Revista Nacional de
Gerenciamento de Cidades
ISSN eletrônico 2318-8472, volume 11, número 83, 2023

Active Mobility and Space Syntax in the city of Blumenau/SC

Edilson Pereira
Professor, PhD Candidate, NPGAU-UFMG, Brazil
arqedpereira@gmail.com

Revista Nacional de
Gerenciamento de Cidades
ISSN eletrônico 2318-8472, volume 11, número 83, 2023

ABSTRACT
This research addresses aspects related to active mobility and its relationship with space syntax. Active mobility is a preponderant factor in the quality of urban space, since it is about the characteristics and conditions that a place presents for walking. In this context, this research aims to correlate, under the light of Space Syntax, the results obtained in the evaluation of active mobility with the configurational pattern of 4 spatial clippings of the city of Blumenau/SC. Through the evaluation results that identified active mobility indexes for each area, and the angle analysis of metric integration, in radius of 500, 1000 and 1500 meters, if you can concluded that the active mobility indexes in the researched areas present better results in the areas where the configurational pattern is more integrated, in detriment of the segregated ones.

KEYWORDS: Active Mobility. Space Syntax. Active Mobility Indexes.

1 INTRODUCTION

Following the global trend, Brazil in the beginning of the 21st century already presented itself as a predominantly urban country, with approximately 82% of its population already residing in cities with urban characteristics. Therefore, making cities more humane and egalitarian through interventions in transportation systems, improvements in urban mobility and accessibility have become one of the priorities and challenges of public policies in the country (ALMEIDA, 2011).

Gehl (2015) makes it clear that it is through walking that people have the opportunity to develop interactions and relationships with their neighborhood. This dynamic has attributes that can keep the city alive and safe, however this relationship only happens when the urban space is structured to receive people, inviting them to the street.

Several international studies (CERVERO; DUNCAN, 2003; SMITH; BUTCHER, 1997; SPECK, 2017), especially in the United States and Canada, explore how the urban structuring of cities affect people's mobility, especially walking. These studies demonstrate the interconnection between physical configuration, landform, and land use with walking.

In this context, it is of utmost importance to understand the relationships between urban form and society, addressing aspects related to appropriation, spatial configuration and natural movement. The Theory of Space Syntax developed by Hillier and Hanson (1984) allows us to interpret the attributes of space, based on the sequence of open spaces (roads, parks, etc.) and barriers (buildings and other forms of movement restrictions). When applied to the study of urban morphology, it began to be used in research on the influence of urban configuration on the movement patterns of people.

In this sense, the concept of spatial syntax has considerable potential for such research by producing data in a less exhaustive manner, through secondary data, and thus makes urban research more feasible to produce.

It is with this conjuncture in mind that this research aims to correlate under the light of Space Syntax, the results measured on active mobility in 4 spatial clippings of the city of Blumenau/SC. Considering as a hypothesis that the best rates of active mobility are precisely found in areas that present greater local integration, according to its configurational pattern.

2 THE PEDESTRIAN AND THE URBAN SPACE

From the twentieth century the concepts of urbanization have changed radically, where urban planners and public administrators began to "requalify" urban spaces, as in the United States that remodeled the territory encouraging urban sprawl, reducing densities and creating the city on the scale of the car, the vehicle becoming the conditioner of modernist urban design. And this milestone made the vehicle a necessity, as walking became impossible (SPECK, 2017).

This vision was replicated in numerous cities, including in Brazil, such as Brasilia, which through the pilot plan and its large blocks, the scale of the car was accentuated giving greater importance to the vehicle than to the pedestrian. At a conference held by the United Nations (UN) in Madrid in 2017, Gehl said that Brasilia is fantastic for those who can see it from above, from above, but totally inaccessible from the ground, where people live.

However, it is not enough just to increase sidewalks, life on the sidewalks is also encouraged by other factors as Jacobs (2011) points out, a street needs businesses, but businesses that present amenities for people, that are useful for their daily lives, so people will leave home on foot and not by car, and they can meet their neighbors and strengthen community life. In addition, there is to be concerned with the human scale, which is that of the pedestrian, what he can observe and feel when he is on the street, because nobody likes to walk from sameness to sameness, from repetition to repetition, even if the effort is minimal.

All these conditions are essential for the pedestrian to live the urban space, and to be truly stimulated to leave home on foot.

3 ACTIVE MOBILITY

Active mobility is used to reflect the frequent conditions of the examined urban space, this analysis can comprise several scales, from an urban section, a neighborhood or the entire city, in addition to routes and road segments, the latter being the focus of this research. Through indicators, which will result in data about the spaces, it is possible to understand which places are more attractive for walking and which points need to be improved because they hinder or discourage walking.

Pires (2018) conducted a research among the active mobility indexes already developed over the years, and identified the main indexes, the study presented a synthesis of 23 evaluation methods, being that stand out for considering different scales of analysis the indexes developed by (SANTOS, 2003; HALL, 2010; CAMBRA, 2012; ZABOT, 2013 and ITDP, 2018).

The index developed by Zabot (2013) considers the evaluation of 12 analysis criteria, identified in Table 01 and pointed out by the author as the variables of higher occurrence among the analysis criteria of active mobility; being the most appropriate method for the Brazilian reality.

Table 01 - Walkability evaluation criteria, ZABOT (2013).

Variável	Abordagem
Accessibility	Sidewalks with tactile flooring and ramps
Visual Attractiveness	Pleasant surrounding use
Barriers	Obstacles
External Conditions	Weather protection
Urban Design	Street widths and vehicle speeds
Pedestrian Infrastructure	Ease of access to other modes of transportation
Sidewalk Width	Block size
Maintenance	Urban furniture
Safety	Signage
Safety	Vegetation
Topography	Lighting
Land Use	Cross-section width

Source: ZABOT (2013), adapted by the author.

The methodology adopted by Zabot (2013) is actually an adaptation Santos's (2003) method. This adaptation occurred through the inclusion of two variables, (topography and land use) which Santos (2013) did not work with. Zabot's (2013) justification for the inclusion of these two variables was due to the fact that he found that these variables were pointed out by other authors in his research as relevant items in the analysis of walkability. However, the scoring criteria, the method for assigning points and the final evaluation remain the same as the methodology of Santos (2003).

4 SPACE SYNTAX

The Theory of Space Syntax developed by Hillier and Hanson (1984) allows us to interpret the attributes of space, and highlights the influence of urban configuration on movement patterns. The natural human movement that occurs in space, that is, the configurational structure that generates a movement of people, stems from three factors:

The first is the global scale of the city, that is, the way space is structured in relation to its surroundings is more important than the arrangement of buildings in places;

The second is the local scale, that is, how public spaces are constituted and how they relate to buildings;

The third, finally, is the social interaction that associated with space through its configuration leads to the probabilities of the natural movement that will occur, and that, in turn, ends up producing attractors.

Thus, Space Syntax through its main syntactic measure, integration, seeks to articulate the spaces with the daily movements that occur in it, and this spatial relationship seeks to highlight the potential for connectivity with the city (HILLIER; HANSON, 1984).

Turner (2001) proposed an advance in the development of Space Syntax Theory, the Angular Segment Analysis, which aims to reduce the problems encountered in the traditional analysis of Syntax Theory, the axial analysis. This advance is not only a topological analysis - which originally always refers to a change of direction in the path, regardless of its angle, but an angular analysis, that is, in the search for a smaller angle at the meeting of two or more segments (paths). This change understands that some routes with smaller sinuousness are understood as straight, or semi-straight routes, better representing the logic of people's movement.

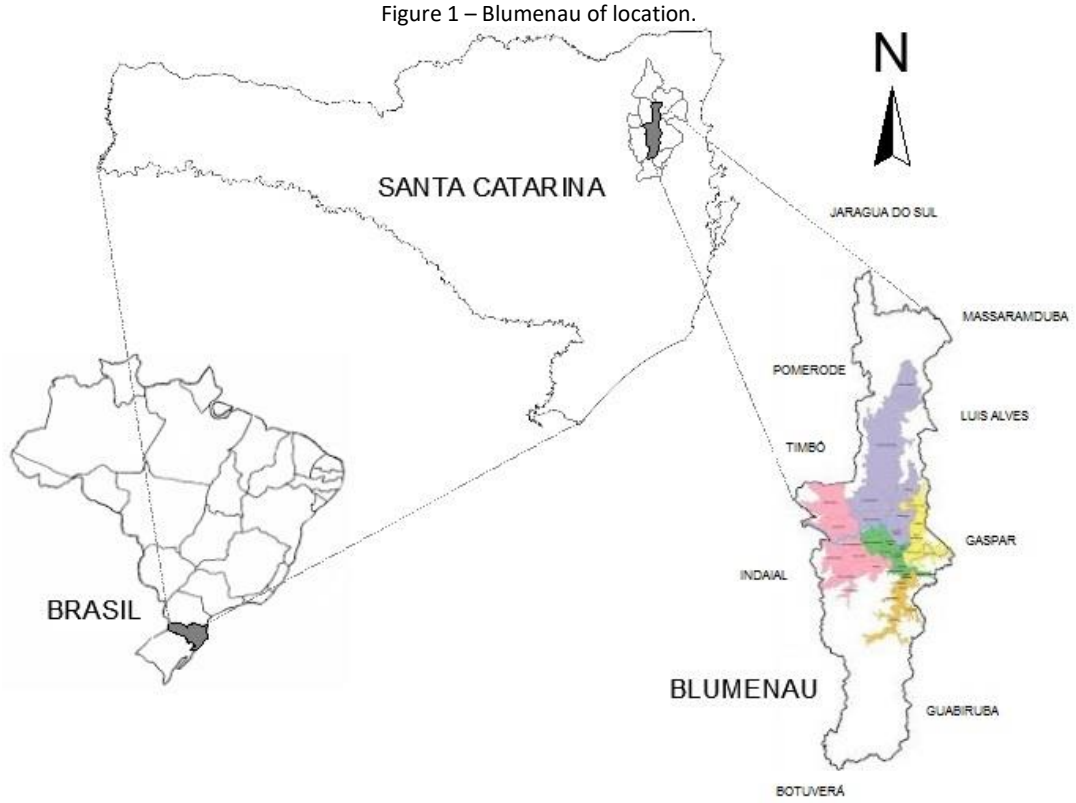
Moreover, it proposes metric analysis, considering radii that can be studied according to the researcher's interest. The fact of being able to use different types of radii, whether metric, angular, or topological, meets the intrinsic characteristics of each city and scale. Hillier himself (2001) admits that the city presents in its morphological structure the two properties, metric and topological, according to the analysis of the scale, be it local or global.

5 BLUMENAU

Blumenau is located 140 km from the capital of Santa Catarina, Florianópolis, as shown in Figure 1, and has a road system with few arterial roads connecting the neighborhoods to the center, and most of them still from the colonial layout of winding and narrow streets. This limited capacity and the incentive for mobility by individual motor vehicle currently presents constant congestion in the city (PATEIS, 2013).

Siebert (2000) believes that due to the centralization of urban equipment, commerce and services and the lack of connection between neighborhoods were the main responsible for the various mobility problems faced by the city until today.

Figure 1 – Blumenau of location.



Source: IBGE (2010), adapted by the author.

According to Piazza and Vieira (2017) the city of Blumenau currently uses the motor vehicle as the main mode of transportation. However, a large part of the population uses public transportation. As of 2011 exclusive bus lanes were implemented in the central region of the city, these measures arose from the need to reduce the numerous traffic jams caused by people moving from the peripheral neighborhoods to the center, where most public services and major shops and private services are located.

Revista Nacional de
Gerenciamento de Cidades
ISSN eletrônico 2318-8472, volume 11, número 83, 2023

6 METHODOLOGY

The methodological approach that met the problematic of this research was exploratory, in that it initially sought the results on the evaluation of active mobility developed by Pereira (2020), and then correlated these results with the concepts and methods on the theory of spatial syntax (BILLIER; HANSON, 1984).

Pereira (2020) defined the spatial clippings used in the research on active mobility considering the crossing and analysis of some important variables, such as population, income and slope of these areas, because it was possible to elect regions of the city with higher population and distinct characteristics between them, especially with regard to income and slope. Thus, through the 2010 IBGE data, information was gathered about the thirteen most populous neighborhoods in the city of Blumenau/SC, as well as the nominal monthly income equivalent to the minimum wage in force at the time.

In this sense, correlating the variables, population, income and slope, four spatial clippings were elected and thus each clipping presented relevant characteristics regarding these variables and contemplates similar characteristics provided in the other neighborhoods of the city. The first of them is the Itoupava Central neighborhood, for having the largest number of inhabitants and income similar to most of the other neighborhoods, besides a slope between 5 to 12%, considered intermediate in relation to the others. The second clipping is in Itoupavazinha, the third most populous neighborhood in the municipality, and stands out from the others in terms of income, presenting one of the lowest incomes of 1 to 3 minimum wages (IBGE, 2010), and slope of 12 to 20%, considered high. The third cut is in the Garcia neighborhood, the fifth most populous neighborhood, with an average income of 1 to 5 minimum wages, and slope of 0 to 5%, considered low, which motivated the choice of this area. And finally, it is worth noting the importance of analyzing an area that presents higher income than the other neighborhoods, so we chose the Vila Nova neighborhood, which presents an average income of 3 to 10 minimum wages, and slope of 0 to 5%.

After defining the clipping, each road segment, i.e., each existing stretch between road intersections was individually analyzed, both on the left and right side of the road. This analysis consisted in verifying the existence, or not, total or partial of each of the twelve variables shown in chart 1, and each variable received scores in three intervals, being 0.00 (zero) for unmet situations, 0.25 (zero point twenty five) for partially met situations and 0.5 (zero point five) when it was totally met.

The definition of the extension of the cutout that was analyzed in each area corresponds to a maximum of approximately 1.25mi *(2000m)*, in the longitudinal direction of the main roads in the selected neighborhoods. This definition took into consideration the research of Junqueira (2003) who states that people are willing to walk up to 0.625mi. For Gehl (2015) the ideal measurement is between 0.3125mi *(500m)* and 0.625mi *(1000m)*. Litman (2010) believes it is up to 0.5mi *(800m)*. And Speck (2017) goes a bit further and considers up to 1.25mi *(2000m)*. In view of this, it was decided to choose a more generous cut-off of up to 1.25mi that encompasses the dimensions of all the authors mentioned.

For the field research, an analysis and evaluation form was used, so after assigning points for each variable in each stretch, as described above, the scores of each one were

added and divided by two, so that the average of the analyzed stretch could be obtained, i.e., this average represents an active mobility index for each stretch.

In view of the results obtained by Pereira (2020), it was possible to correlate them with the syntactic attributes of the regions analyzed. Thus, segment angle maps were developed, and for this the databases of the Blumenau City Hall were used, with its last update in 2021. The barriers and open spaces were identified on this database, and axial lines were drawn over them, i.e., the longest straight lines capable of covering the entire open space system of a given urban area (HILLIER; HANSON, 1984). Then these lines were exported to the software DepthmapX (TURNER, 2017) in its version 0.8 for the generation of the segment angular map. As advised by Turner (2001), a normalization of the results was performed, resulting in a new angular integration map of radius N (Rn)[1]. And, finally, the metric angular integration maps of radius 500, 1000 and 1500 meters[2] were developed for the 4 cuttings mentioned above.

7 RESULTS

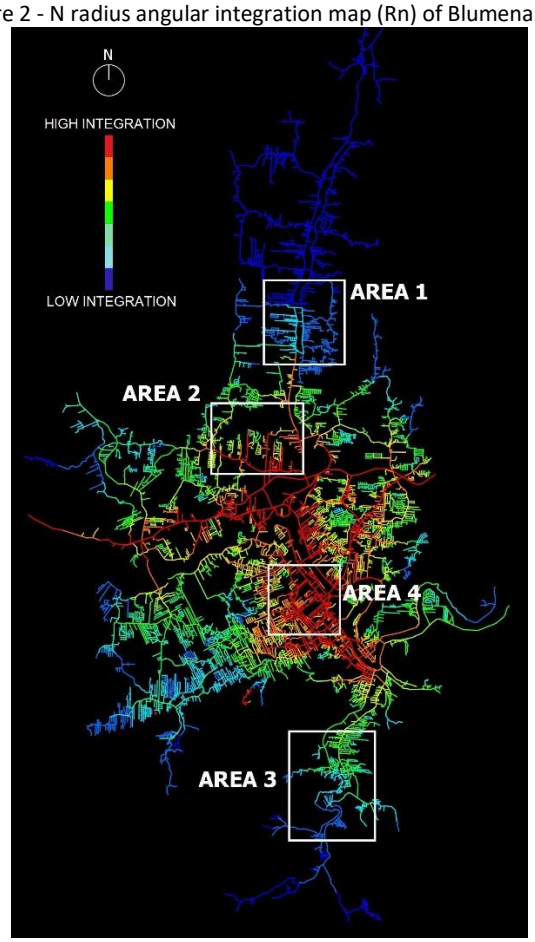
According to the results obtained by Pereira (2020), the evaluation of the active mobility criteria occurred through the analysis of the areas by stretches, which were numbered, from 1 to the total of selected stretches. In this way each area presented a different total of stretches, where area 1 - Itoupava Central neighborhood presented 16 stretches; area 2 - Itoupavazinha neighborhood, 17 stretches; area 3 - Garcia neighborhood, 28 stretches and area 4 - Vila Nova neighborhood, 18 stretches. After tabulating the data it was possible to know the active mobility index for each stretch and reflect on what factors contribute to a higher or lower performance, given that it represents how inviting and pleasant that urban space is for people to move around. Figure 2 illustrates the location of the respective areas (analysis clippings) on the angular integration map (Rn).

[1] In the global analysis, (Rn) represents how accessible a line or axis is to the whole system, it is a global radius. Another way to analyze angular integration is in a local way, choosing a radius according to the need of the study, (R500, R1000, etc.), which refers to meters, 500m radius, 1000m, etc.

[2] the official unit of measurement in Brazil is in meters, and therefore as the case study was carried out in Brazil, it was decided to keep this unit of measurement in the texts and figures.

Revista Nacional de
Gerenciamento de Cidades
ISSN eletrônico 2318-8472, volume 11, número 83, 2023

Figure 2 - N radius angular integration map (Rn) of Blumenau/SC.



Source: Prepared by the author.

It is possible to see that area 4 is very close to the integrating core[3] of the city, while areas 1 and 3 are farther away. It can be seen that the city of Blumenau has an integrating core with linear predominance, but starting a radial development and moving from the southern region towards the north of the city. Through the analysis of global integration as pointed out by Hillier and Hanson (1984) it is possible to identify potential movements within the city, the ease of going from one point to another. Thus, it is evident that area 4 is better positioned allowing easy access to the other areas of the city.

However, as the objective of this article is to correlate the results of the active mobility indexes under the light of Space Syntax, the most appropriate was to evaluate the local scale of these areas, and therefore they were individually analyzed through local metric angular integration maps of radii 500, 1000 and 1500 meters.

7.1 Area 1 – Itoupava Central neighborhood

The area 1 comprises a 2.200m extension of the Pedro Zimmermann street, and according to the result of active mobility presents an average in the walkability index of 3.96 points, considered low, and of immediate intervention. This index reflects a series of identified

[3] The integrating core is the meeting point of the city, where people meet and interact, characterized by mixed use and high density areas. An integrating core requires both global and local integration within the city. (HILLIER, 2001).

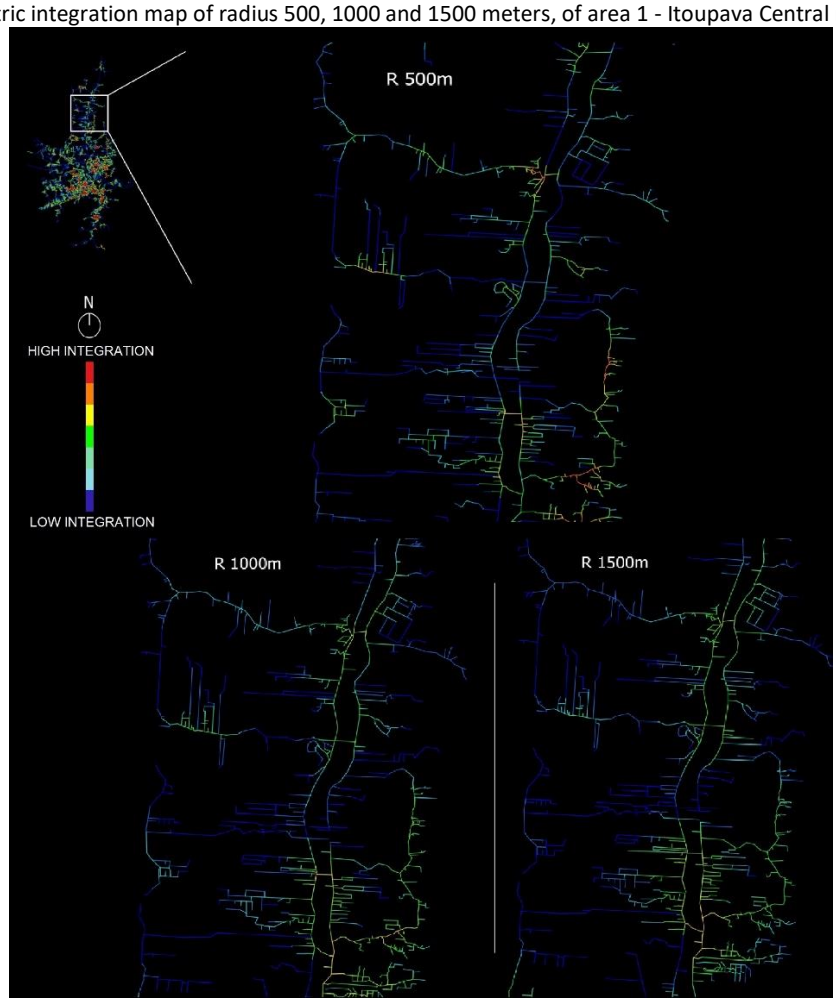
problems and even the inexistence of several attributes necessary for good conditions of displacement on foot.

The indexes of sections 11, 12 and 15 were the ones that presented the lowest scores, because they received zero scores in most of the variables analyzed.

In most stretches, the lack of accessibility, the high speed of vehicles on the road, the insecurity for pedestrians due to the lack of crosswalks and traffic lights, in addition to the absence of urban furniture, vegetation and protection against the weather, and the numerous irregularities in the road surface, such as holes and lack of paving in several stretches were determining factors in this low index result. On the other hand, the topography variable presented the highest score, because it is a predominantly flat terrain, followed by the easy access to public transportation and a more diversified land use between residences, commerce in general and mixed use of buildings in several stretches, besides blocks smaller than 100 meters in others, however, not enough to raise the average of the active mobility index.

A relevant point to be considered is that the stretches with smaller blocks have better scores than the stretches with larger blocks, this fact contributes to reduce distances and allows greater connection for displacement, although as shown in figure 3, there is a segregation between the areas, even in the larger radii of 1000 and 1500 meters.

Figure 3 - Metric integration map of radius 500, 1000 and 1500 meters, of area 1 - Itoupava Central neighborhood.



Source: Prepared by the author.

In this sense, it can be concluded that the analysis of active mobility points to the need for immediate intervention in 10 stretches, out of 16, showing a situation that is not friendly to the displacement of people circulating in the region.

This result is in line with the results identified in the metric integration map, because it shows a region that has a linear urban design, poorly connected and with low integration numbers, both locally and globally, and even in the analysis of active mobility, the best scores are the items of mixed land use and smaller blocks, this was not enough to present syntactic data of a possible centrality for the location. According to Hillier and Hanson (1984) a centrality can be defined when there are global and local characteristics that spatially evidence a very connected urban configuration. A centrality is the place that presents more appropriation, more urban life and social interface.

7.2 Area 2 – Itoupavazinha neighborhood

The analysis of area 2 comprises part of Frederico Jensen Street, approximately 1.700 m of the street, which is the main street of the Itoupavazinha neighborhood, being the region of greatest movement of people. However, it presents an average active mobility index of 4.48 points, classified according to Santos (2003), as an area for short-term intervention, unlike area 1 which required immediate intervention, area 2 is in a slightly more favorable situation, but not fully satisfactory for displacement.

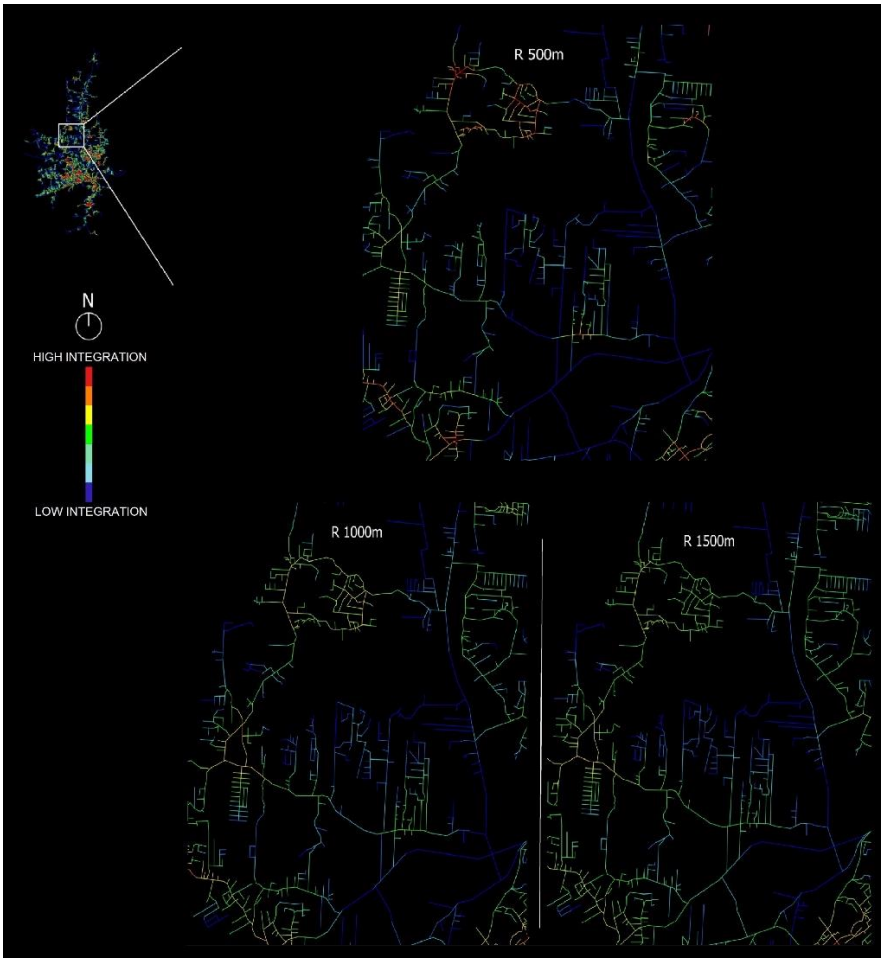
In general, the variables that received low or zero scores concern the lack of urban furniture and protection against the weather; besides the few bus shelters that had coverage and benches. And also the low presence of the elderly and children, and no policing during the research period, criteria that, according to Santos (2003), corroborate in the understanding of the quality of safety of the place. And finally, the most accentuated relief, which was to be expected, since this was one of the reasons for selecting the area for the research.

On the other hand, the cross leveling criteria for sidewalks, with a slope of less than 2%, and the size of the blocks, being less than 100 meters, proved satisfactory in relation to the other variables analyzed.

Meanwhile, the results of the syntactic analysis evidenced in figure 4 demonstrate a segregation between the areas, however, when applied the radius of 1500 meters it is already possible to perceive the beginning of a possible integration between the places, but still unsatisfactory from the point of view of the formation of a centrality and appropriation of the urban space.

Revista Nacional de
Gerenciamento de Cidades
ISSN eletrônico 2318-8472, volume 11, número 83, 2023

Figure 4 - Metric integration map of radius 500, 1000 and 1500 meters, of area 2 - Itoupavazinha neighborhood.



Source: Prepared by the author.

In this context, it can be concluded that as for the active mobility indexes of the area, an intervention is recommended, mostly short-term, for 10 stretches, of the 17 analyzed. However, the results of spatial syntax show that there are still no syntactical attributes for a space appropriation evidencing characteristics that are not inviting to people, especially pedestrians, which was possible to realize empirically in the evaluation of active mobility, in relation to the number of people present on the street during the evaluation.

7.3 Area 3 – Garcia neighborhood

Area 3 corresponds to the partial analysis of Amazonas street, approximately 1.600m long, and presented a very satisfactory result, with an average index score of 6.76, higher than the other two areas. This result is reflected in the maximum scores in numerous variables analyzed.

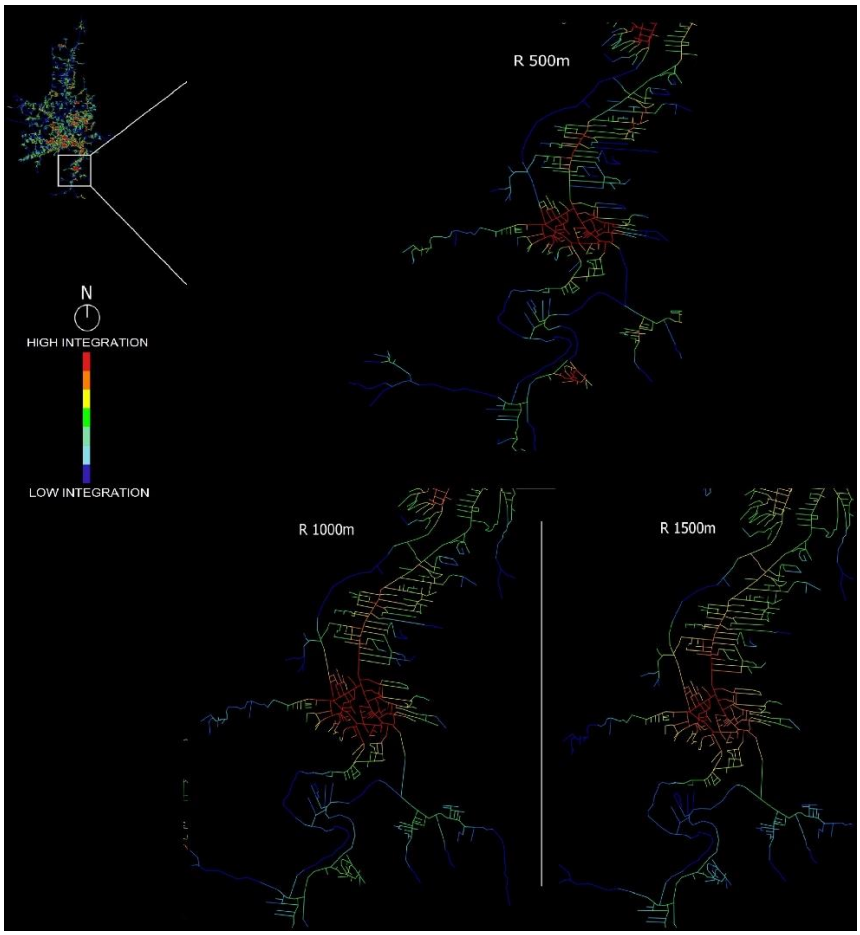
Some variables stand out, three in particular presented maximum scores in all stretches, such as the presence of road and location signs, the predominantly flat topography, and the sidewalks without the presence of barriers for displacement. In addition, it is worth noting that visual attractiveness, accessibility, and quality in public lighting, items that until now had not been mentioned with relevance in the previous areas, received good scores and stood out among the results. As well as issues of diversified land use, block sizes of less than

100 meters, the quality of sidewalk paving, and ease of access to public transportation contributed to the increase in the active mobility index.

The accessibility of the sidewalks, the predominantly flat relief, and the attractiveness of the space (both visually, with pleasant neighboring spaces, with squares, gardens, numerous stores and stores along the road, but also with a diversified land use promoting even more the displacement on foot, either by the opportunity of several services and products or by the proximity of them) meet the statements of Gehl (2015) about active facades, the prioritization of the human scale, a more connected urban design and the diversity of uses and typologies that ensure the necessary dynamism for the constant movement of pedestrians. Thus, one can initially conclude that the result converges to an effective relationship between the quality of active mobility and these variables.

Figure 5 shows a very different situation from areas 1 and 3, the analyzed region presents greater local integration, especially in the 500 meters radius, and corroborates with the results of the evaluation of active mobility of the place. The radius of 1000 and 1500 meters ended up demonstrating a search for integration through Amazonas Street, represented on the map, by the central line in red, it is believed that because the place presents a more linear urban design.

Figure 5 - Metric integration map of radius 500, 1000 and 1500 meters, of area 3 - Garcia neighborhood.



Source: Prepared by the author.

Through this result it can be concluded that the area presents an excellent situation for walking, requiring only improvements and refinements in some variables analyzed in active

mobility. Even the sections that need short-term interventions are actions that can easily be solved.

Moreover, this syntactic scenario when added to the results of micro-scale infrastructure corroborates the strengthening of a centrality and appropriation of the place, a fact that during the active mobility research it was possible to notice a greater presence of people on the street, to the detriment of areas 1 and 2.

This analysis leads to the initial reflection on the theme of this research, that is, the correlation between the active mobility indexes under the light of Spatial Syntax. And so far, it can be seen that the best active mobility index is in the area with greater local integration, as well as the opposite occurs in areas 1 and 2, which besides being more segregated, also presented the lowest indexes.

7.4 Area 4 – Vila Nova neighborhood

Area 4 comprises a 1.550m extension of Almirante Barroso street, and presents an average index of 6.66 points, very close to that found in area 3 (Garcia neighborhood), considered satisfactory, requiring only improvements and refinements. This index reflects a series of favorable scores in the variables analyzed.

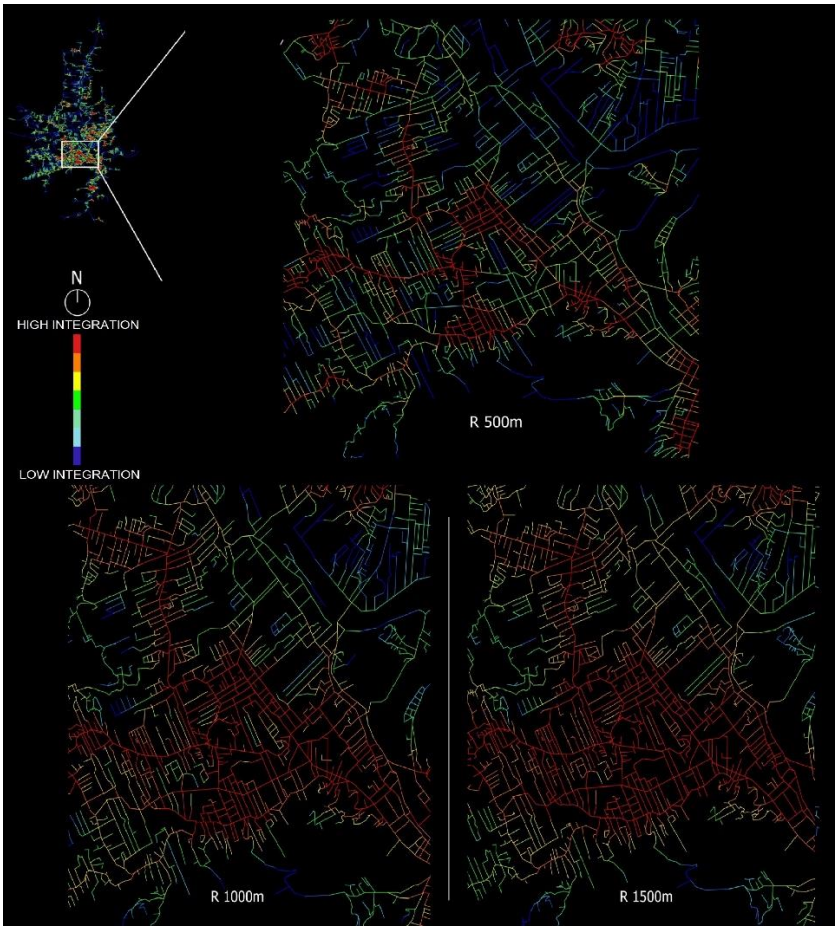
The variables that stand out with the best scores in most stretches are sidewalks free of barriers and obstacles, with firm, non-slip and accessible paving. Road and location signs, adequate public lighting, blocks smaller than 100 meters, and visual attractiveness and mixed land use also contributed to the satisfactory result in the region.

Another factor not yet mentioned with relevance in the previous areas was the cleanliness of the sidewalks, which received top scores in almost all sections, in addition to the predominantly flat topography.

Based on the results of the active mobility indexes, we can conclude that the region of area 4 presents satisfactory conditions for walking, considering the average of the indexes. Thus, as in area 3 (Garcia neighborhood), determining factors in this result are related to the variables of accessibility, relief and attractiveness, in addition to the quality of sidewalks, especially in terms of leveling, paving and comfort conditions such as width.

In relation to the results obtained with the Spatial Syntax analysis, figure 6 shows several small nuclei of local integration in the 500 meters radius, and the range of 1000 and 1500 meters radii end up integrating all these nuclei. This local integration is in line with the satisfactory results of active mobility, evidencing a well-connected configurational pattern.

Figure 6 - Metric integration map of radius 500, 1000 and 1500 meters, of area 4 - Vila Nova neighborhood.



Source: Prepared by the author.

As it was possible to notice in Figure 2, in the global integration map (Rn), area 4 is very close to the integrating core of the city, this approach corroborates for an even more favorable situation for the region, which besides presenting syntactic attributes of local integration, it also allows easy access to the city. This result added to the result of the active mobility index presents a region with very positive characteristics for the appropriation of urban space and the strengthening of the already existing centrality in the area.

8 FINAL CONSIDERATIONS

Active mobility becomes the bias of the urban mobility process that prioritizes the minute movement, making it of utmost importance for the city's urban planning process, it is through it that people have the opportunity to become protagonists in the cities again. Given this understanding, this research sought to reflect and correlate the active mobility, through the analysis of its indexes with the Theory of Space Syntax, in the city of Blumenau/SC.

The results showed that there is a relationship between the places that were identified with the best active mobility indexes, even though these were evaluated in the infrastructure scale and other issues different from the configurational pattern of urban space, with the results of the syntactic analysis.

After the evaluation of the active mobility, it was found that the Garcia and Vila Nova neighborhoods obtained the best indexes, with 6.76 and 6.66, respectively, classified so as to

receive improvements and enhancements, to the detriment of the Itoupava Central neighborhoods with 3.96 and Itoupavazinha with 4.48, in need of immediate and short-term interventions, especially in issues related to sidewalk infrastructure. This result is in line with the results of the syntactic analysis in that it presents areas 3 and 4 as the most favorable to the promotion of centralities and appropriation of urban space, on the local scale, presenting a more connected and integrated urban configuration, as it could be observed on the local integration maps, where the warm colors highlighted the most integrated areas, and the cold colors, the most segregated ones, to the detriment of areas 1 and 2, which presented the opposite.

Thus, it is believed that the most syntactically integrated places end up also presenting the best infrastructure conditions, which in turn end up attracting more people and thus fostering the development of centralities.

Finally, it is believed that the objective of this research was successful in evidencing a relationship between the syntactic attributes of the local scale with the active mobility indexes of the analyzed clippings. It is worth noting that the objective of this article was to analyze a relationship between the results initially obtained by Pereira (2020) on active mobility in his master's dissertation, with space syntax, and therefore, we chose to synthesize the methodology and results presented by the author, but which can be consulted in full through his bibliographic reference.

Furthermore, we suggest research that can somehow correlate the urban density in places with the lowest and highest active mobility rates, and whether these places have favorable syntactic attributes that can validate this density, i.e., are the places with better infrastructure conditions for pedestrians, in a more integrated configurational pattern, the areas with higher density?

REFERENCES

ALMEIDA, H. O. **As Cidades Somos Nós**: 10 princípios para a mobilidade urbana. ITDP Institute for Transportation & Development Policy. Gehl Architects, Rio de Janeiro, 2011.

CAMBRA, Paulo Jorge Monteiro de. **Pedestrian Accessibility and Attractiveness Indicators for Walkability Assessment.** Dissertação (Mestrado em Urbanismo e Ordenamento do Território), Instituto Superior Técnico Lisboa, Lisboa, 2012.

CERVERO, R. e DUNCAN, M. **Walking, bicycling, and urban landscapes:** evidence from San Francisco Bay Area. American Journal of Public Health, 2003.

CONFERENCIA. **Pensar en urbano:** ciudades para la gente en el centro de la Nueva Agenda Urbana. Jan Gehl. Madri. 2017. Disponível em: <https://www.lavanguardia.com/local/madrid/20170626/423709002301/el-arquitecto-danes-ja n-gehl-ofrecera-una-conferencia-en-el-coam-sobre-ciudades-para-la-gente.html>. Acesso em: Mai.2020.

DAROS, E. J. **Anseios e reivindicações para um trânsito seguro:** a visão de um pedestre. VI Congresso Brasileiro e IV Latino-Americano. Associação Brasileira de Medicina de Tráfego – ABRAMET. São Paulo, 2005.

GEHL, Jan. **Cidades Para Pessoas**. 3. ed. São Paulo: Perspectiva, 2015.

HALL, R. A. **HPE's Walkability Index**: quantifying the Pedestrian Experience. 2010. Institute of Transportation Engineers (ITE). Washington, DC, United States.

HILLIER, B. A Theoty of the City as Object Or How Spatial Laws Mediate The Social Construction of Urban Space. **Proceedings of the 3rd Space Syntax Symposium.** Atlanta, 2001.

HILLIER, Bill; HANSON, Julienne. **The social logic of space.** Cambridge: Cambridge University Press, 1984.

IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Censo Demográfico 2010:** características da população e domicílios. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/caracteristicas_da_populacao/resultados_do_universo.pdf>. Acesso em: fev. 2020.

ITDP Brasil. **Índice de caminhabilidade versão 2.0 ferramenta.** 2018. Disponível em: < http://www.itdpbrasil.org.br/icam2/> Acesso em: 15 jun. 2020.

JACOBS, Jane. **Morte e Vida de Grandes Cidades**. 3.ed. São Paulo: WMF Martins Fontes, 2011.

LITMAN, T. **Short and Sweet:** analysis of shorter trips using national personal travel survey, VTPI, 2010.

PATEIS, Carlos da Silva. **A estruturação urbana e a sua relação com os atributos do sítio natural:** o caso da cidade de Blumenau – SC. Tese (Doutorado em Geografia). Universidade Estadual Paulista Júlio de Mesquita Filho, 2013.

PEREIRA, Edilson. **Mobilidade ativa:** um estudo sobre a caminhabilidade na cidade de Blumenau/SC. 2020. Dissertação (Mestrado em Planejamento Territorial e Desenvolvimento Socioambiental) Universidade do Estado de Santa Catarina. Florianópolis, 2020.

PIAZZA, Gustavo Antonio; VIEIRA, Rafaela. **Espacialização do índice de caminhabilidade (ic) como ferramenta de planejamento para mobilidade urbana dos bairros Centro e Badenfurt em Blumenau (SC)**. Raega - O Espaço Geográfico em Análise, v. 40, p. 23-34, 2017.

PIRES, Isabela Batista. **Índice para avaliação da caminhabilidade no entorno de estações de transporte público.** Dissertação (Mestrado em Arquitetura e Urbanismo) Universidade Estadual Paulista. Bauru, 2018.

SANTOS, Evandro Cardoso dos. **Seminário paranaense sobre calçadas.** Curitiba: ABCP, 2003.

SIEBERT, Claudia. Blumenau fim de século: o (des)controle urbanístico e a exclusão sócio espacial. **Novos olhares sobre Blumenau:** contribuições críticas sobre o seu desenvolvimento recente. Blumenau: Edifurb, p. 277-310, 2000.

SMITH M. e BUTCHER T. A. **How Far Should Parkers Have to Walk?** Parking, Vol. 33, No 8, September, 1997.

SPECK, Jeff. **Cidade Caminhável.** 1. ed. São Paulo: Perspectiva, 2017.

TURNER, A. Angular Analysis. **Proceedings of the 3rd Space Syntax Symposium**. Atlanta, 2001.

TURNER, A. **DepthmapX Development Team**. Version 0.8.0 (software), 2017.

ZABOT, Camila de Mello. **Critérios de avaliação da caminhabilidade em trechos de vias urbanas:** considerações para a região central de Florianópolis. Dissertação (Mestrado em Arquitetura e Urbanismo) Universidade Federal de Santa Catarina. Florianópolis, 2013.