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GEODESIGN IN THE PROPOSITION OF URBAN PARAMETERS OF OCCUPATION: POSSIBILITIES OF APPLICATION OF A 3D CADASTRE IN LANDSCAPE MANAGEMENT

Geodesign na Proposição de Parâmetros Urbanísticos de Ocupação Urbana: as Possibilidades de Aplicação do Cadastro 3D na gestão da Paisagem

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ABSTRACT

An urban landscapeis composed by a set of many factors, and each one of them has a role in building a landscape that expresses values, cultural and social aspects of a society. This article focus on investigating possibilities to address urban landscape planning through a methodological approach that explores the urban parameter for occupation as one of the factors that shape our urban environment and landscape. The main goal is to discuss the planner'stask of decoding and translating social and cultural values to the landscape while showingsome possible outcomes from the investment in data acquisition, andthe structuration of an urban multipurpose 3D cadastre.Thus, the case study presents a Geodesign workshop which was held in the Geoprocessing Laboratory of the School of Architecture, from the Federal University of Minas Gerais (*UFMG*) and was attended by 13 participants. The participants were invited to propose new patterns for the land occupation through the definition of urban parameters for an area in Pampulha region, in Belo Horizonte. The methodological process was based on Parametric Modeling for the visualization of alternative futures of urban landscape as a support for the opinion taking process promoted by the framework of Geodesign. As a result, the values and expectations from each group of representatives of the society were analyzed allowing an assimilation of the elements that interfere the most on citizens' interests for the composition of the urban land use. Extending the experience can favor a broader support for decision-making on proposition of Land Use laws as much as justify investments on the formation of 3D cadastre for municipal planning and management.

Keywords: 3D visualization, Geodesign, 3D Cadastre, Urban Parameters, Landscape Management.

RESUMO

A paisagem urbana é composta por um conjunto de muitos fatores e cada um deles tem uma função na construção de uma paisagem que expresse os valores, aspectos sociais e culturais de uma sociedade. Este artigo investiga possibilidades para a atuação noplanejamento da paisagem, através da apresentação de uma abordagem metodológica que explora os parâmetros urbanísticos de ocupação como um desse fatores que compõem a paisagem e o ambiente urbano. O objetivo principal é discutir o papel do planejador em decodificar e traduzir valores sociais e culturais para a paisagem, apresentando ao mesmo tempo, alguns resultados possíveis do investimento em aquisição de dados e estruturação do cadastro 3D urbano. Assim, o estudo de caso apresenta um workshop de Geodesign promovido pelo Laboratório de Geoprocessamento da Escola de Arquitetura da Universidade Federal de Minas Gerais (UFMG), onde os 13 participantes foram convidados a propor novos padrões de ocupação através da definição de parâmetros urbanísticos para uma área da Regional Pampulha, em Belo Horizonte.O processo metodológico foi baseado em Modelagem Paramétrica para visualização dos futuros alternativos da paisagem urbana, como base para a tomada de opiniões promovido pelo framework do Geodesign. Como resultado, foram observados valores e expectativas de cada grupo representante de setores da sociedade, o que permitiu entender quais são as variáveis que mais influenciam nos interesses cidadãos na composição da possibilidade de uso do solo urbano. Ampliações da experiência podem favorecer amplo apoio a tomada de decisões na proposição de Leis de Uso e Ocupação do Solo, assim como justificam investimentos na formação de cadastros 3D para planejamento e gestão municipais.

Palavras-chave: Visualização 3D, *Geodesign*, Cadastro 3D, Parâmetros Urbanísticos, Gestão da Paisagem.

1. INTRODUCTION

The urban landscape is a result of many factors and agents from the urban environment. In fact, each one of them has its relevance and its role in building a landscape that expresses values, cultural and social aspects of a society. Among the main responsibilities of urban planners, we highlight their role in planning and managing the landscape, such a complex task that sometimes gets in the background of city planning.This article focus on investigating possibilities to address urban landscape planning, and tools to support this complex task. For this purpose, the article presents a methodological approach that explores urban parameters for occupation as one of these factors that shape our urban environment and landscape, while discussing the relevancy of the urban planner on decoding and translating social and cultural values to the landscape.

Moura (2014) considers to parameterize as the act of establishing the limits for the shape of an architectural volume, or defining the acceptable maximum envelope of buildings. In this sense, we work with the definition of urban parameters as the resulting parameters, or codes andindexes, of this act of parameterizing, which limits the occupancy of an urban unit (the lot).

The concept of parametric urbanism was first proposed by Gerber (2007), but it became more known after Schumacher (2008), a member of Zaha Hadid Architecture group, started to write about it and to use its logic to propose new way to draw new cities.Parametric Urbanism, based on Parametric Modeling, can be understood as a combination of variables, values and rules that orchestrated together create forms. It's already the language of contemporary architecture, but it can also be used in a different sense.

Parametric Modeling, so as Parametric Urbanism, can also be used as a way to understand the use of morphometric variables and its values to compose forms. In this sense, it is an interesting support to visualization in understanding the future of an urban landscape, especially in Brazil, where Master Plans can be simplified as proposals of land use and land occupation. The land use and occupation determines the kind of use can be accepted in each part of the city, and the limits of morphometric aspects, such as setbacks, floor area ratio, volumetric density and maximum height. Master Plans in Brazil presents references to propose typologies of use per zone, parametric regulations and acceptable limits to roads systems. (BRASIL, 2002a; SABOYA, 2007; SILVA, 1995; VILLAÇA, 1999).

Although there are great variations among the cities in Brazil, usually, the maximum occupation is defined by a coefficient of utilization called *CA* (*Coeficiente de Aproveitamento*), which is applied to the lot's area, and offers the total potential for construction that can be understood as Volumetric Density. Others parameters which are as quite used as the CA are the Floor Area Ratio (FAR), that is the projection of the building in the lot (*Taxa de Ocupação*) and Setbacks. Some Master Plans also controls Maximum Height to the buildings and Rate of Permeability to the lot.

Even though the intention is to control urban growth, restrictions do not consider appropriate areas to land use, minimization of conflicts of interest, road traffic control, and consideration of property values in face of social function and collective interests; the final result in urban landscape is a combination of morphometric rules (MOURA, 2015).

In Brazil, the urban legislation on national level has its basis on the chapter II of the Federal Constitution (BRASIL, 1988), and its guidelines are regulated by the law n° 10.257 from 2001, called 'City Statute' (BRASIL, 2001). Generally, both of them point out the role of the municipal level in promoting the social function of the city and the property while presenting some instruments for this promotion. One of its instruments is the Master Plan, which is mandatory for some cities, and states the basis for the urban development. The master plan is usually associated with the zoning, and determines the legal means for the definition of the main urban parameters in a municipality.

Any planning activity requires a good knowledge of the context of intervention. It is necessary to first know the urban environment in order to intervene on it properly, and an urban cadastre is agreat way of knowing a territory in an urban context. According to Carneiro, Erba and Augusto (2012) most of the instruments presented by the City Statute depend on the Master Plan so that, theyargue on the necessity of a robust and systematic urban cadastre for the implementation of a Master Plan.Henssen (1995) considers the cadastre a public inventory of data concerning properties' boundaries, which is methodically arranged and identifies the nature, size, value and legal rights of the properties. Besides information about the basic data of the property and its value, Carneiro, Erba and Augusto (2012) also list the information about the owner, and public improvements and services for the properties, as items for the cadastre. Moura and Santana (2014) considers that those data mainly aim to address taxation and legal regulation. However, as soon as the cadastral information is georeferenced by a geodetic system and has a statistically proven measurement quality, it can turn to be a Multipurpose Cadastre serving as a tool for the planning process. In addition to economic, physical, and legal aspects of the properties, the multipurpose cadastre adds social information from the property's environment. It includes information on its inhabitants, its use and occupation of the land, among others, with the aim of providing as much products from it as possible(CARNEIRO, ERBA and AUGUSTO, 2012), and greatly supporting the planning process.

In 2009, the national government from Brazil published an ordinance (*PORTARIA N. 511, de 7 dedezembro de 2009)* containing guidelines for the creation, establishment and updating of the Territorial Multipurpose Cadastre (*CTM*) in Brazilian municipalities (BRASIL, 2009). Although, the ordinance doesn't make the CTM mandatory, it sets some important standards and guides for the municipalities to deploy their cadastres. The ordinance n. 511 from 2009 defines the parcel as the smallest unit from the CTM(Moura and Santana, 2014). Addressing only the 2D aspect of a parcel, it defines the parcel as a contiguous part of the earth's surface. However, as stated by Holzschuh (2013), the limits of a parcel don't correspond only to its 2D component, they also have a height and a depth.

In fact, the complexity in property rights and restriction goes beyond the land surface. In this sense, the City Statute alsoinnovates by untying building and land property rights. This dissociation is allowed, for instance, by the possibility of building an area greater than the lot's area, through an onerous granting of the right to build, or the possibility of exercising the right to build in another location, through the transferring of the right to build. Both of them are instruments provided by the City Statute, and need to be regulated by the Master Plan. It reinforces the need for a three-dimensional approach to the urban cadastre in order to address all the aspects of rights on built space.

The cadastre of objects which are not only on the surface, but also above and below it can be addressed by some models. Carneiro, Erba and Augusto (2012) analyze the models proposed by Stoter (2004) considering the 2D cadastre containing 3D information, as the simplest and most suitable for immediate implementation for the Brazilian context. However, the most adequate would be the hybrid model (2D/3D)which uses a 2D cadastre for the parcelsthat doesn't require 3D registration, and a 3D cadastre of the parcels that thelegal case requires the determination of their 3D appearance. And finally, the complete 3D cadastre which would be the ideal, but it still not feasible for the Brazilian case.

In summary, this article presents a case study of Geodesign for the proposition of urban parameters aiming to show some possible outcomes from the investment in data acquisition, and the structuration of an urban multipurpose 3D cadastre. As the multipurpose 3D cadastre has the benefit of concentrating information on various aspects of the urban context, it allows a more efficient performance in landscape management.

2. THE CASE STUDY

The case study presents a Geodesign workshop which was held in the Geoprocessing Laboratory of the School of Architecture, from the Federal University of Minas Gerais (UFMG) in October of 2016. The activity was held in an afternoon and was attended by 13 participants from different backgrounds, including undergraduate and graduate students and faculty members from UFMG, and planners from the local government.The majority of participants were from the field of architecture and urban planning and they were invited to propose new patterns for the land occupation through the definition of urban parameters for an area of the Pampulha region, in Belo Horizonte, Brazil. The methodology involved the preparation of data for the workshop and the development of the activity with the participants. During the workshop, participants worked with the software ArcGisto propose intervention diagrams, and the software CityEngine to simulate and visualize the proposed urban parameters (Figure 1).

2.1 Pampulha Region

The case study addresses a region of great value for the municipality of Belo Horizonte, the Pampulha district (Figure 2). Pampulha holds a World Heritage site from UNESCO, and it represents a landscape of great value and historical significance. Besides modernist architectural works by Oscar Niemeyer, the region presents significant amounts of vegetation and low density occupation for some areas. These characteristics are related to Pampulha's occupation process as the region was firstly created to be a recreation area for the municipality holding an artificial lake, the Pampulha Lake. Nowadays, due to the region's high conditions of infrastructure and the pressure for occupation in Belo Horizonte, some portions of Pampulha are already undergo an intense transformation process mostly by housing densification. The situation raises a concern about theconsequences of adensification process throughout the area, and its results for Pampulha's landscape.

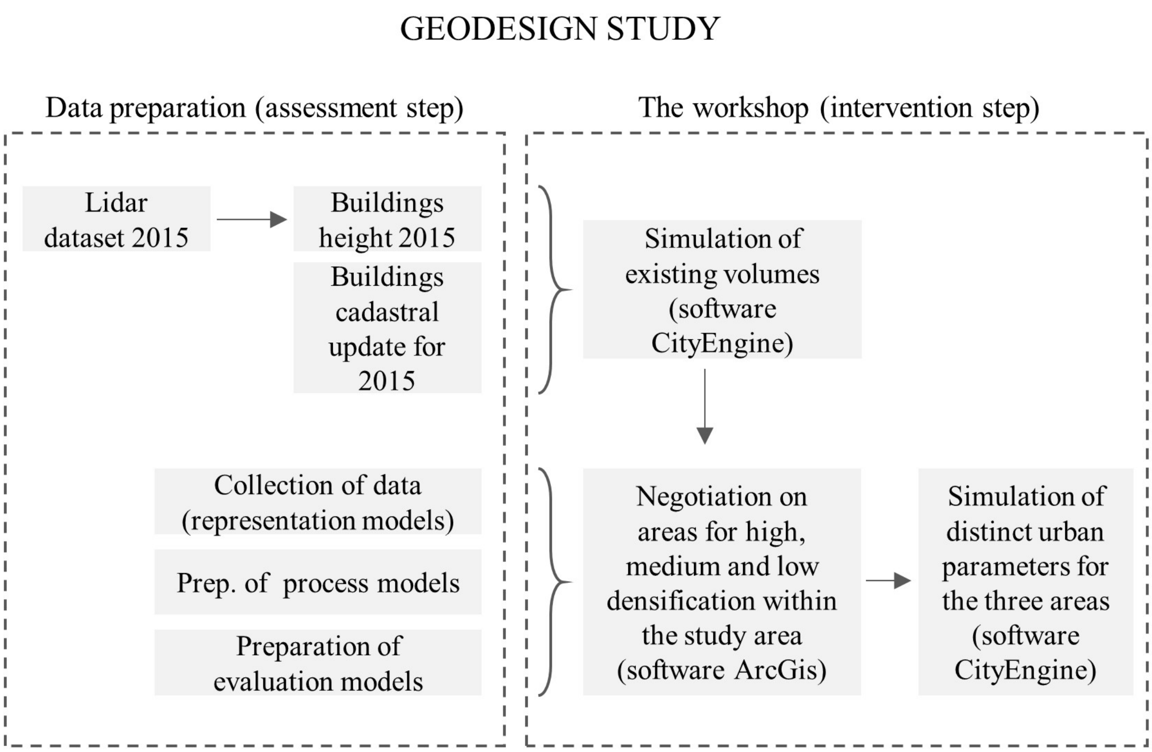

Fig. 1 - Methodology of the Geodesign case study.Source: Elaborated by the authors, 2016.

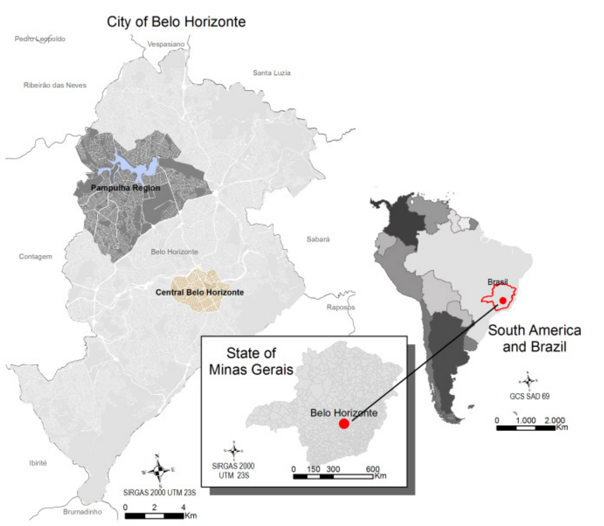

Fig. 2 - Pampulha district in the context of Belo Horizonte. Source: Elaborated by the authors, 2016.

The area chosen for investigation is part of the Pampulha region, and it was indicated as a favorable area to receive high density housing by a first Geodesign studywhich happened in March of 2016(ZYNGIER, 2016). At that time, the participants agreed on five areasto promote the high density housing inside the Pampulha region, considering the concerns about the high historical value and the landscape aspects (Figure 3).

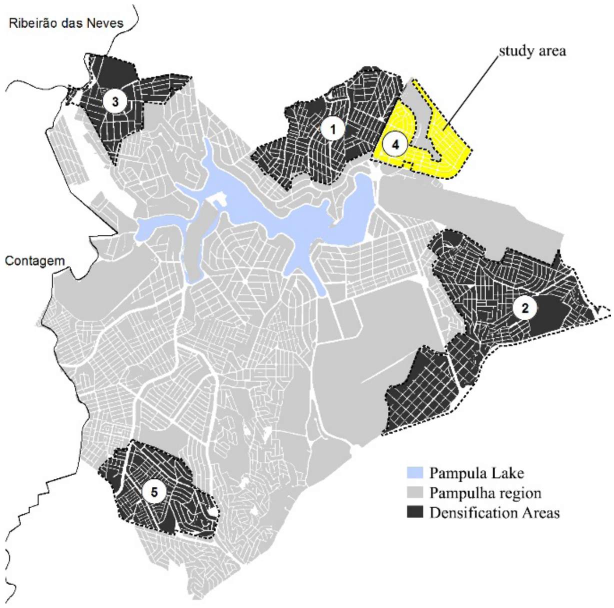

Fig. 3 - Areas to promote the high density housing inside the Pampulha region. Source: Elaborated by the authors with data from the Laboratory of Geoprocessing (EA/UFMG) and Zyngier (2016).

Exploring the potential identified by this earlier study, one of the five areas was selected as a pilot area for the investigation on how this densification process could take place considering the fragilities of Pampulha's landscape.Considering the relevancy of the many factors that build an urban landscape, and specifically addressing the urban parameters for occupation,the case study uses Geodesign as a possibility to reach a collaborativeplan for the context of the study area, facing the interests for this territory.

2.2 Geodesign Framework

Quoting Michael Flexman's presentation at the GeoDesign Summit, Goodchild (2010) considers Geodesign as a planning method that couples the creation of proposals (design process) with impact simulations, considering the geographic context.Differing from traditional planning systems, Geodesign aims to develop a design-oriented method which needs to be more adaptable to the different situations and more purpose driven (YANG, 2014).

For Steinitz (2012), Geodesign changes geography by design. He considers it a collaborative process of design to change a geographic area, and highlights its potential on working with highly complex problems in a little time for decision, and involving people with distinct interests (STEINITZ, 2016).

Thus, we highlight the Geodesign potential of working in a collaborative way, and connecting the two main stages of a planning process: the diagnosis, or the process of understanding the geographic context in its physical and social spheres, and the proposition, or the design process itself.

The Geodesign methodology is based on the framework prosed by Carl Steinitz(STEINITZ, 2012).He proposes six basic questions through which is possible to assess and intervene in a geographic context. According to him, the answers to the questions should be given through six-models of the study area (Figure 4).

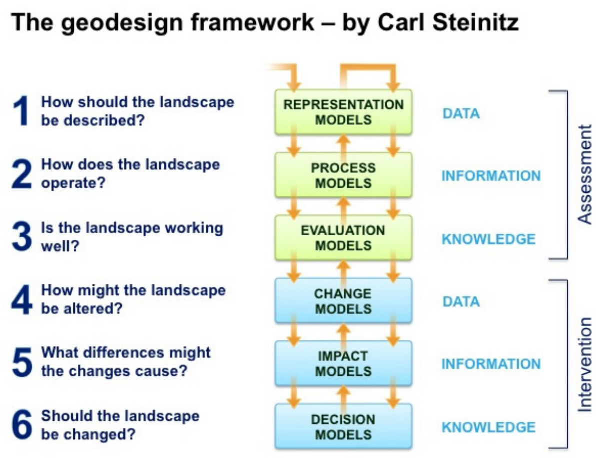

Fig. 4 - Steinitz's Framework for Geodesign. Source:Wheeler, 2012.

2.3 Data Collection and Preparation

The city of Belo Horizontehas a tradition on cadastral data. The firstcadastral documentwas produced before the city's construction and it provided technical information of the intended site for the city. The document was called Cadastral and Topographic Plan, and it was a cartographic basis for the city's development plan defining the buildings and the physical environmental characteristics that existed before the city'splan, which is from around 1895. (AGUIAR, 2012).According to AGUIAR (2012),after the implementation of city, the Cadastral and Topographic Plancontinued to be used until 1928, when the local government started a new cadastral data collection. That collection led to the implementation of a CTM for the municipality between 1972 and 1973. With the creation of a GIS system for the municipality in 1992, the local government started to migrate the multipurpose cadastral data, which were mainly alphanumeric, to the new geographic system. (GOMES, 2005).

Due to its pioneering work on cadastral data collection and maintenance, Belo Horizonte holds a great database on city's information. Thus, the case study uses some of this data provided by the computer and information company from Belo Horizonte municipality(*PRODABEL - Empresa de Informática e Informação do Município de Belo Horizonte*) to the development of the methodology. The main data used for the case study and provided by PRODABEL,were the cadastral polygons of lots and buildings from 2007, a Lidar dataset containing information about the surface elevation from 2015, and ahigh resolutionimagery (A3 Edge - Airborne Imaging System, with20cm pixel resolution) also from 2015.The Lidar (Light Detection and Ranging) is an active remote-sensing system. Its laser scanner system which is an Airborne Laser Scanner (ALS) type, can collect three-dimensional data from the terrain and the surface generating an elevation model (RIBAS, 2011). The methodology used the surface elevation model offered by the point cloud from the Lidar dataset to extract information about the height of buildings.

The initial cadastral data provided by PRODABEL was for 2007 so that, an update work was necessary in order to have the 2015 Lidar Dataset matching the cadastral information. The updating process was executed by visual control using the available high resolution orthoimagery (20cm). Brandão (2003) proposes a method to calculate the error tolerance for urban cadastre based on the Código Civil Brasileiro, Lei 10.406 from 2002 (BRASIL, 2002b). According to him, ±0,10m is the tolerance value for errors on urban territorial parcels in Brazil. Thus, we highlight that the update work of cadastral data did not have a cadastral goal, which would have accurate measurement purposes, but rather it was made for visualization only. So that, the new and altered polygons corresponding to lots and buildings' projections were drawn and properly identified as non-official data.

Afterward, using the updated cadastral data, the Lidar dataset was transformed in height information through the extraction of the "Z" value from the point cloud and interpolation of a raster surface from them (Figure 5).As the point cloud dataset from Lidar covers a continuous surface without distinguishing the elements, additional information such as elevation from cars and vegetation, were excluded using the buildings' projections as a delimitation layer. Also, to avoid variations in the heights of the same element, the majority elevation value for each element was extracted generating only one elevation value for each building. Finally, to reach the height building information, the terrain elevation from the central point of the building projection was subtracted from the elevation information generated from Lidar dataset.

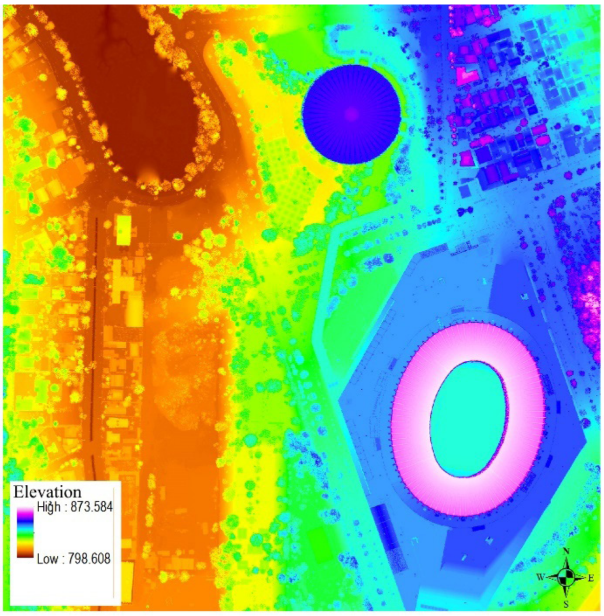

Fig. 5 - Example of a raster surface interpolated from Lidar point cloud. Source: Elaborated by the authors with data fromPRODABEL, 2016.

Previously to the workshop, a set of models were also prepared for the Geodesign study. As indicated by Steinitz's framework, the methodology is dived in two steps: "assessment" and "intervention".While the intervention step focus on the future instead of present and past aspects, the assessment step has the aim of addressing the geographic context through therepresentationmodel – which describes the study area through data, the process model – which provides information on how the area operates, and the evaluation model –which evaluates if the area is working well (STEINITZ, 2014).

In order to elaborate the models, five systems of assessment were defined considering the main impacts caused by a housing densification: traffic, volumetric density, housing density, visibility from the lake shore, and environmental quality. The composition of the five systems is presented below, along with the resulting evaluation models for each one of the systems.In each figure there is a description about the steps involved on the elaboration of the systems (Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10).

The system that evaluates the visibility from the lake shore (Figure 10) uses a digital elevation model composed by the terrain elevation associated with the elevation from the building which was generated from the Lidar dataset.From this elevation model a visibility analysis was held (Figure 11). The visibility analysis shows the height (meters) for the objects to be seen from at least one point of the lake shore (Figure 12).

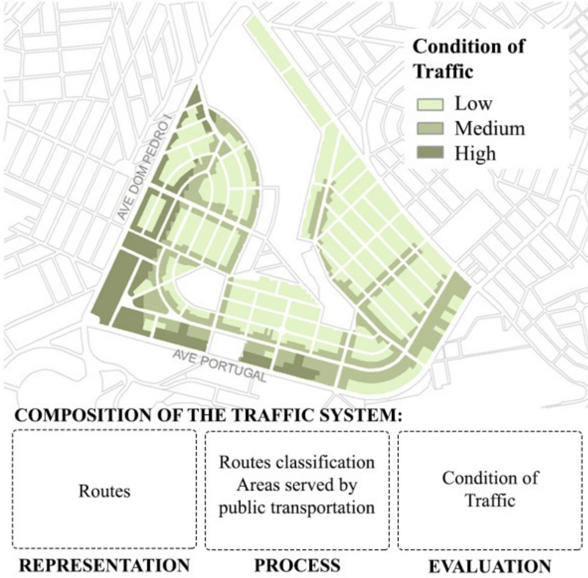

Fig. 6 - Evaluation map from Traffic System. Source: Elaborated by the authors with Laboratory of Geoprocessing data (EA/UFMG) / PRODABEL, 2016.

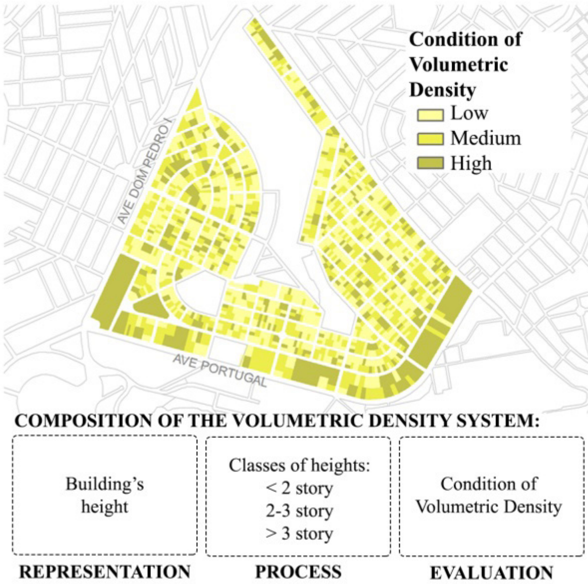

Fig. 7 - Evaluation map from the Volumetric Density System. Source: Elaborated by the authors, 2016.

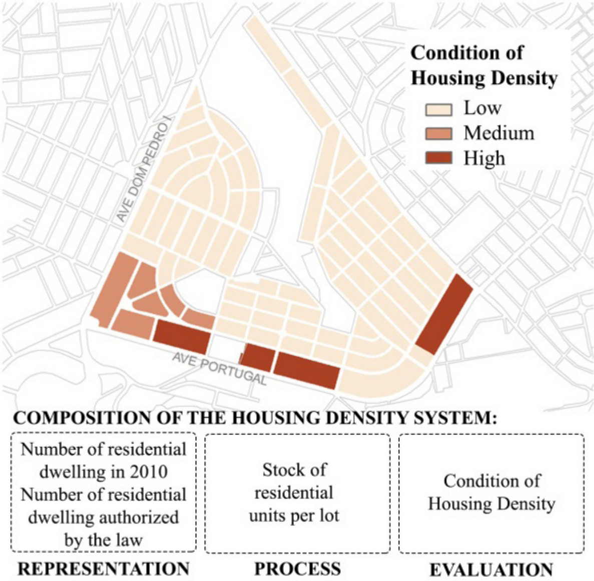

Fig. 8 - Evaluation map from the Housing Density System. Source: Elaborated by the authors with Census data (2010), 2016.

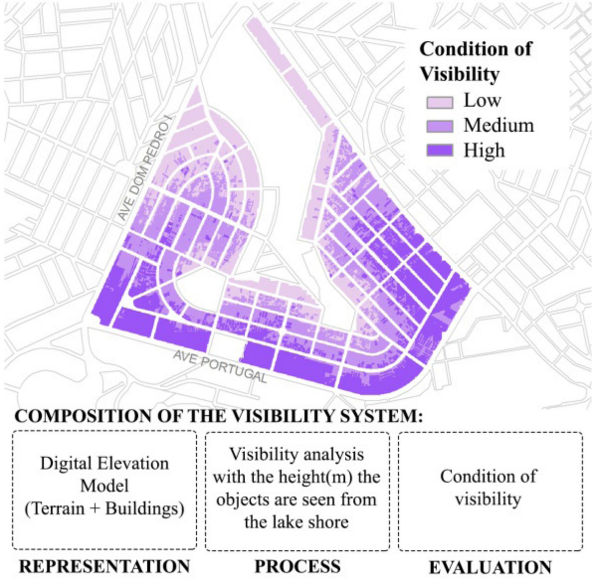

Fig. 10 - Evaluation map from the Visibility System. Source: Elaborated by the authors with data from PRODABEL, 2016.

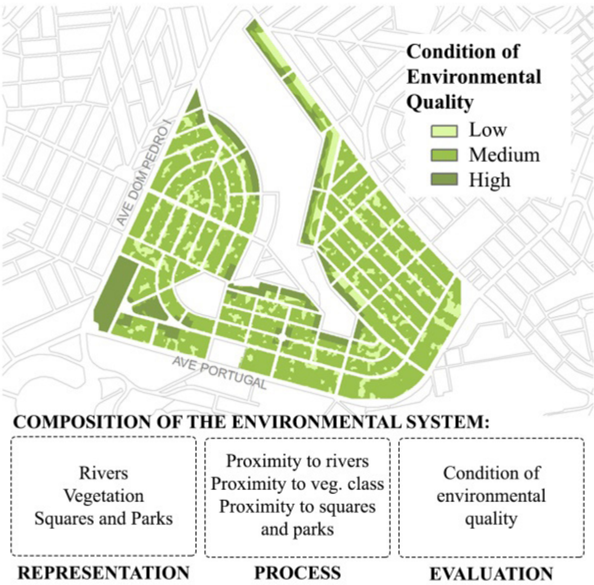

Fig. 9 - Evaluation map from the Environmental Quality System. Source: Elaborated by the authors with data from Laboratory of Geoprocessing (EA/UFMG), 2016.

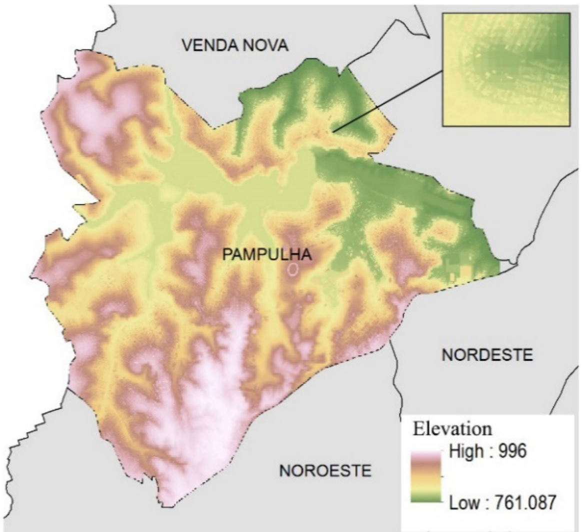

Fig. 11 - Digital Elevation Model with Terrain Building Elevation Information. Source: Elaborated by the authors with data from PRODABEL, 2016.

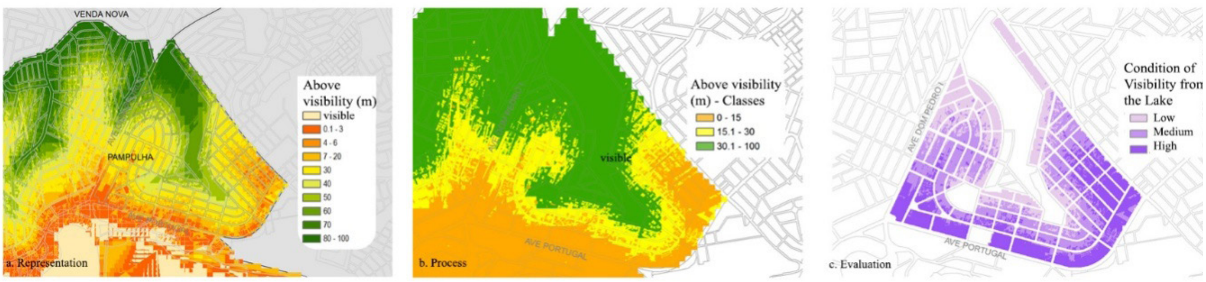

Fig. 12 - Example of Representation, Process, and Evaluation Models for the Visibility System. Elaborated by the authors, 2016.

From the models provided by the assessment step, which were prepared previously to the workshop, we begun the activity aiming to generate the next three models: change, impact, and decision, which compose the intervention step.

2.4 The Geodesign Workshop

The workshop worked on two distinctmoments. Firstly, the participants were invited to analyze the models in order to define homogenous areas which could receive the same urban parameters. This way, in a second moment, participants could work on the simulation of the proposed parameters considering possible particularities in the area.

The participants were divided in representatives of three main groups of social interests: locals, or the people of the place, planners of the public sector, and people from the economic sector. Thus, the three groups analyzed the area mainly through the collection of evaluation models. The aim was to identify differences and similarities that could interfere in the proposition of parameters. Therefore, the participants prosed diagrams, called 'change models,'to represent the most suitable regions for three level of density within the area, using the classes high, medium and low density.

First, each group proposed one diagram of intervention according to the interests they were representing, resulting in three proposals (Figure 13).Then, those proposals were assessed by zonal histograms that analyze the impacts for each diagram according to the evaluation models. The histograms were called 'impact models' (Figure14). At that point, the proposals were presented to everybody, and the whole group of participants collectively decided on one diagram to move forward, considering the impact models and the different interests.

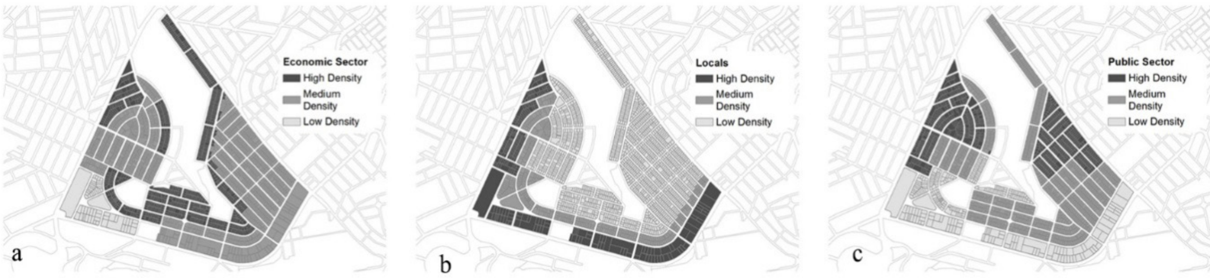

Fig. 13 - Proposals of density level by:**a.**economic interests,**b.**locals,**c.**public sector(darker grey color represents the proposals of more dense areas). Source: Elaborated by the authors, 2016.

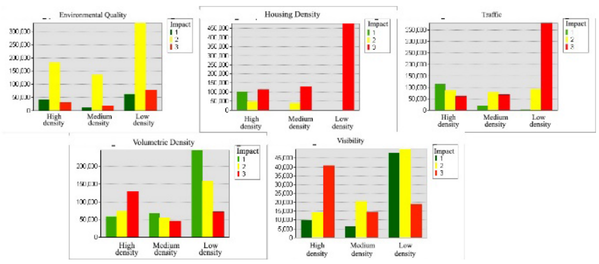

Fig. 14 – Example of impact analysis through histogramsof the proposal from locals group. Source: Elaborated by the authors, 2016.

Afterward, a simulation of the existing volumetric conditions was presented so that the participants could relate the landscape with the current urban parameters provided by law. The volumes of existing buildingswere generated by the appliance of the heights, which were extracted from the Lidar Dataset, to the cadastral polygons of buildings. The generated scenery worked narrowing the distance between the indexes provided by law and its resulting landscape on the urban context (Figure 15).

Fig. 15 – Simulation of volumes of existing buildings for the study area.Source: Elaborated by the authors, with data from Lidar dataset, 2016.

Thereafter, having three distinct areas for high, medium and low density housing, and a comprehension of the current volumetric aspect of the area, the participants could simulate and dynamically visualizenew landscapes through the application of urban parameters according to the rule (Figure 16, Figure 17 and Figure 18).

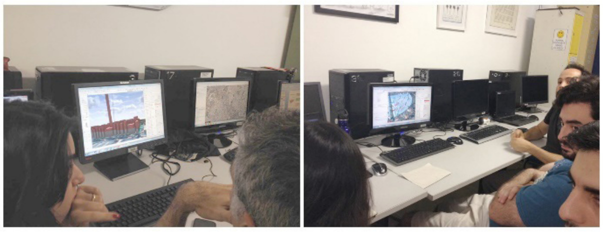

Fig. 16 - Participants working on simulations during the workshop. Source: Authors' collection, 2016.

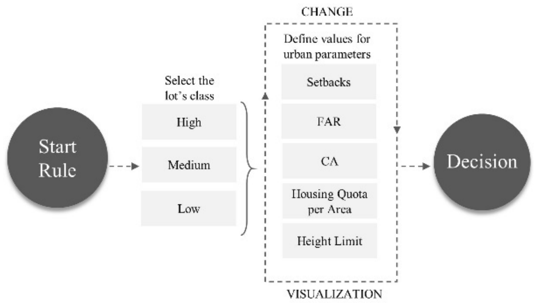

Fig. 17–Main steps of the rule forurban parameters simulation. Source: Elaborated by the authors, 2016.

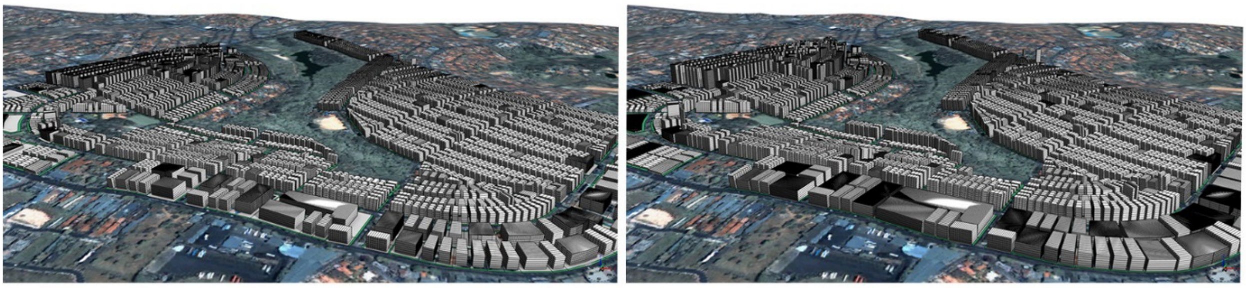

Fig. 18 – Example of simulations changing the indexes of FAR. Source: Elaborated by the authors,

Besides the simulations with the main urban parameters such as the FAR (Figure 18), the participants could also visualize the application of the visibility impact of building's height. Through the option of applying a color to the floors units which are seen from the Pampulha lake shore, participants were able to analyze the height impact from buildings (Figure 19).

impact models. Firstly, the groups agreed on the low density areas, one at the south-west part as the area which has a great visibility impact, and another at the central part, which surrounds an urban park. After, they agreed on one concentrated area for high densification on the west portion, leaving the remaining areas as a medium density class (Figure 20).

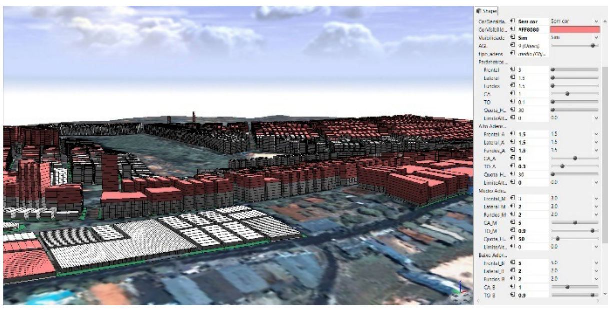

Fig. 19 - Application of the visibility analysis - visualization of the units floors which are seen from the Pampulha lake shore.Source: Elaborated by the authors, 2016.

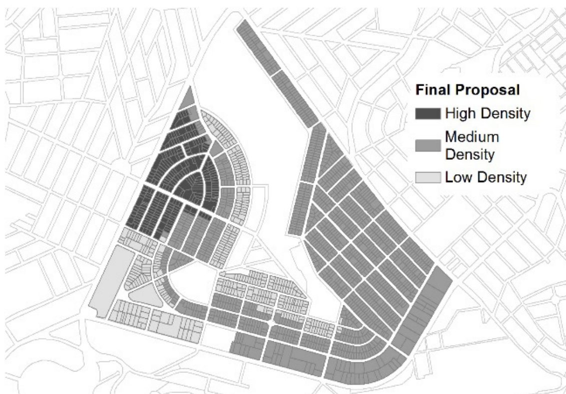

Fig. 20 - – Final proposal of density classes for the study area. Source: Elaborated by the authors, 2016.

3. RESULTS

The final diagram proposal for three classes of density was negotiated by the groups consideringtheir different interests and the

After simulating different values and indexes for the main urban parameters covered by the rule, each group could compare the resulting landscape from different sets, and define an expected landscape result. The example of the set of parameters defined by each one of the groups for the high density areas is shown in Table 1. The resulting sceneries from the values proposed in Table 1 for high density areas are shown in Figure 21.

Table 1 – example of values defined by each groups for the high density class

	Setback front	Setback R/L sides	Setback back	FAR	CA	Housing Quota	Height Limit
Econ. Sector	3	1.5	1.5	1	5	30	-
Public Sector	5	4	4	0.6	4.5	30	-
Locals	3	1.5	3	0.8	1	45	27

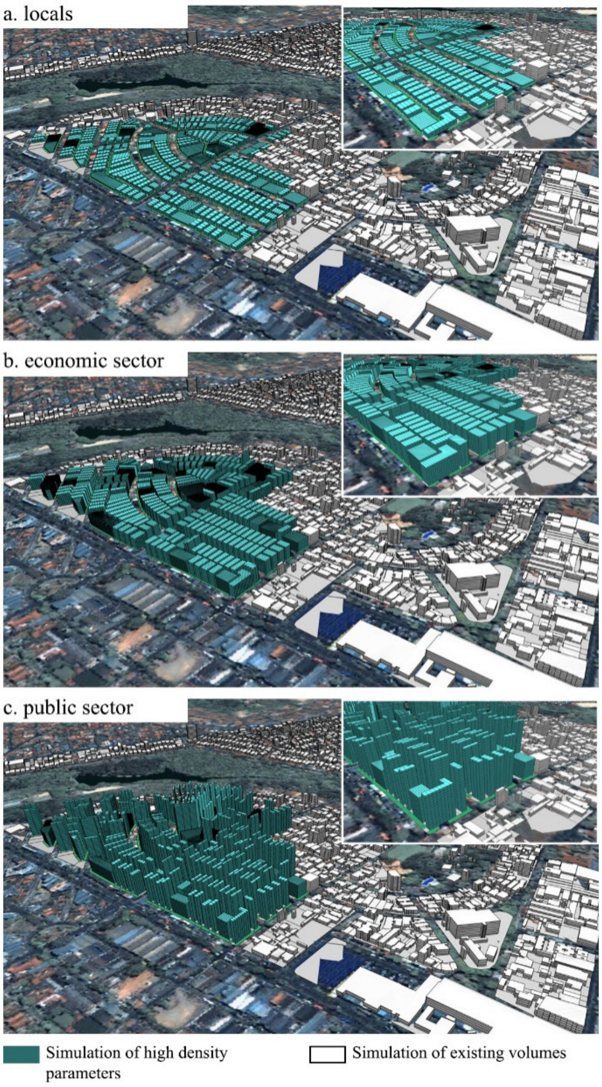

Fig. 21–Example of the sceneries proposed by the groups (a.locals, b.economic sector, c.public sector) for high density areas. Source: Elaborated by the authors, 2016.

4. CONCLUSIONS

Due to the great variation among the municipalities in Brazil, the standardization of urban cadastre is challenging. Brazil has more than 5 thousand municipalities which greatly vary on territorial size, population, and economic conditions; so that, the investment in creating a CTM, which is not yetmandatory, is not a priority for many municipalities that produce and maintains their data in decentralized systems. Even the Master Plan, which is an essential instrument for the promotion of an articulated development of the city, was not implemented in more than 30% of Brazilian municipalitiesby 2013, according to IBGE (*Instituto Brasileiro de Geografia e Estatística*). Identifying an effort to encourage the implementation of a *CTM*, through the implementation of the ordinance n.511 from 2009, we reiterate the possibility of comprising the 3D aspects of the parcels in order to attempt to address the complexity of the built space, even in a simplified way.

Emphasizing the relevancy of the investment in data acquisition by the municipalities, the Pampulha case study shows some effective ways of exploring available technology to improve planning performance. Due to Belo Horizonte's pioneering work on cadastral data collection and maintenance, the available information allowed a great characterization of the context, satisfactory impact assessments, and simulations. Moreover, the available information could greatly contribute to a structuration of a 3D Multipurpose Cadastre. Although a multipurpose 3D cadastre differs from 3D city modeling, it still can provide information on aspects of the built space and building/land property rightswhich can greatly inform 3D simulation and modeling of urban environment. Besides the cadastral information on physical aspects of territorial urban units, the 3D cadastre can also comprise legal aspects of urban regulations, which applied to 3D simulations can greatly contribute to a more informed planning process.

Through the development of the presented case study, we discuss the real awareness about the landscape that is placed, and if the urban parameters we propose and approve in fact, agree with the landscape we look for. Thus, we highlight the relevancy of the visualization tools throughout the proposition of urban parameters process, tying the urban parameters with a mental association with their results for the landscape.

Visualization resulted as a key supporting tool on the decision process on urban context. We call attention for three main results from the use of visualization tools throughout the process. Firstly, it brings the possibility of translating indexes to the individual volumes increasing the participation process and narrowing the distance between technicians and the population. Second, the possibility of identifying values and expectations for a landscape and analyzing possibilities of acting, defining the means to achieve those expectations. And finally, it allows the relative analysis of the application of urban parameters to a context and not only to the building itself.

In short, although the urban landscape is composed by a set of many other aspects, the article addresses the urban parameters and theirimpacts. This is due to the morphometric approach of Brazilian urban regulations that usually defines parameters for occupation considering the lot itself and not the set of objects that compose the urban context. In this sense, further studies may happen in order to explore the parameterization activity and tools that may support on building an urban landscape.

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