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(In)Visible factors affecting people in the spatial appropriation process of urban green spaces in Brazil

Interferência de fatores (in)visíveis no processo de apropriação espacial de espaços verdes urbanos no Brasil

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Abstract

The importance of green areas in urban centers is related to the environmental quality and the sustainable development of these spaces, as well as the desirable interdisciplinary perspective. In addition to their ecological and microclimate functions, urban green spaces contribute to the establishment of a relationship between the environment and human beings, with the potential of stimulating development of sense of place. This study aims to present possible aspects involved in the process of spatial human appropriation in urban green spaces. Squares in Aracaju were the bases for observations of human behavior, which were related to spatial features. The results have revealed that, along with microclimate aspects, spatial composition, and vegetation (presence or absence), other aspects were related to the appropriation process of squares, such as decision-making based on prejudice, exposure to risks, differentiated perceptions, and sense of vulnerability. Therefore, the qualitative, spatial, and cognitive pieces of information presented may contribute to improve the relationship between humans and environment and, consequently the appropriation of urban green spaces.

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Keywords: Urban green spaces. Spatial features. Human behavior. Decision-making. Environmental perception.

Resumo

A importância de áreas verdes em centros urbanos relaciona-se com a qualidade ambiental e o desenvolvimento sustentável desses espaços, como também o desejável viés interdisciplinar. Além da função ecológica e microclimática, os espaços verdes urbanos contribuem para o estabelecimento da relação ambiente e ser humano, com potencial desenvolvimento do sentimento de pertencimento. O objetivo da pesquisa é apresentar os possíveis aspectos envolvidos no processo de apropriação espacial humana em espaços urbanos verdes. Praças em Aracaju serviram de base observacional do comportamento humano, relacionando-os com as características espaciais. Os resultados revelaram que além dos aspectos microclimáticos, composição espacial e vegetação (presença ou ausência), outros aspectos foram relacionados ao processo de apropriação humana das praças como tomada de decisão com base em pré-julgamentos, exposição à riscos, percepções diferenciadas e sentimentos de vulnerabilidade. Assim, apresentam-se informações qualitativas, espaciais e cognitivas, que podem contribuir para a melhoria da relação homem e ambiente, e por conseguinte, da apropriação nos espaços verdes urbanos.

Palavras-chave: *Espaços verdes urbanos. Características espaciais. Comportamento humano. Tomada de decisão. Percepção ambiental.*

Introduction

A set of studies about environmental quality in cities report the importance of green spaces in urban areas. Green spaces are the subject of investigations in different areas, such as urban climate, thermal comfort, urban planning, and environmental psychology. The results converge and reveal agreement in one argument: they recommend improvements in microclimate maintenance, surface drainage, diversification of urban landscaping, and biodiversity because these items contribute to the promotion of the inhabitants' health and well-being (Abreu-Harbich et al., 2015; Anjos & Lopes, 2017; Baklanov et al., 2018; Cui & Shi, 2012; Gonzalez et al., 2005; Jansson et al., 2013; Kaplan & Kaplan, 2002; Lin & Lin, 2016; Lu et al., 2017; Méndez-Lázaro et al., 2018; Oppermann et al., 2017; Santamouris et al., 2018; Taleghani et al., 2015; Taleghani, 2018). Urban green spaces are also essential to promote better thermal conditions for pedestrians in tropical lands and, consequently, assisting in human appropriation associated with increased surveillance (Wolfe & Mennis, 2012).

Despite the benefits of greening for people and the environment, there are factors that may negatively influence human behavior in urban green spaces. These aspects can be visible and easily identifiable; vandalism is one example. However, there can be some hidden factors in places where a complex of inconspicuous signs contributes to change human behavior and to influence the spatial appropriation of these areas. Some studies report on negative aspects associated to urban parks, squares, and green areas in some cities in the world (Fisher & Nasar, 1992; Fleming et al., 2016; Kuo et al., 1998; Kuo & Sullivan, 2001; Maruthaveeran & Van den Bosh, 2015; Michael et al., 2001; Nasar & Fisher, 1993; Shaffer & Anderson, 1985). These issues may affect users' spatial appropriation of the places. Negative values can mean an uncomfortable climate, a sense of vulnerability (mainly in women and children), lack of maintenance (lightening, walk paths, furniture), and urban violence, among others.

This study aims to present factors that may influence the spatial appropriation process, considering that some of these elements might lead to the avoidance of urban green spaces; something which one may consider more useful and sustainable to urban life. Two hypotheses related to personal human evaluation and environmental features arise: the way through which people process environmental information and make decisions is based on perception of place; and the location could assist in this process, offering positive or negative features in the judgment. Moreover, this research is based on interdisciplinary concepts of environmental psychology, economy, architecture, landscaping, and urban design.

Prospect Theory

Some theories try to explain how human behavior works. One of those theories is Prospect Theory, which refers to making decisions under risks. It presents that considering the gains and losses involved in reaching decisions under risk, people take a stand considering the certainty effect. In other words, choosing under risk contributes to risk aversion in situations that involve sure gains and to risk seeking in circumstances involving sure losses. This theory was developed in economic studies, but it is often used in other areas; for instance, in substituting monetary values of attributes and in expecting results to be coded as gains or losses relative to a neutral reference (Kahneman & Tversky, 1979). As this theory maintains, the act of deciding is not planned, it is an unstructured process that can be explained, but this elucidation does not improve results.

In addition, judgments, which can be classified in prescriptive and descriptive approaches, permeate decision-making scenarios. Rational elements, such as official taxes and situational numbers, are applied in the prescriptive process while cognitive aspects are used in the descriptive process. Particularly in the second case, it is necessary to evaluate what is a risk to someone and whether its damage is considered in a danger scale. This process is subjective and difficult to be managed by professionals. However, in the case of someone in a community or a group with a strong collective consciousness, it may occur in line with rational sense.

According to Slovic (1987), risk concerns may offer a justification for actions taken on grounds of different reasons or they may replace other social or ideological concerns. Sometimes, ordinary people do not have certain information about threats. Nevertheless, it does not mean their evaluation is not valid. On the contrary, their opinions shed light on legitimate concerns that are sometimes ignored by experts or theorists in risk assessments. In this sense, risk communication and risk management efforts, as products, are destined to fail unless they are structured as a two-way process: each side contributes to construct the best solution.

Therefore, in general terms, human behavior may be a product of risk evaluation and management, involving individual or group interests, as well as a scale of gains and losses. This rational process is precedent to spatial experience and cognition. The next sections present some factors that may influence people's attitudes in the studied green spaces.

Risk: types and human perception

Risk is inherent to life from its origin for humans and other living beings' first breath or photosynthesis. Similarly, learning processes are natural for humans. Moreover, everything – good or bad emotions, actions, situations – is processed in a region of the cerebral cortex called limbic system in humans, where a complex of neuronal structures are working together to assist the creation of memories, behaviors, and emotions. The limbic system contains all non-isocortical parts of the cortical mantle, along with the lateral basal-cortical amygdaloid complex. In general, information gets to the limbic system through neuronal fibers in the hippocampus, and then moves to the parahippocampal gyrus and fornix. Next, it moves towards the anterior thalamus nuclei, mamillary corpus, cingulate gyrus, amygdala, and, subsequently, thalamus, resulting in learning and long-memory consolidation (Snell, 2010). The amygdala is responsible for emotional responses, mainly for fear, and the hippocampus is responsible for long-term memory. In other words, when someone makes the decision to play in a park and a bad experience (with fear or violence) is experienced, it is memorized in the brain. Thereafter, this situation may influence future decision making due to the natural process of learning and modeling personal memories and emotions, which activate physiological and cognitive responses to preserve the human body.

Regarding risk, Böhm & Pfister (2005) define it as a situation, event or activity which may lead to uncertain adverse results that affect something humans value. Therefore, risks involve a causal chain between a risk source (a situation, event, activity etc.) and an uncertain adverse consequence. The two basic elements of risk are severity and uncertainty of adverse results. Emotions can also occur as reactions to perceived risks. According to the authors, there are three general categories of causal structure: anthropogenic risks which expose only nature; naturally caused risks, with potential damaging consequences for humans; and anthropogenic risks that may harm humans.

Researchers such as Slovic studied the relationship between risk perceptions and some factors (cognitive, cultural, social, political, and psychological) that construct public opinion and risk perception (Talwar, 2021). These studies consider people's appraisals when they need to decide, define, and classify dangerous activities (Slovic, 1987) in political, economic, and environmental issues. This author claims that the ability to sense and avoid damaging environmental conditions is necessary for the survival – which is also assisted by an ability to codify and learn from experience – of all living organisms. To change the environment, as well as respond to it, human beings need the abilities to (re)create their surroundings and to reduce risk.

People's perceptions of danger or risk generally depend on the meaning attributed to objects of potential concern (Wildavsky & Dake, 1990). This risk perception is also known as Knowledge Theory. Different people can perceive the same situation, object, or group in divergent ways because the human cognition creates meanings according to each individual context (social, cultural, educational, economic, to name but a few aspects). In some cases, there could be conflict in knowledge of risk, mainly if it involves value judgment between private and public or

individual and collective levels. People may know about the benefits of their decision to the community, but if it requires taking personal risk, the individual sense overrides the collective. Values and moral assessments can also influence risk perception; in this case, highly altruist people tend to perceive greater global environmental risks (Bhöm & Pfister, 2005) while highly selfish people are likely to show reduced awareness in relation to environmental concerns (Steg et al., 2001).

Focus on risk consequences may lead to emotional responses. These can be prospective, such as increasing fear from anticipation of a robbery, or may be retrospective, for example a panic crisis from suffering physical violence. When people focus on moral righteousness, they experience ethic-based emotions, which can be directed to oneself, through guilt when one takes the blame, or to others, through indignation when a person blames someone else (Bhöm & Tanner, 2019).

Real risk, in turn can refer to a location, a fact or a thing that collects many characteristics related to incidents which caused damage for someone, for instance. In general, the community, the police or an organization have gathered and classified several of these events as dangerous. On the other hand, potential risk regards a location, a fact or a thing that has features of one that was classified as dangerous. It causes association to risk even though there is no registered incident. Vulnerable groups can consider real and potential risk as similar because they are not prepared to be exposed to it.

Therefore, if there is any action involving a kind of risk, there is a process in operation to offer a response, which could be rational or irrational, depending on the perception and the cognition of each human being. This decision will assist the construction of cognitive maps, built based on the experience of sense of place that will regulate human behavior in spaces (Gifford & McCunn, 2018).

Land uses

In an urbanized and contemporary society, the development of urban green spaces has become an integral component in most urban city planning processes (Maruthaveeran & Bosh, 2015). A variety of people recognize the importance of vegetation in cities, mainly in bigger ones, and they are seeking to live close to these places, which can offer some options, such as parks, woods, or squares, that promote health and well-being (Hartig et al., 2003; Liu et al., 2019), as well as physical activities. In general, historical areas or larger urban centers face more difficulty to insert greening surfaces and trees in a consolidated and arid complex of coatings and urban canyons that influence microclimates.

In addition, green spaces can offer opportunities for social meetings and contacts, which contribute to increasing relationships and connections among the members of communities or neighborhoods. According to environmental psychology, sociability depends on a strong connection with the location (regarding the quantity and quality of friends and neighbors associated with the place). The neighborhood is a link between individual and society, environment, and human being, and it can help one in developing familiarity with the area (Milgram, 1977; Moser, 2018). Moreover, the creation of social bonds propitiates a sense of safety and belonging to the community, which goes beyond the courteous relationship among neighbors, changing the sphere of urban identity that has been built through a frequency of encounters and developments of affection (Moser, 2004).

Considering the previous discussion, a landscape design focused on an unblocked view of pedestrians and a policy implementation by security agencies may provide more occupation of urban spaces. In addition, the positive correlation between the diversity of land use and its activities (pedestrian flows and concentrations) leads to increasing surveillance and urban life in cities (Jacobs, 2011). Different patterns of activities may induce more “eyes” towards urban green spaces and assist in the prevention of crime and violence that happen in an opportunistic

process. Furthermore, special equipment or land use in immediate surroundings, such as churches, schools, and grocery stores can promote a flow of people through the green space and keep some urban life alive.

Additionally, the vulnerability sense is highest in areas where there are opportunities for hiding someone (refuges for offenders) offered by vegetation (lowering visibility) or where the space provides a few ways of escaping for potential victims. Green spaces with lots of places for refuge are considered environments of stress and attentional fatigue (Fleming et al., 2016).

Therefore, given the results of studies presented above, small spaces like squares have an advantage in relation to parks because they can amplify the possibilities of visual contact for pedestrians from one border to another, thereby facilitating the establishment of more connections among neighbors and contributing to an improved sense of place.

Environmental quality

The climate influences vegetation and, consequently its maintenance. Equatorial and tropical lands present higher levels of humidity and solar radiation throughout the year than other kinds of weather, which result in rapid growing and reproduction of most species (trees, grass, and shrubs). Constant maintenance is fundamental to preserve the quality of the original landscaping design, given that it ensures good visibility for pedestrians, sidewalks free of tree branches and shrubs, and unobstructed functional lighting. This action contributes to increasing the sense of safety, mainly among women and children (Jansson et al., 2013; Madge, 1997). Most urban green spaces, such as parks and squares, are regarded as public rather than private sites that request more desirable attention. Some factors like dark areas, signs of vandalism, trash deposits, abandoned vehicles or damaged furniture, overgrown vegetation, and drug use cause the feeling that the location should be avoided because it may be an unoccupied place with unsafe conditions. In this sense, one would see no need to check registered numbers of physical violence, robberies, and other crimes with official agencies and the police in sites under such conditions, for they give the understanding that they are dangerous. Therefore, as it was previously mentioned, spatial perception depends on subjective judgments and personal cognition.

According to Dahlberg & Krug (2006), violence is a human experience that impacts life in several ways. Overall, almost everywhere in the world can experience some form of violence and a sense of vulnerability, but people or communities from each country and region may react to them differently. For instance, some populations are used to being more tolerant to levels of vulnerability that imply changes of behavior, mainly in public spaces. Mostly in Latin America, these modifications are driven by aspects of cultural, social, or economic dimensions. This makes one more resilient having to live with urban violence than others. Therefore, adjustments take place in the human processing of information concerning risks and life preservation. Gifford & McCunn (2018) mentioned that aspects of a physical environment can change the relation of spatial cognition; consequently, they can influence the elaboration of cognitive maps and sense of place.

In short, a well-built environmental design may contribute to diminish the occurrences of situational incidents, leading to spaces less likely to be afflicted with violence and more prone to be monitored by users (Kondo et al., 2018).

Methodology

This qualitative and observational study was characterized by a multi-method approach and in this case, it involved topics of Environmental Psychology, Architecture and Urban Planning and Urban Climatology that were applied in the environment to support the hypothesis. Using Prospect theory, human perception and cognition,

environmental quality of open spaces, land uses of surroundings associated with observational tools such as elaboration of behavior maps about the flow and concentration of people.

The microenvironment is made by squares located in Aracaju, the capital in the state of Sergipe, at a latitude of 10°90' S, longitude of 37°07' W, and at an altitude of 17m. The city is located on the coast of Northeastern Brazil. The population of the city is nearly 650,000 people, which is considered one of the smallest capitals, given the Brazilian demographic pattern. Its climate is characterized as tropical (Köppen classification: Am), i.e., a dry period (summer season) and a humid period (winter). The average daily insolation rate is approximately 5 kWh/m² throughout the year. This creates a naturally 'stressful' thermal environment. Furthermore, annual air temperature and rainfall data were taken from a climatological series of 30 years. Average minimum and maximum air temperatures reach 24 °C and 30 °C, respectively, in the summer season. The rainy period is concentrated in March to July, reaching a maximum of 335 mm in May, with average minimum and maximum temperatures of 22 °C and 27 °C, respectively (Anjos & Lopes, 2017). The climate conditions associated with other variables may indicate the level of people staying in open spaces because it is necessary to provide several shaded points in tropical conditions for example. Thus, afforestation can improve thermal comfort for pedestrians (Jim & Chen, 2006; Haq, 2011) due to tree distribution, height, and density of tree canopy (Morakinyo & Lam, 2016; Morakinyo et al., 2017) and may provide amenities to the outdoors.

Squares A, B and C in Aracaju were the examples used in this study, as Figure 1 illustrates. In the collected data (that involved 5 neighborhoods and around 5-7 squares in each one), they demonstrated the phenomenon in the best way that is intended to discuss here. Tools of Architecture and Urban Planning (plans, aerial views, landscaping design, characteristics of urban furniture and equipment, scale of open spaces) were used to collect information about environmental quality. The squares were visited during summers and autumns between 2014 and 2017, two days during weekdays and one day on the weekend, in the mornings and the afternoons (avoiding national holidays and local commemorative dates). On the second time, notes about the flow and concentration of people in each square were taken, and behavior maps were elaborated. Pictures, human connections, and identification of traces of uses were also taken for better characterization of each space - Environmental Psychology tools. The collected information was analyzed in relation to the squares features and their land uses of surroundings. The observations did not involve interactions with pedestrians.

Figure 1 brings squares in the same scale for understanding their dimensions, vegetation distribution and located equipment. Although we considered squares A and B as large places, there is a difference between them: square A is located downtown, and its dimensions are not perceived as large for this context because it is a reference place for the whole city. The same perception does not occur for square B which is in a residential neighborhood and with local context. Square C is in the same neighborhood of square B. It has small dimensions, and the buildings of surroundings are very close (streets are narrow and it has local traffic). These characteristics may also influence human behavior in squares, and they will be better associated with authors in the discussion section.

Square A



Square B



Square C

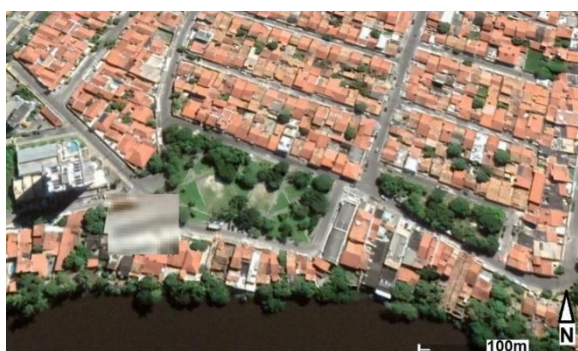


Figure 1 – Squares A, B and C respectively. Source: Adapted from Google Earth (2021).

Results and discussion

This section presents the results and their discussion in line with the notes taken during the observation of human behavior (Figure 2) and with explanations about the characterization of each environment (Figure 3). The discussion was divided into three observations about: environmental quality, sense of place, and land uses, using the behavior maps with the flow and concentration of people in selected squares for examples. These observations do not work dissociated on environments, in fact they represent a complex phenomenon where several factors, visible and invisible, may act in urban context, varying intensities and proportion.

The first observation is that landscape design and vegetation (environmental quality), in addition to activities of surroundings (land uses) influence the decision of pedestrians, such as the choice of sidewalks. The best example of this observation is square A. In relation to environmental quality this place does not have an essential element to encourage people to stay there - benches. The behavior map shows that people prefer sidewalks and points with more pedestrians and spatial visibility. Pedestrians are also used to staying in places close to bus stops (on one side of the square) or street merchant points (in front of the Main Church building that is in the center of the square). A small number of benches are in this area as well as landscaping with organic pathways that have low spatial visibility in most of them. Desired shade is present throughout the square, due to many old trees, which engender a favorable aspect: the incentive of human presence in this area due to the climate conditions. Blue circles on the behavior map represent where people usually stay for a time and are connected to transient activities: bus stops and street merchant points that had mobile furniture. There are no wide places and enough benches to connect to the religious activities of the Main Church which should become a place with more elements to stay. To improve results in this green space, it is recommended to do interventions such as create wider and straighter sidewalks according to current flow of people in the central areas and reduce visual obstruction (to remove bushes where someone can hide and provoke insecure feelings in pedestrians). The main flow of people (red arrow) was observed crossing the area with

a wider spatial vision. It is in accordance with some landscaping design patterns that can affect human behavior in open green spaces (Kondo et al., 2018; Fleming et al., 2016) as well as some studies have associated dense vegetation (shrubs and trees) with a fear of crime in public areas (Maruthaveeran & Van den Bosh, 2015; Shaffer & Anderson, 1985; Nasar & Fisher, 1993; Fisher & Nasar, 1992; Kuo et al., 1998; Michael et al., 1994). Especially large shrubs can support criminal or undesirable activities due to diminishing visibility substantially for pedestrians (Maruthaveeran & Van den Bosh, 2015) which may activate the limbic system for any memory (Snell, 2010). In case of a bad situation, it may provoke several body responses such as fear, panic, bad feelings and to avoid similar situations in the future. As a result, staying in square A may be more stressful in relation to risk and may offer more uncertain consequences (Böhm & Pfister, 2015) than other places downtown. Therefore, square A works as a transient area as the behavior map indeed. Unfortunately, the greater shade area is not useful in this climate condition to cause more people to stay due to the mentioned aspects above.

Different from square A, squares B and C have several benches and other equipment, such as playgrounds and sport courts, to provide accommodation and activities in their places. However, there are concentrations of people close just to shaded points, playgrounds, a high school, and a chapel in square B while concentrations of people were in shaded points and in front some houses in square C. Here, the importance of climate conditions and providing to attenuation of hostility for pedestrians was observed. It was verified there was no use in sport courts during the time that the place was visited in square B because there was undergrowth on them (a vestige of no-use). In the context of square C, inhabitants of surroundings created their own furniture, besides original benches of the place, adapting the place to barbecue activities, children's pool, living "room" (radio, hammock, board games). Its behavior map shows the flow of people in the middle of the square which assesses a safe place to stay as an overriding effect of others.

In summary, square A represents a transient place due to the poor environmental quality which is affirmed by the behavior map, and a lack of benches for example, as it was discussed. In addition, land uses of surroundings may contribute to that - a lack of diversity in it. As in other downtowns of cities, where homogeneous land uses and a lack of sense of place contribute to certain groups appearing that bring some insecure feelings for the population in general, it is not different in Aracaju. To change the surroundings of a square downtown to improve sense of place and human connections, a complex action is needed that involves a large effort of both the public government and private sector.

The second observation made is that to create connections among people and from people to space are fundamental to develop a sense of place. This observation is seen in square B that is closely related to the spatial quality (first observation) that promotes conditions to human appropriation and to surrounding activities (the third observation). According to the background of the commercial area of square A, many people walk everywhere, which could be a positive aspect. However, in this commercial area the flow of people is large and fast, without attention to other inhabitants and sense of place. The engagement level of people to the place increases from square A to B and from B to C. The green space in square B has a little chapel on the corner and a mix of radial and organic landscaping design. Trees of different ages and shrubs compose the area; however, there is medium spatial visibility. Some groups of trees promote desired shade; meanwhile, many benches, two sport courts, a playground, and a bus stop are around the green space, and could contribute to creating a sense of place. Its behavior map shows the flow of people mostly in the peripheral area, with concentrations of people distributed around the chapel, in front of the high school, close to the bus stop and for those activities this place provides some support. Despite the presence of several residences around square B, people were there just for scheduled activities in the mornings or the evenings. The lack of connection among individuals makes the place unfavorable for decisions that involve a group. Need or obligation, not pleasure, motivate activities in this place. Consequently, it is more usual for them to activate, sometimes

unconsciously, alert mechanisms related to personal defense and stress (Böhm & Tanner, 2019) because the human mind naturally fights or escapes given certain patterns of perception (Snell, 2010).

Unlike the above-mentioned square A, the flow of people is mostly made of residents which should contribute to the development of connections among neighbors in squares B and C. In contrast, the neighborhood of square B is composed by people who were not used to being involved in outdoor activities to strengthen the relationship as a group. They would stay in the square for various individual activities at certain times, such as jogging, walking a dog, children playing, and then they would return to their residences. They are self-focused, and the risk of getting involved in other connections is not well evaluated (Slovic, 1987). The location is surrounded by walls, gates, and garage, behind which there are several windows and doors that do not propitiate a direct view to the green space, therefore, not contributing to locals' surveillance and to a safer place as is required (Milgram, 1977; Moser, 2018).

The developed activities, and consequently, possibility of connections in each square increase in order the environment offers more support for each one of them. While squares A e C are the extreme points, square B is the medium point in this supportive scale. In other words, for a transitory place to become a place with identity in its community, it must have shaded points (tropical climate), wide visibility and sidewalks, benches, some equipment such as playgrounds, sidewalk, and board games among others.

The third observation is related to land uses of the surrounding squares and each square (A, B and C) offered different answers for spatial appropriation. We believe that the characteristics of land uses may influence a kind of community that will establish in each place, and consequently it will influence human behavior. According to Moser (2018), the neighborhood and the habitat are the central point of several places and social networks where people are used to being and connecting with other people such as in a workplace, school, leisure, and many others. In general, the peripheral neighborhoods have less attractive points, especially when the income level is low, than central neighborhoods where the infrastructure does not depend on the income level of their inhabitants. In this context, the function of neighborhood connections among its inhabitants establishes some cultural or social meanings, recognized by the community. The land uses of surroundings of square A are made of commercial and services predominately that imply a transitory community, identified by without local interaction and sense of place, and presented high turnover (Moser, 2018). This fact can be confirmed by a lack of residences in the surroundings of this green space nowadays, which is a phenomenon seen in Aracaju and in other downtown areas of Brazilian main cities. However, this area had concentrated several residences of upper and middle-income of local society until the last century. The well-heeled residences and their wooded backyards were located on the blocks around the Main Church and they became stores, service establishments and parking lots nowadays. This process has still resulted in a lack of people in the public spaces after the commercial schedule, holidays and on Sundays has attenuated the connection among people and sense of place mainly.

Squares B and C have the same context: the residential neighborhood. Both places are in the same area of the city, far from around 6 km of downtown. However, both squares have different spatial appropriation. Square B has surroundings composed of an individual house in its private terrain, with more than one car in the garage or swimming pool. In this context, the comfort provided by a private structure (air condition, electronic device use, feeling of security) does not compete with public space with climate hostilities and community's characteristics. High-medium income inhabitants of this place are friends in public, but they are centered in their private lives, and we classified them as a diffuse community, according to Moser (2018). On the other hand, the community established in square C seems as a parochial community that has several interactions, connections and sense of place, essentially it has turned itself inward and isolated from the outside. In this context, the private terrain has more than one house in most cases or does not have free space for leisure. Thus, the public space of square C represents an option for the low-income population to move some activities of the private sphere to the public ones. In general, the popular levels of society have developed stronger connections, so people used to assist and support each other. To maintain these

relationships, the distance between private and public spaces is minor in comparison to square B. Therefore, it was observed that dwellers used to cross the street towards the square to sit and talk, acting as if the place was their private living spaces, as the behavior map shows (blue circles). In addition, people were taking care of the area, engaging in activities such as sweeping leaves, and pruning trees and shrubs. Dwellers also customized benches and some of the pieces of furniture. This open space has two small open spaces that are composed of many benches, a sports court, and a playground. The landscaping design is not the strong point for organizing these spaces, which have a lot of old trees. Additionally, from the border, all spaces become visible. A mix of trees and shrubs are presented on both spaces, offering desirable shaded areas for pedestrians in the tropical climate. A small church is in the surroundings, along with local commercial points or stores and several residences.

Moreover, square C was the only space where dwellers questioned us about the purpose of our observations which reinforces the parochial characteristic. This means that some eyes were monitoring the space and I was identified as a stranger in this environment like the theory that windows and doors facing to the public space are working to observe it and are also restricting suspicious behaviors (Jacobs, 2011), which transmits less sense of vulnerability to pedestrians and contributes to develop a strong sense of place in the community. The involved risk in this space is lower due to the strong connection created in the group (Slovic, 1987). It was evident that people were watching us in other squares, but they did not mind the observations or made the choice to keep their distance.

To encourage human appropriation in urban open spaces and in tropical climates, the existence of shade is essential - something the three places studied are accomplishing. In addition, the quality of shade presence is even more important because some kind of vegetation or construction can obstruct the total or large part of the vision of pedestrians and cause a sense of vulnerability in case of some assumed risks, such as thieves, robberies, and violence. To avoid this, trees are more desirable than shrubs in the composition of a space with wide sidewalks, which decreases the possibility of violence (Dahlberg & Krug, 2006).

The influence of neighbors and land uses were observed in the three squares. When the surrounding areas include a mix of land uses, such as residences, stores, and small businesses, they have the potential to create a safe environment due to different work times and kind of peoples' attraction. Some land uses generate flow of people, and a certain number of individuals are desirable in a space to keep it alive. In the case of square C, the stores cause local flows and connections, unlike square A, which motivates flows in the city's level (another coverage scale).

Physical distance between private and public spaces may contribute to creating a positive relation as their boundaries merge and several doors and windows are closer to the squares. Moreover, residences of square C are closer to other dwellings and to green spaces than those in squares A and B. In general, this particularity only happens in low-income neighborhoods, given that, with less spaces in residences and between them, inhabitants are used to going outdoors to do a lot of activities, consequently creating strong connections with the community that are described by Milgram (1977) and Moser (2018). In some economic levels of society, people are usually less resilient to thermal discomfort, and they prefer to stay in acclimatized rooms rather than going outdoors, mainly in the tropical climate.

Therefore, people do not use open green space just because it is there or because city planners or designers wish they would (Jacobs, 2011) or due to mandatory legislation. Some environmental quality is required for improving human appropriation which will depend on some visible or/ and invisible factors in complex interactions.

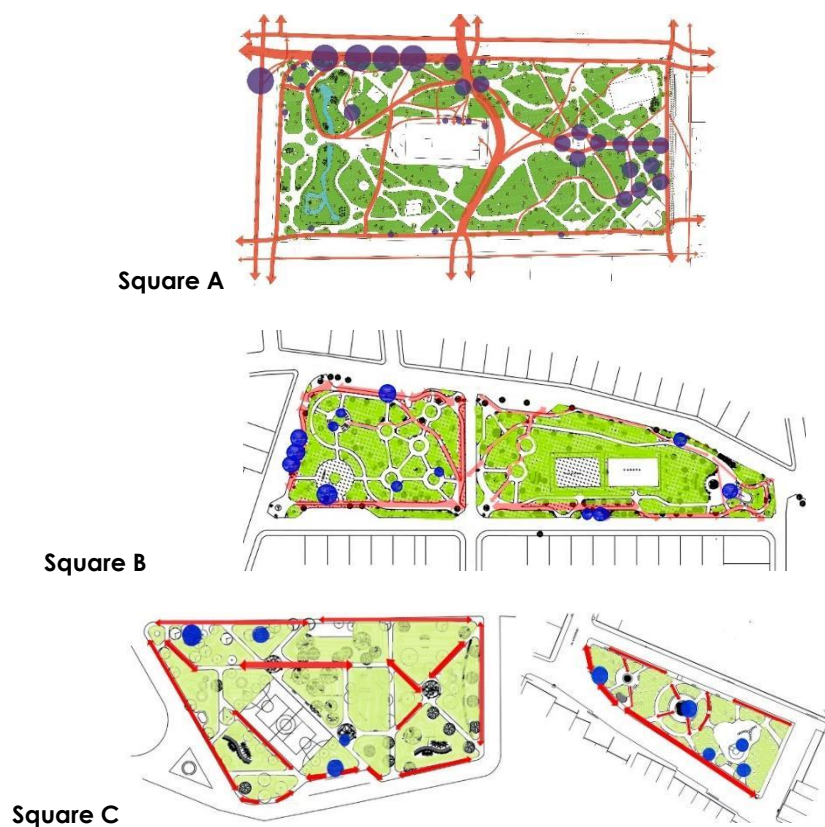


Figure 2 – The behavior maps of squares A, B and C respectively where red arrows are flows of people and blue dots are concentrations of people. Source: Adapted from PMA (2014).

Square A



Square B



Square C



Figure 3 – Features of each urban green space. Source: Authors (2018).

Conclusion

Some concerns that may influence spatial appropriation in urban green spaces were the focus of this study. Despite the benefits to human beings and to the environment, these areas are less useful in some communities and neighborhoods, being criticized due to associations with negative aspects and feelings in some cities. This research promoted an investigation in literature from a variety of topics in some knowledge subjects to establish relations between monitored human behavior and urban green spaces, ranging from Economics to Architecture and Urban Planning.

The green open space is an urban territory where several factors act and influence human behavior. This human behavior is a result of an invisible phenomenon from human perception and cognition, making decisions under risks, sense of place in association with visible factors such as environmental quality, land uses, climate conditions and the kind of communities. Therefore, each square in the city may have the potential to develop from identity to places and strong connections to fear and violence. In the urban context, squares may be a potential green space for people connections, mental restoration, and leisure as also for degradation and marginalization depending on invisible and visible factor actions.

- The analyzed squares are public areas that represent some of urban green spaces in the city. Regular maintenance is required in all of them. Moreover, some appointments were observed:
- Landscaping design should be adapted to current human activities and local needs.
- Trees and shaded areas are required, given the tropical climate conditions; however, clear, and wide spatial visibility is essential for pedestrians, which requires less shrubs and small trees close to sidewalks.
- Urban furniture, such as benches, is required in enough quantity and quality for people staying in these places and for the promotion of sense of place.
- Local and small commercial activities around the urban green spaces may generate flow or concentration of people in neighborhood scale. They contribute to adding diversity in land uses.
- Residences around the squares contribute to creating invisible eyes, which promotes feelings of safety on all weekdays and on weekends mainly.
- The social and economic status of communities or neighborhoods, in addition to dimensions of green spaces may influence spatial appropriation. In this sense, the low-income neighborhood (square C) shows more connectivity and sense of place than others.
- The square A is a reference for all (city scale), so it is possible this square did not work as one in the peripheral neighborhood because the downtown is a point of attraction for people and activities in the whole city and it would make the space more transitory.

In addition, here is the subjective factor which depends on individual judgment and cognition, further it is influenced by environment features and sense of place. In relation to the characteristics of urban green spaces, managers, city planners and designers may make the difference if they work with a multi professional team. Furthermore, for the development of sense of place in a group, it could be interesting to elaborate an educational program focused on elaboration of connection among dwellers and encouraging appropriation of place to affirm it.

In conclusion, this study has highlighted a multi-method approach to understand the complexity of the urban environment. It is a flexible approach, and we believe it may be different in other urban environments according to people's features mainly. The important point is to be open-minded in introducing new approaches and theories to evaluation.

Data availability statement

The dataset that supports the results of this paper is available at SciELO Data and can be accessed via <https://doi.org/10.48331/scielodata.Z9ZZEO>.

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