

# A Brief History of Robotics

## ~ 350 B.C

The brilliant Greek mathematician, Archytas ('ahr 'ky tuhs') of Tarentum builds a mechanical bird dubbed "the Pigeon" that is propelled by steam. It serves as one of history's earliest studies of flight, not to mention probably the first model airplane.

## ~ 322 B.C.

The Greek philosopher Aristotle writes...

"If every tool, when ordered, or even of its own accord, could do the work that befits it... then there would be no need either of apprentices for the master workers or of slaves for the lords."

...hinting how nice it would be to have a few robots around.

## ~ 200 B.C.

The Greek inventor and physicist Ctesibus ('ti sib ee uhs') of Alexandria designs water clocks that have movable figures on them. Water clocks are a big breakthrough for timepieces. Up until then the Greeks used hour glasses that had to be turned over after all the sand ran through. Ctesibus' invention changed this because it measured time as a result of the force of water falling through it at a constant rate. In general, the Greeks were fascinated with automata of all kinds, often using them in theater productions and religious ceremonies.

## 1495

Leonardo DaVinci designs a mechanical device that looks like an armored knight. The mechanisms inside "Leonardo's robot" are designed to make the knight move as if there was a real person inside. Inventors in medieval times often built machines like "Leonardo's robot" to amuse royalty.

## 1738

Jacques de Vaucanson begins building automata in Grenoble, France. He builds three in all. His first was the flute player that could play twelve songs. This was closely followed by his second automaton that played a flute and a drum or tambourine, but by far his third was the most famous of them all. The duck was an example of Vaucanson's attempt at what he called "moving anatomy", or modeling human or animal anatomy with mechanics." The duck moved, quacked, flapped its wings and even ate and digested food.

## 1770

Swiss clock makers and inventors of the modern wristwatch Pierre Jaquet-Droz and later joined by his son Henri-Louis Jaquet-Droz start making automata for European royalty. They create three dolls, each with a unique function. One can write, another plays music, and the third draws pictures.

## 1801

Joseph Jacquard builds an automated loom that is controlled with punched cards. Punch cards are later used as an input method for some of the 20th centuries earliest computers.

## 1822

Charles Babbage demonstrates a prototype of his "Difference Engine" to the Royal Astronomical Society. He continues his work by designing an even more ambitious project "the Analytical Engine" that reportedly was to use punch cards inspired by Joseph Jacquard's invention. During his lifetime he never produces a functional version of either machine. Despite this shortcoming he is often heralded as the "Father of the Computer" and his work lives on as the foundation for the binary numbering system that is the basis of modern computers.

## 1847

George Boole represents logic in mathematical form with his Boolean Algebra.

**1898**

Nikola Tesla builds and demonstrates a remote controlled robot boat at Madison Square Garden.

**1921**

Czech writer Karel Capek introduced the word "Robot" in his play *R.U.R* (Rossum's Universal Robots). "Robot" in Czech comes from the word "robota", meaning "compulsory labor".

**1926**

Fritz Lang's movie *Metropolis* is released. "Maria", the female robot in the film, is the first robot to be projected on the silver screen.

**1936**

Alan Turing introduces the concept of a theoretical computer called the Turing Machine. Despite being a fundamental advance in computer logic it also spawns new schools in mathematics.

**1940**

Issac Asimov produces a series of short stories about robots starting with *A Strange Playfellow* (later renamed *Robbie*) for *Super Science Stories* magazine. The story is about a robot and its affection for a child that it is bound to protect. Over the next 10 years he produces more stories about robots that are eventually recompiled into the volume *I, Robot* in 1950.

Asimov is generally credited with the popularization of the term "robotics" which was first mentioned in his story *Runaround* in 1942. But probably Issac Asimov's most important contribution to the history of the robot is the creation of his Three Laws of Robotics:

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

Asimov later adds a "zeroth law" to the list:

Zeroth law: A robot may not injure humanity, or, through inaction, allow humanity to come to harm.

**1946**

George Devol patents a playback device for controlling machines.

**1950**

Alan Turing publishes *Computing Machinery and Intelligence* in which he proposes a test to determine whether or not a machine has gained the power to think for itself. It becomes known as the "Turing Test".

**1951**

*The Day the Earth Stood Still* premieres in theaters. The movie features an alien named Klaatu and his robot Gort.

**1956**

Alan Newell and Herbert Simon create the Logic Theorist, the first "expert system". It is used to help solve difficult math problems.

Aided by a grant from the Rockefeller Foundation John McCarthy, Marvin Minsky, Nat Rochester, and Claude Shannon organize The Dartmouth Summer Research Project on Artificial Intelligence at Dartmouth College. The term "artificial intelligence" is coined as a result of this conference.

### **1959**

John McCarthy and Marvin Minsky start the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology (MIT).

### **1961**

Heinrich Ernst develops the MH-1, a computer operated mechanical hand at MIT.

### **1962**

The first industrial arm robot - the Unimate - is introduced. It is designed to complete repetitive or dangerous tasks on a General Motors assembly line.

### **1963**

John McCarthy leaves MIT to start the Artificial Intelligence Laboratory at Stanford University.

### **1966**

The Stanford Research Institute (later to be known as SRI Technology) creates Shakey, the first mobile robot to know and react to its own actions. Amongst other achievements SRI was also the research institute that helped bring us modern day laundry detergent in the development of Tide.

An artificial intelligence program named ELIZA is created at MIT by Joseph Weizenbaum. ELIZA functions as a computer psychologist that manipulates its users' statements to form questions. Weizenbaum is disturbed at how quickly people put faith in his little program.

### **1967**

In response to an article written by Hubert Dreyfus in which he declares a computer program could never beat him in a game of chess, Richard Greenblatt writes MacHack, a program that does just that. Greenblatt's program would be the foundation for many future chess programs, ultimately culminating in Big Blue, which beat chess grand master Gary Kasparov.

### **1968**

Stanley Kubrick makes Arthur C. Clark's *2001: A Space Odyssey* into a movie. It features HAL, an onboard computer that decides it doesn't need its human counterparts any longer.

### **1969**

Victor Scheinman, a mechanical engineering student working in the Stanford Artificial Intelligence Lab (SAIL) creates the Stanford Arm. The arm's design becomes a standard and is still influencing the design of robot arms today.

### **1970**

Stanford University produces the Stanford Cart. It is designed to be a line follower but can also be controlled from a computer via radio link.

### **1971**

The film *Silent Running* is released starring Bruce Dern. Dern's co-stars are three robot drones Huey, Dewey, and Louie.

**1974**

Victor Scheinman forms his own company and starts marketing the Silver Arm. It is capable of assembling small parts together using touch sensors.

**1976**

Shigeo Hirose designs the Soft Gripper at the Tokyo Institute of Technology. It is designed to wrap around an object in snake like fashion.

**1977**

*Star Wars* is released. George Lucas' movie about a universe governed by the Force introduces watchers to R2-D2 and C-3PO. The movie creates the strongest image of a human future with robots since the 1960's and inspires a generation of researchers.

Deep space explorers Voyagers 1 and 2 launch from the Kennedy Space Flight Center.

**1979**

The Robotics Institute at Carnegie Mellon University is established.

The Stanford Cart is rebuilt by Hans Moravec. He adds a more robust vision system allowing greater autonomy. These are some of the first experiments with 3D environment mapping.

**1980**

Seymour Papert publishes *Mindstorms: Children, Computers, and Powerful Ideas* in which he advocates "constructionism", or learning through doing.

**1981**

Takeo Kanade builds the direct drive arm. It is the first to have motors installed directly into the joints of the arm. This change makes it faster and much more accurate than previous robotic arms.

**1982**

*Blade Runner* is released. This Ridley Scott film is based on the Philip K. Dick story *Do Androids Dream of Electric Sheep?* and starred Harrison Ford as Rick Deckard, a retired blade runner who hunted replicants (illegal mutinous androids).

**1986**

The LEGO® Group and the MIT Media Lab collaborate to bring the first LEGO-based educational robotics and control products to market. LEGO TC Logo is used by in the classrooms of thousands of elementary school teachers.

Honda begins a robot research program that starts with the premise that the robot "should coexist and cooperate with human beings, by doing what a person cannot do and by cultivating a new dimension in mobility to ultimately benefit society."

**1989**

A walking robot named Genghis is unveiled by the Mobile Robots Group at MIT. It becomes known for the way it walks, popularly referred to as the "Genghis gait".

At MIT Rodney Brooks and A. M. Flynn publish the paper *Fast, Cheap and Out of Control: A Robot Invasion of the Solar System* in the *Journal of the British Interplanetary Society*. The paper changes rover research from building the one, big, expensive robot to building lots of little cheap ones. The paper also makes the idea of building a robot somewhat more accessible to the average person.

Dr. Seymour Papert becomes the LEGO Professor of Learning Research.

### **1992**

In an attempt to build a radio controlled vacuum cleaner Marc Thorpe has the idea to start a robot combat event.

Dr. John Adler came up with the concept of the CyberKnife, a robot that images the patient with x-rays to look for a tumor and delivering a pre-planned dose of radiation to the tumor when found.

Inventor Dean Kamen founds *FIRST* (For Inspiration and Recognition of Science and Technology), a non-profit dedicated to facilitating robotics competitions with the aim of inspiring the next generation of science and technology leaders.

### **1993**

Dante, an 8-legged walking robot developed at Carnegie Mellon University descends into Mt. Erebus, Antarctica. Its mission is to collect data from a harsh environment similar to what we might find on another planet. The mission fails when, after a short 20 foot descent, Dante's tether snaps, dropping it into the crater.

### **1994**

Dante II, a more robust version of its predecessor, descends into the crater of Alaskan volcano Mt. Spurr. The mission is considered a success.

Marc Thorpe starts Robot Wars at Fort Mason Center in San Francisco, CA.

### **1996**

A RoboTuna is designed and built by David Barrett for his doctoral thesis at MIT. It is used to study the way fish swim.

Chris Campbell and Stuart Wilkinson turn a brewing accident into inspiration at the University of South Florida. The result is the Gastrobot, a robot that digests organic mass to produce carbon dioxide that is then used for power. They call their creation the "flatulence engine."

Honda debuts the P3, the fruit of its decade long effort to build a humanoid robot.

### **1997**

The first node of the International Space Station is placed in orbit. Over the next several years more components will join it, including a robotic arm designed by Canadian company MD Robotics.

The Pathfinder Mission lands on Mars. Its robotic rover Sojourner rolls down a ramp and onto Martian soil in early July. It continues to broadcast data from the Martian surface until September.

### **1998**

Tiger Electronics introduces the Furby into the Christmas toy market. It quickly becomes "the toy" to get

for the season. Using a variety of sensors this "animatronic pet" can react to its environment and communicate using over 800 phrases in English and their own language "Furbish".

LEGO releases their first Robotics Invention System™ 1.0. LEGO names the product line MINDSTORMS® after Seymour Papert's seminal work of 1980.

FIRST launches FIRST LEGO League, a robotics competition for ages 9-14 featuring the newly-released LEGO MINDSTORMS robotics system.

### **1999**

LEGO releases The Robotics Discovery Set, Droid Developer Kit and the Robotics Invention System 1.5.

SONY releases the AIBO robotic pet.

### **2000**

Honda debuts new humanoid robot ASIMO.

The Battlebots event is held in Las Vegas, Nevada.

LEGO releases the MINDSTORMS Robotics Invention System™ 2.0

### **2001**

LEGO releases the MINDSTORMS Ultimate Builder's Set

In August, the FDA clears the CyberKnife to treat tumors anywhere in the body.

### **2002**

Honda's ASIMO robot rings the opening bell at the New York Stock Exchange.

iRobot releases the first version of Roomba, the robot vacuum cleaner.

### **2003**

NASA launches both the "Spirit" and "Opportunity" Mars exploration robot rovers.

SONY releases the AIBO ERS-7, it's 3rd generation robotic pet.

### **2004**

The robot rover "Spirit" and "Opportunity" land safely on Mars.

### **2006**

The second generation of LEGO MINDSTORMS is launched, spawning a new generation of robotics enthusiasts at home and in schools.

*Special thanks to MegaGiant Robotics for the content of this document.*