

TeMA

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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.

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papers

Smart City

planning for energy, transportation
and sustainability of the urban system

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PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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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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SPATIAL PERCEPTION AND COGNITION REVIEW CONSIDERING GEOTECHNOLOGIES AS URBAN PLANNING STRATEGY

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ABSTRACT

This article proposes a review of the spatial cognition and perception principles, referring to the definition proposed by Cullen and Lynch, through the geotechnology tools. It presents a case study to be analyzed through Geographical Information Systems (GIS), 3D Modeling, Spatial Analysis and Data Base Structure. This proposition presents reflections about the concepts and values of the early foundations of the spatial perception and cognition theories as a base to promote participative planning, investigating how geotechnologies can favor the registration and identification of landscape values to be considered in urban planning. The downtown of Belo Horizonte (Brazil) was defined as a case study to promote the exercise of these reflections, aiming to present a practical illustration of the methodological proposition. This work tried to reach its purpose inquiring how geotechnologies could enhance knowledge gain in the Urban Planning practice. It points out some research paths that could be followed, as well as new approaches to the development of academic understanding of the geotechnologies role in the urban planning scenario.

KEYWORDS

Perception, Cognition, Spatial Analysis, Geographic Information Systems.

1 COGNITIVE ASPECTS OF SPACE, AN OPPORTUNITY TO GIS

This work started with the idea that: representations of the world, beyond the sensory field, are, in addition to a physical view of the space, being formed with and through the mental faculties of the human being. As indicated by Faria [4] "the view is very far from being confined to the sense externalized through the eyes: it is constructed in the mind."

Thus, this research seeks to consider relations between subject and object and is based upon foundations of perception and cognition spatial theories, with priority to visit works that deal with this subject. From then, this inquiry tries to point out how the physical object and relational spaces could enable a transformation of sedimented perceptions towards the construction of strategies for Urban Planning.

As theoretical bases, classical authors were discussed, such as Kevin Lynch [12], with *The image of the city*, and Gordon Cullen [3], with *Urban Landscape*. On one hand Lynch's readings gave support to perceive "place" concepts through structuring elements, mental map creation, legibility conditions, landscape identity and singularity. On the other hand, Cullen's references helped in the identification of place's cognition, considering one's insertion in a landscape and the proximity of all points of view that it encompasses. Both approaches enabled the identification of *genius loci*, which can be defined, according to Norbert Schultz, as the character of a landscape, what is valued by the community, and must be considered by urban projects [19].

To carry out this exercise, the methodology proposed investigates the potential of geotechnologies and tested it on a case study at the city of Belo Horizonte (Brazil). The choice of the case study refers to the facility to visit the place and to identify axes and notable figures from the point of view of the user's location and culture. It is understood that this relationship promotes the understanding of the processes investigated by reinforcing the importance of space to the human being, and particularly of the changes that are proposed and designed for the environmental and urban space.

2 URBAN PERCEPTION AND COGNITION: THE PROCESS OF FORMING REPRESENTATIONS

Currently, the practice of spatial perception in daily life is superposed by the fast pace of big cities. The need for comfort and displacement ultimately dictate the relationships between subjects and things, and between the subjects themselves. For Lynch [12], "the moving parts of a city, especially the people and activities, are as important as their physical properties and parts."

In this sense, the development of technologies can facilitate the "automatic" understanding of objects and their surroundings. Consequently, seeing the world, beyond the act of "seeing" becomes a distant action of individual and collective naturalness, which is rationalized and becomes part of cold and distant feelings, emotions and affections reality that usually, connect to sensory experiences. Thus, "in most cases, our perception is not full, but very partial and fragmented while involved in other references [12]".

Besides the spatial perception, understood as the instinctive ability of human beings to create a mind map, with references to location and shift in the territory, resulting in the primary identification with the space in which it operates, is also relevant in this research the concept of spatial *cognition*.

The concept of spatial cognition relates to use conditions of memory and sensitivity, and enhances the sense of *space* to be hierarchical among the sense of place, equipped with related spatial experience values. Cognition occurs when there is apprehension of how the world works, with its forms and principles. Cognition is not a static or passive concept, since it is not determined, but conditioned and contextualized.

Through cognition, the subject can transform surroundings according to the cultural baggage that moves him.

Among the authors of spatial perception stands out Lynch [12, 13, 14], and also, in Brazil the group of Brasilia University conducts studies on the topic [11]. In this framework other authors should be cited such as Tuan [27, 28], which discusses the relationship of topophilia (feeling for the place) and space and place; Schulz [24], who introduced the concept of *genius loci* (essence of the place) and Cullen [3].

The moment of perception and cognition of space is a time of social consciousness. It is the funding, selection and organization of environmental information process-oriented decision making. Largely automatic and even unconsciously, a person uses internalized spatial, architectural, urban and landscape understandings to compose a mental frame of the organization of their surroundings and coherence in the dynamics of its functioning.

The revisiting process of perception and cognition theories involves passing from the importance of space to the importance of man-space. This review may contribute to increase understanding about the contemporary city once such process is directly connected to the quest of understanding the subject who experiences space socially produced through experience, memory, intellect, imagination and emotions. This subject "re means" the concerned space and gives sense to the plastic shapes and their relationships.

The figure of the Architect and Urbanist arises in this interim as a decoder process agent including shapes and data. Thus, the "decoder-architect" can enrich the environmental perception, by entering the other beings world to decode it. Therefore, the Architect may come to infer about perceptual reality of the collective social and also about the creation of other sensations from new urban design.

For Cullen [3], the role of the architect, *designing* (related to the *decoder* role here), was disturbed by the speed with which they operate changes. To the author, "the rate at which the changes are processed today prevents urban planners to apprehend and settle empirically to humanize the raw material that comes across them. The environment is poorly digested". [3]. It is interesting to note that the reasons that caused this statement made by Cullen, more than forty years ago, still remain related to such imbalance: "there is more people, more houses and more equipment; increasingly rapid communications, construction methods still poorly mastered", can still be appointed by architects and city planners as a problem for the appropriate perception that leads to well-executed project [3].

In response and indication on how to do planning in such conditions, Cullen emphasizes the need to "popularize as most as possible the *Art of the Environment*." For the author, "the way the environment is constructed is potentially one of the most widespread and exciting sources of pleasure" [3].

Cullen's approach reinforces the need to analyze and study the process of uptake, assimilation and understanding of space by individuals who experience and make their place. In this sense, the architect must take its partial role, intention, and seek a way to translate and decode the desire of the collectivity. The partial role pointed here refers to the cognitive process in the human sciences which will never be fully apprehended and understood, they will always be more accepted solutions and they will always be partial.

3 CONTEXT

"Currently, has grown by town halls the interest and investments in Urban Planning, one time that the organization and life quality in municipalities depends directly of this. Consequently, the demands for tools that enable the creation and analysis of constraints data of this planning have been each time more frequent." [5].

Belo Horizonte is the third largest metropolis of Brazil and, despite its present great advances in public policy and environmental planning, and possess a Master Plan [20] well structured, needs, as how the rest of the country, of strategies and tools for their development considering the landscape as resource planning. In this sense, is scarce the material about municipal normative that addresses the process of land parceling, use and occupation from a landscape perspective. Also, when addressed, is under a very broad conceptual look towards *general aspects that characterize certain areas*, as in the case of a Belo Horizonte Master Plan, which binds to the term *urban landscape*.

Regarding the development of the database, use of geotechnologies and adopting of spatial perception and cognition resources, the municipality, is a national reference of preparation and organization cartographic georeferenced bases. At the same time, "the town halls in general have a poor cartographic base of your municipality. Most of them appear just as papers collections with drawings of lots, often without special precision, reference points, projections nor appropriate scale systems. The drawings are represented in the form of sketches, without geometric rigor and non-georeferenced, hindering the creation of a digital database or providing large distortions in the same." [5].

The use of landscape as a tool for planning might allow problematizing, conceptualizing and especially developing the diversity of issues that involve complex urban environment. The cultural issues may be reviewed, and placed in a similar relevance level to natural issues. In this sense, the Urban Planning processes, which have been applied in Belo Horizonte and other cities, may expand its scope of influence or activity. At the same time, may cover the changing character of environmental realities, approaching its complexity.

Moreover, the adoption of features that search for the landscape resignification and revalorization, considering individual and collective perspectives, move in the same direction that recent research of this field, as pointed by Moura [18]: "recent scenario was one of recognizing Geographic Information Systems' potentials, as well as considering communication and information exchange processes, and initial legislation regarding propagation of information. In a process continuously more integrated and global, geo- technology tools started to respond to the following values: wide communication with different users; wide interoperability; and wide promotion of systemic approach, by modeling processes and building interpretative portraits and simulators for reality." In this sense, Belo Horizonte can contribute, one more time, to the development of tools and instruments for a better understanding of urban, Brazilian and of other realities.

In Brazil, the current scenario of discussions about landscape shows a singular situation. According to Freire et al. [6], "given the intense process of urbanization wide-spread in the territory with forces acting similarly in a greater or lesser extent, not only in large urban centers but as in medium and small size cities. The use of models and geotechnologies grows in importance in its way as supporting tools for planning, insofar as this interferes on planning and defining the landscape that must be understood as a right from all the populations of the cities. In Brazil, changes in legislation process increased popular participation. Thus, the development of studies and investigation of the processes of intraurban change, we must emphasize the utility of geotechnologies and their analysis techniques"

4 INFORMATION MODELING FOR URBAN PLANNING

Under Freire et al. [6] the main features of the projected visible urban landscape can be synthetically quoted as follows:

- The urban landscape is endowed with projected visible dynamism, and is a product of human action that produces a superimposed palimpsest [2, 10, 22, 25];

- It is endowed with a historical dimension combined with a spatial dimension [23];
- The architecture and urbanism aspects are inseparable in the urban landscape, since it is the result of the interplay of these aspects [7];
- Its interpretation depends on the observer's point of view, since it is the result of cognitive processes [15], and also who presents to the public, as this presentation may be imbued with some kind of strategy, for example, related to entrepreneurship [10, 26].

If we can embrace the variety of information that provides the environment when we represent it, we can achieve the diversity of possible perspectives, starting from the object towards the look. The 3D representations carry the potential to cover the environmental spatial and temporal changes, favoring an acceleration of understanding of the spatial processes and phenomena. At the same time, allows the combination of different perspectives, even simultaneously, by handling your tools and building models of representation.

Santana [21], referring to Campagna says: "The conditions that now presents allow the urban planner to simulate, in expanded reality, the resulting on landscapes of their propositions of zoning, occupation models and tables of urban parameters. This employed more largely as tool by the urban planner will allow the bridge among technical, administrative and community languages. Everybody will be able to give opinions and to make decisions, democratically, favored by the best ways of com Giacomelli [8] states that the complexity of those models and the variety and volume of information need to be studied in terms of environment of processing and post-processing, related not only to GIS technology."

5 METHODOLOGY

The first step to execute this work was to identify the most important authors that dealt with space understanding of. We identified Cullen and Lynch as the most relevant to the analysis and others to support some issues. Both have pertinent work towards spatial cognition and perception despite the long distance that they were conceived.

It is well understood and proved that geotechnologies enhance and improve understanding of spatial relationships, so it instigated the research group to revisit Cullen and Lynch concepts using these tools.

As theoretical framework the review and considerations about the concept of urban landscape stated by Gordon Cullen establishes from the process of forming representations that the city is a locus of urban social changes, shall serve as a palimpsest and laboratory for possible interventions in the intention of producing a less segregated and more just space. This concept summarizes and clarifies the difference between a *landscape* and *tangled objects*, and serves as an instrument for establishing relations between objects seen/perceived and the subject. For Adam [1], Cullen's definition to the urban landscape "is the art of making coherent and organized, visually, the tangle of buildings, streets and spaces that make up the urban environment."

To Gordon Cullen [3], the urban landscape is made up of space in which "society shares experiences of pleasure and conflict, encounter and clash, inclusion and exclusion, in a historical dimension that reflects the experiences of its inhabitants". The author highlights the dynamic and propitiator character of various interactions of the urban landscape, defining it as a locus in constant transformation. [3].

To understand this concept and the examples designed by Cullen, some sites where examples could be perceived were mapped in the city of Belo Horizonte. To address the research, a layer of information with the data was created through a table containing: concept, photography of site, and other comments. Then

the occurrences were indexed to corresponding locations of each photograph (Figure 1) using georeferenced points.

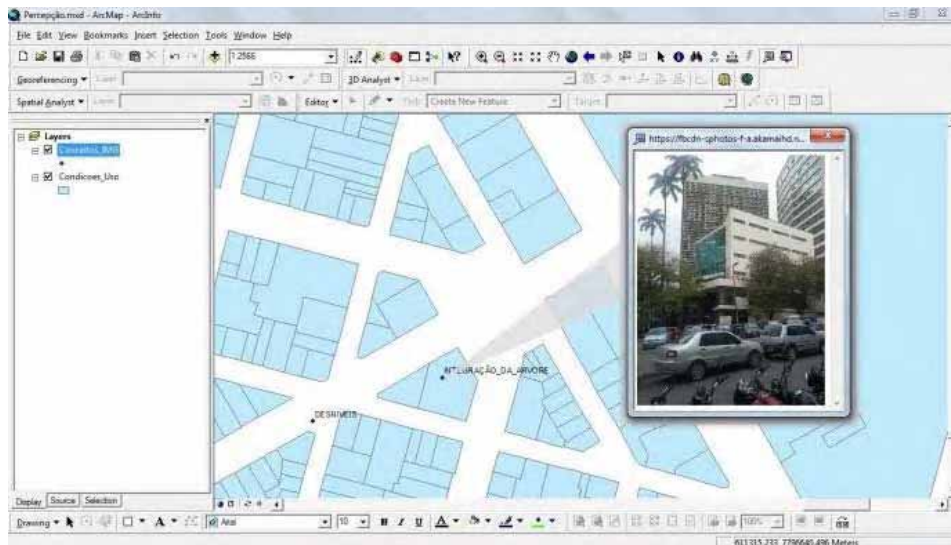


Fig. 1 Mapping of Cullen’s Concepts

After this step, the issue of the space perception through “serial vision” [3] was deepened. According to the author “the path from one end to another in a plan, for example, shows a sequence of views. The uniform progression of a walker is punctuated by series of sudden contrasts that have great visual impact and give life to the path”. [3].

Such indexing, was part of a search for exemplifying Cullen “themes” through new technologies for spatial analysis and relate them to the current reality and to a different spatial area than those shown in Urban Landscape [3].

The potential of geotechnologies favor the revisits to the principles of spatial cognition and perception, to create conditions for practical use in processes of interpretation on environmental and urban planning. Among the resources made available by geotechnologies, more specifically by the Geographic Information Systems (GIS), those which were included in this research can be highlighted:

- Georeferencing information and the possibility of overlapping and combining information from layers;
- Association of cartographic and alphanumeric database and the possibility of feeding it with information detailing the occurrence data;
- Organization of a database;
- Three-dimensional modeling;
- Implementation of combination of variables models;
- Implementation of point of view models.

6 DEVELOPMENT – CASE STUDY APPLICATION IN THE CENTRAL REGION OF BELO HORIZONTE

Some countries, such as Britain already adopt sight fields as a parameter for approval of building impacts. *The London View Management Framework*, for instance, provides protection for some targeted views from defined points of the city considered important as they help define the city's identity (Figure 2). The

applications of this type of analysis are related to the possibility of identifying notable landscapes and, above all, identify the values to be preserved concerning transformations of the urban landscape.

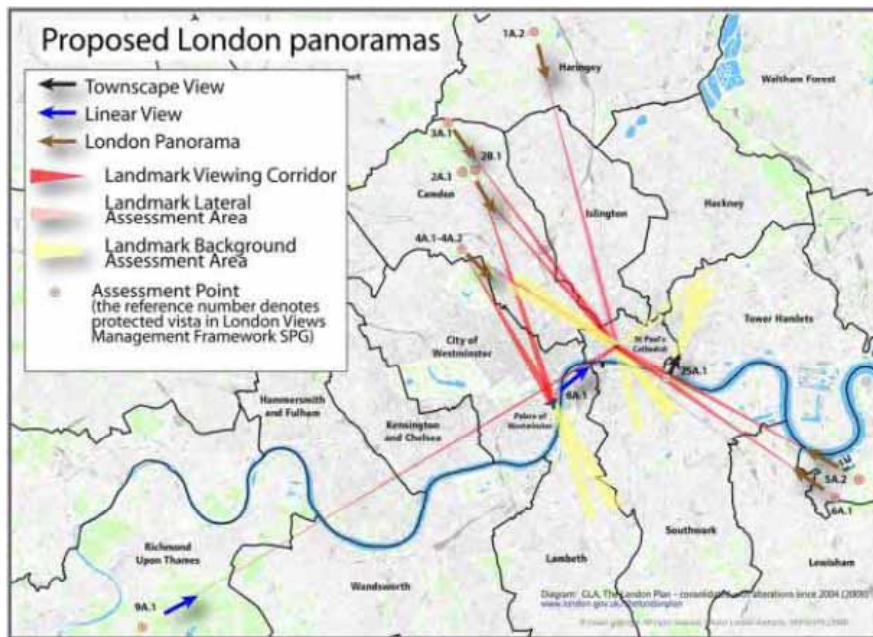


Fig. 2 Map of protected views

Nowadays the municipal law of Belo Horizonte addresses the issue of sight fields only when they are related to the Serra do Curral. Although this mountain range is of great importance and scenic beauty, it is noted that Belo Horizonte, like other cities, when one considers the principles of perception and spatial cognition, has few cultural and historical values sight fields of interest officially contemplated and protected by regulations. So as experimental case study, aiming to expand the panorama of protected sight fields a stretch was chosen in downtown region to demonstrate its importance to their viewing angles. The chosen stretch includes Amazonas Avenue, starts at the Raul Soares Square and goes until Sete de Setembro Square. It also is part of the original urban plan of the Belo Horizonte, designed by the engineer Aarão Reis in the end of the 19th century (Figure 3).



Fig. 3 Case of study area and the viewpoints analyzed

After choosing the stretch, a situation of a person walking on the sidewalk, on the right side of the Avenue Amazonas towards Sete de Setembro Square, was proposed. From then, the research group tried to analyze the landscape by applying the concept of *serial vision* [3] and studying the sight field at each point (Figure 4).



Fig. 4 Application of Serial Vision in the first part of the study area

To study the sight fields, *GeoWeb 3D software* was a valuable tool, because it raised a layer from the ground containing the projection of buildings on lots and their respective heights; allowing the analysis of visible and invisible points, since the point of the observer (Figure 5).

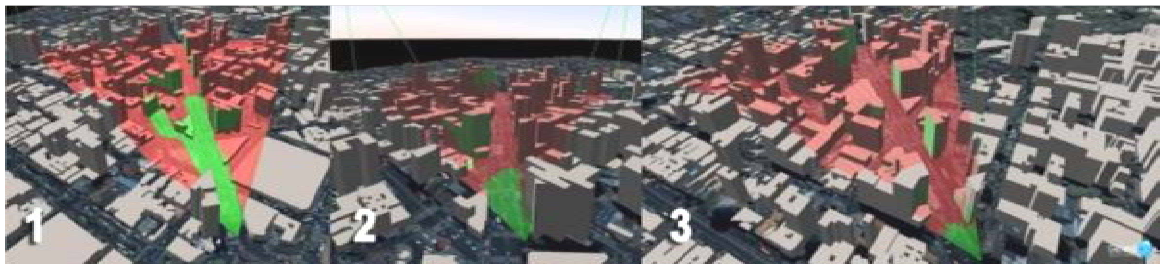


Fig. 5 Field of view analysis related to the first photo sequence (Software: GeoWeb 3D)

Note that the same landscape may prove functionally distinct if placed second different viewpoints, as shown in the second sequence of photos and fields of view (Figures 6 and 7).

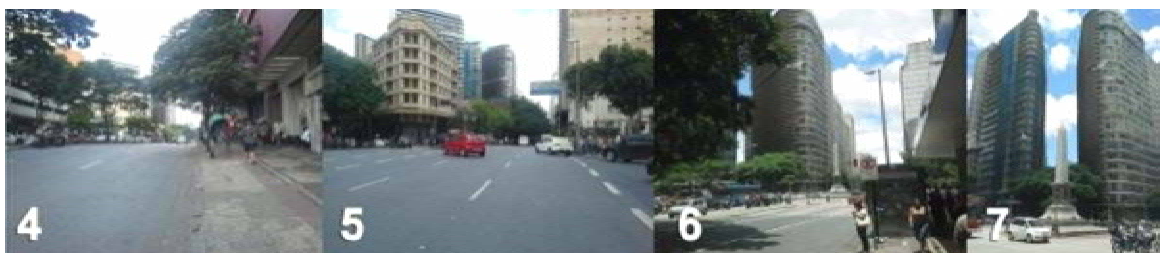


Fig. 6 Application of Serial Vision in the second part of the study area

The sequence of figures shown (Figures 4, 5, 6 and 7) confirms one of the functions of the height differences described by Cullen, in this case clearly separates the studied stretch into two parts (Figure 4, 5, 6 and 7 - sequence of photos 1-3 and 4-7).

In the second sequence of pictures (Figure 6 photos 4-7) we see how it defines a focal point [3] on the landscape. It is a symbol of vertical convergence. In our case, the obelisk of Sete de Setembro Square

emerges as a confirmation. Although the heavy traffic has lost the clear function of room, the "lollipop" (as it is called by citizens) marks the main road crossing of Belo Horizonte.

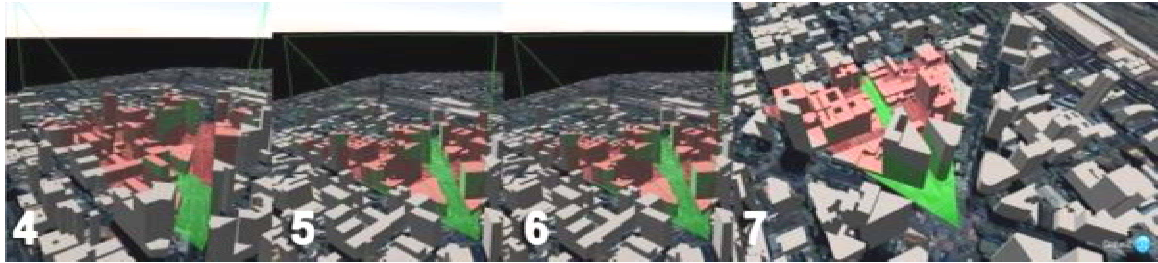


Fig. 7 Field of View Analysis related to the first photo sequence (Software: GeoWeb 3D)

Throughout the selected stretch (Figure 3), the distinction of typologies, shapes and sizes of buildings and landscape elements inserted excitement and drama to the route away from the monotony of a continuous landscape, bringing in all the attractiveness of the unexpected, where the landscape is not only appreciated by individuals, but is in constant interaction with the environment, merging it.

7 CONCLUDING REMARKS

It is recognized through this work that the urban landscape is not considered only by a combination of fixed elements such as buildings and trees but also from the movement of the people among the objects and its interdependent relations. In this sense, the social behaviour shows extreme importance to the study.

Cullen's work shows that as the disposition of space can interfere in the emotional aspects of individuals, its applications in Urban Planning should be adopted in a way to accomplish more attractive and comfortable spaces to user even though considering different ideas, tastes and wills.

The value of the use of geotechnologies is highlighted more specifically in the GIS use and the review of the spatial cognition field of research. Among GIS tools that were implemented stands out the construction of a data base, three-dimensional modeling; implementation of combination of variables models and implementation of point of view models. This tools matching contributed to associate the concepts and the methodology of urban landscape interpretation with a more integrated analysis as stated in the beginning of this research. It was possible to produce a combination of different information with significant power of visualization. This path can be of great value to future development seeking the participative planning support as it is a way to act as principle of "see the unseen" [17].

This research started a path that can promote a way to understand and consider the values of a community to the landscape impacts in the urban planning scenario. In the case study area there are no rules, legislation or parameters that take community opinion or cognition relation in to the decision making process. The paper sought an efficient path that governments, stakeholders and urban planners might start taking into consideration once used accessible instruments.

At the time the spatial perception and cognition theories were initially proposed, the set of tools for representation, visualization and spatial analysis were limited, which has given rise to many improvisations that ended up disqualifying the value of such studies of the relationship between user and territory. Yet, when facing new and meaningful opportunities arising from geotechnologies and the diffusion of information, it is possible to review concepts and extend investigations, considering that there are already tools which used in appropriate methodological processes, might favor analyses with repeatable and defensible criteria.

The instruments shown here are also tools that can help academic development, once they represent a way to promote exercises, be a new subject into the graduation courses curricula, where the understanding the landscape progress is fundamental.

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IMAGES SOURCES

Fig. 1, 4, 5, 6, 7: Author's files.

Fig. 2: Mayor of London. The London Plan: Spatial Development Strategy for Greater London.
<http://www.london.gov.uk/thelondonplan/docs/londonplan08.pdf>. Feb. 2008.

Fig. 3: Google Maps (accessed in January 2014).

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