Asynchronous Mode in the Webgis: A Challenge to Ensure Greater Popular Participation

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Abstract. The covid-19 pandemic has resumed old discussions about the virtual environments´ different functionalities needed to subsidize online activities synchronously (in real-time) or asynchronyously (not in real-time). This article discusses the inclusion of features in the webgis to ensure that their activities can be promoted in a totally asynchronous way, especially when they aim at popular participation. The discussion was developed within the Geodesign Brazil project, which promoted 12 similar workshops, between March and April 2021, each in a metropolitan region of Brazilian capitals. The project focused on the use of Geodesign supported by Giscolab (Brazilian online platform for Geodesign) to identify problems and create territorial proposals on 10 themes (water infrastructure, agriculture, green infrastructure, energy infrastructure, transport infrastructure, industry and commerce, institutional, residential, tourism and culture, carbon storage). Specifically, this article reports the experience that took place in the Recife metropolitan region's workshop, capital of Pernambuco, state of Northeast Brazil. Since it was decided to apply asynchronous dynamics, adjustments and additions of resources were necessary to make it viable, mostly to ensure users' interest, participation and linkage to the project. The asynchronous mode in webgis is a challenge, as it requires resources for greater clarity in the definition of activities; forms of feedback and personification of users' paths and to incentivize the users to complete the activities proposed.

Keywords: Geographic information system · Participatory planning · Geodesign

1 Introduction: The Collaborative Design and the Popular Participation in Post-pandemic City Planning

In addition to climate change, which may be reaching the point of no return, the COVID-19 pandemic has come to ratify how human activities directly affect the quality of the environment and are responsible for the degradation of biodiversity and, thus, for the vulnerability of our planet.

Modern cities have developed through the growing financialization of the economy, which has led to a concentration of wealth and an increase in social inequalities; high

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urban population density and great need for mobility of people and products [1]. And so, they have become gateways to disease, as evidenced by the current pandemic. However, the consequent and compulsory home confinement of humanity caused a change in values and a change in consumption patterns and, mainly, highlighted the essential human needs to: (1) enjoy open spaces and (2) have access to basic products, reinforcing the intrinsic relationship of the rural with the urban world.

Furthermore, emergency moments, as economic crisis in 2008, as in the current health crisis, lead to the emergence of citizenship initiatives to support and care for the most fragile. Such crises often exerted political pressure and promoted legislative changes, adding value and social innovation, showing alternatives for sociability in cities and offering us the possibility of rethinking and redesigning cities, as there is an urgent need to change our way of life.

Digital technologies have been pointing out possibilities of how the city can be apprehended, modeled and managed through the participation of its citizens in the processes of collective socio-spatial decision-making in order to (re)invent it successively; and this is the path in which this article is inserted. For, the covid-19 pandemic resumed old discussions about the different functionalities of digital environments necessary to subsidize online activities synchronously (in real time) or asynchronously (not in real time).

The asynchronous mode in webgis is a challenge, as it requires resources for greater clarity in the definition of activities; forms of feedback and personification of users' paths and promotion of incentives to users to carry out activities. This article specifically discusses the inclusion of resources in webgis to ensure that activities can be promoted in a completely asynchronous manner, especially when they aim at popular participation. Although digital technologies contribute, we also have to find out what their impact on our lives is, in terms of better sociability and, consequently, in combating the emergence of climate and biodiversity.

2 GEODESIGN: The Urban Planning Complexity and the Importance of the Citizen Collaboration and Participation

According to Moura and Freitas [2], Geodesign is product of the evolution of studies that uses geoinformation technologies that prefer representations of spatial reality, focusing on participatory and shared planning by improving communication between different actors in the collective spatial decision-making processes.

Seen as a meta methodology for spatial design processes, in this research, because it adapts to different contexts, scales and proposals, it systematizes the multidisciplinary work of the planning process from the reading and characterization of the area to the development of the proposal, generating models with geographic information and impact simulations supported by digital technologies, which assist in decision making for the preparation of analyzes and spatial projects from the global to the architectural scale [3, 4].

In "The Geodesign framework", Steinitz [5] presents an integrated approach where the design process is divided into stages according to the scale of the intervention and the dimension of the proposal. As it is a set of methods developed to solve problems at different geographical scales, it is necessary to follow the steps, “Iterations of Geodesign”, from a generic methodology that systematizes the spatial process and, for that, it presents the necessary tools and how to apply them (see Fig. 1).

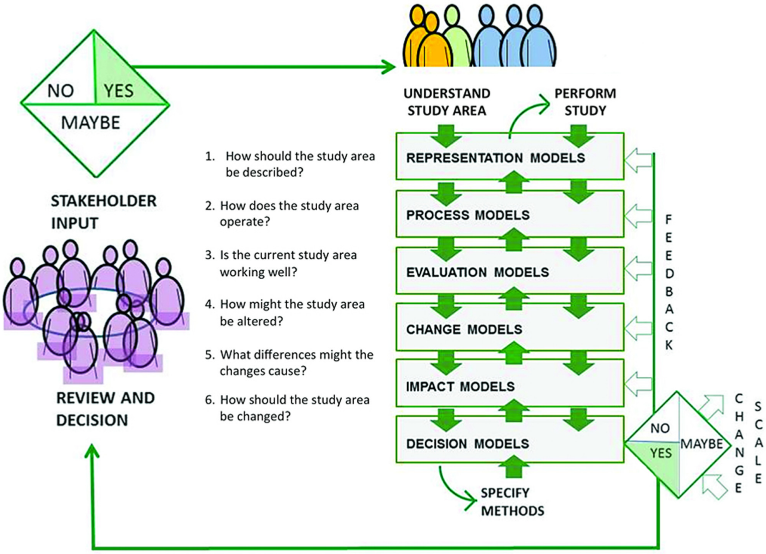

Fig. 1. The team and the Geodesign framework. Source: Steinitz, 2012.

For Steinitz [5], a proposal guided by Geodesign means to develop a project through cooperative work that unite knowledge from different areas of activity between scientists, designers and from the first moment, involving the local population. For this, the team involved in the project must be formed by: (1) designers, (2) digital technologies professionals, (3) geography scientists and (4) local people.

These four agents provide information to the design process organized by “Geodesign Iterations” where answering questions generates answers such as information for the construction of models to describe the area, what can be changed, how to change and what it can cause [6].

These professionals work cooperatively to develop the project. However, the process is not simple or linear and therefore must be coordinated. The difference of Geodesign is the proposal for systematization and awareness of the stages of the design process.

The structure presented by Geodesign is the same for any intervention, which allows the proposal to be adapted to reality and the level of deepening of the answers to the framework questions [6].

The Geodesign application follows a framework and in order to use this framework, the following parameters must be analyzed and defined: (1) The study area delimitation; (2) The level of detail and in-depth of the information; (3) The nature of the intervention; and (4) Who are those affected. Next, it is necessary to know the geography of the area, its physical and social characteristics, the natural environment and understanding of cultural issues [5].

To filter the process information, it is necessary to define the scale of intervention (local, regional or global), in this process it represents the level of information and details necessary for the project, and, in addition, they are related to the level of the intervention, how many people will be affected, and the style of proposal addressed.

Another important reference to be defined for the project is the dimension of the proposal, this is directly related to the intervention's risks, as the dimension increases, more people are affected and consequently the risk increases. Geodesign interventions can vary from a single-family residential project, where the intervention is restricted to the lot, with little interference in the urban context, to an expanding city that requires a study of natural resources, simulation of impacts, social issues and interferes in a large group. Given this, it is important to consider the form of intervention, the more people involved the less invasive the proposal is, and by decreasing the scale and risks, the proposals become more interventionist [5].

Due to the scope of action of Geodesign, it is impossible to develop a step-by-step for its use, and although it does not propose a linear methodology to be followed, Geodesign presents an organization to guide the flow of necessary information. This organization is presented by Steinitz [5] as a Framework, in the sense of structure or organization, for Geodesign. This framework consists of six questions to guide the process [6].

Among the most used methodological scripts is Steinitz, who published it in the book The Geodesign framework [5]. The author separates the work stages into six, in the form of models. Three of them must be fulfilled as preparatory steps for a workshop, prepared by the technical staff through or without consultation with citizens, depending on the expertise of those involved and the knowledge about the challenges of the case study (Representation Models, Processes and Evaluation). After the preparation steps are over, three more steps are elaborated, which take place during a participatory planning workshop to which the different interest groups in the case study are invited (Models of Change, Impact and Decision) [7].

In addition to the questions, models are presented that help in their respective answers, each question in the framework is answered by a model, also presented in the book. The models offer different information on a specific stage of the project. This framework is repeated three times in a cyclic manner during the process, each of these repetitions making up an iteration.

Iterations, as in algebra, are processes used to solve problems through successive repetition operations. The process consists of repeating the framework questions three times. At the end of each iteration, the product of each one is related to the design process [6].

3 GISCOLAB: Webgis, Planning Support System (PSS) and Metaplanning for Citizen Collaboration and Participation

The inclusion of citizen participation in the spatial decision-making process, mainly for urban planning, both to guarantee their participation and their effective collaboration, has largely been made possible by the evolution of GIS. Initially, such computational systems were seen as a geographic database, where georeferenced information was arranged in contextualized layers (thematic maps) and could be manipulated and interpreted to obtain analyzes and to support proposals for a spatial area as a result of a consultation.

However, assuming a consensual urban proposal as a result is also assuming it as a shared spatial decision-making process with the inclusion of new actors and new points of view and management of the planning process itself. For that, they need to be supported by several functionalities that are being added to the GIS, generating extensions such as, for example, webgis, PPS and metaplanning.

> In this sense, it can be said that the advent of GIS has expanded from the production and consumption of data to the support of information construction and the inclusion of new actors. In parallel to GIS development the recognition of different stakeholders in a planning process started to have the support of a PSS (Planning Support System), based on clear definition of actors, tasks, responsibilities, flow of use and production of geographic data. The PSS is designed to address complex planning problems by associating **three general components according to a systemic planning approach**: **GIS**, **models and visualization instruments** [2].

With environmental issues on the agenda, especially those related to climate and biodiversity, territorial issues become urgent and, consequently, the spatial decision-making process as well. Thus, laws that require citizens to be consulted on territorial issues of collective interest are being regulated for different planning scales. In the Brazilian legislation, it was from the Federal Constitution of 1984, called citizen's constitution, that the defense of this inclusion of new actors and collective decisions in the planning began. Principles related to regional and urban planning were inserted in the City Statute, law 10.257 of 2001, which defines that citizen participation and shared decisions in planning are mandatory.

Because the planning process is highly dependent on the spatial, normative, sociocultural context, of the scale and of the technical competence, the replication of PSS in con-texts other than those that were initially designed is discouraged. The PSS should not be reused, except when there is a restructuring of its architecture according to the context of the new process [8].

Thus, a tool is needed to guide the creation of a metaproject (project of the planning process) of the project's path, with a defined time, but at the same time flexible, to guarantee the understanding on the part of all the participants in the phases of work. In addition to this, it is necessary that information and supports are explained before the process to create an open, shared and common knowledge base.

It is suggested that Geodesign can be seen as this tool, a metamethodology, to support the creation of metaprojects, as it favors the creation of different representations of the spatial reality that interact and create a common understanding of planning issues. In addition to improving the visualization of information and communication between different actors for participatory and shared planning.

According to Moura and Freitas [2], the evolution of the idea of Geodesign is structured in the areas of geovisualization, geo-collaboration, citizen participation, web platform and production of information. Based on the extensive practical experience and data obtained in 35 workshops using the Geodesign´s traditional framework, the authors built a Brazilian platform for Geodesign, o GiscoLAB, to provide integrated and geo-referenced information, enabling a wide availability of data for subsidize collaborative initiatives in urban planning.

Such an undertaking wants to provide a tool with resources such as SDI (Spatial Data Infrastructure) and WebGis, enabling an open architecture to dialogue with other systems and to support functionalities with a focus on co-creation and geo-collaboration [2] (see Fig. 2).

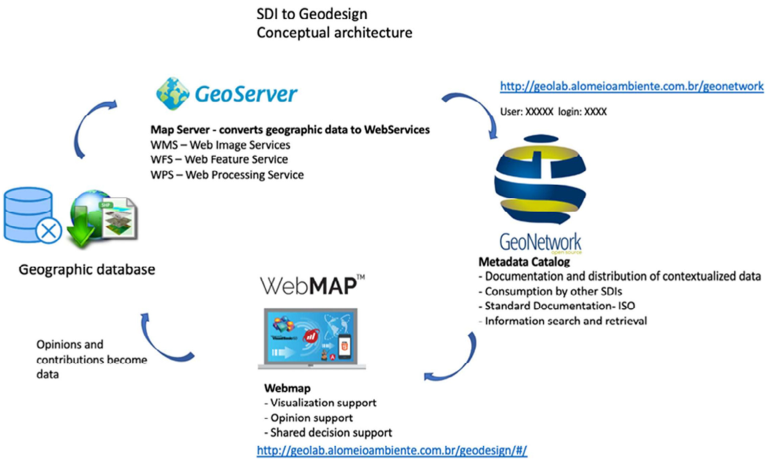

Fig. 2. Giscolab´s the conceptual architecture. Source: Moura and Freitas (2020)

Based on this understanding, the GISCOLAB was used in this estudoa for discussions over the territory. He has performed as a powerful tool of co-creation and geo-collaboration, but this research is to investigate whether its functions are suitable for application in asynchronous mode.

4 Geodesign Brasil Project: RM-Recife

The Used Framework

The thirteen workshops from the research “GEODESIGN BRASIL: TREES FOR METROPOLITAN REGIONS”, included the one reported in this article, followed the guidelines of the Geodesign Framework by Carl Steinitz. However, the “evaluation models” were not used, based on experiences reported by the Geoprocessing Laboratory from the School of Architecture in the Federal University of Minas Gerais, Brazil. The “evaluation models” were criticized in workshops inserted in the Brazilian context by participants who were active and would prefer to produce their own judgment about the territory. Moreover, some of the workshop’s participants adopted a passive posture, and didn’t reflect about how the data presented operated in the study region [2]. Considering that, a collection of 40 maps was prepared as “process models” to give support to the participants, so they could have information about the studied place.

For this research's workshops, it was considered the requirements by IGC 2021. They have required 10 systems, 8 of them being fixed and 2 of them being flexible. All of them following a color scheme for further visual comparison (see Fig. 3). The flexible systems chosen by this research were carbon sequestration, because of the emphasis in this subject on the event's premise, and tourism/leisure, because of the relevance of the theme in the Brazilian socioeconomic context.

Another expectation of IGC 2021 is to start the workshop from a 2021 current scenario to propose a planning for 2035 and 2050. For this to happen, there were placed three scenarios where the participants, divided in Group A and B during all the experience, would work following a workshop schedule (see Fig. 4).

The participants' proposals should contemplate the 10 systems, but always giving priority to projects that could be associated with carbon credit. Moreover, at the end of the workshop, an increase the area of robust vegetation by 30% by 2050, as a contribution to carbon sequestration, was expected. In this way, the project contribution to the "Trillion Trees Initiative" and to project and global Carbon Storage could be evaluated [9].

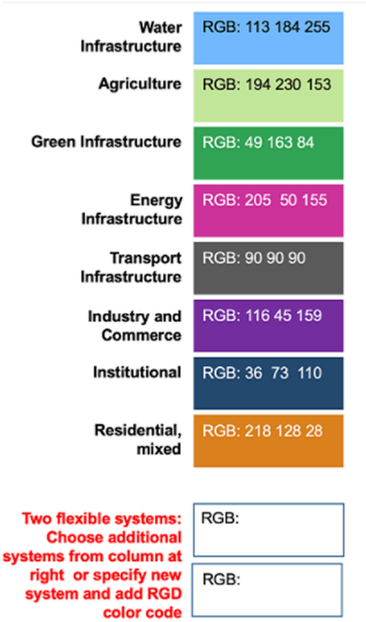

Fig. 3. Geodesign systems and colors by IGC 2021

IGC Requirements

The proposals produced by the participants should take into account the Seventeen Sustainable Development Goals (SDGs) proposed by ONU for further assessment. Moreover, they must have considered the Global Assumptions and Innovations, a list of innovations that would occur by the year of 2050 identified by a group of experts [9].

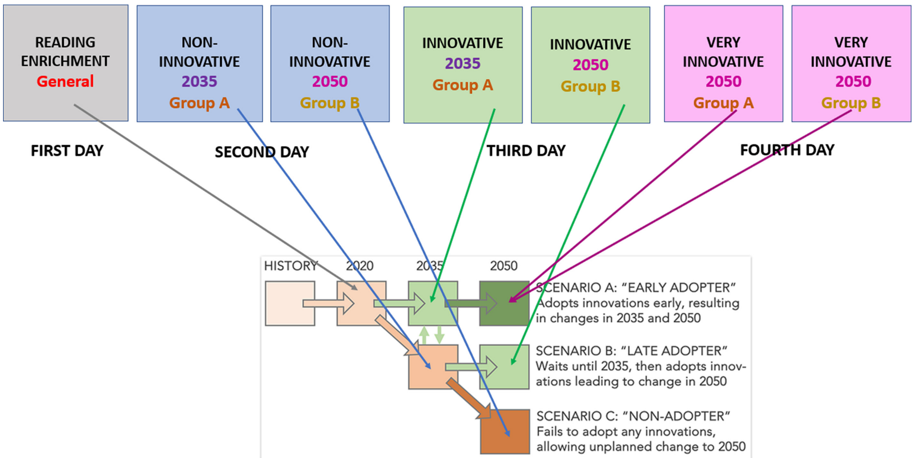

Fig. 4. Geodesign workshop schedule and groups, by the authors.

The Data Production and Giscolab Platform

Considering the established workshop systems, a technical team decided which data would compose the "process models" used as support for the geodesign workshops. Primarily, the data layers to be used for each system were chosen and posteriorly a research regarding where to find them was conducted. The downloaded data originated "representation models" and, after a series of treatment on ArGIS, the "process models" were generated and organized in layers within the 10 systems (see Fig. 5).

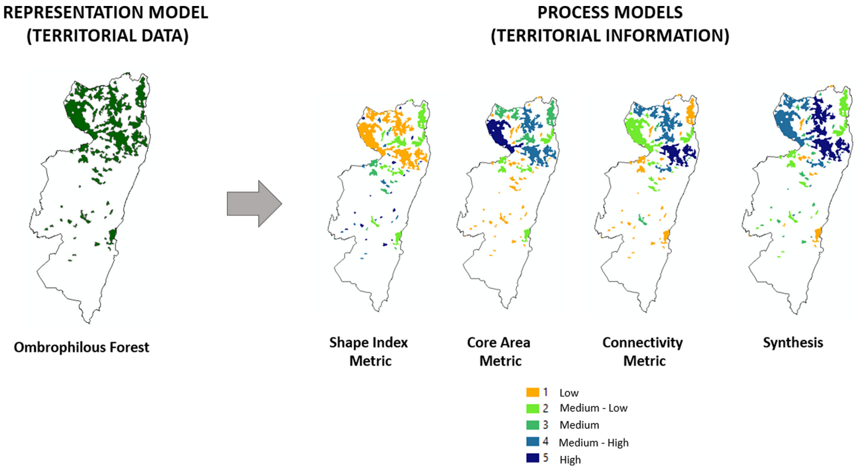

Fig. 5. Example of the Ombrophilous Forest layer as a "representation model" and its transformation in "process model", which is interpreted and displayed as Landscape Metrics used in this research (shape index, core area, connectivity and synthesis), by the authors.

The participants used a login and password made available by the workshop mediators to access the project in your metropolitan region. Once inside the project, the participant accessed the "Context" where they would work that day, following the schedule (see Fig. 6).

Workshop Framework

First day: Reading Enrichment

The participants got informed about the characteristics of the territory and indicated potentialities, vulnerabilities in the 2020 scenario through the tool of "Annotations" on the Giscolab platform (see Fig. 7). The collection of 40 maps of "representation models" were available for query.

Second day: Non-Innovative

Firstly, the participants read the annotations available on the "reading enrichment context" of the A and B groups. The participants constructed ideas for "Late Adopter" 2035 and "Non-Adopter" 2050, through the Dialogues tool (see Fig. 8). The A group projected for the 2035 year and the B group for the year of 2050. It was necessary that the

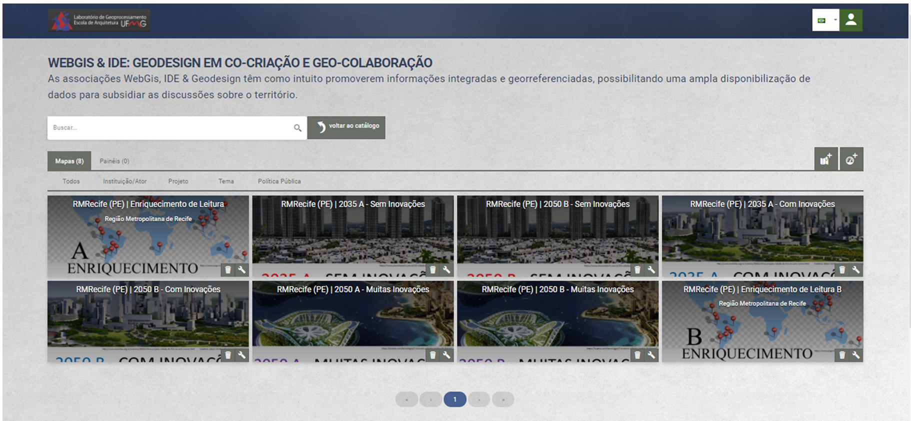

Fig. 6. Giscolab interface after the participant's login, by the authors.

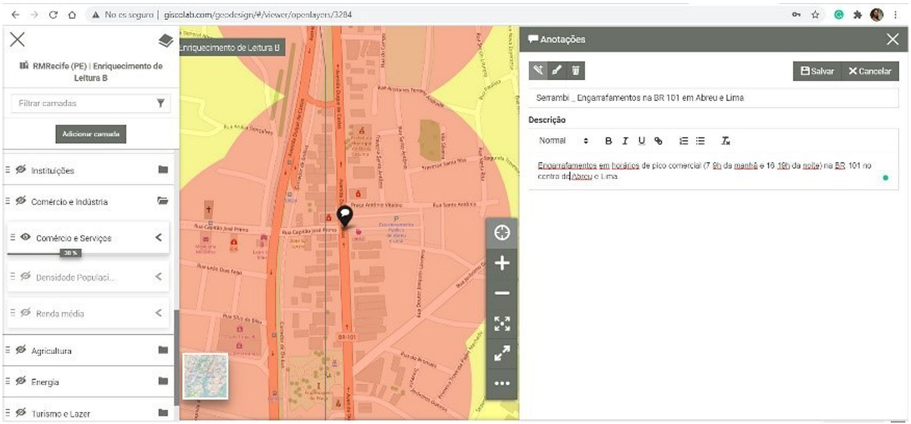

Fig. 7. Insertion of an annotation in the Giscolab platform, by the authors.

participants followed a temporal logic, thus the A group thought about proposals that necessarily should be initiated in 2035, so they could have a chance to be achieved until 2050. Successively, the B group needed to continue the ideas stablished in 2035, so a mismatch among the proposal didn't happen.

Third day: Innovative

A and B groups constructed ideas for "Early Adopter" 2035 and "Late-Adopter" 2050, respectively, through the Dialogues tool, following the temporal logic exposed in the second stage of the workshop. In this day, the participants used the Global Assumptions and Innovations provided by IGC 2021. The use of this list was not obligatory. They also had the target to increase of 30% of CCO2 until 2050, using the tool Widgets that calculates the percentage reached, number of trees and the sequestration of CO2 above and below ground.

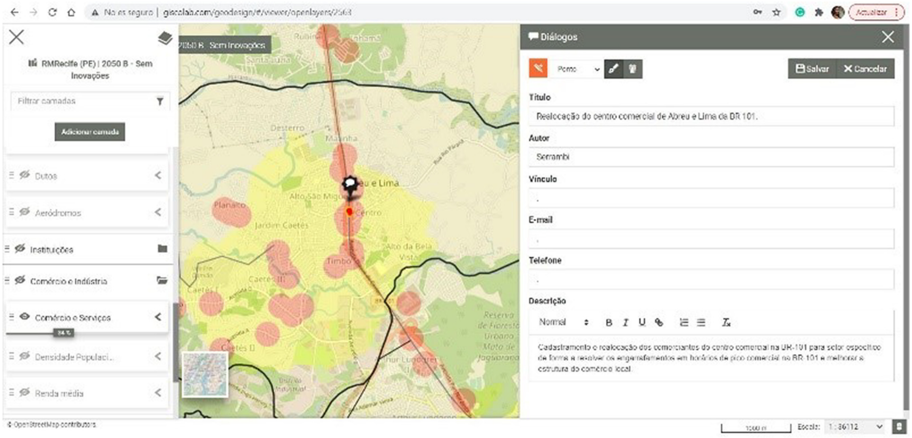

Fig. 8. Insertion of a dialog in the Giscolab platform, by the authors.

According to [10], the problem of the balance of carbon sequestration could be resolved until 2050, if the increment of 30% of robust vegetation of the world happens. This publication brings a quantitative of trees that exists in the world and from this data, a calculation of tree units to be planted in every of the 13 metropolitan regions, this goa in km^2 and also the proportion regarding the 30% to be reached. Beyond that, according to maps made available by [11], was made a calculation of the sequestration of CO2 above and below ground (see Table 1).

Table 1. Data regarding carbon sequestration from the Recife's metropolitan region, by the authors.

Total Trees	6447092
Area/km²	453,25
Area/ha	45325,22
Trees/km²	14224,1412
Trees/ha	142,2407216
Target of 30% Increase in Trees	1934127,6
30% in km²	135,975
CO² Above Ground	1206635
CO2 Below Ground	379849
30% CO2 Above Ground	361990,5
30% CO2 Below Ground	113954,7

Fourth day: Very innovative.
In this stage, A and B groups constructed ideas for "Early-Adopter" 2050, following the temporal logic exposed in the second stage of the workshop, through the "Dialogues" tool. The used of the Global Assumptions and Innovations and Widgets regarding carbon sequestration remained.
For this last stage of the workshop, the construction of ideas for all the 10 systems should be guaranteed. Besides, the minimum reach of 30% of carbon credit expansion, area expansion, number of trees and CO2 levels below and above ground had to be reached. The design proposals from A and B groups were integrated in one final design through comments and voting on the "Dialogues" tool.
Questionnaire.
After the completion of the workshop activities, a questionnaire produced on Google Docs was sent in order to outline the participants' profile. Among the required information are name; studied metropolitan region; knowledge, potential and vulnerabilities of geodesign; knowledge and interest in the territory; opinion on the difficulty of the methodological process and the Giscolab platform; between others.

5 Asynchronous Mode: The RM-Recife Case Study

Synchronicity is the quality or state of being synchronic, of what occurs at the same time, simultaneously [12]. It means making something happen at the same time. In virtual environments, synchronous and asynchronous modes refer to two possible types of online interactions. In the first, the activities (learning, communication, work, fun,…) are carried out with the participants running them online, but at the same time. In the second mode, each participant will perform them at a different time. Both options have their advantages and disadvantages and some things in common, but require different features to be supported by digital environments.

The main benefit of the synchronous mode is that there is real interaction with other people, even if virtually, allowing exchanges and feedbacks (knowledge, experiences, points of view, …) between the participants, in addition to the activities taking place on a scheduled basis. The main benefit of the asynchronous mode, on the other hand, is that participants can perform activities at their own pace and schedule, with a reduction in the need for people to travel, greater range of participants and less infrastructure. Both can be used in a complementary way, there is no better way, but the most suitable for certain activities and for a socio-cultural reality.

In our case, the Geodesign workshop at RM-Recife, was initially designed to be synchronous like all the other 12, the option for asynchronous mode occurred abruptly, one week before the start of activities, to meet the various requests from interested parties who claimed clash of hours with other online activities and greater convenience in being able to program.

So, this research was born, under the largest of Geodesign Brazil, as an answer to the need to make the conditions for its realization flexible within an extremely complex context, the pandemic peak of the 2nd wave of COVID-19 in March 2021. And still, taking advantage to verify the robustness of the Giscolab tool, as well as the applicability of Geodesign in cases of building a spatial proposal with the participation of a community in a media city.

Thus, the central objective of the RM-Recife experiment became, in addition to collaborating with Geodesign Brazil, to assess the challenges of the asynchronous mode in the spatial decision-making process by checking the suitability of Geodesign and Giscolab. Specifically, it would also be like keeping people interested throughout the course of this process.

Thus, all stages of the workshop were carried out asynchronously. To make this possible, a YouTube channel IGC 2021 _ RM-Recife[1] was created first where participants were provided with a series of tutorial videos that explained each step and exemplified how they would be implemented in Giscolab (see Fig. 9).

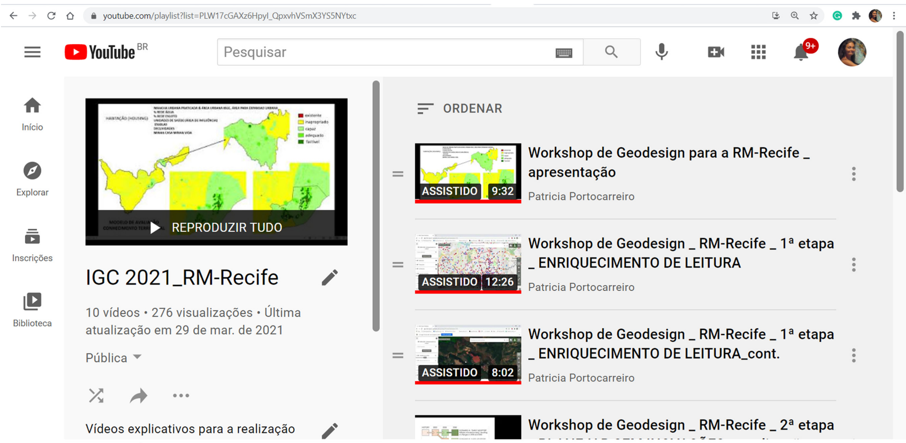

Fig. 9. YouTube channel with explanatory videos by Prof. Ana Clara Mourão from EA / UFMG.

In addition, two WhatsApp groups, A and B, were set up, according to the research dynamics of Geodesign Brasil, for communication between participants and mediators, making it possible to clarify doubts about the process, share ideas and even report errors that happened on the Giscolab platform.

In the first stage, there was a certain inertia of the participants, after viewing the explanatory videos, in the execution of activities in Giscolab, so tutorials in PDF were made, exclusive for RM-Recife, with a step by step to be done by clarifying and exemplifying in greater detail the execution of activities at Giscolab. The repercussion of these tutorials caused some participants to follow their paths and complete the workshop.

With the asynchronous mode, although the number of participants doubled (30 people registered in all), only 8 participated and 5 concluded the workshop. Among those enrolled we had people linked to architecture and urbanism, geography, cartography, water resources management and the environment.

[1] The Youtube Channel IGC 2021 _ RM-Recife can be found in the following link: https://www.youtube.com/playlist?list=PLW17cGAXz6HpyI_QpxvhVSmX3YS5NYtxc.

The group of participants who concluded declared that the main difficulty was to apprehend the complexity of the project on a regional scale and to be confident in their own decision-making. They justified such difficulties by declaring:

a) The importance of different profiles for the construction of a coherent spatial proposal;
b) The difficulty of spatializing georeferenced information;
c) The difficulty of crossing data that requires special knowledge and spatial reasoning;
d) The difficulty of constructing complementary views, because there remains a specific and personal view.

In short, once it was decided by the asynchronous dynamics, adjustments and additions of resources, described above, were necessary to make it feasible. The asynchronous mode proved to be a challenge, as it requires resources before the implementation of activities in Giscolab for greater clarity in the definition of activities; forms of feedback and personification of users' paths and promotion of incentives for users to carry out and conclude activities.

In Giscolab, the asynchronous mode that seemed to bring ease due to the flexibility of time and work pace of each participant, initially proved to be an obstacle to the proper functioning of the workshop itself, since spatial decision-making guided by Geodesign requires a shared build. Because it is believed that it is necessary to build a vision that composes the various interests first in the formulation of the spatial problems of the studied area and, as this decision process matures, it results in consensual solutions.

It was evident that it is not possible to build shared knowledge through the various visions and knowledge of the various participants without necessarily having interaction between people, even without being in the same physical space. It is fundamental to the shared decision-making process that Geodesign proposes to synchronicity.

6 Conclusions and Discussions: Challenges to Expand Collaboration and Popular Participation in Urban Planning

The IGC 2021 _ RM-Recife workshop was not designed to take place in asynchronous mode, but to reach a larger number of participants and test the Geodesign metamethodology and the Giscolab webgis tool, this dynamic was tested.

Initially, in this embryonic research, the asynchronous mode seems to be incompatible with the dynamics proposed by Geodesign, although its implementation in Giscolab is viable. You can add internal communication features (chats, bulletin board,...), version management (who did what and when) and improve the tool's support for asynchronous mode. However, in relation to Geodesign, its core is the construction of knowledge shared by the contribution of several specialized views that complement each other and that respond to the necessary complexity to a response of making a spatial decision. In other words, the process needs to be collaborative so that the product reflects the scalar and dimensional complexity, to guarantee greater popular participation in collaborative territorial projects.

Finally, the asynchronous mode requires more studies to be adopted with Geodesign. However, it is worth expanding the discussion about which steps or processes in Geodesign can be asynchronous, or should all steps be synchronous.

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