

Media Visionaries: Broadcast Radio, Silicon Chips and the Negro Ponte Switch¹

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Introduction

In this chapter I will explore a series of historical case studies examining technical evolution and the interaction of this technical development with the slogans and catch phrases used to help organize the institutional development of the technologies.

Sometimes visionaries set inspiring and empowering words on new technologies that will result in social-structural changes. But not always. We have Gordon Moore's 1965 law describing developments in computing and David Sarnoff's 1920's description of radio as a type of music box. At the same time we also have Herb Grosch's law (also in 1965) describing the need for large computers and William Orton's 1876 suggestion that the telephone was only an interesting toy. Sometimes these descriptions are the rallying cries that move an industry in one direction or another as they crystallize complex issues into a comprehensible insight. At other times they do not even receive their Warholian 15 minutes of fame.

These slogans have careers where they wax and wane and they can constrain opportunities for invention as well as stimulate them. When ideas become slogans imbedded in political, policy and commercial interest, as they often do, we might want to rethink our taken-for-granted notion of their heroic inventors.

¹ The citation for this paper is: Ling, R. (forthcoming). Media Visionaries: Broadcast Radio, Silicon Chips and the Negro Ponte Switch. In W. R. Neuman (Ed.), *Media, culture and society*.

I would like to be so bold as to state the Sawhney principle. To wit, Harmeet Sawhney has suggested that access to unused capacity in a technical system results in creativity (See Sawhney's chapter in this volume). While that may be true, I will posit a corollary that that the sudden access to new technical possibilities, be this via technical development or regulatory fiat, unleashes creativity, a round of catch phrases and slogans and in some cases, the majority of the seven cardinal sins. Indeed Winston posits the "'law' of the suppression of radical potential" saying that between the initial invention of a technology and its mass acceptance there is a period of slower development where the pre-existing structures need to rearrange themselves in relation to the new arrival (Winston 1998, 11). Winston however, discounts the sloganeering associated with the development of technology as rodomontade or pretentious self-importance. Thus, he points to the same situation as Sawhney but puts another spin on it.

This chapter will examine three episodes in the history of technology where a either technical advancement and/or regulatory contortions resulted in new possibilities for mediation, in the first instance the development of broadcast radio and the second is the rise of the integrated circuit and the third, as indicated in the title of the paper, the potential of digital TV and the co-temporal development of mobile telephony. In each case, there was some type of technical advancement either on the door step, or in the recent past. In each case there was also a crystallizing description of the situation that helped to organize the institutional reaction to the development. There was Sarnoff's description of the radio music box, Moore's law and finally the Negroponte switch. The first two were, indeed, associated with developments that eventually led to the situation described by the latter. There was new capacity and a type of rush to innovation – as suggested by the Sawhney principle – and there was the channeling and constraining of the innovation as it interacted with various institutions.

With hind sight, it is possible to say that a phrase was, or was not visionary. At one level, that is beside the point. It is also possible to assert that phrases or slogans such as the Negroponte

switch are a necessary part of the glue that link techno-political developments with the people who are implementing them. In the heat of the institutional scramble to deal with a changing field, these phrases light the way. It is through the establishment and elaboration of these catch phrases that institutions set their course. The problem is that in some cases they help to organize and direct efforts. In other cases they point in a direction that might lead off the edge of the nearest cliff. Finally, some of them never really catch on and end up being historical curiosities.

The basic mechanism here is technological or regulatory development. It is not enough, however, that the elements of new mediation forms are in place; there is also the need to organize institutional capacity for these developments. It is here that catch phrases such as the Negroponte switch or Sarnoff's comment on the radio come into play. These slogans encapsulate a complex technical and policy issue, they come from a legitimate source, and they need to be so pithy that they are engrained in the institutional culture where the developments are taking place. That is, they need to be a rallying cry for the troops who are busy with the development of the technology.

The history of wire and wireless mediation

In this chapter, I will look specifically at the historical context that led up to and coincided with the so called "Negroponte switch." In addition, with almost two decades of hind sight, I

will look into the fate of the phrase and set it into the broader context of the politics of technology development.²

To set the Negroponte switch into a broader historical context it is useful to trace the development of electrical and electromagnetic technology as applied to interpersonal communication and the broadcast of entertainment, news and commercial content. It is these two threads of development that laid the foundation for the mediation of voice, images, entertainment and interpersonal communication. That is, they are the technical core of the Negroponte switch.

The general line of development is that wired point-to-point – and generally interpersonal – communication developed in the mid 19th century in the form of the telegraph and later the telephone. About the turn of the century radio communication developed and by 1920 was also transmitting audio content, not just Morse code. During the early 1920's in the US there was a brief point of convergence – at least at the institutional level – for these two forms of mediation but basically until the late 1980's after the development of the transistor, wired and wireless communication lived their separate and largely parallel lives.³ With the rise of digital TV and cellular telephony the potential again suggested itself that the given practice was not necessarily set in stone. It is at this point that Gilder and Negroponte suggested the idea of the switch.

Ultimately, the prophecies suggested by the switch have, to some degree been achieved, but the picture here is quite muddled. The phrase, however, provides us with good insight into the

² While the Negroponte switch points to the comments of Nicolas Negroponte, it is not necessarily the case that either he or George Gilder, who actually coined the phrase, were motivated to establish a catch phrase. They may have simply meant it as an off the cuff statement. Nonetheless it somehow captured the imagination of others.

³ The technology for mobile cell based telecommunication was not mature in the 1920's.

politics of technology development, particularly when faced with the need to mobilize institutions either for certain types of development or to protect themselves from the assault of new techno-regulatory regimes.

Electricity applied to communication

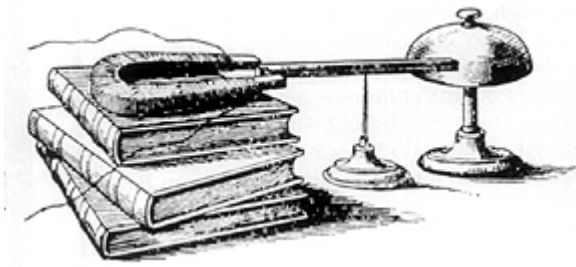
Joseph Henry was the first person to use electricity for the purpose communication. Henry used the principles developed by Michael Faraday, and indeed it is Faraday who laid the groundwork for both wire based and wireless communication.⁴ Henry applied the principles

⁴ To trace fully the development of mediated interpersonal and broadcast communication, it is convenient to go back to the time of Michael Faraday. It is perhaps one of the quirks of history that the fundamental scientific basis for both the generation of electricity and the understanding of the electromagnetic spectrum came from the same person. From relatively simple origins Faraday rose to be Humphrey Davy's assistant and eventually a member of the Royal Institute in London.

Looking first at electricity, that is basic to landline telephony, Faraday discovered the method for generating this type of power. Previous to Faraday electricity was basically equivalent to Leyden Jars and lightning. It was Faraday, along with Ampere, Ohm, Volta and Galvani, who worked out the basis for modern electrical technology. Thomas, Edison, of course was a telegraph operator early in his career and he went on to make improvements in telegraphy and also to engage in a pitched battle with George Westinghouse as to the benefits of AC and DC power. Foreshadowing the later discussion of Negropte et al, there was serious campaign to push the development trajectory of DC power by Edison, and doubtlessly Westinghouse. Each saw the unmet niche of electrification of the home and pressed their case using various forms of what we would call spin. Thus, instead of relying on amber rubbed against felt to generate static electricity, Faraday's work led to the development of reliable production of electricity. Along the way electricity was used for a variety of odd, morbid and even bizarre functions including various forms of therapy, execution and entertainment (Elsenaar and Remko 2002). This obviously found its application in terms of electrification, and more interesting for our purposes, telegraphy and telephony.

The same work on electrical generators led to the development of electromagnetic communication, in other words radio. Inspired by the work of the Dane, Ørsted he carried out a series of experiments that resulted in the discovery of electromagnetic rotation. Faraday's work on electro-magnetism inspired the work of Maxwell in Scotland, Hertz in Germany and finally at the turn of the 20th century, Marconi in the development of radio broadcasting (Winston 1998).

of electricity to various applications in the early 1830's. He developed a system for using magnetism to remotely ring a bell that was the forerunner telegraphy. In 1837, of course, Samuel Morse received his patent for telegraphy in 1848 after learning of Faraday's work and that of Henry.



Moving to the institutional realm, and Sawhney's period of creativity, wire based telegraphy found two niches that immediately assisted in its growth. The first was as a signaling channel for the control of the railroad and the second was the transmission of time-sensitive financial information(Standage 1998). While there was a period of competition in the industry the structure of the telegraph industry moved towards monopolization and by the end of the 1800's, Western Union in the US, The British Post office in the UK and Telegrafverket in Norway were the monopolists. Internationally, the International Telegraph Union was formed in the 1860's to develop standards for international interaction.

The roughly parallel but time shifted development of telephony for interpersonal communication followed somewhat the same development as telegraphy. In the US, based on the developments of Alexander Gramh Bell, the Bell telephone eventually formed into American Telephone and Telegraph (AT&T). Western Union was offered to possibility of purchasing the patents for the telephone. From this episode we have one of the oft repeated quotes – as well

as an illustration of Winston's suppression of radical potential – made by William Orton, the head of Western Union who felt that the telephone was an interesting toy but would not have practical implications (Winston 1998, 54). As with the later Negroponte Switch, the fact that this quip is remembered – and even savored by telephone people – points to the social dynamics of institutional adoption of technology. It is an example of just how wrong we can be. Orton was so thoroughly entrenched in the hegemony of Western Union he failed to grasp the fundamental shift presented by the telephone.⁵

Through a series of consolations and the idea of “Universal service” – another catch phrase that has organized the efforts of many policy makers – the reach of the telephone expanded. By the start of the 1920's wire based interpersonal and voice based communication was a well established institution in major cities and in many rural areas (Fischer 1992). The telephone and the telegraph co-existed for many years with the telephone gradually taking more and more of the traffic.⁶

The role of the telephone was, however, not simply for interpersonal communication. While the telephone was not designed to send or receive audio with any fidelity (de Sola Pool 1983), it was nonetheless used for the transmission of various types of entertainment. Here again is the Sawhney principle at work. In the 1870s music was transmitted over the telephone. It

⁵ Interestingly, this phrase is also recorded for other persons in different countries. According to various sources when “bankadministratoør Borch” first was shown the telephone he is also reported to have called it an interesting toy. This indicates that either the phrase is an urban legend that is retold in appropriate situations, or that the banker somehow knew of the comments by the Western Union executives.

⁶ Western Union had a niche in the area of financial services and the “wiring” of monies that is still essential in many third world countries. This niche is, however being threatened by mobile phone companies who are developing other methods of transferring monies.

seems that there was a positive craze for “telephone concerts” in the late 1879’s. On January 29, 1878 one affair was in Warren County Pennsylvania where in which singers and musicians performing in Jamestown, NY were heard in the hall through the use of the telephone and included a speech by Thomas Edison introducing his new “phonograph” (Warren County Historical Society 2005). From New Orleans in 1879 we hear of a "telephone concert" given by the telephone company in 1879 with Miss Minnie Wolf singing the Pizzicato Polka and other pieces (New Orleans Public Library 2005) and in Lonely Lake City, Colorado – a town with out telephony at the time – in March of 1878 we learn of William Penn Harbottle, the temporary editor of the local *Silver World* and who, among his other talents that were presumably played out in other locations, claimed to be a telephone-concert tenor horn soloist (Thompson 1974). Marvin reports on telephone concerts being sent from New York to Rochester and Buffalo in the 1890’s (1988; see also Nye 1997). Similar services were offered in Paris, London and Budapest. Indeed the last telephone concert sent from Paris seems to have been in 1932 (Crook 1999). Thus, there was the embryonic idea of broadcasting that, while mediated by the telephone, included the one to many structure of the later industry.⁷

Turning to radio based communication, Marconi was at work during the latter part of the 19th century to develop a practical method for the transmission of telegraph signals. During this period he continued to push the boundary for the transmission of telegraph signals until trans-oceanic communication became possible. By 1900 he had sent a message across Newfoundland and the UK.

⁷ Interestingly, the idea of broadcasting concerts is still alive. Concertgoers use mobile phones to transmit the concert to friends outside the concert location. One version is the so called cellcerts associated with the singer Clay Aiken (Watkins 2005). In this case, the remote friend sometimes uses a PC to post a quasi-real time blog to other fans describing which song is being played and the style of costume etc.

At the dawn of the 20th century, radio was basically unregulated, limited to Morse code, and was largely the realm of hobbyists.⁸ However, its unfulfilled role in the Titanic disaster and the use of radio in World War I led to the regulation and the eventual commercialization of the airwaves. This along with the technical development of voice modulation led to a genuine radio craze in the 1920's.

The amateur handling of news regarding the Titanic along with a deep and lurid interest in the fate of so many people changed the public opinion regarding the *laissez faire* regulation of the radio spectrum (Douglas 1987; Hargittai 2000). There was the convening of the International Radio-Telegraphic Convention in London in 1912 where it was decided to require ocean going passenger vessels had to have a wireless communication system that was to be staffed 24 hours a day. In addition, there was the passage of the U.S. Federal Radio Act of 1912 that was the first U.S. government involvement in this area. It required the licensing of operators and set aside frequencies for emergency communication.

The movement from radio based Morse code to the modulation of voice continued into the 20th century. The work of Lee de Forest resulted in the vacuum tube. This was essential since it amplified signals and allowed for the wireless transmission of voice. This period also saw some of the first use of radio for the distribution of entertainment. The idea of broadcasting was starting to coalesce. Mapping onto the idea that phrases help to organize the development and adoption of technologies, one metaphor that captured the idea of using the technology for the distribution of entertainment was Sarnoff's idea of the "radio music box."

⁸ Perhaps this might be described as the "Sawhney" period

The 'Radio Music Box' can be supplied with amplifying tubes and a loudspeaking telephone, all of which can be neatly mounted in one box. The box can be placed on a table in the parlor or living room, the switch set accordingly and the transmitted music received. There should be no difficulty in receiving music perfectly when transmitted within a radius of 25 to 50 miles. Within such a radius there reside hundreds of thousands of families; and as all can simultaneously receive from a single transmitter, there would be no question of obtaining sufficiently loud signals to make the performance enjoyable (Sarnoff 1920).

In January of 1917 Lee de Forest used his vacuum tube⁹ radio system to broadcast music in a "Concert by Wireless" and a month later broadcast a "Wireless Dance" (QST 1917). Writing in the April 1917 edition of the magazine QST de Forest reported:

A novel request was one from two gentlemen in Newark, N. J., who asked that on a certain evening we play dance music. This, in order that their guests of that evening, to the number of one hundred, might dance to our Graphonola Orchestra furnished us nightly by the Columbia Graphophone Company. We heard afterwards that this dance was a great success, as was the previous one in Morristown, N. J., for which we also provided the music at Highbridge, N. Y., thirty odd miles away (de Forest 1917).

The entry of the U.S. into the First World War temporarily halted this development. Amateur radio was suspended during the war for fear of spying and the U.S. Navy took over all radio signaling. Further, the fear of losing control of the radio spectrum prompted the government

⁹ De Forest's vacuum tube was a variation of the tube developed by Ambrose Fleming. The similarity between the two led to endless patent disagreements and, until Fleming patent expired in 1922 these disagreements caused the delay of broadcast radio (Winston 1998).

to regulate it in the years after the First World War. This included the organization of Radio Corporation of America (RCA) that resulted from the nationalized Marconi America. The company, which was controlled by AT&T and General Electric, was given the license to produce radio equipment in the US. Further, the government started the regulation of the radio spectrum and required licensing for those who wished to operate a radio station (For a discussion of this see: Hazlett 2001; and Moss and Fein 2003). This meant that RCA controlled the patents for vacuum tubes which gave it a *de facto* monopoly. After a short and troubled marriage to AT&T, it controlled radio for some time.

Thus, by the end of the First World War wired and wireless mediation were channeled into their separate directions. On the one hand point-to-point communication was carried out via wired systems that were the somewhat competing systems of telegraph and telephone. On the wireless side, the elements for the development of broadcast radio were on the table and they were starting to be used for what we recognize as broadcast entertainment.

Embedding of the channels

There were several issues that resulted in the canalization of telephony in the wired world and broadcast in the wireless world. Not to be a technological determinist, but there are good technical reasons for the paths chosen in the early years of telephony and radio. Following Farley:

As the vacuum tube and the transistor made possible the early telephone network, the wireless revolution began only after low cost microprocessors, miniature circuit boards, and digital switching became available (Farley 2005).

Thus, as of the 1920's, there were not the technical possibilities available for any form of switched interpersonal radio communication such as we now have with mobile telephony. The

development of cellular telephony awaited the rise of enhanced processing power. This is not to say that there was not overlap. Indeed early radio operators sent personal messages to one another and, as we have seen above, the telephone was used for the distribution of entertainment and news.¹⁰

Looking at radio, there are other considerations. In the early 1920's there was little understanding of whether broadcast technology would attract an audience. Up to that point, what we consider as broadcast radio had been dominated by amateurs who were interested in both sending and receiving transmissions. This metaphor was, to a certain degree, explored by AT&T in a period where they investigated the development of radio broadcasting. According to John Brooks, there was a notion that AT&T owned radio stations, starting with WEAJ in New York, would allow a telephone subscriber to call into the station and give a radio talk. Thus, radio would be supported by rental of the transmitter. The open time was to be filled with music (Brooks 1976).

Radio broadcasts for the purpose of entertainment or news started with the Westinghouse owned station KDKA and their reporting of the presidential election in 1920. Soon major events such as the Dempsey – Carpentier boxing match and baseball games were becoming a regular feature of radio broadcasts (Ackerman 1945).

The first use of the medium for advertising came in August 1922 when a real estate developer bought 15 minutes to promote a housing development called Hawthorne Court. There were soon others and eventually radio developed a mixture of entertainment/news (music, sports, comedy, theatrical performances, etc.) and commercial pitches. The owners of the station

¹⁰ There are still vestiges of the interpersonal form of radio contact as seen in HAM and also CB radio.

worked to manage the boundary between entertainment and commercials. The pattern was nonetheless set. In addition, many types of organizations applied for and received licenses for broadcasting during this period. In addition to major corporations newspapers, there were department stores, YMCA clubs, universities and churches. Following Douglas some of the connections were logical while others reflected the breadth of interest in radio during this period.

[. . .] in those euphoric months of early 1922 radio stations were licensed to some very eccentric and inexplicable owners. There was the Yahrling-Rayner Piano Company of Youngstown, Ohio (WAAY); the Palmer School of Chiropractic, of Davenport, Iowa (WOC); the C. F. Aldrich Marble and Granite Co., of Colorado Springs, Colo. (KHD); the Omaha Grain Exchange (WAAW); and even the Nushawg Poultry Farm of New Lebanon, Ohio (WPI) (Douglas 1997).

While there was a clear commercial drift in the US, the situation was different elsewhere. Looking to Europe at about the same time, the BBC was being organized in the UK. After a short period of commercial radio, broadcasting in the UK was nationalized and developed programming to be broadcast to its then wide flung colonial empire. The model, that is still widely copied, relied on licensing fees in lieu of commercials. Thus, the listener paid for their radio use with an annual licensing fee as opposed when they bought the toothpaste or shampoo that was advertised on the radio (as in the commercial US system). In addition to catering to the desires of the listeners, the BBC model also had the explicit mission of educational and public service programming. The motivation, in the words of its first Director General, John Reith was in typically gendered terms “Making the nation as one man.” Thus, we come again to the interaction between ideological perspective and the development of a techno-institutional organization (see Schwartz in this volume).

When thinking of the fast coming canalization of wireless broadcast and wire based telephony, this seems to be a particularly plastic moment in history. On the one hand, the soon to be premier radio broadcasting company RCA and the premier telephone company AT&T were indeed in a loose partnership. By 1923 AT&T was able to open a second radio station in Washington that used its telephone network to carry the signal between New York and Washington. Later that year, AT&T even used its telephone system in conjunction with local radio broadcasters to air the first nation wide address by President Harding.

The cooperation between RCA and AT&T was not easy to maintain. AT&T tried to enforce various types of monopolies and set what RCA believed to be inappropriate prices for use of the telephone transport between radio markets. There were lawsuits and various kinds of bickering between the two. By the middle of 1926 AT&T had sold its radio stations and had agreed to supply RCA with the telephone network in order that RCA could distribute their radio programs. Thus, anticipating the discussion of the Negro ponte shift, while there was a wire based network for the transport of what we have come to call content between local radio stations, the final distribution in a city was via ether.

By the mid 1920's the pattern had been established. While both telephony and radio communication had been used for several decades at this point, it was only when AT&T backed out of the broadcast industry that the pattern upon which Negro ponte and Gilder commented became the norm. As we enter into the first two decades of the 20th century, there was the well entrenched wire based transmission of interpersonal communication (the telephone system) and there is the nascent broadcasting of entertainment, news and not incidentally, commercials via local radio.

The convergence of wired and wireless

From the early 1920's until the late 1970's the model of wired interpersonal communication and wireless broadcasting went almost unquestioned. However, the development of first the transistor by Shockley, Barden and Brattain in 1947, and the resulting development of the integrated circuit in 1959 by Jack Kilby and independently by Robert Noyce changed the situation. Their development radically reduced the energy and size needed for electronic devices and thus enabled much of the technology development in the latter part of the 20th century (Winston 1998, 220). These developments paved the way for the changes brought by cable TV, the promise of HDTV and the growing development of wireless communication.

Looking first at wireless telephony, in the period after the Second World War there were several small trials with the intention of introducing a wireless local loop into the "switched" telephone service. These were the first steps associated with the eventual development of mobile telephony. As reported elsewhere (Ling 2004), one of the first such trials was carried out in eastern Colorado near the town of Cheyenne Wells. It was expensive to set up the telephone lines to the wide-spread farmers in the area. As an indication of the distances, some of the "local" farmers used airplanes to commute into town. From the perspective of the telephone company, it was potentially more efficient to connect the farmers into the system via radio. In town a telephone operator could patch the calls into the traditional wire-based system. In this case, the cells were many 10s of miles in diameter. The installations at the farmers' homes were stationary. Thus there was no need for systems to deal with "handoff" between

cells and indeed the cells were quite spacious when compared with today's. Radio had, however, entered into the realm of switched telephony.¹¹

The next advancement in cellular telephony came in the late 1960's with the trials on the New York – Washington Metroliner. In this trial a system was developed by AT&T that allowed the calls from the train traveling between the two cities to be handed off between cells. In order to deal with this system the engineers had to plan frequency use so that adjacent cells were not operating on the same frequency and thus interfering with each other. The development of the transistor as a supercharged version of the vacuum tube also allowed the development of first “luggable” and later quite portable handsets. Thus, in the latter part of the 20th century the development in telephony has seen the rise of smaller and smaller mobile handsets that move away from the geographically fixed landline telephone.

Looking back to the realm of broadcast, TV arose as a popular medium in the 1950's and 1960's (Schwartz 2002) (See Schwarz in this volume). Advances in television including the rise of cable TV, the attempted development of HDTV and also digital TV also arose from the development of the integrated circuit (Winston 1998, 140). Cable TV started to become a force in television distribution in the late 1970's with the rise of channels such as HBO and CNN. Since that time it has been a major conduit of information into the home. The major impact has been in terms of broadcast TV, but also internet and telephony have been delivered via the “TV” cable.

Interestingly, as these words are being written we see a new technical twist. Broadcast TV as well as “on demand” services such as YouTube clips are being offered via mobile telephone

¹¹ Similar radio based “local loops” have been used in the development of telephony in developing countries. See, for example Castelles et al. on the discussion of Little Smart in China (Castells *et al.* 2007)

handsets. Almost as to make a mockery of the Negroponte shift, if the broadcast material is being remotely gathered by a news team, the transmission involves a radio link into the wire based system where it is carried to the production center of a content provider and perhaps mixed with other programming (for example the anchor person talking to the remote reporter). From there it is sent back out through a cable system to a mobile phone tower where it is sent via a radio link to the final viewer.

Technical Paradigms in Historical Perspective

Faraday did not come close to envisioning the two paths of development traced here. His ideas on electromagnetic induction were, however basic for the development of both wired and wireless communication. Electricity was used as a medium for communication via wired channels first in the guise of the telegraph followed by the telephone and later by broadcast communication that also can include telephony. Electromagnetism developed first into radio based Morse telegraphy and later into voice and visual broadcast. With the development of the transistor it also was pressed into service as a form of mediated interpersonal interaction in the form of the mobile phone – that is now also becoming a TV terminal.

These developments have spun off various phrases to describe the different technologies. Sarnoff's "music box," Moore's prolific transistors and Gilder's formulation are three particularly central examples. Each of them was a prognosis and each of them also functioned to direct the institutional mobilization required for the development of the respective systems.

The context of the Negroponte switch

Thinking specifically about the Negroponte switch, it was posited in 1989 by George Gilder. Based on interaction with Nicolas Negroponte he asserted, "What goes over the air (broadcast

TV and radio) will go via wire and what goes via wire (telephony) will go over the air.” Expanding on this, Negroponete wrote some time later:

George Gilder and I have shared the podium frequently, and I have learned a lot from him. One of our first encounters occurred about 10 years ago at an executive retreat organized by Northern Telecom (now called Nortel). At this meeting, I showed a slide that depicted wired and wireless information trading places. This idea had been prompted, in part, by some early HDTV discussions, during which I and others questioned whether broadcast TV should get any spectrum at all, since stationary TV sets could be better served by wires (read: fiber).

In contrast, the theory continued, anything that moves needs to be wireless. Phones, largely wired at the time, would go wireless, and TV, largely wireless, would get wired. Gilder called this "the Negroponete Switch," (Negroponete 1997).

The Negroponete switch was posited in the era when “fiber to the home” was a popular notion. It was also the era when High Definition TV was under development, mobile telephony was becoming more common and we were at the dawn of the popularized internet. The technologies that were on the horizon at that point indicated that perhaps the public would be better served were the signals that had traditionally traveled wirelessly (TV and radio) could be transported by landline techniques while those that had traditionally been wire bound (telephony) could be transported through the ether. The need for capacity to transmit huge amounts of video material and the fact that telephony required much less band width indicated that the switch would be logical.

Today, there are large numbers of mobile phone users as well as the large reliance on cable TV. Thus, we might assume that the prophecy is true. Seen in this light, the idea of the Negroponete switch is prophetic. However, while there are some general lines of agreement, there

are also many devils in the details. In another sense, the phrase also provides insight into how there is a need to develop institutional ideologies in the sense of Berger and Luckmann (1967). That is, there is the need to mobilize institutions in the implementation of a technical or a regulatory vision. Slogans such as the Negroponte switch serve this goal.

Problems with the prophecy

With almost two decades of hind sight we now have a chance to see the value of the prophecy. As noted in the introduction, the wide spread adoption of mobile telephony and cable TV seem to indicate yes that this switch has indeed happened. In addition, the growing use of mobile communication points in the same direction. Point to point interpersonal communication had a long life in the wired world and has started to move into the wireless sphere. The opposite is, in many respects done the opposite. Thus, we can perhaps assume that Gilder and Negroponte's the prophecy has come true.

However, the details are not quite so clear. If we are only thinking of "Plain Old Telephony" as seems to be the case with Geller and Negroponte, they the slogan holds up. However, taking a few steps back, other issues arise. Looking at this from the perspective of mobile communication there is undeniably a wireless element. However, there is a lot of interpersonal communication that happens over wired systems. A lot of e-mail, chatting and IM'ing is still wired. Further significant portions of the population, particularly the elderly, still use wire based voice telephony.

Thinking of local radio connections, if we are using a traditional mobile telephone (GSM, CDMA, etc.) or if we use an advanced phone with a WiFi connection and, for example a Skype client, or if we use a so-called Wireless Local Loop system such as Little Smart that is widespread in China, the interaction makes the first part of its journey through the ether

(Castells *et al.* 2007; Sandvig, Young and Menrath 2004). After that, however, it is back into the wired world. The series of base stations, routers, backbone, etc are all wire based.

If we look at the local situation, Gilder was right, if we look at the broader system he was not. While in some countries and for some groups, wireless is the dominant form of voice mediation the idea does not hold up in all cases.

Arguing from a slightly different perspective a lot of entertainment has become cable based. This said, there is still a relatively large public for satellite based TV, and increasingly radio (see Carey's chapter in this volume). In addition, the traditional terrestrial TV broadcast system is still in place and occupying radio frequency. Thus, there has been the shift that Gilder suggested, but it is partial and it has not necessarily resulted in tidying up the resource allocation issues.

There is also a definitional question here. Increasingly, people are using local WiFi (read wireless) connections within their homes to afford them mobility and to avoid some of the "wire spaghetti" that seems to be a part of the PC world. Through these local wireless connections they are working (and engaging in interpersonal communication). They are also surfing the net as a form of entertainment. More to the point, they are downloading music and viewing video that are decidedly entertainment and formerly the turf of the broadcast industry.

While the bits that constitute the entertainment flow through different pipes (cable, copper based DSL, etc.) the last critical "local loop" is wireless. To the degree that this is going on, the success of Gilder's prophecy becomes a framing issue. In this case, there is the opposite outcome as when compared to interpersonal communication.

Thus, if we look at the broader system Gilder was right on. If we look at the immediate user configuration the answer is not so clear. Negroponte himself has also posed the same question in 1997 he wrote:

Was the Negro Ponte Switch correct after all? . . .

A decade later, it seems that this whole switching of places has been contradicted left and right. Satellite TV is doing fine. HDTV just got new spectrum. And the cable business is starting to include telephony. So how should one look at RF [radio frequency] today (1997; see also Negro Ponte 2002)?

George Gilder, the person who originally posited the name was also in doubt. He wrote “By 1994 the vision of scarce spectrum behind the Negro Ponte switch was in a rout” (1993). In a subsequent article he sketched some of the scenario outlined above when he noted:

In an era of bandwidth abundance, the Negro Ponte switch - with voice pushed to the air and video onto wires - may well give way to this division between fibersphere and atmosphere. With the fibersphere offering virtually unlimited bandwidth for fixed communications over long distances, the local loop will be the bottleneck, thronged with millions of wireless devices. Under these conditions, a move to high-frequency cellular systems is imperative to carry the increasing floods of digital video overflowing from the fibersphere (1993). Others have suggested that economic mechanisms can address some of the spectrum constraints and ease the issues associated with the transition of TV from its analogue era into the coming digital era (Hazlett 2001).

There are clear prophetic elements to the idea of the Negro Ponte switch and indeed some of the technological changes suggested by it have been realized. However, it would overstate the case to say that reality has followed the plan. The unforeseen rise of WiFi and other technological changes have skewed the picture. In spite of this, for a brief period, the Negro Ponte switch was seen as a clear vision of technical development. It crystallized the gist in both the direction of technical developments at the time and pointed to the problems being faced by

those developments. However, the introduction of other technologies into this mix changed the situation.

The Negrofonte switch as a policy slogan

Were the Negrofonte switch simply a technical prophesy, it would soon have been forgotten. It was, however, much else. The reason that this phrase is so well entrenched is that it summarized a complex technical situation, it stated a probable outcome, it came from a very legitimate source in the form of Gilder and Negrofonte, and that is also helped to marshal activity in important sectors of the society. In later life it serves as a type of benchmark with regards to the political, technical and social vectors of the time and it is indeed still being debated. Further, the statement came at a time when extra capacity was problematic. There were policy issues and technical futures at play. Because of these reasons, it gained legs in the minds of various persons who were engaged in the daily work of either developing or marketing technologies where the turf of the “other” group was for some reason desirable.

The Negrofonte switch was a successful slogan. It was used in the mobilization of certain social forces pushing for or alternatively resisting the establishment of a new technological regime. It was a call to arms for those wishing these changes to be made and it was also a warning to those wishing for the status quo.

As we have seen, the broad sweep of the phrase has been achieved, or perhaps not, depending on the framing of the data. What is interesting from a sociological perspective; however that is the phrase crystallized the tensions between significant institutional actors. Being coined at a meeting of landline telephone executives we might well suspect that it may have scandalized the meeting, or at least those executives whose jobs it was to maintain the copper based telephone system. It probably also energized the troops associated with the development of HDTV and mobile telephony.

To be sure, it was pithy, quick, it seemed to easily encapsulate broad trends in society and it came from highly credible sources who also had access to publication systems where it could be spread to the far corners of the earth. Thus it is not difficult to imagine that it soon appeared in hundreds, if not thousands of corporate presentations associated with the planning and development.

The cable industry saw it as a summary of how the development of technology would eventually trump the terrestrial broadcasting industry. In a similar way the radio based communication industries, such as mobile telephony, saw it as fitting into their campaigns to gain access to additional radio spectrum. For policy makers it outlined the issues with regard to who needed spectrum and who might not need it in the future.

In this respect, it is far from unique. There are many phrases and slogans that are pressed into service in this way. William Orton's description of the telephone as a toy, Sarnoff's radio "music box" and Moore's law have also served a similar function.¹² Looking for a moment at Moore's law, an interesting contrast is seen in the form of Grosch's law from 1956 that noted "computer performance increases as the square of the cost. If you want to do it twice as cheaply, you have to do it four times slower" (see Edward's chapter in this volume). This competed with Moore's law which observed that the computational power of computers would double every 18 months. The former statement suggested that the direction of development for computers would be for larger and larger machines. Here the politicking was between those advocating a few big computers and many small ones. In the early phase of com-

¹² In a more contemporary example, this time coming from Norway there is a slogan regarding the increasing reach of internet protocol that states "Alt over IP og IP over alt." (Everything via IP and IP everywhere) as is John Reith's vision for the BBC "Making the nation as one man." As with Moore's law, this is a statement used in the mobilization of resources. The BBC "Making the nation as one man."

puter development, the period when Sawhney suggests we look for creativity, we see two ideas that help to frame the development efforts.

Time has shown is that Grosch's side lost. Interestingly, however, there is a meta-text associated with each of these two alternatives. First, the notion of Moore's law helps developers, investors and users to think about possible future developments. Its seeming validation lets them orient themselves. Second, the implication with Moore's law is perhaps associated with the inevitability of the PC revolution. The social use of Grosch's law, to the degree that it is remembered is that it points to just how bad we – or perhaps poor Grosch – can be when trying to make prognoses. These other “laws” and slogans have played a similar role to that of the “Negroponte Switch.”

The social framing of technology development

The development of technical regimes is a complex process. The development phase of a technology sees the introduction of new potential and what Sawhney describes as a creative phase. Soon enough the potentials become institutionalized and their interaction with other pre-existing systems that deal with the same realm. In this phase we see Winston's suppression of radical potential. In this process there are technical developments, regulatory issues and there is the need to mobilize large institutions either in support or in the opposition to the change in technology. In an era of convergence we increasingly meet these issues.

It is into this situation that phrases, such as the Negroponte switch find their role. These phrases, coined by central people in the development milieu, often summarize a complex system, help others to understand the issues at play and organize their efforts.

We can see the results of these processes by looking at a perhaps flawed, but interesting meter of popularity. Specifically, as of this writing, there are 136 000 mentions of the Negroponte

switch on the web when queried via Google. There is, however, certain confusion as to its application. In most cases it refers to the cable/mobile phone exchange outlined above. In other cases it is more a reference to a physical switch that would re-route these two streams of information and in some cases it refers to Negroponte's idea regarding the replacement of atoms with bits. By this measure Moore's law is more thoroughly ensconced since it is mentioned on approximately 10.1 million pages while poor Grosch has his law mentioned only about 800 times. Sarnoff's comment on the radio as a "music box" is cited 19 600 times and the quip made by Western Union about the telephone being nothing more than a toy has 43 000 referrals.

These statistics show that these catch phrases also a career. They can become received truth regarding the inevitability of a certain type of development (Moore's Law), a cliché that may even become a straw horse (Western Unions preliminary evaluation of the telephone) a phrase has a perhaps limited shelf life (the Negroponte switch), or it can be forgotten (Grosch's Law). This is determined by the degree that they are oversold and by the degree to which they are overtaken by events.

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