

# Invention of the Telephone

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## Preface

This paper was written in order to examine the order of discovery of significant developments in the invention of the telephone. It is part of my efforts to put the study of social and cultural history and social change on a scientific basis capable of rational analysis and understanding. This has resulted in a hard copy book *How Change Happens: A Theory of Philosophy of History, Social Change and Cultural Evolution* and a website [How Change Happens Rochelle Forrester's Social Change, Cultural Evolution and Philosophy of History website](#). There are also philosophy of history papers such as [The Course of History](#), [The Scientific Study of History](#), [Guttman Scale Analysis and its use to explain Cultural Evolution and Social Change](#) and [Philosophy of History](#) and papers on [Academia.edu](#), [Figshare](#), [Humanities Commons](#), [Mendeley](#), [Open Science Framework](#), [Orcid](#), [Phil Papers](#), [SocArXiv](#), [Social Science Research Network](#), [Vixra](#) and [Zenodo](#) websites.

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## Abstract

The ultimate cause of much historical, social and cultural change is the gradual accumulation of knowledge of the environment. Human beings use the materials in their environment to meet their needs and increased human knowledge of the environment enables human needs to be met in a more efficient manner. Humans have a need to communicate and the invention of the telephone enabled them to communicate in a more efficient manner. It is clear that the telephone could only be invented due to the existence of certain materials in the environment such as carbon granules, electrons, and conducting and insulating materials. If these materials did not exist, then the telephone could not have been invented. It is equally clear the telephone could only have been invented, when it was invented, as before that time humans did not know enough about the materials used in the invention of the telephone, to allow them to invent the telephone. Prior discoveries concerning these materials were necessary before the telephone could be invented. The social and cultural consequences of the invention of the telephone could obviously only take place after the invention of the telephone.

The telephone works by converting acoustic energy into electrical energy. It turns the sound waves of the speaker's voice into a varying electric current which is sent along a wire and is then turned back into sound waves. The telephone consists of a transmitter and a receiver. The transmitter contains a metal box filled with carbon granules. The sound waves from the speaker's voice strike the side of the metal box, known as the diaphragm, causing the diaphragm to press against the carbon granules. This pressure varies as the sound waves vary and an electric current passing through the carbon granules is varied in accordance with the changes in the pressure on the carbon granules. The variable current is an electric copy of the sound waves, and is sent along a wire to the receiver.

The receiver contains an electromagnet and a thin disc capable of vibrating. The variable electric current enters the electromagnet which varies in strength according to the variations in the current it receives. The variations in the strength of the electromagnet causes the thin disc to vibrate, producing sound waves, which are a reproduction of the sound waves produced when the speaker talked into the transmitter. This enables the person listening on the receiver to hear what the person speaking into the transmitter has said. The invention of the telephone also involved the invention of the microphone and the loudspeaker. The microphone is the device in the transmitter which converts the speaker's sound waves into a variable electric current while the loudspeaker is contained in the receiver and converts the electrical current back into sound waves so the listener can hear what the speaker has said.

Alexander Graham Bell is usually credited with the invention of the telephone which was patented in 1876. However at least ten people before him had the idea of the telephone and two of them produced a practical telephone. Philipp Reis made a telephone in 1863 but did not take

out a patent. Elisha Gray also invented a telephone but was beaten to the patent office by Bell by a few hours. This is an example of no one making the invention of the telephone for the two hundred thousand years of human existence and then all of a sudden a number of people invent it at the same time. This shows the telephone could not have been invented before it was invented as certain necessary prior discoveries and inventions had not been made. But as soon as those discoveries and inventions had been made, and the right social conditions existed, then human ingenuity resulted in the invention of the telephone.

Bell's telephone used the same part of the phone for speaking and listening. Within a year Edison produced a phone which had a separate mouthpiece and earpiece and had a better transmitter. The first telephone exchange was created in 1878 in New Haven, Connecticut. It had 21 customers who were connected by operators sitting in front of a simple switchboard. Long distance calls began between Boston and New York in 1884 with copper wire replacing the iron wire which had previously been used. An automatic telephone exchange, which eliminated the need for operators to connect customers, was developed by Almon Strowger in the 1890's. It became widely adopted early in the 20th century. Long distance telephony was made difficult by electromagnetic induction between the telegraph and telephone systems. This problem was fixed by the use of twisted twin cable conductors and by "chokes" in telegraph circuits so as to allow telephone messages to be sent on telegraph wires. This allowed long distance telephone calls to be a reality.

The telephone system has had a dramatic effect on business and social life. It has assisted in the development of large scale national and international business and has kept families and friends in touch from all around the world. The number of telephones grew throughout the 20th century. In 1934 there were 33 million telephones in the world, by 1976 there was 380 million. By the 1970's the vast majority of homes in the western world had a telephone. The growth in the telephone system was accompanied by a substantial decline in the use of the electric telegraph system.

The telephone could not have existed without a means of converting sound waves into electrical waves and vice versa. The telephone was also dependent upon the ability to send an electric current down a wire. If nature did not make these things possible there would have been no telephone system. It is the particular properties of the carbon granules that they will conduct the electric current in proportion to how closely packed together they are and the closeness will vary in accordance to the pressure on them from the diaphragm. If neither carbon granules or any other material was able to cause the variation in the electric current then there would have been no telephones. The telephone would also never have existed but for the existence of electrons and that certain materials are easily able to lose electrons and conduct an electric current. Equally important is that other materials do not gain electrons and so are able to act as insulators to stop the current being lost to the air. If these materials were not available in nature we would not be able to send an electric current down a wire and there would be no telegraph, telephone or

internet over telephone wires. It is the existence of these materials that makes possible the telegraph, telephone and internet so it can be said that the structure of nature, particularly the existence of electrons and conducting and insulating materials has a major effect on human social and cultural history.

The telephone could not have been invented until it had been discovered how to turn sound waves into electric vibrations and how to send an electric current down a wire. These discoveries were dependent upon a series of prior discoveries such as the electromagnet and the battery which were themselves dependent upon earlier discoveries in the history of electricity. This means there was a definite time in human history when the telephone could have been invented. Only when the practice of systematic experimentation had been adopted at the time of the scientific revolution in 16th century Europe was the knowledge of electricity able to grow until it reached the stage of people being able to send a controlled electric current down a wire. The knowledge of how to convert sound waves into electrical vibrations also could not have been acquired until humans became aware of the properties of carbon granules and how to create and control an electric current. The invention of the microphone which converts sound waves into electric currents took place at the time in history when it was able to take place. It could not have taken place any earlier due to the necessity of prior discoveries and inventions.

The telephone was invented after the telegraph as the telegraph was an easier invention than the telephone. The telegraph involved sending and controlling an electric current, a simpler invention than turning sound waves into electrical vibrations. The invention of the telephone involved many of the same problems as the invention of the telegraph, but additionally required the invention of the microphone and the loudspeaker so it was always going to be invented after the telegraph. This meant there was always going to be a brief period when the telegraph dominated long distance communication before the telephone took over.

It is clear that the telephone could only be invented due to the existence of certain materials in the environment such as carbon granules, electrons, and conducting and insulating materials. If these materials did not exist, then the telephone could not have been invented. It is equally clear the telephone could only have been invented, when it was invented, as before that time humans did not know enough about the materials used in the invention of the telephone, to allow them to invent the telephone. Prior discoveries concerning these materials were necessary before the telephone could be invented. The social and cultural consequences of the invention of the telephone could obviously only take place after the invention of the telephone.

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