Optical Timeline
by Tony Oursler

Iris is thought to be derived from the Greek word for speaker or messenger.

Fifth century B.C. Chinese philosopher Mo Ti, in the first description of the camera obscura, refers to the pinhole as "collection place" and "locked treasure room."

Platos Cave depicts the dilemma of the uneducated in a graphic tableau of light and shadow. The shackled masses are kept in shadow, unable to move their heads. All they can see is the wall of the cave in front of them. As a result of being locked into physical sense perception, they are doomed to view only shadows of truth on the wall of the cave. In Platos metaphor, an unseen fire behind the shackled illuminates a marionette or puppet show taking place above and behind their heads; the puppets movements represent the interactions of true contemplation, visible to the masses only as indecipherable shadows projected on the cold stone before them.

Homer equates the rainbow/Iris with a serpent, a sentiment shared in African mythology, in which the colors materialize as a giant consuming snake attacking the unsuspecting. In the tribal myths of South America we find the rainbow personified in evil figures, and in Eastern Europe the colored light sometimes sucks up water and children.

The prophet Zoroaster of Persia describes a character similar to the Christian Devil. He teaches that Ahura Mazda, the god of light, is in battle with the evil Angra Mainyu. A dualist, Zoroaster believes the world is divided between dark and light.

RED

Seth, the Egyptian god most associated with evil, is depicted in many guises:

a black pig, a tall, double-headed figure with a snout, and a serpent. Sometimes he is black, a positive color for the Egyptians, symbolic of the deep tones of fertile river deposits; at other times he is red, a negative color reflected by the parched sands that encroach upon the crops. Jeffrey Burton Russell suggests that "it is possible that the redness of Seth helped make red the second most common color, after black, of the Christian Devil."

Egyptian God Seth

The Devils Arc
A person who crosses or passes directly below will change sex.

First reference to the persistence of vision: "This [perception of motion] is to be explained in the following way: that when the first image passes off and the second is afterwards produced in another position, the former is seen to have changed its gesture." (Titus Lucretius Carus [9855 B.C.]).

384322 B.C.

Symyaz leads the fallen angels. According to Enoch, they came to earth of their own free will at Mount Hermon, descending like stars. This description gives rise to the name Lucifer, "giver of light."

And now there is no longer any difficulty in understanding the images in mirrors and in all smooth and bright surfaces. The fires from within and from without communicate about the smooth surface, and from one image which is variously refracted. All which phenomena necessarily arise by reason of the fire or the light about the eye combining with the fire or ray of light about the smooth bright surfaces. Or if the mirror be turned vertically, the face appears upside down and the upper part of the rays are driven downwards, and the lower upwards. (Plato [427-347 B.C.], *Timaeus*. Translation by B. Jowett, The *Dialogues of Plato* [Oxford, 1875]).

Aristotle writes *De Meteorologica*. His treatise devotes a substantial amount of space to a penetrating discussion on the causes of the rainbow, luminous halos, northern lights. This section may in fact be taken as the first truly systematic theory of the rainbow that has come down to us.

During an eclipse Aristotle notices many images of a crescent sun on the ground below a tree. He later discovers that whatever the shape of the aperture, jagged or smooth, the images projected are the same. The riddle is known as Aristotles Problem.

~300 B.C.

Euclid publishes *Optics*, in which he isolates the concept of a beam of light, suggests the eye sends out visual rays to the object that the viewer wishes to see.

Archimedes (c. 287212 B.C.) is said to have used a large magnifying lens or burning-glass, which focused the suns rays, to set fire to Roman ships off Syracuse.

"I have seen Satan fall like lightning from heaven." (Luke 10:1820)

Balinese Shadow Puppet

GREEN

In the Book of Revelations it is stated, "There is a need for shrewdness here: if anyone is clever enough he may interpret the number of the beast: it is the number of a man, the number is 666." One theory of the numbers puzzling origin has anti-Roman groups giving letters numerical significance so that coded messages could be passed among themselves. By obscure calculation the number 666 has the letter value of Nero, who ruled 5468 A.D. Nero is known to have enjoyed peering through a rudimentary lens crafted of the gemstone emerald, which has the property of enlargement. This is one of the first records of the use of a lens. Ibn al-Haytham (a.k.a. Alhazen), a tenth-century Arabian scholar, publishes Optics, which is the basis of Europes knowledge on the subject until the sixteenth century. In it he describes the camera obscura. He also expands on the

optical understanding of the Greeks, explaining that light spreads out in all directions from an object. In addition he describes the linearity of light through the use of three candles and one pinhole, proving that we see objects by viewing light reflected from them.

Shen Kua (103195), Chinese astronomer, mathematician, and poet, expresses the first moral equivalent of the inherent qualities of the camera obscura. He makes an analogy between the camera obscuras image inversion and the nature of mans vision, which can be so polluted as to see right as wrong.

Christians link the colors of the rainbow to the seven sacraments.

The Comic Devil appears in popular medieval dramas. His role is slapstick-screaming oaths, making obscene gestures, and executing pratfalls. Like Hell, the character was an inversion of norms of the day.

Robert Grosseteste (c. 11751253) translates the works of Alhazen to Latin.

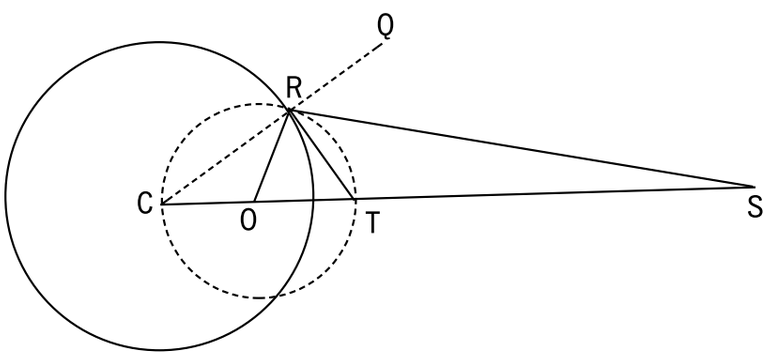
1200

Alhazen, who was no fool, wrote his *Treatise on Aspects*: the wise naturalist who would learn about the rainbow must consult this book and must also possess notions of geometry to understand the demonstrations in this treatise. He will then be able to find the causes and the potency of glasses which possess marvelous qualities: the smallest things, the most minute lettering, tiny grains of sand, are seen so big and thick that they can be exactly distinguished and even counted from afar, which seems incredible to one who has not seen them or does not know the causes thereof.

Others burn and consume things placed before them if the rays of the sun which strike them are cunningly made to converge… .

Others cause different images to appear, straight, oblique or reversed. So that mirrors according to how they are arranged, can show two objects instead of three, eight instead of four (Jean de Meun, *Roman de la Rose*).

"Vision is of three kinds: direct in those who are perfect, refracted in those who are imperfect, and reflected in evildoers and those who ignore Gods commandments" (Roger Bacon [121492]).
French astronomer Guillaume de Saint-Cloud suggests in an almanac of 1290 that viewers of an eclipse use a hole in their roof and a board as projection screen to avoid blindness from staring directly at the sun.



Alhazen's idea of the formaton of the haloc.

It should be noted that a colorless lunar rainbow is widely considered to be an ill omen.

In the thirteenth century, Arnaud de Villeneuve, showman and magician, utilized the camera obscura to stage presentations somewhere between shadow play and cinema: players performed warlike or murderous episodes outside in the bright sunlight, while inside the audience was shocked and delighted by sound effects linked to the dramatic gestures of the projected images. The fact that the audience would stay inside and watch such a mediated event when they could have gone outside and viewed the event directly points to a victory of the virtual image over reality. The disembodiment of the moving image and its removal from the recognizable physical laws that bind the body of the viewer imbue the image with a magical quality at once distant and intimate.

Albrecht Drer (14711528) illustrated two drawing aids: one involving a grid through which to view images, and another using a ground glass pane to trace images from life.

Buddhists associate the colors of the rainbow with the seven regions of the earth and the seven planets.

1450

First book printed with movable metal type. Johannes Gutenberg printed a bible with movable type in Mainz. He perfected interchangeable type that could be cast in large quantities and invented a new type of press. 1452 Sep 30, The 1st book was published, Johannes Guttenberg's Bible.

FORMULA FOR A HOMUNCULUS

"Place human semen in a glass vial and nourish with blood for forty days and forty nights, keeping it at the temperature of a horses belly: and from it will be born a genius, a nymph, or a giant" (Philippus Aureolus Theophrastus Bombastus von Hohenheim [1493-1541]).

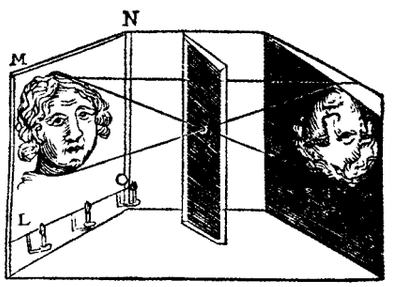
1558

Giovanni Battista della Porta publishes details of construction and use of the camera obscura in the widely distributed and popular *Magiae naturalis*:

First of all you must close the windows in the room; you will make a round hole the size of ones little finger and opposite you will stretch pieces of white sheets or white cloths or paper; and the result will be that all things which outside are illuminated by the sun you will see inside, you will see mthose walking in the streets with their heads downwards, as if at the antipodes, and the things on the right will appear on the left and all things over and the further they are from the hole the larger they will appear. I will not conceal at last a thing that is full of wonder and mirth, because I am faln upon this discourse, that by night an image may seem to hang in the chamber. In a tempestuous night anything may be represented hanging in the middle of the chamber, that will terrify beholders. Fit the image before the hole that you desire to make seem hanging in the air in another chamber, that is dark; let there be many torches lighted around about. In the middle of the dark chamber place a white sheet, or some solid thing that may receive the image

sent in; for the spectators will not see the sheet, will see the image hanging in the middle of the air, very clear, not without fear or terror, especially if the artificer be ingenious. . . . you may see hunting, battles of enemies and other delusions, and animals that are really so, or made by art of wood or some other matter. You must frame the little children in them, as we used to bring them in when comedies are acted; and you must counterfeit stags, boars, rhinoceros… .

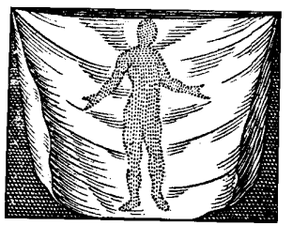
Later he discovers that by adding a lens to the enlarged hole, images can be sharpened.



Giovanni Battista della Porta, 1558

1585 Tulio Caesare Aranzi focuses sunlight through a flask of water and projects it into the nasal cavity. He is the first person known to use a light source for an endoscopic procedure.

1604 The astronomer Johannes Kepler writes *Ad Vitellionem paralipomena*, in which light and the physiology of the eye are explored in depth. He coins the term camera obscura, which had been known variously as *conclave obscurum*, *cubiculum tenebricosum*, and *camera clausa*. By using this device he is able to measure the diameters of the sun and moon. He also demonstrates how the focal distance of a lens can be reduced by interposing a negative concave lens; this may be the first description of a telephoto lens. As imperial mathematician, Kepler used a portable tent camera obscura to survey Upper Austria



Anonymous engraving, The Soul Of Man, 1629

1610 Achilles Landenbucher, a watchmaker, devises musical instruments that play themselves.

"For since God has given each of us a light to distinguish truth from falsehood, I should not have thought myself obliged to rest content with the opinions of others for a single moment if I had not intended in due course to examine them using my judgment; and I could not have avoided having scruples about following these opinions, if I had not hoped to take every opportunity to discover better ones, in case there were any" (Ren Descartes, *Discourse on the Method of Rightly Conducting Ones Reason and Seeking the Truth in the Sciences*. First published anonymously in 1637).

Giovanni da Fontana, 1620

"I will suppose therefore that not God, who is supremely good and the source of truth, but rather some malicious demon of the utmost power and cunning, has employed all his energies in order to deceive me" (Ren Descartes [1638-40], *Meditations on First Philosophy*, 1641).

"All Knowledge is light and all proceeds from the First, Infinite Light Who is God" (Athanasius Kircher [160180]).

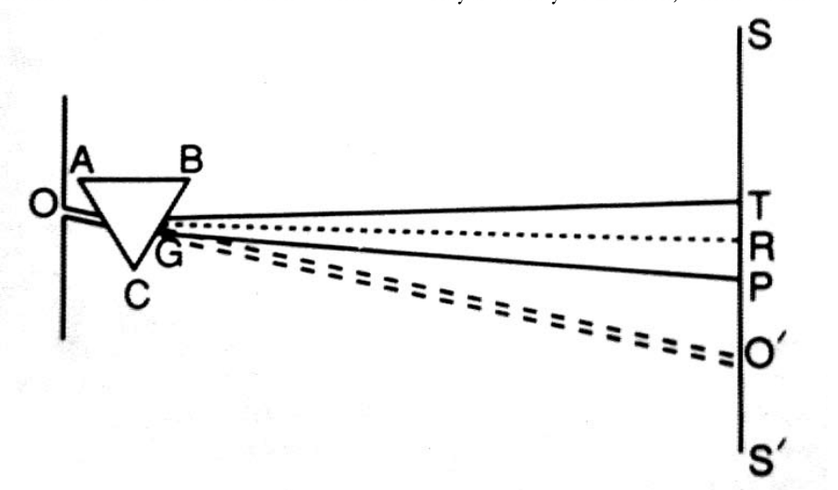
1646 Athanasius Kircher, a German professor of philosophy, mathematics, and Oriental languages at a Jesuit college in Rome, publishes *Ars magna lucis et umbrae*. It includes the earliest known illustrations of magic lantern slides and the first descriptions of lantern shows and other devices such as dioptrics, lenses of pantoscopes, and telescopes, in "which little known powers of light and shadow are put to diverse uses." Two lenses can be put together to create a microscope, "which will amplify a fly into a camel."

Kircher also describes a portable camera obscura with two apertures and an inner cube. The outer box has a hole on one side facing another hole on the opposite side. Inside is another box or frame covered with translucent paper. The draughtsman within is able to see an image on two sides of the little paper-walled room.

Kircher describes persistence of vision, likening the change of color in an after-image to the glow of a phosphorous stone when placed in darkness after exposure to light.

1647 Johannes Hevelius, an astronomer, designs a lathe that can produce large-scale telescope lenses.

1666 Sir Isaac Newton studies the phenomena of colors, laying the groundwork for the modern physical theory of color. To begin, he creates a camera obscura with a triangular glass prism at its "entrance," which he ground himself, focusing and refracting the suns rays through the dark room onto the opposite wall. There it is "a very pleasing divertissement [diversion] to view the vivid colors" of the spectrum. These experiments culminate in his letter of February 6, 1672 to the Royal Society of London, which outlines



Newton's investigation of light refraction through a camra obscura and prism.

his discovery of the properties of light rays. Newton also notes that the relative color or perceived color of objects is determined by the quality of the light striking the object. For example, an apple tends to reflect red in a full spectrum of light. As Newton points out, it is useless to think of an apple as red, for "any body may be made to appear any color" by controlling the reflected light. Newton is also the first person in history to unlock the riddle of the rainbow when he applies his understanding of refraction to the water droplets in the air.

1675 Jean Picard, the French astronomer, is walking home late one night from the Paris Observatory, swinging his barometer by his side. To his great surprise, the glass tube emanates a faint glow; the more he shakes it the more it glows: "the glow of life."

1706 Francis Hauksbee, an English student of Sir Isaac Newton, invents a machine that produces "the glow of life" at will. Hauksbees Influence Machine consists of a hand-cranked device that spins a glass vacuum globe, half full of air. The mysterious luminosity can be produced by touching the surface of the glass as it spins; also produced is a crackling sound that reminds the inventor of lightning

Hauksbee's Influencing Machine

Etienne de Silhouette (170967), French controller general of finances, cuts out profiles of his contemporaries in black paper.

1717 – 1720 Richard Bradly describes the kaleidoscope in a work on garden design.

Louis-Bertrand Castel invents the *clavecin oculaire* or optical harpsichord. The keys trigger not only sound but also a corresponding color produced by transparent colored gels.

1725-27 James Graham establishes the Temple of Health in London. He invites childless couples to indulge in sexual intercourse in his celestial or magneticoelectro bed within a therapeutic electric field created by Hauksbees Influence Machine.

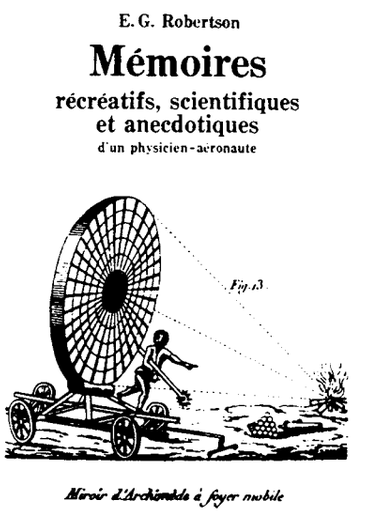
1738 Jacques de Vaucanson amazes the world by exhibiting in Paris a number of automata, including a life-size Flute Player and the celebrated Duck, which is reported to flutter its wings, swim in water, eat, drink, and, finally, pass the food as amorphous matter.

1745 Pieter van Musschenbroek invents the Leyden jar, a storage container for a continuous flow of relatively large amounts of electricity, considered the first battery. Previously, experimental scientists were forced to rely on unpredictable, spontaneous electrical phenomena such as static electricity or attracting lightning to a metal pole, for example.

1746 Abbe Nollet conducts electricity from a Leyden jar through the bodies of Carthusian monks holding iron wire. The monks form a circle 5,400 feet in circumference. The simultaneously shocked contortions that the monks display, when the circuit is closed, proves that electricity is felt throughout the entire circuit and that electricity travels very quickly.

1749 Horace Walpole, a young British socialite, begins to convert his home, Strawberry Hill, into "a little Gothic castle." The interior is to become a repository of everything antique; when he cant find an object he desires, he employs artisans to build a replica for him. His random collection of oddities from throughout the ages, such as a Roman tomb with the bones of a child within, are aesthetically arranged. The towers and stained glass are not in themselves designed to evoke fear; the setting is meant to stimulate visitors to feel a bygone era when our predecessors believed dwellings to be haunted. This influential building may be seen as the origin of a resurgence of Gothic and the camp/pop cultural interpretation of the past that is so prevalent today in theme parks, architecture, and media.

1763 Edward Gaspard Robertson, showman-scientist-occultist, is born in Lige. In his memoirs Robertson writes of his fascination with "Father Kircher" and of the early motivations that he shared: "Who has not believed in the Devil and werewolves in his early years? I admit frankly that I believed in the Devil, in raising the dead, in enchantments. . . Since the Devil refused to communicate to me the science of creating prodigies, I would apply myself to creating Devils, and I would have only to wave my wand, to create all the infernal cortege to be seen in the light. My habitation became true Pandemonium."



Robertson's redesign of Archimedes legendary Burning Glass for the French Government

By the 1790s he shifts his exploration from the occult to the science of optics and, finally, to a new theatrical form. In 1794 Robertson founds the Fantasmagoria, an influential sound and light show in Paris, which makes use of his own graphic designs and innovations in the magic lantern projection system. He combines performers, props, and sound effects produced by the Musical Glass (and a robotic trumpet player) and projects moving images on clouds of smoke and layers of gauze curtains. In the area of slide projection, he introduces the idea of painting images on an opaque black background rather than on clear glassso the images seem to float free in the air. His theater, a "vast abandoned chapel" dressed up with elaborate "Gothic" decor, is the first permanent auditorium (he performs the Fantasmagoria for six years) for projected audio-visual shows. So convincing are his illusions that "gentlemen drew their swords, ladies fainted." He insists that his aim is not to deceive the public

but to arm them against irrational superstition. His themes are culled from popular lore, historic and religious: *The Apparition of the Bleeding Nun*, *Chinese Tamtam*, *The Death of Lord Littleton*, and *Preparation for the Sabbath*.

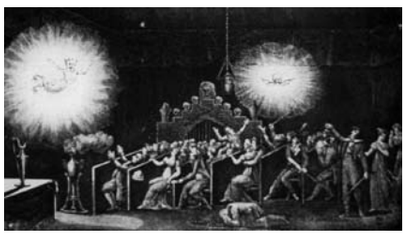


Illustration of Robertson's Phantasmagoria from his Memores

1766 Jean-Jacques Rousseau coins the word melodrama to describe a drama in which words and music, instead of proceeding together, are heard in succession, and in which spoken phrases are to some degree announced and prepared for by musical phrases.

1773 Jean Pierre and Henri-Louis Droz produce The Scrivener, a robotic writing figure who dips his pen into an inkwell and writes a limited number of words.

1784 Friedrich Anton Mesmer, an Austrian physician, is legally forbidden to practice in France. His treatments involve groups of patients conducting the current known as animal magnetism through chambers, huge vats, or metaphorical "batteries" of mysterious solutions. The treatments, accompanied by shouts, hysterical laughter, and music, end in mattress-lined rooms for the patients decompressions.

1800 Humphry Davy, English electro-chemist, is the first to observe the light produced by the discharge of electric current between two carbon electrodes. The arc light is produced.

1801 Frenchmen, J.M. Jacquard invents the Jacquard Loom.

1802 Thomas Holcrofts play, *A Tale of Mystery: A Melodrama*, is innovative in its use of music and calls for intensifying dramatic moments by the sonic expression of "discontent and alarm," "chattering contention," and "pain and disorder." Over the next forty years, stage music evolves into a modular system of repeatable phrases known as melos, each identified with a different emotion.

1806 Bozzini employs an aluminum tube to visualize the genitourinary tract. The tube, illuminated by candle light, has fitted mirrors to reflect images. Bozzini's invention, "a magic lantern in the human body," is ridiculed at the time.

Magic Lantern

1809 Humphry Davy invents the first electric light - the first arc lamp.

1814 Joseph Nicphore Niepce achieves his first photographic images with a camera obscura.

1817 What is the normal state of a room? One could say that a dark room is a more natural and normative state than a lighted room. As with the cave before it, the room is enclosed and inherently cut off from natural light. Windows can be employed to let light and air into a room, but daylight is limited by the cycles of the sun. At night artificial light is needed to illuminate the chamber. The open fire gave way to more controlled forms of light: oil lamps, candles, and finally, in cities, systematically supplied gas.

Swedish Baron Jns Jakob Berzelius isolates the element selenium.

1824 Englishmen, Joseph Aspdin patents Portland Cement, the modern building material.

1825 Peter Mark Roget of thesaurus fame demonstrates the persistence of vision with his Thaumatrope.

William Sturgeon invented the electro-magnet.

1831 Joseph Henrys single-wire telegraph is introduced.

1832 Charles Wheatstone invents a nonpho-tographic "stereoscopic viewing device."

Electric currents can travel rapidly along wires of infinite length. Samuel Morse interrupts the current and shapes it into combinations of dots and dashes to represent the twenty-six letters of the alphabet, the ten numerals, and all punctuation marks. The Morse code foreshadows the on/off nature of binary codea series of zeros and onesused in modern computers.

1833 Michael Faraday investigates electrical discharges of gases using vacuum tubes in which a current is passed from a negative electrode to a positive electrode, producing a glow on the inner surface of the opposite end of the tube.

1834 William George Horner patents an image-animation device, the daedelum, "Wheel of the Devil." Later, around 1864, French inventor Pierre Desvignes refines the device for the home market under the name zoetrope, "wheel of life."

Simon von Stampfer invents the stroboscope, a device using variable-speed, extremely bright flashing light to create the optical effect of capturing motion in a series of frozen images.

1841 Frederick de Moleyn first uses vacuum for electric light bulbs.

1842 Alexander Bain elaborates on Edmond Becquerel's research into the electrome-chanical effects of light and proposes the idea of scanning an image so that it can be divided into small, transmittable parts. According to his theory, electrified metal letters could be scanned by a pendulum and duplicated on chemical paper at the other end of the telegraph wire by a synchronized pendulum.

1843 Rogues Gallery: The first index of photographed criminals is organized by the police of Brussels.

Fox Talbot makes first instantaneous photographs using electric spark illumination.

Telecommunications

1844 Samuel Morse sends the first message by electric telegraph from the Supreme Court in Washington D.C. to Baltimore. Miss Elsworth, the daughter of the commisioner of patents, composes the message: "What hath God wrought."

1858 Heinrich Geissler, a German glass blower and maker of scientific instruments, creates the Geissler tube. A vacuum is created in a glass container sealed with electrodes at either end. Electrons moving through the tube are visible as patterns of light, varying according to the shape of the tube or the type of gas introduced into the vacuum. This invention will lead to the discovery in 1890 of cathode rays, a basic principle of video technology.

1859 1859 Establishing an important principle for the future of electronics, the German mathematician and physicist Julius Plcker discovers that cathode rays (electrons) are deflected by a magnetic field.

Alexandre Edmond Becquerel, a member of the noted family of French physicists, uses a Geissler discharge tube filled with fluorescent material to create the first fluorescent lamp.

1860 Oliver Wendell Holmes invents popular stereoscope viewer.

(1860-80) Photographic lightning is believed to be a flash of lightning that creates the image of a person on an ordinary windowpane or mirror. In American folklore the legend encompasses the possibility that sick, dying, or dead people leave images of themselves on glass surfaces in the building of their confinement. The subjects are criminals, victims, and sometimes Jesus Christ. Folklorist Barbara Allen suggests that popular misunderstanding of the new technology such as the photographic plate spawned such lore, and with the introduction of flexible film, the glass plate legends decline.

1864 Lewis Morris Rutherford pioneers astrophotography.

Pigeons are used to carry microphotographed messages across enemy lines.

1865 Gregor Mendel, "father of genetics" an Austrian monk, publishes his findings on the laws of inheritance based on experiments, begun in 1857, with pea plants. His studies are ignored untill 1900, well after his death in 1884.

1868 Sincere Acting: "This womans nature was one in which all . . . experience immediately passed into drama, and she acted her own emotions. . . . It would not be true to say that she felt less because of this double consciousness" (George Eliot, describing Princess Halm-Eberstien in *Daniel Deronda* [1868]).

1869 Edward Everett Hale's "The Brick Moon" is published in *Atlantic Monthly*. Hale describes an artificial moon, or satellite, that he thought could be used as a military post.

1870 Dr. Vernois of the Society of Legal Medicine of Paris publishes his theory of the optigramme. He believes that at the point of death, the retina freezes the last frame of ones life and retains the image until decomposition of the body. The forensic implications of the theory are explored by surgically removing the retinas of murder victims and examining them under a microscope.

1872 Joseph May, a worker at Telegraph Construction and Maintenance Co., tests transatlantic transmissions using rods made of selenium as resistors. He finds the resistance to be inexplicably variable; his lab desk is near a window, and he notices that when a ray of sunlight strikes the test rods, current flows freely through it, while in the dark the electricity crawls. The companys head electrician, Willoughby Smith, later takes credit for the discovery. Recognizing the implications of the phenomenon, he follows up with extensive experimentation and soon proposes "visual telegraphy." He states at the time, "Seleniums sensibility to light is extraordinary . . . a mere Lucifer match being sufficient to effect its conductive powers."

1876 Alexander Graham Bell, trained in speech therapy for deaf people, patents the telephone. "The telephone operates by translating vocal sounds into a fluctuating electric current, which passes through a wire and is converted back into vocal sounds by a receiver at the other end of the wire" (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).

1878 Eadweard Muybridge publishes *The Horse in Motion*.

Dennis Redmond develops "electric telescope" to produce moving images.

1879 General Electric introduces the first Edison carbon filament electric light bulb.

1880 The first articles written about early models of television are published in *Nature*, *English Mechanic*, and *Scientific American*.

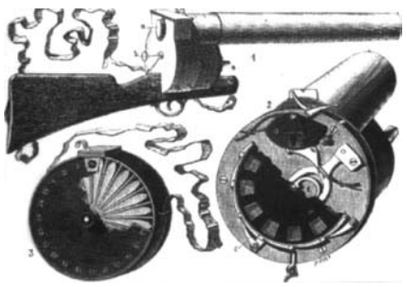
1881 Rudge and Friese-Greene use a lantern with a scissors shutter to animate consecutive images of a man removing his own head.

Brit Shelford Bidwell transmits silhouettes using both selenium and a scanning system. He dubs the device the "scanning phototelegraph."

Artificial lighting during theatrical performances causes audience discomfort; viewers are subjected to extremes of temperature (the ceiling goes from 60 to 100 degrees) and suffer headaches due to the fact that gaslight consumes large amounts of oxygen, while its exhaust includes ammonia, carbon dioxide, and sulfur. In Berlin the effects of gaslight on luxurious public decor and architecture are noted: "The gas flames began their destructive work . . . blackening the ceilings. . . . most surfaces turned yellow . . . and the oil paintings almost disappeared or were darkened by smoke."

1884 Etienne-Jules Marey develops the chronophotography device, which looks very much like a machine gun. He successfully exposes a number of photographic images in quick succession, thus capturing exact details of motion that have never before been seen. One of his first motion studies is of a flying bird, which he then presents on an electric zeotrope. Marey, a scientist, is interested in using his devices only for

speeding things up or down to study locomotion. He shies away from the replication of real time, stating that the absurdity of such an undertaking "would be attended by all the uncertainties that embarrass the observation of the actual movement."



Etienne- Jules Marey, photographic gun

German scientist Paul Gottlieb Nipkow patents an image-scanning machine made up of a spinning disk placed between a scene and a selenium element. Nipkow argues that if the disk is turned fast enough, it can show a moving picture.

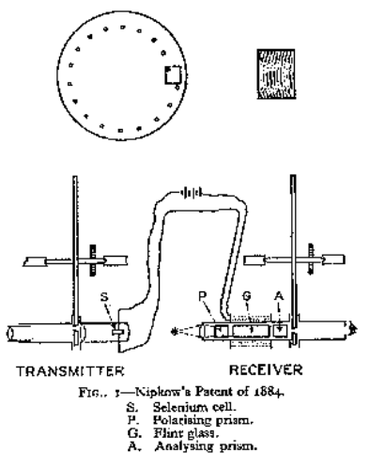


Fig. 1—Nipkow's Patent of 1884.
S. Selenium cell.
P. Polarising prism.
G. Flint glass.
A. Analysing prism.

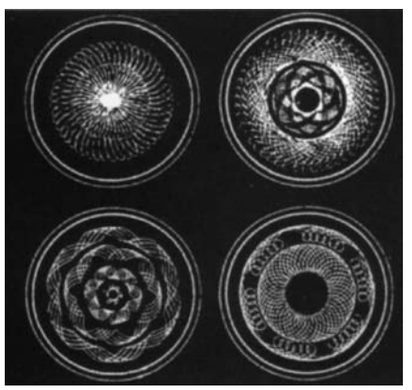
1886 German physicist Heinrich R. Hertz produces radio waves.

1888 On February 27 Eadweard Muybridge meets Thomas Edison and suggests the combination of the respective inventionsthe zopraxiscope and the phonograph.

George Eastman markets the Kodak, a roll-film camera capable of taking 100 separate pictures without reloading. Eastman provides developing and printing facilities: "You press the button, we do the rest." Amateur photographers come into being.

Frederick Eugene Ives files patent for taking color photographs.

Dr. Roth and Professor Reuss of Vienna use bent glass rods to illuminate body cavities.



1889 A. Pumphery (U.K.) invents and markets the cycloidotrope or Invisible Drawing Master, a machine that will "trace an infinite variety of geometric designs" upon smoked or darkened glass slides for the magic lantern. By turning a hand crank, one produces a rudimentary animation of white or tinted lines on the screen.

First commercial transparent roll film makes possible the development of the movie camera.

1890 German physicist Karl Ferdinand Braun invents the Braun tube, an adaptation of a Lenard cathode ray tube, which is the forerunner of the TV picture tube.

Heinrich R. Hertz develops electromagnetic radiation.

Hollerith's Tabulator and Sorter

The U. S. government undertakes the census of 1890, two thousand clerks are hired to run Herman Holerith's mechanized tabulating system. This marks the birth of the now-ubiquitous office-machine as well as IBM (International Business Machines). Clerks translate each citizen's age, sex, and ethnicity into a pattern of holes punched on a card; Holerith's electromechanical machine totals the information. Each machine processes one thousand cards an hour. The census takes two and a half years. (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).

Cycloidotrope

1892 Arsne dArsonval studies the psychological effect of electrical current on humans.

1893 Thomas Edison patents the kinetoscope.

RED SHIFT

The systematic increase of the wavelength of all light received from a celestial object is observed in all segments of the spectrum to shift toward the higher or red end. This is mostly caused by the Doppler effect on the light of the heavenly body as it travels across vast distances of space.

1895 German physicist Wilhelm Conrad Rntgen discovers X-rays; slide makers publish long lists from which to choose interesting and macabre examples ranging from coins in a purse to a bullet lodged in a cranium.

George Mlis works as a magician/artist at the Robert-Houdin Theater, which regularly combines lantern shows with performances. On April 4 Mlis shows his first film at the theater, along with Edisons kinetoscope films. Also on the bill are boxing kangaroos, serpentine dancers, seascapes, and white silhouettes on black. He founds first production company, Star Film, which produces 500 films from 1896 to 1912; fewer than 90 survive. Mlis himself plays the Devil in a number of his own films.

On December 28, in front of the Grand Caf in Paris, thirty people watch Auguste and Louis Lumires *Workers Leaving the Lumire Factory*, as the Lumires and Edison demonstrate motion picture cameras and projectors.

Lumiere Bros. First manufactured camera

1896 Italian physicist Guglielmo Marconi invents a system that allows electric waves to relay Morse Code messages.

German Karl Braun invents the cathode-ray tube.

1900 Max Planck introduces the quantum theory in physics.

First mass-marketed camera, the Brownie, is released.

1901 Marconi transmits the first transatlantic radio signalsthe Morse code signal for SSSSSS.

1902 Otto von Bronk applies for German patent on color television.

Melies as Satan in The Devil And the Statue, 1902

1904 Alfred Korn announces facsimile telegraphy.

Alfred Maul, an engineer in Dresden, Germany, sends cameras up in rockets.

1907 English inventor A. A. Campbell-Swinton and Russian Boris Rosing independently suggest using a cathode-ray tube, instead of the Nipkow disc, to reproduce a television picture on a phosphorous-coated screen. The vacuum tube can both amplify electrical signals and act as a switch for routing electrical pulses through a circuit.

1909 "Phantom Rides," films shot from the front of a boat or train, are distributed. Audiences find the simulated motion intriguing and disorienting.

GE introduces the Mazda trademark on Edison light bulbs.

Electric Extraction of Poisions

1910 Portable (home) high-frequency electrotherapy devices are marketed as health aids. These machines send electrical charges through shaped vacuum tubes filled with various gases to send rays into the body. The tubes are held against the skin or eyes or inserted into the nose, mouth, ear, urethra, vagina, or anus. The violet or ultraviolet ray machines are said to cure everything from pain to cancer. The following is a chart of the possible discharges at various vacuums:

1. Normal red vacuum level
2. Slightly higher violet vacuum level
3. Higher yet white vacuum level (note phosphorescence of glass)
4. Highest Crookes vacuum level (note yellow-green phosphorescence of glass from cathode-ray/X-ray formed inside tube)

1912 Alfred Maul sends a gyroscope-stabilized camera up to two thousand feet. It returns to earth in a parachute.

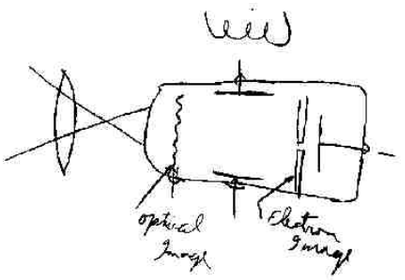
1913 Gene maps show chromosomes containing linear arranged genes

1915 What is that sound? Where is that voice coming from? I dont see anybody, yet I clearly hear a voice speaking to me. It is not inside my head. Could it be God or the Devil? No, it is from inside the machine. Ray Kellogg invents the electric moving-coil speaker.

A case of paranoia. Freud analyzes a young woman who is convinced that someone is following, watching, and photographing her. She has detected this surveillance by hearing clicking or knocking sounds that she believes to be the shutter of the camera taking her picture. Freud analyzes the aural hallucinations as originating within the womans body, and the clicks to be an aural displacement of the throb of her excited clitoris.

1920 Albert Abrams, M.D., invents a "radionics" system, which uses the crystals of dried blood from a patient to perform as do the crystal detectors of homemade radio and transmit the patients disease.

Ernst Belin works on and introduces wireless transmission of photographs.



1921 At fourteen, Philo T. Farnsworth devises electronic television scanning. He tells his friends and teachers about it.

First radio network established by AT&T.

American Charles F. Jenkins engineers a mechanical television system based on the Nipkow disk.

John Baird sells his soap business, moves for health reasons from London to the seaside town of Hastings. There he shares a flat with his boyhood friend Guy "Mephy" Robertson, nicknamed for his seeming resemblance to Mephistopheles. In this pastoral setting he decides to try to construct a television. The worlds first working television was to "grow to fill my bedroom," which he shared with Mephy: "It became a nightmare cobweb of. . . junk. . . . At last to my great joy I was able to show the shadow of a little cross transmitted over a few feet." Some of the objects used in the invention: cardboard cross, wires, old hat box, electric batteries, bicycle lamp lenses, used tea chest, sealing wax, glue, scissors, lamp bulbs, darning needles, neon lamp, Nipkow disk, wireless valves, transformers, selenium cells, and electric motors.

Baird's Nipkow disk, 1922

1923 Vladimir Zworykin applies for patents for a television picture tube.

1925 On October 30, John Baird transmits his first decipherable moving picture: the head of a dummy.

Dinshah P. Ghadiali is jailed for fraud. He is founder of a nationwide cult in the United States that uses his Spectrochrome. His machine, based on a theatrical spotlight, generates and focuses colored light to heal people.

1926 USA Radio Act declares public ownership of the airwaves.

PURPLE

Television is conceived with the advent of photoconductivity and the further refinement of the photoelectric cell. The notion of translating or coding the bright and dark areas of images into a corresponding electrical signal and decoding it back into an image at another location is within reach. Baird, unable to build a photocell that works, is aware that the light sensitivity of the human eye resides in the purple fluid found in the retina called visual purple. He decides to experiment with a real human eye. He goes to Charing Cross Ophthalmic Hospital, is taken for a doctor, receives a fresh eye wrapped in a cotton wool, and returns to his lab in the attic at 22 Frith Street, London. There he dissects the eye with a razor, and unable to put it to use, throws it into a local canal.

1927 On September 7 Farnsworth transmits a straight line, the first image ever to be transmitted electronically.

General Electric invents the modern flashbulb.

Bell Laboratories performs the first mechanical television transmission in the United States.

Warner Bros., faced with bankruptcy, launches sound film, (*The Jazz Singer*).

Radio changes from a two-way communication device to a one-way broadcasting device thanks to commercial interests and their representatives in Congress (Radio Act of 1927).

1928 Panchromatic film that registers all light in the visible spectrum is developed. So is infrared film that is designed to pick up light that is below red on the spectrum, light that is invisible to the unaided human eye, or even an object in no light, just from the heat the object gives off.

1929 On July 17 Dr. Robert Goddard, the American rocketry pioneer, launches the first liquid-fueled rocket equipped with a camera.

1933 The first patent for the Drive-In Theater (United States Patent# 1,909,537) was issued on May 16, 1933. With an investment of $30,000, Richard Hollingshead opened the first drive-in at a location on Crescent Boulevard, Camden, New Jersey.

1934 Philo T. Farnsworth publicly demonstrates electronic television.

Philo T. Farnsworth

Electron microscope developed in Germany.

1936 Alan Turing conceives of a punch card system that can do more than add. The theoretical Turing Machine mechanically scans a virtually endless tape that is punched with coded instructions or digital sequences of zeros and ones. Turing proves that you can translate all sorts of complex problems into these strings of simple elemental operations.

Bell Telephone Co. (BTL) starts exploring a technique to transform voice signals into digital data, which can then be reconstructed (or synthesized) into intelligible voice, the "vocoder" (short for voice coder). The research is developed by the National Security Agency (NSA).

1937 Chester Carlson invents xerography.

1941 FCC authorizes commercial TV in the United States. J. Gilbert Wright, a researcher at General Electric, is contacted by Thomas Edison's spirit by way of the medium, Mary Olson. Spirit directs Wright and his partner, Gardner, to the blueprints of the machine for contacting the dead that Edison had supposedly been working on at the time of his death. They faithfully construct this device, which consists of a sound box, a microphone, and a loud speaker, under Edisons supervision.

1942-43 1942-43 BTL works under direction of A. B. Clar (who later led R&D activities of NSA from 1954-5) to develop vocoder that emphasizes the preservation of voice quality via twelve-channel system. This system becomes known as SIGSALY (Secure Digital Voice Communications). BTL invents the fundamentals and transmission of digital, encrypted voice.

The British Foreign Service's Department of Communications constructs Colossus, the first fully operational, fully electronic computing device. A powerful cryptoanalysis tool, Colasses operates in binary, reads incoming data from punched tape, and is controlled by hundreds of vacuum tubes that serve as switches. (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).

1945 1945 Arthur C. Clark proposes a geosynchronous satellite.

Engineer John Bardeen, with Walter Brittain and William Shockley, attempts to apply semiconductors to electronics. Semiconductors, such as silicon, are materials whose conductivity can be deliberately or predictably altered using electricity.

Vannevar Bush describes Memex, the first personal computer (in theory), in the Atlantic Monthly. The article later reappears in the widely distributed Life magazine. Memex is a desk that contains large amounts of information compressed onto microfilm. The user sits at the desk, swiftly accessing information by operating a board of levers and buttons. The desired information appears on translucent screens propped on the desktop. (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).

ENIAC (Electronic Numerical Integrator and Computer) is unveiled in a basement room at the University of Pennsylvania. It covers 650 square feet and contains 300 neon lights, 10,000 vacuum tubes; 220 fans are required. The massive computer can carry out 5,000 operations per second.

John von Neuman publishes a report on EDVAC (Electronic Discrete Variable Automatic Computer). Von Neuman outlines "stored-program-computing" for the first time: the computer's storage device houses the program's instructions along with the imput data. Thus, more memory is available. Von Neumann also coins the now-universal computing terms: memory, input and output, organs, and gates. (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronolgy* [1999]).

Introduction of the atomic bomb at Hiroshima, Japan.

1946 CBS demonstrates color TV to journalists and the FCC in the Tappan Zee Inn at Nyack-on-the-Hudson, New York.

Whiteside Parsons, a devotee of Aleister Crowleys magick and a brilliant scientist at the Jet Propulsion Laboratory in Pasadena, CA, attempts to create a homunculus, literally an artificially conceived person occupied by a preterhuman spirit. Among the oldest of alchemical legends, Crowleys Moonchild suggests that a homunculus could be created when both parents were Crowleyan initiates who performed the required sex magick rituals. The embryo created by their congress would act as a "butterfly net" to capture the appropriate spirit. The resultant child would be human in the commonplace biological sense but for all pragmatic occult purposes would function as a homunculus. After the appropriate chants, intonations, and gestures, Parsons and Marjorie Cameron commence sex magick congress in the presence of L. Ron Hubbard, who describes the activity taking place on the astral plane.

Tragically, on June 20, 1952, Parsons is blown apart by an explosion in his garage. Bloody body parts are visible in the rubble. Today Parsons is credited with aiding in the creation of solid rocket fuel, which is commonly used in space exploration. A crater on the moon is named after him, honoring his achievements in this field. (Bill Landis, *Anger: The Unauthorized Biography of Kenneth Anger* [New York: Harper Collins, 1995]).

1947 Dennis Gabor describes principles of holography.

Walter Brattain and John Bardeen of Bell Telephone Laboratories devise the transistor, an electronic switching mechanism and amplifier (to replace vacuum tubes). "The first transistor, the point-contact transistor, stands ten centimeters high--contains a semiconducting crystal of germanium, which serves as the amplifier, connected to 3 wire probes. A current entering one probe is amplified when it passes through the crystal and out through another probe." (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).

1948 Ampex Corporation markets first commercial video tape recorder.

A device called the Cathode-Ray Tube Amusement Device was patented in the United States by Thomas T. Goldsmith Jr. and Estle Ray Mann. It described using eight vacuum tubes to simulate a missile firing at a target and contains knobs to adjust the curve and speed of the missile.

1950 First U.S. cable television system appears.

1952 Alan Turing is convicted for indecency (participating in homosexual activity) and is sentenced to take large doses of estrogen.

oxo, a graphical version of tic-tac-toe, was created by A.S. Douglas, at the University of Cambridge, in order to demonstrate his thesis on human-computer interaction. It was developed on the EDSAC computer, which uses a cathode ray tube displaying memory contents as a visual display. The player competes against the computer (which incorporates basic Artificial Intelligence) using a rotary dial.

1953 DNA structure is resolved to be a double helix by James D. Watson and Francis Crick

1954 Alan Turing eats half of an apple dipped in cyanide and dies.

Clarence Kelly Johnson, designer for Lockheed Aircraft, designs the Utility-2 (U-2) Jet and privately dubs it "The Angel." The Hyon Corporation develops the "B-camera" for the U-2. Its revolutionary mylar film and lens (conceived by Dr. James Baker of Harvard) can photogragh the entire U. S. in just twelve flights and can resolve a 2 × 2 ft. object from a thirteen-mile altitude.

Lawrence Curtiss, an undergraduate physics student, invents a process by which fine glass fibers can be coherently bundled in order to convey an entire image: the Fiberscope.

1956 Emmett Norman Leith develops the data processing system that allows holography to work. Holography is the recording and reconstruction of a wavefront. The reconstructed hologram wavefront is identical to that which issued from the object.

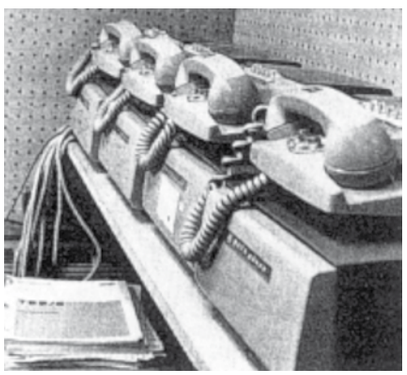
1957 Sputnik, first satellite, launched by the Soviet Union [Union of Soviet Socialist Republics]. The satellite, a metallic object the size of a beach ball, rotates around the earth for three months and then fallsit burns up when it hits the atmosphere.

1958 Color is synthesized from a monochrome television set in the first "flicker color" broadcast.

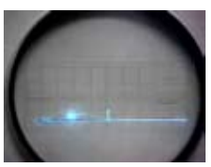
Kukla, *Fran and Ollie*, a childrens show, begins color television broadcast.

Pope Pius XII declares Saint Clare of Assisi the patron saint of television.

Researchers at Bell Telephone Laboratories invent the modem, short for modulator-demodulator. The device converts data from the computer format (digital) to the telephone-line format (analog) and back again. Modems make computer networks possible. (Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, Theresa M. Senft, *History of the Internet: A Chronology* [1999]).



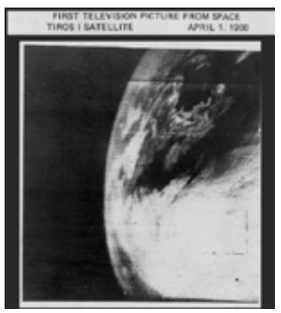
The Dataphone, the first commercial modem, designed by Bell Labs



1958 William Higinbothom created a game at Brookhaven National Laboratory in New York using an oscilliscope and analog computer. Tennis for Two was played with two box-shaped controllers, both equipped with a knob for trajectory and a button for hitting the ball.

1959 Robert Noyce of Fairchild Semiconducutor and Jack Kilby of Texas Instruments simultaneously design the integrated circuit, later known as the microchip. The transistor is miniaturized into a tiny pattern etched onto a slice of silicon, becoming the integrated circuit. This development makes it possible to create much smaller versions of electronic devices, eventually including the microprocessor and personal computer.

1960 First ruby laser built by Theodore Maiman.



First successful hologram produced.

1961 First manned space flight.

1962 Computer engineer Paul Baran, in the paper "On Distributed Communication Networks," describes what later becomes known as packet switching, in which digital data are sent over a distributed network in small units and reassembled into a whole message at the receiving end. The network is designed to improve the security of strategic weapons communications systems that are vulnerable to nuclear attack. The new systems would function even if some of its subcomponents were destroyed:

1) Instead of a common decentralized network (telephone system), several interconnected main centers are linked like a net, each location connected only to its immediate neighbors; messages have multiple pathways by which to reach their destinations and can always be rerouted.

2) The system chops up the message and sends each piece by a different route.

1963 The American National Standards Institute renders the ASCII character table as the standard character representation system for the computer industry. Computers use the binary system, in which numbers are represented by sequences of ones and zeros, to store, process, and exchange information. Programmers use other characters. A translation process is required. ASCII assigns a particular binary number to each character of the alphabet (A = 1000001).

1965 Early Bird (Intelsat I), the first telecommunications satellite, is launched; live video feeds from all over the world begin.

Larry Roberts, a young computer scientist at Lincoln Laboratory in Boston, creates the first long-distance computer connection, a rudimentary telephone link between his computer and one in Santa Monica, California.

Psychologist Tom Marill proposes that ARPA fund a long-distance computer between MIT's Lincoln Laboratory's TX-2 computer and System Development Corporation's Q-32 in CA. The link allows the machines to send messages to one another. The device that connects the computers to phone lines works badly, but it works.

Ted Nelson introduces the terms hypertext and hyperlink, thematic links between documents, to refer to the structure of a theoretical computerized information system called Xanadu that would be organized associatively, not sequentially.

1963 The first video game is created by engineers at Sanders Associates, a New Hampshire-based defense contractor. Ralph Baer conceives the design. He recalls: "I'm ... thinking about what you can do with a TV set other than tuning in channels you don't want." The first toy Baer and Bill Harrison make consists of a lever that players pump furiously to change the color of a box on a television screen from red to blue. The first games are all two-person games in which players control every object on the screen.

NASA launches five Lunar Orbiter satellites. Together they photograph the entire moon.

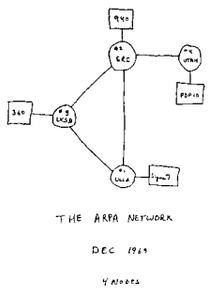
1967 Sony introduces the Portapak, first portable video recording system.

Ralph Baer continued development, and in 1968 a prototype was completed that could run several different games such as table tennis and target shooting.

1969 On July 20 1969 Neil Armstrong became the first person to walk on the moon. Apollo 11 mission is transmitted and broadcast live from the moon.

Glenn McKay creates psychedelic light shows for rock bands that combine the live manipulation of pigmented liquids and film projection systems.

ARPANET prototype of the Internet is initiated.



A sketch of the original ARPA net structure as outlined by Larry Roberts

Allan McLeod Cormack and Godfrey Newbold Hounsfield brought about the use computerized axial tomography (CAT or CT scanning), detailed anatomic images of the brain become available. They win the 1979 Nobel Prize for Physiology or Medicine for their work. This work leads to development of radioligands, single photon emission computed tomography (SPECT) and positron emission tomography (PET).

1973 Magnavox's home-video console Odssey sells for $100 with 20 games including *Tennis*, *Volleyball*, *Shooting Gallery* and *Cat and Mouse*.

Nolan Bushnell created the world's first video-game juggernaut with Atari in 1972.

Brad Fortner and others developed as an educational flight simulator.

U. S. Air Force Development Test Center, Eglin Air Force Base, Florida, begins developing the weapon system to be popularly known as the Smart Bomb. The bomb is guided by a television Electro Optical TV via Mid-course guidance Beacon Data Link during the day, and an Imaging Infrared Seeker via Beacon Data Link during the night. Live images from a camera in the bomb are sent to a remote operator, who uses them to guide the bomb to a target.

It is now estimated that by the time a person reaches eighteen years of age, he or she has, on average, attended school for 10, 800 hours and watched television for 20,000 hours.

Atari's Pong, a home-console version of the coin-operated video game.

The Atari 2600 (originally the Atari VCS) It was the first successful cartridge-based console; had a library of hundreds of games including such classics as *Space Invaders*, *Adventure* and *Pitfall*

SMTE (Society of Motion Picture and Television Engineers) recommends the use of the color bar for registration of color on TV.

Apple introduces home computer; the company logo depicts a rainbow-colored apple with one bite taken out of it.

Apple Computer Logo

Sony demonstrates first consumer camcorder.

1980-85 Scitex, Hell, and Crosfield introduce computer-imaging systems.

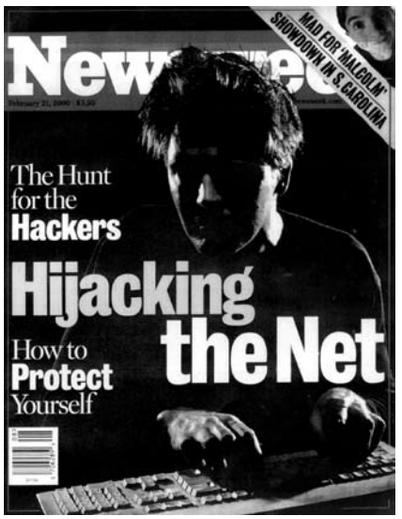
1981 MTV begins broadcasting.

1983 Kary Banks Mullis discovers the polymerase chain reaction enabling the easy amplification of DNA

1986 On October 4, the Transcommunication Study Circle of Luxembourg (CETL) receives its first video image of its spirit partners. Jules and Maggy Harsch-Fischbach record it on a VHS recorder with a Panasonic A-2 video camera. The image of a man, Pierre K, appeared on the TV screen for a duration of 4/50ths of a second. "Using high-tech communication the dead are now transmitting information to our scientists in pictures, text, and voice via television screens, computers, and telephones. Technology allows people without bodies to communicate" (Jules and Maggy Harsch-Fischbach of CETL).

CETL suggests that there is a parallel communications lab in the sprit world: Timestream Space Lab. The facilities are located in the third plane of the astral world on a planet named Marduk. The Sprit-side technicians state; "We have a body like yours. It consists of finer matter and vibration than your dense, coarse physical bodies. There is no sickness here. Missing limbs regenerate. Bodies that are disfigured on Earth become perfect. We live in comfortably furnished houses. We soak up noise, such as hiss between radio stations, and turn it into artificial voices."

1987 FBI creates Carnivore, a clandestine system for sifting through e-mail on the Internet. Carnivore software runs a packet sifting program, which notes all messages inside the ISP network by orgin and destination. Thus the FBI can extract and read messages of interest.



Hijacking the Net' front cover of Newsweek, Febuary 2000

1988 Red-eye reduction is used in cameras.

A human genetic map is produced showing the chromosomal locations of markers from more than 30,000 human genes. Alec Jeffreys introduces DNA fingerprinting as method of identification.

1991 Gulf War news coverage is highly controlled by the U.S. government. Video footage from cameras in the tips of the GBU-15 smart bombs, which features views of their rapid decent to their target, is released to the media. Weapon video is either electro-optical (TV camera) or infrared and is generated in the nose of the weapon. The laser guidance system can bring the bomb within four yards of the target.

CU-SeeMe, a live video streaming program for the Internet, is developed at Cornell University. The program allows anyone to broadcast in cyberspace.

1995: An ATM camera records a Ryder truck outside Oklahoma Citys federal office building just before the blast that kills 167 people. That image helps police track down bomber Timothy McVeigh.

1996 Jennicam. A 23-year-old exhibitionist launches a Web site featuring real-time video of her mundane daily activities. She develops a large following.

Cookie: a piece of information generated by a Web server about the users preferences are secretly stored in the users computer. Cookies are swapped back and forth between the Web servers and the users computer without the users consent or knowledge. As a result personal information of all sorts can be transmitted to Web servers.

Dildo Cam advertised on web-site
Dildo Cam is a ubiquitous feature of pornographic Web sites. Short videos, usually available by subscription only, allow the viewer literal access, via video, into the vaginas and rectums of porn stars.

1997 Six hundred Japanese children and a few adults are rushed to emergency rooms after watching the television program Pocket Monster (Pokmon). The flashing red eyes of the cartoon monster cause some viewers to fall into convulsions. One person in 200 suffers from epilepsy, and of those, 5 percent have photic seizures, which may be provoked by frequencies of 5 to 30 flashes per second. Other triggers may be: TV and computer screens, video games, faulty screens and lights that flicker, sun shining through a row of trees viewed from a passing car, looking out of a train window, sunshine on water, stroboscopic lights, and geometric shapes or patterns.

MUDs (Multi- User Dungeons) Internet gaming expand, Id software's 1996 game "Quake"pioneered play over the Internet in first person shooters: FPS games. MMORPGs (Massively Multiplayer Online Roleplaying Games), such as Ultima Online and EverQuest freed users from the limited number of simultaneous players in other games and brought the MUD concept of persistent worlds to graphical multiplayer games

Rockstar's *Grand Theft Auto III*. An open-ended 3-D crime drama from the third-person perspective, breaks traditional dependence on linear play.

1999 Live slow motion. Lene Vestergaard Hau slows down a light pulse from 300 million meters per second to 17 meters per second by passing it through a cloud of laser-tuned sodium atoms chilled to less than 50 nanokelvins. Optical properties of materials can be altered with this process, she states; "Its really opened up a lot of new exciting things that you can start doing."

New York Civil Liberties Union volunteers walk the streets of Manhattan in search of every video surveillance camera, public or private, which records people in public spaces. Volunteers produce a comprehensive map of all 2,397 surveillance cameras.

voyeurdorm.com, a "reality based" Web site goes online. "Six students live in a house with 40 webcams. For $34 a month, you can watch their daily

activities: smoking, sleeping, urinating, bathing. The rules: no sex, but masturbation is okay; no drugs, but booze is allowed; absolutely no moving the cameras away from you; no skipping out on the daily chat sessions; no boyfriends after 11 p.m.; and most importantly, no leaving the house without consent, except for the two nights a week each resident has off" (Mark Boal, "Behind the Cams at Voyeurdom: Surveillance Sorority" [The Village Voice, August 4, 1999]).

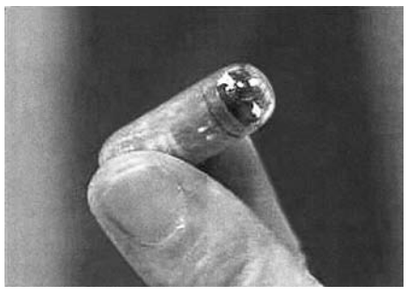
Two variants were adopted for the 1997 IEEE 802.11 standard on wireless communications: 802.11a for the 5.8GHz band and 802.11b for the 2.4GHz band. The technology was soon named Wi-Fi.

First person shooters, a popular form of computer game and MUDs (Multi- User Dungeons) Internet gaming spreads. MMORPGs (Massively Multiplayer Online Roleplaying Games), such as Ultima Online and EverQuest make use of the complex linking of the Internet.

2000

2000 Sikorsky helicopter company constructs a remote controlled, pilotless helicopter drone called the Cypher. It looks like a flying saucer and uses commercially available people-tracking software to find human targets in urban riot situations.

Professor Paul Swain invents the endoscope, a camera in a pill or capsule 11 mm by 30 mm, it includes a tiny light source and transmitter. It radios images from inside the body to a portable recorder strapped to the patients waist. The pill camera is eventually excreted.



Endoscope, pill camera

2001

Ensormatics, a leading manufacturer of surveillance cameras that built its $1 billion international business on anti-shoplifting technology, estimates that 62 percent of middle- and high schools will implement some form of electronic security by 2002.

Fluorescent Green Jellyfish/Monkey Embryo is created in a lab. Scientist Gerald Schatten of the Oregon Primate Research Center at Oregon Health Sciences University introduces jellyfish genes into the developing embryos of Rhesus monkeys. The gene encodes instructions for a protein that gives the jellyfish a green glow. When fluorescent light is shined on the embryos "more than a third of embryos fluoresced." Although the genes are not found in the monkeys after birth, scientists say it is just a matter of time before the procedure will work for primates, including humans. The technique also works with mice. Ryuzo Yanagimachi and his colleagues at the University of Hawaii mix the same jellyfish gene with mouse sperm, injected the sperm into mouse eggs and created embryos. After the birth of the mice, Yanagimachi detects a green glow in the tails of the mice under a fluorescent light.

2001 It was reported that scientists had detected high-energy neutrinos for the 1st time in the Antarctic Muon and neutrino Detector Array (Amanda).

Guilty Knowledge, lie-detection test based on technology developed by Daniel Langleben at the University of Pennsylvania uses f.M.R.I. machines to compare the brain activity of liars and truth tellers.

European Commission's Joint Research Centre used Adaptive Brain Interface, the system they developed to interpret the signals from a plastic cap put on the user's head with attached electrodes that picked electromagnetic signals from the brain. The user, Cathal O'Philbin, a 40-year-old paraplegic, was instructed to think about a rotating cube, moving his left arm (which is paralyzed) and relaxing mentally in between. These three distinct patterns were used to control the cursor on the screen. After several hours Mr. O'Philbin trained the system to recognize his mental states and managed to type "Arsenal Football Club" using his brain alone.

It was reported that scientists in Chicago had connected a lamprey eel's brain to microprocessors to steer a robotic device toward light.

Delft Univ. of Tech. in the Netherlands reported the creation of nanotechnology transistors built from a single molecule.

Max Planck Inst. for Biochemistry in Germany had affixed snail neurons to transistor chips and demonstrated communication.

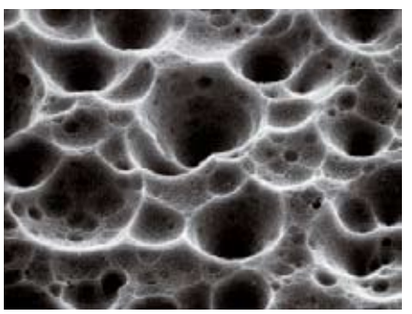
Lucent's Bell Labs reported the development of a tiny new transistor made of a simple cluster of organized molecules.

2003

2003 Image from the revolutionary T-ray camera, sees through fog, clothing (notice the concealed gun in this image) and into deep space. The camera detects terahertz waves that straddle the border between radio and optical emissions.

A US company launched Mexican sales of microchips that can be implanted under a person's skin and used to confirm health history and identity.

Super Black
National Physical Lab in Britain develop NPL Super Black, a nickel-phosphorus compound that absorbs 99.65% of all visible light. Black paint absorbs about 97.5% of visible light.



GeneChip
This is the first chip to contain all the 50,000 known human genes and variants. It is a research tool from the Affymetrix company for identifying and isolating each gene.

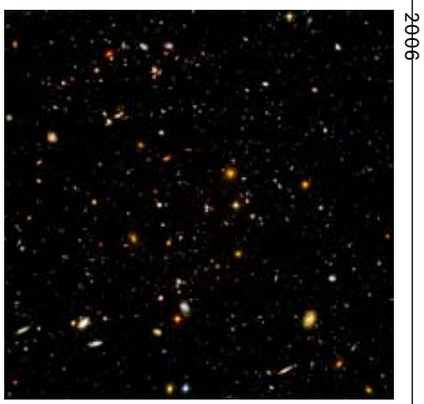
Infrared Fever Screening System
Invented in response to the SARS scare, this device can scan a person and detect temperature from a distance, producing a color-coded thermograph. Located in public spaces such as airports, hotels, hospitals it can help prevent the spread of disease.

New light transmitting concrete has the strength of the traditional material and is embedded with an array of glass fibers that conduct light. Invetntor Áron Losonczi states; "Shadows on the lighter side will appear with sharp outlines on the darker one."

2004

2004 The whole solar system is photographed by the Voyager.

Hubble Space Telescope is launched; this eye in the sky has become the most important instrument in the history of astronomy. Hubble Ultra Deep Field or HUDF is the most sensitive space image ever made: 800 exposures taken over the course of 400 orbits around the earth with a total exposure time of 15.8 days. This data was collected over September 3, 2003 and January 16, 2004. This image is the deepest image of the universe ever taken with visible light looking back in time more than 13 billion years.



Scientists said they had created a new form of matter, called a fermionic condensate. It is the sixth known form of matter, after gases, solids, liquids, plasma and a Bose-Einstein condensate.

Keyhole Inc. program Earth Viewer produced a geospatial virtual image of the globe. A mapping of the whole surface of the earth is available on the Internet site Google Earth.

The FDA approved a clinical trial by Cyberkinetics on implants in humans for a brain-computer interface.

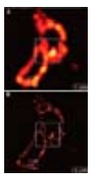
2005

2005 HP researchers introduced groundbreaking nanotechnology that could replace traditional transistors on computer chips.

2006

2006 Invisible? Analyses predicted that it should be possible to ferry electromagnetic waves around an object to hide it. All that was needed was a properly designed shell of "metamaterial," an assemblage of tiny metallic rods and c-shaped rings.

An ordinary microscope cannot resolve features smaller than about 200 nanometers of visible light used to illuminate an object. For years, physicists and engineers have devised schemes to get around the "diffraction limit". Stimulated emission depletion (STED) is used by researchers assembled an image with a resolution of tens of nanometers.



2007 The video game industry has grown to become a $10 billion industry, it now rivals the motion picture industry as the most profitable entertainment industry in the world.

Checkpoint Systems Inc. said it will provide Reno GmbH with RFID (radio frequency identification) tags and store tagging systems. Reno GmbH plans to embed wireless chips in shoes sold at hundreds of stores across the continent.

Washington State will implement a voluntary program to implant radio-frequency ID (RFID) chips in driver's licenses to speed border crossings. Border agents will electronically retrieve identification and citizenship information from people as they drive up to crossings between Washington and Canada.

NYC Police Department is creating Manhattan Security Initiative a web of surviellance cameras around lower manhattan.