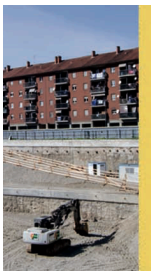

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Data visualisation for the critical interpretation, representation, and communication of the urban image

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This study aims to test the efficacy of a method of critical reading of the urban space, by means of interpretive languages which are capable of displaying different ways to evaluate reality.
We chose to operate in those urban areas, which, suffering from a long process of stratification, ended up expressing strong spatial tensions. The main purpose of this research is to accomplish a representation of the urban environment able to convey the result of critical evaluations in an expressive form, therefore through the production of 3D urban models, exploitable for all possible measures for the requalification of the urban image. The attention is focused on the development of reading and consultation systems, thus allowing the diffusion and sharing of digital representations of the city, both in a scientific and merely professional field.

Keywords: Urban analysis, Representation, Communication

1. The Subject Area

Although the development of new tools and techniques to document the physical structure of cities and the territory has revived interest in problems associated with urban phenomena and transformations, the

same cannot be said for problems related to the urban image; representation of the latter can, however, be considered a cross-section of the different cultural approaches used to interpret the urban environment.
While the urban image can be defined as the representation, from a certain viewpoint, of the visible elements of perceived reality, on the contrary reality involves the whole city and the relationship between its parts; in this case, the viewpoint is both static (the setting based on fixed elements), and dynamic (a series of sequential settings involving dynamic interaction between the elements of perceived urban reality).
Although traditional representation tools have been a very powerful medium with which to document urban transformations, their ability to communicate is often insufficient to reproduce the real complexity and dynamic nature of our contemporary urban environment.
Different representations of the processes of perception and communication of the environment are traditionally divided into two main groups: on the one hand, representations which use "objective", photographic-style methodologies to document reality based on "quantitative" methods, and on the other, representations which use "subjective" interpretation methodologies of reality-based data to study "qualitative" aspects.
However, if surveying quality means using a subjective filter to "reveal" the intrinsic values of the reality of these observed phenomena, then perhaps we should think of assessing how much we can "transform" an environment and yet avoid loosing the identity of its image, to the greatest extent possible.[1]
In recent decades radical changes in the representation of the urban image has given rise to widespread discussions about these new ways to decipher, interpret, and represent the contemporary city.
The enthusiasm accorded in the sixties and seventies to certain theories about new ways to interpret the urban image, for example the ones proposed by K. Lynch, inspired entire generations of students and scholars to adopt an approach to the urban phenomena that privileged the visible aspects of reality. For the first time, the city was deciphered/interpreted using a series of parameters involving images and their recognisability. However, the "symbolic" abstraction of representation limited the possibility to communicate the results of the deciphering/interpretation of perceptive phenomena whose "essence" lies in their relationship with the three-dimensionality of space.[2]
A rapid comparison between those representation tools and methods, and the options provided by contemporary tools, shows how easy it is to overcome those limits. Many of the shortcomings attributed to the studies conducted at that time can now be easily overcome using a different interpretation of the urban image, one which is more closely associated with its real spatial and perceptive dimension. It will becoming increasingly simple to conduct a critical review or interpretation using contemporary communicative tools that include all the elements in the urban image.
These considerations are behind a study project in which representation is the key tool of a method to communicate the results of a critical review of reality expressed, as objectively as possible, as icons. The aim is to elaborate a complex system of procedures to interpret urban reality in several different ways: quantitatively (the morphological ratio between the parts), and qualitatively (critical assessments of those parts). The systemisation and parametrisation of these aspects will lead to the elaboration of a single descriptive process of the complexity of urban reality in which the data appear separately, but also as reciprocal relationships.
From a strictly operational point of view, this means outlining the operations which, by identifying the links between the surveyed data, the analyses in question, and their scalar level of interpretation and transmission, make it possible to rapidly and immediately understand the reality in question. We therefore have to establish a general knowledge system and find new forms and new ways to collect different kinds of data, organise it, and make it compatible, in order to "merge" it and create a multimedia product that

[1] For more in-depth information about the concept of image of the urban environment, see the paper by Piero Albisinni "*Identità e trasformazione dell'immagine urbana. Metodi e strumenti di lettura, interpretazione, rappresentazione*", in the Proceedings of the International Conference "Immagine della città europea", Brescia 2004.
[2] For a critical review of the main representation methodologies used to provide a different interpretation of the urban image, see the paper by Piero Albisinni "*La rappresentazione dell'ambiente nello sperimentalismo degli anni Settanta*", in "Disegnare Idee Immagini" n. 5, Gangemi, Rome 1992.

can express and represent a cognitive process with a sound scientific basis. The objective is to create a descriptive model of reality in which the collected data is visualised and placed in "representations" that can be accessed by all users. This involves creating a geometric-topographical interpretation which can interrelate different data and different ways and types of approaches to urban reality - geometric models, typological interpretations, figurative and perceptive aspects – and merge topics which have so far been considered separately, such as green areas, empty spaces, buildings, elements defining urban space, etc.
By considering the physical element of the city as the material expression of all the evolutionary phenomena of places, morphological data can be used as a basis to be interfaced with the enormous amount of data from other sources. It is increasingly obvious that the basic data we have to initially adopt are the geometric parameters describing the volumetric conformation of the elements of urban space, the characteristics of their geographical position, reciprocal spatial relationships, orientation, etc.
These problems have often been illustrated in different ways and using different tools[3] by the authors of this paper who have repeatedly focused on defining a method which, by examining a specific step in the urban intervention process, would logically organise the operations needed to understand reality in order to provide critical assessments with an eye on the design project. It is an experimental method primarily focused on urban areas with problems which make it necessary to first identify, and then clarify, the gradual decision-making process of a step-by-step vision of the design process. In short, we wish to underscore the important moment of synthesis regarding the acquisition of knowledge of reality: a moment of assessment which should influence and limit possible intervention choices. The key factor in this method involves finding the right visual tools to convey the results of this critical review of reality; the method will use representation tools and procedures to communicate, as objectively as possible, the results of the critical review of urban reality, turning them into visual codes which can be understood and transmitted. These results will also contain indications about the limits of the hypothetically envisaged interventions.
Although the methodologies to understand and document the qualitative recovery of the urban environment are still operatively important, in the past couple of decades the tools with which we transmit and visually communicate this data have changed enormously. To be able to repeat these experiments we need not only to review the more general problems, but also to update methods and procedures, especially bearing in mind how they will evolve and/or vary based on the many operative tools now available. We therefore intend to prefigure urban scenarios using 3D digital models developed using several methodologies; the different results and uses produced by the latter will provide different interpretations of reality: a quantitative interpretation to understand morphological data, and a qualitative interpretation focusing on critical assessments which can be later used during the elaboration of possible transformations. The systemisation and parametrisation of these aspects will lead to the elaboration of a single descriptive model of a complex reality, such as the city, in which data will appear separately, but also as reciprocal relationships. This will make it possible to test potential ways in which to communicate the urban image using state-of-the-art simulation and visualisation techniques.

[3] The theoretical approach to these hypotheses is based on a study by Piero Albisinni and Laura De Carlo published for the first time as "*Oltre il rilievo*" in "Disegno" n.8, September 1984. Its contents and applications were further developed for publication in the book "*Dal rilievo verso il progetto*", Ed. Kappa, Rome 1988, and in the magazine "Disegnare idee immagini" n.0, Gangemi Ed. Rome 1989, entitled "*Uno studio metodologico delle interrelazioni tra rilievo e progetto per l'intervento nell'ambiente costruito*". Subsequently, the subject became a reference topic for studies proposed by Piero Albisinni and Laura De Carlo and financed by Rome "La Sapienza" University. Several doctoral dissertations also focus on this subject, including the research by A. Micucci published in part in the contribution by Piero Albisinni, Laura De Carlo, and Alessandro Micucci, *Nuove metodologie di rilevamento per la costruzione di modelli digitali in ambito urbano,* in: E. Chiavoni, P. Paolini (edited by), "Metodi e tecniche integrate di rilevamento per la realizzazione di modelli virtuali dell'architettura e della città", Gangemi editore, 2007; as well as a more recent dissertation by Valeria Giampà. The images in this article are in fact by Valeria Giampà and were developed for the dissertation "Metodologie di lettura critica per la riqualificazione urbana: il caso di studio di Monterotondo", Research Doctorate in "Scienze della Rappresentazione e del Rilievo", Rome Sapienza University, 2013.

2. The methodology

The proposed methodology, based on the considerations outlined above, is divided into two parts corresponding to the two consecutive method application steps: the first involves basic elaboration and can be defined as a *cognitive moment* following the acquisition of data from iconographic documents, maps, and onsite survey campaigns; the second as a *moment of assessment* illustrating and objectivising the quality of its elements.

Reality has to be organised graphically so that it can be manipulated using drawing tools in order to achieve the general objectives of the study.

As a result, when an objective operation such as a survey is completed, the ensuing physical reality has to be divided into simple parts based on well-established interpretation categories; all this then has to be illustrated in good graphic representations.

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Establishing the *minimum unit of assessment* (the objective of this breakdown) should be considered instrumental to the use of this method which involves identifying the urban areas; the latter are defined according to several uniform characteristics in each urban area which can be considered as unitary systems. The principal parameters used to define system uniformity refer to the history, morphology, and function of the physical environment.

When the method was applied, as a test, to an urban network just outside the old centre of a small town (Monterotondo) near Rome, the work carried out in the study area to establish the uniformity of these characteristics led, for example, to a further breakdown into five different systems divided according to

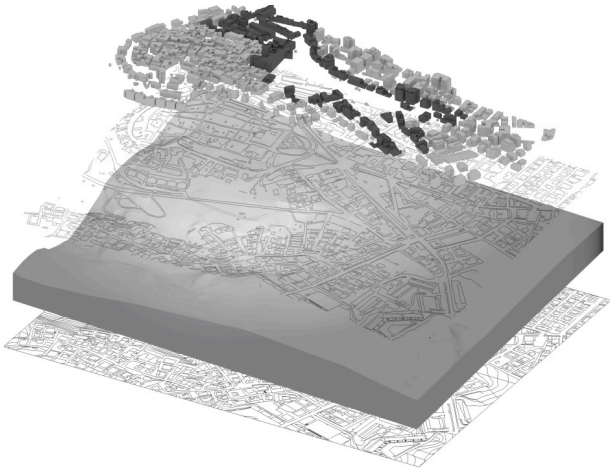


Figure 1. *Exploded view drawing of the fact-finding model of the urban centre of Monterotondo (RM) showing the study area*

whether they were *supported* or *supporting*. The fact the systems coincided with roads meant they could be further divided according to natural interruptions in particular places such as crossroads, directional changes, pre-intersection waiting areas or the presence of buildings of historical or artistic interest. We also discovered that each of these routes coincided with a precise historical-architectural-environmental development phase of the city.

These observations led to a division into categories of *linear* and *punctiform* elements which differ from one another according to their role within each system.

It's useful to elaborate an explanatory diagram which, based on the category adopted, defines the relationship between the elements; this also provides an initial interpretation which helps to clarify the characteristics of each system.
To start an evaluation process to determine the different intervention levels, reality has to be assessed bearing in mind all the elements which internally contribute in various ways to defining the intervention and, as a result, the image. This assessment is a particularly important part of the process; it involves breaking down the elements into categories of elementary spaces (minimum units of assessment) considered as elements of the more general categories identified earlier (lines, segments, points).

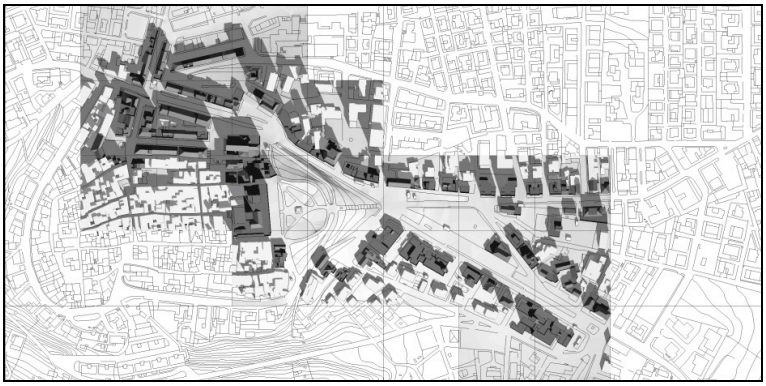


Figure 2. *The study area*

Figure 3. *Identification of one of the uniform systems*

Figure 4. *Visualisation of the "model of reality*"

Furthermore, the system also requires that parameters be established in order to rationalise and quantify the values to attribute to reality, bearing in mind the need to differentiate the assessment criteria according to whether one considers all the open spaces or only their component elements. During this step it is important not to lose sight of the final objective: to use each value to define the spatial quality of more extensive ensembles, bearing in mind the relationships between the parts.

We then identified homogeneous groups of parameters depending on whether or not the assessment involved the buildings or open spaces. In particular, the parameters referred to buildings are *functional, historical, typological* and *contextual*; in the case of open spaces, the parameters refer to their *use, permanence, morphology* and *space*.

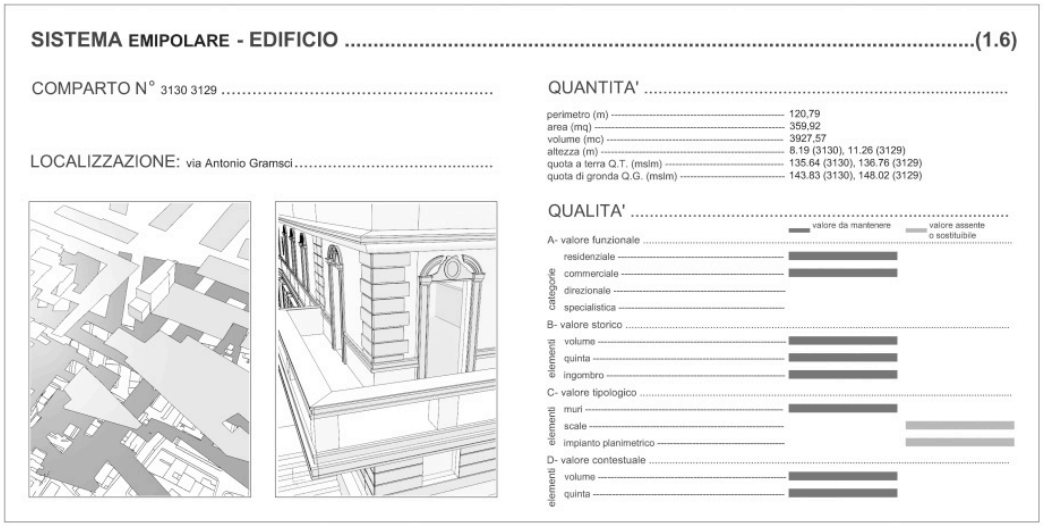


Figure 5. *Typical assessment sheet of the built area, referred to the "semi-polar" system*

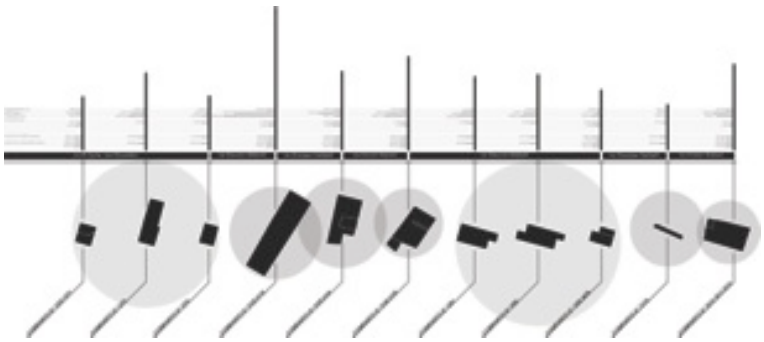


Figure 6. *Chart of the quantitative aspects of the system*

In keeping with the premises of the study, these values are converted into graphics, defined in special technical sheets, by visualising the elements of reality to which a value has been attributed. This means adopting a procedure with which to select these elements so that the representation includes both the overall framework of values in a certain urban area, and the value gradient of each element. A sort of double and simultaneous interpretation which is both concise and analytical.
The problems posed by the construction of this kind of "drawing" requires precise operative answers. First and foremost regarding the representation type and method: to provide all the physical indications of the elements needed to visualise the values we proposed an iconic representation, considered the best way to emphasise the spatial characteristics of the site.
Furthermore, in order to implement a mechanism that turns the drawing into a value, the image has to be processed (transparencies, superimposition of the graphemes, etc.) and a selection has to be made to give it a unique semantic value. By representing its physical features, this value has to portray the qualities of the drawing.

In short, the selection of every representation of reality has to be modified to such an extent that the choice of features to be represented is determined by the importance assigned to the selection rather than the type of graphic restitution.

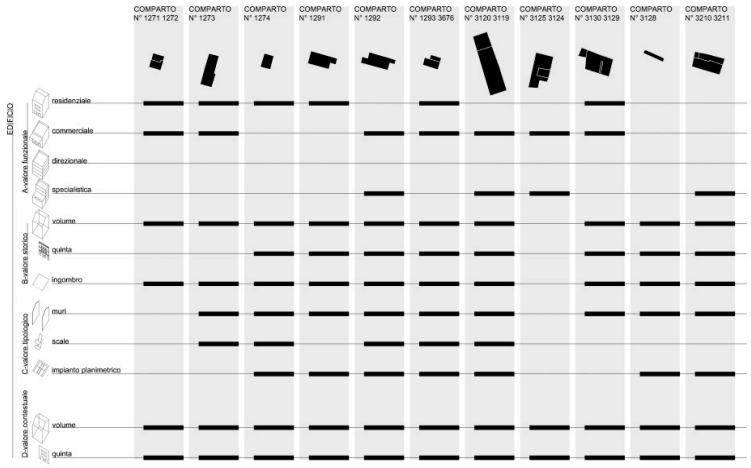
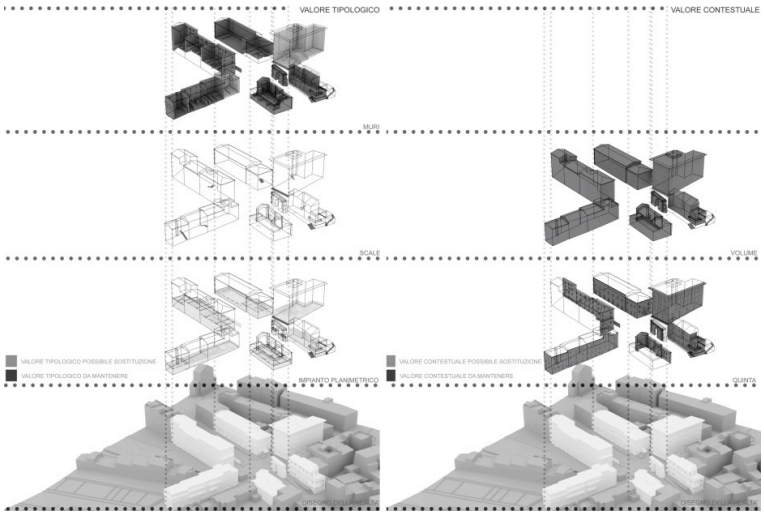
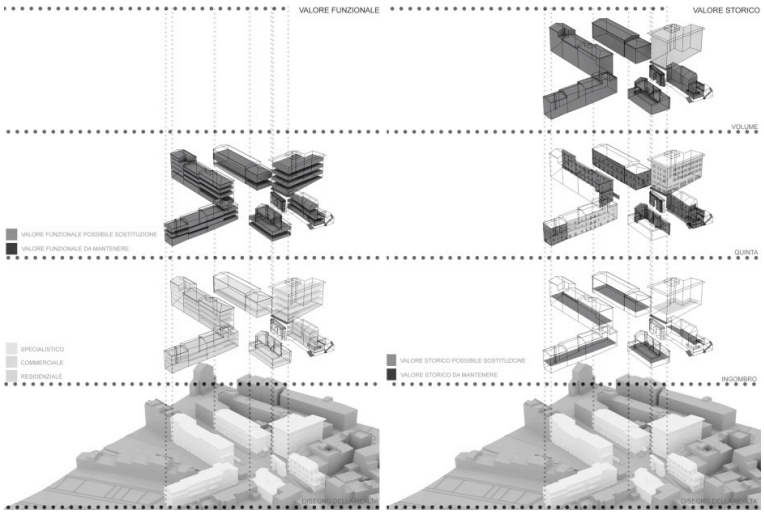


Figure 7. *Chart of the qualitative aspects of the system*

Many diverse kinds of contemporary systems exploit data acquisition and systemisation in several different ways. It's clear that, in general, urban management increasingly needs to create multi-relational databases and dedicated computer systems in order to satisfy the growing demand for knowledge by many different operators in this and other fields. It is therefore extremely important to define the criteria and principles governing consultation of data which need to be constantly updated and monitored.
After the rational construction of several three-dimensional models, the idea of creating a product that could express and represent the entire process described in this paper led to the study of forms of visualisation and communication which could portray the analysed data in concise, efficient representations accessible by all users.





Figures 8, 9, 10, 11. *Representation of the functional, historical, typological and contextual values*

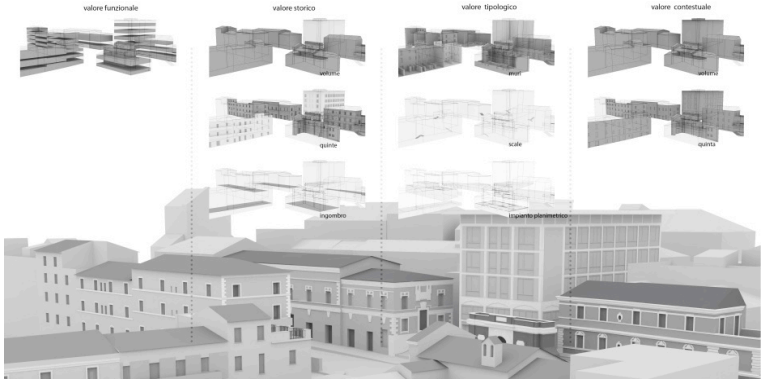
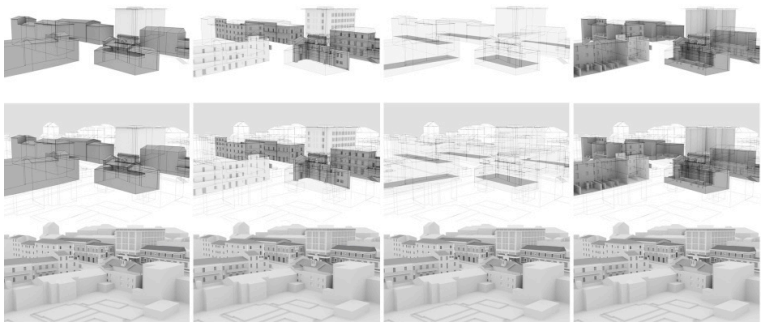
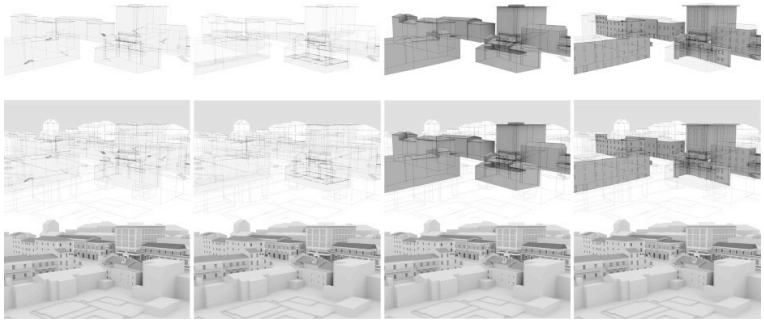


Figure 12. *Synoptic images of the functional, historical, typological and contextual values*





Figures 13, 14. *Concise representation of the values*

The main aim was to formulate descriptive container models which can be queried and surfed in real time. This allowed us to visualise not only the analytical content of the various digital models, but also all possible corresponding forms of visualisation; it also allowed us to prefigure a system to interconnect data and values.
Computer applications and tools were used so that the various models could be accessed and surfed; these applications and tools provided direct interaction with the three-dimensional models without using special software or internet connections.
These tools make it possible to export three-dimensional models into a PDF format, creating scenes in which the recipient can interact with the three-dimensional models without having to use other tools.
The PDF portfolio contains all the topics identified by the survey of the study area; it provides rapid and efficient consultation of a large amount of data expressed as "icons" which can be used by users with different cultural levels and interests. This will allow more and more citizens to be involved in choices regarding their city.

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