Radio and the Internet: A Study in the Development of New Communications Technology

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The Internet and the World Wide Web have already dramatically affected many aspects of library and information work, and promise to bring further change in the years to come. However, the Internet is not the first new communications technology to change the world. Radio, at the time of its introduction, was a dynamic new technology that won rapid acceptance with the public and transformed communications. It can be viewed as one of the starting points of the "Information Age," and as one of the great technological success stories.

This paper first examines the technological development of radio, tracing the factors that allowed radio to become a relatively inexpensive technology that could capture a mass market. These factors show striking parallels to the case of the Internet. The changing content of radio during its period of expansion is then discussed.

The introduction of a new technology is almost inevitably accompanied by a wave of speculation about the future impact of that technology. Many forecasts were made of the effects that radio would have on education and culture, but the actual effects, while very significant, were quite different from expectations.

The paper then discusses factors, suggested by the case of radio, that affect the degree of acceptance of a communication technology. The characteristics of the medium of communication also affect the preferred forms of utilization of the medium. While technology sets the parameters within which any medium will function, ultimately the users’ choices of how to exploit the technology determined the impact of radio on communication. These same user choices will determine the future form of Internet communication. Radio may therefore serve as an instructive case study that allows us to develop some insight into the factors that shape the development and use of new communications technologies.

Origins and Development

Like ARPANET the Defense Department-funded predecessor of the Internet, radio’s initial development was spurred by potential military use. Although tinkerers and hobbyists had experimented with home-built radio sets in the 1900s, maritime wireless communication was the first practical use of radio (Smulyan 1994). Radio was first seen as a replacement for the telegraph where wires were impossible, hence the name “wireless”. Shipping lines began to use radio before the war, and it was obvious that such communication at a distance would be particularly important to military operations. Radio’s transition from a theoretical, laboratory-based curiosity to a practical and effective industry was accelerated by World War I. For the first time, precise remote command of naval operations was possible, as was eavesdropping on the enemy's plans (through code breaking). The steady demand for radio equipment from the military helped consolidate the industry among the large producers: General Electric, the Radio Corporation of America (RCA), and Westinghouse (Barnouw 1966). RCA was an industrial consortium owned partly by GE, Westinghouse, AT&T, Western Electric, and American Marconi (a British corporation). Each of these companies held critical patents and manufacturing technology for radio. RCA was formed to solve the problem of sharing these patents, and particularly to bring the British-owned American Marconi under American corporate dominance, which was a matter of national security in the immediate postwar period (Douglas 1987). The result was a comfortable cartel of producers who were able to allocate production and profits among themselves when radio fever exploded.

After the Great War, many sailors returned home bitten by the radio bug that they had acquired in the service. While amateur transmission was banned during the war for fear of radio interference and for security reasons, the ban was lifted in 1919 (Barnouw 1966). The years 1919 to 1922 saw a rash of amateur tinkering with home-built radios across the country. (The breakdown of radio into eras and much of the information discussed in the following paragraphs is taken from Landry 1942.) Insiders who had been introduced to the technology began to experiment with it in unconventional ways.

A similar phenomenon occurred as ARPANET matured into the Internet, as the foundation built for military and research purposes expanded to include new users who began to experiment with the technology, creating newsgroups or MOOs for their recreation. The World Wide Web was pioneered by amateur experimentation. In radio’s case, the “hams” helped push forward the technology — for example, proving the viability of short-wave transmission over long distances. The demand for technical information was high. In radio hobbyists’ magazines, the same circuit diagram would be reprinted several times, but with the components shuffled about to create an illusion of change. Might we not say the same for the spate of Internet guides?
The amateurs also pioneered programming and helped demonstrate the potential for an interested radio audience. For example, Lester Spangenberg played piano music, phonograph records, and banjo solos from his home, just for the fun of it, broadcasting night after night to his neighbors. Some reported baseball scores and newspaper headlines. A local store might broadcast an hour or so of programming from their store, partly for advertising and partly to take part in the adventure (Reck 1942). There was a sense of mystery and intrigue about these distant voices descending from the air that drew people to radio. The pre-commercial Web of a few years ago was similarly filled with idiosyncratic home pages created by interested hobbyists. The lure of direct communication with far-off lands and people is also present with the Internet.

**Mass Acceptance**

In 1922, the major companies began to enter the radio market. A few years earlier, radio was not viewed as a mass communication device or a broadcast medium. For example, AT&T had become interested in radio to develop voice communications for rural areas that were uneconomical to wire. But the intense dedication of the "hams" showed that an untapped consumer market lay waiting. The major radio manufacturers resolved their difficulties regarding various patents that needed to be cross-licensed and prepared to deliver radio to the masses. Stock prices of radio manufacturers zoomed upwards, and many who were drawn to radio as amateurs stayed on to find lucrative careers. By now, the Web, as well, has made the careers and fortunes of many who were simply playing with the technology a few years ago. Also, major companies have moved in to try to take their share of the Internet market.

Radio saw a truly phenomenal rate of growth in the early 1920s. Sales of radio equipment jumped from $60 million in 1922 to $358 million two years later (Barnouw 1966). This compares to the approximate annual doubling of the size of the World Wide Web in recent years. As the radio was transformed from a do-it-yourself project to an easy-to-use box set, the radio became a status consumer item. The ornate, furniture-like appearance of vintage radio cabinets was a marketing strategy to expand radio's audience beyond the technophile's preference for functional switches and dials (Douglas 1987). We see similar efforts today to simplify the computer experience with WebTV and Network Computers.

By 1935, 93% of the population in cities of 250,000 or more owned a radio. By the mid-40s, 91% of the entire population had a radio (Barnouw 1966). Radio achieved near universal market penetration very rapidly, more quickly than the telephone before it or the personal computer after it.

The growth of the Internet has followed an explosive initial trajectory, but it remains to be seen whether Internet access will be truly universal, or whether it will merely be universal among the computer-owning population. A low-cost and simple-to-operate Internet access device would undoubtedly speed universalization. The cost of radio, while initially high (about $75 in 1920s dollars, or $690 today — comparing 1997 and 1925 *Consumer Price Indexes*), fell rapidly, contributing to its ubiquity. Possibly WebTV or Network Computers will have this effect on the computer market.

**Commercialization**

The years 1926 to 1936 have been described as the adolescent years of radio. In 1926, the National Broadcasting Corporation was formed by RCA. The other major broadcasters, CBS and Mutual, were similarly dominated by promotional concerns. Other countries had adopted government-sponsored broadcasting, such as Britain's BBC, but the United States followed a strictly commercial approach. Broadcasting was initially seen not as a profit center, but as a necessary service if people were to be enticed into buying radio sets (Douglas 1987). David Sarnoff, vice-president of RCA, explained that "we broadcast primarily so that those who purchase" RCA radios "may have something to feed those receiving instruments with" (Douglas 1987). It soon became apparent, however, that advertising revenue could be quite profitable as radio grew ever more popular. After the novelty effect had worn off, radio struggled for respectability in competition with newspapers and motion pictures as a source of quality information and entertainment. Certain stars and favorite programs became magnets to attract listeners. In Chicago, live broadcasts of Mary Garden's operatic virtuosity helped fan the demand for radio (Barnouw 1966). Elsewhere, live sports broadcasts were a major attraction. Events like the World Series and boxing championships could draw the entire nation's attention, helping to create a national mass market for entertainment (Douglas 1987). This mass market was dominated by the major broadcasters, who were able to assemble the best talent and develop a full spectrum of programming, and had the national infrastructure to deliver programming coast-to-coast. Soon, the sheer volume of their audiences would be their greatest legitimizer.

In observing the Internet, we can see efforts to develop star attractions. The Microsoft/NBC partnership of a technology and an entertainment company is a striking parallel, or carryover, from the radio days. Other highly popular web sites include ESPN and CNN. However, rather than develop independent content, most of the Internet relies on other media. We see newspapers, broadcasters, and movie companies throwing up Internet sites, but no Internet-original site seems to have broken through to a mass audience, other than directories and search engines such as Yahoo!. But perhaps this is missing the point. The Internet's genius is precisely that it is open to all
information, from small to large, regardless of its provenance. The fundamental limitation of the radio spectrum restricted the number of broadcasters. Within a certain region, stations had to be spaced out to prevent interference, and boosting a signal to increase its range meant greater interference with neighboring broadcasters. Federal regulation was necessary, and amateurs were banished from the main frequencies. During the 1920s, many broadcasters would voluntarily shut down one night a week so that listeners could tune in to more distant stations without interference. By 1927, these “Silent Nights” disappeared altogether under commercial pressure (Douglas 1987). With the Internet, however, there is no reason for a large and powerful presence on the Internet to prevent smaller voices from being heard, making possible the kind of “narrowcasting” associated with the printed book.

Maturity

From 1936 onward, radio was a mature and stable medium. The nation relied on it for live reports from World War II, for FDR’s fireside chats, for top-rated entertainment such as Jack Benny, and for music. The average home listened to the radio for three hours per day, and many reported that it was their primary news source. The networks promulgated an ideal of public service to further enhance their stature. They were to present balanced viewpoints, entertain the public, maintain certain levels of taste, and censor potentially offensive material (venereal disease could not be mentioned, for example). In most decisions, they appear to have been moderate, fair, and wholly in tune with the temper of the times (e.g., accepting censorship in ways we would be unlikely to approve today). In 1945, listeners reported that radio was viewed more positively than any other institution in America, including schools, churches, and government. It was viewed as more fair in coverage than newspapers (Lazarfeld 1948).

Demise

Yet television quickly eclipsed radio in the 1950s. Why? The medium was richer. Radio receded and continued to do what it did best - music. Even during the peak years of the celebrated comedies and soap operas, music was what people listened to most on the radio. Without a visual component, radio was inherently limited. But although it has diminished in relative importance to other media, radio remains popular and pervasive. A 1995 study reported that more than 95 percent of Americans over age 12 listen to radio at least once a week, a figure matched by no other medium (Levinson 1997). We may wonder whether the Internet will succeed in becoming a true multimedia medium. Although capacities for video and audio are being developed rapidly, it is clear that the Internet remains best equipped to handle print-like documents at present. Whether the Internet will be a rich enough medium to fend off future competitive technologies remains to be seen, but changes can occur quite rapidly under certain conditions. It is possible that rapid developments in video and audio quality could lead to a sudden demise of the discrete media of television, radio, and print, with which we are familiar. The Internet does have the potential to supplant any or all of these.

Education And Culture

Having run through the cycle of radio’s development, let us turn to certain specific issues, starting with education. When radio was first being promoted, it was touted as an enormous boon to education. Radios would broadcast lectures from the finest university professors. The common man would be able to learn from his living room what previous generations had to trek around the world at great expense to discover. Universities and colleges were in fact some of the earliest and most numerous of the radio broadcasters. They acquired licenses in order to broadcast educational programming. Some advocated the “wiring” of every school in the country in order to get a radio into every classroom. The University of Illinois had a sophisticated campus network of underground copper wire, so that programs could be recorded, broadcast, and received at multiple points around campus. But even with such a network, the administrative decision was made not to put lectures and classes on the air (Douglas 1987). Some suggested that directors of radio stations should be granted faculty status. There was obviously a degree of overpromotion and unrealistic expectations in these early efforts. Demand for educational radio programs was far outstripped by the charming entertainments of the broadcasting networks. Radios in the classroom had little practical value. The idea of radio as an educational tool in the traditional sense fizzled out (Siepmann 1950). Eventually educational programming such as NBC’s University of the Air succumbed to commercial pressures as well (Barnouw 1966).

But another look reveals that radio did have profound effects that were part educational and part cultural. While some credited radio for having introduced the corrupt values of New York and Hollywood to small towns across the country, others celebrated the radio as an electronic hearth that bound families together, giving the footloose youth of the roaring 20s a reason to cool their heels at home with their parents. More importantly, the radio tended to homogenize the culture, reporting the same tastes and standards across the country. Some broadcasters and intellectuals hailed the radio as a means for creating moral and political consensus and ending individual isolation (Douglas 1987). It hastened the decay of regional dialects by authorizing and broadcasting a standard style of speech. It also undoubtedly brought information more quickly and directly to households across the nation, helping to sensitize the country to national and international issues. Others point to these
homogenizing factors and the ability of the one to din its voice into the many as a cause of the rise of fascism in Europe. Certainly, the political leaders of all nations of the time were ones who were able to use the radio effectively. The majority of listeners with high school education or less reported that the radio was their primary source of news. While the average radio listener may not have picked up any classical Greek over the radio, he was almost certainly more well informed about current events than he would have been otherwise (Bureau of Applied Social Research 1976).

It would be foolish to presume that the Internet's educational potential will “fizzle out” in the same way that radio's has, but it is important to recognize that the uses to which the Internet is put depend as much on the user's favorite uses for the medium as it does on any imposed “plan” for use. If the medium of the Internet proves in practice to be a good learning environment that can be adopted in educational settings, it will be. If not, it may not have "educational" effects in a strict academic sense, but it will certainly affect people’s thought patterns and the information on which they base their decisions. The nontraditional uses of the Internet can be as significant, if not more so, than uses that fit our expectations, for these will be genuinely new uses that open up potential for people who had hitherto found their needs unmet by existing communication methods.

The use of the means of communication can also differ among different segments of society. A study conducted in 1935 found that 90% of households earning $10,000 or more ($117,518 in 1997 dollars) had radios, while 52% of households with incomes under $1,000 ($11,752 in 1997) had them. 93% of city dwellers had radios, while only 34% of rural households had them. Although these figures reflect a pattern of human communication" (Levinson 1997). It presented the listener with a simple human voice, usually only one at a time. While it is difficult to improve

**Types Of Use and User Acceptance**

In fact, the homogenization discussed earlier came partly from the structure of radio itself. It was a true mass medium. Only a few programs were on at any given hour. Each of those shows had to seek a broad audience in order to maximize its ratings and advertising revenue. The programming was therefore designed to appeal at the broadest level. Minority and special interest viewpoints were not often heard. Today greater segmentation is possible due to radio's shrinking portion of the media pie. Although the networks' public service commitment led them to present balanced and alternative viewpoints on major issues, a program of interest only to a minority had a slight chance of airing. In terms of music, radio stations most commonly played what was derisively called "potted-palm" music, of a mellow and inoffensive type. In the 20s, jazz was in its heyday, and blacks lined up around the block to buy jazz records, making them bestsellers. But radio played very little jazz (Barnouw 1966). It was impossible to broadcast something that 10% of the people might be passionate about, but would upset the other 90%. In this respect, the Internet may be least likely to follow in radio's footsteps. The Internet makes content variation and customization much easier and cheaper than almost any media before it. When more choices are available, it is more important to produce content that closely matches the user's preferences than to try to produce inoffensive, average content.

The influence and importance of any medium depends on the level of its acceptance by the user. The user's acceptance is in turn influenced by many structural factors, such as the ease-of-use of the medium, its cost, and the amount and quality of the material available over it. Radio presents a case of rapid user acceptance and satisfaction. Why was it a success? The users, led by pioneering amateurs, were eager for the technology. The radio industry improved content over its networks by offering the best of the nation's talent, while at the same time lowering the costs of equipment. The broadcasters policed the taste and quality of programming to the satisfaction of the public. At the same time, radio lost ground quickly when a richer medium, television, was developed. Despite years of popularity, it was unable to maintain its dominant position among media, while it held on to its natural area of advantage, music.

To understand the Internet, we can look at the case of radio to see what must happen for individuals to accept and use the Internet as a major media source. It must be easy-to-use and cheap. This condition holds true if you are already the owner of a computer and a phone line, but this is still far from universal. It must present content that users find either useful or entertaining, and must not be viewed as offensive (e.g., offensive material may be present, but users who do not want it should not find themselves or their children stumbling over it frequently). It should have a human scale. Radio “literally spoke to, a basic pattern of human communication” (Levinson 1997). It presented the listener with a simple human voice, usually only one at a time. While it is difficult to improve...
on radio in that respect, it should be possible to go anywhere in the world via the net without feeling that one is in a crowded room with one billion people. Whether using e-mail or listservs, or the World Wide Web, the specter of information overload is always present. Methods of managing this information flow must be devised. Also, the Internet should respect its media limits. AM radio stations tend to play less music than FM stations. Movies are unlikely to be distributed over the Internet unless significant improvements in video quality and capacity occur. Technical constraints may also prevent real-time multimedia interactive communication via the Internet from gaining wide acceptance. While the Internet may play a large role in distance education, we should not expect existing educational structures to collapse.

Finally, we must not discount the possibility of the unexpected. It was not foreseen that radio's greatest potential lay in broadcasting to mass audiences. And the effects of radio programming on the culture were also surprising. Just as radio helped shape and change our culture, we will inevitably find ourselves changed by the Internet. But only the interaction of its users can determine what this change will be.

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