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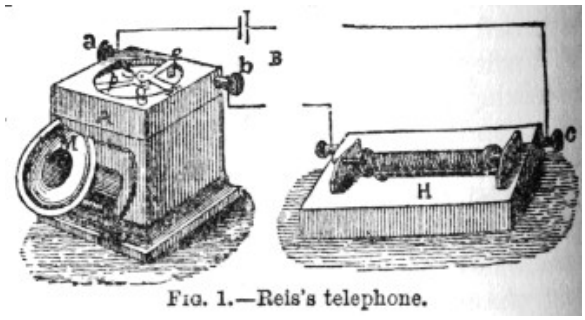
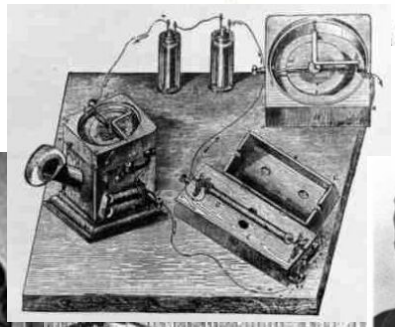


FIG. 1.—Reis's telephone.



NEWS ABOUT/FROM MERCURIANS

BASILIO CATANIA

Fellow Mercurian Dr. Basilio Catania has been appointed editor of the "Historian Corner" of the journal *European Transactions on Telecommunications*.

European Transactions on Telecommunications is a publication of the Associazione Elettrotecnica ed Elettronica Italiana. The journal aims to be the focus in Europe of outstanding contributions from researchers and engineers working in the field of information technology, and to concentrate on papers that deal with the many and varied applications of telecommunications.

Basilio joined the journal's editorial board with the May-June 2004 issue. His appointment, in the words of the *European Transactions on Telecommunications,* was "a recognition of the importance of our roots as telecommunications engineers." As the new editor for the Historian's Corner, Basilio will solicit and select contributions that "will help us and our young readers not to forget important past events in the field of telecommunications which have affected our professional activity or current lifestyle."

Readers of the journal and others are encouraged to submit their papers. Samples of published contributions to the Historian's Corner can be found in *European Transactions on Telecommunications* issues number 6 of the 1999 and 2003 volumes.

Mercurians can contact Basilio via e-mail at: mark3@esanet.it.

JOHN LAPRISE

John Laprise is a new student member of the Mercurians and subscriber to *Antenna*.

He is a Ph.D. student in Media, Technology, and Society in the School of Communication of Northwestern University, Evanston, Illinois, where he is studying under Prof. Jennifer Light.

Prof. Light teaches in the School of Communication as well as in the departments of history and sociology. She received her Ph.D. in the History of Science from Harvard University, and also holds an M.Phil. in History and Philosophy of Science from Cambridge University, where she was the Lionel de Jersey Harvard Scholar. She has taught courses on the history and sociology of technology at Northwestern and Harvard, and also consulted for the RAND Corporation's National Defense Research Institute.

John states that he is interested in "Ships and Chips." He is looking at the intersection of maritime affairs (as a communications/transportation medium) and Internet theory and policy.

RICHARD R. JOHN

Richard John, a professor in the History Department at the University of Illinois at Chicago and author of *Spreading the News: The American Postal System from Franklin to Morse* (Cambridge, Mass.: Harvard University Press, 1995; paperback, 1998), will be speaking at the Center for the History of Business, Technology, and Society at the Hagley Museum and Library on February 10, 2005. The title of his talk will be "Nickel-in-the-Slot: The Public Telephone and the Popularization of Urban Telephony, 1894-1907." The commentators will be Philip Scranton, Professor of History at Rutgers University and Director of the Center for the History of Business, Technology, and Society, and Prof. Susan Strasser, University of Delaware and Senior Research Associate at the center.

The research seminar series meets Thursday evenings at 6 pm in the Copeland Room of the library building. Papers are all unpublished works in progress and are circulated in advance to seminar participants. To join the seminar mailing list and obtain copies of the papers, contact Carol Lockman at clockman@hagley.org or 302-658-2400.

The Hagley Museum is located just north of Wilmington, Delaware. Detailed directions to the library building are available at: http://www.hagley.lib.de.us/hours.html.

Business Matters

If you received an envelope with your copy of the newsletter, your subscription to ***Antenna*** and membership in the Mercurians end with this issue.

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The "Telephon" of Philipp Reis

Basilio Catania

Toward the end of 2003, news from the London Science Museum caused some excitement among the scientific community, when they revealed that successful tests on an 1863 Reis telephone conducted in 1947 by the British company Standard Telephones and Cables (STC) had been kept secret in order not to jeopardize negotiations then in course between Standard Telephones and Cables and American Telegraph & Telephone (AT&T) [1, 2, 3, 4].

The Standard Telephones and Cables tests were said to have shown that Reis's *Telephon* (the inventor's term for his instrument) could transmit speech sufficiently well, and therefore Reis deserved to be recognized as the true inventor of the telephone, perhaps on a par with Antonio Meucci [1, 2, 4].

Having extensively investigated both Antonio Meucci and Philipp Reis, I wish to offer my fellow Mercurians my findings on this subject. An essay of my research on Antonio Meucci was given in *Antenna* some years ago [5, 6]. A full list of my publications on this subject is reported in http://www.esanet.it/chez_basilio/meucci.htm.

Johann Phillipp Reis
1834-1874

Tests on the Reis *Telephon*

Let me first point out that the above mentioned papers [1, 2, 3, 4] do not provide details about the nature of the tests performed by Standard Telephones and Cables engineers nor about the results obtained. Therefore, it is not possible to compare those tests, for instance, with tests conducted in 1932 by British Post Office researchers on the same subject. Contrary to the Standard Telephones and Cables tests, the results of the British Post Office tests were published [7], and later referred to by, among others, William Aitken in 1939 [8, p. 34] and Michael Woolley, International Telecommunications Union (ITU) General Secretary, in 1976 [9]. Here is an excerpt of the British Post Office study as reported by Aitken (italics added for emphasis):

"Recently it was suggested that the description of Reis's instruments in the Science Museum was hardly fair to Graham Bell, and the question was discussed by the Council of The Institution of Electrical Engineers." As a result the Post Office experts tested these instruments and reported that: "When the platinum contacts were so adjusted as to be microphonic they would act as a fairly satisfactory microphone. This was verified by the P. O. Research Section, *using a modern receiver* and a step up transformer. When the adjustment was exactly right, speech was transmitted reasonably well, *the volume being 20 db, or so below that of a carbon transmitter*, but *it was impossible to keep the adjustment right for long*."

Aitken also reported that Prof. David Hughes, universally recognized as the first inventor of the carbon microphone, tested a Reis telephone during his 1865 visit to St. Petersburg. Hughes later commented on those tests [8, p. 33] (italics added):

I was enabled to transmit and receive perfectly *all musical sounds, and also a few spoken words*, though these were rather uncertain, for at one moment a word could be clearly heard, and then from some unexplained cause no words were possible. This wonderful instrument was based upon the true theory of telephony, and it contained all the necessary organs to make it a practical success . . . . I also believe that the often successful transmission of words by Prof. Reis's transmitter was due to an *accidental adjustment of his contacts to a true microphonic condition*.

In more recent times, Prof. Bernard S. Finn, Curator of the Division of Electricity and Modern Physics of the National Museum of American History (Smithsonian Institution) in Washington, D.C., stated [10] (italics added):

. . . . if the sound entering a Reis transmitter is not too strong, contact between the metal point and the metal strip will not be broken. Instead, the pressure of the former on the latter will fluctuate with the sound, causing fluctuations in the electrical resistance and therefore in the current. Similarly, the receiver will respond to continuously fluctuating as well as to intermittent currents (*but not by magnetostriction*). *The sensitivity, however, is extremely low*, so low that it is not unreasonable to question the validity of the limited testimony regarding successful voice transmission in the 1860s.

In other words, the ability of Reis's telephone transmitter to transmit speech with acceptable quality, though at a much lower level, was quite known both before and after

The "Telephon" of Philipp Reis (continued)

Basílio Catania

the aforesaid Standard Telephones and Cables tests. As for Reis's telephone receiver, when operated by magnetostriction—that is, the principle on which it was designed and intended to operate—it had inherent limitations that prevented its use for speech transmission, and was marginally acceptable for the mere transmission of tones. For this reason, the above experimenters generally used a regular electromagnetic receiver to evaluate the "microphonic" performance of the Reis transmitter.

Other authors, among them Silvanus P. Thompson (considered to be the utmost Reis biographer and supporter), have gone so far as to state that that Reis transmitter was "fundamentally similar" to the carbon microphones later patented by Thomas Edison, Francis Blake, and Emile Berliner.

Let us now delve a little more into the birth and development of Reis' *Telephon*.

Invention and Development of the Reis *Telephon*

It has been said justly that the telephone is the son of the telegraph. The success of this great precursor was so overwhelming and so escalating that many inventors began to wonder what else could they do by applying the same marvelous principle of the telegraph, namely the "make-and-break" of the electric current, to transmit other types of signals, such as music or speech.

It is recognized unanimously that the first to envision speech transmission by such a technique was Charles Bourseul who, on August 18, 1854, sent a letter to the Parisian journal *L´ Illustration* [11] in which he stated (italics added):

I have asked myself . . . if the spoken word itself could not be transmitted by electricity. . . . The thing is practicable in this way:—

. . . Suppose that a man speaks near a movable disk, sufficiently flexible to lose none of the vibrations of the voice; that this disk *alternately makes and breaks the connection with a battery*; you may have at a distance another disk which will simultaneously execute the same vibrations. It is true that *the intensity of the sounds produced will be variable at the point of departure*, at which the disk vibrates by means of the voice, *and constant at the point of arrival*, where it vibrates by means of electricity; but it has been shown that this does not change the sounds. It is, moreover, evident that the sounds will be reproduced at the same pitch. The present state of acoustic science does not permit us to declare a priori if this will be precisely the case with syllables uttered by the human voice. . . . However this may be, observe that the syllables can only reproduce upon the sense of hearing the vibrations of the intervening medium. Reproduce precisely these vibrations, and you will reproduce precisely these syllables.

Charles Bourseul
1829-1912 (see p. 10)

There is no doubt that Charles Bourseul would have gone beyond the mere description of a principle, if he were not discouraged by both his managers (he was then working in a telegraph office in Paris) and the scientists of the Paris Académie des Sciences, the latter harshly criticized by the editor of *L´ Illustration* [11]. The Paris article was picked up shortly afterward in September 1854 by the German paper *Didaskalia* of Frankfurt-am-Main [12]. There it appears to have met with greater appreciation. Many writers ([8, pp. 17-18]; [13]) reported that Johann Philipp Reis, professor of Physics at the Garnier Institute of Friedrichsdorf, had read it and decided to embark on a practical realization of Bourseul's ideas.

Philipp Reis essentially devised three different models of his *Telephon*, all of which were based on the same principle, namely, the "make-and-break" of the current in the transmitter and "magnetostriction" or "galvanic music" in the receiver. The latter was first discovered by Prof. Charles Grafton Page in 1837 [14].

GALVANIC MUSIC

In 1837, Page discovered that a needle or thin bar of iron placed in the hollow of a coil of insulated wire made an audible "tick" each time the current flowing in the coil was interrupted. If one interrupted the current fast enough, the individual "ticks" ran together into a continuous hum, which Page called "galvanic music." Also, the pitch of this hum corresponded to the rate at which the current was interrupted.

— Editor

The "Telephon" of Philipp Reis (continued)

Basílio Catania

Reis built his first telephone model in 1858, four years after Bourseul's paper, as related in detail by Silvanus Thompson [15]. The transmitter consisted of an ear-like acoustic structure that terminated in a tympanum whose oscillations caused the make-and-break of an electric current through a slender S-shaped rod glued at one end to the center of the tympanum. The receiver consisted of a six-inches long coil wound on a knitting needle, similar to that shown in Figure 1 below, but set perpendicularly on top of a violin case, which acted as a sounding board.

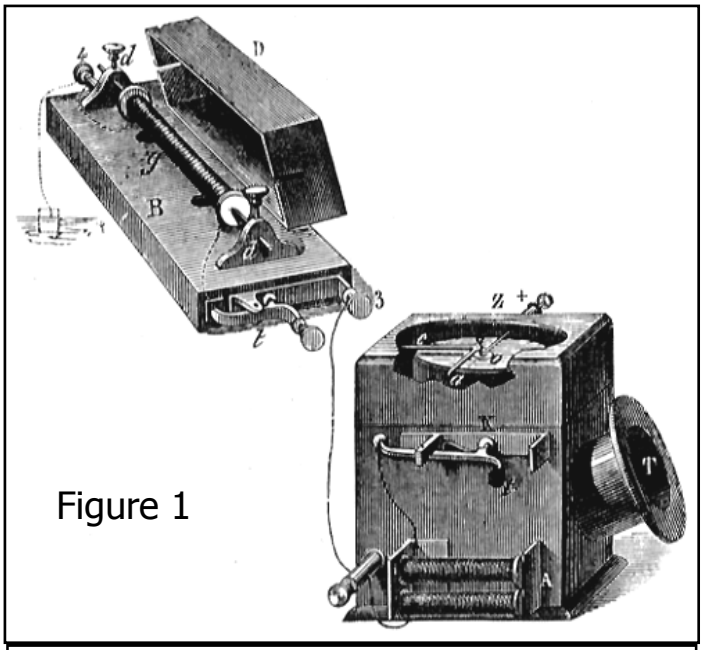


Figure 1

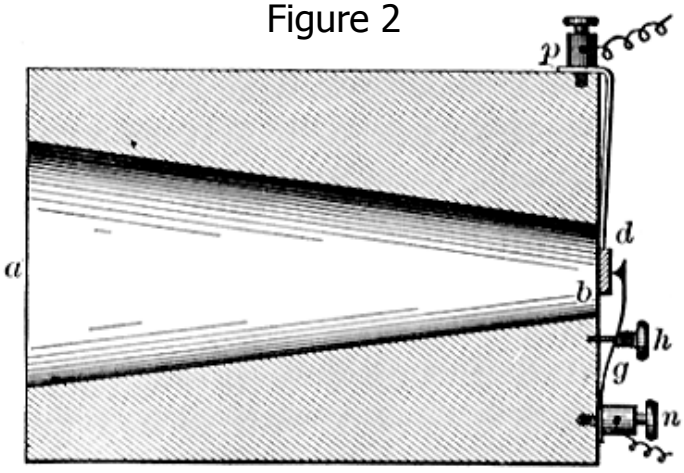
Reis telephone (third version) on sale by Wilhelm J. Albert, Frankfurt, from Comte Théodose Du Moncel, *Le Téléphone* (Paris: Librairie Hachette et Cie., 1882), p. 15.

Reis made his second telephone model in 1861 and demonstrated it before the Physikalischen Vereins (Physical Society) of Frankfurt-am-Main on October 26, 1861 [16]. This time the transmitter (Figure 2) consisted of a hollow conical cavity bored in a block of wood which terminated in an animal membrane upon which was glued a thin strip of platinum that connected to one pole of the battery. Another thin strip of metal, holding at a right angle a platinum wire, was placed in such a manner as to have the end of the wire very near but not touching the other strip at the center of the membrane, in order to make-and-break the current according to the pressure of the sounds channeled into the cone. The screw (h in Figure 2) served to adjust the distance between the aforesaid platinum wire and the strip glued on the membrane.

The receiver was very similar to that shown in Figure 1, differing from that model in that the violin case was replaced by a regular (parallelepiped-shaped) sounding box on which the solenoid (still wound on a knitting needle) was placed horizontally. The operator put his or her ear on top of the wood cover (which was normally closed) for better reception of the sounds.

A variation of Reis' second model was built in the second half of 1862 by Wilhelm von Legat, inspector of the Royal Prussian Telegraphs, on the basis of information gathered from the available literature [18]. Some authors consider this one to be Reis's third model, while others—more appropriately—refer to it as the "Reis-Legat" model. Legat's transmitter differed from Reis' second transmitter model in that it used a hollow conical tube (instead of a hollow bored into a block of wood), and the make-and-break device resembled more Reis' first model's S-shaped rod held in place by a spring. Although Legat based his receiver on magnetostriction, it differed quite substantially in construction from Reis' first and second receiver models. It utilized a horseshoe electromagnet (featuring an iron core much larger in diameter than Reis' knitting needle) placed on a sounding board, but equipped additionally with a light armature that was kept in contact with the poles of the electromagnet by means of a spring and attached to a

Figure 2



Reis transmitter (second version) of 1861 from [Theodor Stein, letter to the editor] "Can Speech be Transmitted with the Bored-Block Transmitter of Philipp Reis?" *The Electrician and Electrical Engineer* (July 1887): 281-2.

The "Telephon" of Philipp Reis (continued)

Basílio Catania

plate "suspended in the manner of a pendulum." The purpose of this alteration was to improve the communication of the vibrations of the core—caused by magnetostriction—to the surrounding air.

Philipp Reis continued his experiments and developed a third model of his *Telephon* (Figure 1). He first demonstrated it to the Physical Society in Frankfurt-am-Main on July 4, 1863 [20]. The third was the most known and widely available Reis model. It was built initially by Johann Valentin Albert of Frankfurt and later by the Hauck firm of Vienna, and it sold in Europe and the United States at a price of 14 or 21 florins, depending on the finishing. Among the most renowned examples of Reis' third model are:

- that of the London Science Museum, said to be the property of the Institution of Electrical Engineers;
- that bought by William Ladd of London, who demonstrated it before the British Association for the Advancement of Science on August 28, 1863 [21];
- that exhibited by Prof. Clifton on November 10, 1864, before the Manchester Literary and Philosophical Society [22];
- that demonstrated by Mr. Shearer, dealer of the shop "Messrs. Kemp & Co." of Edinburgh (where Bell was living) in December 1862, and afterward put on sale in the same shop [23, 24];
- that acquired from Mr. Ladd by Stephen M. Yeates of Dublin in the Fall of 1863 and demonstrated before the British Association at Newcastle-on-Tyne in December 1863, as well as, in a modified version, to the Dublin Philosophical Society in December 1865 ([8], pp. 39-40);
- that seen and tested by Prof. David Hughes in St. Petersburg, Russia; and
- that acquired by the Smithsonian Institution, Washington, D.C., which Prof. Joseph Henry showed to Alexander Graham Bell on March 1 or 2, 1875 [25].

The same model also was demonstrated in September 1863 to both the Emperor of Austria, Franz Joseph, and the King Max of Bavaria, on the occasion of their visit to Goethe's birthplace (which became the head office of the Freies Deutscher Hochstift) in Frankfurt-am-Main ([8], p. 21).

The most remarkable innovation of Reis' third model was in the transmitter, which was now housed in a cube-shaped box of wood (Figure 1), with the upper face holding the membrane and its make-and-break device. Two lateral faces held, respectively, the speaking tube and a simplified Morse apparatus to be used for signaling. A tripod, clamped at one edge and holding the platinum wire in the middle, replaced the corresponding platinum strip employed in the first two models. Also, Reiss suggested putting a drop of mercury in a small bowl at the center of the tympanum to facilitate the intermittent contact with the platinum wire.

Conclusions

Reis's third model met with exceptional success all over the world. It is worth pointing out that the United States, in its case against Alexander Graham Bell, cited Antonio Meucci and Philipp Reis as the precursors of the electromagnetic telephone and the variable resistance telephone, respectively [26]. An impressive list of 61 articles concerning Reis' telephone (plus 5 concerning Bourseul) was appended to the printed version of the "Deposition of Antonio Meucci" available at the New York Public Library.

Antonio Meucci
(1808-1896)

It also is worth recalling that Reis' *Telephon* was studied, tested, and modified by scores of scientists, including Stephen Yeates, Peter Van der Weyde, the brothers Cecil and Leonard Wray ([8, p. 39 et seq]), and Silvanus P. Thompson [26], to name a few.

Philipp Reis would have improved his *Telephon* further and offered us more creations from his ingenious mind, if he had not died prematurely on January 14, 1874, just one week after his fortieth birthday.

Reis must be admired not only because of his inventive genius, but also for his generosity and modesty, since he gave his invention to the world. In fact, not only did he not file an application for a patent, but he also disclosed all details of the construction and operation of his *Telephon* both orally and in writing to anyone wishing to

The "Telephon" of Philipp Reis (continued)

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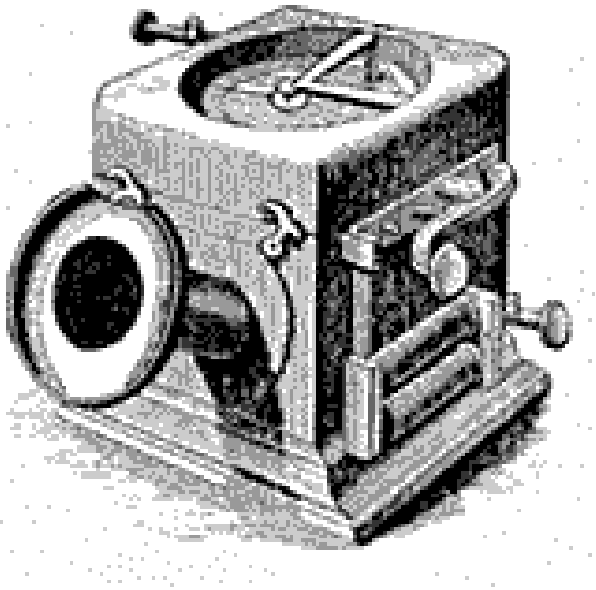
know them. In the circular accompanying the apparatus sold by W. J. Albert, he stated "I am now able to offer an apparatus with which every physicist will succeed in repeating these interesting experiments regarding the reproduction of tone at distant stations." He therefore followed the noble tradition of physicists who used to freely exchange knowledge, instruments, and ideas all over the world without caring about making money out of them.

Very probably because there were no royalties to be paid to Philipp Reis or his successors for his invention (as was the case of Meucci), many competitors of the Bell Company in the United States in the 1880s maintained Reis' priority in the invention of the telephone. They tried to stretch Reis' "make-and-break" transmitter principle



Reis Telephon 1861

into a "loose contact" principle, thence to a "variable pressure" principle, and later to a "variable resistance" principle. Similarly, the Reis receiver as improved by Legat was transformed gradually to work with a "non-zero" air gap, thus obtaining a regular electromagnetic receiver. Lawyers argued for these stretched interpretations and claimed on the basis that Reis had anticipated Bell, Edison, Blake, and Berliner. In other words they maintained that Reis invented everything! God save the physicists from the lawyers (as well as from the physicists who supported the lawyers)!

Unfortunately, while trying to put Reis on a higher pedestal, they ended up damaging his public image, since they unfairly exposed him to the counterattack of Bell's supporters. Nonetheless, Philipp Reis must remain in our hearts and minds as a superb man and scientist, deserving an everlasting recognition for his outstanding contribution to the progress of telecommunications.

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[14] Charles Grafton Page, "The Production of Galvanic Music," *Sillimans Journal*, Vol. XXXII (1837): 354 & 396; vol. XXXIII (1838): 118.

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The "Telephon" of Philipp Reis (continued)

Basilio Catania

beautiful animated computer simulation of Reis' first telephone (a facsimile of a human ear carved in wood) is posted on the Internet by Columbia University at http://www.ilt.columbia.edu/projects/bluetelephone/html/part8.html.

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Johann Phillipp Reis
(January 7, 1834—January 24, 1874)

Born in Gelnhausen (Cassel), the son of a Jewish baker, Reis was raised by his paternal grandmother and guardians, his mother having died when he was a child and his father dying before Reis was ten years old. He attended the (Huguenot) Garnier Institute in Friedrichsdorf, then the Hassel Institute in Frankfurt.

The young Reis showed a love of science, but instead of going to the Karlsruhe Polytechnic School, his uncle, who wanted him to become a merchant, apprenticed Reis in 1850 to the Frankfurt firm of J. F. Beyerbach against his will. While in Beyerbach's service, Reis took private lessons in mathematics and physics and attended the lectures of Professor R. Bottger on mechanics at the local trade school.

When his apprenticeship ended, Reis attended the Institute of Dr. Poppe in Frankfurt, where he believed he found his true vocation: teaching. He also became a member of the Frankfurt Physikalische Verein. In 1855, after completing his year of obligatory military service, Reis returned to Frankfurt to qualify as a teacher of mathematics and science. In the spring of 1858, his old friend and master, Hofrath Garnier, offered him a position in the Garnier Institute. Reis married on September 14, 1859, and soon moved to Friedrichsdorf to begin his new career as a teacher.

Reis wrote a paper describing his experiments on propagating electricity without the use of a material conductor, "On the Radiation of Electricity," and submitted it in 1859 to Poggendorff's *Annalen der Physik*, where it was rejected. Equally unsuccessful was his 1862 submission to the *Annalen der Physik* of a description of the *Telephon*.

Curiously, the first sentence Reis transmitted over his instruments was: "The horse eats no cucumber salad."

From John Munro's *Heroes of the Telegraph* (1891), thanks to Project Gutenberg (www.gutenberg.net).

For more information on Reis, see Silvanus Thompson, *Philipp Reiss: Inventor of the Telephone* (London: E. & F. N. Spon, 1883; Arno Press reprint, 1974).

When Women Were Switches: The Evolution of Telephone Switching

Ronald R. Thomas

The first telephones provided point-to-point communications only. The wires from one telephone connected to only one other instrument. For example, the town doctor might have a dedicated telephone line to the town undertaker.

Obviously, dedicated lines provided only a very limited calling capability. Telephones soon connected to a pair of wires that terminated at a central switching point at the telephone company's central office. At a switching point within that office, calls from one telephone were routed to any other telephone connected to the central office. This arrangement greatly increased the usefulness of the telephone, but it also raised the question of how the routing took place.

Manual Switching

The first telephone "switches" for routing calls were young boys who manually connected one calling party to another using very basic manual switchboards. The young boys were often rude and unpleasant to the customers, and polite, friendly, young women soon replaced them.

Female operators used switchboards that had many small holes called jacks. There was one jack for each subscribing customer. A light by the jack alerted an operator that a particular subscriber wanted to make a call. The operator then placed one end of a pair of wire cords into a jack and talked to the calling party. After determining to whom the calling party wished to talk, the operator placed the other end of the cord pair into a jack that connected to the called party's telephone. When the called party answered, the operator proceeded to handle another call.

When either of the calling parties hung up their telephone, the light by their switchboard jack went out. An operator had to continually scan the lights on her switchboard to determine if a light had gone out and disconnect a cord pair from both jacks.

In the late 1800s, an undertaker named Almon Brown Strowger was unhappy with his local telephone operator. Because he believed she was giving the undertaking business to his competitor, Strowger developed the first electromechanical telephone switch to replace telephone operators.

Electromechanical Switching

The switch Strowger developed is called a step-by-step or Strowger switch. It required placing dials on telephones and assigning each one a unique telephone number. The dial allowed customers to make their own calls without operator assistance.

The term "step-by-step" describes the action of a Strowger switch, which first steps up in response to a dialed digit and then across in response to the next dialed digit. A step-by-step system is also called a progressive system, because a call progresses through a number of individual switches, as the dialed digits are received by each switch.

A typical Strowger switch had 100 sets of contacts in a 10 by 10 arrangement. This corresponded to 100 individual numbers. In response to the number 29, the switch would step up to its second level and move across to the ninth set of contacts.

A large telephone central office could have hundreds or thousands of switches. They created a tremendous amount of noise and were subject to frequent mechanical failure. It also was easy for dust and dirt to interfere with the switch contacts. To address these issues, more efficient telephone switching mechanisms were developed during the 1930s.

A very popular switching mechanism was called the crossbar system. It used an electromechanical switching matrix for routing calls, and electromechanical common control equipment to control the matrix. A crossbar system first stored all of the dialed digits in the common control equipment that would establish a talking path through a switching matrix.

An individual crossbar switch consisted of a set of vertical and horizontal mechanical cross points. The common control equipment caused a set of cross points to connect to establish a connection.

Crossbar systems were much more efficient and cost effective than Strowger switches. The also took up less physical space and required less maintenance. However, they still had little capability to provide special features. In the 1960s, computer controlled switching systems became available, and they soon replaced crossbar systems and revolutionized telephone switching.

Computer Controlled Switching

Computer controlled switching systems utilized computers to perform the common control functions. Computers also enabled many types of special features in addition to normal call routing functions.

For example, if the called number was busy, computerized systems could call the calling party back when the called party was no longer busy.

In addition, computerized systems had an electronic matrix that was noiseless and much more efficient than their electromechanical counterparts.

When Women Were Switches: The Evolution of Telephone Switching (continued)

Ronald R. Thomas

Computer-controlled switching systems took up less physical space than electromechanical systems. They also required less maintenance because they relied on electronic components, rather than electromechanical switches and relays.

Additionally, many computer-controlled telephone central offices could be managed, controlled, and maintained from a central location, thereby greatly reducing operating costs. These electronic switching systems revolutionized the telephone industry, but the revolution did not happen overnight.

Overlap and Coexistence

It is tempting to think that there was a smooth, linear progression from manual switchboards to computer-controlled switching systems. Actually, various systems coexisted for many years.

In the early 1900s, many, but not all, local central offices utilized Strowger switching systems. By 1940, approximately 44 percent of the telephones in the United States still were connected to manual switchboards and telephone operators.

Well into the 1950s, telephone operators at manual switchboards handled all long distance calls. The introduction of direct long distance dialing was a tremendous step forward in reducing, but not eliminating, the need for telephone operators. They were needed still to handle calls that could not be dialed directly and to provide directory assistance.

Furthermore, even though crossbar switching systems began to replace Strowger step-by-step systems starting in the 1930s, many central offices in small towns and rural areas continued using Strowger step-by-step switching systems well into the 1960s.

Thus, when computer-controlled switching systems came along in the 1960s, they coexisted with manual switchboards, Strowger step-by-step switches, and crossbar systems. The tremendous efficiencies and multiple capabilities of computer-controlled systems, however, ensured that they would be well on their way toward replacing the other systems totally by the 1980s.

Customers in small towns and rural areas wanted the features that only computer-controlled systems provided. Manual switchboards and electromechanical mechanisms simply could not provide those features. Furthermore, from the telephone company's perspective, computer-controlled systems were more reliable, efficient, and cost-effective.

Today, telephone operators serving as switches is only a distant memory. For many years, however, they provided high quality service and a human touch that will never be forgotten.

Charles Bourseul

1829-1912

Charles Bourseul was born in Brussels when that country was still part of France. His family moved to France because his father was an officer in the French army. Bourseul lived in Douai until 1848 and entered the French telegraph administration in 1851 after finishing high school.

In 1851, the French telegraphs were undergoing major changes in the types of instruments used and the bureaucratic organization of the networks, in addition to opening its doors to commercial clients and ordinary citizens. Bourseul experimented with the new instruments manufactured exclusively for the state by the firm of Louis Breguet.

In 1854, while still an ordinary telegraph worker stationed in the Paris Bourse, Bourseul wrote the brief article that later brought him fame. Here is the actual text of his note of August 26 that appeared in the popular journal, *L'Illustration:*

"Imaginez que l'on parle près d'une plaque mobile, assez flexible pour ne perdre aucune des vibrations produites par la voix, que cette plaque établisse et interrompe les communications avec une pile: vous pourrez avoir à distance une autre plaque qui exécutera en même temps les mêmes vibrations."

Bourseul continued to work for the French telegraph administration and persisted in his efforts to improve the equipment utilized over the administration's networks. Despite his decades of inventive toil, his only contribution recognized today is the brief note published in a popular magazine. That notoriety is due partly to diligent researchers and partly to the Third Republic, which recognized Bourseul's contribution to the history of telephony, or rather, proclaimed him as the true inventor of the telephone, a gesture intended to bolster national pride, by making him a Chevalier in the Legion of Honor in 1889.

On November 23, 1912, Bourseul passed away in the small town of Saint-Céré (Lot).

A.W.A. Electronic Communication Museum

Pete Sypher & Andrew Butrica

Based on an article in the Sept-Oct 2004 IEEE SCANNER

In upstate New York, about 30 miles southeast of Rochester, you will find a communications electronics museum in the Village of East Bloomfield. The museum occupies the second and third floors of a 150-year-old former schoolhouse. The Antique Wireless Association, founded in 1952 for collectors of radio equipment and students of communication history, owns and operates it. The museum also is a member of the American Association of Museums and the Upstate History Alliance, which is affiliated with the New York State Education Department's Office of Cultural Education. The museum is devoted to research, preservation, and documentation of the history of wireless communications.

The display rooms are packed with equipment as old as an eighteenth century static electric machine to rather recent art deco broadcast receivers. The TV receivers include scanning disk as well as pre-WWII home receivers. Visitors will find autographed posters of the radio greats, such as DeForest and Armstrong, as well as an abundance of telegraph and radio code keys. There also is a large collection of tubes, from tiny acorns to the 100-kW water-cooled tubes introduced in the 1920s for broadcast stations. The third floor houses working spark transmitters whose sound is rasping and penetrating, almost painful to hear. Because of the frequencies used in the first 25 years of the twentieth century, lossy ground wave propagation required high powers for distance communicating, and serious radio amateurs used transmitters operating at one-kilowatt input. The acoustic emission of these spark rigs was so loud that the radio was often relegated to a shack in the backyard, thus the term "radio shack" referred to the operating location, whether or not the equipment was in an outdoor shack.

About a mile away from the main museum is the annex. Located on property owned by the Antique Wireless Association, the annex actually consists of three connected buildings that were constructed one-by-one over a 12 year period. The first building serves just for storage. The second, known as the Bruce Kelley Memorial Research Library, contains books, paperwork, records, and the curator's office. Edward Gable (K2MP/W2AN) is the curator; Tom Peterson, Jr., is the museum's director. The most recent add-on contains a collection of military telephone and radio equipment, a collection of century-old light bulbs, and early television cameras, as well as more tubes and telegraph keys. It also houses ham station W2ICE.

Recent additions to the museum's collection include thirty early radio sets, mostly Crosley, donated by the late Albert Nystrom, a long-time member of the Antique Wireless Association, and from the State of New York, a cold-war era communications suite once used by the New York State Civil Defense and located in a bunker two floors under ground. The museum hopes to dismantle the system, remove it from the bunker, and reassemble it at the Annex, where staff and volunteers will restore it to working condition. Other odds and ends added to the collection are a very early hand-soldered Hitachi transistor radio that features a SW band. The curator is collecting a few mobile phones, as well. But requiring more attention are the tens of thousands of radio and TV tubes stored in the museum's "tube loft."

The museum is open Saturdays from 2:00 to 4:00 pm in June, July, and August, and Sundays from 2:00 to 5:00 pm May through October. Admission is free.

For more information about the museum, contact either the director, Tom Peterson, Jr. (TPFLAB@aol.com); or the curator, Edward "Ed" Gable, at K2MP or egable@rochester.rr.com.

Or better, visit the museum's website: www.antiquewireless.org.

From there, visitors can take a "virtual tour" of the museum's second and third floors: http://www.antiquewireless.org/museum/tour01.htm; or the various rooms and collections house at the annex: http://www.antiquewireless.org/museum/annex01.htm.

The museum is at 2 South Avenue, Bloomfield, New York; the annex is 0.7 miles to the east on Route 5 & 20. The telephone number at the museum is (585) 657 -6260. A map giving driving directions from major interstate highways (I-90, I-490 & I-390) and U.S. routes (96, 444, 65 & 15A) is available at: http://www.antiquewireless.org/museum/musmap.htm.

Visitors might also want to take in the nearby beautiful Finger Lakes, as well as the picturesque farms, Victorian houses, antique shops, and charming small towns scattered throughout the region.

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Articles of Interest from *New Media & Society*

Warren Bareiss, "Telemedicine in South Dakota: A Cultural Studies Approach," *New Media & Society* 3 (September 2001): 327- 355.

The term "telemedicine" refers to health care and health education transmitted over large distances via computer with interactive audio and video capabilities. Over the past decade, telemedicine has been widely hailed as a means of administering health care to rural areas where doctors are scarce. Most research on the subject emphasizes technological, regulatory, and utilitarian aspects of telemedicine. This study, however, develops a cultural studies perspective in order to examine how social relationships are negotiated with regard to telemedicine in a particular context. The contextual focus is South Dakota—a state where telemedicine has rapidly developed in response to an ongoing crisis in health care access. An overview of economic and health care conditions in South Dakota is followed by examinations of network structures through which telemedicine operates in the state and an analysis of how telemedicine is rhetorically constructed in the state's leading newspaper. Concluding sections discuss the hegemonic nature of telemedicine in South Dakota and raise questions about telemedicine in other contexts.

Terhi Rantanen, "The Old and the New: Communications Technology and Globalization in Russia," *New Media & Society* 3 (March 2001): 85-105.

In post-Communist Russia, when talking about new communications technology, one has to ask what is "new" and what is "old." Already in the Communist era increasing availability of new communications technology (for example, fax machines and email) amplified cheap "small" technology as an alternative to "big" and expensive technology controlled by the state. New communications technology, at the crossroads of mass and interpersonal communication, was harder for authorities to control and intensified the process whereby communication has escaped from political control. The introduction of new communications technology has been slow in post-Communist Russia in comparison to western countries, because it is constrained by established state structures. The article concludes that although new communications technology provides new opportunities for individuals, old technology and structures set boundaries to the growth of the new.

Louis Leung and Ran Wei, "Who are the Mobile Phone Have-nots?: Influences and Consequences," *New Media Society* (August 1999): 209-226.

Grounded in the diffusion of innovations theoretical framework, this study focuses on examining who the mobile telephone have-nots are and what are the factors at work. Results of a telephone survey with a probability sample of 834 respondents show that the have-nots tended to be older females with lower household income and education attainment. They had pagers as an alternative and subscribed to no caller ID display service at home. This study also found a polarizing phenomenon in owning new telecommunications technologies. With the poor becoming poorer, the gap between haves and have-nots is widening. A hierarchy of relative influences on the intention to adopt a mobile phone suggests that the effects of age and social differences far outweigh that of the technological differences.

Richard L Ling, Siri Nilsen, and Stephan Granhaug, "The Domestication of Video-on-demand: Folk Understanding of a New Technology," *New Media & Society* 1 (April 1999): 83-100.

This article describes several of the elements that have relevance in the integration of video-on-demand into the home. The specific case examined here involves a trial carried out in Oslo, Norway. Using qualitative methods, the study describes how a selection of users integrated the technology into the mental and physical contexts of their everyday lives. Video-on-demand is a technology that is outside our taken-for-granted experience and thus its integration presents a chance to observe the domestication of technology in everyday life.

Special issues of *New Media & Society* :

April 1999 vol. 1 (1)
What's new about new media?

September 2000 vol. 2 (3)
Content is king? Culture, community and commerce

September 2001 vol. 3 (3)
On the edge: cultural barriers and catalysts to IT diffusion among remote and marginalized communities

June 2002 vol. 4 (2)
The internet in China

September 2003 vol. 5 (3)
Cybercafés

For the contents for all issues back to 1999, the first volume issued by Sage Publications, visit:

http://www.new-media-and-society.com/NM&S%20website/index_contents.html

Communication History in Oral History Collections

1. Cable Center Oral History Collection

Barco Library
Special Collections
Denver, Colorado
http://www.cablecenter.org/library/collections/oral_histories/index.cfm

The Cable Center is dedicated to the world of cable television. Visitors to their website can browse their on-line library catalog:
http://www.cablecenter.org/library/catalog/index.cfm

The website also has a single page devoted to cable history:
http://www.cablecenter.org/history/index.cfm

The Cable Center compiled selected milestones in the history of cable TV in the areas of engineering, business, programming, regulation, and legislation beginning in the year 1948 and the days of Community Antenna Television (CATV):
http://www.cablecenter.org/history/timeline/index.cfm

The Cable Center's oral history project began in 1985 at Pennsylvania State University and continued in Denver with a 1998 gift from Gustave Hauser to establish the Hauser Foundation Oral and Video History Project. The collection currently has a total of over 200 video and audio recordings. The oral histories provide a unique source of documentation about the development of the cable industry. These first hand accounts from industry leaders trace the history of cable from its beginnings to the present and provide invaluable primary source material for research, study and teaching.

The estimated number of interviews varies from 122 to 128.

2. IEEE History Center

Rutgers University
New Brunswick, New Jersey

The IEEE History Center at Rutgers University houses a growing collection of oral histories. The Institute of Electrical and Electronics Engineers, Inc. (IEEE) established the IEEE History Center in 1980. In 1990, the Center moved to the campus of Rutgers University, which became a cosponsor.

The mission of the IEEE History Center is to preserve, research, and promote the history of information and electrical technologies. It maintains many useful resources for the engineer, for the historian of technology, and for anyone interested in the development of electrical and computer engineering and their role in modern society, and most of those resources are available on-line at <www.ieee.org>. Visiting scholars and researchers are welcome to use their research library and archives by appointment only.

In addition to its collection of oral histories (over 200 of which are available on-line), the center's holdings include the IEEE Archives, which consist of the unpublished records of the IEEE, and a collection of historical photographs relating to history of electrical and computer technologies.

The following are the divisions into which the center's on-line oral histories are arranged:

2a. Communications Society Interviews.

http://www.ieee.org/organizations/history_center/oral_histories/comsoc_oh.html

The 21 oral histories of the Communications Society were collected to commemorate the society's fiftieth anniversary in 2002. They cover such topics as the Internet and packet communications, digital networks, satellite communications, undersea cables, fiber optics, cellular telephones, and spread spectrum communications.

2b. RCA Engineers Interviews.

http://www.ieee.org/organizations/history_center/oral_histories/oh_rca_menu.html

These nine interviews were conducted by Mark Heyer and Al Pinsky of RCA Laboratories in 1975 and 1976. The collection does not contain every interview with an alumnus (or alumna) of RCA found in the IEEE History Center's collection.

2c. Rad Lab Collection.

http://www.ieee.org/organizations/history_center/oral_histories/oh_rad_lab_menu.html

Oral histories conducted in 1991 by center staff at the celebration of the MIT Radiation Laboratory's fiftieth anniversary in June of 1991.

2d. Frederick E.Terman Associates Collection.

http://www.ieee.org/organizations/history_center/oral_histories/oh_terman_menu.html

Interviews of six individuals, such as William Hewlett and William Rambo, who studied electrical engineering at Stanford University under Terman.

2e. Japanese Oral Histories.

http://www.ieee.org/organizations/history_center/oral_histories/oh_japan_menu.html

These 18 interviews of distinguished Japanese electrical engineers and managers are the result of a collaboration between the IEEE History Center and the History Committee of the IEE Japan.

Antenna is published for the Mercurians, a Special Interest Group of the Society for the History of Technology. Two-year subscriptions are US$5 for delivery in the United States and US$10 elsewhere. Single issues are $1.50 per copy. Please make all checks out to SHOT in US dollars, write Mercurians on the memo line, and mail to Andrew Butrica at the address below.

Cross-connexions: Communications, Society, and Change

An international conference on the history of telecommunications will take place in London, November 11-13, 2005, at the Science Museum.

The stated goal of the conference is to "stimulate, augment and articulate scholarly research in the field of the history of telecommunications." The conference organizers hope to bring together historians to discuss developments in the field. They also wish to widen the discussions to develop the interaction between the history of telecommunications and computing, electrical engineering, space technologies, modern politics, and business practice, to name a few potentialities.

All relevant themes will be considered. Potential themes include communications and the shifting loci of social power; the automation, analog, and digital revolutions; communications and empire; military power and technology transfer; the relationship between innovation and utility; perspectives on the dilemmas of "discovery stories" in telecommunications; the rise of satellite and mobile phone technologies; and material collections of telecommunications history. Other relevant histories, such as electrical measurement, computing, and physics will augment these categories.

The conference organizers invite all prospective speakers to send a one page preliminary abstract (via email or postal mail) for each submission along with a correct name and postal/email address.

Deadlines for submissions, however, have passed. The deadline for paper submissions was October 31, 2004. All prospective speakers will be notified regarding acceptance by January 1, 2005.

The deadline for proposing organize themed symposia within the conference was August 31, 2004.

It is not, however, too late to register.

Anyone wishing to register their interest in attending the conference without giving a paper, should contact Chris Chilvers, who is the conference organizer. He can be reached at:
e-mail: christopher.chilvers@nmsi.ac.uk
telephone: 0207 942 4183
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The conference eventually will have its own web address.