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SEA AND CITIES:

Spatial Configuration of Brazilian Urban Beaches

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ABSTRACT

This paper compares the spatial configuration of urban beaches in Brazilian cities – Fortaleza and Natal – and looks for patterns that might facilitate arenas of urban vitality. Beaches in Brazil are important leisure and socialization places, and are generally seen as democratic arenas, being federal properties legally accessible to all. The beaches selected in Fortaleza - Barra do Ceará, Praia de Iracema and Praia do Futuro - and Natal - Redinha, Praia do Meio and Ponta Negra - have some similar traits: swimmable warm waters all year round, fine sand and access via public transport. Nonetheless, all beaches are characterised - and seem to be used - differently, albeit Natal's beaches receive a somewhat stronger stereotyping than Fortaleza's. Public spaces are essential assets of urban societies, having a role in fostering social diversity, and spatial form may help unite or separate people. This paper investigates the cities' and beaches' spatial configurations to understand how these might contribute to distinct characterisations and uses, and to qualities of urban vitality. For Natal, this was the subject of a doctoral thesis and showed that space, built form and social life interrelate. When we compare the spatial form of beaches in Fortaleza, we see that in both cities street patterns for each beach are very distinct, and that characterisations relate to space. However, in Natal natural boundaries help set the beaches further away from one another, and not well connected to the city's main routes of movement. Fortaleza, on the other hand, has an overall less fragmented system and beaches are less detached from the main structure. This might help explain a somewhat weaker social distinction between beaches in Fortaleza. In both cities beaches that seem to be frequented by the poorest economically (Redinha and Barra do Ceará) are the least accessible. In Natal, Ponta Negra contrasts with the others as being more connected with the wider urban fabric, and bears comparison with Praia de Iracema in Fortaleza, showing recurrent overlaps between inhabitants' and visitors' potential movement. However whereas in Natal both Praia do Meio and Redinha are spatial enclaves, this applies in Fortaleza only to Barra do Ceará, as Praia do Futuro shows some confluence of movement. The beaches' spatial configuration differences (and similarities) between the cities reveal some urban dynamics, and relate to apparently distinct social lives of beachgoers; further research can enlighten how these correspond.

KEYWORDS

Spatial Configuration, Urban vitality, Urban Beaches, Fortaleza, Natal.

1. INTRODUCTION

This paper compares the spatial configuration of urban beaches in the Brazilian cities Fortaleza and Natal, and looks for patterns that might facilitate arenas of urban vitality, as referred to in the literature.

Despite the role that urban beaches play in Brazilian cities and of what is revealed when studying relations between physical attributes and social life, there is a scarcity of studies focusing on analysing spatial configuration of different beaches, and relating them with urban dynamics.

Beaches in Brazilian coastal cities are major leisure and socialization places. Several factors contribute to this, such as: a historical coastal culture; the beaches' public nature; the scarcity of other public spaces appropriate for leisure uses; and the attractive power of the sea. In the northeast region an all year round favourable climate and warm waters also contribute to beaches being intensely used. As in Brazil beaches are federal properties that legally allow free access to all, there is a general belief that these are democratic arenas.

Space configures fields of potential movement in the city (Hillier et al., 1987), thus shaping fields of potential encounters. Studies have identified that certain spatial patterns may help bring different people together, while others help segregate people (Legeby, 2013; Vaughan et al., 2013). Spatial configuration was pointed out as intrinsic to the appropriation of different areas in the city by different groups (Carmo, 2014; Vaughan, 2007), revealing processes of segregation.

Many cities – of which Brazil's are a markedly strong example - reveal processes of social exclusion and segregation that characterize their urban dynamics (Villaça, 2001). In Brazil different residential neighbourhoods are occupied mainly by certain classes; and people's mobility in the city result in limited spheres of co-presence amongst different classes (Holanda, 2000; Netto et al., 2015).

Urban beaches seem to reflect segregation patterns in the city, as different beaches are generally used by different people. This is expressed by beaches distinct locations and built forms, and by beaches generally having distinct reputations. Doctoral research showed close ties between spatial configuration, built form and social life in urban beaches, which helped reveal urban dynamics and societal spatial relations in Natal (Donegan, 2016; Donegan and Trigueiro, 2016). Beach neighbourhood spatial characteristics either aggravated (spatial enclaves) or eased (grids better embedded within the overall grid) social tensions. These also related to the beaches' distinct reputations. Our master's dissertation focused on a particular beach in Fortaleza (Praia do Futuro) and found out that the distribution of different groups was related to location within the neighbourhood and to building types (Donegan, 2011; Donegan and Trigueiro, 2012).

As shown by earlier research and personal observations, the chosen study cases - Barra do Ceará, Praia de Iracema and Praia do Futuro in Fortaleza, and Redinha, Praia do Meio and Ponta Negra in Natal - are all intensely and diversely used, and represent distinct locations in each city. This paper examines these cases, focusing on street patterns and on spatial configuration attributes – as referred to by the literature and previous research - shown to foster social mixture and ease legibility, as qualities of urban vitality.

1.1 BEACHES IN NATAL AND IN FORTALEZA

All studied beaches benefit from beautiful natural scenery, warm swimmable waters and fine sand, are equipped with waterfront promenades and served by public transport. In a more or less developed manner, all have stalls that function as bars/restaurants. However, they occupy distinct locations within the cities and exhibit different built scenarios and characterizations.

Natal is divided by the Potengi River estuary, on which the city was founded. Redinha beach is located on the northern corner of the estuary, with a coast facing the river, and another the sea (Figure 1). A bridge near Redinha was built recently (Ponte Newton Navarro, 2007). However it has hardly increased mobility to the area, as it passes over the neighbourhood; the ferry that linked both sides of the river and landed at Redinha ceased after the bridge's completion. Praia do Meio is located in a more central position in Natal, closest to the Old Town Centre. Ponta Negra is located further away, at the extreme south, after Parque das Dunas preservation area, having Morro do Careca as its limit on the other side. With approximately 3 km, it is the longest Natal beach studied.



Figure 1 - (i) Natal aerial image highlighting the studied beaches, the airport and the Old Town Centre. (Source: Google earth, edited); (ii) images of the studied beaches (in 2016) (Source: the author).

Beaches in Natal receive distinct descriptions, in terms of location and social aspects, in conversations with various people, conforming to impressions in the media, including Wikipedia. Although not so far from the old city centre (6 km, as opposed to 14 km for Ponta Negra), Redinha is described as a distant place that barely changed throughout the years, and frequented by 'common people' especially from the northern part of the town. Praia do Meio is described as a decadent area, formerly frequented by everyone but now mainly by locals; Ponta Negra as a middle-class beach in a middle-class neighbourhood, and as a tourism and leisure centre.

In Fortaleza the Ceará River marks the western limit of the city, by which Barra do Ceará is located (Figure 2). Praia de Iracema is situated closest to the old city centre and port. The coast continues east to Mucuripe port, after which it turns southeast, becoming the Praia do Futuro beach, at 6 km the longest of all studied beaches.

For beaches in Fortaleza, social distinctions in day to day and media descriptions seem weaker than in Natal, as they mainly address other issues. Although Barra do Ceará neighbourhood is described as a socially troublesome area (due to the highest density of people and level of criminality in the city), descriptions of the beach itself (Praia da Barra e Goiabeiras) relate to its history – as the first arrival place for European immigrants – and to its geography – as the estuary of the Ceará river. Praia de Iracema is usually described as culturally relevant and close to richer areas of the city. Praia do Futuro is described as a popular and touristic beach – one of the most well known in northeast Brazil – with a developed beach huts infrastructure. Although intensely used, the area is less densely occupied than others in Fortaleza due to its strong salt air impacting on building



Figure 2 - (i) Fortaleza aerial image highlighting the studied beaches, the airport and the Old Town Centre. (Source: Google earth, edited); (ii) images of the studied beaches, in 2017. (Source: by the author).

1.2 SPATIAL CONFIGURATION AND URBAN VITALITY

On the face of it, the city is two things: a large collection of buildings linked by space, and a complex system of human activity linked by interaction. (Hillier and Vaughan, 2007, p. 205)

Spatial configuration is a strong promoter of activities and uses in the city, by configuring probable fields of movement and co-presence, i.e., when people are mutually aware of each other (Hillier et al., 1987). Studies here address relations between spatial configurations and social life in the city, searching for patterns that promote qualities of urban vitality, as social mixture and legibility.

Physical attributes of the city have long been studied in relation to their impact on people's movement (Alexander, 1965) and on promoting more urban vitality (Jacobs, 1992). Jacobs (1992) interpreted cities as problems in organized complexity, and highlighted contributing factors to urban vitality, such as diversity of uses and buildings, natural surveillance (eyes on the street), density, and a street grid which allowed many different paths between an origin/destination (more streets).

Space is intrinsic to social life by people's tendency to move in lines, interact in convex spaces and see changing fields as they move in the built environment (Hillier and Vaughan, 2007). Studies comparing locations within the city focus on spaces of movement, relating characteristics of potential movement configured by the grid to different building types, activities, people's residence location and how they move about in their day-to-day business, thus facilitating or restricting co-presence. Such potential movement focuses on topological accessibility, although metric and angular parameters can be included.

In London, studies showed that poorest groups tended to locate themselves continually in most segregated streets, whereas the well-to-do tended to reside near most accessible streets (Vaughan, 2007). In Natal, a thesis showed that economically privileged groups appropriated themselves of highly integrated areas of the city (Carmo, 2014), and that this was a contrast to neighbourhoods with high demographic density. Complementarily, highly accessible streets in Natal also presented more tertiary activities and building renewals (Trigueiro and Medeiros, 2003).

In the USA, more connected areas hosted more social mixture (Carpenter and Peponis, 2010). In Stockholm (Marcus and Legeby, 2012), areas with more confluence between local (R_3) and global (R_n) topological accessibility (synergy, axial analysis) presented more co-presence amongst local inhabitants and visitors from other areas of the city. Intelligibility relates to how well a global attribute (R_n integration) can be perceived on street level (connectivity). High intelligibility characterized older neighbourhoods of Brazilian cities, interpreted as more legible, as opposed to expansion areas, characterized as patchworks that did not connect well to each other (Medeiros, 2013). Strong local-global correlations in axial analysis (Intelligibility and Synergy) outlined areas functioning as independent systems throughout the years (Perdikogianni and Penn, 2005), characterising a well working diversity in Clerkenwell, London.

When considering results of measures mainly addressed by segment maps (e.g. angular segment analysis), to- and through-movement were associated to basic components of human movement (Hillier, 2009; Hillier and Vaughan, 2007), as types of topological accessibility. To-movement (integration) relating to visitors' movement; and through-movement (choice) relating to inhabitants' movement. Corroborating this, places with stronger overlaps of such values at different metric radii were characterized as having more diversity of activities, and promoting more co-presence amongst different users (Vaughan et al., 2013).

Normalized choice (NACH) and integration (NAIN) values facilitated comparison of different sized systems (Hillier et al., 2012). Neighbourhoods with recurrent overlaps of these values through metric radii were better embedded in the overall structure (Yang and Hillier, 2012), and exhibited more co-presence amongst different publics (Al-ghatam, 2015).

This overview summarizes a part of the research repertoire, and guides the methodology in answering the questions: What is the spatial configuration of the beaches within each city? Are there clear hierarchies of potential movement between them? How do they relate to their surroundings? Are there similarities and differences between the cities? Which spatial patterns are prone to facilitate encounters? How do these relate to the beaches' characterization?

2. DATASETS AND METHODS

In order to compare the spatial configuration of the cities and their beaches, linear representations of the cities' open spaces at different modes of analysis and scales were explored. Natal's and Fortaleza's systems considered all vehicular movement routes in the city, processed for axial analysis and angular segment analysis (ASA). For ASA normalized values were focused to compare systems of different sizes (Bill Hillier et al., 2012).

For Natal's system the linear representation was modelled between the years 2013-2015 in GIS platform including the new airport (opened in 2014); the limits for the system encompassed continuous grids to those in Natal's municipality and main routes to the airport. For Fortaleza the linear representation was created by Valério Medeiros (2009), updated by Fernanda Linard de Paula (2011) and by the author (2013); the limits for the system were Fortaleza's municipality, which encompasses the airport.

Both systems were processed for axial analysis at varied topological radii (R_n , R_3 and connectivity) and for angular segment analysis (ASA) at varying metric radii (400, 800, 1200, 2400, 3200, 5000, 7000, n); normalized measures of integration (NAIN) and choice (NACH) were processed at all metric radii. Accessibility values in this paper figures are expressed in a colour range varying from red - for the most accessible entities - to blue - for the least.

For both axial analysis and ASA, subsystems within approximately 400m from the coast of each beach were separated in GIS platform. Mentions of the beaches' neighbourhood or system in this paper refer to this catchment area, seen to represent access routes to the beaches and close-by walkable surroundings. Separate layers allowed comparison of accessibility levels - and correlations between such measures - for the cities as a whole and for the beaches.

3. RESULTS

Main spatial configuration analysis results are described separately for Natal and Fortaleza, followed by discussion comparing the cities and beaches.

3. 1 NATAL

Figures 3 and 4 show the distribution of accessibility for Natal in global radius for NAIN and NACH values (ASA).

In both axial analysis and ASA the integration core is close to the old city centre (and neighbourhoods of Petropolis and Tirol); it is also close to Praia do Meio, but accessibility does not spread smoothly here, as indicated by an abrupt colour change (Figure 5). Ponta Negra, further away, is still able to reach medium-high levels of accessibility. Redinha has a drop in accessibility (blue colours) as the area does not connect to the main set of grids in the north and the bridge passes over it. Natal's main movement routes concentrate south of the river, and, inland, connecting portions further South and North, via the Igapó bridge.

NACH highlights a set of a few main routes that reach most areas, but do not interconnect so well. Igapó bridge has high NACH values and connects other main through-movement routes; towards the west it completes a loop through the access roads to Natal (BR 304) passing close to the new airport in São Gonçalo do Amarante. The loop connects to other routes with high NACH values that spread in different directions, and point towards Redinha and Praia do Meio but do not reach these areas, whereas high NACH values reach Ponta Negra through Av. Roberto Freire. In this measure Ponta Negra reaches highest average global accessibility (Table 2).

Comparing average accessibility measures (Tables 1 and 2), Praia do Meio exhibits highest global integration in axial analysis (Rn) and ASA (NAIN), relating to its central position in the system. However, at all other analysed radii, Ponta Negra presents higher accessibility (and global NACH). Redinha is the least accessible beach at all examined radii, reaching even lower levels than Natal.

However, Redinha reaches, overall, the highest correlation levels between topological radii (table 1), including intelligibility (Rn-con), suggesting it works well as an independent system (I. Perdikogianni & Penn, 2005), and a legible area (Medeiros, 2013). The settlement derived from an old fishermen's village later swallowed by Natal's urban grid, rather than an expansion area. On the other hand, Ponta Negra's lowest topological correlations suggest it does not work well as an independent system.

System (number of lines)	Average Accessibility			Correlations		
	Con	R3	Rn	Rn-con	Rn-R3	R3-Con
Natal (13215)	3.832	2.114	0.631	0.037	0.315	0.278
Redinha (46)	2.957	1.380	0.502	0.296	0.5074	0.795
Praia Do Meio (127)	3.992	1.812	0.687	0.261	0.558	0.671
Ponta Negra (108)	4.518	1.950	0.556	0.146	0.329	0.599

Table 1 - Axial accessibility levels for topological radii (average and correlations) for Natal and its beaches, highlighting top values;

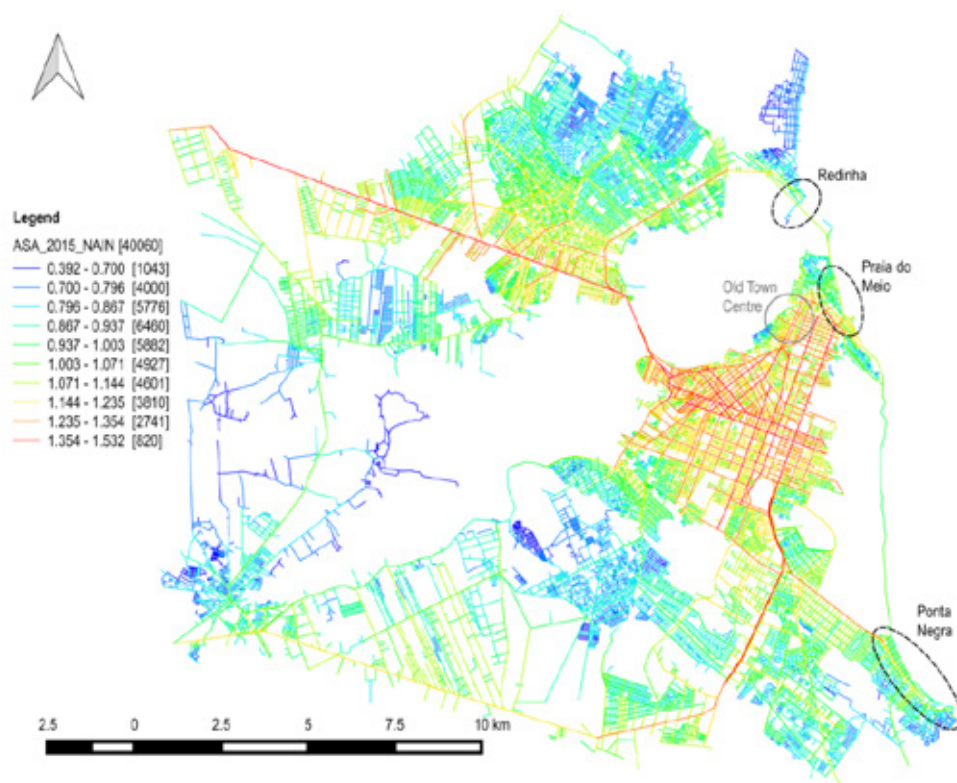


Figure 3 - Natal's segment map (ASA) showing normalized integration (NAIN).

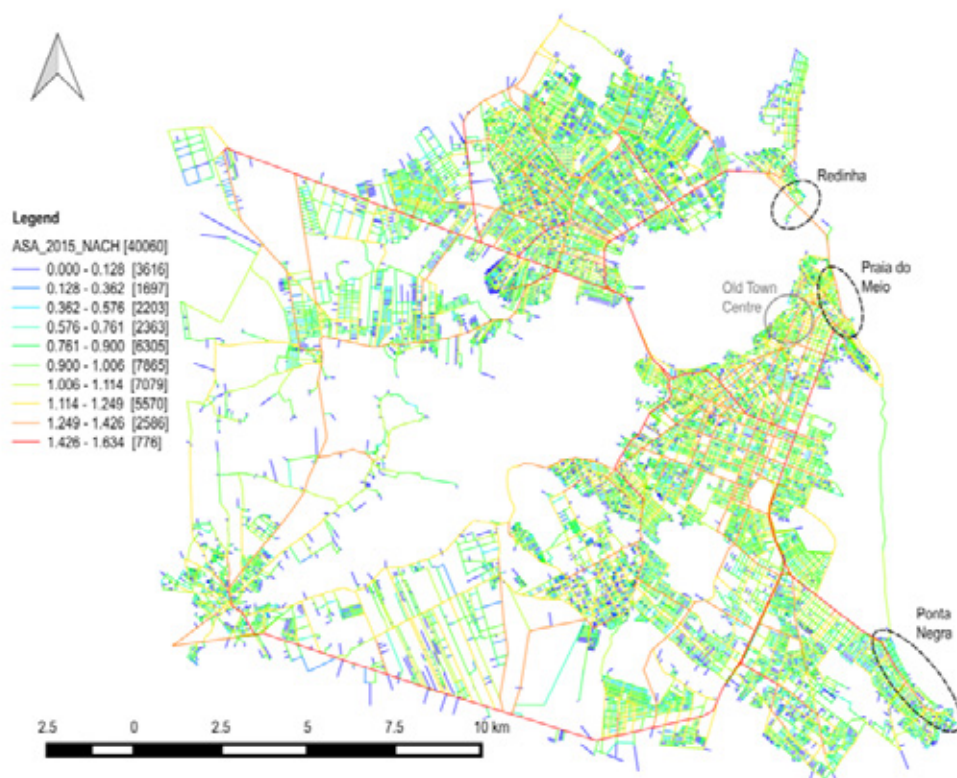


Figure 4 - Natal's segment map (ASA) showing normalized choice (NACH).

Comparing the beaches neighbouring street patterns (Figure 5), Ponta Negra's grid is more continuous to surroundings, with similar sized blocks and a somewhat orthogonal disposition, accompanying the smooth sea bay curve. Roberto Freire Avenue (with an orange-yellow colouring), stretches through the area, approximating the 400m limit catchment area. At Praia do Meio, although the coastal avenue accompanies the sea line, its few parallel routes are short and discontinuous. Its streets form different size and orientation patterns: there are medium-sized blocks close to the sea, followed by smaller blocks and streets that do not connect well to neighbouring areas, and highly integrated routes forming the city's integration core up the hill. Redinha presents a more organic street network accompanying the river and the sea, barely having neighbouring grids to connect with. Situated under the bridge, Redinha barely takes advantage of its potential movement.

Comparing overlaps between potential movement for visitors and inhabitants (NAIN/NACH) at different metric radii (table 3), Redinha and Praia do Meio correlations are strong only at local radii (400 and 800m), after which there is a steady drop for Praia do Meio, and a sharp drop for Redinha. Such restrictions point to potential to- and through-movement rarely meeting and characterize them as spatial enclaves, not well connected with surroundings. Ponta Negra is different, as NAIN/NACH overlaps are lower at local radii (400 m), however for all radii between 1200 and n it reaches markedly higher values.

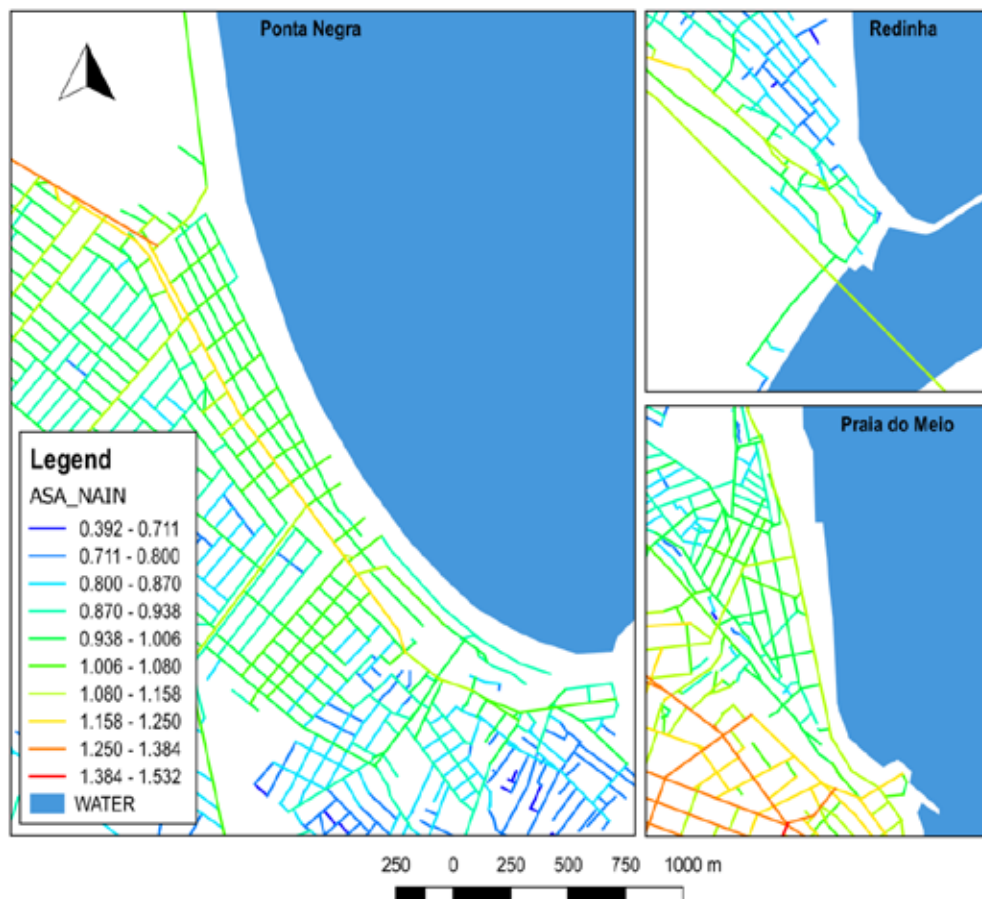


Figure 5 - Natal's beaches street patterns, showing NAIN values (ASA);

System (Number Of Segments)	400	800	1200	2400	3200	5000	7000	n
Natal (40060)	0.299	0.340	0.332	0.299	0.340	0.332	0.299	0.183
Redinha (90)	0.444	0.424	0.271	0.235	0.239	0.240	0.243	0.238
Praia Do Meio (358)	0.449	0.402	0.385	0.313	0.227	0.157	0.185	0.163
Ponta Negra (307)	0.291	0.408	0.461	0.488	0.527	0.558	0.387	0.410

Table 2 - NAIN/NACH Correlations (R^2) at metric radii for Natal and its beaches (ASA), highlighting top values.

Although metrically distant from the city's integration core, Ponta Negra's high average accessibility levels and to- and through-movement correlations show it well knitted to surroundings; albeit not working well as an independent system (low topological radii correlations).

Most of the city's connections face the river rather than the sea, following the old town centre setting. The studied beaches are outside Natal's integration core, and are set apart from each other. This is partly due to natural boundaries: as the Igapó River divides the north and central zones (and Redinha from Praia do Meio) and Parque das Dunas preservation area separates the main grid from the coastal route (and Praia do Meio from Ponta Negra). Fragmentation is also facilitated by its discontinuous grid, corroborating Medeiros' (2013) description of Brazilian cities as patchworks.

3. 2 FORTALEZA

Fortaleza exhibits higher average integration levels (0.919 for R_n , axial and 1.136 for NAIN, ASA) than Natal (respectively 0.631 and 0.863), being an overall less fragmented system. Main to- and through-movement routes in global radius spread out from the old city centre radially, whereas many grids maintain orthogonal connections.

The city's integration core (Figure 6) spreads south and, to a lesser degree, south-east of the old town centre (through Benfica, Joaquim Távora and Aldeota neighbourhoods). The integration core approximates Praia de Iracema, with some drop in accessibility closer to the coast. High NACH values also represent a radial system stemming from the old city centre (Figure 7), with a few routes spreading towards extremes of the system - as Av. Santos Dumont reaching Praia do Futuro – and other more circumferential routes that interconnect the radial.

System (number of lines)	Average Accessibility			Correlations (r^2)		
	Con	R_3	R_n	R_n -con	R_n - R_3	R_3 -Con
Fortaleza (12372)	4.755	2.262	0.919	0.101	0.416	0.406
Barra Do Ceará (133)	4.030	1.952	0.848	0.190	0.628	0.501
Praia De Iracema (77)	7.416	2.667	1.134	0.582	0.883	0.642
Praia Do Futuro (68)	4.60	2.345	0.923	0.101	0.679	0.394

Table 3 - Axial accessibility levels (average and correlations) for topological radii (axial analysis) for Fortaleza and its beaches, highlighting top values;

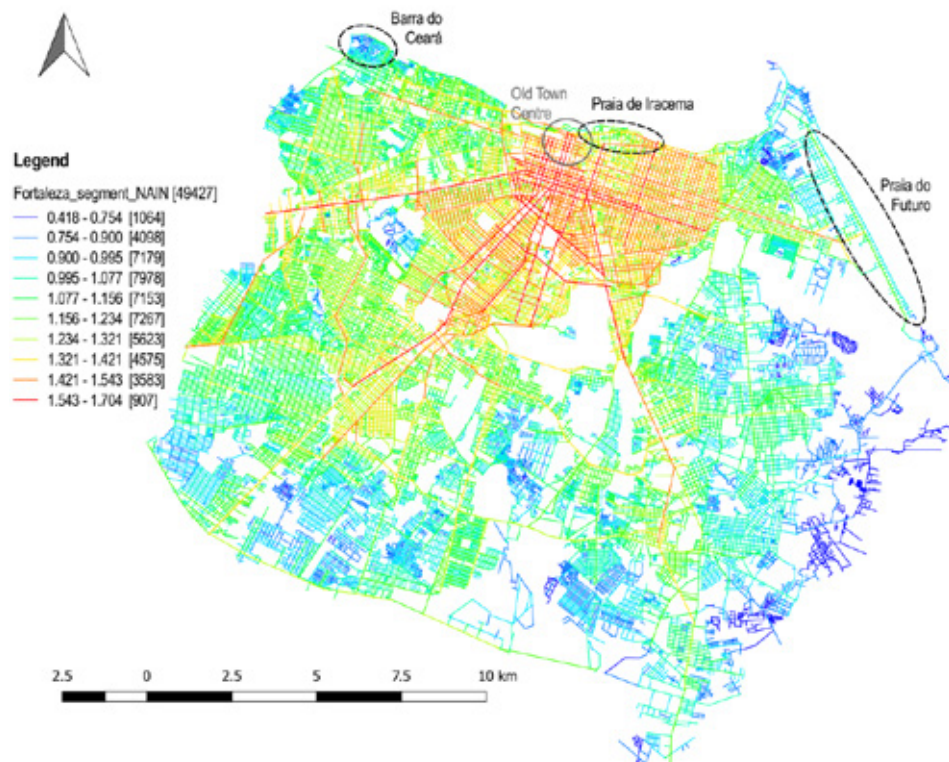


Figure 6 - Fortaleza's segment map (ASA) showing normalized integration (NAIN).

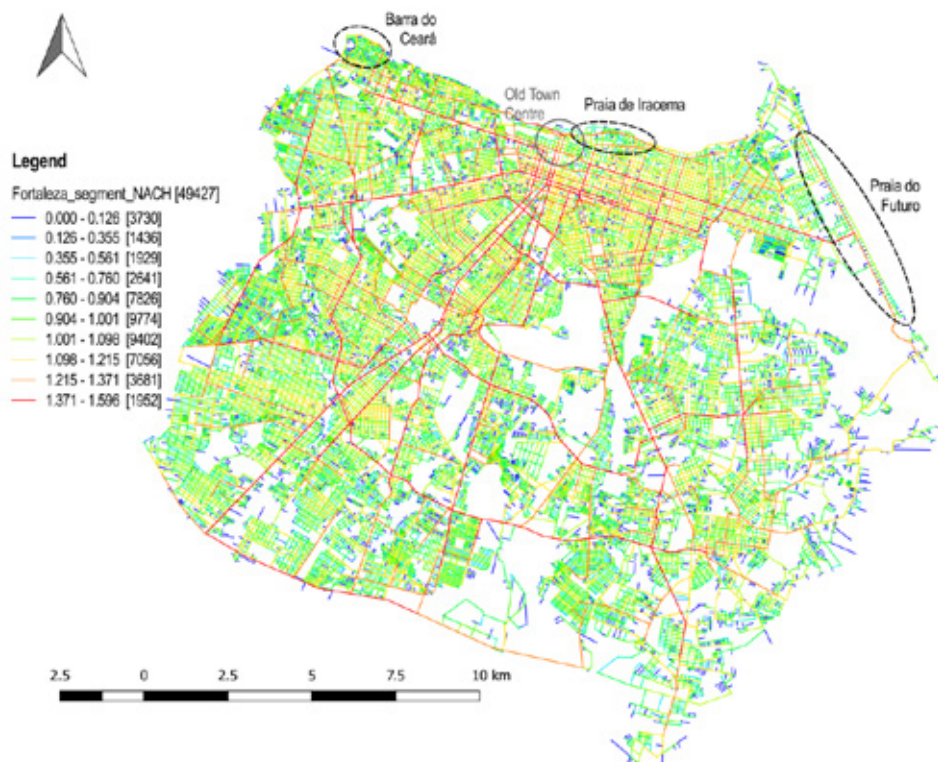


Figure 7 - Fortaleza's segment map (ASA) showing normalized choice (NACH).

Globally, Praia de Iracema reaches highest average levels on all investigated measures (table 5); it maintains highest levels in axial analysis for all radii and at most metric radii for NAIN and NACH. At some local to intermediate radii (ASA, NACH 1200m, NAIN 400m and 1200m), Praia do Futuro reaches higher average accessibility. Barra do Ceará maintains the lowest average accessibility levels at all examined measures and radii, lower than Fortaleza.

Praia de Iracema has highest correlations between topological radii accessibilities (Table 4), exceeding the other beaches significantly for intelligibility. This suggests it is a legible area that works well independently (Medeiros, 2013; Perdikogianni and Penn, 2005).

System (number of lines)	NACH					NAIN				
	400	1200	2400	5000	n	400	1200	2400	5000	n
Fortaleza (49427)	0.967	1.019	1.004	0.977	0.902	1.457	1.352	1.298	1.262	1.136
Barra Do Ceará (381)	0.931	0.945	0.902	0.866	0.785	1.194	0.995	0.977	0.992	0.928
Praia De Iracema (271)	0.974	1.046	1.035	0.997	0.912	1.438	1.504	1.633	1.627	1.305
Praia Do Futuro (210)	0.903	1.069	1.029	0.986	0.889	1.558	1.587	1.259	1.061	1.044

Table 4 - Average accessibility levels at metric radii for Fortaleza and its beaches (ASA), highlighting top values.

Street patterns show that all beaches are distinct in terms of catchment sizes, and that of its blocks and streets, as well as their continuity to the larger urban grid (Figure 8). Although Praia do Futuro is situated at an extreme of the system, its connections are more continuous to surroundings than Barra do Ceará, and it reaches higher accessibility levels. Contrasts in sizes of street segments and blocks can be identified clearly between these beaches, although Barra do Ceará encompasses a smaller area, it has more lines than Praia do Futuro (Table 4). Barra do Ceará exhibits the most irregular and organic distribution of all, working independently from the wider urban system (following Parham, 2012 studies of informal settlements). Praia do Futuro presents longer roads forming orthogonal connections and large blocks with two avenues accompanying the sea line. Praia de Iracema is somewhere in between these situations in terms of block sizes and orientation; there is continuity to neighbouring areas and routes following the coastline, while some smaller routes knit this fabric locally. Praia de Iracema presents a structure with more internal hierarchies than in Praia do Futuro's case, while maintaining some continuity to surroundings.

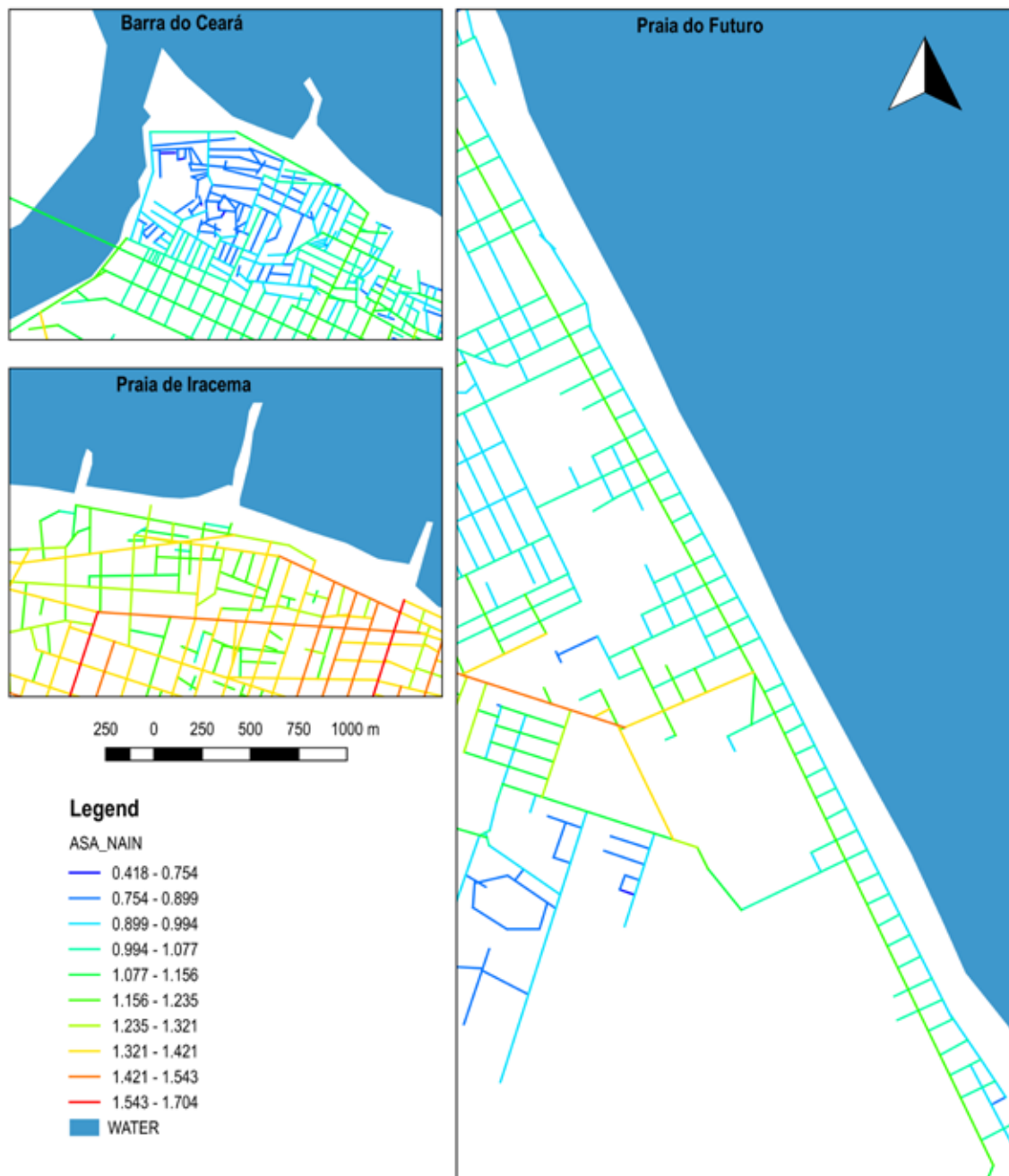


Figure 8 - Fortaleza's beaches surrounding street pattern, showing NAIN values (ASA);

Overlaps between NAIN and NACH values point to potential overlaps in movement for visitors and inhabitants, and was compared for various metric radii (Table 6). As a whole, Fortaleza presents higher values than Natal. Specifically, Praia de Iracema stands out with the highest correlations at all examined metric radii, pointing to various movements logics overlapping in its grid. For the other beaches, correlations are lower and vary, although not as much as occurs in Natal. Praia do Futuro maintains an over 0.3 correlation at most examined radii (and over 0.4 up to 1200m), pointing to some confluence of potential movement between inhabitants and visitors, and some embedding within the wider urban fabric (following Yang & Hillier, 2012). For Barra do Ceará strong overlaps concentrate at local scales – thus not well embedded - but still reach a wider range of metric radii than Praia do Meio and Redinha in Natal.

System (Number Of Segments)	400	800	1200	2400	3200	5000	7000	n
Fortaleza (49427)	0.359	0.373	0.349	0.294	0.271	0.248	0.241	0.229
Barra Do Ceará (381)	0.410	0.426	0.410	0.316	0.301	0.278	0.2919	0.277
Praia De Iracema (271)	0.444	0.498	0.535	0.483	0.508	0.542	0.538	0.490
Praia Do Futuro (210)	0.416	0.483	0.437	0.310	0.374	0.332	0.335	0.262

Table 5 – NAIN/NACH Correlations (R^2) at metric radii for Fortaleza and its beaches (ASA), highlighting top values.

Although Fortaleza also has discontinuous grids resembling patchworks (Medeiros, 2013), its system exhibits more continuity than Natal, and less significant natural boundaries. Although the beaches have distinct spatial configurations, in Fortaleza they are also less detached from the city's main movement routes, which are closer to the coast (as is the old city centre).

4. DISCUSSION AND CONCLUSION

There are similarities amongst the chosen beaches relating to location hierarchies within the city. For each city one beach is closest to the old city centre and is the most integrated globally (Praia do Meio in Natal, Praia de Iracema in Fortaleza). Two beaches are at extremes of the city (Redinha and Ponta Negra in Natal; Barra do Ceará and Praia do Futuro in Fortaleza), and one of these is recurrently segregated (Redinha in Natal, Barra do Ceará in Fortaleza). Nonetheless, there are also some trends that differentiate spatial patterns in both cities, and in their three studied beaches.

Although public spaces of cities should foster mixture (Sennet, 2006), the studied cities and beaches point to spatial configurations revealing urban dynamics and processes of social exclusion. As a common trait in both cities, the least accessible beaches at all examined radii are frequented by the poorest economically (as is the case for Redinha and probably for Barra do Ceará); this reveals strong processes of exclusion and corroborates findings elsewhere concerning the location of marginalized groups (Vaughan, 2007).

Spatial form of beaches in Natal and in Fortaleza show that distinct characterisations relate to distinct spatial configurations. For Ponta Negra and Praia de Iracema, day to day characterization seem to be positive within each city, and seem to relate to a spatial configuration that allows for some intermingling of people and activities.

Ponta Negra is more continuous to the wider urban fabric as opposed to the other beaches in Natal; although metrically further away from the city's integration core and the old town centre, its grid connects better to surroundings and reaches medium/high accessibility. It bears some comparison with Praia de Iracema in Fortaleza, as both show recurrent overlaps between inhabitants and visitors potential movement at different metric scales. Indeed they seem to accommodate more social mixture than the other beaches in each city, although at Ponta Negra earlier research showed that social mixture was still somewhat limited, and many frequenters were tourists (as depicted in its characterisation).

It seems that Praia de Iracema in Fortaleza might approximate more than any other studied beach our ideal situation of urban vitality, as it exhibits spatial patterns shown to facilitate legibility and encounters between people. The area has high accessibility levels at varied scales and modes of analysis, highest correlations across topological radii (axial analysis) and highest overlaps between potential to- and through-movement at all explored metric radii (ASA), implying potential intermingling of diverse people and activities. These spatial attributes are highlighted by the literature and previous research as facilitating urban vitality (movement,

legibility and social mixture). Indeed it seems very lively, as it hosts many local and large scale events, such as the pre-carnival bands and the city's New Year's Eve concerts and fireworks. At another level its promenade and beach seem constantly used by different people.

In Natal natural boundaries help separate the beaches from one another, and from the city's main routes of movement. Fortaleza, on the other hand, has an overall less fragmented system and beaches are less detached from the main structure. This might help explain a somewhat weaker social distinction between beaches in Fortaleza, whereas in Natal the beaches receive stronger locational and social labels, especially those functioning as spatial enclaves. Whereas in Natal both Praia do Meio and Redinha are spatial enclaves – as potential to- and through-movement seldom meet - this applies in Fortaleza only to Barra do Ceará, and even there to a lesser extent. Praia do Futuro exhibits some confluence of movement and was shown to have a heterogeneous public in previous research (Donegan, 2011; Donegan and Trigueiro, 2012), which varied, however, within the beach itself.

Although there are hierarchies amongst the beaches, Fortaleza presents a less spatially reclusive grid than Natal; its beaches, globally and locally, are better knitted with surroundings and allow more overlaps between different potential journeys. Higher degrees of social mixture are hinted at in general descriptions of the beaches, and are perceived in our day-to-day experiences. We thus also suggest that there might be more tolerance between the socially diverse in Fortaleza, in spite of it also being a violent city.

To ascertain whether differences and similarities of spatial configuration do indeed relate to society, and if indeed Fortaleza harbours more social mixture than Natal, the next stage of research will be to survey and compare social life. As studies relating built form attributes and society at urban Brazilian beaches have been scarcely tackled, there are yet other avenues for future research, e.g. studying architecture-society relations in a finer grain and expanding findings to other coastal cities.

Relations between observed uses so far and spatial patterns at our urban beaches reinforce attributes pointed out in the literature as promoting more, or less, urban vitality. Despite the sea's attractive role and the intensity of uses, beaches reveal urban dynamics. Research on this theme contributes to understanding the culture of beach use in Brazil and its relations with overall segregation patterns.

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