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ROBOTICS SEMINAR/WORKSHOP

*by Gilbert C. Zamora*



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# LEGO BASICS



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**THE LEGO GROUP**

Though they make toys, they are not just a toy company. Though they are famous for their product, they are defined by their philosophy.

Their name comes from the combination of the Danish "leg godt", which means to "play well." It is both the company's name and nature. LEGO believe that play is the essential ingredient in a child's growth and development. It grows the human spirit. It encourages imagination, conceptual thinking and creation.

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## LIFELONG PLAY



Mitch Resnick is Associate Professor of Learning Research at the Media Lab of the Massachusetts Institute of Technology (MIT), USA. He is one of the key players in the ongoing development of LEGO® Mindstorms™.

Yali Friedman, a Canadian biochemistry PhD student was stumped when asked to explain the structure of DNA on television. The solution? LEGO® bricks. His simple explanation proved so popular that before long, even the guys at Discovery Channel were itching to get their hands on it. Now he explains it to you.



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**PRODUCT**  
**QUALITY & SAFETY**

To the LEGO Group, quality means product quality and ethical values of a high standard. These matters establish a relationship of trust between consumer and company

The LEGO Group uses primarily ABS plastics in the manufacture of its products. This ABS material has been specially developed for LEGO and is not available to others. This has important consequences: for example, no other manufacturer is able to make products with the same unique clutch power, shine properties and colour stability as LEGO Group products possess.

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The company's laboratories continuously test ABS plastics to the extreme in order to improve resistance, for example, to bite marks and scratching.

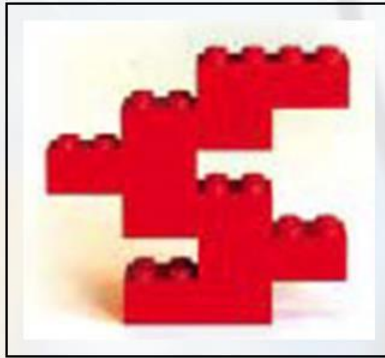
The LEGO Group has opted to ensure that its products not only satisfy the standards for plastics used in making toys but also the regulations that govern food packaging - plus meet a series of specific requirements for the properties of the raw materials.

The company has a development laboratory for plastics materials and a test laboratory in Switzerland as well as its own laboratories in Denmark.

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## THE LEGO ELEMENT

There are 915 million ways of connecting, stacking or combining six eight-stud LEGO bricks.



It is also important to note that all LEGO elements are fully compatible, irrespective when they were made during the period from 1958 to the present or by which factory.

With these reasons, LEGO is being used by several engineering and design schools in making models and designs for new machineries and equipments.

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# ROBOTICS



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## WHAT IS A ROBOT?

- A robot can be defined as a programmable, self-controlled device consisting of electronic, electrical, or mechanical units.
- A machine that functions in place of a living agent.
- Especially desirable for certain work functions because, unlike humans...
  - ✓ they never get tired
  - ✓ they can endure physical conditions that are uncomfortable or even dangerous
  - ✓ they can operate in airless conditions
  - ✓ they do not get bored by repetition
  - ✓ and they cannot be distracted from the task at hand.



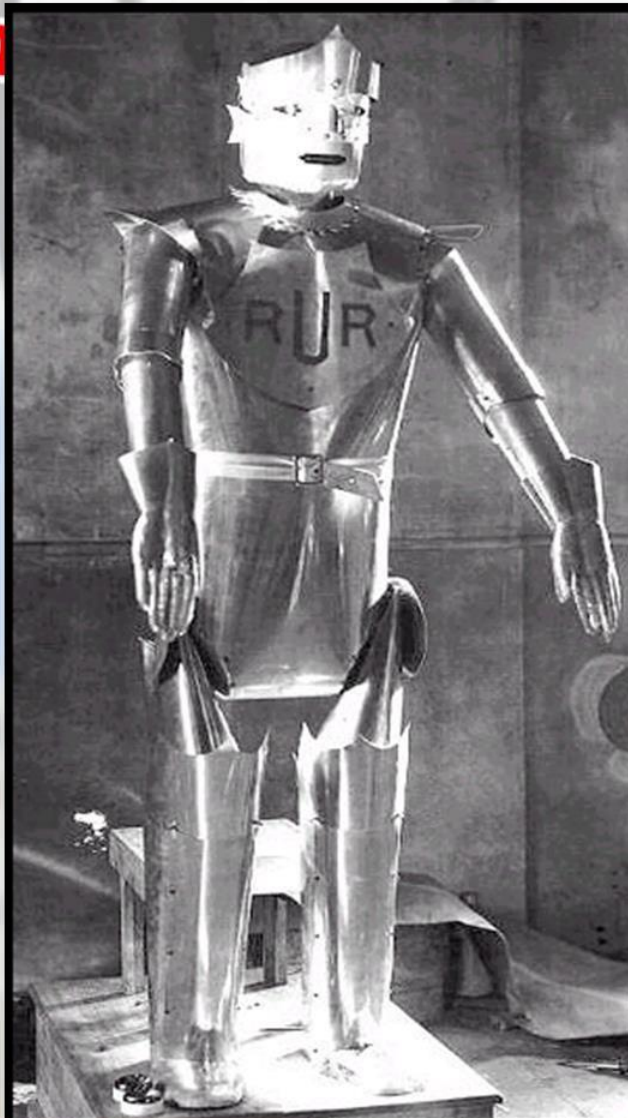
- Robots have been around for less than 50 years
- The ancient Greek poet Homer described maidens of gold, mechanical helpers built by Hephaistos, the Greek god of metalsmiths.
- The golems of medieval Jewish legend were robot-like servants made of clay, brought to life by a spoken charm.
- In 1495, Leonardo da Vinci drew plans for a mechanical man.
- In the 1950s and 1960s, the invention of transistors and integrated circuits gave birth to modern robots.
- The word robot comes from the Czech word “robota”, meaning drudgery or slave-like labor. First used in a fictional 1920s play by Czech author Karel Capek called Rossum’s Universal Robots

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The RUR robot which appeared in an adaptation of Karl Capek's *Rossum's Universal Robots*. [[Click](#) for a larger image.]



The *RUR* robot which appeared in an adaptation of Czech author Karel Capek's *Rossum's Universal Robots*. Circa 1930s.

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# LEGO ELEMENTS



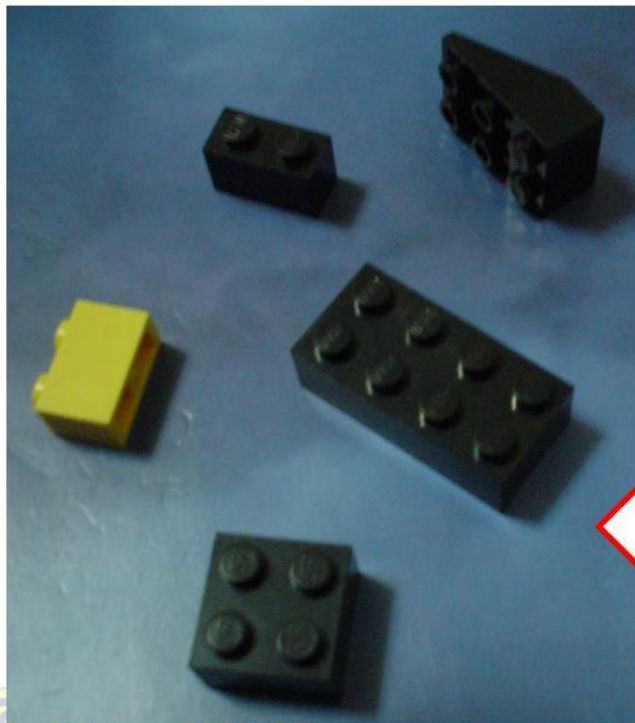
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**Plates** = these are the flat pieces (like plywood)



**Bricks** = resembles a ceramic brick or a hollow block

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**Beams** = these are like steel beams with holes. Long bricks with holes



**Axles** = looks like long rods with groove

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**Gears** = round flat wheels with teeth

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**Wheels and Pulleys**  
= wheels with groove  
in the middle

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**Pegs, Extenders and Bushings** = small parts that are used to connect and fasten LEGO beams, axles and other special LEGO elements



**Hubs** = rims for the rubber wheels; **Rubber tires and Caterpillar treads** = fits on the hub for the robot's locomotion

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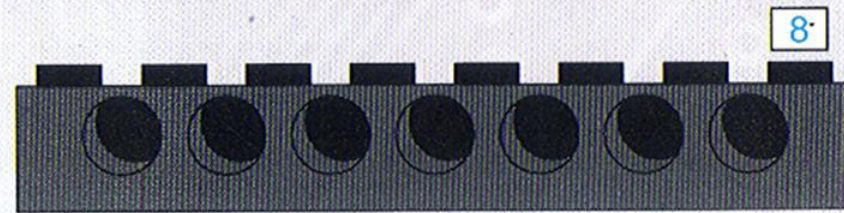
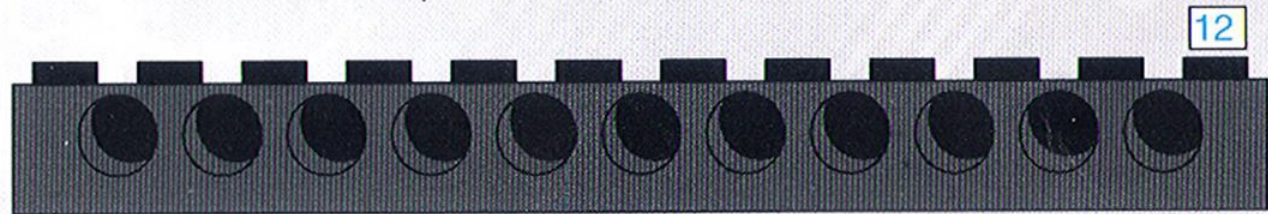
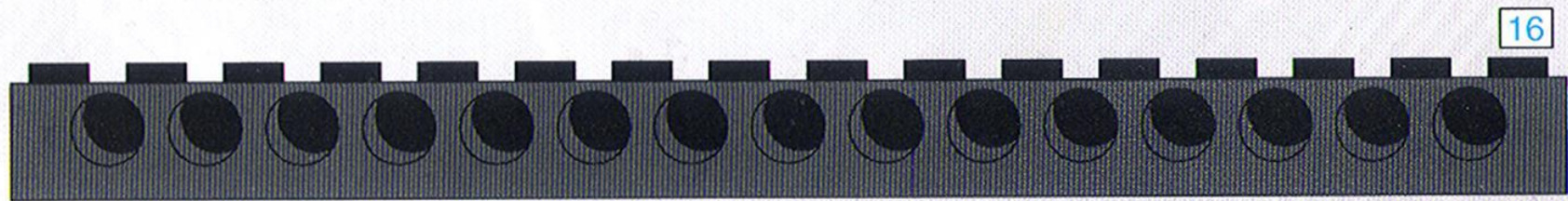
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**Other special LEGO elements** = tubings, arms, angle elements, etc.



# Learn robotics @ your command™ Measurements



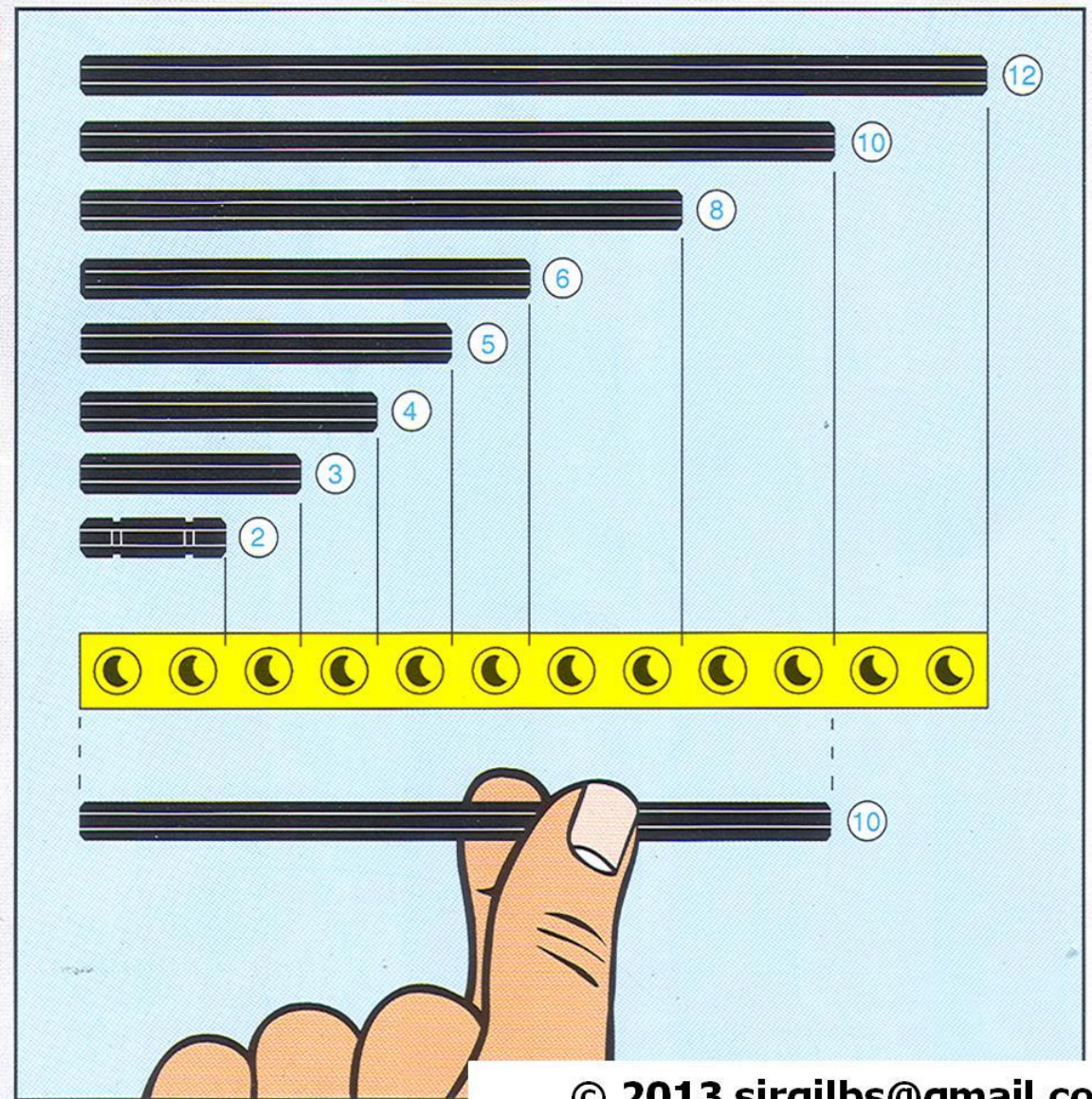
Measurement of the beam is by the number of studs on top of it.

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## Measurements

Measurement of the axle is also by the number of studs it equals with the beam.

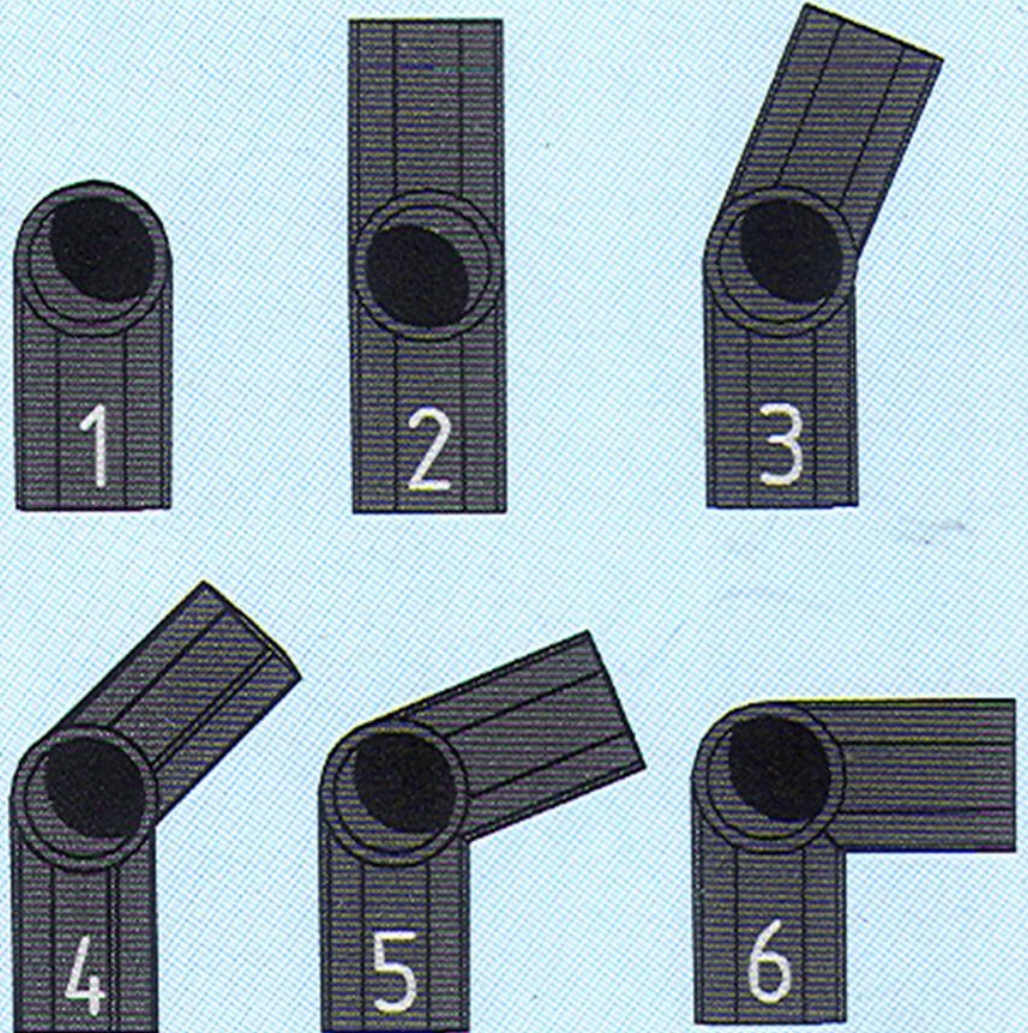


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### Measurements

The numerical number printed on the angle element identifies one from the other. For example, 1 = 0 degree; 6 = 90 degrees bend; 5 = 112.5 degrees bend



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# CONSTRUCTION TIPS AND TRICKS

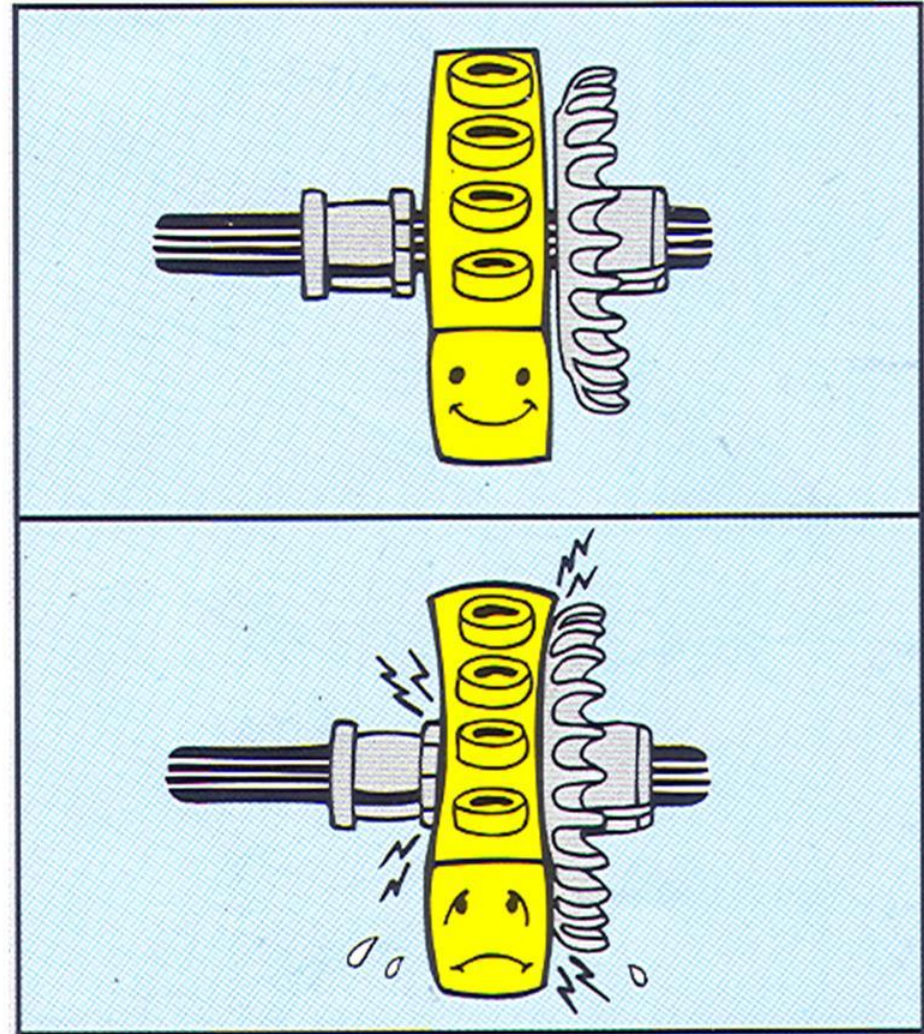


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## BUILDING TIPS, TECHNIQUES AND TRICKS<sup>TM</sup>

When connecting gears or wheels in beams, be careful not to put too much pressure between the gear/wheel and the beam. This will cause too much friction stressing the motors and shortening battery life.

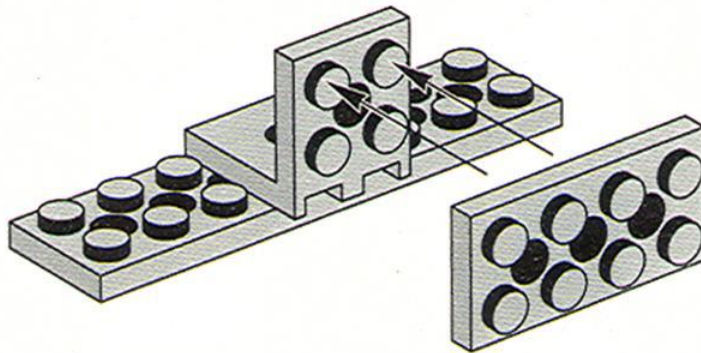
Gears and wheels must turn freely with minimum obstruction.



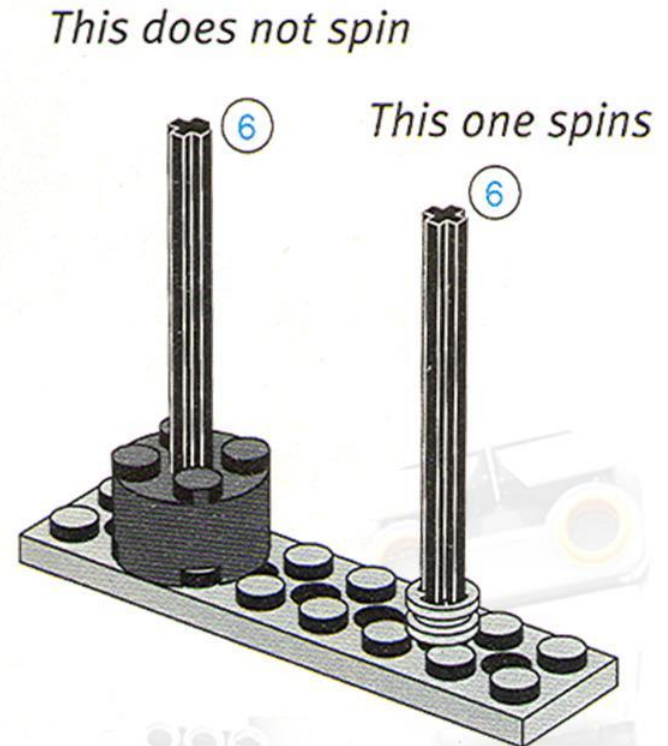
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## BUILDING TIPS, TECHNIQUES AND TRICKS



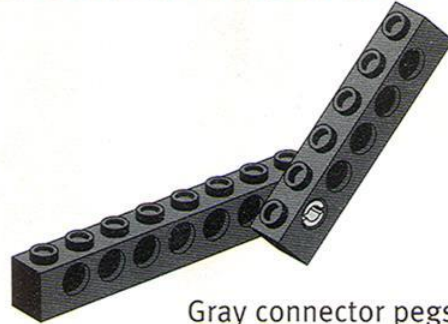
Making angles



Adding axles

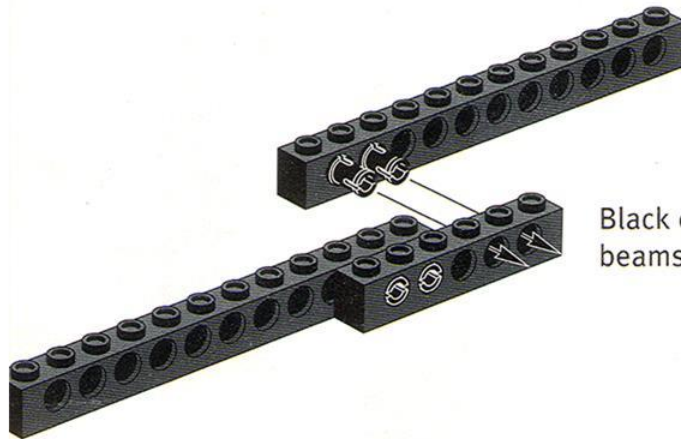
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## BUILDING TIPS, TECHNIQUES AND TRICKS

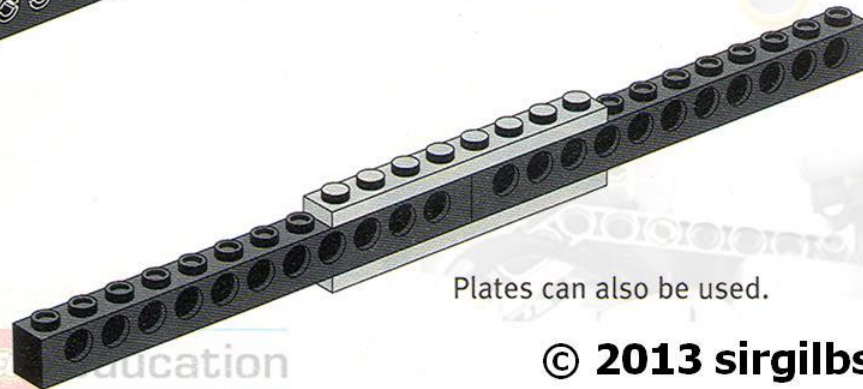


Gray connector pegs allow moveable connections.

Connecting two beams



Black connector pegs lock beams firmly.



Plates can also be used.

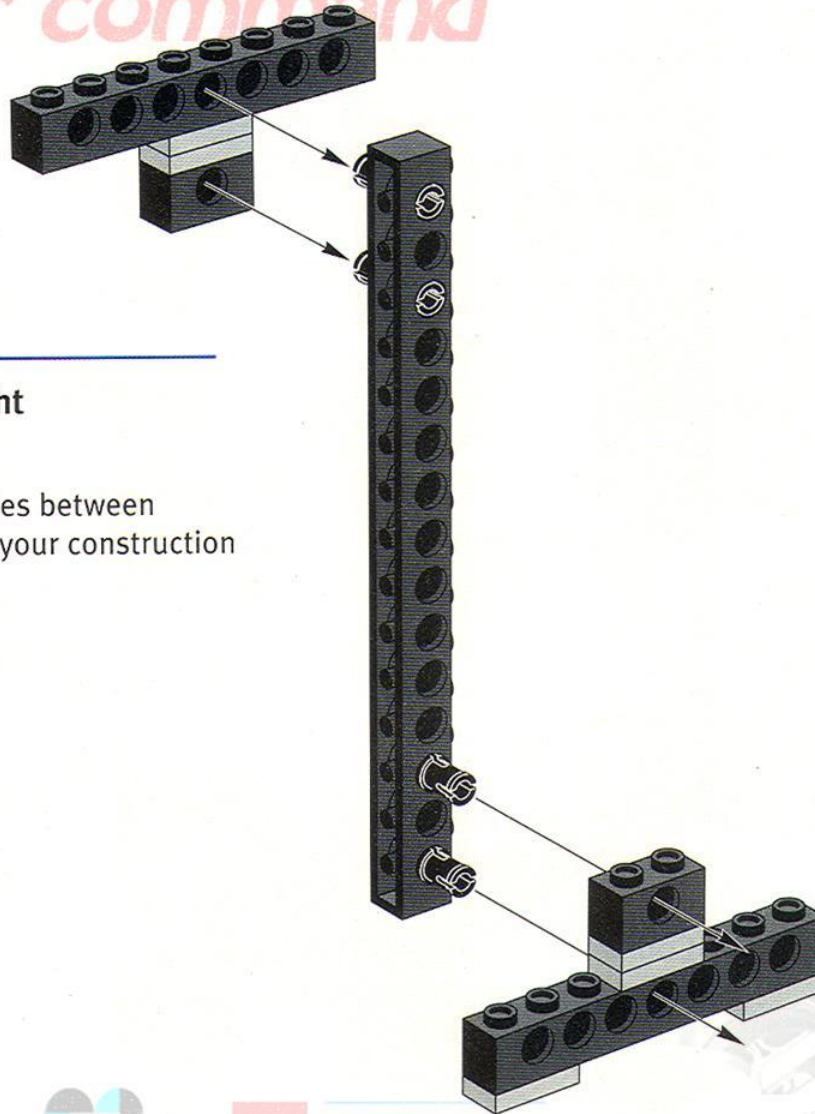


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## BUILDING TIPS, TECHNIQUES AND TRICKS

### Adding height

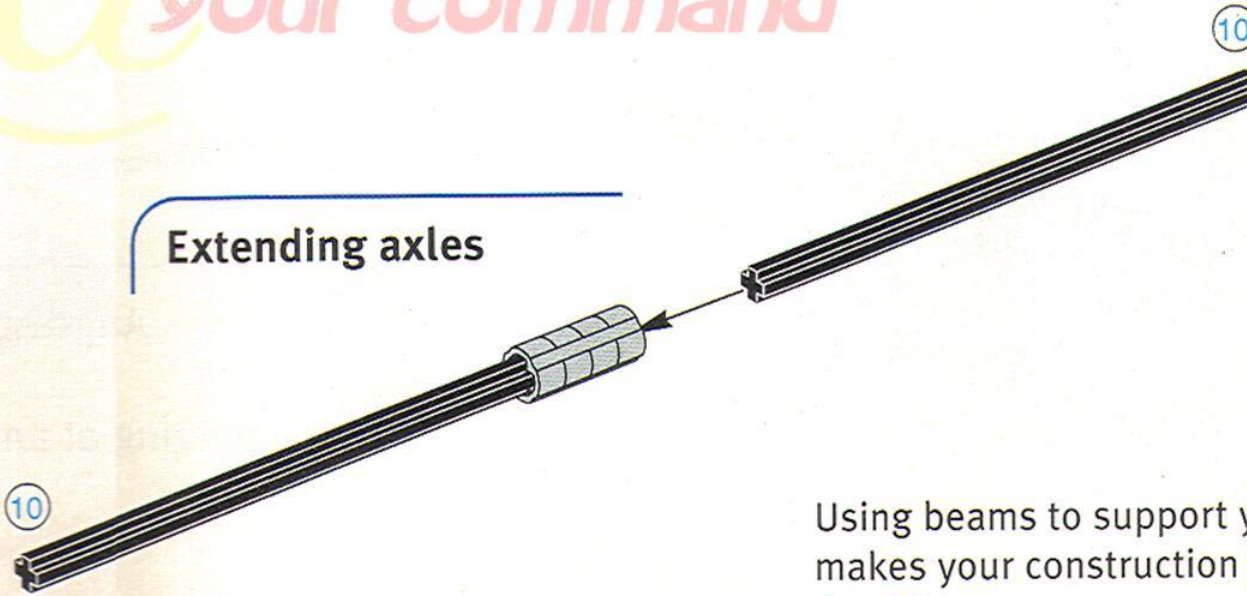
Using two plates between beams makes your construction more durable.



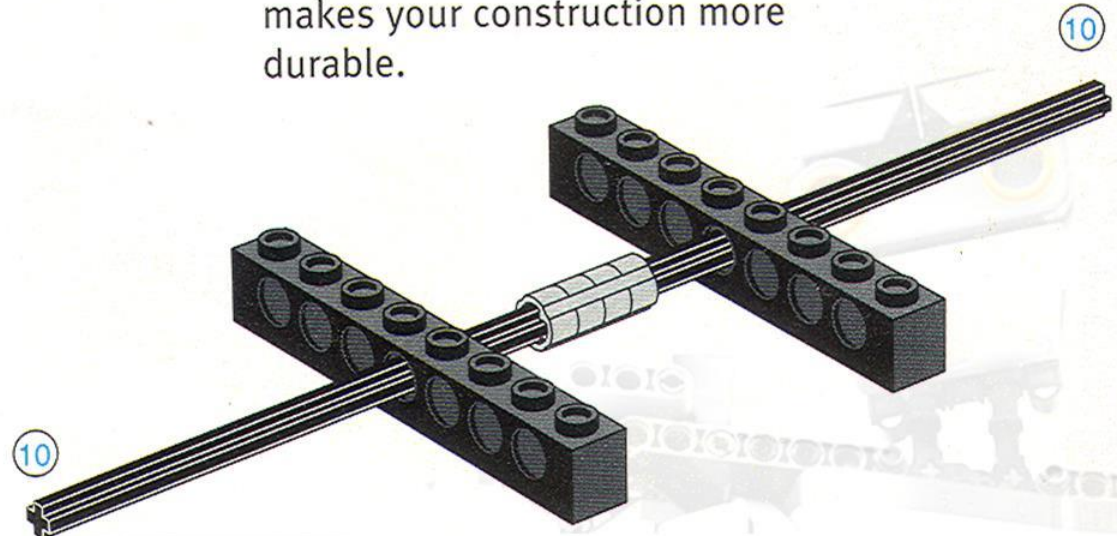
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## BUILDING TIPS, TECHNIQUES AND TRICKS

Extending axles

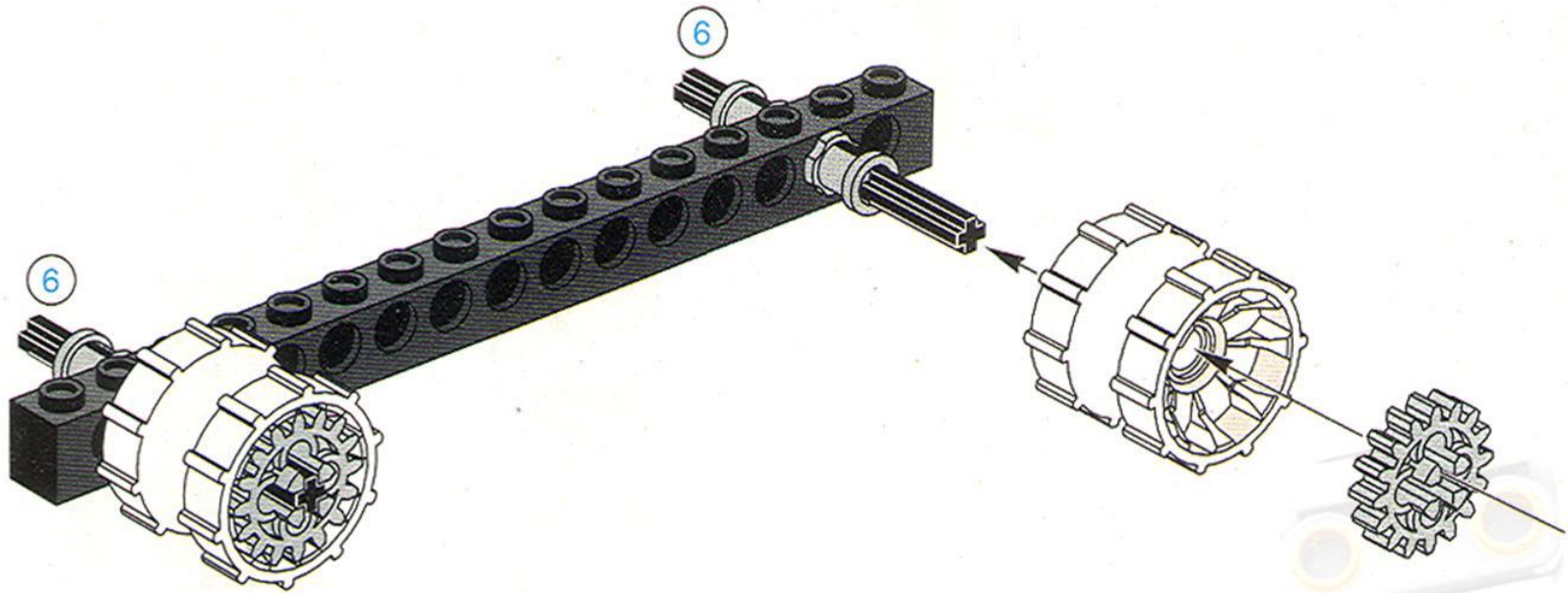


Using beams to support your axles makes your construction more durable.



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## BUILDING TIPS, TECHNIQUES AND TRICKS



### Adding hubs for caterpillar treads

The gears allow the hubs to revolve.

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## BUILDING TIPS, TECHNIQUES AND TRICKS

Ideas for  
connecting  
wheels for  
locomotion

