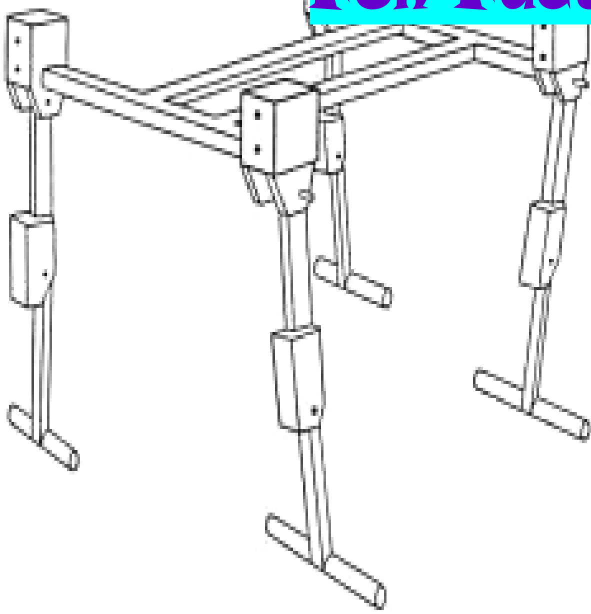
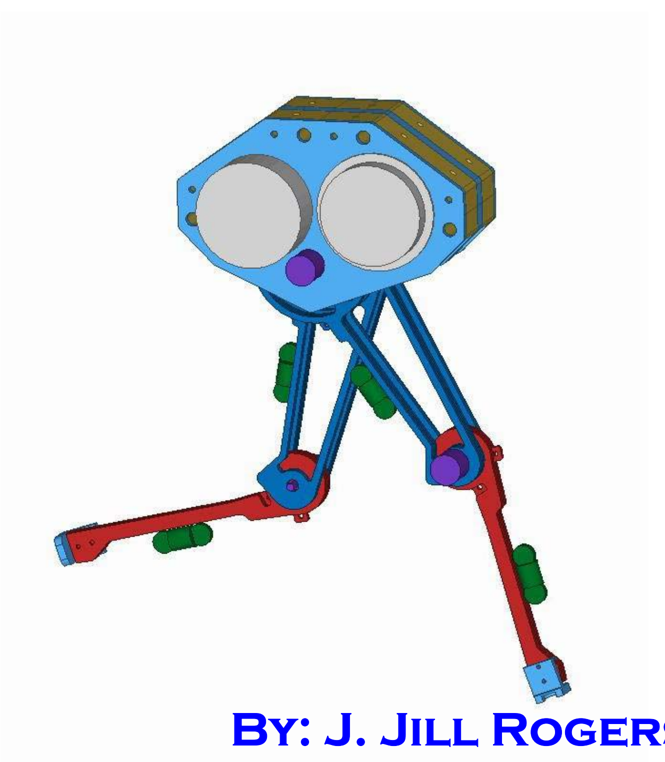
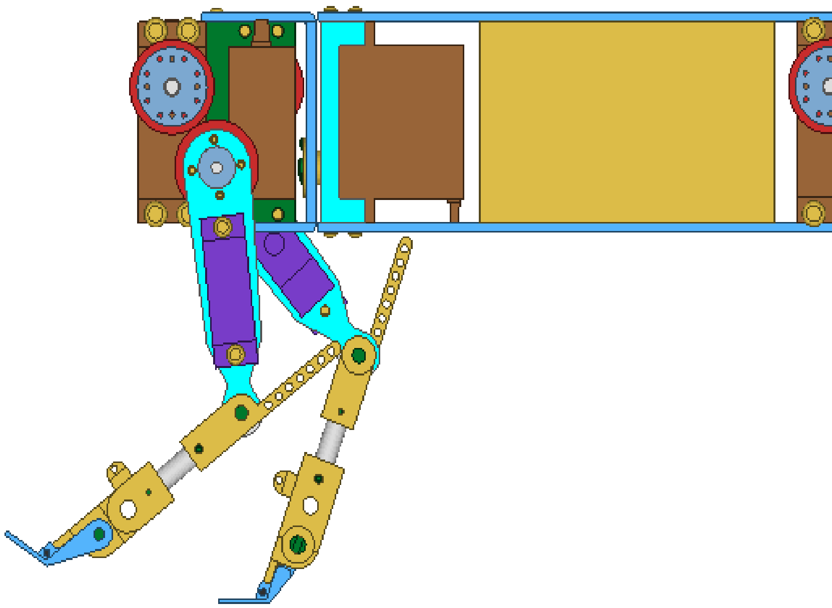
Robo Info:

Fun Facts and Activities







By: J. Jill Rogers & M. Anthony Lewis, PhD

Robo Info:

Robot Activities and Fun Facts

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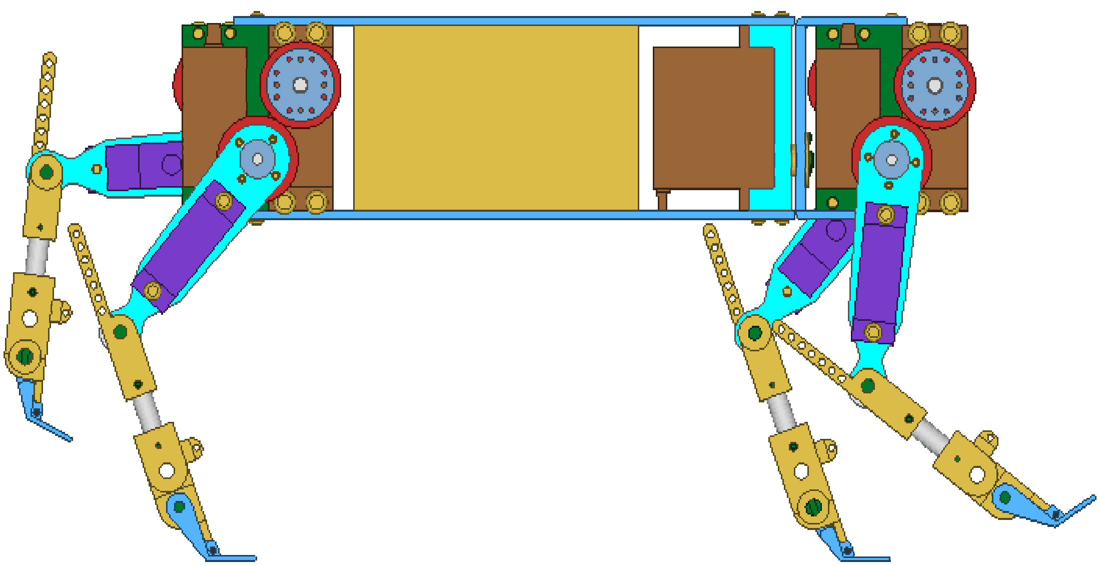

Dedication

To those young people who dare to dream about the all possibilities that our future holds.

Special Thanks to:
Lauren Buttran and Jason Coon for naming this book
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Photography on page 4 by J. Jill Rogers and modeling by Samantha Frisby

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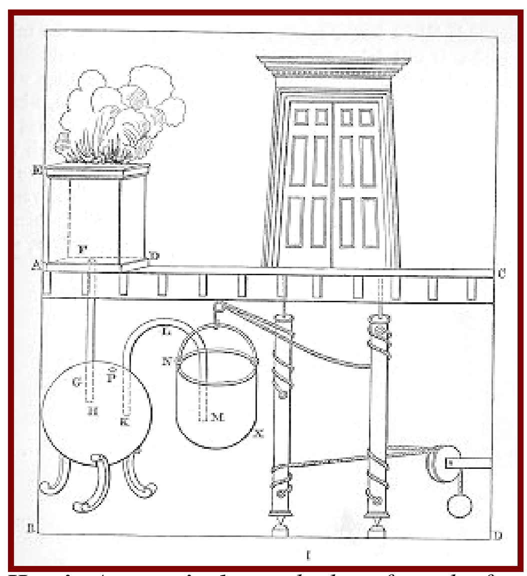
Chapter 1
How Robots were born: Dreams from the past

You might think that the idea of a mechanical creature or robot-type device is a modern one. It is true that the metal parts and computer chips required to build the robots used today were invented in the last half of the 20th century. However, human beings have daydreamed about robot-like creatures for thousands of years. Evidence of robot dreams can be found in myths, literature, and science fiction films. Some ancient inventors actually created robot-like creatures that are still around today. These artifacts and dreams from the past still inspire modern robotic scientists.

Over 2000 years ago, Egyptian inventors built robot-like devices that appeared to move ***autonomously*** (on their own). One such device was found in an Egyptian tomb and looks like a sculpture of a dog. When a lever in the dog's stomach is pressed, its mouth opens. Another, more complicated device looks like an Egyptian baker. The baker is made of painted wood and has levers and fulcrums (turning points) in its arms. With the assistance of a counterweight at the baker's back, the arms pound grain into flour. While both of these devices appear to move alone, some human assistance is needed to start movement.

Greeks mention mechanical devices in many of their myths. In Homer's *Iliad*, mechanical gold women serve as assistants to the god, Hephaestus (or Vulcan). Hephaestus also created Talos, a gigantic animated statue made out of bronze that guarded the island of Crete. While these examples are only myth, the Greek inventor, Hero of Alexandria drew actual designs for real robotic devices. Hero understood the concepts of siphons, and the use of air pressure to make things move. He drew designs for automatic doors (shown in the diagram to the right), moving statues, animal statues that drank, and bird sculptures that sang. Hero was a man before his time; his inventions were built and used a thousand years after his death but probably not attempted during his lifetime.



Hero's Automatic doors, *the heat from the fire caused the water in the sphere to boil, next siphon L carried the hot water into bucket M. As the weight of bucket M increased, the poles would turn and the temple doors would open.*

ACTIVITY: WRITE A ROBOT MYTH

Read below about Talos, a mythological robotic being. Think about the types of characters in a typical myth: heroes, kings and strange beasts. Now write your own Greek myth, using a robot like creature(s) as part of the story. Be certain to include an introduction of setting and characters, a problem faced by the main characters and a solution to the problem in the conclusion.

Talos

by James Hunter

Talos was a man of bronze, made by Hephaestus, whom Zeus gave to Europa after he kidnapped her and took her to Crete. Talos became the guardian of Crete, circling the island three times each day and throwing stones at any ship which approached its shores. He had a single vein, which ran from his neck to his ankle and was closed by a single bronze nail. When the Argo approached Crete on the way back from obtaining the Golden Fleece, Medea cast a spell on Talos and then removed the bronze nail; all of Talos' blood ran out and he died, thus enabling the ship to land.

"Talos." Encyclopedia Mythica. http://www.pantheon.org/articles/t/talos.html [Accessed March 14th, 2003.]

Automatons

During the Middle Ages "***automatons***" became popular. They were fun machines that were able to do automatically only one or two things that they were programmed to do. These artful devices usually moved with ***clockwork technology*** and looked like animals or humans. ***Automatons*** were not able to think or react independently in their environment so they were not true robots. However, they were the source of amazement to all who saw them. Due to their entertainment value, ***automatons*** were a popular art form in eighteenth century Europe.

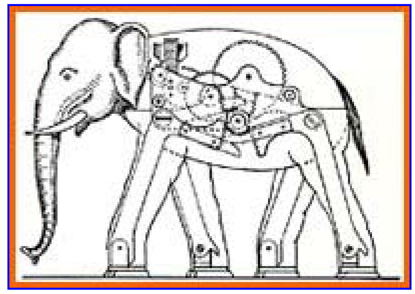
The oldest working automaton known today is the rooster atop the cathedral clock tower in Strasbourg, France. Built in 1352, the rooster flaps its wings, thrusts out its tongue and crows. Like the Strasbourg rooster, *glockenspiels*, German for "players of the bells", are run by the clockwork and move atop clock towers, chiming the hours. *Glockenspiels* can be quite elaborate and are often life-sized figures moving to the clock chimes in a choreographed dance.

By 1770, inventor/artist Pierre Jaquet-Droz (for more information, see *Short Biographies*, p.14) became the first to create ***automatons*** that had all of the mechanisms built in the figures themselves. Droz's "Scribe" was an adorable life-like boy who could dip his pen in ink and write whatever short message the operator selected. "Musician" was a figure who played on a piano with all ten fingers. These figures can still be seen operating in Neuchatel, Switzerland, more than 200 years after their construction.

At the 1876 World's Fair in Paris, some of the last of the great performing ***automatons*** were on display. J. N. Maskelyne created a popular attraction for the fair that featured three musicians who played various tunes on brass instruments, "Zoe," a young girl who drew pictures and "Psyco," a card playing gypsy.

ACTIVITY: AUTOMATON

Consider ***Automatons*** in history and film. Look up the sources listed below. Then with paper and pencil, create your own ***automaton*** cutaway design. Like this



- Watch the 1999, Barry Sonnenfeld film, "Wild, Wild West." Notice the amazing ***automatons*** created by the bad guy, Dr. Arliss Loveless.
- http://www.ancient-automatons.com/cadres/cadres.htm
- http://www.fi.edu/pieces/knox/automaton/

The Principle of Feedback

While ***automatons*** were busy entertaining the general population, other inventors were developing concepts that would help modern robots think and react. The principle of ***feedback*** deals with changes in condition, and then self-correction. A machine that can sense environmental changes and correct for them is using ***feedback***. Your body uses the ***feedback*** principle to survive. For example, when you feel the room is too hot, you open a window and when you are too cold, you put on a coat. Think about other ways your body uses ***feedback***. The idea of ***feedback*** for use with machines was developed in response to industrial needs.

In 1745, Edmund Lee, an English inventor, first used feedback to solve a problem he was experiencing at his lumber mill. At that time in history, logs were sawed into planks by harnessing the power of the wind. A huge windmill would point into the wind and turn a series of gears that were connected to a saw. As the wind blew, the saw turned and the logs would be cut. This system worked well as long as the wind blew in the same direction, but each time the wind changed the huge windmill had to be manually moved.

Lee considered his problem with wind conditions. Using what he knew about the workings of the windmill, Lee developed a perfect feedback system. He mounted two smaller windmills on the back of the large one. If the wind changed direction, the small windmills moved and turned a series of gears attached to the axle of the large windmill. The gears would turn the large windmill until it faced the wind and the small ones stopped. The machine automatically corrected for changes in condition (wind direction).

Activity: Build your own self-correcting windmill

In order to better understand the way Edmund Lee's principal of "***feedback***" works gather these materials and build your own self correcting windmill.

-Three small straws and one large straw
-Three index cards, one 4 X 6 in. and two 3 X 5in.
-A small amount of modeling clay
-Three straight pins

Step 1

<u>Step 1</u>
Fold index cards in half and cut to make two 3 X 3 squares and one 4 X 4 square.

<u>Step 2</u>
Cut diagonally from corners to center of each square.

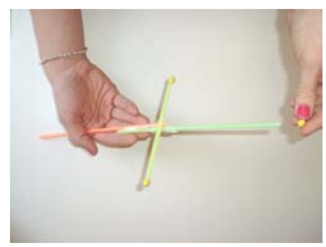
Step 2

<u>Step 3</u>
Poke straight pins through every other corner and then the center to make a pinwheel. Be certain that the two smaller pinwheels are mirror images of each other (see pictures below).

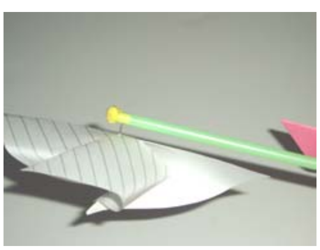
Step 3

Step 3

<u>Step 4</u>
Tape two of the smaller straws together, and cut the third one and tape it perpendicular to the others, in a cross shape. Place a pinch of clay in the end of each straw.



Step 4



<u>Step 5</u>
Poke the pins, through the clay into each straw. Make certain that the larger pinwheel is facing the front and the smaller pinwheels are sticking out of the sides of the cross. Place small pinwheels as necessary to counter the motion of the large one.

<u>Step 6</u>
Slip the larger straw over the bottom straw so that the windmill can turn freely. For best results, hold onto the larger straw and position the larger pinwheel facing a blowing fan. Or blow on the pinwheels to observe how the countermotion of the small pinwheels keeps the larger pinwheel facing the wind.

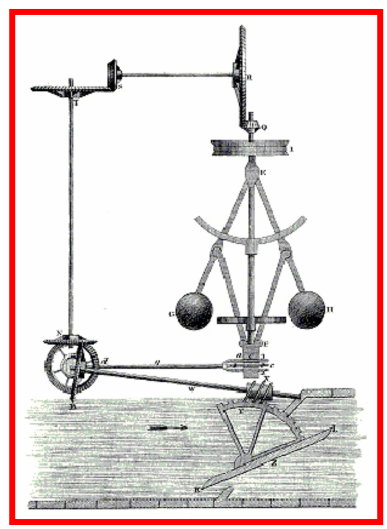
Step 6

Activity: Feedback

For this activity you are going to use your body to illustrate the concept of ***feedback***. Find a partner and choose one person to be the robot and the other will be a vision sensor. The robot/kid will put on a blindfold and the vision sensor/kid will attach to the robot's brain. The vision sensor will use their eyes to give ***feedback*** to the robot using verbal cues (talking). In this formation the two will move around the room. The robot will receive ***feedback*** from the vision sensor, which tells the robot how to behave in the environment. After a few minutes trade places.

☻ Can you think of a way the vision sensor can provide ***feedback*** to the robot without speaking?
☻ How do you think real sensors deliver ***feedback*** to robots?
☻ Which job is more difficult, being the robot/kid or the vision sensor/kid?
☻ How would you play this game if you changed the vision sensor/kid to a taste sensor?
☻ Did you notice that without vision, the robot/kid naturally put up its' "touch sensors?"

James Watts was another inventor who used the principle of ***feedback*** to make his invention better. Watts, who invented the steam engine in the 1770's, wanted to control the fluctuations in steam pressure so that the engine would run at a steady speed. Imagine how uncomfortable a train ride would be if it was constantly speeding up and slowing down. All the passengers would get motion sickness (throw up, barf)! Watts created a device called the flyball governor (shown in the diagram to the right), which automatically adjusted the throttle of the steam engine. If the engine ran too fast, the flyball governor would spin and automatically close the throttle and slightly slow the train.



"Flyball Govenor" *invented by James Watts in 1770*

Chapter 2

What is a robot?

The word "***robot"*** comes from the Czech word for forced labor or boring work. In 1920, Karel Capeck, a Czech playwright invented the word for his futuristic play. The meaning of the word tells us something about what early robot scientists hoped robots would do. The hope was that one day robots would relieve humans of the types of jobs that are boring or dangerous. This would give people more free time to think about things like art, philosophy and music.

Activity: Design a robot

Can you think of a boring job that you always have to do? Why not invent a robot to do this work instead? Draw a picture of your robot and label its parts. Include descriptions of what the robot can do and a catchy name.

Write on the back of the paper what you plan to do with all of your free time!

There are many mechanical devices that have been called "robots," that are not actually robots. When deciding if a device is a robot or not, we first look for ***autonomous behavior,*** which is behavior that happens (without human help) in response to ***feedback***. ***Autonomous behavior*** is not planned in advance but happens as a result of outside influences. Devices must receive and react to ***feedback*** in order to be considered robotic.

To detect changes and then send ***feedback***, a robot needs ***sensors. Sensors*** are small devices connected to the brain of the robot that tell the robot about the environment. Humans have five senses: sight, touch, hearing, taste and smell. ***Sensors*** for robots mimic these human senses and allow the robot to send messages to the brain. The really cool part about robot sensors is that they can be super sensitive. Scientist have created ***sensors*** that tell exact temperatures, see in the dark, and smell small amounts of poison gas. Humans can't do that!

Once the ***sensors*** gather information and send ***feedback***, the robot needs a method of receiving it or understanding what the signals mean. Humans do this with their brain. When you eat something yucky your taste buds don't tell you to spit it out! It is your brain that tells your mouth to open, gag and spit (hopefully, in a trash can). In a robot the ***central processing unit***, or CPU, holds the job of the brain. A CPU uses a series of transistors and circuits that mimic the function of the brain, sort of like a computer. With a CPU, a robot can "think" and perform autonomously.

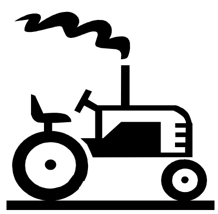
In order for a device to be a robot it must be able to do something. In other words, it needs a body of some sort in order to make a response to ***feedback***. The body of a robot may consist of metal, plastic or other materials, and it must have ***actuators*** that cause movement. An ***actuator*** is another name for a robot's motor. There are many different types of ***actuators***: ***servo***, ***hydraulic***, ***pneumatic*** and direct current (DC) motors, to name a few. An ***actuator*** performs the same duty as a muscle in your body.

So, back to our first question: ***What is a robot? It seems to be a device consisting of sensors, a body and a CPU that together collect feedback and respond to it in an autonomous way.***

Here are some examples. The heating system in your classroom or home is robotic. It has a temperature sensor in the thermostat that indicates when the temperature rises or falls in the room and the furnace turns on or off. The thermostat on the wall is like the CPU or brain and the furnace is like the body that receives the message and then acts. Motion-activated lights are also robotic; they receive feedback from their motion sensors and turn the lights on. A remote controlled car that turns and stops as you move the joystick is not a robot. The car receives no feedback, only direct commands from you through the joystick. The car is not able to think or problem-solve when it encounters an obstacle. It will only do what you tell it to do. If you drive a remote control car into a brick wall, it will destroy itself before it will stop independently.

Activity: What is a robot?

Take a sheet of paper and draw a line down the middle. At the top of the paper write the word "robot" on the left side and "Non-robot" on the right side. Now look around your school or home for mechanical and electrical devices.



As you think about each device ask yourself: Does it receive and respond to ***feedback***? Does it have ***sensors***? Does it have something like a "brain" or ***CPU***? If you answered yes to these questions, list the device in the "robot" column. Put other devices in the "non-robot" column. Keep listing until you have ten items. After you get started, you may want to add a box at the bottom of your paper in which to put items you are not sure about.

◙ Show your list to a partner and compare answers. Do they agree with all of your answers? It is ok if they don't, There are no real, "right" answers!

◙ Defend your answers. Think about why you placed the devices in the column you did.

Biological Systems vs. Artificial Intelligence

One vital aspect of robotics is the workings of the robot "brain" or CPU. In the 1950's, early robot scientists saw a way to teach their mechanical devices to react to ***feedback***. This ability distinguishes real robots from ***automatons***. Today, there are two different ways robot scientists approach this difficult task. One way is to carefully study the way the human brain works and then figure out how it causes certain behaviors. Then scientists apply that knowledge to the intricate workings of a robot. This approach to robotics is called the study of ***Biological Systems.*** Robotisist who study ***neuromorphic engineering*** and ***biomorphic robotics*** focus on biological systems. The second approach to building robot "brains" looks at the behavior itself and figures out how to mechanically copy it. This method starts with a computer and focuses on how to use it to mimic human (or animal) behavior. The second approach is called ***Artificial Intelligence (A.I).*** Scientists who study computer science or electrical engineering might tend to focus on ***A.I.***

Activity: Biological Systems vs. Artificial Intelligence (A.I.)

Let's look at an example. Imagine that you are a robot scientist. You have been given a mysterious toy made by aliens from the planet Xeon. The toy is called "Robota" and looks like a golden, robotic humanoid with lots of buttons and flashing lights. Robota comes with a book of instructions in English. Your job is to recreate the robot for mass production on the international toy market here on Earth. You can achieve this in one of two ways:

1. You can play with the toy, push all the buttons and study what Robota does. Then keep track of what you discover so that you may copy the behavior in the robots you mass-produce. This way doesn't work exactly, but while you are playing you accidentally discover that the robot can mow the lawn. (***Artificial Intelligence* or A.I.).**
2. You can read the instructions, follow the directions and teach Robota to do all the things she is able to do. Next, you open up the toy and study how her ***Central Processing Unit (CPU)*** or "brain" works to figure out how it causes certain behaviors. This takes years, but you discover a cure for cancer while you are at it**. (*Biological Systems*)**

← Which way is the most fun?

← Which way is the fastest?

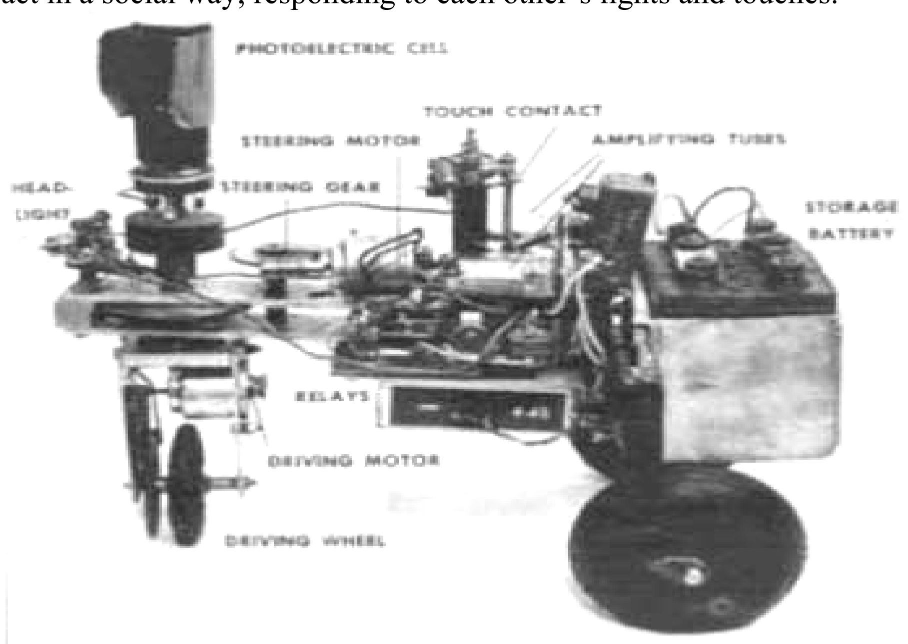
← Which way is the most useful for the robot's future?

← Which way do you think is the best?

There is no right answer to the ***Biological Systems*** vs. ***Artificial Intelligence*** debate. Both approaches have advantages and disadvantages. It seems that modern robot scientists combine aspects of both approaches to dream of, design, and then build robots. Perhaps both approaches are necessary in order to unlock the complicated mystery of human thought.

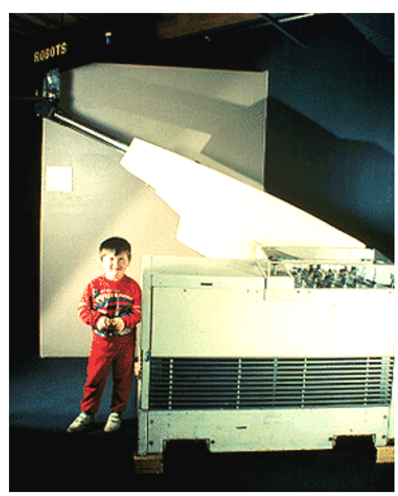
Chapter 3
The History of True Robots

As mentioned in chapter one, robot like devices have been around for centuries. However, in 1948, W. Grey Walter was the first to invent a true robot, one that could sense and behave autonomously (for more information on Grey Walter, see *Short Biographies*, p14). These robots were small turtles that moved around on three wheels. They had light and touch sensors and could amazingly wheel around a room in search of "food." The turtle ran on batteries and when its battery was low it would find, then hook up to a recharging station, "food" for a robot turtle. The really cool part about Grey Walter's turtles was that when many of them were placed in a room together they seemed to interact in a social way, responding to each other's lights and touches.



W. Grey Walter's "Elsie*" the turtle, with its components identified. The robot is called a turtle, due to its appearance. It had three wheels, each one with an independent motor. Power was supplied by a DC battery (right side, at the back of the system).*

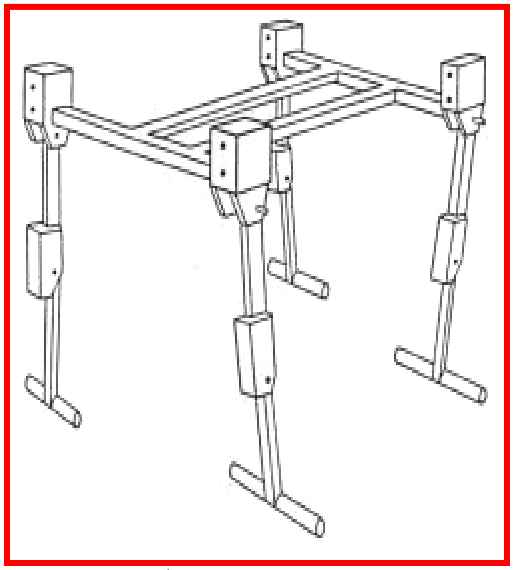
While W. Grey Walter was working on cute, intelligent turtle robots, George Devol and Joseph Engelberger were thinking of practical ways to use this new technology. In 1954, Devol patented his "Unimate," (shown on the right) a robotic arm that was ***hydraulically*** powered, had digital control and could be programmed to do industrial work. Robotic arms are robots that are attached to the floor and often work on assembly lines in factories that make cars or large machinery. They are sometimes quite large and able to lift heavy objects.



"Unimate" *robotic arm*

Other robotic arms are small and capable of intricate work, work humans could not do accurately. Another effective robotic arm named the "Puma" was invented in the early 1970s. Versions of both the Puma and the Unimate are still being used in factories today.

In the mid 1960s, robot inventors began working on legged, or walking robots. Motion with legs provided the robot inventors with many problems to solve. By 1966, McGhee and A. Frank had invented the "Phoney Pony," a four legged, walking robot. Electric drill motors purchased at Sears Department store powered the Phoney Pony's legs. The robot's simple design allowed the inventors to focus on the difficult task of legged motion.



***"Phoney Pony"** design*

Activity: Difficulties of Legged Motion

Think of all the parts of your body you use when you walk across the room. Your knees straighten and bend, your legs move forward and back, your ankles flex and your eyes look to see where you are going. Imagine you had to tell your body (or a robot) how to walk across the room, open the window and sit back down. How many commands do you think it would take to perform the task? With paper and pencil, write down a program you would give to a resting robot, starting at your chair, to perform the task of opening the window. Number the commands on your program so that your robot will know the proper order. Once you are done writing, get into groups of three. One person will be the human programmer and provide the commands, one will be the **CPU** and one person will be the robot. Commands are sent to the **CPU**/kid who reads them to the robot/kid. The programmer may not speak directly to the robot/kid or the **CPU**/kid, all commands must be clearly stated in the written program. After a few tries, change parts until everyone's program is tested.

~ Did your robot make it to the window and back?
~ Would this task be easier if your robot had wheels?
~ How many commands did it take to perform the task?
~ Did your robot/kid move in a natural looking way?

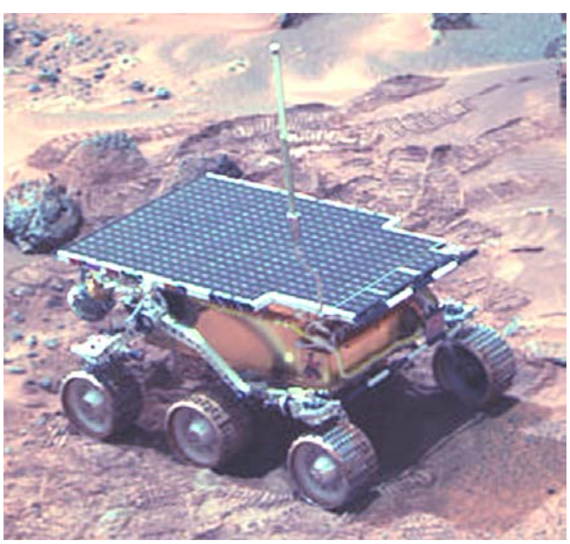
"Shakey," developed by Stanford Research Institute in 1968, was a mobile robot that could take voice commands, perform simple tasks and move around a room without bumping into stuff. The coolest part about Shakey was that it was the first robot to display artificial intelligence, or A. I. Shakey got around on wheels and had sensors for touch, a TV camera to help with vision and an "on board" processor, that allowed perception. This was the first time scientists had tried to put the processor "on board" as part of a moving robot. Back in 1968, computer chips that hold memory had not been invented yet, so computers were huge. Shakey's computer had to be set up in a room near by and connected to the robot by a radio link.

"Uniroo" *from MIT's Leg Lab*

The 70's and 80's brought many refinements to robotic technology. As computer parts got smaller, robots could carry more stuff on board. This allowed for more sensors, motors and neat gadgets to make the robots more autonomous. Legged movement became more refined and at times human-like. Robots with names like "The Ohio State Walker" and "Adept I" came to life. Universities and research institutes all over the world began work on creating robots that would entertain, save lives, and make life easier.

Marc Raibert is a robot scientist who created many unique robots during the early 1990s (see *Short Biographies*, p.14). During research at the Massachusetts Institute of Technology (MIT) Leg Lab, Raibert worked diligently on legged robot walking and balance. This was the first time human-like walking was successfully displayed in a robotic device. Raibert's robots can jump, hop and run.

At the same time Raibert was creating unusual legged robots, the National Aeronautics Space Association (NASA) was busy developing robots to go into outer space. The Mars Pathfinder landed on the surface of Mars on July 4, 1997. The mission had the objective of demonstrating the possibility of low-cost landings on and exploration of the Martian surface. The rover "Sojourner" was a 16 kg., six-wheeled vehicle which was controlled partly by scientists on Earth. Video was taken by the rover and lander, and then sent back to Earth. Since the time delay for the video was about 10 minutes, some autonomous control by the rover was needed. Sojourner successfully explored Martian soil and rock for nearly three months.



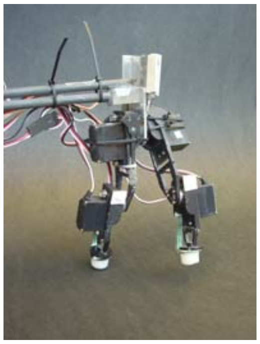
*"**Sojourner"** NASA Mars exploration rover*

By the end of the century, robotic toys became popular. In 1998, "Furby" and LEGO Mindstorms were fashionable gift items. Later, toys like "Tamaguchi pets," "Techno" and "Aibo" hit the toy market.

***AIBO** (shown left) doesn't require walking, feeding, toilet training, bathing, vaccinations, or flea dips. He will walk to the front door to greet you after a long day at the office. He can be happy, sad, hungry, sleepy and playful. The cyber mutt even recharges himself after a long play session. A**IBO** has touch sensors so he wags his tail when you pet him!*

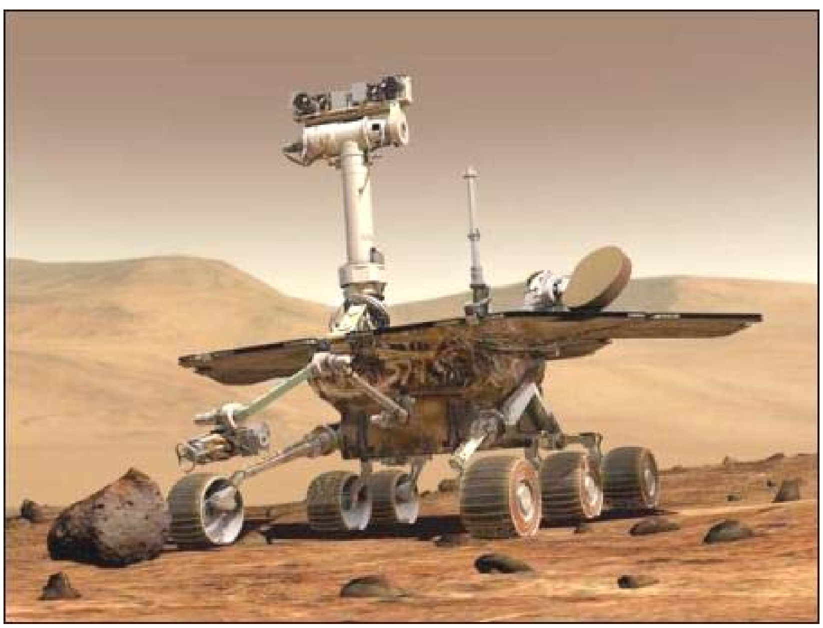
At the turn of the century, robot scientists in Japan put the finishing touches on "Asimo," the first humanoid robot. The letters in Asimo's name stand for: Advanced Step in Innovative MObility. After working for fourteen years, on ten different prototypes, Asimo was finished by the Honda Company in the year 2000. The creators of Asimo have big plans for the four foot tall, walking biped. One use for Asimo is to employ the robot as a caregiver for the elderly and the disabled. Currently, Asimo tours the world, and helps educate people on the benefits and usefulness of robots. Go to this neat website to learn more about Asimo. http://asimo.honda.com/index.asp

The one problem with Asimo is that he doesn't walk in a very natural way. He shuffles along at slow pace with odd looking, bent knees. One reason Asimo doesn't move like a human is that he doesn't use his vision to help him walk. Have you ever tried to walk around a cluttered room with the lights off? Imagine yourself tonight when you go to bed, first you will turn off you bedroom lights and then you will try to make your way to your bed. If your room is messy, lookout! Without vision you *can* get from one part of the room to another, but you must move very carefully and slowly.



Scientists at Iguana Robotics, in Champaign, Illinois are currently working on the vision problem. “Snappy Jr.,” a research robot created by M. Anthony Lewis in 2002, can see obstacles and then choose to step on, over or around them. The robot uses a small video camera and a biologically inspired vision chip to help the robot’s CPU understand what it sees and then move accordingly. Other robots use video cameras but do not know how to interpret what they see. Dr. Lewis hopes that his vision chip will revolutionize robot vision and movement.

“Qrio” (pictured on the right) made his acting debut in December, 2003 at a taping of *Astro Boy.* The bipedal robot provided the voice for an animated robot character in the Japanese children’s program. Qrio is an entertainment robot created by Sony using Aibo technology and special Intelligent ***Servo Actuators*** (ISA). Like Honda’s Asimo, Qrio is a toddler –sized, humanoid robot that can walk on two legs and talk to humans. Qrio has a number of unique talents; it can recognize peoples’ faces, get up from a fall and even dance (quite skillfully). Sony hopes that in the future, Qrio and robots like him will live in private homes and work as partners with humans.



January, 2004 brought the dramatic landing of “Spirit” and “Opportunity,” twin Mars exploratory robots. Like their older sister, Sojourner, these new and improved rovers’ primary mission was to explore the rocks and soil of Mars. If you look at the bottom part of twin robots you can see that the Spirit/Opportunity design is similar to Sojourner’s. However, the younger robots are much bigger than their sister weighing in at 150 kg (over 300 lbs.) The double NASA mission was designed to determine if water ever existed on Mars.

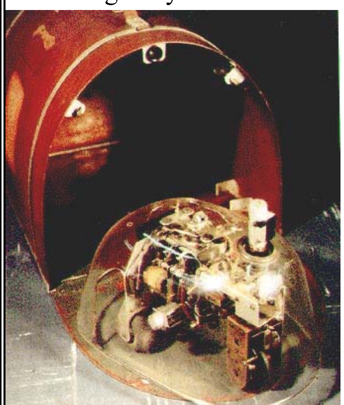
Short Biographies

People in robot history

W. Grey Walter

A Short Biography

W. Grey Walter was born in Kansas City, Missouri, in 1910. His parents were originally German/British, from his father's side, and American/British, from his mother's side. He was brought to England in 1915, and educated at Westminster School and afterwards in King's College, Cambridge, in 1931. In the late 1940's Dr Grey Walter carried out pioneering research on mobile autonomous robots at the Burden Neurological Institute as part of his quest to model brain function. He wanted to study the basis of simple reflex actions and to test his theory that behavior comes from neural interconnections. His highly successful and inspiring experiments with robot "tortoises" "Elsie" and "Elmer" were influential in the birth of the science of cybernetics. Recently, one of the original tortoises was found by Dr. Owen Holland, of the University of West of England, and was restored to order in 1995. Go to this website to learn more about W. Grey Walter, neuroscience and robots.



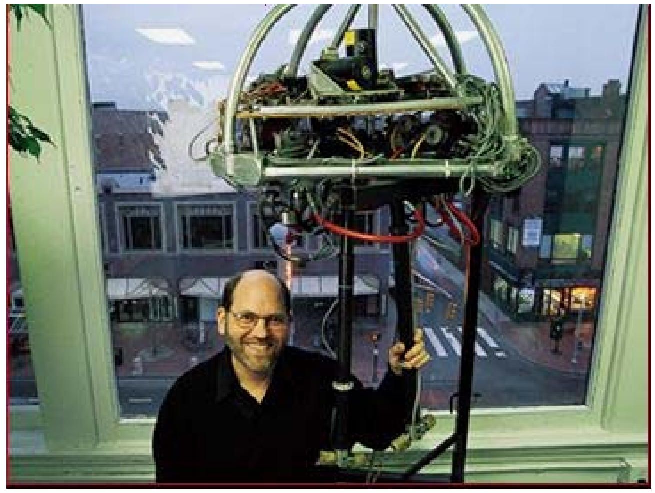
http://www.epub.org.br/cm/n09/historia/greywalter_i.htm

Robin R. Murphy

A short biography

Robin R. Murphy is a professor at the University of South Florida. Though best known for her foundational work in rescue robotics, Dr. Murphy has concentrated her basic research on sensor fusion, distributed sensing, and fault tolerant perception for mobile robots. Since 1995, she has focused on Urban Search and Rescue (USAR) as the test domain for her research, leading to her participation in the first known use of robots for urban search and rescue at the World Trade Center disaster. Dr. Murphy is the author of the widely used textbook, *Introduction to A.I. Robotics*. She was also the first woman to serve on the Executive Committee of the IEEE Robotics and Automation Society.

Marc H. Raibert



A short biography

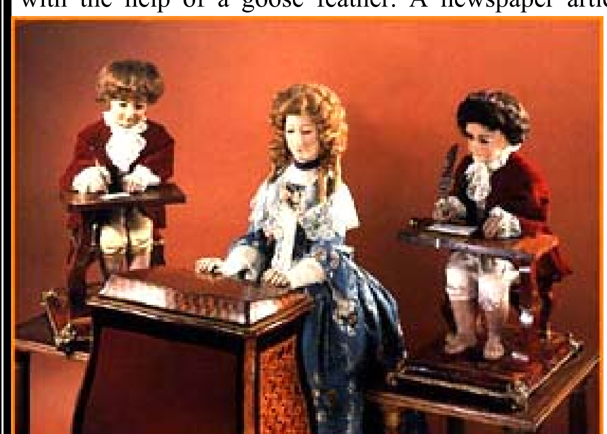
Dr. Marc H. Raibert is currently president of Boston Dynamics, Inc. He founded Boston Dynamics in 1992, a spin off from his laboratory at MIT. The company develops advanced human robotic simulations for government, industry, and international applications. His laboratory at MIT, the Leg Lab, is known internationally for its work on legged robots that move dynamically. The Leg Lab created robots that balance, run, and jump, including one-legged hoppers, biped runners, a quadruped, and two kangaroo-like robots. Two robots (and 3 students) appeared in the movie *Rising Sun* with Sean Connery and Wesley Snipes.

The robot pictured above can jump in the air, flip over and land on its feet.

Pierre Jaquet-Droz

A short biography

Coming from a well-off family in Neuchâtel, Pierre Jaquet-Droz was particularly interested in the science of mechanics applied to watch making. Provided with a scientific culture superior to that of the artisans in his circle, he made his first automaton: a three-year old child, able to write a little text with the help of a goose feather. A newspaper article written at the time described the automaton: "About 70 cm high, goose feather in the hand, set out in front of a little table made of mahogany, his eyes and head are mobile. As soon as the mechanism starts up, he dips the feather into the ink, shakes it twice and begins to write.



http://www.ancient-automatons.com/cadres/cadres.htm

Glossary

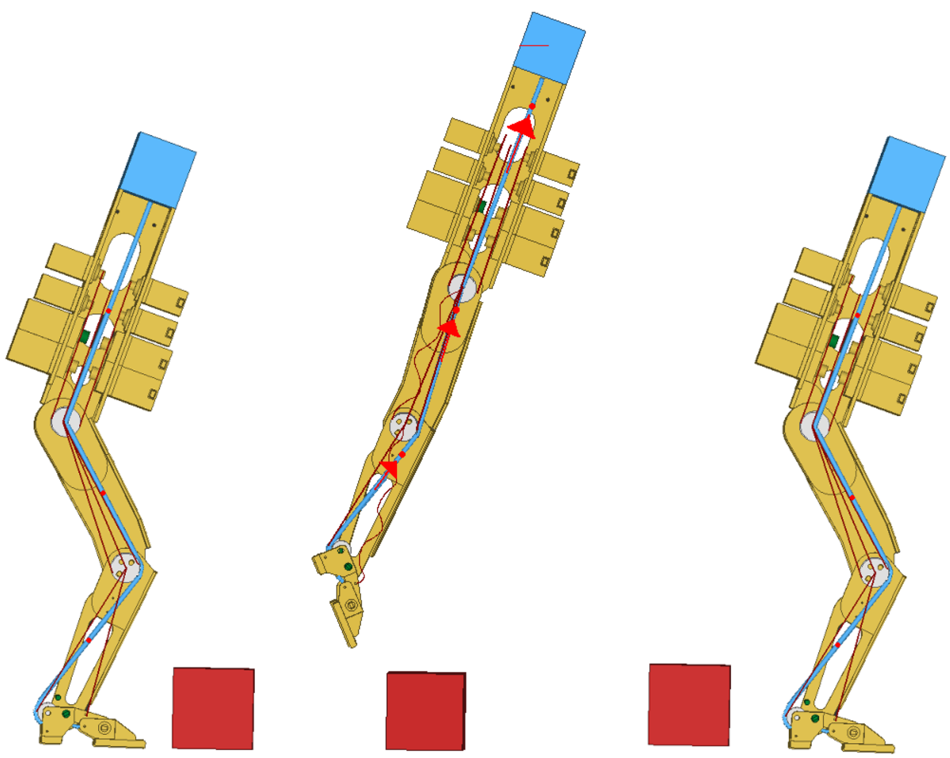
Commonly used robot words

Actuator-	A broad term for any mechanism which causes a robot to move
Artificial Intelligence- (A.I.)	An approach to robotics that focuses on the use of computers to copy behavior
Automaton-	Mechanical devices built during the middles ages that were programmed to do one or two things, not true robots
Autonomous Behavior-	To move or behave in response to outside influences, without help from humans
Biological systems-	An approach to robotics that looks to biology for inspiration
Biomorphic Robotics-	A field of study that focuses on biological systems and how they work in order to design and build robots
Central Processing Unit-	The brain of a robot, usually called the **CPU**
Clockwork Technology-	Mechanical technique using cogs and springs to generate motion in inanimate objects
Feedback-	The principal of self-correction in response to changes in condition
Hydraulic-	A method of powering a robot using water or other liquid under pressure
Pneumatic-	A method of powering a robot using compressed air
Neuromorphic Engineering-	A field of study that focuses on reverse engineering biological nervous systems, and then recreating the circuits in silicon. This technique of building biologically similar electronic circuits was first pioneered by Professor Carver Mead of Caltech in the late 1980's
Robot-	Czech word, meaning forced labor or boring work
Sensor-	Electronic device that tells the robot's brain about the environment
Servo-	A revolving motor commonly used in robots

Robo Info:
Fun Facts and Activities

A non-fiction, Children's book that provides an introduction to Robotics

Discover the History of Robotics, define true Robots and their components, and learn about innovations in robotics over the years
Fully illustrated



- Companion material for the Alegrobot, Inc. "SlugBug kit"
- Includes fun and easy activities for the home or classroom
- Free lesson plans available on-line
- A great resource for Teachers
- Check out this website for more information:

www.alegrobot.com

Iguana Robotics Inc.