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LEVANTAMENTO COLABORATIVO DE DADOS MEDIADO POR PLATAFORMA DIGITAL

COLLABORATIVE DATA COLLECTION MEDIATED BY A DIGITAL PLATFORM

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Abstract

This article presents a citizen-driven initiative of data collection mediated by a digital platform, aiming to discuss its potential and possible developments in the context of a new technological culture due to the COVID-19 pandemic. Assuming that digital technologies could be a powerful tool in data collection for the formulation of urban public policies – including citizens as collaborative co-creators –, we present the project *Rumbora se Amostrar*, a bottom-up initiative about bicycle use in the city of São Luís and Grande Ilha, in the state of Maranhão, Brazil. The study intends to contribute to the current debate about the presence of digital platforms in different areas of our lives. It focuses as well the platforms'

role in urban planning and city management through the report of an experience and the descriptive analysis of the results. Furthermore, it demonstrates how the analysis of geolocalized data can reveal important aspects of the human dimension, highlighting women's behavior on the use of bicycles. It also discusses the relevance of these methodologies and their application possibilities for the development of intervention proposals and actions for increasing active mobility.

Keywords: Digital platform, Geo-located data, Active mobility, São Luís City, Citizen-driven initiative

1 Introduction

The effects of the digital revolution had already been widely debated when, in 2020, with the pandemic caused by the new coronavirus, digital technologies became part of the daily lives of thousands of people around the world, whether they were adepts or not. The prevailing reality presents opportunities for further discussions on the role of digital and digitally mediated communication. The COVID-19 pandemic also emphasized the importance of geolocalized data. Studies such as those developed by LabCidade[1], contribute to the spatial reading of the cases dissemination in the Metropolitan Area of São Paulo. According to Tavolari (2020), geolocalized data is essential to measure the impact of isolation policies.

Advances in geotechnologies field, such as the launch of Google Maps in 2005, caused the geolocalized data ubiquity, the expansion of applications based on user's location (Waze and Tinder), and the use of online maps as a basis for the services for searching information (Batty et al., 2010). The popularization of geotechnologies usage can be of great help for urban planning and management, in a two-way movement, from the public to the government and vice versa. It is increasingly common for municipalities to provide platforms and/or applications that allow access to a series of maps and georeferenced data (GeoSampa[2] and SINGH[3]). At the same time, there are initiatives like Colab.re[4], a social network in which users register problems on urban infrastructure, and some city halls, such as Porto Alegre, follow these contributions (Bugs, Bortolli, 2018).

All data produced by a city is relevant for the formulation of urban public policies, and most of the information needed contains a spatial component (Sieber, 2006). Among the data commonly used in urban planning and management are the physical-territorial (topography), socioeconomic (age range), and land registry (land parceling) data (Ramos, 2005). In this study, however, the focus is on the human dimension data considered as important and equally necessary to make cities better places to live (Kahila, 2008; Bugs, 2019).

Nowadays, these data can be produced either voluntarily, on collaborative platforms, or involuntarily, through applications collecting displacement information. Either way, citizens are co-producers through the massive use of digital tools, online maps, and mobile devices with a global positioning system (GPS) (Batty et al., 2012). Therefore, planners and professionals are no longer the only producers and users of information related to urban issues (Rocha, Pereira, 2010; Bugs, Reis, 2017). These diverse data sources can help to understand urban life from the human point of view, those who make the city, the urban environment users (Horelli, 2013; Mehaffy, 2014).

If the potential of digital technologies to support participatory actions from the bottom up was already acclaimed by scholars, and it seemed inevitable that traditional forms of participation would be gradually complemented by digital arenas (Rocha, Pereira, 2010; Horelli 2013; Bugs, 2019), in the current scenario, it reaffirms itself. Anyway, is it time for participation mediated by digital technologies to become a current practice? According to the inclusive vision of the digital revolution, all inhabitants can and must participate in the construction of proposals for urban intervention and city management, and technologies can be a powerful instrument in this task (Mendes, 2020). With this in mind, we present a citizen action for the collaborative data collection on active mobility, mediated by a digital platform. This work intends to reflect on these issues in the context of the new digital dimension experienced. We hope, therefore, to contribute to the discussions that are re-presenting at present about the presence of digital technologies in different areas of our lives and, consequently, their role in urban planning and management.

The *Rumbora se Amostrar* project collected data related to the use of bicycles in the city of São Luís and Grande Ilha, in the state of Maranhão, aiming to highlight the reality and give representativeness to the citizens adept at active mobility in these cities. Active mobility is understood as the one that uses only the human physical effort for locomotion, with the use of bicycles and walking being the most common forms (Saraiva et al., 2019). An increase in the number of cyclists in some cities has been observed during the

pandemic (Clarín, 2020), since it is considered a healthy alternative, relatively cheap, with adequate social distance. The survey was conducted through an online questionnaire, available from December 2018 to August 2019, totaling 808 responses. Among the 46 questions asked, five requested the answer to be given using an interactive online map.

Thus, through the descriptive analysis of the results, the goal is to discuss the relevance of online methodologies for collecting data produced by citizens. Also, it seeks to reflect on the possibilities of using and applying the results for the construction of intervention proposals and urban policies more appropriate to the desires of a hyperconnected society. In particular, stages of the spatial analysis process of geolocalized data are demonstrated, which can assist in the inclusion of human dimension data, with emphasis on women, in the planning and urban management of post-pandemic cities.

The article is structured in four parts. The first presents the context and specifics of the *Rumbora se Amostrar* project. The second describes the data collection method applied and the digital tool used. The third exposes the results, divided into the respondents' profile, gender profile and thematic maps of the geolocalized data. Finally, the last section brings reflections on the study developed and its contributions.

2 The *Rumbora se Amostrar* Project

The *Rumbora se Amostrar* project collected information on bicycle use in the region illustrated in Figure 1, including São Luís, São José de Ribamar, Raposa and Paço do Lumiar, with the primary purpose of influencing public policies on urban mobility[5], in addition to generating results to foster academic research and safeguard society's right to participation in the review, preparation, and monitoring of the Urban Mobility Plan[6]. This year, the initiative received recognition of an honorable mention in the Data Collection and Research category of the VII Prize Promoting Mobility for Bicycles in Brazil[7]. The research data, as well as the material produced (infographics and reports), are publicly available on the project website[8] (free, unrestricted access, mentioning the source).

Fig. 1: Map of the city of São Luís and Grande Ilha. Source: Authors, 2020 and OpenStreetMap.

The city of São Luís and Grande Ilha house about 1,310,000 inhabitants (2010 IBGE Census). The state of Maranhão has the fourth-largest fleet of vehicles among Northeastern cities, which implies approximately 1,620,000 vehicles, according to the National Traffic Department through the National Registry of Motor Vehicles (Denatran, 2018). According to the agency, automobiles respond to 51% of the vehicle fleet in São Luís. On the other hand, the inexistence of data capable of showing the reality of people with active mobility and, consequently, their consideration in the formulation of public policies, confirms the relevance of the project. The lack of statistical data does not annihilate what is perceived on city streets.

In 2017, the city of São Luís prepared its Municipal Mobility Plan (Law No. 6,292) in a package of laws on an urgent basis, without reading the texts in the Chamber, nor popular participation, in dissonance with the principles and guidelines guaranteed and provided for by the National Policy for Urban Mobility - PNMU, Law No. 12,587/2012. According to the PNMU, the bicycle should be considered a priority because it is an active mode of travel compared to motorized transport (art. 6, II). Active transport is displacement driven by human activity, including walking or using a bicycle, rollerblades, scooter, skateboard. People are the main actors in this scenario. Therefore, with the survey, we sought to guarantee a democratic and participative debate based on a diagnosis of the local reality that considers the wishes and needs of the population.

In addition to the theme of active mobility, considering the particularities experienced, the project also investigated how women move in the city, to understand how the displacements of women on the Big Island occur, and to identify the physical, psychological and social barriers faced for them, the vulnerabilities they encounter and the main motivations for making their displacements. The survey proposed a specific block of questions, entitled "*Chega de Assédio*" [No More Harassment, Translator's Note], to give visibility to the problem, exposing the reality to which women are subjected, either on the street or in public transport. In this way, the context and possible similarities or contradictions are identified, given that earlier studies indicate that individual and social characteristics generate different patterns of urban mobility (Vasconcellos, 2016).

3 Collaborative data collection

The structure of the applied online questionnaire and the digital tool used in the collaborative data collection are presented below.

3.1 Online questionnaire

The dissemination of the *Rumbora se Amostrar* project took place through social networks, through organic and driven campaigns. The link to access the project page was informed with a brief explanation of its objectives, the contact of the organizers, and open admission to the questionnaire. After accepting to participate, the respondent was taken to an introductory page explaining how to answer the questions requiring a map interaction, to after, start responding to the questionnaire itself. The last question requested the email address of those wishing to check the project's actions and/or receive future information about the study.

The questionnaire questions can be grouped into four blocks, containing one main question each, as follows:

1. **Who are you on the bike ride?** Questions common to all respondents, about the socio-economic situation, from gender to the occupation. In cases where the respondent declared herself to be a woman, there were questions added about their marital status and number of children, as well as questions about harassment, such as "Have you ever experienced harassment situations when traveling by bicycle?", was answered only by women, users or no users of a bicycle.

2. **What is your relationship with the bicycle?** Questions related to the cyclist's behavior, the existing motivations, or not, to use the bike as a mode of urban transport and if it participates in a similar group. These questions were not part of the potential demand questionnaire, answered only by women who do not use a bicycle. For this audience, the questions turned to understand the willingness to use a bike in their travels (for instance: "What are the three main reasons that prevent you from using the bicycle in the city?").

3. **What do you use the bicycle for?** Questions about the displacements performed by cyclists, to learn where and how often they travel: origin and destination, how much time was spent on trips, which route they travel, and at what time they usually did it, among others.

4. **How do you feel when cycling around the Grande Ilha?** Questions to understand what feelings permeate the lives of people who adhere to the use of bicycles in their routines (for example: "What are the problems faced daily?", "What are the easiest points to ride a bike in the region? And the most difficult ones?").

Table 1 presents the five questions to be answered that required the use of the online map. According to the question asked, the respondent could choose from 1 to 3 events, adding a dot marker representing the location of the occurrence to the map. Therefore, the answers provided contained additional information: its location.

Question	Number of answers allowed
What is the easiest place to cycle along your travels/paths?	Up to 3
Where is the most difficult place to cycle along your travels/paths?	Up to 3
Have you had a bicycle accident in the past two years? If so, where was the accident location?	Up to 2
Which region, neighborhood or intersection do you consider important to have a bike path or cycle lane?	1
Have you ever experienced any harassing situations while traveling by bike? If yes, in which location did it happen? (to be answered by women only).	Up to 3

Table 1: Questions requiring answers with the use of online maps. Source: Authors, 2020.

3.2 Digital tool

Online research platforms are widely used, but, as a rule, they do not have tools for building questionnaires using maps and, so, for collecting geo-referenced data. The *Rumbora se Amostrar* project used the GS - GAUPSurvey[9] tool which, technically speaking, is a fork of Limesurvey[10], both open-sourced. With GS it is possible to create, within the Limesurvey standard questions menu, questions whose answers are given by marking places on the map, in the format of areas (points or polygons) and/or routes (lines), as shown in figure 2. The geolocation is stored by the values of the pair of coordinates (latitude and longitude), exported in the form of a table (*.csv), together with the other answers to the questionnaire. The coordinates can be plotted in Geographic Information Systems (GIS) software, exploring the potential of these computational environments, as well as enabling the creation of dynamic visualizations in Web maps. The tool was also used to support the work of reviewing the master plan and preparing the mobility plans in Serra Gaúcha (Bugs et al., 2019).

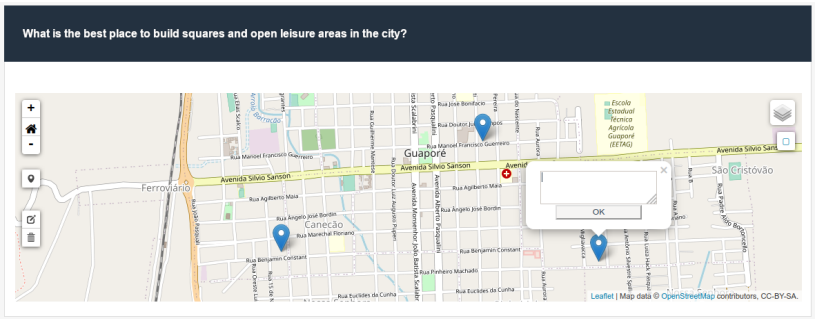

Fig. 2: Graphical interface showing a question that predicts the answer by marking points on the map (GS). Source: Authors, 2020.

4 Results

In this section, the results are exposed, divided into the respondent´s profile, women respondents, and geolocalized data.

4.1 Respondent´s profile

The questionnaire was available online and with open access from December 2018 to August 2019, totaling 808 responses in that period. It was also applied in person, in public places, to expand access to the platform. In rounded figures, 72% of respondents declared themselves to be women, and 28% men. Less than 1% chose another gender identity. Regarding race and color, 34% considered themselves black, 22% white, 43% brown, and only 1% indigenous - see graphs in figure 3. Just over half, 51% of respondents, have a high level of education, that is, attended, or are attending higher education or graduate studies. Respondents between 20 and 29 years old represent 38%, followed by 27% between 30 and 39 years old, 15% between 10 and 19 years old, 12% between 40 and 49 years old, and only 8% aged over 50 years old. Regarding occupation, 28% are formal workers, 24% self-employed, and 22% of students. Besides, 7% work "part time/ "freelance" or work eventually, and 9% are unemployed. Concerning income, 7% did not respond. Of those who answered, 28% earn up to 1 minimum wage, 25% have no income, 18% say they have an income between 1 and 2 minimum wages, 8% of 2 to 3 minimum wages, 5% said they have an income between 3 and 5 minimum wages, 6% between 5 and 10 minimum wages, and 3% above 10 minimum wages, according to figure 4.

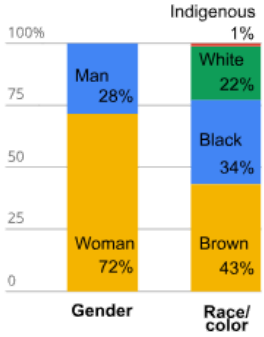

Fig. 3: Gender and race/color. Source: Authors, 2020.

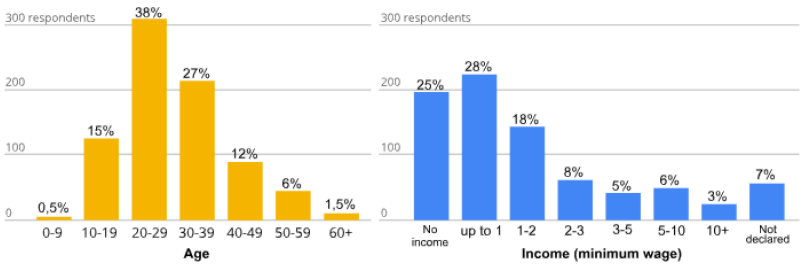

Fig. 4: Income (minimum wage) and age. Source: Authors, 2020.

4.2 Women respondents

Given the gender profile, women respondents were identified in the first block of questions and were divided between users or not of a bicycle in their daily mobility. Of the 582 respondents who declared themselves women[11] (72% of the total respondents), 28% (162) are users of bicycles as a transport mode, 72% (420) are not and were directed to questions about potential demand. The following is the identity profile of the women respondents.

They declared themselves to be 76% cisgender[12] and 66% single, followed by 28% married or in a stable relationship. Regarding race/color, 44% declared themselves to be mixed race, followed by 38% black women and 17% white women. Also, 65% of respondents have no children and the most representative age group was between 20 and 29 years old (40%). Regarding the level of education, 31% of respondents have completed high school and 12% have not. 18.5% have graduated and 18% have not finished their studies. There was only one answer for "no study". A considerable part of the respondents, 33%, declared they had no income, 30% affirmed to earn up to 1 minimum wage. Regarding occupation, 25.5% considered themselves students, and another 25.5% declared to perform formal work. A percentage of 23% said to be self-employed workers, while 10% say they are unemployed, 6% considered themselves as "part time/freelance", and 4.5% housewives.

4.2.1 Potential demand

In the first specific question about potential demand - "What are the three means of transportation that you use most often?" - the first option (there was the possibility to check up to 3, in order of importance) was: walking (40%), followed by a bus (35%). When considering all the answers walking and buses represent almost the same percentage: foot with 27%, buses with 28%. The same happens to car and taxi / Uber, with 13% each. Taxi / Uber is highlighted only as of the third option.

The main reasons for daily commuting were: work (47%) and study (31%). For 41%, leisure is the second option. Another 46% chose shopping as the third option - see figure 5. From all answers, the option leisure was selected by 27%, followed by shopping, 25%, work, 21%, and study, with 16%. When asked whether they use combined means of transportation on the same trip, 67% of respondents reported not combining means of transport. Of these, the most, 66%, use the bus and 21% use their vehicle. Out of the 33% of respondents who use combined means of transportation, 39% take buses, 31% walk, 9% use their own vehicle, and 10% prefer Taxi or Uber.

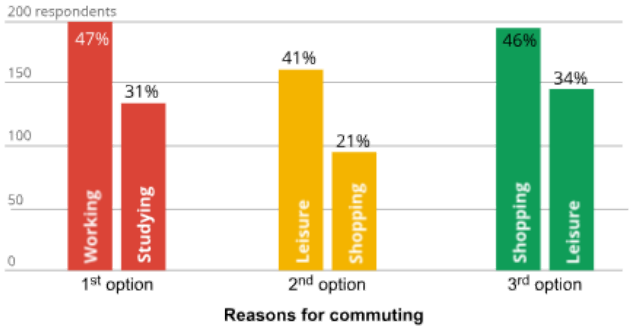

Fig. 5: Reasons for commuting. Source: Authors, 2020.

The figure 6 shows the average time spent commuting daily as 1 to 2 hours for 84%. Of those using the bus, 55% usually wait for 15 to 30 minutes at the bus stop, and 28% wait for 35 to 50 minutes. Regarding the three main challenges, 21% chose insecurity/fear of moving alone as the first choice when getting around/moving around the city, inefficiency/does not meet demand represents 23%, and overcrowding 22%. The challenge that most occurs as a second option is overcrowding (22%) and the third option is insecurity/fear of moving alone (20%). Only 38% of respondents live with people who also use the bicycle to get around.

Regarding the three main reasons that prevent them from using the bicycle in the city, the first is the fact that they do not own a bike, 40% - perhaps a consequence of lack of proper financial conditions since more than 60% do not have any income or receive up to 1 minimum wage. The second option that appears most often is traffic/fear of sharing the road with a motor vehicle with 23%, and risk of robbery (20%) in the sequence.

Still according to figure 6, 44% would be willing to use the bicycle as a means of transport, declaring that they would use it, but with caution (they would prefer to cycle in places with bike lanes/bike paths and would only share the space with cars on streets without heavy traffic). Whereas 28% would use it, but with great caution (only if there were bike lanes/bike paths on most of the route and streets with very low traffic) and only 15% would use it without fear (even sharing with heavy traffic and high speeds). Only 13% would not be interested in using a bicycle. These numbers prove that the lack of bicycle paths is the major impediment to active mobility. A recent article from the G1 news portal (G1 MA, 2020) states that the lack of bicycle paths is a constant complaint in São Luís.

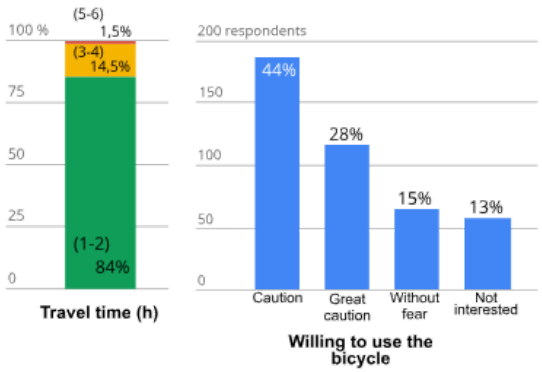

Fig. 6: Traveling time and willingness to use a bicycle. Source: Authors, 2020.

4.2.2 No more harassment

In this block, the types of harassment commonly suffered by women were listed, among them: verbal harassment, whistle, and honking. The option "others" was available to describe a different situation that could be classified as harassment. Declared as equivalent behaviors were: "Improper touching on bus rides", "Immoral words", and similar expressions. Others used the field to declare that they were subject to all types of harassment listed by the questionnaires when reporting: "All previous options". It was also possible to identify cases where the subject came to masturbate and even tried to rape the victim. A field was made available so that the victim could report in detail the situation that characterized the harassment. 164 testimonials can be accessed on the project's website. Such reports open up a veiled reality. In all, 60% of women claim to have experienced harassment in their daily commute. Considering only bicycle users (28% of the total respondents), they are 55%. The means of transport most used by the public in question are public transport and individual modes of travel.

4.3 Geolocalized data

To demonstrate the potential for applying geolocalized data, the following figures illustrate some steps and/or strategies for representing human dimension data treated as an information layer equal to the others commonly used in urban planning. Figure 7 is a mosaic with four maps, resulting from the transposition of the tabulated value (geographical coordinates), where each occurrence is represented by a point plotted on the study area.

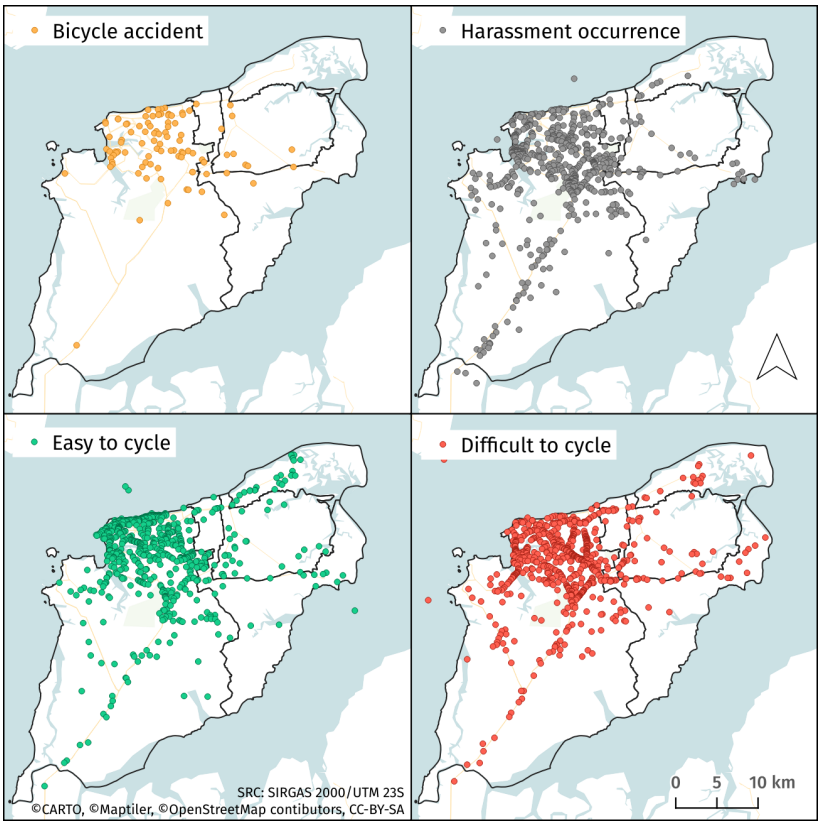

Fig. 7: Maps with geolocalized data. Source: Authors, 2020 and OpenStreetMap.

In the initial visual exploratory analysis, the point spatial aggregation is investigated to outline areas of concentration that, in this case, are directly related to the existing road structure. At this stage, it is necessary to treat "noises", such as, points on the water. Due to the operability on the online map, the respondent can generate unwanted answers and still go ahead with the questionnaire. In such cases, the choice was to remove the answer, since it would not be valid in subsequent analyzes. It is worth mentioning that the platform allows the relocation or elimination of the point.

On the map shown on figure 8, resulting from the question "What is the region/neighborhood/intersection that you consider important to have a bike lane/bike path?" There is a concentration of response in the urbanized areas of the municipality of São Luís. Even if they are continuous structures, there is a fragmentation of occurrences, indicative of generalized demand. The points along the main circulation axes stand out, under the justification of general use, compatible with the regional scale of presentation of the map.

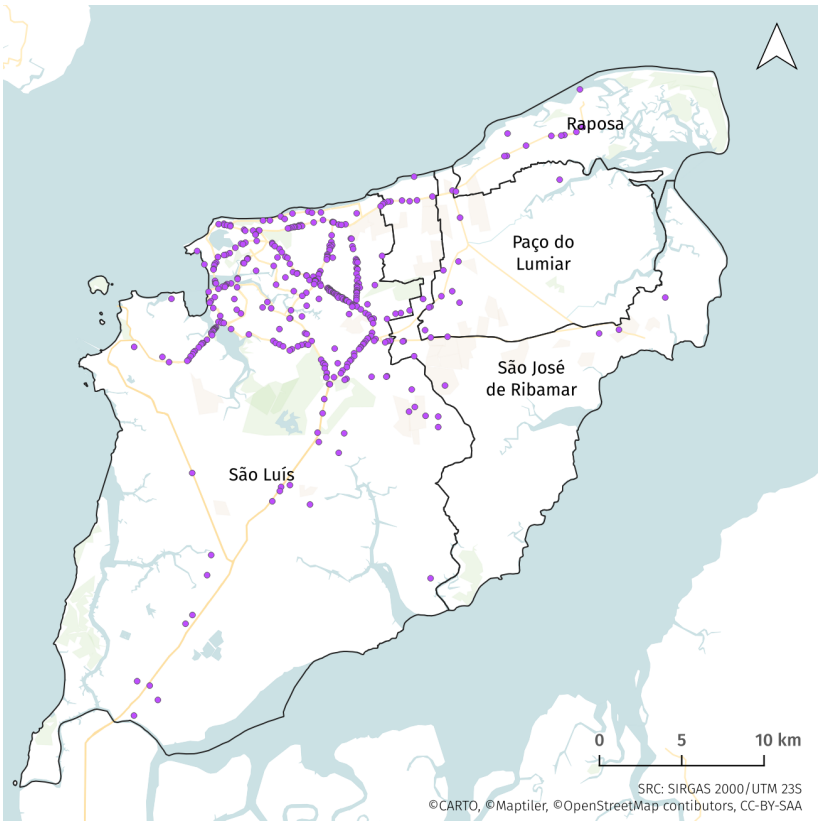

Fig. 8: Map of suggested location of bicycles lanes/paths. Source: Authors, 2020 and OpenStreetMaps.

Moving forward on this issue, the Kernel Density Estimation Process, known as the heat map, was applied, which allows faster reading of the concentration of occurrences. In figure 9, the red spots show that the highest concentrations are, in fact, along the roads that surround the central area of São Luís, being stretches of Av. Jerônimo de Albuquerque (between Av. São Luís Rei de França and Av. Daniel de la Touche), followed by stretches on Av. Dos Holandeses, Av. Dos Portugueses (on the Bacanga Dam), Av. Guajajaras, and Av. Beira Mar. As a next step, we suggest crossing with other layers of information.

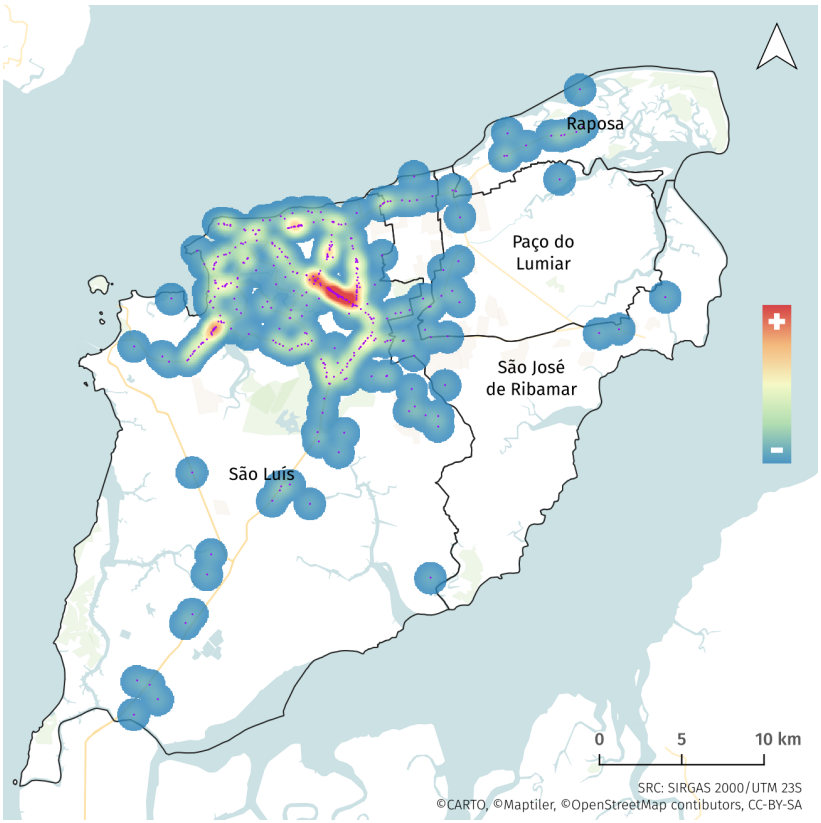

Fig. 9: Heat map showing a cluster of suggested locations of bicycle paths and bicycle lanes. Source: Authors, 2020 and OpenStreetMap.

In this direction, data from existing cycle paths were sought from official agencies, however, without success. Alternatively, we found on the OpenStreetMap[13] collaborative platform, only a few sections of the scarce 18 km of bike lanes in São Luís, the second capital with the least amount of bike lanes in the country (G1 MA, 2018), shown in figure 10. This difficulty in obtaining public information violates the access to information law, which provides for the data democratization so that the population can freely use it. Now, it is a challenge faced by urban managers that limits the collective construction of intervention proposals, differently from what happens in other realities[14].

Fig. 10: Map of existing bicycle paths. Source: Authors, 2020 and OpenStreetMap.

Figure 11 also shows the crossing, on an approximate scale, between the desired cycle path/cycle lane points and those marked as easy or difficult to ride. In some areas, it is possible to see the spatial relationship between the points that represent the desire for improved road infrastructure (purple) and groupings of points that represent the difficulty in getting around by bicycle (red). While some stretches (such as Av. Litorânea) with adequate infrastructure (green) have a lower number of suggested cycle path/cycle lane points.

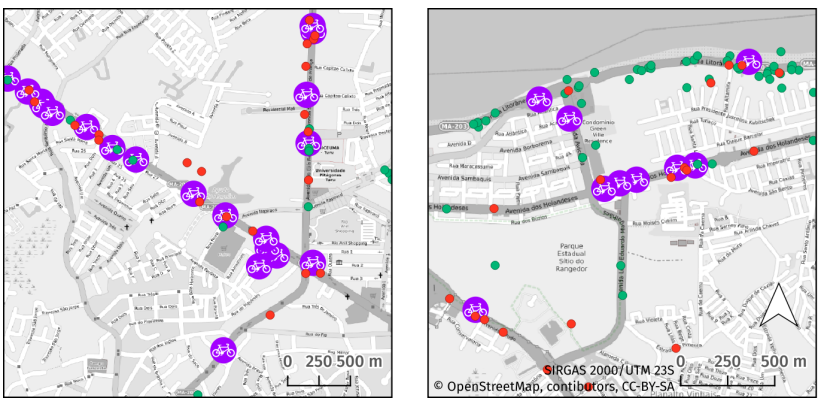

Fig. 11: Suggested path/cycle lane points (purple) and easy (green) or difficult (red) points to ride. To the left, Av. Jerônimo de Albuquerque and to the right, Av. Litorânea and Av. Dos Holandeses. Source: Authors, 2020 and OpenStreetMap.

5 Final considerations

This work presented the results of the *Rumbora se Amostrar* project, which used a digital platform for the collaborative data collection on active mobility in the city of São Luís and Grande Ilha in Maranhão state. The preliminary data and results provide valuable information, inaccessible in other data sources, aiming to assist public policies promoting the use of bicycles, in addition to academic works and related research. Thus, the

project fulfills the function of diagnosing the reality and giving representativeness to citizens adept at active mobility in these cities. Moreover, it grants participants the status of co-creators of data that should be applied in urban planning, reversing the logic of conventional consultations, or just reacting to proposals.

However, such participatory instances seldom are carried out, as there is no political will to insert initiatives that show the interests of the population. The violation of participatory mechanisms is shown in the lack of interest in promoting public hearings, in the case of the São Luís Mobility Plan, and in the strategic choice of groups to prove the participation of civil society in debates that do not dialogue with the concerns of the population in an inclusive way. In the local context, the use of digital data of the human dimension involves the adoption of new work methodologies, as well as the openness to deal with both public opinion and the new information flows of the digital age, as pointed out by Bugs (2019).

The number of respondents and the variety of profiles represented, with emphasis on women, reveal adequate public acceptance to use digital tools and to interact with online maps (which does not exclude the need for improvements, such as explanations on how to use). Besides, it indicates interest in themes that concern their daily activities, such as mobility. In the scenario of the COVID-19 pandemic, active mobility gains strength, as crowding during displacement is reduced, and cities such as Paris (Charleaux, 2020) and Bogotá (Saragiotto, 2020) are betting on this, expanding streets for pedestrians and cycle paths. Therefore, we are experiencing a favorable moment for studies and projects to increase active mobility. Up-to-date information on the demand, desires, and profile of users is valuable for the creation of public policies in line with the dynamics of post-pandemic society.

The thematic maps showed how, in an expeditious and relatively simple way, it is possible to include the human dimension in the spatial database and, ideally, integrate the contributions in decision making, allowing the actors to elaborate, discuss and meet their conceptions. The potential is not limited to urban planning. The data on harassment suffered by women can provide monitoring and prevention actions to reduce the number of cases consequently increasing safety in the use of this model. The visibility of cases can also be informative or educational.

The relevance of this type of initiative is emphasized so that cities do not become dependent on data providers. In the field of smart cities, Mendes (2020) cites the importance of creating own communication networks, free hardware, and software, open codes, public data availability, applications developed for specific groups of inhabitants, among other measures. Organizations like the World Bank are attentive to the issue of data production and use and have been developing studies on how it can improve people's lives, especially those in poverty in developing countries. To this end, it is necessary to have open data environments, as well as measures to protect against abuse. A good practice is the COVID-19 Transparency portal: open data can save lives[15], which organizes data from different sources (such as city halls and hospitals) and makes it accessible.

Finally, the report of this experience demonstrates how actions by organized urban movements have claimed the decentralization of decision-making processes through the use of digital platforms, which undeniably can reach more people and reveal a disseminated knowledge, less concentrated in the opinions of a few. Nevertheless, the problem of digital exclusion persists, reinforcing the importance of public policies for digital inclusion, a human right declared by the UN that now imposes itself as a basic infrastructure for local governments. The method, not allowing interaction between participants, avoids the atmosphere of confrontation, however, it also does not allow opportunities for learning, and collective resolution is restricted. Synchronous platforms could be used in this regard.

It is too early to assess the real changes in society, and specifically in cities, as a result of COVID-19. The fact is that we have never been so digital, and in this environment, new opportunities and space are envisaged for citizen actions made possible by digital technologies to gain visibility and set up themselves as good practices.

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