



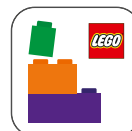
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# Artist, Artisan, Aviation Architect

Leonardo da Vinci (1452-1519) is the undisputed master of Renaissance innovation. Adored by his contemporaries for his visionary talent, boundless curiosity and flamboyant character, da Vinci is still rightfully celebrated for his creative ingenuity. He devoted his life to exploring and pushing boundaries in art, human and animal anatomy, physics and engineering, with unparalleled passion, determination and craftsmanship. Painted masterpieces like the *Mona Lisa* and *The Last Supper* originally catapulted him to worldwide fame, but his lifelong fascination with human flight invokes equal awe.







“The noblest pleasure is  
the joy of understanding.”

– *Leonardo da Vinci*





# Imitating the flight of birds

Although, reportedly, Leonardo da Vinci's aeronautical inventions never came to life during his time, his ideas, designs and studies provided valuable inspiration for the first working aircraft centuries later. The ornithopter is one of his most famous works, but they all rest on the same idea of a single person piloting a mechanical machine with wings. Using their own body strength, the pilot would pull and push on cranks and strings that would make the wings flap up and down.



**"Simplicity is the ultimate sophistication."**

*- Leonardo da Vinci*

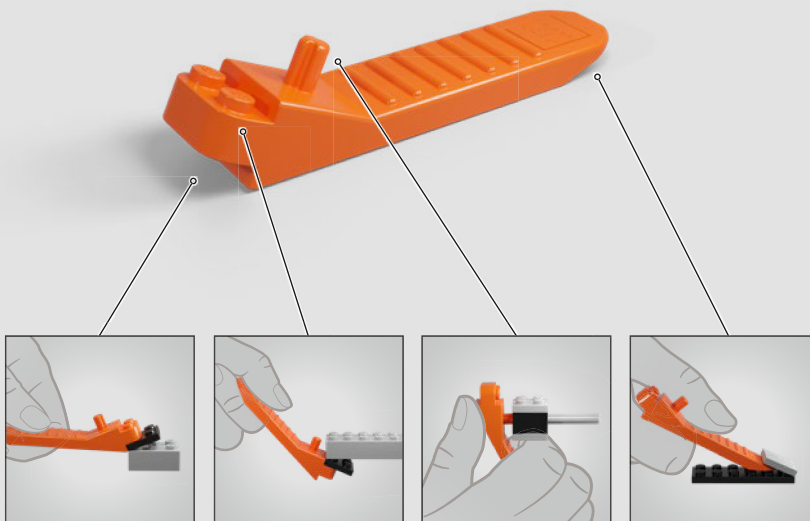




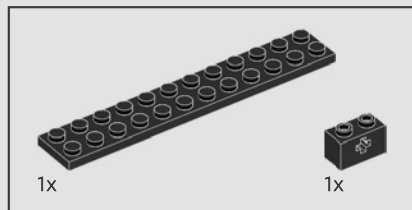
## From the LEGO® Design Team

"This was where our conceiving started – to make a machine with movable parts that are all linked together and activated when pulling on strings or, in this case, on one single string. It's a seemingly simple model, yet a great LEGO® engineering challenge. The model is designed to look as if it was made from wood, linen and rope. It has a brick-built skeleton for the tail and wings, and textile wings with a printed pattern. Incorporating the textile string as the main part of the wing-flapping mechanism was a great challenge! The mechanical parts of the model are left exposed to celebrate the functional parts and Leonardo's vision and to let our own interpretation of the original design take flight."

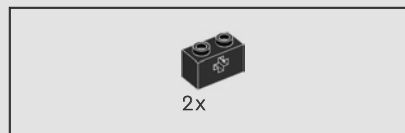
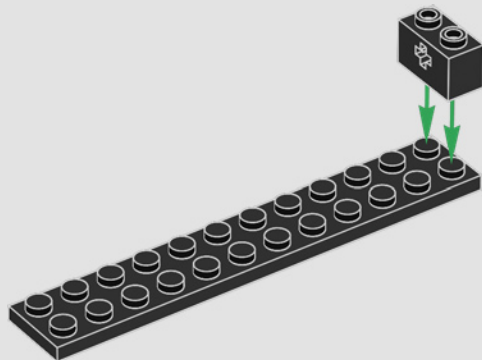
**Antica Bracanov**  
LEGO® Senior Designer



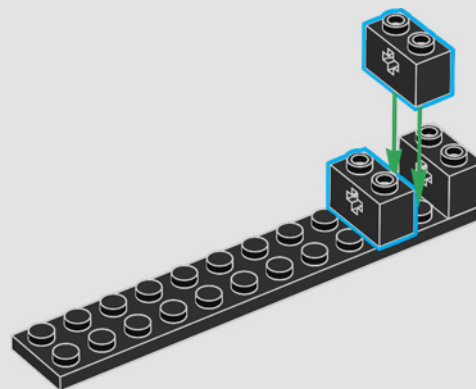


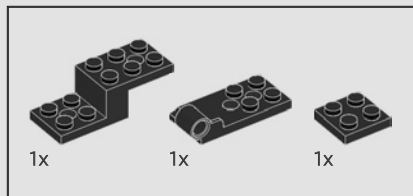


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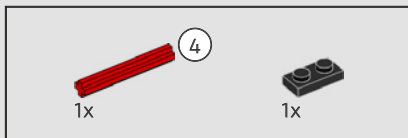
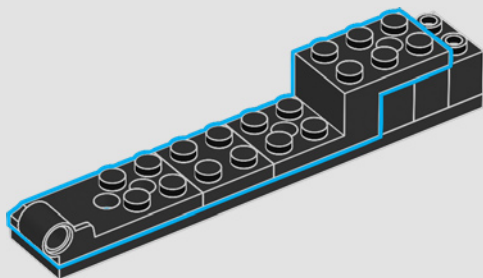


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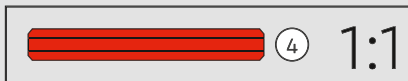
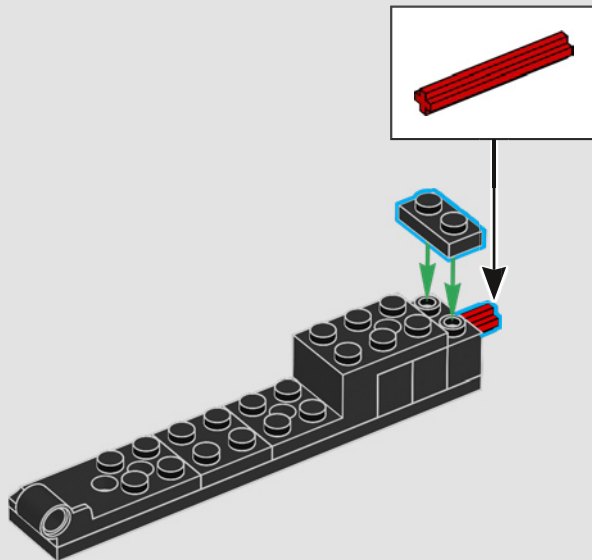




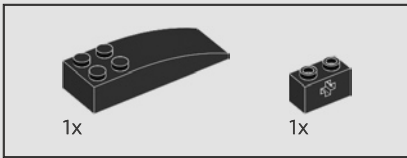
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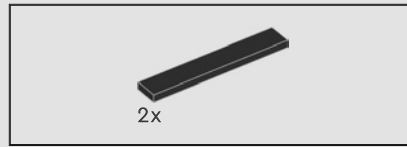
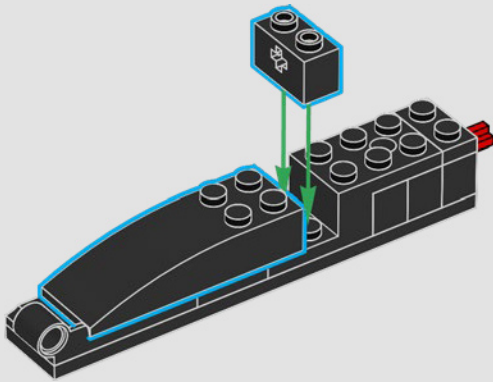
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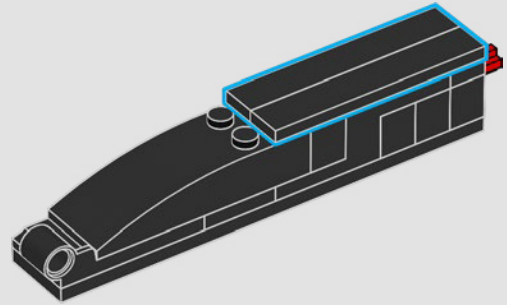


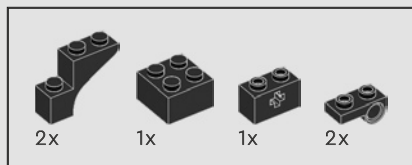


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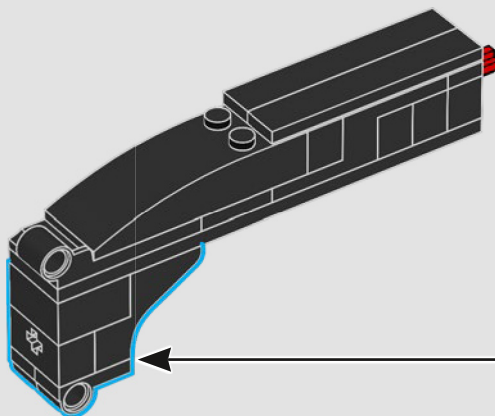
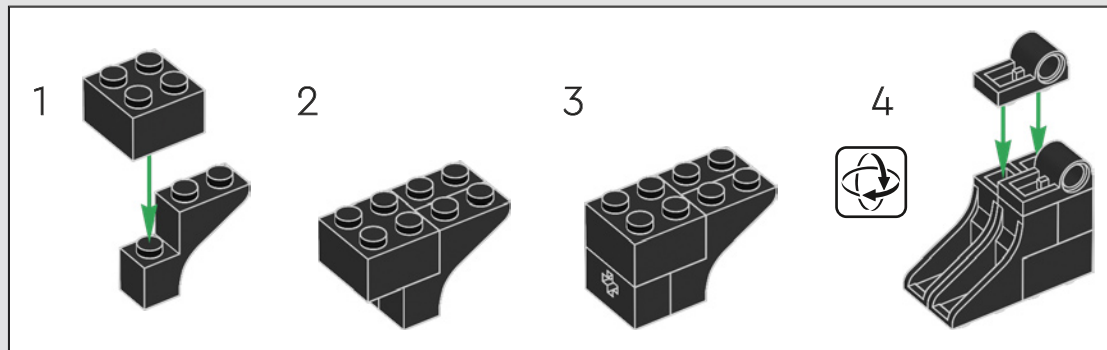


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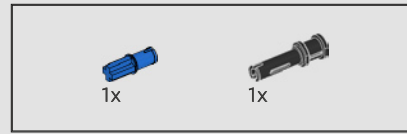
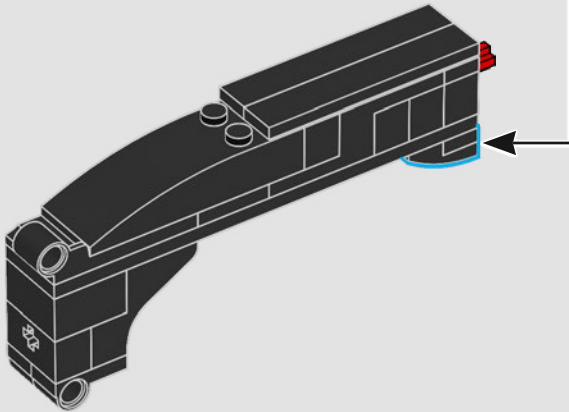
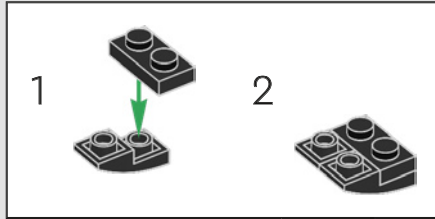


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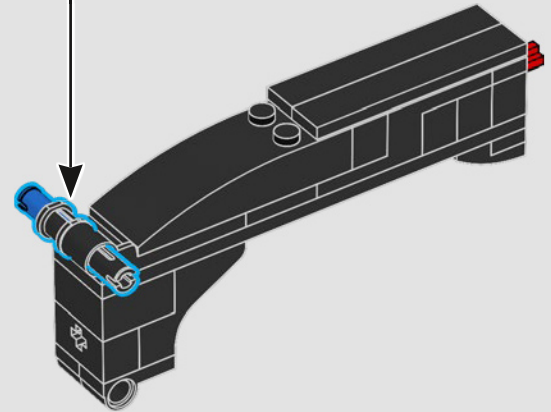
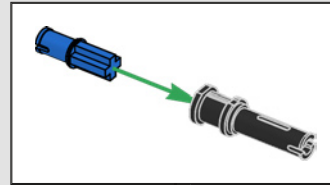


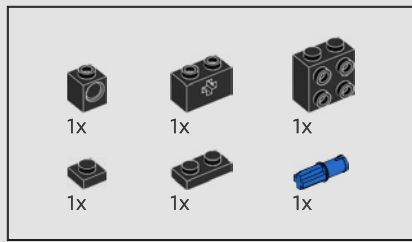


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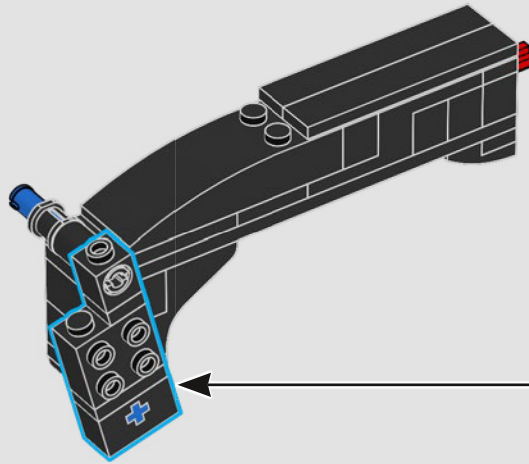
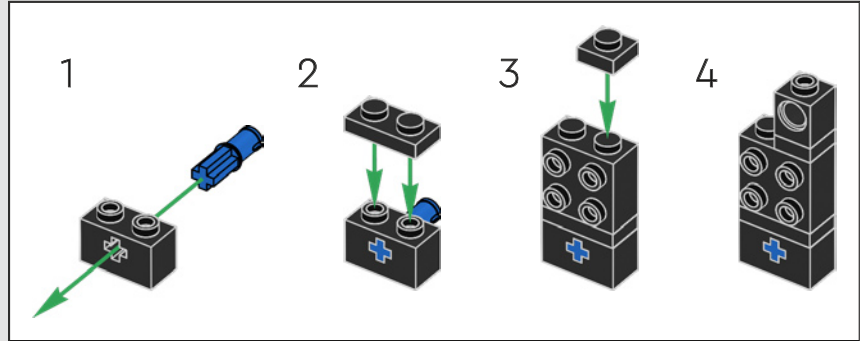


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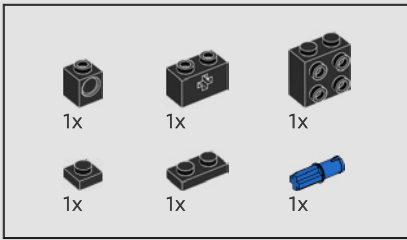




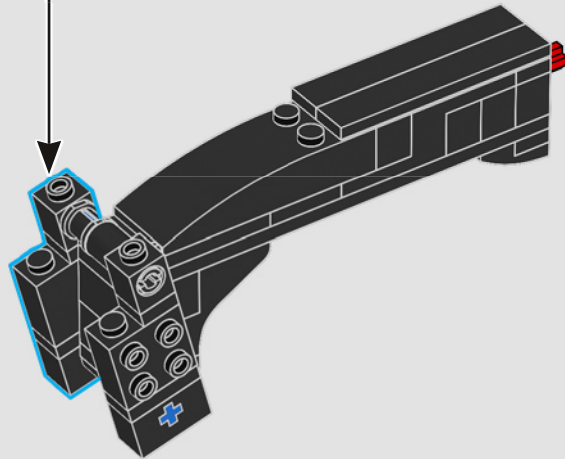
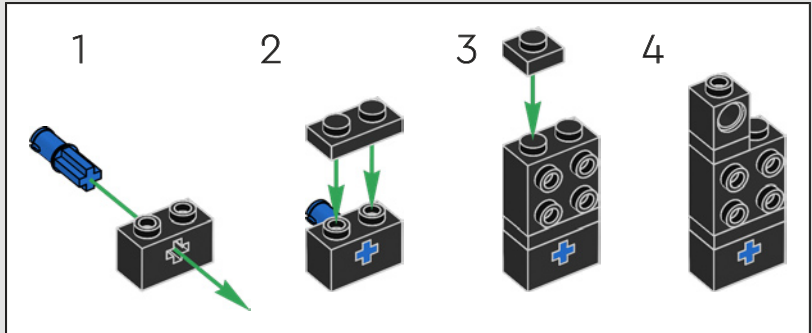
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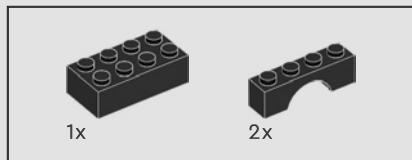




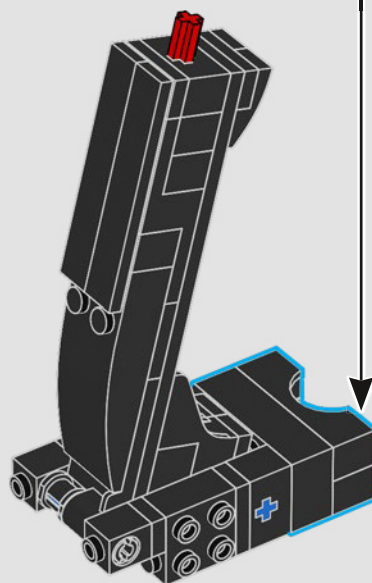
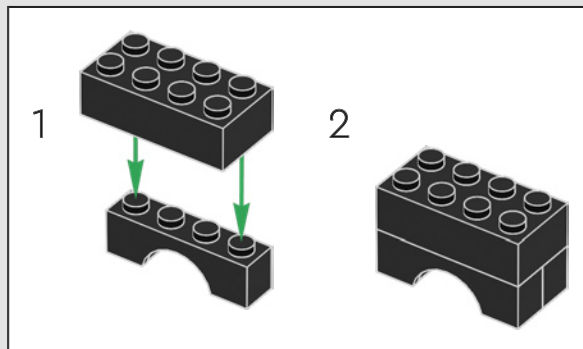
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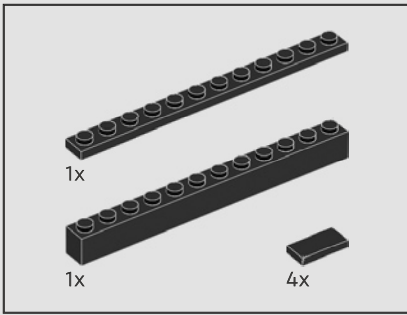


One of da Vinci's machines, known as *Il Grande Nibbio*, was inspired by and named after a bird from the *Accipitridae* family: the kite.

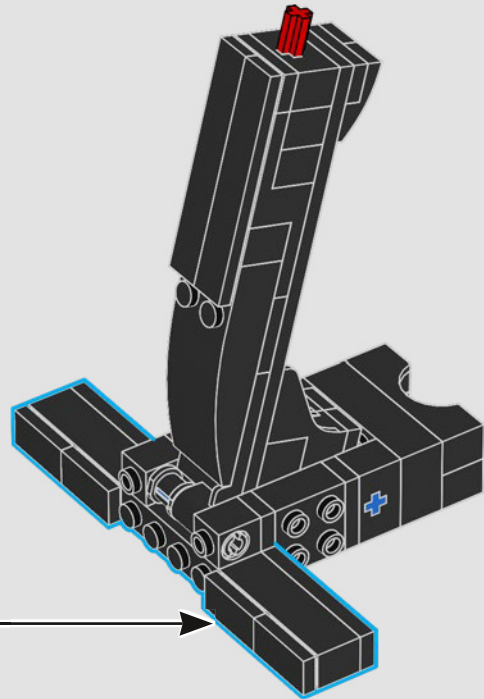
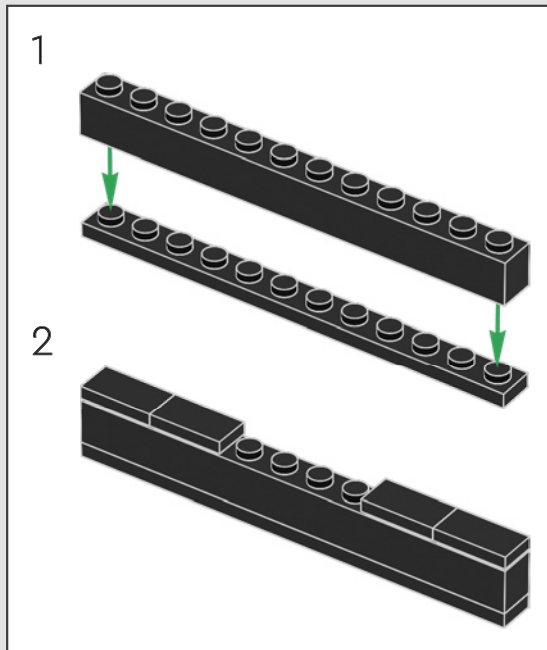


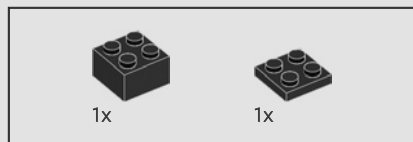
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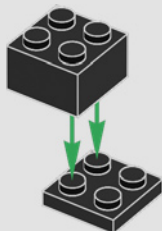


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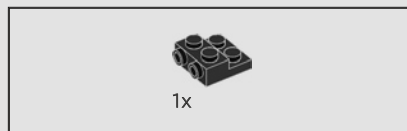
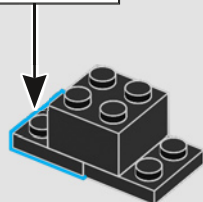
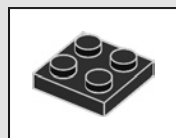




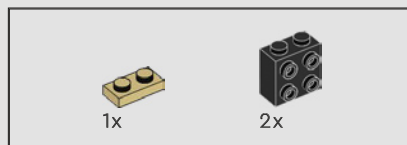
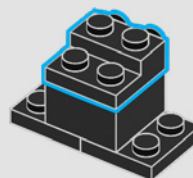
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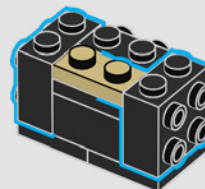
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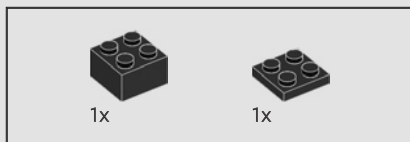
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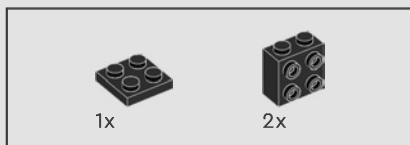
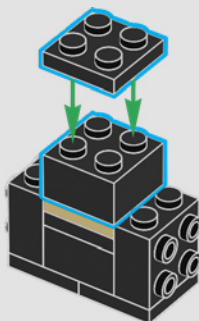
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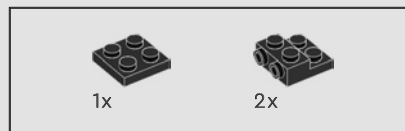
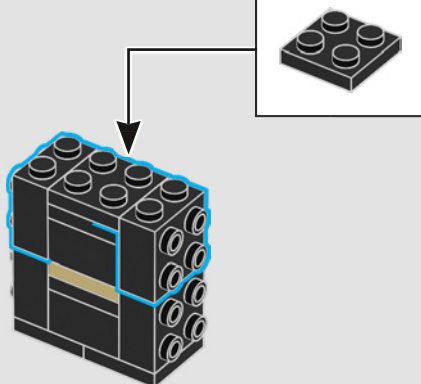




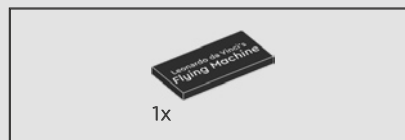
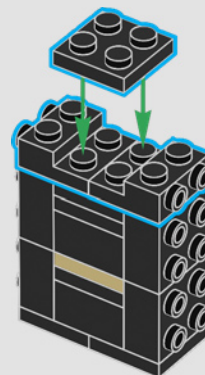
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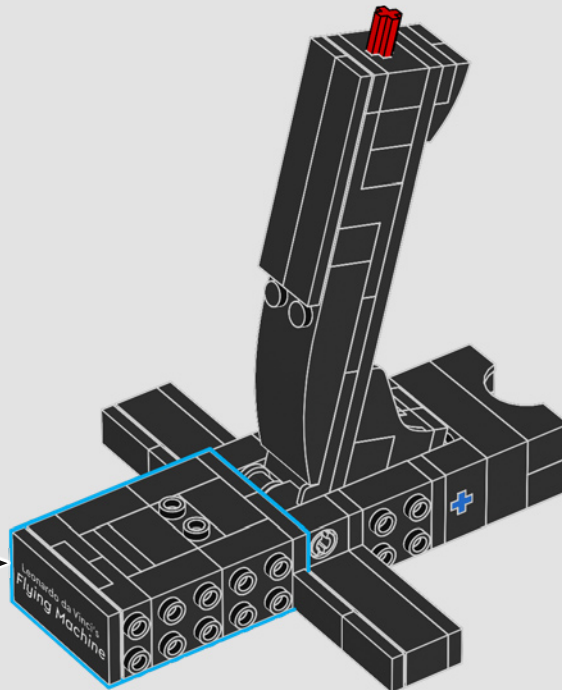
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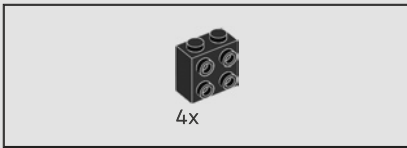




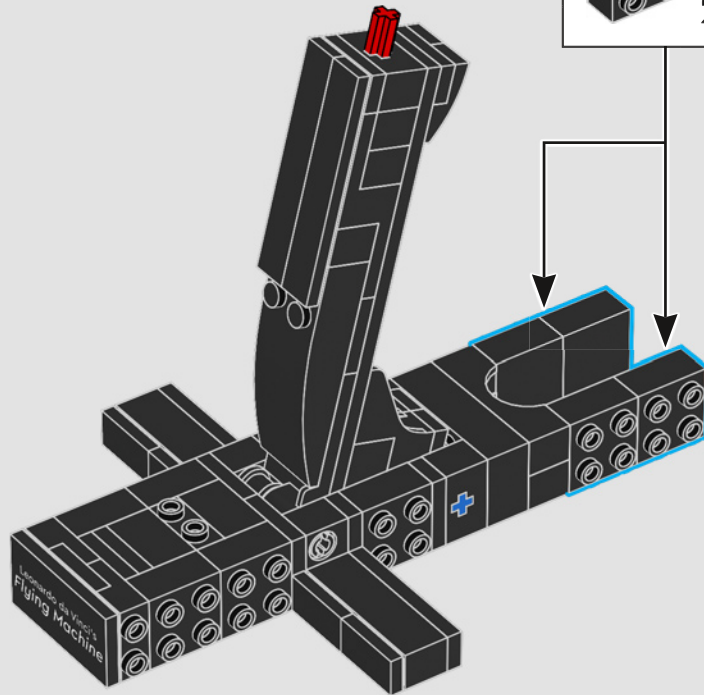
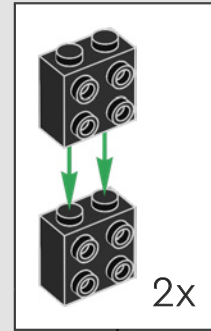
Da Vinci famously wrote in his notebooks in backwards handwriting.  
It could only be read correctly when reflected in a mirror.

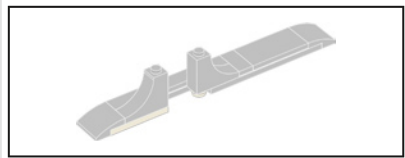
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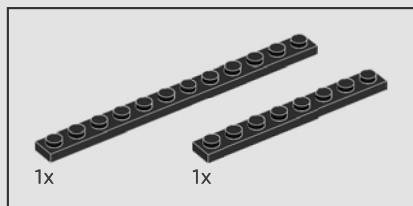


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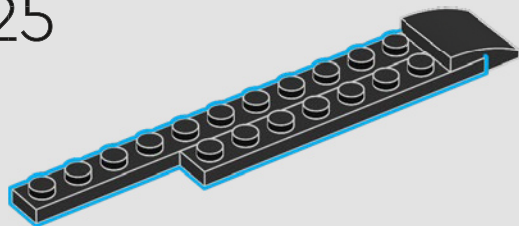




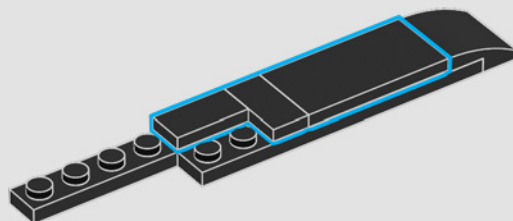
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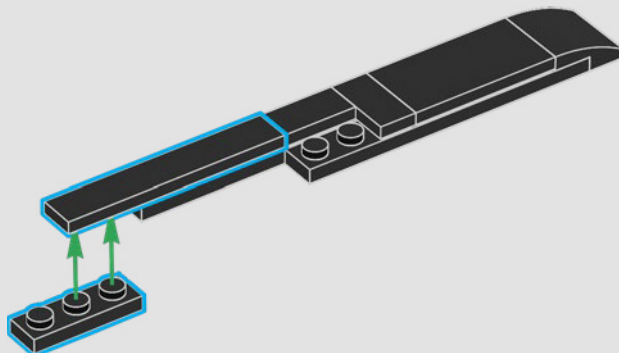
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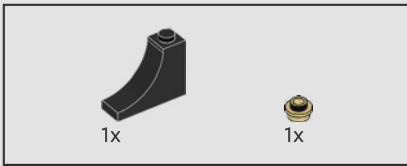
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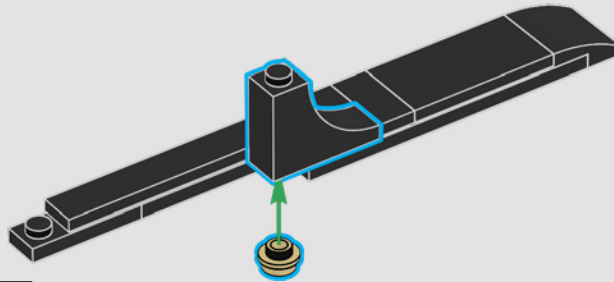
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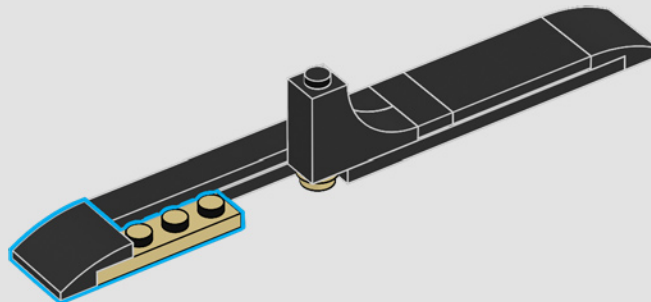


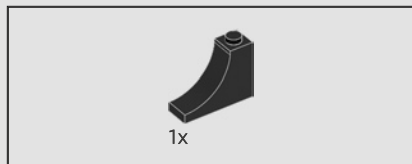


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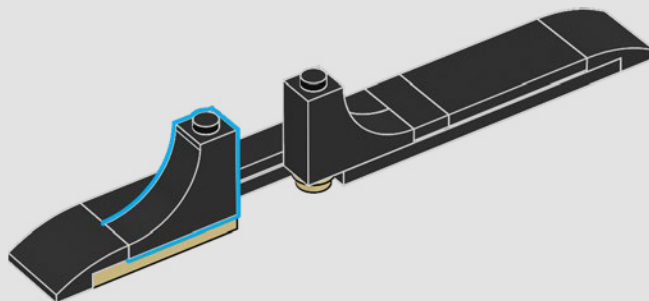


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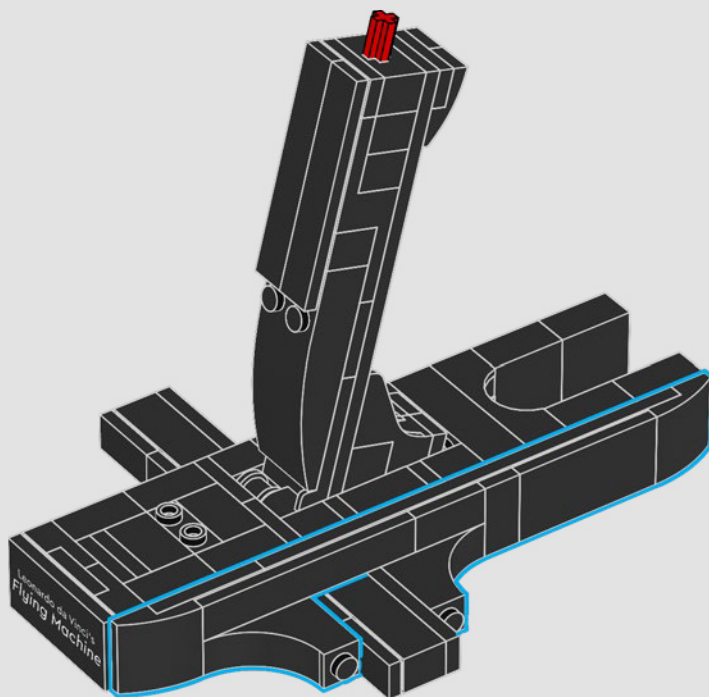


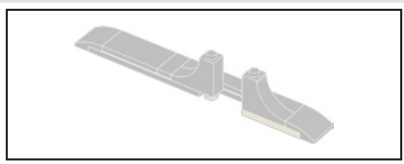


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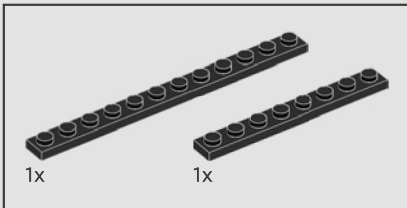


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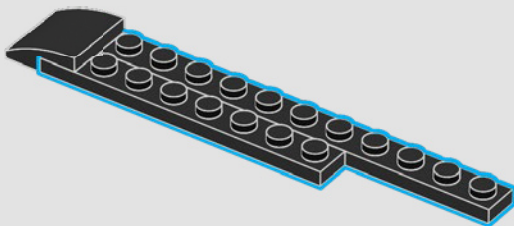




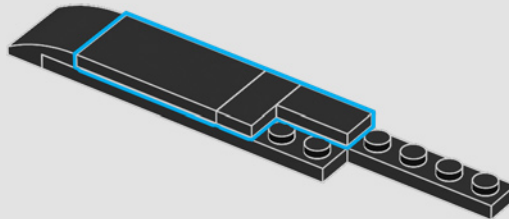
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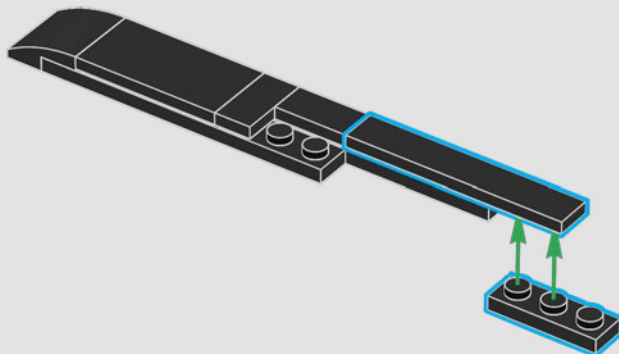
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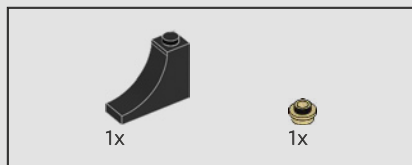


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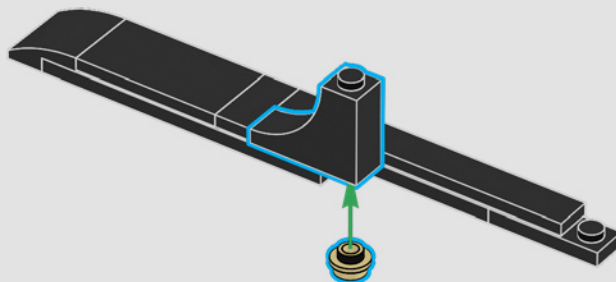


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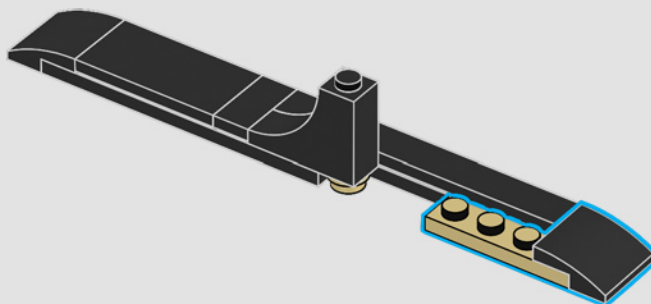


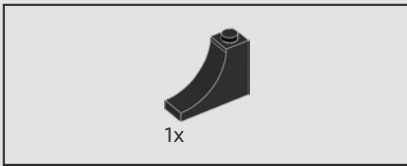


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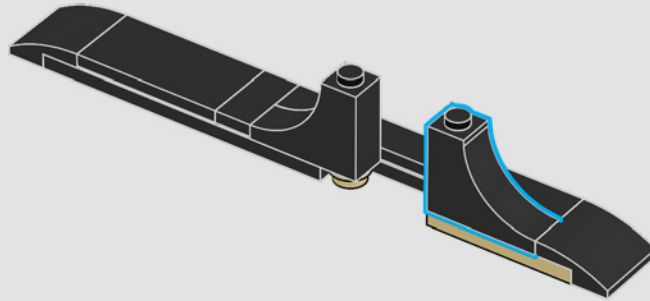


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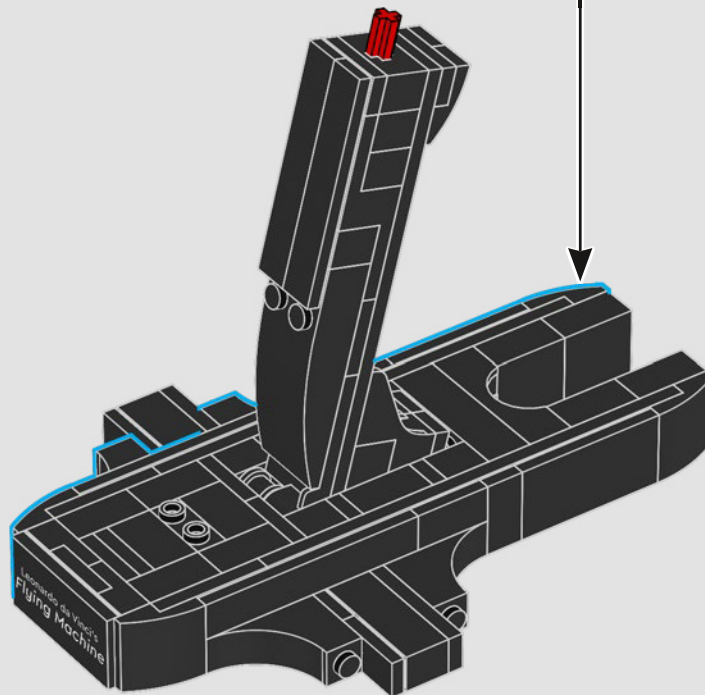




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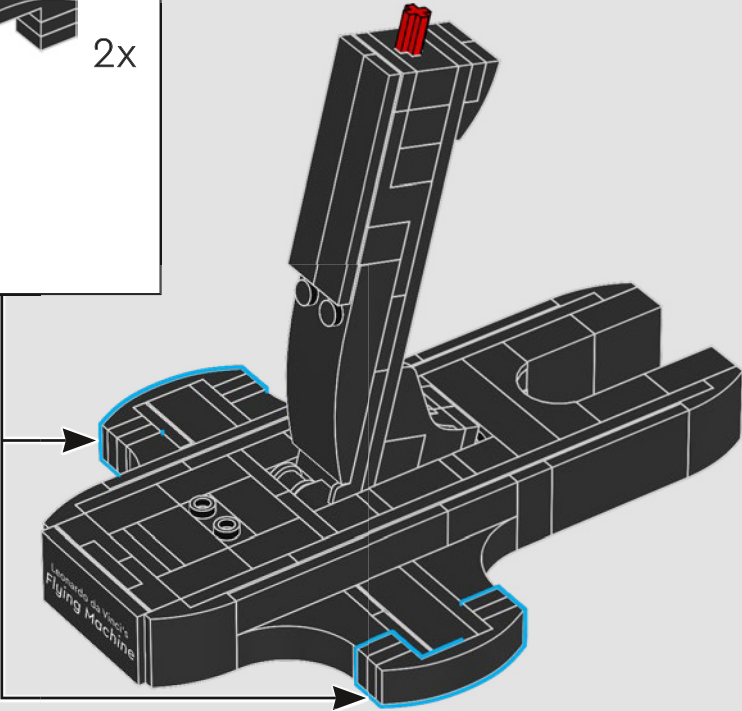
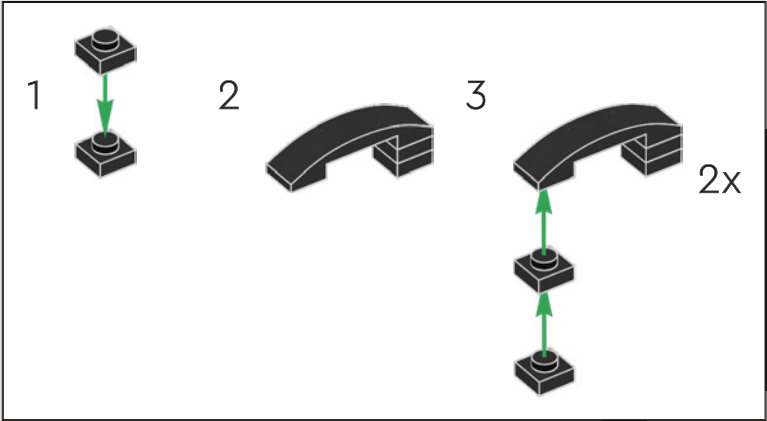






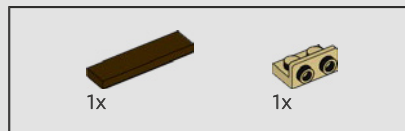
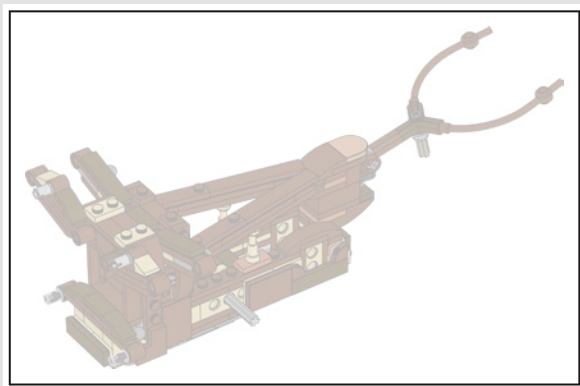
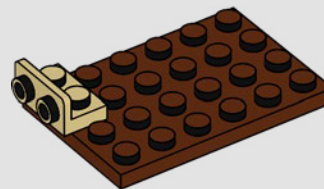
Leonardo da Vinci is known to have produced more than 35,000 words and 500 sketches on flight and flying machines!

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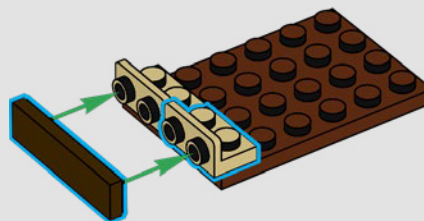




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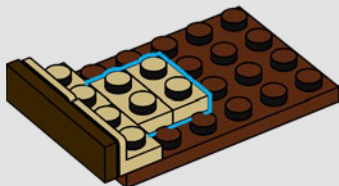


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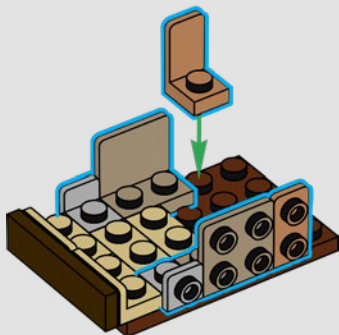




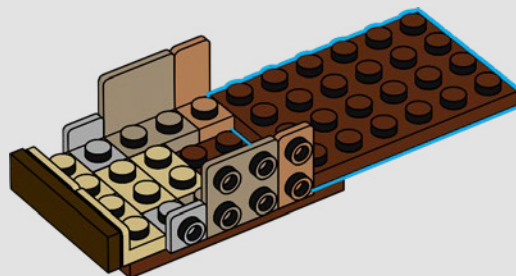
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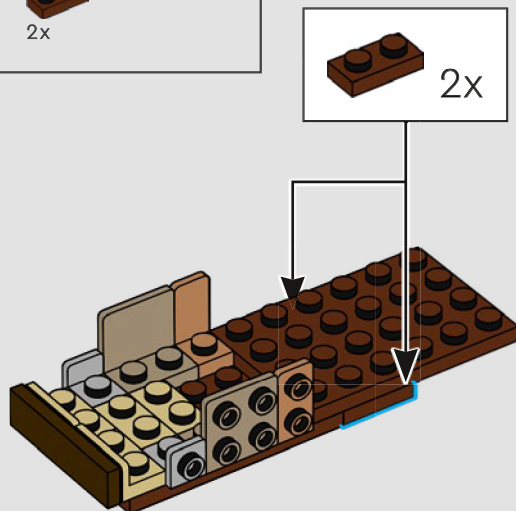
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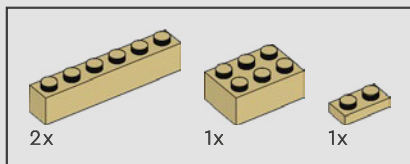
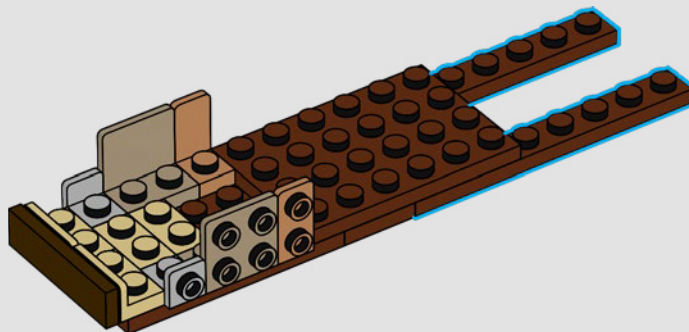


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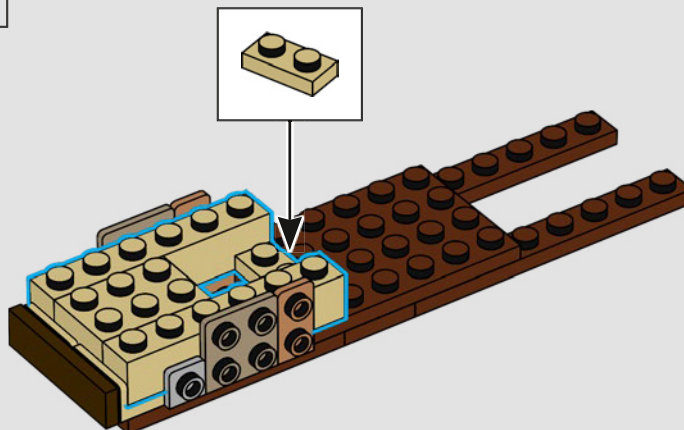


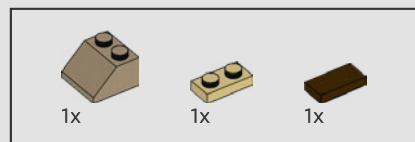


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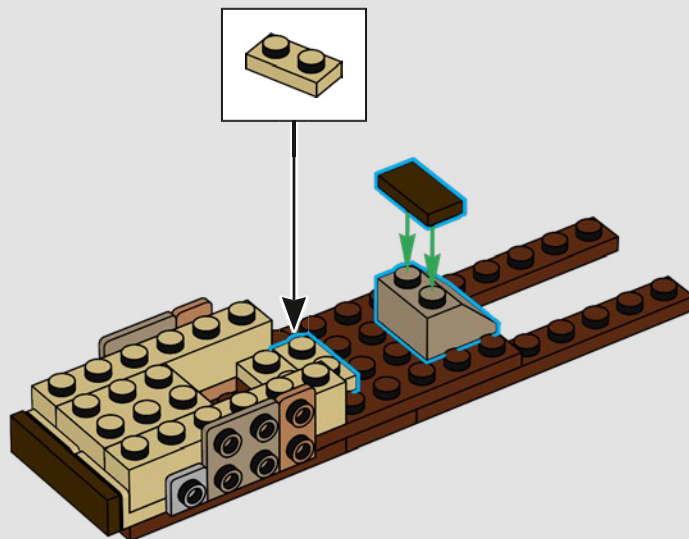


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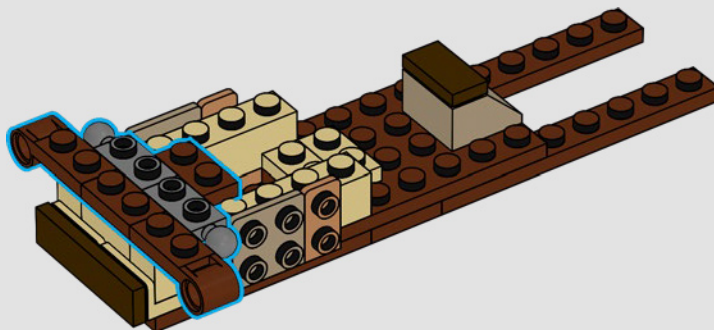




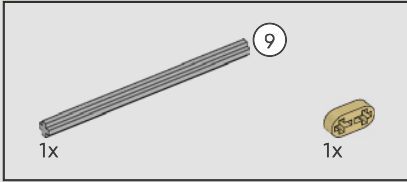
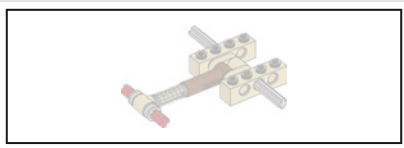
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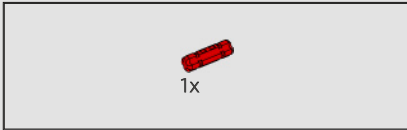
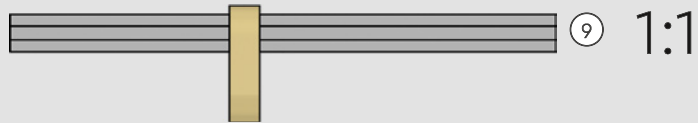
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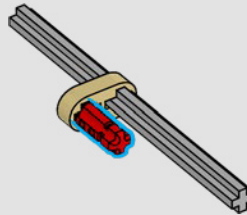


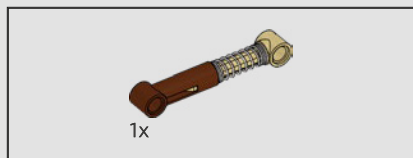


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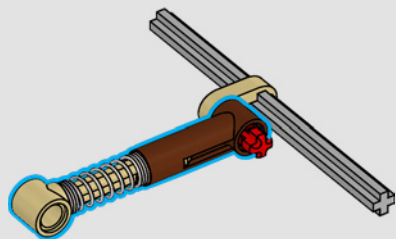


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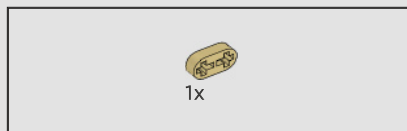
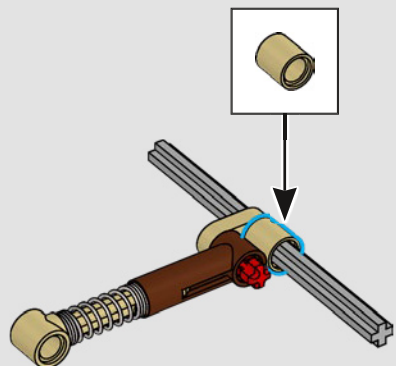




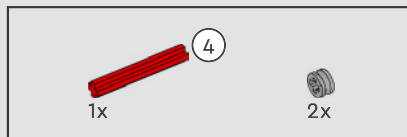
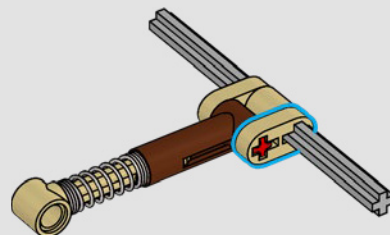
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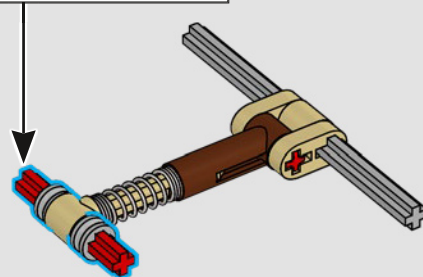
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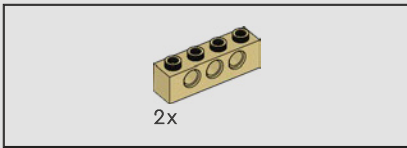


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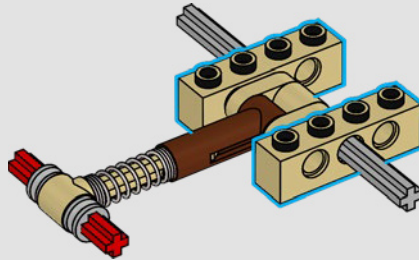


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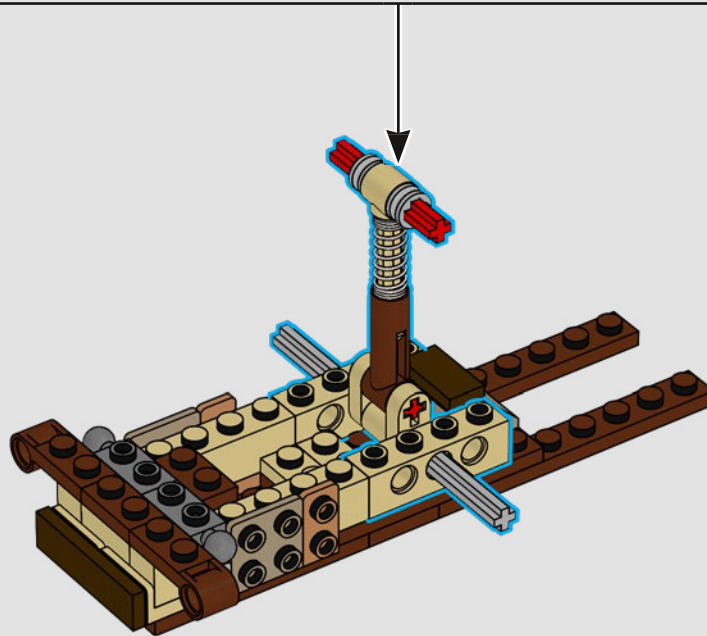




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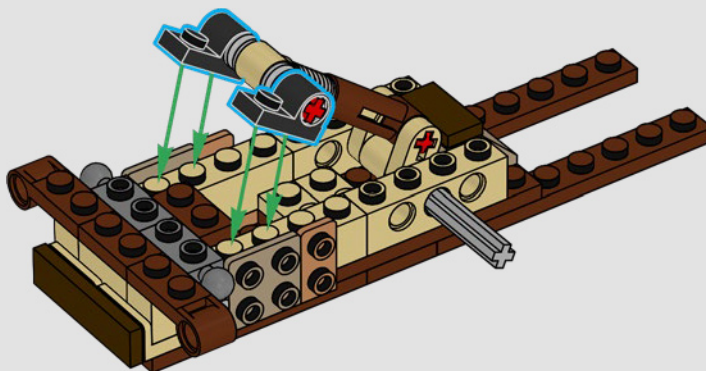
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2x

59

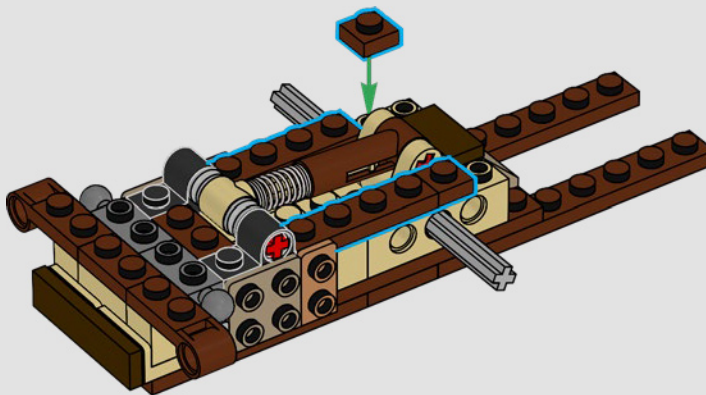


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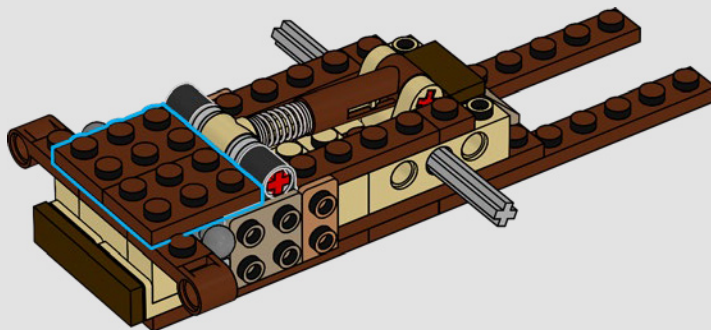
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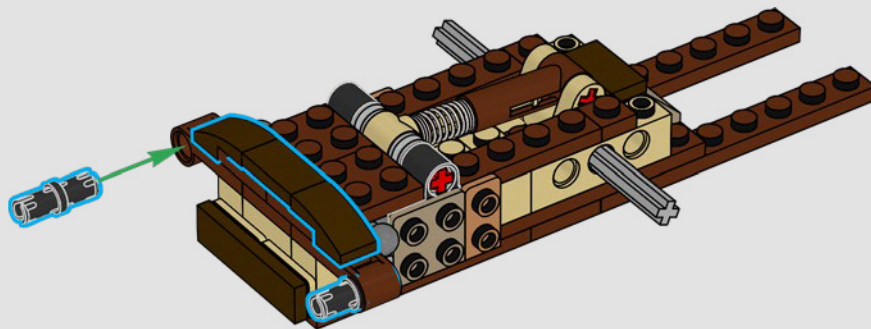




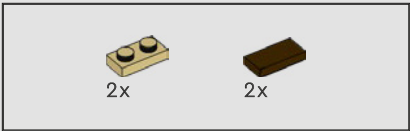
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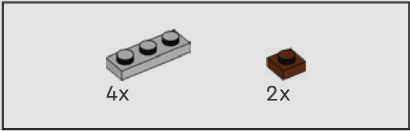
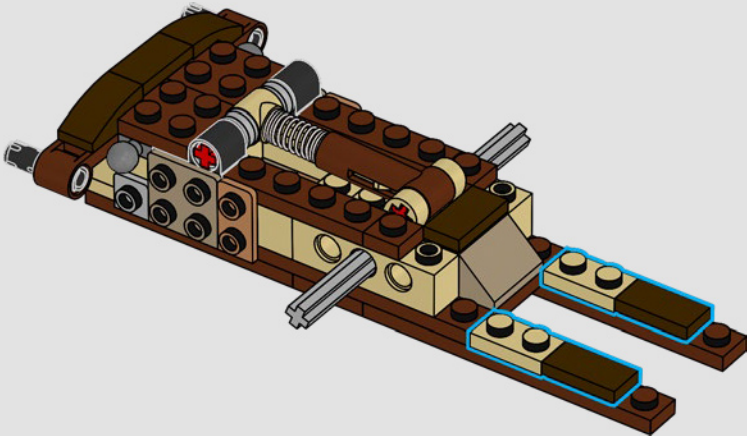
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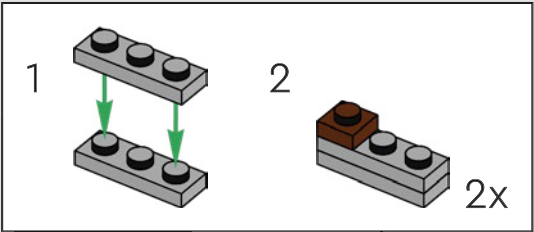
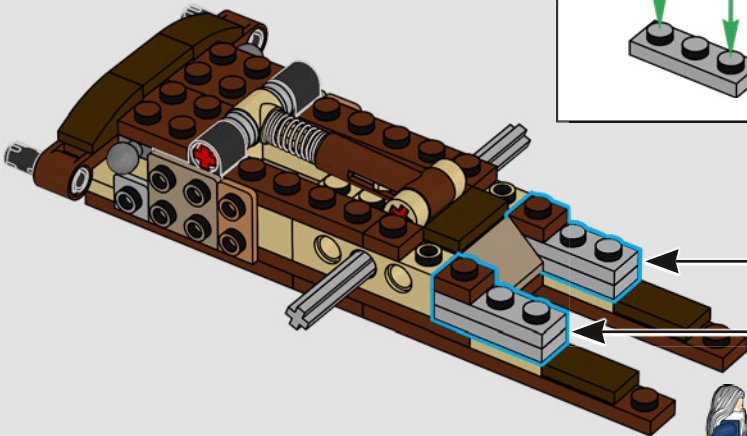


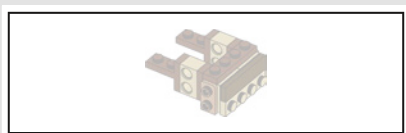


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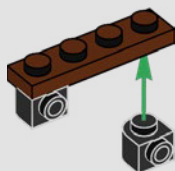


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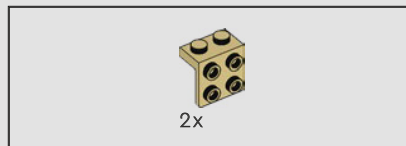
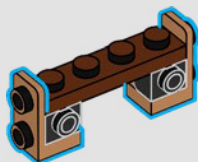




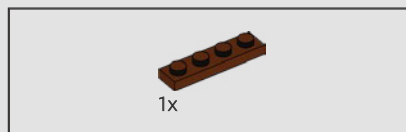
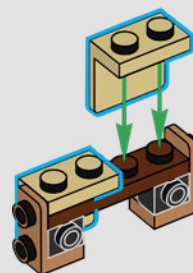
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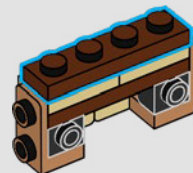
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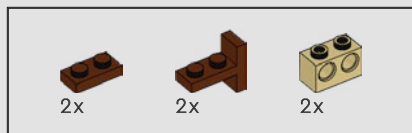


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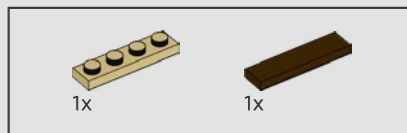
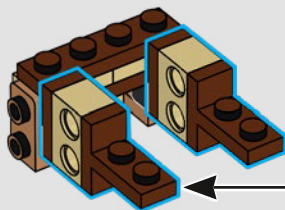
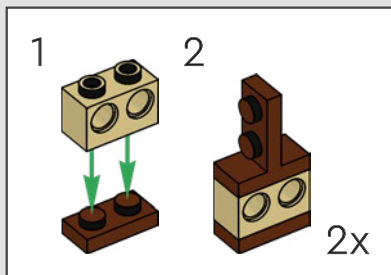


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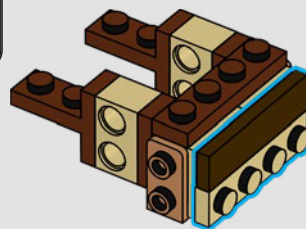




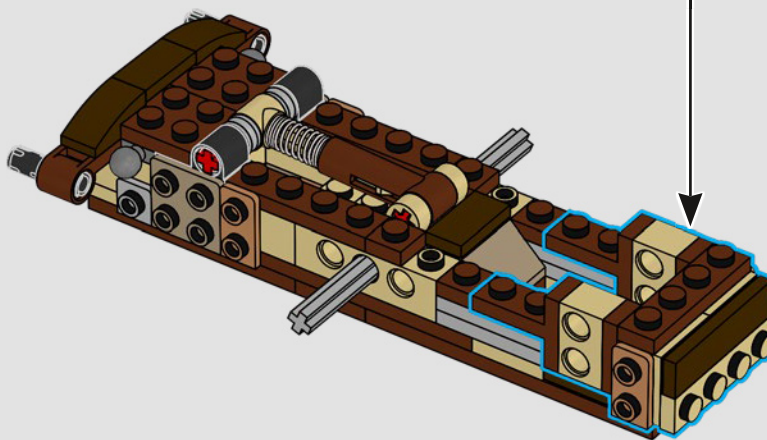
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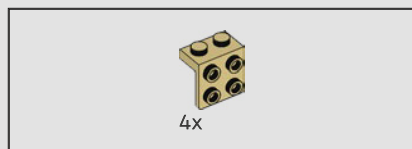


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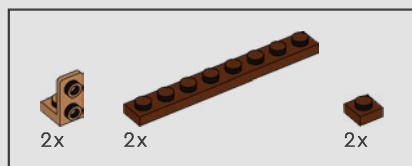
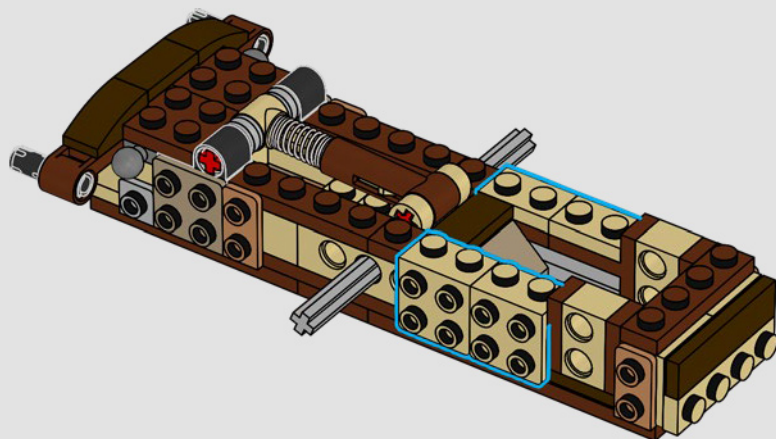


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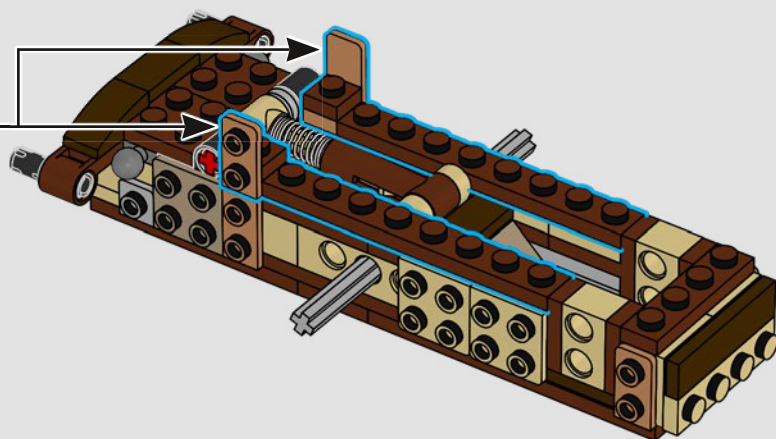
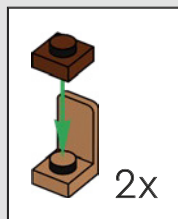




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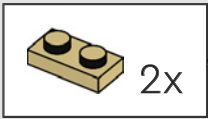
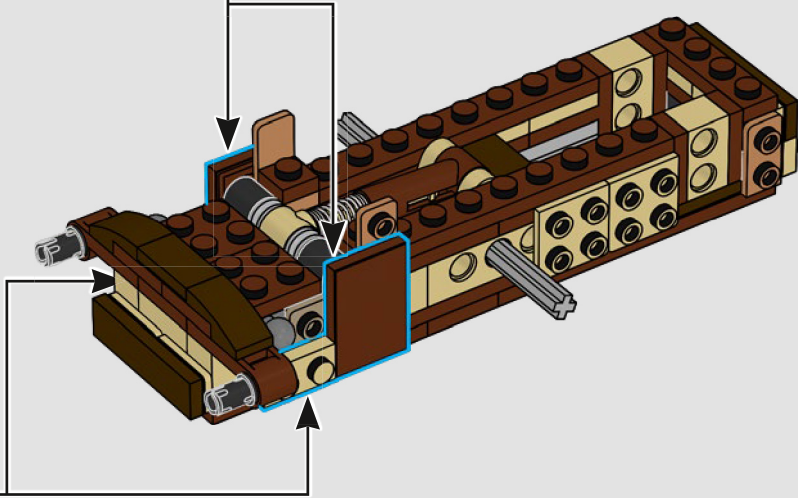
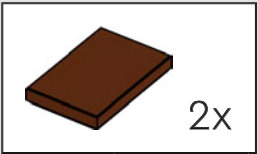


73





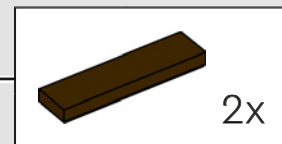
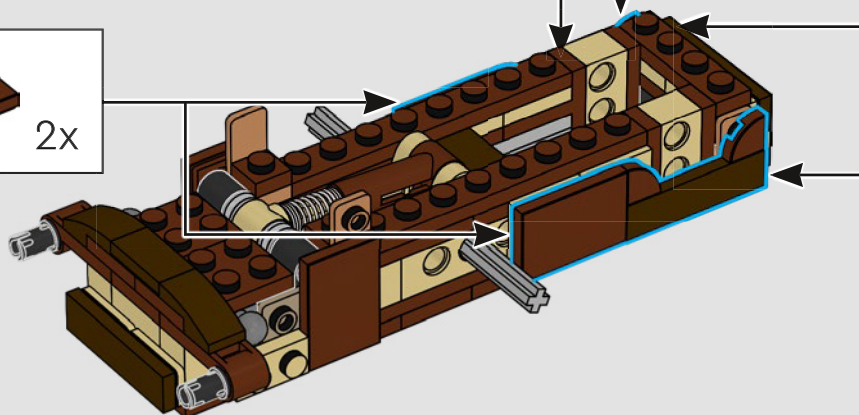
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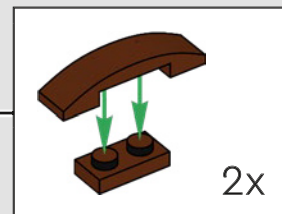
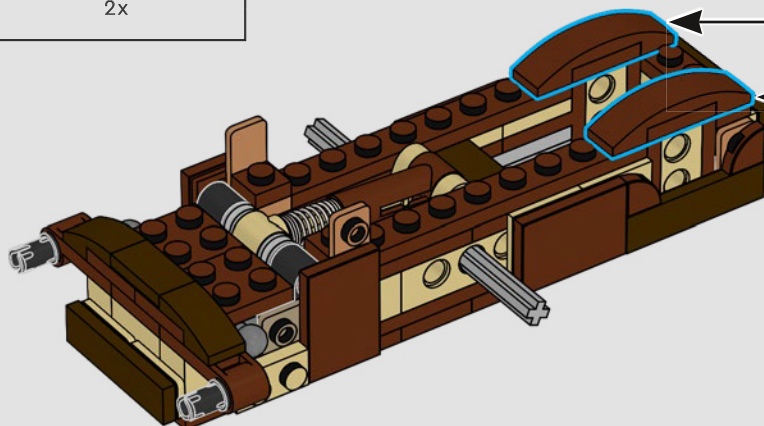


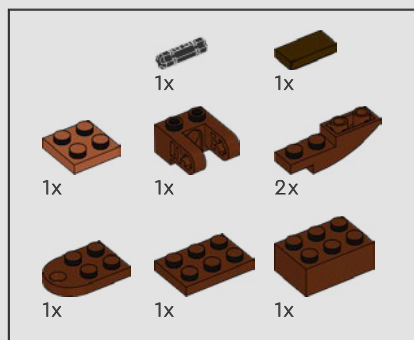


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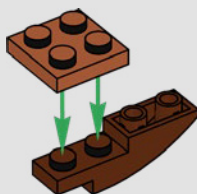
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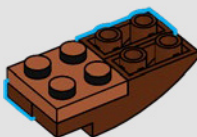


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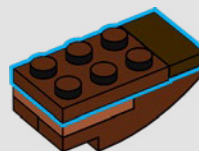
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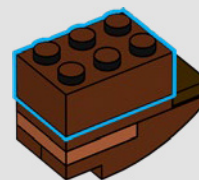
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3



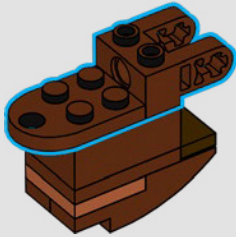
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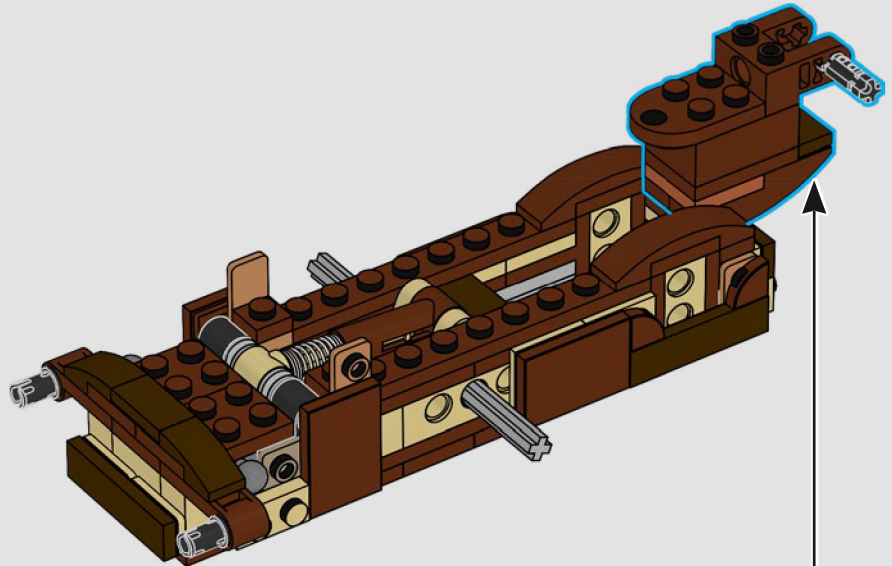
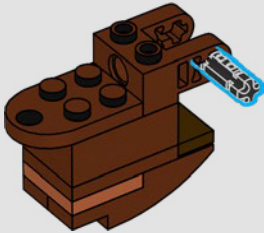


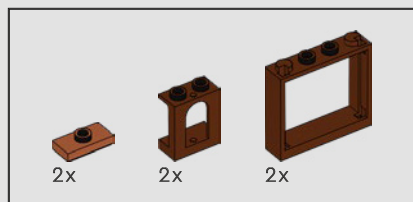
Leonardo's ornithopter, built for and test-piloted from a low altitude by a friend of the artist, wasn't entirely successful. The machine crashed, and da Vinci's friend broke a leg.

5

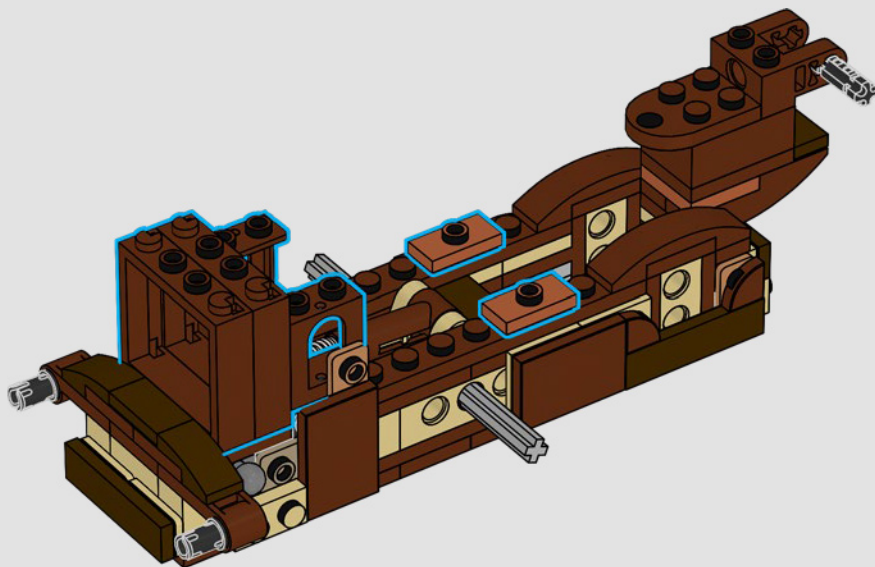


6





78





2x



2x

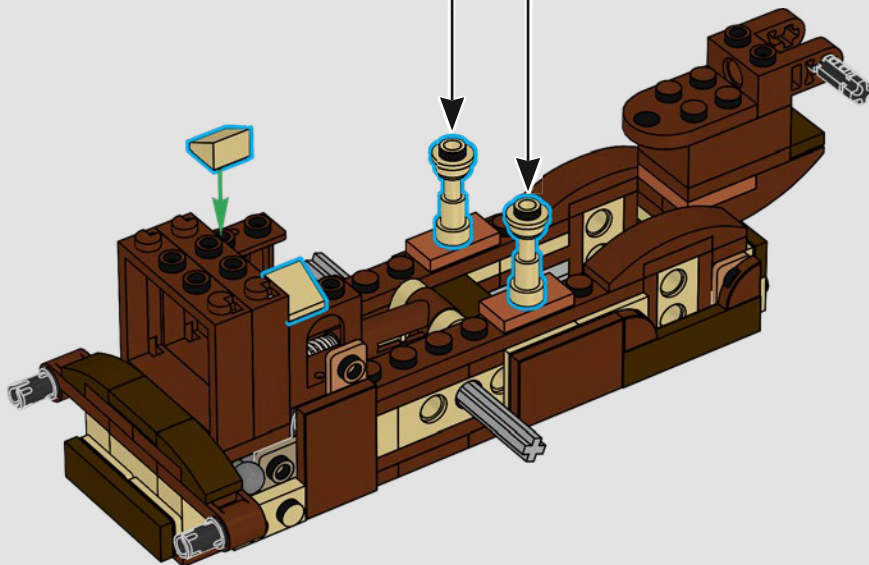


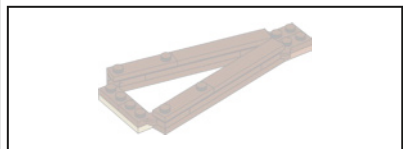
2x

79

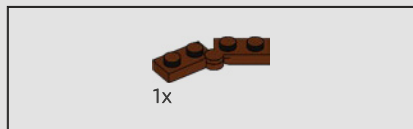
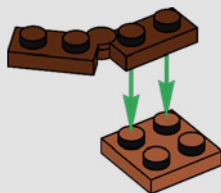


2x

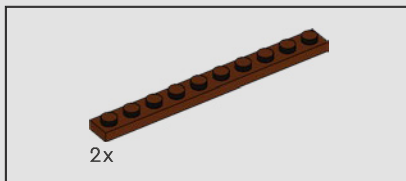
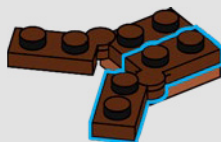




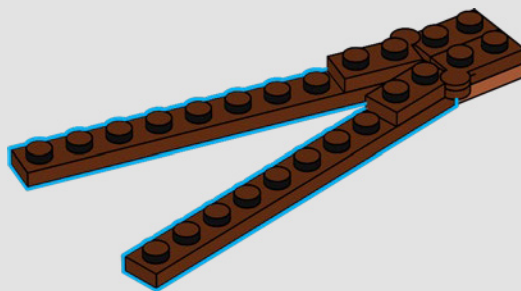
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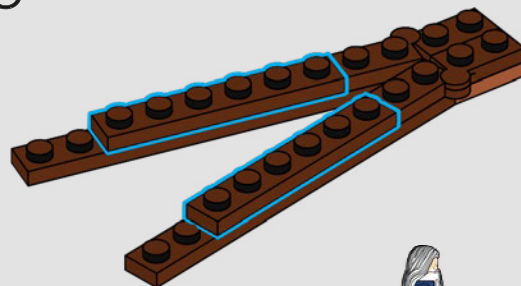
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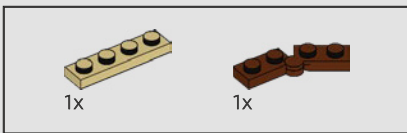
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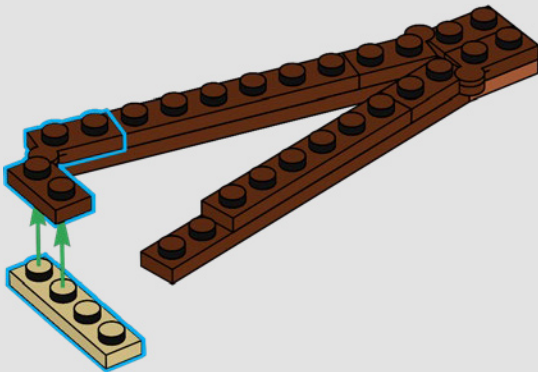
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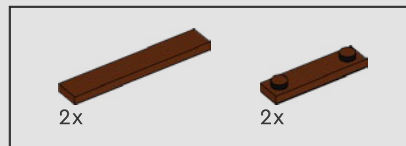
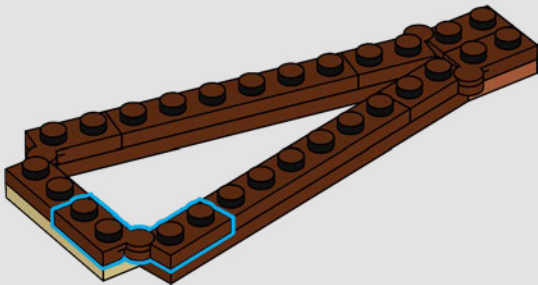




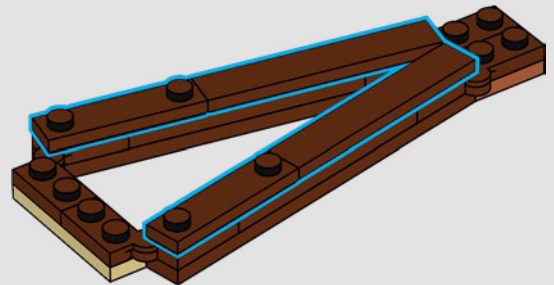
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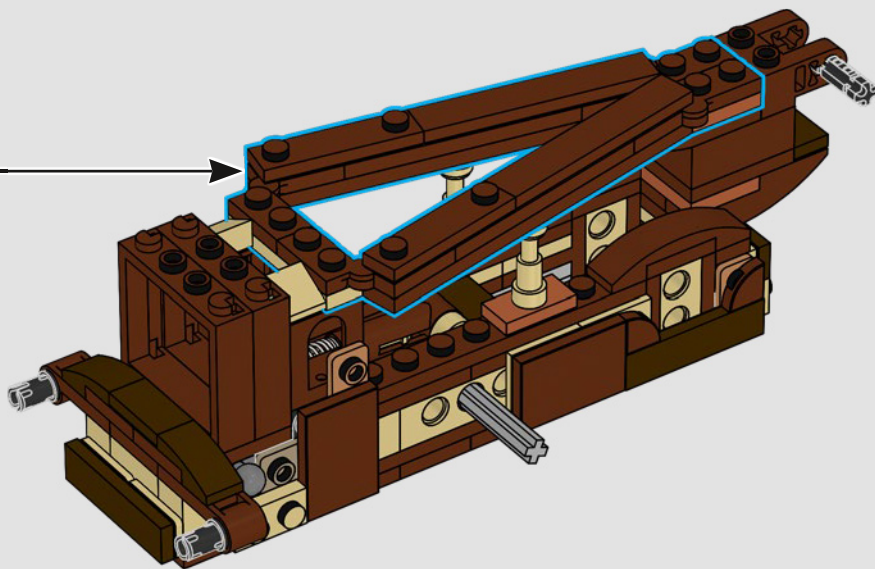
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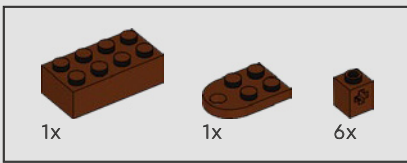


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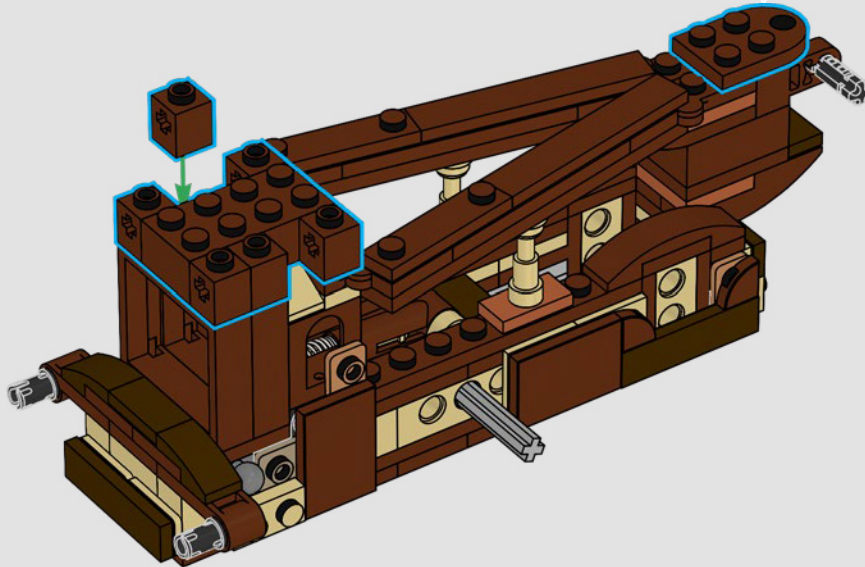
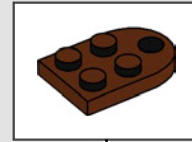


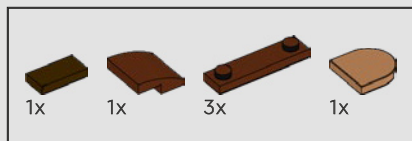
87



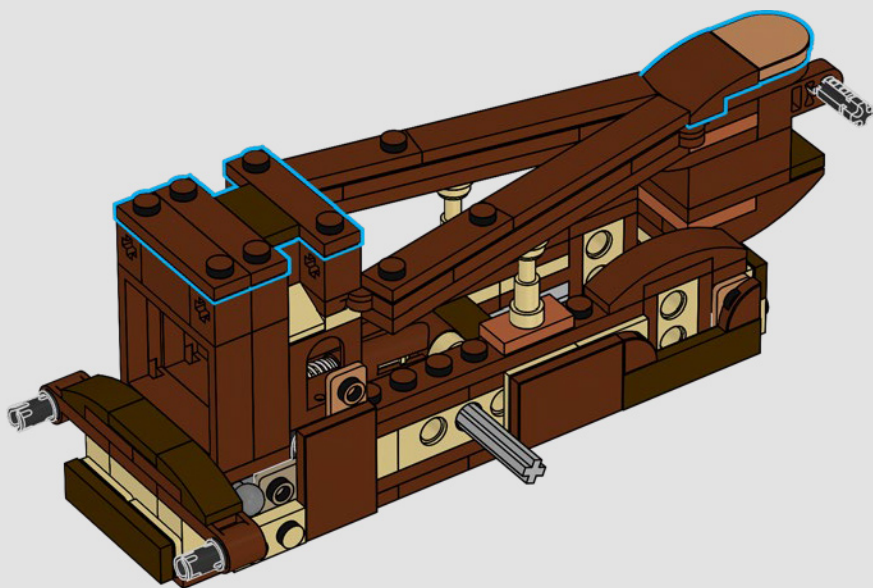


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Leonardo da Vinci was persistent in his idea that the human body could produce enough energy to power a flying machine.

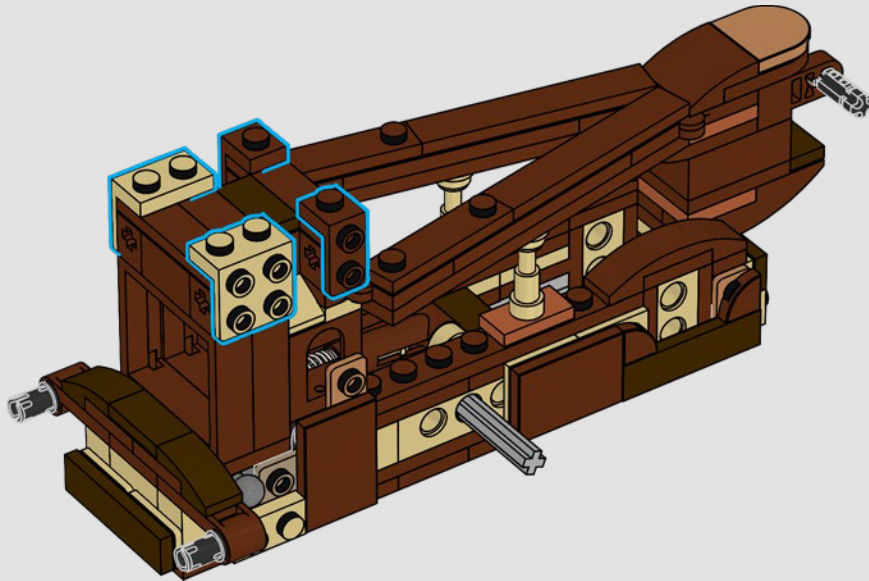


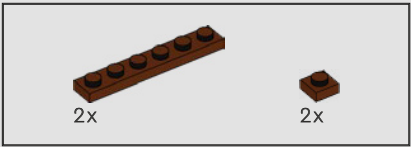
2x



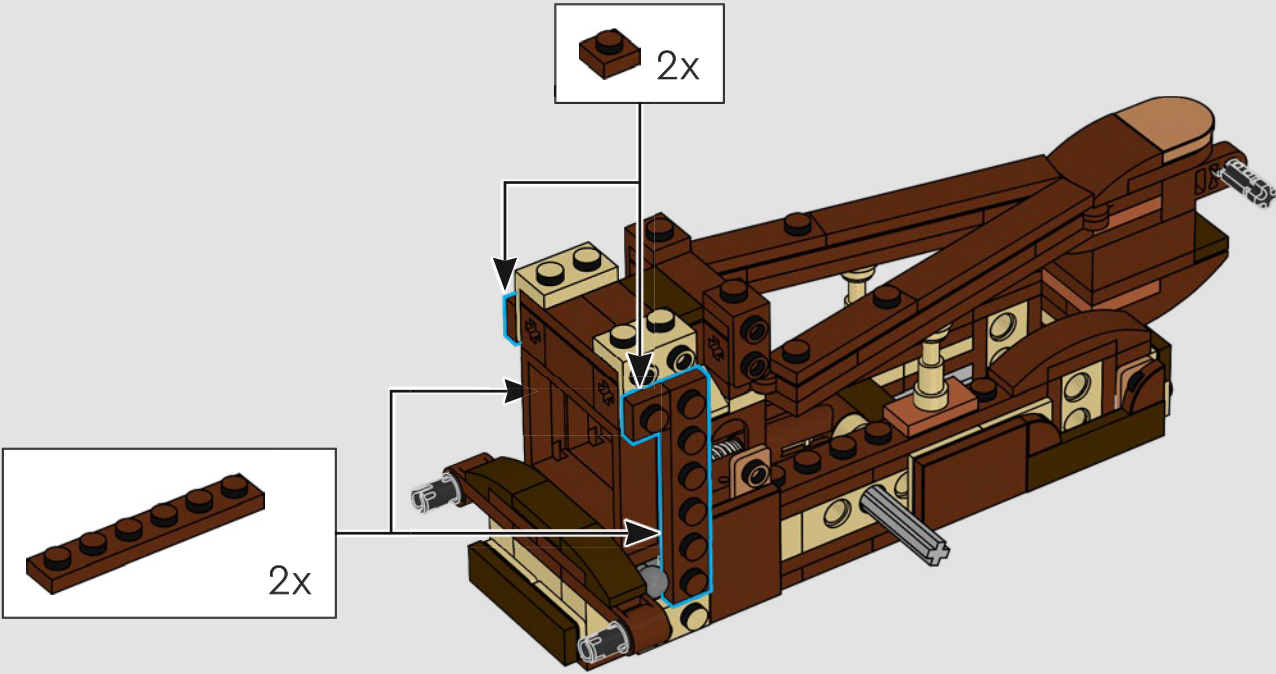
2x

90





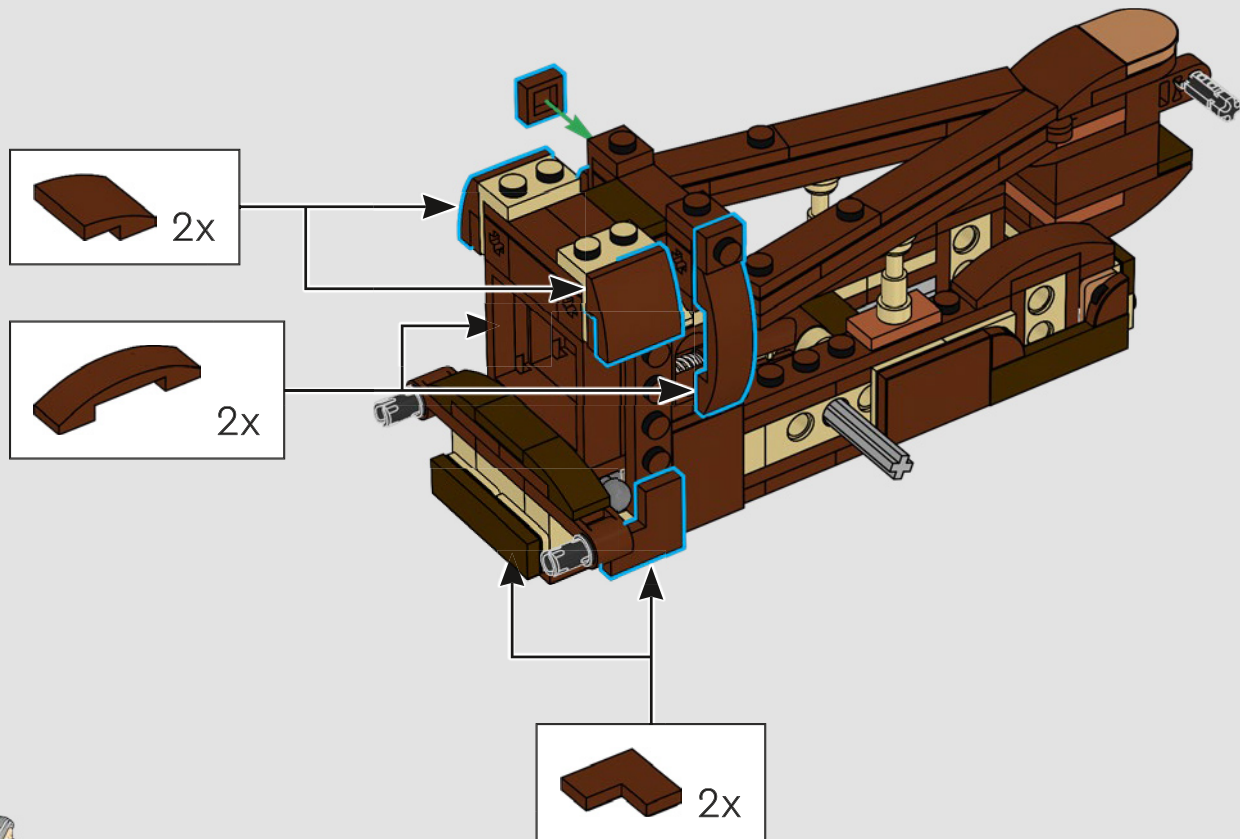
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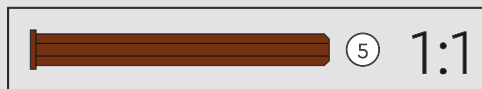
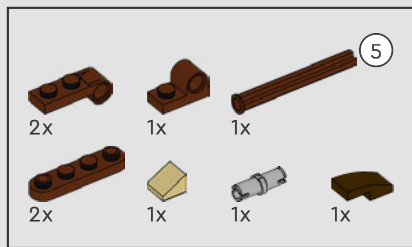




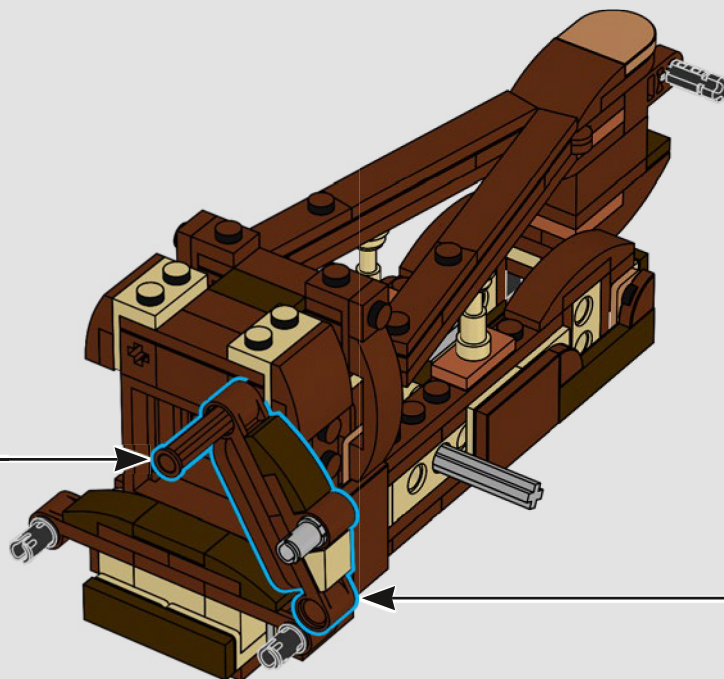
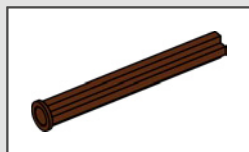
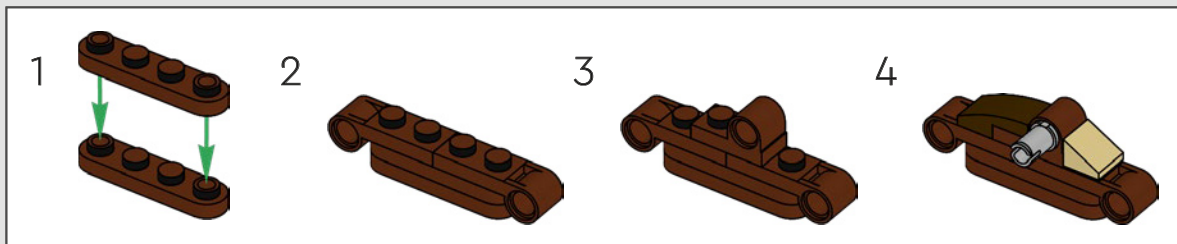


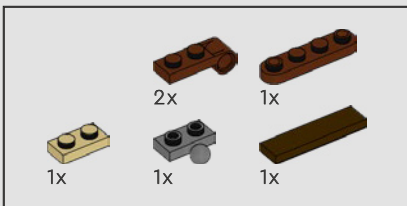
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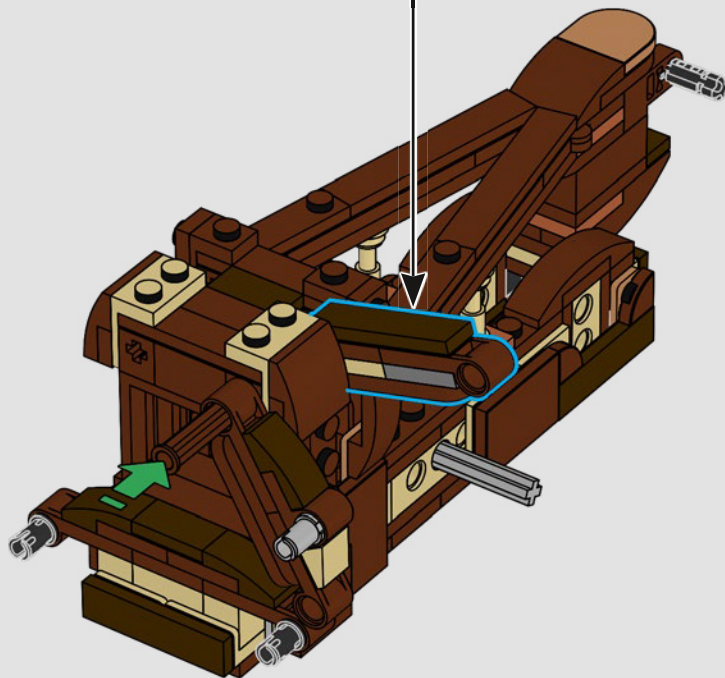
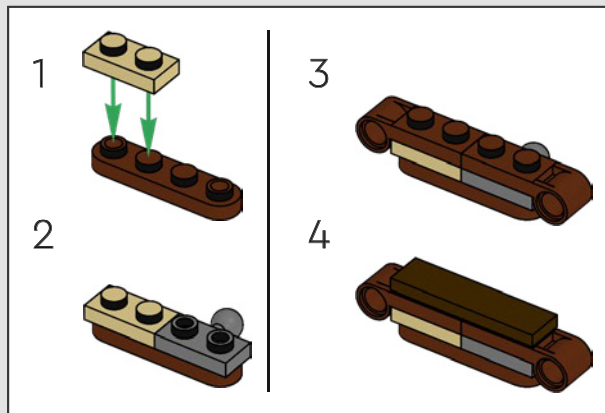


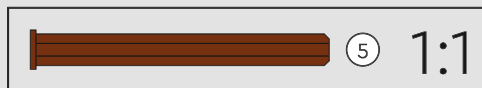
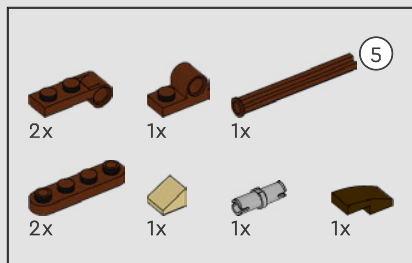
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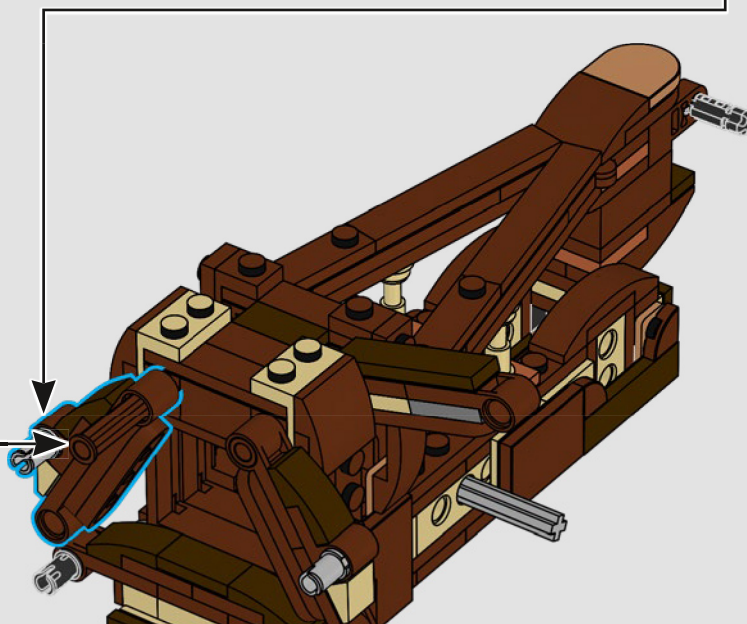
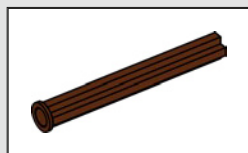
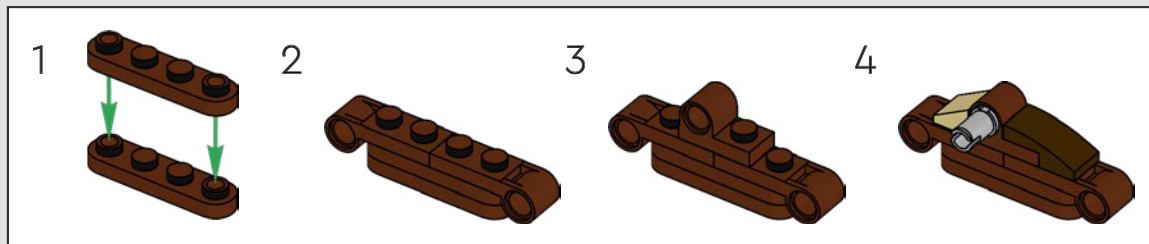


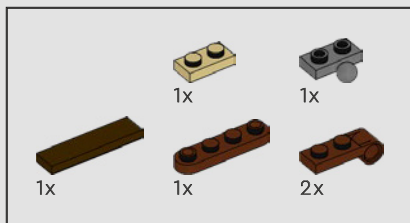
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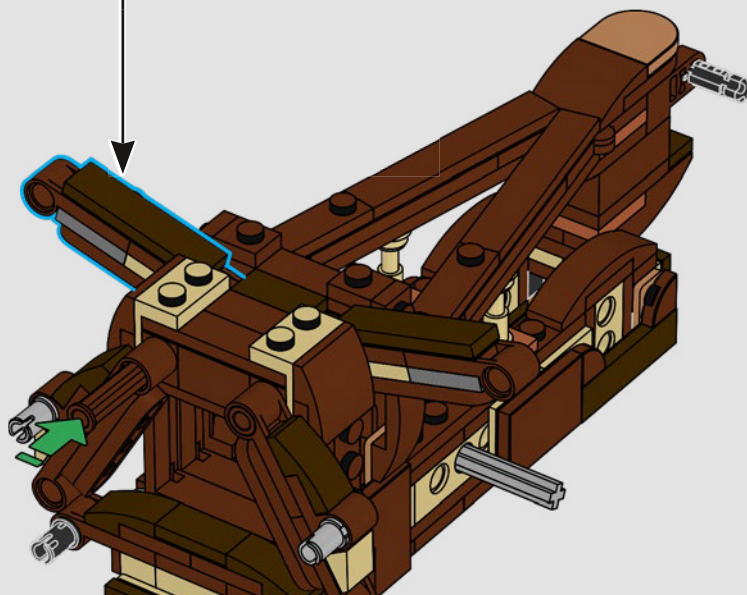
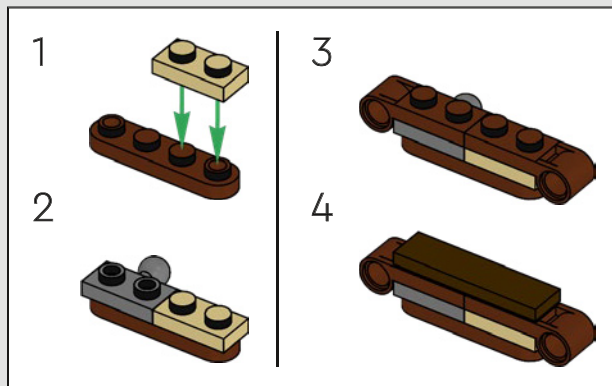


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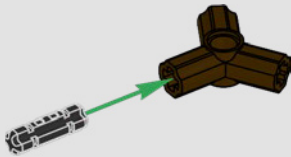


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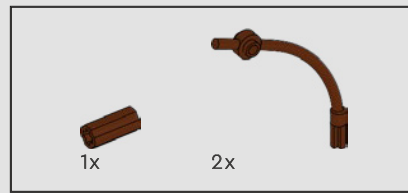




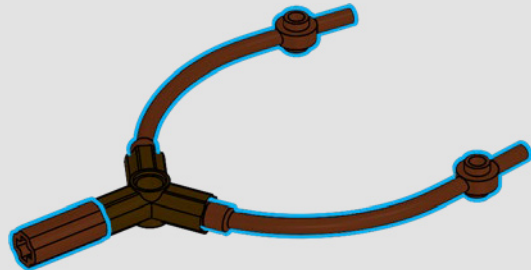
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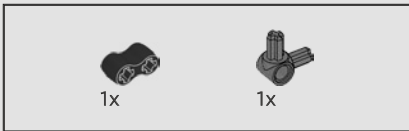
Leonardo da Vinci's sketches show different flying machines operated by a pilot using various power mechanics – some powered by legs, some by legs as well as arms, and others even with rudders connected to the pilot's head.



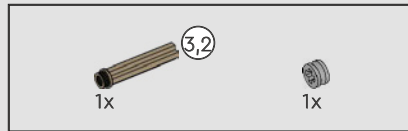
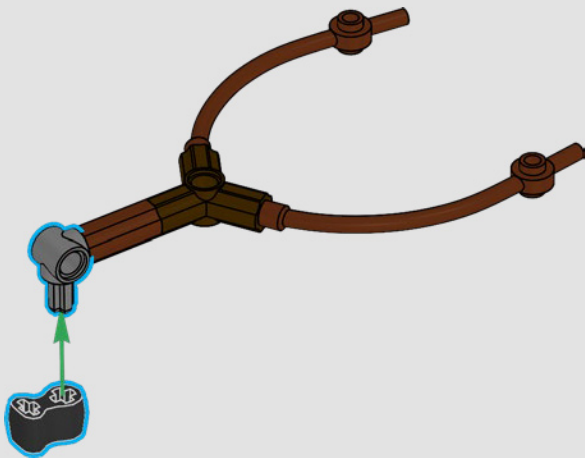
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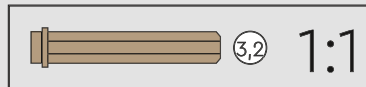
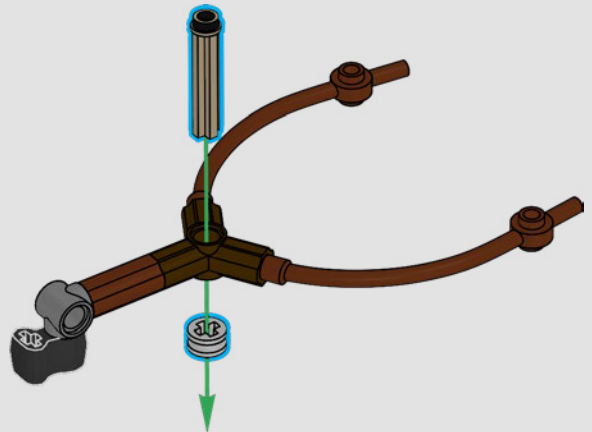




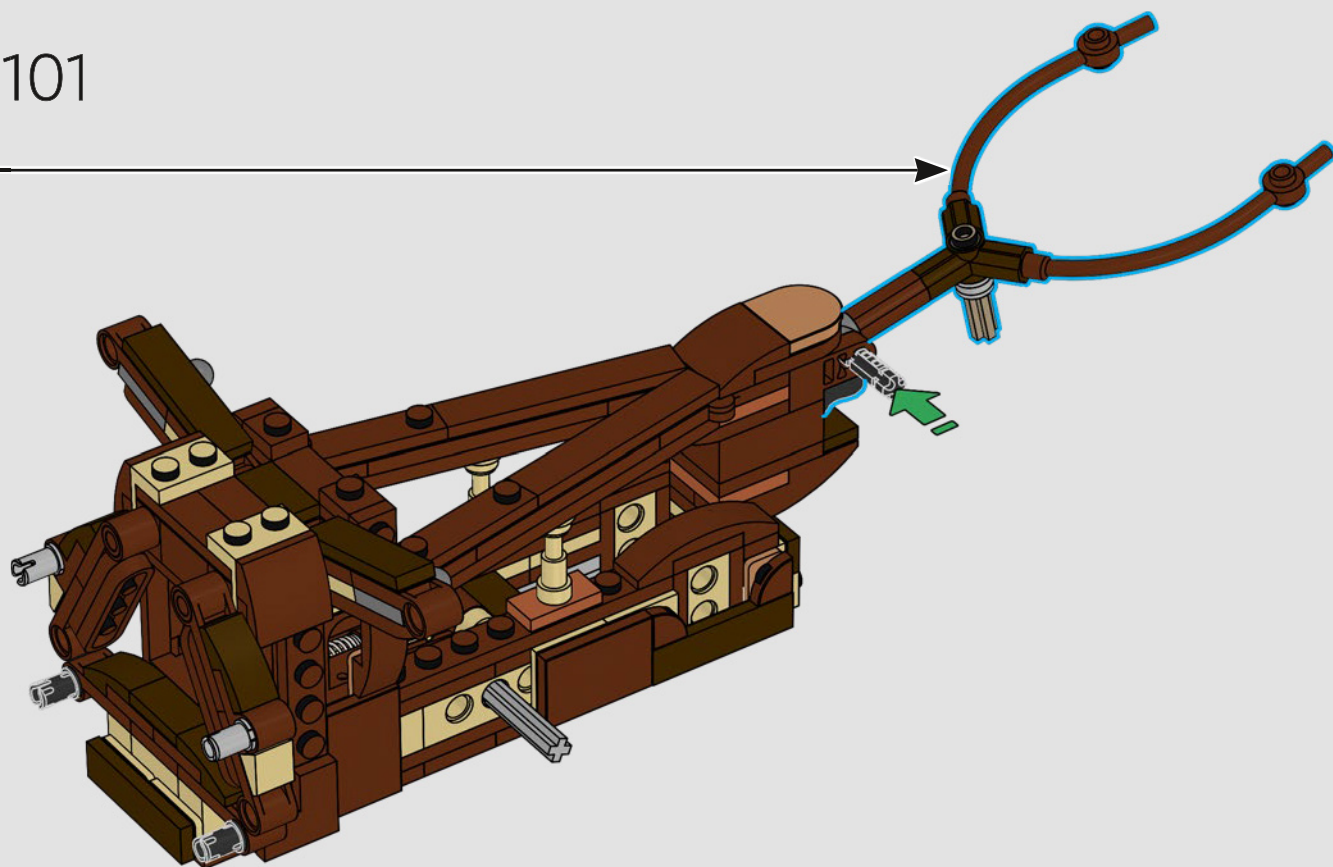
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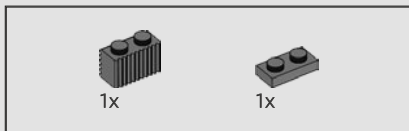
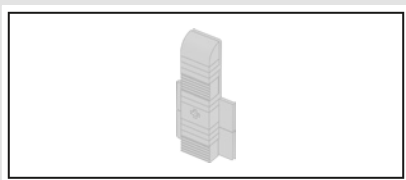


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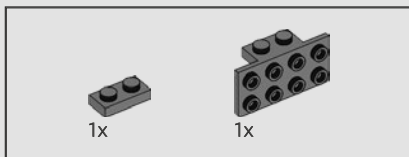
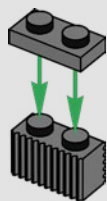


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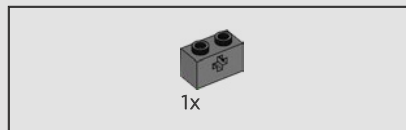
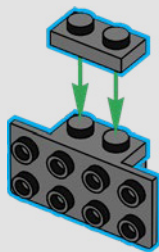




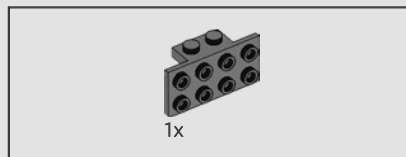
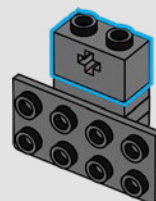
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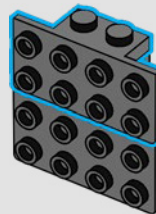
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104

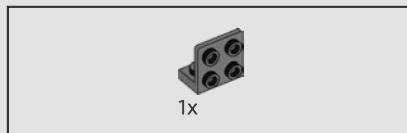
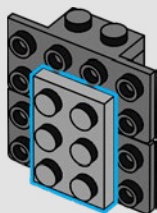


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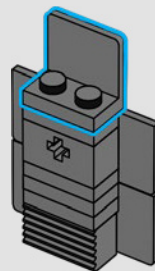


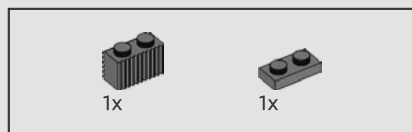


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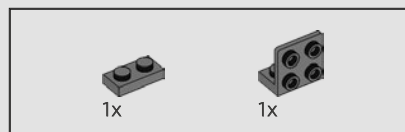
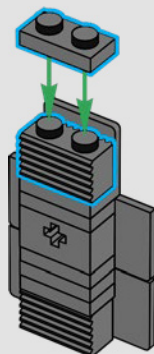


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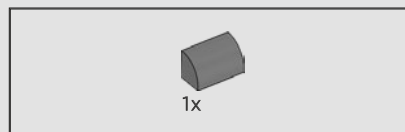
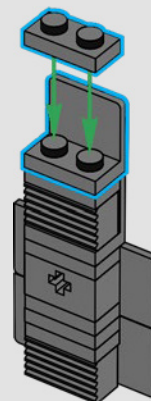




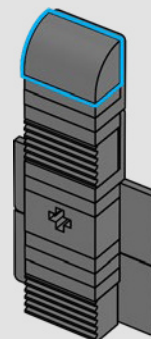
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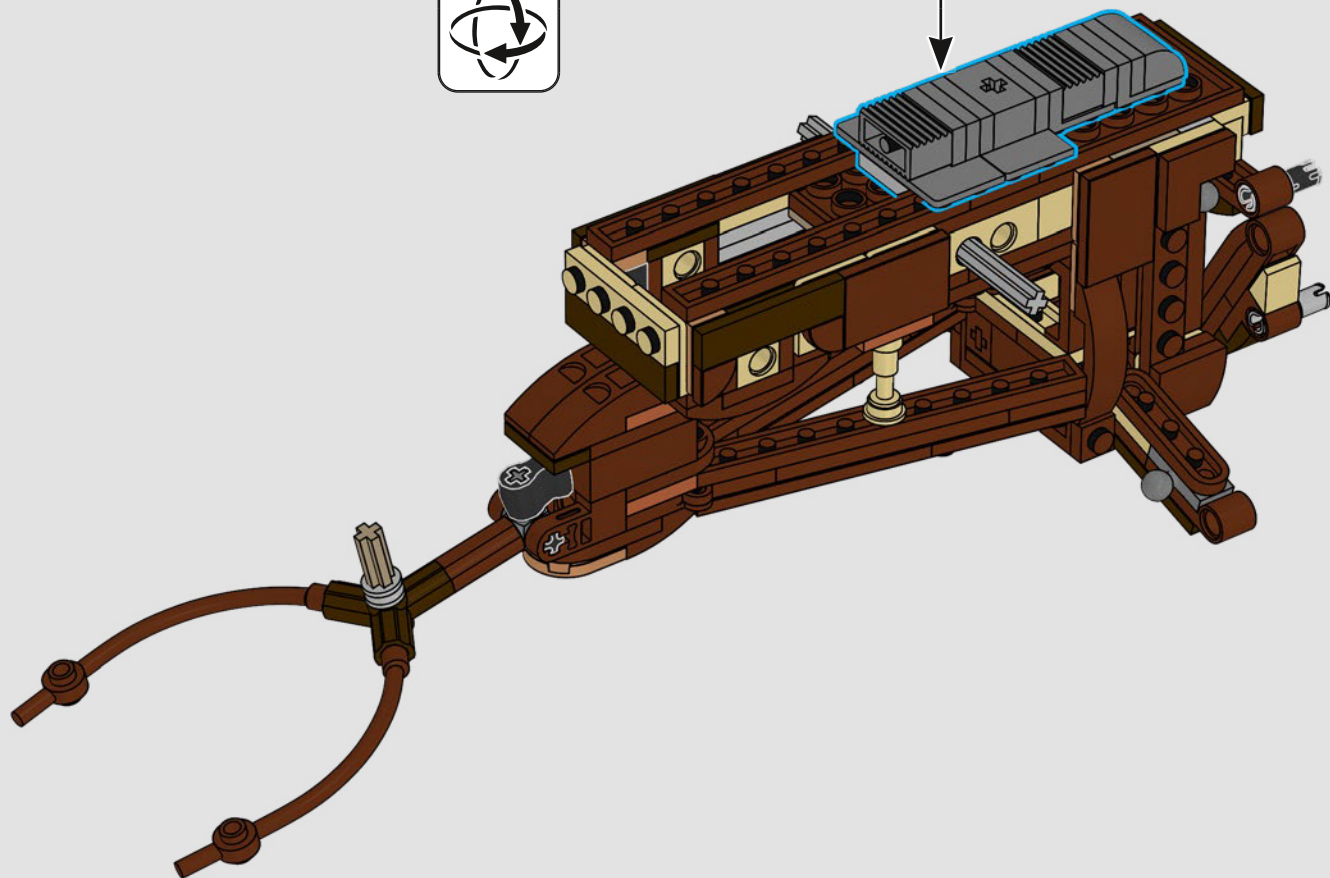


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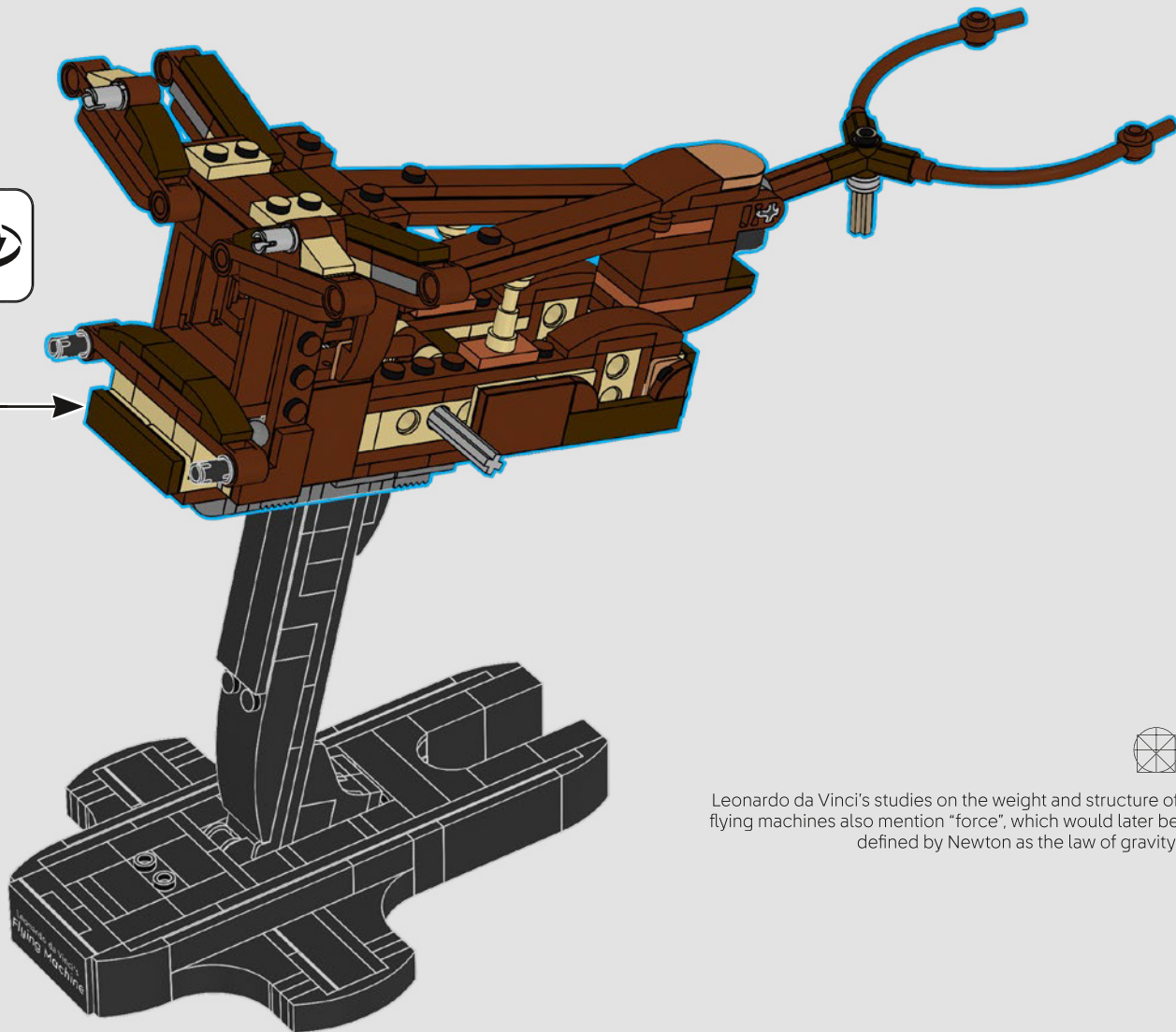
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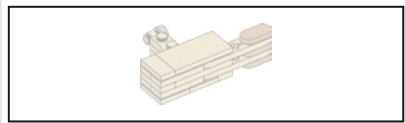


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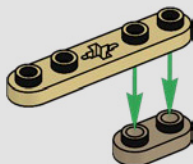


Leonardo da Vinci's studies on the weight and structure of flying machines also mention "force", which would later be defined by Newton as the law of gravity.

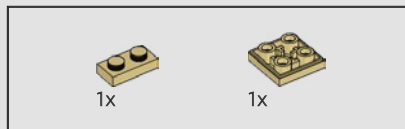
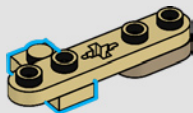




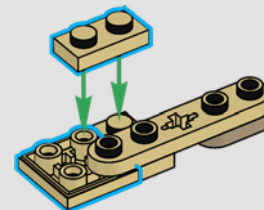
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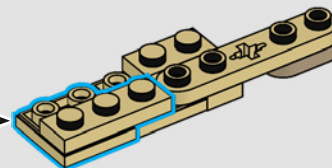
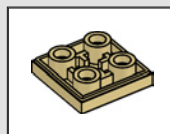
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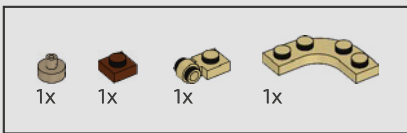


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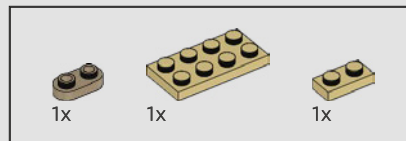
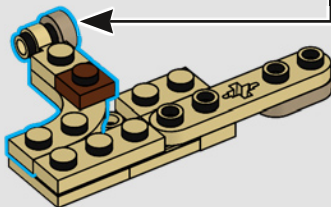
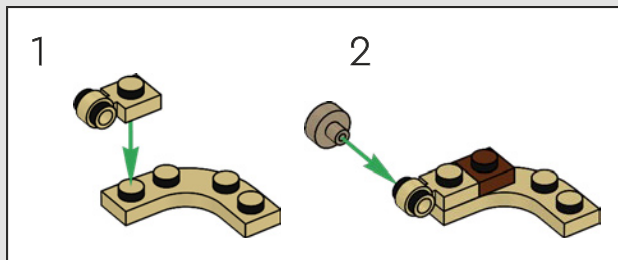


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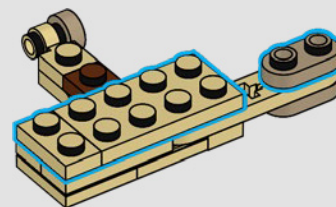


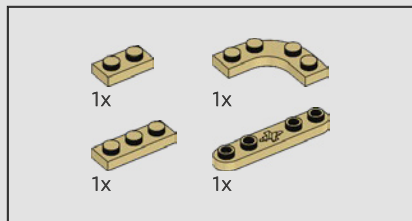


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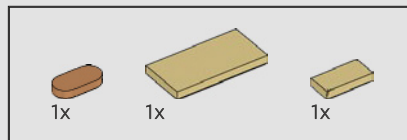
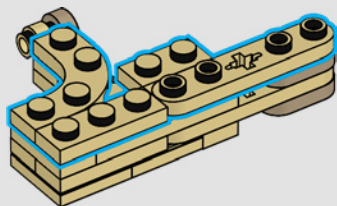


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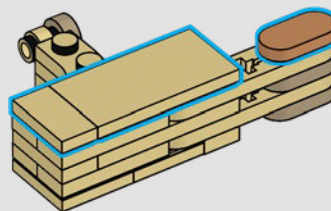


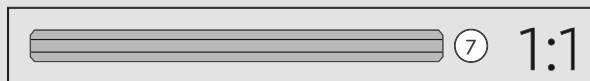
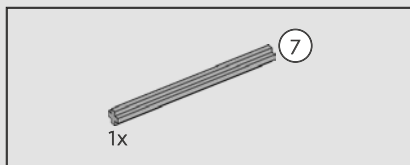


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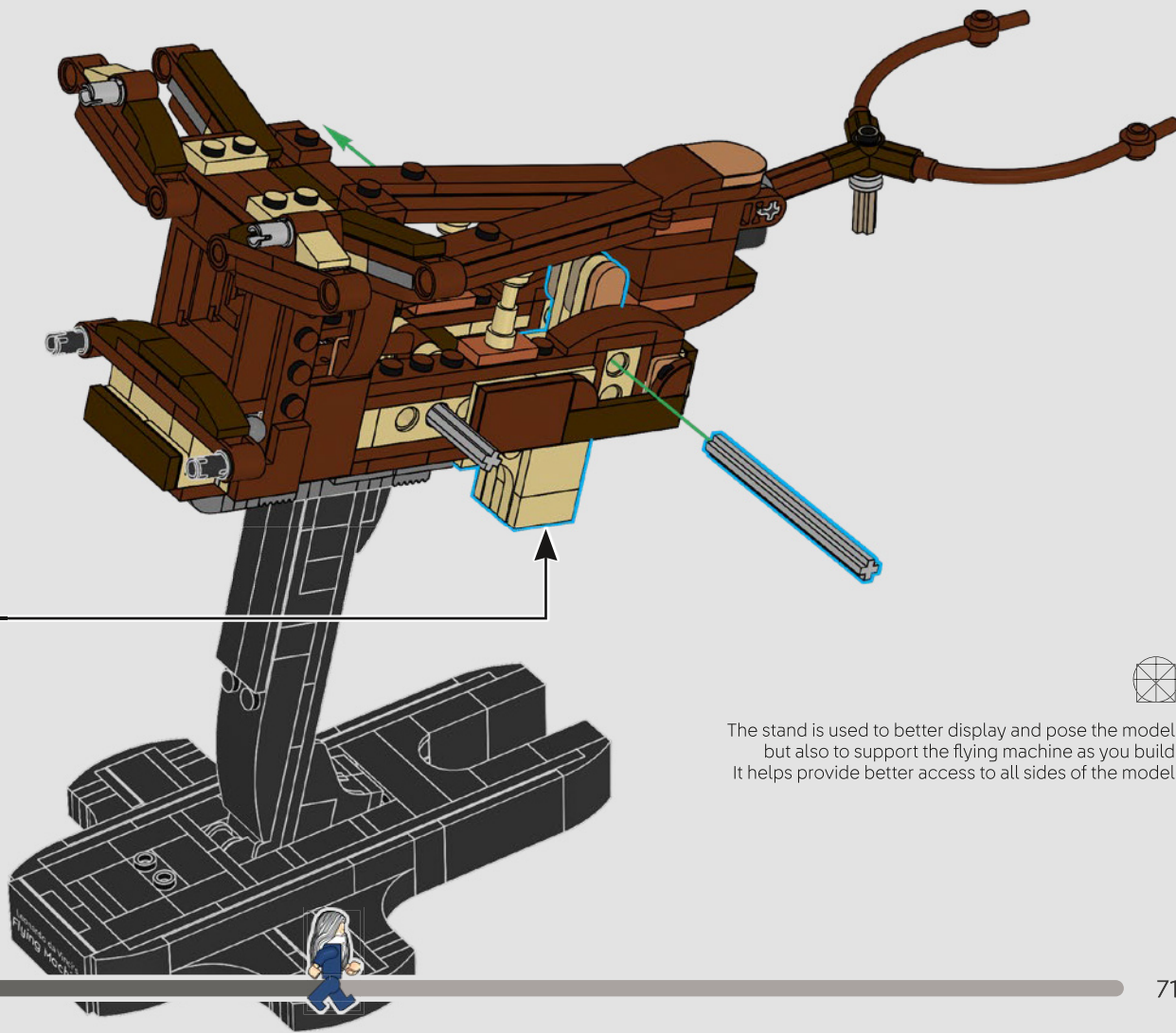


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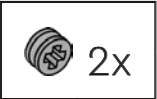
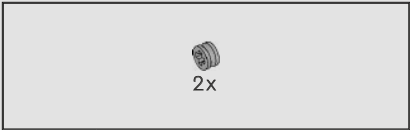




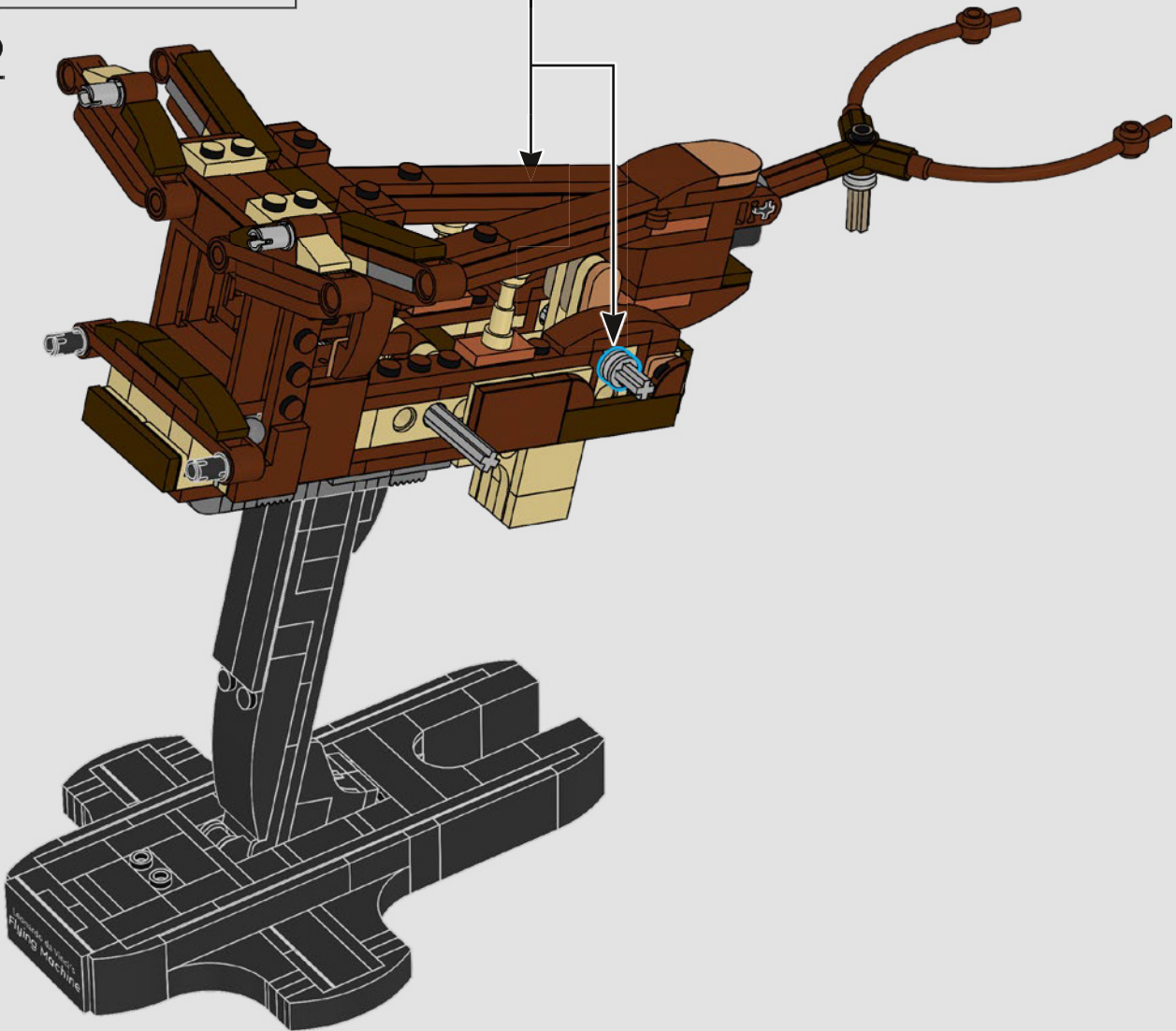
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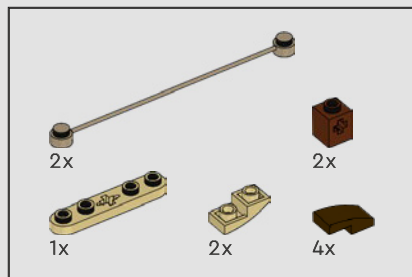


The stand is used to better display and pose the model, but also to support the flying machine as you build. It helps provide better access to all sides of the model.



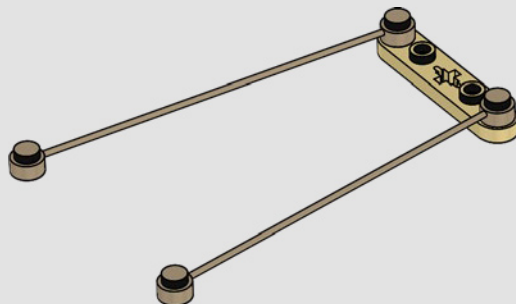
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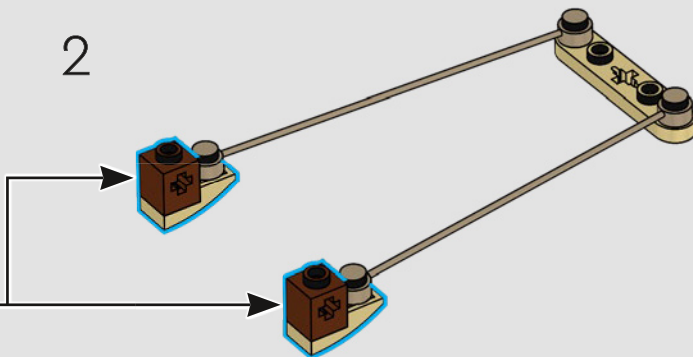
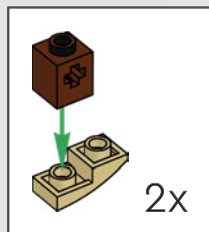


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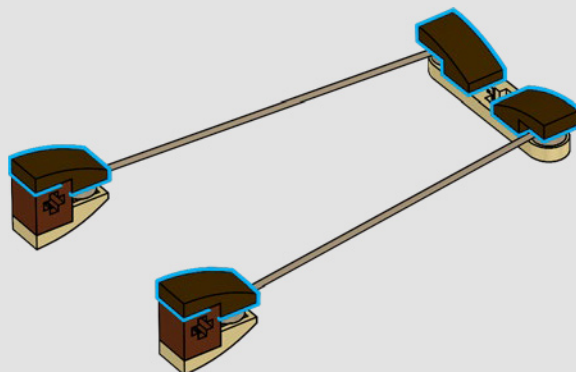
1



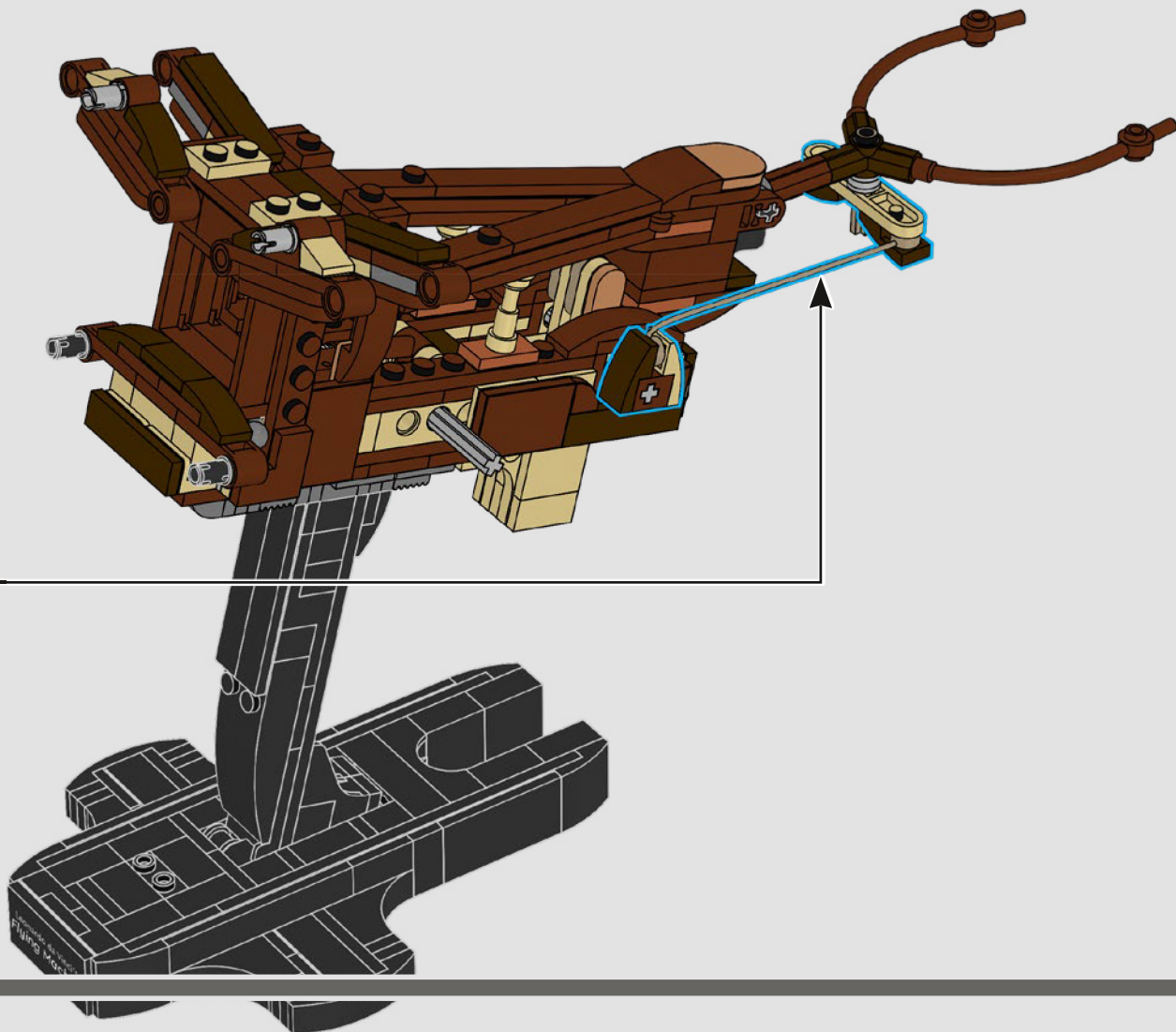
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3



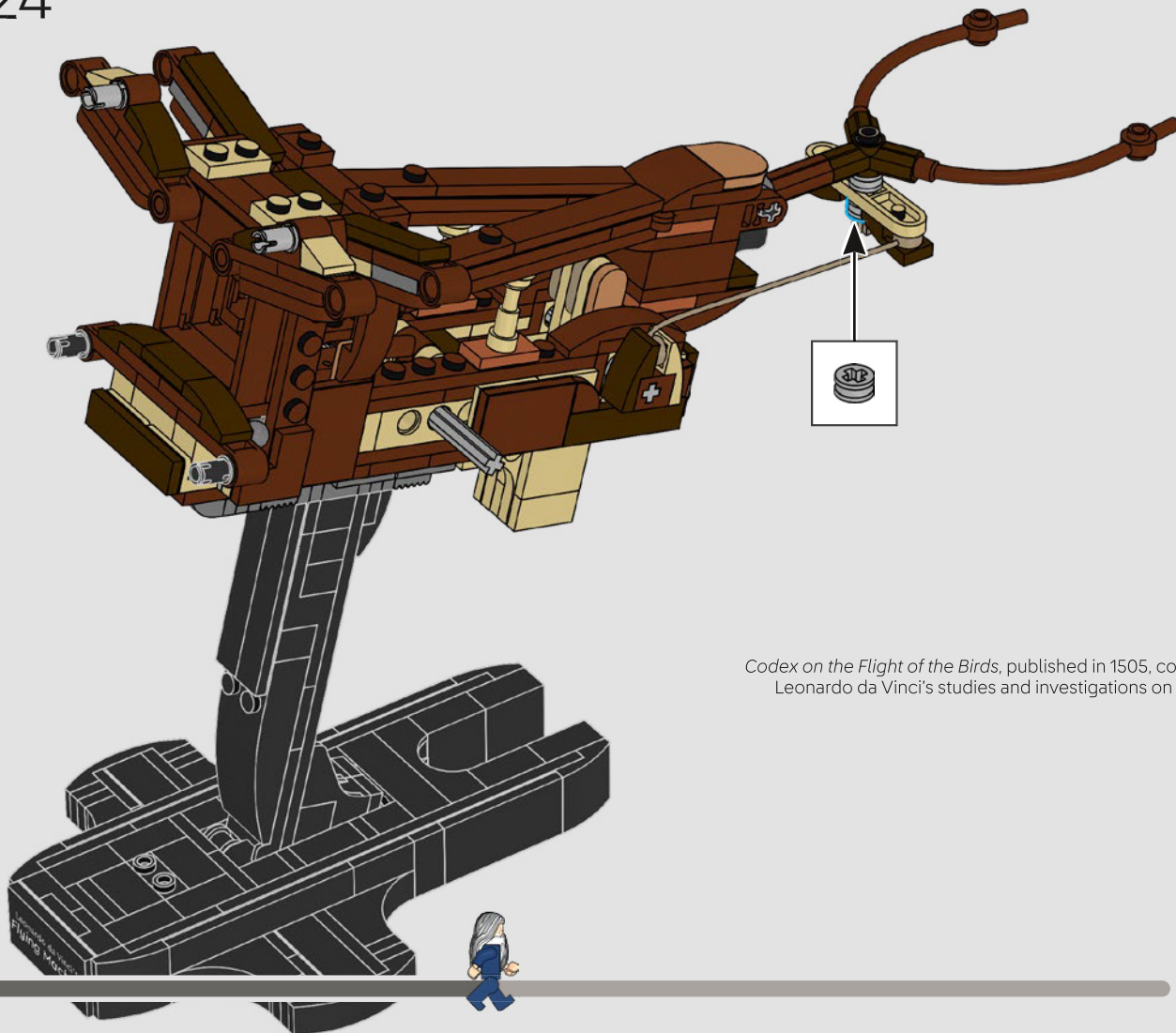




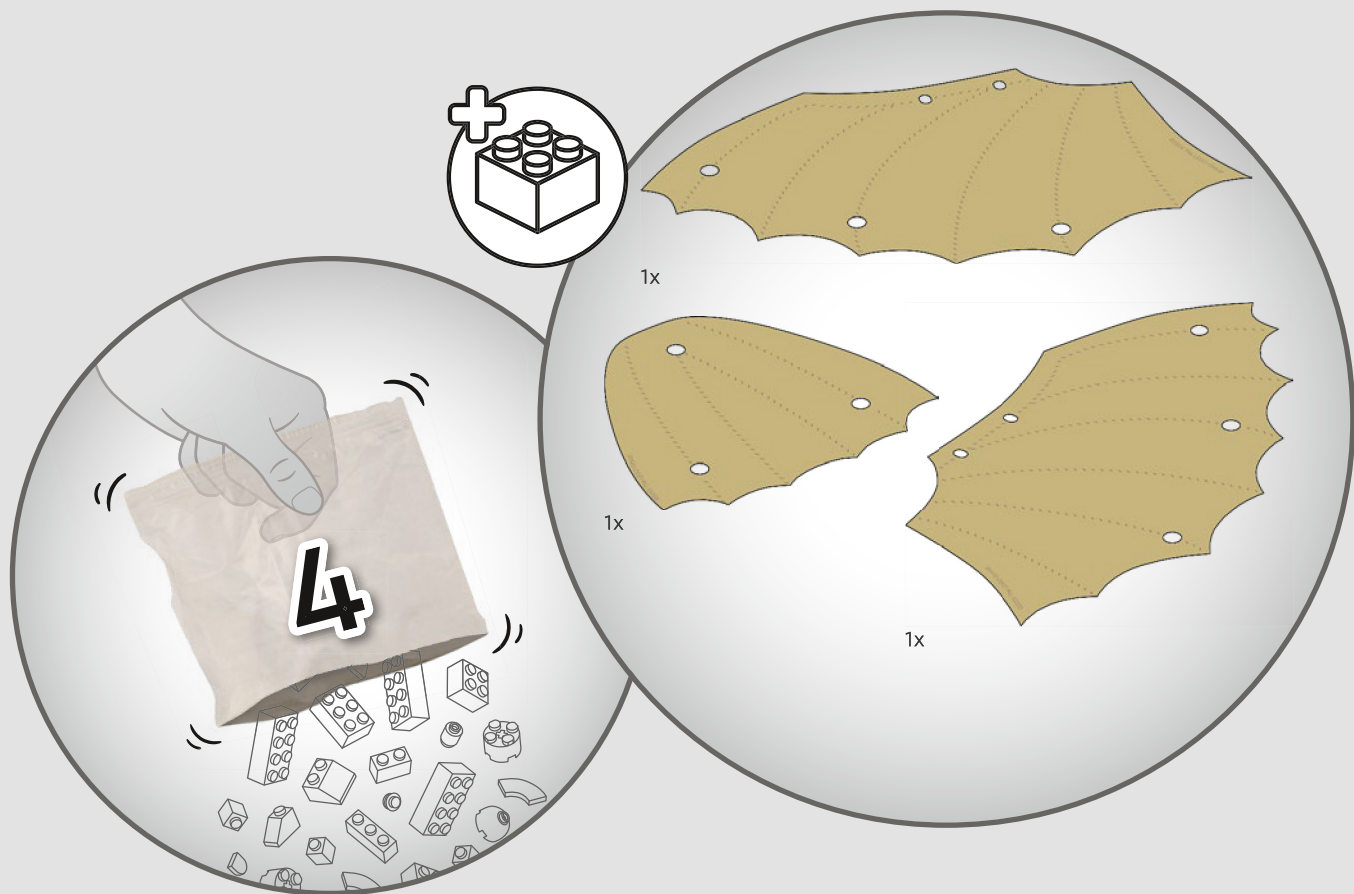


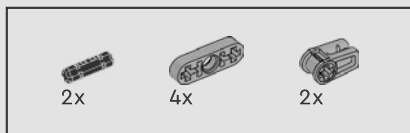
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124

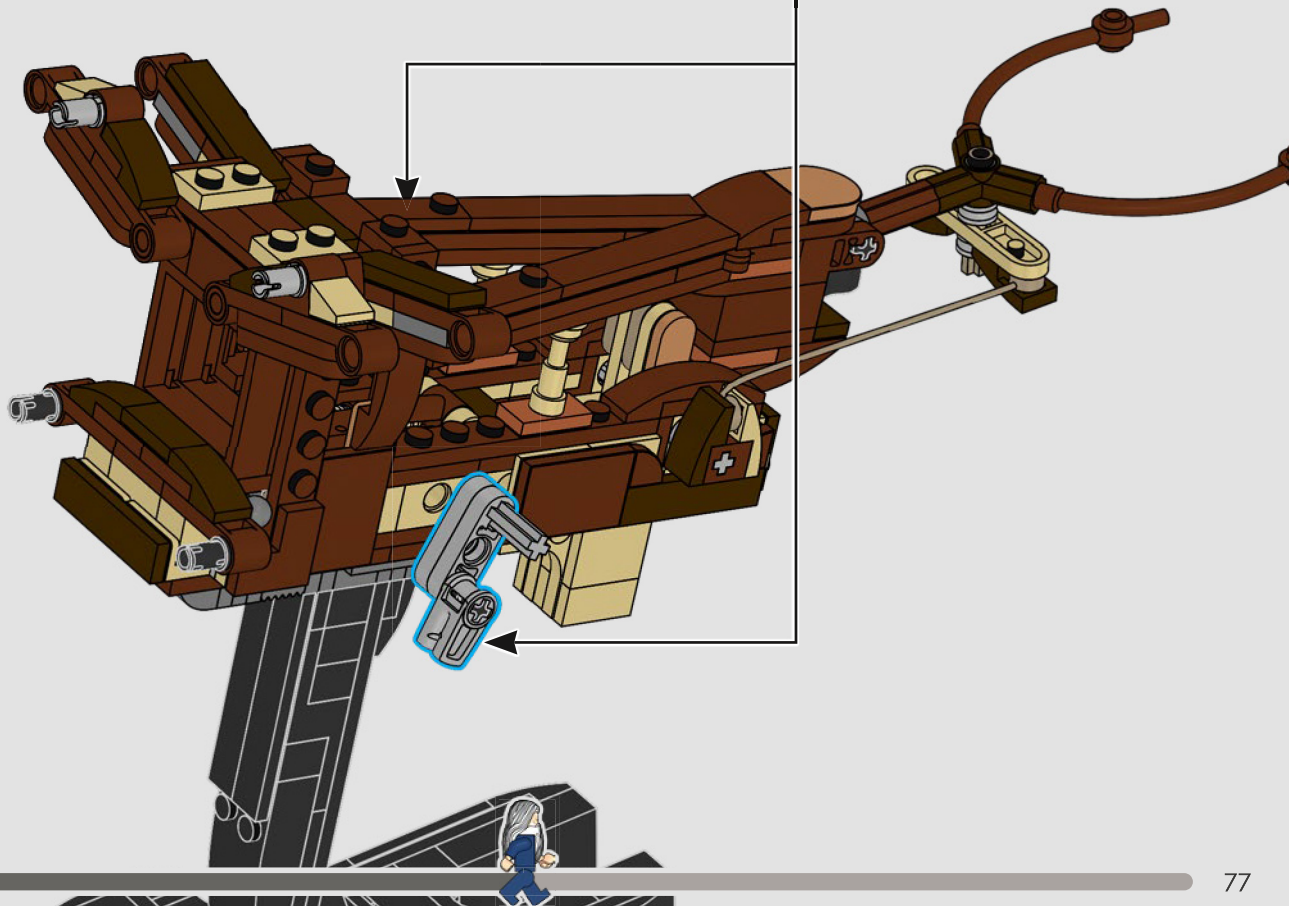
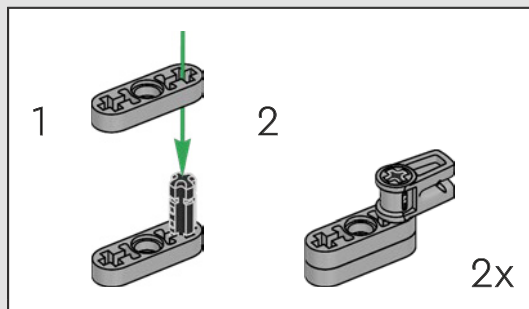


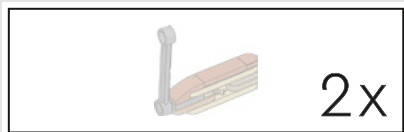
*Codex on the Flight of the Birds*, published in 1505, contains Leonardo da Vinci's studies and investigations on flying.



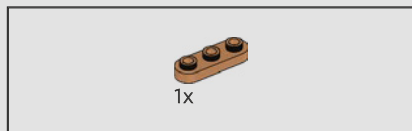
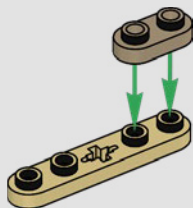


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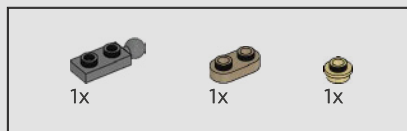
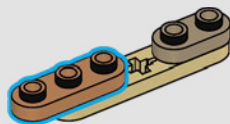




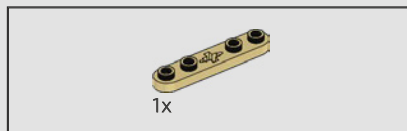
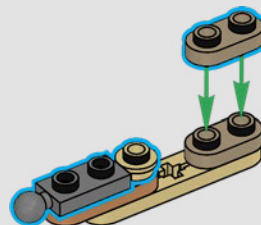
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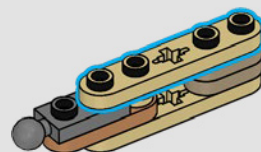
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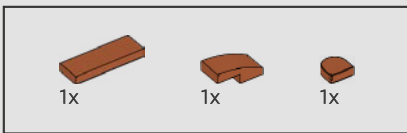
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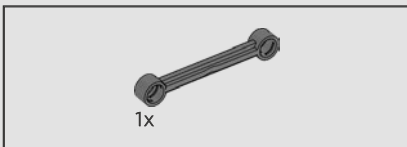
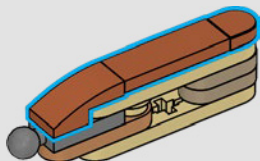
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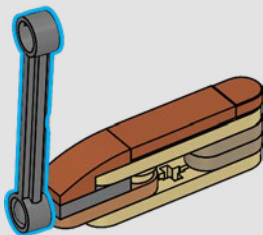




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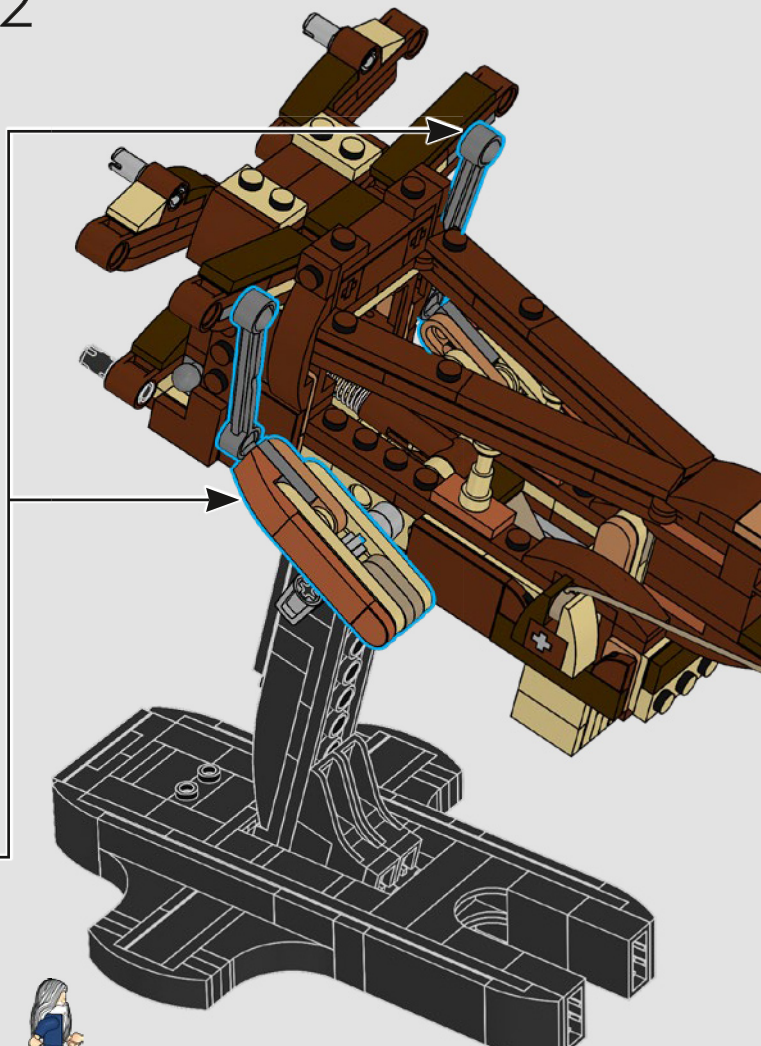


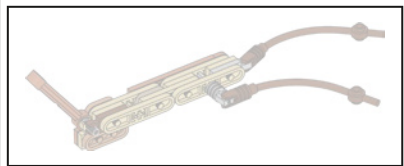
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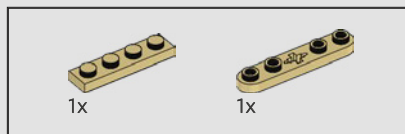
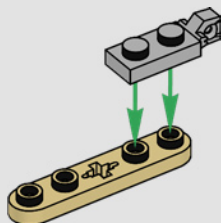
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132

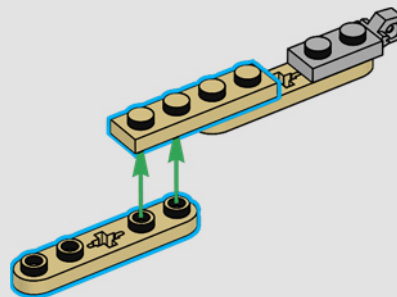




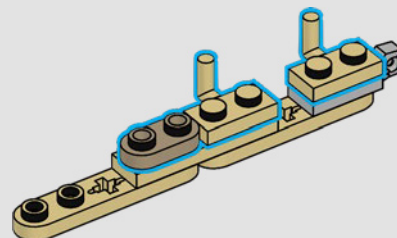
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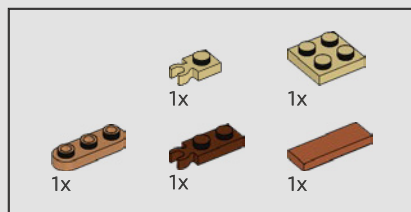
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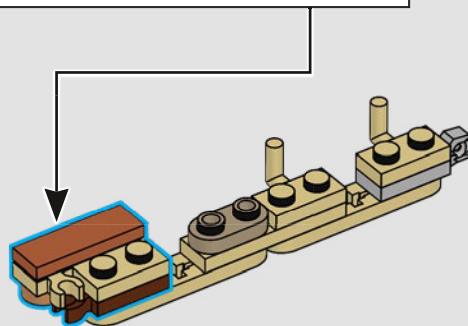
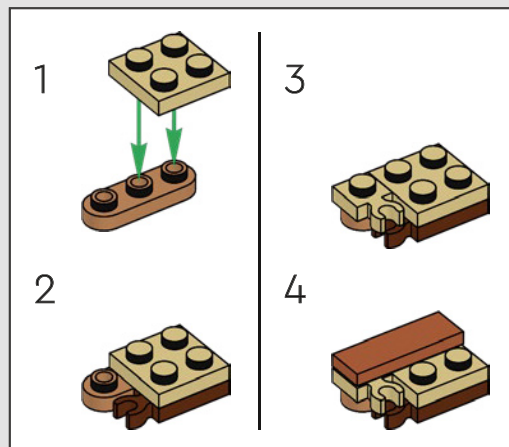
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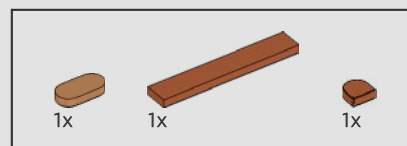
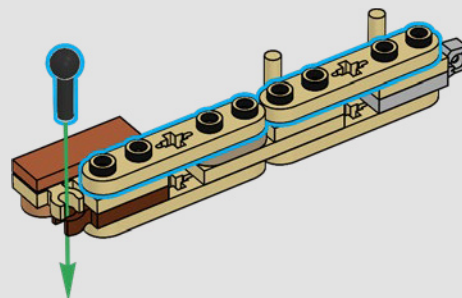




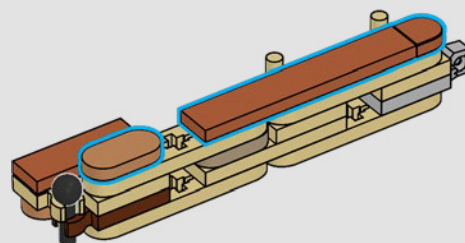
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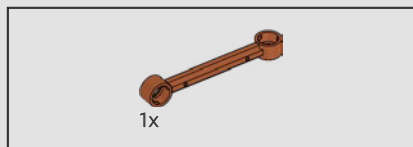


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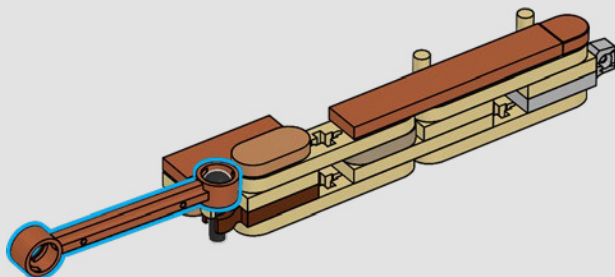


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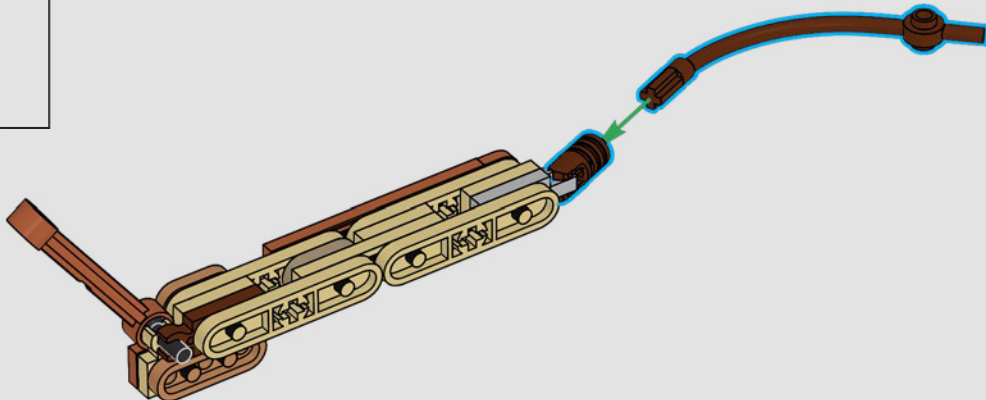


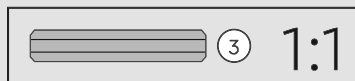
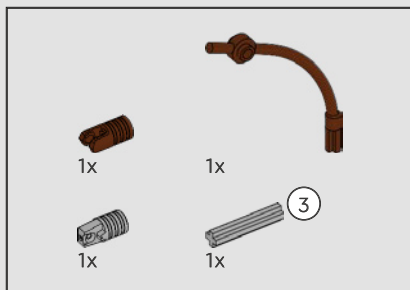


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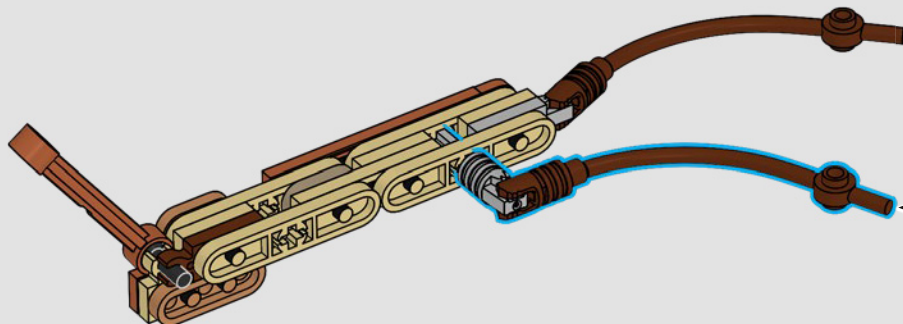
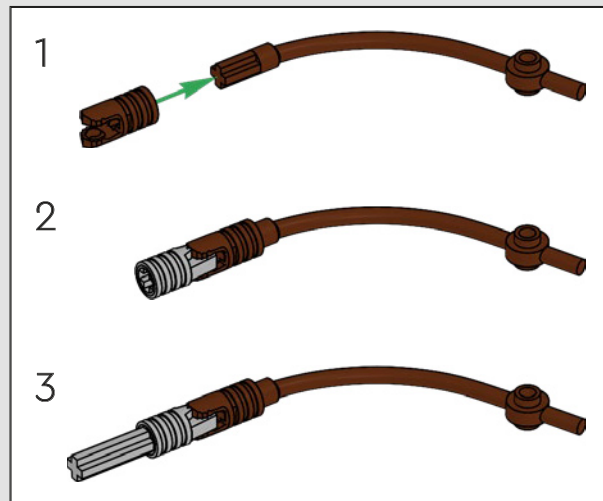


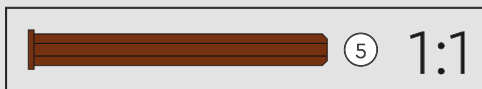
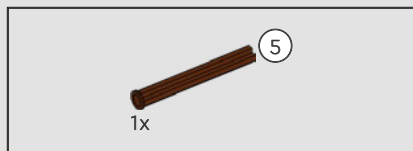
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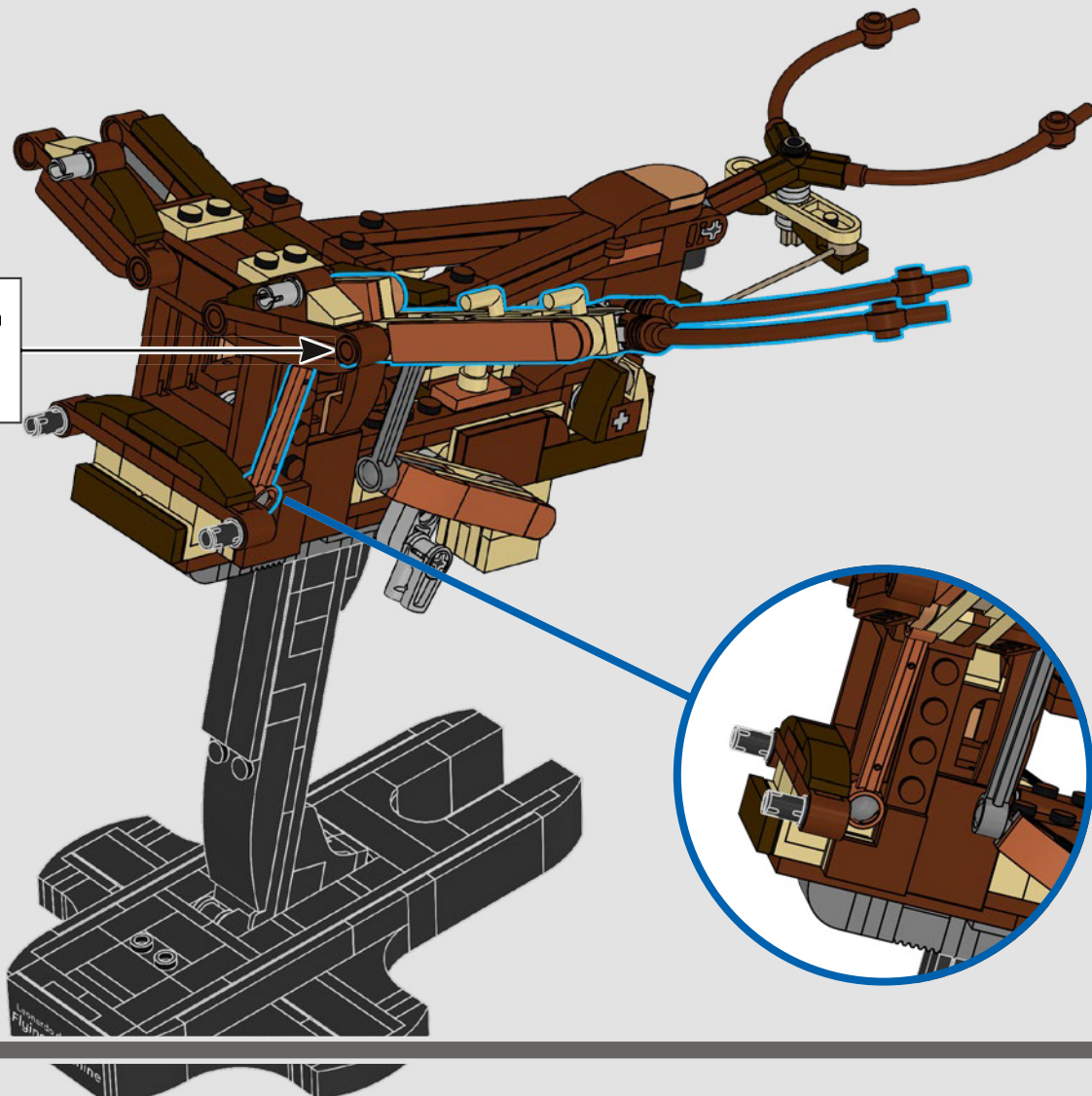
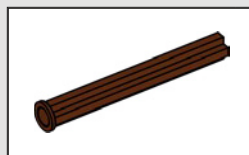


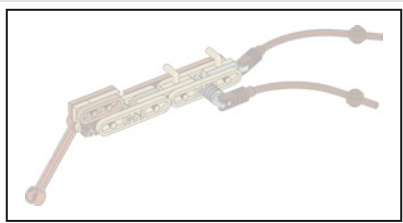
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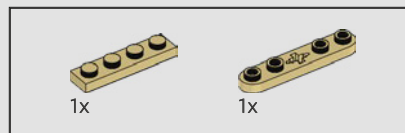
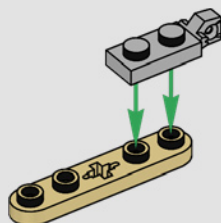


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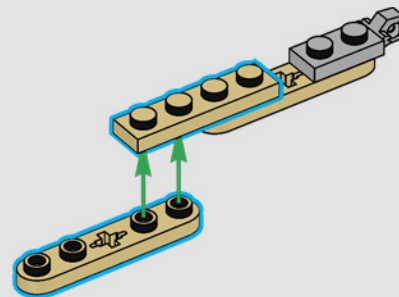




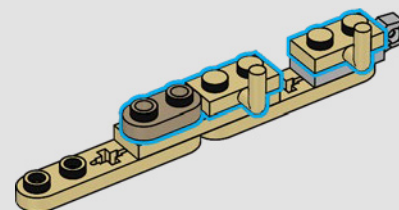
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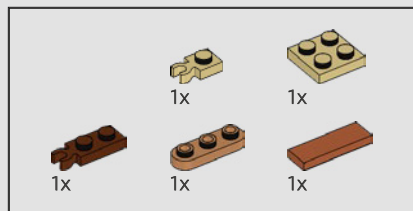


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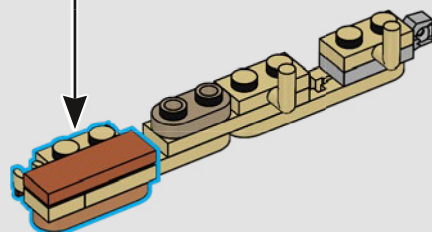
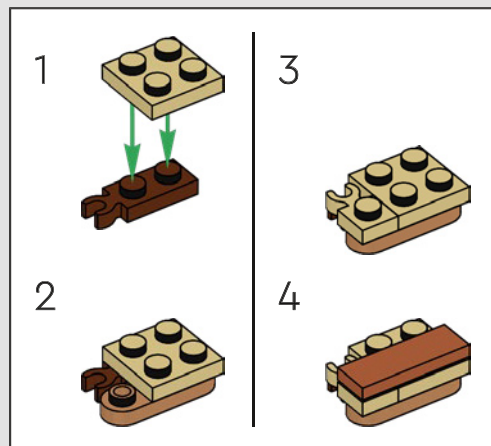


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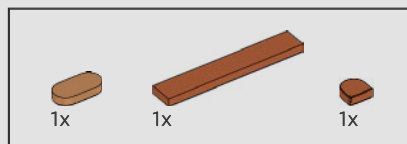
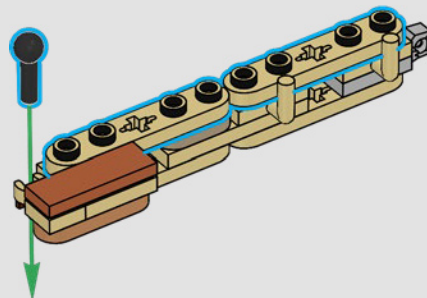




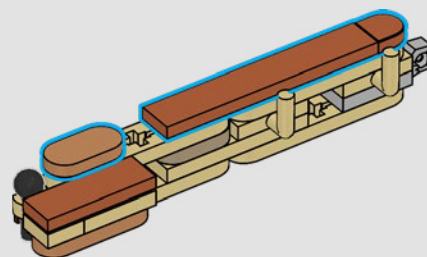
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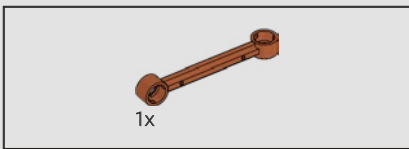


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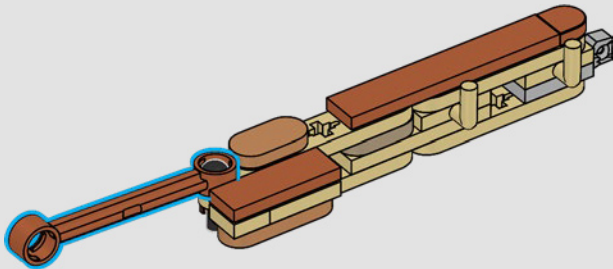


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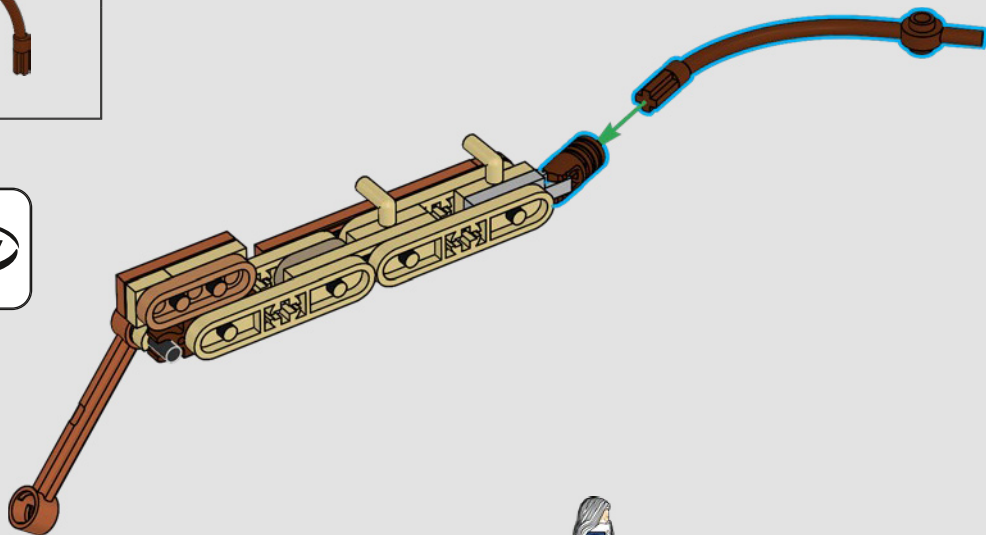




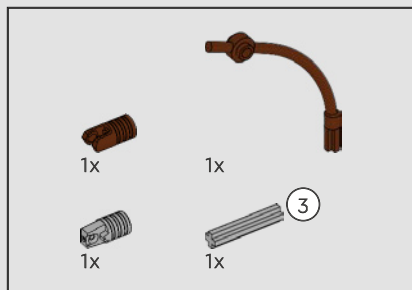
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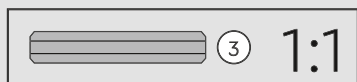
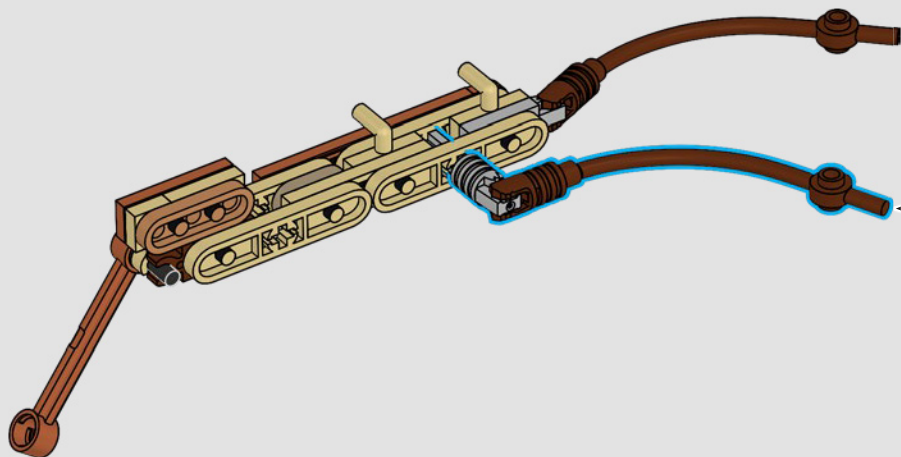
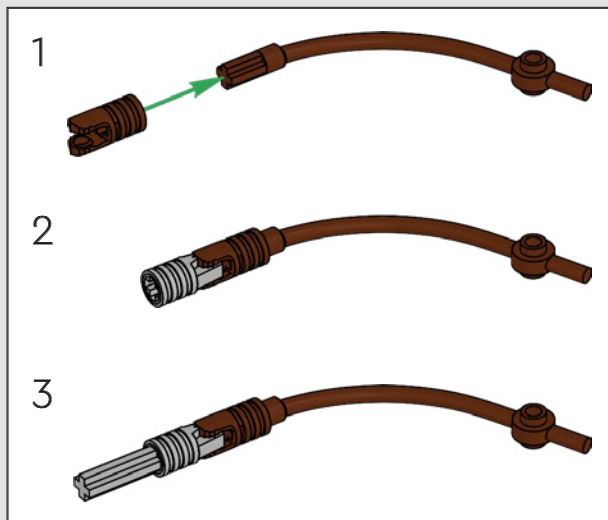
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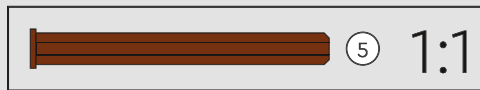
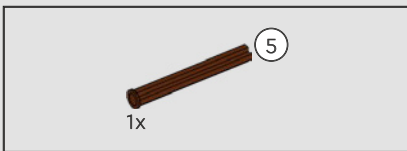




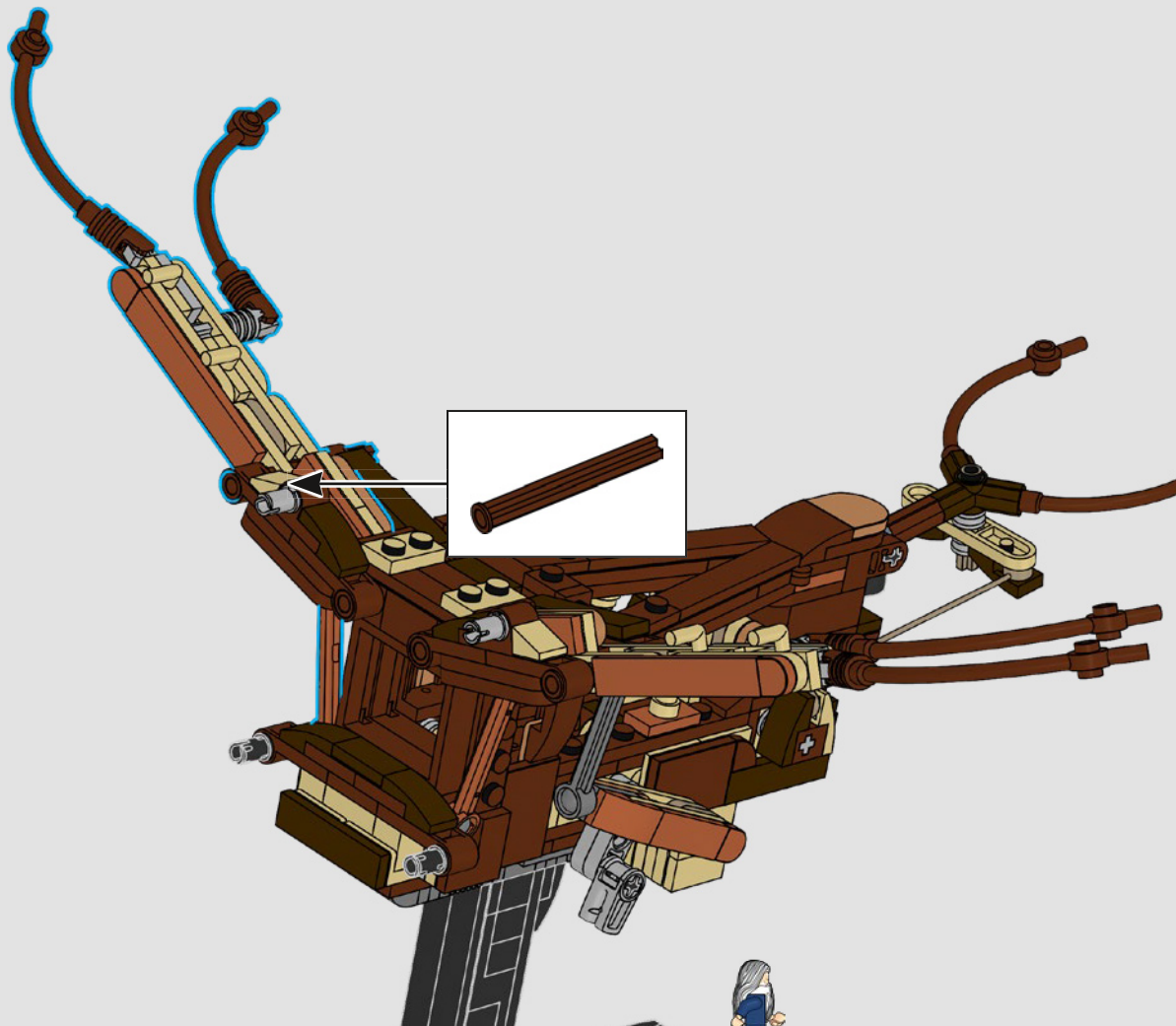


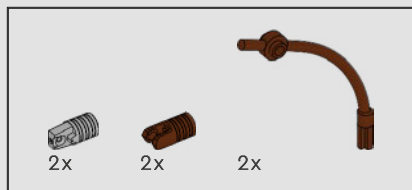
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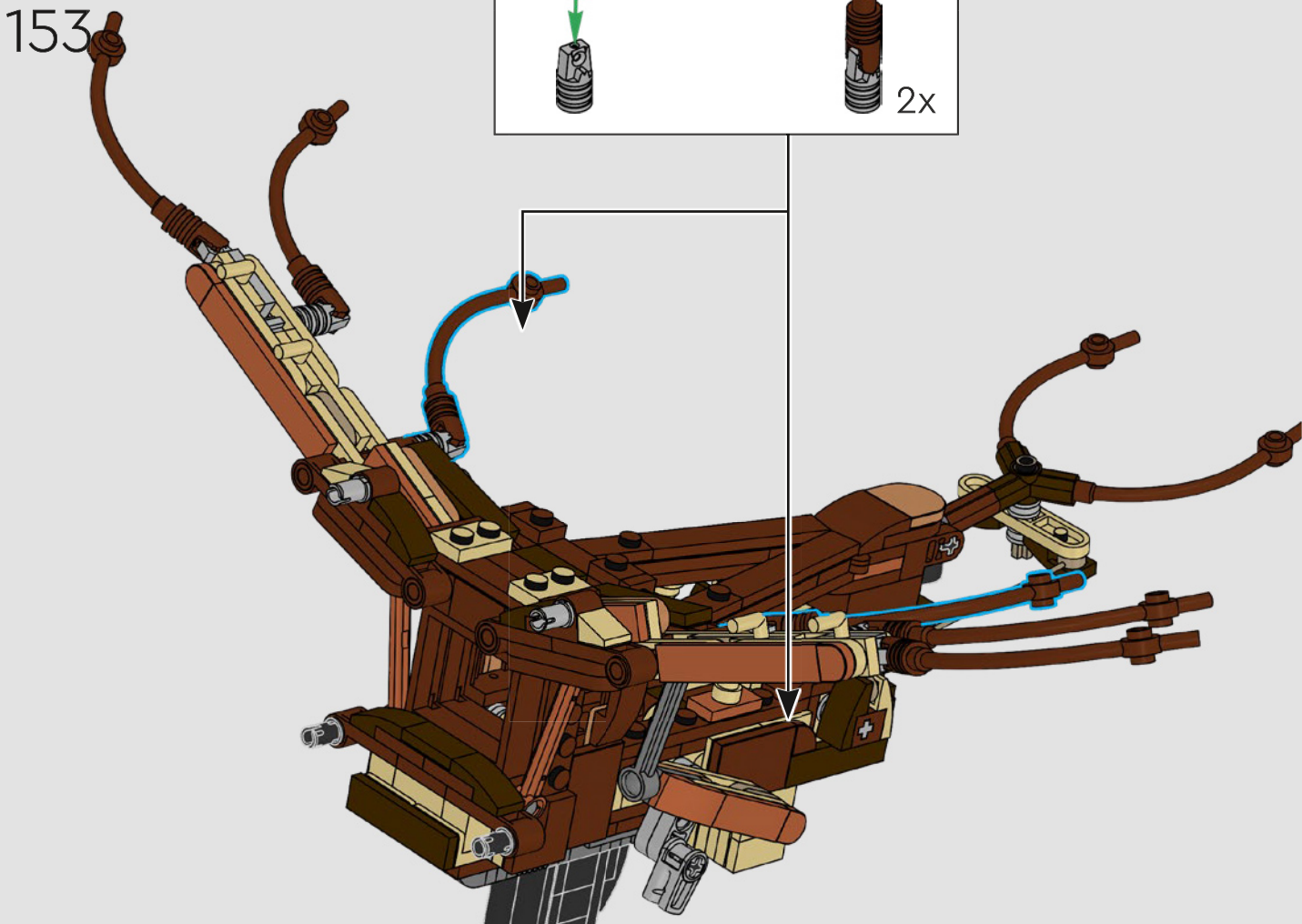
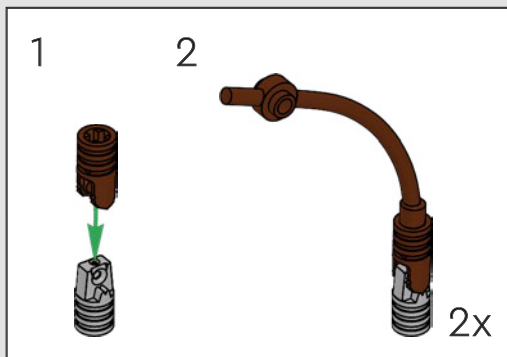


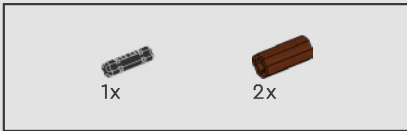
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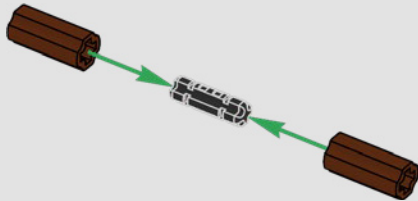


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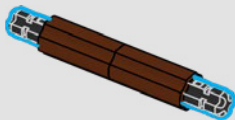




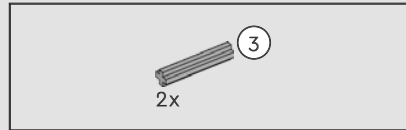
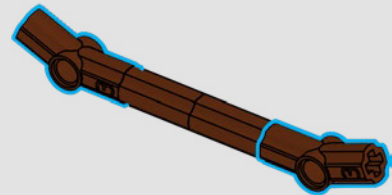
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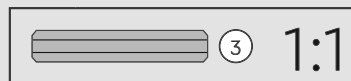
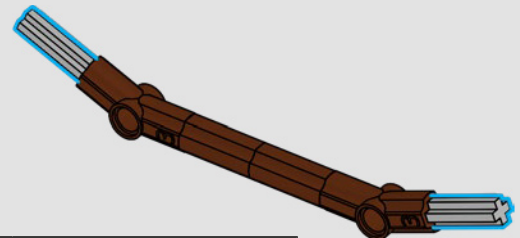
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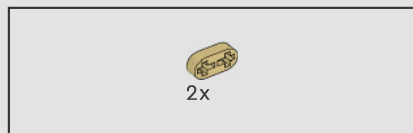


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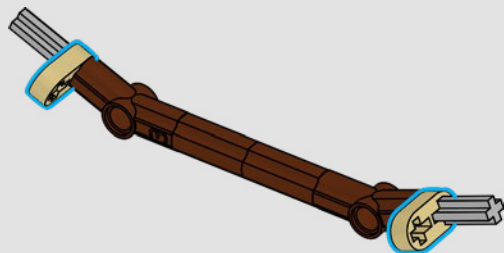


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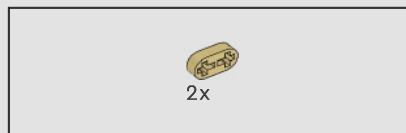
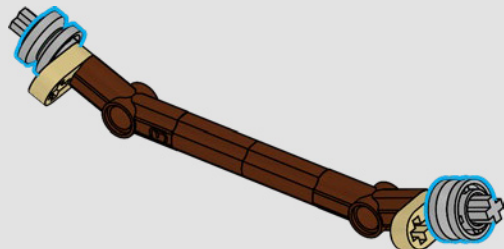




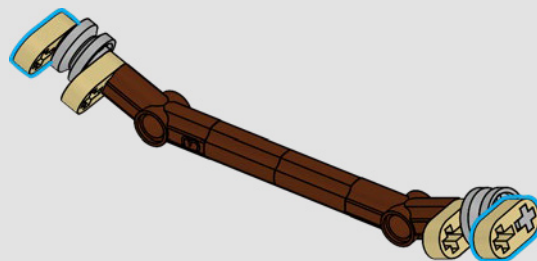
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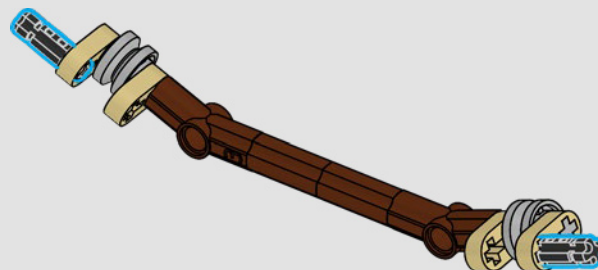
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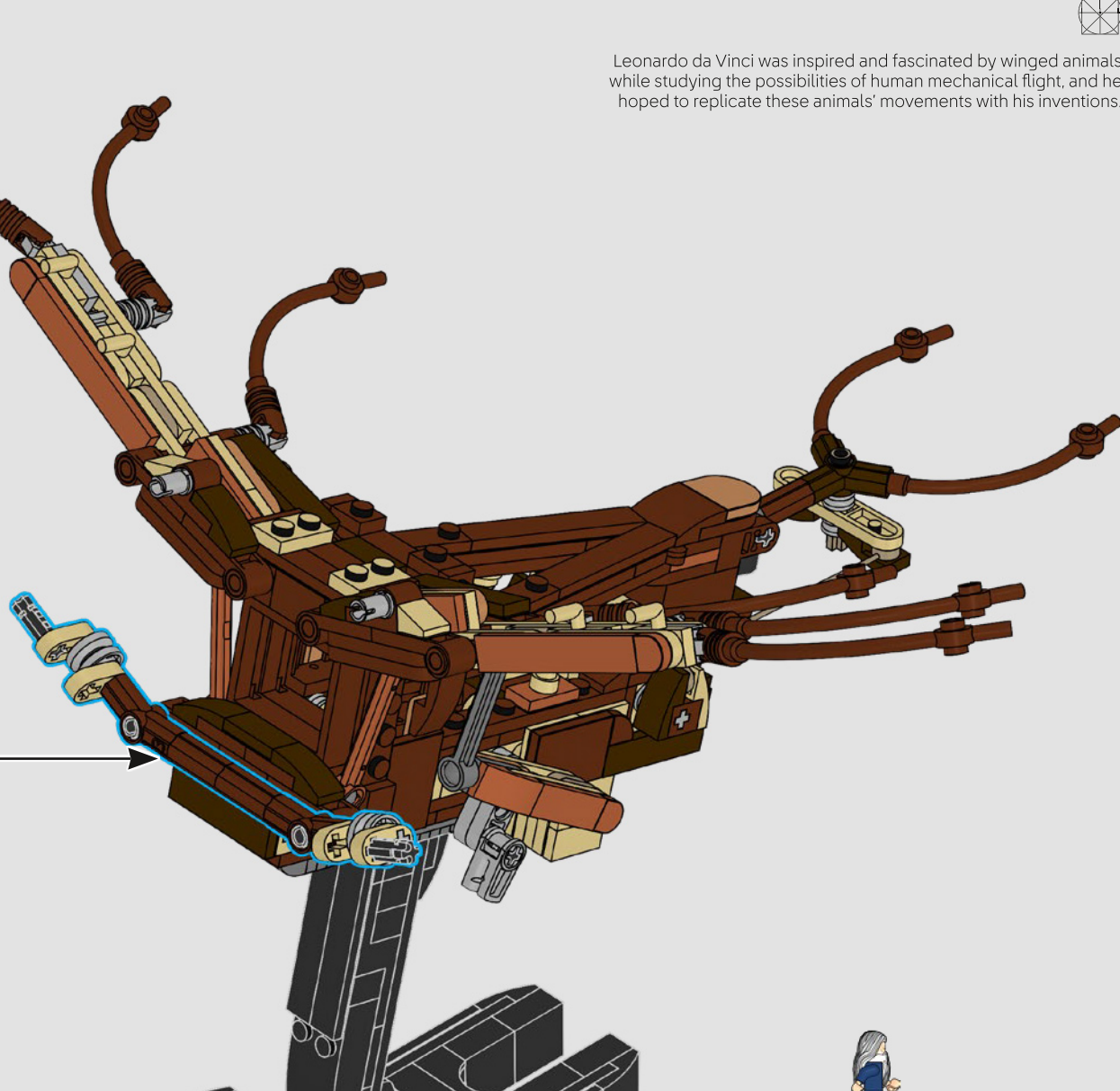
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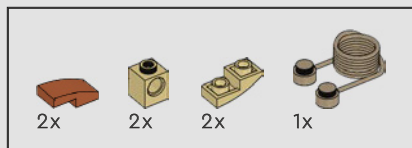




Leonardo da Vinci was inspired and fascinated by winged animals while studying the possibilities of human mechanical flight, and he hoped to replicate these animals' movements with his inventions.

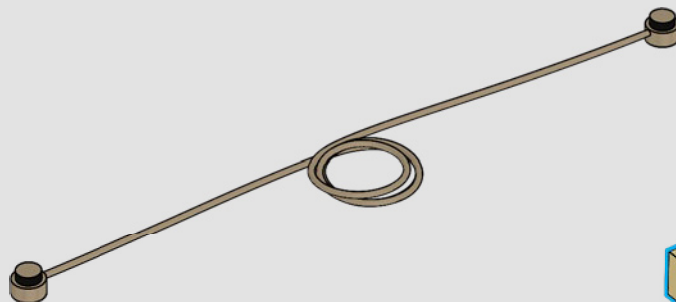
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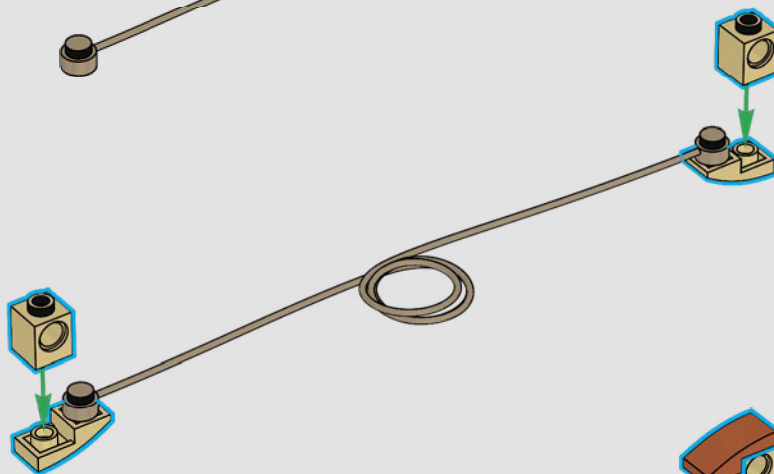


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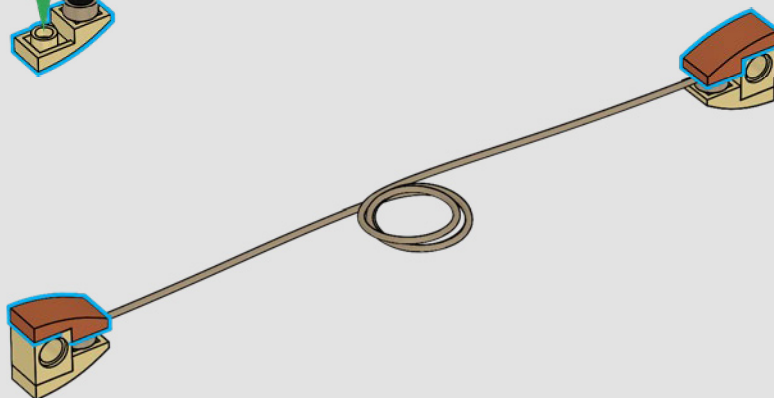
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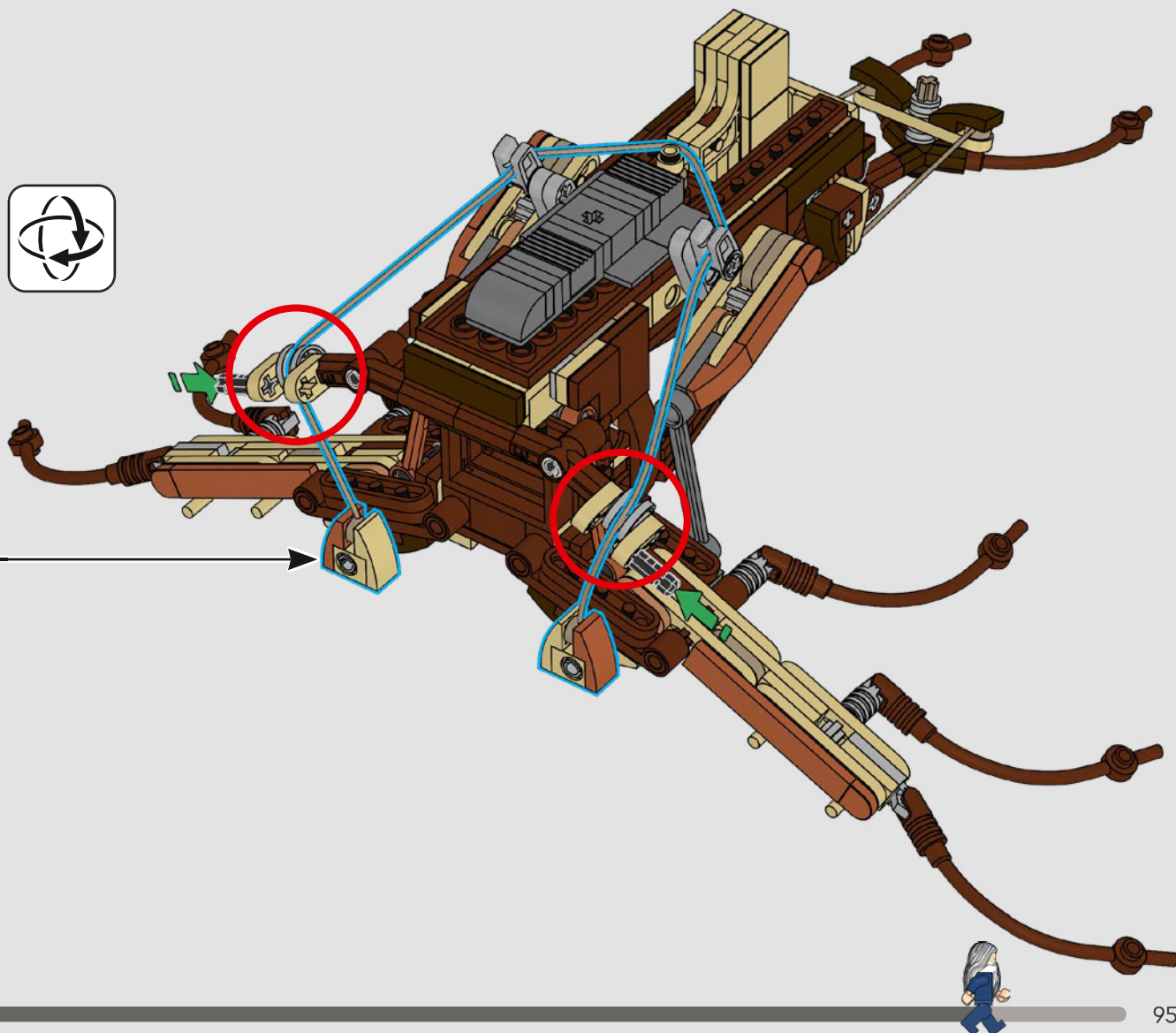
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3

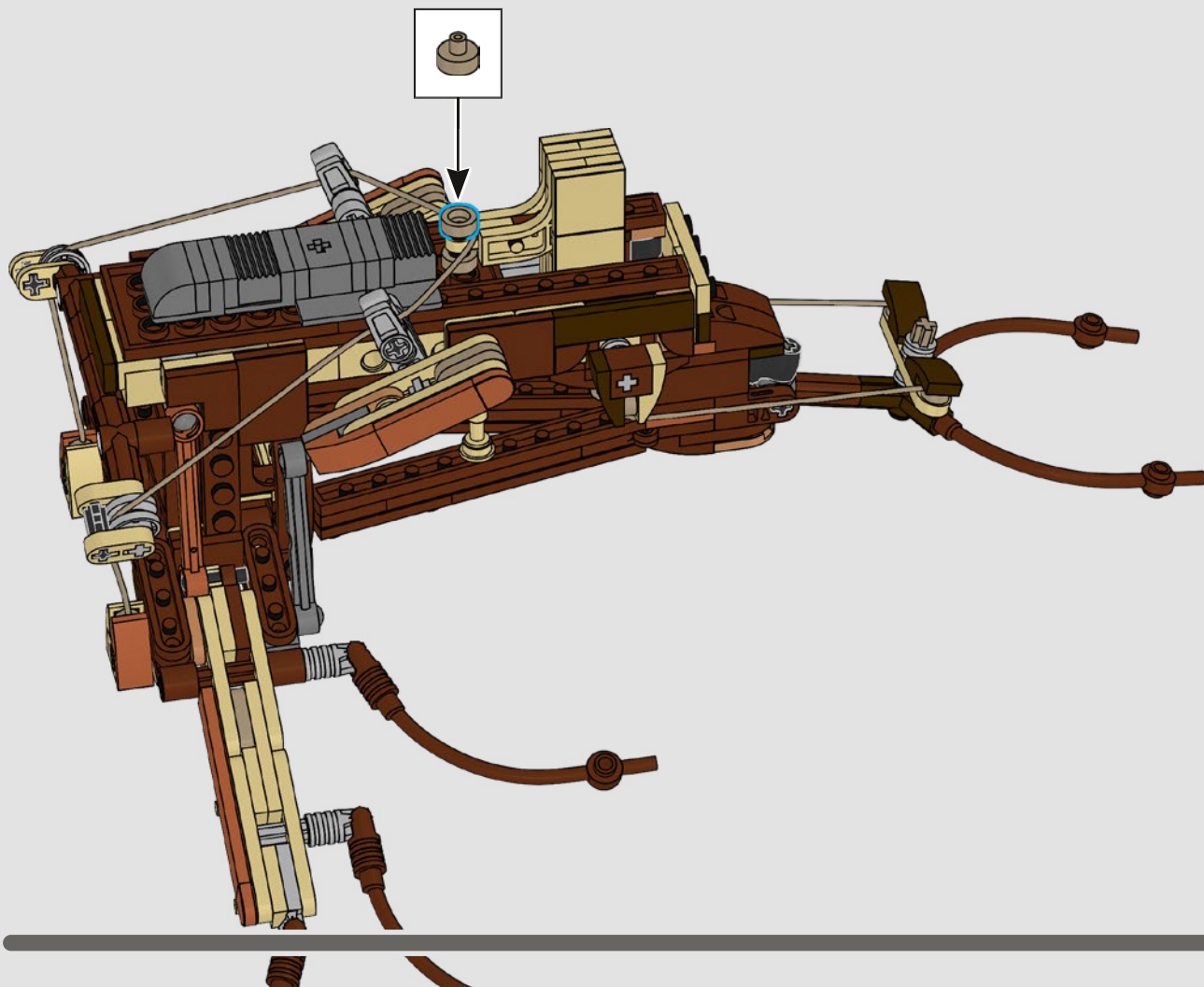




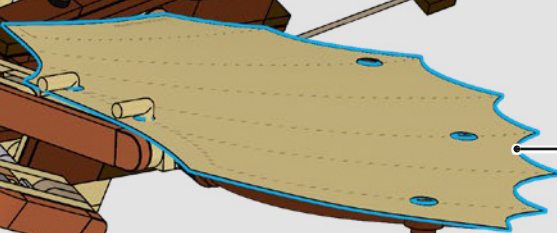
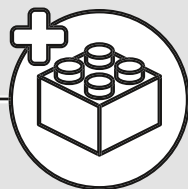
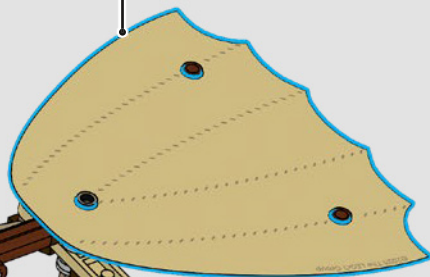
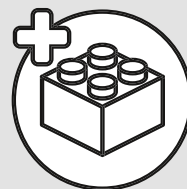
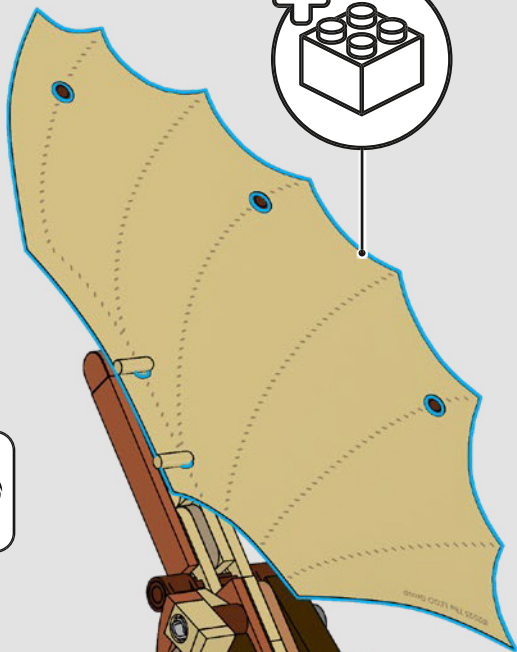
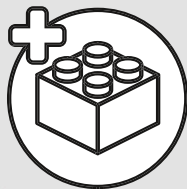


1x

164



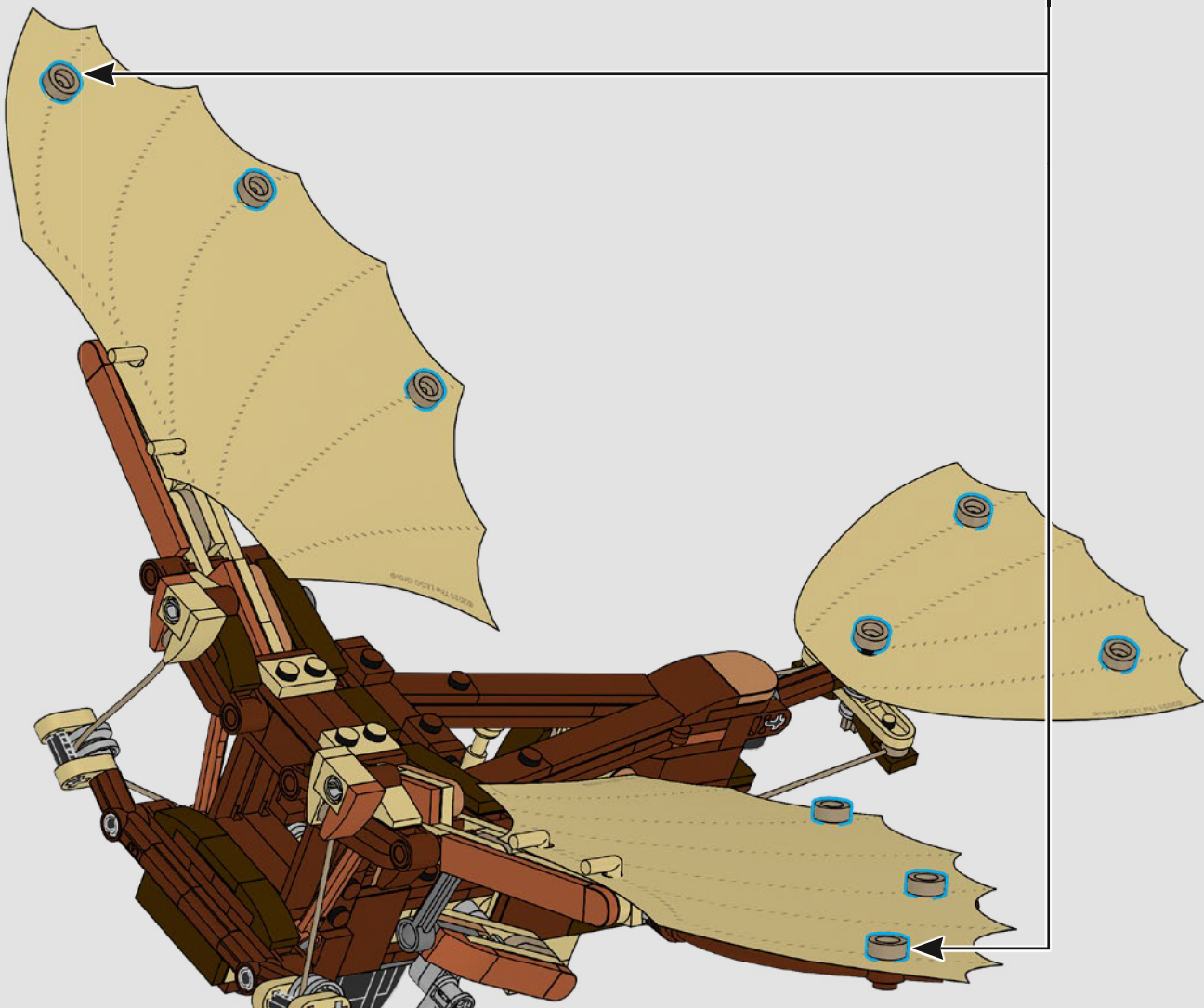
165



9x

9x

166

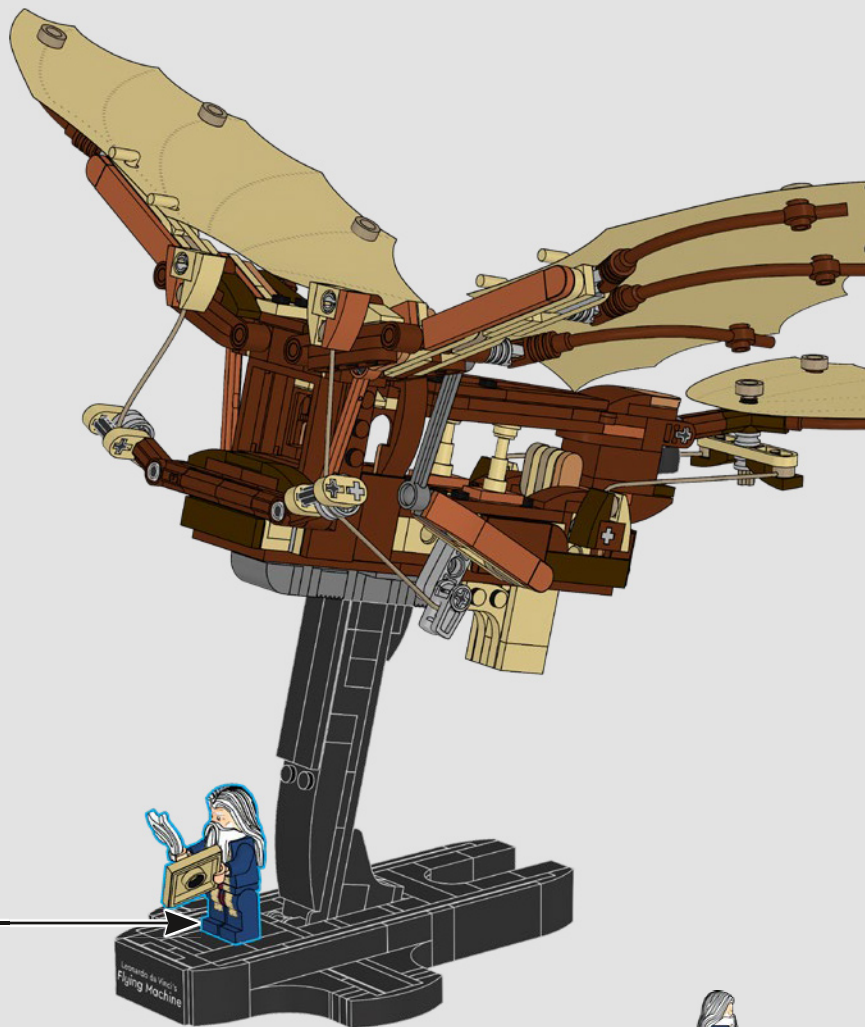
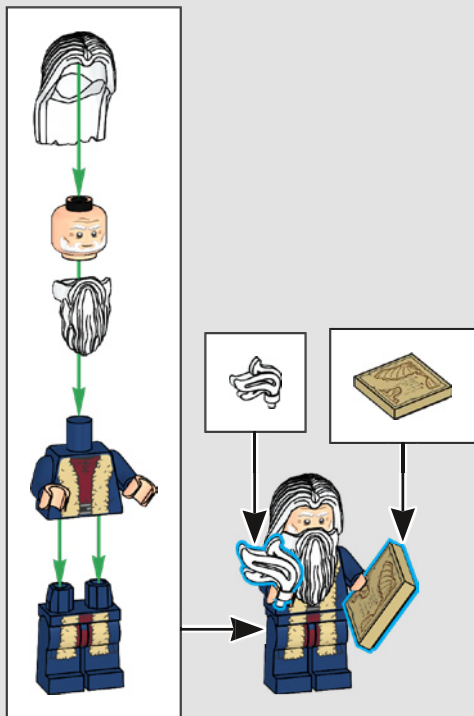






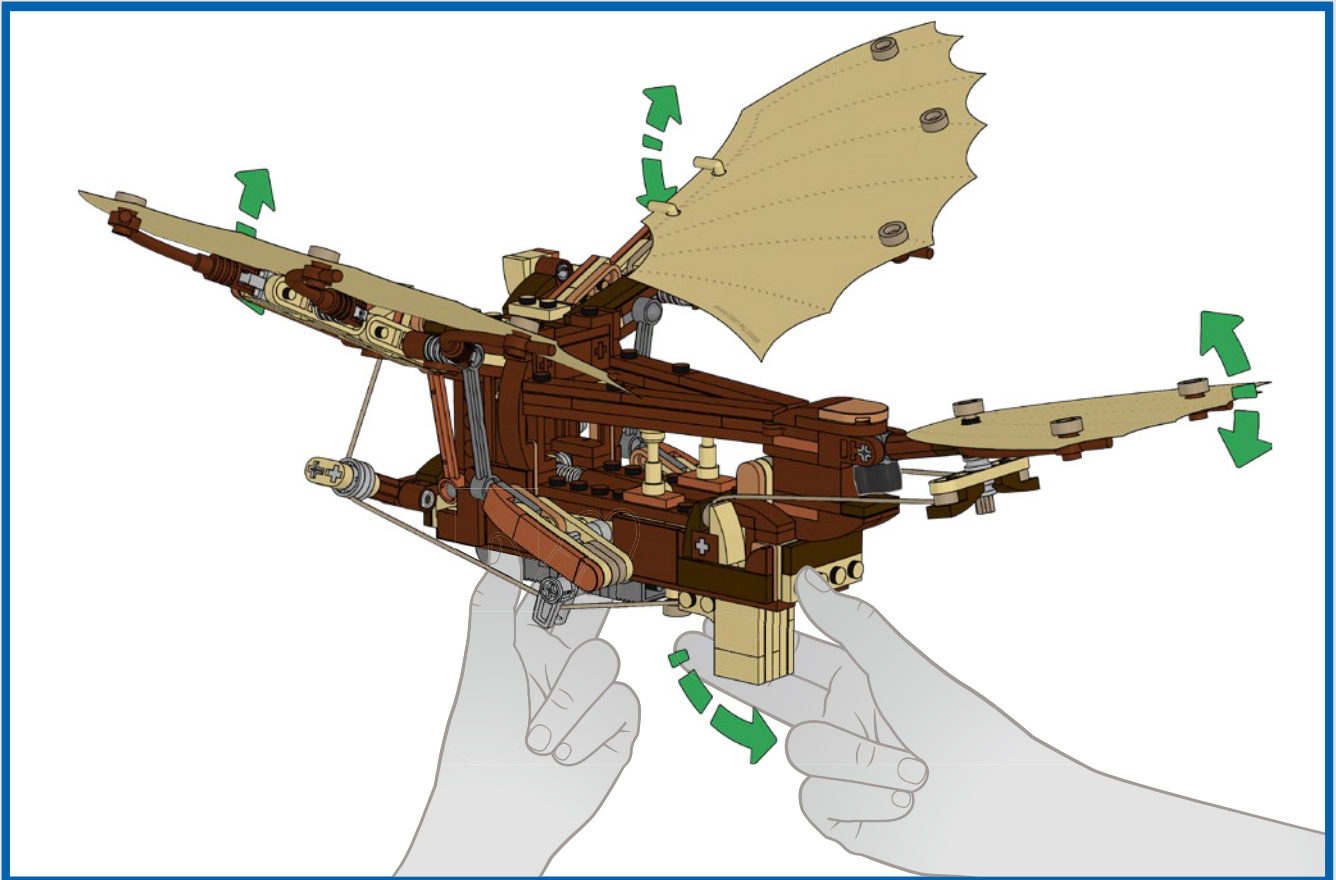
The model was designed so that the trigger can be activated in at least three different ways – on the stand, while held in one hand, and while held with two hands (one on the trigger, the other one holding the model).

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One of the design challenges was to figure out where to place the trigger for the flapping function so that builders' hands don't interfere with any parts of the mechanism or strings.



2x 6424674  
2x 654126  
10x 302426  
2x 6509664  
9x 4109810  
2x 6279875  
1x 4198367  
2x 6114987  
7x 6178922  
4x 302326  
8x 306926  
10x 6275806  
2x 6192309  
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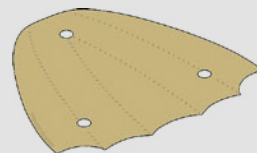
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3x 300326  
4x 6053077  
3x 6469445  
1x 6321745  
2x 4581280  
4x 6154860  
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2x 4613153  
1x 6258904  
1x 300126  
2x 4560182

2x 362326  
1x 6562781  
1x 6533639  
4x 663626  
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1x 611226  
1x 244526  
1x 6523326  
1x 6530674

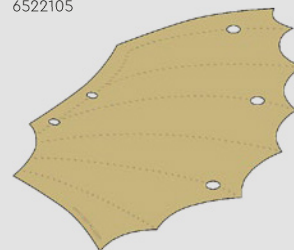
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3x 6507790  
1x 6513939  
4x 6492538  
3x 4206482  
1x 4142865  
2x 6129995  
6x 6443061  
1x 6167923  
4x 4516055  
2x 4179771  
6x 6376461  
2x 6352222  
1x 6281995  
15x 4113917  
2x 4523145

4x 6261357  
4x 6251252  
1x 4114026  
2x 6060850  
2x 6313611  
8x 6117975  
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1x 4159739  
2x 4234365  
6x 4113233

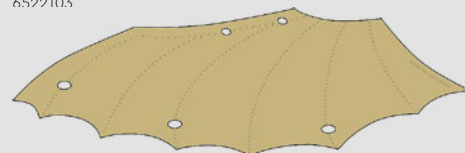
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15x 6311104  
1x 4114309  
1x 6122047  
2x 4112982  
1x 6519042



1x 6522105

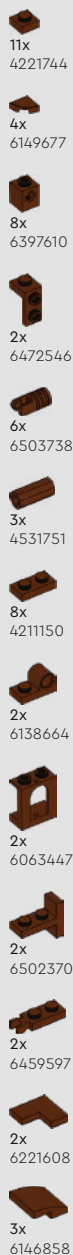


1x 6522103



1x 6522097





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