Trans-disciplinary perspectives between people and environment: a case study of open public spaces in Rio de Janeiro

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Abstract

Many efforts are made to bring new trans-disciplinary perspectives in urban form. This paper is part of a research project about physical and behavioural approaches to the study of urban form, and it is grounded on hybridisation for a holistic understanding of complex and dynamic interactions between people and place. UNESCO states the importance of public space as crucial for sustainable cities and communities: providing ecosystem services, improving health and wellbeing, ensuring social inclusion and economic exchange, offering an opportunity to enrich the quality of life of all urban dwellers, leaving no one behind. However, it seems that few attempts have been made to achieve correlations between human perceptions and spatial patterns. Can we combine hybrid observational human behaviour framework to analyse trends and flows in open public spaces? This study aims to address this question. Two squares in Rio de Janeiro neighbourhood with distinct morphogenesis. Field survey of these spaces was conducted using a framework of observation of the human behaviour. Preliminary results indicate that quantitative and qualitative elements can be used to improve public spaces. The methodological approach was shown to be replicable in systematic investigation of different public spaces. Depending on future results and analyses, this research may shed light to new interdisciplinary perspectives and methods to study human behaviour in public spaces.

Keyword: Human Behaviour, Public Spaces, Rio de Janeiro, GIS

Introduction

This paper presents a study using observational methods to monitor and evaluate human behaviour and urban form. It uses Public Life Tools and Data Protocol developed by Gehl Institute, Municipality of Copenhagen, the City of San Francisco, and from Seattle Department of Transit.

Two squares in suburban area of Rio de Janeiro were chosen based on demonstrated criteria and short review of early studies about places, public life and environmental-behavioural research.

Two digital worksheets to gather physical and social attributes in public spaces were developed using mobile applications and Geographic Information Systems (GIS) and auxiliary tools were used to process and analyse data.
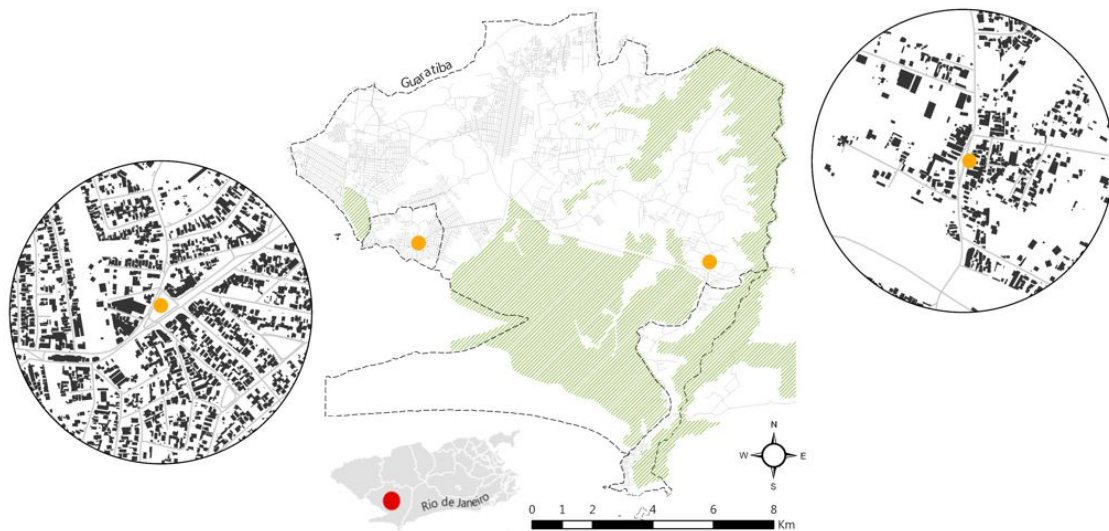
Background

Measuring human aspects of urban form

The environmental-behavioural studies date back from 60's and focus on observational, questionnaires and interviews to comprehend people in place (Whyte, 1980, Gehl, 1987 and Lynch, 1960). Today many organizations and researchers raise awareness about the importance of public spaces to people through studies and programs.

Although recent trending in measure human behaviour in urban spaces use mobile cell phone data (Xu, 2018), digital counting sensors (Williams *et al.*, 2019) and computer vision (Wang and Vermeulen, 2020) can provide interesting data and promising results, social and behavioural aspects to analyse people in place, although it usually lacks high resolution or doesn't aim it. This study will use traditional observational non-intrusive approach and open-source public life tools to study two squares in Rio de Janeiro.

Case Study: Guaratiba, Rio de Janeiro, Brazil

The study was conducted in two squares of suburban area of Rio de Janeiro. The Guaratiba administrative region, which corresponds to 12% of Rio de Janeiro (16.000 ha), have a population of 110.000 and is near 50 kilometres from downtown. Below you can find Figure 1 where Pedra de Guaratiba neighbourhood was located at left area with orthogonal urban fabric, and at right area, Barra de Guaratiba neighbourhood, with sparse and organic urban fabric. Those places are selected due to locals and authorities recognize these squares as neighbourhood centralities.

Figure 1. *Guaratiba, suburban located at west zone of Rio de Janeiro.*

Methodology

Gehl Institute co-created the public life tools and protocols with the Municipality of Copenhagen, the City of San Francisco, and with support and input from Seattle DOT. Such protocols and manual were released in 2017 as open-source tools to measure, monitor and evaluate public life.

These tools and data models were design to fit in spatial databases and GIS. To perform data gathering, the creators proposed pen and paper worksheets to survey public spaces. A digital version of these worksheets was developed with Survey 123 for Arcgis (ESRI, 2017) to automatically input data collection with mobile device and apps into spatial database.

Two protocols were used in our study. The Place Inventory Protocol is a map, coded with distinct symbols that represents physical aspects of place. Benches, vegetation, shelters, bicycle parking, trash cans, lighting poles and street lights, water features, public art and street crossing, pavement, etc. Municipality of Rio de Janeiro lacks of information and master plans about those squares.

The Stationary Activity records postures and actions of people in place, which results in 35 possible cross-joined variables of postures and actions of human behaviour. The Stationary Activity final dataset contains location, time, weather, date, activity and postures of use. An example of data gathering can be seen at Table 1.

The observations were carried from 7 AM to 8PM on business days at 15 and 22 August 2018 and on weekends at 19 and 26 of same month and year. Observations were made in the first 15 minutes time frames of each hour. These data are processed and analysed to provide descriptive and indications and metrics of people and place. External spatial data from multiple public sources are used to add context to researched areas.

Table 1. Activity and positions attribute table from Stationary Activity Protocol example, excluding system fields.

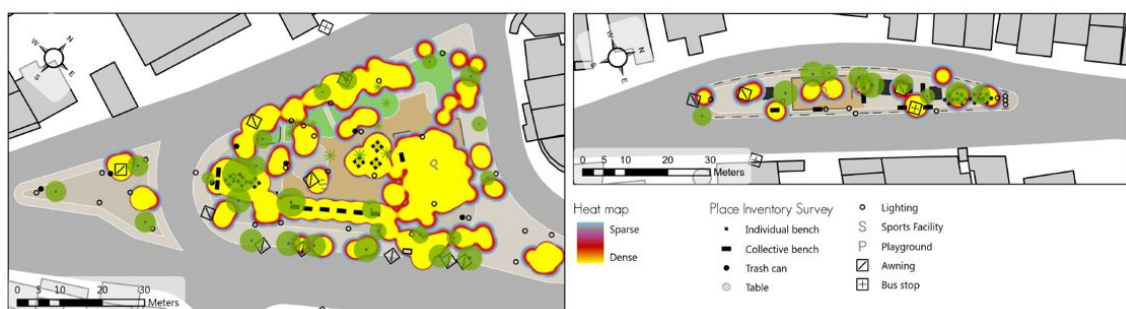| StudyArea	DayType	StartDateTime	Time frame	Weather	TempC	Posture	Activity
CapelloBarroso	Weekday	2018-08-15 08:00	15	Sunny	20	Conversing	Standing
CapelloBarroso	Weekday	2018-08-15 09:00	15	Sunny	20	Exercise	Moving
LargoIlha	Weekend	2018-08-22 14:00	15	Rainy	18	CulturalActivity	PublicSitting

Results

Spatial patterns of activity

The heat map displayed in Figure 2 was taken from entire business day and weekend and shows preferred areas of two squares: Dr. Capello Barroso Square was shows at the left and Largo da Ilha Square at the right.

People sometimes preferred standing in mid-sidewalk, mostly due to shelter in both squares and sometimes individuals dispute tree sheltered benches. Similar patterns of activity were noticed where people tend to look for benches or chairs, or/and sheltered places, which confirms early finds on environmental-behavioural studies (Nasar, 1990 and Whyte, 1980).

Near the bus stop were crowded sometimes, and people sit informal in sidewalk to wait buses which can be dangerous. Sometimes people hop off bus and take a lunch in benches and tables in both squares.
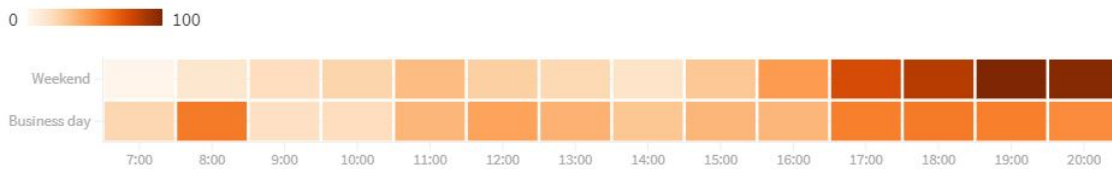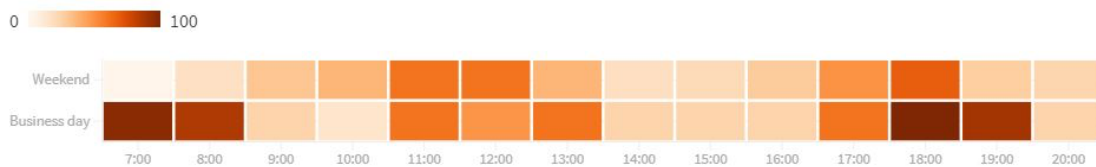
Temporal patterns

Figure 3 and Figure 4 shows occupancy number, which means the total number of people present in a single square during the specific time intervals throughout the day. The majority of space use were noticed in early working hours, from 7 to 8 AM, probably due to travel times, in mid-day from 11 AM to 1PM due to come in and out and late working hours from 5 to 7 PM.

Capello Barroso Square (Figure 3) maintain regular use all day long. At weekends, starting from 5 PM with peaks at 7 to 8 PM, the use increase by 3 times the average total number of users, reaching maximum of 143 at one time interval. This is due to itinerary food market, where 15 food trucks stay stationary and bring urban vitality to neighbourhood.

Largo da Ilha Square (Figure 4) appears to have vacant time intervals and peaks use at early morning and late afternoon, which can indicate a different use of place. Different from Dr. Capello Barroso, this plaza appears to be less desirable and used as support to commercial activity and transport activities.

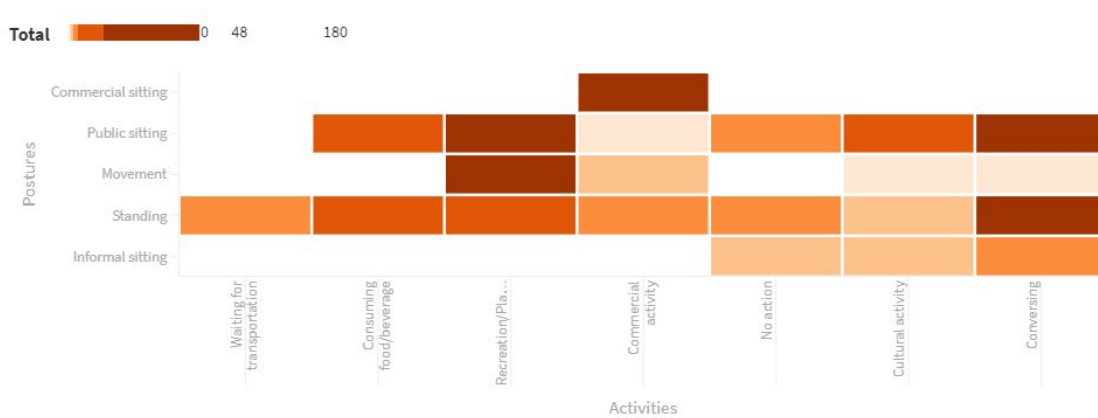*Figure 3.* Dr. Capello Barroso occupancy numbers per time interval (max = 143; %).

Figure 4. Largo da Ilha occupancy numbers per time interval (max = 83; %).

Behavioural patterns

Playground was the most used area, where almost every parent that went to the market or retail shops and crossed through square paths, stopped at least 5 minutes to let children play. The

opposite area was most used by retired elders that played cards for long hours. Usually, these elders stayed all day long and publicly cooked meat in barbecue grill. This behaviour was noticed only in Capello Barroso Square which appears to be more desirable by its users.
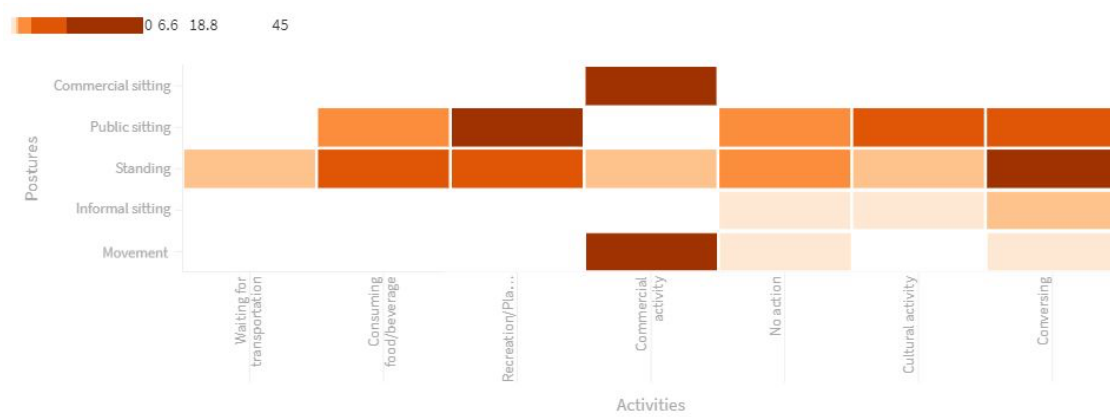
Seated recreational activities displayed in Figure 5 were increase due to retired elders that stayed all day long. Most of the movement were from children's playground activities. Great commercial activities (sitting and commercial) and consuming food (sitting or standing and consuming food/beverages) were noticed due to nightly food market. Sitting and standing for talk was the third most common posture and activity perform.

Figure 5. Dr. Capello Barroso postures and activity records on business day and weekend.

A disparity comparing with Dr. Capello Barroso Square was noticed in Largo da Ilha Square, shown in Figure 6. Less consuming food and beverages activity, probably due to temporary food market and also less elders playing cards and lunching in the afternoon. These human behavioural patterns appear to be intrinsic to Dr. Capello Barroso Square.

While staying all day long appears to be common in Dr. Capello Barroso, behavioural and temporal patterns evidence that Largo da Ilha Square appears to be used as support for other activities, like commercial and transport activities as stated and displayed in Figure 6.

Figure 6. Largo da Ilha postures and activity records on business day and weekend.

Discussions

Some advantages and limitations can be found in any non-intrusive observational including this study. The advantages are typical behavioural data gathering with introspection that questionnaires or interviews scripts cannot show as direct methods to observe general behaviours. Some limitations can be observers bias, surveyor can't presence phenomenon, some social aspects cannot be observed and simultaneous interactions can be hard to input (Marconi and Lakatos, 2003).

The advantages of these protocols provide compatible, scalable, and comparable datasets that can be used across departments, agencies, cities, and regions. Otherwise, the public life protocols have systematic methods to apply and generate results which can streamline those limitations, while some limitations can be solved with complimentary methods.

The results are descriptive in that they not suggest design directions for change *per se*. Although the objective is providing measurements and indicators to support decision making, public policies and better neighbourhood planning. Notwithstanding, continuously monitor public spaces may be not viable to public departments. As an alternative, these public spaces surveys can be deployed on an annual basis, sampling squares or with support of university students and engaged citizens.

Conclusion

The two data life protocols were useful to collect and process experimental data of two public squares in suburban area of Rio de Janeiro. These protocols have potential to support public spaces surveys and socio behavioural interactions at microscale or as (Romice *et al.*, 2017)

defined, pedestrian scale. Other protocols can be used concurrency to obtain desired information or holistic understand of public spaces.

Those results indicate patterns of human activity in public spaces, urban furniture, vegetation and local shops. For example, some squares appear to need more trees to shelter people while sited or standing. Sittable spaces seem to be one of most desirable features, which agree with early finds from (Whyte, 1980).

The inventory protocol gathers important physical aspects of urban form such existing urban furniture, vegetation, pavement and amenities. These data or square master plan do not exist in local town hall, open street maps or other knows resource or repository. The stationary activity protocol simplifies the data gathering important human aspects of urban form at small scale thought short time periods of hours and days.

While the future effectiveness of urban design and management for public spaces in Rio de Janeiro depends of major public policies and citizens participations, monitor changes over time, pedestrian displacement, human activity records with this methodological approach can simplify and become beneficial to identify, plan and manage better places.

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