FRONTIER CONURBATIONS: rather than twin cities, a symbiotic outcome of two national cultures and identities

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Abstract

This paper explores, using Space Syntax methodology and tools, the role played by cultural differences in shaping the spatial structure and granting configurational peculiarities to the process of emergent international conurbations. Case studies are two existent "dry frontier conurbations" along Brazil-Uruguay borderline: Santana do Livramento (BR) / Rivera (UY) and Chuí (BR) / Chuy (UY). Both conurbations spatial structures emerge from continuous urban grids between pairs of cities without geographical barriers. These urban systems have high permeability through and around the two settlements, non ostensive checkpoints or geographical barriers.

Field observation showed intense and fuzzy movement and indistinct co-presence of Brazilian and Uruguayan nationals within the conurbations perimeters along both national territories. Advantages taken by local population and tourists from a wide range of complementarities in commerce, services and exchange rates fluctuation between currencies, intensify the fluidity of the categories strangers / inhabitants underlying co-presence and natural movement phenomena.

Despite continuity and permeability of both conurbation urban grids, morphological peculiarities and the spatial structure of each city keep configurational differences imprinted by each national social codes and cultural identities. Space Syntax measures, provided evidence to discuss social and spatial life of these peculiar settlements and establish their typification among a broader Brazilian and Latin American cities sample.

Our purpose is threefold: (1) to describe and analyze differences on urban spread, potential movement and land use allocation and indicate important, although subtle, configurational distinctions in space production due to national social and cultural codes; (2) to discuss which are the typical features of Latin American and Brazilian spatial configurations and how they affect the conurbations spatial structure emergence, drive

distinctions in centrality and potential movement at conurbation level; (3) to focus broadly at the Conurbation Index (CI, as in RIGATTI, 2009) strength in order to verify continuity and connectivity efficiency in fusion processes between the cities and their linkage and complementarities beyond contiguity.

Evidence collected so far indicate a tendency of the conurbations spatial systems to comply with Brazilian average patterns of depth and fragmentation, while their centrality cores lay within the orthogonal grids characteristic of Latin American cities morphology, allowing us to speculate about their underlying cultural and social effects on local community spatial and social lives. (367 words)

I.　　INTRODUCTION - THE EMERGENCE OF INTERNATIONAL CONURBATIONS

The studied conurbations are located along the 1006Km long borderline between Brazil and Uruguay: ***Chuy*/UY - *Chuí* /BR** is close to the Atlantic shore of both countries; ***Rivera* / UY 0- *Santana do Livramento* / BR** is situated inland on SW Brazil – NW / Uruguay. Both are dry border settlements formed without geographical barriers between them.

The borderline between Brazil and Uruguay history is punctuated by riots and disturbances caused by wars and disputation over the territory; initially, between Portuguese and Spanish Crowns and later, by Argentina, Uruguay and Brazil. Disputes lasted from early 17th century until mid 19th century, since the inland area, once called *Misiones / Plata Basin* was of economical and strategic importance for the parties competing to achieve its sovereignty.

On Colonial times, the Brazilian urban net spread from coastal settlements inland. Contrary to that, the Rio Grande do Sul urban net spread from the *Misiones* nuclei and from lagoon harbors inland (Rio Grande, Pelotas, Porto Alegre) which offered better conditions to penetrate and colonize the Southern territory. The region, insulated from Brazilian most important towns and easier communication with Montevideo through the Uruguayan railroad system (Montevideo – Rivera, 1892) and road system (Ruta 9, Montevideo – Chuy, 1930), established a fruitful exchange with Uruguay and borderline villages became regional commercial and exports entrepots linked to Montevideo port (Figure 01).

Social and economic practices often disregarded political struggles between Nations, forming a "real" frontier territory which shrike and expanded according to economical and political advantages perceived by locals who ignored frontiers and borders establishing an authentic transnational "way of life" through commerce, seasonal work and social networks (BRAGA & RIGATTI, 2009).
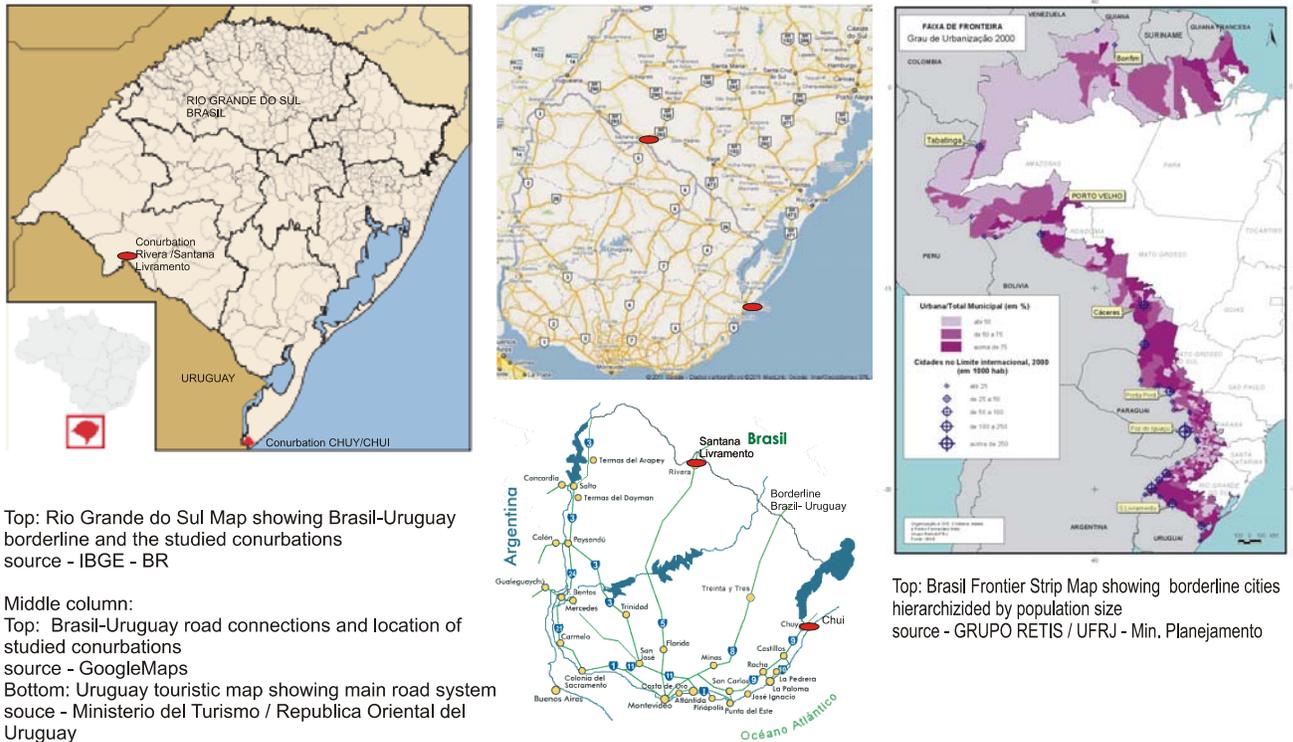
Top: Rio Grande do Sul Map showing Brasil-Uruguay borderline and the studied conurbations
source - IBGE - BR

Middle column:
Top: Brasil-Uruguay road connections and location of studied conurbations
source - GoogleMaps
Bottom: Uruguay touristic map showing main road system
souce - Ministerio del Turismo / Republica Oriental del Uruguay

Top: Brasil Frontier Strip Map showing borderline cities hierarchizided by population size
source - GRUPO RETIS / UFRJ - Min. Planejamento

Figure 01 – Conurbations location maps

The founding of *Republica Oriental del Uruguay* (1811) and its recognition as an independent nation (1848) caused the setting of actual borderlines and the establishment of surveillance / military settlements scattered along it, implying in a mirror-like choice of building spots: a village built in Brazilian territory causing the rise of an Uruguayan one opposite to it, and vice-versa, in order to restrain permeability and vulnerability on both territories. The consequence is an impressive symmetry on both National Governments locational choices and the recurrence of twin-cities phenomena along the borderline's whole extension. Urban spread and local patterns of interaction between these *transfrontier* communities led to a special kind of conurbation which distinguishes *Rio Grande do Sul* among Brazilian urban net (NEVES, 1990).Settlements were separated from each other by a stretch of open / *non aedificandi* land along the borderline which, in time, became gathering places for both communities and today are public spaces separating the doubled street system running on each side of the borderline.

II.   METHODOLOGICAL PROCEDURES AND REFERENCES

We use Space Syntax theory and methodological tools to evidence structural and morphological peculiarities of the conurbations and highlight the typological differences and dominances that emerge from a single urban grid generated by two national societies.

By decomposing the urban grids into axial maps (HILLIER & HANSON,1984), and after that, processing the obtained graphs using MindWalk® (FIGUEIREDO, 2002) set of tools, some measures and correlations were

selected to describe how morphological differences driven by cultural and social distinctive patterns give way to shared centrality processes.

By means of a spatial description of accessibility hierarchy, and analyzing how grid deformation produces different patterns of permeability which define sociability territories. Patterns of co presence between locals and strangers (HILLIER and HANSON, 1984) and pedestrian movement potential (HILLIER et al, 1993) are analyzed from the description of each city and the conurbations they form.

The measures used to describe the spatial configurations are Global (Rn), Local (R3) and Radius Radius (RR) Integration. The correlations of Integibility (global integration / connectivity), Synergy (global / local integration) and Choice Map (most frequently used nodes in journeys from / to all spaces in the system - HILLIER et al,1987) enable to identify distinctions in national social codes and consolidation of centralities. Differences of urban spread peculiar to both national societies are pointed out and compared with Brazil and Latin America sample results (MEDEIROS & HOLANDA, 2007).

Finally, the Conurbation Index (RIGATTI, 2008) is applied as a verification tool, informing if the interpenetration of the contiguous urban grids effectively structure a new kind of spatial system, where Space Syntax compactness indicators (Rn, Mean Depth, Integibility and Sinergy) are improved through the conurbation process.

The Conurbation Index (CI) is obtained dividing the mean Rn of the grouped subsystems (each city) by the sum of mean Rn of isolated subsystems divided by the number of subsystems (IC= R / Σ (Rn/n)). Results analysis indicate that IC > 1 is an indicator of strong conurbations, expressing that in strong conurbations syntactic measures tend to be more robust for the whole conurbation system than for its composing parts (each city). In strong conurbations, spatial patterns and urban dynamics processes are better explained if taken as a whole system than if taken in separated parts, proving that the spatial structure logic lay in the core of the conurbation process (RIGATTI, 2009, 2011).

III. GENERAL DATA ON CHUY (UY) / CHUÍ (BR) & RIVERA(UY) / LIVRAMENTO (BR)

Uruguay Northern region is one of its less developed. Cities suffered the impact of massive urbanization suffered by Latin American countries from 1980's on. Uruguay is particular, since urbanization is concentrated at Montevideo area (45% of urban population) and is a "small" country towards South American patterns – 3.4 million inhabitants, equivalent to Porto Alegre Metropolitan Area. Its Northern region displays the worst development and unemployment indexes. Despite the fact that Rivera is the 4th Uruguayan city in size and income and situation is improving after the creation of duty free zones in all borderline towns regional development remains uneven and subject to Brazilian economical shifts. From 2005 on, Rivera became a preferential destination to weekend shoppers, most of them coming from *Rio Grande do Sul* central region and surrounding towns. New duty free shops, hotels and restaurants are being opened everyday; commerce and services are now the city most important income revenue and working positions quantity offer.

Santana do Livramento, on the other side, suffered a reverse process. An important centre of industrialization of primary goods the city is now starting to overcome the decay it has been suffering since 1960. Until 2000, commercial activity was stronger on the Brazilian side of the border, with several shops and supermarkets supplying Uruguayan market. Today, Santana do Livramento commercial activity and

services are complementary to Rivera free shop zone and as the Brazilians long for being "in foreign country", the city acquired a sort of "peripheral" role in the conurbation.

The case of Chuy / UY and Chuí / BR is quite different: both cities are, from the start, commercial entrepots. Chuí /BR were insulated from the rest of the national territory until 1970, when a road linking it to Rio Grande Port was opened (BR 471). Until then, both cities were linked to Montevideo (Ruta 9 / 19) since 1930, being the closest borderline spot to Montevideo (320Km). The cities are placed in area (Figure 01), which has been considered *Neutral Fields* until 1814, meaning that neither Spanish nor Portuguese were allowed to settle on the area.

Settlements start with the building of Portuguese fortresses and a village now belonging to Uruguayan territory. Chuy / UY was built earlier and their government made an effort to populate the area with nationals, granting land to minorities groups responsible for most of the land parceling in order to contain the Brazilian appropriation of rural land in Uruguayan territory and minimize the borderline ambiguity.
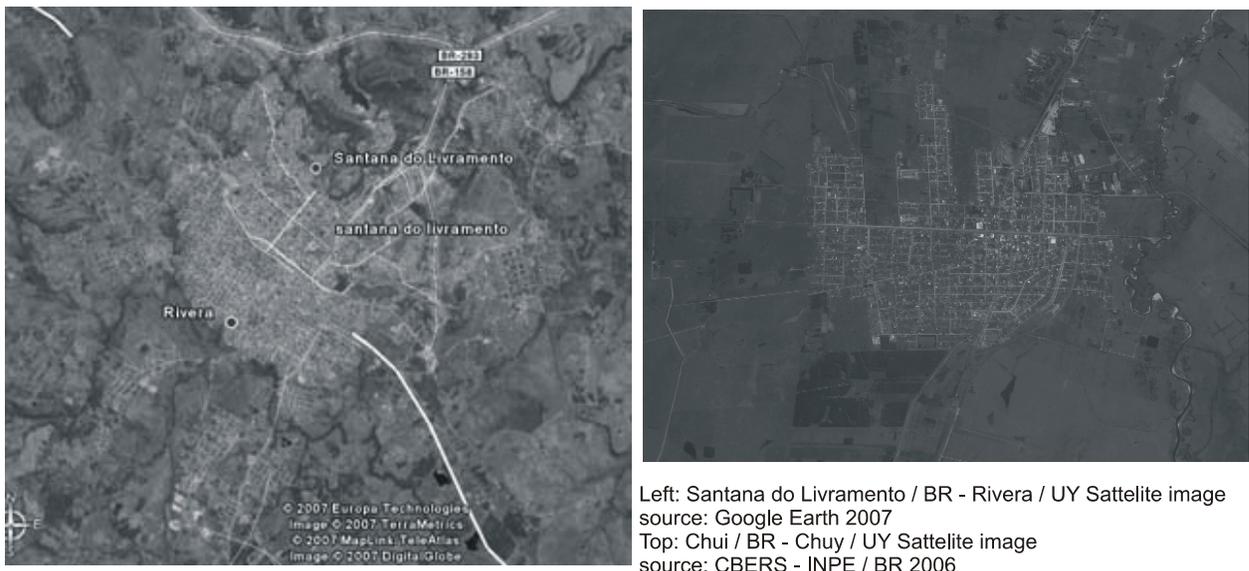

Left: Santana do Livramento / BR - Rivera / UY Sattelite image
source: Google Earth 2007
Top: Chui / BR - Chuy / UY Sattelite image
source: CBERS - INPE / BR 2006

Figure 2: Satellite images of both conurbations

Chuy/UY and Chuí / BR are small settlements living out of commerce and services, especially during summertime when the region receives a great amount of Uruguayan tourists. Due to its proximity to Montevideo, Chuí/BR became a wholesaler centre (from 1975-2000) for Uruguayan population. Chuy/UY is the less busy Duty free zone due to its distance to most of Rio Grande do Sul bigger cities. The conurbation is very small and urban spread is constituted almost of low income dwellings meant to absorb migrant rural population on both sides of the border. Infrastructure problems are remarkable also on both cities and their peripheral condition, undeniable. Besides, unlike Rivera / Santana do Livramento that had a wealthy and "cosmopolitan" past (from the 1st World War to 1950) before decaying into periphery; Chuy / Chuí were peripheral from their start as villages.

We can think about these conurbations as a spatial display of multiple social territories, places marked by more than one border or frontier: they might be either, social, cultural, identity or economical ones and established according to the strategies required by historical switches. Nevertheless, the conurbations are a strong indicator that urbanization is a consequence of significant transformations suffered by national economies and social expectations in both countries.

The frontier social pattern of interaction is marked by a pretense invisibility or unawareness of the *stranger* (here mentioned as in HILLIER & HANSON, 1984) as a way of coexistence. Despite cherished statement of national identities and territories, everyday life functions on the assumption that *local* is everyone: Brazilians and Uruguayans, no matter on which side of the border they are moving about. *International* and *transnational* exchange in all levels is routine and Uruguayans and Brazilians play foreigners / strangers on their daily movements. Culture and social practices acquired mixed national standards, even if living together doesn't imply in a shared identity. (CHASTEEN, 2003).

TABLE 01 - General data on studied municipalities

	Rivera / UY	Santana do Livramento / BR	Chuy / UY	Chuí / BR
Settlement Foudation	1865	1857	1888	1927
Municipality / Department	Rivera	Santana do Livramento	Rocha	Chuí (from 1995)
Location Coordinates*	30°53'59,33"S 55°32'29,43"W	30°53'21,47"S 55°31'57,32"W	33°41'40,16"S 53°27'14,35"W	33°41'28,41"S 53°27'23,15"W
Geographical area	N (UY)	NO RS	NE Uruguay	SE Rio Grande do Sul (Brazil Southernest point)
Distance to Montevideo	501 Km	502 Km	340Km	340Km
Distance to Porto Alegre	500 Km	500 Km	515Km	515Km
Acessibility	Ruta 5 (UY)	BR 290 BR 158	Ruta 9 (UY) BR 471 (BR)	Ruta 9 (UY) BR 471 / 116
Urban population	101.504 hab	74.910 hab	9804 hab	5697 hab
Urban area	6.950 sqKm	9,370sqKm	sq Km	9,370sq Km

*Datum WGS 84 from Google Earth® Statistics data: FEE / RS-BR http://www.fee.tche.br
INE – Instituto Nacional de Estadistica – Republica Oriental del Uruguay – www.ine.gub.uy

IV.   SANTANA DO LIVRAMENTO / BR AND RIVERA / UY CONFIGURATIONAL DESCRIPTION

Santana do Livramento / BR system is composed by 1128 axial lines. Its Global Integration (Rn) map displays a quilt of grid patterns separated by voids (hills, military headquarters, abandoned plants) and connected by

a deformed wheel macro system of longer and more integrated lines that outline the road connections to Rio Grande do Sul / BR (BR 290 and BR158), and to Montevideo / UY (*Ruta* 5), where a dry port area is placed.

From the old city core (an orthogonal grid) and starting directly from the road system, the city spreads as a tree like urban structure forming highly insulated enclaves. The configuration profundity is coherent to Brazilian patterns of urban growth and suburbanization, where the population is clustered into up and low market residential neighborhoods (RIGATTI, 2003), which are discontinuous on the territory and highly spatially segregated from each other, reproducing the uneven Brazilian social and economical structure, answering only to property development speculation logic, which is also responsible for forcing the increase of urbanized perimeter with very low density rates (BRAGA AND RIGATTI, 2009). Following the logic imposed to the urban system by the high integration values of the main road system, punctual centralities were formed along it, anchored by big scale commercial activities.
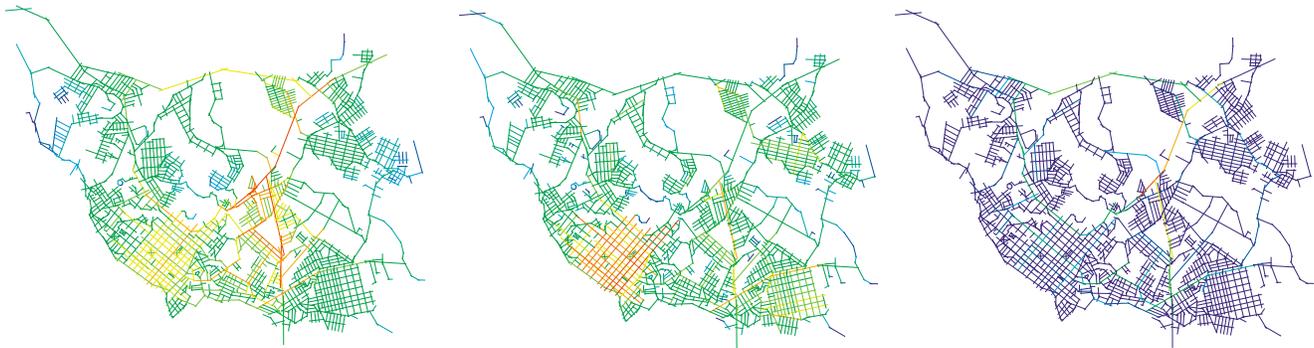
SANTANA DO LIVRAMENTO syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map
source: the author

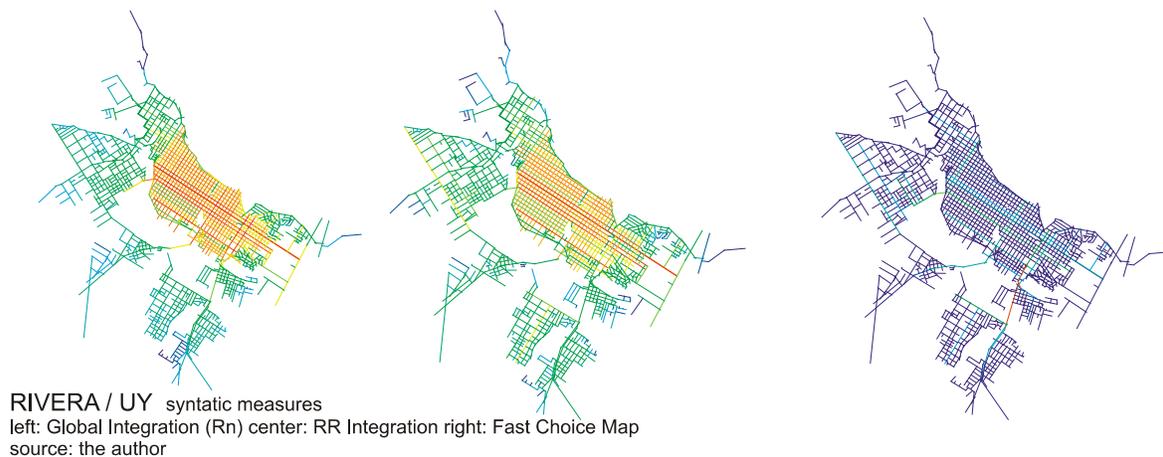**Figure 03**: Santana do Livramento Rn / RR / Choice Maps

The orthogonal grid correspondent to the old city core and its most integrated axis - the street linking *Rivera* and *Livramento* symbolic city centers (perpendicular to the borderline) are the busiest commercial streets of both towns. This axis corresponds to Sarandi (Rivera / UY) which concentrates most part of *duty-free shops* and Andradas (Livramento / BR) with low cost products shops and hotels. The commercial activities are coherent with the orthogonal grid low hierarchy and control levels, providing good conditions to an even spread of movement and co presence of locals or strangers (tourists) and land use diversity. This characteristic is reinforced by analyzing Local Integration (R3) and RR Integration graphs(Figure 03). Both display the unevenness of integration distribution on the urban grid, allowing us to conclude that, in local terms, the role of the orthogonal grid towards the constitution of centralities based on natural movement equity potential and inductor of diversified co presence are clarified.

The "X" shape axes (RR Integration graph) starting on the border line and enclosing areas that are potentially more integrated than in local and global graphs, represent the oldest city suburbs that housed slaughter and dried meat plants and concentrated the most part of job offers until 1960. As workers were indistinctively Brazilians and Uruguayans, their accessibility amidst the system were required as well as a shallower configuration that could provide coexistence of social, cultural and national diversity of workers.

Choice map (Figure 03) displays the importance of ring roads system to regional and international transit inside and through the city. It means that accessibility is concentrated on these axes and there are few options to cross the settlement except through them. Economy of lines, patchwork resemblance grid, low integibility and synergy measures and mean depth of the system is high, consistent with MEDEIROS & HOLANDA (2007) typification of a Brazilian large sample of cities from various sizes (in number of lines). It is to say that even small towns reproduce complexity; fragmentation and clustering that reflect weak city governance parameters, always subject to market laws, discontinuity of urban planning public policies.

The analyses also reflect that if social investments target segregation, urban spread patterns deconstructs the once accessible grid structure by means of investing in a morphology that captures movement in and out the city (ring roads with higher Global Integration levels) and favors new kinds of centrality that are intrinsically linked to private transportation.

Rivera/ UY is composed by 742 axial lines, a system smaller than Santana do Livramento / BR, although urbanized area is much more compact and axial lines are longer. What calls immediate attention on Global Integration (Rn), Local Integration (R3) and Radius Radius (RR) Integration graphs (Figure 04) is the similarity of Integration measures on the 3 levels, meaning that accessibility is non-hierarchical, the configuration is shallow, permeability is high and these patterns are similar on both local and global scales, a phenomenon characteristic of the orthogonal grid that dominates the Rivera spatial system. Therefore co presence between locals and strangers (HILLIER & HANSON, 1984) and indistinctive locational patterns of land use are consequent to the configuration non-hierarchical character (FIGUEIREDO & AMORIM, 2007) allowing a theoretical pulverization of centrality along the urban area.

RIVERA / UY syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map
source: the author

Figure 04: Rivera Rn / RR / Choice Maps

The city grew through the extension of its longer lines parallel to the border line maintaining the orthogonal grid pattern despite the local topography. The orthogonal grid represents the oldest, most consolidated and larger part of the system, since the city growth has been under stagnation until the end of 1980. Recently, tree shape clusters for low income dwellings were built along the roads leading to Montevideo (Ruta 5) and to the Uruguay – Argentina border towns. These are insulated from the city by a river, military facilities and wildlife conservation areas and their population is that of rural migrants.

Distinctions seen in Global (Rn) and Local (R3) Integration values are credited to the system longer lines that connect the urban core to the road network and its new suburbs. Those axes are centrality generators both at Global level, linking Rivera/UY to Livramento/BR (the continuous Sarandi / Andradas) through the border line; and at Local level, where the longest axis parallel to the borderline (avenida Brasil), connects the city core to its surroundings and new suburbs.

It is possible to talk about a hierarchy of centrality amidst the Rivera orthogonal grid, granted by its two longer axes: one running perpendicular to the borderline concentrates the symbolic uses, commercial activity and, since 2008, when Brazilian economy started to overcome crisis and currency was strengthen, *Sarandi* is suffering a major commercial restructuring by means of recycling its historical buildings (banks and cinemas) that were closed since long to accommodate new duty free shops and hotels (bigger in size and displaying a more diversified selection of products) as a consequence of the always improving tourist fluxes. The other centrality pole, *Brasil*, where commercial land use overcomes dwellings, is the longest line of the system, which represents a local centrality and commercial pole to the city's suburban population.

Choice map (FIGURE 07) highlights these centrality axes, along with the most important connection between *Livramento* "dry port" and Montevideo on Ruta 5. This area is becoming a new shopping centre with the building of a large *duty free shopping mall* close to the borderline which aims to minimize the traffic of tourist buses in the centre.

The orthogonal grid area retains richer dwellings and sophisticated commercial activities and operates as a large center full of activity, movement and core of the city social life. Segregated dwelling areas have been recently incorporated to their governance system as a way to absorb traditionally rural population into urban areas. The social differentiation comes from the opposition rural / urban recent background more than from economical classes. Cultural and educational differences are the first reason for spatial segregation.

Rivera's urban grid is more economic than that of Santana do Livramento. It also has higher integibility and synergy measures while the mean depth of the system is lower. These data are consistent with MEDEIROS & HOLANDA (2007) typification of Latin America sample of cities. Urban planning focuses mostly in the improvement and qualification of public places within the orthogonal grid and even distribution of infrastructure systems among new governmental housing expansions. Unlike the Brazilian case, city centre was not emptied or degraded, on the contrary, land plots and dwellings are more valuable than ever on the city core and the mix of land uses is real and evenly scattered.

V.   THE CONURBATION SANTANA DO LIVRAMENTO / BR AND RIVERA / UY

The differences between Brazilian and Uruguayan social and spatial dynamics became evident through social and spatial lives found in both cities centralities. Rivera centre is a consolidated place which maintains its

symbolism while updates the uses and activities that apply both for locals and foreigners. Santana do Livramento centre has been emptied of its symbolic significance and centralities shifted according to cultural and social expectations based on more excluding co presence patterns, therefore leaving the shallower old centre spaces for local interfaces mostly.

TABLE 02: Comparative Space Syntax measures/correlations Santana do Livramento /BR - Rivera /UY

	No Axial Lines	Rn max	Rn min	RR max	RR min	Integibility	Synergy	Mean Depth
Santana do Livramento / BR	1128	1,49	0,43	1,66	0,32	0,39	0,62	7,58
Rivera / UY	742	1,31	0,47	3,04	0,35	0,64	0,84	4,97
CONURBATION	1889	1,31	0,47	2,15	0,33	0,48	0,67	7,33

(data: by the author, already published in SSS7, Stockholm, 2009)

The graphs obtained for the conurbation (FIGURE X), are remarkable: instead of a complementarity between the two systems, it seems more like a symbiosis that structures the conurbation, since its configuration is a whole new system in which the orthogonal grid captivates integration, and therefore centrality and provide a shared field propitious for diverse co presence and distributive movement that constitutes a single centre at the same time local and global (BRAGA & RIGATTI, 2009).
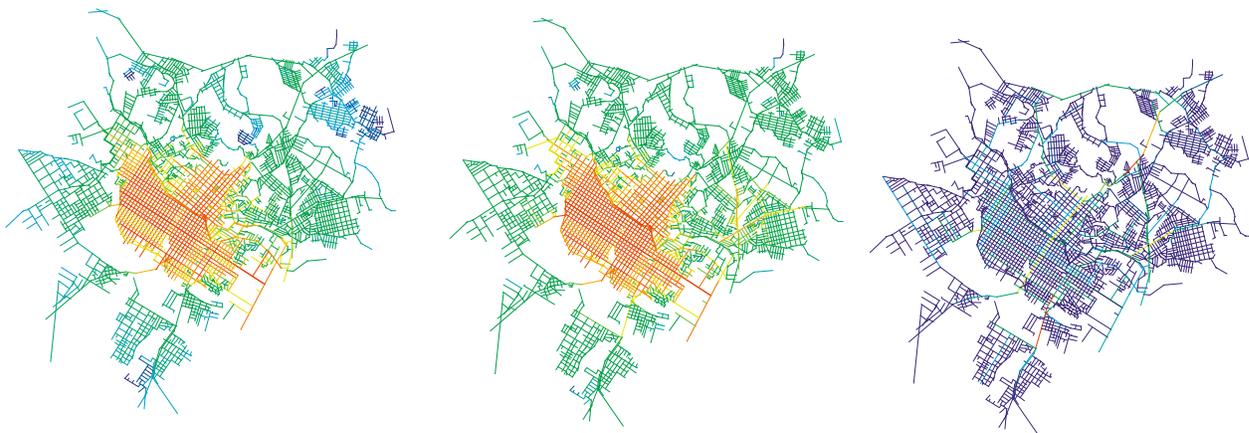
RIVERA / UY - SANTANA DO LIVRAMENTO / BR
Conurbation syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map

Figure 05: The conurbation Rivera –Santana do Livramento Rn / RR/ Choice Maps

Global Integration highest values for the conurbation are concentrated mostly along the orthogonal grid. The street system that runs along the borderline is included in the set of most integrated lines instead of acting as a barrier between the cities, giving away the conurbation symbiotic structuring process. Local Integration (R3) remains stronger within the orthogonal grid, but values are weakened and the main axes

connecting suburban clusters are added to the system. Mean Integration (RR) reinforces the importance of global integration to typify the conurbation spatial structure.

Choice map captures preexistent ringness of Santana do Livramento Choice Map, but selects from Rivera urban grid only the most integrated axis which is composed by its main commercial streets, the ones functioning as modern promenades and duty free shop zone.

TABLE 02 indicates that measures of integibility, synergy and mean depth of the conurbation are contaminated by Santana do Livramento indexes although weakened, making the conurbation closer to Brazilian patterns of integibility and mean depth.The conurbation has a cosmopolitan centre in Sarandi-Rivera and a local centre at Andradas- Livramento which is peripheric to the Rivera one.

The afflux of Brazilian tourists since 2005 is causing a considerable change in location patterns of duty free shops. As they travel mainly by bus and the hotel net is deficient, they usually don't stay overnight and Parking areas for buses became a problem near the centre. A huge duty free shopping mall is being built on the confluence of BR 290 and Ruta 5, right on the borderline and at the conurbation Eastern. This will probably cause a shift on the area kind of movement / land use since it's placed on one of the Conurbation Choice Map outlined axes and follows the trend of hybridization and symbiosis described for the conurbation, forcing us to consider it ambiguous *vis a vis* HOLANDA & MEDEIROS (2007) proposed typification of Brazilian and Latin American cities.

VI.   CHUY/ BR AND CHUY / UY CONFIGURATIONAL DESCRIPTION

Chuí / BR system is composed by only 186 axial lines, therefore, small. Its Global Integration (Rn) map shows Uruguay avenue (which runs parallel to the borderline) as its most integrated axis. A deformed triangle that has Uruguay avenue as its basis and sides composed by BR 471 with the customs office at its vortex surrounds a small stretch of orthogonal grid that concentrates centrality functions and land use (city hall, hotels, restaurants and shops). The intensity of commercial land use is also stronger on this stretch of Uruguay Avenue, corresponding to the triangle basis. Apart from that area, dominant use is residential or abandoned commercial structures, and the avenue ends abruptly on its Western side.

The city stretches inland (N) through new land parcels corresponding to low income housing estates. Empty plots and the cemetery separate those from the urban fabric itself and urban infrastructure in these areas are quite insufficient or inexistent. Urban voids (areas belonging to the water company, hospital, abandoned plants) clearly cut the urban grid development parallel to the border line and its segregating effect is strong enough to cause complaints from municipality technicians. They form barriers not only to the urban spread, but also to pedestrian / vehicular movement. Apart from Uruguay Avenue, permeability parallel to the borderline is quite difficult and, therefore, the city seems to be made of several mismatching urban grids with very high average depths, connecting directly to its most integrated axis.

Integibility is low (0,29) coherent with Brazilian patterns: a stranger has to relay on only one axis to perceive and access all the other parts of the system (Uruguay Avenue).

Local Integration (R3) and RR graphs basically reproduce Global integration (Rn) logic, exception being the incorporation of the longest perpendicular axis which leads to most of low income housing estates built aligned and on sequence on one of the axis side. The high system synergy (0,91) demonstrates the coherence between local and global integration and, as a reinforcement, R3 and RR are equivalent, meaning

that either aren't local clues in the system to help orientation on the micro level or the system is so small that scales are indistinct.

The city has no vertical density, three stories buildings being it's highest. Mixed uses are ordinary at the central area, with a commercial ground floor topped by dwellings, usually the shop owners and their extended family. The city Eastern periphery, displays the road linking the Brazilian customs office to the Uruguayan one, and the road leading to the shore. Hotels, motels, petrol stations and warehouses are placed along this stretch of BR 471 on the city outskirts.

The urbanized perimeter can be considered large due its extremely low densities and its segmented urban grid. As in Santana do Livramento, the urban structure can be compared to a half fish-bone where neighborhoods are linear and, theoretically, indefinitely able to stretch North (away from the borderline) without connecting through E-W direction. Once more, the discontinuity logic of Brazilian urban spread is noticed and spatial segregation among social classes is given by the ever increasing metric distance from the most integrated axes.

Centrality is also linear, along Uruguay avenue (along the border line). This is coherent to the fact that Chuí / BR majority of shops and commerce targets Uruguayan public, especially wholesalers that supply Montevideo and regional shops (clothing, house ware). The central streets perpendicular to the borderline and connecting directly to BR 471 and to Chuy / UY centre and customs office have the most intense commercial activity on their 2 blocks immediately close to the borderline.

Choice Map (Figure 06) only highlight what was already clear on Rn and RR graphs: that the most important street of the town, vital to vehicular and for foreigners circulation is the avenue running parallel to the borderline and the actual only possibility to access all neighborhoods. System's logic lay on the interface with Uruguay, being the connections to Brazilian territory are less important, therefore the city first expansion dealt with the improvement of interface area with the facing town.
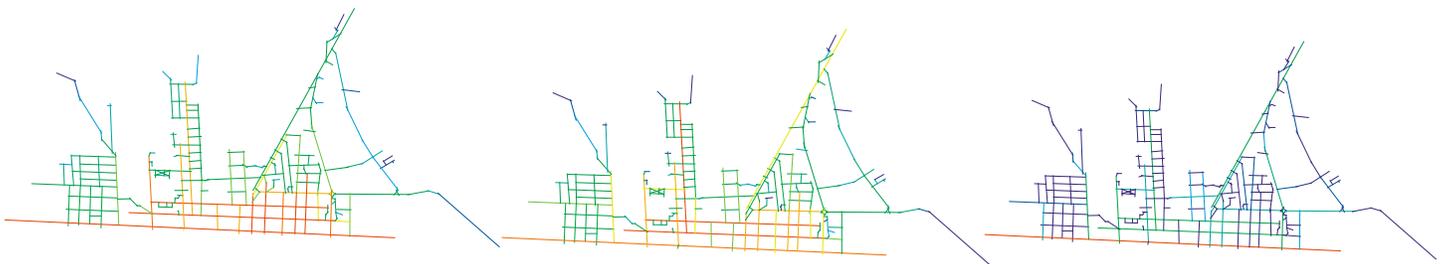
CHUI / BR syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map
source: the author

Figure 06: Chuí Rn / RR / Choice Maps

Economy of lines, patchwork resemblance grid, low integibility measures are consistent with MEDEIROS & HOLANDA (2007) typification of Brazilian cities. Nevertheless mean Depth (4,39) is much lower than those found on Brazilian samples and synergy is high, which means that ,so far, the system spread and growth (stagnated due to economical collapse) haven't reach its peak, but the linear tendency it displays already means that Depth levels tend to increase if the patterns of urban spread, fragmentation, clustering and discontinuity of the urban grid are maintained.

Chuy / UY system is composed of 220 axial lines, therefore, slightly bigger than that of Chuí / BR. Its Global Integration (Rn) map is quite uniform, with the orthogonal grid patches displaying a general level of integration lower than that of Chuí / BR. Exception is the diagonal cutting the entire urban grid and connecting *ruta 19* to *ruta 9* and BR 471. This avenue has no commercial activity at all and canalizes heavy load traffic from inner Uruguay to international roads. It cuts the grid in a way that establishes a peripheral limit to the city symbolic, institutional and commercial centre. Urban grid is much more compact than the one of Chuí/BR: less integrated axes are located on its SW / SE periphery, which are composed by a "slum like" settlement - rural migrants and gypsies (SW) - and sports facilities - soccer club and stadium (SE)-.

CHUY / UY syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map
source: the author

Figure 07: Chuy Rn / RR / Choice Maps

Ruta 9 encircles the city Eastern limit and the customs office is set outside the urban perimeter halfway to other coastal villages on the Atlantic shore.

The axis constituted by avenida Brazil (running parallel to the borderline) continues to the next Uruguayan city (19 de Julio) forming the road Ruta 19. The only perpendicular axis which is slightly more integrated than the others is the one connecting Chuy city centre (general Artigas) and its main square to rua Argentina on the Brazilian side. On avenida Brazil, apart from the stretch correspondent to both city centers, where main duty free shops, casino and restaurants are located, residential use is dominant. Commercial use spreads towards the city Eastern fringe (close to Ruta 9 and coastal towns and resorts).

As in Chuí / BR synergy is high (0,9554) and main distinctions on Rn and R3 / RR are constituted by the 3 - 4 lines perpendicular to the borderline that form the city core. A more integrated axis on the SW periphery denounces the connection to the "slum informal grid" were a big land parcel was subdivided by dwellers according to their own acessibility needs.

Integibility is higher (0,56) coherent with Latin American cities patterns despite the fact that the urban fabric is composed by a patchwork of mismatching orthogonal urban grids. The strength of the diagonal axis cutting the city in two halves is important in identifying the city parts and also to orientability in global and local scale.

The city is also horizontal, mainly composed by single family dwellings. Centrality is not linear, spreading on the Northern part of the orthogonal grid, especially on the stretch of avenida Brazil (parallel to the borderline) between Artigas and Numancia and on the blocks surrounding the main square (limited by Artigas, Amazonas and Guaiba streets). In this area is possible to find hotels, restaurants, duty free shops up to 3 stories high. It contradicts tendencies depicted from Rn map and indicates that to understand the city centrality location is necessary to analyze it as a conurbation along with Chuí / BR.

Choice Map (Figure 07) only highlight what was already clear on Rn and RR graphs: that the most important street of the town is the diagonal running E-W and cutting the urban grid in two halves. It also limits distinct morphological zones, where the orthogonal grid changes proportions (blocks tending to a more rectangular shape) which represent newest urban expansions. It also makes clear that the most important axis is the one that enables free circulation through the urban area, connecting its rural surroundings to the main road system, evident due to heavy traffic of trucks carrying crops products to Brazilian plants (rice is the main regional agricultural resource and most beneficial plants are Brazilian).
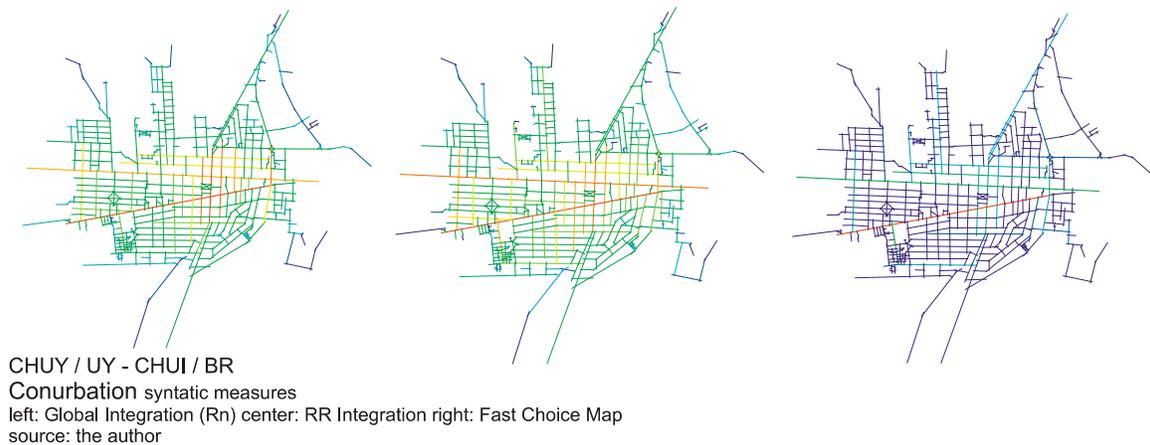
Patchwork of urban grids and lower than average integibility measures (0,56) distinguish Chuy/UY among other Latin American samples (MEDEIROS & HOLANDA, 2007). Mean Depth (3,59) is low thanks to the diagonal axis. The urban fabric has several voids and city grow through informally built and very low income dwellings. The city centre built stock is being renovated and new duty free shops are being built close to the junction between Ruta 9 and avenida Brazil outlining the contrasts with the average city landscape.

VII.   THE CHUÍ / BR AND CHUY / UY CONURBATION

The conurbation itself explains the functioning of both cities, fact that is difficult to grasp analyzing the cities separately. All the Syntatic graphs for the conurbation Chuy-Chuí (Rn, R3, RR) make clear the spread of centrality along the borderline, a shared linear centre for both towns and its immediate adjacencies contained by road accesses on both sides. As happened in the process of analyzing the cities separately, Rn, RR and R3 graphs display similar integration on most axes, in this case, R3 and RR almost equivalent and reinforcing global centralities on local level and vice-versa.

As said before, it seems to be a consequence of the small system size coupled with the symbiotic effects of the conurbation itself.

The diagonal highest integration (Rn, R3,RR) implies that the connection between Uruguayan and Brazilian countryside is extremely important for regional economy and the borderline street system is the core of both towns and forms a linear centrality to the conurbation.

CHUY / UY - CHUI / BR
Conurbation syntatic measures
left: Global Integration (Rn) center: RR Integration right: Fast Choice Map
source: the author

Figure 08: The conurbation Chuí / Chuy Rn / RR / Choice Maps

The high synergy level confirms the coherence between global and local integration and basically reproduces the individual cities parameters. Integibility on the other hand is improved to Latin American patterns, confirming what was stated above. The conurbation mean depth is maintained and is much lower than the Brazilian sample (MEDEIROS & HOLANDA, 2007).

TABLE 03: Comparative Space Syntax measures / correlations Chuí /BR - Chuy /UY

	No Axial Lines	Rn max	Rn min	RR max	RR min	Integibility	Synergy	Mean Depth
CHUÍ / BR	182	3,04	0,56	3,4	0,33	0,29	0,91	3,44
CHUY / UY	220	3,21	0,33	4,47	0,33	0,58	0,95	3,59
CONURBATION	398	2,38	0,64	4,20	0,33	0,58	0,94	4,28

(data: the author)

I dare to say that the Chuí-Chuy conurbation is almost like a single city, instead of a conurbation, its system illogical and impossible to perceive separately. Its level of symbiosis is really high, sharing centrality in all senses as well as social and spatial segregating patterns.

VIII. COMPARING FRONTIER CONURBATIONS ALONG BRAZIL – URUGUAY BORDERLINE

As displayed on Table 04, Conurbation Index is lower than 1 to Santana do Livramento / BR – Rivera / UY conurbation, meaning that the cities systems are better understood separately. This phenomenon is due to the clear morphological contrast between both urban grids. Rivera incorporates the Latin American typology (MEDEIROS & HOLANDA, 2007) and the weight of its orthogonal grid and compactness contrast with Livramento characteristics such as high Mean Depth, fragmentation and territorial dispersion. Despite the

fact that Rivera is a bigger system than Livramento, the conurbation syntactic measures are contaminated by the last one, weakening the system performance.

According to RIGATTI (2011) causes for this might be that Livramento urban spread is completely different from Rivera orthogonal grid and the interpenetration of both systems is weakened outside Livramento city core (which also has an orthogonal grid) and becomes concentrated on few axes (the ring road system) that concentrate integration.

Empiric observation also denotes that the blurred city limits are only noticeable when inside the city core, being easily perceived the morphological and structural changes on newest parts of both towns, even if the systems interpenetrate. The street system running along the borderline is able to connect the cities without interpenetration Rivera concentrating most part of the conurbation integration core.

Once again, we can say that the reproduction of economic and social patterns of dependent capitalism which marks Latin America and Brazil is followed by social and spatial segregation within the cities. National identity peculiarities are imprint on the way urban grids spread, peripheries are formed and conurbations grow stronger.

The Chuy – Chui conurbation is quite different. It has a strong Conurbation Index which validates filed observation that is impossible to understand both systems independently. Despite the fact that the conurbation most integrated axis is not responsible for its good performance, interpenetration between systems is high and the conurbation core is equally spread along both cities. The fact that the axis connecting both settlements grants it the longest possible interface between systems also helps. And, finally, the small size of the system and urban dynamics contribute to reinforce the conurbation character. Higher levels of Integration even on the Brazilian part of conurbation are also important: despite the fact that morphological differences between both cities are noticeable, Chuí / BR is closest to the Latin American samples than to the Brazilian ones, allowing us to think that if we were to pick up a sample from Mercosul borderline conurbations, certainly Chuy-Chuí would set typological parameters.

TABLE 04: Comparing conurbations: Chuí/BR - Chuy/UY & Santana do Livramento/BR – Rivera/UY

CONURBATIONS	Mean Rn Subsystem 01	Mean Rn Subsystem 02	R - Mean Rn conurbation	CI - Conurbation Index	Integibility	Synergy
Santana do Livramento / BR – Rivera /UY	0,78142693	1,04	0,850749101	**0,930725**	0,48	0,67
CHUí / BR – CHUY / UY	1,245928	1,572854	1,426498	**1,0121378**	0,58	0,94

(data: the author)
5991words

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