IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN:2278-487X, p-ISSN: 2319-7668. Volume 25, Issue 11. Ser. 4 (November. 2023), PP 23-34
www.iosrjournals.org

Multi-Methods For Evaluating The Appropriation Of Public Spaces In Squares Based On Their Physical Attributes

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Summary:
Context*: Between 2017 and 2020, the city of Cuiabá-MT carried out a revitalization and construction program for approximately 100 (one hundred) squares. Considering its relevance, it was used as an object of study, aiming to understand to what extent these squares, through their physical attributes, contributed to their appropriation as a public space.*
Materials and Methods*: a single case study was applied in multiple units of analysis, divided into four stages. Initially, the essential concepts for theoretical support were worked on. Then, the inventory of the squares of Cuiabá was surveyed before and after the aforementioned program of interventions, for later definition of a sample of eight squares. Based on this choice, field visits were carried out, through which the levels of appropriation were measured, relating them to the physical aspects of the squares studied.*
Results*: This methodological contribution allowed us to understand, through the review, the phenomenon studied in his theory, and through field studies and maps, to prove that physical attributes influence the appropriation of public space.*
Conclusion: *The complementarity of the methods allowed us to mutually analyze physical and behavioral aspects of public spaces, enabling the replication of case studies such as this one in other urban realities.*
Keywords*: Case Study; Assessment Methods; Appropriation; Public place; Square*

Date of Submission: 11-11-2023 Date of Acceptance: 20-11-2023

I. Introduction

Public spaces are places where equality of opportunity, physical freedom and expression to be experienced by individuals is manifested (SERPA, 2004). However, their enjoyment depends on the use given to them. Such characteristics come from the material capacity of these places to promote unscheduled meetings, enabling social relations between citizens. Such capacity depends on its physical attributes, such as accessibility, urban furniture and, mainly, the quality of its equipment (CERQUEIRA, 2013).

According to Miranda Magnoli (1982), open public spaces have wide access and contribute to multiple experiences. Among these spaces, the most well-known typology, especially because it allows greater appropriation by the population and because of its recognized relevance in the urban landscape, is the public square (MACEDO; ROBBA, 2003). Due to its various physical attributes, it presents itself as a scenario of significant value in the construction of a positive image of cities, both for its materiality and also for its subjectivity, as it enriches the affective memory of those who use it (QUEIROGA, 2012).

All these possibilities brought about by the materiality of public spaces, especially squares, are put into practice through the appropriation that is made of these spaces. In this way, it is possible to compare the physical attributes of squares with the levels of appropriation observable in them.

In this area, this study aims to present a multi-method approach (bibliographic research, cataloging, field studies, data tabulation and cartography) to assess the interference of the physical attributes of the public space in its appropriation process, through data obtained in a research carried out in a sample of eight public squares in the city of Cuiabá-MT inserted in the time frame from 2017 to 2020.

II. Materials and Methods

The research explored the potentialities of empirics, placed itself in a practical nature, and took place, as Yin (2015, p.70) demonstrates, through a single case study in multiple units of analysis. From this approach, the city of Cuiabá was understood as a case study, and each square studied was understood as a distinct unit of

analysis, considering the different contexts of each project and each neighborhood. To this end, the research was divided into four stages, each constituting multiple methods of analysis.

Theoretical Review

The first stage was concerned with presenting a review of the specialized literature, in order to establish the conceptual bases for the analysis of the phenomenon studied, bringing the understanding of the main notions and concepts involved in the theme.

The databases consulted are widely and freely accessible – databases of theses and dissertations from universities, online portals fed by scientific journals of wide circulation, such as Scielo, Periódicos Capes, EBSCO and Google Scholar – as well as renowned books in the area of architecture, urbanism, urban planning and urban landscape. The concepts researched were public spaces, public open spaces, appropriation, squares, and urban intervention.

Cataloguing of the Squares of Cuiabá

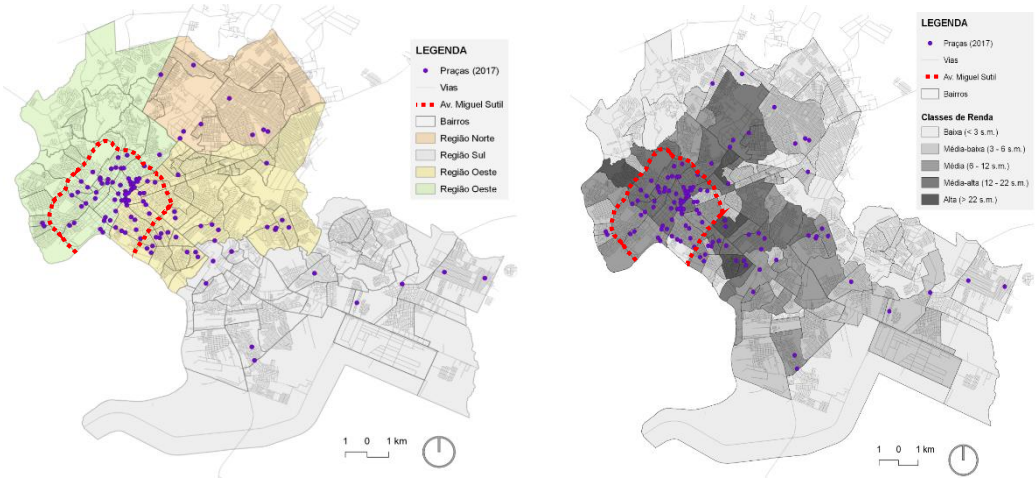
Next, it was essential to map and catalog the inventory of all existing squares in the urban perimeter of Cuiabá, divided into two periods: until 2017 – before the interventions; and between 2017 and 2020 – the period in which the interventions were carried out.

The data used for this cataloguing were collected from official sources of the municipality of Cuiabá - especially the official website of the city hall and the publications of the book Socioeconomic Profile of Cuiabá, prepared by IPDU (Institute of Planning and Urban Development) - and from the list of squares available on Google Maps.

Squares until 2017

The primary information collected was the names of the squares and their location in the urban fabric of Cuiabá, these were used for the composition of maps alluding to the beginning of the time frame, 2017 – beginning of the implementation of the revitalization program of the 100 Squares, produced by the Qgis software with the support of Google Earth software (maps 01 and 02).

Maps 01 and 02 – Survey of existing squares until the year 2017



Squares between 2017 and 2020

In continuity, the inventory of the squares was surveyed, but adding the new units, created during the time frame until 2020, the year of the end of the municipal management responsible for the program studied. To carry out this stage, initially managers and technicians of the city hall responsible for the execution of these interventions were consulted, these managers were in the exercise of their function in the Municipal Secretariat of Urban Services (SMSU), which was responsible for most of the interventions. However, there was no precise survey of all the reformulated squares, only the information that there would be at least one hundred squares.

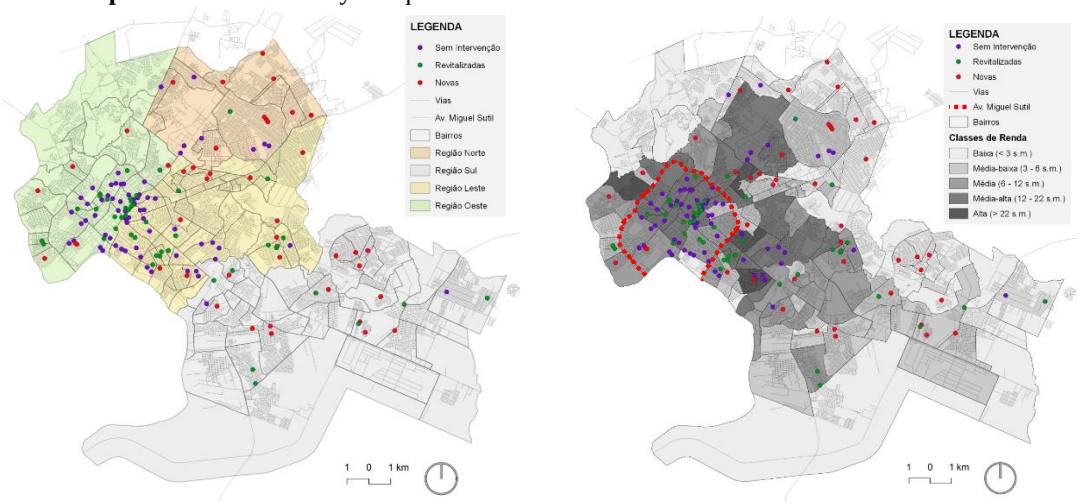
The lack of this survey required a greater work of investigation, which occurred through the individualized search of each new or renovated square. For this stage, the investigation was carried out in a digital environment, on local news sites, on the official web pages of the city hall and the city council of Cuiabá, where it was possible to find the date of inauguration and location of most of the squares. To conclude the last phase of this stage, a new consultation was made with SMSU managers and technicians in order to carry out a general conference of the number of squares covered by the program and, mainly, of the last squares delivered that were

not broadcast in the researched media. This fact occurred due to the impossibility of inauguration during the electoral period in question during this research (November 2020).

This survey was supported by the information and resources available on Google Earth, which allowed to resolve doubts about the interventions by enabling the visualization of old (before the intervention) and current (after the intervention) aerial images. Each square was cataloged according to its location, including neighborhood and geopolitical region of Cuiabá, as well as its area, taken from the Cuiabá GIS (Geographic Information System). In addition, each one of them was classified according to its typology according to the function performed.

From the updated inventory, maps alluding to the current situation were generated (maps 03 and 04), demonstrating the location of all squares, and also differentiating those that were created, from the renovated squares, and from those that did not receive interventions. In this survey, the Qgis software with the support of Google Earth was also used.

Maps 03 and 04 – Survey of squares that received intervention between 2017 and 2020



Case Study

The high number of interventions, totaling 92 (ninety-two) squares and 2 (two) parks, made it extremely difficult to undertake a timely analysis of all the units selected for study, especially with regard to physical attributes and levels of appropriation. For this reason, it was necessary to list selection criteria for the definition of a sample, in order to represent the object studied in its spatial scope – Cuiabá, and thematic – squares.

Sampling

Thus, eight squares were chosen for the sample, which individually correspond to the units of analysis, and represent the city of Cuiabá as a single case study. The criteria for defining this sample were:

1 – *Location by region* - it was defined that, in order to equally cover the entire territory of Cuiabá, there should be the same number of squares per administrative region of the city. Thus, two squares were delimited for each region (north, south, east and west);

2 – *Location by income pattern* – it was defined that, in order to analyze the extent to which economic factors influenced the appropriation of these spaces, it was necessary that each of the two squares be inserted in places with opposite income patterns. Thus, one square should belong to a high- or upper-middle-income class neighborhood and the other to a low- or lower-middle-income neighborhood;

3 – *Size* – it was defined that in order to enable the analysis of the number of people appropriating the squares, it was necessary that they had close numbers of users. Thus, the eight squares should have similar dimensions, in terms of projected and/or implanted areas, especially the pairs of squares in each region.

4 – *Typology according to use – it was* defined that in order to enable the analysis of the appropriation of the squares, it would be necessary for their uses to be similar, since it was understood that different uses could condition different intensities of appropriation.

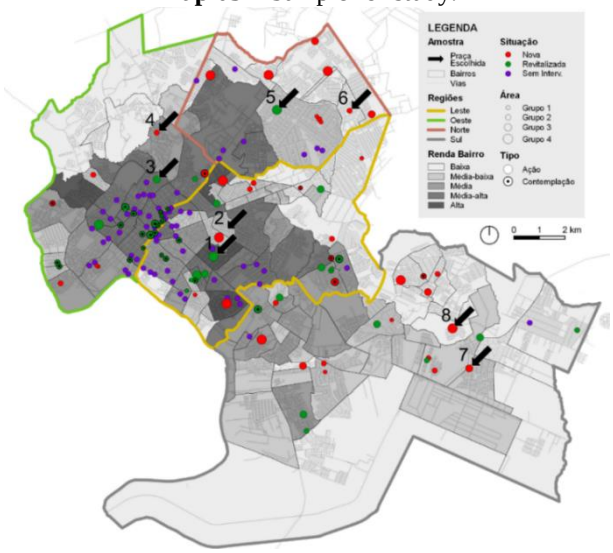
Based on these criteria, the sample (table 01) was chosen, whose spatialization in the territory of Cuiabá was cartographically represented by map 05.

Table 01 - Sample for study - Comparative Table.

		Name	Situation	Area	Kind	Income
East	1	Jardim das Américas Square	Revitalized	Group 4	Share	High
	2	Firmino Pinheiro da Silva Square	New	Group 4	Share	Low

West	3	Mitsuo Doima Square (or Mq. de Pombal)	Revitalized	Group 3	Share	Medium-high
	4	Maria Murtinho de Lara Square	New	Group 3	Share	Medium-low
North	5	Praça do CPA I Square	Revitalized	Group 4	Share	Medium-low
	6	Profª Elizângela Pereira de Souza Square	New	Group 2	Share	Low
South	7	Maria das Dores Moura Square	New	Group 3	Share	Medium-low
	8	Avelino Lima Barros Square	New	Group 4	Share	Low

Map 05 – Sample for study.

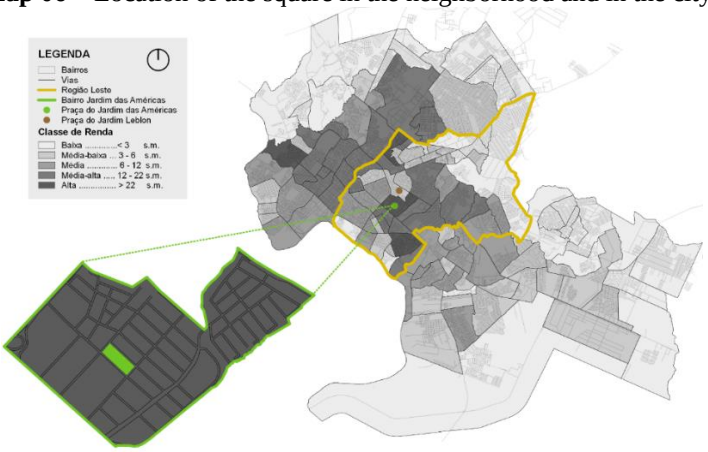


Field Surveys

Before starting the surveys, the location of each square in the city of Cuiabá and in its respective neighborhood was studied using maps 06 and 07. Then, a survey of the use and occupation of the land was carried out within a radius of 500 meters from the respective square (map 08). This was done primarily through virtual visits through Google Street View, and through specific points in person during the field surveys. Subsequently, these data were spatialized in maps and made using the Qgis software.

To start the surveys and organize the initial information of each of the chosen squares, two analysis sheets by Mattos (2017) were used as a basis, which were used in studies of green areas. Thus, for this procedure, part of the information contained in the forms entitled "documentary file" (appendix 1) and "physical-environmental analysis" (appendix 2) was used, which made it possible to select diverse but important information to meet the proposed objectives, such as: topography, types of vegetation found, degree of insolation, accessibility, accesses, activities, lighting, coatings, among other characteristics. Their choices were made to the extent that they allowed us to draw an overview of the structures of the squares studied and to compare them with each other, in addition to assisting in the reading of the relations of their physical attributes with the appropriation observed in the subsequent surveys.

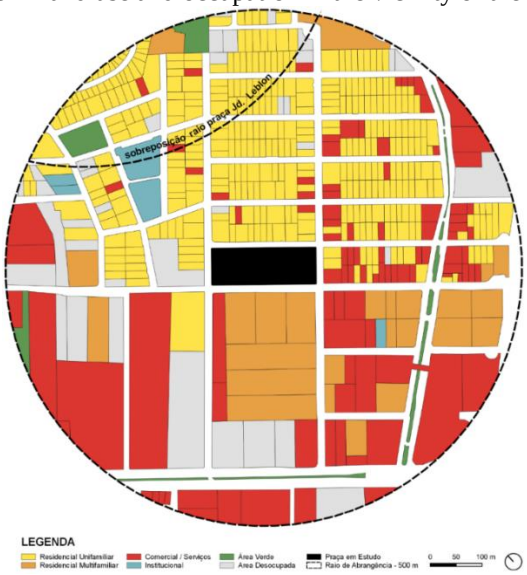
Map 06 – Location of the square in the neighborhood and in the city.



Map 07 – Location and scope of the square in the neighborhood.

Fonte: Google (2020) (adaptado pelo autor)

Map 08 – Land use and occupation in the vicinity of the square.



For the quantitative analysis, the methodology of De Angelis and Castro (2004) was chosen with the form "quantitative survey of existing equipment and structures" which "proposes to survey the existence or not of equipment and structures, quantify them and, whenever possible and necessary, determine the material with which they are made". It can be applied to survey, register, diagnose and evaluate squares, and is based on two fundamental points: physical structure and use.

In the case of this research, dedicated to the study of squares, this form was used to complement the information extracted from Mattos' (2017) files, which were developed, more comprehensively, for green areas. These complementations helped in the diagnosis and evaluation of the furniture and the like, as they allowed us to trace relationships between their physical attributes and the appropriation observed in the subsequent surveys.

From these methodological references, the Documental-Physical Survey table (table 02) was developed, which gathered fields to be filled in with the physical aspects of the implemented project. This table made it possible to objectively compare design issues from different squares by means of standardized criteria. The completion was carried out concomitantly with the next stage, measurement of appropriation, during the first visit to each square, accompanied by a photographic survey.

Table 02 - Documental-physical survey

Levantamento Documental-Físico							
	Endereço						
	Região		Situação		Inauguração		
	Área		Tipo		Renda Bairro		
Caracrísticas Gerais	Formato do terreno			Mobiliários e Equipamentos	Bancos		
	Entorno				Pérgolas		
	Função Utilizada				Lixeiras		
	Edificação				Fonte D'água		
	Ponto de ônibus				Escultura		
	Topografia				Arquibancada		
	Comércio Ambulante				Floreiras com Banco		
	Comércio Formal				Equip. Calistenia		
	Estacionamento				Academia		
	Acessibilidade						
	Conservação e Manutenção				Parquinho		
Conforto Ambiental	Sombreamento						
	Iluminação Natural				Pintura Recreativa		
	Iluminação Artificial						
	Ventilação				Parcão		
Paisagismo	Arborização						
	Espécies Ornam. - Médio e Grde Porte				Quadra Poliesportiva		
	Espécies Ornam. - Pequeno Porte						
	Cobertura do Solo				Quadra Areia		
Projeto	Acessos						
	Revestimentos				Campo Futebol		
	Setorização						
	Arranjo Compositivo				Cabine de Vigilância		

From the information collected in this survey, the map-implantation of the square was made, containing the compositional arrangement and the respective equipment and furniture. On the edges of this map, some photos of the survey were inserted in order to illustrate the real situation of the square, as shown in map 09, presented below.

Map 09 – Map of the implementation of Acsa Vitória Square (one of the squares in the sample studied)

Measuring and Tabulating Settlement Levels

To measure the levels of appropriation in the selected squares, Tenorio's (2012) method of "survey of public life" was used - elaborated from the writings of Jan Gehl. This method, as in the previous stage, consisted of making observations about the context, to support the preparation of behavioral maps. Simple surveys were carried out, but they required observation time and aimed to "identify pedestrian traffic and stationary activities in selected locations" (TENORIO, 2012, p.127). For the pedestrian count, the details were defined as per the objective - age, gender, direction of flow, etc. Thus, the procedure for counting determined that it should be carried out in different periods:

The count is done in winter and summer, in countries where these two seasons are very different. Day and night, on a typical weekday (usually Tuesday through Thursday), and on a weekend day (usually Saturday). The number of pedestrians who pass through a given point for 10 consecutive minutes every hour is counted. (TENORIO, 2012, p.128)

Tenorio (2012) explains that "the techniques range from the simple counting of people who do specific activities in a public space (excluding passing through) to the realization of a behavioral map". In this study, both procedures were performed.

To aid this technique, the Behavioral Survey table (table 02) was elaborated, which has fields that were filled in according to the flows and activities observed. For its application, strategic points of the squares with wide views were chosen, so that the researcher could see different points, visualizing the possibilities of use in each environment, such as: playground, spaces with benches, pergolas, sports equipment, etc. – as well as see the pedestrian paths.

Armed with a clipboard with maps of the selected squares, a walk through the entire area of each square was first carried out, filling in the **Documental-Physical Survey** table (table 02). Thus, this initial procedure also allowed the choice of strategic points for the observation of flows and appropriation of space, and the completion of the **Behavioral Survey** table (table 03).

Next, the researcher positioned himself at the chosen points and observed the direction of movement (passage) and the performance of stationary activities (permanence) counting people, identifying by age group and sex, as well as observing the ways of using furniture and other structures present in the space.

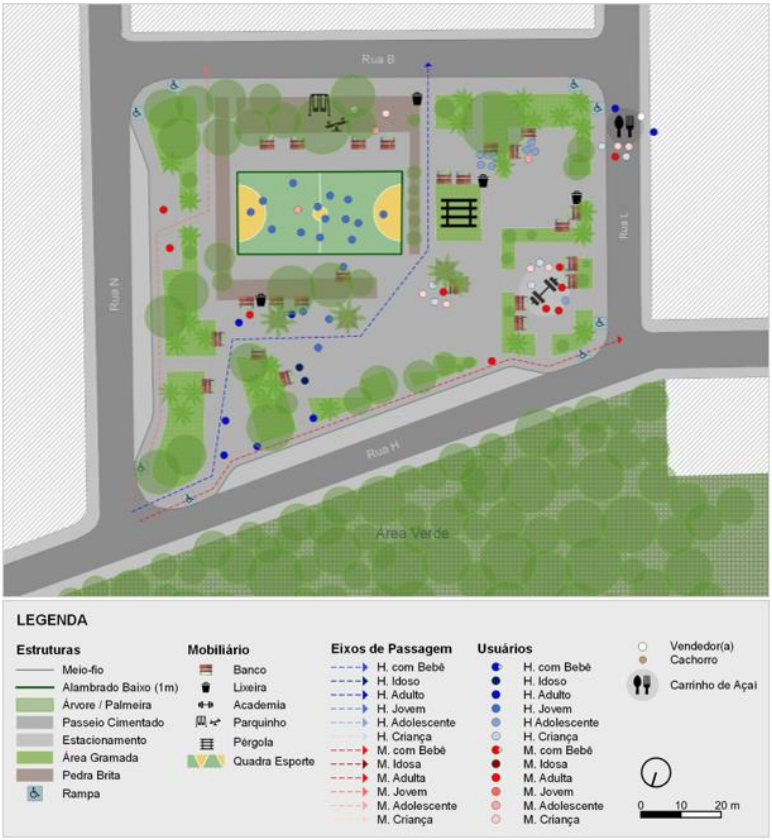
Initially, 4 surveys were carried out, using weekdays - considering Tuesday, Wednesday and Thursday - and weekends and holidays - in the early morning (7 am to 9 am) and late afternoon/early evening (5 pm to 7 pm). Subsequently, an extra survey was carried out, because during the data collection process, due to the Covid-19 pandemic, municipal decrees were published that modified the dynamics of the circulation of people in public spaces.

Table 03 - Behavioral Survey

Levantamento Comportamental								
Identificação								
Resumo		Dia - Período						
		Data	Horário					
Temperatura								
Sol								
Vento								
Eixos Passagem								
Polos Permanência								
Usos Predominantes								
Comércio Ambulante								
Público Predominante								
Setor	Usuário (anos)	Usuários em Permanência			Usuários em Passagem		ΣH	ΣM
		Nº de homens	Nº de Mulheres	Atividade observada	Nº de homens	Nº de mulheres		
	Adulto c/ Bebê (0-1)	A	A		B	B	3.A+B	3.A+B
	Criança (1-12)	A	A		B	B	3.A+B	3.A+B
	Adolescente (13-18)	A	A		B	B	3.A+B	3.A+B
	Jovem (18-22)	A	A		B	B	3.A+B	3.A+B
	Adulto (23-60)	A	A		B	B	3.A+B	3.A+B
	Idoso (60+)	A	A		B	B	3.A+B	3.A+B
	Comercio Ambulante	A	A		B	B	3.A+B	3.A+B

After filling out this table for each survey, the data collected by means of maps were spatialized, and also one for each survey.

Map 10 – Map Appropriation Acsa Vitória Square (one of the squares in the sample studied)



After filling in this table, the number of users of the squares per day was calculated, and it was possible to establish levels of appropriation of these spaces. To this end, a model created by Cabral (2015) was used in this research, which establishes that people in transit and people in permanence appropriate these spaces in different intensities. For this author, "the activity of permanence is more important for the notion of a well-used square than the activity of passage" (CABRAL, 2015, p. 69), making it possible to attribute different weights to them when defining the levels of appropriation. Cabral determined, for the calculation of the levels of appropriation, that permanence in space confers three times more sense of appropriation than passage, for which he proposed the formula "3A + B" (figure 01)

Figure 01 – Appropriation Calculation Formula - Source: Cabral, 2015, p.70

Fórmula utilizada:

3 A + B,

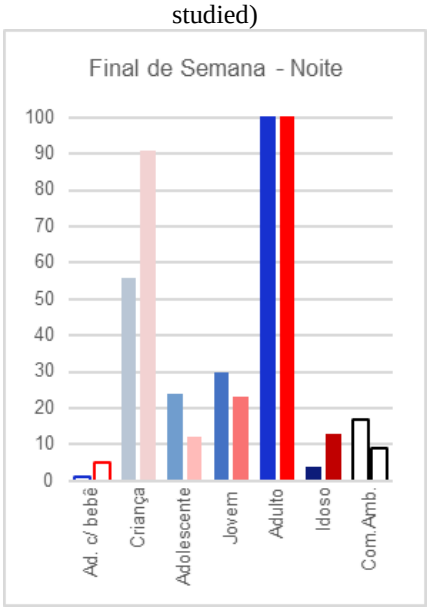
onde :

A = número de pessoas em permanência, e

B = número de pessoas em passagem.

After filling out the **Behavioral Survey** table, graphs were generated with the results of the appropriation calculation for each survey, separated by gender and age group of user, as exemplified by graph 01. The visualization of these graphs made it easier to compare the difference in appropriation between the days and times surveyed, as well as between the different squares of the sample, and to superimpose the information collected in the **Documental-Physical Survey** table**.**

Graph 01 – Levels of appropriation of the Jardim das Americas Square (one of the squares in the sample studied)

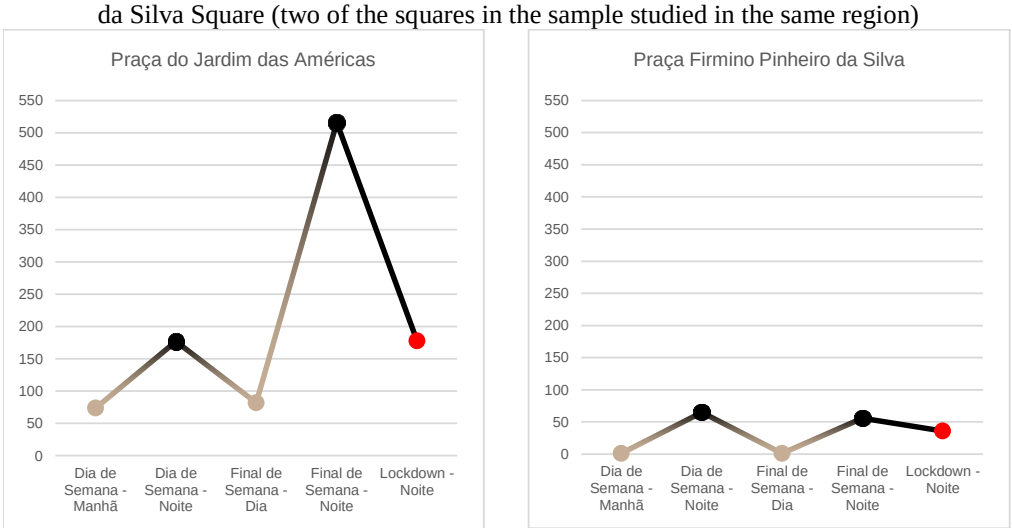


Discussion of results

With the values resulting from the quantitative surveys and the levels of appropriation of each of the 8 squares in the sample, it was possible to draw parallels, and relate which spatial factors and which local attributes influenced the appropriation of these spaces.

Then, the levels of appropriation of squares inserted in opposite income patterns were compared, in order to verify whether the economic condition of the users influences the appropriation of the public space of the squares.

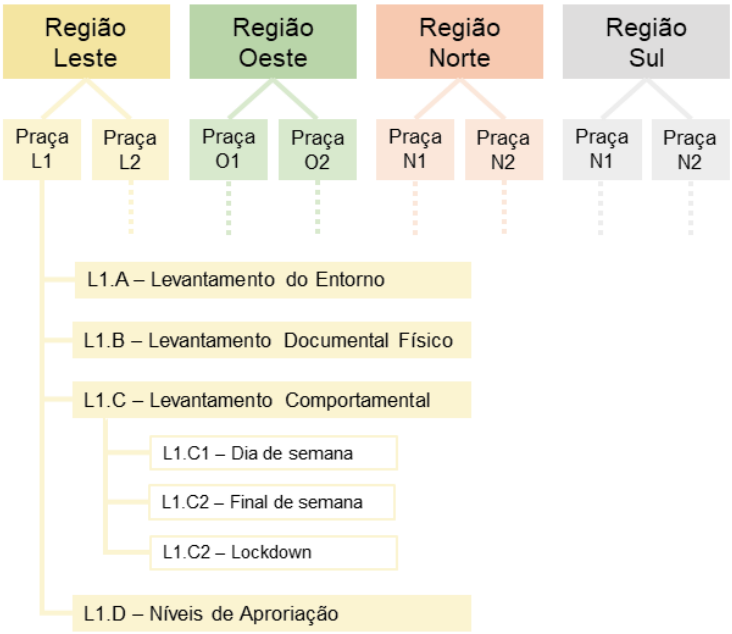
Graphs 02 and 03 – Levels of appropriation of the Jardim das Américas Square compared to Firmino Pinheiro da Silva Square (two of the squares in the sample studied in the same region)



III. Results

From the collection and organization of all the procedures previously applied in the study of each square, it was necessary to organize them in a linear way, to enable the easy reading of the information collected and its respective analysis. Thus, the procedures performed sequentially for each of the eight squares in the sample followed an arrangement guided by insertion in the region and neighborhood, as shown in the following flowchart (Figure 02).

Figure 02 – Flowchart of organization of the methods used



In this way, each part begins by demonstrating the insertion of the square in the region and in the neighborhood, then the use and occupation of the land present in this scope is demonstrated. This step is important because it outlines the scenario in which the square is inserted and its implications, that is, it intends to verify if the surroundings have activities that interfere with the circulation of people and at what times they occur, as well as illustrating the density of occupation of the surroundings, the activities that occur and the road accesses to the site.

From the survey of the surroundings, the internal characteristics of the square are exposed, which were visualized during the first field visit and noted in the Documental-Physical Survey table. This table was based on the methodology of Mattos (2017) and De Angelis and Castro (2004), and is divided into five fundamental parts: general characteristics, design, environmental comfort, landscaping and furniture. All of them served as a support to interpret its influence on the appropriation observed later. As support, a base-map-implantation of the square is presented, developed in QGIS and complemented by a photographic survey, which illustrates the structures of the square. From the survey carried out, considering the procedures used - Documental-physical Survey and its subcategories, it was possible to make notes, and final considerations.

The results from the observation of the appropriation of the square are presented below. For this stage, the table called Behavioral Survey was used, elaborated for the development of this research and has the function of tabulate and organize the count of people and record the activities observed during the visits. It should also be noted that this table generated an appropriation calculation for each user profile, where, for each person who was permanently on the basis of the survey, a weight corresponding to three points was assigned, and for each person who was passing through, a weight corresponding to 1 point.

It should also be mentioned that this methodological procedure is based on the studies of Cabral (2015). In addition to this tabulated presentation, the data were spatialized in the base-map-deployment, in which all user profiles and flows are represented in accordance with the categories and subcategories listed in the table.

Both the Behavioral Survey table and its representative maps were presented five times for each square, according to the five surveys carried out. Initially, the chosen methodology, based on Tenório (2012), defined four surveys: two different schedules on weekdays and on weekends or holidays.

However, exactly during the process of the visits, there was a worsening of the Covid-19 pandemic in Mato Grosso, especially in the capital Cuiabá, a factor that pushed the city hall to determine lockdown. This was done via decree 3,888/2021, which provided for a regulation for public spaces, specifically, item V of article 16 determined the suspension of the use of public spaces in the city, including squares (CUIABÁ, 2021).

This unforeseen event generated another possibility of analysis. Many people, especially those with lower purchasing power, do not have leisure spaces in their homes, and with the increase in the time spent in their homes due to the lockdown, the need to carry out activities outdoors and to breathe other air is also increasing. The squares, because they are open spaces, therefore sanitarily safer, and because of their ease of access, are the first options to meet this demand. Thus, it was understood the need to include a survey during this critical period to visualize the use of these spaces during the prohibition period.

Thus, a total of five surveys were carried out for each square in the end, four original surveys were temporarily stopped, and an extra survey was initiated for each square. This decision was made because it is understood that the squares are free spaces with unrestricted access, therefore, even with the decree prohibiting it, there would be people appropriating the space. For this purpose, the night period during the week was defined for the visits. At the end of its validity, the original surveys were resumed.

The five Behavioral Survey tables, along with the five corresponding deployment maps, were grouped into three topics according to the days: 1 – weekday surveys, 2 – weekend surveys, and 3 – survey during lockdown. This organization made it possible to simplify the process of reading and interpreting the data, but it allows us to suppose that in future studies that apply these procedures, the number of visits may be reduced.

This quantity used proved to be redundant to the extent that the daytime surveys, in general, brought few readings of appropriation, and most of them were detected fast flows. The uses were actually richer at the end of the day, outside of business hours. Therefore, in order to gain time for other analyses and simplify the process of reading public spaces, it is suggested to reduce it to two surveys, both at night, maintaining parity between weekdays and weekends.

Finally, in each part (square) of the chapter, a graph was elaborated for each survey from the calculation of the Behavioral Survey table. The five graphs generated were grouped and interpreted according to the comparison of the levels of appropriation and the variation of user profiles (age group and gender) between the days surveyed.

Tenório's (2012) methodology did not foresee the consideration of such characteristics of users, it only considered total numbers of people, despite making the research process even more complex, this change proved to be beneficial for the results, as it allowed two investigations. Firstly, it allowed us to evaluate which local attributes and furniture attract specific profiles, and secondly, it allowed us to evaluate the diversity of users, in order to understand how comprehensive/democratic that space is in relation to different ages and genders.

IV. Conclusion

The potential of empirics was explored by adopting a single case study in multiple units of analysis. The city of Cuiabá was understood as a case study, and each square studied was understood as a distinct unit of analysis, due to the different contexts of each project and each neighborhood.

The analysis of the distribution of the new squares inaugurated by the program showed that there was a correction, in a certain way, in the scarcity of public spaces in the regions beyond the perimeter of Avenida Miguel Sutil. And it showed that, by analyzing the simple implementation of these public spaces at the scale of the city, without verifying aspects related to their insertion in the neighborhood and their design quality, it can lead to very positive results.

However, in order to verify the true performance of new spaces such as these that can contribute to the daily life of the local population, other analyses are necessary, such as the measurement of appropriation carried out in this research. For this to be possible, it was necessary to mutually analyze physical and behavioral aspects of public spaces. The complementarity of the methods made it possible to accomplish this task.

Studies of this nature, in which different socioeconomic realities are contrasted with visible design disparities, bring to light important understandings about the planning of public spaces. These understandings are only possible due to clear methods of analysis capable of illustrating the performance of urban interventions in public spaces.

The first understanding is that the implementation of equipment of this nature needs to consider its insertion in the fabric of the city. It is necessary to understand the conformation of the roads and the arrangement of the buildings in the immediate surroundings, as well as the uses that these properties perform, and to what extent they can impact the modes of appropriation. In addition, the behavioral reading of the user after the occupation of public spaces proved to be an important thermometer to understand the performance of these spaces.

These readings can become important subsidies for the efficient guidance of technical and political decisions regarding the planning and operation of public spaces. Through this knowledge, it is possible to truly understand the real and priority needs of the population, proposing new approaches, maintaining or renewing concepts and creating conditions for reorientation in critical situations in the urban environment.

In this way, the present work reveals and sustains the importance of the study of public spaces, and through the multi-method analysis listed, it enables the replication of case studies such as this one in other urban realities. This research allowed to deepen the understanding of the way of life of the city's inhabitants, and may constitute a reliable collection of information about the expectations and needs of its inhabitants, bringing clarity about the rights and wrongs of existing solutions, allowing to advance in concrete proposals for intervention in the urban environment.

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