History of Communications Media

Class 6

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What We Will Cover Today

- Radio
  - Origins
  - The Emergence of Broadcasting
  - The Rise of the Networks
  - Programming
  - The Impact of Television
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- Phonograph
  - Origins
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Origins of Radio

- James Clerk Maxwell's theory had predicted the existence of electromagnetic waves that traveled through space at the speed of light
  - Predicted that these waves could be generated by electrical oscillations
  - Predicted that they could be detected
- Heinrich Hertz in 1886 devised an experiment to detect such waves.

Hertz - Heinrich Hertz (1857-1894) deduced from James Clerk Maxwell's theory that electromagnetic waves, generated by a changing or oscillating electric current, traveled through space with the same velocity as light. This suggested an experiment.

He connected two ends of a coil of wire to the opposite sides of a small gap and then shot a high-voltage spark across the gap. Hertz found that as the spark jumped the gap, a much smaller spark flowed between two other wires, similarly configured, on the other side of the room.

Origins of Radio - 2

- Hertz' experiments showed that the waves:
  - Conformed to Maxwell's theory
  - Had many of the same properties as light except that the wave lengths were much longer than those of light – several meters as opposed to fractions of a millimeter.

Origins of Radio - 3

- Edouard Branly & Oliver Lodge perfected a coherer
- Alexander Popov used a coherer attached to a vertical wire to detect thunderstorms in advance
- William Crookes published an article on electricity which noted the possibility of using "electrical rays" for "transmitting and receiving intelligence"

Branly Coherer – Branly discovered that loose metal filings in a glass tube (which normally have very high electrical resistance) would lose their resistance in the presence of electrical oscillations, cohering and thereby becoming a conductor. As the resistance fell sharply, a coherer in a circuit containing a battery and an electrical bell served as an effective detector of Hertzian waves. The vibration of the bell set the instrument for the next signal. Lodge added wires at each end that allowed each successive impulse to produce coherence and de-coherence. This both amplified telegraph signals and allowed a recording device attached to one of the wires to receive telegraphic messages, taking the place of a telegraph key.

Popov – Popov was the first to see that the detection of radio waves could have a practical use.

Crookes – In 1892, physicist William Crookes wrote an article, "Some Possibilities of Electricity," that appeared in the *Fortnightly Review* in which he wrote:

"Here is unfolded to us a new and astonishing world — one which it is hard to conceive should contain no possibilities of transmitting and receiving intelligence. . . . What therefore, remains to be discovered is — firstly, simpler and more certain means of generating electrical rays of any desired wavelength . . . secondly, more delicate receivers which will respond to wavelengths between certain defined limits and be silent to all others; thirdly, means of darting the sheaf of rays in any de-sired direction. . . . This is no mere dream of a visionary philosopher. All the requisites needed to bring it within the grasp of daily life are well within the possibilities of discovery."

Origins of Radio - 4

- Guglielmo Marconi had attended lectures on Maxwell's theory and read an account of Hertz's experiments
  - Read Crookes article
  - Attended Augusto Righi's lectures at Bologna University on Maxwell's theory and Hertz's experiments
  - Read Oliver Lodge's article on Hertz's experiments and Branly's coherer

Sources of Marconi's Idea - Although much work was being done on Hertzian waves, it was in physics and not technology. Guglielmo Marconi (1874-1937) had attended Augusto Righi's lectures at Bologna University on Maxwell's theory and on Hertz's experiments; and he had read Oliver Lodge's London lecture on Hertz's experiments. He could, he said later, hardly credit that the great men of science had not already seen the practical possibilities of Hertzian waves; but, as Lodge later confessed, they had not. ***Marconi, in short, was the typical outsider who, having no prior connection with an art or technology, revolutionizes it.***

Marconi's radio - After Hertz's death in 1894, Marconi replicated Hertz's experiment and then added to the smaller spark gap a Branly coherer, attached the Branly coherer to a battery, and the battery to a Morse printer. Here in primitive form was a wireless telegraph, set to record messages in the dots and dashes of Morse code that were beamed electronically from a transmitter across the ether to a receiver.

What Marconi Accomplished - 1

- Realized that Hertzian or radio waves had a practical use – they could be used to send and receive messages
- Devised a practical wireless telegraphy transmitter and receiver
- Visualized a market for the device
  - Navies and shipping companies that wanted to be able to communicate with their ships at sea

What Marconi Accomplished - 2

- Gradually improved his invention over time
  - In 1901, he actually transmitted a message from Cornwall in England to Newfoundland
    - This led to the discovery of the ionosphere since what Marconi accomplished was theoretically impossible if radio waves like light followed lines of sight.
- Established the Marconi Company which
  - Leased wireless sets to hundreds of naval and commercial vessels
  - Set up land stations worldwide to communicate messages to ships at sea

Wireless Telephony

- After Marconi created wireless telegraphy, scientists worked on wireless telephony
- Wireless telephony required overcoming various obstacles
  - Tuning of transmitters and receivers so that they stayed on one frequency
  - Generation of uniform high-frequency electrical waves
  - Modulating electrical waves in accordance with sound waves
  - Linking of wire and wireless telephones by means of suitable relays

Marconi's "wireless telegraphy" system involved the transmission of Morse Code. Wireless telephony involved the transmission of speech without wires.

Tuning – Early transmitted radio signals generally drifted in a band around the desired transmission frequency as did the tuning mechanism. While imperfect tuning was a problem for wireless telegraphy, it was even more of a problem for wireless telephony since it would introduce static into the transmission and interfere with transmitters on nearby frequencies. The military was particularly concerned since they wanted transmitters that could communicate messages with one receiver to the exclusion of others and vice versa.

Uniform waves - Telegraphy, whether wire or wireless, involved the transmission of pulses of electric current. Wireless telephony required the generation of uniform high-frequency radio waves that were sufficiently continuous to generate the upper harmonics of human speech.

Modulation – This involved creating a technology that could make the radio waves carry the exact amplitude and frequency of the human voice (which will vary from speaker to speaker and by the same speaker when speaking different phonemes and using different voice intonations – such as whispering or shouting). The two technologies were first amplitude modulation (AM) and later frequency modulation (FM).

Reginald Fessenden

- Fessenden and Ernst Alexanderson of GE developed a high-frequency alternator that allowed continuous wave transmission
  - This made possible voice and music radio transmission
- On December 24, 1906, Fessenden began transmitting voice and music from his experimental radio station in Plymouth MA.

Reginald Fessenden, a Canadian electrical engineer who had worked for Edison and later taught electrical engineering at the University of Pittsburgh, realized that if wireless telegraphy was possible, so was wireless telephony -- the transmission of voice and sound via electromagnetic waves. In 1901, Fessenden designed a heterodyne receiver which could convert high-frequency waves produced by a spark gap into low-frequency waves -- the kind that could make diaphragms resonate in telephones. By 1902, Fessenden developed a high-speed spark transmitter, called an *alternator*, that could generate almost continuous waves [while Morse code could make use of intermittent waves, voice transmission required continuous waves]. Fessenden convinced General Electric to build an alternator powerful enough to generate a continuous wave. By 1906, GE had created a 100,000 cycle alternator, powerful enough for Fessenden to transmit a Christmas Eve broadcast from his experimental radio station in Plymouth MA. Spurred by this success and by the possibility of transmitting intelligible sound, GE had by 1914 built alternators that could transmit voice sound across thousands of miles.

Lee De Forest

- Invented the audion tube, which permitted the detection and amplification of radio signals and sound
- Started radio broadcasting of lectures and phonograph music by 1910
  - On January 12, 1910, he broadcast part of a live performance of *Tosca* and, the next day, a performance of the Italian tenor Enrico Caruso from the stage of the Metropolitan Opera House in New York City
- Invented the Phonofilm sound-on-film method of recording talking pictures

Audion tube – The Audion is a vacuum tube that takes relatively weak electrical signals and amplifies them. The vacuum tube helped to usher in the widespread use of electronics.
De Forest's innovation was the insertion of a third electrode, the grid, in between the cathode (filament) and the anode (plate) of the previously invented diode. The resulting triode or three-electrode vacuum tube could be used as an amplifier for electrical signals, notably for radio reception. The Audion could also act as a fast (for its time) electronic switching element, later applicable in digital electronics (such as computers). The triode was vital in the development of long-distance (e.g. transcontinental) telephone communications, radio, and radar.

Phonofilm – This process recorded sound on film in the form of variable area electrical waveforms from a microphone, which were translated back into sound waves when the movie was projected. This system, which synchronized sound directly onto film, was used to record stage performances (such as in vaudeville), speeches, and musical acts. In November 1922, De Forest established his De Forest Phonofilm Company but none of the Hollywood movie studios expressed any interest in his invention. Shortly before the Phonofilm Company filed for bankruptcy in September 1926, Warner Brothers introduced a sound-on-disc process called Vitaphone, with the John Barrymore film *Don Juan*, released 6 August In 1927, producer William Fox introduced sound-on-film Fox Movietone with the film *Sunrise* by F. W. Murnau, and in 1928, the sound-on-film process RCA Photophone was adopted by the newly created studio RKO Radio Pictures and by Paramount Pictures.

Effects of World War I

- Led to a government shutdown of non-governmental radio transmitting
- Sparked a huge demand for both wireless equipment and trained radio operators
  - Trained thousands of radio operators and familiarized them with the latest developments in radio technology
  - Led many of these new radio operators to become postwar amateur radio operators or hams.
  - Wartime desire to intercept German radio communications inspired Edwin Armstrong in 1918 to invent the superheterodyne circuit
- Laid the groundwork for the 1920s boom in radio and radio broadcasting

Demand for radio equipment and operators - World War I sparked a huge demand for wireless equipment -- millions of vacuum tubes, thousands of transmitters, large numbers of receivers and head phones. These demands were met by General Electric, Westinghouse, and Western Electric (the manufacturing subsidiary of AT&T). Also, thousands were trained as radio operators. In January 1917, there were 970 Navy radiomen; on November 11, 1918, there were 6,700.

Superheterodyne circuit – The circuit was an effective tuning device for electromagnetic signals that remains to this day the central element in radio and television transmission at precise and differentiated frequencies. Prior to Armstrong's invention, each radio transmission covered a range of frequencies, thus hogging spectrum space and interfering with

Frank Conrad

- Conrad was an amateur radio operator who was head of Westinghouse's radio operations
  - Regularly broadcast music from his home radio station
  - On September 20, 1920, the Joseph Horne Department Store ran an ad saying that their radios could receive Conrad's transmissions
- The ad triggered an epiphany in Westinghouse VP Harry Davis
  - Radio was a broadcast medium
  - There was money to be made in selling receiving sets

When Harry P. Davis, a Westinghouse vice-president, saw the ad, he suddenly grasped that the company's concep-tion of the wireless market had been much too limited in scope. He realized that "the efforts that were then being made to develop radio telephony as a confidential means of communication were wrong, and that instead its field was really one of wide publicity, in fact, the only means of instantaneous communication ever devised." He now com-prehended that the amateurs did not represent a discrete market limited to technically inclined boys and men; rather, the amateurs were simply the forerunners of a much larger market for radio receivers. As Davis later remarked, "Here was an idea of limitless opportunity."

Radio Broadcasting

- Davis got Conrad to build a radio station at Westinghouse – KDKA – to transmit the 1920 election returns.
- Result – A splurge of radio broadcasting
- One broadcast that helped fuel the radio surge was the broadcast of the Dempsey-Carpentier heavyweight championship fight on July 2, 1921

Davis urged that Westinghouse authorize Conrad to build a more powerful transmitting station at the Westinghouse plant and that Conrad broadcast on an even more regular basis. These broadcasts, according to Davis's plan, would stimulate sales of radio receivers, and the profits from the sales would defray the cost of the station. Davis wanted the station completed by November 2, so Conrad could broadcast the presi-dential election returns. At 8:00 P.M. on November 2, 1920, the newly licensed station KDKA, operating at 360 meters, broadcast the election results. Amateurs listened enthusiastically, sometimes rigging up loud-speakers so friends and family members could listen, as well. To ensure that the broadcast had the right effect, both within and outside of the company, Davis provided Westinghouse officers with receiving sets, and also helped arrange for local department stores to have their radios tuned to Conrad's station. Newspapers in Pittsburgh and elsewhere took note of the event, but most newspapers and magazines ignored the broadcast. News of it was spread most rapidly and enthusiastically by word of mouth among amateurs and their families and friends. Over the next year and a half, the "broadcasting boom" swept the United States, beginning in the Northeast and moving south and west, reaching unprecedented levels of intensity by the spring of 1922. By the end of 1922, 572 broadcasting licenses had been issued.

Radio Sets

- 1920 – Most radios were homemade crystal sets with earphones
- 1922 – RCA Radiola
  - 6 tubes, amplifiers, and a superheterodyne tuner that required no external antenna and
  - Was simple to operate, but required a battery
- 1928 – Console radio
  - Had a large wooden cabinet with plug-in circuitry and loudspeakers that was sold as furniture
- 1928 – First car radio
- 1930 – Relatively inexpensive table model radios

RCA Radiola

Console Radio

Table Model Radio

radi02s www.fotosearch.com

Early Radio Programming

- Music – both live performances and phonograph recordings – dominated programming
- Other programming consisted of
  - Election returns, political party conventions, and major sports events
  - Lectures, dramatic readings, and church services
- No regular news coverage
  - Newspapers refused to make wire service reports available to radio stations for broadcasting

From the outset, music filled much of radio's available broadcast time. Live performances of the parlor piano and vocal music of re-cent decades were most common at first, but classical music, espe-cially opera and orchestral performances, enjoyed frequent broadcast. While many Americans had joined in or at least heard the more popular music at home, in saloons and vaudeville theaters, or elsewhere, few had attended an opera or symphony concert. The au-dience that heard classical music with the low sound quality of early radio was soon eager for live performance. Between 1928 and 1939 the number of major professional symphony orchestras increased from 10 to 17; the total number of orchestras, including part-time less professional ones in smaller cities, grew from 60 to 286. Perhaps !! more significant, whereas musical instruction in public schools was almost unheard of in 1920, two decades later it was widespread. Thirty thousand school orchestras and 20,000 bands had sprung up. Radio was much more effective than the earlier technological in-novation, the phonograph, in building an audience for classical mu-sic. Until the long-playing record was developed in 1948, phonograph records could hold only about five minutes of music per side, creating difficulties in the presentation of all but the shortest classical works. Furthermore, by 1924 superheterodyne radios were producing better-quality sound than phonographs. Radio therefore I took the lead in presenting classical music. The phonograph indus-try went into a radio-induced slump that lasted through the 1930s. Radio also promoted the popularity of other forms of music. Both jazz and country music reached beyond the audiences they had known and evolved significantly as a result. Music that could be and often had been performed at home in the parlor included sentimen-tal songs, ballads, vaudeville and musical comedy tunes, and less-challenging operatic pieces. Such parlor music was familiar, traditional, and remained widely enjoyed by early radio audiences. The limitations of radio, however, reshaped this sort of music. Intense voices, especially high sopranos, had a tendency to blow out the tubes on radio transmitters. As a result, a number of singers developed a new soft, gentle style that came across well and soon became known as "crooning." Female singers such as Vaughn De Leath and Kate Smith as well as males such as Rudy Vallee and Bing Crosby built large and loyal audiences as they perfected the "croon-ing" style.

Notes on Programming - 1

- Initially limited to the evening hours
- By the late-1920s, broadcasters realized that the right daytime programming might attract housewives
  - Result: serial romantic dramas, such as “Ma Perkins” and “The Romance of Helen Trent”
    - Termed soap operas because these programs were most often sponsored by laundry soap manufacturers

A Note on Sports Broadcasting

- The uncertainties of early radio required radio announcers who could fill airtime with a gift of gab if something went wrong
- Since many radio announcers lacked an athletic background, two or more announcers often teamed up to report a game
  - One described the play-by-play action and the other provided analysis, information on players, and 'color'.
  - With football, there was three announcers – one for play-by-play description, one for color, and a spotter to identify the large and constantly shifting cast of players on the field.

One early sports broadcaster was Ronald Reagan who broadcast baseball games by reading off the sports telegraph ticker and creating the impression he was broadcasting from the game. One time, he was broadcasting a baseball game when the sports ticker got interrupted. Reagan had the batter foul off pitch after pitch until the ticker resumed.

Characteristics of Broadcast Radio

- In the 1920s, radio took on many of the characteristics that marked radio and later television during their heydays
  - Bandwidth & wattage allocations that favored well-heeled stations
  - Commercial advertising as a source of radio station revenue
  - Networks that provided programming to individual stations

Bandwidth - A major initial choice facing the FRC at its inception was the design of the spectrum -- how to divide the bandwidth allotted to broadcasting among different kinds of channels. Since broadcast channels needed to be 10 kHz apart, this meant that 96 channels could fit on the broadcasting band. Six of these were set aside for Canada. The number of stations that the remaining 90 channels could support depended on the location and power levels of broadcast transmitters. At a high power, only one station could occupy a channel; at moderate power, there could be several regional stations at the same frequency spread around the country; and at the lowest power level, many dispersed local stations could use the same wavelength. Thus, the greater the number of high-power or clear channels, the less the number of regional and local stations. Because clear channel stations required more expensive transmitting equipment, the interest in clear channels was greatest among the well-financed commercial broadcasters. !! Convincing the FRC to set aside clear channels was a high priority for the emerging national radio networks. Non-profit broadcasters, in contrast, preferred more affordable local stations. Since clear channels could reach rural listeners who otherwise might lack access to radio and also provide better reception for people with cheaper radios, there was a strong argument for clear channels

Commercial advertising & networks - Before 1927, stations were able to operate on minimal budgets. In 1925, the average station was on the air only five hours per week, most broadcasters operated at low frequency, and programming was inexpensive since many performers appeared for free and many stations paid no royalties to composers. By the late-1920s, regulatory and competitive pressures had sharply increased costs as stations moved to higher power levels, stricter engineering standards, and 17-hour daily broadcast schedules together with higher programming costs as listening audiences demanded higher quality programs and composers/musicians demanded payment of royalties. Without a license fee or tax support to bear its mounting cost, American radio was certain to be dominated by commercial broadcasters, and these broadcasters were bound to turn to networks to control programming costs and advertising to provide revenue,

Networks

- The 1920s and early-1930s saw the emergence of four networks – NBC Red (1926), NBC Blue (1928), CBS (1927), & Mutual (1934)
  - In 1943, NBC-Blue was sold off and became ABC
- Networks provided programming to the affiliated local stations
  - Programming was produced by the networks, individual sponsors, and increasingly over time by advertising agencies.
  - Networks gave advertisers access to a large national audience

Networks gave advertisers of brand-name consumer products efficient access to a large national audience, and out of their advertising revenue they provided stations with a dependable stream of income to run the programs the advertisers sponsored. Networks also gave their affiliates a competitive advantage by supplying popular and high-quality programs at low or zero cost that unaffiliated stations in their local markets found it difficult to match. Networks had an economic logic, based on the relatively high cost of producing content (programming) compared to the costs of transmission and reproduction. The additional role of connecting national advertising and national audiences gave the networks an unbreakable hold on broadcasting. With advertisers came increasingly influential ad agencies. Although the agencies started out by preparing copy for the radio advertisements and negotiating with stations on behalf of sponsors, they quickly assumed the central role in program production. Increasingly, the agencies came up with the ideas for programs, wrote the scripts, hired the performers, found sponsors, and presented shows to the networks as a complete package. By 1929, advertising agencies were producing 33 percent of programs; individual sponsors, another 20 percent; the networks, 28 percent; and special program builders, 19 percent. !! Within a few years, the agencies took over virtually all but the sustaining programs the networks produced for use during unsold airtime.

Notes on Programming - 2

- By the early 1930s, morning programming focused on weather reports, recorded music, and talk a la "Don McNeill's Breakfast Club"
- By 1930, evening programming focused on the radio genres with mass appeal
  - Domestic sitcoms
  - Crime, mystery, & detective shows
  - Comedy/Variety shows
  - Radio versions of plays and movies

Domestic sitcoms – These combined comedy and drama, often in the form of a husband-and-wife sitcom. This genre included *Vic and Sade, The Aldrich Family, Fibber McGee and Molly, The Life of Riley, the Bickersons, The Great Gildersleeve,* and *The George Burns and Gracie Allen Show*

Crime-mystery-detective shows – These included *Mr. District Attorney; Mr. Keen, Tracer of Lost Persons; The Shadow; The Fat Man; The FBI in Peace and War; Candy Matson; Yours Truly, Johnny Dollar; The Adventures of Philip Marlowe; Richard Diamond*; and *The Adventures of Ellery Queen*

Comedy/Variety shows - comedy/variety shows included *The Jack Benny Program, The Edgar Bergen and Charlie McCarthy Show, Burns and Allen, The Fred Allen Show, The Bing Crosby Show,* and *The Bob Hope Show*

Radio Versions of Plays & Movies – Radio versions of films were done by *The Lux Radio Theater.* Radio versions of plays and novels were done by Orson Welles' *Mercury Theater of the Air*, and *The Hollywood Playhouse.*

Notes on Programming - 3

- By the late 1930s, most of the programs that would occupy the top broadcast ratings slots until television (i.e. the next ten years) had made their debut on the air.
- Only in the mid-1930s did radio networks begin to broadcast regular news programs
  - Prior to that, radio lacked the resources and incentive to gather news on its own
  - Rising international tensions made news programs popular
    - What Saddam Hussein did for CNN during the Gulf War, Adolf Hitler did for NBC and CBS News

Radio Penetration

- Radio quickly penetrated the American market
  - 1927 – 25% of all American households had a radio
  - 1929 - 1/3rd owned a radio
  - 1934 - 60% of all homes had a radio;
  - 1939 - 86% of all households owned at least one set. There were also 6.5 million radios in automobiles.

Notes About the Radio Medium - 1

- With radio, the speaker addressed an audience that was invisible and unknown
- Radio allowed millions to hear the same program at the same time
  - It provided a speaker with an audience that dwarfed any audience that could fit in an auditorium or theater
  - Along with the phonograph, it gave any song, symphony, or opera more listeners than any theater or symphony hall

Audience – With radio, the audience was invisible and unknown. The speaker or performer could not see facial responses or hear laughter, booing, or silence; nor was there applause. At the same time that the size of the speaker's audience had multiplied beyond anyone's calculation, his visual relationship with that audience was severed

Notes About the Radio Medium - 2

- Radio leads people to create images in their mind to provide a picture background for the actions and dialog that they are hearing in the broadcast
- Radio is a medium that allows people to do other things while they are listening
- Radio fostered the creation of “imagined communities” of people who never met but of which we were a part – E.g. sports fans, Fred Allen fans, rock 'n' rollers, ham operators, Dittoheads

Radio imagery - There are compelling physiological reasons why people are so nostalgic for radio. “People loved radio -- and still do -- because as cognitive psychologists have shown, humans find it useful -- in fact, highly pleasurable -- to use our brains to create our own images. What we call our imagination is something the brain likes to feed by generating images almost constantly: that’s what imagination is, the internal production of pictures, of images. Autobiographical accounts from great conceptual scientists like Michael Faraday, James Clerk Maxwell, or Albert Einstein describe a process in which they did their most creative work using visual imagery, which was later translated into equations and theorems” Dr Mark Tramo, a Harvard Medical School neurobiologist, emphasizes that when information comes solely through our auditory system, our mental imaging systems have freewheeling authority to generate whatever visuals they want. Anyone who has camped out in the woods at night, associating different night noises, with all kinds of soothing and dangerous possibilities, knows the power of sound. When sound is our only source of information, our imaginations milk it for all it’s worth, creating detailed tableaux that images, of course, preempt.

Radio – a multi-tasking medium – With radio, you could do something else while listening, you didn’t have to watch and you didn’t have to concentrate, depending on what was on. Radio could adjust much more to physical circumstances -- cooking dinner, driving to work -- than any of the other media. We could ‘continue with our lives’ while listening. This meant that radio listening also became interwoven with the ritualized routines of everyday life -- reading the paper, eating meals.

Imagined communities – The concept of “imagined communities” derived from Benedict Anderson who asked how nationalism -- the notion of a country with a distinct identity, interests, and borders to which one belonged -- came to emerge so concretely by the end of the 18th century. He insisted that while political states had borders, leaders, and populations, nationality and nations are *imagined*, because most of the nation’s members will never actually meet another, ’yet in the mind of each lives the image of their communion’ -- a communion that transcends divisions based on class, race, and gender and which has both historical continuity and a future directed toward the realization of some larger, grander purpose. While Anderson saw nationally distributed newspapers and

Impact of TV on Radio - 1

- Before television, radio was a centralizing medium because of both its expense and its broadcasting nature
- After television, radio became:
  - A narrowcasting medium that appealed to specific niches of listeners through specific types of content – specific forms of music, all news, conservative talk shows, etc., and/or
  - Audio wallpaper that served as background while doing other things at home or in the car

Audio wallpaper - TV replaced radio as the box families gathered around in their living rooms. As a result of TV, radio adopted shorter programming formats and became the background music and chat while people ride in cars or do other things at home — "audio wallpaper," as Paul Saffo, a technology forecaster in Silicon Valley, puts it

Impact of TV on Radio - 2

- Radio networks broke down and local stations found themselves on their own
  - Rise of music format stations with disc jockeys
  - Later AM radio became dominated by all news and talk/call-in shows as music migrated to FM
- Decline of advertising on radio
  - From a high of $133 million in 1948, advertising time sales on network radio dropped to $35 million in 1960.

As radio waned as a national medium, networks broke down and local stations found themselves increasingly on their own. The rise of 'music format' radio made use of the newly 'discovered' FM band to encourage a new local approach to radio. As the disc jockey, previously featured in some local morning and late nighttime slots, slowly took over the entire radio schedule and network-distributed programs declined to virtually zero, in many cities a new 'black format' arose, pioneered in Chicago by Jack L. Cooper, and directed at black audiences. By 1948, Cooper was a successful radio entrepreneur with more than 40 hours of programs airing on four Chicago radio stations, grossing more than $185,000 annually.

FM Radio - 1

- In 1933, Edwin Armstrong patented Frequency Modulation radio
  - Superior to AM since it eliminated static, provided a wider range of sound, and used spectrum more efficiently
- FM did not take off until the late-1960s due largely to opposition from RCA
  - RCA saw FM as a rival to television for investment capital and available spectrum
  - FM threatened to undermine the position of NBC, an RCA subsidiary

Superiority of FM - FM sounds better than AM in part because it's in a portion of the spectrum less prone to natural interference, and because its channel width is 200 kilohertz -- twenty times the 10-kilohertz channel width of AM (of which only 5-kH actually contains information). Thus, FM has a rich sound modulation that AM simply can't achieve. FM, because it operates at higher frequencies than AM, is also slightly better at penetrating solids, like buildings.

Delayed takeoff of FM - There were two reasons for this. First, David Sarnoff, RCA president, saw television as the future and regarded FM as a rival for available spectrum as well as investment capital. Second, far from promising to improve RCA's profits, FM threatened to make many RCA patents obsolete and to undermine the position of its NBC subsidiary as the dominant radio network. Armstrong believed the long-delayed development of FM was the result of a conspiracy between big business and bureaucracy, but the chief reasons for FM's delayed success were the twin difficulties of introducing an alternative radio technology when AM was already well-entrenched and of obtaining spectrum and investment capital at the same time as television. *It was not really until the development of high-fidelity and later stereophonic music recording that FM began to come into its own since FM but not AM had the capability to broadcast high fidelity and stereophonic music.*

FM Radio - 2

- After the mid-1960s, FM radio took off. There were several reasons for this:
  - FM radio offered a more lucrative investment opportunity than network-dominated TV and the overcrowded AM band
  - The arrival of stereo and high fidelity
  - Increased advertising on FM as advertisers discovered the quality of its listening demographics
  - AM-FM radio sets become commonplace
  - An FCC decision in 1964 that AM and FM stations owned by the same company could not duplicate more than 50% of their programs on both bands simultaneously

Takeoff of FM - In 1964, total net FM revenues were $19.7 million. Ten years later, the figure was $248.2 million. In 1962, there were, according to the FCC, 983 commercial FM stations on the air; by 1972, their number rose to 2,328. By 1976, there were nearly 3,700 FM stations on the air. By the 1970s, it was estimated that 95% of households had FM sets. Soon, more people were listening to FM than to AM.

Reasons for FM's takeoff - There were several reasons for this mush-rooming of FM broadcasting: (1) a better chance of success for investors than in network-dominated television and the badly overcrowded AM field; (2) an increased interest in cultural affairs and classical music; (3) the arrival of stereo and the high-fidelity industry, coinciding with this interest in better music; (4) various FCC decisions that helped give FM a separate identity from AM, its longtime subsidizer; (5) the driving away of some of the audience by the poor programming of television and AM; (6) the increasing use of FM by advertisers as the quality and quantity of its audience became known; and (7) the growing sales of FM sets, from 2 million a year in 1960 to 21 million in 1968. By the 1970s combined AM-FM sets were commonplace.

Non-duplication - Since the late 1940s many FM outlets owned by AM stations simply broadcast the same programming their AM parents did. But by the early 1960s FCC Commissioners Robert E. Lee and Kenneth Cox argued that frequencies had become so scarce in the face of increasing demand that duplication was "a luxury we can't afford." In 1962 the FCC had ordered a freeze on AM license applications while it tried to address the overcrowding in the spectrum. The solution it chose was to promote more aggressive commercial exploitation of the FM band. In May of 1964 the commission issued its non-duplication ruling, which was to take effect in January 1967. In cities of more than 100,000 people, radio stations with both AM and FM could not duplicate more than 50 percent of their programming on both bands simultaneously. Although the edict affected only 337 of the country's 1,560 commercial FM stations (and of these, 137 had already been programming separately), it nonetheless helped promote much more enterprising exploitation of the medium. Between 1964 and 1967, 500 new commercial FM stations and 60 educational stations took to the air

Effects of Radio - 1

- By broadcasting the same content to a vast audience at the same time, radio created a shared simultaneity and unity of experience
  - This led to both a standardization of culture and also of speech
- It led people to focus on and know about what was happening at the national and international level as distinct from the local community level
  - Thanks to radio and later TV, we now have people who are well-informed about what is going on in Washington or in the Middle East, but who have no idea of who their local mayor or city council representative is

Standardization of Speech – Fully established networks and the advertisers who controlled much of the radio programming imposed standards of radio pronunciation. Diction contests set norms for announcers and listeners. Thus, announcers, newscasters, dramatic actors/actresses, and those who read the commercials spoke an 'official' English that was largely mid-Western in form.

Effects of Radio - 2

- Along with the movies, led to the rise of a popular entertainment industry geared to the mass market
  - Reduced traditional forms of high art to elite ghettos of the well-to-do and the highly educated
- Radio made music a more integral, structuring part of everyday life and individual identity.
  - Fostered an interest in classical music – especially live performance due to the poor sound quality of early radio
  - Fostered an interest in country/western music and jazz

Radio – Radio led to the rise of a revolutionary popular entertainment industry geared to the mass market which reduced traditional forms of high art to elite ghettoes inhabited by the well-to-do and the highly educated. Thus, the attendees of the theater and the opera, the visitors to the museums and the art galleries, and the readers of poetry and literary classics were increasingly among the educated elites while the common culture was based upon the mass entertainment industries -- cinema, radio, television, and pop music -- which the elite shared while the general public rarely encountered the traditional high arts
Music – Prior to the radio and the phonograph, people heard music only when in the presence of musicians. Now they could hear music whenever they wanted – by either putting a record on the phonograph, or tuning into the proper radio station. From the outset, music filled much of radio's available broadcast time. Live performances of the parlor piano and vocal music of recent decades were most common at first, but classical music, especially opera and orchestral performances, enjoyed frequent broadcast. While many Americans had joined in or at least heard the more popular music at home, in saloons and vaudeville theaters, or elsewhere, few had attended an opera or symphony concert. ***The audience that heard classical music with the low sound quality of early radio was soon eager for live performance. Between 1928 and 1939 the number of major professional symphony orchestras increased from 10 to 17; the total number of orchestras, including part-time less professional ones in smaller cities, grew from 60 to 286***. Perhaps !! more significant, whereas musical instruction in public schools was almost unheard of in 1920, two decades later it was widespread. Thirty thousand school orchestras and 20,000 bands had sprung up. Radio was much more effective than the earlier technological in-novation, the phonograph, in building an audience for classical music. Until the long-playing record was developed in 1948, phonograph records could hold only about five minutes of music per side, creating difficulties in the presentation of all but the shortest classical works. Furthermore, by 1924 superheterodyne radios were producing better-quality sound than phonographs. Radio therefore took the lead in

Effects of Radio - 3

- The concept of the audience led to the concept of the average American
  - This provoked an interest in ratings, audience demographics, and the tastes and attitudes of the presumed average America
    - What was the average American listening to? Or buying? Who was listening to *Our Miss Brooks* or *The Shadow*?
- Radio adversely affected the advertising revenues of newspapers and magazines

Audience - The object of this scrutiny—the audience—was itself an invention, a construction that corralled a nation of individual listeners into a sometimes monolithic group that somehow knew what "it" wanted from broadcasting. But the most important thing to remember is something we now take totally for granted: how the audience spent its leisure time was up for study and study, in fact, became a hugely profitable industry. Beginning in the 1920s and continuing to today, the corporate obsession with the tastes and preferences of the broadcast audience has produced a nationwide, technologically instantaneous network of audience surveillance. Audience ratings got their start when Archibald Crossley developed a ratings service that relied on telephoning people and asking them what they had listened to the night before

Print advertising – Advertisers preferred radio over print media for the following reasons:
1. Like graphics, but unlike the printed word, radio could influence illiterates
2. Unlike newspaper and magazine ads, radio commercials could not be skipped over.
3. “Not only could one listen to radio while engaged in other activities, including reading, one could continue to listen long after becoming too tired to do anything else.”
4. Unlike print communication, radio could be received by groups of people -- a family in a living room, friends riding in a car,
5. Because radio carried the human voice, broadcasting seemed more personal and more intimate than print, and thus was more persuasive than print.

Effects of Radio - 4

- The technical limitations of early radio:
  - Precluded use of very high or very low frequency musical instruments – cello, oboe, violin
  - Favored use of certain musical instruments - piano, clarinet, and saxophone
  - Led to the use of crooning as a singing technique
  - Favored jazz despite its frequent association with prohibition-era speakeasies and its black roots

Crooning - *The limitations of radio, however, reshaped music.* ***Intense voices, especially high sopranos, had a tendency to blow out the tubes on radio transmitters. As a result, a number of singers developed a new soft, gentle style that came across well and soon became known as "crooning" --*** singing in a gentle murmuring, soft, intimate manner that was adapted to the limitations of early amplifying systems.

Crooning was pioneered by Vaughn de Leith, "The First Lady of Radio' who performed frequently on WJZ in Newark in the early 1920s. De Leith developed a soft, cooing approach to her singing that was less stage oriented and more intimate, and that didn't do violence to transmitters.[14] This style was emulated with great success by other singers, most notably Rudy Vallee, Kate Smith, and Bing Crosby, who built large and loyal audiences as they perfected the 'crooning' style.

Effects of Radio - 5

- Radio and WWI led to code encryption and code breaking
- Radio paved the way for radar, TV, and cellular telephony
- Radio made music an acceptable endeavor for men
- Radio led people to match their personal schedules to the schedules of the broadcast day

Code encryption - Radio was an awkward instrument of war since radio messages could be heard by anyone listening in. This led governments to begin encrypting radio transmissions in code and subsequent attempts on the part of rival governments to break the codes. Thus, radio made code encryption and code breaking key elements of intelligence in war and peace.

Set the stage for TV - Radio is arguably the most important electronic invention of the century. Technically, culturally, and economically, it set the stage for television. Technically, television was, in the words of David Sarnoff, "radio with pictures." Once radio came on the scene, there emerged a strong desire on the part of engineers and networks to add moving picture to voice transmission. Finally, the networks, genres, many of the programs, and even the actors/actresses that emerged with radio carried over to TV.

Men and Music –In the Victorian era, music was normally the province of women, who as girls were taught how to play the piano, and, as a consequence, monopolized the local (as distinct from the professional) playing of music, thus identifying music as a feminine pursuit. Susan Douglas in *Listening . Radio and the American Imagination* noted that radio - by identifying music with technology and by producing a fraternal subculture of hams eager to feel a sense of connectedness to each other – made musical pleasure acceptable to men.

Leisure by the clock – What the workplace (with its getting to work on time), the railroad (with its time schedules), and World War I (with its need for synchronized action) began, the broadcast schedule completed. Now everyone, not just workers or train travelers, had to match their daily routines to the clock. Not only men but also women and children now began to wear wristwatches.

Effects of Radio - 6

- Revolutionized advertising
  - Radio enabled the advertiser to reach into the home
  - Radio helped create the celebrity product endorser
    - This promoted an ethic of consumption, by encouraging people to buy the product or service that a psychologically-significant person endorsed
  - Radio enabled sponsors to identify their products with certain lifestyles and demographic groups
    - E.g. the Lucky Strike campaign which popularized smoking by women
    - Sponsors often became identified with the programs they sponsored

Reach into the home - "Frank A. Arnold, director of development for the National Broadcasting Company, called broadcasting the "Fourth Dimension of Advertising," an addition to the three traditional advertising media of newspapers, magazines, and outdoor displays. Arnold elaborated the image of radio advertising as a sort of psychological burglar in the home. The fourth dimension allowed business men to invade psychic space previously unreachable.

"For years the national advertiser and his agency had been dreaming of the time to come when there would

be evolved some great family medium which should reach the home and the adult members of the family in

their moments of relaxa-tion, bringing to them the editorial and advertising message. . . . Then came radio

broadcasting, utilizing the very air we breathe, and with electricity as its vehicle entering the homes of the

nation through doors and windows, no matter how tightly barred, and delivering its message audibly through

the loud-speaker wherever placed. ... In the midst of the family circle, in moments of relaxation, the voice of

radio brings to the audience its program of entertainment or its

Effects of Radio - 7

- Revolutionized politics
  - Enabled politicians to go over the heads of both the press and the political party, thus weakening their relative power
  - Helped set the national agenda on significant issues and events
  - Created an 'imagined community' of like-minded listeners who could be politically mobilized

Disintermediation of local newspaper and political elites - Before radio, politicians on the national and large-state level wishing to get their messages across to the voting public had to rely either on the press, the political party, and/or the local party machine. States and nations were just too big for a politician to be able to speak to each voter individually. One reason FDR resorted to the radio was that 3/4th of the newspapers supported his Republican opponents.

Agenda setting – What was talked about on the radio was what the politicians, pundits, and newspapers talked about. What was not talked about was ignored.

Radio & imagined communities – Radio, even more than newspapers, created an 'imagined community' among listeners who could be constituted as such by the speaker's verbalization of the values, ideals, or grievances of his listeners. Aimee Semple McPherson, Billy Sunday, Adolf Hitler, FDR, Huey Long, Fr. Charles Coughlin, and Rush Limbaugh were all expert at using radio to create an 'imagined community' of listeners.

Phonograph

The Phonograph is an instrument for reproducing sounds (normally music) by means of the vibration of a stylus or needle following a spiral groove on a revolving disc or cylinder

Before the Phonograph

- Before the Phonograph, the piano
  - 1855 – The Steinway cast-iron frame piano
  - 1890s – Mass production and the upright made the piano generally affordable to the middle class
    - 1890 – 32,000 pianos produced
    - 1914 – 374,000 pianos produced
    - By 1920, about 25% of American homes had a piano
  - 1900s – Player piano

Steinway - In 1855, a German-born American piano maker named Henry Steinway began to manufacture a piano with a cast-iron frame that gave its sound much greater brilliance and power than earlier forms. There have been no fundamental changes in the design and construction of pianos since 1855. This improvement prompted widespread interest in pianos and musical compositions for it.

Mass production of pianos - By the 1890s, mass production and coming of the upright piano [*A piano having the strings mounted vertically in a rectangular case with the keyboard at a right angle to the case*], made the piano generally affordable to the middle class, so much so that c1900, there were an estimated one million pianos in use in American homes

Player piano - In 1896, Jacquard's concept of the punch card was applied to the piano to produce the player piano. Nearly every celebrated pianist of the time was recorded on the system Player pianos, which played music using perforated paper rolls to play specific songs were popular in the early-20th Century.

Invention of the Phonograph

- Edison invented the phonograph in 1877 because of concern that the high cost of telephones would limit their use
  - Edison had two concepts as to how the phonograph would be used
    - A person would record a spoken message and then take the record to a central station which it could be transmitted to an addressee over a telephone
    - A businessman would use it as either a dictating device to a secretary or as a device to record his phone conversations

Emile Berliner

- 1887 – Replaces the Edison wax cylinder with a flat disc (initially glass) & invents the gramophone to play it
  - Simplified both the recording and reproduction process
- Berliner saw the gramophone as a music player
  - He persuaded popular artists such as Enrico Caruso and Nellie Melba to record music on his system
  - Created the trademark of "His Master's Voice"
  - Licensed the Victor Talking Machine Company (later acquired by RCA) to use his patents and trademark
- 1906 – the Victor Talking Machine Company creates the Victrola – a phonograph that is also a piece of stylish furniture

Berliner - The first records were made of glass, later zinc, and eventually plastic. A spiral groove with sound information was etched into the flat record. The record was rotated on the gramophone. The "arm" of the gramophone held a needle that read the grooves in the record by vibration and transmitting the information to the gramophone speaker. Berliner's disks (records) were the first sound recordings that could be mass-produced by creating master recordings from which molds were made. From each mold, hundreds of disks were pressed. Berliner founded "The Gramophone Company" to mass manufacture his sound disks (records) and the gramophone that played them. To help promote his gramophone system Berliner did two things, he persuaded popular artists to record their music using his system. Two famous artists who signed early on with Berliner's company were Enrico Caruso and Dame Nellie Melba. The second smart marketing move Berliner made came in 1908, when he used Francis Barraud's painting of 'His Master's Voice' as his company's official trademark. Eventually, Emile Berliner sold the licensing rights to his patent for the gramophone and method of making records to the Victor Talking Machine Company (RCA) who made the gramophone a successful

The Victrola

Phonograph Timeline - 1

- Mid-1890s - An Edison subsidiary developed phonographs for public nickel-in-the-slot operations that played musical selections. Such prototype jukeboxes were soon installed in neighborhood soda fountains and saloons
- Mid-1920s – Electrical recording using microphones and acetate records replaces acoustic recording
- Radio initially has a depressing impact on phonograph sales but later serves to popularize records sales
  - Quality of radio music was superior to that of phonograph music
  - 78 rpm records could contain only 4 minutes of music

Acoustic recording - Until the mid-1920s, when electrical recording, which used microphones and acetate masters, became the standard, recording was done by the 'acoustic' method. Performers sang or played into a tin horn connected to a hose, which was in turn connected to a needle. The needle turned these sonic impulses into grooves on a wax disk. The process turned high and low notes into noise, and percussive sounds from drums, pianos, or musicians tapping their feet knocked the needle off the wax.

Radio - Radio stations, of course, had started out in the 1920s by relying heavily on phonograph music, but that had changed with the rise of the networks, which showcased live music, largely to avoid copyright infringement suits from composers and record companies. The crash of 1929 nearly destroyed the phonograph industry as people turned to radio as their main source of music. But by the late 1930s a renewed symbiotic relationship began between the two industries, especially when the country's 162 non-network stations (almost one-quarter of all AM stations in the country) were exempted from the deal struck between the American Federation of Musicians and the networks that restricted the use of mechanically reproduced music on the air. These smaller stations became outlets

Phonograph Timeline - 2

- 1948 - The 33-1/3 long-playing record (LP) and 45-rpm single were introduced
  - Unlike the earlier 78 format, these were vinyl rather than glass or metal coated with shellac
  - This paved the way for both high fidelity recordings and
- 1950s – High Fidelity recordings
  - Created the audiophile
- 1958 - The first stereophonic phonograph discs made available to the general public in 1958.
- 1961 - The FCC announces stereo FM technical standards

Phonograph Timeline - 3

- 1961 - Licensed regular stereophonic FM radio broadcasting begins
- 1960s – Dolby stereo recording
- 1963 – Introduction of the audio cassette
- 1971 – Quadraphonic sound
  - Led the way to the surround sound systems of today
- 1982 – Dolby surround sound
- 1985 – "Yellow Book" standard for CD-ROMs published
  - Meant that CD-ROMs could hold either music or data

Audio cassette - Between the early 1970s and late 1990s, the cassette was one of the two most common formats for prerecorded music, first alongside the LP and later the Compact Disc.[2] *Cassette* is a French word meaning "little box." Compact Cassettes consist of two miniature spools, between which a magnetically coated plastic tape is passed and wound. These spools and their attendant parts are held inside a protective plastic shell. Two stereo pairs of tracks (four total) or two monaural audio tracks are available on the tape; one stereo pair or one monophonic track is played or recorded when the tape is moving in one direction and the second pair when moving in the other direction. This reversal is achieved either by manually flipping the cassette or by having the machine itself change the direction of tape movement ("auto-reverse").[3]

Quadraphonic sound - The development of quadraphonic records was announced in 1971. These recorded four separate sound signals. This was achieved on the two stereo channels by electronic *matrixing*, where the additional channels were combined into the main signal. When the records were played, phase-detection circuits in the amplifiers were able to decode the signals into four separate channels. There were two main systems of matrixed quadrophonic records produced, confusingly named SQ (by CBS) and QS (by Sansui). They proved commercially unsuccessful, but were an important precursor to later 'surround sound' systems, as seen in

Impact of the Phonograph - 1

- Along with radio, made music an major part of people's lives
  - Before the phonograph (and radio), hearing music required the presence of musicians, singers, or a player piano
  - Made listening to music a passive experience
- Provided much of the broadcasting content for both early radio and current FM radio
  - Fostered the development of FM radio

Impact of the Phonograph - 2

- Gave rise to the juke-box (and the teenage hangout)
- Fostered the development of portable music media
  - The record gave way to the 8-track, then the audio cassette, and finally the CD-ROM and iPod.
- Provided through the sale of records (and related media) a major source of income for musicians, singers, opera companies, choruses, and others involved with music

Impact of the Phonograph - 3

- In the form of the audio cassette and its related player-recorder
  - It gave Third World peoples a relatively cheap and easy technology by which they could make audiotapes of whatever they wanted to hear -- their native music, stories, myths, chants, prayers, sermons, and speeches. Their impact has frequently been revolutionary.
  - It permitted the survival and even the renaissance of many forms of local music and stories that were in danger of dying out
  - It facilitated the cross-cultural dissemination of musical forms and styles

Third World effects - "The Islamic revolution of Iran in 1978 and 1979 was probably the first revolution of the world conducted primarily through the cassette recorder. For many years before the revolution, the Ayatollah Khomeini and other exiled religious leaders recorded sermons of revolution in Paris and then distributed them throughout Iran. Each tape player is also a recorder, so that each owner can make new copies as well as play the old ones. In this way the anti-Shah and anti-Western message of the cassette spread throughout Iran from one backwater village to another. Even those beyond the reach of the government-controlled radio found easy access to the ideas of the Ayatollah in France."