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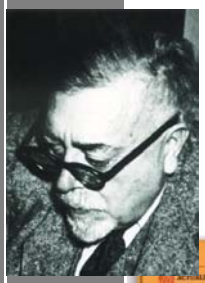
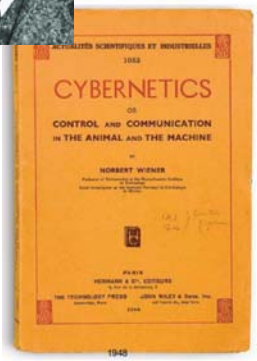
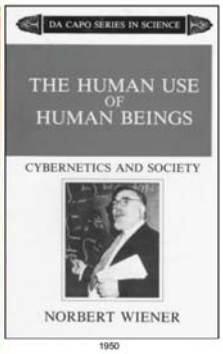
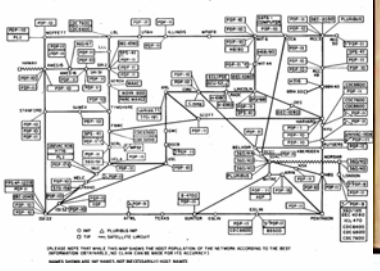
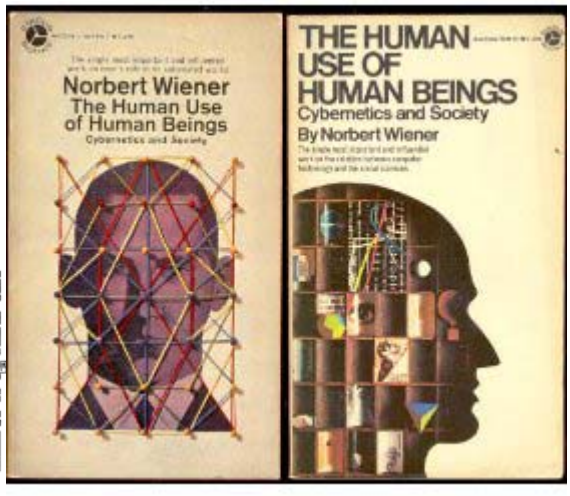










"The Computer as a Communications Device: Wiener and Licklider and the Internet"

Jay Hauben

Since the 1970s, a new communications medium, the Internet, has been emerging with a growing effect on most aspects of human society. It functions as a globally distributed interconnection of people, computing machines, and communications media. The Internet has made obvious that computers are communication devices. The communications essence of computers was appreciated at least as early as the 1940s.

In the actual envisioning and launching of the Internet, a prominent role was played by the American physio-psychologist J. C. R. Licklider (1915-1990). Licklider foresaw a great leap for human society based on a tight coupling and networking of people and computers. He did much to infect others with his early enthusiasm. He also set in motion in the U. S. a public sponsorship and funding mechanism that brought the communications network he envisioned into reality. In the 1960s, Licklider published two seminal articles, "Man Computer Symbiosis"[1] in 1960 and "The Computer as a Communications Device"[2] written with Robert Taylor in 1968. Looking for the conceptual roots of Licklider's vision and of the Internet itself, several researchers[3] have been drawn to cybernetics and the work of Norbert Wiener (1896-1964), a mathematician and philosopher at the Massachusetts Institute of Technology (MIT). A thread that runs through the connected work of Licklider and Wiener is the conception of the computer as a communications device.

Norbert Wiener

In connection with World War II, a number of research teams including one centered on Wiener, undertook to analyze the problem of improving the success of anti-aircraft artillery fire. Fire control technology had been developed between the two world wars especially addressing ship to ship warfare. Elaborate semi-automatic and automatic systems were already in place which could track a target ship, calculate its motion and help aim the big guns that would fire so as to attempt a hit. It was upon this technology that anti-aircraft fire control was built.[4]

Anti-aircraft artillery must be aimed at a

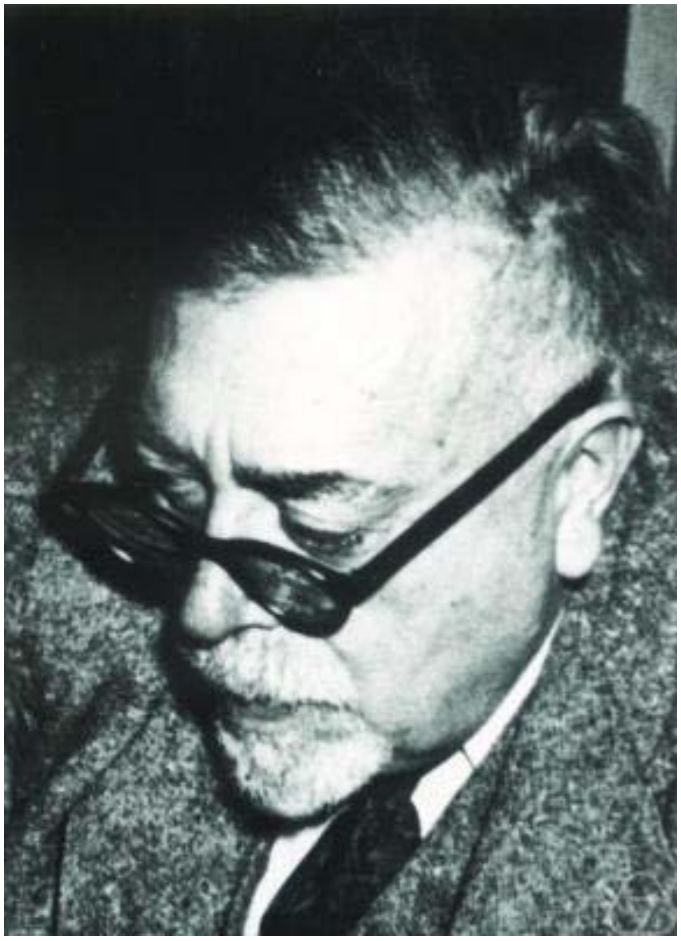
[1] Licklider, "Man-Computer Symbiosis," *IRE Transactions on Human Factors in Electronics*, Vol. HFE-1 (March, 1960): 4-11. Online: http://groups.csail.mit.edu/medg/people/psz/Licklider.html.

[2] Licklider and Taylor, "The Computer as a Communication Device," *Science and Technology: For the Technical Men in Management*, No 76 (April, 1968): 21-31; reprinted in: *In Memoriam: J. C. R. Licklider, 1915-1990*, Report 61, Systems Research Center, Digital Equipment Corporation, Palo Alto, California, August 7, 1990, pp. 21-41, on-line at: http://memex.org/licklider.pdf.

[3] See for example, Chapter 6 in Michael Hauben and Ronda Hauben, *Netizens: On the History and Impact of Usenet and the Internet* (New York: Wiley-IEEE Computer Society Press, May 1997); Chapter 8 in Jérôme Ségal, "Théorie de l'information: Sciences, techniques et société de la seconde guerre mondiale à l'aube du XXIe siècle," doctoral thesis, History Faculty, University of Lyons, December 1998, available on-line at: http://www.mpiwg-berlin.mpg.de/staff/segal/thesis/; and Chapter 1 in David A. Mindell, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics* (Baltimore: John Hopkins University Press, 2002. For the earlier period as well as for other sources of cybernetic insights, see, for example, Stuart Bennet, *A History of Control Engineering 1930-1955* (London: Peter Peregrinus, 1993); and F. Dittmann, "Aspects of the Early History of Cybernetics in Germany," *Transactions of the Newcomen Society* 71, 1 (1999-2000): 143-154.

[4] See, for example, Chapters 1 and 2 in Mindell.

"The Computer as a Communications Device"
Jay Hauben (continued)



Norbert Wiener

substantial distance ahead of where the target is at the time of firing because of the relatively great speed of aircraft. Where to aim is based on knowledge of how the plane has been traveling and where it is likely to travel in the time the shell takes to reach it even if the pilot takes evasive action. The amount and direction ahead must be estimated quickly and accurately. The speed of World War II aircraft moved the problem beyond human capability unless aided by automatic rapid calculation. Wiener felt he would be able to contribute significantly to the solution of the prediction part of the problem partly because he had previously developed the equation to be solved when knowledge in one region is used to predict, via a statistical analysis, behavior in another, the so called Hopf-Wiener integral equation[5]. Wiener was also familiar with the work at MIT of Vannevar Bush with analog computers and work he had done with Yuk Wing Lee on creating electrical circuits that correlated with mathematical equations. Together with the engineer Julian Bigelow (1913-2003), Wiener was confident he could build circuitry that would solve the prediction problem, as he said, "in the metal."

Wiener and others working on the anti-aircraft fire control problem envisioned the coupling of anti-aircraft guns with human tracking fed to a computing circuit with output based on the mathematical solution of the prediction equation[6]. Motors attached to the gun turrets could position and aim the gun under the control of data generated by the mathematical processing of input from the human trackers. Later, as radar became perfected humans played a diminished role in the process. But humans were still needed as spotters and gun loaders[7].

Wiener reports that his work on this problem had a profound impact on him.

Up until this work, the mechanisms for the control of gun turrets were almost always assumed to belong to power or control technology rather than communications technology even when they were automated as servomechanisms. What Wiener reports dawned on him was that the action of the motors could be conceived valuably as communicating the aiming parameters to the turret and hence that the motors and the computers controlling them could be treated as communications devices. Input into the computing circuits and the output from them could be analyzed as signals or messages conveyed to the motors. So, what appeared as control mechanisms could equally well or even better be analyzed mathematically as communication processes based on frequency analyses of messages.

Wiener wrote that this point of view made him "regard the computer as another form of communications apparatus, concerned more with messages than with power."[8]

[5] See Pesi Rustom Masini, *Norbert Wiener 1894-1964* (Boston: Birkhäuser, 1990), 185.
[6] See illustration, Mindell, 204; and illustration, James Phinney Baxter, *Scientists Against Time* (Boston: Little Brown and Co., 1946), between pp. 214 and 215.
[7] See illustration, Robert Buderi, *The Invention that Changed the World* (New York: Simon & Schuster, 1996), p. 133.
[8] Norbert Wiener, *I Am a Mathematician: The Later Life of a Prodigy* (Cambridge: The MIT Press, 1956), p. 265.

"The Computer as a Communications Device"
Jay Hauben (continued)

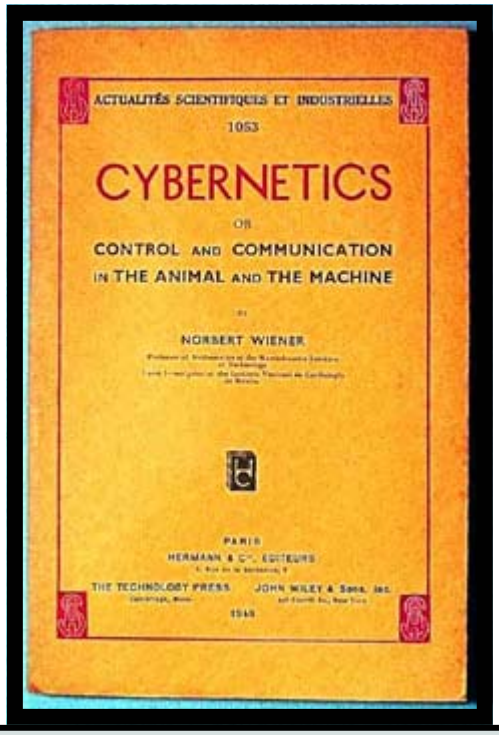
Wiener's phrase "computer as another form of communications apparatus" appeared in print in 1956 but he was writing of the time in the early 1940s. The computers which Wiener had in mind were collections of electrical resistances, potentiometers, capacitors and vacuum tubes, connected together in various configurations to take as input voltage variations from tracking devices. The combination of circuits was constructed so as to represent a solution of the path prediction problem. It would give as output resulting voltage variations. These would be used as control inputs to the motors which mechanically set the height and angle of rotation of the artillery pieces. Together with the time of firing setting, these settings located a point in three-dimensional space at which the shell would explode calculated to be in close proximity to the aircraft at the time of explosion. The motors had self correcting features which made them servomechanisms. The purpose of this whole system was to increase the chance that the shell would explode sufficiently close to the target aircraft some 20 seconds after firing to damage or destroy it.

The nature of such a computing machine, Wiener continued, "was that of a series of switching devices, so enchained together that the information coming out of a number of stages of these was introduced into a subsequent stage as ingoing and regulating information."[9] That is, the internal functioning of the computing device was conceived by Wiener to be communication among its various internal circuits. Also, the resulting output variable voltage was conceived as a signal or message conveyed to the servomechanism of the aiming motors which controlled the angle of rotation and elevation of the anti-aircraft gun. Since this was an ongoing process, the changing motion of the plane was matched by changing orientations of the guns appearing as if the gun was following where the plane would be.

With this point of view, Wiener saw a striking analogy between the workings of an automatic anti-aircraft system and that of a living organism. There was input, processing of that input, and resulting action, which was corrected by further input so the action brought closer the achievement of the goal. He began to regard a computing machine in much the same light as the brain and nervous system, both as communications with self correcting feedback mechanisms. Out of such considerations a new synthesis emerged which Wiener eventually termed cybernetics (from the Greek word for "steersman").

Wiener worked out his new synthesis in *Cybernetics or Control and Communication in the Animal and the Machine* (Cambridge: The MIT Press, 1948) and later popularized it in *The Human Use of Human Beings* [10].

Communication—for Wiener the receipt, processing, transfer and correction of messages—was



Norbert Wiener's *Cybernetics or Control and Communication in the Animal and the Machine*

the unifying thread in this synthesis. He even concluded that "communication is the cement of society. Society does not consist merely in a multiplicity of individuals meeting only in personal strife and for the sake of procreation, but in an intimate interplay of these individuals in a larger organism."[11]

Wiener included that society had a memory of its own facilitated by the invention of writing, now

[9] Wiener, *I Am a Mathematician*, p. 265.
[10] Wiener, *The Human Use of Human Beings: Cybernetics and Society* (New York: Discus Books, 1950).
[11] Wiener, *I Am a Mathematician*, p. 326.

"The Computer as a Communications Device"
Jay Hauben (continued)

further facilitated by online archives.

Also, Wiener's work raised a question. What will be the relations between humans and machines in the age of computers and automation?[12]

After WWII, cybernetic ideas from many sources in the United States, the United Kingdom, Germany and elsewhere, began to be known and discussed in scientific circles. Licklider attended such discussions in Cambridge, Massachusetts. He brought to them his relevant experience gained from research in psycho-acoustics. His papers, mentioned above, carried on the work. In them he formulated his answers to the question of the relation between humans and computers and the importance of communication.

JCR Licklider: Man-Computer Symbiosis

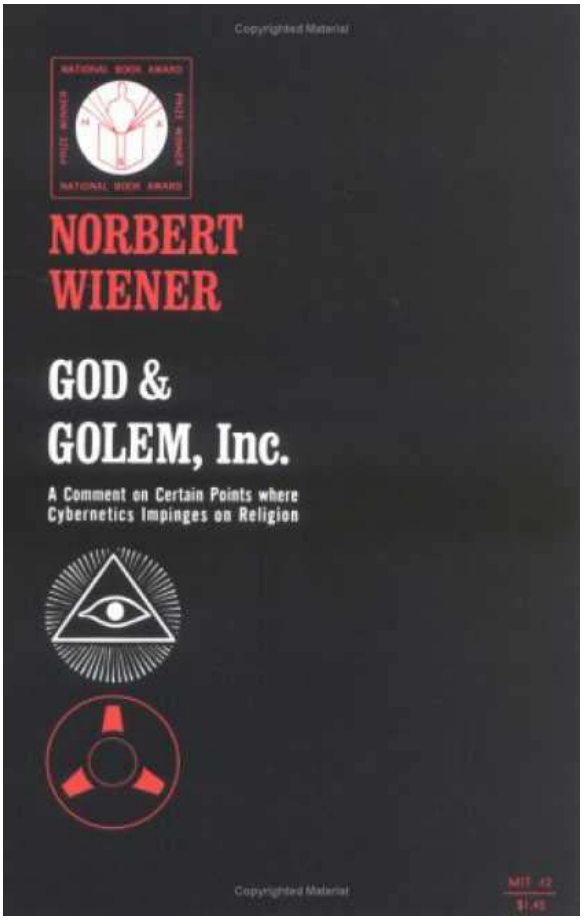
In1960, in the article "Man-Computer Symbiosis"[13], Licklider envisioned a tight coupling of people and computing machines in which each would contribute what it did best. Both the thinking of the people and the information processing of the computers would thereby improve with time. The main aims of the partnership would be to let computers facilitate formulative thinking and to enable human-computer cooperation in decision-making and in the control of complex situations with greater flexibility. Licklider opposed his vision to that of creating computers that would be able to do thinking and problem solving without human assistance. Licklider saw the possibility that the time-sharing computer centers could all communicate with each other so that in some way all users and all computers would become one vast human-computer communications system. He began to use the name "Intergalactic Network."

For Wiener the communication was within the device or organism. Licklider, a psychologist and acoustic scientist, centered his career around communication, in the brain, in aircraft and in society as well as between people and machines as separate species. In 1968 he expanded his vision in an article which he co-authored with Robert Taylor, "The Computer as a Communication Device"[14].

JCR Licklider and Robert Taylor: The Computer as a Communications Device

Now in 1968, Licklider and Taylor saw the communication device as the whole human to human communications system. They wrote that their "emphasis on people is deliberate," that human to human communication is more than the engineering task of sending and receiving information. Their starting point was that humans communicate meaningfully when they can share and compare mental models. So in some ways human minds are part of the communications systems. With graphical input and output devices and rapid computer information processing, mental models will be more

Wiener's God & Golem, Inc.: cybernetics meets religion



[12] See Wiener, *God & Golem, Inc.: A Comment on Certain Points Where Cybernetics Impinges on Religion* (Cambridge: The MIT Press, 1964), Chapter 6, which begins on p. 71: "Thus one of the great future problems which we must face is that of the relation between man [sic, humanity] and the machine, of the functions which should properly be assigned to these two agencies."
[13] Licklider, "Man-Computer Symbiosis," 4-11.
[14] Licklider and Taylor, "The Computer as a Communication Device," 21-31.

"The Computer as a Communications Device"
Jay Hauben (continued)

accurately externalized and shared. They will be easier to interact with and to combine. The result will be a greater chance to achieve common understandings and purposes.

Such communication, Licklider and Taylor argued could be more effective even than face-to-face communication. A well-programmed networked computer will provide direct access both to informational resources and to the processes for making use of and sharing the resources. Each communicator can better work out his or her model and present it to others with text and graphics and whatever else the computer was developed to do. The full value would come from the media allowing interaction, people with computers, computers with computers and people with people via the net yielding a joint construction beyond what would be possible without the computer communications system.

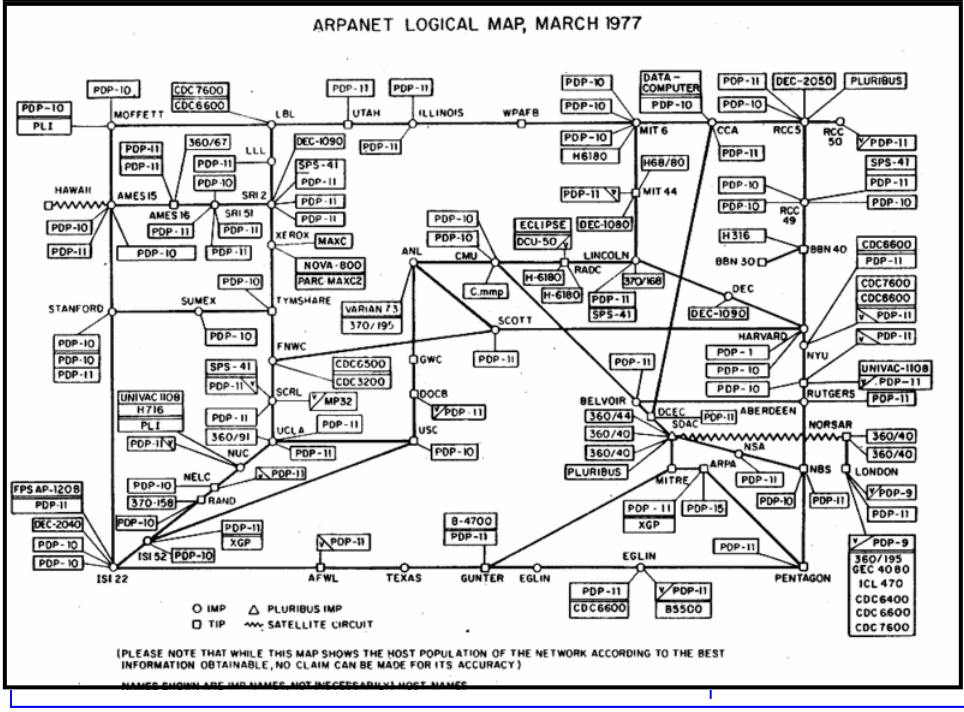
For Licklider and Taylor, this modeling function of the computer as communication device was primary.

But they also saw the importance of the communication switching function of the computer. They had seen time-sharing technology make a central computer accessible to many simultaneous users. It had done that by parceling out quanta of processor time to all users in a round robin fashion with such speed that each user had the perception of being the sole user. And by so doing, it had helped communities of users form around each such time sharing computer. The shared computer gave rise to the sharing of programs and know-how and data and even personal message files users could leave in each other's directories. Such sharing glued the users together.

As Licklider and Taylor wrote their article, the ARPANET, an experimental packet switching network that would connect the separate time shared computers was being planned. By breaking up all messages into parcels of data called packets and interspersing the packets from many users, packet switching technology would use communications lines with a great efficiency. Each packet would contain address and sequence data as well as a string of data from the message. Each packet would be passed on by computers as switches along the network until it arrived at its destination. Error detection and correction or retransmission would insure the accuracy of the data. The messages would be reassembled at their destination computers and delivered to the addressee. As opposed to voice messages using circuit switching technology, the packets would not have captured or dedicated circuits for their exclusive use. During a communications session each packet shared the lines with all other packets.

Licklider and Taylor saw that all of these communications functions would be played by the computer as a communications switching device. Perhaps the most important aspect of this use of computer technology was the great decrease in cost interspersing packets would achieve. Packet switching made possible for the first time full time utilization of the full capacity of communications lines. The prevailing circuit switching technology originally designed for voice data required payment for the line during an entire communications session whether there was traffic on the line or not. Also, with packet switching, with more users, the degree of sharing and efficiency increases yielding an economy of scale. The resulting decrease in cost makes possible long distance even international communication on a par in cost with local communication.

ARPA Logical Map, March 1977



"The Computer as a Communications Device"
Jay Hauben (continued)

Such a packet switching network of time shared computers allows the central computers to communicate with each other and through them all the members of the separate local communities to communicate and share files, programs, opinions, news etc. without regard to geography. Connecting all such packet switching networks, which is the technological feat of the internet, produces perhaps the largest human-machine interconnection history has ever seen. Considerations like this led Licklider and Taylor to emphasize that the new system would foster the creation of online interactive communities, communities not of common location, but of common interest.

Licklider and Taylor, like Wiener, saw that the technological system would have a social component. By eliminating distance and technological and geographic barriers as obstacles to communication, users will be able to find other people with similar or a common interest. When the system has spread far enough, for each interest, a "critical mass" of people may find each other so that they are empowered to act on that interest or to offer each other support. (For example, today there are online rare-disease-sufferers support groups, graduate students uncovering and exposing scientific fraud, mailing list and web sites by means of which masses of people are organized to protest an injustice and social networking systems that help users keep track of and in touch with "friends.")

Licklider and Taylor projected in 1968 that life with an online component would be a life improved via computer enhanced communication. And that the benefit to society from people acting in communities of common interest and communicating across the world could be significant.

But they had a warning:

> "For the society, the impact will be good or bad, depending mainly on the question: Will 'to be on line' be a privilege or a right? If only a favored segment of the population gets a chance to enjoy the advantage of 'intelligence amplification,' the network may exaggerate the discontinuity in the spectrum of intellectual opportunity."[15]

The Internet: Global Communications

That was in 1968. In 2008, nearly 40 years later, the Intergalactic Network of people and computers and communications media that Licklider and others foresaw has spread to almost every country, even if not yet by a long way to most people. There are positive signs that access to the Internet is still increasing. There are reported to be an increasing 163,000.000 people in China with Internet access. It is reported that North Korea has sought to have its country code domain acknowledged by the International Corporation for Assigned Names and Numbers (ICANN).[16]. Over 800,000 blogs have been started on the Internet by Iranians, Bloggers in Egypt are helping the mainstream Egyptian media report on strikes and demonstrations. Still the question of access both to the Internet and to all content and full use of the Internet is a struggle everywhere. An advanced example is South Korea.

A reported 80 to 90% of South Korean households have computers and affordable broadband connectivity, thanks in part to governmental investment and encouragement. It is not uncommon for Koreans of all levels of society to spend many hours a day online. In a sense everything anyone does online is a form of communication. There is massive online sharing, online experimentation and online communities of common interest. The full political spectrum has online presences including progressive and conservative and radical. The Internet has been described by one researcher as an important social infrastructure. Even in politics, mass sports cheering, exposure of scientific fraud and journalism, netizens of South Korea are a major force. By and large South Koreans are comfortable and excited about their intimate relation with their computers as communication devices. Yet, before the 2007 presidential election, the Korean government enforced a harsh Internet censorship law which inhibited online discussion and participation in the evaluation of potential candidates.[17]

Despite the contradictions and efforts at control and censorship, there is evidence that a human-computer symbiosis, an intimate global relation among humans and between humans and computers, is emerging. The insights in the 1940s and 1960s seem supported by the continuing growth of the Internet as a global communications system based on the computer as a communications device.

[15] Licklider and Taylor, "The Computer as a Communication Device," 31.
[16]) See ICANN website at: http://www.icann.org/announcements/announcement-2-17aug07.htm (accessed December 31, 2007)
[17] See Ronda Hauben, "Netizens Censored in South Korean Presidential Election: Harsh New Election Rule Prevented Online Discussion and Debate" December 25, 2007, OhmyNews International, http://english.ohmynews.com/articleview/article_view.asp?no=381313&rel_no=1 (accessed March 8, 2010)

"Mysterious Radio: Kipling and Cheever"

A. David Wunsch

"Any sufficiently advanced technology is indistinguishable from magic."

--- Arthur C. Clarke 1961

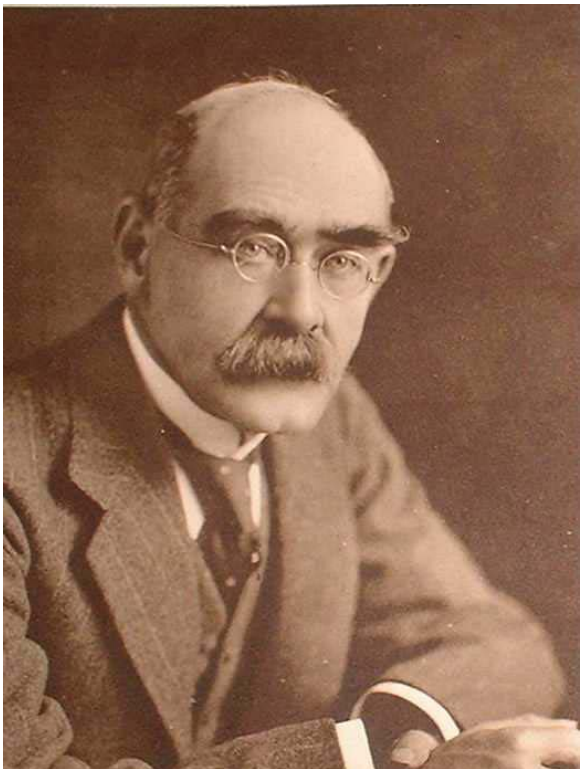
"The very fabric of life now she thought . . . is magic. In the eighteenth century, we knew how everything was done; . . . I listen to voices in America; I see men flying—but how it's done I can't even begin to won der. So my belief in magic returns."

---Virginia Woolf (from *Orlando*) 1928

A colleague—whom I will refer to as E.—asked one day that I step into his laboratory as he had something to show me. The audio tape that he placed inside a cassette deck had been used, he said, to record music and conversation, all of which he had carefully erased. He played this supposedly blank tape through his machine for me at high volume, during which in several instances he insisted that he heard a human voice—that of a dead relative. Buried somewhere in that painful white noise I did, at odd moments, hear something that might have been human, but nothing that I could discern as speech. Thanking him for his "interesting demonstration," I left, having had my first experience with what I now know is a branch of the paranormal called "Electronic Voice Phenomena."

Actually, I wanted to thank him for something else, but thought it prudent to keep my mouth shut. He had just treated me to a scene from the long history of the marriage between communication technologies and a belief in the supernatural. In E's lab I felt transported back to western New York state to the company of the three Fox sisters who, in 1848—four years after Morse's spectacular demonstration of his telegraph—asserted that they could decode the mysterious rapping heard inside their parents' house—messages, they claimed, from the dead. These interpretations caused a sensation, and the three girls, who said that they had opened a "telegraph line" to another world, are credited with founding the modern Spiritualist Movement that spread through the United States and into the United Kingdom, and, as my friend had demonstrated, persists in various forms today. Central to this movement is the belief that the living can communicate with the dead.

The great advances in communication and transportation of the 19th century gave birth to the literature of science fiction—writing that we associate in that same century with two familiar names, Jules Verne and H.G. Wells—but which engaged the interests of



Rudyard Kipling (1865-1936)

other serious authors as various as Twain, Hawthorne, and Poe. Somewhat lesser known because of fame garnered in other genres, but equally interesting, are the fantasy and science fiction contributions of Rudyard Kipling. To students of radio and its ancestor the wireless telegraph, there is one short story of his that continues to fascinate: "Wireless," which appeared in *Scribner's Magazine* in August of 1902. This tale—in which the wireless telegraph apparently enabled a spiritualist experience—has attracted considerable scholarly attention.[1] Kipling is not the only highly regarded writer

[1] Gillian Beer, "'Wireless:' Popular Physics, Radio, and Modernism," in Francis Spufford and Jenny Uglow, eds., *Cultural Babbage* [sic] (London: Faber and Faber, 1996); Sylvia Pamboukian, "Science Magic and Fraud in the Short Stories of Rudyard Kipling," *English Literature in Transition* 47 (2004): 429-445; and Jeffrey Sconce, *Haunted Media: Electronic Presence from Telegraphy to Television* (Durham: Duke University Press, 2000), 69-70.

"Mysterious Radio: Kipling and Cheever"
A. David Wunsch (continued)

to exploit in fiction the apparent strangeness of electromagnetic communication, and we will look not only at his piece but also at a radio related story of John Cheever's which appeared nearly 5 decades later.

About Kipling's decline in reputation as a writer, starting perhaps almost from the time of his Nobel Prize in 1907, I need say little here. Most people are astonished to learn that he died as recently as 1936—just 5 years before Woolf and Joyce—so identified is he with Victorian England. Some three dozen of Kipling's stories continue, however, to be held in high regard by science fiction and fantasy buffs, and anthologies with generous introductions appeared in the late twentieth century.[2]

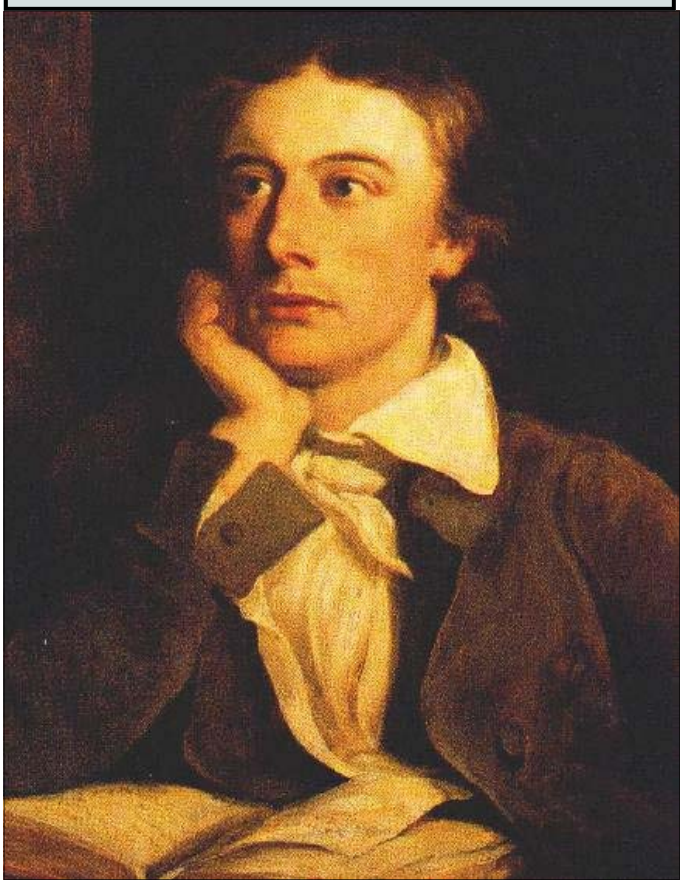
The scene of *Wireless* is an unnamed coastal British city. The time is presumably the present (1902), a fact evident from the contemporary technology. We are in a druggist's shop, heavily illuminated by electricity, on a painfully cold winter Saturday night. The shop's owner is absent, but his nephew, young Mr. Cashell, situated in a room connected to the store, is engaged in operating a wireless telegraphy set for sending and receiving Morse code. Tending the shop is an apothecary, Mr. Shaynor, who we will soon learn is dying of consumption.

There is an unnamed visitor, the narrator, a friend of the owner, who enters the shop to see the wireless set in action. Cashell explains to the narrator that he is trying to signal to the Marconi station in the city of Poole—he is waiting for Poole to "call us up"—and anticipates communication around midnight. While they are chatting, a young woman walks in and seeks to coax Shaynor into a "walk round by St. Agnes," presumably a local church. Shaynor agrees, and the narrator mans the counter for him. Alone with Cashell, the visitor confesses to him that he is ignorant of exactly what electricity is. He receives the reply, "If you knew *that* you'd know something nobody knows." Cashell then displays a device at the heart of his wireless receiver that will show the "magic" manifestations of Hertzian (radio) waves: the *coherer*, a glass tube with two tiny silver plugs and a quantity of metallic dust between them.

Shaynor returns without the girl. He is coughing blood, and the narrator, who has some knowledge of pharmacology, hands him a remedy he has formulated to give the poor man some comfort. While Shaynor dozes off from the medicine, Cashell gives his visitor a little lecture on wireless, explaining how a transmitted signal " induces" a received signal. We also learn from Cashell that the name of Shaynor's female friend is Fanny Brand.

Educated British readers in 1902 knew their romantic poets. Their mental antennae would have been raised by the girl's name, the name of the church, the weather, Shaynor's profession, and his terminal illness. All point to the poet John Keats (1795-1821) who died in his youth of consumption. He had studied both pharmacology and medicine. His mistress was Fanny Brawne, and, in 1820, he wrote the well loved poem *The Eve of St. Agnes* whose opening line is "St. Agnes' Eve—Ah, bitter chill it was." Shaynor's girl resembles an image in an illuminated toilet water advertisement in the shop, so there is a double pun on the name Brand—she is both Brawne and a brand.

John Keats (1795-1821)
Poet and Surgeon's Apprentice



[2] John Brunner, ed., *Kipling's Fantasy Stories* (New York: Doherty Associates, 1992); and Brunner, ed., *Kipling's Science Fiction* (New York: Doherty Associates, 1992).

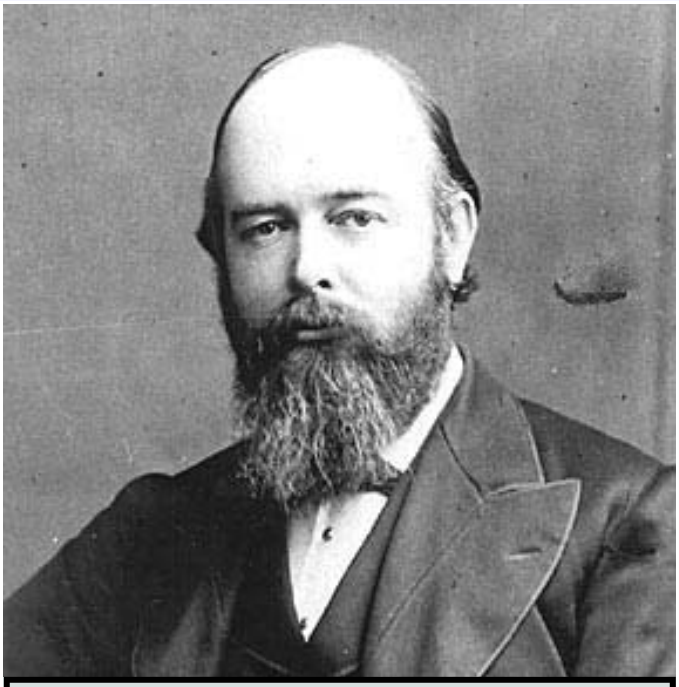
"Mysterious Radio: Kipling and Cheever"
A. David Wunsch (continued)

The narrator leaves Cashell in his lab-office and returns to the main shop to find Shaynor in a daze, fixated on the glowing simulacrum of his Fanny, and, in a tentative and imperfect way, reciting lines that are unmistakably from Keats's *The Eve of St. Agnes.* Shaynor begins writing, and lines from the poem now emerge on paper. At this moment Cashell tries to draw the visitor into his office: "there's something coming through from somewhere; but it isn't Poole." But the narrator is irritated at the interruption and tells him harshly: "Leave me alone till I tell you." Shaynor continues with his writing and reciting, rendering the poem nearly correctly, and then moves to a bit of the same poet's *Ode To A Nightingale.* Suddenly, he begins to shake and in a moment is out of his stupor, back to his normal self, and unaware of what has transpired. When questioned, he denies any knowledge of Keats and says, "Is he a popular writer?"

Cashell now moves the pair into his office to witness a "curious performance." Two ships out of Portsmouth are trying to make wireless contact, but neither can detect the other's message. Cashell tells his listeners that: "Their transmitters are all right, but the receivers are out of order, so they only get a dot and a dash there." When queried about the cause, he explains: "God knows—and Science will know tomorrow." Finally, the signal from Poole is heard, and Cashell asks the narrator if there is anything he'd like to tell them in reply. He declines: his interest in wireless has dimmed, and he wants only to get to bed.

In most interpretations of the story, the presence of the operating wireless set is the catalyst or medium that allows Shaynor to establish an invisible channel to Keats. It has been suggested that the inability of the two ships to communicate is due to wireless communication being diverted at that moment to convey or "induce" the poet's words. Gillian Beer points out that the story raises the question of why we assume that only the medium of print allows us to commune with a dead author and asks us to consider the possibility that Kipling is suggesting that this novel medium of the Edwardian era might be similarly employed.[3]

It is easy to lose sight of how the communications technologies developed in the nineteenth century mystified and thrilled its witnesses. The Morse telegraph made possible nearly instant communication and for the first time reliably separated communication from transportation. Listening to an Edison cylinder one could hear the recorded voice of someone who had died, while the wireless telegraph made possible communication with no visible connection between sender and receiver. Kipling's story takes advantage of this aura of mystery. Are we to imagine that Kipling himself believed that a scene such as the one he described was possible? I think not. His younger sister "Trix" suffered from mental illness for most of her life.[4] Modern Kipling biographers have diagnosed her as schizophrenic; she heard mysterious voices, attended séances, and indulged in "automatic writing" (like Shaynor) in a trance-like state.[5] All of this, together with her frequent hospitalizations, was disturbing to Kipling and it would be hard to imagine his assigning credibility to her delusions.



Sir Oliver Lodge (1851-1940)
Physicist and Member
Society for Psychical Research

If Keats is the invisible major player in the story, there is yet another who isn't named but who was alive when the piece was published, and who stands at the intersection of the major currents in the tale. The

[3] Beer, "'Wireless:' Popular Physics, Radio, and Modernism," 157.
[4] Her married name was Alice Fleming. She is listed under this name in Kipling biographies.
[5] Andrew Lycett, *Rudyard Kipling* (London: Weidenfeld and Nicolson, 1999); and Harry Ricketts, *Rudyard Kipling: A Life* (New York: Carroll and Graf, 1999).

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coherer, whose operation Cashell explains to his visitor, has a complicated history, but the term itself is attributed to Sir Oliver Lodge (1851-1940) who was to improve its sensitivity and who, circa 1894, was among the first to apply it to wireless telegraphy. Cashell's coherer is much like the one Lodge employed. It is clear to wireless historians that, during the period of its use, no one really knew how the invention worked.[6]

Lodge was a distinguished physicist and educator. However, he had another life for which he was famous both in the UK and America, a life involving belief and research in psychic phenomena.[7] In 1884, he joined the Society for Psychical research, which was founded in 1882, with the purpose of investigating scientifically such questions as whether there is life after death and whether one might communicate with the dead. The Society exists today and is proud of past members who were distinguished scientists and men of letters including William James, who like Lodge was once President, Sir William Crookes, Sir Arthur Conan Doyle, Henri Bergson, and Alfred Wallace.[8] Although the organization has a record of unmasking fortune tellers, fake mediums, and other psychics, most of its members shared a belief in life after death and in the ability of the living to communicate with the dead. Kipling's sister, using a pseudonym, participated in activities of the group.[9]

Lodge lost a son in World War I as did Doyle. Both soon reported having communicated with their dead boys. About a year after his son's death, Lodge published a book about how he had exchanged messages with him by means of séances conducted with a medium. The book, *Raymond or Life and Death*, became a best seller principally as a result of the large number of British families that had suffered a similar tragedy.[10] Kipling's son John died in the war, but his biographers don't mention his resorting to a medium to reconnect with the youth. Indeed, some have suggested that his poem *En-dor* is an admonition against such practices as "the craziest road of all."[11]

The nature of invention in the nineteenth century and the first decade of the twentieth was virtually a guarantee that both inventors and their followers in the general public would be drawn to a belief in the supernatural. One easily overlooks how ignorant inventors of that period were of the basic science underlying their inventions. By 1880, the cities and towns of the United States had been linked for several decades by the electric telegraph, and there was a telegraph cable under the Atlantic Ocean that joined the United States and Great Britain. Electric illumination in U.S. cities via incandescent bulbs was only a few years off. Yet, Oliver Lodge could say in a public lecture in 1882: "What is electricity? We do not know. We cannot assert that it is a form of matter, neither can we deny it."[12]

The modern theory of electricity—now only a little over a century old, and based on the electron as the elemental particle of charge—dates from J. J. Thomson's experiments of 1897. It took several years for scientists to accept that these particles were essential components in our evolving understanding of the atom. Cashell's ignorance of the precise nature of electricity would have been typical of wireless operators of his era.

In December of 1901—a year before the publication of Kipling's story—Marconi and an assistant were in Newfoundland and reported repeatedly hearing the letter S in Morse Code sent by wireless telegraphy from a transmitter in England, the first wireless transatlantic message. The sensational news made the front page of the *New York Times*, but the achievement was dogged by a problem: It was known for several decades that electromagnetic waves, like visible light, traveled in straight lines once the wave was launched. The signals heard by Marconi obviously had managed to follow the curvature of the Earth, yet he could offer no explanation. In fact, the physical theory explaining the bending of waves when they reached the upper atmosphere, which permitted the success of the experiment, was not established successfully until 1924 and not by Marconi.

It was the work of Edward Appleton, who later was knighted and awarded the Nobel Prize in 1947. As early as 1902, Arthur Kennelly and Oliver Heaviside

[6] Hugh Aitken, *Syntony and Spark: The Origins of Radio* (Princeton: Princeton University Press, 1976), Chapter 4.
[7] W. P. Jolly, *Sir Oliver Lodge* (Rutherford, NJ: Fairleigh Dickinson Press, 1974.
[8] Deborah Blum, *Ghost Hunters: William James and the Scientific Proof of Life After Death* (New York: Penguin Press, 2006).
[9] Blum, 283-285.
[10] In her 1919 story *Kew Gardens*, Virginia Woolf presents us with an elderly man having a mental image of widows in contact with their dead husbands—war casualties—through the intervention of a wireless set.
[11] Ricketts, 337.
[12] Quoted in J. J. Fahie, *A History of Wireless Telegraphy* (New York: Dodd Mead, 1901; reprinted 2000), 262.

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separately had conjectured the existence of a conducting layer in the upper atmosphere that reflected radio waves over the horizon.

These examples are not atypical. The triode vacuum tube, developed in 1906, was the crucial invention in radio for 42 years until the introduction of the transistor. Yet, Lee de Forest, the self-styled "father of radio" who discovered the triode, did not understand its principles.[13] A vast public came to believe that modes of communication in daily use required explanations that would be far in the future. It is no surprise to learn that in 1909, William James remarked that, in denying the possibility of spiritualism we might be "ignoring a *natural kind of fact* of which we do not *yet* know the full extent."[14] Understandably, Cashell tells the narrator of the story that he cannot explain the failure in communication between the two ships, but that: "God knows—and Science will know tomorrow."

In the era of the story *Wireless*, a core belief was that the electromagnetic waves in use for communication moved from transmitter to receiver through a medium referred to as the ether or aether. The ether was seen as a conduit for these waves just as air was required for the existence of sound waves. The medium of the ether was central to most nineteenth-century thought about electromagnetic waves but, unlike air which you could store in a balloon, the ether had never been detected. It is an example of the "natural kind of fact" that James spoke of, and it was at the center of Lodge's spiritualistic beliefs. Where else did the dead and their voices reside but in the ether? As he put it, the ether is: "… where our existence lies, and there is our spiritual home."[15]

The crumbling of a general belief in the existence of the ether dates from 1905 and the publication of Einstein's theory of special relativity, which held that the laws of physics turn out to be exactly the same in all frames of reference moving at constant velocity with respect to one another. If the ether existed, an observer at rest in the ether would enjoy a privileged position in physics and directly contradict the new theory. Einstein's work explained the negative outcomes of all experiments designed to detect the ether.[16] Gradually, belief in relativity took hold in the physics community, but not in the mind of Lodge who, at his death in 1940, clung firmly to a concept which by then had virtually no other proponents in the physics community.[17]

Interestingly, Kipling, who in a sense intersects with Lodge in *Wireless,* had his own problems with Einstein's work—in this case the general theory of relativity published in 1916. Although Kipling embraced the technologies of modernity—he was greatly enthused by the automobile and electrification—there were limits to what he would accept from modern physics. Writing to a friend ostensibly about the Germans the year after WW I ended, he asked:

> "Do you notice how their insane psychology attempts to infect the Universe? There is one Einstein, nominally a Swiss, certainly a Hebrew, who (the thing is so inevitable that it makes one laugh) comes forward scientifically to show that under certain conditions Space itself is warped and the instruments that measure it are warped also. . . . When you come to reflect on a race that made the world Hell, you see how just and right they should decide that space is warped, and should make their own souls the measure of Infinity . . . Einstein's pronouncement is only another little contribution towards assisting the world toward flux and disintegration."[18]

Although the wireless transmission of voice and music became possible in 1906, radio broadcasting in the United States began on a sustained basis only in 1920. Despite some resemblance of the hardware to that used in wireless Morse code transmission, we must

[13] Hugh Aitken, *The Continuous Wave* (Princeton: Princeton University Press, 1985), Chapter 4.
[14] Blum, 26.
[15] Courtenay Grean Raia, "From Ether Theory to Ether Theology: Oliver Lodge and the Physics of Immortality," *Journal of the History of Behavior Science* 43,1 (2007): 19-43; and Jolly, 237.
[16] This includes an attempt by Lodge. See Jolly, 107-109.
[17] Interestingly, the entry for "Ether" in the 14th edition of the *Encyclopedia Britannica,* published in 1939, was written by Lodge who still maintained its existence. The entry for "Relativity" contradicted Lodge's entry.
[18] Evidently some mixture of Kipling's anti-Semitism and anti-German feelings blinded him to Einstein's pacifism during the war. Had more Germans been like Einstein, Kipling would not have lost his son. The quote is from Ricketts, 350-351.

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regard radio broadcasting as a new medium, different from wireless telegraphy. Unlike the wireless telegraph whose termini were in offices, radio entered the home, and unlike its predecessors the phonograph and telephone, which also created disembodied voices, radio was a mass medium affording instant communication but which could be received in isolation. Jeffrey Sconce has documented how the new mass audience for radio created, at the same time, consumers of bizarre science fiction stories in which for example, a maniac broadcasts "a cursed piece of music that will draw its nation of listeners to mass suicide." He remarks, with some hyperbole, that: "the institution of broadcasting came with a price: the invasion and dissolution of the private sphere of the home."[19]

In 1947, forty five years after the appearance of *Wireless*, John Cheever, who later won the Pulitzer Prize, published in the *New Yorker* one of his best known stories, *The Enormous Radio*.[20] In post-war America, a radio set was sufficiently commonplace so that one might imagine it to be as devoid of magic as the toaster. Nonetheless, the device still had sufficient aura of mystery so that a radio might plausibly become a catalyst for the supernatural in one fictional New York apartment. Some indication of the destructive magic—and in this story it is destructive—seemingly inherent in radio, can be seen in a letter written by Ezra Pound to a friend, just 7 years before the Cheever piece appeared, in which his new radio is referred to as a "Goddamn destructive devil of an invention," "… a devil box," and a "devouring *serpent*."[21] We can look at the stories of Kipling and Cheever as a pair of markers embedded in the eras of wireless telegraphy and radio in which the authors exploit the strangeness attached to these inventions.

Cheever's plot illustrates an invasion, to use the language of Sconce. The tale takes place in the apartment of Jim and Irene Westcott, who live in the comfortable Upper East Side of Manhattan. In their middle thirties, they have a seemingly agreeable life typical of their social class: they have two young children, a maid who also serves as a cook and nurse, and they frequently attend concerts and the theater. Their radio breaks down, and because of their interest in classical music, they buy an expensive replacement. The new set is ugly and gives off "a malevolent green light." At first it works to their satisfaction, but Irene, who is home most of the day, soon discovers that the device picks up and rebroadcasts into their apartment music and voices generated within their very own apartment building.

They both initially enjoy the novelty of spying on their neighbors, learning their intimate secrets, and they spend an enjoyable evening so well entertained that they go to bed "weak with laughter." But in the next two days, Irene continues what has become an addiction, and what she learns is distressing. A neighbor is having an affair with the building's handyman, another woman is a "common whore," a man beats his wife, a neighbor sells a diamond that a guest has accidentally lost at a recent party. A sick woman cannot afford more visits to the doctor. Irene is tormented by her new knowledge. Her appearance changes from one of cheerful innocence to "radiant melancholy."

Jim arranges for a repairman to fix the set, but their lives are not mended. He begins to fret about their financial situation, and he reproaches Irene for her extravagance. Irene is terrified lest his voice be broadcast to the neighbors through their own radio. Jim explodes at her apprehension and reminds her of some ugly truths with which they have, until now, apparently lived without rancor: Irene has had an abortion or as Jim puts it, "went off to have that child murdered." Irene has cheated her sister on their inheritance. She moves to the radio, hopeful that she might hear the neighbor's nurse saying something soothing to the children she cares for, but the repaired set flatly reports news from the outside world, including a railroad disaster that has killed 29 people and some information on temperature and humidity. The Westcotts will not be the same.[22]

If Keats's *St. Agnes* resides openly in the Kipling story, the Book of Genesis slithers beneath this one. The ugly radio set with its green glow evokes the snake in the tale of Adam and Eve. There is even a passing reference to an apple core. Pound's comparison of radio to a "devouring serpent" is apt here. It would be

[19] Sconce, 109.
[20] John Cheever, *The Stories of John Cheever* (New York: Ballantine Books, 1980).
[21] As quoted (italics added) in Daniel Tiffany, *Radio Corpse: Imagism and the Cryptaesthetic of Ezra Pound* (Cambridge: Harvard University Press, 1995), 245 and 282.
[22] The title *The Enormous Radio* may be an allusion to a novel published in 1922, *The Enormous Room*, by e. e. cummngs, which was based on a time he spent imprisoned during World War I. The Westcotts are now in their own prison.

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simplistic to read this story as a critique of technology. It is, more broadly, a statement of the torment that awaits us when we become aware of the meanness, dishonesty, and cruelty in the world. We might then see these very aspects of our own lives. The tale condemns the cliché that one's pain becomes more bearable, if one places it in the context of the sufferings of humanity.

The mechanism whereby an ordinary home radio becomes an eavesdropping device is technically preposterous, and there is nothing in Cheever's biography to suggest he imagined it plausible.[23] It is plausible, though, that Jim and Irene, ignorant like much of the public of the physics of radio, would be prepared to accept the tale's premise. We also should keep in mind that, during the 1940s, AM radio receivers often did pick up strange and inexplicable sounds (especially in city apartments). This observation is doubly true for the period of wireless telegraphy appearing in Kipling. The FM radio that most of us listen to provides little in the way of mysterious noises that were once commonplace.

In the very year that *The Enormous Radio* appeared, the transistor was introduced to the world by three U.S. physicists at Bell Telephone Laboratories. These men, all with PhDs in physics, understood the quantum mechanics that explained their invention which was to revolutionize the construction of radios—and all electronics—over the next decades. Unlike the coherer, the vacuum triode, and radio propagation over the horizon, there was no whiff of mystery to this device that replaced the radio tube. The absence of this aura is characteristic of most of twentieth-century inventions with which we are familiar, and it perhaps explains why mainline (i.e. non-science fiction) writers are no longer producing stories such as *Wireless* and *The Enormous Radio*.

To be sure, there are still small societies of believers using radios or recording machines to communicate with the dead. A collection of essays, *Radiotext(e),* contains *Radio From Beyond the Grave* by Carola Morales, who describes her group: *The American Association for Broadcast Voice Phenomena*.[24] They are "one hundred strong" and report hearing George Washington and Adolf Hitler. The reader can find the organization's site on the Web in addition to one for the *American Association of Electronic Voice Phenomena*, to which my friend E with the "erased" tape belongs.

To an electrical engineer, there *is* something miraculous about radio—but not the miracles reported by such groups. The wonder is in the engineering itself. The electrons on the rabbit ears antenna that I'm using at this moment to hear a college FM radio station are moving about in a highly complex pattern, altering their behavior millions of times per second. Yet my radio, tuned to 95.3 MHz, has made itself sensitive only to that motion—vibrations of the current taking place in a small spectrum centered at 95.3 million times per second. The current itself is tiny—it's measured in millionths of amperes. The radio senses that minute current and turns it into Beethoven. Now *that* is a miracle.

If the plot of John Cheever's *The Enormous Radio* rings a bell, you may be recalling its adaptation for television. The story originally ran in the May 17, 1947, issue of The New Yorker. Forty years later, on May 17, 1987, the episode "The Enormous Radio" aired during the third season of the Twilight-Zone-esque series called Tales from the Darkside. The teleplay was by Guy Gallo; the director was Bill Travis. A trivia note: The enormous radio is a Majestic Multisonic manufactured in West Germany by Grundig. The first televised version of Cheever's short story, however, was on the first season of The Revlon Movie Theater and aired on July 21, 1953. The teleplay was by Reginald Rose; the director was Daniel Petrie. That production featured Darren McGavin, who performed in many of the classic anthology dramas of the 1950s and starred as Mike Hammer (1958-1959). Source: Internet Movie Database www.imdb.com

[23] Scott Donaldson, *John Cheever: A Biography* (New York: Random House, 1988). Cheever, however, did play tricks with the physical world in a haunting story, *The Swimmer*, which was adapted into a well known film. Here, a man seeks to swim across his suburban county, going from one swimming pool to the next, in an effort to return to his own house. In the course of this midsummer afternoon, there is a compression of time, so that by the time he reaches home, the seasons have changed, the house is empty, and his family has vanished.

[24] Neil Strauss and Dave Mandl, eds., *Radiotext(e)* (New York: Semiotext(e), 1993).

The Mercurians Are Changing

The Mercurians are instituting a number of changes that affect both subscribers to the Antenna newsletter and members of the Mercurians.

Antenna Subscriptions

Beginning with this Spring 2009 issue, the annual subscription rate is US$5.00 for delivery in the United States. The annual subscription rate for delivery overseas is US$7.50.

Article Prize and Travel Grant

The Mercurians are establishing a new initiative that consists of a prize for the best article by a junior scholar and a travel grant to junior scholars to defray the cost of traveling to a research collection.

Both graduate students and postgraduates are eligible for the article prize and travel grant, but not those postgraduates who are more than three years beyond the terminal degree in their field. All articles considered for the award program will have undergone peer review and will have complete scholarly apparatus. Only travel to a recognized archival collection will be supported.

The prize and grant will be awarded in alternating years. We anticipate presenting the first article prize during the SHOT annual meeting in 2011 and the first travel grant at the 2012 meeting.

The amount of the prize and grant are determined by the amount raised during the previous year. Members are asked to contribute an annual membership fee of US$5.00 for the purpose of supporting this program. Larger donations are encouraged. Those contributing more than US$5.00 may earmark their funds for either the article prize or the travel grant.

Rationale for Program

One of the Mercurians' missions is to encourage scholarship in the history of communication technologies. There is no prize or travel grant either within or outside SHOT for scholarship on the history of communication technologies. The history of communication technology literature is vast and always growing, but the quality of the research and historical erudition exhibited too often falls short of scholarly expectations. The Mercurians are hopeful that their award and travel grant program will help to raise the level of scholarship in the history of communication technologies.

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