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THE USE OF GEOPROCESSING AS A MEAN OF INFORMATION CONCERNING URBAN PLANNED LANDSCAPES

Camila Marques Zyngier
Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brasil
camila.zyngier@gmail.com

Ana Clara Mourão Moura
Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brasil
anaclaramoura@yahoo.com

The main purpose of this research is the reflection on the means available today for the interpretation of "possible landscapes", understanding those as the result from interventions guided by urban regulatory applications. The methodology is based on instruments provided by geoprocessing. The methodological script is based on the selection of areas related to conflicts and which are suffering great urban changings. After selecting the areas the Spatial Analysis was applied in order to understand the values and the existing landscapes. Concerning the results the methodology was well evaluated and is considered to be applicable to diverse situations. It can represent a gain concerning knowledge and performance in urban landscape planning processes. The development of the applied methodology can be an interesting tool to give visibility to the public administration and promote community involvement.

KEYWORDS: geoprocessing; landscape management; urban parameters communication

INTRODUCTION

The urban landscape is the result of transformations that take place in different scales: temporal and spatial. This landscape results from the application of official regulatory standards that configure volumes that are "punctual", but that together form a complex set. On another scale, interventions in urban landscape are given by "urban operations", driven by entrepreneurship. Concerning these ways on how urban landscapes are formally planned, some questions arise and motivate this research: (1) the community – that dwells, notes, and constructs in this landscape – can understand, monitor and approve the new configuration of space performed by these interventions agents? (2) Is it possible to contribute in some way, so that this follow-up process by community promotes the science about the proposals and possibilities contained in standards that shape these landscapes? (3) What is the "State of the art" of these transformations, especially those promoted by urban parameters and resulting from the application of official urban regulatory and laws?

From these questions a concern that guides this article is built: how the possibilities involving the formal urban landscape are communicated? The fact is that on one hand, there are official mechanisms for this modeling, through regulatory standards. On the other hand, there are also other active agents that belong to the private sphere, and which among entrepreneurship stands out (Harvey, 1981).

So, the need to analyze case studies sets to contribute to the discussion followed by the guiding question. In this way, two territorial realities – here called *case studies* – were listed to support this research.

METHODOLOGICAL SCRIPT

For the accomplishment of the main goals of this work, case studies have been chosen because of their similarities regarding physical characteristics and territorial conformation, but also for their differences concerning the context of the processes of planning and managing territory. The choice of such case studies is justified for the fact that they generate examples that favor the discussions generated by the guiding question: (1) the study of conformation of

the urban landscape as a result of urban regulatory standards, (2) the importance of encouraging better communicability of information so that in the future the community can enter consciously in decision-making processes and become a critic agent of territorial transformations.

Among the techniques applied the research used geotechnologies, specially geoprocessing and georeferencing. The geoprocessing was used as a tool for the characterization of case studies, through the spatialization of information and multi-criteria analysis of landscape. The georeferencing was used for the preparation of historical maps from various sources, used for the observation of the growth of the occupation of the investigated areas and that to encourage the observation of layers in the urban palimpsest.

The approach of this methodological script is divided in two levels of characterization and research separated by didactics issues but considering that the process is systemic and that scales of territory transformation interrelate: (1) the characterization that directs from the *general to the particular*, related to the construction of thematic maps and combination of variables that allow to analyze the scale of urban set. (2) the characterization from *the particular to the general*, focusing on the studies on the scale of lots, through settlement of buildings model in lots, which takes place in the form of individual cells that together make up the urban landscape.

The two axes of investigation – general *to particular analysis and vice versa* – can elucidate how a landscape can be conformed through the action by the agent modeler represented by the urban regulatory standards. These two axes show that, if GIS tools were used to communicate each regulatory approach, the community could have been better informed and able to act, in fact, as responsible for the choice of its urban landscape.

Characterization of the general to the particular: the choice of geoprocessing as a tool

The first approach is global and aims to build a synthetic picture of the urban set, in order to characterize the conditions of study case area chosen. This scale is considered important since

management and planning decisions that apply to the territory of a neighborhood interfere in occupations of lots.

According to Freitas (2007: 79), technological advancements have made available more data to be considered, analytical instruments and techniques of cartographic representation, composing resources that cannot be ignored. It can be said that geoprocessing and, above all, the Geographic Information Systems (GIS) are among these resources to be exploited.

The GIS is associated not only to the representation, but also to the association of this act to "a new look at the space, a gain of knowledge, that is information". (Moura, 2007: 2899). The spatial analysis in GIS models go beyond simple description of elements or facts. May be important to "trace scenarios, simulations of phenomena, based on trends or trials of conditions" (Moura, 2007: 2899). The use of this resource relies on the selection of analysis variables and the study of their combinations.

Geoprocessing as a tool is useful as a means of expression to show the action of modelers agents, responding thus to one of the main issues of this survey. The use of GIS facilitates the systemic approach, which may represent a significant increase in expression of the urban landscape. In short we can say that this type of analysis allows transforming *data* into *information* to gain knowledge about the focused reality.

Multi-criteria Analysis Composition: urban and environmental diagnosis

According to Moura (2007: 2901), Multi-criteria analysis is a methodological procedure of crossing variables. It is the translation of the logic expressed by the "Decision Tree" or by the application of "Hierarchical Weights Analysis". The author points out that this procedure is based on: (1) the variable mapping by plan information, and (2) on the definition of the degree of relevance of each plan of information and each of its components for the construction of the final result.

Following this procedure, after organizing and structuring data that characterize different aspects and layers of anthropogenic and environmental landscape of case studies, the variables synthesis was proposed for the conformation of profiles from depicted realities. The

aim of this procedure is above all show how the geoprocessing tool has strong communicative appeal, in the composition of diagnostic and prognostic studies. This appeal can favor the dissemination of Information and so increase the understanding of the population about the decision-making procedures of urban planning and management.

Thematic maps have been prepared to show potential surfaces of the distribution variables elected to preparation of synthesis (Moura, 2007). The goal was to present some images of existing realities to prove the effectiveness of geoprocessing. We talk about "some" portraits, because landscapes are quite complex to cover in just a few looks.

Thus, two paths were chosen for the synthesis, the initial portraits of the landscapes: (1) the composition of the urban expansion interest synthesis map, (2) the composition of the environmental interest importance synthesis map.

Combination Matrix: identification of potentialities and conflicting interests

In this subsection conflicts of interest are identified. In this research the synthesis of "urban expansion interest" and "environmental interest" were overlapped. Through this association, it was possible to check conflicts, possible combinations and potentialities of case studies. The logic comes from the matrix analysis, in which possible combinations are identified. (Moura et al. .2011).

Characterization of the particular to the general

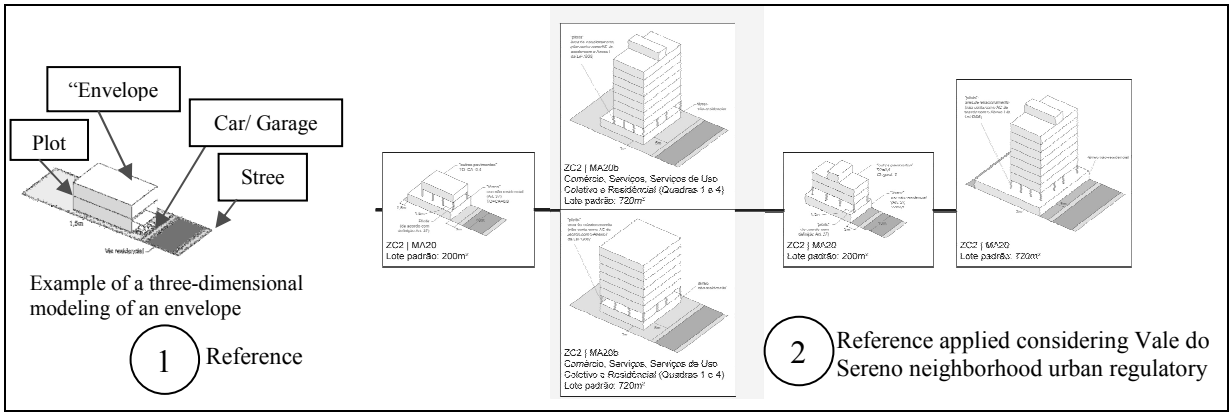
Considering the plot scale, the goal in this section is to ponder how each *punctual unit* – that results from the modeling application of parameters contained in urban regulatory laws – gathered in groups forms the complex of landscape.

This scale analysis also has a methodological proposal of presentation templates that determine the shape and position of built volumes, considering that their juxtaposition results in urban planned landscape. This analysis enriches the characterization of study area cases because approaches the level of units that make up the layers of *palimpsests*: the buildings.

This task was carried out through: (1) the analysis of changes in the regulatory settlement models lots, (2) zoning in maps areas of application of urban parameters, (3) composition of

three-dimensional models representing the parameterized volumes according to regulatory. These models represent *envelopes* related to the maximum possible constructive parameter and their respective settlements over lots. The result, presented in comparative tables, is useful as a referential frame both served as to broader historical analysis and to the current portrait of the layers that make up the palimpsest (Harvey, 1994) of case study areas. (Figure 1).

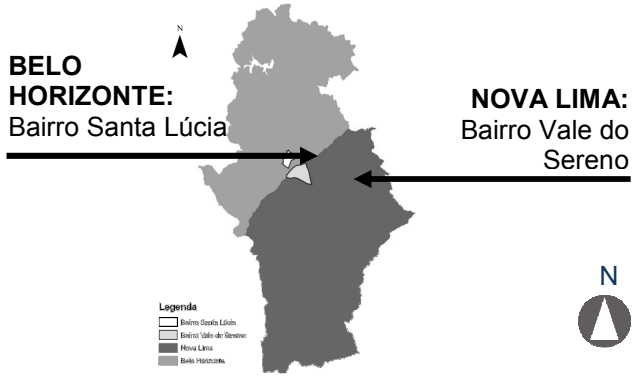
Figure 1 – Example of evolutionary study of possible constructive "envelopes" of the urban planned landscape from Vale do Sereno Neighborhood. Source: Zyngier, 2012



CASE STUDIES: METHODOLOGICAL SCRIPT APPLICATION

Two border neighborhoods between the limits of the municipalities of Belo Horizonte and Nova Lima were selected as case studies. The first area was the Vale do Sereno Neighborhood (Figure 2), in Nova Lima, chosen for being used as a research theme of subjects investigated in the Geoprocessing Laboratory at the Architecture School of the Federal University of Minas Gerais. The second selected area was the Santa Lucia Neighborhood (Figure 2), in Belo Horizonte. The choice of these case studies was done based on the fact that both have similarities regarding topographical and geological conditions, accessibility, being morphologically characterized as valleys in "amphitheater". Beyond that, the two areas suffer the same pressure from real estate growth from Metropolitan Region (Região Metropolitana – RMBH). (Rodrigues, 2001: 90).

Figure 2 – Location of case studies. Source: PRODABEL. Adaptado por Zyngier (2012).



Despite the physical resemblance and location on the shores of the municipalities involved – Belo Horizonte and Nova Lima – the differences between case studies are also justifies their choice as pilot areas: both belong to distinct municipalities, have different maturities in the processes of planning and urban management and also unlike stories concerning urban regulatory development. The timescale of the regulations also differ, because the process of landscape management is being developed in Belo Horizonte há mais tempo, while in Nova Lima this issue is more recent and marked by legislative changes in large quantities and in short time. Therefore, the history of regulatory is distinct, especially considering community participation, experiences in management of urban planning instruments, and also their effects applied in formal urban landscape.

The case studies are located in an area of importance for the environment of the Metropolitan Region, contiguous to springs and woodlands. As a consequence this borderline presents contradictions concerning the use of land and the correlation regulatory laws versus real estate interests. (Gomes, 2002: 192). In this zone there is a combination, under pressure, between woodland (Mata do Jambreiro), an ecological reserve (Estação Ecológica do Cercadinho) and the intensification of human settlement. This cutout contains consolidated settlements and others with potential for change. It is also the target both of entrepreneurship and environmental interest, in different proportions and in distinct moments (Zyngier, 2012).

"Possible landscapes" in case studies areas: analysis of conflicting interests

The analysis of conflicting interests is performed from the "Combination Matrix" (Moura, 2007) and applied in the methodological script presented by Zyngier (2012). This analysis seeks to identify situations that: (1)) are naturally conflictive, , (2) clearly present the tendency of settlement, (3) that have conditions of being transformed and so causing effects that promote changes in landscape and (4) don´t present conflicts or clear vocations. (Table 1)

Table 1 – Combination matrix: conflicting interests. Source: Moura, 2007.

		Environmental interests				
		High	**Medium to high**	**Medium**	**Medium to low**	**Low**
Urban growth interests	**High**	Conflict	Conflict	Sustainable urban settlement	Urban settlement	Urban settlement
	Medium to high	Conflict	Conflict	Potential for change	Urban settlement	Urban settlement
	Medium	Environmental with investment	Potential for change	Potential for change	Potential for change	Urban settlement with investment
	Medium to low	Environmental protection	Environmental protection	Potential for change	Non conflict	Non conflict
	Low	Environmental protection	Environmental protection	Environmental protection with investment	Non conflict	Non conflict

According to this methodology, Santa Lucia Neighborhood is predominantly characterized by an extensive area in which prevails the "urban growth interests" and the "potential for change", distributed along the borders of the neighborhood, and especially around the "Praça do Sol". This fact may indicate that the neighborhood has the potential to be led to transformations as, for instance, the replacement of single-family residential buildings for vertical multifamiliar residential buildings. The areas in which the "Environmental protection" predominate are quite dispersed and are related mainly to the immediate surroundings of the conservation unit and some expressive patches of vegetation cover. Few "conflicts" áreas as noted. The vocation of this neighborhood is already very strong, with a predominance of urban settlement and growth, except in regions that represent risks to the occupation, such as the high slope – but that can also go through significant investments concerning topographic correction if the cost/benefit ratio warrants (considering here the entrepreneur's point of view).

The analysis of Vale do Sereno Neighborhood confirms that it is mainly covered by three categories: predominance of urban settlement; urban settlement with investment and potential for change (this is a transition zone capable of receiving changing actions and that consequently change existing landscape). This may indicate that there is great predominance of potential of settlement managed by entrepreneurs.

These agents can, through financial efforts, invest in areas which, at first place, would be difficult to occupy (either by high slope or also because of its geological fragility, for example), if the cost benefit is justified. As a result, any "Potential for change" area presents the possibility of dramatically be urbanized. Notably, in Vale do Sereno Neighborhood there are few areas in which prevails the "environmental protection".

It is worth to say that when a "spatial analysis" is drawn up it reveals "non conflict areas", where the environmental issue is not expressive and nor the entrepreneurial interest has yet settled. The presence of "non conflict areas" is critical to the identification of sites where major urban equipment can be installed, especially those which location could bring some questioning, such as sewage treatment plants, landfills, industrial parks, among others.

Concerning Environmental protection, the studies clearly showed that both Neighborhoods , Vale do Sereno and Santa Lucia, are actually on the "fire line" of urban sprawl of the "border zone" of Belo Horizonte/Nova Lima and antagonistically surrounded by environmental heritage. This fragility is relatively smaller in Santa Lucia, where the settlement is more established. However, the Vale do Sereno is still "helpless" of protection, because there are no municipal instruments that ensure protection to the significant vegetation that still remain, except by a few areas protected by federal legislation ("Áreas de Preservação Ambiental", APPs). (Zyngier, 2012).

In relation to the "real" preventing the occupation, supported by legislation, it is observed that, in Saint Lucia, there are more than one reason to not deal with certain areas, such as slope values that overcomes the allowed limits . However, most of the areas that should be *non aedificandi* are already occupied. In Vale do Sereno, this analysis can indicate a clue to

be considered in future occupations: various areas, with high slope and related to water bodies, are still unoccupied.

DISCUSSION: "STATE OF THE ART" IN CASE STUDIES AREAS

In official documents that are references to composition of the Vale do Sereno and of Santa Lucia landscapes (municipal, State standards, etc.), there are not any type of instrument that produce the simulation of the final configuration of formal urban landscape. The exception is a drawing presented in a plan presented in a document that preceded the Municipal Urban regulatory Law of 1976, prepared by the official organ called Plambel. The image didactically produced contains correlations between the proposed parameters and their possible production.

Briefly, the difference in diffusion, in communication and in the manner in which these data was overlapped over time was noted. It should pointed out that such overlap is clearly more frequent in Vale do Sereno, where many changes in zoning took place in the short space of time without public approval which reduced the ability of the population to understand and monitor these changes. It can be said that this process hampered the dissemination of standards and even caused the inaccessibility by the community to its content, restricting the understanding and democratic participation. This fact can still trigger both the devaluation of a particular good – a house being "circumvented" by high towers, for example – and also the devaluation of public good – a landscape being superimposed by buildings that mangle your scenario (Zyngier .2012).

RESULTS: THE BOUNDARIES AND THE FRONTIER ZONE

This study confirms that understanding until this moment is rather limited in relation to the production/communication planning parameters and the resulting landscape management by the community from a possible understanding of what it means from the deployment of what is expected.

In “frontier zone” barriers to understanding are even more intense once the parameters and the means to communicate them are very different and in some ways reach the opposition.

The case studies analyzed in this paper are example of this conflict that reinforces the “misunderstanding” on the part of the community. The lack of dialogue in “frontier” in relation to communication of urban parameters to the community and the result is strengthened when the entrepreneur transfers the pressure from one side to another.

Highlights include two relevant borders as sources of analysis to the current study of cities: the first is the physical, territorial and political. The second is the border to be overcome and relates to the need for construction of truly intersections planned through the consensus of parameters that consider the possible landscapes of these tracks.

Two case studies were carried out with the aim to prove the effectiveness of the methods and techniques elected in different situations, especially from the point of view of political representativeness of ripening’s community participation and monitoring conditions of propositions for the use of the soil and the formation of the urban landscape. The two chosen neighborhoods, clipped by submit territorial morphology, much like even showing different conditions, different borders on community participation in decision-making about their landscapes, resemble in proof of the efficacy of the method supported by Geotechnology, and that can have their jobs enhanced and developed in future work. Remembering that the GIS is a set of methods and techniques to support decision-making, which if confirmed in both case studies.

CONCLUSIONS

One of the concerns that motivated the investigations of this work was the guiding question: how are communicated the possibilities involving the urban landscape designed? On the reflections undertaken case studies and promoted, it is observed that this research results in contribution to clarify the assumptions related to the theme.

In relation to the neighborhoods analyzed, the medium used for communication of legislation (responsible landscapes designed in two case studies) is mostly the Middle writing (text, tables, or decrees). The two-dimensional images appear more accessible from the year 1976, in the case of regulations of Barrio Santa Lucia (Belo Horizonte) and since 2007 in the case of the Serene Valley (New file).

Search – if, through this research, contribute to the reflection on the means available, today, to the interpretation of "possible landscapes". The decoding of the main instruments that regulate them urban landscapes built the reference area, such as the laws of use and occupation of the soil and master plans, through the analysis of urban parameters and its systematization in tables and schematic volumes that provide various comparisons and configure a sample that illustrates various parts of "cells" that make up the palimpsest of the landscape. This exercise of decoding was important to allow the verification of how, currently, if "they" and "demonstrate" the contents of regulatory plans, including territory, exposing, limits and contradictions.

In this context, it was observed that the decoding that enables the understanding of the possibilities for the projected landscape depends on technical knowledge. It is there that the result for the lay community is the restriction of understanding and why not say about participation, since often the lack of understanding can lead to lack of interest. To address these limitations we must seek more languages accessible to the population can adopt the "possible" landscapes "eyes open", so conscious and critical.

To seek out new languages, application simulations of thematic maps and synthesis on 3D surfaces, along with the exercises of perception and the use of GIS for construction of Multi-criteria Analysis, broadened the perception and understanding of the territory on the part of the students who were still at the beginning of the course of architecture at the federal University of Minas Gerais in 2011. In this research, that the experience of this group of students, just because it is still not mature in the technical area, is equivalent to the experience that can be made with the population.

It is worth saying that would have been very useful to conduct interviews with community residents, showing both the Multi-criteria Analysis in three-dimensional prototypes representation, and also the prototypes of 3D envelope models. Nevertheless, it is considered that the evaluation of the results was positive once the monitoring of students cited, showed maturing and growth of understanding of the topic. It can be said that, as well, a plausible path was located to amplify the communicability and understanding concerning the topic related to possible planned urban landscapes. So, another premise of this proposal was fulfilled: expand the means of cognition.

In relation to the use of GIS as a tool it can be said that it was important for the verification of the sustainability of existing actions in landscapes.

One of the contemporary issues that might be observed in the case studies was the remarkable and contradictory juxtaposition of interests resulting from the landscape approach. On one hand it is considered as "selling-attribute" or a *private good* – ex. the valley view from the tower window being offered as an attribute when a residential building is being commercialized. On the other hand, as *collective good* that is being modified by the introduction of that same object that provides and sells the "view" as "attribute". There is a dichotomy given by forms of ownership of the landscape in a way that still requires maturing in discussions and interpretations by the technical and, especially, of the community.

The case studies characterizations presented are useful as portraits of a timeframe and can, as one of the initial premises of this research, be useful for regulatory qualification of urban neighborhoods, once allowed to identify potential restrictions, vocations and conflicts of interests in the use and occupation of the territory.

Briefly, some empirical activities developed from the methodological script that can contribute as subsidies to the development in other investigations can be listed: (1) the preparation of three-dimensional unit models, the "envelopes" that can serve as "cells" to be grouped into larger scale modeling, such as blocks, neighborhoods, etc., inserted in the urban landscape, so that the proposal and approval of urban parameters are properly understood and monitored. (2) The preparation of GIS models in 3D can represent an increase in quality of communication, in order to be used in urban planning meetings, public hearings and decision-making processes, including the possibility of being applied in interactive navigation interfaces. (3) The use of Webgis as informational method for releasing data collection and for collaborative activity when community participation occurs.

The current time is characterized by a new phase in urban planning and management, when the lack of information is being replaced by excess data. However, *data* is not *information*: data becomes information when it is structured, systematized and made available to the users interpretation. The geoprocessing is an interesting tool, in this sense, since it promotes the systemic information handling and has significant communication potential.

The initial concern that motivated this work is part of urban dynamics: modifications of its landscapes will continue to be performed, they are unavoidable and necessary. The solution that defended here is the support for this dynamic development, through of instruments such as the exercised in this research, pursuing the possible landscapes layers and the means to communicate them.

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