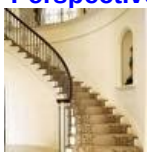
Science & Technology Stair Steps for

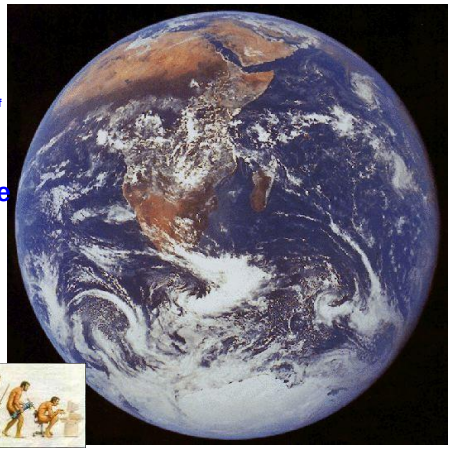
the Continuous Ascent of

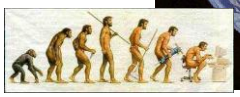
Homo Sapiens

A Historical

Perspective







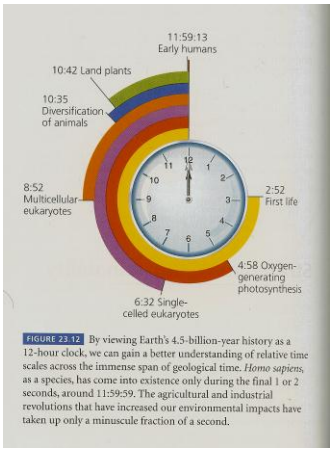
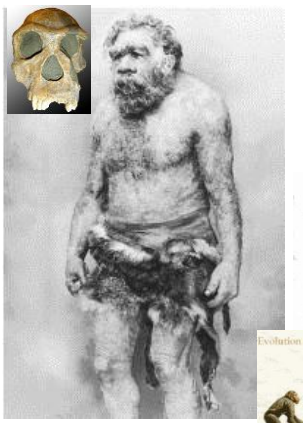
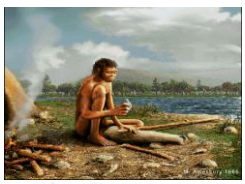


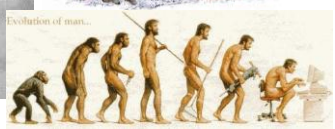
FIGURE 23.12 By viewing Earth's 4.5-billion-year history as a 12-hour clock, we can gain a better understanding of relative time scales across the immense span of geological time. *Homo sapiens*, as a species, has come into existence only during the final 1 or 2 seconds, around 11:59:59. The agricultural and industrial revolutions that have increased our environmental impacts have taken up only a minuscule fraction of a second.

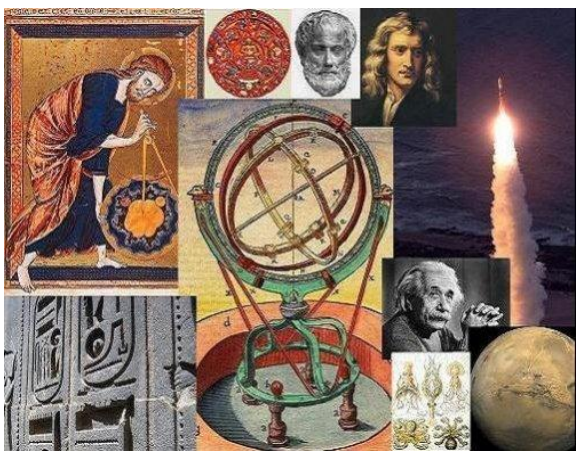
A ***eukaryote*** is an organism whose cells contain complex structures enclosed within membranes.



George







History of Science & Technology

The **history of technology** is the history of the invention of tools and techniques, and is similar in many ways to the history of humanity. Background knowledge has enabled people to create new things, and conversely, many scientific endeavors have become possible through technologies which assist humans to travel to places we could not otherwise go, and probe the nature of the universe in more detail than our natural senses allow.

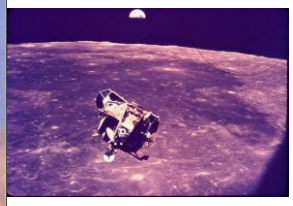
Pyramids(118) of Egypt

Acropolis, Athens

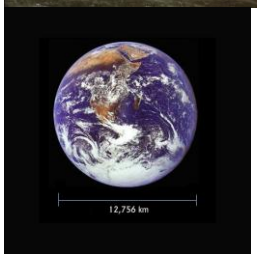
Persepolis, Iran

FIGURE 23.16 In 1961, U.S. President John F. Kennedy called on Congress to fund a space program to send men to the moon before 1970. Addressing our environmental problems and shifting our political, economic, and social institutions to a paradigm of sustainable development will require still more vision, resolve, and commitment. The fact that astronauts reached the moon just 8 years after Kennedy's speech demonstrates the power of human ingenuity in meeting a challenge, and provides hope that we will be able to meet the larger challenge of living sustainably on Earth.

APOLLO 11 MOON LANDING JULY 20 1969



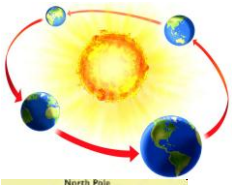
On July 20, 1969, the human race accomplished **its single greatest technological achievement of all time** when a **human** first set foot on another celestial body.
Six hours after landing at 4:17 p.m. Eastern Daylight Time (with less than 30 seconds of fuel remaining), Neil A. Armstrong (Born August 5,1930-died August 25,2012) took the **"Small Step" into our greater future** when he stepped off the Lunar Module, named "Eagle," onto the surface of the Moon, from which he could look up and see Earth in the heavens as no one had done before him.
He was shortly joined by "Buzz" Aldrin, and the two astronauts spent 21 hours on the lunar surface and returned 46 pounds of lunar rocks. After their historic walks on the Moon, they successfully docked with the Command Module "Columbia," in which Michael Collins was patiently orbiting the cold but no longer lifeless Moon.

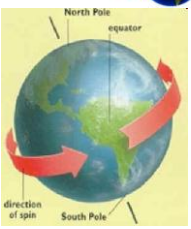


Introduction

Spaceship Earth

Our little Spaceship Earth is only 12,756 KM or 10,000 miles in diameter, which is almost a negligible dimension in the great vastness of space. Our nearest star; our energy-supplying mother-ship, the Sun; is 92,000,000 million miles away.





Our little Spaceship Earth is right now travelling at **60,000** miles an hour around the sun and is also spinning axially, which, at the latitude of Washington, D. C., adds approximately another **1000** miles per hour to our motion. Each minute we both spin at one hundred miles and zip in orbit around the Sun at one thousand miles. That is a whole lot of spin and zip.

Spaceship Earth was so extraordinarily well invented and designed that to our knowledge humans have been on board for two million years not even knowing that they were on board of a ship.
So part of the invention of the Spaceship Earth and its biological life-sustaining is that the **vegetation** on the land and the **algae** in the sea, using **photosynthesis**, are designed **to make the life-regenerating energy** for us to an adequate amount. But we can't eat all the vegetation. As a matter of fact, we can eat very little of it. We can't eat the bark or wood of the trees nor the grasses. But insects can eat these, and there are many other animals and creatures that can. We get the energy relayed to us by taking the milk and meat from the animals.

In the imagination of those who are sensitive to the realities of our era, the earth has become a Space Ship, and this, perhaps, **is the most important single fact of our time**. For millennia, the earth in humen's minds was flat and limitless. Today, as a result of exploration, speed, and the explosion of scientific & technological knowledge, earth has become a tiny sphere, closed, limited, crowded System, and hurtling through space.

This change in human's image of their home affects their behavior in many ways, and is likely to affect it much more in the future. It is not only that human's image of the earth has changed; the reality of the world social system has changed as well. As long as human was small in numbers and limited in **technology**, they could realistically regard the earth as an infinite reservoir, an infinite source of inputs and an infinite cesspool for outputs. Today we can no longer make this assumption. Earth has become a Space Ship, not only in our imagination but also in the hard realities of the social, biological, and physical system in which human is enmeshed.

In what we might call the "old days," when human were small in numbers and earth was large; they could pollute it with impunity, though even then they frequently destroyed his immediate environment and had to move on to a new spot, which he then proceeded to destroy. Now human can no longer do this; they must live in the whole system, in which they must recycle their wastes. In a space ship there are no sewers.

You begin to develop quite a little thermodynamic sense. You know that you're either going to have to keep the machine (which operates with precise physical, chemical , biological & geological principles) in good order or it's going to be in trouble and fail to function. We have not been seeing our Spaceship Earth as an integrally-designed machine which to be persistently successful must be comprehended and serviced in total. Now there is one outstandingly important fact regarding Spaceship Earth, and that is that no instruction book came with it.
Lack of instruction has forced us to find that there are two kinds of berries-red berries that will kill us and red berries that will nourish us. And we had to find out ways of telling which-was-which red berry before we ate it or otherwise we would die.

So we were forced, because of a lack of an instruction book, to use our intellect, which is our supreme faculty, to devise scientific and technological experimental procedures and to interpret effectively the significance of the experimental findings. Thus, because the instruction manual was missing we are learning how we safely can anticipate the consequences of an increasing number of alternative ways of extending our satisfactory survival and growth-both physical and metaphysical.

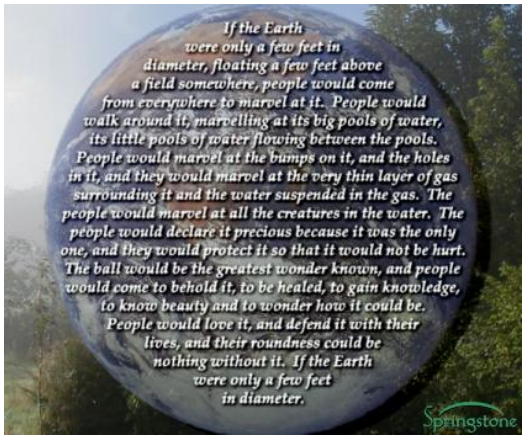
The designed omission of the instruction book on how to operate and maintain Spaceship Earth and its complex life-supporting and regenerating systems has forced us to discover retrospectively just what our most important forward capabilities are

We are finally going to have to face the fact that we are a biological system living in an ecological system, and that our survival power is going to depend on our developing symbiotic relationships of a closed-cycle character with all the other elements and populations of the world of ecological systems.

Now the whole Earth is in our hands.

Collectively, disregard of our race and nationality, we must maintain it for now & future generations!

Once we begin to look at earth as a **Space Ship**, the appalling extent of our ignorance about it is almost frightening. Finally, the consequences of earth becoming a **Space Ship** for the social system are profound and little understood. It is clear that much human behavior and many human institutions in the past, which were appropriate to all infinite earth, are entirely inappropriate to a small closed space ship. We cannot afford unrestrained conflict, and we almost certainly cannot afford national sovereignty in an unrestricted sense.

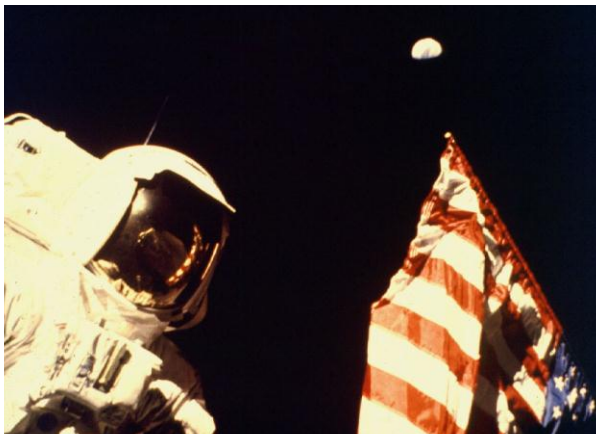


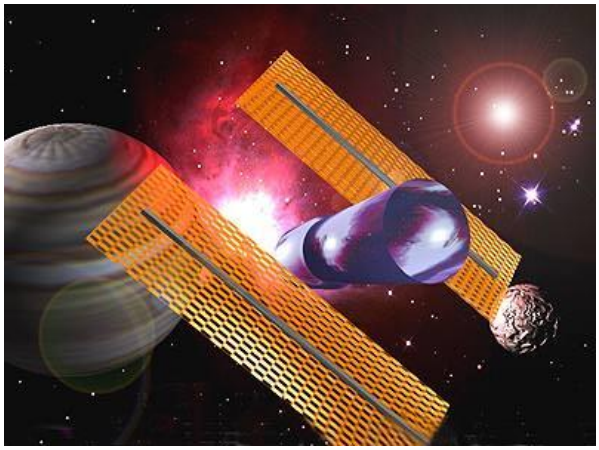
4:17pm EDT on July 20, 1962

The Eagle has landed

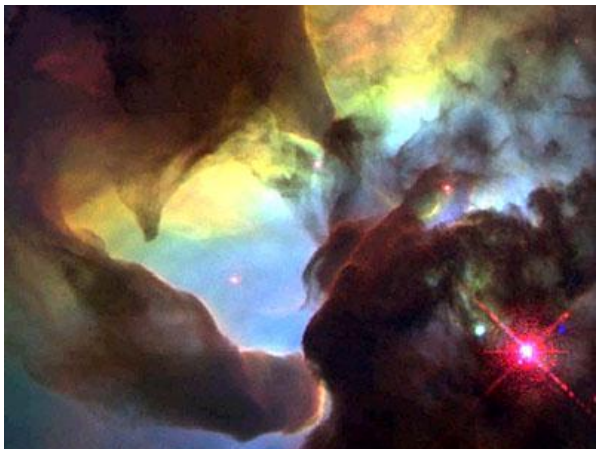
A small step for human a giant leap for humankind

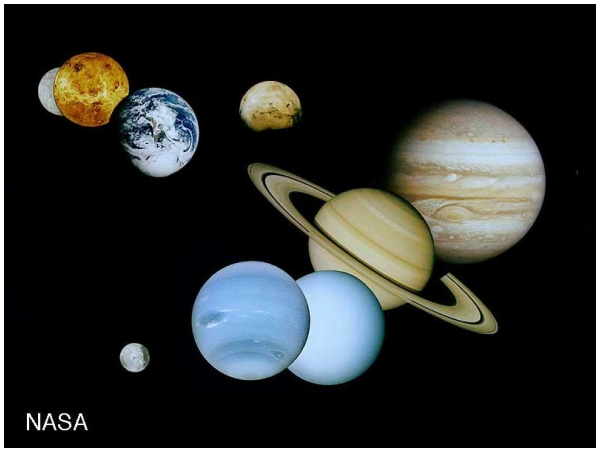
Neal Armstrong





Mars Pathfinder (**MESUR Pathfinder**[2]) was an American spacecraft that landed a base station with a roving probe on Mars in 1997. It consisted of a lander, renamed the **Carl Sagan Memorial Station**, and a lightweight (10.6 kg/23 lb) wheeled robotic Mars rover named ***Sojourner***





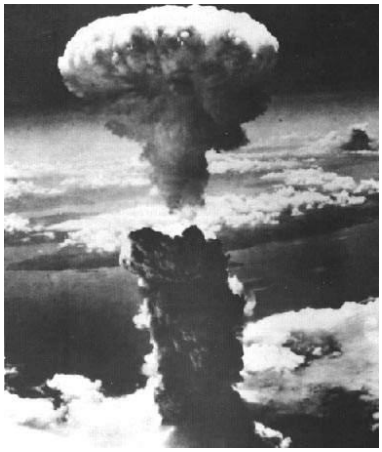
September 11/ 2001

You just saw some of our impressive accomplishments, Now just a few tragedies

This is the "Fat Man" atomic bomb dropped on Nagasaki, Japan

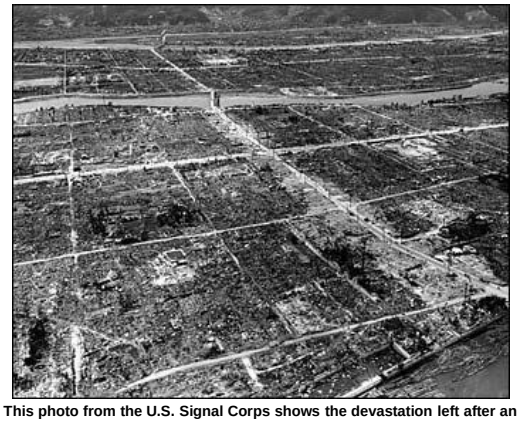
B-29 Aircraft in Tinian Island On August 6, 1945

At 8:15 AM On August 6, 1945 Enola Gay Plane dropped A 20 kiloton Atomic Bomb Over Hiroshima Japan. Moments after a mushroom cloud rises 20,000 feet over Hiroshima,



Within 11 seconds 200,000 People Died- Still is Taking life

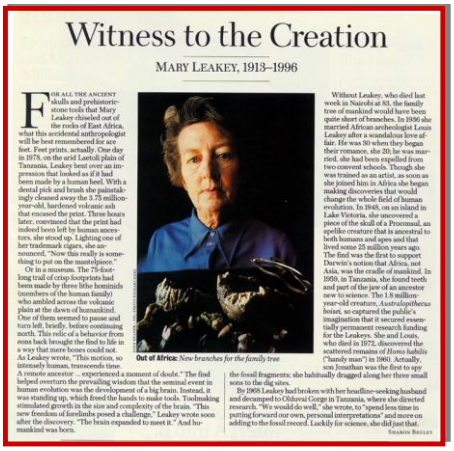
An allied correspondent stands in a sea of rubble before the shell of a building that once was a movie theater in Hiroshima Sept. 8, 1945. On Aug. 6, 1945, an atomic bomb instantly destroyed almost all of the houses and buildings in Hiroshima.



This photo from the U.S. Signal Corps shows the devastation left after an atom bomb exploded over Nagasaki, Japan, on Aug. 9, 1945

A Historical Perspective

-How various civilizations, cultures & great thinkers have related to & discovered the nature of science & technology



Witness to the Creation

MARY LEAKEY, 1913–1996

FOR ALL THE ANCIENT skulls and prehistoric stone tools that Mary Leakey chiseled out of the rocks of East Africa, what this accidental anthropologist will be best remembered for are feet. Feet prints, actually. One day in 1978, on the arid Laetoli plain of Tanzania, Leakey bent over an impression that looked as if it had been made by a human heel. With a dental pick and brush she painstakingly cleaned away the 3.75 million-year-old, hardened volcanic ash that encased the print. Three hours later, convinced that the print had indeed been left by human ancestors, she stood up. Lighting one of her trademark cigars, she announced, "Now this really is something to put on the mantelpiece."

Or in a museum. The 75-foot-long trail of crisp footprints had been made by three lithe hominids (members of the human family) who ambled across the volcanic plain at the dawn of humankind. One of them seemed to pause and turn left, briefly, before continuing north. This relic of a behavior from eons back brought the find to life in a way that mere bones could not. As Leakey wrote, "This motion, so intensely human, transcends time. A remote ancestor ... experienced a moment of doubt." The find helped overturn the prevailing wisdom that the seminal event in human evolution was the development of a big brain. Instead, it was standing up, which freed the hands to make tools. Toolmaking stimulated growth in the size and complexity of the brain. "This new freedom of forelimbs posed a challenge," Leakey wrote soon after the discovery. "The brain expanded to meet it." And humankind was born.

Out of Africa: *New branches for the family tree*

Without Leakey, who died last week in Nairobi at 83, the family tree of mankind would have been quite short of branches. In 1936 she married African archeologist Louis Leakey after a scandalous love affair. He was 30 when they began their romance, she 20; he was married, she had been expelled from two convent schools. Though she was trained as an artist, as soon as she joined him in Africa she began making discoveries that would change the whole field of human evolution. In 1948, on an island in Lake Victoria, she uncovered a piece of the skull of a Proconsul, an apelike creature that is ancestral to both humans and apes and that lived some 25 million years ago. The find was the first to support Darwin's notion that Africa, not Asia, was the cradle of mankind. In 1959, in Tanzania, she found teeth and part of the jaw of an ancestor new to science. The 1.8 million-year-old creature, *Australopithecus boisei*, so captured the public's imagination that it secured essentially permanent research funding for the Leakeys. She and Louis, who died in 1972, discovered the scattered remains of *Homo habilis* ("handy man") in 1960. Actually, son Jonathan was the first to spy the fossil fragments; she habitually dragged along her three small sons to the dig sites.

By 1968 Leakey had broken with her headline-seeking husband and decamped to Olduvai Gorge in Tanzania, where she directed research. "We would do well," she wrote, to "spend less time in putting forward our own, personal interpretations" and more on adding to the fossil record. Luckily for science, she did just that.

SHARON BEGLEY

WITNESS TO THE CREATION

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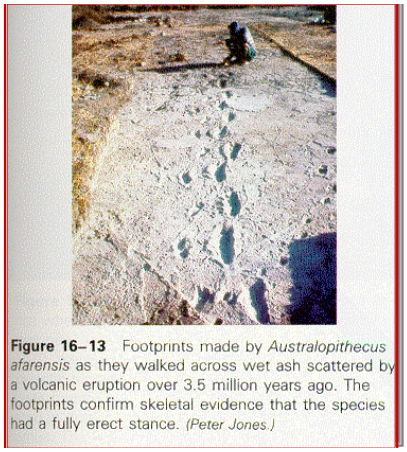
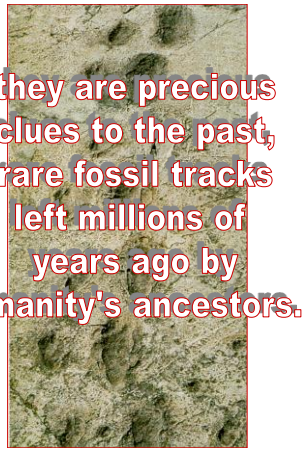
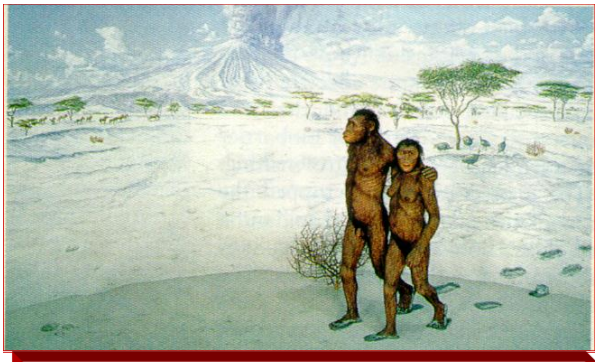


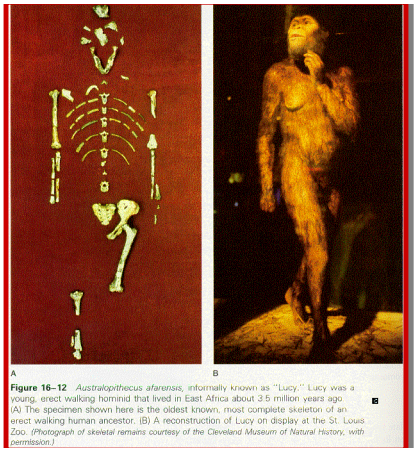
Figure 16–13 Footprints made by *Australopithecus afarensis* as they walked across wet ash scattered by a volcanic eruption over 3.5 million years ago. The footprints confirm skeletal evidence that the species had a fully erect stance. *(Peter Jones.)*



they are precious clues to the past, rare fossil tracks left millions of years ago by humanity's ancestors.



Lifelike diorama's of the Laetoli hominids with the stark landscape background in Smithsonian museum.



EARLIEST

TECHNOLOGIES:

FIRE

STONE AX

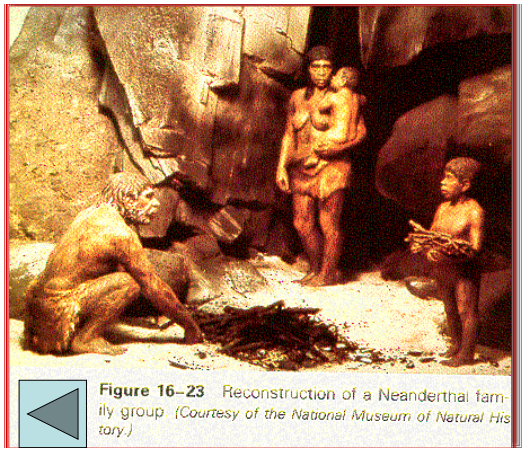


Figure 16–23 Reconstruction of a Neanderthal family group. *(Courtesy of the National Museum of Natural History.)*

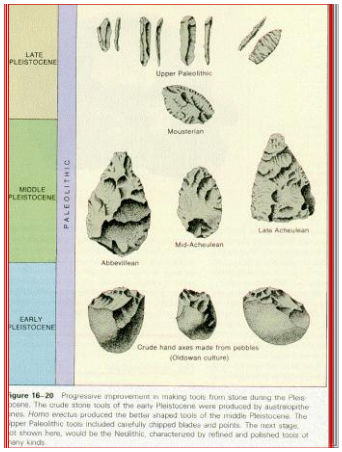


Figure 16–20 Progressive improvement in making tools from stone during the Pleistocene. The crude stone tools of the early Pleistocene were produced by australopithecines. *Homo erectus* produced the better shaped tools of the middle Pleistocene. The Upper Paleolithic tools included carefully chipped blades and points. The next stage, as shown here, would be the Neolithic, characterized by refined and polished tools of many kinds.

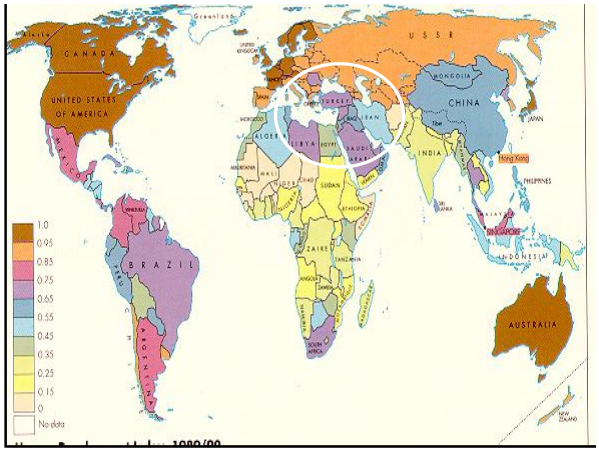
Greeks

Romans

Persians

Egyptians

Mesopotamians



The Earth's Natural Forces (i.e. Volcanoes, Earthquakes, Tornadoes, Hurricanes, Thunder, Lightening, Seasonal Climates, Forest & brush wild fires), diverse forms of life & their relationships, and disease & death, have been of intense interest to Homo sapiens since their earliest appearance on earth.What or who is responsible for all these events? Understanding the cause and effect of these natural forces are the stepping-stones and staircase of Science & Technology and the ascent of Homo sapiens in a continuous journey of knowledge and excellence.

Role of Gods & Goddesses in Ancient Civilizations

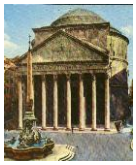
The Gods & Goddesses were blessed with powers and cursed with human emotions like love and anger. Their residence has been atop the Mount Olympus, the highest mountain of Greece, from which derives also their characteristic name, Olympian Gods.

The Important characteristic of the Olympian twelve gods was their immortality. Each one of them has the ability to appear in front of mortals and provide them with advice and help. Many examples of that can be found in the Iliad and Odyssey, works of the poet Homer. In them many time god Athena appears in various forms to Odysseys, as she has been his protector.

It is not rare of course to see the opposite. Some of the ancient Greek gods to get angry with the mortals and try to harm or punish them.

The Gods & Goddesses were worshipped by the ancient civilizations, who built impressive temples and sacrificed animals or even humans for them. They also constructed temples which were dedicated to them. Very famous ones are Greek Parthenon, Roman Pantheon, Egyptians, Persians & Meca temples.

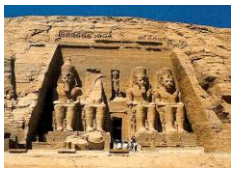
Parthenon Greece



Panteon-Roman

Meca-Islam

Osiris was one of the most important deities of ancient Egypt. Osiris is often considered to be the first ancient Egyptian god to be officially recorded in written scripts of ancient Egypt. Since Osiris is the god of afterlife.



Egyptians worshiped Many Gods & Goddesses

Zuraster Persian God

Poseidon – god of the sea. Trident is a weapon that could shake the earth and destroy any object. He was second only to Zeus in power amongst the gods. Beneath the

Mithra Persian Goddess of Rain & light

Romans Adopted most of Greek Gods and Goddesses with the addition of Volcan & Venus

Mesopotamian God & Profits

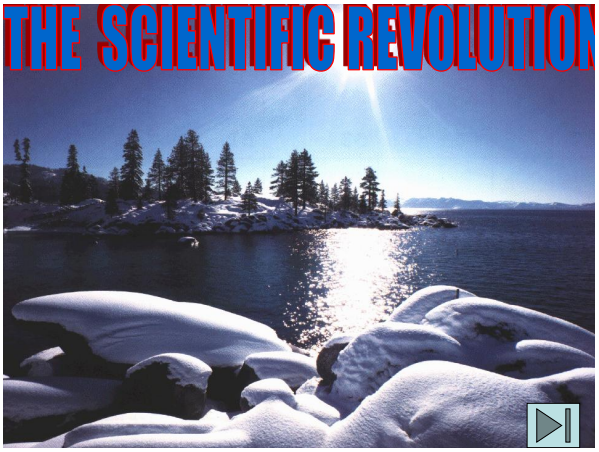
God

Moses

Jesus

Mohammad

Devil


THE SCIENTIFIC REVOLUTION


Francis Bacon 1561-1662

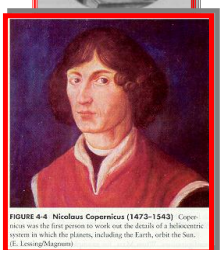
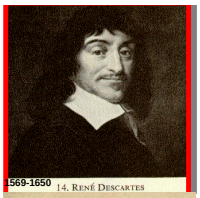
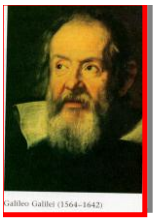
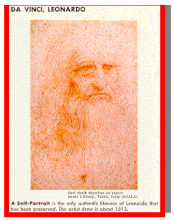


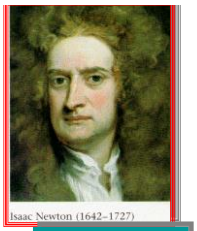
FIGURE 4-4 Nicolaus Copernicus (1473–1543)

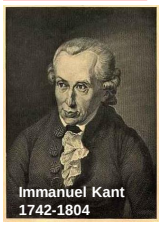

1569-1650
14. René Descartes

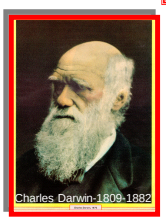

Thomas Malthus 1766-1834

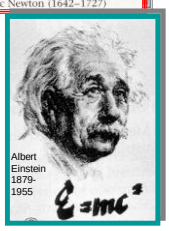

Galileo Galilei (1564–1642)


DA VINCI, LEONARDO


Isaac Newton (1642–1727)

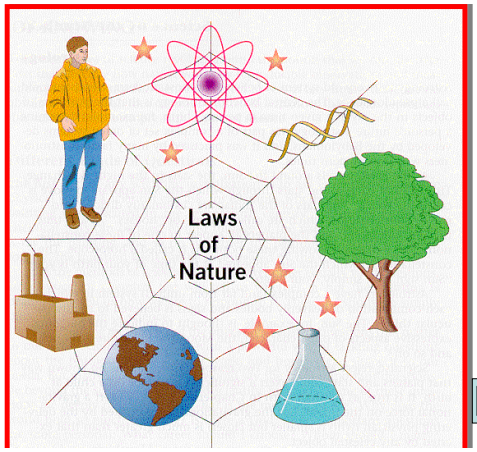

Immanuel Kant
1742-1804


Charles Darwin 1809-1882


Albert
Einstein
1879-
1955
E=mc²

* III. THE SCIENTIFIC REVOLUTION (RENAISSANCE):

NATURE IS SUBJECT TO RATIONAL NATURAL LAWS



SCIENTIFIC REVOLUTION!

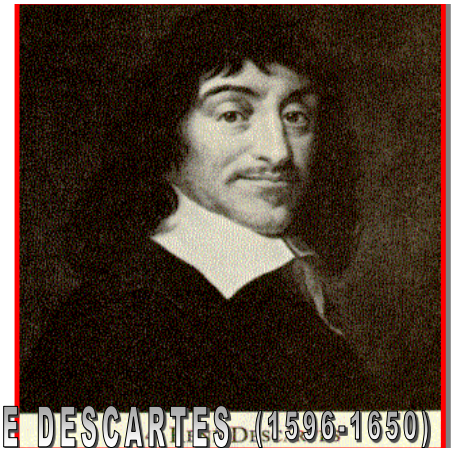
- NATURAL MAGIC
- WITCHCRAFT
- ALCHEMY

FRANCIS BACON

(1561-1662)

FRANCIS BACON (1561-1626)

MECHANISTIC PHILOSOPHY-NATURE OBEYSLAWS OF SCIENCE



RENE DESCARTES (1596-1650)

RENE DESCARTES
(1596-1650)

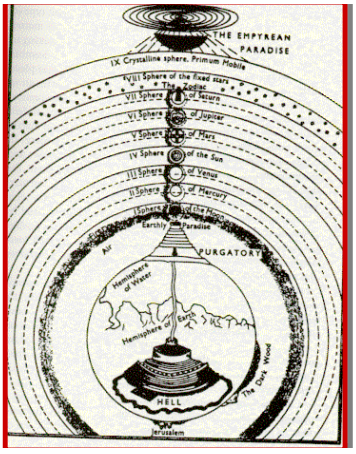
"I THINK, THEREFORE I AM"

Augusta Rodin, The THINKER In Paris museum

Augusta Rodin, **The THINKER,**

The nakedness of Rodin's famous statue of a solitary thinker deeply wrapped in thought suggests that human is a uniquely reflective and self-aware living, and that this is something fundamental to the human condition.

GEOCENTRIC CONCEPT:
EARTH IS IN THE CENTER OF UNIVERSE:



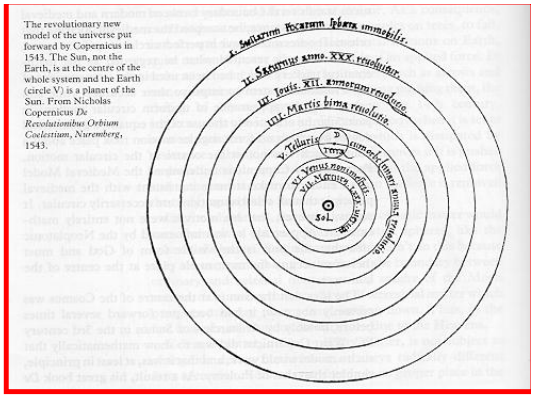
BELIEVED BY ANCIENT CIVILIZATIONS, JEWS, CHRISTIANS, MUSLIMS

FIGURE 4-4 Nicolaus Copernicus (1473–1543) Copernicus was the first person to work out the details of a heliocentric system in which the planets, including the Earth, orbit the Sun. (E. Lessing/Magnum)

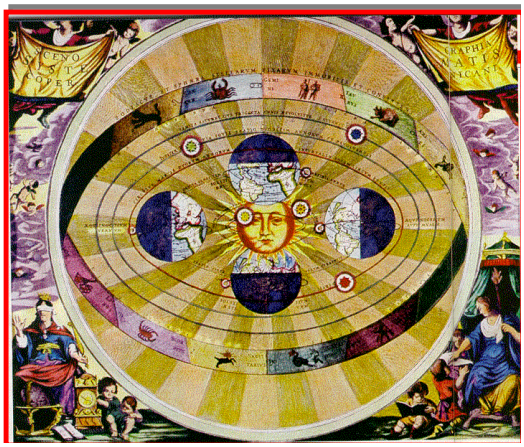
NICOLAUS COPERNICUS (1473-1543)

NICOLAUS COPERNICUS (1473-1543)

HELIOCENTRIC CONCEPT: SUN IS IN THE CENTER OF UNIVERSE

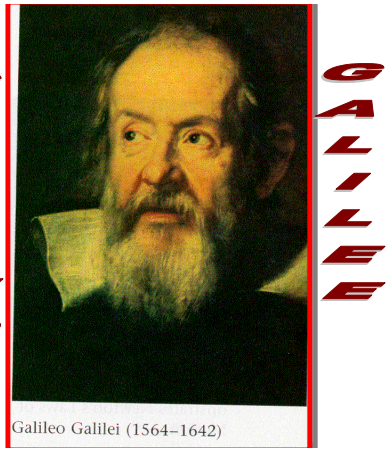


The revolutionary new model of the universe put forward by Copernicus in 1543. The Sun, not the Earth, is at the centre of the whole system and the Earth (circle V) is a planet of the Sun. From Nicholas Copernicus *De Revolutionibus Orbium Coelestium*, Nuremberg, 1543.



DISPLACED THE EARTH FROM THE CENTER OF THE UNIVERSE

GALILEO GALILEE

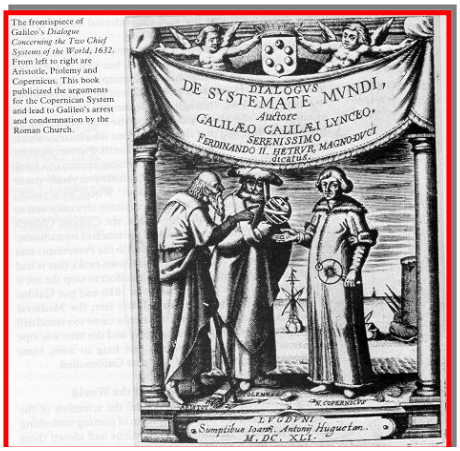


Galileo Galilei (1564–1642)

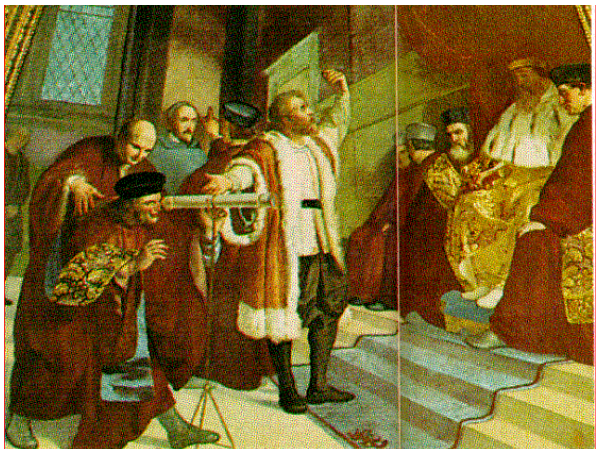
Figure 2–7
Telescopes used by Galileo Galilei in his astronomical studies.

GALILEO GALILEE (1564-643)

EXPLAINED AND SPREAD THE HELIOCENTRIC CONCEPT



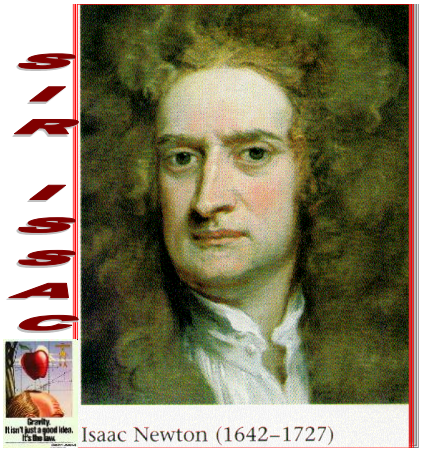
The frontispiece of Galileo's *Dialogue Concerning the Two Chief Systems of the World, 1632*. From left to right are Aristotle, Ptolemy and Copernicus. This book publicized the arguments for the Copernican System and lead to Galileo's arrest and condemnation by the Roman Church.



SCIENCE VS. TECHNOLOGY

- **LEONARDO DA VINCI (1452-1519)**
- ***PHYSICIAN VS SURGEON-PHYSICIAN ARE SCIENTIST SURGEON ARE TECHNOLOGIST***

SIR ISAAC NEWTON

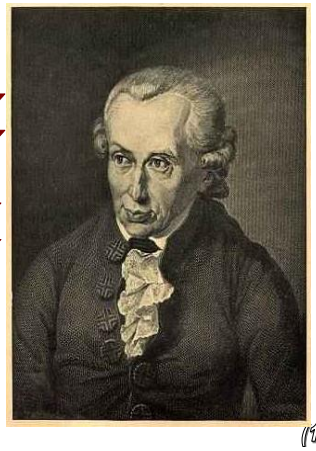


Isaac Newton (1642–1727)

THE TRIUMPH OF SCIENCE (EXPERIMENTAL PHILOSOPHY)

- **SIR ISAAC NEWTON(1642-1727)**
- LAW OF GRAVITATION
- WORLD AS A GREAT MACHINE

IMMANUEL KANT


(1724-1804)

IMMANUEL KANT(1724-1804)

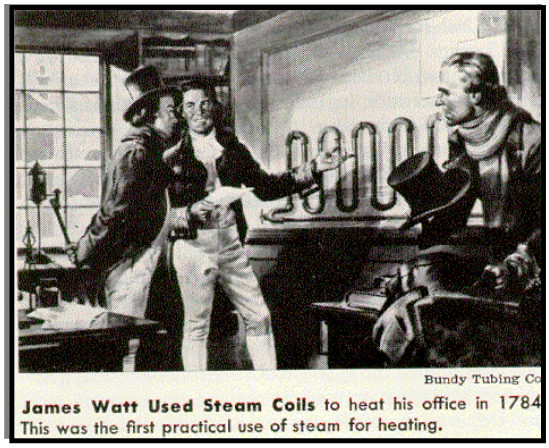
EMPIRICAL WORLD -

SUBJECT TO THE LAWS OF SCIENCE

WORLD OF IDEAS - DIRECTLY APPREHENDED BY MIND (MORAL CATEGORIES- PHILOSOPHY)

* IV.THE INDUSTRIAL REVOLUTION

- **ROLE OF INVENTORS:**
- **JAMES WATT (1736-1819)**
- STEAM ENGINE
- **ROLE OF BRITAIN:**
- - IRON & COAL
-



INDUSTRIALIZED WAR

- COMMUNICATIONS
- ELECTROMAGNETIC TELEGRAPH
- FIREARMS

APPRECIATION FOR WILDERNESS:

"ENGLISH GARDENS",

PESSIMISM ABOUT NATURE'S ABILITY TO SUPPORT HUMANITY

Thomas Malthus

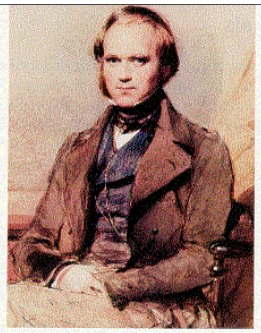
1766-1834

THOMAS MALTHUS(1766-1834)

- ESSAY ON THE PRINCIPLE OF POPULATION
- GEOMETRIC INCREASE OF HUMAN POPULATION VS LINEAR INCREASE OF HUMAN SUBSISTENCE

CHARLES

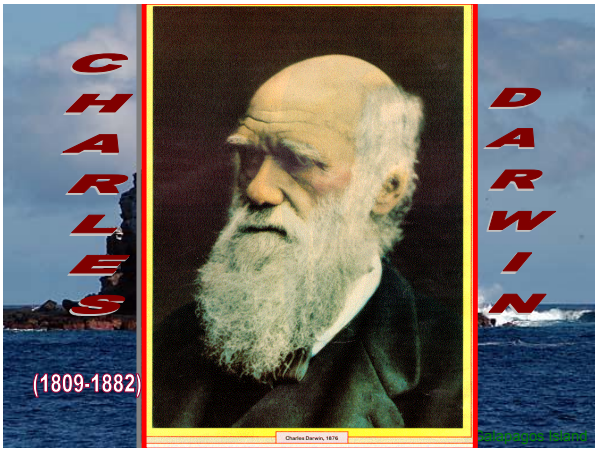
22 years old



DARWIN

(1809-1882)

Figure 1–16 Charles Darwin as a young man. This portrait was made shortly after Darwin returned to England from his voyage around the world on the *H.M.S. Beagle*. Observations made during this voyage helped him formulate the concept of evolution by natural selection.



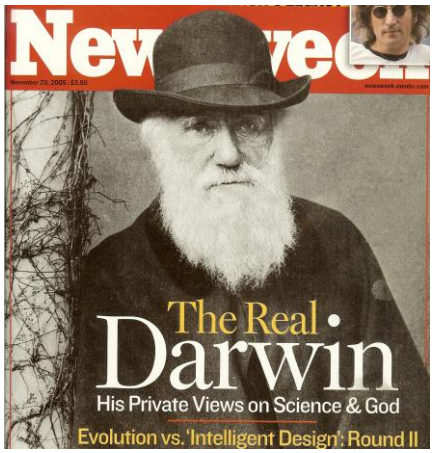
CHARLES DARWIN(1809-1882)

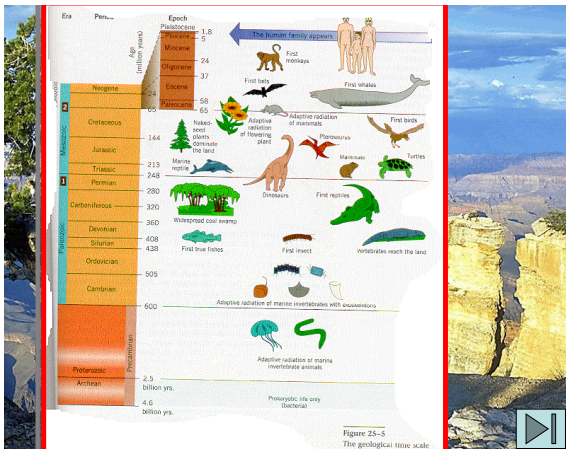
SPECIES ARE NOT FIXED, CHANGE UNDER THE INFLUENCE OF THEIR ENVIRONMENTS AND EACH OTHER.

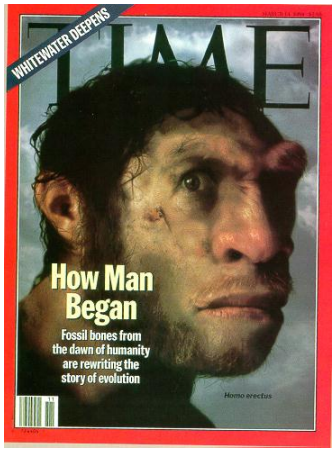
***CONCEPT OF PROCESS AND A PROGRESSIVE MOVEMENT**

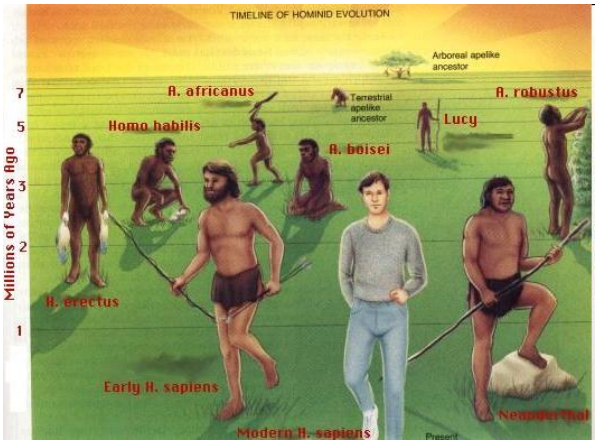
***PHYSICAL LAWS GOVERN BOTH, ORGANIC WORLD (ALL LIVING THINGS) AND INORGANIC UNIVERSE**

- DISPLACED THE MAN FROM THE CENTER OF CREATION





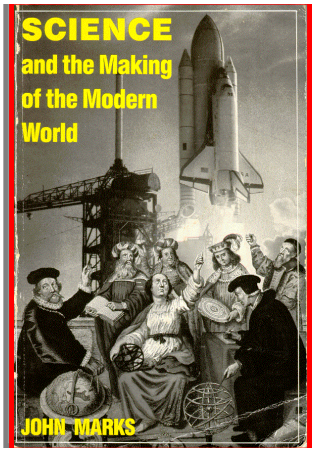


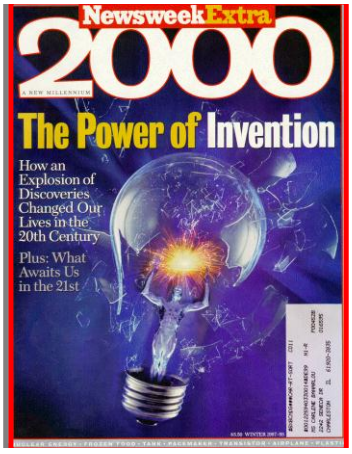


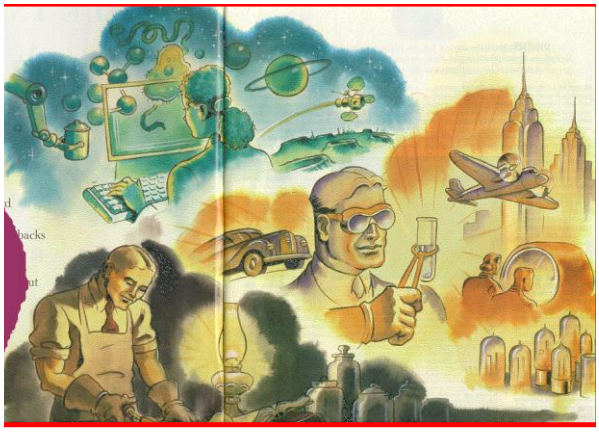
The achievements of modern science seem to contradict religion and undermine faith. But for a growing number of scientists, the same discoveries offer support for spirituality and hints of the very nature of God.

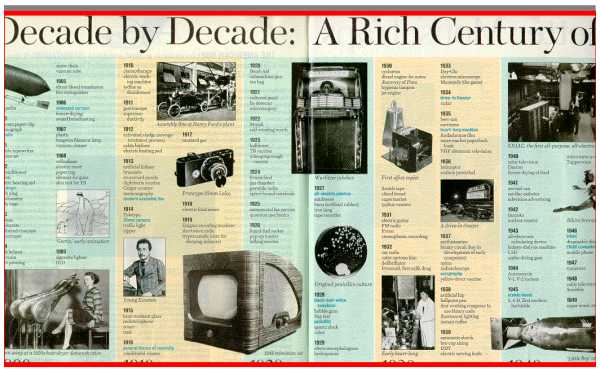
THE BEGINNING OF TECHNOLOGY

- **COUNT CLAUDE DE SAINT - SIMON (1760-1825)**
- A BLUE PRINT FOR A NEW WAY OF LIFE IN A NEW SOCIETY THAT WOULD BE COMPATIBLE WITH THE TRIUMPHANT NEW INDUSTRIALISM. "SOCIETY SHOULD BE DOMINATED BY THOSE WHO CONTRIBUTED MOST TO IT - INDUSTRIAL" - THE BUILDING OF A TECHNOLOGICAL SOCIETY









20TH CENTURY-DECADE BY DECADE: A RICH CENTURY OF INVENTIONS
(Excerpts from Newsweek Extra Winter 97-98 Issue)
TIME LINE
1900-Brosnon paper clip, seismograph, Zeppelin airship
1901-**Electric typewriter**, Erector set
1902-**Air Conditioner,** Crayon, **Electric hearing aid**, Hair dryer, Spark plug, speedometer, Teddy bear
1903-**Airplane**, Barbiturate, Reinforced-concrete, skyscraper
1904-Crash helmet, **Novocain**, Offset printing, Snow chain, Vacuum tube
1905-Direct blood transfusion, **Fire extinguisher**
1906-Animated cartoon, Freeze-drying, **Sound broadcasting**
1907-**Plastic**, Tungsten filament lamp, Vacuum cleaner
1908-Cellophane, Electric razor, Paper cup, Silencer for guns, Skin test for TB

1909-Cigarette lighter, IUD
1910-**Chemotherapy**, **Electric washing machine**, Iodine as disinfectant
1911-Gastroscope, Superconductivity
1912-Activated sludge(sewage treatment process), Cabin biplane, Electric heating pad
1913-**Artificial kidney**, Brassiere, Crossword puzzle, **Diphtheria vaccine**, Geiger counter, **Mammography**, Modern assembly line
1914-Teletype, 35mm camera, **Traffic light**, Zipper
1915-Heat-resistant glass, Radiotelephone, Sonar, Tank
1916-General theory of relativity, Windshield wipers
1917-Mustard gas
1918-Electric food mixer
1919-Enigma encoding machine, Shortwave radio, **Tryparsamide (cure for sleeping sickness)**
1920-Band-Aid, Submachine gun, tea bag

1921-Cultured pearl, Lie detector, Microsurgery
1922-Muzak, Self-winding watch
1923-**Bulldozer**, **TB vaccine**, Whooping-cough vaccine
1924-Frozen food, Gas chamber, Portable radio, Spiral-bound notebook
1925-Commercial fax service, Quantum mechanics
1926-Liquid fuel rocket, Pop-up toaster, **Talking movies**
1927-All-electric jukebox, Antifreeze, Buna (artificial rubber), Iron lung, Tape recorder
1928-**Black and white television**, bubble gum, Pap test, **Penicillin**, Quartz clock, Robot
1929-Electroencephalogram, Hydrophonics
1930-Cyclotron, Diesel engine for autos, Discovery of Pluto, **Hygienic tampon,** Jet engine, **Scotch tape**, Sliced bread, Supermarket, Typhus vaccine
1931-Electric guitar, **FM radio**, Freon, Stereophonic recording
1932-Car radio, Color cartoon film, Defibrillator, Prontosil-first sulfa drug

1933-Day-Glo, Electron microscope, Monopoly (the game)
1934-Drive-in theater, Radar
1935-Beer can, Cortisone, **Heart-lung machine**, Kodachrome film, Mass-market paperback book, VHF electronic television
1936-**Helicopter,** Sodium pentothal
1937-Antihistamine, Binary circuit(key in the development of early computers), **Nylon**, Radio telescope, Xerography, **Yellow-fever vaccine**
1938-Artificial hip, Ballpoint pen, First working computer to use binary code, Fluorescent lighting, Instant coffee
1939-Automatic clutch, Bra-cup sizing, DDT, Electric carving knife
1940-Color television, Dacron, Freeze-drying of food
1941-Aerosol can, **Cardiac catheter**, Television advertising
1942-Bazooka, **Nuclear Reactor**
1943-All electronic calculating device, **Kidney-dialysis machine,** LSD, Scuba-diving gear

1944-Aureomycin, V-1,V-2 rockets
1945-**Atomic bomb**, 2,4-D (first modern herbicide), **Microwave oven**, Tupperware
1946-Bikini, **Disposable diaper**, ENIAC computer, Mobile phone
1947-**Transistor**
1948-Cable television, Scrabble
1949-Super music amplifier
1950-Credit card, Embryo transplanted in cow
1951-Power steering, Super Glue
1952-**Amniocentesis**, Mr. Potato Head, **Salk's polio vaccine**, Sex-change operation, Telephone- answering machine, Thermonuclear blast, 3-D film
1953-**DNA**, **Kidney transplant**, Radial tire
1954-Nonstick pan, **Oral contraceptive**, Silicon photovoltaic cell (solar power), TV dinner, Thorazine, Vertical-takeoff plane
1955-Field-ion microscope, Hovercraft, Lego, Optic fiber, Synthetic diamond, Tetracycline, Tylenol

1956-Computer hard disk, DNA biosynthesis, Human-growth hormone
1957-Fortran (computer language), High-speed dental drill, ICBM, **Live polio vaccine**, Sputnik
1958-**External pacemaker,** Hula-Hoop, Integrated circuit, Modem, Ultrasound examination of fetuses
1959-**Electrocardiograph**, **Internal pacemaker**
1960-Breast implant, Fiber-tip pen, Halogen lamp
1961-Discovery of acid rain, Nondairy creamer, Valium
1962-Audiocassette, Laser-eye surgery
1963-Instant color film, **Liver transplant**, **Lung transplant**, **Measles** vaccine, Navigation satellite, Videodisc
1964-Acrylic paint, Permanent-press fabric, touch-tone phone
1965-Astroturf, BASIC (computer language), Dolby sound lab opens, hologram, Kevlar, Miniskirt, NutraSweet, Portable video recorder, **Soft contact lenses**, **Virtual reality**
1966-Fuel injection for autos, Rubella vaccine
1967-**Coronary bypass**, **Handheld calculator**, **Heart transplant**, L-dopa (Parkinson's drug)

1968-Computer mouse, Computer with integrated circuits
1969-Arpanet (proto Internet), Artificial heart, ATM, Bar-code scanner, Ibuprofen, **In vitro fertilization**, **Lunar landing**, Unix (computer operating system)
1970-Daisy-wheel printer, Floppy disk
1971-Dot-matrix printer, **Food processor**, Liquid-crystal display, **Space station**
1972-Compact disc,**Landsat**,Pong (1stcomputer game),wordprocessor
1973-**Gene splicing**
1974-Post-it note
1975-Ethernet (computer network), Laser printer, Personal computer, Push-through tab on drink can
1976-Ink-jet printer, VHS system for video recording
1977-Apple II, Fiber optic communication, Linked ATM, **Magnetic resonance imaging**, Neutron bomb
1978-**Test-tube baby**
1979-**Artificial blood**, Rubik's cube, 24-bit microprocessor
1980-**Gene transfer, Hepatitis-B vaccine**

1981-Aspartame, Cloning of zebra fish, MS-DOS, **Space shuttle**
1982-Clone of IBM personal computer, **Human growth hormone from genetically engineered bacteria, Human insulin made by bacteria**
1983-**Cellular-phone network**, Computer virus, **Human embryo transfer, I mmunosuppressant**- cyclosporine, Lisa (prototype of Macintosh computer)
1984-Computer animation-"The Last Starfighter", CD-ROM, Factor VIII (treatment for hemophiliacs), fetal surgery, Macintosh computer, random access memory (RAM)
1985-**Genetic fingerprinting**, Implanted cardiac difbrilator, Pagemaker (desktop publishing program), Windows
1986-Digital audiotape
1987-**Gene gun**, Implanting cells to cure or alleviate Parkinson's, Prozac approved in U.S., Soy milk, 3-D videogame
1988-Chicken feed that makes low-cholesterol eggs, Disposable contact lenses, Doppler radar, Inputing data by writing on screen, Positron microscope, **RU-486** (abortion pill)

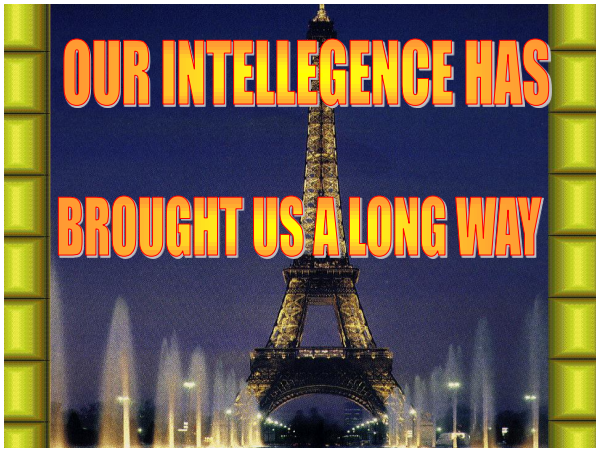
1989-Global positioning system by satellite, High-definition television, Stealth bomber
1990-**World Wide Web**
1991-Digital answering machine, Plastic-explosive detector
1992-Baboon-human liver transplant, Crystal holograph memory, Instant language translator, 'Smart pill' (travels to specific locations), Taxol (cancer drug)
1993-'Intelligent' metal (gets harder under stress), Mapping of the male chromosome, Pentium processor
1994-Channel tunnel opens, HIV protease inhibitor, Microwave clothes dryer
1995-Carbon-monoxide-to-carbon dioxide converter, Gene for obesity discovered, Java (computer language)
1996-Antimatter created in a lab, EV1 (first commercial electric car), Web TV
1997-**Cloning of adult mammal**, Gas-powered fuel cell

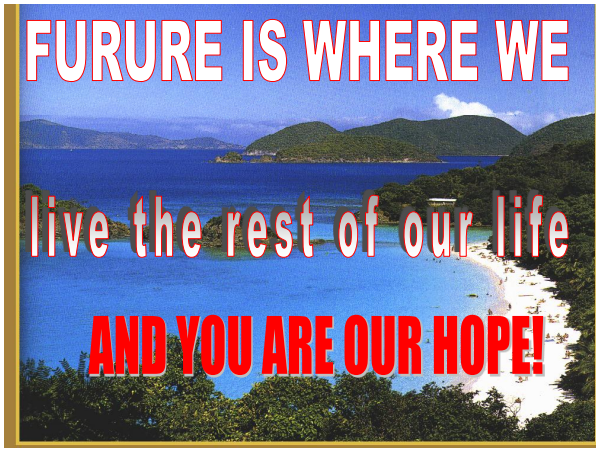
Epilogue

In 1500 A.D. educated people believed themselves living at the center of a finite cosmos, at the Mercy of (supernatural) forces..

beyond their control, and continually menaced by Satan and his allies. By 1700 A.D. educated people for the most part believed themselves living in an infinite universe...

on a tiny planet in (elliptical) orbit about the sun no longer menaced by Satan, and confident that understanding the natural world lay within their grasp.



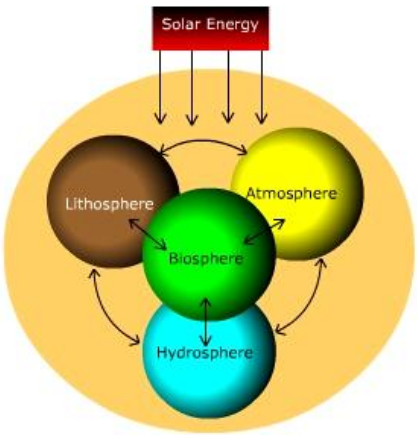


TECHNOLOGY AND CHOICE

With humans, the technology we choose to build and the manner in which we use it is totally a matter of choice. We have an infinite capacity to produce technological goodies, within the boundaries of natural law, and we can accept or reject an idea as we choose. It is in that choice of what artifacts to produce and the range of artifacts that we are capable of producing that we find the true nature of technology. And, as nearly as we can tell, that choice seems to be the sole province of human activity.

TECHNOLOGY AND EVOLUTION

Technology is a vital part of what it is to be human; in order to understand our world, it is necessary to understand the purpose, the source, and the processes of our technological world. For a human being, doing technology is a natural process. It represents one of the chief capacities with which nature has provided us for our survival. Ecologically, we are an integral part of a much larger system that is designed to grow, develop, and maintain itself as an extensive living



Every form of life in that system has the capacity to survive based on certain characteristics. For human beings, those ***survival traits***, as these characteristics are called, include our capacity to create and use technology. There are specific and overwhelming advantages to this ability. Because we use artificial structures for our survival rather than develop the necessary characteristics through genetic alteration to our being, we are able to develop and adapt at a much higher rate than other animals or plants. We have effectively externalized the process of evolutionary development.

As an example, consider the characteristics of other animals versus those of a human being. Other animals have the advantage of speed, or claws, or special poisons that they can inject into their prey. Herbivores have specially designed digestive systems that allow them to consume large amounts of cellulose, a very difficult substance to break down, and turn it into useful energy. Some animals fly, others are very fleet of foot, others have incredible capacities to blend into the environment, and still others design complex living environments (e.g., hanging basket nests or colonized networks of tunnels). Each species has specific characteristics that offer it an advantage.

Now compare this with a human being. We do not have armored bodies covered with scales or shells. We cannot run particularly fast (though genetically we do have incredible stamina compared to most animals, a characteristic that allowed our hunter ancestors to follow game for days until the game was exhausted). Nor can we take to the air, with wings on our backs, or glide on membranes built into our bodies as bats or flying squirrels do. Yet we are capable of moving at a rate of speed far beyond that of a cheetah or other fleet-footed animal. We are able to fly across the face of the planet and into the outer reaches of our world and beyond. We can live underwater in craft that outperform the largest fish and exist in environments in which the extremes of temperature or altitude would kill most other cre-atures. We do it all in spite of the fact that we have at our disposal not a single physical trait.

That is because the nature of our evolution has been external to our bodies. Like other animals, we use the laws of nature to develop technolgy to aid us in our survival, but whereas other species do this through genetic alteration, a process that takes thousands if not millions of years, we manufacture the alterations quickly and efficiently. We find ourselves at last at a point at which we do not adapt to nature, we adapt nature to us! Such capacity is unparalleled in nature.

But with this capacity comes a problem. Nature is an experimenter. Nature will try numerous variations on a theme to find the combination of characteristics that allow a given organism to survive in a competitive world. If one alteration does not work, such as growing extra wings or limiting the number of eyes of a species to one, then that version fails and does not survive long enough to create progeny, or pass on the undesirable trait. If a variation offers superior opportunities for survival, many more of that version survive to pass on the characteristics to offspring, and eventually, that version predominates. Thus, through evolutionary mutation and survival of the fittest, we arrive at a creature that is perfectly adapted to its environment.

This is also true of humans, but with one exception. Since we are producing change through the creation of technology rather than trial-and-error mutation, we can very quickly generalize a new "trait" over the entire population in a relatively short period of time. In a matter of generations rather than millennia, a new technological device such as the bow and arrow or the chariot can come into general use by everyone who sees it. If it offers a very great advantage to those who have it, everyone either perishes or soon learns to use the new technology. There is little time for experimentation and testing here.

This has been seen often in the past with sometimes devastating results. The practice of agriculture is an excellent example if we look at the relationship between climatic change and the extensive use of agriculture in a region. Some of the most arid regions of the globe were once great forests or grasslands that were cleared for agriculture. Unfortunately, with the deforestation came a host of environmental changes that led to everything from soil erosion to changes in weather patterns. This is just a single example of the problems that can arise from moving too quickly to embrace a technology.

Other examples include the virtual lack of forests in Lebanon today, where once stood vast woodlands of cedar, a prized wood traded all over the Mediterranean, from North Africa to Egypt to ancient Israel, and the cliff dwellers of the southwestern United States, who flourished toward the end of the first millennium and then abandoned their cities when they could not adjust to climactic changes in growing cycles.

What if the governments of the world in the last half of the twentieth century had decided that since nuclear weapons were the ultimate in destructive power, they would embrace that technology as is and abandon other means of war?


Young Einstein

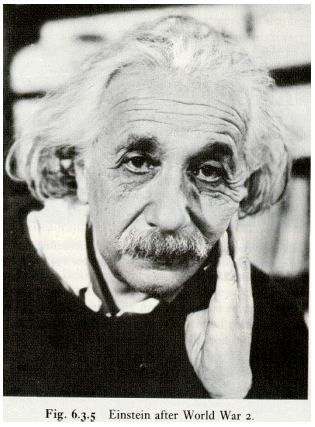
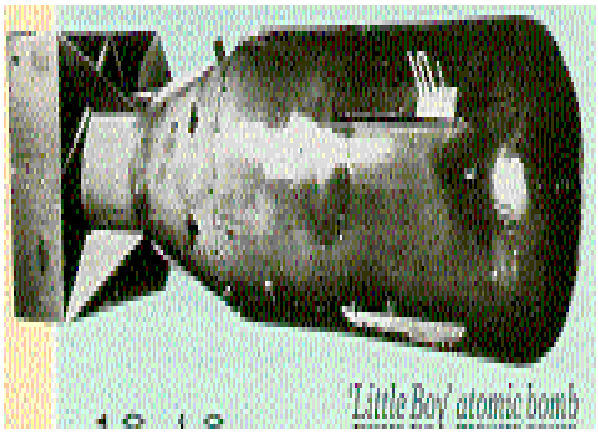


Fig. 6.3.5 Einstein after World War 2.


Little Boy' atomic bomb

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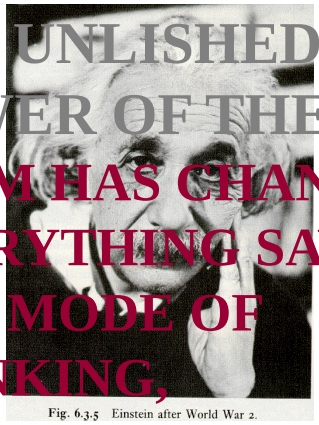
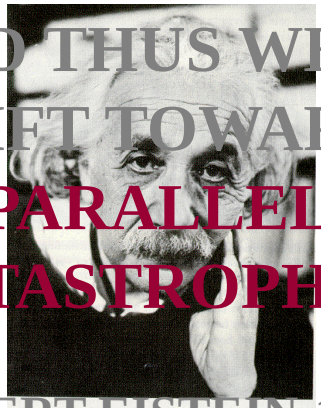


Fig. 6.3.5 Einstein after World War 2.

AND THUS WE DRIFT TOWARD **UNPARALLELED CATASTROPHE.**



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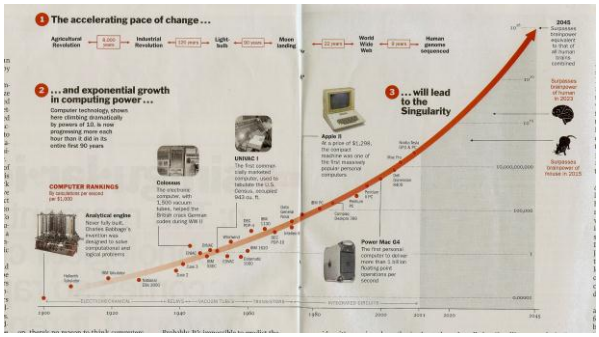
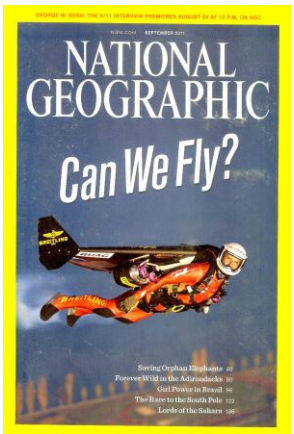
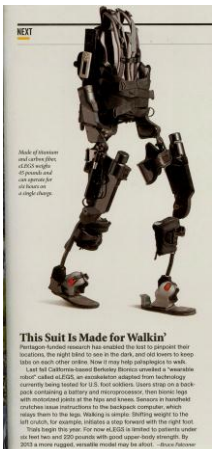






"I steer myself in space with only my body," says pilot Yves Rossy, who invented his jet-powered personal wings

Quest for Flight

Leonardo da Vinci: To fly. The Renaissance genius spent years deciphering the flight of birds and devising personal flying machines. On his deathbed in 1519, Leonardo said one of his regrets was that he had never flown. Five hundred years of innovation since then had produced the hang glider, simple and safe enough to be offered as a tourist entertainment. With centuries of adventure and experimentation, personal flight—the ability to bound from Earth like skylark, swoop like a falcon, and dart as blithely as a hummingbird is getting closer.

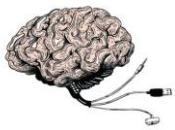
We have developed some of the imaginative methods

That human have used to soar into space.

New Technology Can Read Your Mind

Feb 13, 2012 12:00 AM EST

Steven Spielberg's 2002 science-fiction thriller *Minority Report* conjured a world where computers could read minds and predict the future. It seemed fanciful at the time**, but fantasy is edging closer to fact**.
On Jan. 31, a team of scientists at the UC Berkeley, led by Robert Knight programmed computers to decode brain waves and replay them as words. Five months earlier, another group of Berkeley scientists showed their colleagues movie trailers and used computers to play back in color what people saw.



These experiments are a big leap forward from 2006, when a French scientist first replayed images from a human mind, a crude black-and-white checkerboard pattern. The possibilities are immense: a paralyzed person could "speak"; doctors could access the mind of a patient in a coma; you could rewatch your

dreams on an iPad. **There are, of course, equally dark prospects, such as the involuntary extraction of information from the brain.**

"Eventually," says Gallant, "someone will invent a decoding machine you can wear as a hat." A giant leap into the human mind

In Race for Fastest Supercomputer, China Outpaces U.S.
Nov 28, 2011 12:00 AM EST
Supercomputers help build nuclear weapons, design aerospace engines, and produce lifesaving drugs. For years, the U.S. had the best and biggest arsenal. Until China got in the game.

By running thousands of processors in parallel, supercomputers not only help design weapons systems, they also model climate change, crack codes, and help develop new and life-changing drugs. Cranking out 500 trillion operations per second, just one of Livermore's supercomputers throws off so much heat that if the air-conditioning system were to fail, the computer would start to melt within minutes.

the Chinese had unveiled the world's most powerful supercomputer, a machine five times more powerful than Livermore's biggest computer

When China flipped the switch on the Tianhe-1A, also called the **"Milky Way"** supercomputer, last fall, it placed itself at the top of the technology world with a stunning demonstration of its newfound engineering prowess**, The Chinese grip on the top spot turned out to be short-lived, since six months later, a team in Japan announced an even bigger supercomputer that bumped Tianhe-1A into second place.. Experts predict China will soon leapfrog Japan again.**

The Tianhe-1A supercomputer in Tianjin, China

WASHINGTON -- **Are hardbound textbooks going the way of slide rules and typewriters in schools? Education Secretary Arne Duncan and Federal Communications Commission chairman Julius Genachowski on Wednesday challenged schools and companies to get digital textbooks in students' hands within five years.** Digital books are viewed as a way to provide interactive learning, potentially save money and get updated material faster to students. Digital learning environments have been embraced in Florida, Idaho, Utah, and California, as well as in individual schools and districts such as Joplin, Mo., where laptops replaced textbooks destroyed in a tornado.

BIOTECHNOLOGY

- **Moving molecular biology from laboratory to marketplace (scientific manipulation of**

Glimpse of Things to Come

DATELINE BOSTON: very near future (2015)

Sometime in the not-so-distant future, you may visit the maternity ward at a major university hospital to see the newborn child or grandchild of a close friend. The new mother, let's call her Barbara, seems very much at peace with the world, sitting in a chair quietly nursing her baby, Max. Her labor was in the parlance of her doctor- "uneventful," and she is looking forward to raising her first child. You decide to make pleasant conversation by asking Barbara whether she knew in advance that her baby was going to be a boy. In your mind, it seems like a perfectly reasonable question since doctors have long given prospective parents the option of learning the sex of their child-to-be many months before the predicted date of birth. But Barbara seems taken aback by the question. "Of course I knew that Max would be a boy," she tells you. "My husband Dan and I chose him from our embryo pool. And when I'm ready to go through this again, I'll choose a girl to be my second child. An older son and a younger daughter-a perfect family."

Now, it's your turn to be taken aback. "You made a conscious choice to have a boy rather than a girl?" you ask.

"Absolutely!" Barbara answers. "And while I was at it, I made sure that Max wouldn't turn out to be fat like my brother Tom or addicted alcohol like Dan's sister Karen. It's not that I'm personally biased or anything," Barbara continues defensively. "I just wanted to make sure that Max would have the greatest chance for achieving success. Being overweight alcoholic would clearly be a handicap."

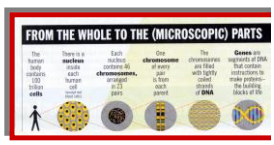
Scientists Listen In on Thoughts

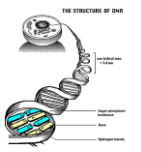
Scientists at University of California, Berkeley, have found a way to reconstruct words someone hears based on their brain waves, a breakthrough that could someday help patients stuck in a coma. By mapping brain activity when a patient heard a certain word, the Berkeley team was able to later determine what word a patient was thinking of. They were even able to reconstruct some of the words using a computer model that suggested what the brain waves meant. “From a prosthetic view, people who have speech disorders ... could possibly have a prosthetic device when they can’t speak but they can imagine what they want to say,” said one of the researchers, though such a tool is a long way off.

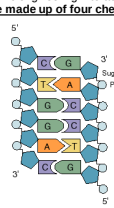
Harvard cracks DNA storage, crams 700 terabytes of data into a single gram-A bioengineer and geneticist at Harvard's Wyss Institute have successfully stored 5.5 petabytes' of data — around 700 terabytes — in a **single gram of DNA**, smashing the previous DNA data density record by **a thousand times**.

In the latest effort to contend with exploding quantities of digital data, researchers encoded an entire book into the genetic molecules of DNA, the basic building block of life, and then accurately read back the text.

The experiment, reported **Thursday April 18 in the journal Science,** may point a way toward eventual data-storage devices with vastly more capacity for their size than today's computer chips and drives.
"A device the size of your thumb could store as much information as the whole Internet," said Harvard University molecular geneticist George Church, the project's senior researcher.
In their work, the group translated the English text of a coming book on genomic engineering into actual DNA.
DNA contains genetic instructions written in a simple but powerful code made up of four chemicals called bases: adenine (A), guanine (G), cytosine (C) and thymine (T).








Dr. George Church

The Harvard researchers (Dr. George Church & Sri Kosuri) started with the digital version of the book, which is composed of the ones and zeros that computers read. Next, **on paper, they translated the zeros into either the A or C of the DNA base pairs, and changed the ones into either the G or T.**
Then, using now-standard laboratory techniques, they created short strands of actual DNA that held the coded sequence—**almost 55,000 strands in all. Each strand contained a portion of the text and an address that indicated where it occurred in the flow of the book.**
In that form—a viscous liquid or solid salt—a billion copies of the book could fit easily into a test tube and, under normal conditions, last for centuries, the researchers said.

The technique likely is a long way from being commercially viable. But it highlights the potential of DNA as a stable, long-term archive for ordinary information, such as photographs, books, financial records, medical files and videos, all of which today are stored as computer code.
"It shows that the vast increase in capacity to synthesize and sequence DNA can be applied to store significant amounts of data," said pioneering synthetic biologist Drew Endy at Stanford University, who wasn't involved in the project. "If you wanted to have your library encoded in DNA, you could probably do that now."
Molecular biologists have long known that DNA is a natural information-storage system inside every cell that encodes the recipe for individual heredity

it's volumetric (beaker) rather than planar (hard disk); and it's **incredibly stable** — where other bleeding-edge storage mediums need to be kept in sub-zero vacuums, **DNA can survive for hundreds of thousands of years in a box in your garage.**

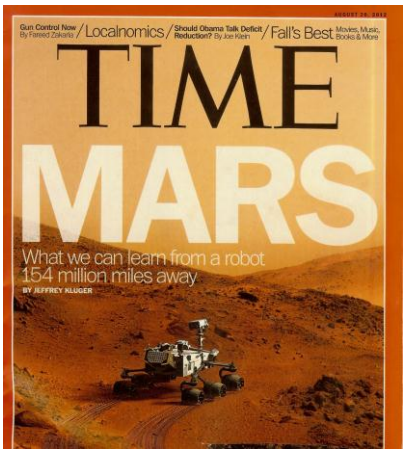
Just think about it for a moment: One gram of DNA can store 700 terabytes of data. That's 14,000 50-gigabyte Blu-ray discs... in a droplet of DNA that would fit on the tip of your pinky. To store the same kind of data on hard drives — the densest storage medium in use today — you'd need 233 3TB drives, weighing a total of *151 kilos.* In Church and Kosuri's case, they have successfully stored around 700 kilobytes of data in DNA — Church's latest book, in fact — and proceeded to make 70 billion copies (which they claim, jokingly, makes it the best-selling book of all time!) totaling 44 petabytes of data stored

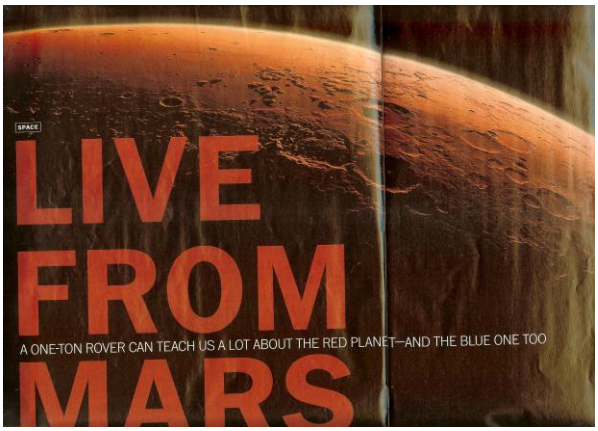
Looking forward, they foresee a world where biological storage would allow us to record anything and everything without reservation. Today, we wouldn't dream of blanketing every square meter of Earth with cameras, and recording every moment for all eternity/human posterity — we simply don't have the storage capacity. There is a reason that backed up data is usually only kept for a few weeks or months — it just isn't feasible to have warehouses full of hard drives, which could fail at any time. If the entirety of human knowledge — every book, uttered word, and funny cat video — can be stored in a few hundred kilos of DNA, though… well, it might just be possible to record everything (hello, police state!)
It's also worth noting that it's possible to store data in the DNA of living cells — though only for a short time. Storing data *in your skin* would be a fantastic way of transferring data securely

Global Technology is becoming Universal Technology

The U.S. Curiosity Rover which took of at 10:02 EST on November 26, 2011 landed on foot of a mountain inside Gale Crater on Mars on Aug. 6, 2012 (7 Months). During a nearly two-year prime mission after landing, the rover will investigate whether the region has ever offered conditions favorable for microbial life, including the chemical ingredients for life

Like all Mars missions, Curiosity blasted off in a precise window in which the ever changing distance between Mars and Earth affords it the quickest trip possible. At the moment of launch, the blue planet and the red planet were 127 million miles (205 million km) apart, which is less than a third of the maximum distance they reach during their differing orbits around the sun. That's still a lot of cosmic real estate to cover though, enough that when the rover does land, any signal beamed from Mars to Earth or Earth to Mars — traveling at light speed — will take nearly **14 minutes to arrive**.





paying work flying both manned and unmanned missions for NASA, but it's hard to say how private that effort has really been so far. NASA has shared some of the R&D costs with its candidate companies and signed lucrative contracts with them before they even proved they were up to the job—to the tune of more than $4 billion covered by taxpayers.

The President's plan gets less clear—and less credible—when it comes to manned travel to deep space. NASA is developing a new crew vehicle called Orion—essentially a souped-up Apollo spacecraft—and a new heavy-lift booster dubbed the Space Launch System (SLS), similar to the venerable Saturn V. Returning to the old model of the expendable booster with the crew vehicle perched on top is a safe and smart decision after the disasters of the shuttle era, but that old model was well funded. The first Saturn V was launched in 1967, the 12th and last in 1973, and nine of those rockets took people to the moon.

The SLS, which in one form or another has been in the planning stage since 2004, is not scheduled for its first unmanned flight until 2017 or its first manned one until 2021. After that, it would fly every other year—at best. It's not clear what its destination would be—perhaps an asteroid, perhaps Mars, perhaps somewhere else. "This is a pass that doesn't make any sense," says John Logsdon, professor emeritus at George Washington University's Space Policy Institute. "When Kennedy said he'd get to the moon by the end of the decade, he actually meant 1967, and he thought he'd still be President."

Incrementally, of course, wasn't humstrung by budget issues, and Obama's space team is quick to point that out. "I would be thrilled if we could land on Mars in the 2030s, and I truly believe that is within the capability of this country," says John Grunsfeld, head of the NASA science directorate and a five-time shuttle astronaut. "I don't believe it is necessarily within the capability of this country with a flat budget."

For the unmanned program, a flat budget would actually be an improvement. Funding for Mars missions is set to fall from $583 million in 2012—that's *million*, with an *m*—to $360.8 million in 2013, causing the U.S. to drop out of a planned collaboration with the European Space Agency for two missions, one of which would have returned a sample from the Martian surface. Already in the pipeline is a new

2018 and 2020—maybe. Says Grunsfeld: "We can just barely afford those missions."

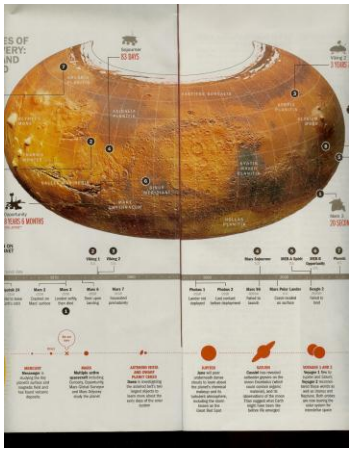
What any nation can afford, of course, is at least partly a function of what it chooses to afford, even in straitened circumstances. The genius of Kennedy's commitment to a lunar landing before 1970 was its simplicity—a single goal and a deadline. The current plan—with ever changing destinations and dates—has none of that New Frontier clarity.

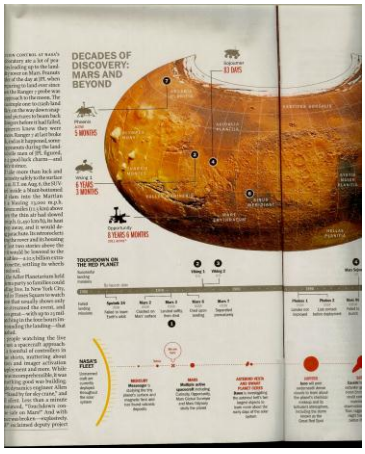
Kennedy, however, had the help of other Presidents and a cooperative Congress. The space push spanned four Administrations—counting that of Eisenhower, who created NASA—and six Congresses. And while they often scrapped over the budget, they agreed on the goal. A legislature that can barely keep the FAA funded is not an easy partner for any White House with grand ambitions to spend first, but with NASA's budget hovering in the vicinity of just $15 billion per year, or 0.45% of the total federal budget, it's hard by a bank breaker either. The Department of Defense, by contrast, gets $530 billion, or 18.9%. What's more, as with Defense, NASA no doubt pays dividends. The Curiosity program has employed 2,000 high-tech workers in most of the 50 states. And as Grunsfeld points out, the rover's chemistry sniffers—sensitive to individual organic molecules—could have national security applications at ports and airports.

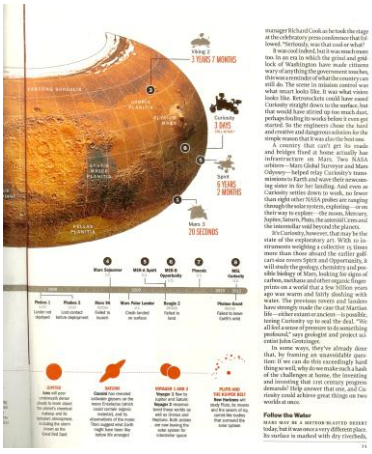
But the extraordinary success of the Mars Curiosity rover marks a far greater truth about space exploration: it requires monomaniacal commitment and an exceedingly high tolerance for failure. In her own way, the JPL peanuts are a reminder of that fact. It's unimaginable in today's attention-deficit political climate that there ever would have been a Ranger 3 after the repeated failures of Rangers 1 through 5. But it took mastering unmanned crash landings before we could master unmanned soft landings. And it took mastering unmanned soft landings before Neil Armstrong—five years almost to the day after Ranger 7 made its suicide plunge into the moon's Sea of Clouds—could set his boot onto the Sea of Tranquility. That's the way science progresses: incrementally, patiently and ultimately spectacularly. Some of America's grandest moments have come when we've trusted that fact.

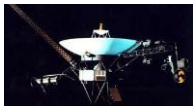
—WITH REPORTING BY DAN CRAY/PASADENA AND MICHAEL SCHERER AND ALEX ROGERS/WASHINGTON ■

SPACE TRAVEL AT 140 CHARACTERS









Thirty-five years (On September 5, 1977), after launching from Cape Canaveral , **Voyager 1** is reaching for the stars. Sooner or later, the workhorse spacecraft will leave the solar system and enter a new realm of space - the first time a human manmade object will have escaped to the other side.
Perhaps no one on Earth will relish the moment more than 76-year-old Ed Stone, who has toiled on the project from the start.
"We're anxious to get outside and find what's out there," he said.
When NASA's Voyager first rocketed out of Earth's grip in 1977, no one knew how long it would live. Now, it is the longest-operating spacecraft in history and the most distant, at billions of miles from Earth.

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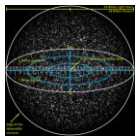

Observable Universe

Milky Way Galaxy

Solar System

In Big Bang cosmology, the **observable universe** consists of the galaxies and other matter that humans can in principle observe from Earth in the present day, because light (or other signals) from those objects has had time to reach the Earth since the beginning of the cosmological expansion

http://www.youtube.com/embed/XRCIzZHpFtY?rel=0

Nuclear generator powers Curiosity Mars mission

Solar panels, used in the past Mars missions, were passed up in favor of a space battery for powering the car-size Curiosity robot. However, exploration was slowed down by dust build-up on the solar panels or short winters days with little sunlight. The Curiosity Rover, which is as big as a large car, is also significantly larger and ten times heavier than previous Martian rovers. It's designed to run at least one Martian year, which is almost two Earth years.
The Curiosity is essentially a robotic science lab, equipped with sophisticated instruments for taking ground samples and analyzing their chemical make-up in the search for signs of life. This testing and communications equipment needs a lot of power to operate and needs to maintain a certain temperature to effectively operate on Mars where temperatures can go far below freezing.
The nuclear generator delivers both heat and 110 watts of steady electric power from an array of iridium capsules holding a ceramic form of plutonium dioxide.