NATIONAL SCIENCE EDUCATION STANDARDS

A. Science as Inquiry

Abilities necessary to do scientific inquiry
Understanding about scientific inquiry

E. Science and Technology

K–4

Understandings about science and technology

- o People have always had problems and invented tools and techniques (ways of doing something) to solve problems.
- o Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.

Abilities to distinguish between natural objects and objects made by humans

- o Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life.
- o Objects can be categorized into two groups, natural and designed.

5–8

Understanding about science and technology

- o Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
- o Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

G. History and Nature of Science

5–8

Science as a human endeavor

- o Science is very much a human endeavor.

Written by Julia Wall

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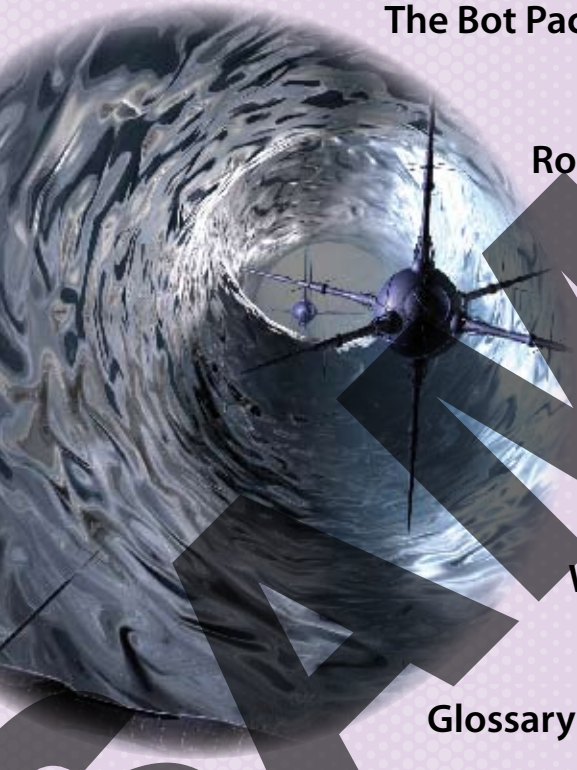
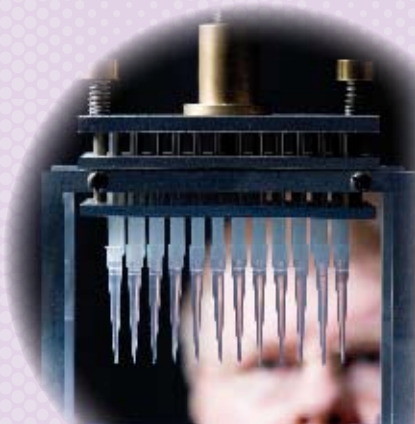
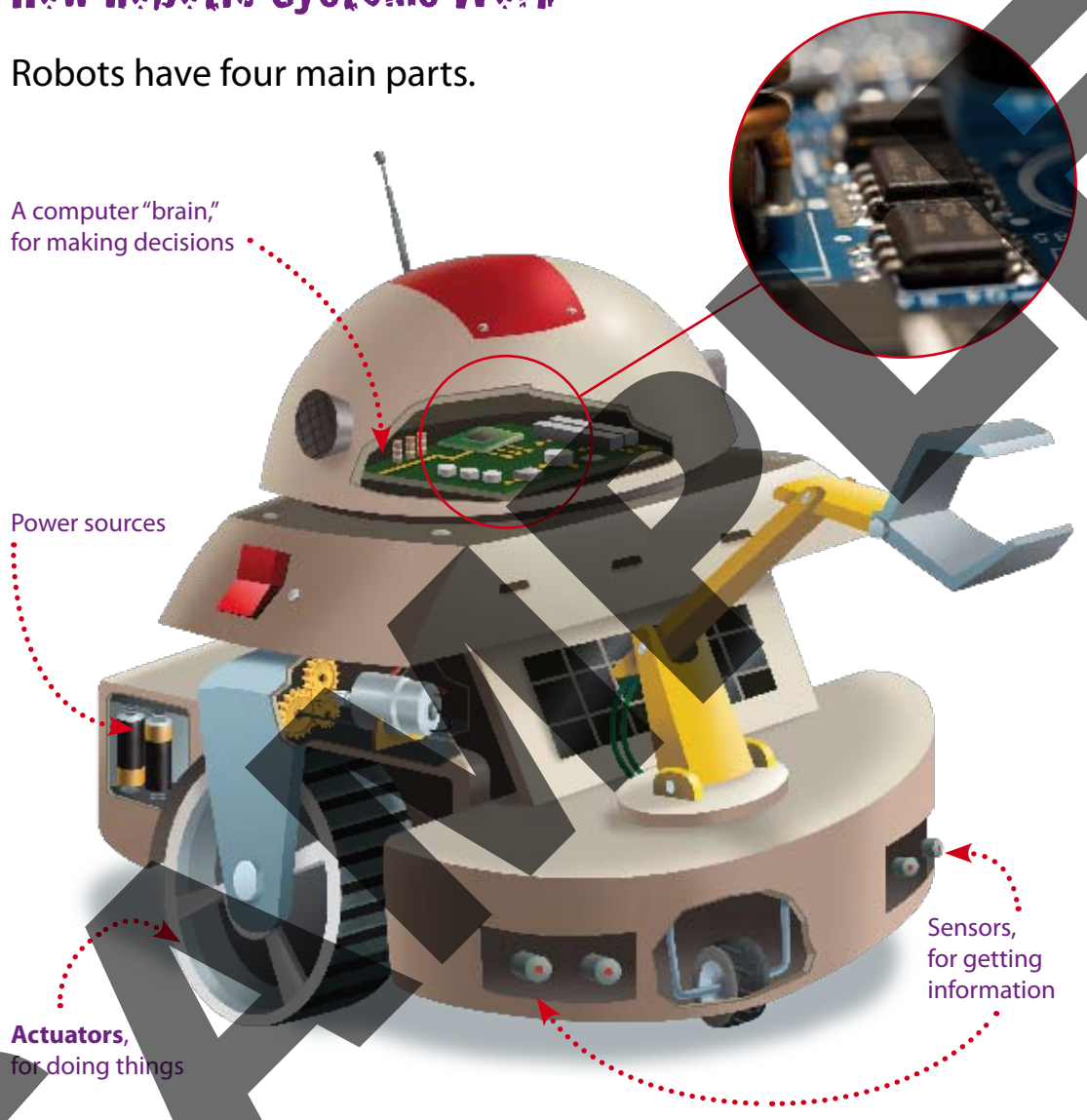




How Robotic Systems Work

Robots have four main parts.

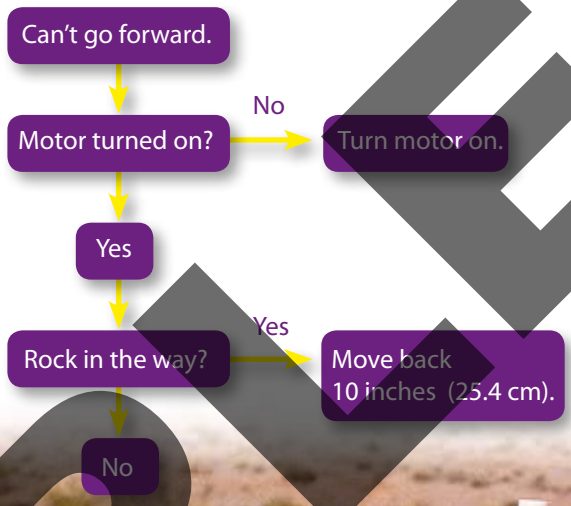


We control robots by programming their computers—putting instructions in their computers that tell them how to think. A robot that can learn from its mistakes has artificial intelligence (AI).

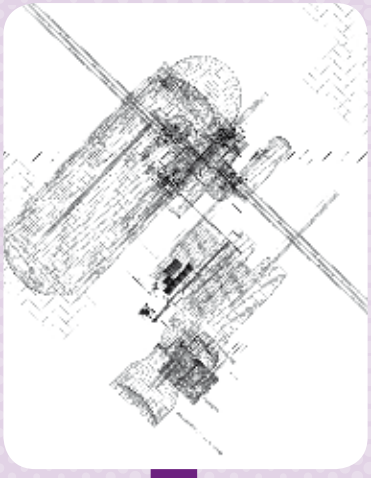
Algorithms

Algorithms are step-by-step rules for doing something. The programs that control robots use algorithms so that the robot knows what to do. Here is part of an algorithm a robot could use.

An algorithm

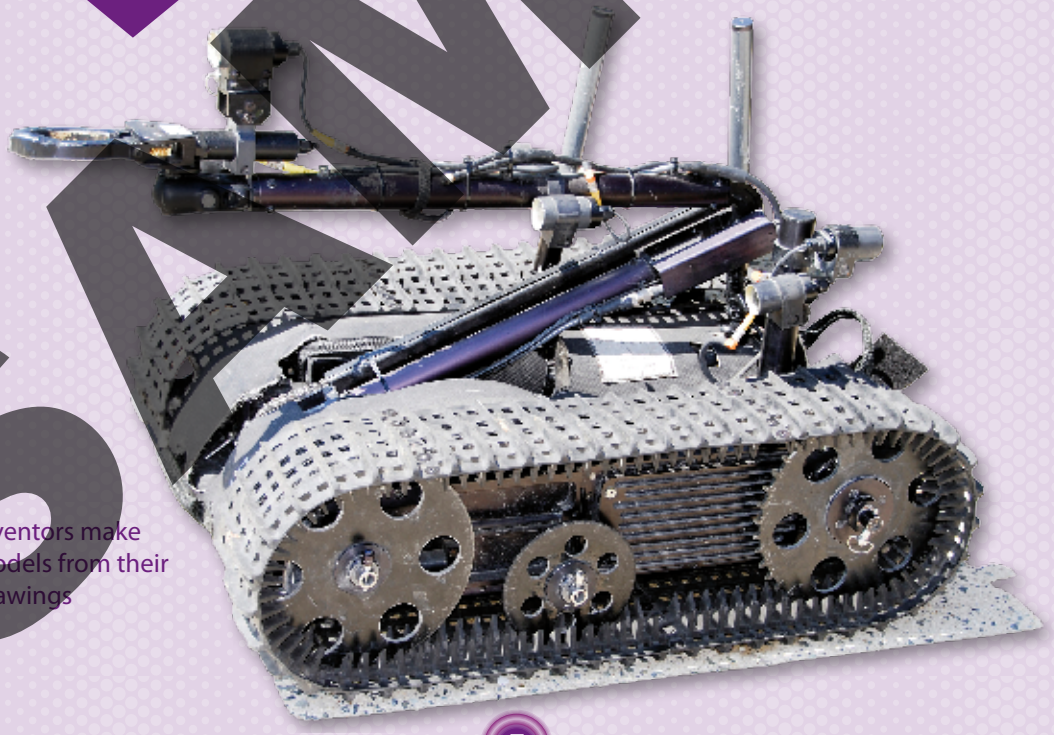


ROBOTIC APPLICATIONS



People invent robots to solve problems. These are called applications. For example, one **inventor** in the Philippines, Roel Judilla, wanted to solve the problem of how to **defuse** a bomb safely. He decided it would be safer to use a robot to do this job.

He began by drawing something that he thought might work. Using his drawing, he made a model.



Inventors make models from their drawings

Space Bots

We are already using space bots to explore outer space. Space bots are programmed to do things like **analyze** gas or pieces of rock and take photographs. Space bots are controlled by signals from earth when they are near earth. But what happens once they are a long way away?

Voyager 1 and *Voyager 2* explored the outer planets in our solar system. Then they became the first space bots to leave our solar system.

Once space bots are too far away for signals to reach them quickly, they need to have AI—they need to be programmed to do some things on their own.

The Phoenix Mars Scout digs into the soil to see if there is ice underneath.