

# Access to the Electromagnetic Spectrum is a Foundation for Development

Christian Sandvig, *University of Illinois at Urbana-Champaign*

## ACCESS TO THE SPECTRUM: NEW RULES IN THE PLAYGROUND

*"Purbo and Mahato are called pirates because they don't have the government's permission to transmit, but they haven't stolen anything."*

In 1985, unusual waves began to propagate from Yuendumu township - population 1,000 - on the edge of the Tanami desert in Australia. The waves were a television signal, an entirely "unauthorized, unfunded, uncommercial, and illegal" effort of the Warlpiri aboriginal nation.<sup>17</sup> Over the next years, the Warlpiri Media Association produced local, independent news broadcasts, aired indigenous language educational programming, and parlayed locally-controlled television exposure into political organization, tangible educational reform and other self-development assistance. In one memorable moment from the earliest days, the entire Yuendumu School Council traveled 290 kilometers to confront regional education officials with a video camera. As one council member said on tape, "We want this video to prove that we really did come and ask for these things, as the education department is taking no notice of our letters." The project has been a celebrated success in media development,<sup>18</sup> leading to a larger indigenous broadcasting movement and popular, award-winning content.

Twenty years later, Raghav FM Mansoorpur 1 began illegally broadcasting in Bihar, India with a related agenda. Raghav FM broadcasts brief, locally-produced news, HIV and polio prevention information, and a mix of Bhojpuri, Bollywood, and devotional songs.<sup>19</sup> Both Raghav FM and the Warlpiri Media Association could be seen as examples of many things: both were locally-initiated, had no outside support, had a development agenda, and were initially illegal.<sup>20</sup> In the 1980s and 1990s, it was enough to conceptualize these projects as falling within the category of "media for development" and to discuss them as independent broadcasters or media producers.

However, much has changed in the twenty years between the Warlpiri broadcasts and Raghav FM. Before considering the status of these projects as broadcasters or as producers of content, first step back and witness that these efforts require access to the electromagnetic spectrum. These transmitters produce invisible radiation that carries their messages of news, education, and entertainment to their destinations. The electromagnetic spectrum (or just "spectrum") is the range of all possible electromagnetic radiation: the playground on which the waves of Raghav FM intermingle with those of other stations and other services, from cellular phones to radio telescopes, military radios to wireless pacemaker controls, garage door openers to aircraft radar. The technical, legal, even notional and conceptual conditions for access to this resource - the electromagnetic spectrum -

<sup>17</sup> This quote is from Michaels (1994, p. 98).

<sup>18</sup> For example, leading to the **Australian Broadcasting to Remote Aboriginal Communities Scheme** (Warlpiri Media Association, 2003).

<sup>19</sup> For news coverage, see Tewary (2006). For an overview of recent similar efforts across media, see Slater & Tacchi (2004).

<sup>20</sup> The **Warlpiri Media Association** later received a license.

have been wholly transformed since 1985 because of plummeting costs, new digital applications, and new laws allowing transmission without a license in some countries. This and many other rules of this playground have great significance for media development projects, and may now be in flux.

## THE RADIO SPECTRUM

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Discussion of the spectrum is off-putting because it is even more heavily cloaked by jargon than other technology topics. However, the noun "*spectrum*" simply indicates a range, as the phrase "the political spectrum" is sometimes used to indicate a range of ideas. The spectrum used for communication is the range of electromagnetic radiation - the stuff that the familiar antennas of our cellular telephones and radios are designed to send and receive. The concept of "*the political spectrum*" is a range organized by opinion (the "*left*" and "*right*" of this spectrum refers to historical seating arrangements in the French National Assembly). The electromagnetic spectrum is a range organized by frequency - in other words, organized by the length of the wave (as in wavelength, shortwave, microwave etc.). Waves as long as atoms or amoeba sit on one end, compared to waves as long as football fields and planets on the other. As a physical phenomenon, there are no gaps in this spectrum and a wave could be infinitely long or infinitely short.

The key point to be made here is that human communication systems are not solely physical phenomena; they are also political and technical phenomena. Radio is as much a kind of physical wave as it is the result of the human capability for transmitting and receiving waves, combined with political decisions about how to design, deploy, and organize transmitters and receivers. That portion of the electromagnetic spectrum that can be used for communication is called "radio spectrum" or the "*useful spectrum*," but the definition of which waves can be used has expanded with the human ability to manipulate them.

It has been helpful to conceptually divide the radio spectrum into passages through which we can transmit - in everyday life most people know these passages as the channels of the television and the frequencies on the radio. These passages represent the imposition of human order on the spectrum. The definition of a useful passage always depends on the available knowledge and technology of transmission and reception. At the dawn of this knowledge, separating radio transmissions into different passages by frequency was not well understood, and Guglielmo Marconi began radio with effectively one channel. As knowledge about manipulating these waves has developed, so too the definition of the radio spectrum has continually changed. For instance, in North America AM radio was succeeded by FM radio, VHF television (channels 2-13) succeeded by UHF (14-83), with each new definition of passages for communication allowing more capacity.

At the turn of the 21st century, the notion of the radio spectrum continues to change. The old trick of defining a channel or a passage now appears suddenly less helpful, throwing long-held ideas about the organization of broadcasting and the media into question. It is not just that more channels may be available than previously thought, but that channels might not be necessary at all. It could be that everyone can have their own radio station.

## POLITICAL CONTROL OF THE SPECTRUM

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If the above suggests that the human capability to use the spectrum has been ever-expanding, this could easily lead to the conclusion that more channels are

necessarily a boon to media development and democratization. More capacity could ease entry for new broadcasters and promote pluralism in content and services. More channels must mean more voices, and that must be good. However, this conclusion should be put off. The Warlpiri Media Association and Raghav FM began their transmissions as pirates. That is, despite the fact that capacity in the spectrum was available for them, they were breaking the law because they did not have permission from their respective governments to transmit on the frequency they were using. The requirement that those who wish to transmit must first obtain government permission is axiomatic in the regulation of communication. This permission, in the form of the broadcast license, is a profound way that the state intervenes to control media and communication. The license limits the entry of new broadcasters, for instance blocking the unpopular and subversive from having a public voice in repressive regimes.

This kind of control over spectrum and its danger for the freedom of information is old news. One rationale for government licensing has been the perceived scarcity of channels. The introduction of channels served in part to meet the limitations of early radio technology that could not effectively distinguish between different signals. Since it is obvious that there are far fewer channels than citizens, some system of allocation was required. However, this rationale of scarcity is only one reason to impose licensing. Licensing was and is expressly political and limiting dissent and controlling speech is often the goal.<sup>21</sup> That means that more capacity does not necessarily mean more voices.

When the Warlpiri began broadcasting in 1985, they were afraid of new technology and new capacity. They acted just in advance of the introduction of TV signals across the Tanami desert via a new satellite, Aussat. The introduction of mainstream English-language television was a danger to the preservation of Aboriginal culture, language, and way of life. After the introduction of Sesame Street into every home, why would children still speak Kaytetye and Warlpiri? Of course the planned promulgation of Sesame Street far and wide across the Tanami desert was not the manifest destiny of spectrum expansion, satellites, or new technology generally, it was a political decision.

Careful attention needs to be paid to the political and institutional surroundings that determine these choices. In 2006, nations are again at the brink of an expansion in communication capacity that could mean many things, depending on political decisions.

<sup>21</sup> For a review, see Horvitz (2005).

## NON-MONETARY RADIO AND DIGITAL CONVERGENCE

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A number of new developments in both technology and regulation have intervened in the twenty years between the foundation of the Warlpiri project and Raghav FM. The first is the dramatic improvement in wireless technology and the dissemination of knowledge about it. While the Warlpiri project was noncommercial, Raghav FM was almost non-monetary. Raghav Mahato found out how to build his transmitter from parts worth 50 rupees (about US \$1). This is more than a decline in price: it turns the typical thinking about the costs of "mass" communication on its head. According to a BBC estimate, the transmission equipment for Raghav FM costs 1/5 as much as the amount that listeners in Mansoorpur pay for the radio set that receives it (about \$5).<sup>22</sup> This fall in costs is not limited to old-fashioned analog radio. While new digital systems are not free, they have declined dramatically in price while offering new abilities.

<sup>22</sup> This phenomenon is global. Radio pirate Stephen Dunifer has recently distributed a transmitter kit for \$300-700 that allows an audio broadcast radius between 5 and 15 miles.

These kits have been used for new stations across the United States, in Haiti, and in Chiapas, Mexico.

While the Warlpiri station was a story about cheap, new technology (videotape), the features and organization of radio technology at the turn of the 21st Century

are now fundamentally different. As alluded to earlier, the old trick of defining a passage or a channel in the spectrum now seems to be less necessary. In a 1983 experiment, the US FCC allowed the use of devices that spread their transmissions out over many channels and did not require a license to transmit. New technology and a short range obviated the need for licensing to prevent collisions and interference when two users wanted the same channel. This unlicensed or "license-exempt" band gave the world cordless phones, garage door openers, baby monitors, and generally a wealth of short-range radio stations that did not require government permission to operate. In the late 1990s, "Wi-Fi" wireless Internet technology came on the market and used this regulatory easement in the spectrum.

## A FIRST QUESTION FOR MEDIA DEVELOPMENT

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Around 2000, Wi-Fi allowed cheap, high-speed computer-to-computer communication over short distances. It became a demonstration of the new rules of a transformed spectrum.<sup>23</sup> Media development activists and entrepreneurs the world over quickly took this indoor, short-range equipment out to their rooftops and started building cheap and unlikely communication systems that promote new voices.

California's Tribal Digital Village uses solar and gasoline-generator-powered Wi-Fi to provide high-speed Internet access on rural, mountainous Indian reservations that have no power or telephone service.<sup>24</sup> Free2Air patches Wi-Fi networks together with wired telephone lines to extend telephone service to artists lofts in London.<sup>25</sup> In India, wireless allowed n-logue to launch an ambitious, sustainable rural Internet kiosk project offering, among other services, agricultural, veterinary, or medical queries to government officials (US\$0.23/each), English lessons (\$5.74/month), and Internet horoscope matching (\$0.69 for 40 pages).<sup>25</sup>

The happy marriage of computers with cheap wireless equipment has allowed these groups to supplement and disturb (if not usurp) the monolithic media and communication systems that did not serve them well. It is this marriage that changes the policy landscape for media development today. Connecting cheap radios to computers has allowed distinctions between applications to disappear: wireless Internet providers offer videoconference, audio and video content, email, telephone, one-to-many or one-to-one communication. More fundamentally, these new wireless systems have the prospect of using the spectrum much more efficiently than in the past - many more systems can cheaply coexist with Wi-Fi and related technologies. In some places, good advice for the social entrepreneurs of media development is then: go digital. But to launch these services, the way forward is not to wait for these unstoppable technological potentials to unfold on their own. Those interested in media development must act.

While these upstarts have potential, the future is not yet theirs to make. Governments the world over are used to imagining telecommunications and the spectrum as a lucrative purse that can be used to extract license fees for the treasury. While research and investment in advanced wireless technology has produced new possibilities for communication systems, this has been coupled with laws that allow free access to the spectrum only in parts of the global north. In contrast, building your own Wi-Fi project is legal and does not require advance government permission in only 4-6% of Africa. Sometimes new information sources have proven popular enough to sustain and protect illegal pirates with popular sentiment, but this sort of security is uncertain. As Indonesian Wi-Fi pioneer Onno Purbo writes, "*we run the [equipment] without any license from*

<sup>23</sup> See Werbach (2003).

<sup>24</sup> see <http://www.sctdv.net/>

<sup>25</sup> see <http://www.free2air.org/>

<sup>26</sup> See <http://www.n-logue.com/> and for a review, see Proenza (2005, p. 19-20).

the government. Fortunately, the Indonesian media helps keep us from being jailed.”<sup>27</sup>

If media projects promise to help alleviate social problems in developing countries, a first question for media development is, “What are the conditions for access to the spectrum?” The politics of spectrum have always underpinned questions about the media, and while spectrum policy is as important as ever for television and radio stations, the 2000s have presented the world with a chance to seize new capacity through digital systems. This chance is only open to developing countries if the law permits at least some unlicensed access to spectrum - access without a fee and without advance permission. To truly celebrate the communication of health, education, and political information on Onno Purbo’s Jakarta Wi-Fi network or Raghav Mahato’s Mansoorpoor 1, projects like these need encouragement. Purbo and Mahato are called pirates because they don’t have the government’s permission to transmit, but they haven’t stolen anything.<sup>28</sup>

27 Depending on the frequency used (Neto, Best, & Gillett, 2005, p. 76).

28 From Purbo (2003, p. 24).

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# media matters

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