GET YOUR STUDENTS EXCITED ABOUT SCIENCE, MATH,
READING AND THE FUTURE WITH...

WORLD OF ROBOTS

School Assembly Programs

A Window to Our Technological and Scientific Future

Teacher Guide
(K-8)

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Presentations

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ROBOTS IN HISTORY

The concept of robots dates back to classical mythology and even ancient legend where gods created mechanical people to be servants, soldiers, or utilitarian objects that moved under their own power.

Topics for research: Cadmus, Pygmalion, Vulcan, Hephaestus, Golem, Mistcalf

Ancient Greek texts also detail stories of automata that were used for theater and religious purposes, including organs, water clocks, and other complex mechanical devices.

Topics for research: Hero of Alexandria, Ctesibus, Vitruvius, Vitruvian Canon

Perhaps inspired by these ancient accounts, Leonardo da Vinci is credited with the first design of a humanoid robot in around 1495. The mechanical knight, based on his Vitruvian Man, was designed to sit up, wave, move its head, and open and close its mouth. The detailed drawings, rediscovered in his notebooks in 1950, include designs for the joints, as well as a programmable controller in the chest to direct their movements. It is unknown whether da Vinci ever attempted to build his robot.

In 1738, Jacques de Vaucanson built the first known functioning robots, including an android that played the flute and a duck that allegedly ate and digested grain. But many people consider Nikola Tesla to be the father of modern robotics. Tesla's radio-operated boat, which was demonstrated at Madison Square Garden in 1898, was based on his patent for "teleautomation."

Other milestones in robot history:

1939: Westinghouse unveils Elektro, a humanoid robot, at the World's Fair.

1948: Grey Walter of Bristol University in England develops the first electronic autonomous robot.

1969: Shakey the Robot, the first fully mobile robot with artificial intelligence, is developed at the Stanford Research Institute.

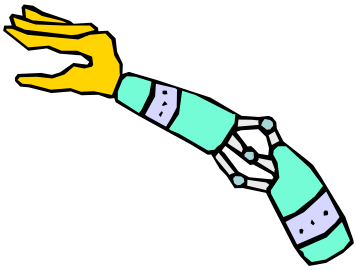
ROBOTS IN LITERATURE

The word "robot" appeared for the first time in 1920 in a play by Karel Capek called “R.U.R.” (an abbreviation for Rossum's Universal Robots). It comes from the Czech word "robota" meaning "labor."

Isaac Asimov was the first author to use the word "robotics" in his story called *Runaround* in 1942. Later, in his *I, Robot* series, Asimov outlined the "Three Laws of Robotics," which were meant to control competition between robots and humans:

1. A robot may not harm a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by the human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence, as along as such protection does not conflict with the First or Second Law.

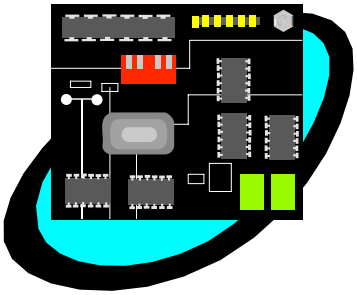
Since then, there have been many, many fictional books and movies on robots and the role they could someday play in our society.



PARTS OF A ROBOT

Basically, robots are computers that move. They can be designed to do many different things, but are generally used to perform tasks that are too dangerous, difficult, or dull for humans. They can go places where humans cannot go without expensive protection, such as under water or into outer space; they can work for hours on end without needing sleep; and they are generally good at doing the same thing without making mistakes.

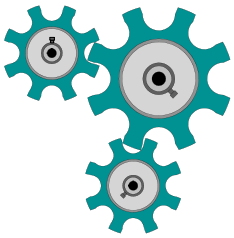
The "brain" of every robot is its central processing unit (CPU), which is made up of one or more computers that control what the robot does. The CPU receives input from a variety of sources.



Input ports can be hardwired or wireless and are used to transfer data and information directly to the robot from other electronic devices (such as computers, keyboards, or control panels) to the robot. They can also be used to send information from the robot to other types of equipment such as machinery in a manufacturing plant.

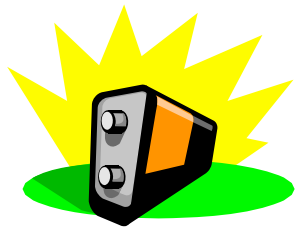
Sensors allow robots to detect and record information directly from their environment, for example:

- Audio sensors pick up sounds (such as voices, music, or coded beeps). Many are capable of distinguishing differences in volume, tone, pitch, and frequency so they can respond to a wide variety of audible commands.
- Video sensors (such as cameras) detect and encode images. They range from simple shape recognition devices to complex systems with sophisticated color and pattern recognition capabilities.
- Distance and position sensors (including sonar and infrared detectors) help robots navigate and even allow them to construct maps of their environment, while motion sensors detect when there is movement around them.
- Tactile sensors allow a robot to touch and feel. They can be very important when handling fragile objects.
- Environmental sensors provide information like temperature, pressure, and humidity.



Because robots are computers that move, they generally need motors (also called actuators) for movement or locomotion. The motors can drive wheels, propellers, or legs for the robot to get around. They also provide power for manipulators (such as arms, hands, and grippers) that give robots the ability to handle physical objects.

Robots can also be equipped with a variety of output devices to relay information back to their operators. These include things like speakers (for audio information) and indicator lights, gauges, or displays (for visual information).



And, of course, the whole thing needs a power cord, battery, or other source of electricity in order for everything to work!

TOPICS FOR RESEARCH

Current Uses for Robots:

Industrial Automation
Space Exploration
Medicine
Military Applications
Entertainment

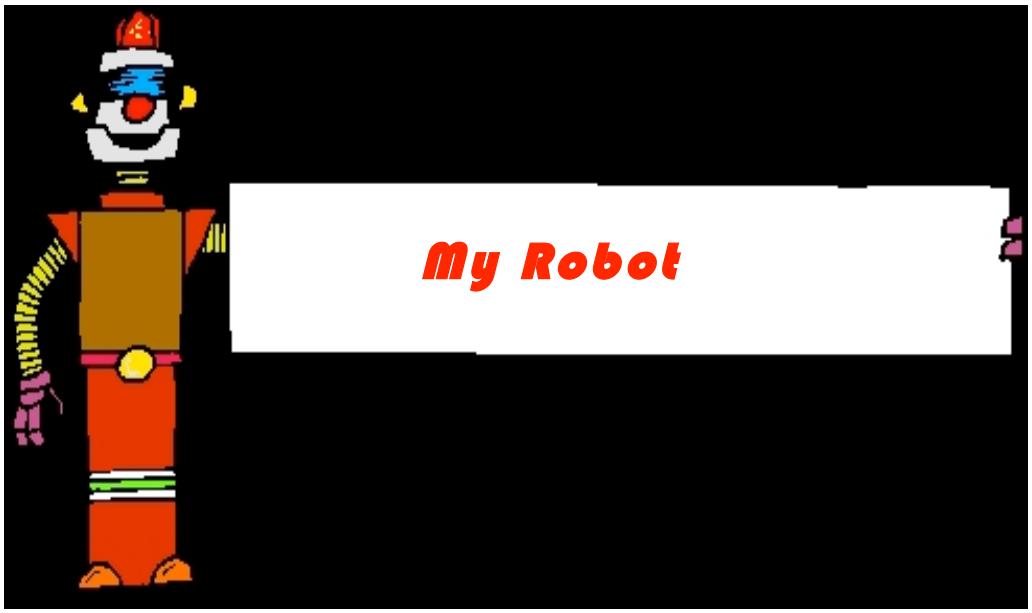
Robotics Research:

Android
Artificial Intelligence
Cybernetics
Cyborg
Neural Networks
Nanotechnology

CLASSROOM ACTIVITIES

The following pages describe some activities you can use before or after your program to reinforce the ideas presented.

My Robot	Encourages students to think creatively about how robots work and what roles they can fulfill in our lives.
Robot Word Search	Familiarizes students with some of the terminology typically associated with robots and robotics.
Digital Pictures	Illustrates how digital optical sensors work.
Can You Tie My Shoes?	Helps students understand the complexity required to program a robot to do even a simple task.
Assembly Line	An interactive exercise that demonstrates how individual parts of a process must work together.

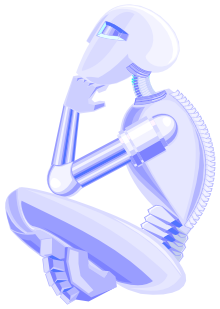


Design a Useful Robot

1. List what job or jobs your robot will do.
2. Describe how your robot will perform its jobs.
3. Draw a picture of your robot and label all the parts.
4. Name your robot.
5. Build a model of your robot using typical household items.

Send us a picture of your robot on an 8.5” x 11” sheet of paper along with your name and the name of your school, and we will post it on our Web site at www.RobotAssemblies.com.

Robot Word Search



T B R Q S F B C M T F D A D R L G Z I C
E E W M R E T U P M O C M O Y P C W D O
M L O R A K W P V R Q L T W H E E L A N
B I D U V C M L R U K A X P I V T M G T
S E N S O R E J P X U B V F M U W A C R
D D V T B W U D Q T R P G Y Q R A N V O
R R M O A I Z K C M I G N N P O V I T L
F K B E T M Q A W E Y T E B C B C P K P
Y I O R T A N E X C G Z F A I O R U E A
A C E S E R S O L H F H L I R T M L Y N
U A C I R F A U T O M A T O N S F A B E
F P F M Y K H W I P M N I G B C G T V L
B Y U U N Y G A D J E D B L G R H O L W
C L S K R H L V I N V M H Z O P Q R A H
Y W U O Q S P H S D H J K B J B Y K M E
J C M T N D I O P R I E Y M A K D I W O
B E A E Y A N K L U W C R K Z E N F J R
M H K P L E R Q A M T R A N S I S T O R
O G R I P P E R Y I J L X U W J M U Q C
X R I Z W J A M E Z A T O R E K A E P S

Find these words in the grid above. Look up their definitions to learn how they are used in robotics. NOTE: Words can go up or down, forward or backwards, and diagonally.

ACTUATOR
AIBO
AUTOMATON
BATTERY
COMPUTER
CONTROL PANEL
CYBORG
DISPLAY
GEARS
GRIPPER
HAND
MANIPULATOR
MEMORY
ROBOT
SENSOR
SONAR
TRANSISTOR
WHEEL

Robot Word Search KEY

T B R Q S F B C M T F D A D R L G Z I C
E E W M R E T U P M O C M O Y P C W D O
M L O R A K W P V R Q L T W H E E L A N
B I D U V C M L R U K A X P I V T M G T
S E N S O R E J P X U B V F M U W A C R
D D V T B W U D Q T R P G Y Q R A N V O
R R M O A I Z K C M I G N N P O V I T L
F K B E T M Q A W E Y T E B C B C P K P
Y I O R T A N E X C G Z F A I O R U E A
A C E S E R S O L H F H L I R T M L Y N
U A C I R F A U T O M A T O N S F A B E
F P F M Y K H W I P M N I G B C G T V L
B Y U U N Y G A D J E D B L G R H O L W
C L S K R H L V I N V M H Z O P Q R A H
Y W U O Q S P H S D H J K B J B Y K M E
J C M T N D I O P R I E Y M A K D I W O
B E A E Y A N K L U W C R K Z E N F J R
M H K P L E R Q A M T R A N S I S T O R
O G R I P P E R Y I J L X U W J M U Q C
X R I Z W J A M E Z A T O R E K A E P S

Digital Pictures

Background

In order to interpret images, computers need to convert them into a series of ones and zeroes. This is called "binary code." Once it is in this form, the computers can analyze the picture in different ways.

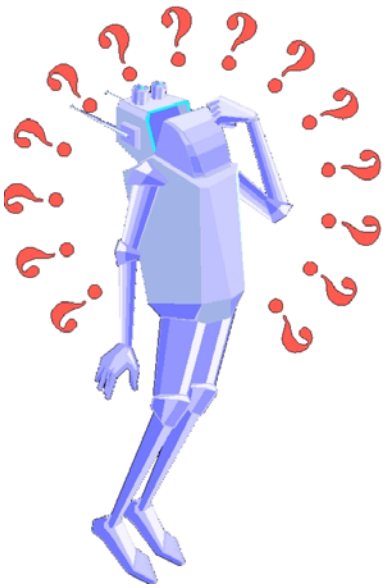
A "seeing" robot might use a digital picture to compare an object with a picture stored in its memory and remove the object if it is faulty or doesn't belong in a particular place.

Instructions

1. Copy a grid from graph paper (or use the grid on the following page) onto an overhead transparency.
2. Place the transparency on top of a simple picture.
3. In each square that is at least half covered by the picture, place a "1." In each square that is *not* at least half covered by the picture, place a "0."
4. Color only those squares containing a "1" to reveal the digitized version of the original picture.

NOTE: You can also illustrate how the data is transferred back and forth by having one student read the series of 1's and 0's to another student while they fill in a blank grid.

Can You Tie My Shoes?



Background

Robots can do many things, however, they must be programmed with instructions for each step, and have limited movement, so even seemingly simple tasks can be difficult for a robot.

In this activity, students analyze a task from the point of view of a robot. Sensory input is limited by using blindfolds, gloves, and tools to simulate the type of information a robot would have available to it when performing a similar task.

Instructions

1. Tie your shoes blindfolded. How did that compare to tying them normally?
2. Now put on some heavy gloves. Try tying them again. What's different?
3. Next, try tying your shoes using pliers instead of your fingers. How does this limit your movement?
4. Finally, have two people work together, each holding a pair of pliers, to attempt to tie the shoes. How did you do?

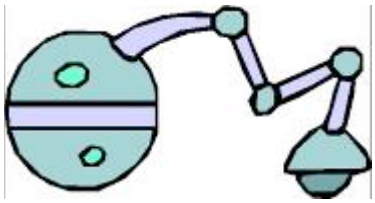
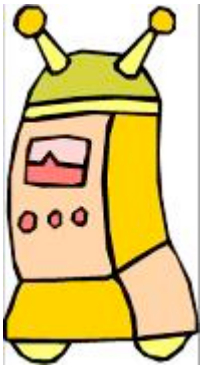
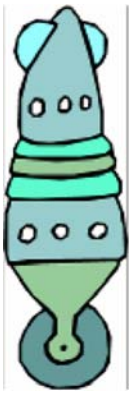
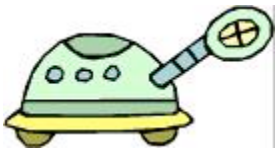
.....The Assembly line.....

Background

When robots are used in factories, each one performs a specific job. The project they are working on usually moves along a conveyor belt, and it is important that every robot do its job correctly and on time, otherwise the entire system can be disrupted.

Instructions

1. Think of a task that requires several steps to accomplish and could be done in a classroom on a long table (e.g. assembling a Lego structure, wrapping a gift, or completing an art project).
2. Have students line up on both sides of the table.
3. Each "station" has one task to complete. Then the project moves on to the next "station."
4. Appoint one person as the "conveyor belt" to move the project along at a steady pace.
5. Have students reflect on their experience:
    a. What parts of their body did they use the most?
    b. What would happen if one person took longer than the others to complete their task?
    c. Did they get tired? Robots can do the same thing over and over without even needing a break.
    d. Was it easier to complete your task when the project came to you right-side up?

USEFUL LINKS FOR EDUCATORS

Robotics Competitions

Best Robotics, Inc.	www.bestinc.org
DARPA Grand Challenge	www.darpa.mil/grandchallenge
First Robotics Competition	www.usfirst.org
Robotics Alliance Project	www.robotics.nasa.gov

Robotics Programs

Botball	www.botball.org
First Lego League	www.usfirst.org/jrobtcs/flego.htm
Technology Short Courses Program	http://tscp.open.ac.uk
RoboFesta UK	http://robots.open.ac.uk

Resources

RoboDoodle	http://robodoodle.open.ac.uk
Squeak Media Authoring Tool	www.squeakland.org
Robot Kits	www.hobbyengineering.com
Burrus Research Associates, Inc.	www.technotrends.com

Education Standards

Mathematics	www.nctm.org
Science	http://stills.nap.edu
Technology	www.iteaconnect.org
	www.cnets.iste.org
Language Arts	www.ncte.org
Social Studies	www.ncss.org

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