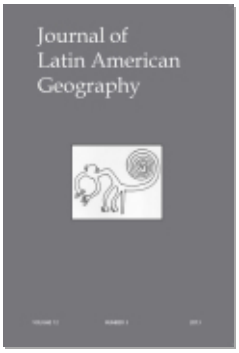
Technological Dependency and the Internet: Latin American Access from Buenos Aires, 2001–2013

Gustavo D. Buzai



Journal of Latin American Geography, Volume 12, Number 3, 2013, pp. 165-177 (Article)

Published by Conference of Latin Americanist Geographers

Technological Dependency and the Internet: Latin American Access from Buenos Aires, 2001-2013

Gustavo D. Buzai
Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
Grupo de Estudios sobre Geografía y Análisis Espacial con SIG (GESIG)
Universidad Nacional de Luján

Abstract
Although the Internet was born from the desire to maintain decentralized research sites via high-speed interconnections, its development, however, has produced a highly hierarchical and centralized network space. Through the application of spatial analysis here is represented cartographically the new global map of cyberspace as viewed from Buenos Aires, Argentina. This space is suitable for conducting further explorations but it also has potential geopolitical dimensions. It verifies the emergence of new digital borders between central and peripheral countries, and an increasing fragmentation in interconnecting Latin American countries. Reversing this situation provides future challenges.
Keywords: *cybergeography, cyberspace, Internet cybermaps, spatial analysis*

Resumen
Aunque el Internet, nació del deseo de mantener sitios de investigación descentralizados a través de interconexiones de alta-velocidad, su desarrollo ha producido un espacio de redes altamente jerarquizado y centralizado. A través de la aplicación de procedimientos del análisis espacial aquí se representa cartográficamente el nuevo mapa mundial del ciberespacio visto desde Buenos Aires (Argentina). Un espacio apto para la realización de nuevas exploraciones pero también un espacio que presenta posibilidades geopolíticas. Se verifica el surgimiento de nuevas fronteras digitales entre los países centrales y periféricos, ampliando la fragmentación en la conexión de los países de América Latina. Revertir esta situación es un desafío futuro.
Palabras clave: *cibergeografía, ciberespacio, cibermapa Internet, análisis espacial*

Introduction

We all maintain a location (site and position) in geographical space while we are using a computer to enter cyberspace. From both locations simultaneously one performs the usual tasks of sending and receiving emails and visiting websites. It is always surprising to experience the almost instantaneous form of this kind of communication and at the same time, seen from a geographical perspective, one might experience some kind of concern to witness many opinions from different sectors that emphasize the lack of relevance that geographical space may have (Creig 2002) in the context that the current digital technologies have produced.

At the onset of the 20th century has begun to developing the core countries a new specialty in our science: cybergeography, whose study includes the spatial nature of computer communication networks, including the Internet and all electronic "places" that can exist between computer monitors (Kitchin1998; Dodge and Kitchin 2001a; Buzai 2001; Buzai and Toudert 2004; Lopez Levi 2006), which is known as cyberspace.

Cybergeography, considering the new socio-spatial relationships, involves clear lines of study including: the spatial distribution of physical equipment of information technology and communications (ICT), socio-demographic aspects of the new virtual communities, perceptual visualization of new electronic spaces and the geographical study of communication flows. This paper focuses on this last aspect.

When we connect to the Internet and perform any procedure our communications follow a path; messages and requested searches circulate through precise locations of computer servers that both store and process digital data. The geographical analysis of these flows allows us to see this new digital world map and we can measure the integration, or lack thereof, of Latin American countries within the current cyberspace borders.

The Internet, the network of networks that was born from the desire of linking decentralized research sites (Torres Martinez 2008) also shows other features and components. Some of them may be revealed through geographic analysis. This paper initially explores the emergence of the network as an idea and its evolution to achieve partial globalization today. We then proceed to assess the current possibilities offered by cybergeography and via its exploration and through the use of specific software, to measure certain of its components. By determining the positions of cities worldwide relative to Buenos Aires (Argentina) new cybermaps are composed to demonstrate of the existence of new data nodes and digital frontiers.

The Network as an Idea

History clearly demonstrates that many advances in applied science and technology were driven by war activities: the Internet is no exception. It started on October 4, 1957 with the successful launch of Sputnik 1. The first artificial satellite sent into orbit by the USSR generated an immediate response from the United States to expand the financial budget for the development of aerospace activities and initiate the so-called space race. Organizations such as the National Aeronautics and Space Administration (NASA) were designed to advance astronautics and the Advanced Research Project Agency (ARPA)

within the Department of Defense, to develop advanced communication systems (Kitchin 1998).

In 1961 a great impetus was given to the activities of ARPA when a set of re-transmission antennas was sabotaged in Utah showed the high vulnerability of military communications system (Morriss 1998). For this reason, in the following years there was a notable promotion of intellectual efforts aimed at providing concrete answers to achieve communication channels resistant to local sabotage or a massive potential missile attack from the communist bloc, mainly the USSR. The communication network was launched as a priority in strategic development by the United States during the Cold War years.

The Network in Reality

High speed communication between computers was made possible and its growth increased exponentially. The onset of this process occurred when ARPANET was developed in 1969, linking four dispersed research computer clusters (Los Angeles, Santa Barbara, Utah and Massachusetts) inside the United States. In early 1980 ARPANET was split into two separate networks: MILNET (Military Net) for military use and NSFNET (National Science Foundation Net) for civilian use, mainly academic. The latter, NSFNET was the original US component of what is now known as the INTERNET when different national civil society networks began to connect to it. NSFNET evolved to become the "backbone" of the network connecting an ever-increasing number of super-computer nodes. By the end of the 1980s some 19 countries were connected to NSFNET: Australia, Germany, Canada, Denmark, Scotland, Finland, France, Wales, Holland, England, Iceland, Israel, Italy, Japan, Mexico, Norway, New Zealand , Puerto Rico and Sweden (Zakon 2011). For its part, Argentina would not be connected to the grid until 1990.

A new world began to develop between computer screens. Initially only a landscape of inhospitable alphanumeric data was visible on-screen until 1990 when the first Internet browser program was created by Tim Berners-Lee, called World Wide Web, and later Nexus. Then in 1993 Marc Andreessen created the more popular graphical browser Mosaic (Netscape from 1994). This allowed any user to move within the whirlpool of ever-increasing electronic data through relatively simple hypertext links and through a selection made with the new "mouse" to instantly access any point in the network regardless of the geographic location of the target. Mosaic made possible a multimedia presentation of data which could access and exchange of information. The developing Internet network, now came to be called the World Wide Web (www) and rapidly began showing complex data landscapes in an efficient and enjoyable manner. Connections to the Internet grew rapidly so that by the beginning of the 21st century millions had access to the online texts, images and videos (Table 1).

Table 1. Worldwide Internet users (Source: Miniwatts Marketing Group)

Regions	Population (2012 Est.)	WWW Users Dec. 31, 2000	WWW Users June 30, 2012	% Population (Penetration)	Users % world
Africa	1,073,380,925	4,514,400	167,335,676	15.6	7.0
Asia	3,922,066,987	114,304,000	1,076,681,059	27.5	44.8
Europe	820,918,446	105,096,093	518,512,109	63.2	21.5
Middle East	223,608,203	3,284,800	90,000,455	40.2	3.7
North America	348,280,154	108,096,800	273,785,413	78.6	11.4
Latin America/ Caribbean	593,688,638	18,068,919	254,915,745	42.9	10.6
Oceania/ Australia	35,903,569	7,620,480	24,287,919	67.6	1.0
World total	7,017,846,922	360,985,492	2,405,518,376	34.3	100.0

Cybergeography and its Exploration

In 1984 the science fiction novelist William Gibson in his book Neuromancer first used the term cyberspace, defining it as:

> A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught high mathematical concepts... A graphic representation of data abstracted from the data banks of every computer in the human system. An unimaginable complexity. Light lines classified in the non-space of the mind, clusters and constellations of data. As a city lights away... (Gibson 1997: 69-70).

From this perspective, cyberspace appears as an electronic matrix of interconnections between digital databases through computer systems connected to the network; a new space that overlaps with the actual physical geography and empirical landscapes, in turn, whose populations support geopolitical strategies for its control.

Browsing this new space involves the objective of arriving at places unknown, the use of material means to locate this new data world and the possibility of conserving the findings for later dissemination. The relational space found today between computer screens has generated new possibilities for exploration and some geographers were soon interested in the adventure that involves the study of cyberspace. The forest maze of information can now be opened up via hypertext links that allows pathways for the machete of the mouse

In this sense, the 21st century began with new and interesting perspectives for the analysis of the relationship between the real world and its digital representations at different scales, in the context of cyberculture and advances in digital simulation from virtual reality as an exploratory medium (Fisher and Unwin 2002). Cybergeography is presented as the study of the spatial nature of existing communication networks and the spaces between the computer monitors.[1] Possible studies include a wide range of types, from those focused on the materiality of the spatial distribution of the physical infrastructure, to the most abstract and aspects of the perception of new digital places of Code/space (Kitchin and Dodge 2011). Communication flows show spatial relationships which, based on the content--be it a cultural or decisional matrix, can show among many others, demographic characteristics of the new virtual communities whose locational characteristics are characterized by spatial fragmentation (Riviere 2009); globalization of economic activities through e-commerce; teleworking within the organizational restructuring of employment, and restructuring the real physical geographic spaces. From the point of view of geopolitics one can study the socio-national Internet-space technology (Warf 2009) and advance the study of cybernetic control of society (Lobohem 2010; Buzai 2012; Shiller 2013).

Cybercartography

A central interest has been the mapping of cyberspace, as demonstrated when *National Geographic* in its first issue of 2000 published maps made by Bill Cheswick and Burch Hall of Bell Laboratories (Carroll 2000) and shortly afterwards the publication of the first of two elegant systematizations by

geography pioneers Dodge and Kitchin (2001a, 2001b), then by Toudert and Buzai's (2004) conceptual perspectives from Latin America.

There are clearly different possibilities of objectifying cartographic representations of reality. Topological maps are those that present lineal connections of relational space, the links between places, their relative positions and cyberspatial distances in a functional space measured by time (Mihalache 2002). Using this cartographic perspective and methodology this paper attempts to measure the relative position of Buenos Aires in global cyberspace and specifically in relation to other Latin American countries.

The methodology used was based on one of the software programs called traceroutes, which allows one to follow communication paths between computers and produces a report indicating why the connection went via certain places and how long the connection took.[2] The data obtained are converted to become the basic input for mapping geographic and cartographic modeling techniques to attain cartographic representations.

Cyber-cartographic Analysis

Visual analysis of spatial configurations presented in the three representations of cyberspace immediately present number of issues of interest. Cyberspace is characterized by a highly hierarchical network configuration with a clear center and a periphery. The empirical spatial distributions show it to be an equal space only in theory.

In this test of network connectivity the connections were established at approximately 13:00 hours (local Buenos Aires time) to university academic websites of different countries, one for each major city (usually capital cities)[3] in the 192 countries in the world (Le Monde Diplomatique 2012) and the evidence demonstrates (Figure 1) that 27.27 percent passed first through Pennsauken (New Jersey, USA), 25.75 percent through of Tysons Corner (Virginia, USA), 15.91 percent through Italy, 15.15 percent through Middletown (New Jersey, USA), 11.36 percent through Miami (Florida, USA) and the 4.56 percent balance through Boston (Massachusetts, USA), Bagnolet (France) and Vienna (Virginia, USA).

While in physical geographical space Argentina borders five countries: Bolivia, Brazil, Chile, Paraguay and Uruguay, in cyberspace, Argentina represented by its capital, borders three countries: USA, Italy and France (Focás 2013), with percentages of 82.57 percent, 15.91 percent and 1.52 percent respectively. After passing through the servers of one of those digital neighboring countries Buenos Aires can reach any other country in the world system.

This exercise in tracing the routes of connections from Buenos Aires revealed no path that is direct and without steps to the destination cities. For example, the connection between Argentina and Uruguay (geographically a straight line) did not cross the Rio de la Plata, but the path began in Buenos Aires and then went by way of Miami, Atlanta, New York, Newark, Baltimore, and Fairfax, finally reaching Montevideo. To reach to Chile was even more strange from a strictly geographical perspective, of course that the connection crossed the Andes, but from Buenos Aires the route went to Pennsauken, Elkridge, Washington, New York, Boston, returned to Buenos Aires and from there, went to Santiago de Chile!

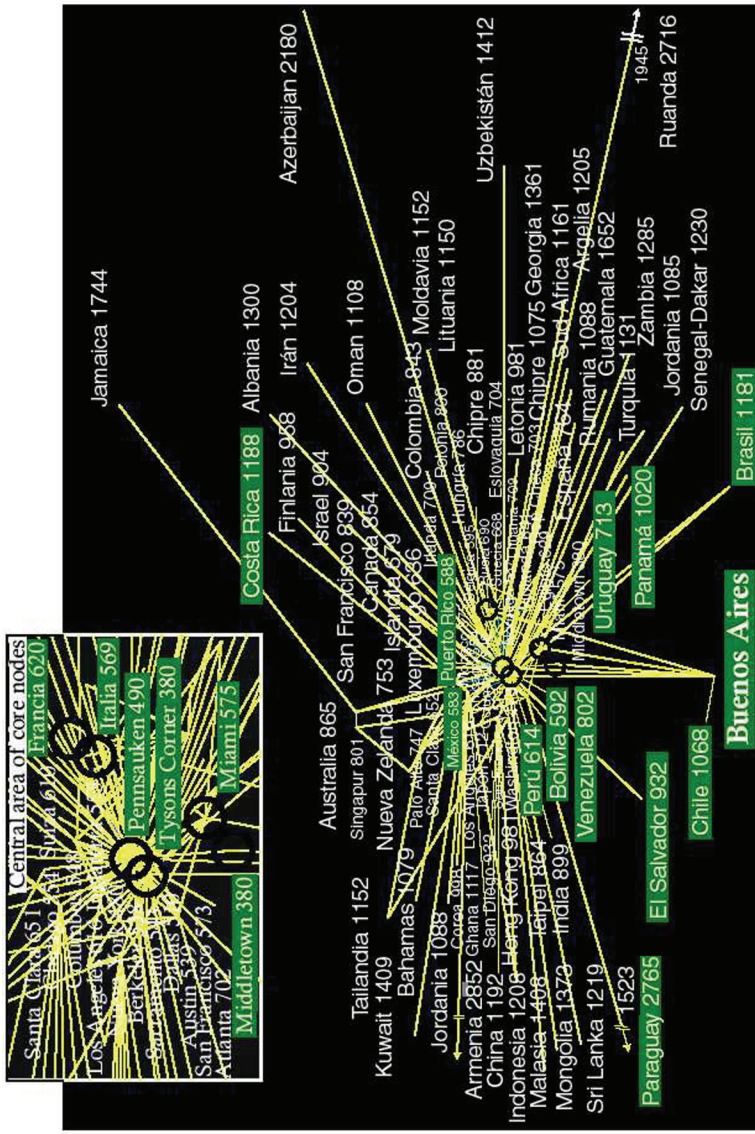


Figure 1. Communication flows from Buenos Aires to Latin American cities (Source: the author)

Figure 2. Positions in space-time relative to Buenos Aires (Source: the author).

But upon examining the cluster of high-speed server gateways in the US, which act as Network Access Points (NAPs), one can appreciate that they reflect the location of key private sector network providers such as Sprint. The center of cyberspace can be defined are the zone in which connection time is less than half a second (Figure 2): Middletown (380ms), Tysons Corner (470ms), Washington (470ms), New York (480ms) and Pennsauken (490ms). Other semi-central locations are also within

Very close time distances: Boston (552ms), London (555ms), Montreal (583ms) and Italy (559ms). Other Western European points form a first ring Paris (620ms), Luxemburg (637ms), Geneva (646ms) and Stockholm (668ms). Eastern Europe is further distant: Moscow (690ms), Bratislava (704ms), Budapest (786ms) and Warsaw (800ms). The Pacific Ocean region further extends the distances: Auckland (753ms), Sydney (865ms), Hong Kong (981ms), Canberra (994mls) and Beijing (1,992ms).

This situation, for Argentina link origins, shows that Oslo, Copenhagen, London and Monte Carlo are closer in cyberspace to Buenos Aires than any Latin American city. One may note that Mexico City, La Paz and Lima are located in the first outer ring on Figure 2; Moscow, Stockholm and Cairo are closer in linkage time-distance than Montevideo. Madrid, Tokyo or Prague are closer than Caracas. Hawaii, Aukland or Budapest are closer than Bogota. Taipei, Vancouver and Zurich are closer than El Salvador. Jerusalem, Hong Kong and Helsinki are closer than São Paulo. Argentina is as distant in cyberspace as Armenia (2,852ms), but our second most distant "cyber-neighbor" is Paraguay (2,765ms), which is geographically one of our bordering neighbors!

Currently connections between Latin American countries cannot occur without passing through the gateway-hubs located in the United States (Figure 3). Communication paths measured during the August 2013 can be seen to be concentrated 88 percent in Miami (Florida) and 8 percent in Broomfield (Colorado); in total 96 percent of the connections requested from Buenos Aires to the different Latin American cities as destinations passed through the Unites States.

More recent developments related to a direct connection to Montevideo from Buenos Aires derive from a new submarine fiber-optic cable (UNISUR) between Argentina, Uruguay and southern Brazil described by Warf (2006). This explains the remaining 4 percent of communication that does not go via the usual high-speed distant hubs but rather directly between Buenos Aires and Montevideo.

For Argentina and other Latin American countries this may be considered the first sign of an impending spatial transition. Currently building a mega optical-fiber ring 10,000 km. that traverses the oceans' shore and closing the circle with the direct terrestrial link between Santiago (Chile) and Buenos Aires (Argentina) should integrate all the countries of South America (Zibecchi, 2012). Is expected to be fully operational in 2014 and thereby eliminate the current dependence on the U.S. to maintain high-speed communication. In this sense, the spatial configurations of the three Figures (cybermaps) presented here constitute a basic state of the system in the early 2000s that will allow one to evaluate spatial changes that will occur in the not too distant future.

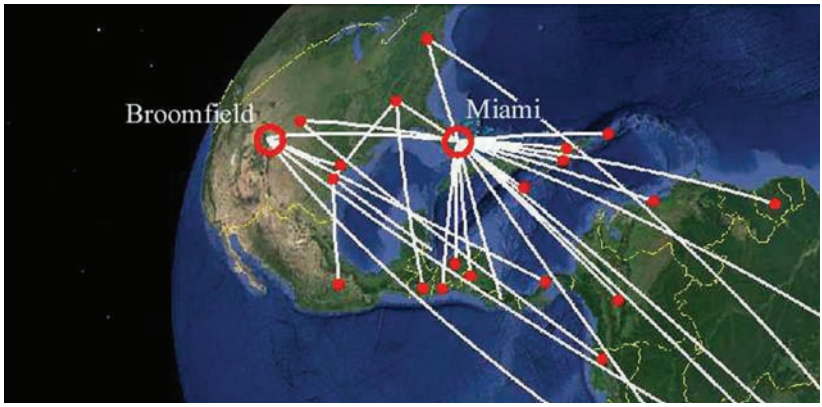


Figure 3. Linking Latin America (Source: the author)

Conclusions

Cyberspace was once thought of as a process of consolidating globalization in which national boundaries would be erased (Castells 2001); the world would be smaller (Harvey 1998) and the Earth would be 'flattened' (Friedman 2006). But today we know that new frontiers of cyberspace are generated through communication links distributed in relational but also geographical space, the barriers being costs of infrastructure and demand for service. For the case of Buenos Aires it appears that its neighboring countries in cyberspace are several core technologically well-developed countries through which the flows of most of the world's communications flow.[4] Test measurements show that the core countries are near-neighbors of all the peripheral countries, with few exemptions: in general none of the latter can limit/link each to another directly. Connections to the U.S. are made directly, but any connection between Latin American countries will continue to be mediated by the central server nodes located primarily in the USA.

Historically the great powers have fought for control of the roads (Romans, Mongols), oceans (Spain, Portugal, England), air (Germany, Britain, USA) and outer space (U.S.A., USSR, Europe and now China). At the present time some still dominate cyberspace by their advanced technology and controls over the processing of digital transfers, and thus defining new 'borders' and new geopolitical relationships.

This case study demonstrates the persistence of high 'fragmentation' of Latin America in cyberspace (Abramson 2001).In this sense we believe that plans for technological implementation of new regional-based Internet support should be useful to the countries involved—in this case Latin America, but of course that would involve generous international financial investment, and the private companies that run the systems agreeing with such a move. Whether such a shift to decentralized networks would be advantageous remains a moot point.

Notes

[1] Cybergeography:
http://personalpages.manchester.ac.uk/staff/m.dodge/cybergeoraphy/about.html (Accessed May, 2013).

[2] VisualRoute5.0 software was used with14.0I versions. The connections were made from Buenos Aires (at 13:00 local time) to every country in the world during the period 2001-05, mostly in 2003. There port included the number of routers that the connection was going through, their name and identification number (IP), geographical location in latitude and longitude, time zone world travel and temporary extension (total and in each section of the network) in milliseconds(ms).The cartographic design was conducted using the following procedures: (1) connection to a web site from Buenos Aires to a city of a country; (2) calculation by the traceroute and obtaining the corresponding report, (3) trace the path of the connection on the world map with software; (4) obtaining 192 world maps (layers) with a single stroke each; (5) Overlay of all layers; (6) conceptual generalization dashed simplification process; and (7) final design including plotting of country names and distances in milliseconds (ms).

[3] For certain countries the largest city was selected, rather than the capital, these included: São Paulo, Sydney, Toronto, Mumbai.

[4] Aspects related to the complexity that represent multiple and shifting Internet borders, associated with the loss of materiality and symbolic gain can be found in Gómez Aguilar (2005). These considerations conceptually difficult situation to make a single mapping relations to complete viewing from a site cyberspace panopticon not linked to a specific location.

References

Abramson, B. D. Internet Connectivity in LDCs
www.itu.int/osg/spu/ni/ipdc/workshop/presentations/Abramson.ppt (Accessed 6 August 2013)

Buzai, G. 2001. Paradigma Geotecnológico, Geografía Global y CiberGeografía. La gran explosión de un universo digital en expansión. *GeoFocus*. 1: 24-48.

_____. 2012. El ciberespacio desde la Geografía. Nuevos espacios de vigilancia y control. *Meridiano.* 1: 265-278.

Castells, M. 2001. *La galaxia internet.* Barcelona: Plaza & Janes.

Carroll, A. 2000. Mapping Cyberspace. *National Geographic*. January: 140.

Ceruzzi, P. 2011. *Internet Alley. High Technology in Tysons Corner, 1945-2005*. MIT Press. Cambridge.

Creig, J. M. 2002. The End of Geography? Globalization, Communications and Culture in the International Systems. *Journal of Conflict Resolution*. 46(2): 225-243.

Dodge, M. and R. Kitchin, 2001a. *Mapping Cyberspace*. London: Routledge.

_____. 2001b. *Atlas of Cyberspace*. New York: Addison-Wesley.

Fisher, P. and D. Unwin, 2002. *Virtual Reality in Geography*. London: Taylor & Francis.

Focás, B. 2013. En el "cibermapa" el país limita con EE.UU., Italia y Francia. (Report on Gustavo Buzai's research). *Perfil*. (Buenos Aires) Domingo 28 de junio, pp. 44-45.

Friedman, T. 2006. *La Tierra es plana. Breve historia del mundo globalizado del siglo XXI*. Buenos Aires: Planeta.

Gibson, W. 1997. *Neuromante*. Barcelona: Minotauro.

Gómez Aguilar, A. 2005. Fronteras electrónicas y nuevas dinámicas trasnacionales en Internet. *Comunicación* 3: 39-49.

Harvey, D. 1998. *La condición de la posmodernidad*. Buenos Aires: Amorrortu.

Kitchin, R. 1998. *Cyberspace*. Chichester: John Wiley & Sons.

Kitchin, R. and M. Dodge. 2011. *Code/Space: Software and Everyday Life*. Cambridge Mass.: MIT Press

Le Monde Diplomatique. 2012. Estados: un puzle mundial de 192 piezas. *Altas de las Mundializaciones*. Fundación Mondiplo-UNED. Valencia.

Lobohem, F. 2010. *Así nos vigilan*. Madrid: i.punto.

López Lévi, L. 2006. Geografía y Ciberespacio. En Hiernaux, D. and Lindon, A. (eds.) *Tratado de Geografía Humana*, pp. 538-553. Barcelona: Anthropos.

Mihalache, A. 2002. The Cyber Space-Time Continuum: Meaning and Metaphor, *The Information Society* 18(4): 293-301.

Miniwatts Marketing Group. 2012. Estadísticas mundiales del Internet. http://www.exitoexportador.com/stats.htm (November 22, 2012; Accessed August 4, 2013).

Morriss, A.P. 1998. Does the Internet Prove the Need for Government Investment? The Real Internet Grew out of a Spontaneous Ordering Process.

Foundation for Economic Education: http://www.fee.org/the_freeman/detail/does-the-internte-prove-the-need-for-goverment-investment#axzz2aztYSpVp (November 1, 1998; Accessed August 4, 2013).

Riviere, I. 2009. Un mundo comunicado y territorialmente fragmentado. *Geografía y Sistemas de Información Geográfica* 1: 1-16.

Shiller, D. 2013. El ciberespacio en disputa. *Le Monde Diplomatique*, Edición Argentina. Buenos Aires. Febrero, No. 164: 22-23.

Torres Martínez, R. 2008. *Los nuevos paradigmas en la actual revolución científico-tecnológica*. San José de Costa Rica: UNED.

Toudert, D. and G. Buzai, 2004. *Cibergeografía*. Mexicali: Universidad Autónoma de Baja California.

Warf, B. 2006. International Competition between Satellite and Fiber Optic Carriers: A Geographic Perspective. *The Professional Geographer*. 58(1): 1-11.

_____. 2009. Diverse Spatialities of the Latin American and Caribbean Internet. *Journal of Latin American Geography*. 8(2): 125-145.

Zakon, R.H. 2011. Hobbes Internet Timeline 10.2/
http://www.zakon.org/robert/internet/timeline/#1980s (December 30, 2011; Accessed August 4, 2013).

Zibechi, R. 2012. Unasur desarrolla un mega-anillo de fibra óptica que pondrá fin a la dependencia de Internet con EEUU / *La Jornada*: http://comunicaciónpopular.com.ar (5 de enero de 2012; Accessed 1 August, 2013).