MODELAGEM PARAMÉTRICA DA OCUPAÇÃO URBANA – DO PLANEJAMENTO URBANO AUTORAL À DECODIFICAÇÃO DE VALORES COLETIVOS, DE VALORES ABSOLUTOS A RELATIVOS

PARAMETRIC MODELING OF URBAN OCCUPATION – FROM AUTHORIAL URBAN PLANNING TO THE DECODING OF COLLECTIVE VALUES, FROM ABSOLUTE TO RELATIVE VALUES

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RESUMO

O trabalho apresenta discussão geral sobre questões relativas ao meio urbano e planejamento da paisagem, com ênfase na visualização. O artigo revisa alguns dos desafios envolvidos no planejamento usando ferramentas de visualização e de Sistemas de Informações Geográficas. O objetivo é o de apresentar uma motivação para pensar sobre as escolhas que os usuários fazem quando aplicam métodos de análise em geoprocessamento porque, de alguma forma, a maioria dos usuários não questiona sobre os significados dos modelos e de suas representações. Uma adequada base conceitual é uma forma de se evitar o uso de novas ferramentas, mas sem contribuir de fato em novas metodologias e sem de fato utilizar os potenciais reais dos Sistemas de Informações Geográficas.
Estamos vivendo um novo paradigma no planejamento urbano, mudando do desenho autoral para a atuação através da decodificação de valores coletivos, usando a modelagem paramétrica para entender, definir e controlar valores e expectativas no uso do solo urbano. As responsabilidades em tornar claros os propósitos da ocupação urbana têm como objetivo não só fazer os cidadãos entenderem os planos, mas também como instruir em aprendizados de se começar a entender como é composta a paisagem urbana coletiva, o que é um papel da visualização. Discute conceitos em visualização e apresenta propostas metodológicas para transformar a representação de absoluta em relativa, para dar apoio a tomada de decisões sobre a paisagem urbana. Discute técnicas para se construir diagnósticos identificando potencialidades e limitações, para a proposição de envelopes máximos construtivos para a ocupação de lotes urbanos e para promover a visualização que favoreça o compartilhamento de decisões com a comunidade, sobretudo a abordagem da Modelagem Paramétrica da Ocupação Territorial.

Palavras chaves: Modelagem Paramétrica, Ensino Urbanismo, Visualização Urbana

ABSTRACT

This work provides a general discussion of the issues involved in urban and landscape planning, with an emphasis on visualization. The paper reviews some of the challenges involved in planning using visualization tools and Geographic Information Systems. The goal is to present a motivation to think about choices that the users do when applying methods to geoprocessing analysis because, somehow, most of the users are just applying tools but not questioning the meaning of them. A conceptual base is a way to avoid following new tools without really contributing to new methodologies and not using the real potential of Geographic Information Systems.
We're living a new paradigm on urban planning, changing from authorial design to the decoding of collective values, using the parametric modeling to understand, define and control values and expectations in urban land use. The responsibilities to make clear the urban proposals have the goal not only to make citizens understand the plans, but also to instruct about urban common landscape, what is a task on visualization. Discusses concepts on visualization and presents a methodological proposal to transform representation from absolute to relative, to support decision-making in urban landscape. The paper presents techniques to construct diagnosis of potentials and limitations, to propose

maximum constructive envelopes for lots occupation, and to promote visualization to share the decision with the community, specially the proposal of **.**Parametric Modeling of Territorial Occupation.

Keywords: Parametric Modeling, Urban Design Teaching, Urban Visualization

1. INTRODUÇÃO

This paper provides a general discussion of the issues involved in urban and landscape planning, with an emphasis on visualization. The paper reviews some of the challenges involved in planning using visualization tools and GIS. The goal is to present a motivation to think about choices that the users do when applying methods to GIS analysis because, somehow, most of the users are just applying tools but not questioning the meaning of them. A good conceptual base is a way to avoid following new tools without really contributing to new methodologies and not using the real potential of Geographic Information Systems.

Parameterize means establish limits, acceptable envelopment or wrappings for the composition and construction of the architectural volumetric shapes. It is the function of the urban occupation managers to establish these limits, because they are the ones who will create the relation of society and collective respect in the urban occupation.

Thus, within the acceptable limits, it is seen the action of the architect who employs his creativity to propose, within the maximum envelopes, the materialized expression in his project. The action of the architect can be individual, giving each project a character and an identity, but what connects it with the context and makes it perform in society is the respect for the shared parameters. This means proposing the order inside the disorder, because the maximum envelopes allow a set homogeneity, while the individual expressions within these envelopes will allow the natural diversity of the architectural response to every situation.

While the architect expresses his creative proposal when working inside the envelopes, the urban planner that establishes the parameters of this maximum envelope acts as decoder of the collective will. In this sense, the role of the urban planner as an authorial planner, proposing his point of view, tends to be reduced and he's expected to work in a very important task to the society: to identify and put on parameters the values which will promote the landscape expected by society.

The urban planner, as a decoder of the collective will, has as a fundamental tool the parameterization. Far from being seen as a rationalization of the landscape, in fact the parameterization is the establishment of shared criteria that reflect what is valuable for a society.

What is questioned, in this reflection, is if citizens, when voting for a zoning and for a table of urban parameters, are aware of the landscape to be generated by those values. As a proposal to deal with this challenge, a set of steps are structured in a methodological script:

-Significant investment in visualization of information, since the structure of initial data until the promotion of interface platforms that create a shared language for technicians, administrators and citizens that are able to interact and take decisions having a shared code of communication;

-Investments in social media for the community consultation, allowing the participation of individuals interested in exchanging values and expectations about the collective landscape being shaped. The participation has the role of building knowledge and spreading information that keep the system evolving. Use of social media through crowdsourcing mapping (in which data is collected without, necessarily, the specific response of the citizen to urban issues) and through actions of VGI – Volunteered Geographic Information, in which a citizen voluntarily responds to specific questions about the reason of the research;

-Application of spatial analysis models based on the reproducible and defensible criteria that promote the representation and the simulation of different views and values about the urban landscape. Investments in geo-processing technology that favors the modeling, including models of information integration (Multicriteria Analysis), models to verify the validity and the defensibility of responses (Suitability Analysis) and evaluation models of carrying capacity of environments (neighborhood impact, carrying capacity studies and analysis about the resilience of the territory).

-Development of models based on Geodesign processes. The process of Geo-design means structuring a script of spatial management that begins with the characterization of the reality, which involves the production of different perspectives on the territory according to different actors and values, it steps forward to possible landscapes simulation and it acts mainly on the purposeful phase. Miller (2012) advocates "Regarding the future of Geodesign, it is as the Abraham Lincoln, Buckminster Fuller, Alan Kay, and Peter Drucker all said, 'The best way to predict the future is to create it'."

-Along with the Geodesign, the Planning Support System (PSS) structures the actions of the actors and the processes, proposing a system where there is more clarity of the steps of feedback and verification on certain points, evaluation and validation of results in different stages and of the integration of the system with other contexts. The

system puts the actions in a transparent plan in order to inform and to plan the responsibilities, conditions modes and the action modes of the different agents.

Finally, all the stages of the proposed procedures integrated; understand values, expectations and acceptable limits; get the result of Parametric Modeling of Territorial Occupation which consciously reflect the landscape expected by the society and sees it as a collective good and as a value to be defended.

In this paper the emphasis is on the role of visualization in this process of decoding of collective values. In fact, to act as the decoder and not only as the author of urban transformations, the urban planner should follow the steps we are proposing to use the potentiality of GIS: visualization to decode values to community, Geodesign to structure the models and present a system of goals and steps to support decision making, Spatial Analysis based on models and simulations to understand the challenges, and VGI to involve the community and receive their opinions. In this sense, it presents the first step, the processes on visualization to decode values and principles to the community and prepare to construct the Parametric Modeling of Territory Occupation.

2. THE ROLE OF VISUALIZATION AND ITS SIGNIFICANCE

The dynamics inherent in the urban space imposes the need to work with a systemic vision of the whole. The representation of the spatial elements that interconnect and, at the same time, are individually identifiable, brings along the development of the cartography and Geographic Information Systems as vehicles of visual communication of the analysis and proposals for urban issues. A thematic mapping of territory that is expressed through the graphical representation must not ignore the principles of graphic semiology, in the most different media of information visualization. The topics mapped are portraits of certain aspects of reality, and they can focus on qualitative and quantitative questions.

In order to adopt the participatory planning and the development of work in interdisciplinary teams, the capabilities of visual communication of cartography are a common language which enables the exchange of information and opinions.

The importance of the cartographic visualization must be recognized in its most different nuances (two-dimensional, three-dimensional and in simulations of fourth dimension) as the language which translates the current trends of systemic vision of urban issues, besides enabling the management and analysis of the complex and dynamic databases.

It is a language that allows the community to monitor the diagnostics and the proposals of interventions that are consensus among the planners and the users, and that are within the concepts of transformation capacity and resilience of the landscape on land use and land cover changes.

The cartographic representation and the use of forms of visual representation are, by nature, the most eloquent form of communication and exchange of information and comprehension among the individuals. Much more expressive than verbal, writing or numbers communication, the visualization favors the vision of the synthesis on a spatial phenomenon or occurrence.

According to Bertin (1967) and also Bonin (1975) visual communication is developed from the general to the particular, because apprehension of the total is set in the first process of observation. This is the opposite of other forms of communication in which the observer goes from the particular to the general, as the case of writing in which the reader understands the words, conforms the sentences, and then builds the understanding by the sum of the parts.

The cartographic visualization process an “Open Work” (*Opera Aperta*), in the sense advocated by Eco (1962), due to its synthetic nature, which promotes construction of the synthesis of information but also the possible analytic decoding of its composing elements, from the general to the particular. Thus the visual communication is initially monosemic in the sense of where/how/how much, but the construction of why/what if it is needed to develop an understanding and decoding of it, which makes it polysemic. The support of the geo-technologies enables this polysemy, because visualization allows, according to Manovich (2004), the endless variations of images, which means the construction of the comprehensions in the logic of “Open Work”.

Translating the visual information, McCormick et al. (1987) define that investments in visualization in the territorial representation allow "to see the unseen", because it makes clear the perceived aspects that are not explicit, and reveals correlations as the data are put on spatial representation.

Andrienko et al. (2010) advocate all citizens are potentially space-time analysts, although different actors act at different levels of the process, what provides a support to solving space-related decision problems through enhancing human capabilities to analyze, envision, reason, and deliberate.

The visualization also meets an educator role because it instructs on the understanding of the occurrences in territorial phenomena. According to Snyder (2002), citizens change from a reactive one (peaceful information receiver) into a proactive one (provider of information and consumer of information in order to build new information and positions).

The issue of visualization as the basis for the interaction of the different actors in the decision making must be very well proposed, in order to avoid the use of visualization as a way to hide erroneous logic and/or invalid data. Some

GIS users invest much in aesthetic appeal of visualization, which enchants but can deceive. The goal is to transform from absolute to relative representation, to favor the decoding of the data.

2.1. Composition of the territorial information visualization – from the absolute representation to relative representation

The well-structured and planned visualization is the basis for the interaction of the different actors in the decision-making. However, in order to be a shared code where users meet to interact and dialogue, it is necessary to follow some principles for the transformation of absolute values into relative ones.

This is because the absolute data, regarding its territorial position, its quantitative values and its mode of representation, does not often offer full understanding by the user. On the other hand, when the data is treated in a relative way, compared to existing conditions, the understanding of its meaning is closer to the language of the different actors. The visualization of data, which will be understood as information, must go through the process of transformation from absolute to relative, on the scales of measurement, values, representation, and territorial scales.

2.1.1. Visualization by adjustments to the measuring scales

The construction of adjustments in the scale of measurement is an important procedure in preparing the data for visualization when the goal is the combining among variables. Working with standardization of scales allows qualitative data (descriptive or nominal) to be presented quantitatively (by numbers) according to the evaluation or ranking of its qualities.

The set of natures of data is divided into nominal, ordinal, interval and ratio:

- Nominal - it is qualitative or selective. As an example it is cited the land use and land cover. The legend components cannot be presented as hierarchical, except when it is according to some judgment of value. It cannot be said that the vegetation cover is more or less important than the urban area, except when it is in accordance with a specific classification, for example, assessment of the land value to implement the electric power transmission line.

The nominal scale representation does not permit the application of arithmetic operations since it is not possible to say, for example, that vegetation cover is the double of the urban areas. It is only possible to apply mathematical operations if the legend components are transformed into numeric values that have a level of relevance for an analysis.

- Ordinal - the components can be presented according to the greatness or preference, but, as in the previous class, it is not possible to apply arithmetic operations, but only to assess the frequency and modal class. It is based on the hierarchy of positions, and it's not right to say that second place means the double value of first place.

- Interval - the ranges are known and each observation can receive accurate numeric value. The zero point is arbitrary and does not indicate absence of measured characteristic, as the example of temperature. It is infinite in extent and density between two positions. The use of arithmetic operations is limited to linear transformations. Parametric statistical techniques can be applied.

- Ratio - the ranges are well known and the zero is a real source. The case of the number of inhabitants per municipality can be cited, as the components are listed, classified and measured. It allows the wide use of the arithmetic operations and the applications of parametric statistical techniques.

The transformations of nominal, ordinal and interval scales for the ratio scale allow the application of arithmetic operations and parametric statistical techniques. The components are placed in a ranking represented by numeric values. This ranking is established according to the distribution of the level of relevance of the variable for the purpose of the investigation. This means to transform from absolute values into relative ones, having the relative values as the numeric values between the minimum and maximum positions. Thus, the data undergo a preprocessing process, aiming at the standardization that will allow the study of correlations of variables in the evaluations of the spatial phenomena.

2.1.2. The visualization according to adjustments in the scales of values

Each variable has its representative values and they go according to its intrinsic characteristics. The representation of the distribution of average income values, number of years of study, temperature, slope, accessibility indexes, for example, have quite different distribution graphics and numbers of maximum and minimum. The behavior of the variable is its signature in the reality.

Moreover, the absolute intrinsic values to the variable often have low meaning on the understanding. If it is informed, for example, that in a location there is slope of 20 degrees, the understanding of it depends on the use that they establish for that place and the creation of a comparison with previously known situation. This means turning the absolute data on relative.

The transformation process of the relative data into absolute is quite simple, and it means to set values in a range that the beginning and the end are controlled (Figure 1). In mathematical terms, it means to normalize the data. Once standardized the sets of data, it is possible to perform comparisons between them and understand their behavior as an individual and as a member of a set.

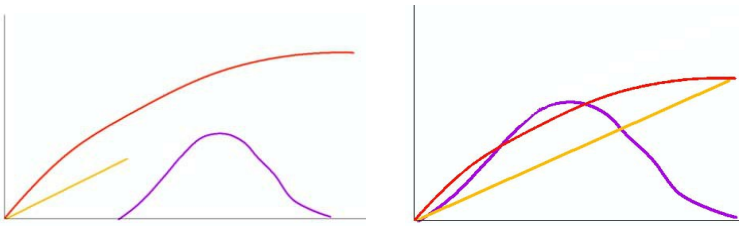

Fig.1. Standardization of data to facilitate comparisons in visualization - adjustments of initial and final limits in distribution curves.

2.1.3. The visualization of models that are the simplifications of the reality

The visualization of an event or the territorial occurrence necessarily goes through processes of simplification. The reduction is required since the reality can only be represented according to conceptual, temporal and methodological simplifications. The visualization is a model of representation of the reality which symbolizes a way of understanding – conceptual simplification; a temporal response about a condition –temporal simplification; and a reduction in main variables representing a complex system – methodological simplification.

The visualization is a reduction that represents the reality according to a point of view, among many possible ones. This simplification is necessary in a time when the excess of information puts the user in a maze of possibilities. McCormick et al. (1987) warned that the excess data generated by different systems and origins would have limitations of interpretation due to the lack of tools. The same concern was shared by Andrienko at al. (2007) who wrote about the risk of the labyrinth of information in counterpoint with the absence of data.

Thus, the models which are the simplifications of the reality, if presented in the form of defensible and reproducible criteria, adjustable to users' interest, are much more eloquent and favor the understanding of the information. The level of the detail of the information should be structured so as not to lead the user to have a wrong understanding of the reality, imagining landscapes that you can't say that will be of that form.

In some cases it is necessary to represent the possible landscape as thorough as possible, as in the simulation of the reconstruction of the landscapes whose process will be in charge of an entrepreneur, and the final result can be stated (Figure 2 up to Figure 5). In this case, the accurate representation is relevant, as in the example of the recovery of mined landscapes by processes promoted by the companies to support decision-making:

Fig. 2. Example of mining landscape to be recovered.

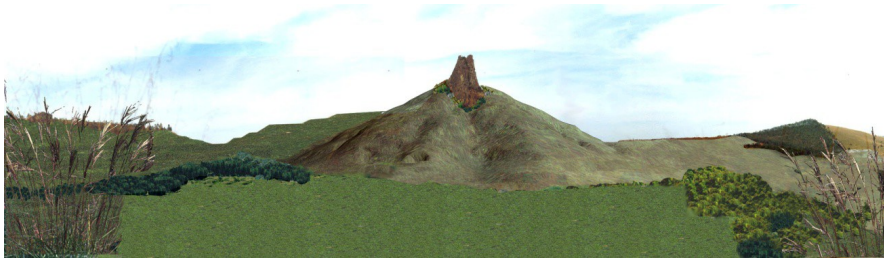

Fig. 3. Recovering proposal of mining landscape, with simulation process represented according two principles: simplified simulation of the vegetation cover and complex simulation, by fractal logic, in the hillside to be recovered.

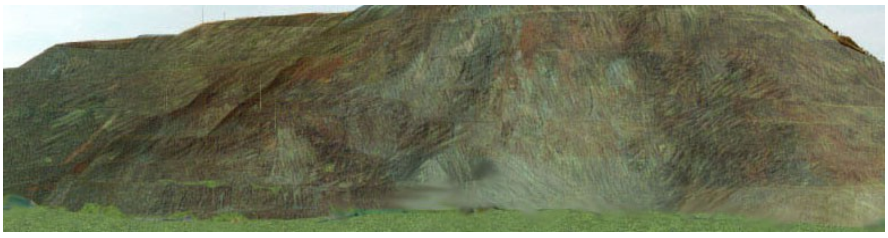

Fig. 4. Detail of fractal modeling representation of hillside to be recovered.

Fig. 5. Detail of simplified modeling of plant cover, by repetition of pattern.

It is observed, in the example of the recovering of mined landscape, which the objective was the realistic simulation, as there was a project of transformation of the landscape, the representation made possible to visualize the outcome of the future landscape. Even so, there were performed two types of modeling: a realistic one and a more simplified one. The realistic modeling was employed in the area of the hillside, the principal element of the recovering of the territory, through fractal modeling based on the choice of grains, textures and colors. The simplified modeling was performed by repetition of patterns, in representation of vegetation, once that could still occurs variation in the proposal of landscape project.

In other cases, it is important not to apply textures, because it cannot be stated that they are, in fact, the representations of the future landscape, because one cannot say that they will actually happen. It is the case of the simulation of future landscapes in an urban environment by applying symbolic representations in order to make the design more real, but in fact can create false expectations, illusions or misinterpretations by users. The visual attraction employed in the simulation can fool the observers since the digital technology allows you to create beautiful landscapes that have not yet been built and you cannot state that will be exactly that way. In this situation, it is strongly recommended not to use the textures, but a representation as simple as possible, in the form of maximum envelopes that respond for what can be actually stated about the future landscape (Figure 6).

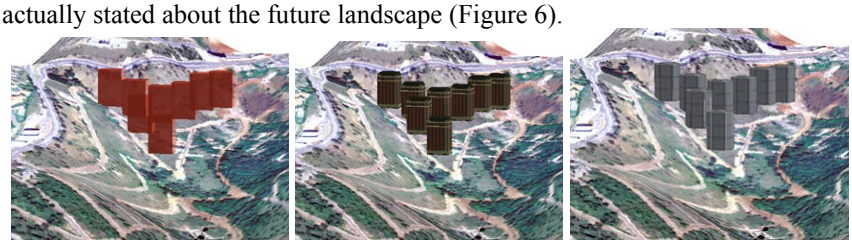

Fig. 6. Landscape simulation representing only maximum envelopes versus representation of textures.

2.1.4. Visualization by adjustments to the territorial scales

Cartographic and the geometric precision often need to be adapted in favor of a more generalized representation which facilitates the simplification of the information. This is the principle that governs the topological cleaning in cartography, when there is the function of representing an element by its basic components, and the excessive details are abandoned.

Cartographic generalization should be well structured so as not to lose the essence of the element. It is, then, the function of the specialist user to understand the main components of the element represented and to define the acceptable limits of generalization.

It is proposed that, in studies of visualization by adjustments of scales of representation, the choice of territorial units which allow the comparison of attributes. It is the reduction in territorial units of integration that is a commonplace in comparison between different situations. It is the option to be chosen, for example, when there are multiple layers of information at different scales of resolution, and it's necessary to choose a scale and convert all other layers to the chosen scale.

This is also a necessary choice in when comparing the landscape. According to Pensa (2013), it is an acceptable option to choose a scale or mode of representation of a variable in the territory, and this reduction must be used as the basis for the data to be evaluated in order to achieve a basis for comparison. This is the case, for example, in the interest of the comparison between an existing volumetric shape in the past and the new transformed volumetric shape along the time or simulated for the future. It would not be possible to promote visual comparisons between objects "a" and "b" since they do not have a basis in common, but if the user opts for the adoption of the basis of "a" and simulate the condition of "b" from "a." (Figure 7 and Figure 8). This means not to represent the volume in an absolute way, but in the relative way.

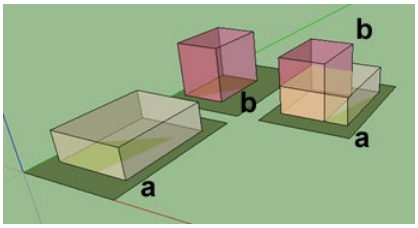

Fig. 7. Absolute representation of volumes. For example: Volume 'a' is in fact constructed, and the volume 'b' is the maximum envelope defined by the legislation. The comparison between them is hampered by absolute representation.

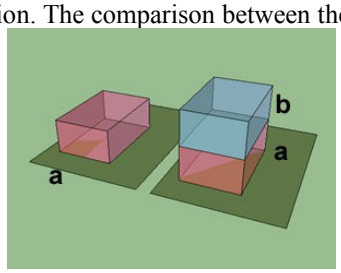

Fig. 8. Representation of relative volumes. For example: Volume 'a' is in fact constructed, and the volume 'b' is the maximum envelope authorized by legislation. The volume constructed was used as the basis of footprint, and the representation of 'b' denotes only the inventory of possibilities to increase the volumetric occupation. The comparison between them is facilitated by relative representation. (Pensa (2013)).

3. PROPOSAL FOR CHANGE FROM AUTHORIAL URBAN PROJECTS TO PARAMETRIC MODELING OF TERRITORIAL OCCUPATION

We live in a moment of change of paradigms in urban planning. We are turning from postmodernism to the parameterization of processes and values dictated by the limits of what is acceptable according to the sustainable values of the society. In the contemporary times the new values are representing and managing the urban territory based on the principles of parameterization, interoperability among systems, Geodesign, strong investment in communication and the dissemination in the network, community involvement (VGI - Volunteered Geographic Information), the adjustment of standard procedures supported by the legislation and policies to access information.

Only the ordinations of sectored and functional zoning spaces no longer meet the speed and the dynamics of the territorial transformation. Facing the economic crisis, the urban planning acquired a new function, different from mere regulation of the private sector. This is the promotion of economic growth and corporate action to attract investments that invigorate the local economy by restructuring its production chain and redefining its economic role.

Upon the interest and the need to make the city a site of economic production the planners seek to model a renewed image of the cities within the logic of interurban competition to attract investments. This has been termed by Harvey (1992) as "city marketing" and "entrepreneurship" of cities. These urban transformations act as the catalysts of complex transformations in the use and occupation of the territory. In this type of intervention is common the association between public and private capital, with interests in both parties.

The entrepreneurship occurs with the private capital investment in public works, upon the interests of direct or indirect capital gain. Direct capital gain takes place in the form of increased commitments to constructive coefficient or the occupation of areas through new real estate developments. Indirect capital gain occurs through recovering the area of intervention and ensuing real estate asset gain resulting from the surge of interest in the territory. But it's absolutely necessary to define limits of territorial occupation conditions, which means establishing urban parameters. In different scales, parameterization aims to define limiting conditions or envelopes.

The laws of urban land division and of occupation of the territory set up the tables to establish, by the zone, types of occupation and to define references to distances, occupancy rates and coefficients of occupation, among others. Building codes are established references of maximum dimensions for various building components to ensure the minimum quality for the occupation. It is defined by the participation of the community, having the planner as the manager of the actions and the decoder of those interests.

The Master Plan and the laws of Land Use and Land Cover on Urban Occupation can no longer just set up the sectioning of the activities in the city. It is necessary to propose instruments to evaluate the different conformations of the use and the occupation, so that the requirements of sustainability and the capacity of receiving the transformations are met.

A major challenge of technology applied to urban planning is the development of techniques and methodologies that are able to adequately represent dynamic variables and create future scenarios of possible conformation of the city to define the best strategies and the decision-making. It was inaugurated the time of parameterization, with the new conditions of visualization, storing and sharing data, and modeling processes of urban and architectural landscape, as advocated by Schumacher (2008). The author gives great importance to these new

values, arguing that the parameterization is the new style after the modernism, while postmodernism and deconstruction were only premature and transitory episodes.

What differentiates the postmodern era of what we are terming parameterization time – until a new term comes up – is that the proposed rules do not need be applied homogeneously to all components of an environment, and even within the same zoning. There are already legal and technical conditions for this new way to manage urban occupation.

From a technical point of view, the new challenges are based on configuring rules of behavior for variables and the acceptable limits of alterations. Investments must be made in visualization, so that once created the rules, the non-expert user can perform simulations of changes in standards and observe the results on the landscape. This process will result in dynamic maps.

From a legal standpoint, it is acceptable and desirable that each territorial unit of occupation can receive its volume supported by the calculations related to their own conditions and the conditions of its context. This means that even within a same zoning or a settlement model, it is not mandatory that all lots observe the same coefficients and occupancy rates, the same heights. It is observed the potentials and constraints of each sector. Each individual unit can have its parameters, within the principle of seeking a dynamic equilibrium of the whole.

The expected responsible and sustainable flexibility in the occupation of the territory, especially in occupation of lots, need to be supported in the new simulation capabilities of the volumetric composition of the occupation, in a process defended by Moura (2012) as Parametric Modeling of Territorial Occupation.

3.1. Example of application of the methodology

It's present the main steps on a case study which goes from the variable representation up to the simulation of urban landscape, using the capacities on visualization and the treatment from absolute to relative values.

3.1.1. Definition of principal variables which characterizes the territory

Fig. 9. Individual variables.

3.1.2. Adjustments to the measuring scales – from nominal, ordinal and of interval scale up to ratio scale

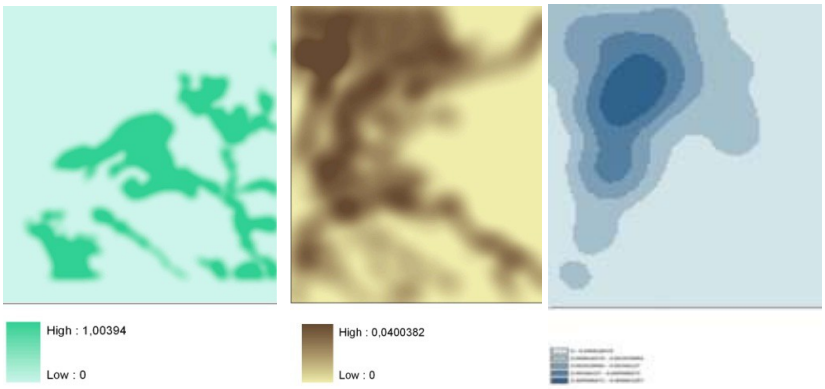

Fig. 10. Variables adjusted to ratio scale of representation.

3.1.3. Adjustments in the scales of values – normalization of values

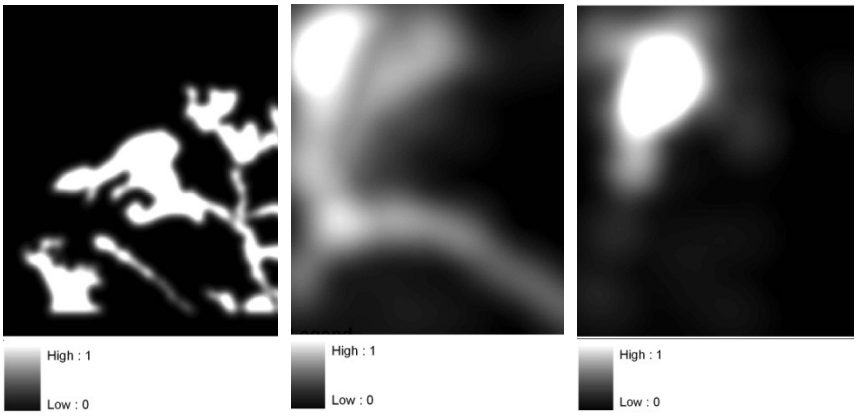

Fig. 11. Normalization of variables.

3.1.4. Application of models of integration of variables – Multicriteria Analysis, and Analysis of levels of confidence on results (Suitability Analysis)

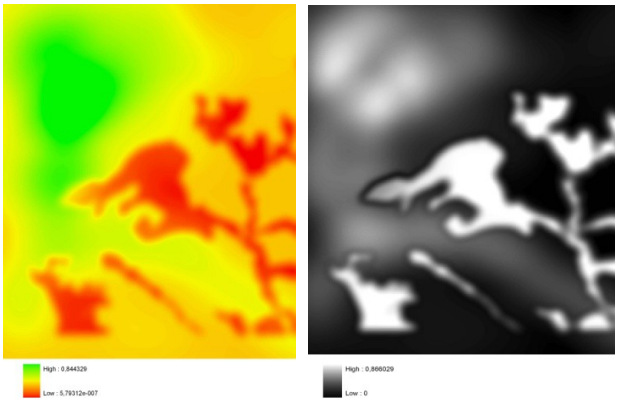

Fig. 12. Multicriteria Analysis and Suitability Analysis

3.1.5. Definition of potential areas and carrying capacity of the territory

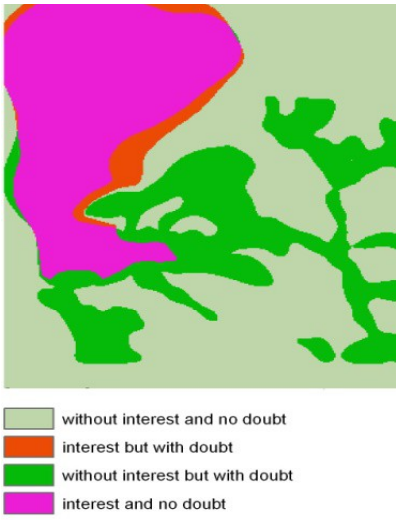

Fig.13 . Synthesis of potentiality on land use according to the combining of Multicriteria Analysis and Suitability Analysis.

3.1.6. Proposal of land use and simulation of possible new landscapes on urban territory

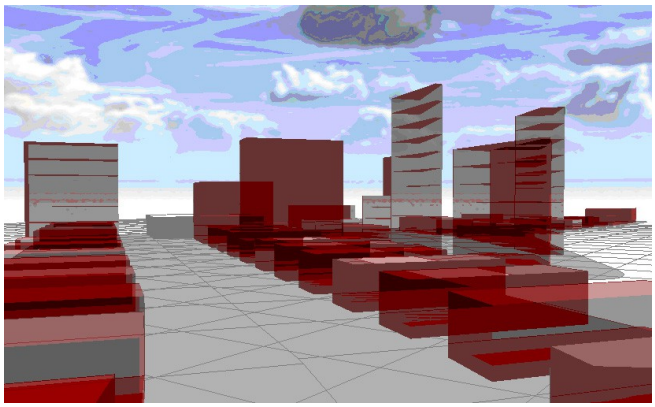

Fig. 14. Parametric Modeling of Territory Occupation – simulating urban landscape.

The proposal is to apply visualization tools to promote a first step: to allow the interface and communication with the community. With the right transformation of data and process based on changing from absolute do relative values, it's possible to make people understand the characteristics, the potentials and the restrictions on the urban landscape and land use. Creating this interest in understand the urban planning, users can be involved to decide, together with the urban planner, the acceptable limits to the transformations of urban landscape.

This means to use the parametric modeling to decode the collective values, because it can be a dynamic process of suggesting and visualizing the results, in each step of the process: the definitions of potential areas (item "3.1.4" – Multicriteria Analysis to establish the area which can receive the interventions and transformations), the definitions of land use and land cover (item "3.1.6" – visual modeling of urban parameters) and, what is most important, the construction of a culture to take part of decision making processes.

The Laboratory of Geoprocessing from the Architecture School of the UFMG has made significant investment in studies of Parametric Modeling of Territorial Occupation. The need became with urban planning teaching and the observation of the great difficulty in understanding urban proposals, not only by the community, but, surprisingly, by experts – architects and urban planners, because neither the specialists have the capacity to predict the future of a landscape defined by morphological parameters in Master Plans.

Brazil has a tradition in employment of morphological criteria in urban planning as a main reference, which differs from other countries in order to manage the urban occupation. We need, however, to consider a new morphology: not the modernist morphology that defines architectural design, but the new morphology that translates the goals and collective values from a society to model the common landscape.

In these studies of landscape simulation, with the challenge to make it an information from absolute to relative, to create a condition of understanding to different users, the laboratory has invested in programming rules, which are scripts that structure definitions of morphological criteria (setbacks, rate of occupancy rate, coefficients of utilization, maximum heights, among others) (Figure 15 and Figure 16). Using these rules, with variations in the values of the attributes, or possibly adjustments in rules to meet the specific needs of some zoning, any municipality can make clear its urban proposals (Figure 17). Among some recent articles on the development of rules, we may mention Moura et all (2014).

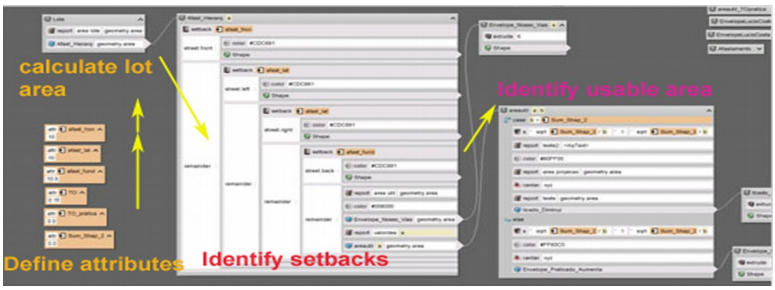

Fig. 15 – Definition of initial attributes

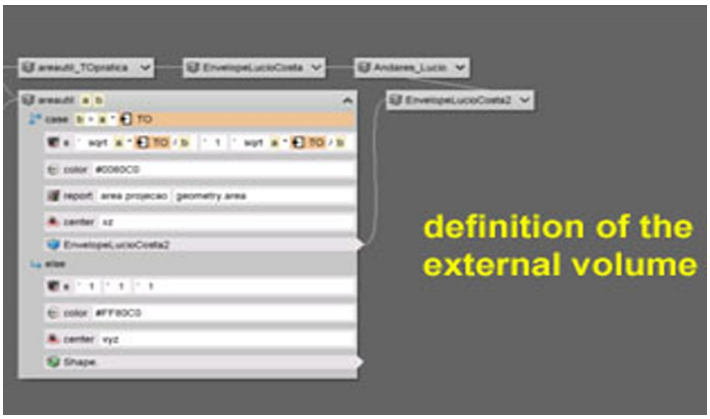

Fig. 16 – Rules of composing maximum envelopes

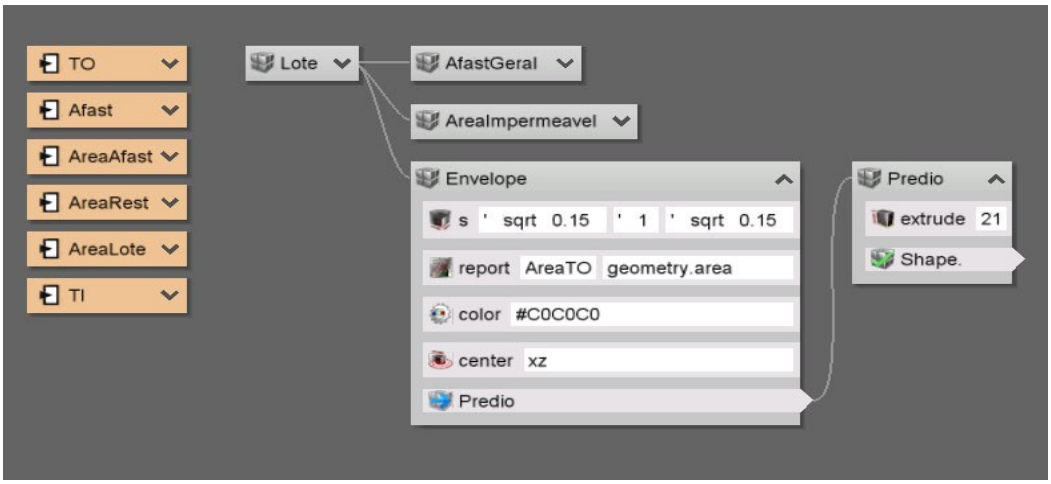

Fig 17 – Example of a rule constructed to simulate urban maximum envelopes

In the example presented we are simulating possible envelopes to the occupation of blocks in Brasília, as an academic essay to develop rules and to make understood the parameters of setbacks, rate of permeability, rate of occupation, coefficient of utilization and maximum heights. (Figure 18 up to Figure 21).

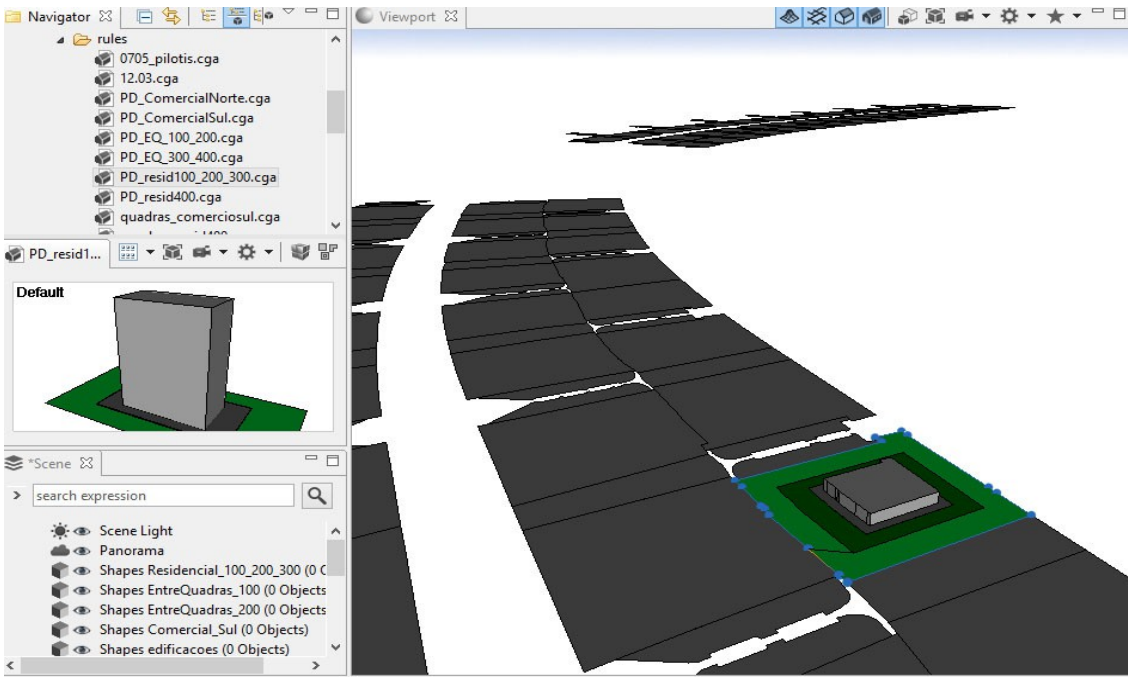

Fig 18 – Example of selection of one block, to which there is a rule structured to simulate the results in urban parameters.

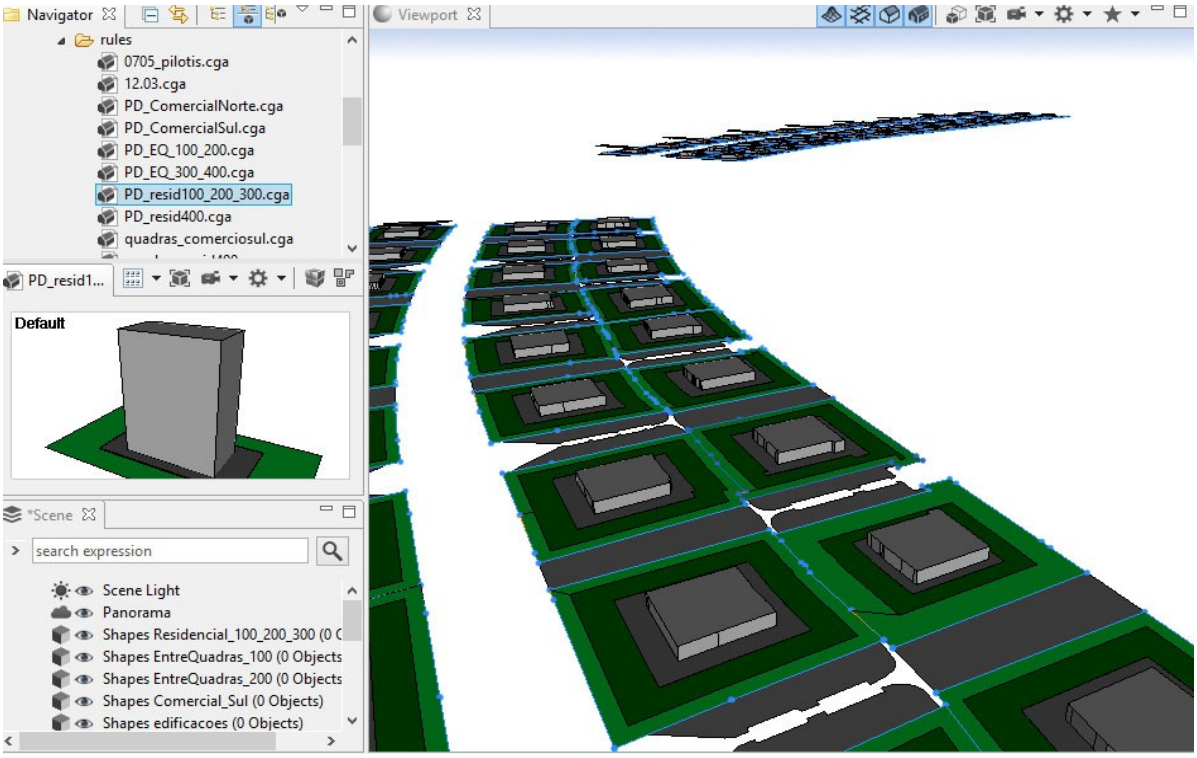

Fig 19 – Example of application of the rule to all the blocks that have the same conditions in urban parameters.

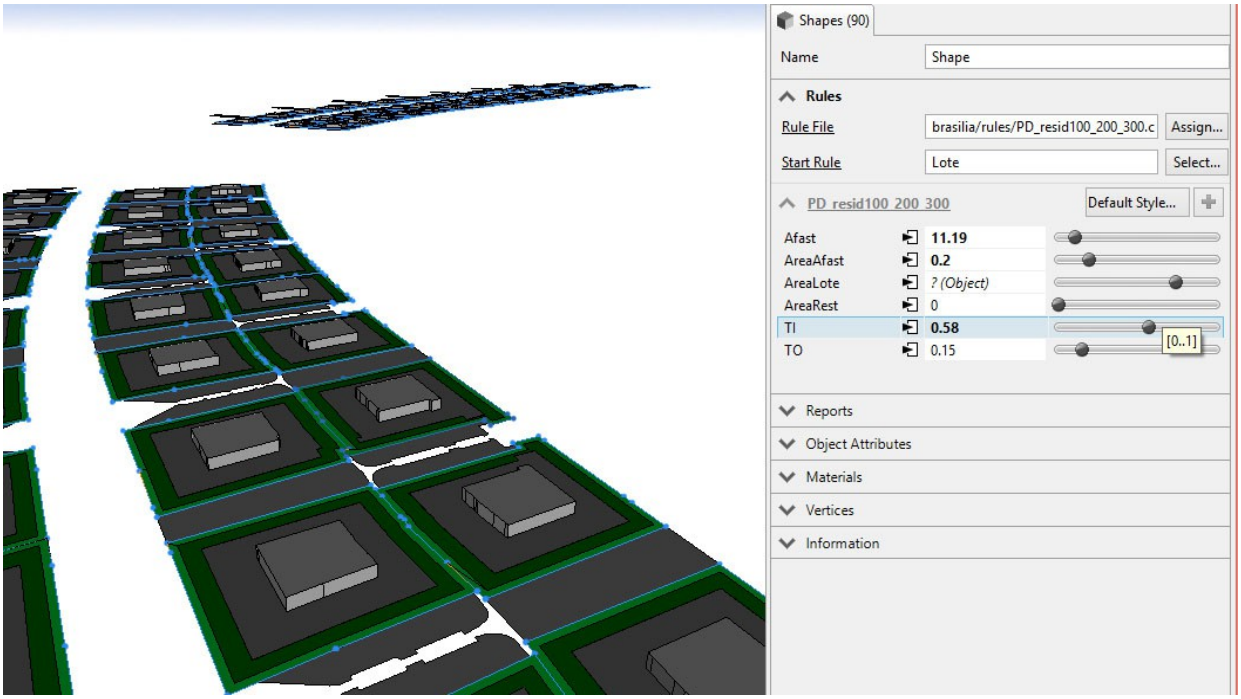

Fig. 20 – Simulation of changing in attributes – changing rate of permeability area

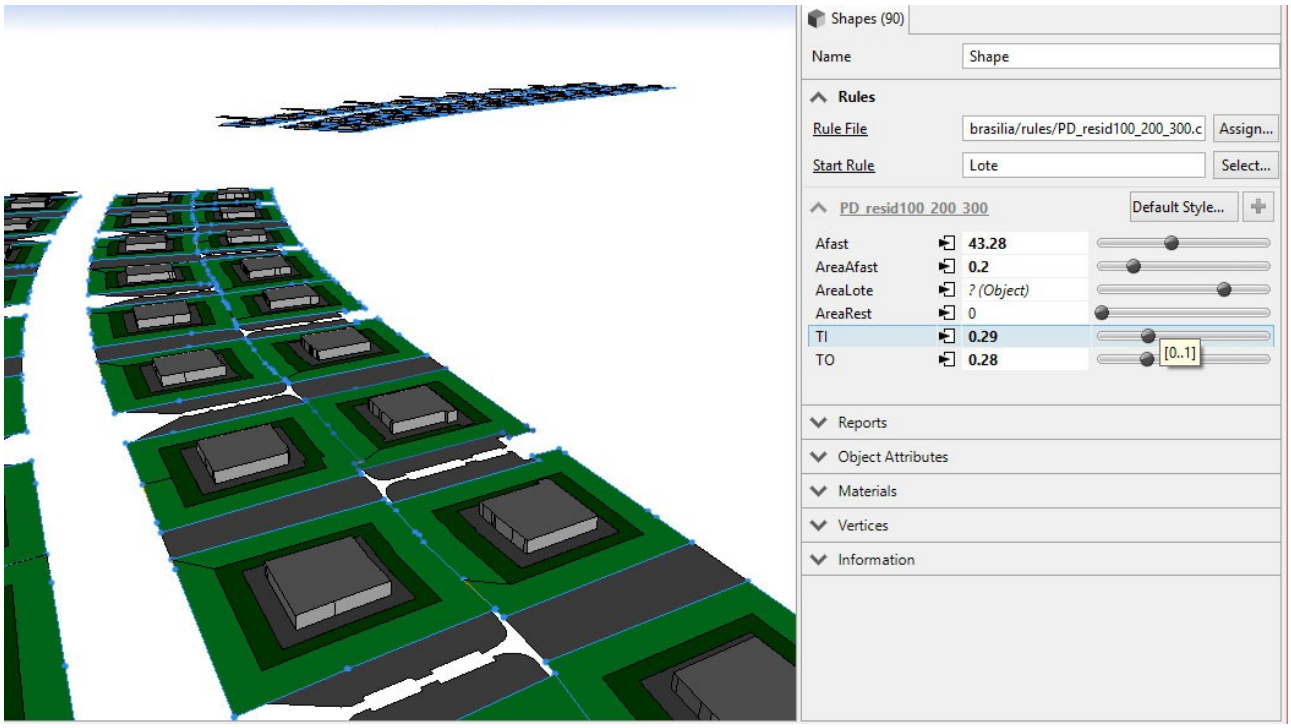

Fig. 21 – Simulation of changing in attributes – changing setbacks

4. CONCLUSIONS

We are experiencing a significant change in the paradigm of urban design that is based on processes of requalifying of landscapes, urban surgeries guided by processes of entrepreneurship, and more active participation of the users of the city in defining their values and expectations. This brings the compromise to use more effective forms of representation to the designs proposed to environmental planning and management.

The new procedures require studies of predictive simulation of intervention in the urban landscape and the composition of significant collection of information to support decision making. In this sense, the geo-technologies, and in particular the Geographical Information Systems, occupy increasingly and prominent role in the actions of the architectural and urban planning.

50 Years ago, when Roger Tomlinson proposed the first Geographical Information System, developed for Canada, perhaps it was not possible to predict how the simple operation of automated maps analysis could become the reference for the construction of new and complex methodology for representation, characterization, analysis, proposition and simulation of landscape and urban design.

The methodological approach was quite simple: digitalizing of space into territorial units of analysis, variable selection about main components that could characterize the territory, the proposition of forms of combination of variables, what means: systemic approach. In fact, the technique gave support to a way of thinking, and this was widely accepted, because presented instruments which facilitated methodological processes that were recognized by the logic in vogue.

The initial enchantment with the tools in itself was natural, because the human being feels comfortable when acknowledges in a new proposal the mirror of their way of thinking about the world. However, for some decades there was the question: new tools and old methods? The charming tools permitted the urban designers to draw up new questions and acquire gain of knowledge, or only made their work easier?

After the initial stage of the enchantment, when the expressive production of beautiful thematic maps was enough, the GIS was conducted to the construction of models, which are simplifications of reality, in order to give support for decision making in the use and occupation of the territory.

There are still different situations and conditions of application of GIS in public sectors and in teaching institutions that prepare the professionals for the urban planning. There have been many efforts in legislation and standardization for the production and dissemination of territorial information, aiming to promote the creation of a significant data base that can give support to the analysis, proposals and predictive studies in urban design. There is a broad access for software, either free software or those that require some investment. The digital communities are already articulated in order to facilitate quick exchange of experiences. Then, what are the limitations and the challenges to be faced?

Initially, it's important to underscore that the tools, for more charming they are, are just tools. They must be guided by logical thinking that need to be well structured by planning teams. Thus, everything begins with the clear definition of goals to be achieved. And for the definition of these objectives it's needed to recognize the society demands and contemporary values.

Some GIS users invest much in aesthetic appeal of visualization, which enchants but can deceive. This is not the goal. The goal is to decode the comprehension of spatial analysis, urban parameters and urban landscape transformation to the community. This doesn't mean to hide erroneous logic and/or invalid data, but the opposite of it: to make clear complex information. This means to transform from absolute to relative representation of the whole process, avoiding the gap of communication that exists thought planners and society. The parametric modeling of the territory is a way to arrive in a common decision, when the urban planner acts decoding the collective values.

The user of GIS that can exploit the resources of geo-technology is the one that dominates, with knowledge, the proposition of methodological approach using models of spatial analysis, models to the representation of propositions and to the simulation of the results. This user should be able to apply the heuristic logic to learn with the data and with the information built by the system, to adjust his methodology and the models employed. The action of structuring processes and models, to carry out investment in methodologies of spatial analysis supported by geo-processing, has been called by some authors as Geodesign.

The process of learning with the information must be supported in the consciousness that the models are simplifications of reality that meet certain objectives. This way, all models are partly questionable, but all models are useful. As each model is intended for a specific purpose in spatial analysis, it is important to promote interoperability between systems, for which there is facilitation of the interface and data exchange between applications. It is important to also promote interoperability between actions and actors, because the process must be understood as a systemic structure, and that changes at any stage can cause changes in the system as a whole.

The wide dissemination of territorial visualization tools in the worldwide network of computers permitted the users to understand spatial data, because expanded the situations in which they consult maps and look to the urban spaces. These same tools promote the three-dimensional viewing, as well as the presentation of temporal changes and of dynamic maps. These facilities established conditions to the interest in geo-referenced information. It is argued, then, that the use of GIS can be an interface for communication between different actors of planning and of management of urban space, which brings with it the need for improvements in processes of map viewing and urban design.

Another actual issue is the changing role of the urban designer. The actions of authorial urban drawing, with decision making responding by individual choices in creative process, are increasingly restricted in face of contemporary values. The urban landscape is understood as a collective good, and for this reason should be tied to the values and to the interests that are the maximization of collective consensus. Thus, the designer must work within these limits defined by the society as acceptable and as representatives of their cultural values.

The contribution of this paper also is to question the way the users are applying GIS, because it's important to have control of the meaning of the tools and what they promote. The tools are creating users which are working to themselves, but not interested in listening to community values or to decode the common interests. The Parametric Modeling of Territory Occupation can be a way to promote interaction. The first step is investing on visualization, but it must be followed by the use of methodologies of receiving community opinions' (VGI), to structure a process of work defining rules and actors (Geodesign) and to invest on models of Spatial Analysis and Simulations of urban planning and design.

It is important to propose researches that are able to identify the essence of collective values. Once characterized these values, they turn into urban settings that will shape the urban landscape built. The GIS is intended then the Parametric Modeling of Territorial Occupation.

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