To cyber or not to cyber: how cyberculture shape the virtual environments of cognition institutions of science, technology and innovation in the Brazilian Amazon

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 Abstract

This thesis aimed to understand and try to explain that the institutional actors of Science, Technology and Innovation - STI, on Amazon, take ownership of cyberspace, technology offered by Information and Communication Technologies - ICTs, to relate and produce virtually epistemes so institutional and mutually shared. Generally aimed to investigate the field of STI in the Amazon, distilling its historical processes and formatting a virtual cyberspace shaped by relations that should be set up in the processes of generation epistemes in the Amazon region. It was found that this proposition is not manifested, primarily due to the absence of a set of epistemic forces generated by multi-dimensional features of the Interweb, not incorporating thus cyberculture as a trace of epistemic actors in this region. The methodology consisted of a combined process in three stages: first, through a literature review rose the historical process of the field of STI on Amazon. Then pitched the theoretical framework that has placed the purposes epistemic sustainability, especially the theories of networks and graphs and the theory of cyberculture. Through its categorical instrumental framed up an operational plan that allowed deploy the methodological strategies to appropriate the object of issues and propositions in a set of operations that had the element 'hyperlink' its central manifestation, to constitute the empirical realm research. All the work of 'field' occurred in cyberspace, where the technological tools and cognitive resources were shifted in scope to capture, process and polish the graphs - sociograms - which allowed to deduce the structures underpinning the institutional relations of actors STI Amazon.

Introduction

This article is the product of a recently completed doctoral dissertation that broke the proposition that the said Society of Information and Knowledge not yet reached the institutional sphere on the outskirts of the planet, even in environments where digital information and communication technologies already installed for nearly two decades, as is the case of institutions that produce Science, Technology and Innovation - STI in the Brazilian Amazon. The question that arises reports on virtualization of the processes of epistemic production by institutions that generate, distribute and promote STI in a peripheral region as the Amazon, where it should take more significant proportions, not only because the STI are main source of socio-economic rise of nations, until recently, poor or remedied, or because of the world's largest economies take root in their assumptions, but also because virtualization in production processes has become common scenario inserted in contemporary environments institutions in which cyberinfrastructure is already a reality , becoming a determining factor in the production of technical artifacts or explicit knowledge .

Moreover, the Information and Communication Technologies - ICT - have been central players in the generation of new technologies that induce new production processes, distribution and communication, among which stand out from those who are considered the main of recent times: the Internet and the Web - the Interweb. Like a ball of wool that grows to the extent that the loom is accelerating the production of yarn, epistemic digital technologies will grow as ICTs are increasing their resources interface between human cognition and cybernetic mind.

Object and problem

The incremental production of epistemes - explicit scientific knowledge - that which accumulates historically favors the construction of new knowledge and has expanded geometrically as digital platforms of communication and information evolve on their attributes of cognitive tools [Levy, 1993; Johnson, 2003; Lessig, 2005]. One of these features highlights the ability of these tools need to coalesce cognoscent in virtualized epistemic circles of rhizomatic or reticular, and which contribute to a massive

process of communication and information exchange, among other possibilities offered by ICTs.

Front of a mediation paradigm of information flow [theater, book, press, cinema, TV], according to Di Felice, to digital, which is "reticular, interactive and collaborative", the generation of epistemic knowledge in this digital age [Negroponte, 1995] affront reflections on ways to articulate ideas and thoughts that rest on digital platforms and their transformation into new knowledge. This digital paradigm that emerged in the mid – 60's of XX century, on the west coast of the United States, the academic- scientific laboratories of the University of California Los Angeles and the Stanford Research Institute, in partnership with the U.S. military scientists, has expanded since then in a rhizomatic way, in the sense that Deleuze and Gauttari [2000] gave the word, and producing different perspectives of subjectivity.

The idea of network in which the ideas of rhizome and reticle are supported, and emerged with graph theory in pre - modern periods [Euler, 1736], was also appropriated by the creators of the Internet since Bush [1945] launched the idea of creating machines that could help the man in the filing and handling of information. Thus, network graph, rhizome and reticle are concepts that keep analogies of content and form to represent sets of 'things' [Durkeim, 2007] which are joined together by relations of epistemic coherence from the perspective of scientific production. This notion of 'things together by relations' was always present in the processes of social transformation and has always adapted to the interests of anyone who had recourse to better understand a given fact or social phenomenon.

Sociologist Di Felice, when asked about these technological advances afforded by ICTs, recalled, "The advent of a new communicative technology generates qualitative changes in all sectors of society" [Ibid, Online] . Another important matter expert, McLuhan [1969, p.29], also made the same reference to information and communication technologies, saying, "Societies have always been influenced more by the nature of the media by which men communicate, that the content of the communication." In other words, they are technological interfaces that introduce new perceptions and subjectivation, to extend the limited sensory and cognitive capabilities of man as their

scientific and technological creations have been increasing their intervention in nature and society .

If the networks are manifested through relationships with a mutually shared sense, without which they will not emerge in the midst of society, and the development science and technology in the Amazon have in common purpose - to generate epistemes favoring the balance between action on their environment in a sustainable manner and ensuring their economic viability - then Amazon epistemic relations reveal a virtual pattern of cognitive production of reticular format, where relationships are bidirectional and prevails a decentralized, non-linear and non-hierarchical communication loop.

This proposition is based on two assumptions: first, the results achieved by researchers who have studied the dynamics of epistemic field in the Amazon in last twenty years, and that conclusions converged by the absence of a mutually shared production, precisely the absence of a paradigm informational and communicational favoring knowledge sharing, files, repositories, databases, an extensive range of tools for epistemic production and media that promote the technological quality, innovation and dissemination of the results to their institutions, along with their actors and society in all its socioeconomi , political, cultural, scientific and technological spheres. Second, because the networks are spread by rhizomes done all dimensions of human reality, particularly in Network [Castells, 1999] which constitutes the network of all networks: the Interweb.

Occurs a dispute over Web cyberspace similar to concrete spaces, not only in the imagination of people, an occupation and expansion of symbolic spaces through content available in the network, requiring its actors strategic actions to attract the attention of their audiences. Kleinberg says, "Science progresses when the invisible becomes visible" [Online]. Making a mapping of network addresses through Twitter, for example, is viewed as each actor is distributed within a network graph. A website can also be dissected into its structures through the analysis of their internal and external connections textual loops through their tags, or through the links on keywords in post, text, images, signs in general, a set of attributes that can be linked, and visualized related through mathematical and/or graphs models .

The relevance of the Internet to the networks of STI has been highlighted by many scientists as Barabási [2002] , who said, "The scientific community supports and depends on many aspects of science on the Web, as networks of computers via cables, nodes, hyperlinks, networks of people and organizations" [Online - Royal Society Web Science Meeting]. However, some requirements are needed to attract convergent cognitions, and Eco [Online] noted that, in a forest as the Web, which determines the convergence of flows of relationships among internet users are the attractions that cyberspace presents: portals, or megasites, that own more connections because they are more accessible for people. Chayes [Online], scientist and math Microsoft, commented, "The networks can be modeled as large graphs, that can be very useful in studies of social phenomena" [Online], and the search engines also use these charts together with the "Page Rank" device to reveal the structure and level of relevance of actors in the network.

Connections, along with the actors, are the elementary properties of the network system. Examining networks *in totum*, can be identify the number of actors, the amount of bonds that could be established, and that in fact occur. Differences on the size of networks, and how actors are connected can reveal critical points about human groups, as small groups differ in several important ways, and even the size of their sets is one of the main variables in sociological studies. How talk Hanneman and Riddle [Online], "Differences in how actors are connected in a population can be key indicators of 'cohesion', the 'solidarity', 'moral density' and 'complexity' of the social organization of a population." The networks may have many or few ties, but can also be 'strong ties' or 'sinks ties', those who receive calls but do not go ahead, or both.

The ways how actors construct relations in cyberspace can be crucial to understand how they see the world and how the world sees them. The number and type of bonds that keeps the actors in the network are a basis to indicate similarities and dissimilarities between them, also to determine how their inclusion in the network restricts their behavior, their range of opportunities, its influence and its power in the network. In other words, how actors are positioned in the network, the virtual center or periphery.

Methodological dimension

Two approaches have been applied for the detection of hyperlinks: Hyperlink Network Analysis and Webometrics. Both approaches examine sites [or virtualized documents] based on relationships with others [or documents], rather than analyzing the individual attributes of websites. In other words, these methods examine the relational attributes among websites. However, they differ in their interpretation of the meaning of hyperlinks. The first tends to interpret hyperlinks between websites as social and communicational ties, while the Webometrics has focused on the study of hyperlinks in the relationship due in large part to the several academic and scientific researches about the production of STI.

Although the latter seems to be the most consistent, in reality it does not sit well with the proposition designed for this research, since it is not to know more about the production in the sense of the results achieved by these actors, and be available in cyberspace such. Interested to know how the epistemic institutions while co-actors a set of actions aimed at enhancing knowledge and human interference with the environment through Amazon sociobioanthropological relate through the Interweb in ciberreality and its repercussions in shaping their epistemic capital.

From this perspective, the interfaces and hypertext are here understood as the core, the core elements, the crucial factors in the configuration of virtual ambiences, and the structural elements of the degree of interactivity and communicability in multiple dimensions of cyberspace, and navigability of the endogenous interactions working environments of each research institution. There are various aspects that contribute to the modeling of a productive sphere in cyberspace. Especially, in the networks of STI interfaces and hypertext are the highways that structure the dynamics of production and circulation of explicit epistemes. Platforms like the SciELO and ScholarOne are typical ciberepistemics models of STI interfaces that aggregate and provide tools and documents for free access to the entire global network of researchers .

Analyze the scanned structures of networks of STI system through models of graphs that are simple representations of complex networks, allows to define the number of actors in the network, and understand how they establish relationships and connections between them, how they fit into regional and global socio-economic context, and interact

with society. Models of graphs can be generated by means of mathematical formulations or digital tools for social network analysis, there is a considerable variety of them, some appropriate to the purposes outlined here, where are highlight the interfaces and hyperlinks as structural elements of the virtual society. The graphs allow to make comparisons between networks and draw inferences about how they are incorporated in cyberspace dimension; understand their dynamics, their morphology through the establishment of hyperlinks, the distribution network of its actors and the relationships between them possible to occur, their diversity and density flows and connectivity bonding of its contents, are some of the aspects of subject be understood by means of graphs.

Obtaining the information presented here was through a primary data collection conducted with specialized tools for collection and treatment of hyperlinks - OPEN SITE EXPLORE and SEMRush. Subsequently, these data were refined with the EXCEL tool, where basic spreadsheet and then exported to GEPHI software, tool specialized in making graphs and stencils were produced.

The analyzes were performed by using the following analytical operational categories: Network Size - Degree of density - Grade Entry [Indegree] - Grade Output [Outdegree] - Degree of Proximity - Centralization of Mediation - Authority - Hub and PageRank. It is noteworthy that the actors referenced in the analyzes that will be triggered are represented by URLs - virtual addresses - of each of the institutions in the Amazon STI cyberspace at this stage of the work, and were listed in Interweb websites.

Partial results achieved

Only part of the results achieved is presented here, in view of the limitation of space in relation to the set of tables and graphs developed for the achievement of the dissertation. However, the graphs shown here are for the two main actors in the network STI brazilian Amazon, and the third order the set of all the actors that produce STI in Amazon. Starting with epistemic network of Amazonas state, then the state of Pará, who is the head of the northern region of Brazil and in finalizing the graph than the set consists of all networks in this region, here called Epistemic Network The Virtual STI Amazon.

The Virtual Epistemic Network of Amazonas State

Whereas the objective of the income statement that reveals structural patterns of institutional relationships established in network, cyberscience in the state of Amazonas demonstrates some, not much, integration between its institutional actors through cyberspace. It is a system composed of 73 actors with the incidence of 99 relationships between them, of 5,256 possible if there were full interaction between all of them.

In the graph below lists the top five actors of STI in the epistemic system of the state of Amazonas, and the other actors can also be viewed in this sociogram, where it is possible get an overview of the relations of each actor in the set of all relationships identified in epistemic cyberspace of Amazonas state.

Source: elaborated by the author from analyzes with GEPHI tool - 2013.

Sociogram 01 - Topological Representation of Virtual Network Epistemic of Amazonas State - 2013

The Virtual Epistemic Network of Pará State

In the graph below lists the top five actors of STI in the epistemic system of the state of Pará, and the other actors can also be viewed in this sociogram, where is possible get an overview of the relations of each in the set of all relationships identified in epistemic cyberspace of Pará state.

The CyberScience of Pará state presents a more complex scenario, not much, considering the size cybercosmic that befell the epistemic actors after the emergence of the Interweb in the social relations of production of STI. The virtuality of the reticular structure of STI Pará state consists of 102 actors with the incidence of 174 relationships between them, the 10,302 possible if there were full connection between all of them.
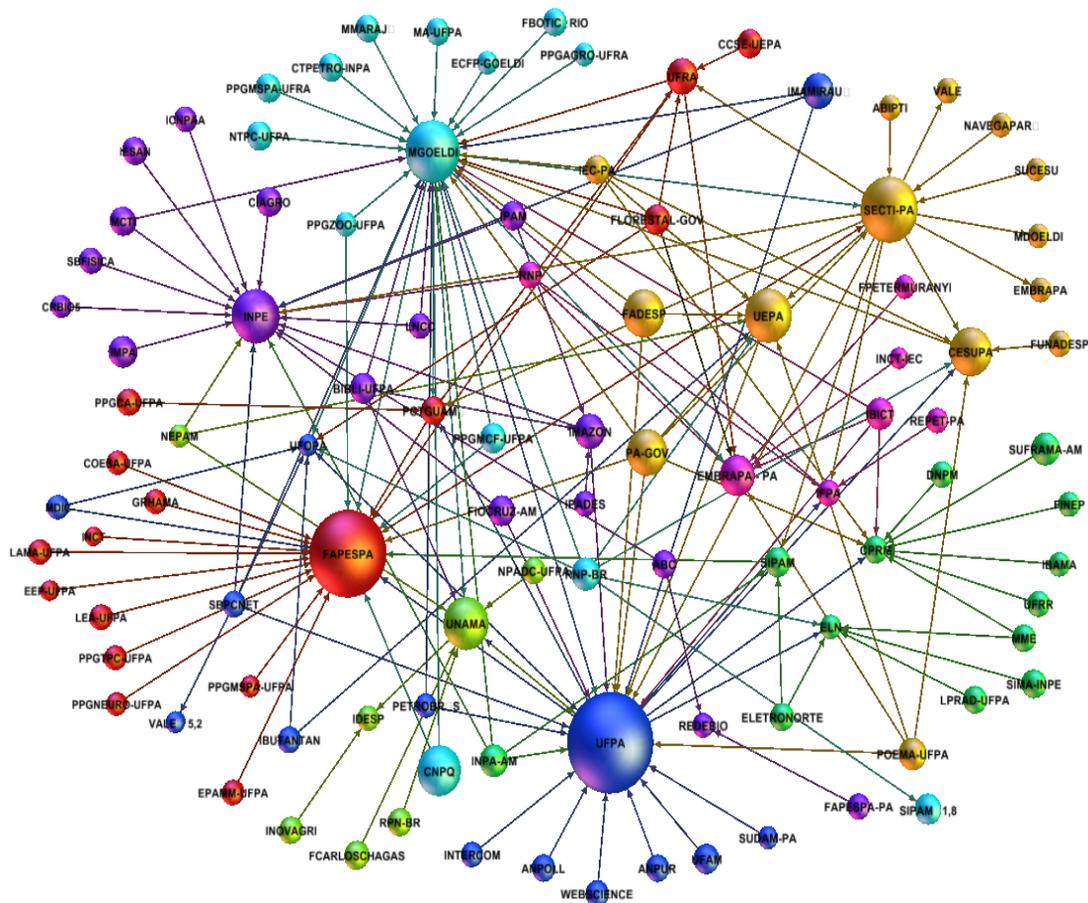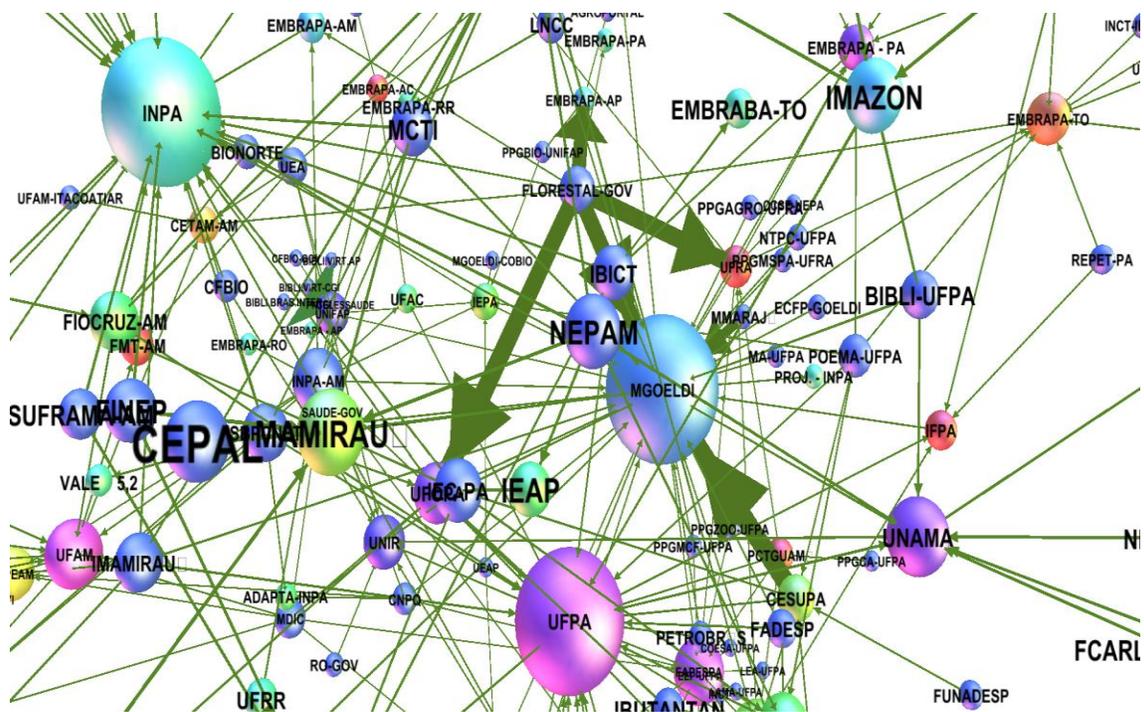

Prepared by the author from analyzes with GEPHI tool - 2013.

Sociogram 02 - Topological Representation of Virtual Network Epistemic of Pará State - 2013

The Virtual Epistemic Network of Amazon

Unlike analyzes distinctly on the reticular structures of the actors in each state, the Amazon CyberScience is a much more complex scenario, projecting what is likely to be a set of epistemic forces highly connected, integrated and articulated in its mission to reverse the problem that propagate in its tissue ecosystem in opportunities for their biosocioanthropologic systems. The creation of a virtual network of macro Amazon STI is configured through a set of 196 epistemic actors, with 356 relations of 69,776 possible if there were full connection between all of them.

Elaborated by the author from analyzes with GEPHI tool - 2013.

Sociogram 03 - Topological Representation of Virtual Epistemic Network Amazon - 2013

Conclusions

Through sociograms proved a very different reality for institutions that work with STI in Amazon region. The more they are located in more remote geographical regions disconnected - or cyber-excluded - they are. What would be the reason for this virtual self-exile? And not only they, but also the institutions that are in the Amazon region of epistemic production center are in situations of cyber-exclusion. All sociograms revealed this reality: *virtualis* paradigm is still an ideal to be achieved.

Even its main epistemic actors - the MGOELDI, INPA, UFPA and UFAM - are far from a minimum standard of connectivity oriented by mutually shared interests.

A region with more than 240 courses of post-graduate with thousands of PHDs and hundreds of institutions engaged in the generation of explicit knowledge on Amazon region, cannot - or could - afford to ignore - or scorn? - all material and immaterial effort being made to implement a cyberinfrastructure in this region, with the scope to increase the quantity and quality of knowledge about their biosocioanthropologic ecosystems.

Several explanations can be inferred from relationships between the theoretical foundations that underpin this dissertation and the results obtained. But one seems to be the most relevant: not yet germinated the seed of cyberculture in epistemic Amazon forest. As rich and diverse as its vegetable and organic forest - its entire ecological system composed of the *animalia* kingdom of vertebrates and invertebrates, its vegetable and mineral kingdoms - these are the cognitions that study and investigate all its lush sociobiodiversity.

A society that intends to take some kind of protagonism of their destiny must change their relationship culture, ie, accept a change of mentality. To this end, within the networks of STI in the Amazon, the epistemic institutions should adjust not only their natural ecosystems, as well as the cognitive glocalized to thus seek to understand the dictates of their critical points, linking its entirety, supplying its actors on their needs and providing connectivity so they could generate knowledge for the benefit of STI not only for its region, but for all mankind.

Of the several conclusions which reached this thesis, two stood out: the lack of communication and lack of articulation of the epistemic network production. Two priority elements in any cognitive enterprise that aims at the concatenation of efforts to

achieve mutually shared goals. Then imagined that the Interweb could be contributing to overcoming historical barriers. Hence having initiated this scientific journey in order to understand whether the epistemic Amazon actors were solving their problems - or part of them - through the incorporation of this digital technology: the Interweb.

To paraphrase the famous reflection of William Shakespeare in the sixteenth century, "To be or not to be: that's the question", an adage that revealed the emergence of a new man reborn with the invention of printing, now a new metamorphosis breaks the social relations of epistemic production that imply a new approach and professional attitude that induce saying "to cyber or not to cyber: that's the question to create epistemic relations!".

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