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## Hierarchy and heterarchy in Brazil's urban network<sup>1</sup>

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### RESUMO

As ideias de hierarquia urbana e heterarquia urbana são discutidas neste texto para analisar os movimentos que compõem, no período atual, a rede urbana brasileira. Tratando-se de um país de grandes extensões, cuja ocupação territorial ainda está em processo, a reestruturação da rede urbana é constante e rápida. O aumento das possibilidades de interação espacial por meio de novas tecnologias de informação e comunicação torna as dinâmicas ainda mais intensas e amplia as possibilidades de articulações multiescalares, não apenas de tipo verticais entre cidades de diferentes tamanhos e importância, mas também horizontais e transversais. A rede urbana brasileira vem sendo estruturada, de modo mais intenso, pela ação do capital que promove processos sob os quais o território brasileiro é produzido de forma desigual. Às cidades atribui-se diferentes papéis e funções na rede urbana, de acordo com a

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concentração espacial e econômica em cada uma das cidades, formando, portanto, uma rede de cidades diversa e desigual, na qual a hierarquia espacial se amplia. A reprodução do capital promove esta forma de estruturação, ao mesmo tempo em que se aumenta a complexidade das interações espaciais interescolares, geradoras de articulações complexas, levando-nos a adotar uma ideia de complementação da hierarquia urbana que é a proposta metodológica da heterarquia urbana.

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KEY-WORDS:

Urban network  
Urban hierarchy  
Urban heterarchy  
Brazil

ABSTRACT: The ideas of urban hierarchy and heterarchy are discussed in this paper so as to further analyze what composes the present-day Brazilian urban network. Brazil is a vast country, whose land occupation is still in process, and its urban network quick and constant, to say the least. The increase in possibilities of spatial interaction by means of new data and communication technologies in turn make these dynamics ever so intense, thus amplifying the possibilities of multi-scale articulations not only vertically in cities of of different sizes and importance, but also horizontally and cross-sectionwise. The Brazilian urban network, due to its capital actions which promote processes under which territories are produced unequally, has been structured in a most intense manner. Different roles are attributed to cities in the urban network according to their spatial and economic concentrations in each one of those cities, therefore composing a city network which is diverse and uneven, in which spatial hierarchy continues to grow. The reproduction of capital does in fact promote this sort of structure, at the same time as the complexity of spatial and inter-scale interactions expand, thus generating complex articulations which lead us to adopt an idea of complementation of urban hierarchy; the very same methodological purpose of urban heterarchy.

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RESÚMEN:

Red urbana  
Jerarquía urbana  
Heterarquía urbana  
Brasil

RESÚMEN. El presente trabajo reflexiona sobre las ideas de jerarquía y heterarquía urbana, con el fin de analizar los movimientos que vive actualmente la red urbana brasileña. La ocupación territorial de Brasil se encuentra todavía en estado de configuración, dándose un constante y rápido proceso de reestructuración de la red urbana. El aumento de las posibilidades de interacción espacial por medio de las nuevas tecnologías de la información y la comunicación, aumenta y amplía las posibilidades de articulación multiescalar, no sólo de tipo vertical entre ciudades de diferentes tamaños e importancia, sino también horizontal y transversal. La red urbana brasileña se sigue estructurando más intensamente por la acción del capital que promueve

procesos territoriales desiguales. Las ciudades adquieren roles y funciones diferentes en la mutante red urbana según la concentración espacial y económica de cada una de ellas, configurándose una red de ciudades heterogéneas en donde la jerarquía espacial se expande. La reproducción del capital promueve esta forma de estructuración, al mismo tiempo que aumenta la complejidad de las interacciones espaciales, generadoras éstas de articulaciones complejas. Todo ello nos lleva a adoptar una nueva propuesta metodológica que complemente el concepto de jerarquía urbana, nos referimos a la de heterarquía urbana.

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Introduction Brazil is an extensive piece of land where, for the last 20 years, there have been a series of structural transformations in its economy and society. The occupation of its territory by capitalist means of production is still underway, which means there are areas of great demographic density as well as others that are still poorly inhabited. The intensification of the globalization process directly accelerates economic and social processes, thus demanding and promoting alterations in spatial forms. This trend generates a greater technical and territorial division of labor, revealing itself as an intensification of the inter-urban division of labor, which is characterized by: - the specialization of space, - the amplification of complementarity relations among cities, - and an elevated standard of functional complexity.

Historically speaking, Brazil's economic development is based on regional economies, those of which had very few relations with each other in periods such as: Colonial (1500 - 1822), Imperial (1822 - 1989) and the Old republic (1989 - 1930). In other words, each region had their own agricultural and/or mining economy base, and their respective economic relations seemed to be more intense with the Portuguese Crown rather than between other regions.

With the introduction of the agrarian-export economy, an urban network started to come forth in order to meet the needs of the urban-industrial economy. This in fact was the industrialization process, based on the establishing of a national consumers' market, which offered enough conditions for better spatial interactions between different regions of the country.

Due to its recent origins and the processes which previously generated regional economies, a Brazilian urban network is made up of a set of different standards which, among themselves allows us to recognize a social-economic establishment as well as various social-spatial establishments.

A number of features – the strengthening of the State, the industrial development, the set up of a national market – all explain a 20th century trend of economic concentration and centralized decisions which simultaneously indicate: a) the existence of an urban network, even though there were a series of social-spatial establishments; b) the predominance of hierarchical relations in the ordinance of flows which establish themselves and the spatial interactions which reveal them.

Having that trend in mind, the Brazilian Institute of Geography and Statistics (IBGE), carried out a series of studies whose goal was to trace regions of influence in Brazilian cities between the years of 1966, 1978, 1993 and 2007 (IBGE, 2008), with the prevalent perspective of urban hierarchy in the analysis. However, in the latest research of that series (IBGE, 2008), it is noticed that in the Brazilian urban network, there is a coexistence of hierarchical and non-hierarchical standards of structure.

CATELAN (2012), while trying to understand the complex movement of spatial interactions between scales which articulate medium-sized cities in the state of São Paulo and other cities, worked under the premise that, in the configuration and the structuring of the urban network, given the articulations that extrapolate hierarchical levels, there are relations which categorize a certain "urban heterarchy". Such approach does not oppose the paradigm of urban hierarchy, but does in fact assist us in the understanding of the articulations generated in the movement of spatial interactions between agents which act in multiple scales.

Therefore, in this paper we propose an analysis of the Brazilian urban network based on these approaches, considering the pair hierarchy ↔ urban heterarchies, as methodological and analytical in order for us to understand the structure and articulations of the Brazilian urban network at the beginning of the 21<sup>st</sup> century. And to do that, we shall discuss over urban network and urban hierarchy and synthesize the elements of the "Regiões de Influência das Cidades" (Regions of Cities' Influences) publication, so that we may in sequence deal with the hierarchy ↔ urban heterarchy pair.

### Urban network and urban hierarchy

Although the term "network" has been used widely, it is polysemic, and that may lead to imprecisions (SANTOS, 1996 : 208). In the last decade, with the diffusion of virtual communication environments (such as Facebook, to name one of the most popular ones), the term "social networks" has been adopted in order to deal with relations that take place in these environments; something which only serves to increase the diversity of acceptance associated with this term. To us on the other hand, it is important to be precise to what we are referring to as being in fact an "urban network".

A lot of the approaches attributed to the concept of urban network<sup>2</sup> and, in the case of French Geography, to which Brazilian Geography is affiliated in its origin, the concern with the study of relations between these cities takes us back to Reynaud, 1841, and Réclus, 1895, (PUMAIN, 1993 : 665).

GEORGE (1983) develops this concept from the relations that are established between the city and the region, and reinforces the French tradition of working with that sort of scale, since for him "[...] the urban networks are truly an arrangement from each region" (p. 206).

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<sup>2</sup> On the distinction between the concepts of urban networks, urban systems and urban armor, see Beaujeu-Garnier (1983) and Pumain (1993, p.665).

BEAUJEU-GARNIER (1983, p. 406) has a similar approach, which comprises the urban network as a spatial fact of repartition of cities in a given 'chunk' of space. An important point highlighted by the author is that the urban network has nothing to do, at least in principle, with location or classification.

CORRÊA (1997, p. 131) reiterates that "[...] the urban network is the most finished, the best known and most studied of all geographical networks" and still, it is the main synthesis between these networks (CORRÊA, 1999 : 69).

ROCHEFORT (1998, p. 20), starting from a question, proposes elements in order to comprehend the urban network:

Could one suggest referring to an urban network as the organization of urban centers and their zones of influence in the interior of a region controlled by a regional center, and an understructure commanded by the national capital? The fact that the study of the place being situated in one or another of these spatial scales, the differentiation of urban centers rests in a variety of nature causes, and the elements of the urban network, constituted by the diverse types of centers are more numerous, according to the establishment modes of the latter. (ROCHEFORT, 1998, P. 20)

This approach contains two analytical categories (form and function), those of which CORRÊA (1989, p. 70-71) uses to affirm that: "the urban network may be considered as a spatial form through which urban functions take place", and adds moreover, on the need to report to social processes and the capitalist structure.

Many authors affirm that there is an ample set of factors and dynamics which constitute the urban network, and that is why the models and theories of idealistic character present so many limits.

In the case of these models and theories, the central idea is that the relations between cities are in essence defined by the market, and that its demands should be met promptly, whilst considering little about the genesis of those cities and their history. ROCHEFORT (1998, p. 23) reiterates that urban networks don't merely structure themselves considering present needs, but also express what remains of previous phases. With concerns of the same nature, CORRÊA (1999, p. 67) writes on the historical aspects of geographical networks<sup>3</sup> and DIAS (1995, p. 12) finds base in the idea that the networks don't appear out of nowhere, but in fact they come out of geographical spaces that are full of social and regional disparity.

SANTOS (1996, p. 209), on the other hand, reinforces the same idea in highlighting that networks could be examined by genetic or present approaches. At a first instance, they are seen as a process where movements of different times take place, and whose succession is not random; much to the contrary, they always occur whenever a morphological or technical change becomes necessary; something that, according to him, makes it something complex, though fundamental to the reconstitution of their history.

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<sup>3</sup> For a deeper debate on the contemporary purpose of networks of different types and topologies, please see CASTELLS (1999), mainly p. 487 and subsequent pages.

What we intend to reinforce with these highlights is the importance which one must give to the analysis of networks, as well as the retention of its different levels of determination. The diagnostic to a given urban situation in the context of a territory and the geographical possibilities it offers in terms of meeting the demands defined by the market are not enough to understand the urban roles performed by a city, though they may also be levels of determination of the economic and territorial division of labor which is established between cities which make up an urban network.

If on the master plan it is necessary to understand the stage of development of capitalism and its productive forces, it may be necessary on the other hand, to recognize and consider the specificities of different historical formations which organize spatially, in order to analyze the structuring of urban networks which support and express them.

Moreover, this articulation process does not come about in a direct nor simple manner, since regional urban networks or the regions with the least number of urban centers or territories which are virtually without cities integrate themselves into the consumer market generated by industrialization<sup>4</sup>, and realize that they are full of history, since their economic, social and cultural past are inscribed in space and shall be part of the new set up and the new relations network being established.

The issue on the genesis and, by coincidence, the search for what makes up the history of a society's urban network, its economy and politics is therefore fundamental, from a number of points of view.

An angle of interest, especially to Geography is that which refers to the ways the flows that articulate the cities themselves and compose the configuration and the existence of an urban network are established.

There is a direct link between the concept of urban network and that of urban hierarchy, that being an expression of classification of cities according to a greater or lesser number and the importance of roles which play out in the scope of a network, and, consequently the breadth of the spaces commanded or polarized by them.

Furthermore, not all flows which put forth the relations between cities of an urban network are of a hierarchical type and/or are restricted to one region or national spaces. Presently, it is important to note that there are other logics guiding the structure of urban networks.

CAMAGNI (1993a and 1993b) evaluates that today urban networks have distanced themselves from the supposed Christaller Model, which asserted another closed hierarchy of market zones and centers. CAMAGNI affirms that it is important to consider now that the paradigms of networks, i.e., recognizing the overlap or coexistence of three spatial organization logics (territorial, competitive and network) which correspond to "vertically hierarchical" networks, "of complementarity" and "of synergy and innovation" (CAMAGNI, 1993a : 112). From that perspective, the

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<sup>4</sup> Another author has drawn attention to the intrinsic relations between the constitution of a Brazilian urban network and the process of integration to the national market. See DIAS (1995), OLIVEIRA (1982), SANTOS (1967) CORRÊA (1967), SPOSITO (1992).

networks organize themselves not only by hierarchical flows, but also by competitive and/or cooperative relations, as will be dealt with in section 4 of this paper.

CORRÊA (1997a, p. 133 e 1997b, p. 112) effectively contributes to the unveiling of differences between the networks, in distinguishing traces in their organizational dimension (existence, construction, formalization and organicity), in their temporal dimensions (duration, speed and frequency of flows), as well as spatial ones (scale, spatial and connection forms). These attributes are important to recognizing the degrees of space-time determination of urban networks and the ways they combine elements and constitutive logics for each one of them.

This multiplicity of possible combinations between elements and constitutive logics from networks make them even more complex in present times, where the presence of overlapping material and immaterial flows structure the networks in general and urban ones in particular.

MACHADO (2001, p. 5) explains that "[...] in the present study of spatial organizations one needs a more complex network than that geographical common sense". Amongst other points the author reiterates that

[...] the connective study of networks obeys, at least in principle, a theological concept: it selects places according to objectives for which the network is driven for, and not necessarily by the set of endogeneous variables which conform to the place. This process may be selective not only in terms of chosen places, but also by individuals and participating groups. (MACHADO, 2001 : 5)

Even after recognizing the connective structure of present urban networks, we should not forget however, about the plurality of determinations and elements which compose it and, furthermore, that it is in itself a synthesis of other networks since they are simultaneously, according to SANTOS (1996, p. 220), real and virtual. To him, the material reality of networks is a promise which is realized when communication is established through them, making them real and historically valid. Cities are support points for multiple networks and compose an urban network. This, in turn is an overlap; the sum and synthesis of all types of networks. Hence, the urban network is real, since it is material and virtual at the same time, since their cities are articulated by means of the transportation of goods and people, as well as by the circulation of data and all natures of value.

The role developed by the advances obtained by means of telecommunication in the last decades is responsible, for the most part, for the growing importance (and not the genesis) of spatial logics configured in the networks. What these telecommunications in fact provide is the shortening of distance (and not its annulment, as some postulate), as distances are no longer necessarily the central element of the structure of networks.

When one analyzes urban networks of the hierarchical type<sup>5</sup>, one may notice that they are structured by: a) poles (cities) and their areas of influence, b) the city's

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<sup>5</sup> For a better understanding of the specificities regarding urban hierarchies in "developing nations", please see SANTOS (1967b e 1970).

importance in the scope of the network, c) the size of the area it commands, d) the distance between it and other urban poles, e) the economic importance and the extension of rural areas which are within its polarization area. It is based not only on the centrality but also in the concentration of capital in the space, and in the interrelation between such points.

This relation between centrality and concentration of capital in the Brazilian geographical space is where we seek to go beyond the simple notion that the Brazilian urban network is hierarchical, with city typologies along with different roles and functions. Hierarchy truly is still expressed in the arrangement and structure of the city networks as well as in the process of articulation of cities in network, though this isn't everything. To say that the Brazilian urban network (or those of other countries or subcontinents) is hierarchical would be relevant, but today it comprises a more relevant methodological purpose, albeit incomplete. If the urban network undergoes transformations, for the most part, due to the reproduction of capital and the inter-scale spatial interactions, it is agreeable to consider that processes, dynamics and logic impose forms and standards of transformation, as in the case of global companies which act locally and regionally, aside from the response-actions of these agents to impositions and demands from global capital.

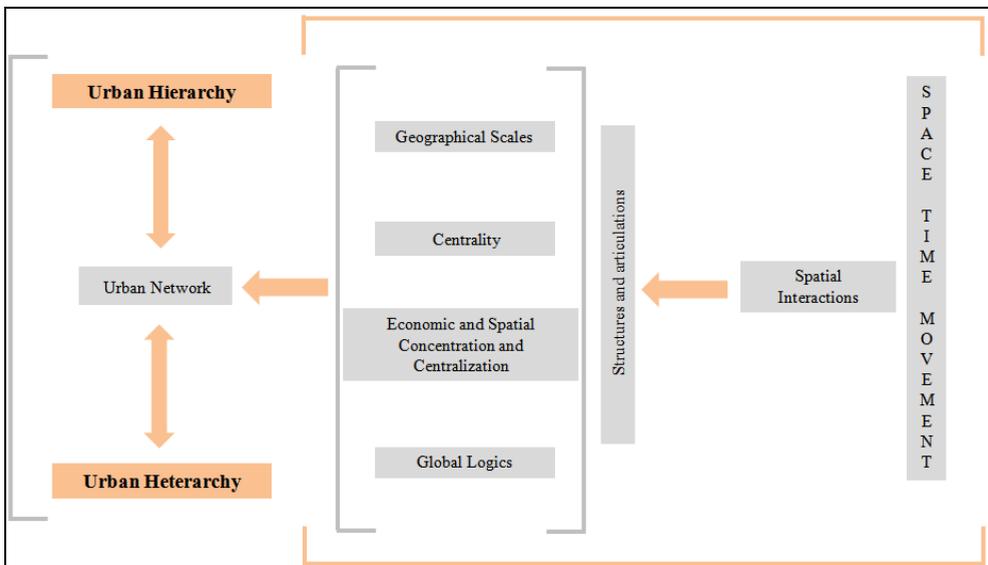


Figure 1: Theoretical-methodological structure for the reading of combined hierarchy and heterarchy.

Organized by Márcio José Catelan, 2012.

This organogram brings together our analytic perspectives for the conception of the urban network which results in the complex relation between time and space animated by the reproduction movement of society which in our era is that of reproduction of capital. We also adopted spatial interactions such as key

concepts, in order to comprehend this reproduction movement between society/capital, understanding that this concept may aggregate a series of other further explaining concepts in regards to the formation of cities in a network and the network of cities.

The Brazilian urban network, and perhaps other networks of cities wherever country they may be, is structured by articulations from the spatialization of significant processes in order to understand the different typologies of cities and especially their unequal position in the urban network. In this paper we have adopted the following as processes, as well as analytical perspectives to be considered: spatial interactions which articulate the geographical scales, no longer allowing a fragmented analysis of space in networks from the local, regional, national and international; centrality, which allows us to recognize the movement of capital in space, as well as understanding the formation of territory points which gain higher importance given a significant increase of flow in its direction; economic and spatial processes of concentration and centralization, the increase and diversification of points in the urban network with a solid presence of commerce, services and industrial and agricultural production; the effects of globalization, which imposes a multi-scale scheme over the urban network, where the logic of action from global capital imposes itself on a national scale with significant effects on local and regional scales via response from the acting agents on these scales. Therefore, the idea of complexity on the urban network is structured, to the point where we propose, as illustrated on the organogram, two complementary methodological pathways for the reading of cities in the network and the network of cities – hierarchy and urban heterarchies.

### The Cities' Regions of Influence

Brazil is known for its studies on the urban network, carried out by the Brazilian Institute of Geography and Statistics (IBGE). This institution has developed research on regions of influence in trying to identify the urban network's hierarchy while classifying cities from the presence and concentration of economical activities which generate inter-urban centrality; mainly those linked to commerce and other services. In these studies, an analysis of the relations between cities and the regions commanded by them was also conducted.

The most recent version of this series, named "Região de Influência das Cidades (Cities' Regions of Influence - REGIC)", was first published in 2008, based on research carried out in 2007. This last version provides continuity to a number of projects conducted within IBGE's scope, having as its first milestone, in regards to research on the Brazilian urban network, the study called "Divisões do Brasil em regiões funcionais urbanas" (Brazil's Divisions in functional urban regions) from 1966, with the goal of understanding the relations between Brazilian cities based on the demand of the flow of goods and services in Brazilian territory.

Since then, IBGE has sought to demonstrate spatial differences, something deemed of extreme importance in a land containing the territorial dimensions of one such as Brazil, and also due to its regional disparity which permeates its history. Moreover, the series allows us to better analyze changes over time,

through this sequence of research which offers us elements in order to evaluate what is modified and what remains in terms of the structure of the urban network and regional polarization. In 1978, 12 years after the pioneering study, the first version of "Regiões de Influências das Cidades (REGIC)" was published, followed by a newer version in 1993.

The research that took place in 2007, one which supports the analysis of this paper, was conducted with the following goals in mind:

[...] to subsidize state planning and decisions as to the location of economic activities of production, private and collective consumption, as well as providing tools for seeking out knowledge on present social relations and spatial standards from which they emerged. (IBGE, 2008, p. 9)

This study differs from others by the fact that there was the "introduction of new technologies and changes of technical networks, the increase of globalization in the Brazilian economy and the advance of the occupational frontier, which have caused powerful impacts on our land" (IBGE, 2008 : 9). For that reason, the fundamentals of this research were extracted from the perspectives of VELTZ (1996), CORRÊA (1996), DEMATTEIS (1999) and OFFNER (2000).

Our research sought to define the centers of the Brazilian urban network by finding data on:

- a) Administrative subordination of the public federal sector, in order to better comprehend our public management system;
- b) The location of companies' branches and headquarters, in order to verify entrepreneurial management;
- c) The offer of equipment and services capable of enabling a city of inter-urban centrality.

On the topic of that last aspect, we sought out data on: - aerial links; - hospital admittance flux; - coverage areas of TV broadcasting stations; - college offers; - diversity of commercial activities and services; - bank service offers; - presence of internet domains etc. (IBGE, 2008).

The variables described were chosen in order to define the knots, if you will, of the urban network; in other words, the centers which develop roles of inter-urban centrality. At the other 4,625 cities<sup>6</sup>, the material and immaterial flows were studied; mainly those which had been noticed as being more important in the proposed typology. On the chart below, one may see how this typology was organized, and have some basic information on its assembly.

Urban network level	Sub-level of urban network	Number of urban	Demographic size (2007)*
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<sup>6</sup> According to legislation, in Brazil every headquarters of a municipality is in itself a city. In 2007 the country had 5,564 municipalities, those of which these 4,625 did not exert central roles, being that 85% of them had less than 20 thousand inhabitants (IBGE, 2008).

		centers	
Metropolises	Great national metropolis	1	19.5 million inhabitants
	National metropolises	2	Between 11.8 and 3.2 million inhabitants
	Metropolises	9	Between 5.6 and 1.6 million inhabitants
Regional capitals	Regional capitals A	11	Median of 995 thousand inhabitants
	Regional capitals B	20	Median of 435 thousand inhabitants
	Regional capitals C	39	Median of 250 thousand inhabitants
Sub-regional centers	Sub-regional center A	85	Median of 95 thousand inhabitants
	Sub-regional center B	79	Median of 71 thousand inhabitants
Centers of zones	Center of zone A	192	Median of 45 thousand inhabitants
	Center of zone B	364	Median of 23 thousand inhabitants

Source: IBGE (2008)

\* There are overlaps in the demographic intervals, since this aspect was not a defining factor in the layers which compose this typology.

From a spatial point of view, Figure 2 contains a synthesized map where the configuration of the Brazilian urban network is represented from the flows which conform the relations between cities contained in the chart, as well as the cities which polarize, thus conforming the cities' regions of influence.

The analysis of cities of greater or lesser centrality is established as a basis in a standard of vertical interactions, as clearly seen in figure 1. According to this map, Brazil is seen from the flows which reveal studied spatial interactions per analytical paradigm of hierarchical character.

In regards to the hierarchical idea between urban centers, the proposal is still based on Christaller's conception (1966), in his Theory of Central Locations, which still today is capable of explaining the way in which the Brazilian urban network is set up.

From the point of view of the distribution of command centers over national territory, the greater urban density in the coastal areas is notorious; the result of colonial periods where direct relations between Brazil and Portugal were carried out by cities which were important in order to assure political dominance, as well as commercial exports relations with Europe.

When studying this coastal area in greater detail, São Paulo clearly stands out as being the densest territory, which represents the mid-south of the country, where the presence of metropolises and medium-sized cities is important and where the most intense flow of people and merchandise irradiates from. The importance of this area to the country reveals the action of capital reaching a rationality of space "an expression which serves certain portions of territory,

whose material and political conditions allow for a usage which is considered productive by economic, social, cultural and political players, capable of rationality" (SANTOS, SILVEIRA, 2002, p. 306).

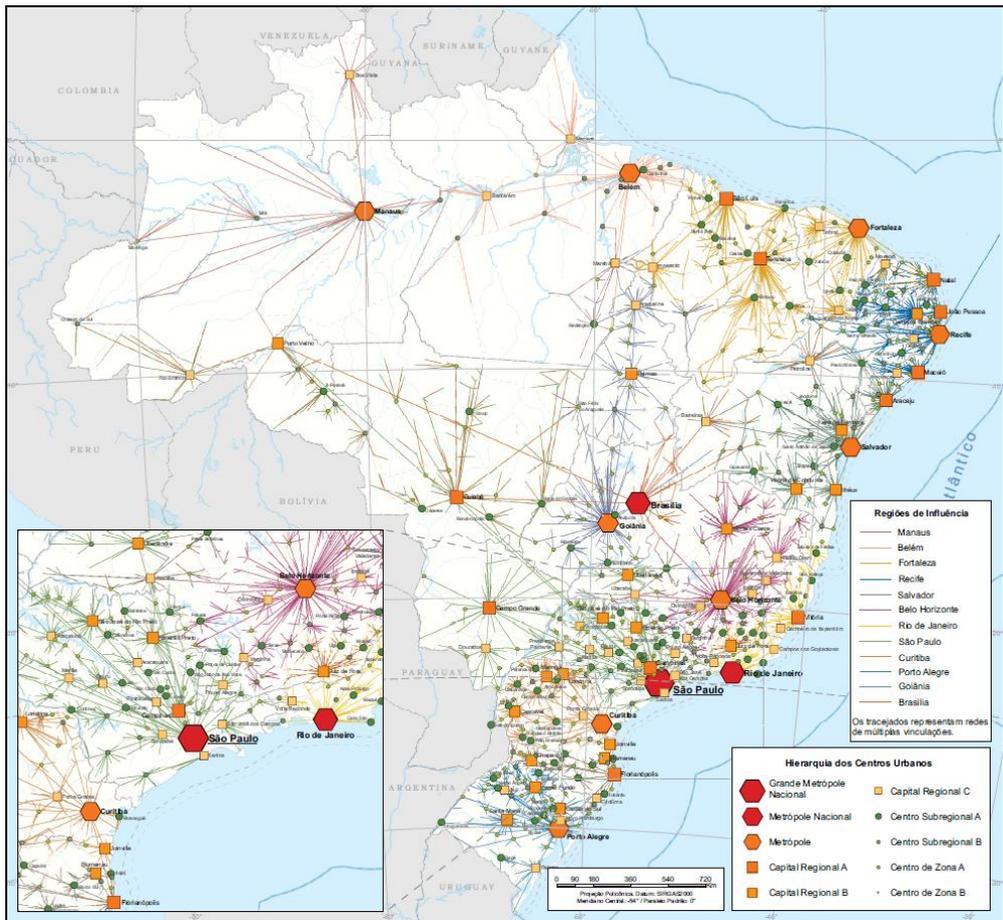


Figure 2: Brazilian Urban Network, 2007  
Source: REGIC, 2008.

Not only in this REGIC (2008), but in previous others as well (1978 and 1993) the study of urban networks, analyzed by means of articulation between cities and regional spaces is noticed.

Nevertheless, the complexity disseminated by the spatialization of the globalization process brought to studies of urban networks a series of logics of capital articulation which extrapolate the hierarchical standard that seeks to comprehend the relation between cities. One way we sought to observe such change was by recognizing that cities began to perform multiple roles in the urban network.

At the introduction of the document (IBGE, 2008, p. 9), there are clear references to the fact that the urban network does in fact contain an "architecture" if you will, formed by material flows of a hierarchical standard and more dynamic

points articulated with the global networks. That would be why there is a reference to the Camagni and Salone proposal (1993), which considers horizontal, non-hierarchical relations of complementarity and cooperation. However, by the nature of adopted variables and by the difficulties in attaining for the national scale of such flows, as we have tried to demonstrate, IBGE's typology maintains its conception of verification of vertical interactions by organizing the urban network.

### Hierarchy and urban heterarchies

At present, the division of space isn't given exclusively by hierarchical principles, but combines specialization, complementarity and competition, according to RONCAYOLO (1990 : 65) The changes which took place in the last quarter of the 20th century demonstrate that multiple network flows establish themselves, placing cities into evidence, according to the logics which respond to different regional divisions of labor which overlap and are overlapped, denoting that space is, as highlighted by Milton Santos, "an unequal accumulation of time".

There is more than one logic behind the structure of an urban network, since there are diverse technical means of circulation which respond to equally distinct demands, making the existence of more than one logic more evident. This occurs not only due to the changes over the course of time, but also, above all due to the combination of different constitutive determining elements of the urban network given in a diverse way in each piece of territory, in each region, and in each country or continent.

Today, the weight in the the changes derived from possibilities created by the technical advances is notorious, since they make new forms of configuration and structure of urban networks more viable. Despite that, one must be cautious in regards to the tendency to overvalue technical roles, especially in a country such as Brazil, where their density and distribution does not reach the level of central economies of advanced capitalism. OFFNER (1993, p. 236-237) points out that technical devices are social constructs, and should not, therefore, be conceived of as engines of change.

The "[...] meaning of the technique is essentially a political one", since it "[...] objectively and subjectively – is built by social actors, i.e., within the context of society itself" (BENAKOUCHE, 1999, p. 2) In present day, the articulations between these different scales of realization in economic, social and political life are viabilized by the existence of technical networks which reconfigure urban networks, but these networks are not the subjects of this process<sup>7</sup>.

Recognizing the possibilities offered by technical advances in order to have new forms of relations between individuals, companies, institutions and places does not mean that network relations are the sole forms where relations take place.

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<sup>7</sup> For a deeper analysis on the relationship between technology and society, please see Benakouche (1999).

LÉVY (1994, p. 313) affirms that “[...] the other option to fight against the distance which represents telecommunication equalizes situations, creating ubiquitous diffusions” (author's emphasis) remembering that a certain number of functions demands physical contact and direct communication, since, for him, the

[...] tele-sociability does not erase the city, if not by lesser interactive and/or more banal relations, something which, in certain domains (political life, for one), is far from being negligible. What remains from the urban order is benefitted by the ubiquity of imaterial networks for instigating its attractions and its hierarchies until even the most remote outskirts. The opposition between points of a given territory can no longer be fundamented in the access to services, but over the internal or external character of accessibility. (LÉVY, 1994, p. 313-314).

The present Brazilian urban network results from the occupation of territory in the course of a complexity of inter-scale spatial interactions which reach an international scale. They come from material dislocations of material and personal goods, as well as from the circulation of data, ideas and values, as previously emphasized. The present complexity in the structure and articulations which form the Brazilian urban network is assumed in this paper as a methodological commitment in order to move beyond the hierarchical paradigm, and for that we adopted the concept of urban heterarchy, developed by CATELAN (2012), in order to analyze it as a pair of perspective of urban hierarchy.

Our methodological proposal rests upon four analytical perspectives and modes of reading the urban network and the inter-scale spatial interactions which contain:

a) differentiation of territorial basis, worked on by ULLMAN (1980), as well as the perspective of spatial interactions;

b) articulation between dialectic pairs so that one may understand the spatial movement where interactions occur; something that, for CHEPTULIN (1982), was a way to comprehend the complexity of space;

c) relations between processes and dynamics by means of networks, which CAMAGNI (1993) values by the analysis of dislocation in space, as a way to understand the construction of standards in networks;

d) spatial interactions as reflexes of social reproduction, promoting an increase in the interconnection between cities and networks, as seen by CORRÉA (1997) with a theoretical-methodological elaboration capable of showing us exits to the relational movement in space.

This relational movement brings complexity as a condition of the contemporary Brazilian urban network. The concept of spatial interactions encompasses perspectives of mentioned authors and allows us for a more dynamic reading between geographic scales, and for that we added the adjective "inter-scale" to the concept of spatial interactions; something already used in Catelan (2012). Another aspect in regards to the construct of a theoretical-methodological framework for the dynamic reading of the Brazilian urban network is the differentiation that this author makes between the interactions to a

concept capable of explaining the relational movement to space. The author stresses that due to those two conditions we have:

Urban territorial interactions are flows and material means as to how cities inter-relate in the scope of networks, due to the actions of their agents. Those interactions reinforce the constitution of a territorial base, better observed in local and regional scales, but that also have strength in national and global scales.

Urban spatial interactions also refer to the former, though, besides that, they may be the movement through which the process of urbanization is produced, determined by the interests of agents and spatialized capitalist forces. A result of this process we have cities and urban networks. (CATELAN, 2012, p. 47, author's emphasis)

These definitions are of relevance to us, so that, in the urban network, while a scheme that joins cities in a certain territory, on multiple scales, where the flow of people and material and immaterial merchandise reign, and the concept of interaction isn't mistaken as a mere synonym flow, despite the fact that it also may refer to them. On our part, we proposed using the concept of inter-scale spatial interactions as a category in the scope of geographical studies, since it offers reading elements for the dynamics, processes and logics which compose the urban network. From them, we may look at the constitution of roles and functions of cities, their nature of flows, territorial differentiation, and finally the movement and forces which transform space in the network.

For CORRÊA (1997), from spatial interactions one may approach the relational movement in space in two ways: (i) through the space-time variability of standards of interaction; (ii) and the geographical networks. By adding these two interpretative manners of interaction movements we have, as pointed out by Corrêa (1997, p. 300), "another significant division of labor and a distinct geographical position from those central locations".

The transformations from the reproduction of capital printed in space, establishing networks of cities and connecting cities to networks, significantly modifies and diversifies the roles and functions of cities in the urban network set on multiple scales. Change and diversification of roles and functions of a city in regards to another is given by relations in the urban network as well as their hierarchical paradigm, still in force. Due to such relations, two forms of organization in the Brazilian urban network begin to coexist. One way it is directly associated to the structure of the network, configuration, the design of the urban network in space which is hierarchical, with urban centers arranged by levels of importance, commonly understood from how much logic and force on multiple scales the capital of these urban centers were able to aggregate – that is urban hierarchy. Another form is that organized by articulations, something not so clear to the eyes of the hierarchical paradigms, nor as organized in space, where the inter-scale interactions of the logics no longer generate more univectorial and hierarchical models – something CATELAN (2012) calls urban heterarchy.

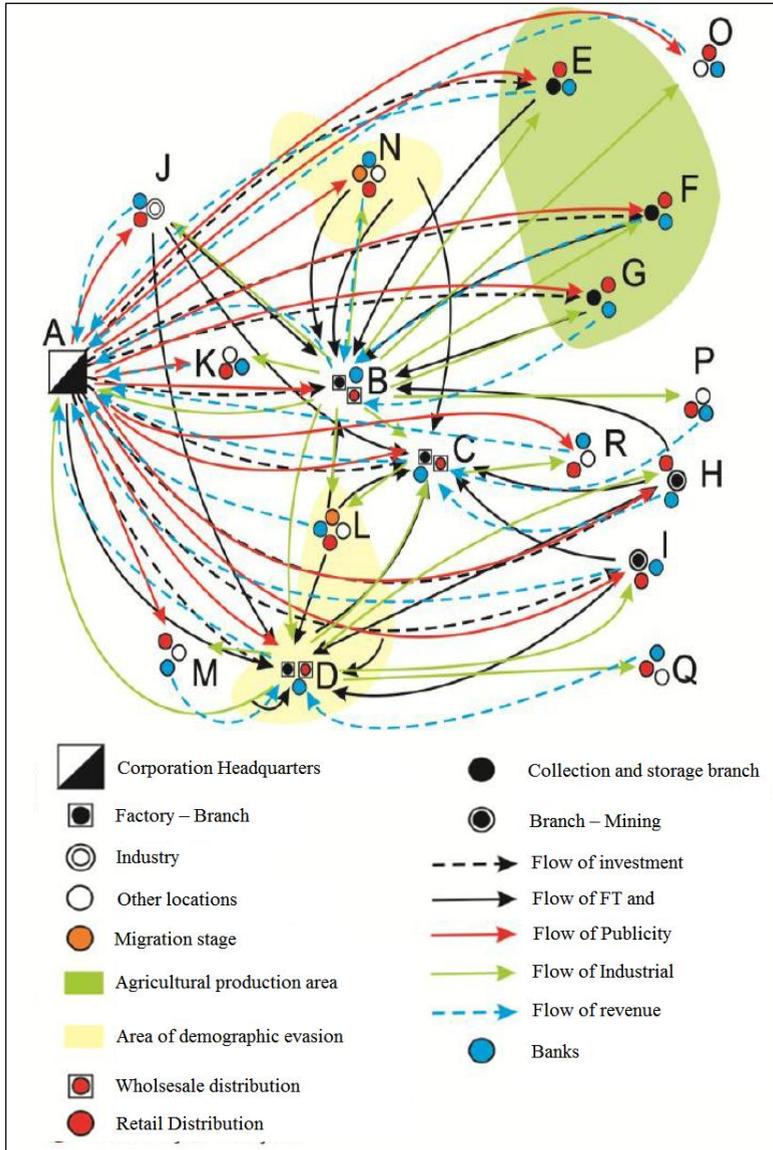
Urban hierarchy is the possibility of a typological construction in the urban network since it allows for the classification of cities by their different roles and

functions which change according to the set of adopted variables, and shows the relation between permanences and the new. The "urban heterarchy is, therefore, the possibility to comprehend the interstices generated in the hierarchical structure of the urban network and in the complex scheme of inter-scale urban spatial interactions [...]" (CATELAN, 2012, p. 60). Therefore we have a hierarchical and heterarchical perspectives as a means to understand the Brazilian urban network; hence we have the pair – hierarchy ↔ heterarchy –, as well as a possible proposal to better comprehend the structure and articulations of urban networks and other national formations.

Both forms of understanding the set up and the relations which are built in the urban network are generated by the action of capital in spaces and territories. Nowadays the effects of globalization in Brazilian territory are undeniable, and for that reason, this process must be taken into consideration so that we may further understand the content of the urban network in order to go beyond the hierarchical paradigm.

Figure 2, created in the celebrated study *Interações Espaciais* (Spatial Interactions) by CORRÊA (1997) and adapted by CATÃO, REOLON and MIYASAKI (2010), demonstrates the relation between structure and articulation, between hierarchy and heterarchy. The detailing of the items in the legend shows us that the hierarchical construction is an arrangement made up from the reunion between two or more variables, therefore a methodological construct, which leads to study models in trying to show the structure of space in networks. The concentration of capital in space, something which generates centralities in the urban network, is seen starting from this set, and may be relative depending on which are the chosen variables. As we observed in figure 3, there are points of a portion of the urban network, which go from A to Q, commanded by the action of a company throughout its productive circuit. Each one of these points contains its level of importance, considering the activities attributed to them. Point A is the headquarters of the corporation, though it is relevant to observe that the flows converge not only to this point, but to others as well, with territorial interactions converging, above all between other points before reaching center A. Some command points are highlighted in the urban network, whatever the analysis scale may be, such as, for instance, point B, which represents banks and financial activities, as well as point D, which gathers banks, a factory branch and a distribution retail outfit. This demonstrates the importance of the capital's spatial concentration process so we may better understand the urban network from a reading of the pair hierarchy ↔ heterarchy.

We have already seen this relation of centrality when working previously with figure 3, which showed us a Brazilian urban network expressed by the capital, economic and spatial concentrations, with results on the roles and functions measured from the centrality that this concentration provides.



Source: CATAO, REOLON and MIYASAKI, 2010.  
 Figure 3: Reproduction cycle of capital and space overlap

We brought the issue of geographical scales to this movement of transformation and inter-scale spatial interactions, something which on the hierarchical paradigm appears in fragmented and segmented form, and on top of that, due to its importance in relation to others, it pervaded the methodological elaborations used for the analysis of relations of the urban network.

## Conclusions

By accepting the growing importance of immaterial flows in the constitution of relations which structure urban networks, one may recognize that fluidity is the element that defines the degree of accessibility capable of making relative the distances and the hierarchies which organized past networks by allowing, within their scope, competitive or cooperative relations between cities of different sizes.

In spite of that, one must recognize that fluidity is not a technical category, but a socio-technical entity, as emphasized by SANTOS (1996, p. 219), who, in order to characterize it, stressed that present fluidity is the result of a combination of three possibilities, provenient from the existence of: "1) perfect universal forms; 2) universal norms and, at the same time, universal de-regulation; 3) universal data, which also is a basis for universal discourse".

This fluidity is revealed in space and time, since it designates the relativization of the extension and duration of phenomena and dynamics. On the other hand, the circulation of immaterial ideas, of information and capital in its financial form amplifies the possibilities for the constitution urban networks, whose cities participate simultaneously and selectively in local, regional, and even national and international spaces.

One must still note however, that cities which constitute an urban network, do in fact participate in them and/or in other networks, according to continuous spatial logics (as is common in relations established in a hierarchical manner) and discontinuous ones (as may occur in the case of defined flows according to the logics of cooperation).

In the case of Brazil, as well as in other capitalist nations, the relations between cities, in lands of greater or lesser density, are being commanded more and more by the relations between production and consumption. These depend on the technical density of the points that make up the network, especially when the distribution of such conditions is not on equal terms throughout the land, as is the case in Brazil. Alternatively, the multi-scale level must be observed carefully, such as in a period when there is a greater amplitude in the action of agents and institutions as an important vector in redefining the social and territorial division of labor.

The urban network continues to be hierarchical, but now, with inter-scale spatial interactions, it produces a space with greater fluidity and malleability in scale.

The perspective from the geographical scale not only aids us in explaining urban hierarchy, as also capital organizes space in a network through connections and by spatial selectiveness, as well as helping in explaining urban heterarchy, since its connections and articulations of various types compose spatial interactions.

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