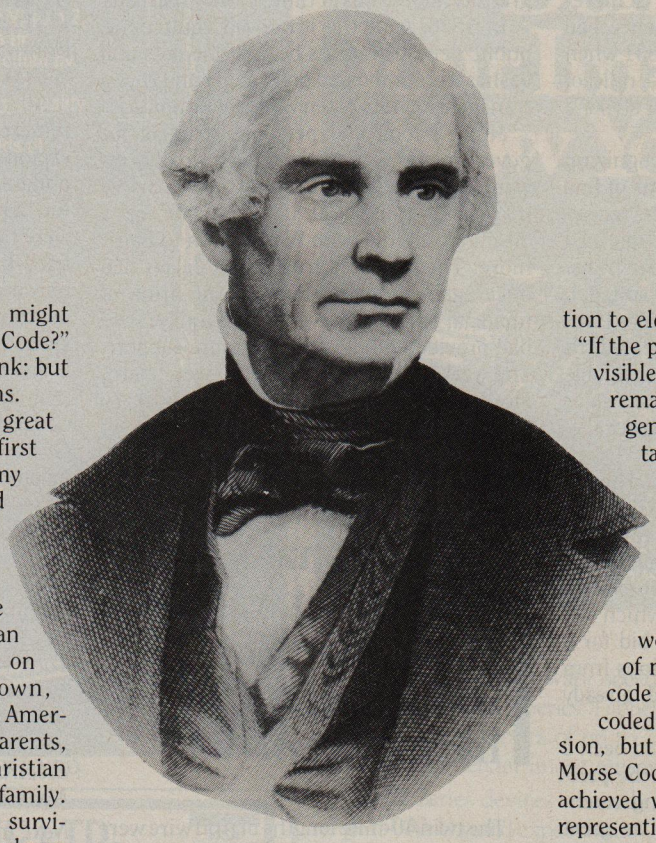
Pioneers

5. Samuel Finley Breese Morse (1791–1872) – the American Leonardo



Institution of Electrical Engineers.

A good Trivial Pursuit question might be, "Who invented the Morse Code?" Not very taxing, you might think: but the answer is less obvious than it seems.

Morse was an artist, painting his great love. He was a founder and the first President of the US National Academy of Design. When he took up a second career as an engineer-inventor he left his art unwillingly and grieved over the loss for years.

Samuel Finley Breese Morse – the American Leonardo, according to an enthusiastic biographer – was born on 27th April, 1791 in Charlestown, Massachusetts, a sixth-generation American. Named after his mother's parents, taking their surnames as his Christian names, he was called Finley by his family. He and two brothers were the only survivors through birth and infancy of eleven children. Later he fathered eight of his own.

Whilst a student at Yale his reputation as an artist began to grow, especially for his ivory miniatures. But his father dissuaded him from art as a career and, for a time, Morse became a clerk in a bookshop.

His talent was not to be restrained, though. On 13th July 1811, aged 20, and with his parents blessing, he sailed for England where he studied art for the next four years, mainly at the Royal Academy in London. Among his works were at least three of outstanding merit. One, 'The Dying Hercules', was exhibited at the Royal Academy; another, a statuette of Hercules, won a gold medal from the Society of Arts.

On his return home his hopes of reviving the splendour of the fifteenth century crashed. Though admired, his historical paintings were not bought and for income he turned to portraiture, seemingly the only form of painting Americans would buy. At this he excelled.

His personality brought him social respect; his art scratched him a living, though at times meagre. Best known of his works are probably two portraits of Lafayette, painted in Washington in 1825, and the slightly earlier 'The Old House of Representatives' which includes 86 portraits.

> **"If the presence of electricity can be made visible... I see no reason why intelligence may not be transmitted instantaneously."**

Even in those early years Morse appears to have been something of an experimenter. For a portrait of his wife and children he ground the pigments in milk. Another time he used beer!

The mid-1820s brought change for Morse. In four short years his wife, father and mother all died. In 1829 he again sailed for Europe and spent the next three years mostly in France and Italy.

On the return voyage in 1832 a fellow passenger drew the dinner-time conversation to electricity. Soon Morse was hooked. "If the presence of electricity can be made visible in any part of the circuit," he remarked, "I see no reason why intelligence may not be transmitted instantaneously by electricity." By the end of the voyage his notebook was crammed with sketches and ideas. The next dozen years transformed his life – and the world.

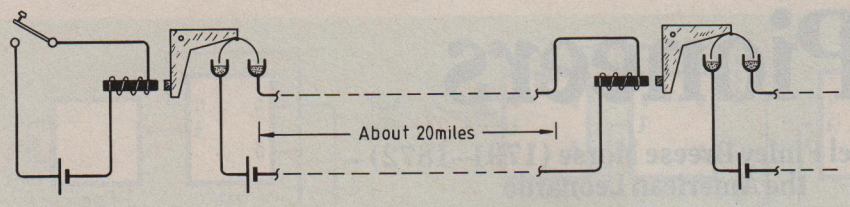
He devised a system in which words were represented by groups of numbers and he began work on a code book. Each numeral was further coded into dots and dashes for transmission, but this was not the now famous Morse Code. Speedy transmission was to be achieved with lead 'types' which had teeth representing the dots and dashes of the numerals. Assembled on a bar, they were pulled across contacts so that the teeth switched a battery in and out of a two-wire circuit. From the beginning he wanted a receiver that would give a permanent record of the message. The earliest model had an electromagnet which moved a pencil to mark the dots and dashes on to paper tape driven along by clockwork.

Evidently Morse's proposals owed little to the rush of European ideas for magnetic needle telegraphs. His thoughts were his own, and for years he found it difficult to believe that anyone had considered electric telegraphy before him.

After landing at New York he tinkered with telegraphy until necessity forced itself upon him. He had children to support, paintings to finish, and very little money.

By the end of 1835 he was at the University of the City of New York (now New York University) as professor of painting and sculpture (later as professor of literature of the arts of design). Apart from teaching and painting, both of which brought in a little money and took most of his time, he was once again working on the telegraph.

A friend who saw this early telegraph was Leonard D. Gale, a professor of science, and in him Morse found a partner. In particular



Morse relay system, as published in 1867. An electromagnet closed a mercury switch which activated the next battery and a further 20 miles or so of wire.

he learned from Gale of Henry's achievements with electromagnetism. Henry had pointed the way to telegraphy in 1831 when he signalled through more than a mile of wire to cause an electromagnet to strike a bell – the first electric bell!

Gale's contributions included recognizing the need for a large number of turns of fine wire (hundreds instead of tens) at the receiving electromagnet, and a multiple-cell rather than single-cell battery at the transmitter (so as to give a much higher voltage). This knowledge Gale had learned from Henry, and with such help Morse increased his range from a meagre 40 feet to a respectable 10 miles. On a number of occasions later Henry gave direct advice and encouragement.

Meanwhile the US Government had begun to consider whether some form of telegraph system would be of use to America. Amongst others, Morse responded with his proposals on 27th September, 1837. In October he began his application for a patent, which was granted on 20th June, 1840. His bid for a British patent was foiled by objections from Cooke and Wheatstone who had already patented their own telegraph system.

A third man, Alfred Vail, who had been a student only a year before, joined the partnership in September 1837, bringing much-needed financial backing as well as great mechanical skill. In Morse's own words, the original equipment was made up of "an old picture or canvas frame fastened to a table, the wheels of an old wooden clock moved by a weight to carry the paper forward" and "three wooden drums". It was so crude he was reluctant to have it seen.

Morse and Vail set to work to improve it. The lead types at the transmitter were soon replaced by a key and keyboard. At the receiver, pencils, fountain pens and embossers were tried, and the number-coded words and code book were thrown out in favour of a dots-and-dashes code for each letter. It is likely that this 'Morse' code, which underwent a number of changes, was actually designed by Alfred Vail. Morse who was very protective of his own inventions, did not refute the suggestion.

F.O.J. Smith, a fourth partner, joined in March 1838. As a lawyer his job was to steer the telegraph through the labyrinths of Washington. Here Morse made a dreadful mistake. Smith has been described by many adjectives of which perhaps the gentlest is unscrupulous. In his attempts to further the telegraph, of which he was now part owner, he is said to have abused his position as a congressman. Much later he harried Morse for a share of 400 000 francs which European countries had given to Morse as an honorary gratuity. Morse was at times close to despair.

In 1838, with the improved equipment, public demonstrations began. The dots and dashes were embossed on to paper and gave a transmission rate of ten words per minute.

Morse's long and personal struggle for government recognition was finally rewarded in 1843 when Congress, by a narrow margin, granted $30 000 (£6000) for a 40-mile trial line from Washington to Baltimore. The long and frustrating delays had once again brought Morse to the brink of financial ruin, with even Vail's family, who had provided funds, refusing more support. The years from 1837 to 1844 were hard, Morse preferring poverty and hunger to debt. It was his tenacity in the face of rejection which brought him eventual success.

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The twin 40-mile lengths of iron wire were tested before laying. Then, with a specially designed 'plough', the wires were encased in hot lead and speedily buried. When it was discovered that the line no longer worked (the insulation having been damaged by the heat) all was discreetly recovered (Government money was involved) and the line strung up on chestnut poles using glass doorknobs as insulators.

As the two-wire line reached out from Washington it was regularly checked by sending messages both ways. At last on 24th May 1844, soon after his 53rd birthday, Morse opened his telegraph with the famous first message, "What hath God wrought!"

That year's Democratic Convention in Baltimore brought further publicity. The vote for the presidential nomination ran to nine ballots. The result of each was telegraphed immediately to Washington where Morse had cunningly established his office in the Chamber of the Supreme Court. As the excitement grew politicians flocked to Morse's room in such numbers that the Senate was adjourned. The Morse telegraph had arrived.

By 1845 the line had been extended to New York and Boston, using one wire and an earth return. The paper embossers were eventually replaced by inkers. In turn these gave way to the sounder, perfected by Vail after it was realized that operators could recognise messages from the clicks of the receivers.

Rarely can anything so novel have caught on so quickly. After only four years there were 6000 miles of wire in use in America and after eight years the figure was over 16 000 miles, about 70% of the world total. Morse had hoped that the Government would take up and run the telegraph as a national asset but this was not to be. Instead licences were granted and private companies set up. The first big merger took place in 1851 and produced the Mississippi Valley Printing Telegraph Company, better known later as Western Union.

At 57, after 23 years as a widower, Morse remarried. Later, as he grew rich from the exploitation of his system he became a philanthropist and again supported the furtherance of art, though his own skills were never really recovered. In 1836 he had tried his hand at politics when he ran for mayor of New York. Aged 63, he had another go, this time attempting to become a Democratic Congressman. Again he was defeated.

As the Morse telegraph spread, only memories remained of the early system over which the artist had laboured in New York. Gone were the lead types, code book, pencil or embosser and buried line. In their place was a simple system of Morse key, overhead wire, and sounder. Gone too was a public naivety which prompted one Washingtonian to ask the cost of sending a parcel to Baltimore by telegraph.

Tony Atherton works at the Independent Broadcasting Authority's engineering training college in Devon. His book, From Compass to Computer, A History of Electrical and Electronics Engineering, was published by Macmillan in 1984.

Next in this series of pioneers of electrical communication will be William Thomson (Lord Kelvin).

The distinguished group below comes from a photograph in the collection of Mr Peter Mallett.