"Even in an age of wonders": Radio as an information resource in 1920s America

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Abstract

Purpose
The development of broadcast radio in the USA during the 1920s is analysed, focusing on the legislative and regulatory background, considering the broadcasting spectrum, programme content, and nature of radio as an information resource at that time.

Design/methodology/approach
Analysis of primary materials, and of recent secondary materials, is carried out.

Findings
The legislative and regulatory framework failed to take note of the unique attributes of information resources, and attempted to treat them in the same manner as more traditional resources. Records of the early days of USA radio are very limited. More positively, radio information resources played a major part in developing several aspects of society, including education, agriculture, and jazz culture.

Research limitations/implications
The study shows lessons for development of current information society. The research is limited to one communication medium, in one country, in one decade. It is not a full historical analysis of the development of radio broadcasting, rather it is limited to information resource aspects, largely of public sector broadcasting.

Originality/value
It is the first study of the early development of radio broadcasting from an information perspective. It shows the value of the 'information-as-resource' model for analysing developments in the communication of information.

Keywords
radio broadcasting; information resources; information history; United States of America; early twentieth century

Paper type
Research paper

Introduction

This paper analyses certain aspects of the development of radio in the United States during the 1920s, focusing on the idea of the broadcast spectrum, and the content of broadcasts, as information resources. This is not a historical analysis of broadcast radio: rather it is an analysis of historical information resources, specifically those relating to broadcast radio, making use of primary sources as well as more recent analyses.

By understanding how contemporaries viewed, understood and used radio, as well as by examining the developments of the time, it becomes possible to paint a larger picture of the nature of broadcast information resources during this period, and perhaps to draw lessons relevant to the information society of the present day.

The article is structured into sections dealing with the origins and development of radio in the USA, and with the developing regulatory framework, followed by an analysis of the extent to which it is helpful to regard the radio spectrum, the content of radio broadcasts, and the permanent records derived from them, as information resources. The concept of information resources follows that outlined by Eaton and Bawden (1991) and Yates-Mercer and Bawden (2002).

The origins of radio in the USA in the 1920s

The 1920's has long held a special place in the history of the United States, conjuring vivid images of flappers dancing the Charleston, bootleggers and gangsters skirting the prohibition laws, and the care-free post-war socialites of F. Scott Fitzgerald novels. As with many evocative eras in history, the 1920's has been given many titles which seek to capture and convey its very nature, labels which attempt to express the mood and events of the time. Most commonly referred to by historians and lay people alike as the 'Roaring 20-'s' or the 'Jazz Age', the 1920'-s in the United States is often categorized as one long sigh of relief coming from the nation as a whole, stretching from the end of the First World War to the beginnings of the Great Depression. As Thompson (1973, p. 296) notes the nation was ". . . weary of two decades of 'the strenuous life', [and] sought to regroup and reconstitute itself-albeit through self indulgence". This was also a time of great contradiction, with speakeasies and jazz clubs existing alongside prohibition raids and religious revivals.

Perhaps more than anything, the 1920's is perceived as being a time of dramatic change within the United States. The 'Great Migration' shifted the entire geographically identity of the nation; for the first time more Americans lived in cities than in rural areas. America and its population were leaving the traditional down-home, agrarian life of the Jeffersonian farmer and embracing the cosmopolitan existence offered by major cities such as Chicago, New York and Detroit. The huge number of refugees and displaced persons in Europe after the First World War were also flooding into American cities, creating even greater growth and ethnic diversity within urban centres (see, for example, Kutler and Goldberg 1999).

One of the greatest changes experienced in the United States during this time was the advent and meteoric rise of broadcast radio. Despite all the images and events

associated with the 1920'-s, perhaps none is as evocative or illustrative as radio. Broadcast radio was exactly what the war-weary nation craved; the 1920'-s ". . . was an age of frenzy and boredom; a period when a restless nation demanded to be entertained" (Rodnitzky 1968, p. 505). Starting with the first radio broadcast in 1920, the United States quickly developed an insatiable appetite for radio. There is no hyperbole in stating that broadcast radio was born and reared in the 1920'-s. As such, the broadcasting of radio was both defined by and served to help define the decade itself. Indeed, as J.L. Clifton, director of the Ohio State Institute for Education and a pioneer of the use of radio for instruction and education, noted at the close of the decade: "Even in an age of marvels, there is something awe-inspiring about the radio" (Clifton 1930, p. 201).

Although broadcast radio was born and developed in the 1920'-s, radio itself had been developed decades earlier; Henrich Hertz's experiments with the electromagnetic spectrum at Karlsruhe in 1887-1888 can be taken as its starting point (Aitken 1994); for overview of the early history, see Douglas (1989) and Garratt (2006). During these early years, radio was known as wireless telephony and was utilized strictly in a point-to-point manner as opposed to broadcast which was first used commercially in 1920. "It will be noted that radio communication can be grouped in two ways: (I) when voice and sound waves of various kinds are transformed into electromagnetic waves, carried through the ether, and reconverted into sound waves, it is called telephony; (2) when a message is transformed by hand or machine into a system of dots and dashes, carried through the ether, and by means of the proper rectifying agency, reconverted into dots and dashes to be read by machine or by ear, it is called telegraphy." (Jome 1925, p. 198-199). Radio telephony would later become known by the more familiar term of broadcasting. Wireless telephony's first main application was ship-to-shore and ship-to-ship communication. As such, radio during the turn of the century was almost exclusively a maritime pursuit and fell mostly under the jurisdiction of the United States Navy.

On December 12, 1901 the British Marconi company, established four years prior, sent the first transatlantic communication when the letter 's' was transmitted from Poldhu, Ireland to a receiving station near St. John's, Newfoundland. While there has been some skepticism as to whether the transmission was actually the letter 's' in Morse code or merely atmospheric noise crackling, there is no question that by October of 1902 wireless transatlantic communication was indeed taking place (Belrose 1995). As with many emerging technologies and their associated fields, radio was not regulated at this time. As Aitken points out, it was clear that some form of structure was essential to the effective use of this medium. Specifically, a set of standards needed to be arrived at so that ships at sea could function under an increased level of safety: "Regulation was required in order that standard wavelengths could be designated as calling frequencies or distress frequencies, to ensure that radio stations using different equipment would communicate with each other, and to mandate that all vessels over a certain capacity carried radio equipment and operators" (Aitken 1994, p. 690). The desire to secure the safety of ships at sea in turn lead to the Berlin Conference of 1906 and the London Conference of 1912, both of which sought to establish some form of international

standard for this very purpose. The United States enacted its first piece of meaningful legislation with regards to wireless telegraphy and radio in 1912 and did so in response to tragedy. "The Radio Act of 1912 was passed only in the aftermath of the Titanic disaster and because a statute was required to implement the provisions of the London Wireless Conference of that year [1912]." (Aitken 1994, p. 691) For radio broadcasting during the 1920's, the Radio Act of 1912 was crucial. Indeed, even though this Act was passed 8 years before the first commercial radio broadcast, it would provide the basis for the understanding and use of the radio and its associated spectrum for most of the decade, until the Radio Act of 1927. We will now consider this regulatory framework in more detail.

The changing regulatory framework

Radio Act 1912

The Radio Act of 1912 was the first legislation that sought to regulate radio within the United States itself, as opposed to international conferences which dealt with the safety of ships at sea, and formed the basis for all regulation of radio and its associated parts for much of the 1920's. As was noted above, the Radio Act of 1912 was in many ways a response to the sinking of the *RMS Titanic*, and at first glance the seems to deal primarily with ships at sea, confirming the London Conference of the same year and creating stronger legislation than the Wireless Ship Act of 1910 (Congress considered at least six separate proposals between 1910-1912 before settling on the Radio Act of 1912). However, it also played a critical role in the development of American broadcasting and the use of its associated information resources and records, during the initial growth of the industry and its market. In what were seen as relatively insignificant stipulations at the time, the Act set the standard for the use of radio *within* the United States. In order to cut down on interference, specifically from the amateur sector which had come into existence in the early years of the twentieth century, the Act called for the licensing of all radio stations within the United States (including amateur operators), and put this licensing authority in the hands of the United States Department of Commerce and Labor. The rationale behind this was that Congress had been invested with the power to regulate interstate trade under the United States Constitution. While this may not seem analogous, the prevailing theory was that since radio was not bound by state lines it was, by nature, interstate. The management of information resources, in the form of radio, was therefore based largely on precedents set with regards to more traditional resources; specifically, water, land and mineral rights.

While the Radio Act of 1912 charged the Commerce Department with issuing radio licenses, ". . . it did not grant to the Secretary of Commerce the authority to deny a license to any citizen. The Radio Act of 1912, in short, did not limit access to the [radio] spectrum. That was neither its purpose nor its effect." (Aitken 1994, p.691) This approach to the radio spectrum was unique to the United States. While most countries viewed the ether as exclusive property of the state, such as the BBC in the United Kingdom, the spectrum was very much seen as part of the public domain within the United States. "Government ownership of the spectrum -

'nationalisation' of the resource on the British model - was never seriously proposed in the United States except by the Navy Department, and then only on the condition that the navy should hold the monopoly" (Aitken 1994, p. 688).

While the Act did not control access to the radio spectrum as a whole, it did seek to proportion the spectrum into segments with assigned uses. Amateur operators were relegated to shortwave frequencies in order to eliminate any possible interference with marine communication. "The conventional wisdom of the age held that only long waves could cover long distances: wavelengths shorter than 250 meters were thought to be essentially useless for commercial work, which is why it was given to amateurs. The effect was to confine commercial and government use of the spectrum to a narrow segment. That meant a higher probability of interference as stations multiplied" (Aitken 1994, p. 691-692). [By 'commercial' here is implied both marine communication and also nascent public broadcasting activities.] Scarcity of frequencies, interference within the spectrum, and attempts by the Department of Commerce and Labor to regulate the spectrum itself, were the defining characteristics of radio broadcasting and its associated information resources during the 1920's. At the time however, no one believed, nor was there any reason to believe, that the provisions set forth in the 1912 Act were insufficient for the management of radio and its resources. "With the amateurs out of the way, the major source of interference to commercial and government stations had been removed. International conventions, backed up by treaty and implemented by statute law, provided whatever additional coordination was required." (Aitken 1994, p.691). Little did policymakers know that something which would change the face of radio as it was understood prior to 1920 was coming into existence, popular broadcasting. "In the late fall of 1912 Attorney-General Wickersham held that the issuance of a license was mandatory upon the Secretary of Commerce and Labor . . . There was not, however, another occasion calling for an opinion of either the Attorney-General or of any court until the advent of broadcasting" (Smith 1929, p. 295).

One consequence of the 1912 Act was a restructuring of the major commercial interests involved in radio, as they sought to divide the radio market amongst themselves. A key event was the formation of the Radio Corporation of America (RCA). In October of 1919, the General Electric Corporation (GE) bought out the American Marconi company. At the urging of the United States Department of the Navy, GE (with the addition of several other minor companies) turned the former American Marconi holdings, assets, and patents into RCA. RCA was owned by a GE-dominated partnership that included Westinghouse, American Telegraph and Telephone Company (AT&T), Western Electric, United Fruit Company, and others. There were cross-licensing agreements, also known as patent pooling, between GE, AT&T, Westinghouse, and RCA, which had purchased the assets of Marconi's company. Patent pooling was the solution to the problem of each company owning some essential patents (Scott 2010): "The companies wrote into the contract certain interesting restrictions concerning patent rights. The restrictions did not cover particular patents, but rather defined the fields of exploitation open to each company. AT&T received exclusive licenses under everyone's patents in wire

telephony and telegraphy and certain specified rights to radio in conjunction with the wire telephone network. RCA and GE similarly acquired rights to use all parties' patents in wireless telegraphy, in international two-way radio communication, and 'to make, use, lease, and sell all wireless telephone apparatus for amateur purposes' " (Reich 1977, p. 217). In other words, as part of their agreement, each individual company would effectively specialize in certain areas of radio, thus eliminating unnecessary and unwanted competition with each other. The idea of using radio to "broadcast" to the general public, rather than from point to point, had played no role at all in the negotiations that led to the consolidation of the post-World War I radio industry. RCA had been formed to serve only two functions: first, to be a radio-operating company for ship and intercontinental traffic; and second, to be a sales agent for radio equipment manufactured by GE, Westinghouse, and Western Electric, the manufacturing arm of AT&T. Similarly, the division of manufacturing rights among the constituent companies had at first seemed simple enough: the "radio group" (GE and Westinghouse) would manufacture receivers and radiotelegraph equipment, Western Electric would be responsible for making radiotelephone transmitters, and AT&T would have a monopoly of radiotelephone service. This division of aspects of radio between the companies provided an impetus for broadcasting, and for the emergence of radio as an information resource.

In November of 1920, Westinghouse began regular broadcasts from station KDKA in Pittsburgh; essentially attempting to create a demand for their product. Under the RCA agreements, Westinghouse was charged with the production of receivers, among other equipment, and, in order to sell their product, they needed to provide something to listen to; after all, what good is a radio if there's nothing on to listen to? While there has been much written about the business behind the advent of radio (see, for instance, Reich 1977, Leblebici et al. 1991, Lippmann 2007 and Scott 2010), a significant point is that broadcast radio was developed as a way to sell both radio transmitters and receivers; it was, at its inception, not considered a product or a profitable resource in and of itself.

Indeed, few could have imagined the appetite of the American public for radio broadcasting and how quickly the industry was growing. "Shortly after the first commercial radio broadcast on station KDKA in Pittsburgh in 1920, the medium's popularity exploded. By 1923, there were 510 stations in operation with many more under construction (U.S. Department of Commerce 1923). Small businesses, large corporations, churches, educational institutions, radio set manufacturers and other groups realized the potential that lay in this revolutionary form of mass communication and established stations to serve their diverse interests." (Lippmann 2007, p. 467). That number more than doubled to a total of 1105 licensed stations in August 1924, less than one year later, with total sales of radio products in 1925 approximating $400 million, and the net profits of RCA rising from $400,000 in 1921 to $9.5 million by 1924 ,according to contemporary sources (Harbord 1929, Jome 1925, Beuick 1927).

Despite this evidence that the sale of radio equipment, if not broadcasting itself, was quickly becoming a very profitable endeavour, some commentators still regarded it as a fad. Beuick (1927), for example, declared that it could never compete with the phonograph or the theatre or concert, though it might be of value to "isolated persons – the sightless, deaf [sic], bed-ridden, and farmers: an interesting example of comments suggesting a lack of insight, or perhaps hindsight, shown towards many information innovations (for other examples, see Bawden 1997 and Bawden and Robinson 2012, chapter 15).

Intercity*, *Zenith*, and *Oak Leaves cases

These three landmark legal cases showed that the Radio Act of 1912 was not sufficient in its provisions, and led to the passing of its replacement, the Radio Act of 1927. The issues raised by these cases are essential to the understanding of the use of information resources in the context of radio during this period.

In the Intercity and Zenith cases, the radio stations had their licenses withdrawn because of interference caused to maritime radio (Intercity) and to Canadian stations (Zenith); the issue was whether the authorities had the right to revoke a licence under these circumstances. The Oak Leaves case revolved around what 'rights' stations had to their frequencies. These cases raised complex issues and motivations, and are discussed in detail by Aitken (1994), Twight (1998), Hazlett (1998) and Lippmann (2007). However, their import was clear; the regulators' only power was to issue licenses, and could not exercise discretion to whom they were issued, or how they were used; and rights to a frequency were determined simply by who held it first. Furthermore, the issues were decided in a legal framework which treated use of the radio spectrum in the same way as the use of conventional resources; specifically water, land and mineral rights (Twight 1998).

Radio Act 1927

Signed into law on February 23, 1927, the Radio Act of 1927 was intended to alleviate the chaos on the airways which had reigned since the verdicts in the above legal cases, and to deal with the particular problems of spectrum scarcity and of broadcast interference. Most notably, it created an independent regulatory commission to oversee the industry.

The Federal Radio Commission (FRC), the forerunner of the current Federal Communications Commission (FCC), was made up of five commissioners, each representing one of the five zones into which the country had been divided by the 1927 Act. The FRC had wider powers than those allowed to regulators under previous legislation, including the issuing and renewing licenses, the assignment of frequencies and the control or limitation of the broadcast power of stations. The commission had no powers of explicit censorship, such as came later, although stations had to provide equal time to political candidates, effectively censoring stations with 'fringe' political views, such as those which promoted labour solidarity. Additionally, Section 4 of the Act contained the famous words ". . . as public convenience, interest, or necessity requires." These seven words would often be used to justify control of radio content and as grounds for the revocation of

broadcast licenses. Rather unsurprisingly, given what we have seen regarding the way in which these information resources were viewed, used and managed at the time, similar (if not identical) language was found in numerous state statutes with respect to public utilities (Anon 1932).

Perhaps in response to the Oak Leaves verdict, the Radio Act of 1927 sought to prevent broadcasters from staking claim, much like the homesteaders of the mid-nineteenth century did to the lands of the American west (in part the precedent on which the Oak Leaves decision was based), to specific frequencies within the spectrum. It was seen as vitally important that the spectrum be kept as a public domain and that no 'monopoly of the air' was allowed to exist. "The shift from a market logic to a public-interest logic in broadcasting happened quickly and formally. The market logic, which had emerged de facto in the fledgling industry, was replaced by the public interest logic that was codified in the FRA [Federal Radio Act of 1927]" (Lippmann 2007, p.478). Despite this shift, both in the way information resources pertaining to radio were managed (regulated) and viewed, there were exceedingly close ties between the FRC and the broadcasting industry. Two thirds of the original six commissioners had careers in commercial radio broadcasting either before or after their terms serving on the FRC. Given the vagueness of the concepts outlined in the Act, these connections were to prove influential in determining what was to be understood by "public convenience, interest, or necessity'.

Despite the increased scope of regulatory powers under the 1927 Act, we still see a failure of legislators to fully understand that newer forms of information resource, such as radio broadcasts, and the communications channels over which they are disseminated, are inherently different from their more traditional, typically paper-based, counterparts. We will now go on to consider this explicitly, focusing on the concept of scarcity, central to thinking about radio at the time.

The radio spectrum as an information resource, and the concept of scarcity

Without question the largest issue involving radio at this time was, as we have already seen, interference. The unprecedented rise in commercial broadcast stations after KDKA's first broadcast in 1920 obviously played a large part in creating this interference. The main cause of interference during the 1920's was believed by contemporaries to rest on the scarcity principle. The Radio Act of 1912, the only relevant legislation concerning radio for the majority of this period, broke the radio spectrum into sections, each with a specific use (such as commercial, government/naval, amateur). In doing so it took an already finite resource, the spectrum waveband, and reduced access to and the use of it even further. Additionally, the Radio Act of 1912, as demonstrated by the verdict in the *Intercity* case, made no provision to keep would-be broadcasters from accessing the spectrum effectively at will. The scarcity principle then seems quite clearly to be a simple problem of supply and demand. The limited resource of the spectrum, further reduced by legislation, was trying to accommodate seemingly endless demand in the form of newly propagated commercial broadcast stations.

The scarcity principle itself was the driving factor behind many of the legal decisions and subsequent legislation involving radio during the 1920's and beyond. The broadcasting spectrum was to be considered as a common-property resource, which is finite and may be depleted, analogous to natural resources such as fisheries, oil reserves and water resources, and, like them, liable to be overexploited (Aitken 1994). These beliefs were widely held at the time and, as such, formed much of the basis for how radio broadcast information resources were viewed, managed and used during the 1920's.

The idea of the radio spectrum as a common-property resource is an interesting one and one which is in many ways unique to the United States. As was noted earlier, most other countries opted for allocating the spectrum to a government monopoly, such as that found in Iceland, Italy, Turkey and the U.S.S.R., or the creation of an independent public corporation which held the monopoly, such as the United Kingdom's BBC. The United States was then not alone in considering the spectrum public property, but it was unique in that it allowed this public resource to be controlled, at least prior to 1927, by private corporations; for detailed discussion of this point, see Aitkin (1994) and Leblebici et al. (1991).

There is a wealth of both scholarly and contemporary evidence, set out in the references above and shown most clearly by instances such as the *Oak Leaves* verdict, to suggest that within the United States the spectrum was viewed little differently from natural resources such as oil or coal. There was however one major difference. While a mining company must purchase or, at the very minimum, lease the land on which they intend to mine, commercial broadcasters had free access to the spectrum. While the costs of building, running, and maintaining a commercial broadcasting station still existed, there was no fee associated with accessing the spectrum. While the spectrum was seen as a finite resource, it was also not one which could be owned by the user; it belonged to the American public as a whole. Although later scholars have queried this rationale (see, for example, Logan 1997), it is clear that the prevailing concepts about the spectrum in 1920's America were formed by its definition as a common-property good, to be used much like the minerals found beneath the soil. This failure to create a market, in the economic sense, for these resources suggests two things of particular relevance. First, that despite repeated attempts to manage radio (i.e. information-related) resources within the traditional framework for managing other forms of resource, this proved impossible; second, that the scarcity principle was not wholly detrimental, indeed perhaps on the whole beneficial, to the interests of large broadcasting corporations.

These conclusions force us to examine the very essence of the scarcity principle; the question of whether or not this scarcity ever existed. That the broadcast spectrum is finite and that the effective use of it was limited by the level of sophistication of the available technology is not in question here. What is in question is how much of the perceived scarcity actually existed and to what level the scarcity principle was used by legislators and industry players as leverage for greater control over the use of this resource. It seems clear that scarcity was not as great a threat as it was made out to be by those with interest in extending regulation and, in turn, their ability to

manage and control this resource. As Hazlett points out, the key " . . . to this institutional innovation was the strategic manufacture of air-wave chaos by Secretary of Commerce, Herbert Hoover, who willfully suspended enforcement of 'priority-in-use' property rights to frequencies on 9 July 1926 [after the *Zenith* verdict and subsequent opinion issued by William Donovan]. . . . While Hoover and radio broadcasting interests had been unsuccessfully advancing 'public interest' licensing since at least 1922, the static interference produced by 'wavejumpers', 'pirates', and 'trespassers' (as the popular press then called them) finally succeeded in moving Congress to enact a law" (Hazlett 1998, p. 279). There are certainly a number of actions that would support this viewpoint. For instance, the restrictions governing the allocation of the spectrum could be changed or expanded to fit the needs of the time. Hoover first expanded the available broadcast spectrum in 1923 (Twight 1998), and we have already seen that, almost from its inception, the FRC went about trying to reapportion the spectrum among existing stations. Another example of these artificial controls placed on the spectrum comes from the then Solicitor of the Department of Commerce Stephen Davis. During Senate hearings in 1926, Davis was asked by Senator Dill (D., Washington) whether the use of the spectrum was absolutely confined to the current wave lengths available. Davis's response was telling; he stated: "No, not at all. In other words, you can shift that band any way that it is desired to." (Twight 1998, p. 258) Perhaps even more telling is Davis's response to a similar question posed by Senator Howell. "When Howell asked whether 'this field [the spectrum]could be very much broadened if the Department of Commerce saw fit to broaden the field,' Davis replied 'That is correct'." (Twight 1998, p. 258). These facts alone clearly indicate that, on some level, the amount of scarcity in the spectrum was controlled and as such could be alleviated, at least partially, by Hoover and the Department of Commerce. While not enamoured with his chronology, Twight points out that ". . . Hazlett correctly concluded that much of the pressure for passage of the 1927 radio act [sic] came from individuals who had much to gain or retain: already licensed broadcasters who wanted the government to limit entry; government officials who did not want to lose the opportunity to control this vast and portentous new industry." (Twight 1998, p. 250-251) It seems quite clear then that the level of scarcity as it was perceived at the time was as much a construct of legislation and economic issues as it was a product of the spectrum's finite nature and the limits of the contemporary technology.

Much of the scarcity principle, then, existed in perception rather than actual fact. What this demonstrates is that information resources are inherently different than their traditional counterparts. Despite the best attempts of judges, legislators and industry leaders, the spectrum (as an information resource) could not be managed in the same way as other resources.

So what of the spectrum itself? Can it indeed be considered an information resource? If we look at the characteristics of 'information-as-resource' - see, for example, Eaton and Bawden (1991) and Yates-Mercer and Bawden (2002) - we see that the spectrum meets many of the criteria. The spectrum and radio broadcasts which traverse it are certainly intangible and could easily fall into the category of a collection of abstract objects. Broadcast information is transportable virtually

instantaneously from transmitter to receiver. In doing so it clearly substitutes for other resources, such as transport links; after all, one need not take the train to a concert if that same concert is being broadcast into your home. Certainly the information sent across the spectrum was shared, not exchanged; a record played in New York and listened to in New Jersey is not exchanged but rather given away and retained at the same time. The only potential problems arise when one considers whether or not it is expandable, capable of increasing with use. Certainly the spectrum is not, unlike other resources such as oil and coal, able to be depleted. The use of the spectrum does not cause less of the spectrum to exist. Under the scarcity principle it is believed that the use of a certain section of the spectrum precludes the use of that same section by others and thus reduces the totality of the spectrum in that manner. While we have seen that this is partially true, the use of the spectrum does create more of the resource which is of interest to this work, information. Just the act of debating the validity of the scarcity principle creates and expands the amount of information resources available. Additionally, by acting as the conveyance for the distribution of information itself, the use of the spectrum fulfils these criteria.

It seems clear that the spectrum generally meets the criteria put forward for information resources. While contemporaries seem to have been aware that they were dealing with something unique, they did not possess a clear understanding of the nature of the resource which they were trying to manage. The piecemeal legislation and use of 'homesteading' principles, coupled with its designation as a common-property good to the exclusion of a market economy provide substantial evidence for this conclusion.

We now consider the extent to which radio broadcasts of the period created tangible records; a permanent form of document.

Broadcasts as record

Radio broadcasts are inherently intangible and ephemeral resources. Records on the other hand are by nature tangible. This means that the intangible information broadcast on radio has to be captured in some form to create a tangible and permanently available artefact.

This section will focus on three forms of radio records which have survived from the 1920s era: audio recordings of broadcasts, written records of broadcasts, and written records of advertising in print media.

While phonograph recording existed alongside radio during the 1920s priority was not given to making recordings of actual broadcasts, and there does not seem to have been any desire for this to be done systematically. In fact, it was not until 1935 ".. . that NBC, spurred by the introduction of the so-called "acetate" recording disc, established its radio recording division. For the first time, a radio network took it upon itself to record and archive its programming for the use of artists, advertisers, and network staff. CBS began making recordings on a more limited basis three years later" (McLeod 1999).

This should not be taken to mean that no recordings from this time exist; rather it demonstrates that the recording or capturing of radio broadcasts was not seen as an essential undertaking at the time. Turning intangible broadcasts into tangible records was not a priority for most. However several companies, such as The Victor Talking Machine Company, the Thomas A. Edison Laboratories, and Western Electric, did make experimental recordings before 1935. This was often done by a process which used the newly-developed electrical recording process and produced phonograph-record pressings from wax masters. By the late 1920's the recording process had been refined and private studios began to make primitive instantaneous recordings of broadcasts, often at the behest of advertisers or their agents and the performers themselves.

While it is clear that recordings of broadcasts were made, very few have survived to this day. Many of the original recordings were made on aluminium discs, a medium with inherent fragility. "The soft metal grooves were easily gouged into an unplayable condition. The discs were intended to be played only with fibre or bamboo needles. A single pass with a common steel needle was enough to permanently destroy the recording. Many discs no doubt suffered this fate" (McLeod 1999). In addition, many of these recordings were victims of the war effort, as aluminium was a crucial war material. Clearly, during the Second World War many users deemed the value of these recordings to be less than then the value of the raw material on which they were recorded, an interesting dynamic given comparisons discussed under the scarcity principle which seemed intent on treating information resources as much like more traditional resources as possible.

Another issue is the purpose for which the recordings were made. "[Most] artists and agencies didn't have the foresight of … Rudy Vallee, who began to keep a meticulously catalogued archive of his programs in mid-1932. Independently made broadcast recordings, for the most part, were made for purposes of immediate evaluation...and once they had been examined, they might be put aside and forgotten or even thrown away" (McLeod 1999).

It is clear then that recordings of radio broadcasts were not seen at the time as a valuable information resource to be archived for later use. But the final factor to which McLeod points to as effecting the number of existing broadcast recordings is that of people simply being unaware of what it is they have: "Labelling information is often sparse on the discs, often no more than pencil scrawling on the bare metal...and if you don't know what they are, it's easy to pass them by."

It would be good to think that lessons had been learnt in the intermediate period, but the loss of many television programmes from the 1950s and 1960s, for essentially the same reasons, shows that this is not the case. And indeed the same problems are now arising with records of 'born-digital' material (Rowland and Bawden 2012).

In addition to the audio recordings discussed above there are also a number of print records related to broadcast radio. While it may seem something of an oxymoron, the medium of print was of great importance for radio during the 1920s, with many stations owned by newspapers. Clearly it made economic sense, to cross-promote the fledgling radio endeavours in the well-established print media. It is important to note that while much advertising and sponsorship took place on the airwaves themselves, a major demographic which advertisers of the period sought to reach was those who did not yet own their own radio set, particularly those in rural communities. As such, much radio advertising was also done in the print media: "The initial organization of the industry was thus simple. Radio stations were operated either by the radio manufacturers or retailers to stimulate the sales of receivers or by newspapers and department stores to spotlight their services. To ensure the value to listeners, the new stations evolved the convention of broadcasting on regular schedules. And with broadcasting tied so directly to selling the products of Westinghouse, GE, and RCA, its value to them was also clear" (Leblebici et al. 1991, p. 344).

Newsprint records of radio broadcast usually came in the form of a time schedule, listing which programs would be on when. In some cases the name of the artist or cast would also be included. While these records contain limited information, their value should not be dismissed. For instance, a study of black entertainers on the radio was based almost exclusively on newspaper records of radio programming (Randle 1977).

Advertising media from this period exists in greater amount then newspaper lists of programs. As noted above, the vast majority of these print advertisements seems to have been aimed at individuals from rural communities. In fact the printed advertisements for radio at this time offer great cultural insight into the shifting demographics within the United States, particularly the 'Great Migration'. It is important to note that developments in advertising were of the utmost importance to radio. Especially during the first half of the decade, commercial radio stations were funded almost entirely by sales of radio equipment. "Given the nature of radio goods, a stable cycle of exchanges between broadcasters and listeners would have to be achieved before broadcasting could evolve into a privately owned and commercially supported activity" (Leblebici et al. 1991, p. 335).

Two points emerge here, of particular relevance to the idea of radio as an information resources. First, unsure what to do with this emergent technology, radio operators were not focused on making sound recordings, so that many records of early radio are to be found in print media rather than audio records. While some of this has to do with technological limitations, limited understanding of the radio as a unique means of disseminating information also played a role. Second, radio as an information resource was instrumental at generating more and more information, a key criterion of 'information-as-resource' (Eaton and Bawden 1991, Yates-Mercer and Bawden 2002). As radio broadcasts became more and more popular, more and more program lists were created to inform the public of broadcast scheduling and advertising became more and more prevalent as broadcasting grew into a

commercially viable medium. The fact that it was able to extend its influence into other forms of media such as print is a testimony to how important radio had become as well as to how little its nature was fully grasped at the time.

We now turn to consider how radio broadcasts themselves began to function as significant information resources in 1920s America.

Radio broadcasts as information resources

The rapid diffusion of information to more people through media, which began with print media in the nineteenth century was intensified with the advent of radio (Pratt 1990). Indeed radio was as transformative in the 1920's as the Internet and World Wide Web would be at the close of the twentieth century. Its impact on information and, by extension, the users and consumers of that information should not be marginalized. We will consider three specific aspects – information for farmers, the use of radio for general education, and the influence on radio on the development of jazz – while noting that there are many other instances, for example the influence of radio information on industrial relations (Roscigno and Danaher 2001). A particularly relevant example is an analysis of the early use of radio broadcasting by American children's librarians between 1922 and 1941 (Welch 2012).

Practical information: radio and farmers

As noted above, even commentators sceptical about the general value of radio agreed that farmers, and rural communities in general, would be major beneficiaries. While those living in urban centres may have seen radio as a source of entertainment, for the farmer it was a much a tool of the trade as a tractor. The Official Record of the United States Department of Agriculture from December 17, 1924 estimated that more than 370,000 farmers had their own receiving sets (Jome 1925).

Determining the economic value of any information resource, or particular piece of information, is difficult. However, as Tigert points out, ". . . certain features of the [radio] program, such as market reports and weather forecasts are so immediately necessary as to have actual monetary value to a great proportion of the audience" (Tigert 1929, p. 73). As early as 1923, there were 27 naval stations and 117 general broadcasting stations making daily weather forecasts, enough to cover the entire nation. Henry C. Wallace, at the time the Secretary of Agriculture, estimated that these broadcasts had saved Illinois farmers over $10,000,000 and saved over $1,000,000 of livestock in Arkansas alone (Wallace 1924). So important was the radio for farmers that Herbert Hoover decreed at the National Radio Conference in 1922 that "no single use of radio should take precedence over its use for agriculture" (Wik 1981). Until the advent of broadcast radio, farmers were forced to use unreliable or out-dated information, particularly in relation to the current market value of their goods. As Wik points out, ". . . most rural Americans had been slow in getting the latest market quotations for farm commodities. As a result they were usually forced to take the word of grain and livestock buyers. At times when a farmer asked why his livestock was not worth more he would be told, "Well,

unfortunately the market is down this week.' After the sale the farmer might discover that these prices had actually risen. Since farmers were the last to get the word they could be bilked by their old nemesis the middleman" (Wik 1981, p. 342). Radio provided a huge upgrade in disseminating these information resources over previously established means, such as the local paper. One farmer from Missouri claimed that information received via the radio was more than a day ahead of that found in the daily newspaper (Wik 1981). As the figures from the Department of Agriculture allude to, the ability of the farmer to receive accurate and timely information had great value. There can be no doubt that broadcast radio had a noticeable impact on American agriculture at this time. That it was able to have such an impact is a product of the nature of information resources themselves. The ability of these resources to bridge geographical divides, travelling in near instant fashion changed the way American farmers did business.

Educational information: radio and students

One of the clearest and most striking examples of the radio as a means to distribute information and knowledge comes in the form of educational programming, pioneered in 1920s America, though there was some interest in Britain at the same date (Diamond 1929). As a contemporary educator, Dr. W.H. Lighty, Director of the Department of Extension Teaching of the University of Wisconsin and Chairman of the Radio Committee of the National University Extension Association, stated: "Radio in education has its greatest possibilities in the field of inspiration, interpretation, orientation and educational guidance" (Tigert 1929, p. 71-72).

Indeed, universities and other educational institutions during this period became closely tied to radio (Slotten 2008). For example, the Department of Electrical Engineering at the University of Illinois was particularly involved with radio research, and in March 1922 the University received authorization to broadcast for three hours an evening, while the Ohio State University had established the Ohio School of the Air by 1929 (Rodnitzky 1968). Educational radio was also established for school pupils, with the American School of the Air offering a series of bi-weekly lectures over a fifteen week period in 1930, and local trials carried out in primary and high schools (Bagley 1930, Mersand 1938).

One of the greatest perceived benefits of education by radio at the time was its ability to help educate those with special needs, unable to attend conventional schools, and also for its ability to reach isolated and rural areas, where cultural facilities were few and far between (Bagley 1930, Tigert 1929). This is a clear example of information resources not only being independent of distance, but also acting as substitutes for other resources, further criteria for 'information-as-resource'.

While the lack of interactivity of broadcast radio may have compromised its use for education in the face of emergent technologies such as film, so that education by radio may today be considered more a fad than a viable educational model, that would be doing a disservice to these resources. It is clear that many contemporaries

saw a value in educational radio, and indeed we may see it as the forerunner of today's idea of distance learning, perhaps more so than the paper-based 'correspondence course'.

Creative information: radio and jazz

Jazz is often closely associated with 1920'-s America, so much so that this period is often referred to as the 'Jazz Age'. Equally, jazz was also closely tied to the African-American community. As more and more African-Americans left the South, particularly cities like New Orleans, and headed to northern cities such as Chicago and New York during the 'Great Migration', they brought with them their musical heritage. The combination of urban life and this 'down home' music led to what would today be considered jazz; see, for example, Carr (1998) and Cooke (1998).

The ability of the broadcast radio to disseminate jazz into the homes of American citizens is what proved to be the great step forward for this genre however. Many radio broadcasts were made from clubs and dancehalls, sending the live performance of these entertainers out over the airwaves: "During 1924 the Club Alabam was on the air at least forty-seven times on several New York stations; the Plantation was broadcasting five nights a week until it was closed by federal authorities" (Randle 1977, p.70). These broadcasts allowed for a much wider audience and greater exposure to this new kind of music. Radio made jazz, the music of a racial minority living in many ways on the fringes of polite society, accessible to the masses: "Local radio remapped the symbolic geographies of class and race by bringing African American music to a wider audience. Broadcasting afforded African American jazz and blues artists a new level of exposure, bringing a 'culture on the margins' to the attention of the mainstream." (Vaillant 2002, p. 34). What is also clear is that the masses influenced jazz as well. As jazz music was disseminated through the airwaves, more and more musicians began to turn their hands to this new genre and several distinct styles of jazz began to emerge.

As the influence of jazz was spread on the waves of the broadcasting spectrum, mainstream musicians began to incorporate aspects of jazz into their works. While many factors went into the development and success of jazz during the 1920s, it is clear that the genre's meteoric rise in cross-cultural popularity could not have been possible without broadcast radio. Radio was able to transform the average living room into a dance hall or speakeasy with the turn of the receiving set dial. As radio broadcasts spread jazz across the country new musicians and new types of jazz were created. While it is all but impossible to assign a value to the influence of radio on the creativity and innovation which was and still is jazz, there can be little doubt than that broadcast radio played a large part in shaping jazz music; a good example of the synergy between creativity and the communication of information. [An anonymous referee suggests that there may be analogies between the development of jazz in the radio context and that of open source software today; an intriguing suggestion which space does not allow us to develop further.]

Conclusions

'Those who ignore history are doomed to repeat it.' This axiom may be seen as relevant for the preceding discussion of information resources. The 1920'-s in the United States was a pioneering time and place for the development of radio broadcasting. From the KDKA's first commercial broadcast at the beginning of the decade, radio swept over the country like a wild fire, igniting passion, innovation and development. It was during this period that policy and conceptions of radio were formed and these concepts still have bearings on modern perceptions. In many ways our modern information society is analogous to this time period. The advent of broadcast radio may be seen as amounting to an 'information revolution' in the 1920'-s, in a way analogous to the development of the Internet and all its ramifications are in our own time, and indeed to that of earlier technological advances (see, for example, Weller and Bawden 2005, Bawden and Robinson 2000, Standage 1999). While the media and the methods have certainly changed, information resources form the backbone for all of these advances. It can be questioned as to whether our understanding and perceptions have changed to the same degree.

A priority is to assure ourselves of an effective understanding of the resources which we are using. As the importance of information within our society grows every day, it is imperative that we understand information resources, their nature and their uses. As was illustrated by the Radio Act of 1912 and the subsequent legal proceedings prior to the Radio Act of 1927, understanding that information resources are unique and cannot be managed or regulated in the same way as traditional resources is of particular importance. Much of the early legislation was based on errors and misconceptions because contemporaries were unable to grasp this key point. Furthermore, the underlying motives involved in the passage of the Radio Act of 1927 clearly demonstrate that legislation which on the surface seems innocuous can be anything but. Politicians and industry leaders were able to effectively create an economic monopoly of the airwaves through the concept of scarcity and broadcasting for the 'public good'. Policymakers were also able to extend the government's control over the resource through these principles as well, effectively censoring and eliminating stations with divergent or fringe ideas. The conceptual foundation of much of this was erroneous at best, particularly the scarcity principle.

The management of records at this time left much to be desired, very few individuals at the time seeing a need to preserve these information resources. We have also seen that the perceived value of these records at the time may not be the same as their perceived value later. This strikes a particular cord with the Library of Congress's commendable project to systematically archive postings on Twitter.

Not all of the lessons from this period are negative. The development of jazz from the regional musical style of a racial minority on the fringe of 1920'-s society to a worldwide institution and a source of national pride is a shining example of the power that effective dissemination of information can have on creativity. By bridging racial, economic, and geographical divides jazz was able to change and develop. This is, in many ways, the ideal model for the use of information resources.

They are freely shared among users and as they are used, more information is created. In much the same way, broadcast radio proved an excellent means of disseminating knowledge. Broadcast radio was able to provide both formal and practical knowledge to those who wished to acquire it, overcoming constraints of distance, isolation and, to a degree, economic status. While radio cannot be compared with modern interactive systems, it was revolutionary for its time.; no other communication mechanism of this period could disseminate as much information over as wide an area so rapidly.

If modern society is experiencing an information revolution and if we have moved closer to an information society, this is not the first time that this has happened. While technologies change, the distinct nature of information resources remains a constant. It is only by truly understanding these resources and the unique concepts that underpin them that modern society can push forward without repeating the errors of the past.

References

Aitken, H.G.H. (1994), Allocating the Spectrum, *Technology and Culture*, 35(4), 686-716

Anon. (1932), Appellate Procedure under the Federal Radio Act, *Yale Law Journal*, 41(5), 751-757

Bagley, W.C., Radio in the Schools, *The Elementary School Journal*, 31(4), 256-258

Bawden, D. (1997), The nature of prediction and the information future: Arthur C Clarke's Odyssey vision, *Aslib Proceedings*, 49(3), 57-60

Bawden, D. and Robinson, L. (2000), A distant mirror ?; the Internet and the printing press, *Aslib Proceedings*, 52(2), 51-57

Bawden, D. and Robinson, L. (2012), *Introduction to information science*, London: Facet

Belrose, J.S. (1995), Fessenden and Marconi: Their differing technologies and transatlantic experiments during the first decade of this century, *International Conference on 100 Years of Radio*, Institute of Electrical and Electronics Engineers (IEEE) Canada, (5-7 September, 1995), available at http://www.ieee.ca/millennium/radio/radio_differences.html

Beuick, M. (1927), "The Limited Effect of Radio Broadcasting", *American Journal of Sociology*, 32(4), 615-622

Carr, R. (1998), *A century of jazz*, New York NY: De Capo Press

Clifton, J.L. (1930), Education by radio, Recent activities of the Ohio State Department of Education, *Educational Research Bulletin*, 997), 199-201

Cooke, M. (1998), *The chronicle of jazz*, New York NY: Abbeville Press

Diamond, T. (1929), Radio as an aid in British education, *School and Society*, 30(782), 848-851

Douglas, S.J. (1989), *Inventing American Broadcasting, 1899-1922*, Baltimore MD: Johns Hopkins University Press

Eaton, J.J. and Bawden, D. (1991), What kind of resource is information?, *International Journal of Information Management*, 1991, 11(2), 156-165

Garratt, G.R.M. (2006), *Very early history of radio from Faraday to Marconi*, London: Institute of Engineering and Technology

Harbord, J.G. (1929), The Commercial Uses of Radio, *Annals of the American Academy of Political and Social Science*, 142(Supplement: Radio), 57-63

Hazlett, T.W. (1998), Oak Leaves and the Origins of the 1927 Radio Act: Comment, *Public Choice*, 95(3/4), 277-285

Logan, C.W. (1997), Getting beyond scarcity: a paradigm for assessing the constitutionality of broadcast regulation, *California Law Review*, 85(6), 1687-1747

Jome, H.L., (1925), Public Policy toward Radio Broadcasting, *Journal of Land & Public Utility Economics*, 1(2), 198-214

Kutler, S.I. and Goldberg, D.J. (1999), *Discontented America: the United States in the 1920s*, Baltimore MD: Johns Hopkins University Press

Leblebici, H., Salancik, G.R., Copay, A. and King, T. (1991), Institutional Change and the Transformation of Interorganizational Fields: An Organizational History of the U.S. Radio Broadcasting Industry, *Administrative Science Quarterly*, 36(3), 333-363

Lippmann, S. (2007), The Institutional Context of Industry Consolidation: Radio Broadcasting in the United States, 1920-1934, *Social Forces*, 86(2), 467-495

McLeod, E. (1999), Documenting Early Radio: A Review of Existing Pre-1932 Radio Recordings [online], available at http://www.midcoast.com/~lizmcl/earlyradio.html

Mersand, J. (1938), Radio Makes Readers, *The English Journal*, 27(6), 469-475

Pratt, R. (1990), *Rhythm and resistance*, New York NY: Praeger

Randle, W. (1977), Black entertainers on radio, 1920-1930, *The Black Perspective in Music*, 5(1), 67-74

Reich, L.S. (1977), Research, Patents, and the Struggle to Control Radio: A Study of Big Business and the Uses of Industrial Research, *Business History Review*, 51(2), 208-235

Rodnitzky, J.L. (1968), Getting the ear of the state: a pioneer university radio station in the 1920s, *History of Education Quarterly*, 8(4), 505-509

Roscigno, V.J. and Danaher, W.F. (2001), Media and mobilization: the case of radio and Southern textile worker insurgency, *American Sociological Review*, 66(1), 21-48

Rowland, L. and Bawden, D. (2012), The future of history: implications of preservation of information in the digital age, *Library and Information History*, in press

Scott, C.E. (2008), History of the radio industry in the United States to 1940", EH.net Encyclopedia, Whaples, R. (ed.), Economic History Association, [online], available at (http://eh.net/encyclopedia/article/scott.radio.industry.history).

Slotten, H.R. (2008), Radio's hidden voice – non-commercial broadcasting, extension education, and state universities during the 1920s, *Technology and Culture*, 49(1), 1-20

Smith, R.C. (1929), Legal phases of Radio Communication, *The Journal of Business of the University of Chicago,* 2(3), 291-311

Standage, T. (1999), *The Victorian Internet*, London: Phoenix

Thompson, K.W. (1973), America: promised land or wasteland, *The Review of Politics*, 35(3), 291-301

Tigert, J.J. (1929), Radio in the American School System, *Annals of the American Academy of Political and Social Science*, 142 (Supplement: Radio), 71-77

Twight, C. (1998), What Congressmen know and when they knew it: further evidence on the origins of U.S. broadcasting regulation, *Public Choice*, 95(3/4), 247-276

Vaillant, D.W. (2002), Sounds of whiteness: local radio, racial formation and public culture in Chicago, 1921-1935, *American Quarterly*, 54(1), 25-66

Wallace, H.C. (1924), The Year in Agriculture: The Secretary's Report to the President, U.S. Department of Agriculture, *Agriculture Yearbook 1923*, Washington DC: Government Printing Office

Welch, C.C. (2012), Children's stories through the air: librarian-broadcasters, 1922-1941, *Library Quarterly*, 82(2), 141-159

Weller, T. and Bawden, D. (2005), The social and technological origins of the information society: an analysis of the crisis of control in England, 1830-1890, *Journal of Documentation*, 61(6), 777-802

Wik, R.M. (1981), The Radio in Rural America during the 1920s, *Agricultural History*, 55(4), 339-350

Yates-Mercer, P.A. and Bawden, D. (2002), Managing the Paradox: the Valuation of Knowledge and Knowledge Management, *Journal of Information Science*, 28(1), 19-29