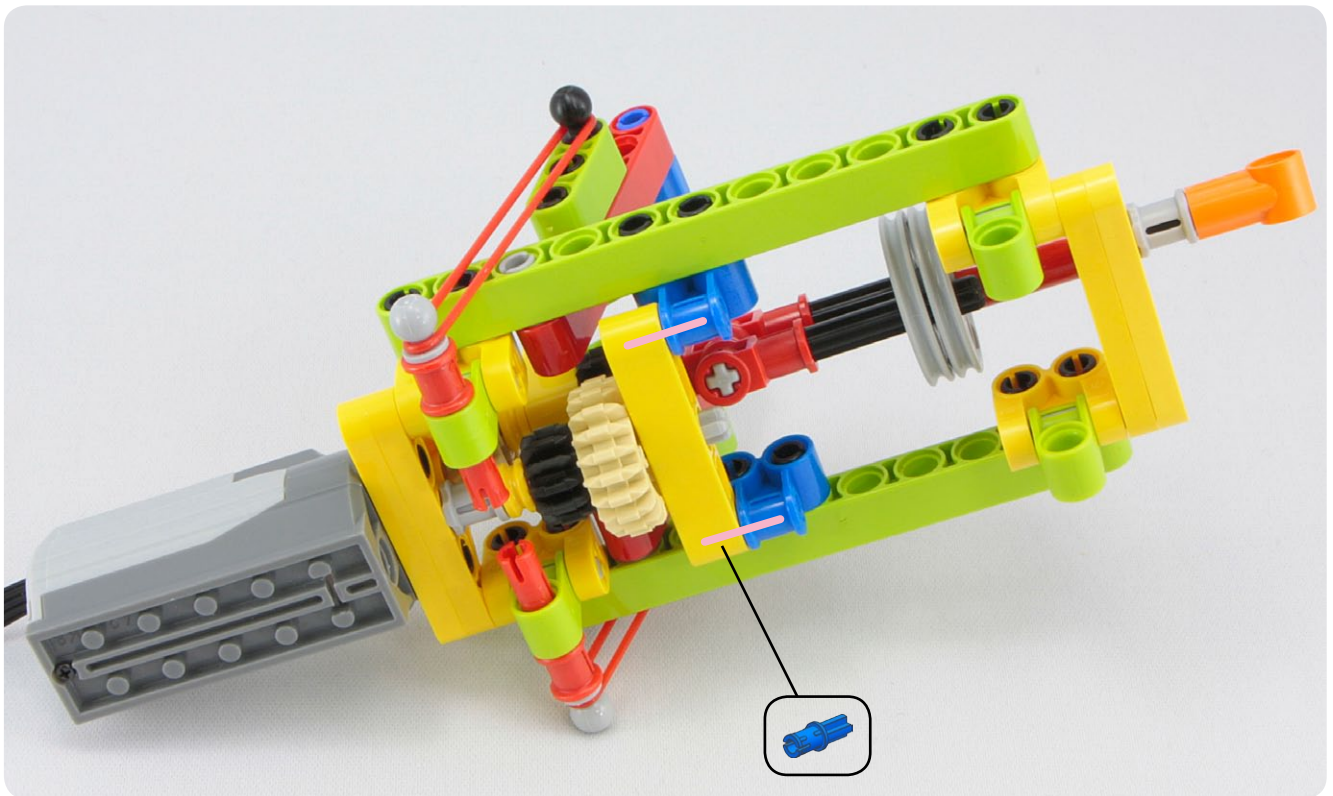
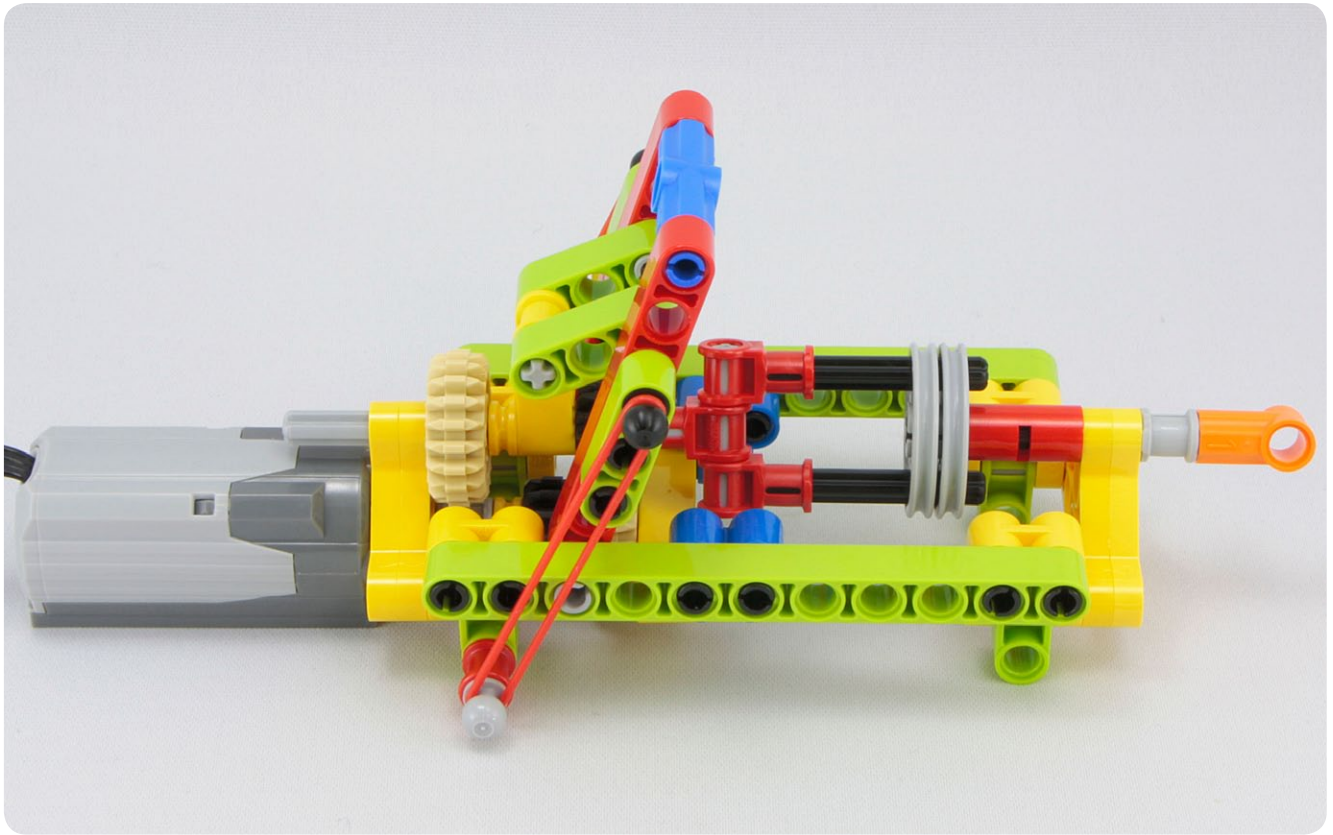


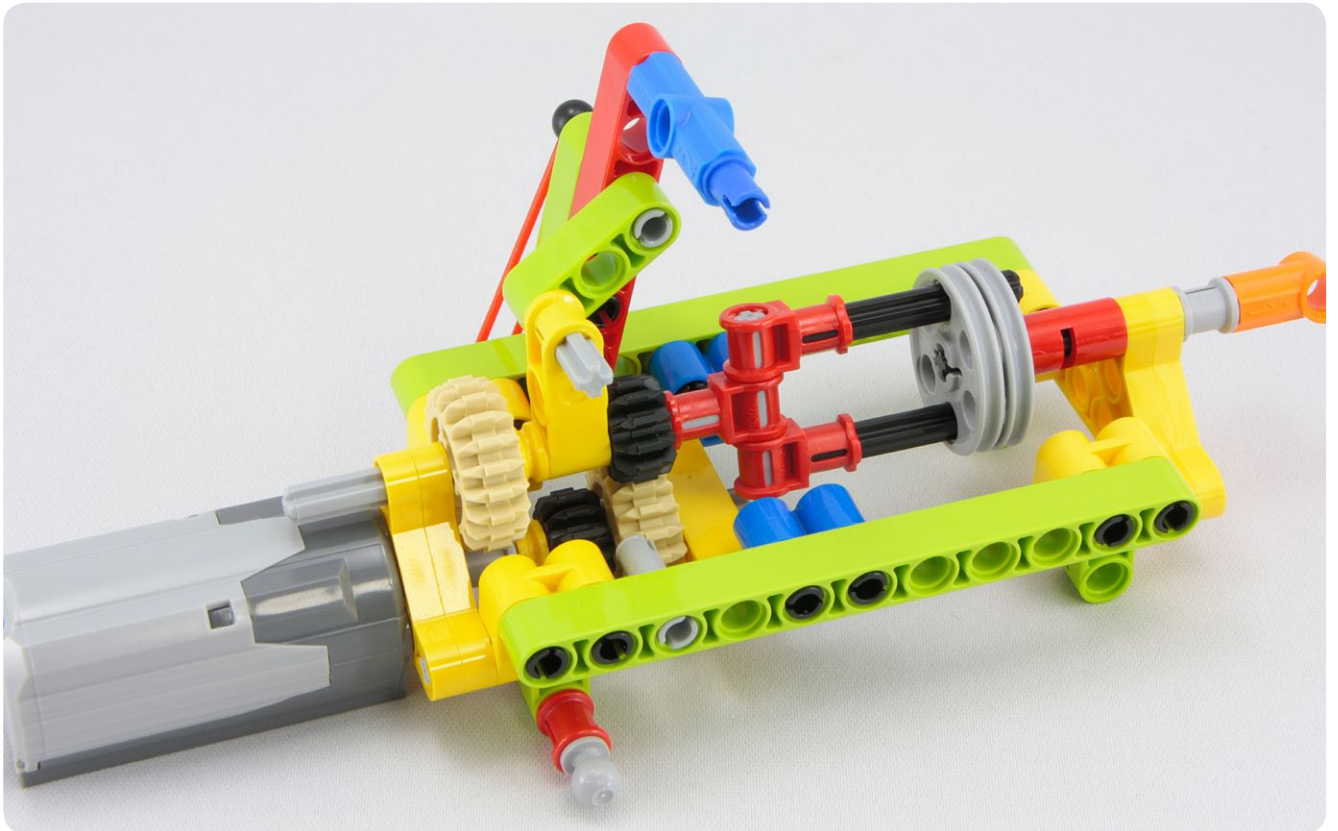
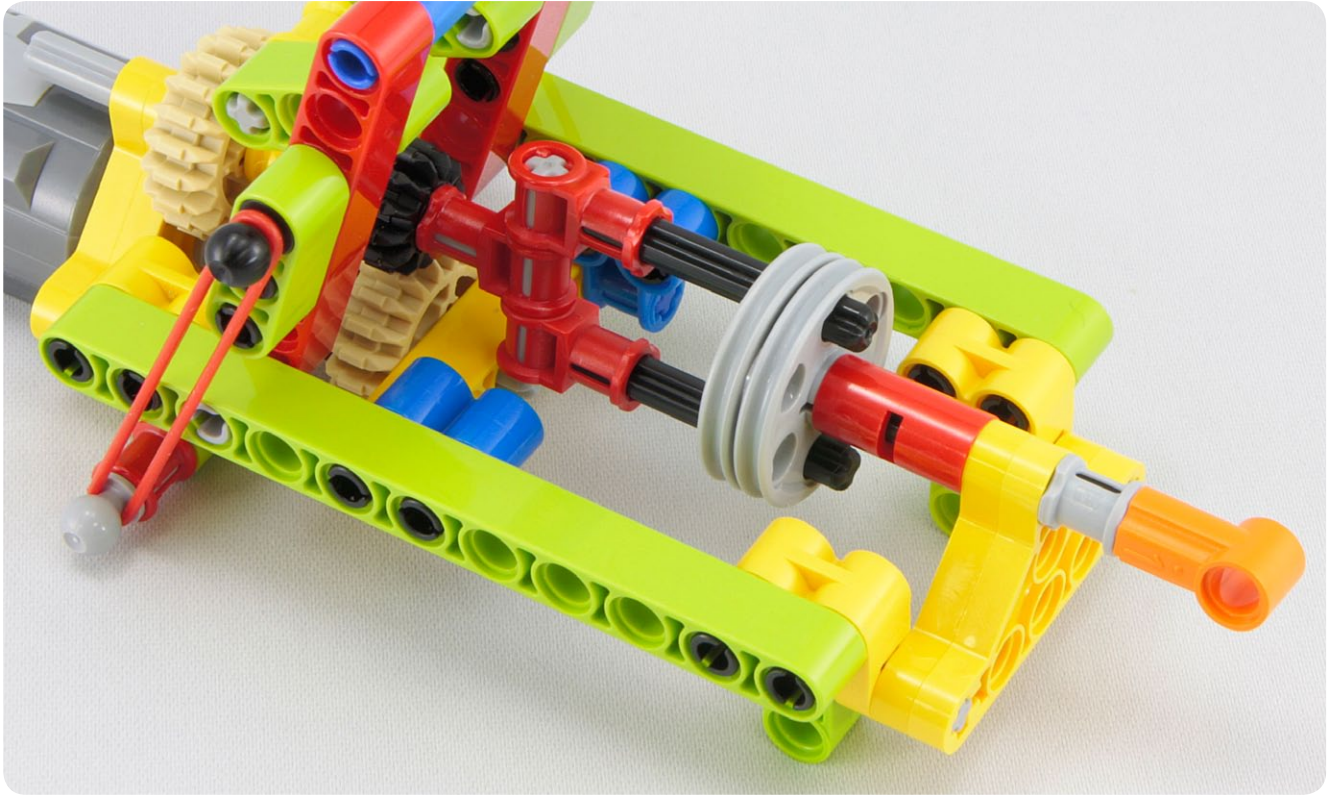







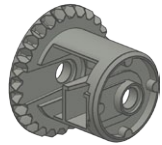



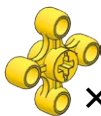

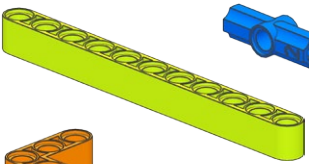

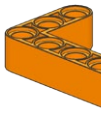

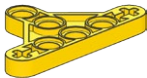
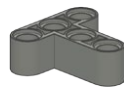

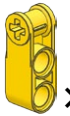

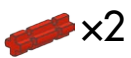


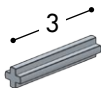
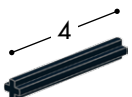

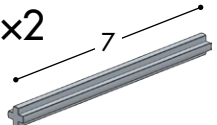
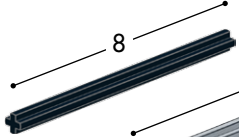
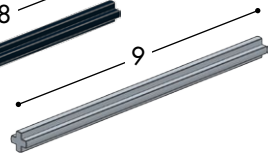


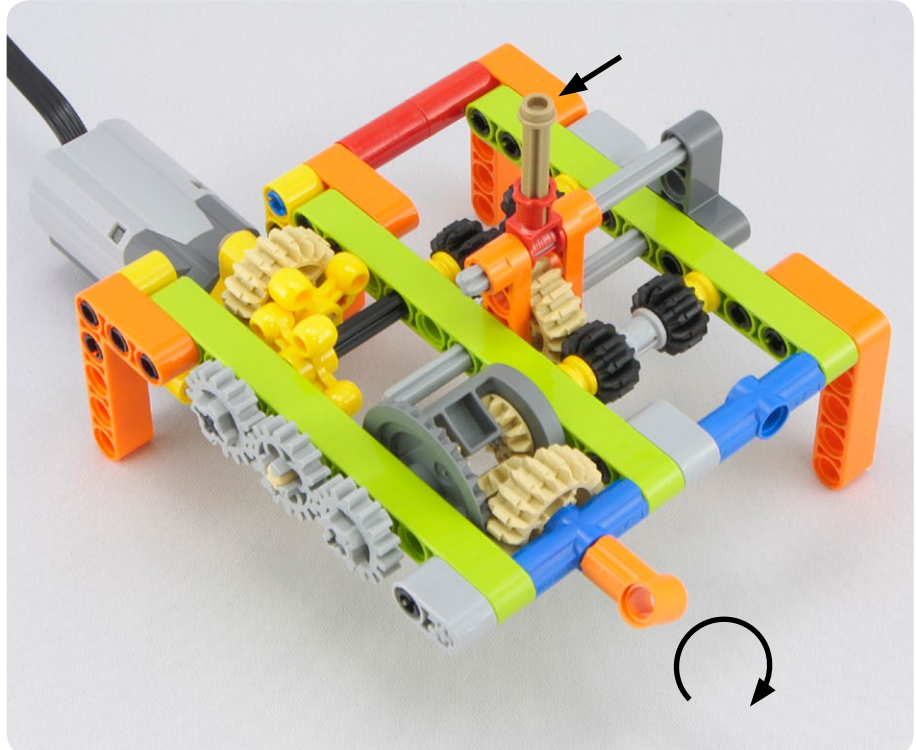
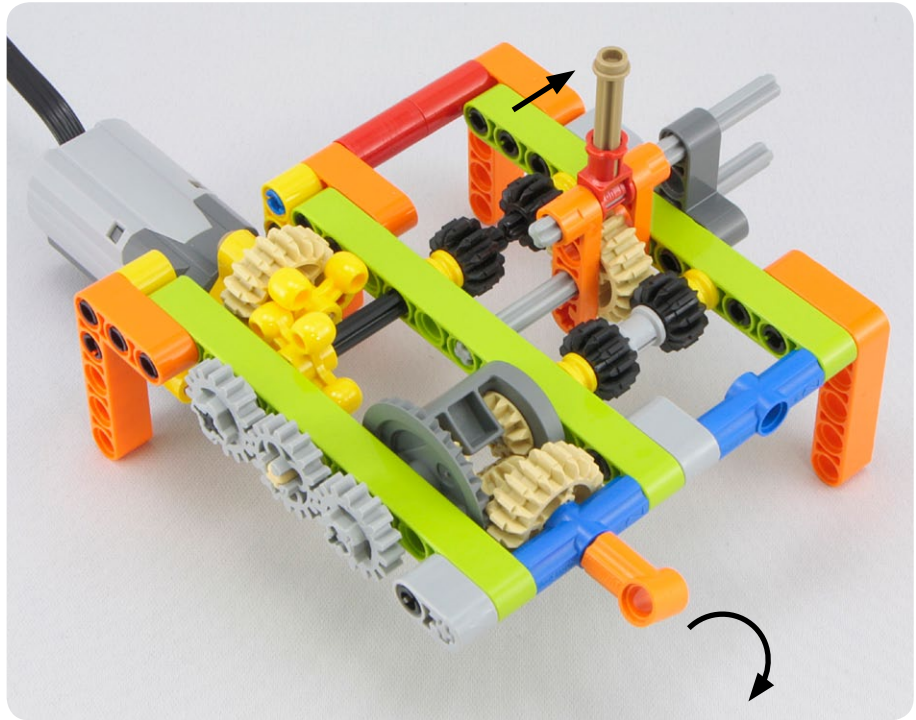


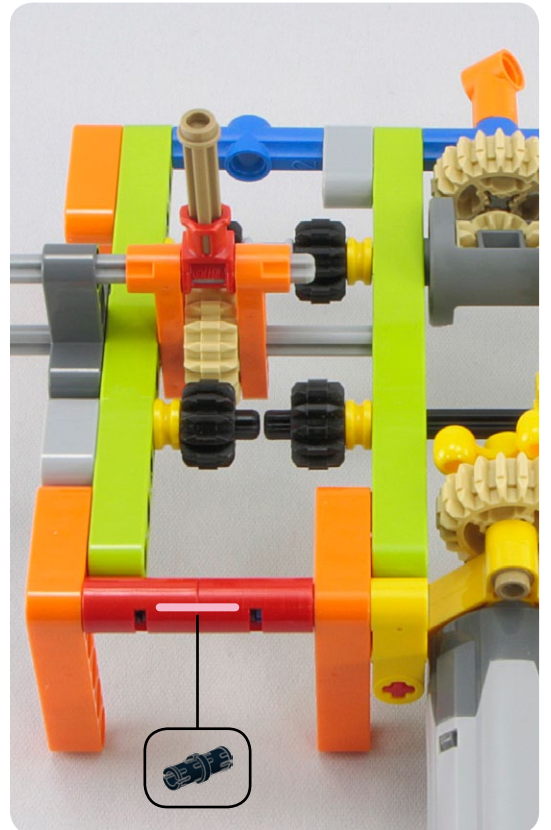
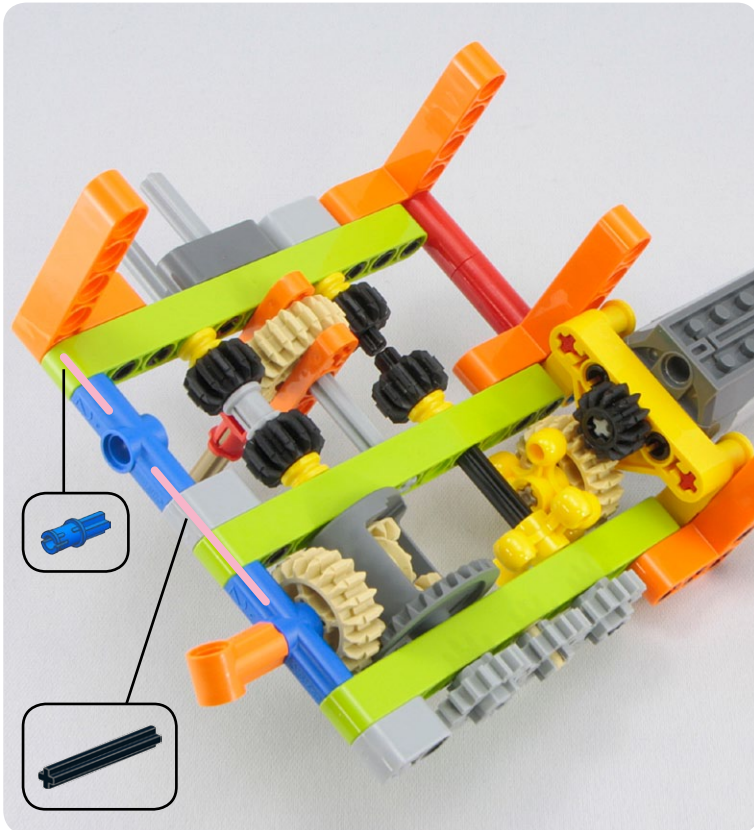
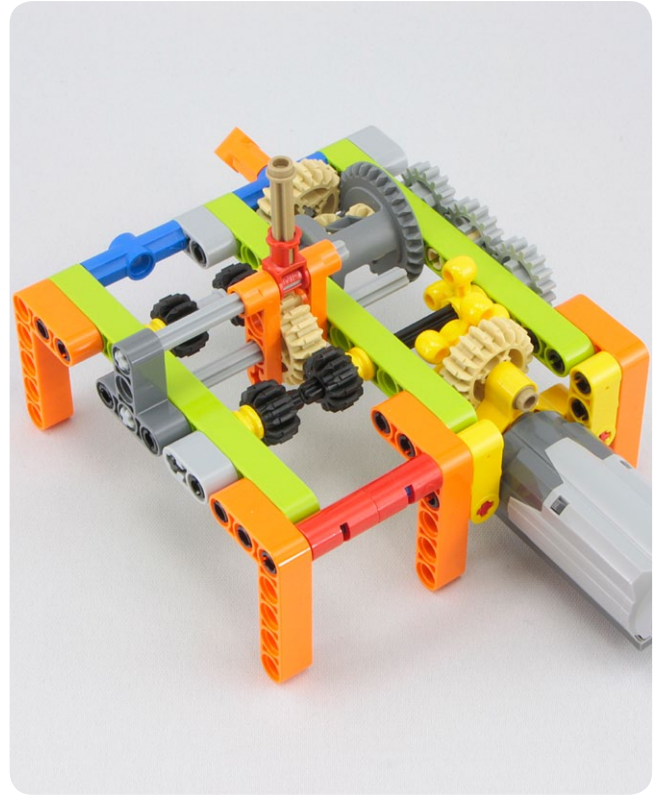


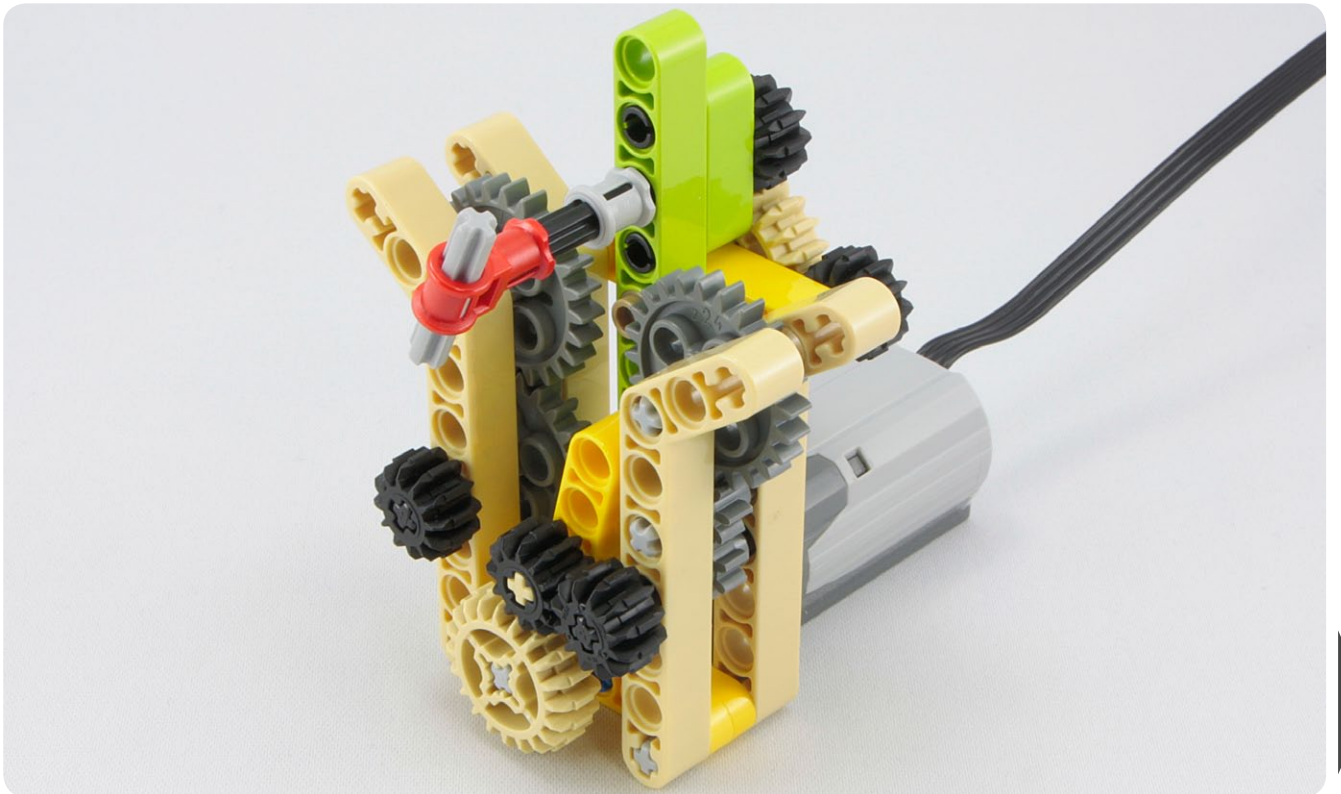
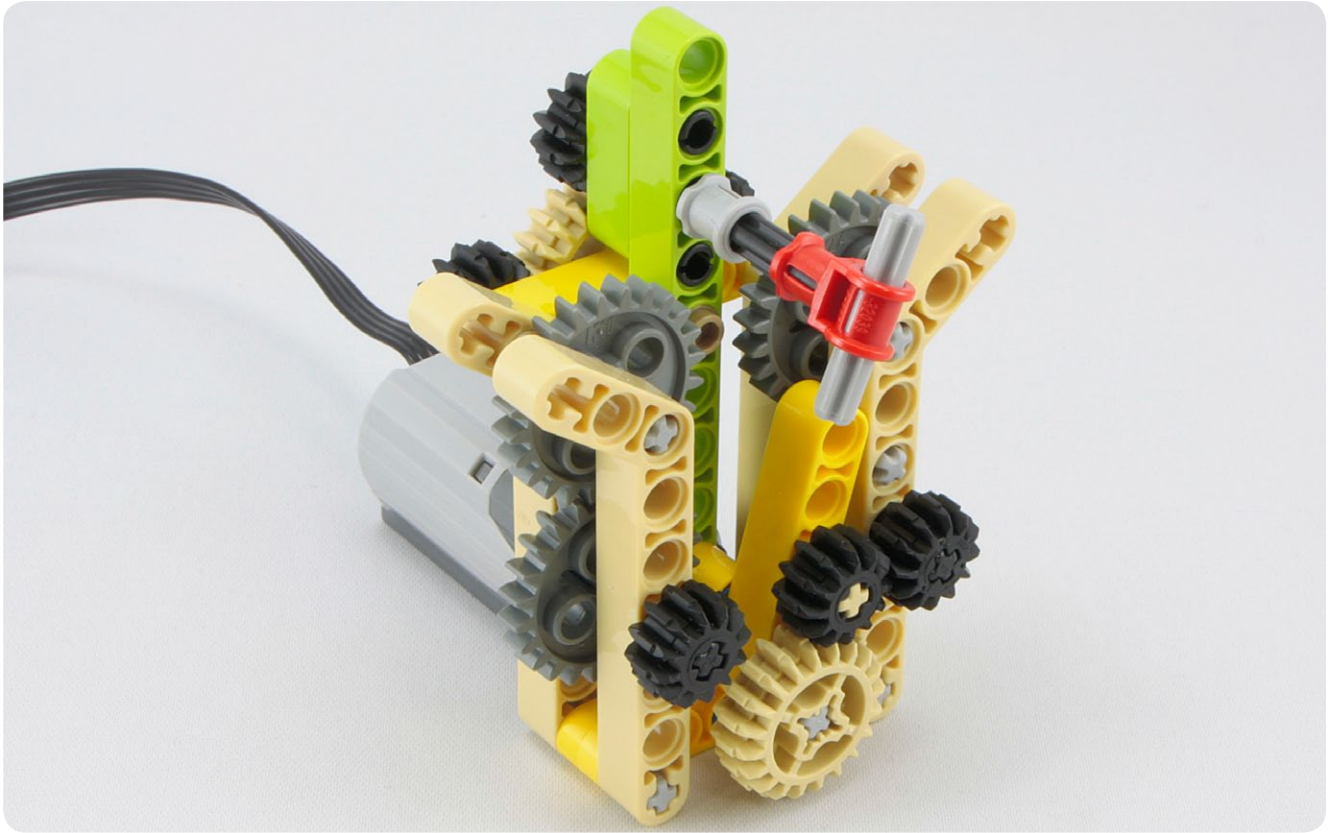
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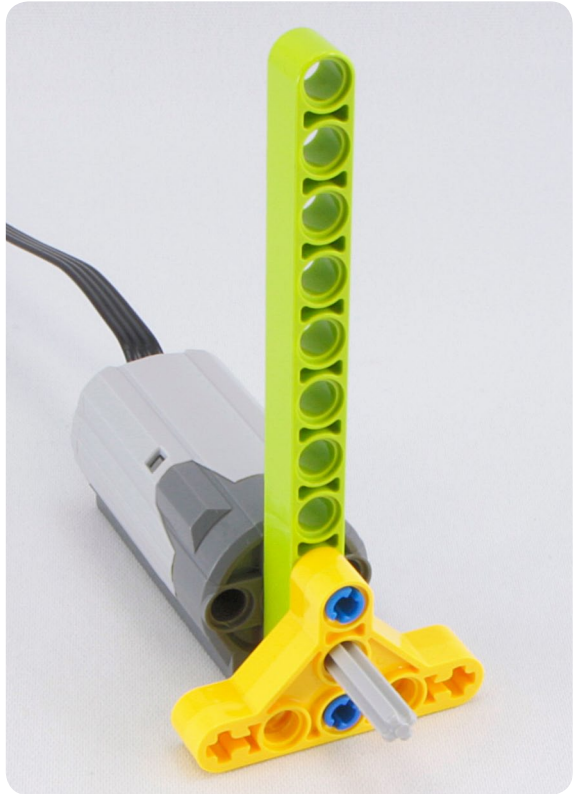
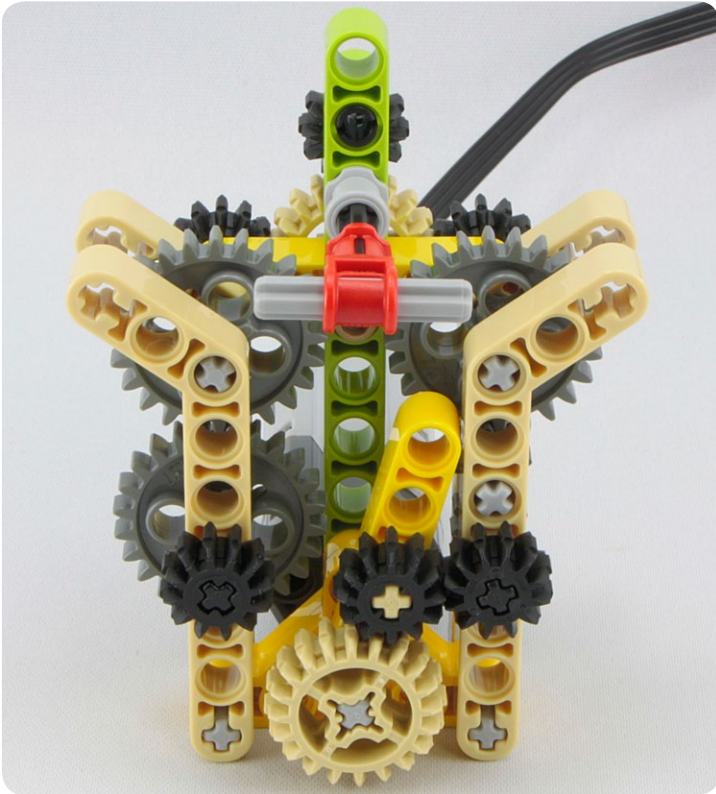
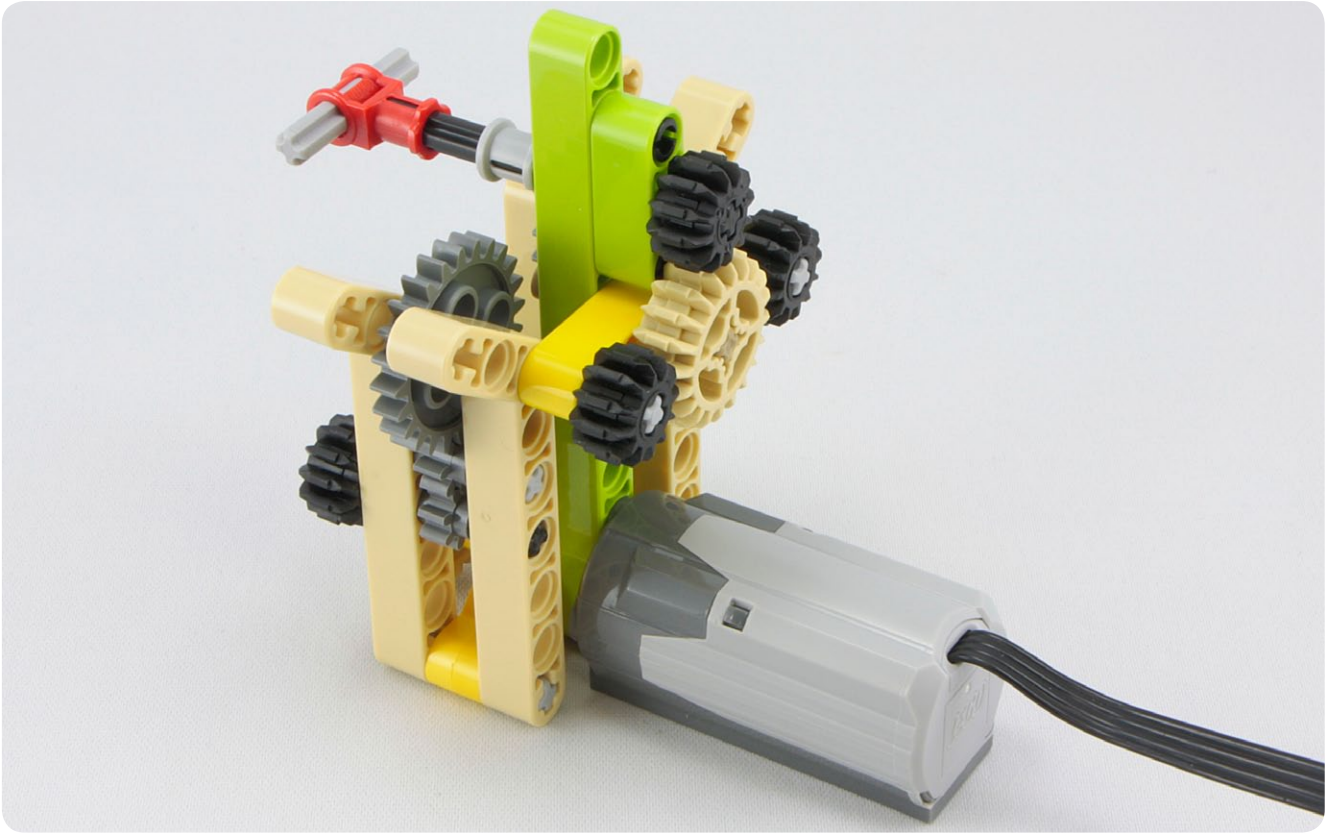
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-  x20

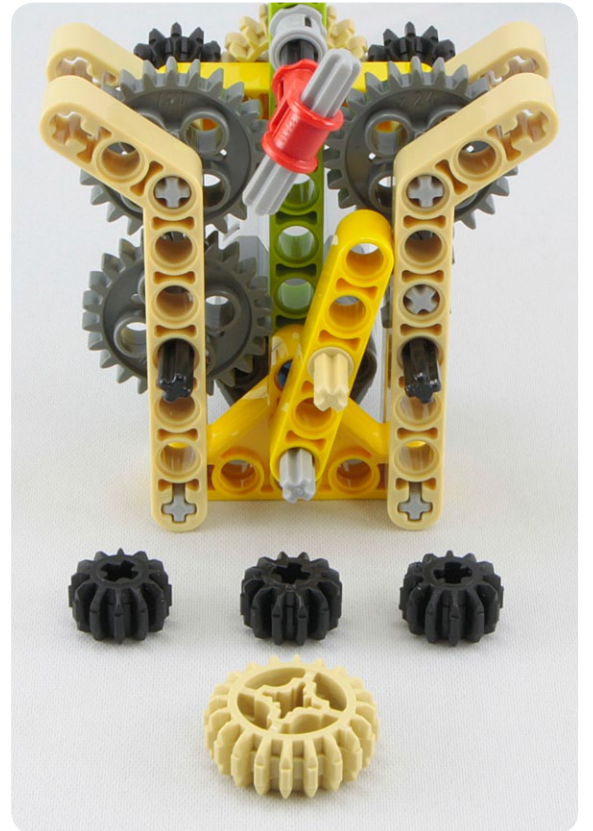
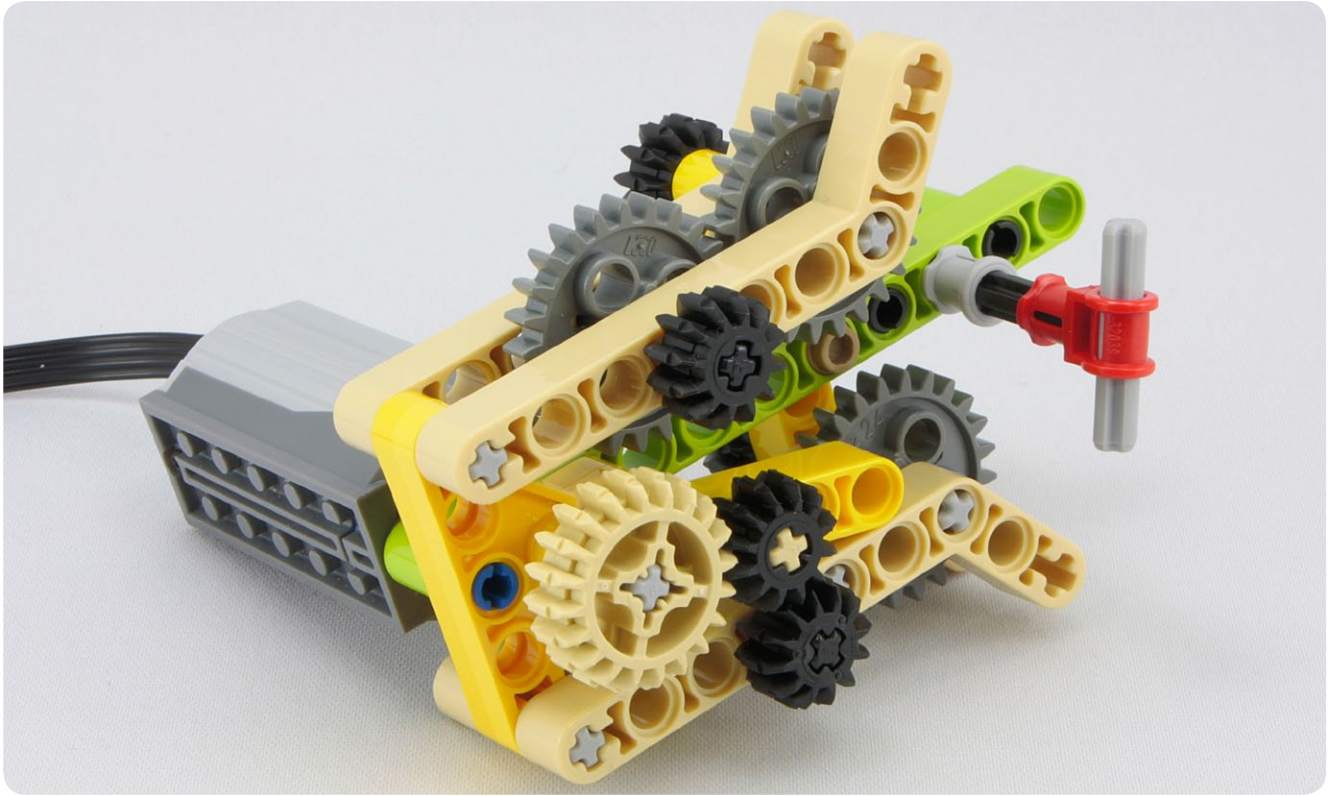
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-  x3
-  x5
-  x3
-  x2
-  x3
-  x3
-  x2
-  x4
-  x3
-  x2
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-  x2
-  x2
-  x2
-  x2
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-  x4
-  x2
-  x2
-  x2
-  x2
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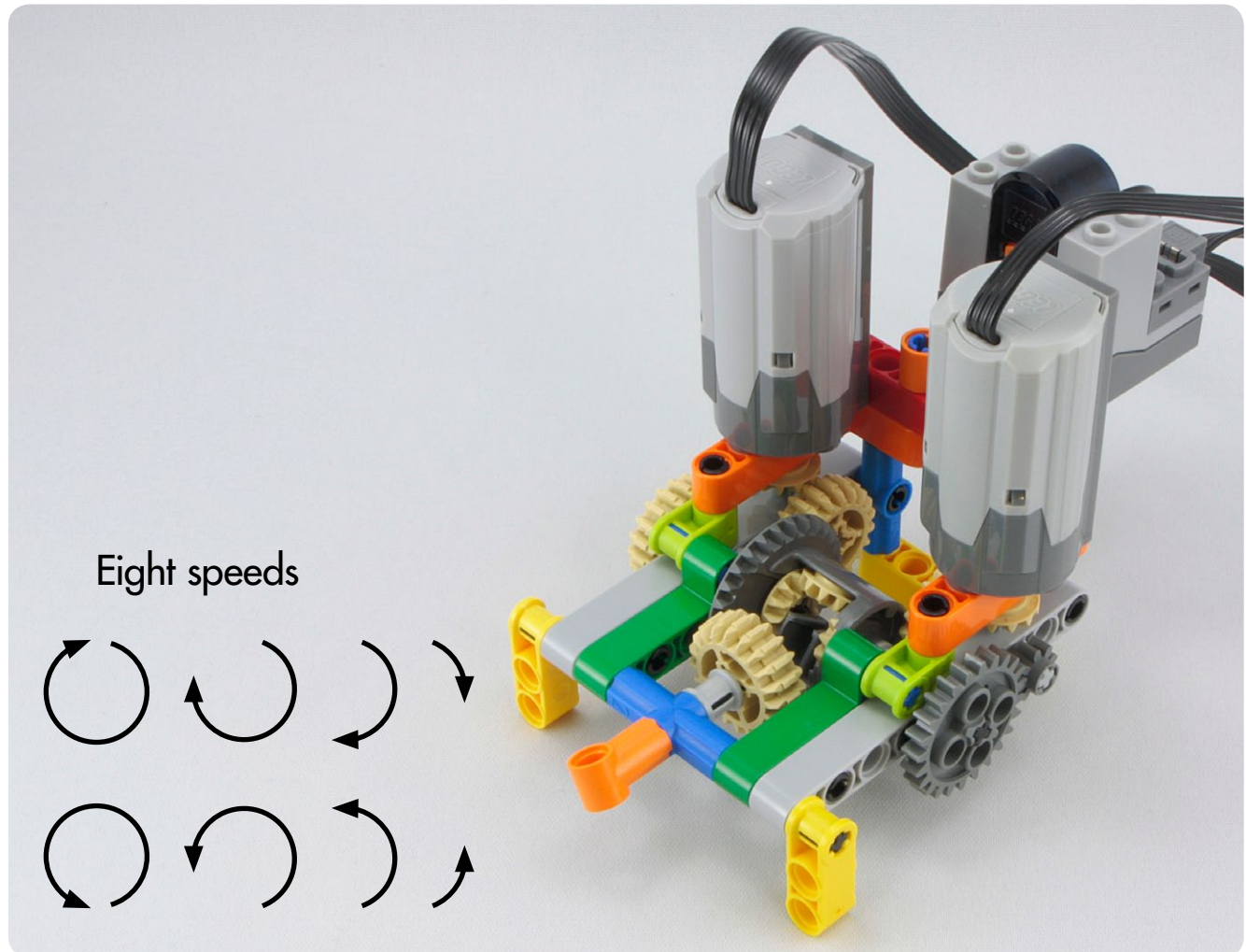


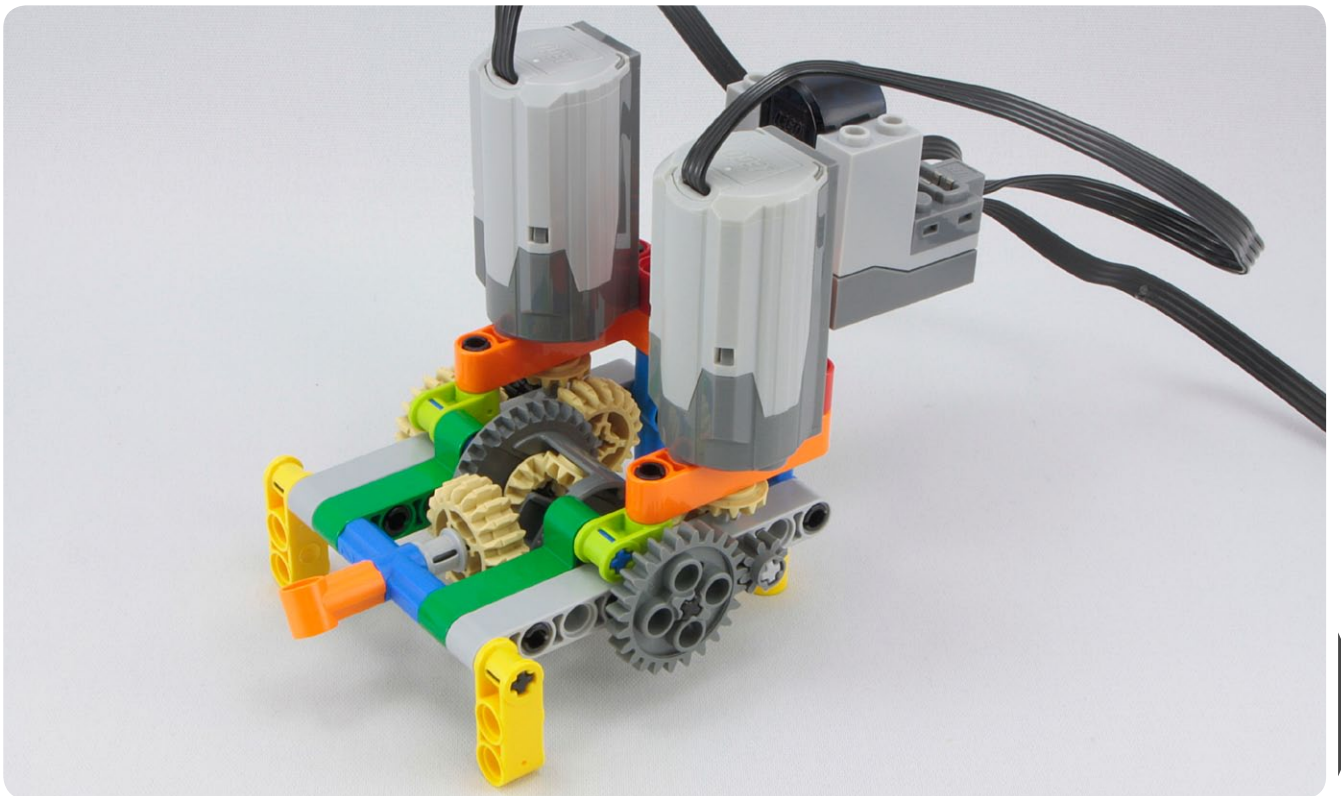
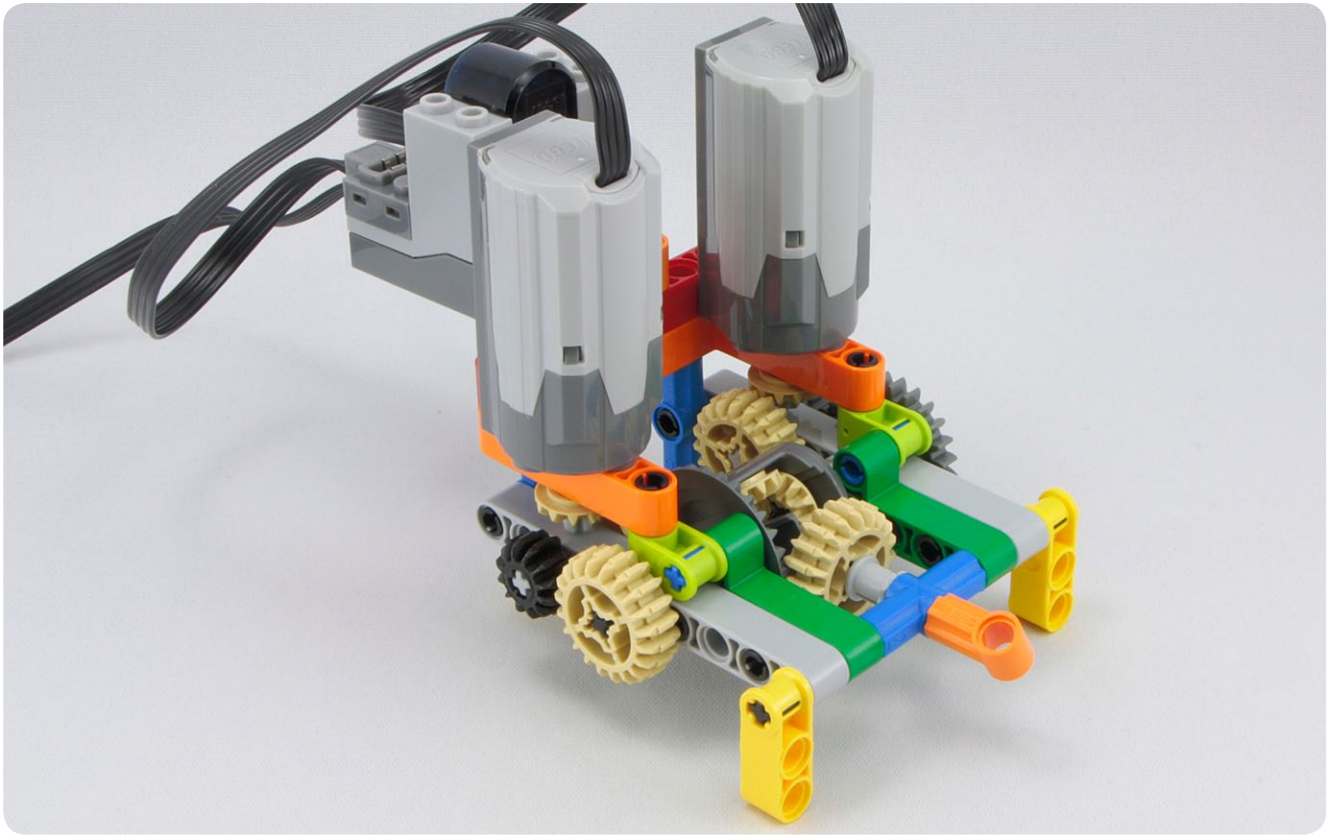


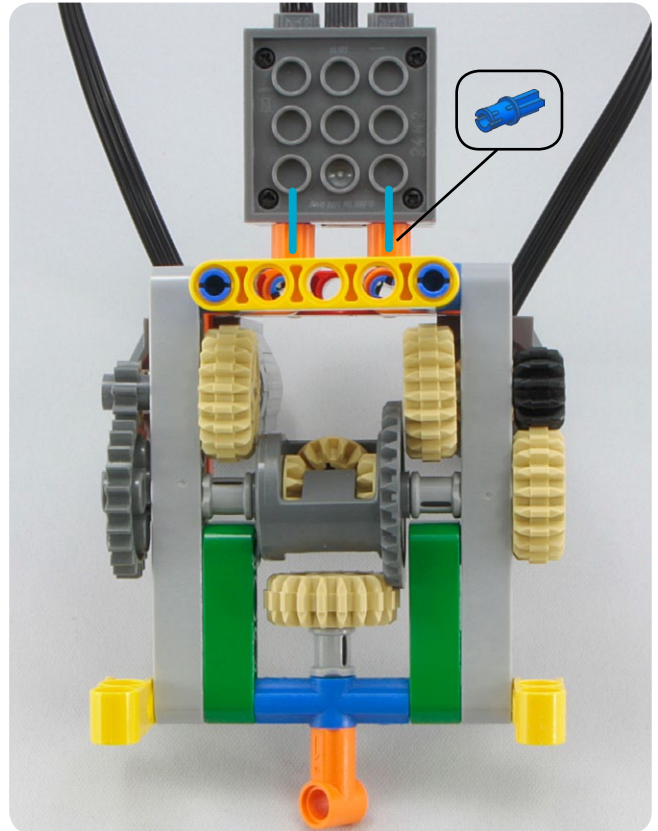
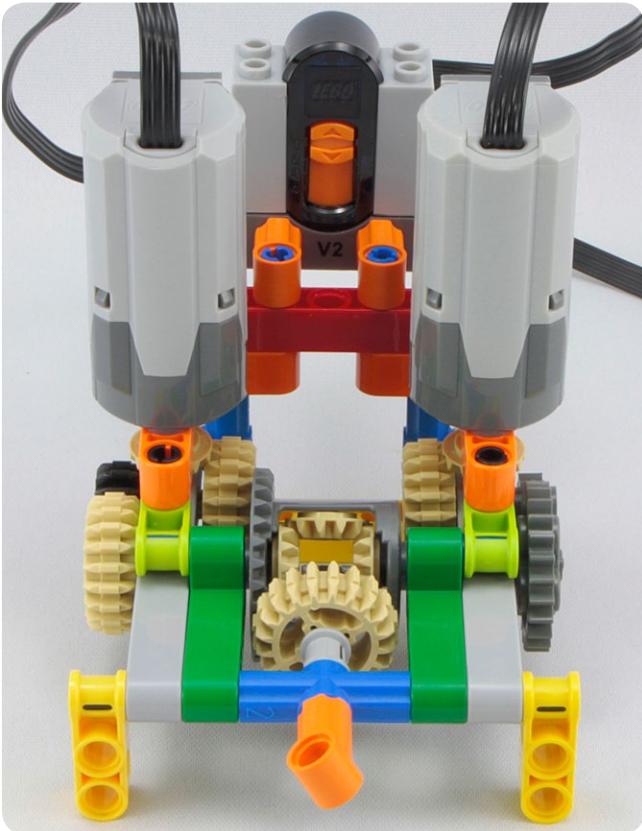
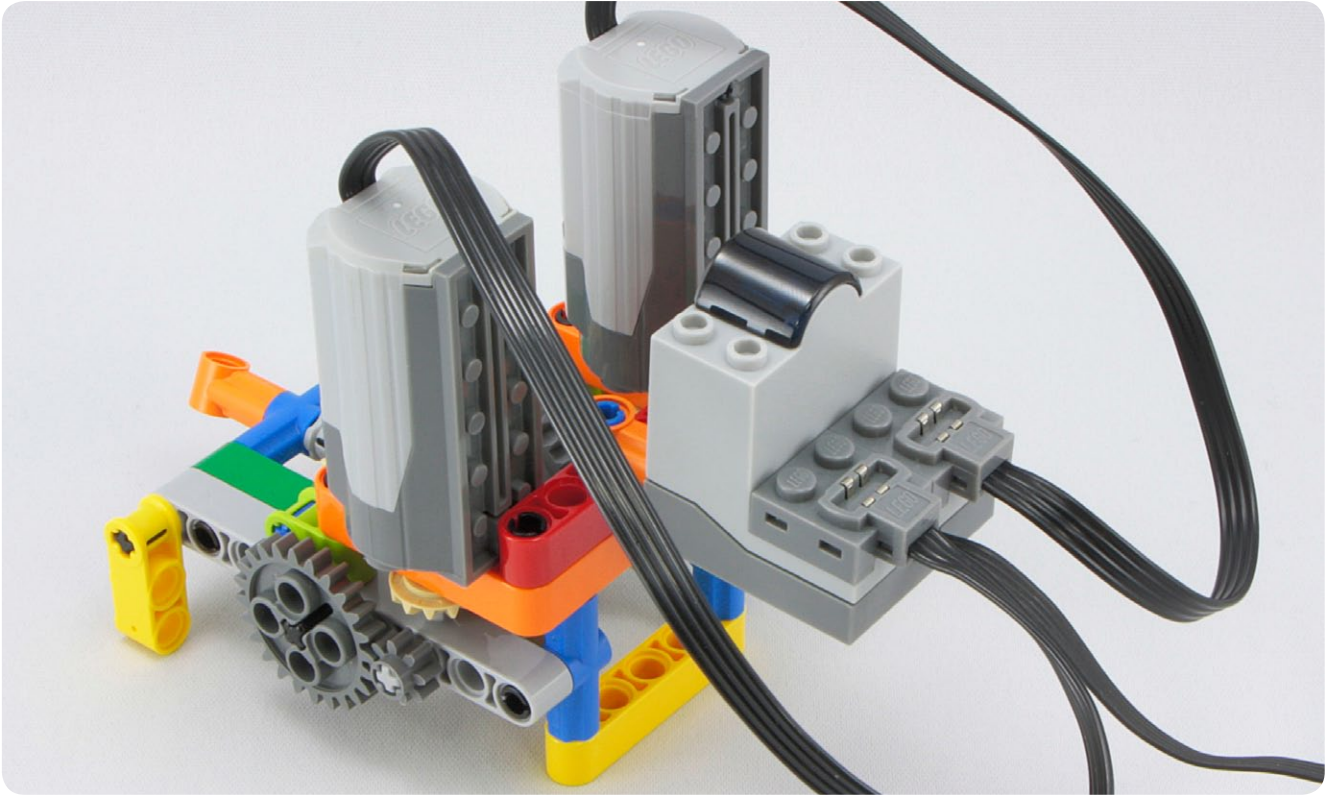


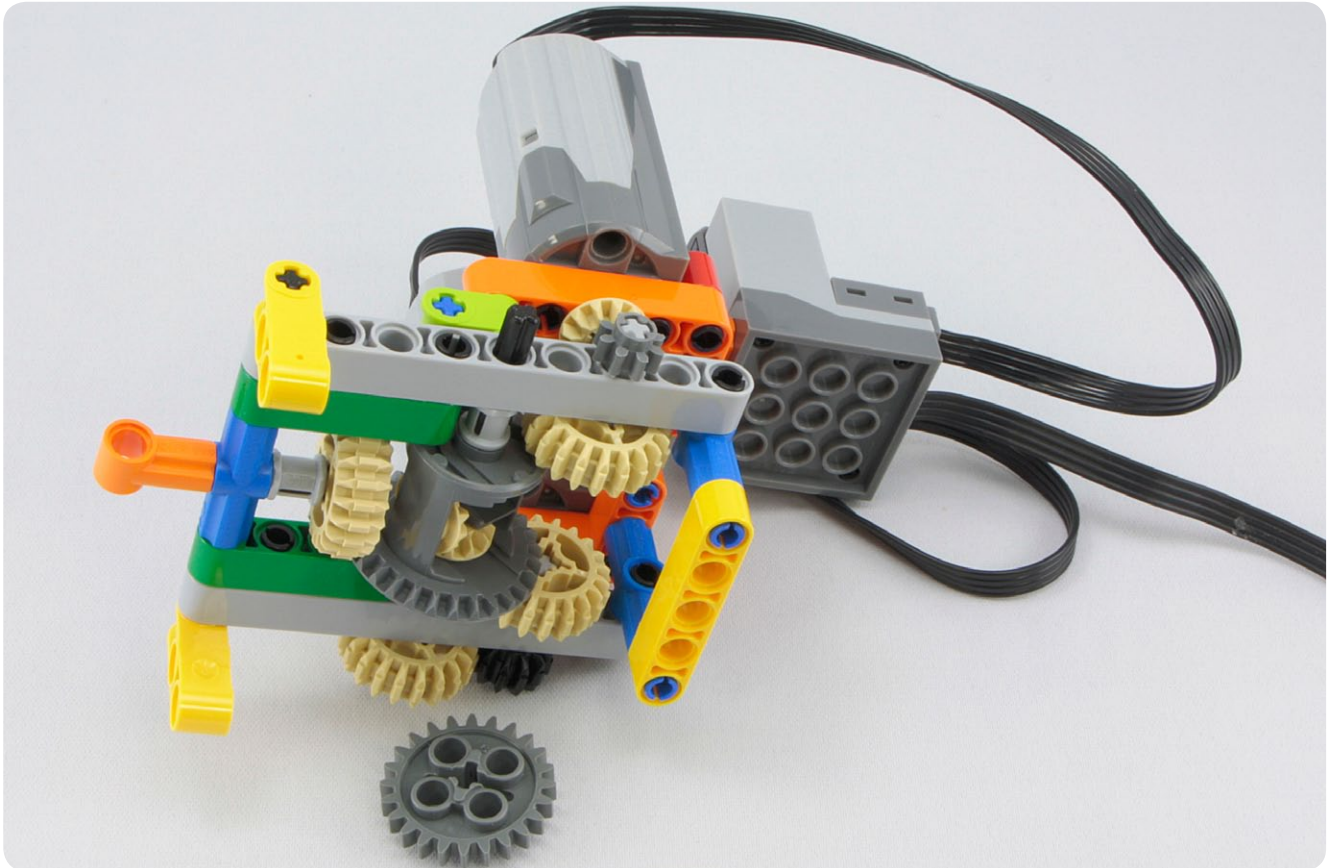
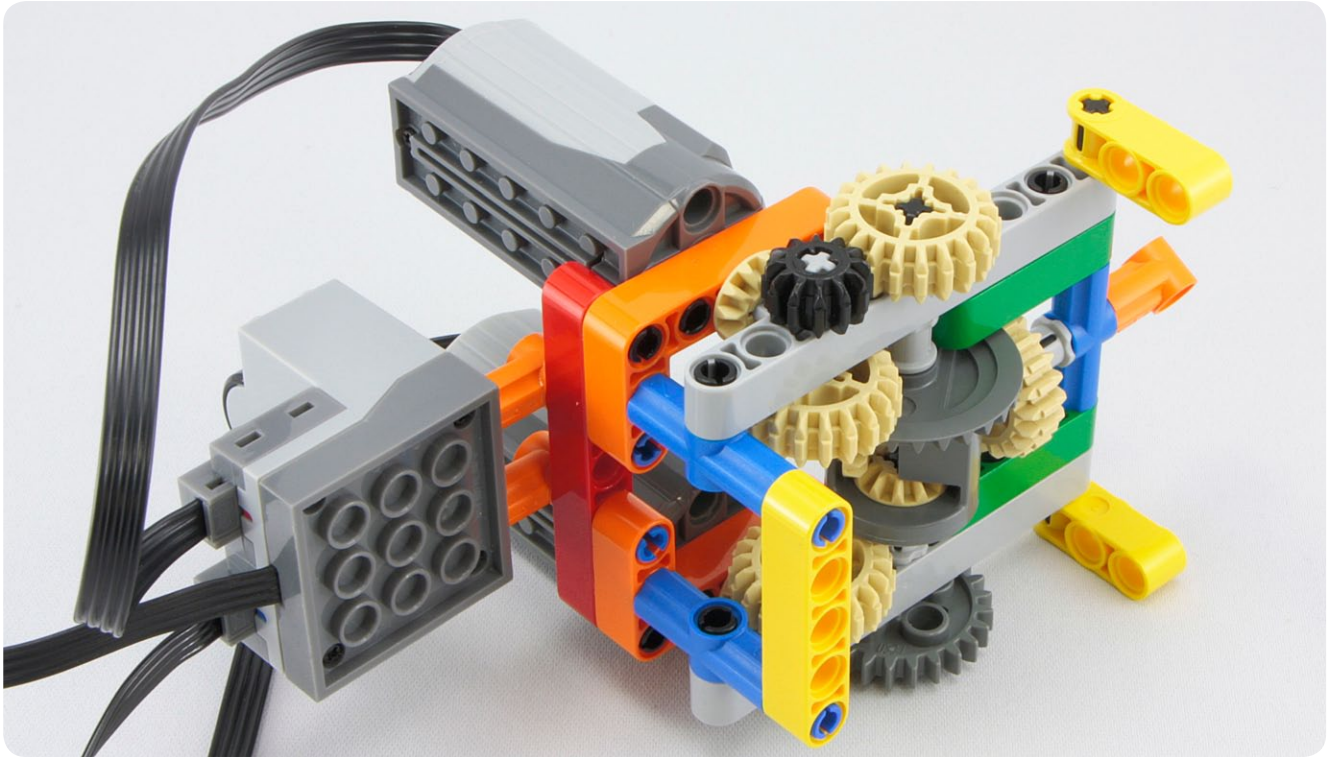


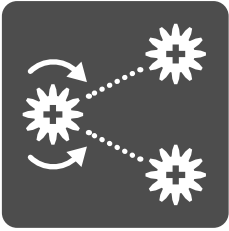
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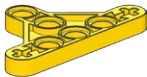

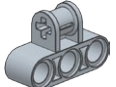

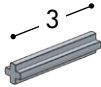
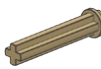
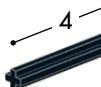
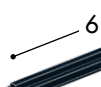




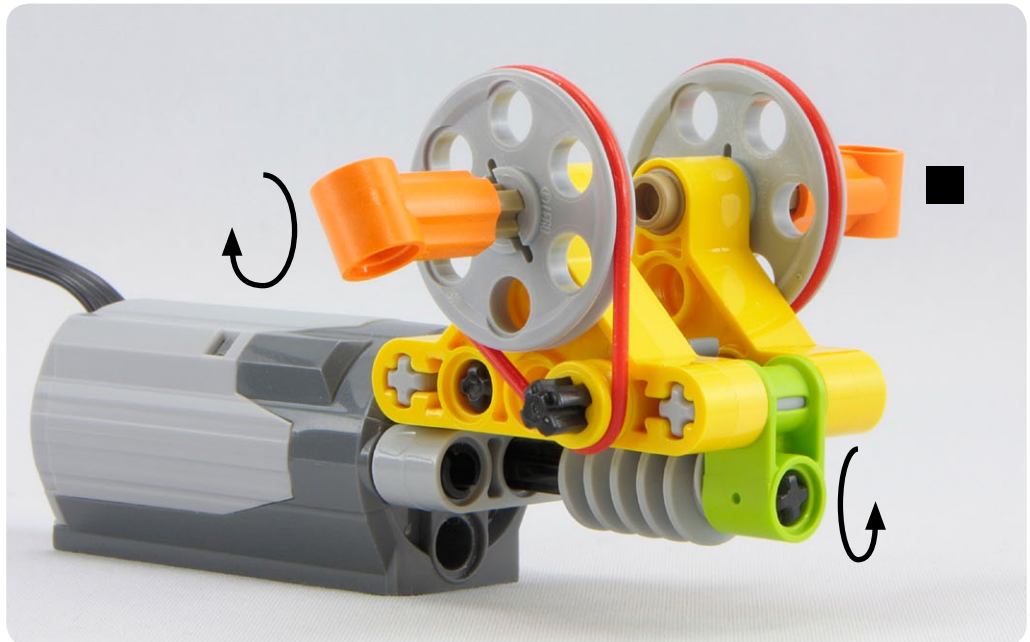
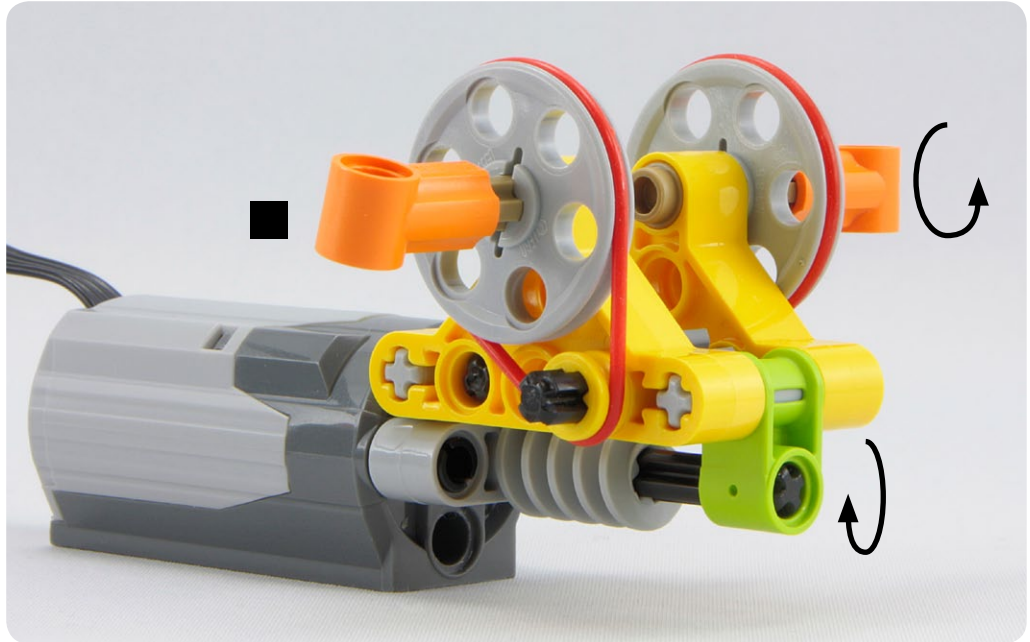


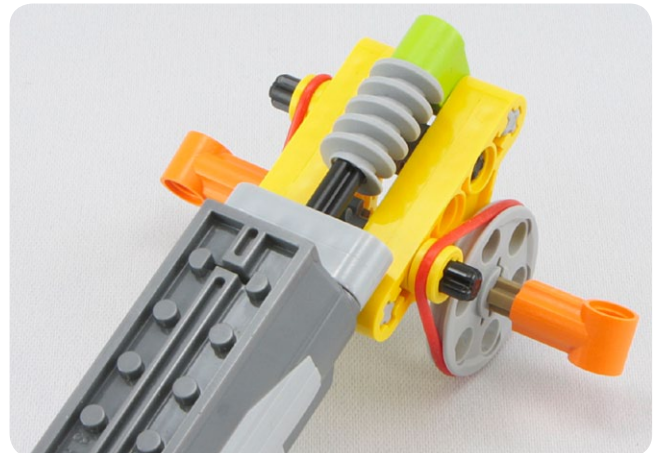
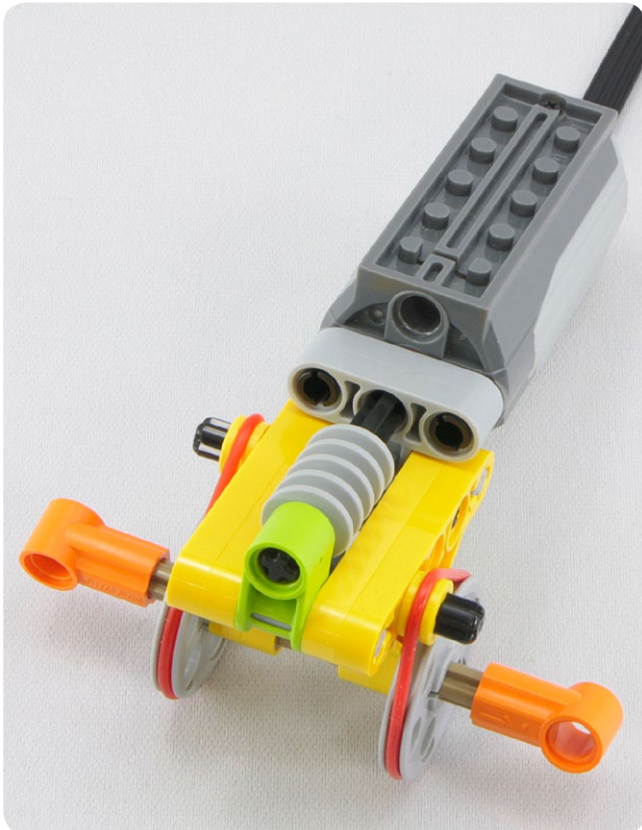
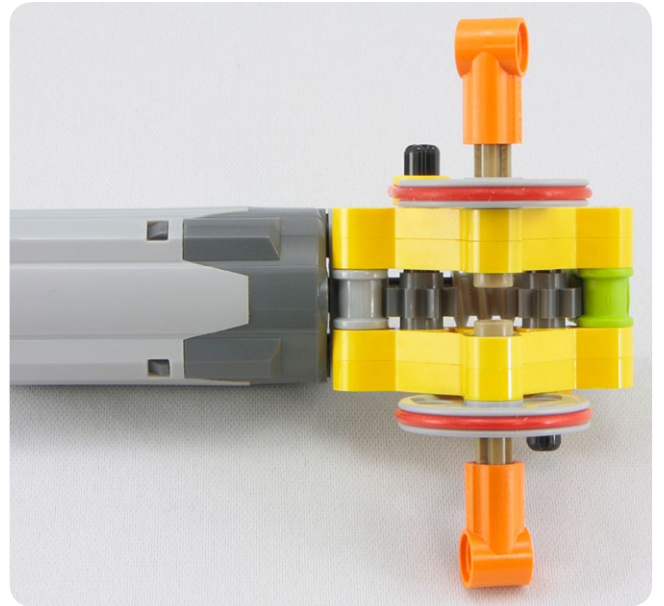
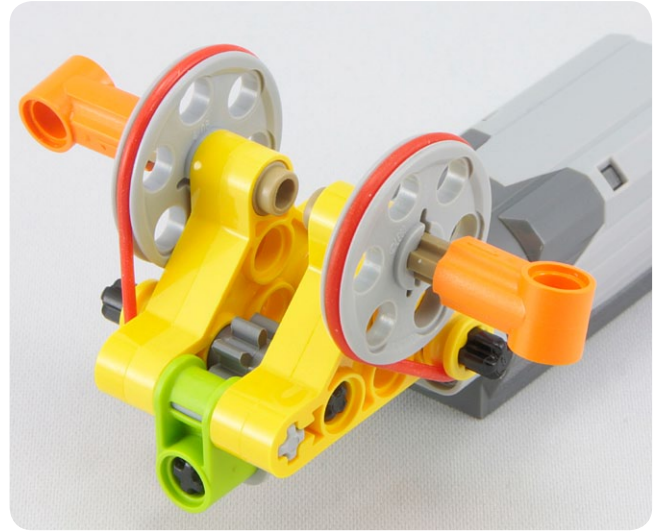


Changeover mechanisms using rotational direction

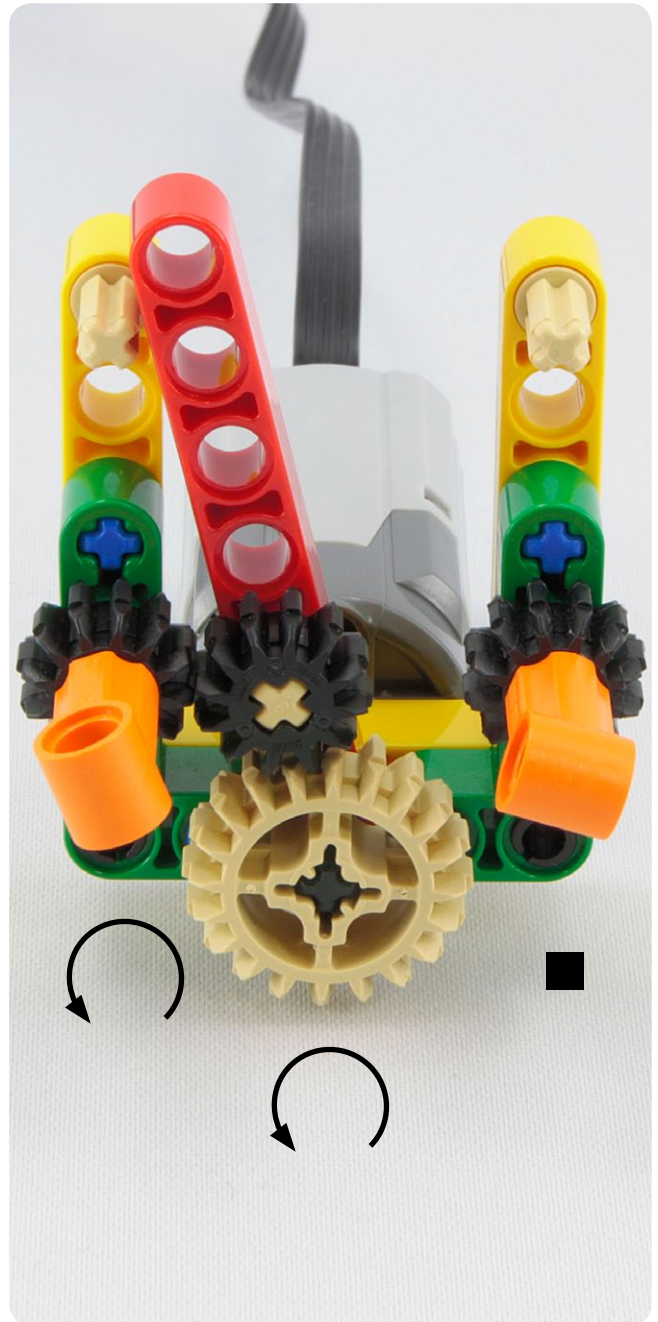
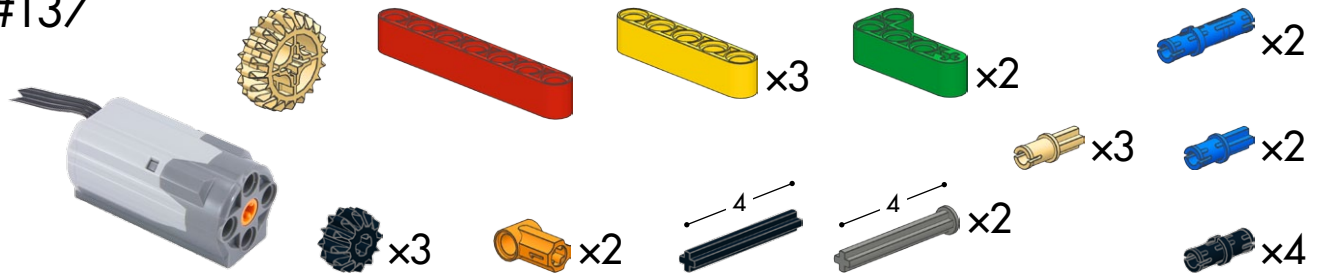
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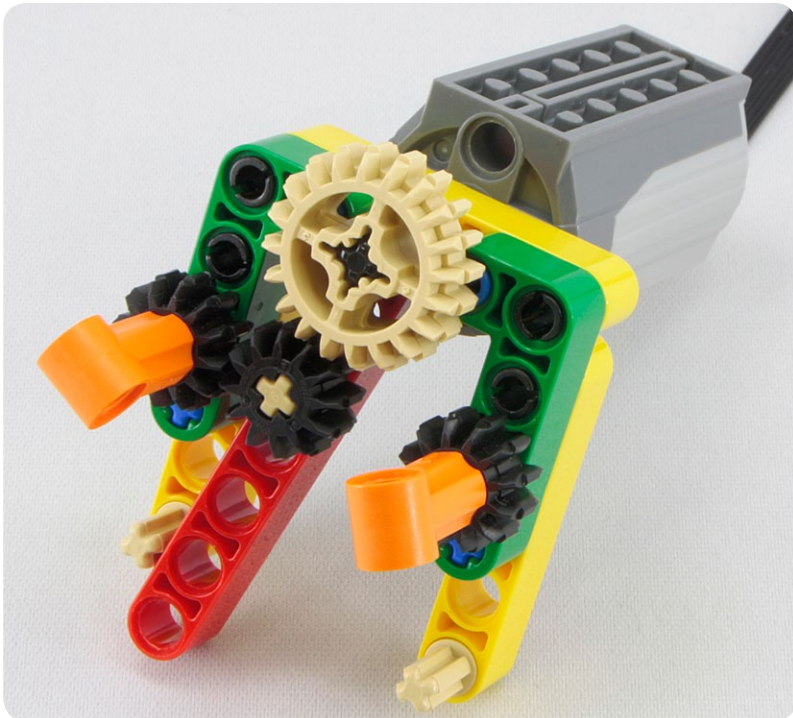
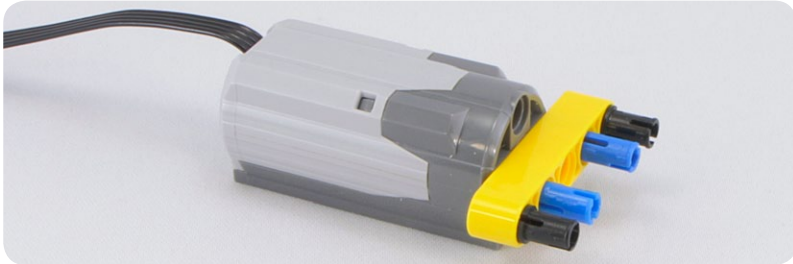
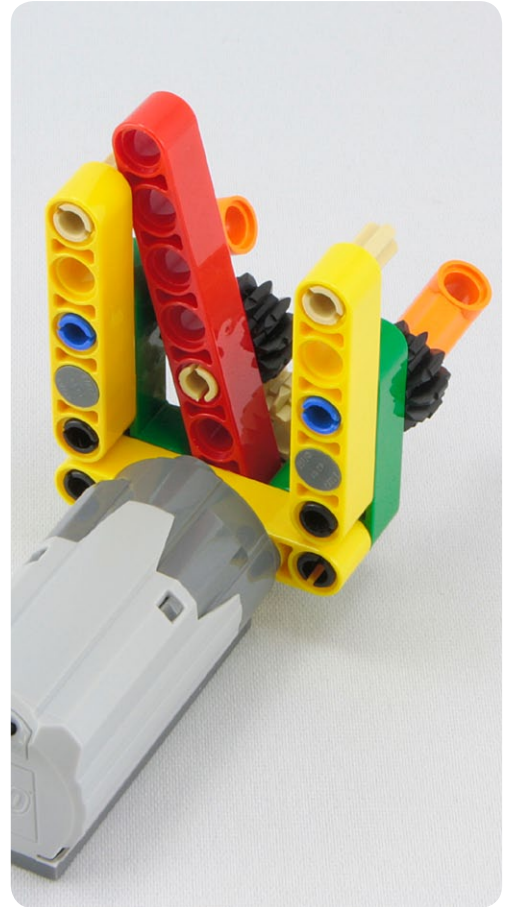
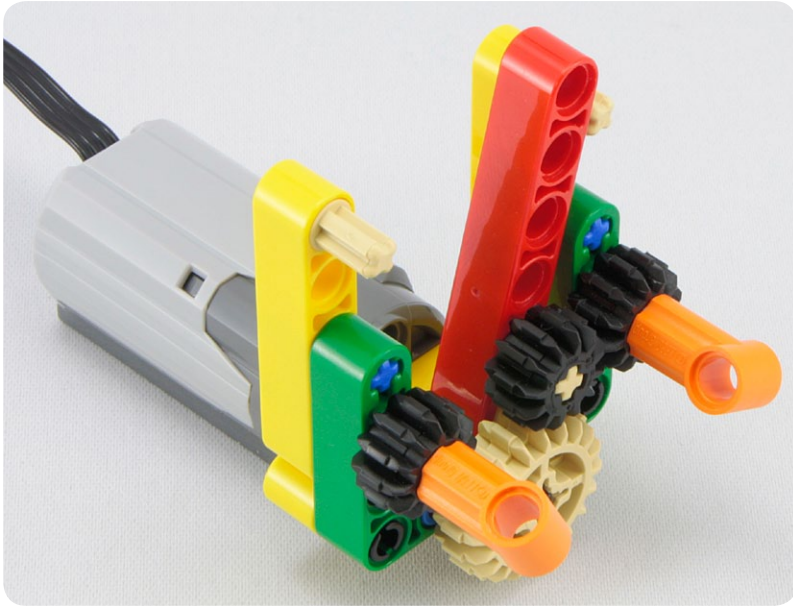
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-  x2



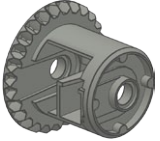





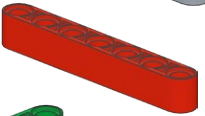
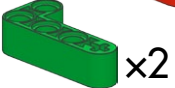




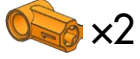
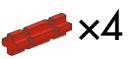
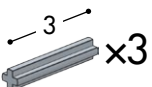
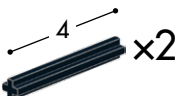
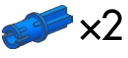




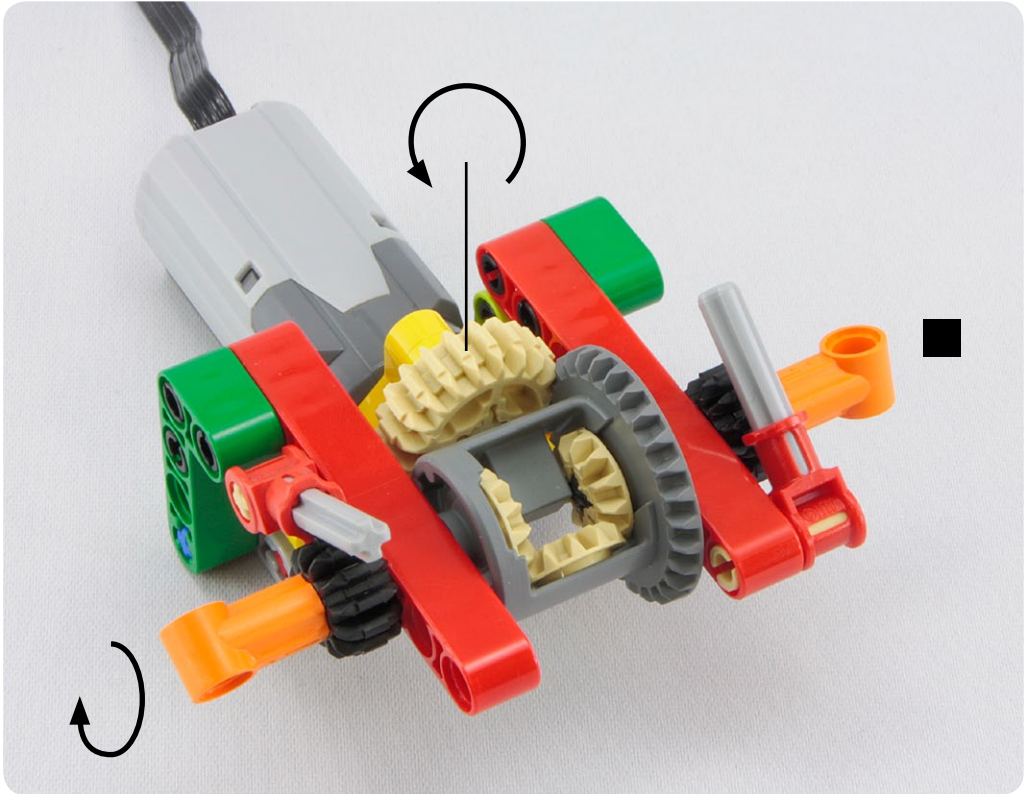
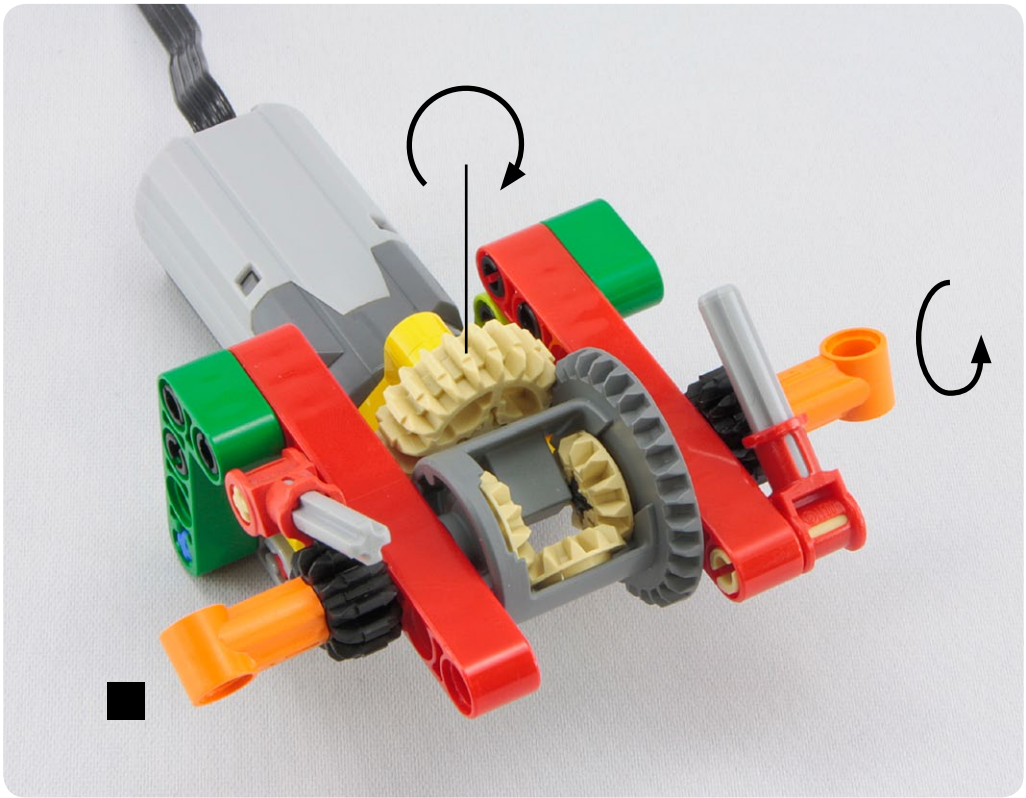
#137

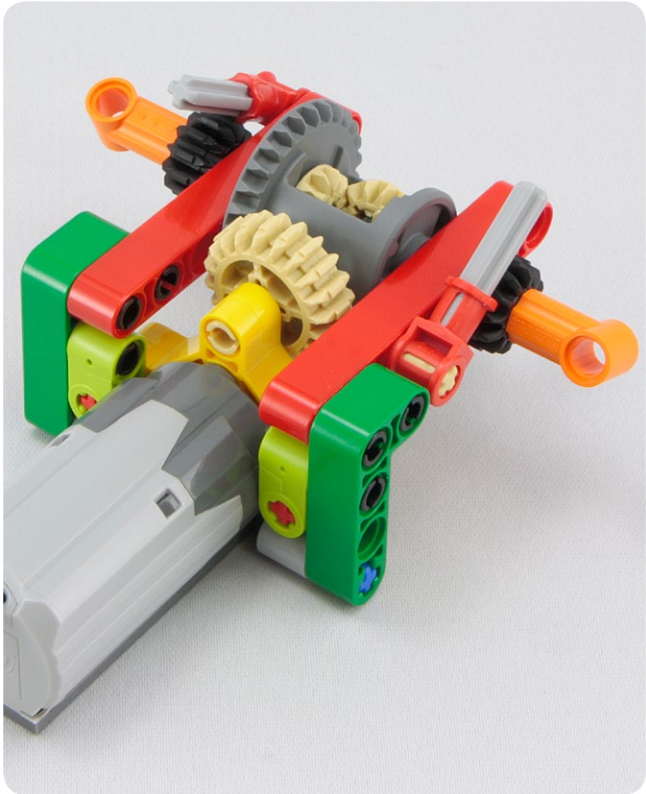
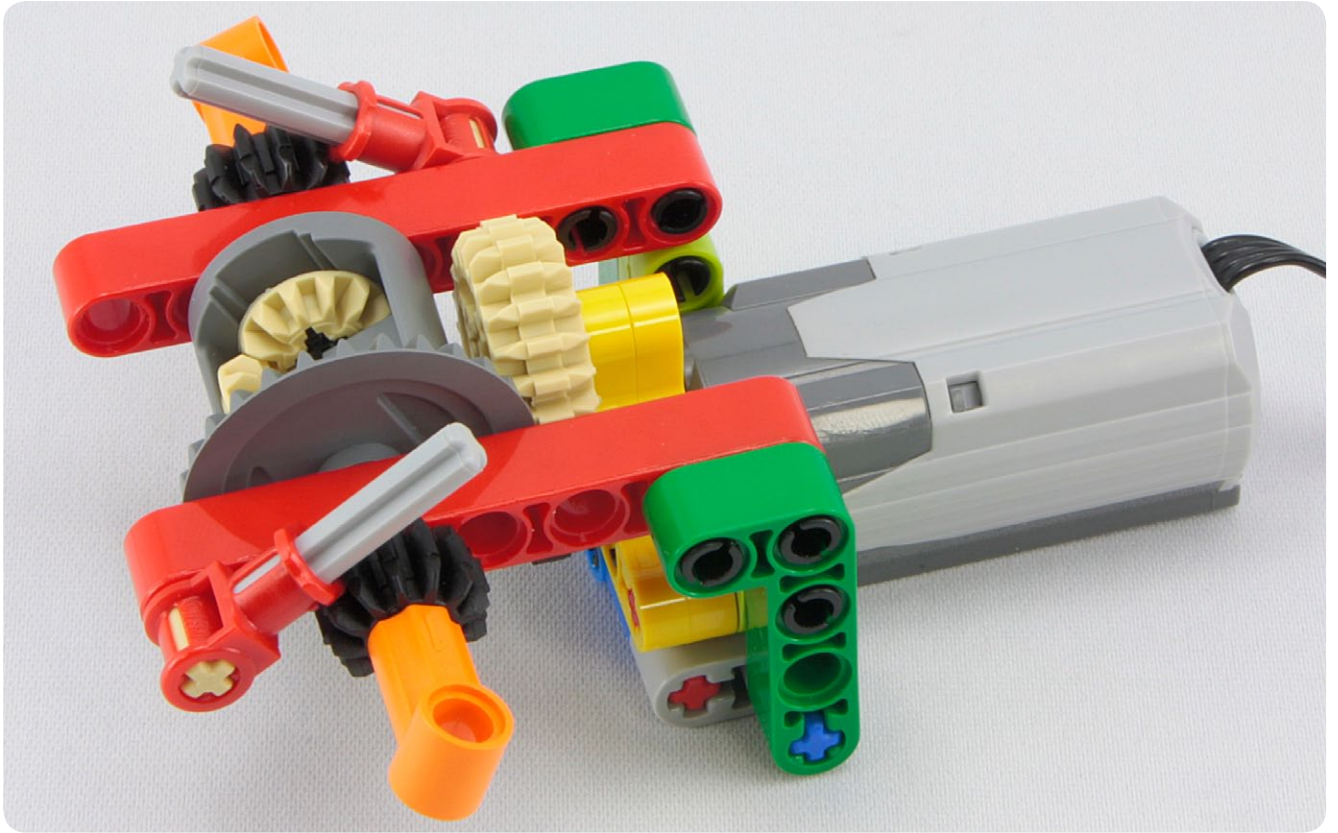


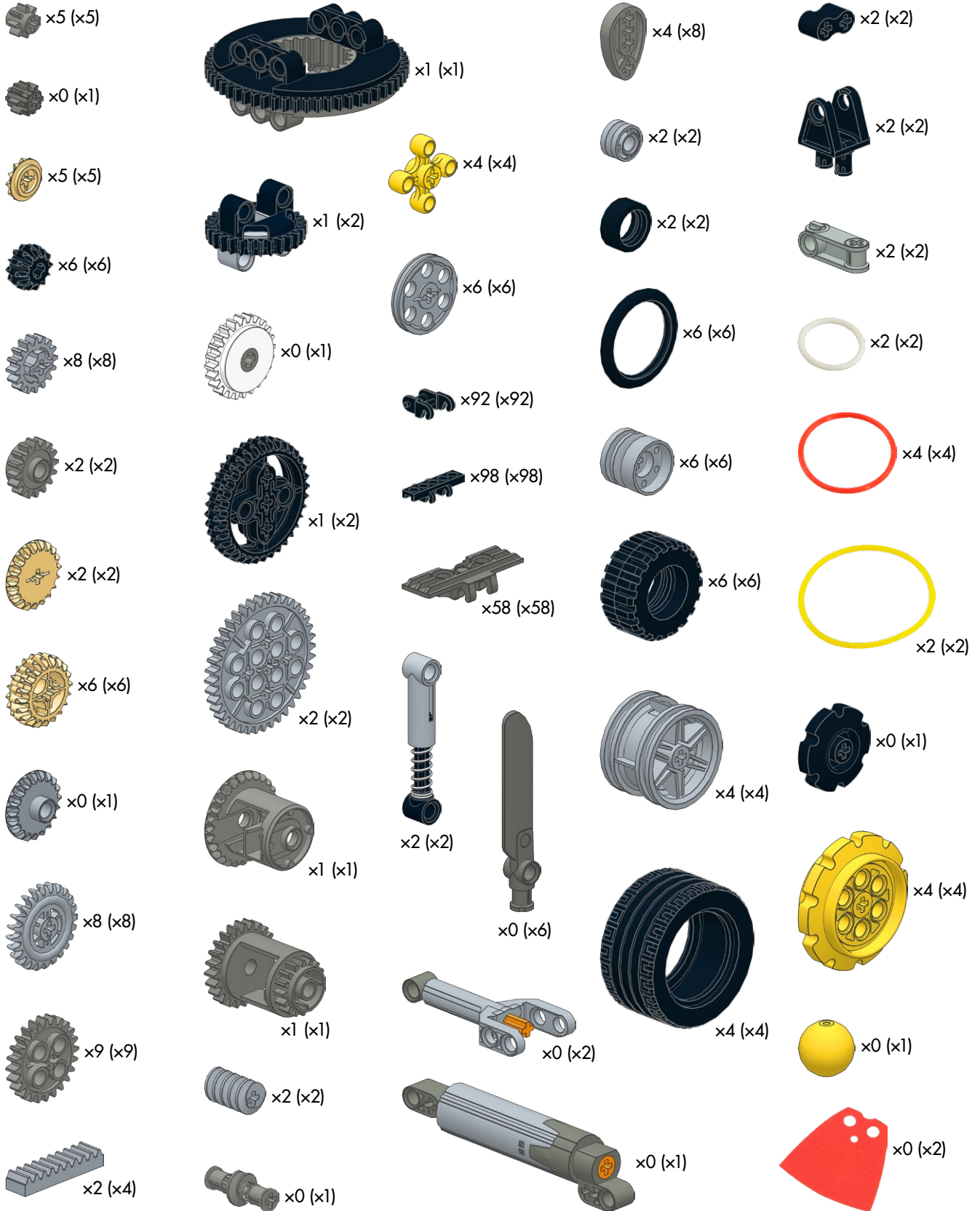


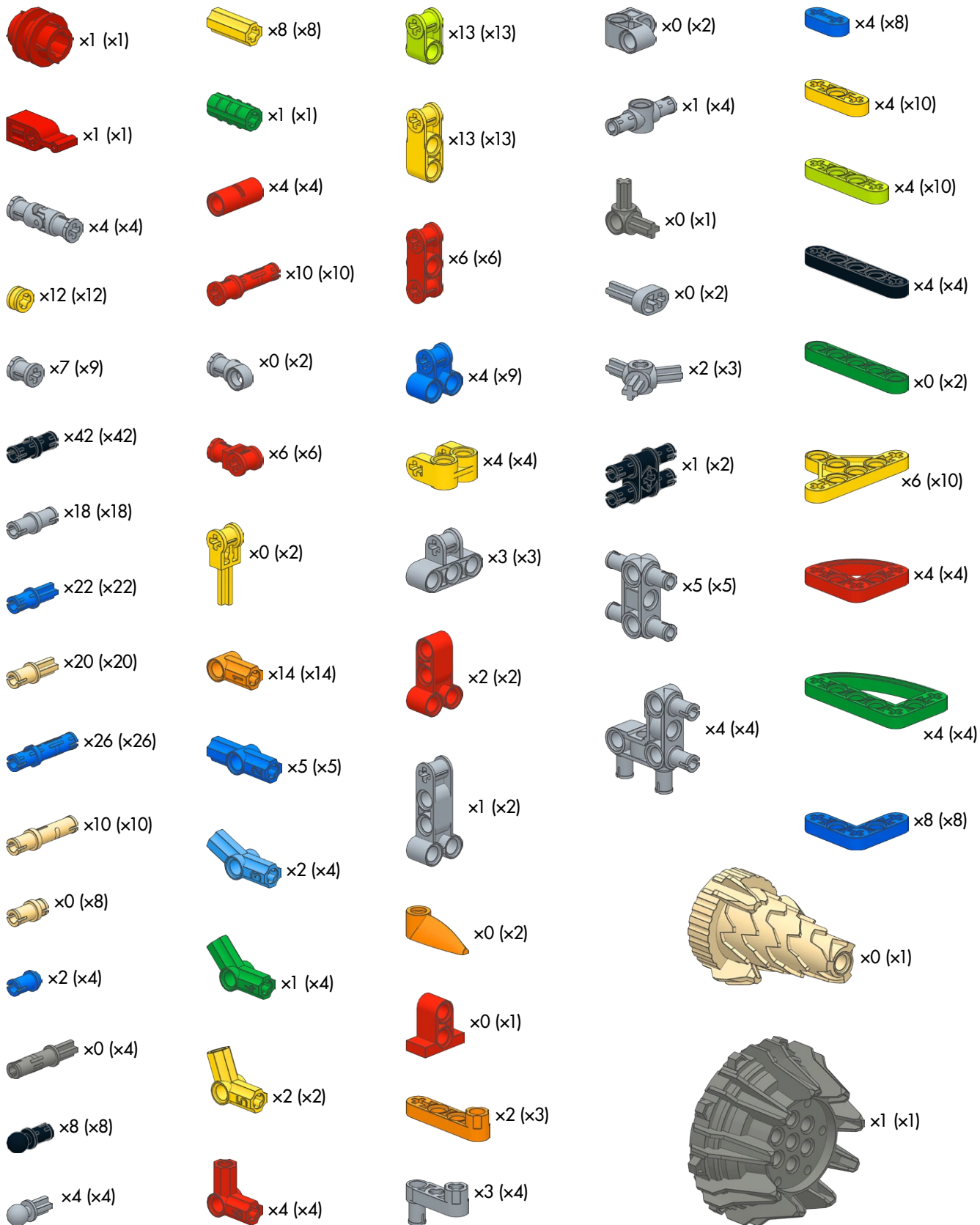
#138

- 
- 
-  x3
-  x3
- 
-  x2
-  x2
-  x2
-  x2
-  x2
- 
-  x2
-  x2
-  x4
-  x3
-  x2
-  x2
-  x3
-  x9



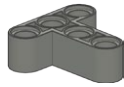








x16 (x16)



x4 (x4)



x2 (x2)



x2 (x2)



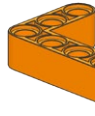
x10 (x10)



x2 (x2)



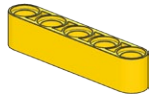
x4 (x6)



x6 (x8)



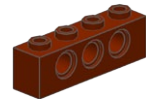
x0 (x2)



x10 (x10)



x4 (x4)



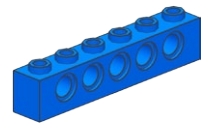
x2 (x5)



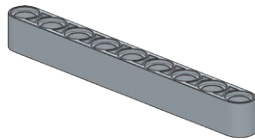
x6 (x7)



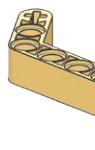
x4 (x4)



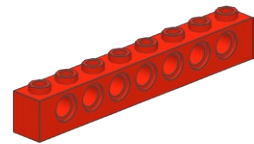
x0 (x4)



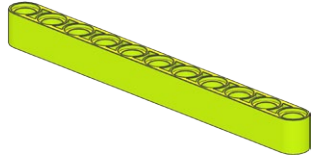
x6 (x6)



x4 (x4)



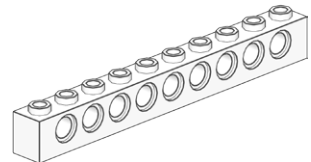
x4 (x4)



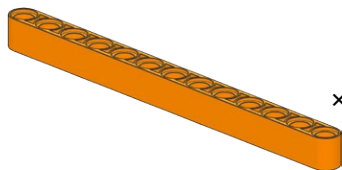
x6 (x6)



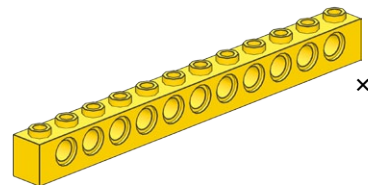
x2 (x2)



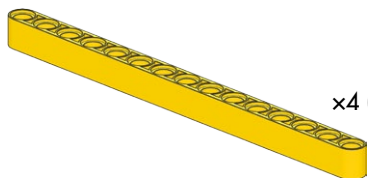
x2 (x2)



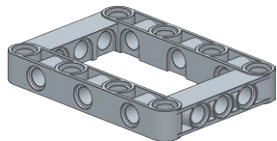
x2 (x2)



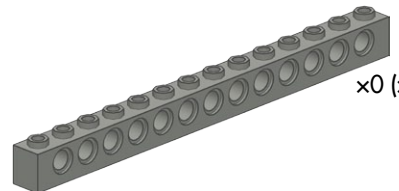
x2 (x2)



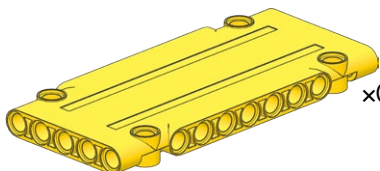
x4 (x4)



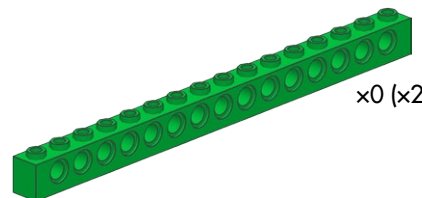
x0 (x1)



x0 (x2)



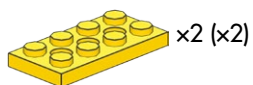
x0 (x3)



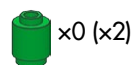
x0 (x2)



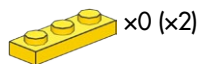
x2 (x2)



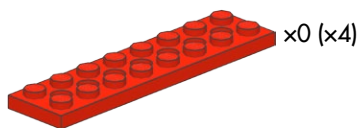
x2 (x2)



x0 (x2)



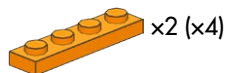
x0 (x2)



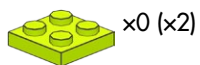
x0 (x4)



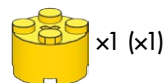
x1 (x1)



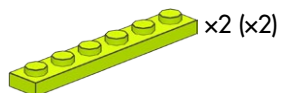
x2 (x4)



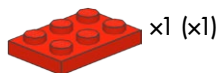
x0 (x2)



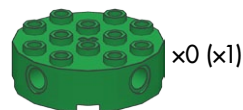
x1 (x1)



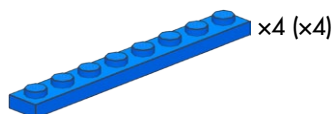
x2 (x2)



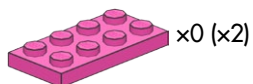
x1 (x1)



x0 (x1)



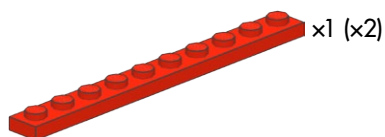
x4 (x4)



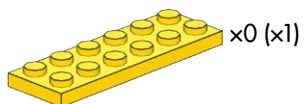
x0 (x2)



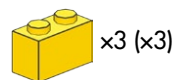
x0 (x2)



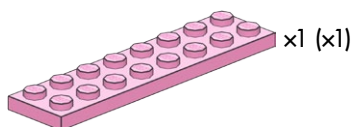
x1 (x2)



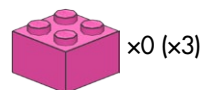
x0 (x1)



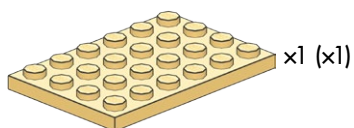
x3 (x3)



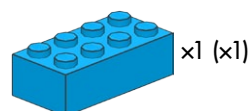
x1 (x1)



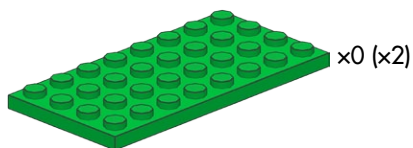
x0 (x3)



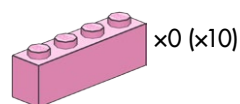
x1 (x1)



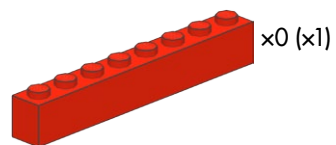
x1 (x1)



x0 (x2)



x0 (x10)



x0 (x1)

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