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ULTISCALE URBAN ANALYSIS FOR CYCLEWAYS SYSTEM

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ABSTRACT

The proposition of mobility systems for bicycles has become a focus in recent years due to displacement problems presented in major cities. The present study sought to explore methods of evaluation of urban space in different scales in order to verify the conjoint applicability of such methodologies in order to a better effective reading of the urban space, serving as a subsidy to the urban planner in structures proposition intended for non-motorized modes, specifically the cycleways system. It was sought to assess which methodologies, qualitative and quantitative, implemented together, can support the transportation planning by bicycle. The application of methodologies in several scales served as subsidy for the definition of areas to be evaluated, where the crop began in a city scale and finished on a local scale, through the neighborhood scale. Reading the urban space using different scales allow better understanding of the urban area as a whole and the aspects that induce people to use non-motorized models, especially the bicycle.

KEYWORDS

Urban mobility. Non-motorized transport. Urban planning. Cycleway system. Bicycle modal.

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MULTIESCALAS DE ANÁLISE URBANA PARA SISTEMAS CICLOVIÁRIOS

RESUMO

A proposição de sistemas de mobilidade para bicicletas tornou-se foco nos últimos anos devido aos problemas de deslocamento apresentados nas grandes cidades. A presente pesquisa explora métodos de avaliação do espaço urbano em diferentes escalas, a fim de verificar a aplicabilidade conjunta de tais metodologias com o intuito de embasar a leitura mais eficaz do espaço urbano, servindo de subsídio ao planejador urbano na proposição de estruturas destinadas aos modais não-motorizados, em específico o sistema ciclovitário. Buscou-se avaliar quais metodologias, qualitativas e quantitativas, aplicadas em conjunto, podem subsidiar o planejamento do transporte por bicicleta. A aplicação da metodologia multiescalas serve de subsídio para a definição de áreas a serem avaliadas, em que o recorte inicia-se na escala de cidade e finaliza na escala local, passando pela escala de bairro. A leitura do espaço urbano utilizando diversas escalas possibilita melhor compreensão da área urbana como um todo e os aspectos que induzem as pessoas a utilizarem os modais não-motorizados, principalmente a bicicleta.

PALAVRAS-CHAVE

Mobilidade urbana. Transporte não-motorizado. Planejamento urbano. Sistema ciclovitário. Modal bicicleta.

pós-
| 13

I. INTRODUCTION

Considered as one of the challenges in urban planning over the past years, present urban mobility in Brazilian cities results, among other aspects, from (i) urban planning based on individual motorized transportation; (ii) incentive to the expansion of the urban perimeter of the cities; (iii) urban zoning characterized by the specialization of urban plots; and, (iv) economic policies based on consumer goods. These aspects have shaped the location logics of city activities, in which the predominantly residential uses, usually in peripheral areas outside the city center, have significantly increased the need for motorized transportation for the everyday activities.

For the purpose of sustainability, either social or economic, by need and urgency, the concept of sustainable city arises, which gets reinforced when urban mobility takes place on foot, by bicycle or public transport (POLUS *et al.*, 1983). These movements from one place to another result into benefits for the economy and the environment, through the reduction in the consumption of natural resources like fossil fuels, and limitation of gas emissions, besides reducing the levels of noise, which directly affect the quality of life in cities (GEHL, 2010). The relationship of the non-motorized modals, represented by the movements on foot or by bicycle, with motorized public transport, provides people with the chance to go on rather distant trips. To this end, there is need to maximize these modals and the quality of the urban spaces in order to make it possible for the users of the individual motorized modals to adhere to non-motorized modals and collective motorized modals. Upon associating the use of these modals, all people are given the chance to move from one place to another in an equalitarian manner, as the use of motorized public transport and bicycles makes it possible to reach more distant places than pedestrians can reach, besides going on multiple trips. (BRASIL, 2007 a, 2007b).

Nonetheless, the planning of the necessary infrastructures for such transportation modals have been neglected over the past decades, by virtue of the predominance of individual motorized urban transportation, distorting the main function of the cities, which consists in providing a good quality of life. What is observed is a growing intensification of conflicts between transportation modals, a fact that, consequently, generates significant investments by public administrators in an attempt to make urban transportation viable (DUARTE, 2007). There is also the fact that, nowadays, in a lot of Brazilian cities, only criteria regarding traffic engineering are taken into consideration when it comes to implementing bike lanes, and only universal accessibility, through technical rules, are put on the agenda for the requalification of pedestrian walkways. However, for efficiently stimulating the use of non-motorized modals, particularly bike lanes, there is need to understand the dynamics of their use, as well as the relation exerted by a certain modal in urban space.

The search for the functionality and the operational capacity of the mobility plans based on the joint use of non-motorized transportations calls for a systemic view. Besides the traffic engineering aspects, other aspects that should be taken into consideration include urban-related aspects and fundamentally the appropriation of the city by the people.

In light of what has been explained, the theme multiscale methods of quantitative and qualitative analysis for the implementation of cycle lane systems has to do with urban accessibility and mobility. The problem that surfaces consists in compiling which methodologies, qualitative and quantitative, jointly applied, could provide inputs to integrated planning of non-motorized transportation, especially when it comes to bike lanes. The hypothesis of listing the evaluation method of urban space is considered in different scales, it is possible to verify its joint applicability with an eye on an effective reading of it for proposing directives towards the implementation of bicycle lanes. The present research suggests the application of qualitative and quantitative evaluation methods of urban space in the city scales, district and location with the aim to evaluate the implementation of alternatives for cycling in the urban environment.

2. URBAN PLANNING IN HUMAN SCALE

Gehl (2010) considers that the city should comply with four basic principles: vitality, security, sustainability and health. These principles are accomplished if the city is produced for the people, that is to say, the city should have a scale suitable to the possibilities of the human being. In line with this concept, the use of automobiles for covering long distances in urban centers is no longer a priority, and turns into a variable to be considered within the human dimension criteria in urban planning.

A sustainable city gets stronger when urban mobility occurs when people walk from place to place, go by bicycle or by collective public transport. The transportation modes provide benefits for the economy and the environment, through a reduction in the consumption of natural resources, like fossil fuels and limitation to gas emission, besides a reduction in the level of noise, which directly affects the quality of life in the cities. (GEHL, 2010).

Urban planning based on the human scale tries to reconcile social life with city space, an aspect that was present in the daily life of the cities up to the early 20th century. It seeks to turn the environment attractive for the people to resume their activities through public space, utilizing the city both for carrying out their daily tasks and as a vector of social interests, in which such an environment exerts the function of a structuring hub of urbanity (DUARTE, 2007). To this end, the city should adjust to this new reality of resuming the priority status of the people in the urban space. It needs to qualify the public spaces figured out for, and based on people's perception (GEHL, 2010).

In considering the multiscale system for planning urban mobility the presuppositions of the human scale should be incorporated, making it possible for the facilitating structures of the movement of people to be connected and accessible, strengthening the non-motorized cycling travels inside the districts and through collective transport models between districts.

3. MULTISCALE ANALYSIS METHODS

The application of an analysis methodology could imply in restrict understanding of area and/or object of study, once the various conditioning factors present in urban space could hardly be approached completely utilizing just one specific method. Therefore, the idea is to analyze three methodologies of different scales, but complementary, for a reading of the urban space with the focus on the propositions for bike lanes that meet demand and attract new users. In comparative term, two methodologies per scale will be analyzed in order to define which ones present the best applications and synergy in joint application.

In the infrastructure proposition destined for the cycle lane system there is need to evaluate the city in several scales: the city scale, observing the urban morphology through the road system; the district scale, defining the places where the equipment and the uses that exert the biggest attraction of people are located; and, the local urban space scale, decisive for the potential of immediate use of the proposed infrastructures.

The use of urban space evaluation methodology in different scales – city, district and local – arises with the intention to make the urban space reading process more dynamic, making the interventions related to urban system interventions assertive and relevant for the attraction of new users of the non-motorized transport modals, by bicycle.

The methodologies that fit into the city scale, particularly intend to explain the morphology and the urban connections, however, with less effectiveness in the dynamics of the occupation of urban soil. On the other hand, the methodologies in the district scale seek to evaluate this dynamics, but with less emphasis on matters related to urban space quality, while the local scale methodologies are responsible for addressing this aspect.

In the city scale, the methods to be evaluated include the Centrality Measure (KRAFTA, 1992) and Space Syntax (HILLIER; HANSON, 1984); in the district scale the methodologies to be studied include Travel Generating Hubs – TGHs (PORTUGAL; GOLDNER, 2003) and Urban (de)centrality (BARRETO, 2010) and, in the local scale evaluations include the methodology of Level of Quantitative Service (FRUIN, 1971) and Level of Qualitative Service (SARKAR, 2003; KHISTY, 1994).

The Centrality Measure, as well as Space Syntax, are methodologies based on the theory of graphs that were adapted to applied social sciences. On the other hand, the TGHs and Urban (De)Centrality are methodologies based on quantitative analyses, through the perception of the occurrence of the phenomenon or by definitions of territorial planning that induce the creation of these nuclei. With regard to the level of Quantitative Services, they use mathematical models to determine the capacity of the road system, both for vehicles and people. The Levels of Qualitative Services, which, in spite of generating final numeric data, rely on the definition of technical and theoretical criteria to subsidize the variables of this indicator.

In the sequence, the described technologies will be approached, so as to understand which main applications and research segments stand out in order

to list three methods, one per scale, to serve as basis for the analyses of the bike lanes systems.

3.1 City Scale

The methods to be analyzed include the greatly divulged reading space relations on the city scale. It is necessary to stress that either the Centrality Measure or Space Syntax do not come as specific methods for the implementation of cycle lanes. It happens because neither of them is aimed at providing the evaluator with all the conditioning factors involved in the proposition process like, for example, the relation of the road system with declivity, width of the road, etc.

These methods utilize the same basis for the reading of the city, the road system, and can be applied on the same scales, regional, city and district. However, the reading of the graphs occurs in a different way. In the Centrality Measure, the main aspect to be evaluated is the set of “knots” and the relationship between them. As to Space Syntax, the main aspects are “axial lines” and the relations between them (Fig. 1).

The Centrality Measure presents a different focus for the definition of the intentions of the movements. With regard to the attractiveness of the road system, the Centrality Measure method stands out, once the most attractive “knots” can easily be identified by virtue of their integration with the other “knots”, which could offer the main points of the urban system that represent the biggest destinations. This possibility of reading the attractive urban activities could lead to relevant results for understanding the cycling distances in the cities, seeing that the origin/destination aspect is essential for the movement of people to occur in the urban space. However, if only the attractiveness is taken into consideration to define the main travel routes, the other relations with accessibility would be disregarded, which, consequently, would distort the global reading of the system.

The Space Syntax method provides for the reading of the movements as a whole, demonstrating through the connectivity axes (axial lines representative of the road system) the movement morphologically more integrated of the system. In the case of the non-motorized movements, it comes as a relevant point for

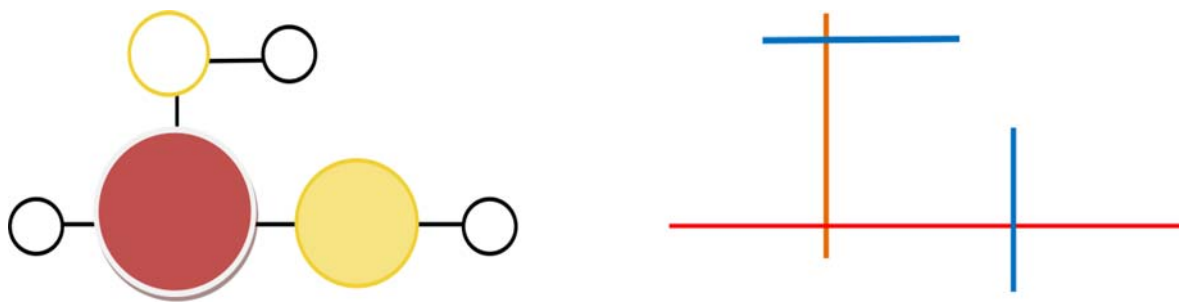


Figure 1 – Representation of the centrality “knots” and the syntactic axial lines
Source: Lanziotti (2016)

defining the cyclable roads in an urban space. Therefore, Space Syntax determines the accessibility of the road system as a whole, based on the level of integration of the connections of the road system, that is to say, it takes into consideration the route and not the final destination as far as the evaluation of the movements go. Furthermore, the reading of the connectivity and of the integration of the road system is of uttermost importance, once it makes it possible to define the most accessible routes, an intrinsic and fundamental aspect to the theoretical bases of Space Syntax. Due to the operational facility and city reading abstraction, through the graphic analysis of the more accessible axial lines of the road system as a whole, Space Syntax becomes the most satisfactory and appropriate method for joint application with the other methods in the district and local scales.

3.2 District Scale

After the evaluation of the urban space in the city scale, it becomes necessary to understand the social urban dynamics around the neighboring units, city sectors, the latter figuratively represented by districts. It is thus possible to verify which points in the city are more relevant by virtue of the attraction of people, so as to determine the origin and the destination of the main cyclable routes, considering that the maximum movement of a cyclist, in a comfortable manner, ranges around the district scale.

In order to define the main points of interest in the district scale (what is understood by district is not the political and territorial unit, but the similar socio-spatial characteristics) the methods that furnish data for the reading of areas with tertiary and leisure activities will be evaluated.

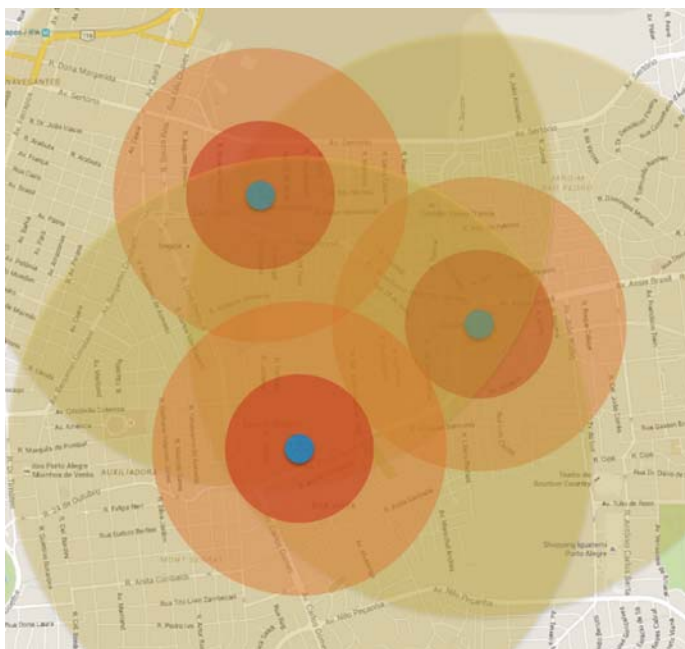


Figure 2 – Area under the influence of the Travel Generating Hubs and Urban (De)Centralities
Source: Google Mapas, 2016; Lanziotti (2016).

Notwithstanding the similarity of the methods as to spatial organization, enclosed areas and focus on the assisted population, Urban (De)Centrality encompasses Travel Generating Hubs – TGHs, seeing that they are responsible for the arrival of new Urban (De)Centralities, just like the implementation of a shopping center, which has an influence upon the arrival of new activities, exerting the same attraction and distribution power imparted by Urban (De)Centralities (Fig. 2).

It can thus be considered that the TGHs are integral parts of the Urban (De)Centralities, and it is not possible to dissociate them. However, the identification of the Urban (De)Centralities, sub-centers and linear centralities, among others, meet in a more satisfactory manner the proposal to implement non-motorized mobility

systems with the focus on bike lanes, once, contrary to the TGHs, the Urban (De)Centralities present a wider range of attractive activities and of interest to a diverse public.

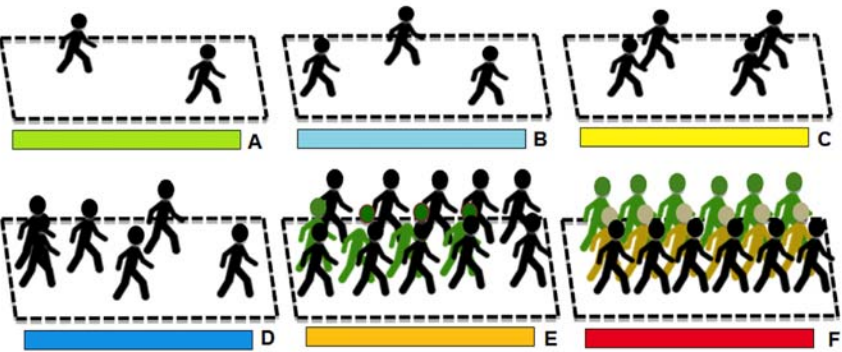
3.3 Local Scale

After analyzing the city as a whole, defining the main connectivity axes and the attraction points in the district scale, it is necessary to verify if these connections possess the qualitative conditions to receive the structures for non-motorized bicycle transport.

Thus, for the local scale reading, two methods were selected, which, just like the scale of the city and the district, possess the same conceptual basis. However, they evaluate in a different manner the local space when determining the Service Level (Fig. 3) both in the quantitative mode (FRUIN, 1971) and in the qualitative mode (SARKAR, 2003; KHISTY, 1994).

The Service Level methods, either quantitative or qualitative, stem from the need of the dynamic understanding of public space by the pedestrians. Equally from their need to utilize the walkways, no matter the quality and appropriate

Figure 3 – Level of Quantitative and Qualitative Service, respectively
Source: Fruin (1971); Ferreira and Sanches (2001). Adapted by the authors, 2017.



		Security	Maintenance	Effective Width	Security	Visual Attractiveness
Block	1					
	2					
	3					
	Average					

Quality Index	Condition	Levels	Color
5	Excellent	A	
4.0 to 4.9	Optimum	B	
3.0 to 3.9	Good	C	
2.0 to 2.9	Fair	D	
1.0 to 1.9	Bad	E	
0. to 0.9	Very Bad	F	

dimensioning of the use proposed by the pedestrian. Therefore, if for one thing, the quantitative method evaluates the moving capacity in a system, the qualitative method evaluates aspects that have a direct influence upon the utilization or not of a certain infrastructure.

The method of the Qualitative Service Level, upon evaluating the structure of urban space, makes the reading possible and the proposition to do alterations in specific places, in order to attract the biggest number of people to these structures, whether through covering the distance on foot or by bicycle. It means that any urban space with no vitality tends to be avoided due to the feeling of insecurity that this space conveys to people. On the other hand, Gehl (2010) considers that the quality of the infrastructure has a direct influence on the vitality and security of the public spaces, which are no longer just passageways, becoming permanent by virtue of the increase in the co-presence of people.

It is thus considered pertinent to utilize the Qualitative Level of Service in order to determine the capacity of the infrastructure for the movement of pedestrians and cyclists consequently.

4. METHODOLOGY

Through selected methodologies, Space Syntax, Urban (De)Centralities and Qualitative Level of Service, the urban space conditions are verified for the

development of movements through non-motorized modals, giving priority to the use of the bicycle as an everyday transport model in the city (Fig. 4).

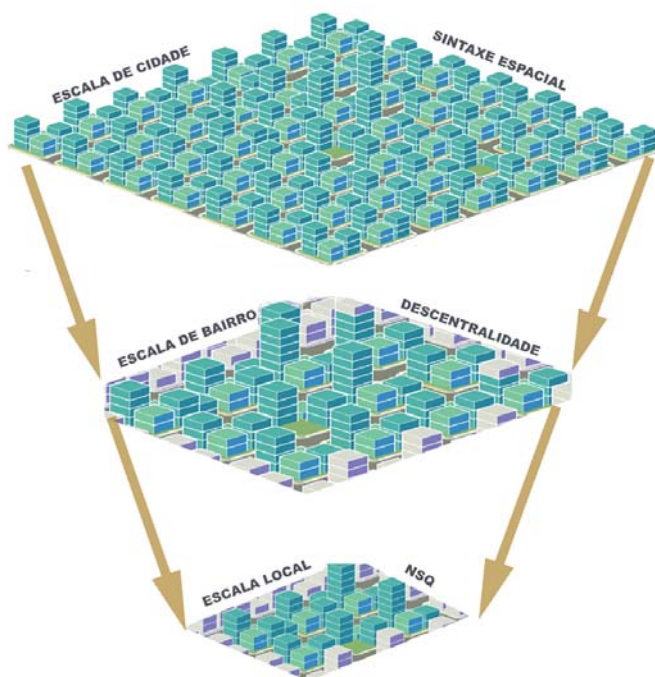


Figure 4 – Reading multiscales and analysis of the urban environment
Source: Lanziotti (2016).

The criterion utilized for the application of selected methodologies and the respective outline necessary for the study is divided into three parts, in accordance with the reading scales of the proposed urban space. The first step consists in the application of the Space Syntax methodology, in order to identify the main connectivity hubs of the city. The second step considers the portion of a certain area by virtue of the syntactic level of accessibility around one hub of the road, whose Urban (De)Centrality indicates an area of bigger attractiveness for users of urban space. Finally, starting from the portion of the previous area, in one of its sections the Qualitative Service Level methodology is applied, in order to verify the quality of the space for non-motorized transport and its respective activity.

4.1 City Scale – Space Syntax

It is the scale of the city that makes it possible to identify the main hubs that conform the urban space and demonstrate the ordering and indicate the expansion directions of the territory. In order to define which area of the city should be evaluated in relation to the other methodologies, the local and global integration graph is generated in terms of the topological relation among all axial hubs that make up the roadway system of the city. It is therefore possible to identify the main natural movement hubs, indicated in the methodology of Hillier *et al.* (1993).

After the reading and selection of the most relevant hub in relation to the others, the locally parameterized graph is generated, in order to visualize the influence of such hub in the scale of the district. This provides for higher assertiveness in the identification of the possible Urban (De)Centralities, as through local integration the relations between the relatively immediate hubs are evaluated. This, though not representing a metric distance, encompasses in a general way the influence of a certain hub upon an area that borders it.

4.2 District Scale – Urban (De)Centrality

Based on the determination, through Space Syntax, of the potential area for developing urban mobility, the next portion is characterized by a fraction of the hub that presents the Urban (De)Centrality of the highest attractiveness within the urban area. This Urban (De)Centrality, due to its scope, shows its influence on the district scale, essential for mobility due to the possibilities of moving presented by the non-motorized modals.

It is thus necessary to highlight that the district scale does not provide any reference to the administrative unit itself, but to the territorial portion in which the Urban (De)Centrality exerts its direct influence (DUARTE, 1974). Therefore, it is possible to identify the necessary urban diversity for the area to be characterized as an Urban (De)Centrality, thus demonstrating the potential attraction in the scope of its area (shops available in the area, especially geared towards the daily consumption needs, characterized by small retail stores).

4.3 Local Scale – Qualitative Service Level

Once the portion of the district has been defined, the Qualitative Service Level is applied in a section of an area selected by virtue of the quantity, variety and distribution of residential and non-residential activities. In the local scale, the evaluation is conducted from a person's point of view, that is to say, the aspects of the analysis directly related to the available conditions for the daily activities to occur in a comfortable manner for the users of the space.

In this analysis scale, all effective actions are planned in order to qualify the urban space for movements through non-motorized transport modals. Therefore, the evaluations include the variables proposed by Ferreira and Sanches (2001), verifying the infrastructure for pedestrians and the aspects of space quality shared with cycling transportation.

5. CASE STUDY

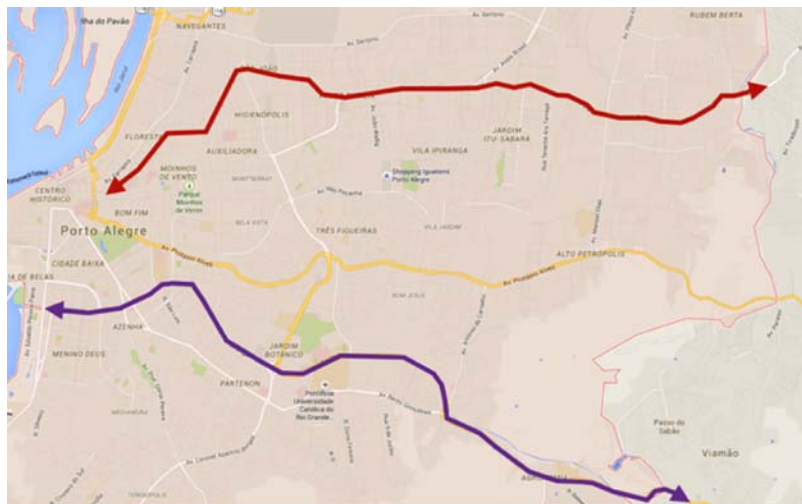
So as to validate critically the aspects considered jointly with the multiscales method of urban analysis for cycling systems, a case study is conducted in the city of Porto Alegre, whose master plan sets forth a system that is 495 kilometers long, with the capacity for 300 thousand travels a day in 2022 (according to the site of the Municipality of Porto Alegre). As currently only around 12% of the proposal has been concluded, either the existing cycle lanes or the anticipated ones are gradually getting out of phase and/or insufficient, seeing that the urban dynamics and socio-spatial demand suffer changes as time goes by.

The analysis in the city scale (Space Syntax) indicates that Assis Brasil Avenue (Fig. 5) conforms an important structuring hub in the city, connecting the Historical Center to the bordering districts and to the metropolitan region from East to West, connecting the cities of Viamão and Alvorada to downtown Porto Alegre, respectively.

When it comes to mobility through non-motorized transport modes it becomes evident that, through Space syntax, defining the inducing hubs of the natural movement of people, both pedestrians and cyclists tend to opt for these hubs for their mobility needs so as to carry out their daily activities.

Therefore, upon evaluating the scale of the city (Space Syntax) it is possible to define the outstanding points that need to be deeply considered in the subsequent analyses, specifically Urban (De)Centrality in the district scale, in order to define the influence of the area as a gathering point for people and attraction of cyclists from adjacent districts of the route in question. It is possible to verify the predominance and influence of the hub formed by Assis Brasil Avenue as an attracter of natural movement, as well as demonstrate the urban appropriation modes. Characterized as a commercial road, either as everyday consumption or specialized, the selected area section possesses the four commercial dimensions proposed by Duarte (1974) in terms of Urban (De)Centrality.

Figure 5 – East-West structuring hubs of Porto Alegre: Assis Brasil Avenue (red)
Source: Google Maps (2016); Adapted by Lanziotti (2016).



Based on this definition, the next step consists in understanding the local scale (Qualitative Service Level), considering the aspects proposed by Ferreira and Sanches (2001). It is thus possible to determine the quality index of the road segment presented for travels by non-motorized transport modes. It has to be stressed that, although the chosen methodology is centered on the evaluation of the quality of the sidewalks, some aspects that make up the index apply to the qualification of the space for cyclists, as both possess the same urban dynamics.

The methodology listed for the application is the Sidewalk Quality Index (SQI) by Ferreira and Sanches (2001). This methodology is described in two stages: (i) the technical assessment stage – through pictures previously defined in five dimensions; and, (ii) the interview stage with users of the road. However, it is considered effective only applying the technical assessment stage, once the consideration carried out at the interviews does not present any significant alterations in the final result of the index.

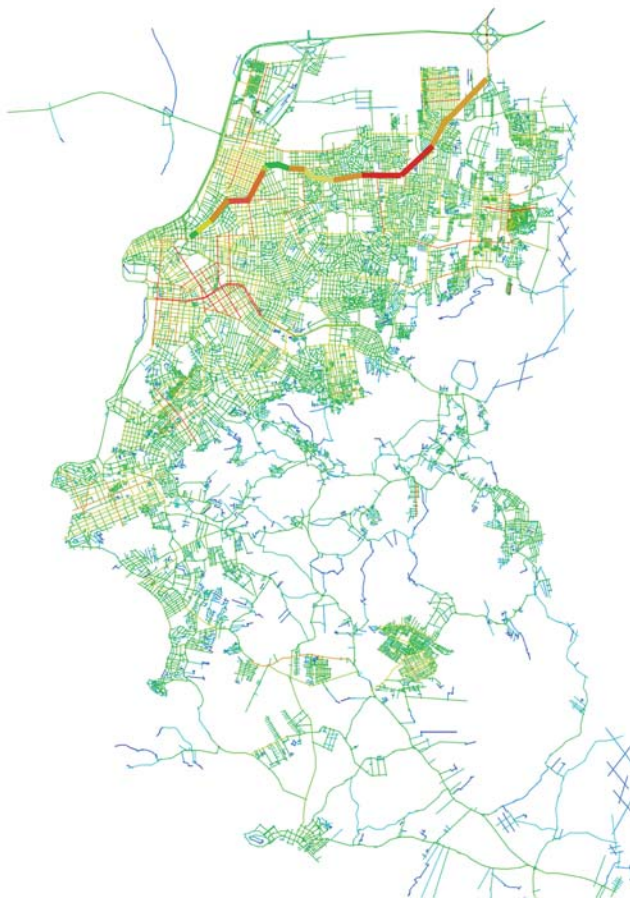


Figure 6 – Syntactic accessibility map of local integration:
Assis Brasil Avenue (highlighted)
Source: Lanziotti (2016).

5.1 Analytical Triad

The proposition by multiscale methodology of analyses centered on three scales (city, district and local) for reading the urban space from the point of view of cycle lane planning, makes the decision process dynamic and paves the way for more effective guideline propositions that are suitable to the human scale. It is possible to (i) establish the relations between use and occupation of urban soil, urban morphology and mobility; (ii) verify the determining aspects for choosing the non-motorized modals, especially bicycle, for the users to move around the town; and, (iii) propose the use of consolidated methods as an input for planning urban mobility.

In the city scale, because the basis of Space Syntax is the theory of natural movement, it comes as a method indicated to the proposal of urban analysis. Its focus on the road system connections, through the axial lines, in general, leads to an understanding of the urban structure as a whole.

The analysis of the syntactic accessibility through the local integration map demonstrated high assertiveness in the definition of areas destined for non-motorized modals, as in comparison with the cycling lanes master plane of Porto Alegre, one can ascertain that the axial lines selected for the research (i) are part of the proposed system, (ii) have a busy flow of cyclists and, (iii) make up part of the system of structuring roads of the city of Porto Alegre (Fig. 6).

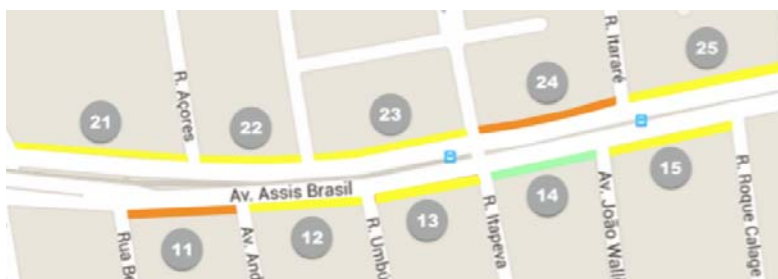


Figure 7 – Predominance of activities in Assis Brasil Avenue
Source: Google Maps (2016); Adapted by Lanziotti (2016).

In the district scale, the evaluation of the Urban (De)Centrality for non-motorized mobility in cycle lane systems is of fundamental importance, because, through its concepts it is possible to define a scope area compatible with the mobile possibilities of the users of these modals. It is also capable of defining the portion of area of priority intervention based on the consumption frequency induced by certain types of attracter activities, directly reflecting on the movement of people in the urban space. Therefore, the Urban (De)Centrality method is appropriate to district reading, as the methodology encompasses fundamental requisites that influence and attract the movement of people across the space (Fig. 7).

Figure 8 – Evaluation of Qualitative Service Levels in a section of Assis Brasil Avenue
Source: Google Maps (2016); Adapted by Lanziotti (2016).

Assis Brasil Avenue can be classified as an Urban (De)Centrality of the commercial hub type (SOUZA, 2009), due to the prevalence of non-residential everyday activities (DUARTE, 1974; SPÓSITO, 1998; SERPA, 2012).



Segmentos de calçada	segurança	manutenção	largura	seguridade	visual	média	Nível de Serviço Qualitativo
11	3	2,6	2,3	3	3	2,8	
12	3,3	4	4	3	3,6	3,6	C
13	3	4	4	3	2,5	3,3	C
14	4	5	5	3	4	4,2	B
15	3,7	4,7	4,5	3	3	3,8	C
21	3,5	2,5	4	3	4	3,4	C
22	3	3	4	3	4	3,4	C
23	3,5	3	4	3	3,7	3,5	C
24	3	2,3	3,3	3	3	2,8	D
25	3	3	3,3	3	3,3	3,2	C

Figure 9 – Evaluation of Qualitative Service Levels of the sidewalks in Assis Brasil Avenue
Source: Ferreira and Sanches (2001); Adapted by Lanziotti (2016).

The evaluation of Urban (De)Centrality for non-motorized mobility proved to be significant, whose frequency of people moving around certain types of commercial activities defined the study section of the next analysis scale, the local. In the same scale, the Qualitative Service Level was used, which evaluates factors related to the quality of the infrastructure and urban space, of primordial importance for attracting people to the urban environment, consequently, inducers of the movement through non-motorized cyclable modals.

The section of Assis Brasil Avenue evaluated (Fig. 8) presents a Qualitative Service Level that could be considered, for its most part, appropriate for the mobility of pedestrians. The highlighted segment represented by block 14 presents average service levels of 4.2, whilst blocks 11 and 24 present service levels around 2.8 (Fig. 9).

The application of the Qualitative Service Level methodology made it possible to perceive space as an attractor of the movement of people by virtue of the quality of the urban space indicated by the significant levels in the evaluated requisites.

6. FINAL CONSIDERATIONS

The present research addressed and applied the methodologies of Space Syntax in the city scale, Urban (De)Centrality in the district scale and Qualitative Service Level in local scale, in order to synthesize the non-motorized modal planning process, giving priority to the use of bicycles, in the city of Porto Alegre. Such evaluation of urban space in multiple scales facilitates the non-motorized modal planning process, coming on the heels of the bicycle route systems, whose methodologies prove to be in line with the analysis scale, resulting into practical data for analysis and comparison, besides speeding up the reading of the urban environment.

The Space Syntax method has the capacity to indicate a great part of the potential bicycle routes in the city as a whole, just like the Urban (De)Centrality method makes it possible to define the importance of a certain area over the other area that composes the district. On the other hand, the Qualitative Service Level facilitates a detailed analysis of the attributes necessary for the development of movements through the non-motorized cyclable modals.

In short, it was ascertained that the application of the listed integrated multiscales methodology paves the way for maximizing the achievement of data and operationalizing all the information, so as to potentiate the basis for decision making as to the planning of non-motorized urban mobility, in the human scale, specifically with regard to cycle lanes.

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