

Thomas Alva Edison wrote, "If we all did the things we are capable of doing, we would literally astound ourselves." This simple statement recognizes a primary law of human creativity, namely the great potential hidden in each of us. Many of the inventions that have transformed our daily lives seem to be the outcome of purposeful research, passions or hobbies, but the long history of human creativity finds its ancestral motivation in the need to solve a problem. This general law is an instinctive force that invents, discovers, manipulates and recreates in every age and culture. Who knows what the first reaction of humanity was, 35,000 years before the birth of Christ, when it was first observed that attempts to start a fire had produced a regular hole? After some nervousness, it seems to have led to the invention of the bow drill. Over time the ability to associate individual inventions, hybridize them and create new uses has produced extraordinary insights. So in about 3500 B.C., the combination of the potter's wheel with a sledge produced the first revolution in human transportation, the wheeled cart. Some inventors have even become celebrities, real stars of antiquity. One of the best known, Archimedes of Syracuse, said, "Give me a place to stand and I will move the whole world." The lever and the Archimedes screw, an ingenious system for raising water, suggest that it was difficult to find a place to stand, as Archimedes was not joking. In the Middle Ages, ancient inventions were improved and new ones saw the light. Apparently humble objects like scissors, the sickle or nail spread and completely transformed everyday life. The first pen (a goose quill, of course) was invented, being mentioned by Isidore of Seville in 580, lenses were designed by the "father of optics", the Arab Alhazen, and we are indebted to Oriental culture for Arabic-Indian numerals. After the appearance of the "hipposandal" as the horseshoe was called, the stirrup was used for the first time in Europe at the Battle of Poitiers in 732, radically changing the techniques of war. Yet many of these inventors, some even endowed with real genius, have never enjoyed the fame of Archimedes. Regarded as a humble mechanic, the creative derived limited financial benefits from his or her inventions. One of the greatest, Johannes Gutenberg, having invented and perfected the printing press with movable type, the machine that has transformed the whole history of culture, was left nearly blind in his old age to live on an allowance of corn and wine granted by a charitable prince.

Some inventions arise in unexpected ways. The Reverend William Lee seems to have devised the first model of the stocking frame (or mechanical loom) (1589) to help his mother and sister turn out woolen stockings, though malevolent rumors insinuated that he was really after the attention of a girl, too busy to notice him. Simple and brilliant insights owe much to chance. The telescope (1609), the instrument that would open the universe to study by Galileo, seems to have grown out of a game devised by two children in the workshop of their father, the optician Hans Lippershey, who realized its importance and tried to sell it to the Dutch army. Other devices, now widespread, had illustrious parents. The scientist Denis Papin, after endangering members of the Royal Society with the explosion of his first "steam digester", introduced a new solution in 1682, equipping it with a valve and so creating the ancestor of our pressure cooker. The selfless philanthropist Benjamin Franklin refused to patent his safety stove, so ensuring it would be cheap and popular. A clever insight even reveals the incredible versatility of the invention of a technician. Who would imagine that it was actually a watchmaker, Alexander Cummings, who in 1775 invented the flush toilet, a perfect mechanism and odor trap that improved hygiene in modern homes? on another occasion a single glance sufficed to invent the corkscrew. In 1795 the Reverend Samuel Henshall realized that the gun worm, an instrument used for removing unexploded charges from muskets, could easily be turned into a peaceful attacker of corks. Individual inventions were spread by the industrial revolution in Britain in the eighteenth and nineteenth centuries. Against the backdrop of discoveries that transformed the use of metals and the production of energy, simple innovations like the screw-thread cutter (1797) made the everyday work of laborers and craftsmen lighter and quicker. The whole of society was traversed by a new creativity, surrounding the work of humble artisans with acclaim and even fortune. A new figure emerged, the "inventor," who struggled with designs and patents and even invented himself by transforming the experience of ancient craft production.

Chance once again made a mockery of years of research and fruitless applications. The Montgolfier brothers received the inspiration for their discovery by observing a fire. "Get a roll of taffeta," wrote Joseph Montgolfier to his brother "and you will witness one of the most amazing spectacles in the world." Often accidental discoveries are made to overcome problems at work or financial difficulties, with workers driven by hardship or necessity to refine on the tools of their trade. The problems of food preservation were solved by the humble Parisian confectioner Nicolas Appert. Napoleon Bonaparte needed to provide meals for his large standing armies. This was done by improving the system of boiling vacuum-packed food, a method whose validity was scientifically demonstrated by Louis Pasteur in 1860. This was followed by the technique, patented in 1810, of preserving meat in cans, which accompanied Napoleon's troops as they marched across Europe. Though it increased the shelf-life of foods, the system was limited to the army because of the difficulty of opening the cans, which required the use of knives, guns or stones. The can opener was only invented in 1870. Together with scientific research, medical practice also had an important role in the experiments. In 1800 Sir Humphrey Davy observed the effects of "laughing gas" (nitrous oxide) as an anesthetic. A few years later, instruments such as the endoscope (1805), tested on a sword swallower in a circus, made it possible to improve diagnostic techniques. An amusing episode, involving the embarrassment of Dr. Laennec when faced with the large breasts of a patient, gave rise to the invention in 1816 of the stethoscope, an essential tool for diagnosing cardiac and respiratory diseases. The doctor had to auscultate his patient's heart, causing him some embarrassment (the operation involved placing one ear against the patient's breast), when he recalled that he had observed children playing with hollow sticks to transmit sound. Sometimes complex researches lose their strictly scientific value and produce unexpected results that continue to produce amusement, like children's balloons, created in 1824 by Michael Faraday, one of the best-known English physicists, or modern chewing gum derived in 1850 from experiments with the use of the rubber in industry. The research was a failure, but the addition of corn syrup, sugar and essence of mint produced a product still as popular as ever and selling steadily. Spirit of observation and brilliant insights have led to many inventions, such as dry cleaning (1849), the safety pin (1849), linoleum (1860), and even the carburetor (1893). So much a part of the future automotive industry, it was devised by casual observation of a florist's watering system. At other times the solution was intended to overcome physical difficulties. The phonograph (1877) was built by Edison to solve hearing problems and the zipper (1913) was invented by Whitcomb Judson to help a friend who unable to tie his shoes because of backache.

Many inventions are the result of a spontaneous improvement suggested by refining the use of some existing object. The telephone handset appears to be due to the intuition of an anonymous Swedish receptionist, who combined receiver and microphone with a rod so as to keep her hands free. Women, increasingly engaged in work outside the home, took center stage and made many inventions in the twentieth century. We owe the non-stick pan (1954), the world's best-selling kitchen implement, to the practical spirit of the wife of the engineer Marc Grégoire, who suggested using Teflon for the many pans in the home and not just for coating gun barrels or fishing tackle. In 1992, another woman, observing a child drinking with difficulty, devised a new baby's bottle called the Anywayup Cup, fitted with a valve to stop the liquid leaking out. Other articles have been given a function quite different from their original one and been an immense success. They range from the Post-it note, made using an adhesive too weak for other purposes, to the TV remote control, originally designed to silence irritating commercials. At other times experiments have suggested original applications. Nitroglycerin, a powerful and unstable explosive, is used as a vasodilator in treating angina pectoris. Radar valve waves, incredibly useful for cooking popcorn, form the basis of the microwave oven. Even a drug like Viagra (1998) owes its worldwide success to unexpected side effects, reported with some embarrassment by healthy volunteers taking part in trials. It was originally formulated to prevent blockage of the coronary arteries. Sometimes a stroke of genius struggles to get established, being blocked by a wall of distrust and superstition. Just read a hilarious review of errors of judgment from *Nuovo e Utile*, the online bible of creativity: "Nowadays it is practically impossible to discover unknown lands" (Council of Advisors to Isabella I of Castile, 1492). "This

'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us" (Western Union internal memo, 1876). "This invention of electricity is a total failure" (Erasmus Wilson, president of the Stevens Institute of Technology, 1879). "The cinema is an invention without a future" (Antoine, father of the Lumière brothers, 1895). "Planes will never be as fast as trains" (William H. Pickering, astronomer at Harvard College, 1908). "Cartoons about a mouse? What a wretched idea. It will scare all the pregnant women" (Louis B. Mayer, head of MGM, rejecting the Mickey Mouse character). These discoveries and inventions have changed the world. They keep us company and amuse us. They have improved the quality of our lives. In everyday life, every day, other objects are being reinterpreted, reconstructed and adapted to serve new human needs, following a steady flow of spontaneous creativity that applies absolute and logical solutions. Unflagging research even replaces technology that seems to have found all the answers. Low Cost Design is part of this reflection and enters into the processes of formation of spontaneous creativity. It is immediate, instinctive, impatient of rules, like the spirit of the American King Gillette, the inventor of the safety razor. He famously asserted: "If I had been technically trained I would have quit, or probably would never have begun."