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WEAVING A BRIDGE ACROSS THE ATLANTIC:

Points of Approximation in the Spatial Structure and Urban Character of Natal (Brazil) and Dakar (Senegal)

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ABSTRACT

The research that anchored the study to be presented here forwards a comparative analysis of two cities sited in opposite continents across the Atlantic – Natal in Brazil, and Dakar in Senegal – aiming to draw attention to similarities or “points of approximation” concerning the nature of their foundation, their urban development and the relations they have sustained with their territories. This paper addresses specifically the spatial imprint, which resulted from, and upheld, the establishment and expansion of the two cities, as concerns topological accessibility and the formation of centralities, in diachronic and comparative perspectives. Natal and Dakar were both founded within the context of the European mercantile expansion, serving as spearhead settlements for conquering, consolidating and controlling territories under colonial rule as well as giving support to commercial routes. Their privileged positions, east and west of the Atlantic, also rendered them key roles in overseas routes connecting Europe, Africa and America, particularly in the so-called “Golden Age of Aviation” (1920s and 1930s), and in World War II, when they became strategic points in the international geopolitical scene and sites of important military bases. Natal and Dakar were examined by means of space syntax procedures (axial and segment analysis) to represent successive stages of their urban expansion along the 20th century and enable comparison of morphological features amongst development phases for each city and between them, in the light of the literature about their urban character and transformation during the studied time-span. The diachronic configuration analysis revealed expansion axes that anticipate future occupation, exposing how accessibility properties shifted over time and centralities were created, thus showing the physical imprint of actions (or their absence) that structured the urban milieu and defined the social distribution of inhabitants in both cities. Besides adding to the understanding of our common historical legacy, this brief insight shows that despite the radical sociocultural differences concerning the two cities, the physical attributes of their natural sites coupled to the roles they played in the world political

scene, and to the social logic of space in national and global capitalism, have left formal imprints that indicate similar processes of accessibility formation and transformation throughout time and how these accessibility patterns have been unequally reached by socially distinct people.

KEYWORDS

Space configuration, Urban expansion, Points of approximation, Natal, Dakar

1. KNITTING POINTS OF APPROXIMATION ACROSS THE ATLANTIC

The research on which this study is based aimed to explore similarities between two cities sited opposite one another across the Atlantic – Natal (Brazil) and Dakar (Senegal) – concerning their physical relations with their territories and their urban development since their foundation. It was developed along ten years (2006 to 2015), involved fieldwork in both cities and rooted papers that addressed findings from consecutive stages of the research progress, now being gathered into a forthcoming book (Teixeira, 2017). These findings outline “points of approximation” linking the history of the two cities that are ingrained in their physical milieu. Based on a gargantuan effort of textual and iconographical data collection, the analysis about how the two cities related to their territories as they expanded in time, carried on by Rubenilson Teixeira, the researcher who conceived and coordinated the project, was complemented by space syntax analysis for which we were invited to collaborate. The study herein presented stems from such collaboration, dealing with topomorphic relations of Natal and Dakar in diachronic and comparative perspective. It specifically addresses the spatial imprint, which resulted from, and upheld, the establishment and expansion of the two cities, as concerns topological accessibility, the formation of centralities, and the distribution of functions.

A crucial obstacle to the study was the meagre array of detailed cartographic records (displaying the complete street grid) for both towns, more so for Dakar, despite the efforts of the historiography research team to gather maps from digital and printed sources. The problem was partly overcome by the acquisition of a few precious items, courtesy of overseas researchers, or during scrutiny in the archives of academic foundations in Dakar, although the short time available for fieldwork, within the limits of the research project, impeded a thorough search. At length, an array of maps from various sources, epochs, information content and accuracy levels was examined and helped to clarify aspects concerning the morphological nature of the physical artefact of Dakar in combination with the literature. Of these, the ones we considered that represented more clearly the street grid at consecutive time intervals were chosen to anchor the configuration analysis, which progressed independently from the historiographical review, with researchers meeting on occasion to compare findings regarding the physical objects that comprise both cities, especially Dakar since that of Natal had been an item of morphological investigation for decades. Configuration findings were however refined in recent times for both cities through the application of later space analysis tools, which although not substantially altering previous results, contributed to further their comprehension, especially regarding the formation and co-existence of distinct centralities.

Natal and Dakar were examined by means of axial and segment analysis to represent successive stages of their urban expansion along the 20th century with the aim of inquiring on the possible interplay of morphological features and the character and function of certain places, to enable comparison among development phases for each city and between them, in the light of the literature about their urban character and transformation during the studied time. Despite the representation difficulties and the distinct investigation paths trod by the researchers – that of understanding urban form and function from the historiography and that of understanding social history from spatial relations – the two sets of findings mostly confirmed and reinforced one another.

Various “points of approximation” were disclosed throughout the investigation of historiographical and iconographical records (Teixeira, 2017, *passim*). Of these some that have particularly strong physical expressions and may be considered as common imprints bridging

the two cities are: (1) geographic limits and natural barriers orientate their expansion; (2) long axes, formerly roads connecting isolated settlements, conduct the expansion by linking the old town centre to strategic locations (of which air fields deserve distinction), and generating a new powerful accessibility network that unites and sets apart, also functioning as border lines to define social clustering within the territory; (3) expansion axes distribute accessibility unequally along the territory creating routes that develop in certain directions, which will become privileged exclusory urban areas; and (4) occupation patches sprout from tracts of land interspersed amongst main axes giving rise to new centralities that may respond to the needs of socially diverse residents.

2. NATAL AND DAKAR: TWO CITIES SEPARATED AND UNITED BY AN OCEAN

Natal and Dakar were both founded within the context of the European mercantile expansion, serving as spearhead settlements for conquering, consolidating and controlling territories under colonial rule as well as giving support to commercial routes that bonded colonies to their respective metropolises. Their privileged positions, east and west of the Atlantic, also rendered them key roles in overseas routes connecting Europe, Africa and America, particularly in the so-called "Golden Age of Aviation" (1920s and 1930s), and in World War II, when they became strategic points in the international geopolitical scene and sites of important military bases.

Natal was founded in 1599, by royal decree, the year following that of the construction of the Reis Magos fortress, one of many erected along the South American coastline as part of a defence strategy to protect Portuguese / Spanish domains (the two crowns were united from 1580 to 1640) in South America. The settlement, said to have been designated as "town" from start, though being nothing more than a poor hamlet, was established in the hope of providing some support to the fortress, constantly ransacked by Indians and smugglers (notably French invaders). Surrounded by the wide estuary of the river Potengi (the "great river" that gave name to the state of Rio Grande do Norte, of which Natal is the capital city), the ocean and a desert of sand dunes stretching out east and south, the town suffered severely during the Dutch invasion (1630-1654) and remained isolated and poor for nearly three centuries so that in 1899 the estimated population was little more than 16,000 souls.

The 20th century brought trade growth, immigrants, the dawn of aviation and hordes of transitory people following the installation of military bases during World War II. New neighbourhoods (Cidade Nova, Alecrim and Rocas) enlarged the 19th century urban occupation formed by Cidade Alta (or "high town" the foundation site on the hill overlooking the river) and Ribeira (the "riverside" surrounding the harbour)¹. The new neighbourhoods signal the socioeconomic logic of territorial occupation that would shape Natal along the century. Cidade Nova, the first planned residential neighbourhood was conceived under precepts loosely guided by garden city principles with broad tree-lined avenues flanked by detached houses with front gardens; bordering country land that belonged to prominent families was turned into valuable urban ground, which would, from then on, concentrate public and attract private investment, thus becoming a high-status location to this day. Rocas, on the contrary, was gradually occupied by poor migrants, mostly peasants driven out of their land by the severe droughts that made surviving impossible in the sertão hinterland. Another frequent destiny for newcomers, the Alecrim – the first arrival point as one approached Natal from the hinterland by the neighbour town of Macaíba – developed into a residential and commercial location, later to become the most densely populated part of town, mainly inhabited by middling social sectors.

In the early 20th century Natal, therefore, comprised Cidade Alta, Ribeira, Alecrim, Cidade Nova and Rocas. In the foundation site of Cidade Alta, churches and public buildings signalled its religious and administrative functions and the variety of house forms indicated a socially mixed residential ensemble; Ribeira, site of the harbour, the railway termini and later, of a hydroplane base was rapidly being consolidated as the new active centre whereas Alecrim developed into an alternative centrality especially as concerned the commerce of farming goods. Cidade Nova

¹ "Upper town" and "lower town" settlement comprise a mode of occupation extensively adopted by Portuguese founders. Salvador, in Bahia, and Olinda, in Pernambuco, are two notable such cases in Brazil, as is Lisbon itself.

and Rocas were sparsely occupied as residential neighbourhoods for the richer and the poorer, respectively.

Besides the hydroplanes base near the harbour, land airfields were built in the vicinities of the town in the late 1920s, initially by French companies in a location known by the Indian toponym of Parnamirim. A direct navigation route between Natal and Dakar was started at the time to aid the newly born transatlantic aviation link.

Parnamirim was also the location chosen by the American forces to build what was considered as the most important military base outside the United States territory at wartime. A second base, controlled by the Brazilian military (namely to keep up some appearances of authority) was also established there. The South Atlantic route, departing from Miami, Florida, with stops in the Caribbean, Brazil and Africa, mostly through a Natal-Dakar direct link, gains importance after the unsuccessful attempt from British and French forces to take control of Dakar in 1940. From September 1941 on and until the end of the war the American base of Parnamirim is said to have been crucial as part of the attack strategy for the allies. Historians (i.e. Hendricks, 1992 :43) mention, for instance, 1675 combat planes having passed through Natal in March 1944.

By the end of the war, other neighbourhoods were being developed from settlements – mostly poor – along the coast (Praia do Meio and Areia Preta) and the river (Quintas), as well as in the vacant grounds (Lagoa Seca) interspersed amongst roads running to other towns and hamlets. The south and east parts of Natal spread from the old town centres of Cidade Alta and Ribeira, through the first planned residential area of Cidade Nova – current neighbourhoods of Petropolis and (part of) Tirol – branching into a series of axes that link Natal's municipal perimeter to those of Parnamirim, Macaíba and beyond.

The north part of town across the river – the Zona Norte (North Zone) – remained as a small settlement alongside the road to hinterland and coastal regions until the 1970s when it was developed as a residential area, predominantly to accommodate low income housing estates. It is now undergoing a process of centrality generation brought about by the expansion and conurbation of municipalities and settlements within the great Natal and strengthened by the proximity to the new airport located in the neighbouring town of São Gonçalo do Amarante. Natal's population grew from 103,000 inhabitants in 1955 to approximately 800,000 in 2005, considering the municipality boundaries and to 1.3 million people (2010 census) considering the nine municipalities that comprise its metropolitan area, spreading both sides of the Potengi and along the coastlines, north and south of the river estuary.

In the 19th century an estimated population of 12 thousand Lebou people lived in the settlement denominated Dakar. In 1857, the town of Dakar was planned and established on a high land or Plateau. In the early 20th century – according to the studied map dated 1908 (SECK, 1970: 124-125), the urban occupation had nearly doubled having stretched in all directions but mainly towards south (Cape Manuel) and west.

The great epidemic of 1914-15 led to the construction of the Medina – a regular grid of orthogonal streets built over a swampy terrain – and consequent separation of the population in two urban settlements: the Plateau for the French, the Medina for natives, well set apart by a *non aedificandi* area. Thus, the construction of the Medina turned out to be an obstacle to the town growth as the neighbourhood (and its *cordon sanitaire*) isolated the old town centre from the north of the Peninsula. The imposing barrier of the Medina was eventually overcome as the land where construction was formerly prohibited appears in a 1934 map comprising an allotment showing signs of occupation though sparse, in the area where Rebeus now stands. By that time, investments had turned the harbour into one of the most important French naval bases in the Atlantic and a key support point for the action of the allied forces – naval and air – from 1941 on.

As had occurred in Natal, there were two aviation fields in Dakar before wartime: the formerly military aerodrome of Quakam, out of town, and a maritime hydroplane base (in Bel-Air), from where planes arrived and departed to overseas routes across the Atlantic. Besides these, a third aviation port was built in 1941 as part of the complex pertaining to the American military base,

initially in Rufisque, later transferred to Yoff. To a considerable measure therefore, aviation shaped the territory and set the pace for urban development along the 20th century Dakar.

By the end of World War II the city had expanded from the extreme south of Cabo Manuel towards northwest and northeast, in the directions of Almadies, N'Gor, Yoff and Camberène. However, these areas were still not part of the urban grid that had spread throughout the south half of the Peninsula so that the former *route des puits*, or “wells way”, present day Bulevar du Presidente Habib Bourguiba, located half way up the land (figure 9), marked the town limits until the 1950s. Scattered settlements lay to the north and northwest of that road, some of which surrounding the military airfield of Quakam, in 1945. Lebou villages and territories had suffered constant subtraction and shifting, being pushed beyond the area of Quakam. The population grew from 92,000 in 1939 to 382,000 in 1960 (FREUND, 2007: 66) and to the present day estimated over a million people within the city borders and nearly two and a half million in the metropolitan area.

Notwithstanding the long historical processes that bound the fate of these two cities together, since the dawn of mercantile globalisation round the Atlantic, aviation stands out as the key point of approximation as concerns the physical marks left on their spatial configuration to this day. Geographic proximity was the crucial point at the time of the heroic transatlantic flights in the 1900s and 1930s, and even more dramatically so, in the 1940s.

In both cities, other than the facilities demanded by the economic mechanisms of the post-industrial revolution world, such as a railway network and a large-scale harbour, important urban equipment installed in the early 20th century – the hydroplane base and airfields – are there to make the Atlantic air crossing feasible. Various aspects render such equipment highly and similarly important in the two cases as pointed out by Teixeira (1917: 256): in both cities the harbour, the railway termini and the hydroplane base are closely linked in space thus impacting strongly the coastal areas where they are located; the airfields although sited at a considerable distance from the urban limits at the time, become attraction poles for the urban growth, especially during and after the War.

The geopolitical circumstances of Natal and Dakar at the dawn of aviation against a background of a continuously exacerbating process of social differentiation and distribution within the urban milieu will shape their configuration, allowing for the retrieval of marks which reveal how the human action over the territory has engendered unequal levels of accessibility and diverse modes of centrality.

3. MATCHING HISTORICAL RECORDS AND DIACHRONIC SPACE ANALYSIS – THE PHYSICAL IMPRINT

In previous research phases, the topological accessibility of streets in Natal and Dakar was collated to information about evidences of human activity and social cleavages, stemming from the notion that high topological accessibility is an indicator of consolidated or potential centrality (Hillier and Hanson, 1984), understood as a concentration of diversified activity. Contemporary sources – photographs, live and virtual (google images) observations – as well as iconographic and textual records from earlier times were examined in search for the physical aspects of these places, for signs of economic status, for the presence of buildings that might benefit (and intensify) movement of pedestrians and vehicles in open public spaces.

Syntactic measures and references converged to outline a hierarchical contour of topological accessibility that shaped occupation and revealed the material imprint of actions (or their absence), which structured the urban milieu and defined the social distribution of inhabitants in both cities. Accessibility anchored the formation and transformation of centralities, which were unequally appropriated by social groups, and responded to different needs and possibilities being, in turn, instrumental for redefining occupation, social distribution, configuration and so on.

Having confirmed the confluence of axial accessibility and references about the urban occupation and expansion from the 19th to the late 20th century in both towns, we proceeded

to explore space configuration through later, more detailed representation procedures with the aim of investigating relations that might have escaped axial analysis.

In the diachronic configuration analysis of axial maps, future occupation and new centralities that would relate to the global spatial structure at consecutive time periods were indicated by expansion axes that anticipated them. The segment analysis confirmed and refined those findings, adding nuances concerning the development of most potentially passed-through thoroughfares and, by fine-tuning findings using metric scales, signalled the presence of simultaneous centralities related to the demands and circumstances of diverse social spheres.

Linear representations of Natal have been explored as a basis for various studies since the 1990s. The ones examined here represent the town configuration in 1924, c. 1940, c.1970 and 2002. The earlier representations were based on a town plan commissioned by the government of Rio Grande do Norte, in 1924, to subsidise the water and sewage services. Only the streets sided by continuous buildings, as shown in the plans, were considered for the 1924 linear representation; these, plus planned and unoccupied streets (dotted lines), made up the 1940 (circa) representation, considering that it was round that time that they became more densely occupied (Figure 1a). Natal's representation of approximately 1970 was constructed over a large blueprint – a patchwork made up of successive updating amendments – courtesy of the state water and sewage supply company². The 2002 map was drawn over a digital base issued by the municipality administration of Natal.

The first linear representation of Dakar used in our research was drawn over images displayed by Google Earth in 2012. Lines were erased from this representation to model the city in 1930, 1945 and 1964, according to historical maps that were gradually found along the phase of data collection. In this process, some simulation was necessary. The best cartographic representation of Dakar immediately after its independence in 1961 – a city plan produced by the geographic institute of Paris in 1964 – did not include the north of the peninsula, where a street grid, although sparse, was clearly defined in the map of 1945, indicating the urban expansion move towards north and northeast. The north axes shown in the 1945 map were, therefore, added to the 1964 map. We must concede that this is hardly a faithful representation, considering that in the 19-year break between the two plans, a denser tissue would be expected to have developed there (figure 1b). However, we believe that by applying such artifice more gains than losses were achieved in terms of representation.

The current segment analysis for Natal and Dakar was hence based on those previously explored axial maps, whose findings shall be briefly exposed next, since they were confirmed by the segment analysis.

2 Companhia de Águas e Esgoto do Rio Grande do Norte - CAERN. In the 1990s, CAERN's geographic information system was being created so that this (and other) blueprint was still being used as reference for managing the water and sewage service.

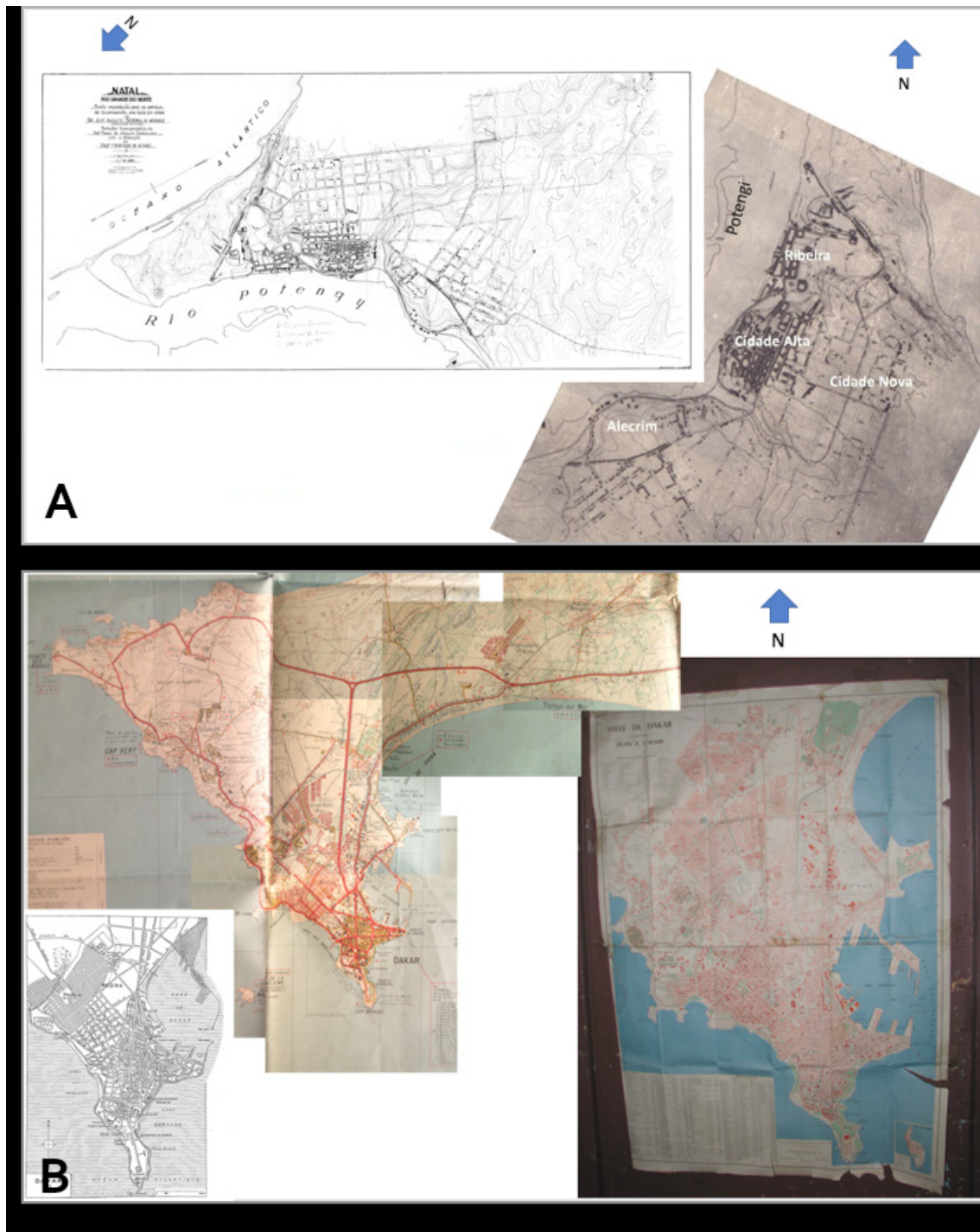


Figure 1 - Cartographic bases: A - Natal in 1924 (only roads sided by building representation considered) and 1940c (all roads considered) (top); B - Dakar in 1930, 1945 and 1964 (bottom)

3.1. NATAL'S CENTRALITIES: SHIFTING, EXPANDING, MULTIPLYING

In Natal, the town foundation nucleus – Cidade Alta – “the high or upper town” sited on the hill top facing the river, concentrates all highly accessible axes until around the mid-19th century when the most integrated road is that which connects Cidade Alta and Ribeira, “the riverside or lower town”, by the river’s edge, where the harbour was (and still is) located.

The strong magnet of the harbour and later that of the railway and the hydro aeroplane base concur to turn the lower town into the heart of the urban scene until around the 1950s, and very especially during the war years. Even though regular space syntax analytical procedures fail to account for accesses through water, rail and air, the effect that these transportation means exerted over the grid, conducing to its rapid growth, was strong enough to define an accessibility core formed by the street grid that linked the two parts of town. By 1940, when Ribeira was at its peak as the active town centre, most highly accessible streets are again part of Cidade Alta’s grid. The new integration core is located further east of where it had previously been formed, pulled by the highly connected regular grid of Cidade Nova, the residential neighbourhood planned in the early 20th century for the economic elites that, although still a slowly expanding and low density neighbourhood, was becoming increasingly occupied. Not surprisingly, after the war, the active centre returns to Cidade Alta, partly also due to the shrinking roles of previously key transportation modes located in Ribeira. Trains were being substituted by motor vehicles, hydroplanes ceased to exist in this part of the world, and sea journeys were gradually being ousted by air trips. The new airport, which originated from the military air bases built during the war was located further south (and well out) of town until the late 1970s.

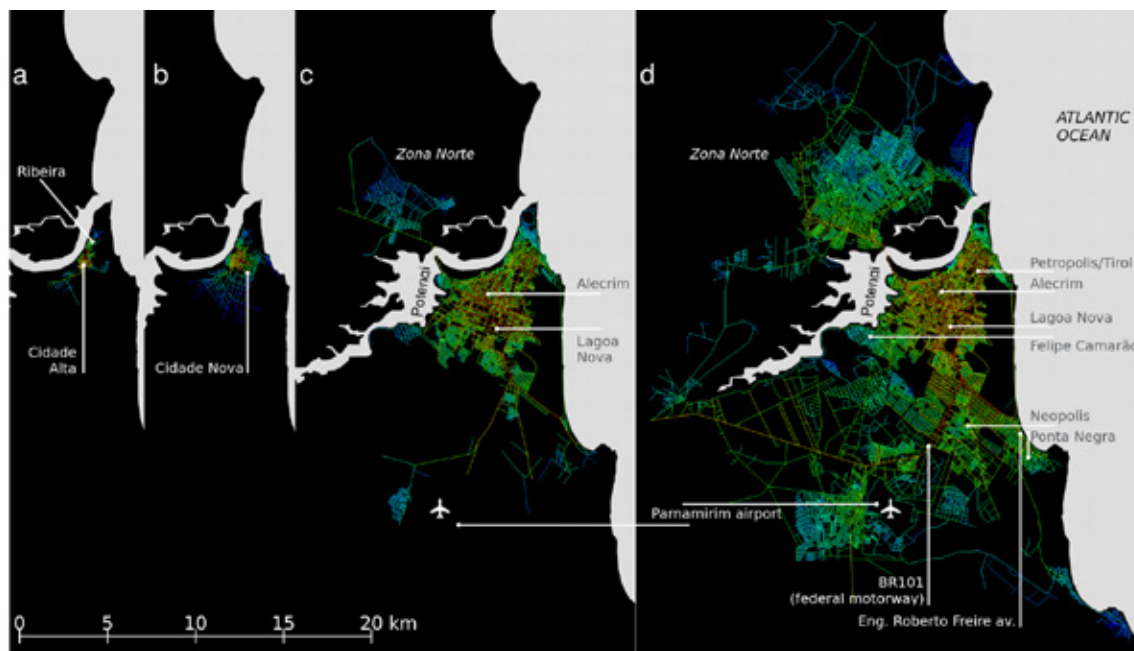


Figure 2 - Global accessibility (normalised integration – NAIN) in Natal: high accessibility links Cidade Alta and Ribeira (a) in 1924; starts shifting towards Cidade Nova (b) round 1940; shifts further south to Lagoa Nova (c) in the 1970s; and expands from there (d).

After 1970, following the intense urban expansion in Brazil and in Natal, the accessibility core stretches and partially shifts south-eastwards, alongside and parallel to the road that linked the harbour to the military base and airfield of Parnamirim, site of Natal airport until 2014. Scattered within the city’s street grid and in its fringes, poor residential enclaves appear, thickens and multiply, almost always configuring spatially segregated, labyrinthine tissues.

The morphological imprint of Natal's expansion along the 20th century examined by means of diachronic segment representation confirmed findings from previous axial analysis, contributing a few points worth mentioning. The accessibility calculation (normalised integration – NAIN, figure 2) exposes an urban tissue that encapsulates and conducts accessibility along certain directions leaving out huge parts of town. It is worth noting, for instance, the vast tissue of highly integrated segments that spreading from the east side of town – Lagoa Nova, Alecrim, Tirol and Petrópolis (the last two neighbourhoods being part of the former Cidade Nova) is channelled into a southeast (eng. Roberto Freire avenue) and a southwest (BR101) line. Most of what lays out of the large integration core or away from the cone formed by these southeast-southwest-running lines present the greens and blues of segregation.

The representation of most potentially passed-through thoroughfares (normalised choice – NACH, figure 3) shows that the 21st century main road structure, although clearly defined in the 1970s, appears to have suffered a reductive process which shrank (in relative terms) the number of roads with high potential through-movement in the central area, strengthening the main road circuit.

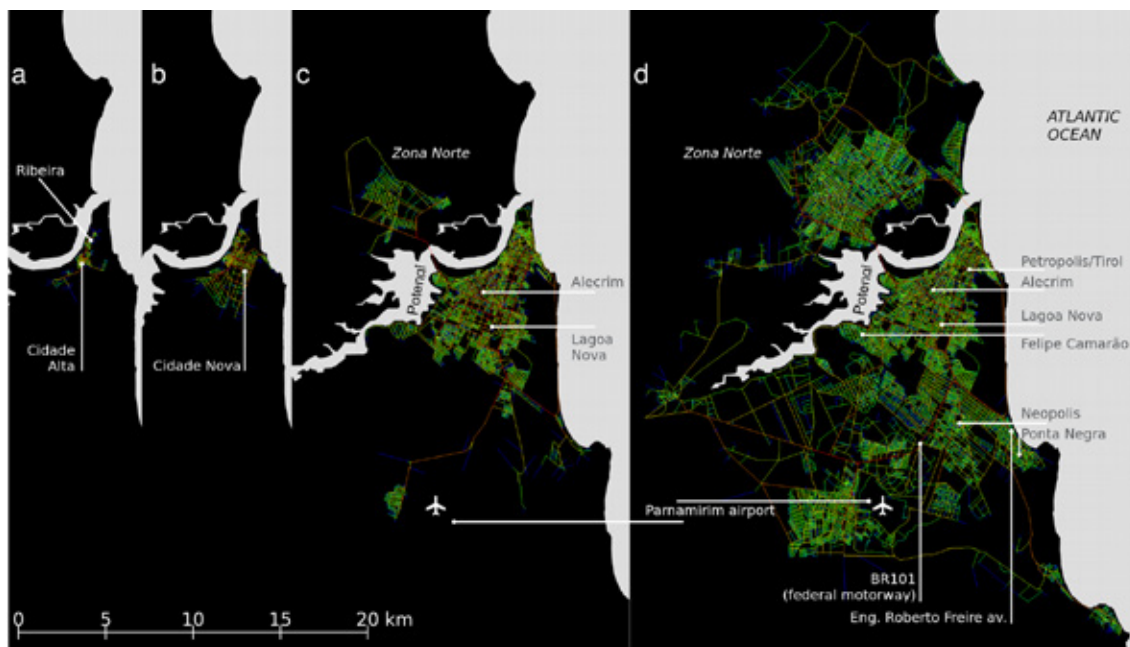


Figure 3 - Potential through accessibility (normalised choice – NACH) in Natal: high potential through movement permeates the whole tissue in the early 20th century (a) and (b); and defines a hierarchical foreground in the 1970s (c), which will be strengthened in the 21st century (d).

In the early 21st century grid structure represented (as segments) within a catchment area of 1200m (figure 4d), two cobwebs of warm colours signal centralities in the north and southeast halves of town. This contrasts with representations of previous expansion phases, when there would be only one town centre, topologically speaking, that of 1970 being the most widespread. The southeast centrality spans from the regular grid of Petrópolis/Tirol to the tightly woven tissues of Lagoa Nova and Alecrim, being, in fact, a faithful representation of Natal's active centre at metropolitan scale as this area concentrates the most volume and variety of urban functions and uses (figure 5-top).

The representation also catches the active centre of Parnamirim, the tourism and leisure compound of Ponta Negra, and the suburban centres of Neópolis and Felipe Camarão, which are, all of them, centralities, although of different natures and social meaning.

The accessibility scale, therefore, picks up well established centralities as concerns movement (vehicular and pedestrian) and functions (number and variety of non-residential uses), as, for

instance, the important arteries of Bernardo Vieira and Salgado Filho avenues (figure 5 bottom left). But the red-orange-yellow segments also pick up crossroads on which a modest array of first need facilities – supermarket, chemistry, etc. – concentrates (figure 5-bottom). This appears to relate not only to differences in the functional nature of those centralities or to the socioeconomic profile of the area's residents, but also to demarcate temporal stages of the city expansion and transformation, by signalling a suburban centrality of fairly recent formation that will most probably be embodied in the larger metropolitan active centre in the near future (Vaughan, 2015), or become a large active centre in its own right.

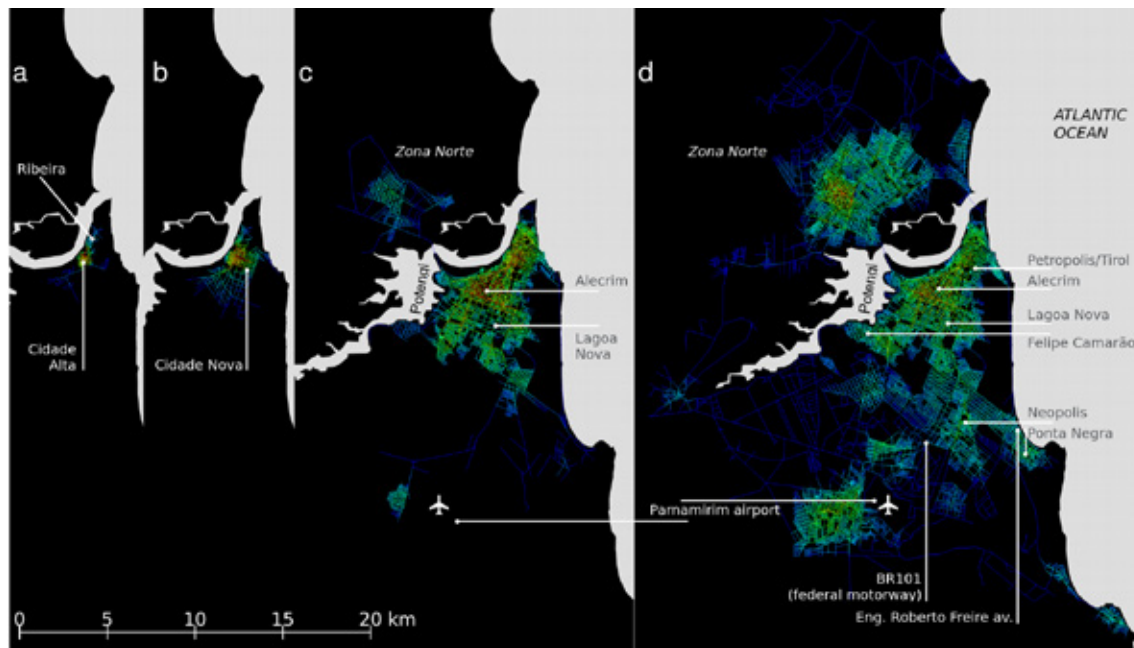


Figure 4 - Accessibility within a catchment area of 1200m (integration 1200m) in Natal. 1924 (a); 1940 (b); 1970 (c); 2002 (d).

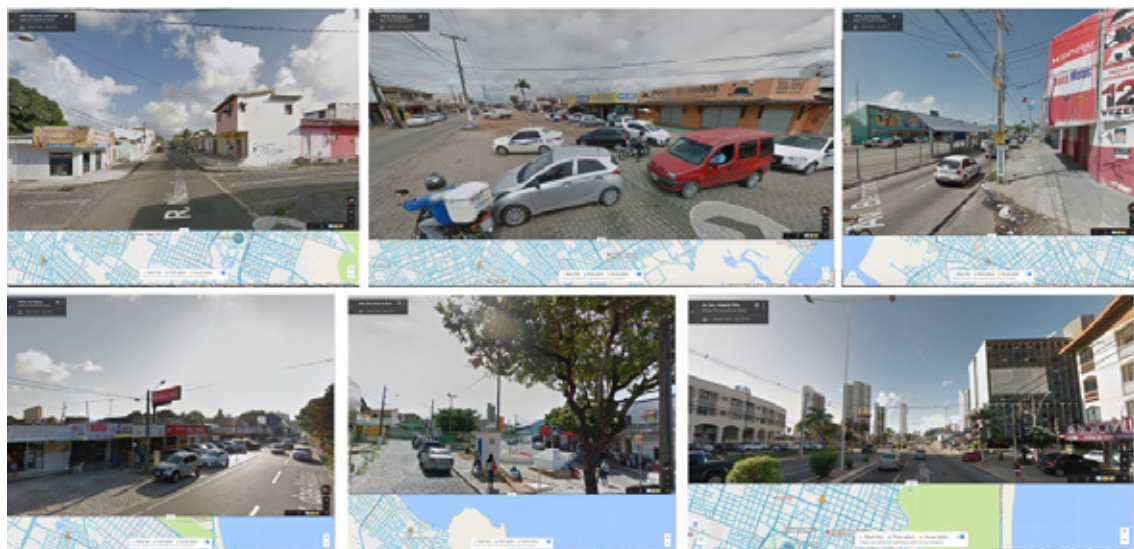


Figure 5 - Centralities of diverse scales and functions in Natal: (top) Felipe Camarão, Potengi, Alecrim (Bernardo Vieira av); (bottom) Neópolis, Ponta Negra, Lagoa Nova (Salgado Filho av).

3.2. DAKAR'S CENTRALITIES: SHIFTING, EXPANDING, MULTIPLYING

In Dakar, high topological accessibility navigates from the Plateau – to this day the formal city centre – to the Medina, spreading northwards from there: northwest towards the airfield of Ouakam; north until reaching the crossroads that branches west to the airport of Yoff, and east into the road to Rufisque; and northeast, bifurcating into a route to the hydrobase of Bel-Air and another running past it towards Hann.

Round 1930 the accessibility core was formed by the tightly knitted street grid of the Plateau. Poor residential settlements occupied low accessibility enclaves within the main street grid and especially in its fringes (Figure 6a). The long highly accessible Pasteur/Jean Jaurès avenue (figure 6A) runs across the grid, bordering the Plateau's integration core, and joins the likewise Blaise Diagne avenue that transects the Medina, signalling the northwest expansion and the shift of topological accessibility towards Quakan, to be confirmed in the segment representation of 1945 (figure 6b).

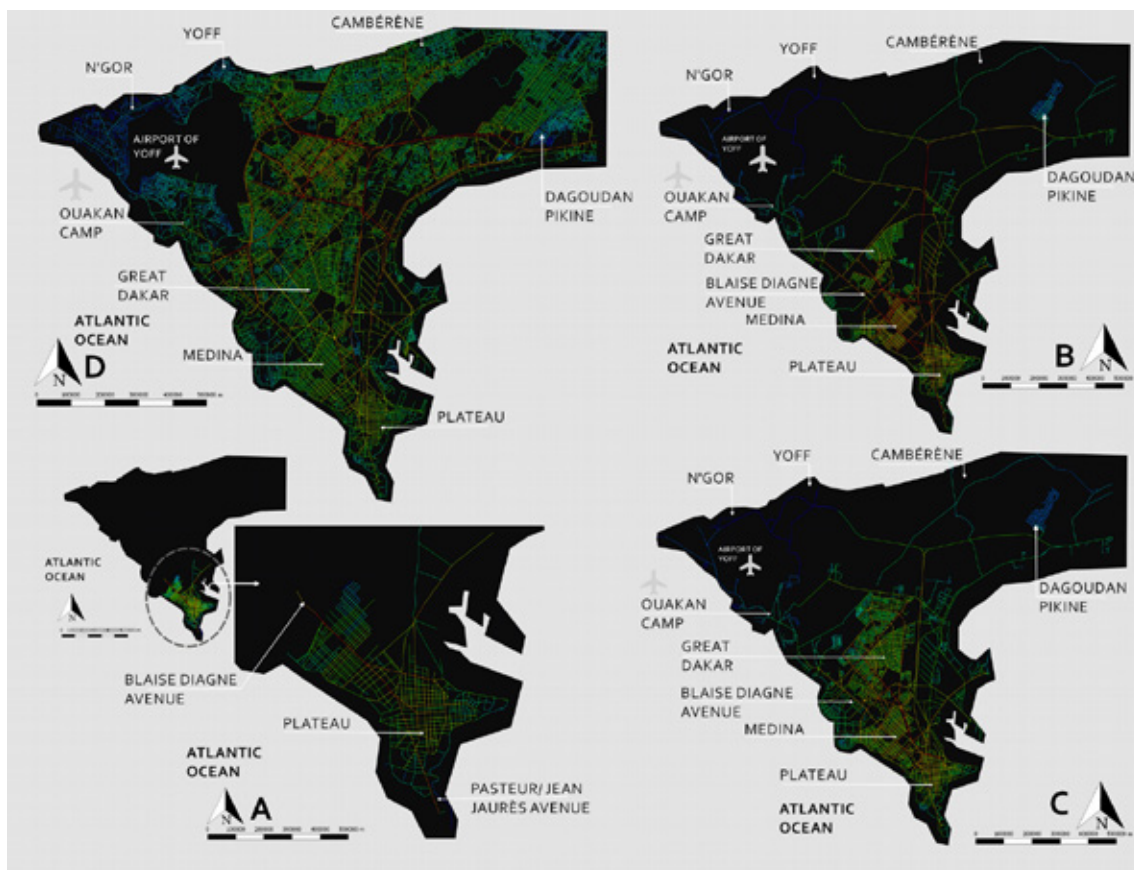


Figure 6 - Global accessibility (normalised integration – NAIN) in Dakar. (a) 1930; (b) 1945; (c) 1964; (d) 2012.

By 1945, besides the very integrated Blaise Diagne avenue (Figure 6b), the north sector of the Medina contains highly accessible axes that foretell the dislocation of accessibility northwards and herald the occupation of the large central area of the Peninsula after the war. Sparse patches of buildings near the airfields of Quakam and Yoff strengthen the attraction power exerted by them. The villages of N'Gor, Yoff and Cambérène remain isolated, flimsily connected to the overall spatial structure by a few lines.

In the segment analysis calculated to gauge potential through accessibility (normalised choice – NACH, Figure 7d), the two expansion axes that stemming from Dakar-ville, the town centre, stretch along the coast to the northwest and northeast of the Peninsula, flank the areas where the airfields of Quakan and Yoff were established. A line bisects the angle formed by

the two expanders, defining a third axis in post-war Dakar (1964 map, Figure 7c). Autoroute N1 will connect the wide central area of the peninsula gradually to be occupied by residential neighbourhoods, mostly low cost at first, then housing estates for the middling sectors, setting the founding grounds for what is referred to as Great Dakar. In the late 1960s, the city comprises four zones: Dakar-ville, the old and to this day established city centre; Great Medina; Great Dakar; and the Industrial Zone. The latter includes the railway network area, the dockland and the industrial sector, being linked by the centre-Northeast axis running towards Rufisque (Figure 08).

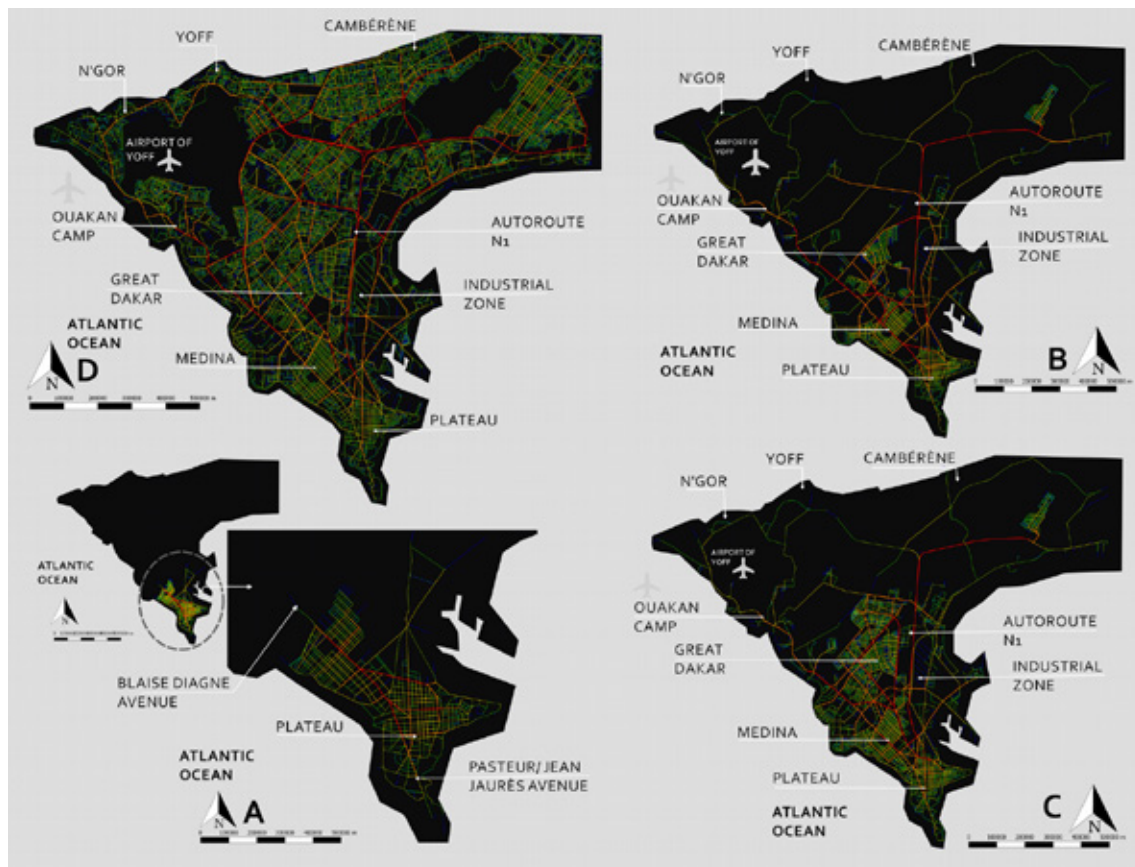


Figure 7 - Potential through accessibility (normalised choice – NACH) in Dakar. (a) 1930; (b) 1945; (c) 1964; (d) 2012.

In the segment map showing the most passed-through roads in 1930 (figure 8A), three of the routes that demarcate the urban limits in 1862, 1908 and c. 1915, according to Teixeira (2017), based on Seck (1970:149) appear highlighted: (1) the south-north running Av. Du President Lamine Gueye (though a pale blue), the urban borderline in the 19th century; (2) the lines west of it connecting the present day avenues Pasteur/Jean Jaurés, Petersen and Blaise Diagne; and (3) the southwest end of avenue Malick Sy, that sat the boundary beyond which nothing could be built in the early 20th century.

In the likewise representation of 1964, two other boundaries are highlighted: (1) the Boulevard President Habib Bourguiba, which limits the northern urban area with continuous grid at the end of the war (figure 8C); and (2) the curved line running from the city centre towards northwest – current Voie de l'Alternance or Route the Front de Terre that demarcated the urban boundary, according to Seck (apud Teixeira, 2017), in 1967.

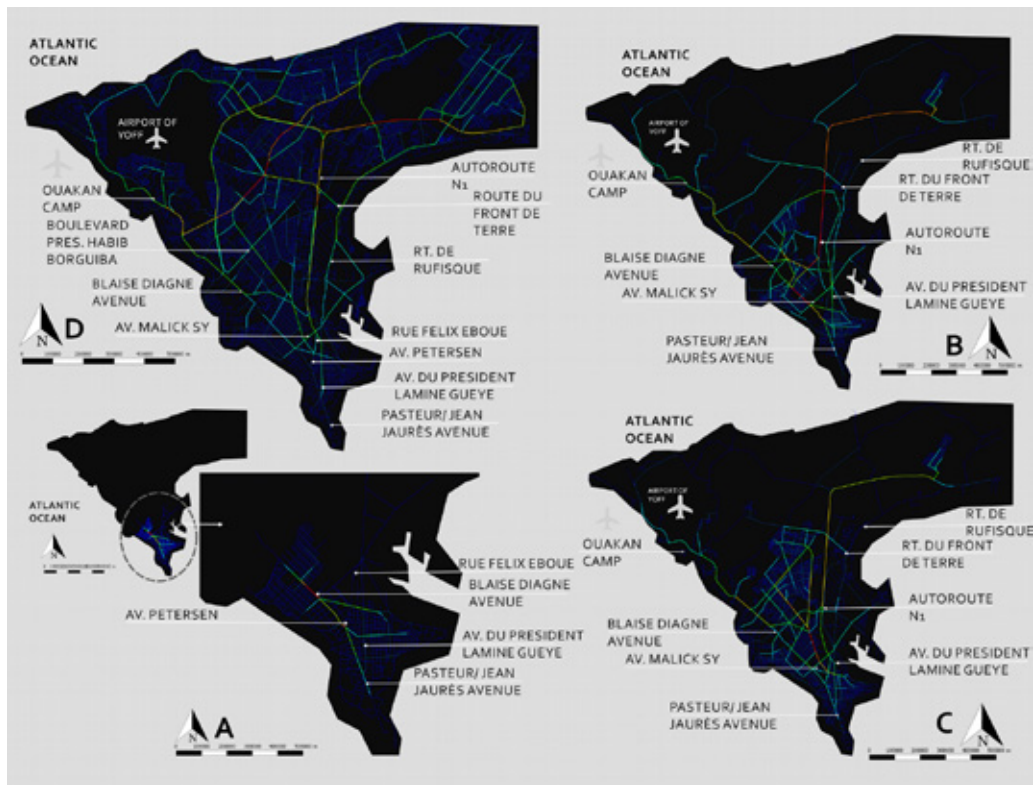


Figure 8 - The linear skeleton of potential through accessibility (choice) in Dakar. A) 1930; (B) 1945; (C) 1964; and (D) 2012.

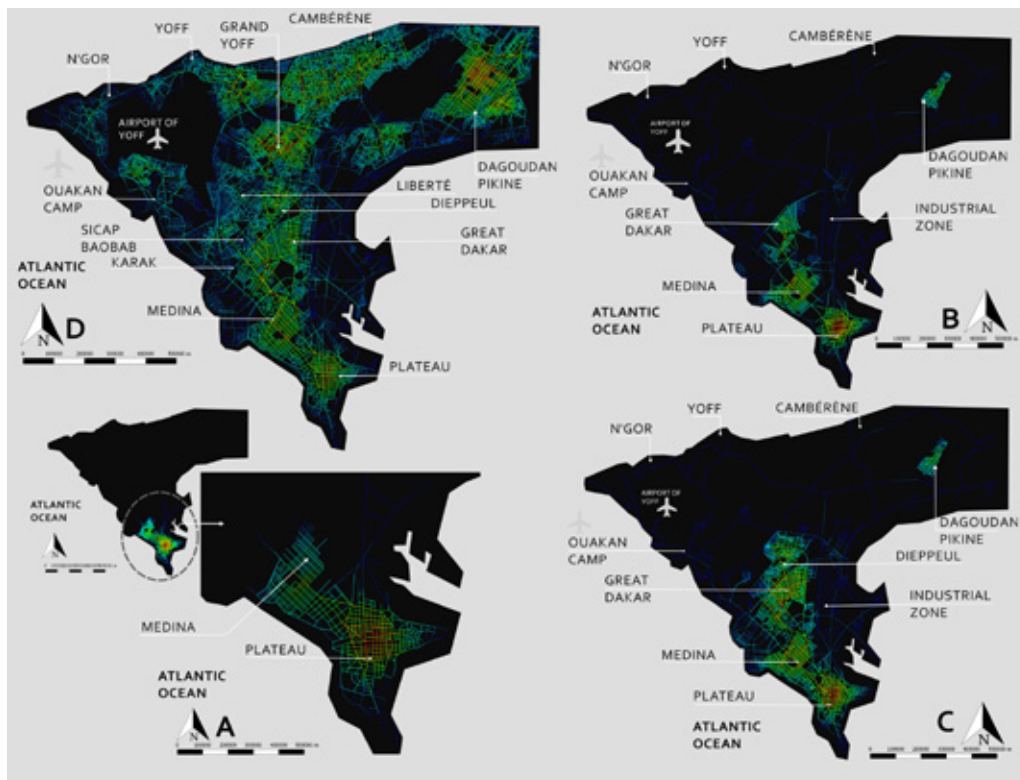


Figure 9.- Accessibility within a catchment area of 600m (integration 600m) in Dakar. A) 1930; (B) 1945; (C) 1964; and (D) 2012.

When the grid structure is calculated to account for relations within a metric distance of 600m, various simultaneous centralities emerge. In the 1964 segment map, Dakar-ville, the traditional centre on the Plateau surfaces as a tightly knitted central grid (figure 9C). In the Medina, centrality appears diffused throughout its regular grid and in the north settlements – round Grand Dakar, Biscuiterie, Dieuppeul – curved ways running south-north retain high topological accessibility within the partially radial layout. 21st century Dagoudane Pikine (2012 map, Figure 9D) contains some nuclei of high topological accessibility, perhaps the strongest in the whole urban structure, within a catchment area of 600m. Grand Yoff, Yoff and Cambérène also comprehend webs of highly accessible streets defining a local integration core, and in the villages located in-between the present International Airport Léopold-Sédar-Senghor of Dakar (in Yoff) and the old airfield of Ouakam, an embryonary integration core indicates the formation of a sub-centre.



Figure 10 - Diverse centralities in Dakar: (Top) Grand Yoff, Biscuiterie, Pikine; (bottom) Grand Dakar, Medina, Plateau. Source: Google Maps Street View, access on April 2017.

4. IN THE GUISE OF CONCLUSION

Why was it that Natal and Dakar, despite being abundantly cited in the contexts of the war and the early stages of transatlantic air crossing have deserved so little saying about the material urban expression of their parallel historical roles? The desire to start filling this gap motivated this brief insight, sparked off by the intent to weave a comparative historical account of these two cities separated and united by an ocean, that set in motion the study conducted by my friend and fellow researcher Rubenilson Teixeira (2017).

Teixeira's study, of which this morphological analysis is but a complementary contribution, furthers the understanding of aspects from our common South American and African historical legacy, highlighting the fact that notwithstanding their huge sociocultural differences, the roles Natal and Dakar played in the world political scene, which are closely related to the physical attributes of their natural sites, combined to the social logic of space in national and global capitalism have left common marks in their urban form. Some of the marks discussed here – mainly the ones pertaining to the street configuration – reveal ways in which space has been handled over the 20th century to secure accessibility privileges that are unequally reached by people of distinct social stand, and ways in which those excluded from the privileged bits overcome segregation by building up other modes of centrality. Out of the myriad of aspects not addressed here it would be valuable to examine common features concerning the building ensemble in the two cities, particularly those of the peripheral centralities that appear to bear so many common traits at a first look. Another is the explorations of possible reasons why

whereas in Natal the metric distance of 1200m coincides better with multiple centralities, this is better attained in Dakar by a metric ratio of 600m. Would that mean that the more regular grid of Natal's configuration is less favourable to pedestrian movement than that of Dakar? Yet another is the examination of the nature of these multiple centralities that at face value appear to be split into those for the rich and those for the poor, but that we know to be much more complex than that in sociocultural aspects, with modes of interface among residents from distinct backgrounds and between residents and visitors, being only one of the most obvious aspects demanding investigation.

Geographic features and proximity at a continental scale were crucial factors that triggered the destinies of the two cities in similar lines from the start, being intensified at the time of the early transatlantic aviation routes. It was, however, the human action directed at setting people and cultures apart the matrix that shaped and carries on shaping accessibility and centrality in the two cities, of which the purpose to persuade the rich and thrust the poor out of town in the planned residential neighbourhoods of Cidade Nova (Natal) and Medina (Dakar) are highly emblematic examples.

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