

TeMA

Journal of
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This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

INPUT 2014

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Smart City

planning for energy, transportation
and sustainability of the urban system

SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

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This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

SMART CITY PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM Special Issue, June 2014

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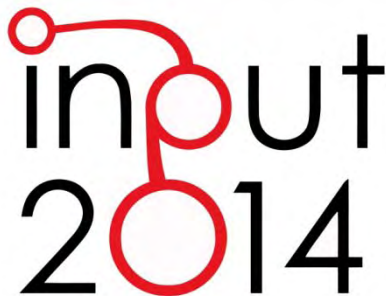
SPECIAL ISSUE

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The logo for the INPUT 2014 conference. It features the word "input" in a lowercase, sans-serif font, with the "i" and "n" connected by a red line that forms a loop. Below "input" is the year "2014" in a larger, bold, sans-serif font. The "0" in "2014" is also connected to the red line from the "input" logo.

PARAMETRIC MODELING OF URBAN LANDSCAPE: DECODING THE BRASILIA OF LUCIO COSTA FROM MODERNISM TO PRESENT DAYS

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ABSTRACT

The paper presents the case study of the Pilot-Plan of Brasilia, important example of modernist urban design protected as human heritage. Discusses a methodological process to promote visualization of maximum envelopes of urban volumes, organized in a set of rules and scripts which structures urban parameters in a logic of volume constructions. Applies City Engine - ESRI facilities to construct and visualize the urban rules. It has the goal to promote characterization, analysis, proposals and simulation of urban parameters in order to support decision making in land use transformation. The research deals with the difficulties of management urban pressure of transformation and the maintenance of urban cultural heritage. The methodology defends the change from authorial urban design to the decoding of collective values and goals. The 3D modeling and dynamic visualization promotes the composition of the whole, which means to work in a relative mode, and not in an absolute sense. Although it had been developed for a particular case study, the protected historical area of Brasilia, it presents methodological processes of how to structure rules of three-dimensional modeling to simulate the maximum constructive authorized by planning legislation (maximum envelopes), so that it can be reapplied in any other situation of definition of parameters in urban master plans and in laws for land use and occupation.

KEYWORDS

Parametric modeling of urban landscape, Visualization, Landscape simulation

1 INTRODUCTION

The parametric modeling nowadays is the new way of managing the urban occupation and to translate the urban logical to architectural scale. The establishment of urban parameters is at the origin of the urban design and in urban zoning proposed in the laws for the soil use and occupation still in modern period, but the parameterization applied today presents different motivations and goals.

The urban design emerges as authorial proposals of planners who aimed to transpose to the territory their ideals of organization of anthropic occupation of urban space. The drawings resulted in new urban projects or for reconstructions for areas already occupied. Many of these authorial projects were not translated to parameters which could represent them, as they were proposed as an absolute way, as conclusive designs.

The new way of drawing and designing the urban space puts the urban planner as a decoder of collective will, and not anymore as author of conclusive forms. As decoder of the collective will, the new urban planner must understand what composes the essence of the landscape expected by citizens and translate this essence to urban parameters. These parameters comprise maximum constructive or envelopes where the individual expression of each architectural work must fit. With this, the landscape of the city is sharpened, so as to allow the individual expressions but, at the same time, ensure the composition of the whole, which means to work in a relative mode, and not in an absolute sense.

The three-dimensional and contextualized view should be used as a principle of analysis, proposition, communication and simulation of urban parameters. It supports decisions making on projects which are the translation of the willingness of an urban region. Aware that consensus doesn't exist, the choice of defining maximum envelopes ensures the management of a collective landscape, within which the singular building performs its individual formal manifestation.

The needs of visualization, to portray the contextualized urban proposals, and not absolute and conclusive proposals, are being favored by applications of geo-technologies available nowadays. These applications transform values in volumes representing, in three-dimensional view, to favor the understanding of its significance.

In this respect, emerged the "City Zoom" in Brazil who works with the principle of visualization of the results proposed by Master Plans and to simulate the results of urban parameters to encourages the perception of the landscape (Turkienicz, et al., 2008); in Italy was developed "Invito" to promote the dialog between technicians and representatives of community to support decision making (Pensa, et al., 2013); and there is the "City Engine", proposed initially to represent cities for virtual games, adapted to ESRI systems to the employment of a basic set of geometric rules so as to encourage the construction of scripts for modeling of urban forms.

The parameterization has been the new path in architectural design, to meet a set of limits justified by the juxtaposition of isolated units that constitute the whole. The regulation plans of cities are presenting modeling parameters that requires a 3D representation for their calculations, as the example of solar envelops and axes of visualization analysis.

Brasilia is an emblematic case for studies of urban planning, as it is the most important example of modernist urban design. However, completed 50 years of its foundation, it has been observed that the risk of transformation of landscape and urban heritage and the loss of essence of territory due to new demands and the value of the land soil. The present study aims to use parametric modeling tools of urban occupation to promote visualization of the ideal ideas which generated the Pilot Project, and as a tool for the management of new landscape in face of current demands of transformations and new constructions.

2 BRASÍLIA – THE MODERNIST CITY, PRODUCT OF THE URBAN DESIGN

Created in 1957 and inaugurated in 1960, Brasilia is Lucio Costa's urban project and Oscar Niemeyer's architectural concept that translates all values of modernist urbanism recommended by Le Corbusier. The urban and architectural importance of the city made the core pilot be protected by IPHAN (National Institute of Historical and Artistic Heritage), receiving the title of Heritage of Humanity by UNESCO. Today, the city is inserted in a metropolitan region that has more than 3 million inhabitants and is under pressure of transformations that threaten this unique example of modernist city.

The city was built "in the heat of the "national-developmentalism", a period in which Brazil had high rates of economic growth and urban expansion. Having been designed and built by Brazilians, there has been an unprecedented effort for its realization, because "it was a project linked to the assertion of Brazil as modern nation." (Government of the Federal District, 2009).

According to Francisconi (2011), management of the historical heritage's landscape today is of great complexity, being characterized by an unsustainable urbanization, because the Pilot Plan of Brasilia does not have the legal background-normative required to promote a sustained urbanization, and there is a lack of clarity in the application of values recommended by Lucio Costa of four scales: monumental, urban residential, gregarious and bucolic. The difficulty exists, also, because two pilot plans were created by Lúcio Costa for Brasilia: the first was the original pilot plan selected by international jury as winner of the tender for the New Capital; the second was the pilot plan that guided the construction of the Pilot-Plan. (Figure 1).



Figure 1 - Original Pilot Plan, submitted in the competition (a), and Pilot-Plan built (b). (Source: Lúcio Costa, Brasília 57-85, 1985). Scales bucolic (green), gregary (red), residential (yellow) and monumental (blue), (Adapted from SEDHAB, 2013)

The sketches of Lucio Costa present the definition of intent of landscape in residential scale modeled by maximum constructive in the region of residential blocks. But Lucio Costa did not specified in parameters these maximum constructive, committing only in carrying out the design of the patterns of the first buildings, in the expectation that the example of drawing was sufficient to establish the standard of what would be the remainder of the assembly.

Lucio Costa (1957) describes his expectations for the residential sector:

"As regards the residential problem, I thought the solution to create a continuous sequence of large blocks arranged in order double or simple, both sides of the strip road, and framed by a wide band densely forested, large trees, prevailing in each block certain plant species, with ground lawn and a curtain of shrubs and foliage, in order to safeguard better, whatever may be the position of the observer, the contents of the blocks, as always seen in the background and muffled in the landscape. Provision which has the double advantage of guaranteeing the ordination planning even when varies the density, category, standard, or quality architectural design of buildings, and offer the residents extensive shaded bands to tour and leisure activities, regardless of free areas provided within the blocks.

Within these "super-blocks" the residential blocks may have the most varied manner, but obeying the two general principles: uniform maximum template, maybe six decks and piers, and separation of the traffic of vehicles from pedestrian traffic for the special access to primary school and the facilities existing in the interior of each block." (Figure 2).

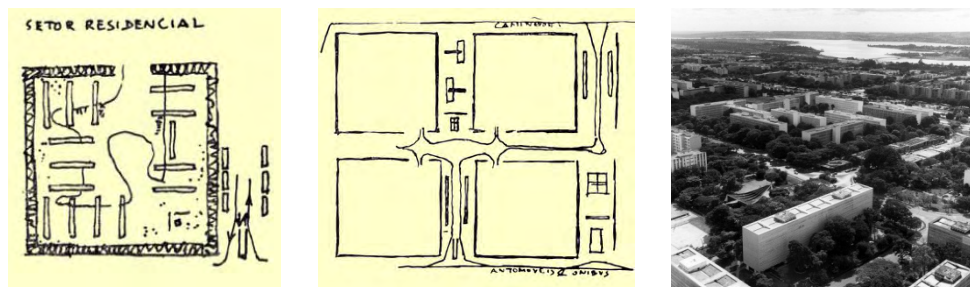


Figure 2 – (a) Lúcio Costa's sketches – the inside of the super-blocks. (b) Lúcio Costa's sketches – the articulation of super-blocks. (c) South Wing – Super-Block, Brasília, 1990. Picture from Duda Bentes (Depart. Patrimônio Histórico e Artístico do DF, Source: Paviani, Aldo, Vitruvius, 2013.)

About the essence defined for residential sectors of blocks, Lucio Costa (1987), writing about Brasília revisited years later, thus explains:

"The residential scale, with the innovative proposal of superblock, the urban serenity assured by template uniform six floors, the free and accessible floor to all through the widespread use of piers and the predominance of green, brought with it the embryo of a new way of living, own of Brasília and entirely different from other Brazilian cities."

The result of the planned image by Lucio Costa in residential super-blocks can be seen in the following image (Figure 2-c), in which it sees example of superblock designed by him. Many other super-blocks were not designed and occupied during the period of implementation of the plan, but there was an expectation not translated into parameterization, of which the essence if he repeated throughout the set, even with different architectural solutions. As maximum constructive were not defined, as well as other urban parameters, how to ensure homogeneity of the urban landscape assembly?

2.1. BRASÍLIA AND ITS CONTEMPORARY ISSUES

In 2011, according to the importance of Brasília as Patrimony of Humanity and, above all, as a cultural and architectural Brazilian heritage, a study was carried out by the State Department of Housing and Urban Development to define criteria and care for the occupation of preserved areas and for ordering the growth of occupation on the edge of these areas. The report has detected the following needs and defined by the following headings:

- Currently the preserved area is all under the same level of protection;
- There is no demarcation of patrimonial interest area around the polygon of the preserved area. Therefore, it is not considered the importance of the surroundings that conforms, also, the modernist landscape.

Given the existence of significant pressure for transformation both preserved area as its edge, bearing in mind the existence of non-occupied areas in both territories, the study proposes:

- The definition of different levels of protection of this urban assembly has already been the subject of previous studies by working groups that dealt with the preservation of Brasília. This definition is critical because not all areas that integrate the preserved polygonal must have the same level of protection,

since they have different physical attributes that participate in different ways to characterize the "Urban Design";

This decision by the establishment of levels of protection for the assembly, to act in a contextualized way on the individual conditions of each portion of the territory, relies on Decree no. 299 of the National Institute of Historical and Artistic Heritage, which establishes the methods and instruments of inventory as subsidies for characterization of historic sites and the definition of differing levels of protection. (Figure 3).

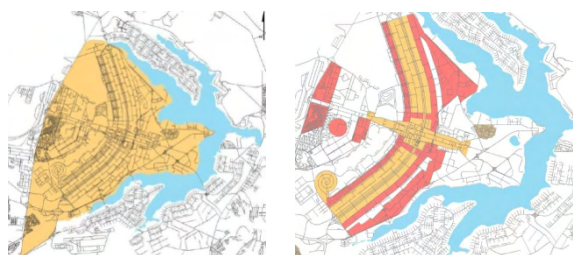


Figure 3 - Heritage area from Brasilia. Priority areas for conservation - in yellow the sectors and blocks deployed according to the pilot drawing and in red those deployed until 1967. (Source: SEDHAB, 2011)

The analysis of the criteria for preservation and for the evaluation of new uses in the preserved area should consider the landscape maintenance and urban monumental axis, with its sense of unity and of ordination, the vision of the horizon of heaven that characterizes Brasilia and the treatment of open spaces.

As a main criterion for the preservation of the preserved area, the same study indicates the identification of the design of the Pilot-Plan in its original proposal and the aspects incorporated throughout the time of its urban sedimentation, delimiting areas inside the polygonal for the maintenance of the "readability" of the landscape.

Some sectors were defined as priority areas for conservation: some camps of initial work, the sectors and blocks deployed according the Pilot-Plan, and the sectors and blocks deployed until 1967. (Figure 3). The study provides the detail of conditions of preservation in the area of the Pilot-Plan and its environs, classifying each characteristic according to their levels of need of preservation (complete, partial or no value). The characteristics proposed for evaluation in these three levels were: urban fabric (mesh, division of soil, relation of empty and full), open spaces (drawing and composition, vegetation, paving, furniture and decorations, usages) and buildings (volumetry, language and composition, historical value and uses).

In the specific evaluation of "super-blocks" and the recently practiced volumetry by buildings, the report identified the risks relating to the rupture of the initial idea of the plan through construction of volumes that promote ways that transcend the prismatic envelops provided, such as the employment of roofs with the formation of the 7th floor and the absence of leafy green belt.

The verification of setbacks also needs to be revised, because in 2007 was deployed a supplementary law that allowed the growth of buildings by advancement of projection in public areas and whose result was the increase of density built, the approximation between the buildings and the reduction of green spaces. It is also observed the constant increase on areas that should be destined for gardens or the circulations. In areas intended for houses, it was observed that they had a transformation of the landscape to respect the maximum height (7 meters at most), which would mean two floors in form of prismatic volumes.

Another risk to the preserved landscape from Brasilia is the existence of spaces still not occupied between the blocks, requiring management of typologies of occupation to avoid the rupture of language, landscape values and composition of the whole historical and cultural. In free areas, that constitute real land parcels, it is still essential to avoid conurbations of constructions and disruption of the pattern of landscape.

According to Granja (2005), the super-blocks began to be established around 1958 and, since then, this process has been occurring slowly and continuously, but with dissonance between the two wings, not being, even today, entirely constructed. According to the author, of 120 super-blocks designed, 30 are still incomplete. This means need to modeling the urban parameters for proper occupation of areas of significant value, which are under pressure of transformation, especially in the north wing.

The disregard for the protected project is denounced in blogs and manifestations by groups that have an interest in the preservation of the landscape, as is the case of the group "Planners for Planners" and "More Community", as well as other groups and professionals who has acted actively in questioning the PPCUB (Plan for the Preservation of Urban Assembly of Brasilia) and LOUS (Law of Land Use and Occupation) (Paviani, 2013), and also criticized by Ramos (2013). It is justified the need to further discussion of parameters to shape the new occupations of vacant areas, in order to preserve the genius loci of the set.

It is observed that in front of the existence of areas with conditions of crowding of the occupation, of the existence of areas still not occupied, and the significant demand and value the possibility of occupation, the proposition of instruments for the management of urban development parameters that shape the landscape is fundamental.

Another example of the manifestation of the community against the occupation of areas that are still free and whose occupation can lead to disfiguration of landscape values of the Pilot-Plan, in the light of pressures of processing and expressive value of land, is the case of the central area, in the Field of Large Areas. In this region, the district government and the urbanizing company proposed the increase of urban parameters without the prior analysis of IPHAN (Institute of National Historical and Artistic Heritage). The complaint was published on the blog "More Community" in 2012. It stands out that for obtaining the interest of the citizens and to illustrate what would be the result of the change of landscape parameters of urban area, the blog used three-dimensional viewing, demonstrating the impact that could happen in an area of extreme interest to the assembly and still little occupied.

The State Department of Housing and Urban Development Regularization of the Federal District - SEDHAB (2013) presented in the Supplementary Law of Use and Land Cover of the Federal District document explanations to make clear the meaning of urban parameters, and argues that the use of different parameters of occupancy for each city is justified in order to maintain the local characteristics and needs, in order to respect the elements that confer uniqueness and identity to the spaces of each urban center: "By PARAMETERS OF OCCUPANCY shall mean: the maximum area that can be built; the amount of land area that can be occupied; the quantity of free permeable areas that must be kept on the land; the maximum height of the building; the mandatory setbacks and others."

The process of building a law, according to SEDHAB (op. cit.), Should be based on knowledge of the real city, knowledge of applicable laws, preparation of preliminary proposals, in the discussion of these proposals in workshops, followed by their presentation in public consultations and public hearings. The contribution of the visualization mechanisms favors all stages of proposal and decision on the urban parameters.

The establishment of zoning and urban parameters, parts of the drafting of Use and Land Cover Law of a city, must follow the principles of urban policy designated by the Federal Law No. 10,257, of July 10, 2001 - City Statute, in particular with regard to democratic management based on the participation of civil society and the population in general. This means that the preparation of the LOUS must be based on collective construction of decisions, and should provide activities and participatory events involving government agencies and the public. With the need to foster dialogue with the population for collective definition of parameters that, once charged, shape the landscape, it became fundamental the investment in the

visualization of urban information, especially to view the possible results of applying the proposed urban parameters.

In this way, this paper defends the application of Parametric Modeling of Territorial Occupation, employed in the scale of the protected landscape of Brasilia, to visualize the results of the decisions on the management of the city landscape.

3 METHODOLOGY

The methodology was composed by the following work steps:

- a) Construction of cartographic base adapted to geoprocessing;
- b) Revision of rule-base parameters lettings composed by the ratio of returns in the currencies, occupancy rate, coefficient of utilization and maximum height of buildings;
- c) Decoding of the ideas of Lucio Costa through creating rules of urban parameters that present the maximum envelope defined by him;
- d) Study of the existence of areas in change for new occupations;
- e) Analysis of the suitability of urban parameters proposed by the legislation for the use and occupation of the soil in face of the logic of Lucio Costa;
- f) Presentation of the logic of Parametric Modeling of Territorial Occupation for the management of collective heritage and landscape.

Although it had been developed for a case study, the protected historical area of Brasilia, it presents methodological processes of how to structure rules of three-dimensional modeling to simulate the maximum constructive authorized by planning legislation (maximum envelopes), so that it can be reapplied in any other situation of definition of parameters in urban master plans and in laws for land use and occupation.

4 DEVELOPMENT AND RESULTS OBTAINED

4.1 CONSTRUCTION OF CARTOGRAPHIC BASE ADAPTED TO GEOPROCESSING:

Construction of the mosaic of CAD files, separated by layers, associated with attributes containing alphanumeric values of areas, occupancy rates practiced in each super-block, zoning proposed and its respective parameters (occupancy rate, maximum height, setbacks).

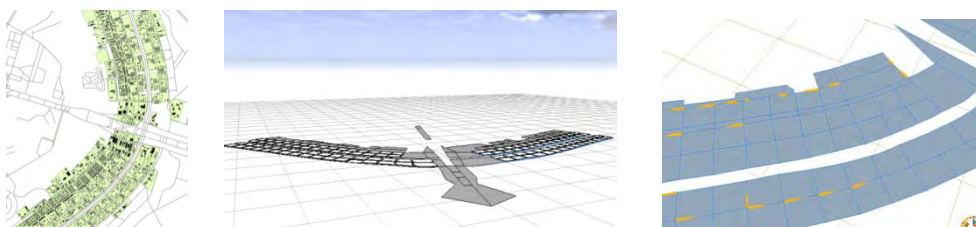


Figure 4 – Cartographic base (a) and (b). Establishment of the front of the block - in the figure the orange one represents what the system considers the front or the first line, and must be redefined (c).

Considering that the shapes at this step is not dynamic, what means to compose the territory in the form of continuous (polygonal geometry of tracks by connecting perfectly with polygonal blocks, in the form of territorial contiguous parcels), by this time it was necessary to specify the front of the lots, as some parameters differs according to the side of the block (Figure 4).

In next steps of the project it will be identified the geometric logical that structure the drawing of streets, roads and avenues of Pilot-Project, because it has a special logic, and this will allow the working with dynamic shapes, and not just static with singular layers of each variable. This means that any transformation in the geometry of a polygon is automatically reflected in the geometry of the shapes that are contiguous.

4.2. REVISION OF RULE-BASE PARAMETERS LETTINGS COMPOSED BY THE RATIO OF RETURNS IN THE CURRENCIES, OCCUPANCY RATE, COEFFICIENT OF UTILIZATION AND MAXIMUM HEIGHT OF BUILDINGS

In previous studies from the Laboratory of Geoprocessing of EA-UFMG for structuring of rules for the application of urban planning parameters for simulation of envelopes that translate the maximum constructive in Brazil, Saliba and Santana came to publish a first basic-rule (2014), but it was revised by us because of the identification of an error in geometric calculation of useful area, the maximum projection of the building.

The new basic-rule applies the following logic (Figure 5):

- Calculation of the area of the lot followed by projection of frontal, side and of back setbacks (in Brazil it's common the specification of different values for the setbacks), for the drawing and calculation of the useful area of projection of the building;
- If the value of the usable area of projection of the building is greater than the Rate of Occupancy (R.O., in Brazil T.O.) allowed by law, it must be scaled in order to be reduced and operate as the real usable area set of deployment of the edification. In this point the error in the first basic-rule was identified, because the initial formula applied the scale factor ignoring that the reduction should occur in two axes, on "x" and "y", what means it is necessary to work with the square root of the value of reduction.
- From the value of the new usable area set to the projection of the building, and within the limits of projection identified, is calculated the final volume to be built according to the restrictions of the Coefficient of Utilization (C.U., in Brazil C.A.).

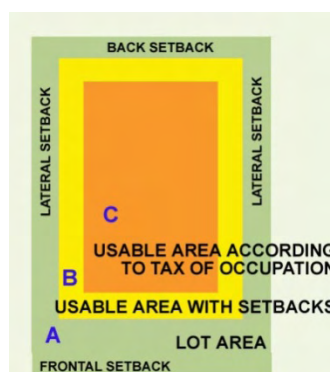


Figure 5 – Representation of main urban parameters

New Script: Calculation of "AreaLot A" and calculation of "AreaUsable B" resulting from the subtraction of the setbacks. If "AreaUsable B" > RO (Rate of Occupation authorized by law), do "AreaUsable B" * Scale Factor. Scale Factor = "AreaLot A" * RO / "AreaUsable B". Considering the the scale must be applied apart in each axes "x" and "y", this means to apply the square root of Scale Factor in each axe. "AreaUsable B" * $\sqrt{\text{Scale Factor}}$ in one axe and "AreaUsable B" * $\sqrt{\text{Scale Factor}}$ in the other axe = "AreaUsableAdapted

C". After that, to generate the Final Volume: "AreaLot A" * CU (Coefficient of Utilization authorized by law) / "AreaUsabelAdapted C" = Number of Floors to be built ("Pav"). "Pav" * 3m = Maximum Height of the envelop.

4.3. DECODING OF THE IDEAS OF LUCIO COSTA THROUGH CREATING RULES OF URBAN PARAMETERS THAT PRESENT THE MAXIMUM ENVELOPE DEFINED BY HIM.

Lucio Costa didn't stipulate parameters to be followed the new blocks from the expansion of the occupation of Pilot-Plan. As representative of modernist urban design, he drew the urban landscape in a conclusive way, what means to draw the urban territory projecting its final form. Together with Oscar Niemeyer he was responsible for the design of large part of the buildings in the first super-blocks. When he explains the intentions in the form of parameters they are vague, and because of that the simulations promoted in this case study had the goal to represent the three-dimensional form and, above all, to build the logic rules that could tell about the volumetric intention of Lucio Costa. The rules and the visualization of the rules were drawn up with the employment of software City Engine – Esri (Figure 6).

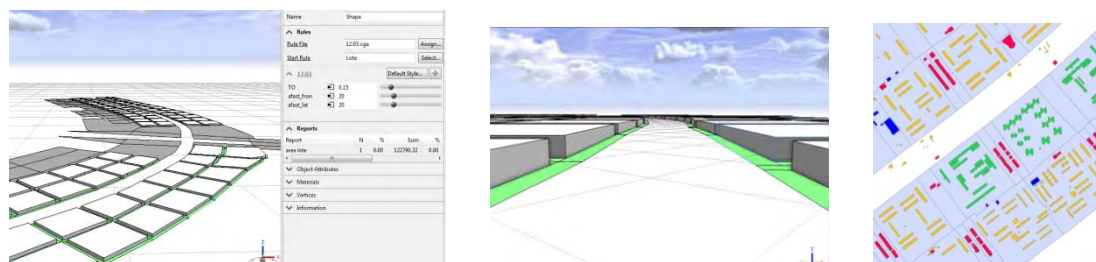


Figure 6 – (a) Decoding of the drawings and the volumetric intention of Lucio Costa. It's interesting to observe the similarity with the first drawings (Figure 01) and the relation of parameters considered as initial attributes. (b) Visual perception of setback and height. (c) Observe how the occupation in green are example of differences pattern of occupation, although follow the generic parameters proposed by Lucio Costa.

This study of the simulation of the maximum envelope favored understandings about perception of landscape, perspectives and views of space designed. Allowed to understanding, for example, on the scale of the user, the impact of the elements placed in the vertical axis, because when the parameter of height is equivalent to the parameter of frontal setback, the vertical element gives the impression of being larger than the horizontal element (Figure 6-b). Changes of values on attributes were tested, to promote understanding of the possible compositions of the landscape, as the use of City Engine allows the dynamic modeling of volumetric results while changing the attributes established on the "rules" programed.(Figure 6-a)

When Lucio Costa wrote about the expectations of landscape designed, he established only the setbacks and maximum height, but didn't define the rate of maximum occupancy per block, even though he wrote about the intention to preserve expressive natural areas with large trees among buildings. It's observed that blocks with buildings designed by him have a recognized standard, but the others projected later by other architects presents the same setbacks and height, but the volumetric language is quite different, not characterized by prismatic volumes of modern architecture. (Figure 6-c).

4.4. STUDY OF THE EXISTENCE OF AREAS IN CHANGE FOR NEW OCCUPATIONS

As registered by bibliographic research that reports the views of urban planners who operate at the scene of the reality of Brasilia and studied the issues that are pressuring the transformations of landscape, and through diagnostics produced by public institutions, Brasilia still has areas not built which can be used in the

area of the Pilot-Plan. But the point is how maintain and reproduce the essence of the landscape and urban design proposed by Lucio Costa and Niemeyer, decoding these values on contemporary parameters to authorize interventions that doesn't change the urban heritage.

The evaluation began investigating, initially, the proposal of the Master Plan and the parameters set forth for what Lucio Costa defines as residential scale (the four scales which are: bucolic, gregarious, monumental and residential), and were created rules to analyzed each sector this residential scale. (Figure 7).



Figure 7 – (a) Residential Sector Blocks 100, 200 and 300 (b) Residential Blocks 400; (c) Residential Blocks 700; (d) Commercial Blocks

It was observed the definition of a set of parameters established for the blocks of the sectors 100, 200 and 300; another set for the blocks of the sector 400; another set for the blocks 700 characterized by collective housing; and another set for the commercial blocks, placed between the super-blocks. In the sectors of blocks 100, 200 and 300 the current parameters proposed occupancy rate of 15 %, setbacks of 20 meters and buildings maximum height of 6 floors, but do not determine limiting of heights, which ends up resulting in 7 because of the useful area in the terrace, what is not adequate to the initial proposal.

To view this proposed envelope for these sectors was generated a logic rule: calculation of the area of the block, application of setbacks, calculation of usable area withdrawn from the setbacks, reduction of the envelope of the usable projection area by scale factor applied in both axis of the footprint, vertical extrude according to 6 floors and, as they establish the maximum height the Coefficient of Utilization is not applied. (Figure 8).

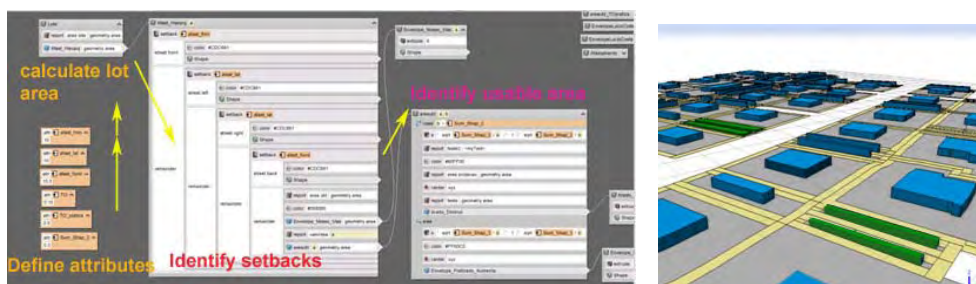


Figure 8. (a) Rules. (b)Result of the rules.

The same procedure of rules creation was carried out for the blocks of sector 400, with the parameters: maximum height of 12 meters where there are no piers; 15 meters where there are piers, but which must occupy only 30% of the area of projection; the incredible rate of occupancy of 100%; and setbacks only to control the projections of piers. For the blocks of 700 sector there is variation in the parameters, as there are different uses: the residential use receives Rate of Occupancy of 20%, maximum height of 8.5 m and Coefficients of Utilization Basic 0.2 and Maximum 0.4; and other uses arrive at 100% of Rate of Occupancy, Coefficient of Utilization 1.8 and maximum height 8.5 m. To the commercial sector the Rate of Occupation is

100%, maximum height of 6 m, Coefficient of Utilization 2.0 and, in case of lot dismemberment the minimum lot is 36 m² and in case of lot unions the maximum lot is 140 m².

Performed the construction of the rules to represent authorized parameters for each of the 4 zones, was promoted to the comparison between the authorized and practiced volumes. The rules were structured so as to represent the volumes authorized versus the volumes practiced in the same volumetric reference, to allow the comparisons. Through association of colors it is possible to identify who predominates - the authorized or the practiced volume, so that the larger composes the maximum envelope and contains in its interior the smaller one. This comparative study was applied to the rules of the groups of residential zoning occupancy and the commercial zoning one. (Figure 9)

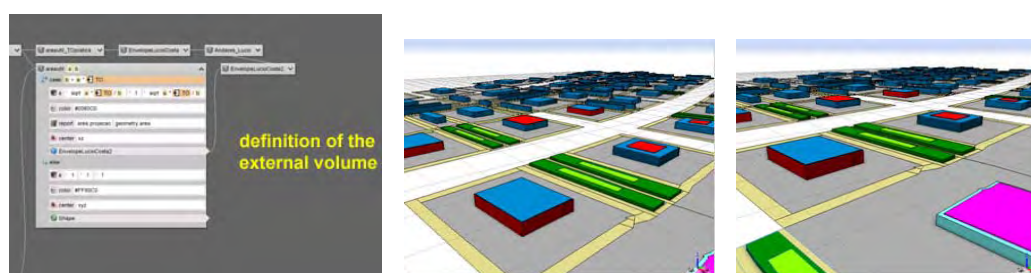


Figure 9. (a) Rules to build the inner and the external volumes. (b) Comparison of predominant volume – the authorized versus the practiced – differences in colors are due to different zonings.

4.5. ANALYSIS OF THE SUITABILITY OF URBAN PARAMETERS PROPOSED BY THE LEGISLATION FOR THE USE AND OCCUPATION OF THE SOIL IN FACE OF THE LOGIC OF LUCIO COSTA

The objective of the rules is the visualization of parameters to support the decision-making process for new interventions. Because of that, the first step is to evaluate if the parameters proposed by PPCUB (Plan for Preservation of Urban Heritage of Brasilia - SEDHAB) are in fact meeting the maintenance of ideal proposed by Lucio Costa.

The first analysis reflected rate of occupancy proposed. By analyzing the relationship between the rates, especially in blocks where the buildings were designed by Lucio Costa and Niemeyer, it was observed the average rate practiced between 10 and 15 %, even in the zone of blocks 400, lower than the values proposed to be adopted. In the region of blocks 700 the rate of occupancy practiced is around 20 to 30%, what means a little greater than the proposed for the residential area, but quite lower than the proposed rates in the blocks with other uses.

In a general sense, the rates of occupancy proposed by PPCUB are larger than those practiced today and are larger than those practiced by Lucio Costa. It's possible to say that the Pilot-Plan is in risk of changing the landscape values, because of market pressure to promote new layers in replacing the existing ones and, more importantly, because it was also observed vague areas or with low occupancy rate that will have legal support for increasing occupation, especially in the north wing of the territory.(Figure 10).

The north wing is characterized by the concentration of blocks with higher rates of occupancy and, at the same time, with concentration of higher number of blocks with low occupancy rates. The point is due to legal permission for densification, due to the effect of neighborhood typology already denser, and by the fact of presenting a landscape not so close to the design of Lucio Costa as the south wing does, the north wing has the risk of going through significant and worrying transformations.



Figure 10 – Distribution of building density – rates of occupancy

4.6. PRESENTATION OF THE LOGIC OF PARAMETRIC MODELING OF TERRITORIAL OCCUPATION FOR THE MANAGEMENT OF COLLECTIVE HERITAGE AND LANDSCAPE.

Once structured the rules in the form of scripts or algebras which reflect the expectations of maximum envelopes that are approaching the Lucio Costa ideal; and once structured the rules which translate the PPCUB values, the system favors the visualization of landscapes modeled for both references. The rules generated demonstrate not only the different references, as they are also prepared for simulating the different sets of parameters, because as the modeling is dynamic, the process of viewing allows the user to change parameters and visualized their effects in reality. The whole process functions as a support to characterizing, analysis and support to decision making. (Figure 11).

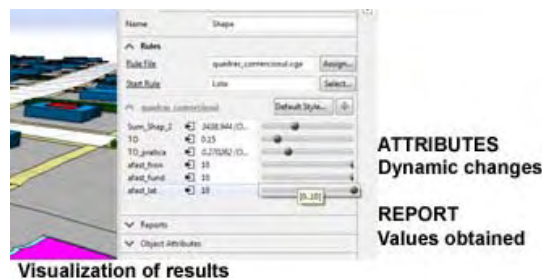


Figure 11 – Changes on attributes, resulting in dynamic visualization and production of reports with new values

5 CONCLUSIONS

The Parametric Modeling of Territorial Occupation is a new way to promote the visualization of different steps of the management process of the landscape: characterization, analysis of potential and constraints, analysis of proposed values and decisions making in face of possibilities. It allows, in particular, that the different agents of the transformation of the territory can act as decoders of values of an era, and not just drawing according to their individual wills.

This promotes the discussion about urban design and not about the urban designer, about the architecture and not the architect. The individual manifestations will continue to happen, on the scale of the individual lots, but the actions that are results on the scale of collective will can be well-orchestrated.

The eloquence of the visualization makes it easier the exchange of ideas, and promotes the capacity of understanding. The dynamic representation, which responds in synchrony to changes in parameters, allows the user to work with relative values, and not in an absolute sense. The context is evaluated and the vision

of all is favored. The development of rules to model the 3D aspects of the city is a way to simulate the maximum constructive authorized by planning legislation (maximum envelopes), so that it can be reapplied in any other situation of definition of parameters in urban master plans and in laws for land use and occupation.

Finally, the construction of rules favors the teaching of architecture and urban planning, because it enables professionals to organize logical reasoning which translates their ideals. It creates a new language and a new mode of operation on the territory, constituting in new paradigm in territorial management.

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Fig. 1: Lúcio Costa, Brasília 57-85, 1985) and adapted from SEDHAB, 2013.

Fig. 2: Lúcio Costa, 1985 and Aldo Paviani, 2013.

Fig. 3: SEDHAB, 2011.

Figg. 4, 5, 6, 7, 8, 9, 10, 11: The authors.

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