Thomas Alva Edison

Contributions to Entertainment and Communications

K D Pavate

This article highlights Edison's contributions to communications and entertainment, which has changed the way we live.

Thomas Alva Edison (1847-1931) had a remarkable career in the field of applied science, spread well over six decades. The second half of the nineteenth century was an age when new scientific advances were being made rapidly, and simultaneously applied scientists were attempting to quickly put these discoveries into practical use – for the benefit of mankind. Edison came under the second category. Coming as he did from a typical 'Yankee' family known for its self reliance and self confidence, he rose to become an enormously successful inventor, a business tycoon and a living legend. In 1913 he was voted 'America's most accomplished inventor'!

Young Americans of those days were fascinated by railways, telegraph and newspapers. The telegraph (first introduced by Morse in 1844) had become an accepted means of spreading news across the country, and there was plenty of news in 1861 when the American Civil War commenced. Edison sold newspapers and sweets on a commuter train, which did a round trip from Port Huron to Detroit each day. He was enterprising enough to set up a small printing press in the baggage wagon of the train. There he printed supplementary sheets of local news, which he sold along with his newspapers. The telegraph operators at the wayside stations provided him with the latest war news for inclusion! On one occasion he heroically saved a Station Master's child from being run over by a moving train. Edison's bravery was rewarded by the grateful father who taught him the secrets of telegraphy. Edison was a quick learner and operating Morse's telegraphic equipment was to become his

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means of survival for the next ten years!

Edison's Universal Stock Ticker

The next decade found Edison wandering around the country working for the Western Union (which had a monopoly over telegraphy in America). He also spent some time in a jeweller's workshop where he learnt all about precision machining, clockwork and printing mechanisms and a variety of telegraph instruments. Edison was bursting with ideas on how to improve the telegraph and put it to new uses. He invented an automatic electric vote recording machine which could be used in legislatures. Unfortunately for him, the elected representatives still preferred the old fashioned 'show of hands' method of voting! Private telegraph lines were being used between stock exchanges and the offices of the agents who wanted to know the variations in share and gold prices as they moved up and down during the course of the day. The agents could register their share quotations by this private telegraph. One day the main instrument in the New York stock exchange stopped working and there was an immediate crisis. Edison not only put the machine right quickly but came up with a better design. When his new machine (the Edison Universal Stock Ticker) was perfected he discussed it with the Director of the Gold and Stock Telegraph Co. who straightaway offered Edison forty thousand dollars for this invention. It was a sum far beyond what he had ever expected. He used the money wisely to set up his first laboratory in New Jersey to manufacture these and similar instruments.

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The Phonograph

Edison had an interesting way of reasoning and that was by the process of 'analogy'. If a line of reasoning was satisfactory in one particular application then he would try it again in another situation. An interesting example of this was his work on recording sound in the year 1877. Edison had spent a decade in recording or embossing the telegraphic dots and dashes on thick paper tapes or even on tin foils so that these messages could be

retransmitted without the mediation of a human operator. It then occurred to Edison that perhaps the vibrations of a diaphragm could also be embossed directly on a tin foil. This flash of insight led to his inventing the phonograph. He wound a tin foil on a cylinder, which could be rotated initially by cranking but later by means of a clockwork mechanism. The sound waves caused a diaphragm (placed at the narrow end of an acoustic horn) to vibrate and this in turn caused a steel needle to make scratches on the rotating tin foil. The recording was in the form of an undulating groove, which spiraled from one end of the cylinder to the other. When the needle retraced these scratches the diaphragm vibrated and reproduced the original sound. Edison placed this device in front of his visitors who invariably cranked the handle. Imagine their surprise when they heard Edison's voice reciting 'Mary had a little lamb'. However, at about the same time Edison got busy with the design of incandescent lamps. This along with his concept of a total electrical system (including generators, meters etc.) kept him occupied for over a decade. Edison returned to the phonograph in 1888 to further improve upon it. He found that the phonograph appealed to children of all ages as a sophisticated toy. Edison's machine delighted and thrilled them. Later, he designed another version, which used wax cylinders in place of tin foils. These were used as dictating machines in offices for many decades. Edison was the first to record speech and music on a moving mechanical medium. This mechanical process of reproducing music continues to this day – though in vastly improved form now known as 'compact discs'.

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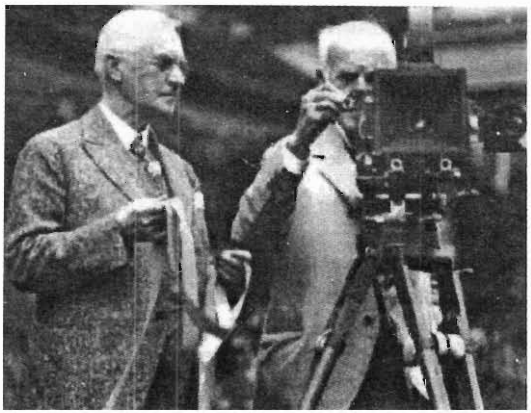
Edison also made a very important contribution to telephony. Bell had in his design of the telephone instrument made both its transmitter as well as its receiver similar. They both consisted of electromagnets, which actuated steel diaphragms. The transmitter was not very sensitive. In 1877 Edison designed a new transmitter with a bag of carbon particles pressing against the diaphragm. These carbon granules acted as a variable resistor to current flowing through the circuit. However, the actual resis-



George Eastman (left) with Thomas Edison (right) operating a movie camera.

tance depended on the extent the diaphragm pressed against the bag of carbon. This arrangement resulted in a sensitive microphone and very soon all the telephone systems in the world were using it. The sound reproduced at the receiver was now loud enough to be clearly heard by the listener. The carbon transmitter has only recently been replaced by the *electret microphone*.

Edison Effect

While carrying out a large number of experiments to perfect the light bulb (see accompanying article) he observed that the glass bulb was darkened by deposits emitted by the carbon filament. It was a potentially fatal flow inherent in what he considered his most important invention. He observed with the help of a metal probe that the region around the filament became negatively charged. This discovery came to be known as the 'Edison effect'. Edison saw no immediate commercial application of this discovery. This discovery anticipated the electronic vacuum tube (the diode) a decade before it was actually perfected by Fleming.

Moving Pictures

In 1888 Edison started work on adapting the phonograph mechanism to display moving images. The groove was replaced by discrete pictures on a cylinder. A shutter mechanism was used to interrupt the viewing so that the viewer could see 20 stationary, though slightly different, pictures each second. The overall impression was one of seeing images, which kept on moving in a continuous manner. The viewers were quite charmed with what they saw. There were long queues of people willing to pay and wanting to peep through Edison's kinetoscope. He made improvements first by replacing the circular cylinder by one. which had a polygon as its cross-section. He then used solenoids, ratcheted wheels, shutters, etc. in his mechanism, which enabled the pictures to be viewed only when they were station-

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ary for a short while, through an eyepiece. This mode of entertainment received a push forward by advances which were being made in the field of photography. Though the first photographs had been made in the 1830s, yet the procedure was cumbersome. The photographic plates had to be sensitised just before use and the exposure times were exceedingly long. In the 1870s gelatin-coated dry glass plates were being used to capture light images. These were far more sensitive to light than earlier versions. Later, George Eastman discovered that celluloid film could be used as the base (in place of glass) for the light sensitive chemicals. The exposure time was now as short as one fifteenth of a second. The new projector carried rolls of developed celluloid film and these had sprocket holes for a claw mechanism to pull the film downwards. The film itself was kept stationary for a moment while light (from an arc light source) passed through the picture frame to form an image on a screen. A shutter would then cut off the light while the film moved forward by one frame. A single viewer kinetoscope gave way to film projected for mass audiences! These new projectors were known in America as Edison's vitascope. The timing for its introduction was perfect. Public wanted entertainment and Edison along with others provided them with the cinema as we know it today. Edison was the first to attempt synchronising the movement of the film with sound recorded on the phonograph. He also developed a movie camera (the kinetograph) to record moving pictures. Edison even tried his hand at producing some feature films to entertain the public! Motion pictures became a successful multi-million dollar entertainment industry in less than a decade. With these inventions Edison opened the doors to what has come to be known as 'commercialization of leisure'!

Each technology 'that Edison put his mind to' became a large industry in its own right. Whatever Edison worked on sooner or later added to the quality of life all over the world. His successes were mainly on account of his drive, personal energy, courage to explore and his vision.

Suggested Reading

[1] Colin Chant, *Science, Technology and Everyday Life – 1870 to 1950*, (Chapter 7), The Open University, UK.

[2] Louise Egan, *Thomas Edison–The Great American Inventor*, Barron's Educational Series.

[3] Edison Papers Project - Edison.rutgers.edu

[4] The Undiscovered World of Thomas Edison, by Kathleen McAuliffe, http://www/thomas-edison.com

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