LESSON NINETEEN

Morse's Telegraph and Edison's Electric Light

Cornerstone Values: Liberty, Community, Life

When you are at home and need to ask a friend a question about homework, how do you contact them? You pick up the phone and call them or send them a text!

But it wasn't always this easy. There was a time when you would have had to walk to your friend's house, knock on the door, and ask them in person. Or, to contact your friend if they were really far away (perhaps on vacation) you would have had to send them a letter. With the slow letter delivery process, you may not have gotten your question answered in time to turn in your homework!

Fortunately, this all began to change because of a man named Samuel Morse and the invention of the telegraph, which was a device that allowed people to communicate instantaneously over long distances. Morse didn't actually invent the telegraph, but he took old models that were inefficient and made them better so that they could be used easily by lots of people in many different places.[1]

Samuel Morse was born on April 27, 1791, in Charlestown, Massachusetts. He went to Yale University and began his professional career not as an inventor, but as a painter. [Note: He was always interested in inventions, however; he filed three patents for pumps with his brother in 1817 – Morse focused on building his early career in the art world.][2] After graduation from Yale, Morse studied art in Boston and later in London where he was accepted as a student at the Royal Academy of Art.

He returned to America in 1815 determined to pursue art professionally and experienced (as most artists do) both failures and successes. His painting, The House of Representatives, flopped, though he reached the high point of his career when he was commissioned to paint a full-length portrait of The Marquis de Lafayette.[3] He had a reputation for radical politics – even ran for New York mayor twice and lost – and was a staunch crusader for artists' rights. In 1826, he led other young artists to secede from the American Academy of Art and founded the National Academy of Design where he served as the organization's first president for nearly two decades.

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[1] https://www.pbs.org/wgbh/theymadeamerica/whomade/morse_hi.html
[2] https://lemelson.mit.edu/resources/samuel-morse
[3] https://www.nga.gov/collection/artist-info.1737.html

He again traveled to Europe in 1829 and it was on his trip back to the U.S. in 1832 that he became interested in telegraphy after overhearing a conversation on a ship about electromagnetism. As mentioned, Morse didn't invent the telegraph – he improved it. At the time, telegraph machines used multiple wires (one used 26 and another model used 5). Morse, however, thought he could get the number of wires down to just one.

From 1832 to 1837, Morse, along with his two partners, Leonard Gale and Alfred Vail, created a working electric telegraph model. The inventors used items such as a homemade battery and old clock gears. [4] In 1837, Morse gave up painting after being humiliated for being denied a commission to paint a mural for the Capitol Rotunda, possibly due in part to his radical political beliefs.[5] That same year, Morse completed his first telegraph device and gave the first public demonstration for members of Congress in 1838 in Washington, D.C. He continued to improve upon this model and in 1843, got $30,000 from Congress to support his plan to "wire" the United States.[6]

He continued working and got more advice from experts such as Joseph Henry and Louis Breguet and in 1844, filed a patent for his printing telegraph (it was granted in 1849).[7]

What made Morse's system better you ask? It was much simpler to set up and use! All that was needed was a key, a battery, a single wire, and a receiver. To transmit messages across the wires, Morse and Vail developed Morse code, which gave each number and letter a "code" represented by dots and dashes. A dot was quick and short while a dash was long. Letters that were used a lot got a simple code, while letters that were not had more complicated codes. Eventually, operators would listen to the clicks and beeps to translate the coded messages and so printing the marks on paper was no longer necessary.[8]

On May 24, 1844, the first official telegraph was sent by Samuel Mors from the Supreme Court Chamber (which at the time, was in the Capitol) to Alfred Vail in Baltimore. The message that was sent was "What hath God wrought!" a reference to Numbers 23:23 in the Bible.[9]

With these four words, Morse transformed the world of communication. The usage of the telegraph exploded – even faster than the railroads – and by 1854 there were 23,000 miles of telegraph wire across the United States.[10] This development enabled President Lincoln to receive instant updates

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[4] https://lemelson.mit.edu/resources/samuel-morse
[5] https://www.nga.gov/collection/artist-info.1737.html
[6] https://history.house.gov/Exhibitions-and-Publications/Electronic-Technology/Telegraph/
[7] https://lemelson.mit.edu/resources/samuel-morse
[8] https://www.history.com/topics/inventions/telegraph
[9] https://www.history.com/this-day-in-history/what-hath-god-wrought
[10] https://lemelson.mit.edu/resources/samuel-morse

from the battlefields during the Civil War, transformed the news industry, changed how money was sent, and connected people through real-time communication.[11]

Innovators continued to improve upon Morse's system, including Thomas Edison, who in 1874 developed the Quadruplex system that allowed for four messages to be sent at the same time on the same wire.[12]

But this wasn't Edison's only innovation. Though he received little formal education, Edison, became one of history's most well-known and successful inventors, patenting a record-setting 1,093 inventions throughout his life. (This is approximately equivalent to one patent every 11 days.) One day in 1888, he wrote down 112 ideas!

Born on February 11, 1847 in Ohio, Thomas Edison had an unquenchable sense of curiosity from a young age. He built a chemistry laboratory in his family's basement when he was a child. When he was 13 he began selling snacks to railroad passengers, then started selling copies of the Detroit *Free Press,* and finally began printing his own newspaper while on the moving train. His paper grew and sold 400 copies per week. However, he also was still an inventor at heart and constructed a small chemistry laboratory on the train (which later caused a fire, so Edison was kicked off the train by the conductor).

From a young age, Edison was both an inventor and an entrepreneur. But what set him apart was first his approach to invention. He didn't try to start by finding a problem and coming up with a solution. Instead, he looked at what solutions had already been created and found ways to improve them. This is what Edison referred to as "perfecting" – rather than inventing. He took things that were already out there and worked to make them work better or to make them less expensive.

In 1869 Edison patented his first invention – an electric vote recorder. This device made it so that votes in a legislative body (which is a government body that makes laws, such as the U.S. Congress) could be counted instantly, instead of going through a long roll call process. But no legislative body wanted this. This was because the roll call process allowed for more time for representatives to try to sway their colleagues' votes one way or another.

Edison learned from this failure that it was a waste of his time to invent something just because he could. He learned that he needed to invent – or "perfect" – something that people wanted, that he could make cheaply, and that he could sell.

In 1875, Edison bought 30 acres of land 12 miles south of Newark, New Jersey, in Menlo Park. He built what he called an "Invention Factory" with a two-story laboratory that conducted chemistry

[11] https://www.pbs.org/wgbh/theymadeamerica/whomade/morse_hi.html
[12] https://www.history.com/topics/inventions/telegraph

experiments on the top floor and a machine shop on the lower level. The facility, which became known as Menlo Park, was the first research-and-development facility. It had numerous teams of various experts focused on chemistry, physics, and electricity. The Menlo Park research and development model divided up problems into these areas so that various teams could collaborate and experiment on the different components before going into production. This model has been adopted by universities, governments, and other corporations.

It was at Menlo Park that Edison and his team (known as "muckers") perfected the incandescent lightbulb (incandescent is a fancy way of saying that something lights up when it's heated. That's what we're talking about in this lesson!). In the 1870s many homes were lit with gas lamps – which smelled terrible – and a few cities had arc lights that were unbearably bright. Many scientists had tried to make incandescent lamps for decades – but they didn't stay lit for long enough, they were too expensive to make, or they used too much energy. [13]

When Edison and his muckers turned their attention to light in 1878, they focused on experimenting with the filament, which is the part of a lightbulb that lights up when an electrical current heats it.[14] They tried hundreds of materials.[15] In October 1879, they used a carbon filament in a light bulb that could last for 14.5 hours. The next year, they used carbonized bamboo, which burned for up to 1,200 hours! [16]

With the breakthrough in incandescent lightbulbs, Menlo Park became known as the "Village of Light" that drew in hundreds of people to marvel at the glow illuminating through the windows of Edison's house and along the streets.[17]

Edison then went a step further and developed lighting systems that made his new lightbulb technology useable. He showed how electricity could be distributed from a central generator, as well as made electric generation better, and created the first electric meter to show how much electricity people were using. [18]

By February 1880, Edison had patented both the electric lamp and his system for electrical distribution.[19] Though they were just two of his more than one-thousand patents, Edison brought the world out of the darkness and forever changed the way that research and development are done.

Though Morse and Edison came from different backgrounds and took different paths toward success, each were highly observant, learned from others and their discoveries, and sought to make

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[13] https://www.newyorker.com/magazine/2019/10/28/the-real-nature-of-thomas-edisons-genius
[14] https://www.energy.gov/articles/history-light-bulb
[15] https://www.newyorker.com/magazine/2019/10/28/the-real-nature-of-thomas-edisons-genius
[16] https://www.energy.gov/articles/history-light-bulb
[17] https://www.newyorker.com/magazine/2019/10/28/the-real-nature-of-thomas-edisons-genius
[18] https://www.energy.gov/articles/history-light-bulb
[19] https://www.newyorker.com/magazine/2019/10/28/the-real-nature-of-thomas-edisons-genius

improvements. Science is like a pyramid of building blocks that are continuously added by many different people throughout history!

The next time you switch on the light in your room or pick up your cell phone to text your friends, remember that none of these modern luxuries would have been possible without the work of Morse and Edison.

But we encourage you to put your phone down more often than you pick it up. Stay curious and observant. Look all around you and spend time thinking about what you could do to make the world, or even daily life, more efficient. Just like Morse and Edison did. You never know what you might perfect!